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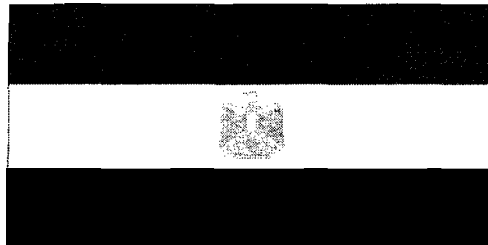
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INTERNATIONAL GROUP FOR CONSULTATION AND TRAINING

Final Report under the Contract with UNIDO for Part I No.16001460 and Amendment no.1 UNIDO Project MP/EGY/06/004 National CFCs Phase-out Plan Phase II

For provision of equipment, engineering services and technical assistance for conversion of selected groups of enterprises to non-CFC technologies as demonstration sub-projects in Egypt, (Part I)



January 2010
Cairo, Egypt

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- Annex 1 :
Ten (10) Copies of the final versions instructions and manuals.
 1. Booklet (conversion manual) retrofit of commercial refrigeration and installations
 2. Booklet (Training manual) refrigeration recovery and recycling
 3. Training manual on retrofitting and replacement of simple domestic and commercial refrigeration units
 4. Book (Training manual)of Retrofitting and Replacement of industrial and chillers refrigeration units and systems
 5. Book (manual) of modern technology for the maintenance of ref & AC units
- Annex 2 :
One (1) CD in Arabic containing all necessary recommendations drawings, technical specifications and instructions sufficient for a team of qualified technicians
- Annex 3 :
One (1) copy of CD in Arabic to be submitted to EEAA/ PMU for further reprinting and distribution

I. Introduction

From the initial contacts with PMU of EEAA, IGCT was aware that the main objective of the NPP is to phase out the remaining 217 tons of CFCs for the year 2007-2008 from refrigeration manufacturing and servicing sectors in most technically and commercially efficient manners, including strengthening of relevant legislative and policy measures and the public awareness.

Taking into consideration that all main project components are interrelated (procurement of equipment and engineering services, public and technical awareness program, training of technical, managerial, supervising and controlling personnel, strengthening of local management and monitoring of legislative control measures of ODS import and consumption etc.), the concepts, structures and contents of the awareness and training nature publications and other materials developed and produced by IGCT under the Contract have been thoroughly discussed with EEAA and PMU staff.

This contract is really considered a pilot model for introducing the replacement, retrofit and drop-in operations for the different industrial, commercial, and agricultural sectors in addition to service sectors of the country through provision of a package of technical assistance (engineering service, equipment, comprehensive, and consultancy and training services .disseminations of the achievements and good practice of CFC's replacements through the public and technical awareness activities)

In our final report, IGCT would like to thank all who worked on the success of this contract from EEAA- MSEA, participating parties and beneficiaries of the project whether governmental or nongovernmental entities for their sincere cooperation with the contractor and facilitating the implementation of the project. **Special thanks shall go to UNIDO for the great effort** in the preparation of the project documents which really needed thorough study of the needs of the ref.and A/C sector in Egypt including its different fields and sectors represented in the service sector (workshops), industrial companies sector, Agricultural companies sectors, Transportation sector (buses and railways).

II. All Activities Performed by IGCT during the Contract 2007-2010

In this part we are going to summarize all the reports previously submitted to UNIDO to clarify the positive and negative aspects that faced IGCT during the different stages of the contract implementation.

- A. Summary of Interim report
- B. Summary of Progress Report 1
- C. Summary of Revised Progress Report 2
- D. Summary of Revised Commissioning Report

A. Summary of Preliminary Report

Upon receipt of IGCT to the Fax on the contract award (Part I) from UNIDO, dated 8th of November 2007, the sub-contractor initiated the respective activities stipulated in the TOR.

