OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

22670

FINAL REPORT

For

Contract Number 01/315

Abu- Azmi Factory, Hasouni Refrigeration Factory and Majdi Factory

In this final report we describe our activities as well as providing all documents prepared from our previous reports. Some test sheets results are attached to this report for your evaluation and any suggestion to improve the performance criteria of the prototypes manufactured by the counterpart. This report could be used as a guideline for counterparts for future use, especially on selection of new components. Special consideration must be taken to select proper R134a compressor to replace with conventional R12 compressor. It is also important to adjust refrigerant charge balance to the existing refrigeration cycle with any major changes to the evaporator and condenser. In high back pressure type compressor it might needed to adjust capillary tube to balance pressure increase into the refrigeration system. All necessary advises were given to the counterparts during our several visit to their premises and conduction of technical course.

Since these companies are the same in nature and usually do not have any testing facility to test their new and existing models during changing compressor models. It is seriously recommended to use one of existing hot chamber in the city, to assure safe and economical operation of refrigeration system.

We are proud to have the opportunity to be UNIDO's team member to phase out OSD from many companies. We will attempt to use our experience and capabilities to continue assisting UNIDO and small commercial refrigerator sector to improve their technical awareness, and count us as a focal point to access to up to date information and technical assitance.

هاتف المعرض : ٤٦٥٣٢٦٢ – المصنع : ٤١٦١٣٧٢ – فاكس : ٩٦٢-٦-٤١٦٠٧٨٦ – فاكس : ٩٦٢-٦-٤٦١٣٣٤٠ – ص.ب : ٩٢١٩٤٠ عمان – الأردن
Tel Showroom : 4653262 - Factory : 4161372 - Fax : 962-6-4160786 - Fax : 962-6-4613340 - P.O.Box : 921940 Amman - Jordan

Activities

1- Visiting counterparts premises several times to assure precise technical data for providing necessary information for calculating refrigeration load calculation.
2- Assisting counterparts to select most common and well selling prototype models to be made and test under new circumstances.
3- Supervising related activities concerning making prototypes.
4- Conducting several briefing meeting and training session at our classroom located beside our hot chamber at our factory and counterparts premises to familiarize the counterparts technical staff with new refrigerant physical, chemical and operation properties and behavior.
5- Contacting UNDP and Ozone office in several occasion to plan for implementation of the project in time.
6- Coordinating with UNIDO staff and Ozone office staff in Beirut for execution of different activities foreseen in the contract.
7- Storing and preserving charging equipment at our warehouse to assure safe and trustful stocking as requested by UNIDO's project manager and Ozone Office.
8- Deliver all charging equipment to counterparts as they were received in accordance with packing list and project documents.
9- Assuring safe handling and equipment free of any defects by visual inspection due to possible mechanical damages, before delivery to the counterparts.
10- Explaining to the counterparts operation purposes and application of each machines as purchased and supplied by UNIDO and manufacturer.

11- Conducting an orientation course for technical staff of counterparts to be familiarized with application of equipments and use of them.

هاتف المعرض : ٤٦٥٣٢٦٢ – المصنع : ٤١٦١٣٧٢ – فاكس : ٩٦٢-٦-٤١٦٠٧٨٦ – فاكس : ٩٦٢-٦-٤٦١٣٣٤٠ – ص.ب : ٩٢١٩٤٠ عمان – الأردن
Tel Showroom : 4653262 - Factory : 4161372 - Fax : 962-6-4160786 - Fax : 962-6-4613340 - P.O.Box : 921940 Amman - Jordan

12-Testing Performance test on all prototypes to assure accomplishment of contract to fulfill new R134a refrigerant.

13-Evaluation on performance test results of prototypes to adjust and do necessary changes to refrigeration cycle in retrofit program foreseen in the contract.

14-Advise the counterpart to do necessary changes to all models produced. These changes could be defined as proper amount of refrigerant weight and proper compressor selection, using cooling capacity calculated in this program.

15- This to notice that amount of cooling capacity could be used as guidance, obviously it is almost impossible to find a compressor model to fit excite cooling capacity. There are a lot of factors which should be into consideration while selecting compressor.

16-The counterparts were advised to do performance test on all new compressor models selected to replace the old model, regardless of performance and technical characteristics defined by the manufactures.

17-A comprehensive explanation given to the counterparts to use different compressor manufacturers brochure and technical data.

In this report we explain our activities and technical data gathered for component selection and also determine proper configuration for new design criteria.

We spent a lot of time in market to suggest to the counterparts the new component replacement to fit R134a ozone friendly refrigerant system circuit.

هاتف المعرض : ٤٦٥٣٢٦٢ - المصنع : ٤١٦١٣٧٢ - فاكس : ٩٦٢-٦-٤١٦٠٧٨٦ - فاكس : ٩٦٢-٦-٤٦١٣٣٤٠ - ص.ب : ٩٢١٩٤٠ عمان - الأردن
Tel Showroom : 4653262 - Factory : 4161372 - Fax : 962-6-4160786 - Fax : 962-6-4613340 - P.O.Box : 921940 Amman - Jordan

Compressor selection was the main concern in this regard due to certain limitation of compressor capacity availability in Jordan market.

Our main concern in implementation of project is testing prototypes which are the most important part of project.

Counterparts showed good role and cooperat5ion to make prototypes and testing them are on process, the test results will be submitted to you whenever they are completed and pass performance test requirement.

The new criteria is defined as new operating condition under usage of R134a Ozone friendly refrigerant. As we learnt through our experience, following components have significant role to be adapted for new environmental and technical circumference.

- Compressor
- Drier
- Capillary tube
- Refrigerant Charge

هاتف المعرض : ٤٦٥٣٢٦٢ – المصنع : ٤١٦١٣٧٢ – فاكس : ٩٦٢-٦-٤١٦٠٧٨٦ – فاكس : ٩٦٢-٦-٤٦١٣٣٤٠ – ص.ب : ٩٢١٩٤٠ عمان – الأردن
Tel Showroom : 4653262 - Factory : 4161372 - Fax : 962-6-4160786 - Fax : 962-6-4613340 - P.O.Box : 921940 Amman - Jordan
E-mail: maurice@joinnet.com.jo

Introduction

Please find below our first progress report, concerning calculation and redesign of the prototypes to be made by the counterparts and they will be tested at our hot chamber, at our site in Amman. These prototypes are to be manufactured under our engineering supervision and will be 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. We hope that this first report could have satisfied the UNIDO in order to comply with our contract. In the second progress report we will provide you more technical details of all prototypes to be made by the counterparts.

The refrigeration load calculation is made here for following companies subjected to the UNIDO contract number 01/315A implementation of CFC phase out projects at,

- Abu Azmi Factory
- Hasuoni Refrigeration Factory
- Majdi Factory

هاتف المعرض : ٤٦٥٣٢٦٢ – المصنع : ٤١٦١٣٧٢ – فاكس : ٩٦٢-٦-٤١٦٠٧٨٦ – فاكس : ٩٦٢-٦-٤٦١٣٣٤٠ – ص.ب : ٩٢١٩٤٠ عمان – الأردن
Tel Showroom : 4653262 - Factory : 4161372 - Fax : 962-6-4160786 - Fax : 962-6-4613340 - P.O.Box : 921940 Amman - Jordan
E-mail: maurice@[illegible]

Load Calculation for Water Cooler
Abu Azmi Factory

Q1 = m C ΔT, Where:

Q1 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 28 C.

m total weight of original water in the water cooler storage tank in Kg. Considering that one litter of water at 25 C is equal to approximately one Kg.

Tank Volume = 30 lit

M = 70 liter = 30 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 = 28 °C and Tc = 7 °C

Ti – Tc = 28-7 = 21 °C

Q1 = m C ΔT = 70 x 1 x 21 = 1470 Kcal = 1470 x 1.163 = 1710 Watts/24 hrs

Q1 = 1710 /24 water cooler operating time per day = 71.2 Watts

Q1 = 71.2 Watts

$Q2 = \dot{M}\ C\ \Delta T$

Q2 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 = 20
M = Kg weight of water in one Glass of Water = 0.2 Kg
$\dot{M}$ = (16 x 20 x 0.2) = lit. +20% Waste Water = 77

هاتف المعرض : ٤٦٥٣٢٦٢ – المصنع : ٤١٦١٣٧٢ – فاكس : ٤١٦٠٧٨٦-٦-٩٦٢ – فاكس : ٤٦١٣٣٤٠-٦-٩٦٢ – ص.ب : ٩٢١٩٤٠ عمان – الأردن
Tel Showroom : 4653262 - Factory : 4161372 - Fax : 962-6-4160786 - Fax : 962-6-4613340 - P.O.Box : 921940 Amman - Jordan
E-mail: maurice@icejmst.com.jo

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

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

Ti = 28 °C and T= 7 °C

Ti – Tc = 28-7 = 21 °C

Q2 = m C ΔT = 77 x 1 x 21 = 1617 Kcal = 1617 x 1.163 = 1880 Watts/16 hrs

Q2 = 1880/12 compressor operating time per day = 156 Watts

Q2 = 156 Watts

Q3 = UA ΔT, Where:

Q3 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

K = 0.0178 W/mt.K

$$U = \frac{1}{1/hi + x1/K1 + x2/k2 \cdots\cdots 1/ho} = 0.40$$

hi = ho = 9.37 W/m^2. K

A Total Area which heat is transmitted by. In Sq. Mt.

A= [(3.14x0.3x0.3)/4]x0.8 = 0.56 Sq.mt.

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

Ta = 32 °C and Tc = 7 °C

Ta – Tc = 32-7 = 25 °C

Q3 = (UA, ΔT) = (0.40 x 0.0.56 x 25)= 1.4 Watts

Q3 = 1.4 Watts

Qt = Q1 + Q2 + Q3 = 71.2 + 156 + 1.4 = 228 + 10% safety factor = 251.5 Watts

Refrigeration Load Calculation
Majdi Factory Chest Freezer

a) Transmission load calculation

Freezer Compartment	Dimension Cm.	Area (sq.mt.)	Insulation Thickness	Temp. Difference
Side Walls	2 x (65x88)	1.444	40mm	55 c
Back Panel	125x88	1.1	40mm	55 c
Bottom	65x88	0.572	40mm	65 C
Top	65x88	0.572	40mm	55 c
Doors	125x88	1.1	40mm	55 c

Insulation Type: Pu Foam with R141b blowing agent.
Thermal Conductivity for Foam = 0.027 W/ mt. ° C
Temperature Difference Refrigerator Compartment:
$\Delta T = 32 - (-23) = 55$ ° C
Ambient Temperature = 32 °C
Freezer Air Temperature = -23 °C

Calculation :

Heat Leak For Freezer Compartment.

