



TOGETHER
for a sustainable future

OCCASION

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



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

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

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

22588



AUSTIN LAZ & CO. LTD.

National Merit Award Winner for Engineering Designs & Fabrications

HEAD OFFICE:
No 136, 2nd East Cir. Road,
Benin City, Edo State.
Tel: 052 - 250026, 258811,
Fax: 052 - 258811
E-mail: austinlaz@yahoo.com

- * Air Conditioning
- * Refrigeration &
- * Electrical Engineering
- * Ice Block Machine Manufacturers

BRANCHES:
No 3, Layi-Oyekanmi Street, Shop 7, Karu Corner Shop
Off Isolo Road, Off Karu Market Road,
By Palm Avenue Junction Near Min. of Agric. Qtrs,
Mushin-Lagos Karu, Abuja.

NIGERIA'S PREMIER ICE PLANT MANUFACTURERS

Your Ref: _____

Your Ref: _____

Date: _____

6th September 2001

The Director,
FOA/FPC/GES, UNIDO,
P.O. Box 300,
A-1400 Vienna,
Austria.

RECEIVED
10 SEP 2001
Office of the Director
FOA/GES
ML
[Handwritten signature]

11/09/01

Sir,

SUBMISSION OF FINAL REPORT

We forward herewith our Final Report on the re-design and conversion of refrigeration circle of "AUSTIN LAZARUS ICE MACHINES" in Nigeria. This is vide Project No. MP/NIR/99/173 and contract No. 01/023.

Kind regards,

[Handwritten signature]
AUSTIN ASIMONYE
(Managing Director/CEO)

**PLEASE BE AWARE THAT
ALL OF THE MISSING PAGES IN THIS DOCUMENT
WERE ORIGINALLY BLANK**

TABLE OF CONTENTS

	PAGE
SYNOPSIS	1
INTRODUCTION	1
 <i>SECTION I</i>	
1.1 COMPACT MODELS	3
1.2 REASON FOR RESTRUCTURING	3
1.3 CONDENSER FEATURES OF THE NEWLY DESIGNED SYSTEM	3
1.4 CONDENSING UNITS FOR MODEL ALOO1410P, ALOO2410P & ALOO1420	4
1.5 CONDENSER COIL DRAWINGS	5
1.6 EXPANSION VALVE	5
1.7 INNER LINING	5
 <i>SECTION II</i>	
2.0 RESULT OF PRELIMINARY TESTS	6
2.1 CONDENSATION TEMPERATURE	6
2.2 REDUCED CONDENSATION TEMPERATURE	6
2.3 SPLIT CONDENSER	7
2.4 POOR VENTILATION DESIGN	7
2.5 SOLUTION TO THE PROBLEM	7
2.6 LEAKAGE PROBLEM	8
2.7 IMPROVED ICE HARVESTING TIME	8
 <i>SECTION III</i>	
3.0 TECHNICAL MODIFICATION	9
3.1 THE MANGEMENT OF HIGH CONDENSATION TEMPERATURE	9
3.2 IMPROVED AIR FLOW	9
3.3 SYSTEM CLEANNES	10

3.4	COMPRESSOR	10
3.5	PROPER VENTILATION OF WORKING ENVIRONMENT	10
4.1	FURTHER REPORT ON LEAKAGE PROBLEM WITHIN THE SYSTEM	10
5.1	ACCEPTABILITY OF THE NEW PRODUCT IN THE NIGERIAN MARKET	11
5.2	CUSTOMERS' FEEDBACK	12

SECTION IV

CONCLUSION

LIST OF APPENDIX

APPENDIX I

APPENDIX 11

FINAL REPORT

TO

**UNITED NATIONS INDUSTRIAL DEVELOPMENT
ORGANISATION (UNIDO)**

OF

VIENNA INTERNATIONAL CENTRE, WAGRAMER STRASS 5,
A-1400 VIENNA, AUSTRIA.

ON THE

**RE-DESIGN AND CONVERSION OF REFRIGERATION
CIRCLES OF AUSTIN LAZARUS ICE MACHINES**

IN

NIGERIA

BY

AUSTIN LAZ & CO. LTD.

OF

**136 2ND EAST CIRCULAR ROAD, BENIN CITY,
EDO STATE, NIGERIA.**

PHONE: 234-52-250026

FAX: 234-52-258811

6TH SEPTEMBER 2001

**PROJECT NO. MP/NIR/99/173
CONTRACT NO. 01/023**

SYNOPSIS

With reference to the contents of our earlier submitted Interim and Draft final reports, this Final report would do a concise co-ordination of the mentioned reports. It will also focus on the improvements of the re-designed models of "AUSTIN LAZARUS ICE MACHINES".