Following the requirements of the TOR, several meetings were held between the team of PMU experts and IGCT representatives to discuss and elaborate the Plan of Action and various modalities of cooperation and coordination of the contract execution and reporting processes. In the course of the meetings the main following topics were discussed:

- The scope of supply of the contract was limited to Part I, the contract aimed at providing services for two main sectors:
 - a. Commercial Refrigeration Manufacturing and Services: Cluster A (group 1)
 - b. Industrial Chillers and Commercial Refrigeration: Cluster B (groups 2 to 6)

Therefore three different formats of technical agreements were prepared, one for each cluster in addition to a list of equipment that was provided for each beneficiary.

- Reviewing and updating the lists and baseline data of the parties selected by PMU as the beneficiaries of the contract and project.
- According to the NPP implementation concept and strategy, the objectives of CFC-12, CFC 502 CFC 11 replacement at the CFC users were achieved through provision of a package of technical assistance (engineering services, equipment, comprehensive consultancy and training services, dissemination of the achievements and good practice of CFCs replacements through the public and technical awareness activities) as well as using an incentives program.
- The baseline data of the NPP project document showed that a large amount of the remaining CFCs was consumed by commercial refrigeration and chillers sector which included various civil, industrial, commercial and transportation refrigeration and air conditioning units and systems.
- In order to achieve the main objectives of the NPP, the remaining CFCs users and enterprises were split into several most typical groups using key criteria and from each group several enterprises or chillers users/owners were selected for the provision of a package of equipment and services for conversion as the demonstration models.

The package of equipment and services included technical and commercial consultancy, mechanical and electrical engineering design services, supply of production, maintenance and servicing equipment, components and materials for retrofitting and drop-in replacement, supervision of installation and commissioning of new and retrofitted units, training of the personnel, elaboration of operational and maintenance manuals, etc.

The results and “good practice” of the conversion were disseminated among the concerned enterprises through the training programs and technical awareness activities that were organized and conducted by PMU and UNIDO separately.

Joint meeting between IGCT – PMU- National Consultants and Representatives of end users from group (1- 6) to review the sectors and beneficiaries participating in the project

According to the TOR requirements and recommendations the meetings was held at EEAA with participation of consultants who carried out the sectoral surveys in order to get IGCT introduced to the current operation and management practice of the sectors participating in the contract and the overall NPP.

Overview of the Scope of Supply and Services

According to the TOR the selected demonstration projects were split into the following Clusters

Part I	Name of end user (groups)	Phase out concept	End users
Cluster A	Group 1	• Commercial refrigeration manufacturing and maintenance	Provision of equipment and materials 253 enterprises
	Group 2	• Al Obour Market • Egyptian for cold storage	Replacement 2 unit 3unit
Cluster B	Group 3	• Helal & Negma co.	Replacement 1unit
	Group 4	• El Gohary for Metal co.	Replacement 1unit
		• Chloride Misr co.	Replacement 1unit
		• El Alamia for Refrigerators Production co.	Replacement 1unit
		• Egyptian Spanish for Metal co.	Replacement 1unit
	• Power SMC co.	Replacement 1unit	
Group 5	• Technogreen co.	Replacement 5 unit	
Group 6 ¹	• Al Obour Market (60 COMPANIES)	Retrofit 60 unit	

The interim report summarized the achievement of the following tasks

- Signing the “Agreements” by the beneficiaries and PMU (copies of the Agreements were given to IGCT and used in the preparation of respective work programmes and schedules); preparation and submission the Interim Report for Part I to UNIDO.
- Establishing the project work plan which was implemented successfully with exception of group 6 of Part I (a report on the reasons justifying the incompleteness of group 6 attached to the commissioning report).

¹ Group 6 was omitted of the contract due to some obstacles and difficulties in implementation, IGCT had submitted a report on this issue to UNIDO and the relevant fund was deducted from the payments upon mutual agreement of the parties.