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

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

$$U = \frac{1}{1/h_i + x1/K1 + x2/k2 \cdots\cdots 1/h_o}$$

Where :

U = Heat Resistance Coefficient Factor
K_1 = Foam Thermal Conductivity
$h_i = h_o$ = Air Convection Factor = 9.37 Watt/Mt^ K

Due to the short thickness of cabinet out side panel and Metal inner liner heat resistance of these materials have been considered negligible.
Therefore:

1- $Q_{SideWalls} = [U A (T_a - T_r)]$
T_a = Ambient Temperature 32
T_r = refrigerator air Temperature -23
U = 0.59 W/ sq.m °C
A = 1.444 Sq. Mt., T_a = 32 °C, T_f = -23 °C
therefore
$Q_{SideWalls}$ = 0.59 x 1.444 x 55 = 48.9 Watts
$Q_{SideWalls}$ = 48.9 Watts

2- $Q_{Top\ door} = [U A (T_a - T_r)]$
U = 0.59W/ sq.m °C , $T_a - T_r$=55, A = 0.572,
Q_{doors} = 0.59 x 0.572 x 55 = Watts Q_{doors} = 18.6 Watts

3- $Q_{Front\ Panel} = [U A (T_a - T_r)]$
U = 0.59 w/sq. Mt. °C,
Ta - Tr= 55 ,
A = 1.1
$Q_{Front\ Panel}$ = 0.59 x 1.1 x 55 = 35.7 Watts
$Q_{Front\ Panel}$ = 35.7 Watts

4 -$Q_{back\ panel} = [U A (T_a - T_r)]$
U = 0.59 w/sq. Mt. °C,
$T_a - T_r$= , A = 1.1
$Q_{back\ panel}$ = 0.59x 1.1 x 55 = 35.7 Watts
$Q_{back\ panel}$ = 35.7 Watts

5 -$Q_{Bottom} = [U A (T_a - T_r)]$
U = 0.59 w/sq. Mt. °C,
Ta - Tr= 65, A = 0.572
$Q_{Bottom\ Surface}$ = 0.59x 0.572 x 65 = 22 Watt
$Q_{Bottom\ Surface}$ = 22 Watts

Total Refrigerator Heat Leak =46.9+35.7+18.6+35.7+22 = 158.8 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

Since this product is mainly used for storing fresh Lamb meet and beef above

freezing point at -23 C, we consider 30 Kg of meet to be stored in this Freezer therefore we calculate as follow,

$$Q_1 = mc(T_1-T_2)$$

M = 30 kg
$C_{\text{Above Freezing}}$ = 3.2 Kj/kg K
T_1 = 25 C

$T_2 = 0$ C
Q = 30000x3.2x [25-0] =2400000 jul/86400 = 28 Watt

$Q_2 = mc(T_1-T_2)$
M = 40 kg
C Below Freezing = 1.61 Kj/(kg. K)
$T_1 = 0$ C
$T_2 = -23$ C
Q = 30000x1.61x [(0-(-23)] =1110900 jul/86400 = 12.8 Watt

$Q_3 = mh$

$Q_3 = 30000 \times 204/86400 = 71$

$Q_{\text{total for product loaded}} = 28 + 13 + 71 = 112$

Internal Load
N/A

Door Opening
Refrigerator Internal Volume 400 lit.
Number of air change as per ASHREA standard = 70 per day
Heat removed per cubic meter of air 75000 j

Air Change load = 0.4x20x75000/86400 = 6.9
Watt

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

$Q_{Total} = 159 + 112 + 7 = 278$ Watts

Considering 10 % of Q total for safety factor

Cooling Capacity Required = $Q_{\text{Grand Total}} = 278 + 10\%(81) = 306$ watts

Load Calculation for Water Cooler
Hasouni Refrigeration Factory

Q1 = m C ΔT, Where:

Q1 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 28 C.

m total weight of original water in the water cooler storage tank in Kg. Considering that one litter of water at 25 C is equal to approximately one Kg.

Tank Volume = 30 lit

M = 30 liter = 30 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 = 28 °C and Tc = 7 °C

Ti – Tc = 28-7 = 21 °C

Q1 = m C ΔT = 30 x 1 x 21 = 630 Kcal = 630 x 1.163 = 733 Watts/24 hrs

Q1 = 733 /24 water cooler operating time per day = 30.54 Watts

Q1 = 30.54 Watts

$Q2 = \dot{M}\ C\ \Delta T$

Q2 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 = 20
M = Kg weight of water in one Glass of Water = 0.2 Kg

$\dot{M}$ = (16 x 20 x 0.2) = lit. +20% Waste Water = 77

هاتف المعرض : ٤٦٥٣٢٦٢ – المصنع : ٤١٦١٣٧٢ – فاكس : ٤١٦٠٧٨٦-٦-٩٦٢ – فاكس : ٤٦١٣٣٤٠-٦-٩٦٢ – ص.ب : ٩٢١٩٤٠ عمان – الأردن
Tel Showroom : 4653262 - Factory : 4161372 - Fax : 962-6-4160786 - Fax : 962-6-4613340 - P.O.Box : 921940 Amman - Jordan
E-mail: maurice@joinnet.com.jo

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

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

Ti = 28 °C and T= 7 °C

Ti – Tc = 28-7 = 21 °C

Q2 = m C ΔT = 77 x 1 x 21 = 1617 Kcal = 1617 x 1.163 = 1880 Watts/16 hrs

Q2 = 1880/12 compressor operating time per day = 156 Watts

Q2 = 156 Watts

Q3 = UA ΔT, Where:

Q3 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

K = 0.0178 W/mt.K

$$U = \frac{1}{1/hi + x1/K1 + x2/k2 \ldots\ldots 1/ho} = 0.40$$

hi = ho = 9.37 W/m^2. K

A Total Area which heat is transmitted by. In Sq. Mt.

A= [(3.14x0.3x0.3)/4]x0.45 = 0.32 Sq.mt.

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

Ta = 32 °C and Tc = 7 °C

Ta – Tc = 32-7 = 25 °C

Q3 = (UA_1 ΔT) + (UA_2 ΔT = (0.40 x 0.0.32 x 25)= 0.32 Watts

Q3 = 0.32 Watts

Qt = Q1 + Q2 + Q3 = 30.54 + 156 + 0.32 = 186 + 10% safety factor = 205.5 Watts

Product Technical Specification ***Abu-Azmi Workshop***	
Description	**Specification**
Company Name	Abu-Azmi Workshop
Product Name	Water Cooler
Product Model	AZ-100
Product Application	Water Cooler
Operating Temperature	32 C
Climatic Condition	Normal
Product Overall Dimension WxLxH mm	41*67*127 cm
Freezer Compartment Overall Dimension and Wall Thickness	N/A
Refrigerator Compartment Overall Dimension and Wall Thickness	N/A
Product Shape, Double Doors, Upright, Chest, etc	Stand
Freezer Internal Net Volume	N/A
Refrigerator Net Volume	N/A
Product Net Volume	N/A
Product Inside Temperature C	+ 7 C
Water Storage Tank Capacity, Water Cooler	30 Litters
Type of Water Storage Tank Cylinder, Cubic, etc.	Cylindrical
Water Fellow per hour for water cooler	80 Liters/H
Water Storage Tank Dimension	45*30 cm
Water Outlet Temperature	+7 C
Water Inlet Temperature	+28 C
Freezer Inside Temperature	N/A
Refrigerator Inside Temperature	N/A
Evaporating Temperature	-23 C
Foam Insulation Thickness mm Side Walls, Top, Bottom, Door, Back Panel	40 mm
Type of PU Foam	R11 Pu Foam
Foam Density, Kg/Cu. Mt.	40 Kg/Cu. Mt.
Foam Mixture, Percentage Pol% + R11% + Isocyanate%	37% + 13% + 50%
Total amount of Foam Injection, Kg	6 Kg
Refrigerant Type	R 12
Refrigerant Charge Weight Gr.	240 Gr.

Type of Compressor, Hermetic, Semi Hermetic, Open	Hermetic
Compressor Cooling System Static, Oil Cooled, Fan Cooled	Fan Cooled
Compressor Cooling Capacity Watt	250 Watts
Compressor input Power, Watt	¼ Hp, 184 Watts
Compressor Model Number	L88 TX
Compressor Manufacturer	Electreloux
Compressor Mounting Place Top, Bottom, Front, Back	Bottom
Condenser Type, Static, Fan Cooled	Fan Cooled
Condenser Dimension, Length, Inside Tube Diameter,	Two Rows ., 5/16 inch
Condenser Material, Aluminum, Copper, Copper Coated, etc,	Copper and Aluminum
Condenser mounting Place, Back Wall, Top, Bottom	Bottom
Evaporator Type, Fin and Tube, Roll Bond, Wire and Tube, etc.	Copper Tubes Surrounding the Tank
Evaporator Dimension, Length, Surface Area, Inside Tube Diameter	15 m. Length
Evaporator Material, Aluminum, Copper, Copper Coated, etc,	Copper
Dryer Type,	Ranco
Dryer Material, Weight and Size	Silica, Cylindrical, 15 Gr.
Capillary Tube Diameter and Length	1 mm , 1800 mm length

Product Technical Specification ***Hassouni Refrigeration Factory***	
Description	**Specification**
Company Name	Hassouni Refrigeration Factory
Product Name	Water Cooler
Product Model	HS-WC75
Product Application	Water Cooler
Operating Temperature	32 C
Climatic Condition	Normal
Product Overall Dimension WxLxH mm	35*35*95 cm
Freezer Compartment Overall Dimension andWall Thickness	N/A
Refrigerator Compartment Overall Dimension andWall Thickness	N/A
Product Shape, Double Doors, Upright, Chest, etc	Stand, Two water Tabs
Freezer Internal Net Volume	N/A
Refrigerator Net Volume	N/A
Product Net Volume	N/A
Product Inside Temperature C	+ 7 C
Water Storage Tank Capacity, Water Cooler	8 Litters
Type of Water Storage Tank Cylinder, Cubic, etc.	Cylindrical
Water Fellow per hour for water cooler	60 Liters/H
Water Storage Tank Dimension	21*32 cm
Water Outlet Temperature	+7 C
Water Inlet Temperature	+28 C
Freezer Inside Temperature	N/A
Refrigerator Inside Temperature	N/A
Evaporating Temperature	-23 C
Foam Insulation Thickness mm Side Walls, Top, Bottom, Door, Back Panel	40 mm
Type of PU Foam	R11 Pu Foam
Foam Density, Kg/Cu. Mt.	40 Kg/Cu. Mt.
Foam Mixture, Percentage Pol% + R11% + Isocyanate%	37% + 13% + 50%
Total amount of Foam Injection, Kg	4.5 Kg
Refrigerant Type	R 12
Refrigerant Charge Weight Gr.	240 Gr.