INTRODUCTION

In this Final Report, we will briefly state the level of our achievement of results since the redesign project took effect. A lot of successful efforts were put into the re-designing of 5 models of AUSTIN LAZARUS ICE MACHINES and the conversion of its refrigeration circle from CFC-12 to HFC-134a. As mentioned in our earlier reports, this exercise was carried out by an engineering team from our company. The team was led by our Managing Director (MR. A. L. ASIMONYE), who by his discipline is a refrigeration engineer. It is to be noted that the original design and development and production of AUSTIN LAZARUS ICE MACHINE was his own personal brain work and efforts, which earned him National Merit Award in his country Nigeria.

As stated in our Interim Report, the five models under discourse have been completely restructured and re-designed and thus have become the first Ozone friendly Ice Plant in Nigeria. The essence of this re-design exercise is to produce Ice making machines that Operate with Ozone friendly refrigerant, and at same time prove effective and efficient in its refrigeration output. It is also pertinent to state early enough in this report that the entire efforts of the engineering team handling this project has yielded tremendous good results.

The effort to improve on the design and structure of the condensing units that would enhance the condensation temperature of the new 134a refrigerant dramatically led us into changing the entire structural design of our compact models (ALOO143P and ALOO145P). The separate condensing units of the larger plants namely models ALOO1410P, ALOO2410P, ALOO1420P etc, are not left out as they have equally turned out to be esthetically outstanding alongside effectiveness and efficiency in its heat exchange performance.

SECTION I

1.0

WORK PERFORMED

COMPACT MODELS:

- 1.1 Our compact models, AL00143P and AL00145P have completely been re-designed structurally.

The picture of this new model has earlier been sent to Dr. Oshima, it is also enclosed in this report.

1.2 **REASON FOR RESTRUCTURING:**

Prior to the re-designing period, the condenser coil was placed horizontally at the bottom level of the condenser frame work. The gap between the floor and the condenser coil is about 150 mm. The condenser fan motor was mounted directly above the condenser coils thereby expelling the heat in an upward direction.

1.3 **CONDENSER FEATURES OF THE NEWLY DESIGNED SYSTEM**

- The condenser coil has been increased in capacity. The fin capacity has been increased, also the tube diameter has been increased from 3/8" to 1/2".
- The condenser coil attached with a fan coat is placed in a vertical position with a mounted fan. All of these with other condensing unit accessories and devices like the compressor, Liquid receiver pressure controls are carefully mounted on the condensing unit metal chassis/frame work.
- The condensing unit is neatly located at the down part of the brine tank, while the

brine tank itself which before now was mounted on a single straight line chassis with the condensing unit is now mounted directly on top of the condensing unit. The new design has a more compact structure. It has a single skeletal structure which has the brine tank at the top. The bottom side of the structure provides a wide empty space which now houses the condensing unit. The side where the condensing unit is placed is covered with fabricated metal vents designed to allow free cross ventilation.

This new arrangement exposes the condenser to a much better ventilation than the previous design.

This was prompted by the characteristics of the new refrigerant 134a which has a higher temperature. Therefore, in order to maintain a good condensation of the refrigerant there was need to improve the air flow arrangement as well as the size of the condenser. For better understanding, see diagram marked (APPENDIX 1).

1.4 CONDENSING UNITS FOR MODELS ALOO141OP, ALOO241OP AND ALOO142OP

These units are larger plants with detached condensers.

The changes:-

- The condenser coil capacities have been slightly increased to accommodate the higher temperature characteristics of R134a.
- In order to increase the volume of air-flow through the condenser coil, we decided to:
 - a Increase the height of the condensing unit stands (legs) from 230 mm to 760 mm.

By this, the space measurement between the floor and the condenser coil has greatly improved to allow a good deal of air flow through the condenser coil thereby making room for a better condensation of the hot gas.

1.5 CONDENSER COIL DRAWINGS:

This is marked APPENDIX 11. These drawings are the new condensers imported from LORDAN & CO. of ISRAEL. They are designed specifically for our five models of Ice makers under discourse.

1.6 EXPANSION VALVE:

The expansion valve of each of the units were changed to that marchable to R134a.

1.7 INNER LINING:

Our inner lining has remained metal as usual. The inner lining of our brine tanks has been metal and since metal has no negative reaction with the new foaming chemical agent, we have decided to go along with it.