B. Summary of Progress Report 1

The Progress Report 1 was submitted after fulfilling the following terms and conditions of the contract:

- Elaboration by PMU and IGCT (with participation of representatives of the major groups of the beneficiaries) the Plan of action of the Part I and Part II execution, including clear definition of the responsibilities of the parties concerned.
- Elaboration of the models of individual or group "Agreements" between the project beneficiaries and PMU on behalf of EEAA on provision of facilities, utilities, materials and tools (if not included in the scope of the contractor supply), manpower and other supports to replace CFC under supervision of IGCT experts as the prerequisite for receiving of the technical and financial assistance;
- Preparation of the detail lists and specifications of all equipment, components, materials, spare parts, instrumentation, tools and consumables procured from local and international markets.
- All information was prepared separately for each beneficiary of clusters A and B included in the Part I as follows:
 1. Commercial refrigeration manufacturing and maintenance (group 1)
 2. Industrial chillers and commercial refrigeration (group 2-6)
- Preparation of a list of manufacturers and suppliers of the above equipment and materials contacted by the sub-contractor:
 - a. PU foaming units
 - b. R&R, charging units and other equipment for refrigerators manufacturing, maintenance and servicing
 - c. New compressors, components and spare parts for replacement and retrofitting of selected industrial and commercial chillers and transportation air conditioning systems
 - d. Alternative refrigerants and compressor oils
- Preparation of priority list for procurement, delivery, distribution and installation/commissioning of the equipment and materials among the end users included in the respective sub-contracts and purchase orders
- Preparation of the detail scope of the engineering services to be delivered for each group and reflecting specific features and technologies applied for the conversion

At the office of the contractor

- Elaborated in detail the specifications and procurement of equipment, components and materials;
- Elaborated technical (including computer optimization of cooling and energy consumption parameters) and commercial options of replacement or retrofitting of CFC based systems to alternative refrigerants.

At the project premises

- Selection of the final conversion option in consultation with the client;
- Advising on the preparatory works for conversion;
- CFC-12 recovery using equipment of IGCT or the clients;
- Supervision and assistance of CFC based system dismantling process;
- Supervision and training of new oil and R-134a charging;
- Supervision of installation, commissioning of new systems;
- Test run; conversion certification (including signing the Service acceptance protocol).
- Elaboration of the templates (or outlines) of the "conversion guidance (or instructions/ manuals)" used further by the sub-contractor in the preparation of the documents as requested by the TOR.

This activity included provision (licensed by IGCT) of a software tool for computer design and optimization of cooling and energy consumption parameters of the conversion processes as the technical options and commercial options of replacement or retrofitting of CFC based systems to alternative refrigerants:

Brief characteristic of the software

1. The software tool is “easy” in use and understanding
2. The software tool covers Arabic and English languages
3. Calculation and designing software for refrigeration and air-conditioning applications (existing and intended) e.g. retrofit calculation
4. The software tool consists of the databases like copper-tubing dimensions, all important refrigerants, components (compressors, evaporators, filter-drier, solenoid-valves, etc.)
5. The software tool makes all important calculations in the field of refrigeration and air conditioning quickly, efficiently and accurately including calculation and comparison of energy efficiency and CO₂ consumption for “single-stage” applications.
6. Verification possibilities and control measures for system components, pipe-work, insulation, application load, air-flow, etc.)
7. The selection of all necessary refrigerant transfer tubes is done by the software.
8. Changes in the dimensions of the tubes can be calculated immediately, and the influence on the main properties like filling amount, discharge temperature, necessary displacement of the compressor or total capacity are displayed.
9. The tool creates part lists, (graphics), print outs and the export-possibilities are easing the necessary documentation in the company.

Progress Report 1 summarized the achievement of the following tasks

- Preparation of the detail lists and specifications of all equipment, components, materials, spare parts, instrumentation, tools and consumables procured from local and international markets. This information was prepared separately for each beneficiary group included in Part I.
- Preparation of a list of potential manufacturers and suppliers of the above contacted by the sub-contractor.
- Preparation of priority list for procurement, delivery, distribution and installation/commissioning of the equipment and materials among the end users included in the respective sub-contracts and purchase orders
- Preparation of the program of the engineering services delivered for each group and reflecting specific features and technologies applied for the conversion.
- Elaboration of the templates (or outlines) of the “conversion guidance (or instructions/manuals)” used by the sub-contractor for preparation of the documents as requested by the TOR.