Type of Compressor, Hermetic, Semi Hermetic, Open	Hermetic
Compressor Cooling System Static, Oil Cooled, Fan Cooled	Fan Cooled
Compressor Cooling Capacity Watt	250 Watts
Compressor input Power, Watt	¼ Hp, 184 Watts
Compressor Model Number	L88 FW
Compressor Manufacturer	Electrelux
Compressor Mounting Place Top, Bottom, Front, Back	Bottom
Condenser Type, Static, Fan Cooled	Fan Cooled
Condenser Dimension, Length, Inside Tube Diameter,	Two Rows , 5/16 inch
Condenser Material, Aluminum, Copper, Copper Coated, etc,	Copper and Aluminum
Condenser mounting Place, Back Wall, Top, Bottom	Bottom
Evaporator Type, Fin and Tube, Roll Bond, Wire and Tube, etc.	Copper Tubes Surrounding the Tank
Evaporator Dimension, Length, Surface Area, Inside Tube Diameter	15 m. Length
Evaporator Material, Aluminum, Copper, Copper Coated, etc,	Copper
Dryer Type,	Ranco
Dryer Material, Weight and Size	Silica, Cylindrical, 15 Gr.
Capillary Tube Diameter and Length	1 mm , 1800 mm length

Product Technical Specification ***Majdi Workshop***	
Description	**Specification**
Company Name	Majdi Workshop
Product Name	Chest Freezer,
Product Model	MAJ-200
Product Application	Freezer
Operating Temperature	32 C
Climatic Condition	Normal
Product Overall Dimension WxLxH mm	140x64x85
Freezer Compartment Overall Dimension and Wall Thickness	N/A
Refrigerator Compartment Overall Dimension and Wall Thickness	50 mm
Product Shape, Double Doors, Upright, Chest, etc	Chest Freezer
Freezer Internal Net Volume	600 liter
Refrigerator Net Volume	N/A
Product Net Volume	650 liter
Product Inside Temperature C	- 18 C
Water Storage Tank Capacity, Water Cooler	N/A
Type of Water Storage Tank Cylinder, Cubic, etc.	N/A
Water Fellow per hour for water cooler	N/A
Water Storage Tank Dimension	N/A
Water Outlet Temperature	N/A
Water Inlet Temperature	N/A
Freezer Inside Temperature	N/A
Refrigerator Inside Temperature	N/A
Evaporating Temperature	- 23.3 C
Foam Insulation Thickness mm Side Walls, Top, Bottom, Door, Back Panel	50 mm
Type of PU Foam	R11 PU Foam
Foam Density, Kg/Cu. Mt.	40 Kg/ Cu Cm

Foam Mixture, Percentage Pol% + R11% + Isocyanate%	37% + 13% + 50%
Total amount of Foam Injection, Kg	15 Kg.
Refrigerant Type	R12
Refrigerant Charge Weight Gr.	500 gr.
Type of Compressor, Hermetic, Semi Hermetic, Open	Hermetic
Compressor Cooling System Static, Oil Cooled, Fan Cooled	Fan Cooled
Compressor Cooling Capacity Watt	400Watts
Compressor input Power, Watt	450 Watts
Compressor Model Number	L88 TX
Compressor Manufacturer	Electrelux
Compressor Mounting Place Top, Bottom, Front, Back	Bottom
Condenser Type, Static, Fan Cooled	Fan Cooled
Condenser Dimension, Length, Inside Tube Diameter,	Four Rows Tube Coil, and Fins
Condenser Material, Aluminum, Copper, Copper Coated, etc,	Copper
Condenser mounting Place, Back Wall, Top, Bottom	Bottom
Evaporator Type, Fin and Tube, Roll Bond, Wire and Tube, etc.	Tube
Evaporator Dimension, Length, Surface Area, Inside Tube Diameter	Tube Coils 40 mt.
Evaporator Material, Aluminum, Copper, Copper Coated, etc,	Copper
Dryer Type,	Cylindrical
Dryer Material, Weight and Size	Ranco, 30 gr.
Capillary Tube Diameter and Length	0.8 mm Dim, 3000 mm Length

Printing In Labaratory Of
Maurice Ind. [Jordan]

Maurice Ind. [Jordan]

TestDate: 02/01/16 11:57
TestName: Energy Consumtion

Report No.: Spec & Remark
ReportDate: 2002/02/15 14:59

Total Result :

1 - Total Test Time	96 Hours
2 - Working Percent	11 %On
3 - Energy	0.21 kwh
4 - Zoom Time	96:34 Hour
5 - Compr Current	0.11 Amp
6 - Evaprator Mean Temp	31.3 C
7 - Cabin Mean Temp	10.9 C
8 - Crisp Temp	10.2 C
9 - Compr Temp	50.2 C
10- Condensor In Temp	48.8 C
11- Condensor Out Temp	36.1 C
12- Condition	42.6 C 35 %H
13- Volt	Max=221 Mean=221 Min=221
14-	
15-	
16-	
17-	

Product Spec :

1 - File Name		02011611.k57
2 - Test Kind	G	Perform.
3 - Product Serial		
4 - Product Name		Water Cool
5 - Product Model		AZ-100
6 - Product Capacity		100 Lit/h.
7 - Compressor Name		Electrolux
8 - Compressor Model		GL 70 AN
9 - Compressor Power		1/4 Hp
10 - Compressor Amper		2 Amp
11 - Thermostat No.		2
12 - Thermostat Type		Ranco
13-		
14-		

Technical Manager: ICRC

Lab Chief : MARIO AL-DEEK

Lab Specialist: ZIAD

Remark :

Remark1
Remark2
Remark3

Remark :

sign :

Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
Maurice Ind. [Jordan]

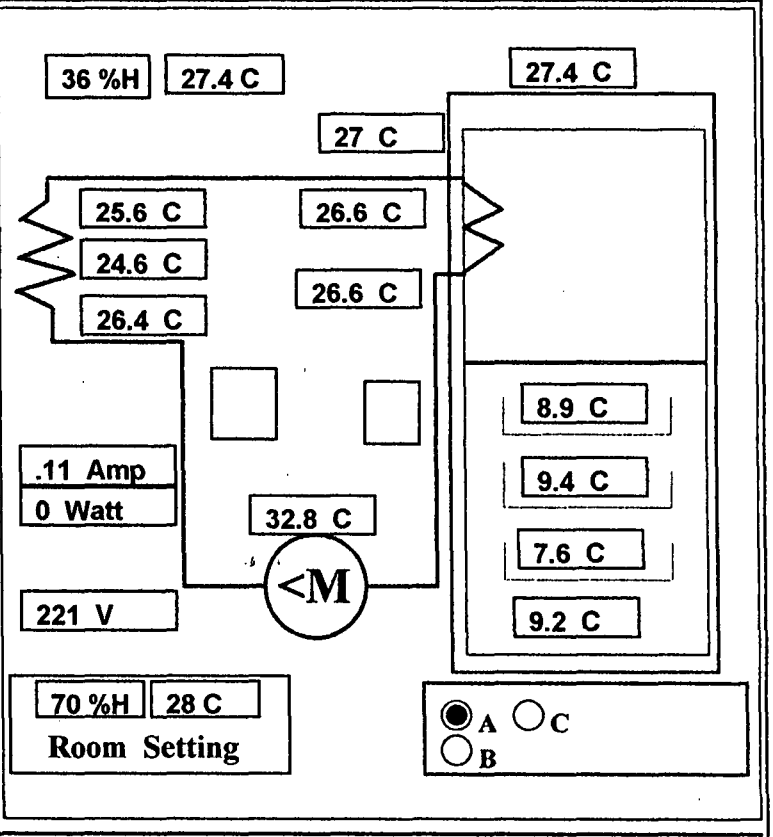
Maurice Ind. [Jordan]

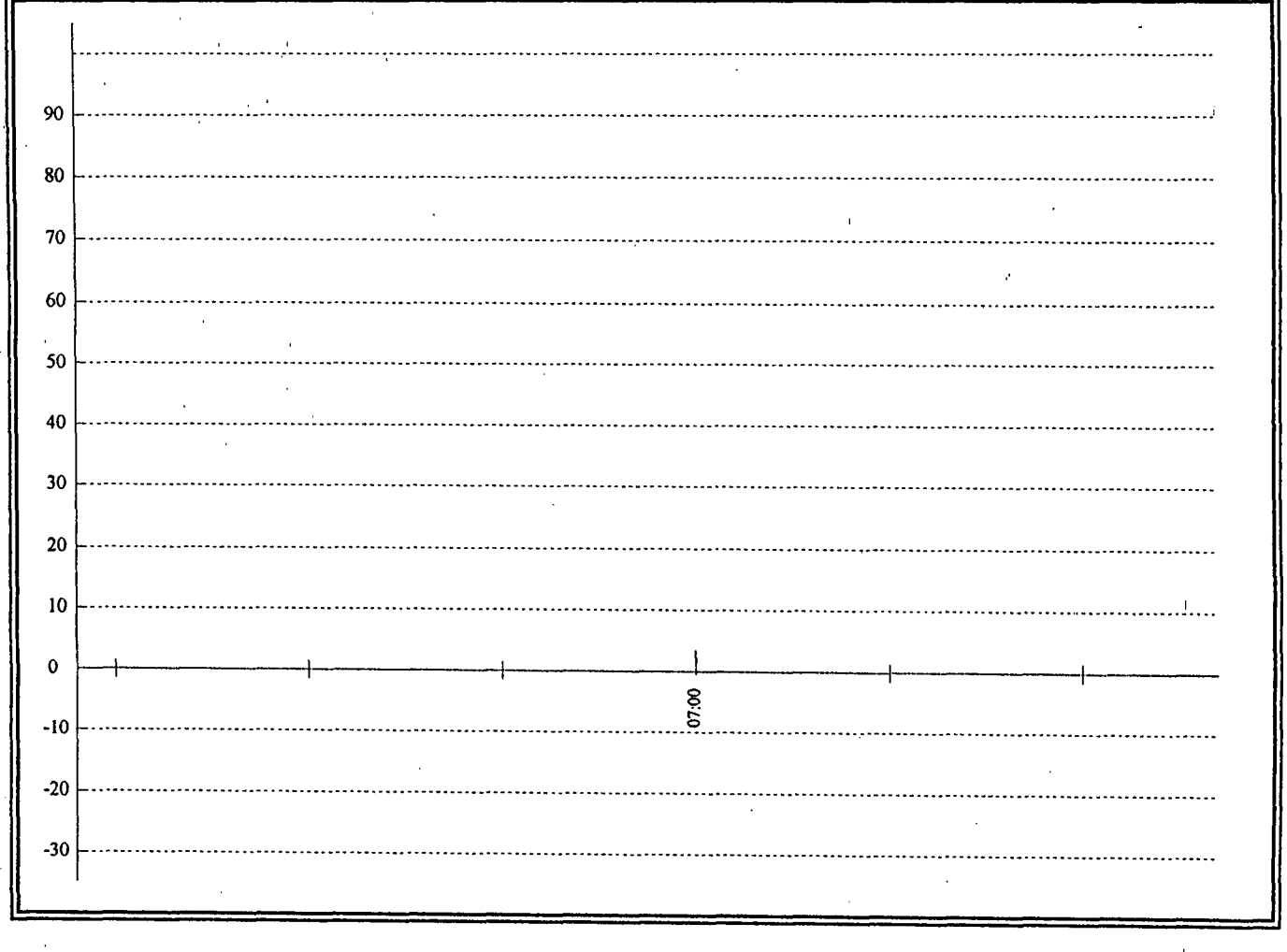
TestDate: 02/01/16 11:57 **Report No.:** ( ) - Page 1

PageTestName: Energy Consumtion **ReportDate:** 2002/02/15 14:59

Page Result :

1 - Page Test Time	96 Hours
2 - Working Percent	11 %On
3 - Energy (Accord to page)	0.21 kwh
4 - Zoom Time	96:34 Hour
5 - Compr Current	0.11 Amp
6 - Evaprator Mean Temp	31.3 C
7 - Cabin Mean Temp	10.9 C
8 - Crisp Temp	10.2 C
9 - Compr Temp	50.2 C
10- Condensor In Temp	48.8 C
11- Condensor Out Temp	36.1 C
12- Condition	42.6 C 35 %H
13- Volt	Max=221 Mean=221 Min=221
14-	
15-	
16-	
17-	

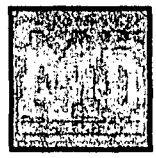




Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
Maurice Ind. [Jordan]

Maurice Ind. [Jordan]