SECTION II

2.0 RESULT OF PRELIMINARY TESTS:

The new design has been on test for about four months now. We have also moved the new product into the Nigerian market and this has enabled us receive valuable feedback on the performance of our new designs. Like we earlier mentioned in our re-design proposal, we started our re-design experiments since last year directly after Dr. Oshima's visit to our factory and the subsequent RE-DESIGN workshop organized for us in Lagos last August.

2.1 CONDENSATION TEMPERATURE:

At our first attempts, the condensing temperature was as high as between 50^{°c} - 53^{°c} despite the various steps undertaking to create improved condensation in the system as earlier stated. This prompted us into re-designing our condensers into higher capacities. These condensers were made for us to specifications by LORDAN & CO. of ISRAEL. See attached APPENDIX 11. The drawings for the five condensers.

2.2 REDUCED CONDENSATION TEMPERATURE:

With the new condenser coils, along with other measures undertaking to improve ventilation of the entire condensing units, we have been able to achieve condensation temperature of 41^{°c} - 43^{°c}. The difference in temperature is necessitated by the differing climatic temperature of Southern Nigeria and Northern Nigeria. Our machines which are bought and used in the North maintain higher condensation temperature than the ones working in the South.

2.3 SPLIT CONDENSER:

In view of the above, we are already fabricating separate split condensing units for our compact models (ALOO143P and ALOO145P) for sales orders from the far tropical North where the ambient temperature is as high as 38^{oC}.

2.4 POOR VENTILATION DESIGN

Within the past three months, we observed a constant problem of tripping compressors with models ALOO143P and ALOO145P. On proper investigation, we discovered that one of the condenser panels constituted a blockade to the air flow of the condenser fan. This caused a temperature build up within the enclosed condenser compartment which eventually trips off the compressor from time to time while on load.

2.5 SOLUTION TO THE PROBLEM

We have already changed the affected side blind panel to vent panel and this has since solved the said problem. Our technicians have also be instructed to change all such panels to vent panels during their routine maintenance visits.

2.6 LEAKAGE PROBLEM

We discovered there are more leakage problems in our plant using R134a. This results from the fact that the molecules of R134a is smaller than such gasses like R.12 and R.22.

2.7 IMPROVED ICE HARVESTING TIME

Our Ice plants have been able to achieve an improved freezing period from 10 hrs to 8 hrs. This is a resultant effect of our improved condensation temperature which increased the refrigeration effect in the cooling chamber/the brine tank.

SECTION 111

3.0 TECHNICAL MODIFICATIONS

The major technical modifications had been stated in our Interim Report. Being an existing machine, all that was our concern was how to get the refrigeration system/circle adapted to the characteristics of the new 134a refrigerant. The major changes were in the following areas:

3.1 THE MANAGEMENT OF HIGH CONDENSATION TEMPERATURE

The management of the high temperature effect of the new 134a refrigerant within the condenser region in a manner that the temperature would be reasonably brought low while maintaining a constant temperature.

The measure we adopted was to change our condenser totally from what is used to be to entirely new design. For details, we refer to sub paragraph 1.3 above. The condenser was produced to our specifications by Lordan of Israel. In our balance, we simply describe the condensers' temperature reduction capability as "Fantastic". Once again, we refer you to Appendix 11 for the technical drawing and details.

3.2 IMPROVED AIR FLOW

Improved Air Flow was another aspect. This was what led us into the re-designing and restructuring of the frame carcass of our compact models. For

details, we refer to sub paragraph 1.4 and appendix 1.

3.3 **SYSTEM CLEANNESS**

We have increased the effectiveness of our vacuuming techniques along with precautions and rules meant for achieving high system cleanliness suitable for the new refrigerant .

3.4 **COMPRESSOR**

We are presently using Copeland hermetic brand of compressors suitable for R134a

3.5 **PROPER VENTILATION OF WORKING ENVIRONMENT**

Our new factory which coincidentally was under construction as at the time the e-design project was going on has been provided with cross ventilated windows. This is to prevent high concentration of R134a in the air within the factory floor which could be fatally hazardous to human if inhaled in large dozes.

4.1 **FURTHER REPORT ON LEAKAGE PROBLEM WITHIN THE SYSTEM**

With reference to our earlier report in the Interim Report, we are delighted to report that we have recorded tremendous success in that aspect. The solution technique we adopted was simple.