C. Summary of Progress Report 2

The Revised Progress Report 2 presented the volume of the tasks achieved or not achieved (referring to group 6 of Part I- Obour Market) along with the justifications clarifying the obstacles that hindered the implementation in the project site.

Progress Report 2 summarized achievements of the following tasks:

Follow up to the contract activities, described and summarized in Progress Report 1, Progress Report 2 was prepared in accordance with the respective requirements of chapter 4, item 1.8 of the Terms of Reference of the contract No. 16001460.

Summary of Procurement Process

Upon acceptance and approval by UNIDO to Progress report 1, the relevant requests for quotations were distributed. *Techno-commercial evaluation of quotations and selection* was conducted following the main principle of "technical acceptability and lowest cost". The summary list of the selected equipment, components, spare parts and materials was presented in part 1 of the Received Progress Report

Summary of Delivery and Distribution

The consignments were delivered to the warehouse of IGCT for grouping and distribution in accordance to the respective lists for the individual end users of each group (see Progress Report 1).

Most of the end users included in the "incentives" sub-groups A, B and C of cluster A collected their sets of servicing tools and materials directly from IGCT.

The equipment, materials and tools for Cluster B clients were delivered by IGCT and distributed to the beneficiaries' project sites.

The delivery and acceptance of received consignments by the end users were properly registered and reflected in the respective Rosters, presented in Part 2 of this report.

NOTE : Upon the recommendations of the National Project Coordinator and the Chief Executive Officer of the EEAA, all the delivery and distribution activities were carried out under the supervision of the representatives of EEAA Committee consisting of the PMU Staff and a supervisor from Central Financial, Administrative and Legal Department of EEAA in cooperation with IGCT .

In the context of individual Technical Agreements between EEAA and the selected beneficiaries of the Demonstration contract, the end users are responsible for proper storage of collected or delivered equipment and materials at their premises. The end users are aware that the delivered equipment and materials are property of UNIDO until completion of the respective formal transfer arrangements from UNIDO to the Government of Egypt and then to the end users.

Further and as follow up to the contract execution activities described in the Progress report 1 all equipment, refrigeration units and components, instrumentation and materials have been purchased in accordance to the approved by UNIDO final lists and technical specifications.

This part of the Report presents the list and brief specification of purchased goods indicating the names of original manufacturers and suppliers.

This part of the Report described the main details and methodology of IGCT preparations for subsequent delivery of engineering, technical services, training of technicians during installation and commissioning of the delivered equipment.

A special attention was given to the adaptation of the computer simulation and optimization program (purchased and licensed by IGCT from Mergl, Germany)

Rosters of delivery of equipment and materials to the project sites (client premises), upon the recommendations of the National Project Coordinator and the Chief Executive Officer of the EEAA, all the delivery and distribution activities were carried out under the supervision of the representatives of EEAA Committee consisting of the PMU Staff and a supervisor from Central Financial, Administrative and Legal Department of EEAA in cooperation with IGCT.

Copies of Rosters of Equipment Delivery and Distribution the records on delivery and distribution of purchased equipment among the selected contract clients (end users) of groups 1-5 of clusters A and B were summarized in the respective Rosters duly signed/certified by IGCT and the recipients.

Equipment and materials of group 6 were not delivered because of the obstacles that hindered the implementation process concerning this group. (Justification in the technical report attached)

D. Summary of Commissioning Report

Summary of conversion process for manufacturing CFC based commercial refrigeration units (Cluster A, (group 1, sub-sectors A, B and C)see TOR

In accordance with the general and specific requirements and conditions of the TOR and Contract, the clients were aware of their responsibilities related to the conversion process as per relevant formal Technical Agreements with EEAA.