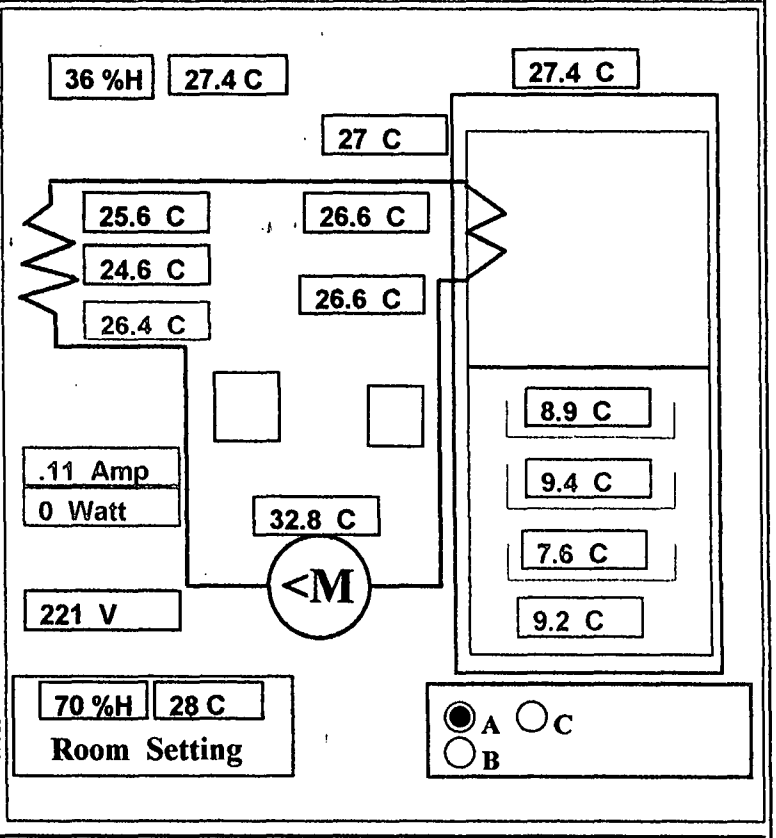


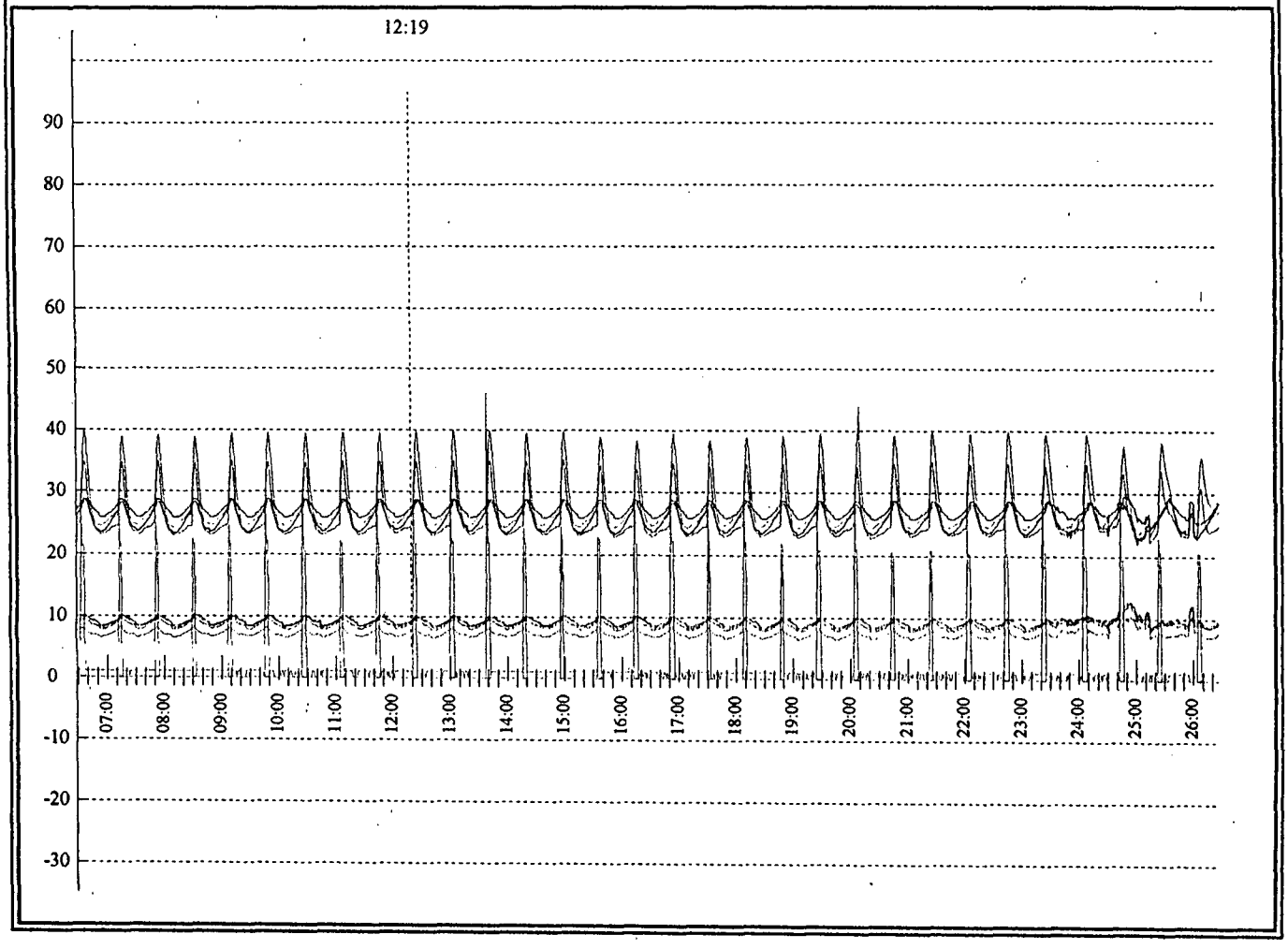
TestDate: 02/01/16 11:57 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2002/02/15 15:02

Page Result :

1 - Page Test Time	*20 Hours*
2 - Working Percent	*9 %On*
3 - Energy (Accord to page)	*0.158 kwh*
4 - Zoom Time	*12:19 Hour*
5 - Compr Current	*0.11 Amp*
6 - Evaprator Mean Temp	*19.9 C*
7 - Cabin Mean Temp	*8.6 C*
8 - Crisp Temp	*9.2 C*
9 - Compr Temp	*32.8 C*
10- Condensor In Temp	*26.4 C*
11- Condensor Out Temp	*25.6 C*
12- Condition	*27.4 C 36 %H*
13- Volt	*Max=221 Mean=221 Min=221*
14-	
15-	
16-	
17-	





Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
Maurice Ind. [Jordan]

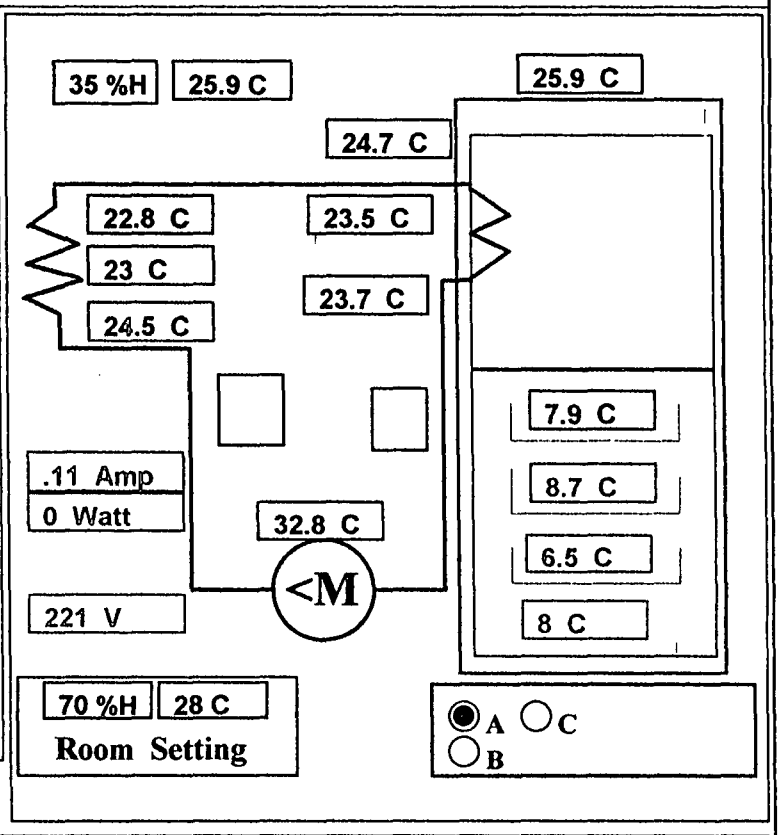
Maurice Ind. [Jordan]

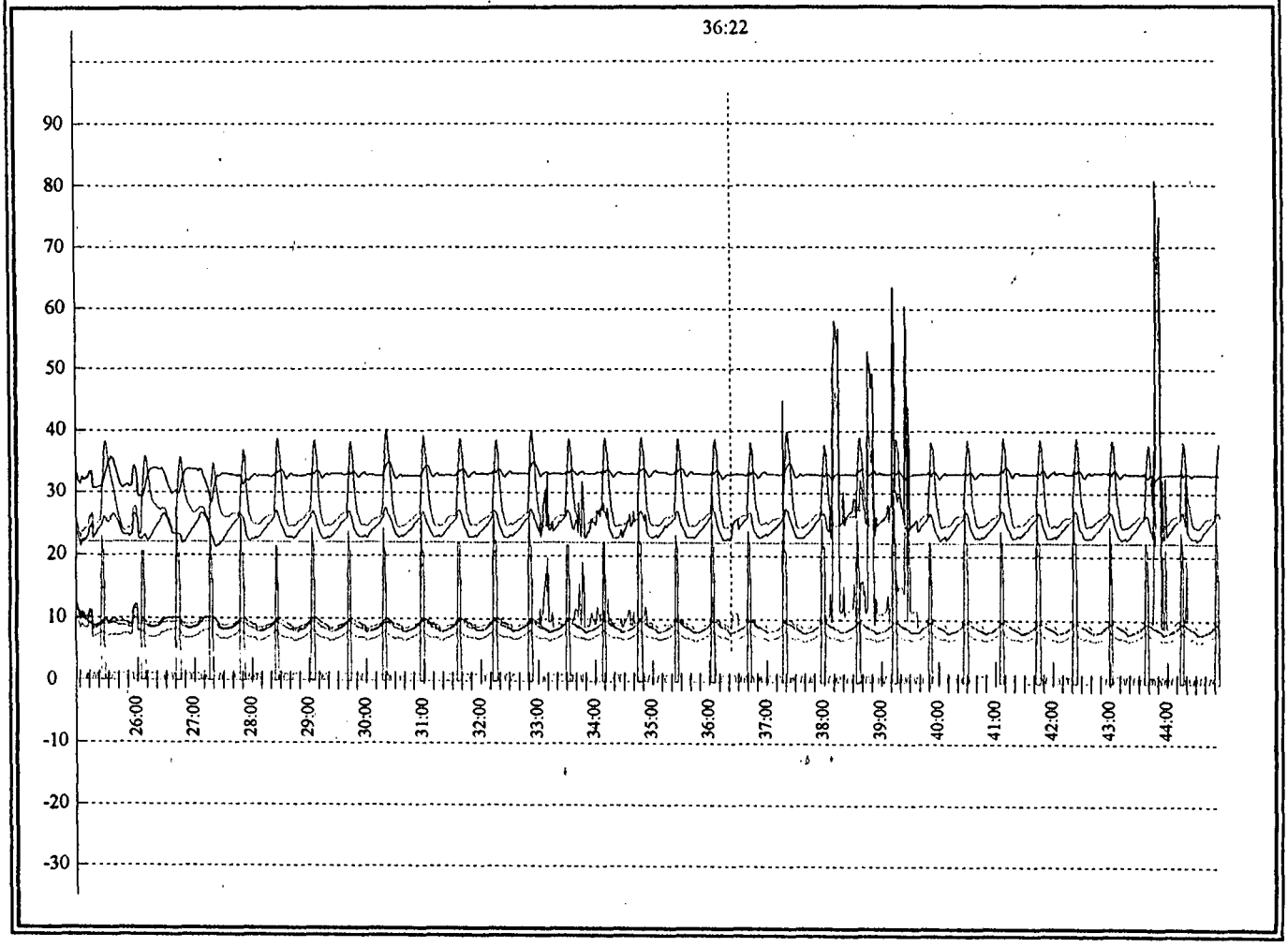
TestDate: 02/01/16 11:57 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2002/02/15 15:08