Having identified the characteristics of the new refrigerant, we simply instructed our technicians in the Evaporator Fabrication Department, Condensing Unit

Assembling line and our Refrigeration Assembling department to handle the brazing of our copper tube joints more skillfully, by carefully and deliberately allowing the brazing silfos to form thicker membrane over and over while the silfos is in its liquid state while brazing tube joints. We make assurance double by seeing to it that each joint is satisfactorily brazed to the point that someone is satisfied even through eye gauge assessment that leakage at each joint is not feasible.

We equally hope that when the expected electronic leak detectors arrive, our effort would be further complemented.

5.1 ACCEPTABILITY OF THE NEW PRODUCT IN THE NIGERIAN MARKET

It is gladdening to state that our newly designed machines had been introduced into the Nigeria market since the first quarter of this year. With reference to our Interim Report, this quick achievement was possible because we started the re-design research since last year through the advice of Dr. Oshima, and directly after the re-design workshop organised by UNIDO in Lagos.

As at the end of the second quarter of this year, we had sold over 60 machines of the redesigned models. Right from the inception of its introduction into the market, we noticed customers increased appetite in demand because of its improved beauty and efficiency.

5.1 CUSTOMERS' FEEDBACK

At the first quarter of the year, we experienced increased number of customer complaints which of course got us worried and overworked. Frantic efforts were made to overcome the observed problems as stated in the Interim Report. During the second quarter of the year till date, we have observed a gradual disappearance of those early complaints. And we are glad that we have sailed through the redesigned difficulties successfully.

CONCLUSION

In our humble opinion, and particularly in appraising our customers' appealing feedback, we are compelled to consider the redesign exercise a success.

Through our effort to meet up with the demands of achieving the required objective of this project, we make bold to state that we have been able to produce latest compact model ice maker in our company. This of course has become the first Ozone friendly Ice making machine being successfully introduced into the Nigeria market through this redesign exercise which was carried out under UNIDO by AUSTIN LAZ Engineering Team.

We wish to assure you that we are not in the least static, by the grace of God, we shall remain innovative and dynamic towards the continuous improvement of our technology.

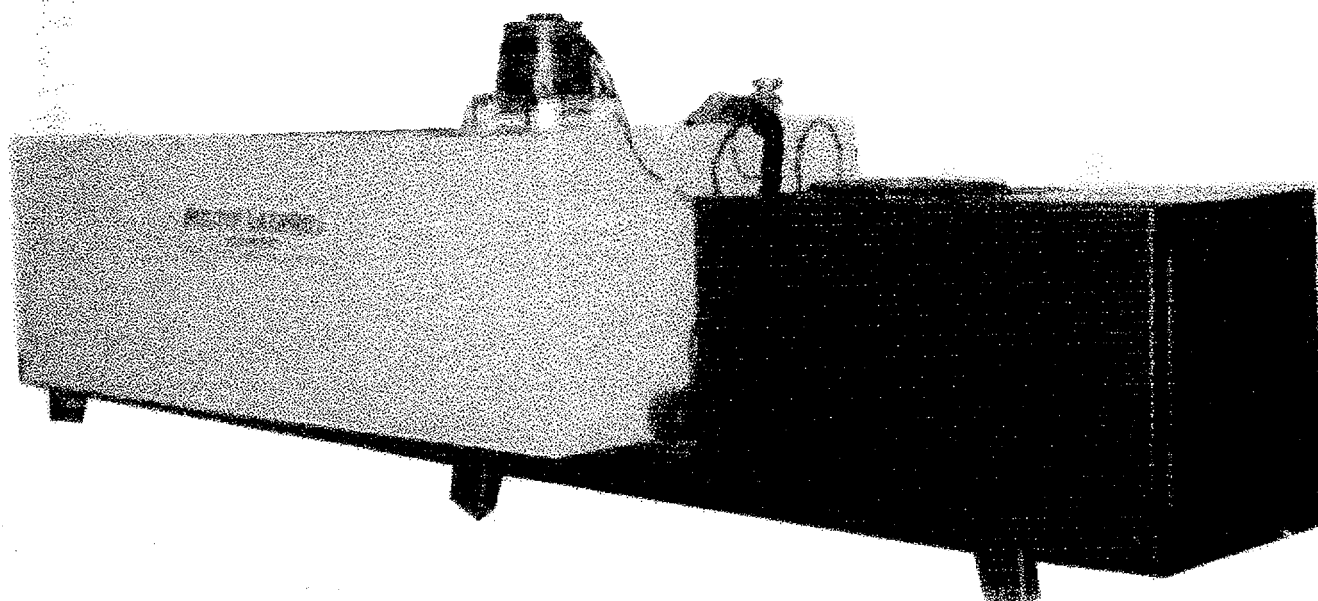
We are grateful to UNIDO for its assistance in many ways, and particularly for the opportunity given to us to carry out this redesign exercise by ourselves. It certainly posed before us positive challenges, which has at the end, helped us to gain tremendous improvement both on our skills and our machine.