Therefore the technicians of IGCT visited the sites to verify that they were prepared for the conversion programme.

During the pre-conversion and verification visits the clients were recommended about the technology options, the delivered and available PU foams processing equipment (including fixtures, presses, chemical storage and transfer facilities) that were inspected, chemical and other materials, utilities, qualified technicians, tools and instrumentation, etc. were checked.

In the course of subsequent visits IGCT technical staff provided assistance and supervision on dismantling/disassembling of relevant units and systems that were going to be retrofitted/converted, installation of delivered equipment and practical introduction of the selected alternative foaming technology, test run of the foaming equipment, visual and other express tests/check the quality of the final products.

The formal acceptance of the delivered services by IGCT was reflected in the respective "Certificates of acceptance" duly signed by the clients and IGCT and cleared by representative of EEAA/PMU.

For visual presentation of the commissioning process of services of IGCT (retrofitting, drop in using alternative refrigerants, replacement of the certain components, training and technical assistance, etc.) provided for Cluster A, (group 1, sub-sectors A, B and C, digital photos attached to progress report 2)

Summary of retrofitting and drop-in process of industrial chillers and commercial refrigeration (Cluster B except for group 6) , see TOR

Similar to the procedure described above, during the pre-conversion and verification visits the clients were recommended about the alternative refrigerants options, the delivered and available equipment and components inspected, availability of chemical and other materials, utilities, qualified technicians, tools and instrumentation, etc. were assessed.

A special attention was given to application of the computer simulation and optimization programme (purchased and licensed by IGCT from Mergl, Germany) bearing in mind the relevant challenging matters pointed out in "Introduction" above.

Subsequent scheduled visits for provision of assistance and supervision of dismantling/ disassembling of relevant units and systems retrofitted/converted, installation of delivered equipment, re-assembling the converted systems and units and practical introduction of the selected alternative refrigerants, test run of the retrofitted equipment including check of stability operation.

The formal acceptance of the delivered services by IGCT was reflected in the respective "Certificates of acceptance" duly signed by the clients and IGCT and cleared by representative of EEAA/PMU.

For visual presentation of the commissioning process of services of IGCT (retrofitting, drop in using alternative refrigerants, replacement of the certain components, training and technical assistance, etc.) provided for Cluster B, digital photos attached.

A committee consisting of representatives from UNIDO and EEAA was formed to ensure that all the contract works and requirements were met and implemented and to ensure that all the equipment, materials and engineering services were delivered and provided for the beneficiaries of Part I of the contract, with exception to group 6, it was agreed with UNIDO and IGCT that the relevant amount allocated to group 6 will be deducted from the total budget of the contract.

III. Problems & Lessons learned from Part I Cluster A- Group 1 (Sub groups a, b & c)

A. Problems encountered during the selection stage of the small workshops

1. About 80% of the small maintenance workshops are not commercially registered and do not have any tax ID.
2. At the very beginning the workshops refused totally to cooperate with us thinking that we are representing a governmental or Tax agency.
3. These small workshops are located in very small shops and not equipped with any kind of modern tools, equipment or even safety means, they just rely on a motorcycle or portable tools kit to provide their maintenance services using very primitive methods.
4. Most of the technicians in these workshops are not qualified and many of them are illiterate and practicing the profession by observation.
5. Nobody at the beginning believed the concept of the project as it was the first time for them to receive such assistance or subsidy.
6. There was a great difficulty in gathering all these workshops (253 workshops) under one objective due to the geographical diversity of their locations all over Egypt in addition to that most of the owners do not have an idea about the depletion of the ozone layer.