Page Result :

1 - Page Test Time	*20 Hours*
2 - Working Percent	*9 %On*
3 - Energy (Accord to page)	*0.157 kwh*
4 - Zoom Time	*36:22 Hour*
5 - Compr Current	*0.11 Amp*
6 - Evaprator Mean Temp	*20.6 C*
7 - Cabin Mean Temp	*7.7 C*
8 - Crisp Temp	*8 C*
9 - Compr Temp	*32.8 C*
10- Condensor In Temp	*24.5 C*
11- Condensor Out Temp	*22.8 C*
12- Condition	*25.9 C 35 %H*
13- Volt	*Max=221 Mean=221 Min=221*
14-	
15-	
16-	
17-	

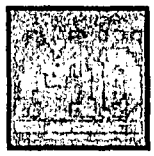




Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
Maurice Ind. [Jordan]

Maurice Ind. [Jordan]



TestDate: 02/01/16 11:57
TestName: Energy Consumtion

Report No.: Spec & Remark
ReportDate: 2002/02/15 15:12

Total Result :

1 - Total Test Time	*96 Hours*
2 - Working Percent	*17 %On*
3 - Energy	*0.442 kwh*
4 - Zoom Time	*96:34 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*27.9 C*
7 - Cabin Mean Temp	*23.6 C*
8 - Crisp Temp	*-10.5 C*
9 - Compr Temp	*46.5 C*
10- Condensor In Temp	*46.3 C*
11- Condensor Out Temp	*-3 C*
12- Condition	*42.6 C 35 %H*
13- Volt	*Max=221 Mean=221 Min=221*
14-	
15-	
16-	
17-	

Product Spec :

1 - File Name	*02011611.k57*
2 - Test Kind G	*Perform.*
3 - Product Serial	
4 - Product Name	*Water Cool*
5 - Product Model	*HS-WC75*
6 - Product Capacity	*60 Lit/h*
7 - Compressor Name	*Daewoo*
8 - Compressor Model	*HPL27YG 1-*
9 - Compressor Power	*1/4 Hp*
10- Compressor Amper	*2*
11- Thermostat No.	*2*
12- Thermostat Type	*Ranco*
13-	
14-	

Technical Manager: *ICRC*

Lab Chief : *MARIO AL-DEEK*

Lab Specialist: *ZIAD*

Remark :

Remark1
Remark2
Remark3

Remark :

sign :

Industrial Control Research Center HotRoom Ver 5

Printing In Laboratory Of
Maurice Ind. [Jordan]

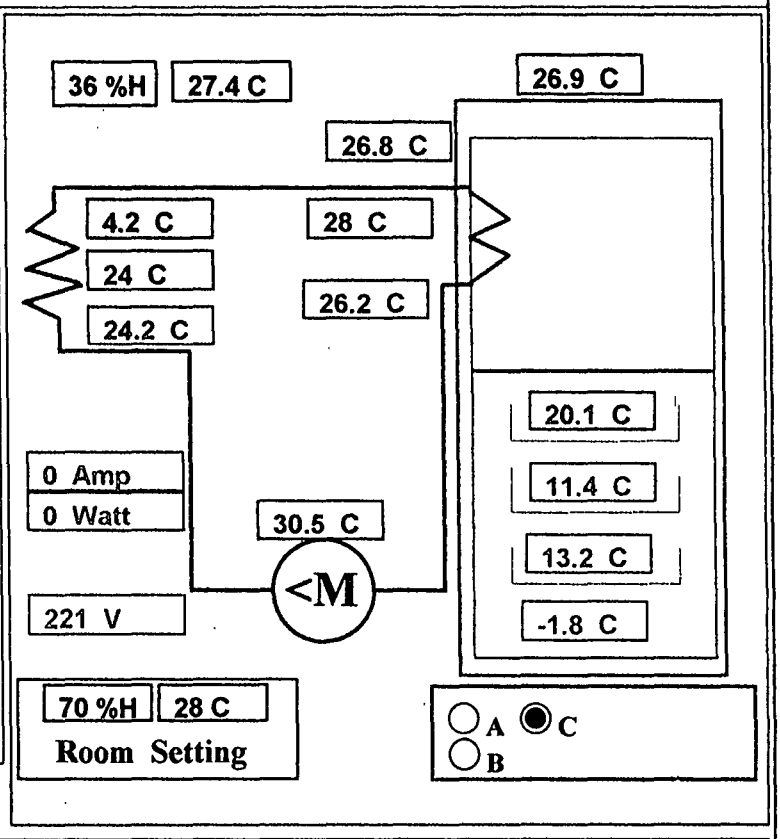
Maurice Ind. [Jordan]

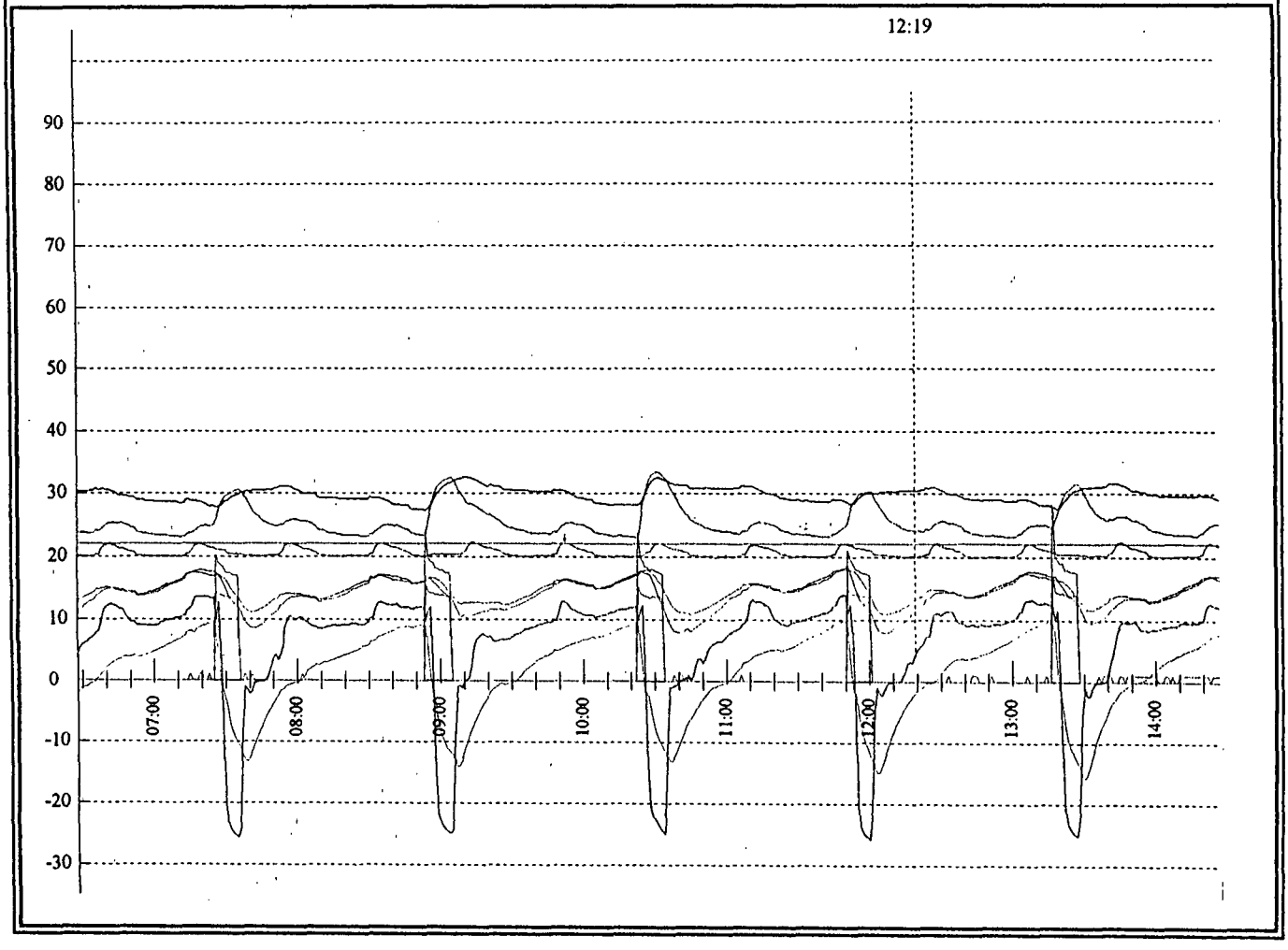
TestDate: 02/01/16 11:57 **Report No.:** ( ) - Page 1

PageTestName: Energy Consumtion **ReportDate:** 2002/02/15 15:12

Page Result :

1 - Page Test Time	*96 Hours*
2 - Working Percent	*17 %On*
3 - Energy (Accord to page)	*0.442 kwh*
4 - Zoom Time	*96:34 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*27.9 C*
7 - Cabin Mean Temp	*23.6 C*
8 - Crisp Temp	*-10.5 C*
9 - Compr Temp	*46.5 C*
10- Condensor In Temp	*46.3 C*
11- Condensor Out Temp	*-3 C*
12- Condition	*42.6 C 35 %H*
13- Volt	*Max=221 Mean=221 Min=221*
14-	
15-	
16-	
17-	





Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
Maurice Ind. [Jordan]

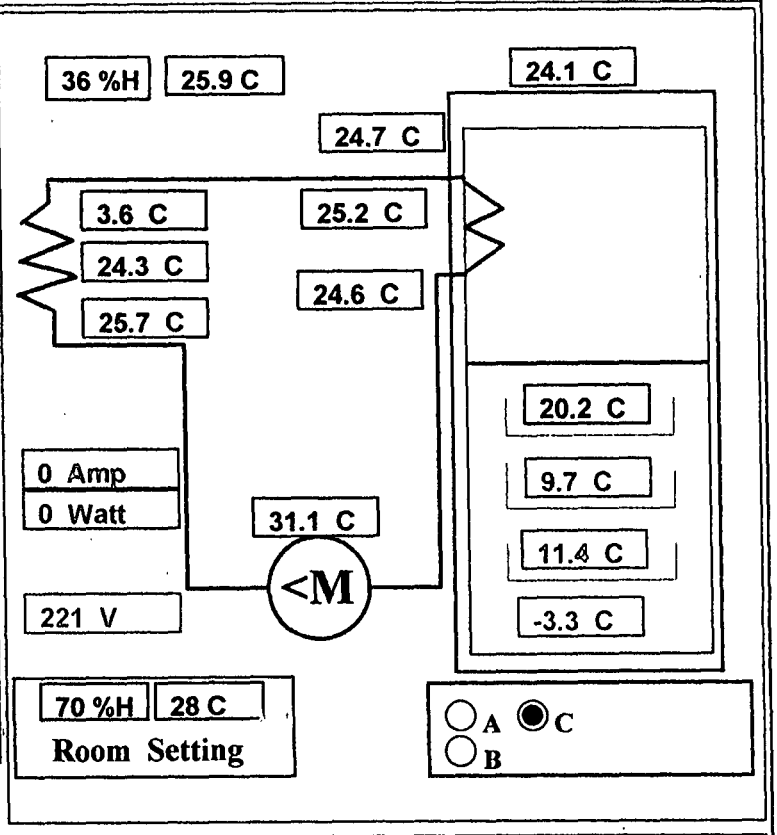
Maurice Ind. [Jordan]