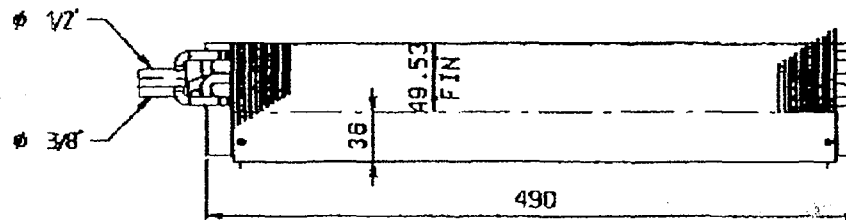
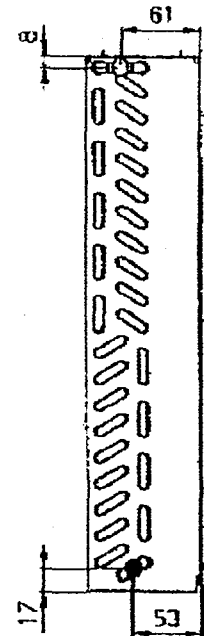
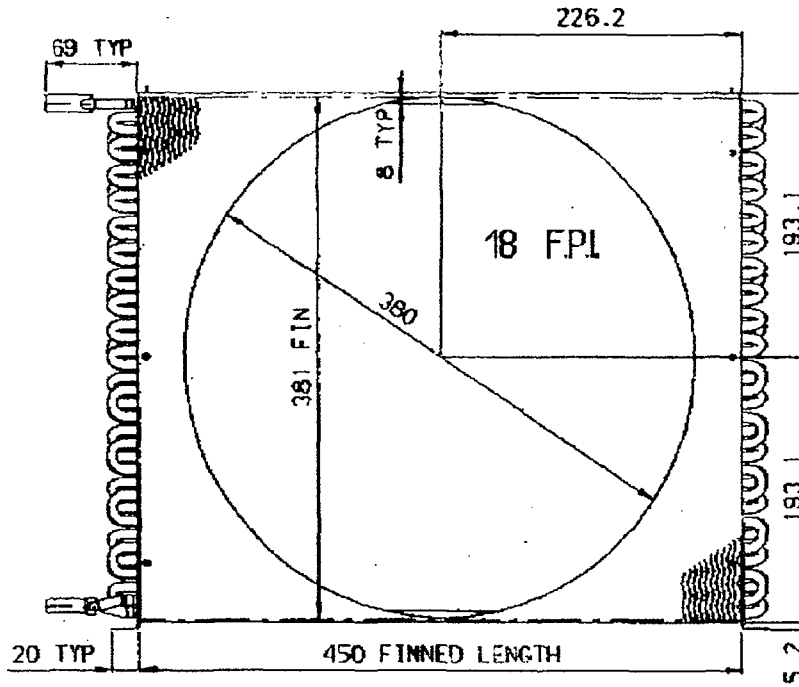
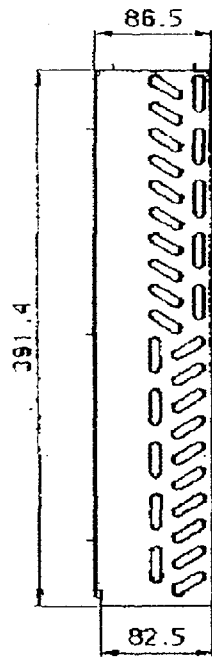
APPENDIX I

THE NEWLY REDESIGNED COMPACT MODELS AL00143P & AL00145P



THE OLD MODELS AL00143P & AL00145P





TOTAL WEIGHT=5.9 Kg
 CORRUGATED FIN.
 END PLATES 1.2 mm. GALV.
 FRONT PLATES 1.0 mm. GALV.
 TOLERANCES PER UNEN 1001

NO	REV.	BY

LORDAN & CO.
 Heat Transfer Equipment
 Customer Model No. AUSTIN LAZ 2 HP COND.

Description		Cat. No.		15/3x20x450/18-2101	
				8x5 UL30	
date	by	proj	scale		
draw	05-05-05	DPA			
check	6-06-07	gpc	UL30		
app			REV	A	