B. Problems encountered during distribution of equipment

1. In the first day of equipment distribution only 30% of the workshops representatives were present, as the rest thought the whole matter is not real. Later after all the workshops gained confidence in the reality of the project and were sure that the distribution of equipment is free and void of any governmental complexes, they came to receive their equipment and tools.
2. There was another difficulty in convincing the workshops owners/ representatives to sign the delivery notes and the certificates of acceptance.
3. Some of the workshops requested delivering the equipment to the location of the workshop, which was totally unreasonable request.
4. Many of the owners/ representatives insisted on opening the equipment and operating it on delivery which caused many delays in the distribution process.
5. When all the news of the technical assistance and equipment provided to the beneficiaries prevailed in the field, the rest of the workshops (those which were not included in the project) submitted urgent requests (including their tax Id and commercial registry) to provide them with similar technical assistance and equipment.

C. Problems encountered during training

1. The technicians are not convinced with the concept of being trained, as they have not been ever trained before.
2. Due to the wide geographical diversity, it was very difficult to gather all the technicians in one place, therefore the training was held in each government separately.
3. There was difficulty in finding a training center in each governorate.
4. We faced in many cases different technical and mental levels in a single training course which required dividing the trainees in each training course according to their technical and mental qualifications (the trainees ranged from Engineers to illiterate technicians).
5. There must have been an awareness campaign launched in order to raise the awareness of the technicians about the concept and the objectives of the project.
6. In order for the training to succeed and be effective it must be repeated more than once.
7. Sometimes the training took place during the summer season which has lead to low percentage of attendance.
8. There was a suggestion of establishing one main training center which will overcome many of the above difficulties and problems.

D. Lessons learned

1. The training course introduced the technicians to:
 - The importance of the ozone layer and how to preserve it through using ozone friendly substances.
 - The importance of using R&R equipment for its positive technical and economical influence.
 - The technical methods of using the alternatives (whether gaseous or liquefied) through advanced Charging Boards.
 - Carrying out the retrofit process for the domestic refrigeration units:
 - Refrigerator
 - Water Cooler
 - Refrigeration or freezing chamber (cold storage)
 - Air conditioner

- The training course included distribution of guidebooks and brochures about the modern technology of maintenance and servicing of refrigeration and air conditioning units.
 - An agreement contract was signed between IGCT and the General Union of the refrigeration and A/C centers in Egypt on providing technical assistance concerning the introduction of the modern technology of maintenance and servicing of the refrigeration and air conditioning units. In addition to holding free training programs for these workshops on monthly basis provided that the member centers in the general Union buy their requirements of materials and spare parts from IGCT.
 - The workshops of manufacturing simple refrigeration units (not less than 150 unauthorized manufacturing workshops) used to follow very primitive foam insulation operations (see the photos in the album), these primitive operations consumes huge amounts of foam (about 25 tons) and does not follow the percentages of mixing it all depends on mere estimations.
 - After the provision of the (LP) foaming unit to 13 workshops, here was the surprise, most of the workshops agreed with the manufacturing company of the unit to manufacture additional units for them. The price of the local unit is about US\$ 6,000 in comparison with the imported unit of US\$ 25,000 not including any shipment cost or taxes or customs fees. The technicians were trained on the machine, its specifications, its way of operation and applications and the percentages of mixing.
 - Maintaining frequent and continuous contacts with the beneficiaries of the project and paying them field visits in order to follow-up the technical progress achieved using the modern equipment.
 - Each technician who was trained is considered as a model to be followed by other neighboring technicians.
 - Frequent follow-up will minimize any negative impacts or misuse of the provided equipment.
2. The great success that was achieved through convincing many technicians of the importance of using ozone friendly refrigerants and equipment proves the necessity to enlarge the base of the future beneficiaries of such projects in order to be more comprehensive for the ref. and A/C sector in Egypt.

IV. Cluster B- Groups (2-5) – Industrial Companies

A. Problems encountered during the retrofit and replacement operations in the industrial companies

1. Unwillingness of the Management of the company/ factory to carry out the retrofit/ replacement operations from CFCs to HFCs in order not to hinder the production process.
2. Lack of technical information provided from the technicians in the factory about the dates and methods of the periodical maintenance of the units.
3. Unwillingness of the technicians to cooperate or provide any technical assistance, tools or materials during the retrofit/ replacement processes.
4. The poor technical experience of the technicians hindered their understanding to the importance of carrying out the replacement/ retrofit processes.
5. Most of the technicians are not specialized in the refrigeration and A/C field their field of specialization is power or mechanics.
6. Most of the units that were replaced had severe technical breakdowns which in turn lead to low production in the production lines.