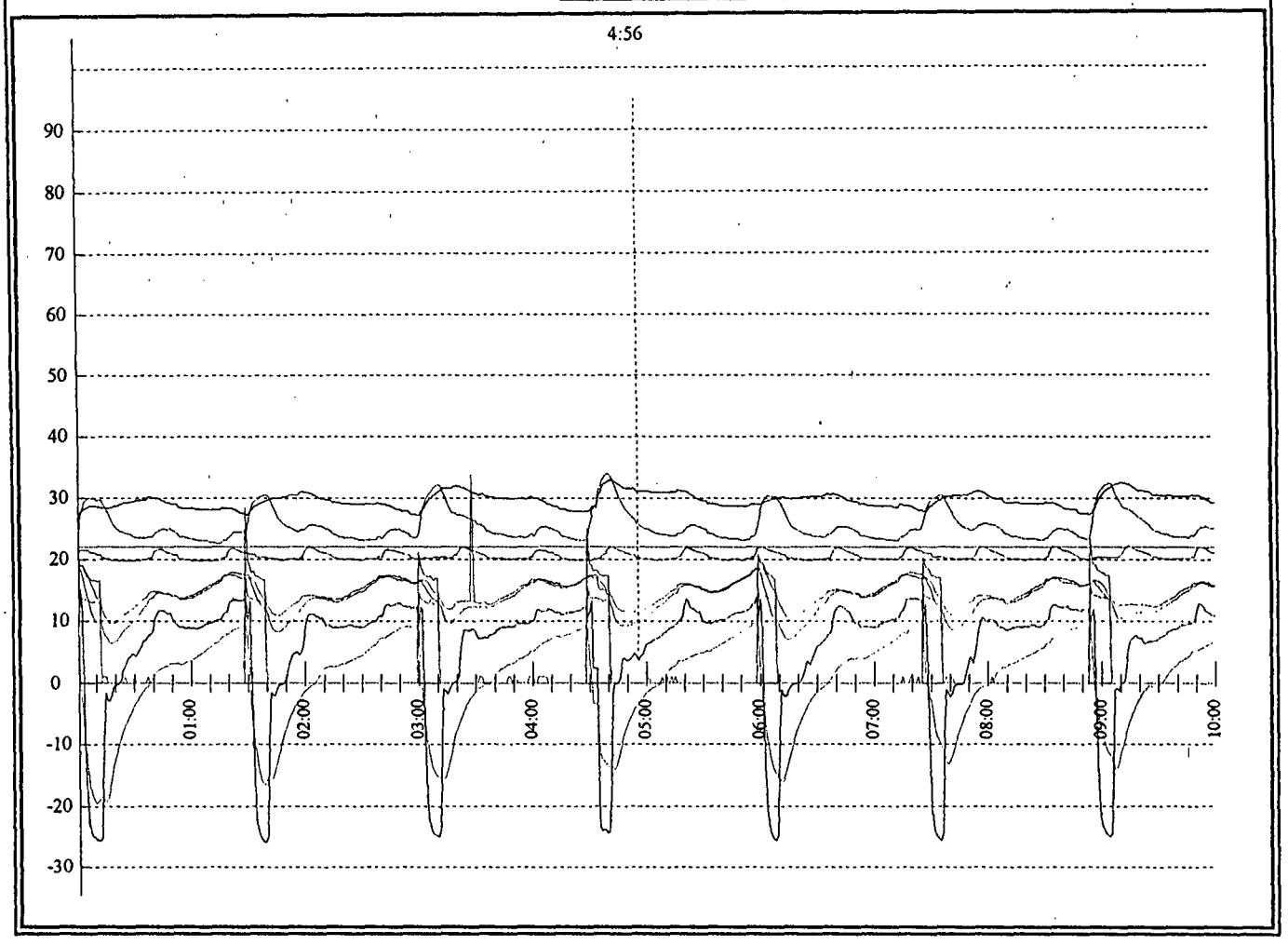
TestDate: 02/01/16 11:57 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2002/02/15 15:17

Page Result :

1 - Page Test Time	*10 Hours*
2 - Working Percent	*12 %On*
3 - Energy (Accord to page)	*0.446 kwh*
4 - Zoom Time	*4:56 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*19.8 C*
7 - Cabin Mean Temp	*13.7 C*
8 - Crisp Temp	*-3.3 C*
9 - Compr Temp	*31.1 C*
10- Condensor In Temp	*25.7 C*
11- Condensor Out Temp	*3.6 C*
12- Condition	*25.9 C 36 %H*
13- Volt	*Max=221 Mean=221 Min=221*
14-	
15-	
16-	
17-	





Industrial Control Research Center HotRoom Ver 5

Printing in Labaratory Of
Maurice Ind. [Jordan]

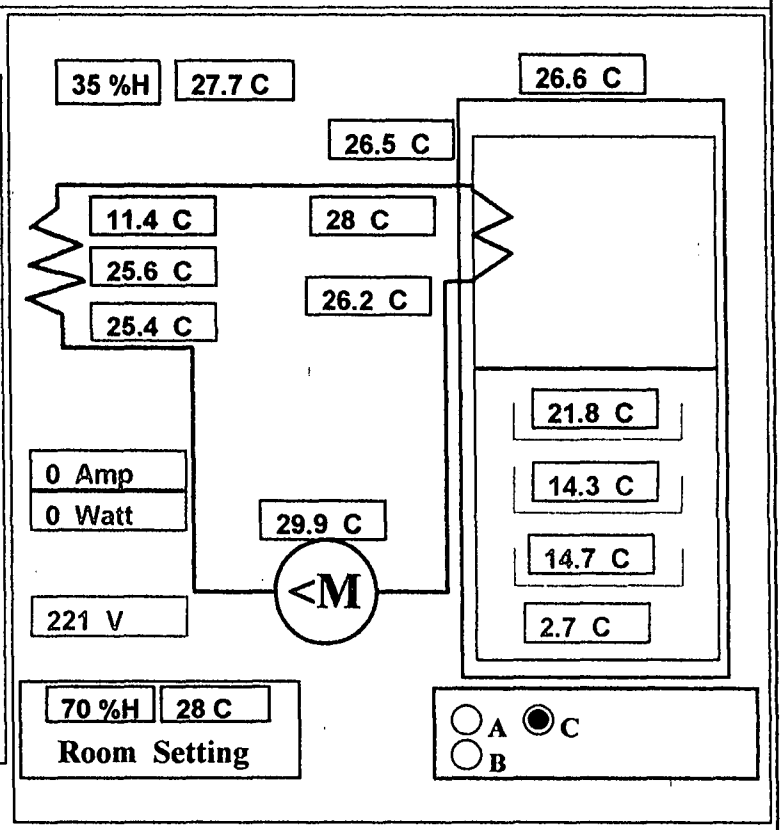
Maurice Ind. [Jordan]

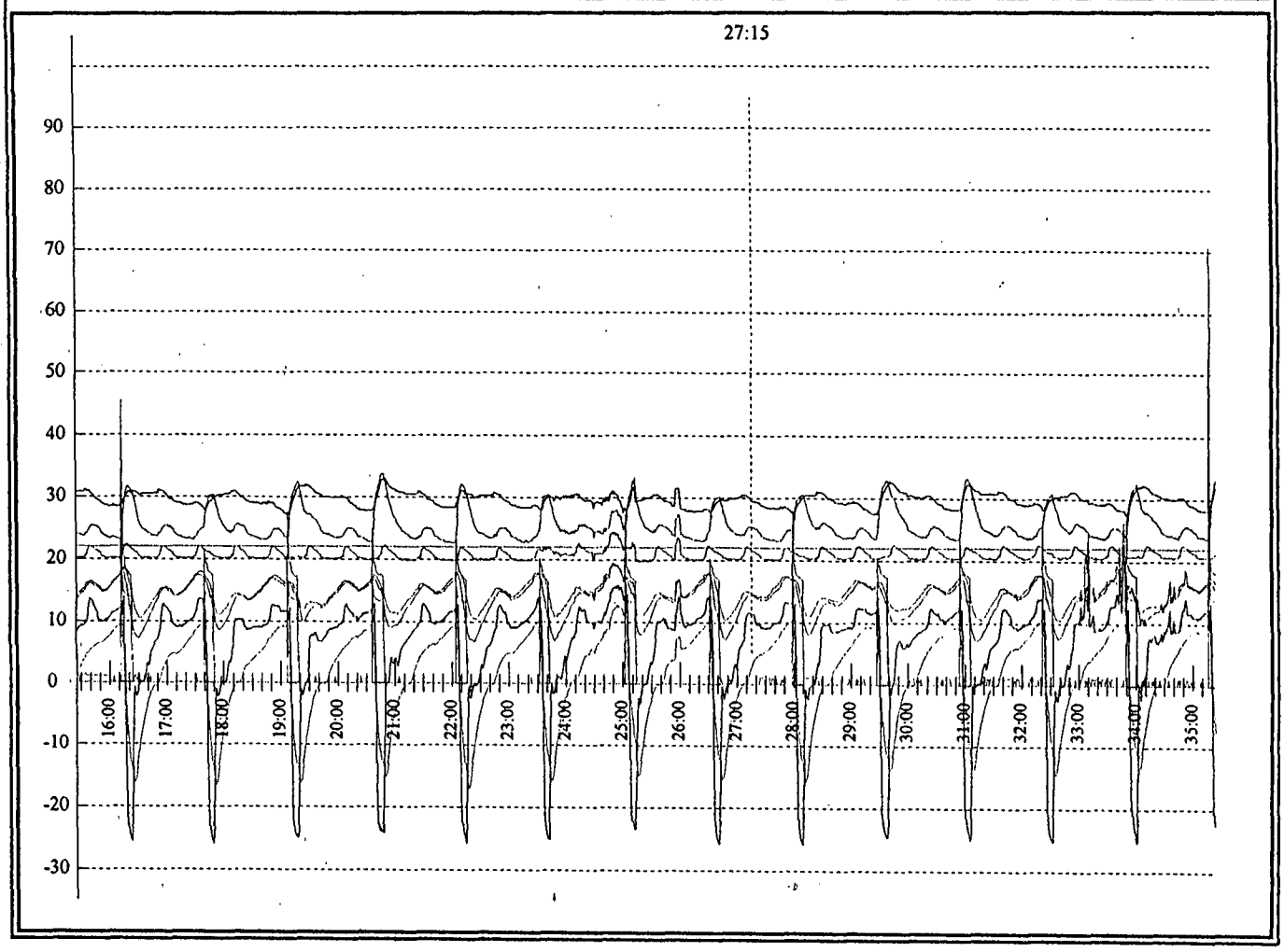
TestDate: 02/01/16 11:57 **Report No.:** ( ) - Page 1

PageTestName: Energy Consumtion **ReportDate:** 2002/02/15 15:19

Page Result :

1 - Page Test Time	*20 Hours*
2 - Working Percent	*12 %On*
3 - Energy (Accord to page)	*0.433 kwh*
4 - Zoom Time	*27:15 Hour*
5 - Compr Current	*00 Amp*
6 - Evaprator Mean Temp	*21.2 C*
7 - Cabin Mean Temp	*16.9 C*
8 - Crisp Temp	*2.7 C*
9 - Compr Temp	*29.9 C*
10- Condensor In Temp	*25.4 C*
11- Condensor Out Temp	*11.4 C*
12- Condition	*27.7 C 35 %H*
13- Volt	*Max=221 Mean=221 Min=221*
14-	
15-	
16-	
17-	





Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
Maurice Ind. [Jordan]

Maurice Ind. [Jordan]

TestDate: 01/11/08 17:40
TestName: Energy Consumtion

Report No.: Spec & Remark
ReportDate: 2002/02/15 15:47

Total Result :

1 - Total Test Time	*72 Hours*
2 - Working Percent	*85 %On*
3 - Energy	*0.963 kwh*
4 - Zoom Time	*70:47 Hour*
5 - Compr Current	*2.2 Amp*
6 - Evaprator Mean Temp	*-13 C*
7 - Cabin Mean Temp	*-13 C*
8 - Crisp Temp	*-12.9 C*
9 - Compr Temp	*74.9 C*
10- Condensor In Temp	*78.6 C*
11- Condensor Out Temp	*41.4 C*
12- Condition	*43.8 C 35 %H*
13- Volt	*Max=221 Mean=221 Min=221*
14-	
15-	
16-	
17-	

Product Spec :

1 - File Name		*01110817.k40*
2 - Test Kind	G	*Perform.*
3 - Product Serial		
4 - Product Name		*Chest Fre.*
5 - Product Model		*MAJ-210*
6 - Product Capacity		*500 Lit*
7 - Compressor Name		*Electrolux*
8 - Compressor Model		*GL90 AN*
9 - Compressor Power		*1/4 Hp*
10- Compressor Amper		*2*
11- Thermostat No.		*4*
12- Thermostat Type		*Ranco*
13-		
14-		

Technical Manager: *ICRC*

Lab Chief : *MARIO AL-DEEK*

Lab Specialist: *ZIAD*

Remark :

Remark1
Remark2
Remark3

Remark :

sign :

Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
Maurice Ind. [Jordan]

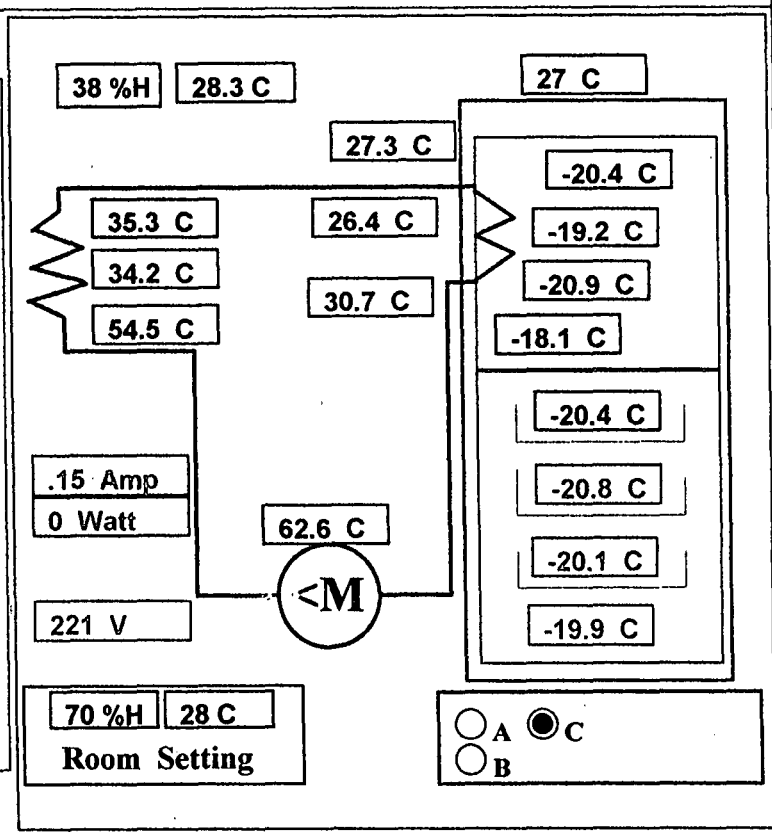
Maurice Ind. [Jordan]

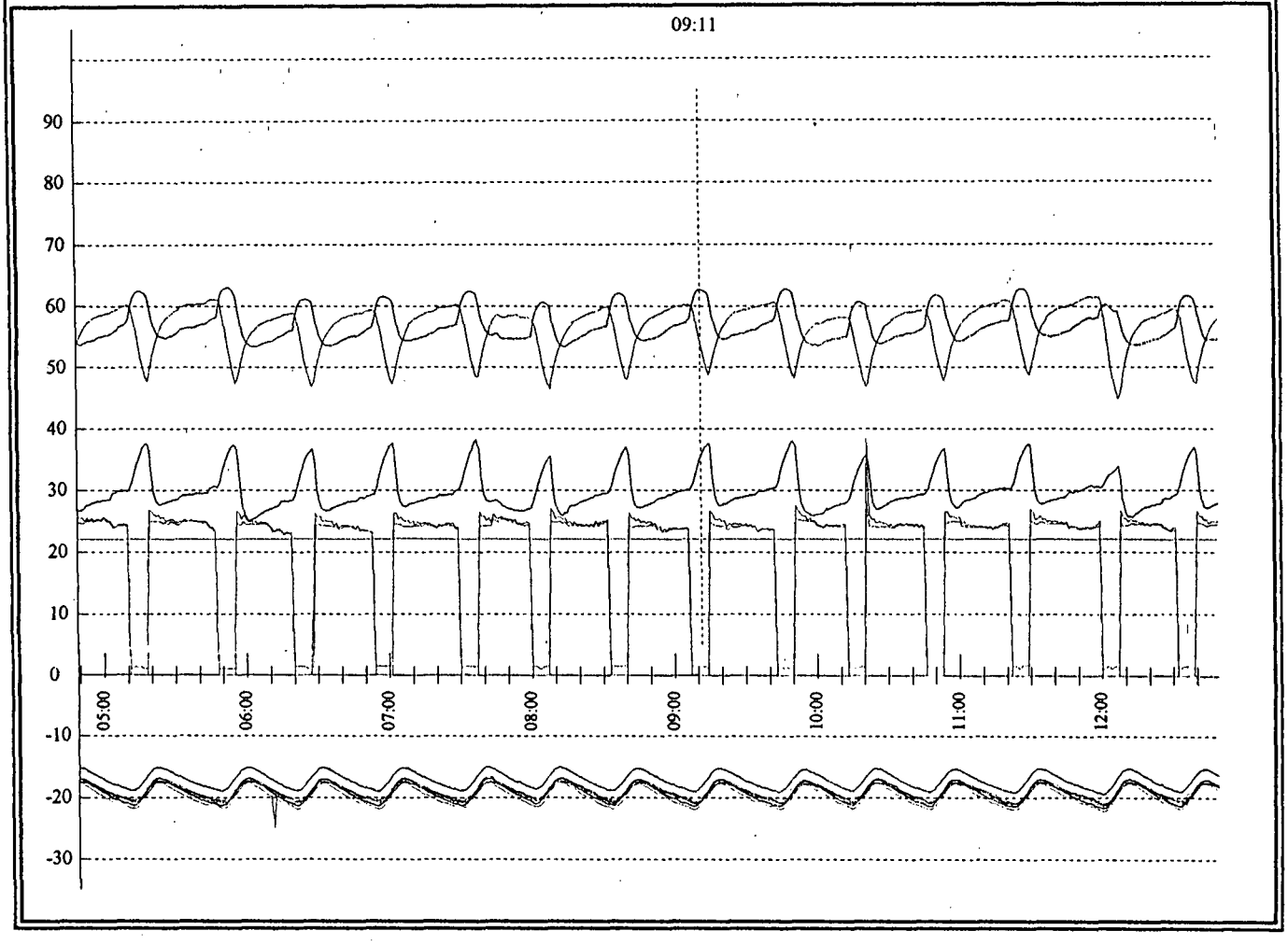
TestDate: 01/11/08 17:40 **Report No.:** ( ) - Page 1

PageTestName: Energy Consumtion **ReportDate:** 2002/02/15 15:47

Page Result :

1 - Page Test Time	72 Hours
2 - Working Percent	85 %On
3 - Energy (Accord to page)	0.963 kwh
4 - Zoom Time	70:47 Hour
5 - Compr Current	2.2 Amp
6 - Evaprator Mean Temp	-13 C
7 - Cabin Mean Temp	-13 C
8 - Crisp Temp	-12.9 C
9 - Compr Temp	74.9 C
10- Condensor In Temp	78.6 C
11- Condensor Out Temp	41.4 C
12- Condition	43.8 C 35 %H
13- Volt	Max=221 Mean=221 Min=221
14-	
15-	
16-	
17-	





Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
Maurice Ind. [Jordan]

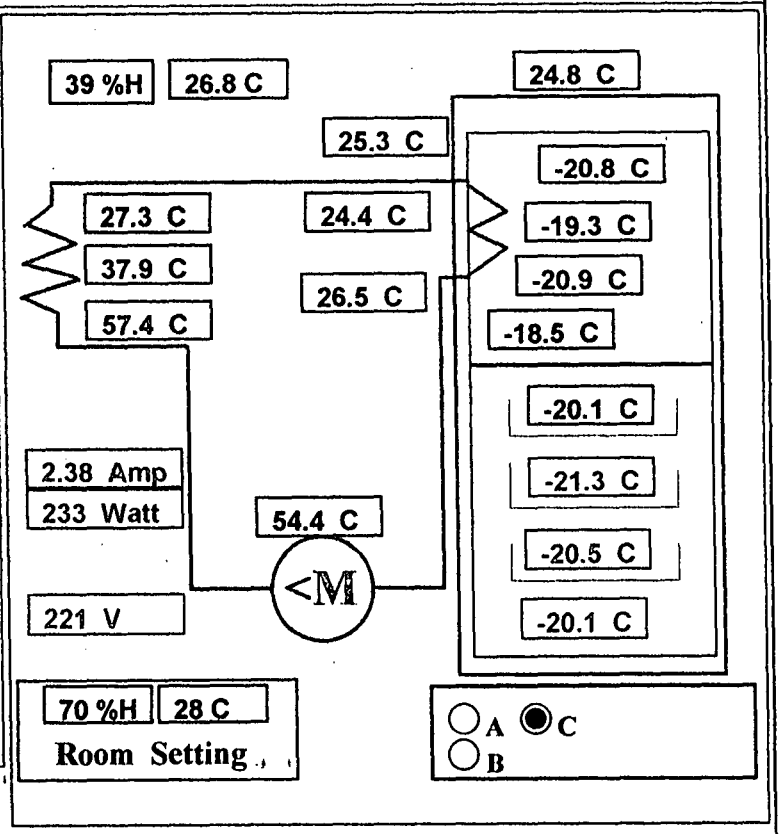
Maurice Ind. [Jordan]