7. The difficulty of convincing the Management of companies and/ or factories to sign up the delivery notes and the certificates of acceptance.
8. The request of the owners of companies and/ or factories to cover the delivery of the equipment, tools and materials during the retrofit/ replacement operations by the budget of the project without providing any financial assistance concerning the transportation costs.

B. Lessons learned from the retrofit and replacement operations in the industrial companies

1. The replacement/ retrofit operations were carried out without hindering most of the production lines.
2. IGCT held quick training courses to the specialized and non-specialized technicians before and during the retrofit/ replacement operations in coordination with the Management of the companies.
3. The attention of the industrial companies and factories was drawn to the necessity of replacing the CFC-based units by HFC-based units especially after HFCs proved high efficiency in the pilot models concerning cooling temperature, energy saving and water saving in the processes of industrial cooling.
4. Technical and financial assistance were provided to the companies in addition to maintaining continuous contact with their technicians to provide them with booklets, brochures, and printed materials illustrating the importance of conversion for CFCs to HFCs and the methodology of applying this conversion on the different models of industrial refrigeration units in addition to providing technical consultations for a year after the date of replacement/ retrofit.

**V. Summary of the Activities Performed by IGCT Part I (groups 1- 5)
In accordance with the terms final report**

IGCT performed the relevant activities that in summary are presented in this Final Report.

a. Ten (10) Copies of the final versions instructions and manuals

The training manuals and guidebooks introduced the methodology of applying many operations that were carried out during the implementation of the contract and which should be carried out during maintenance operations, the operations are:

Booklet retrofit of commercial refrigeration and installations

1. This part includes thorough explanation to the technical steps that should be followed during the operation of replacing the refrigerant R-12 by R-134a for a domestic refrigerator
2. This part includes thorough explanation to the technical steps that should be followed during the operation of replacing CFCs by HFCs in a cooling chamber
3. This part includes thorough explanation to the technical steps that should be followed during the operation of replacing CFC-12 by HFC-407c for a domestic A/C unit
4. Flushing the system prior to charging and vacuuming operation

Book of Retrofit and Replacement of industrial and chillers refrigeration units and systems

This part provides thorough explanation about the optimum methodology of replacement and retrofit of the industrial chillers system from CFCs to HFCs.

Training manual on retrofitting and replacement of simple domestic and commercial refrigeration units

This part provides thorough explanation on the methodology of using conversion and retrofits and drop in for the domestic, commercial unit and A/C unit from CFC or HCFC to HFC without takeoff any item from the unit just drop in and retrofits.

Booklet refrigeration recovery and recycling

This part provides thorough explanation on the methodology of using the R&R units and the optimum method of vacuuming and recharging without causing any refrigerants to escape into the atmosphere.

Book of modern technology for the maintenance of Ref. & A/C units

This book provides explanation of the principles of Ref. and A/C and talks about the industrial revolution in this field in addition to providing an explanation about the different operations of maintenance and servicing of the different Ref. & A/C units.

b. One (1) CD in Arabic containing all necessary recommendations drawings, technical specifications and instructions sufficient for a team of qualified technicians, includes the following

- Conversion / retrofitting A/C Condition from (HCFC) R22 to HFC (R407)
- Conversion and retrofitting Fridge from CFC (R12) to HFC (R134a)
- Conversion and retrofitting Gold room from CFC (R502) to HFC (R404)

c. One (1) copy of CD in Arabic to be submitted to EEAA / PMU for further reprinting and distribution

This CD includes a copy ready for print of all the guidebooks and manuals agreed upon according to the terms and conditions of the contract of Part 1 (groups 1-5)

General Manager

Eng. Galal Galal