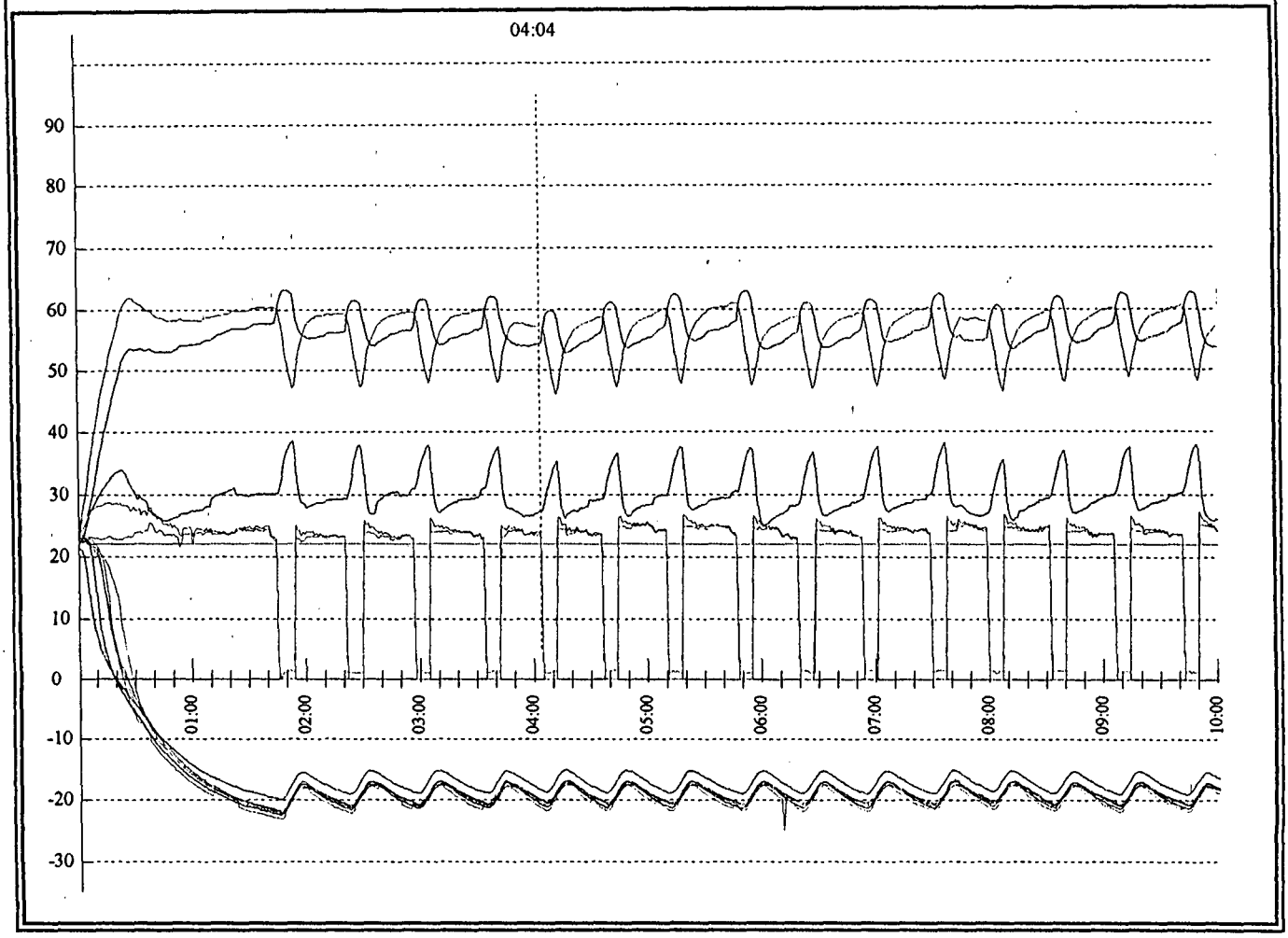
TestDate: 01/11/08 17:40 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2002/02/15 15:47

Page Result :

1 - Page Test Time	*10 Hours*
2 - Working Percent	*79 %On*
3 - Energy (Accord to page)	*1.045 kwh*
4 - Zoom Time	*4:04 Hour*
5 - Compr Current	*2.38 Amp*
6 - Evaprator Mean Temp	*-19.8 C*
7 - Cabin Mean Temp	*-20.6 C*
8 - Crisp Temp	*-20.1 C*
9 - Compr Temp	*54.4 C*
10- Condensor In Temp	*57.4 C*
11- Condensor Out Temp	*27.3 C*
12- Condition	*26.8 C 39 %H*
13- Volt	*Max=221 Mean=221 Min=221*
14-	
15-	
16-	
17-	





Industrial Control Research Center HotRoom Ver 5

Printing In Labaratory Of
Maurice Ind. [Jordan]

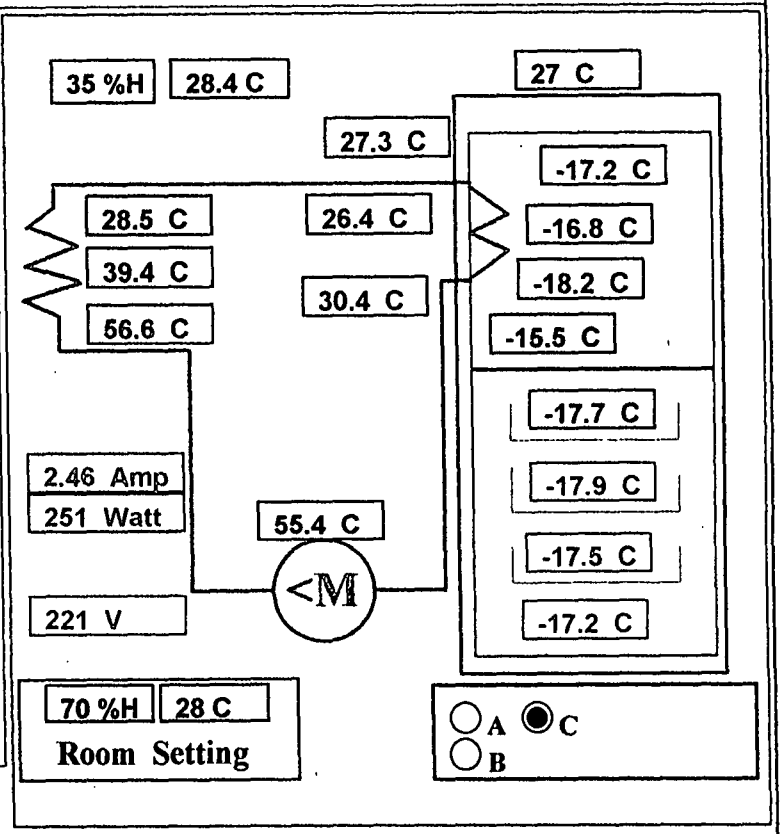
Maurice Ind. [Jordan]

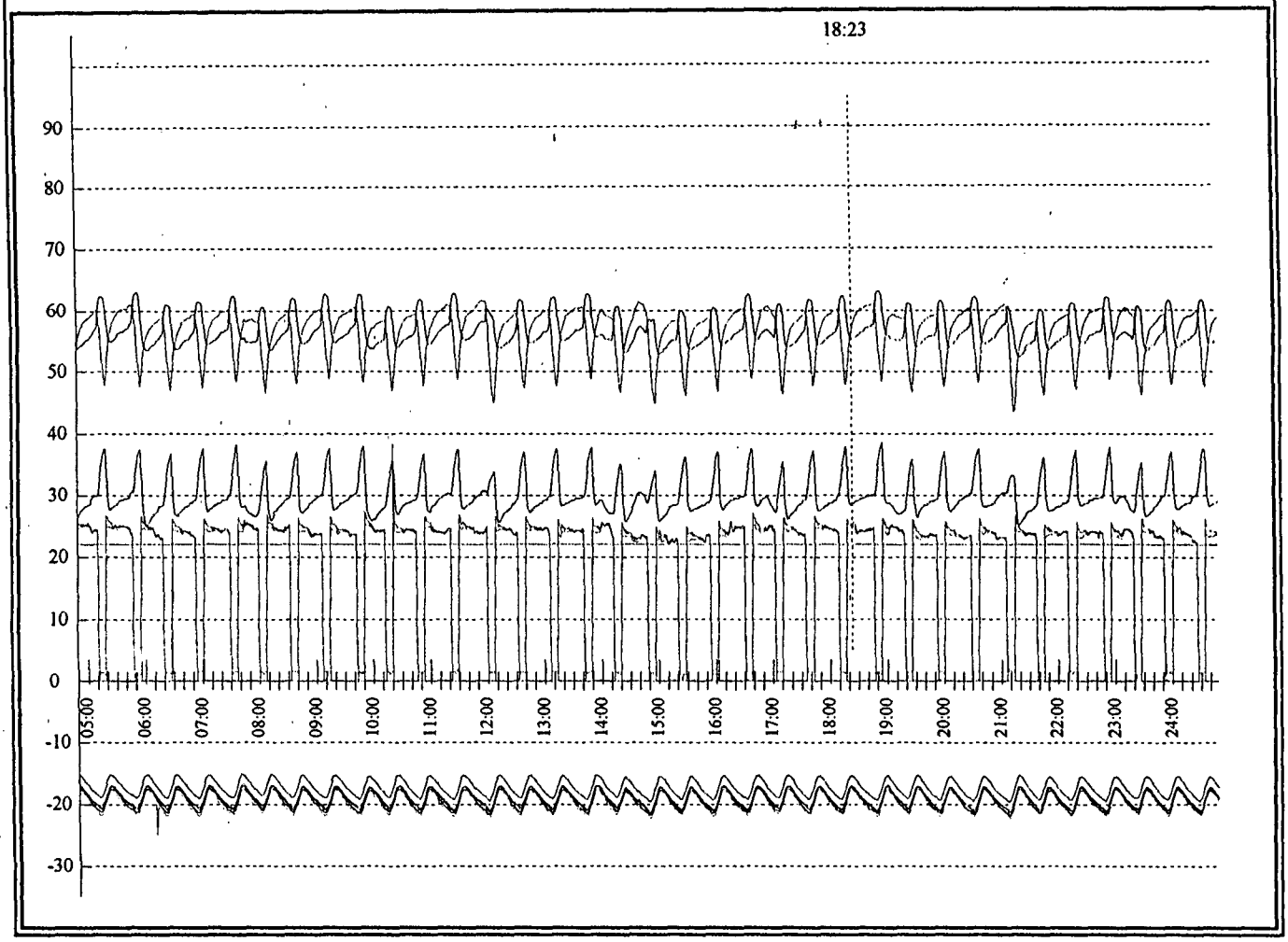
TestDate: 01/11/08 17:40 *Report No.:* ( ) - Page 1

PageTestName: Energy Consumtion *ReportDate:* 2002/02/15 15:48

Page Result :

1 - Page Test Time	*20 Hours*
2 - Working Percent	*76 %On*
3 - Energy (Accord to page)	*0.97 kwh*
4 - Zoom Time	*18:23 Hour*
5 - Compr Current	*2.46 Amp*
6 - Evaprator Mean Temp	*-16.9 C*
7 - Cabin Mean Temp	*-17.7 C*
8 - Crisp Temp	*-17.2 C*
9 - Compr Temp	*55.4 C*
10- Condensor In Temp	*56.6 C*
11- Condensor Out Temp	*28.5 C*
12- Condition	*28.4 C 35 %H*
13- Volt	*Max=221 Mean=221 Min=221*
14-	
15-	
16-	
17-	





Industrial Control Research Center HotRoom Ver 5