



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

TECHNICAL SPECIFICATIONS

For the conversion of seven refrigeration and air-conditioning manufacturing enterprises in Tunisia

UNIDO SAP ID: 210279

Grant number: 2000005294

Project title: Kigali HFC implementation plan (stage I, first tranche) (residential RAC manufacturing sector) in Tunisia

These **technical specifications** shall be used for the preparation of bids for the supply of equipment and technical services required for the conversion of seven Tunisian companies, in order to phase-out of R-410A in split air conditioning manufacturing sector and HFC-134a in the manufacturing of water dispensers. This document specifies the scope of supply of goods and related services as well as the obligations and responsibilities of the supplier.

1. BACKGROUND INFORMATION

The use of hydrofluorocarbons (HFC) refrigerants in Tunisia is contributing to global warming. The Kigali HFC Implementation Plan (KIP) Stage I for Tunisia was approved at the 94th meeting of the Executive Committee of the Multilateral Fund for Implementation of the Montreal Protocol in May 2024.

The key objective of the KIP is to undertake activities that work to meet Tunisia HFC reduction targets and strengthen the capacities of individuals and organizations working with HFCs and their replacements. The goal is to reduce 23.8 per cent of the country's HFC baseline for compliance by 2030.

One of the activities included in the KIP is the conversion of the production lines of seven local manufacturers that produce air-conditioning units based on R-410A, one of them producing also water dispensers based on HFC-134a, for the introduction of HFC-32 and R-600a, respectively. The activity is an important part of this national strategy since it will contribute to the phase-out of R-410A in split air conditioning manufacturing sector and HFC-134a in the refrigeration sector in Tunisia. This will result in reduction of 294,884 metric tonnes of CO₂-eq.

2. SCOPE OF THE REQUESTED EQUIPMENT AND SERVICES

The current bidding process is open for the provision of the equipment required for the conversion of the seven companies, including transportation, installation and commissioning, training and provision of spare parts and final operating instructions and manuals.

The requested equipment is specified in annexes I and II. [Annex I](#) describe the list of equipment by company, including information on the regions where they are located in Tunisia. [Annex II](#) presents a summary list, for easy reference by bidders.

3. GENERAL TIME SCHEDULE

The equipment here requested should be commissioned and the related services duly delivered not later than five months from the date of the contract's signature by all parties involved. Bidders shall indicate the earliest possible delivery date.

4. DELIVERY TERMS

The required equipment and related services are to be delivered based on DAP 2020 Incoterms, Tunisia, including the insurance and unloading.

5. TECHNICAL REQUIREMENTS FOR THE PROVISION OF EQUIPMENT AND SERVICES

The provider of the requested equipment and services should ensure a proper communication with UNIDO and the counterparts in Tunisia in French and English languages.

After signature of the contract, and in cooperation with UNIDO and the Tunisian counterparts, the provider should perform direct communication with the companies to be converted for the preparation of the equipment and for the following activities:

- Installation and commissioning.
- Product testing and optimization.
- Training on equipment use, and on maintenance and servicing of the equipment.

The set of consumable and most wearing and tearing spare parts for at least two years of equipment operation (guarantee period) are to form part of the service.

After completion of activities and once the initial operation of production lines is accomplished, a Certificate of Acceptance will be duly signed by the beneficiary companies, the supplier of equipment and UNIDO in order to close the contract.

The installation, commissioning and training are all required on-site in person.

6. DELIVERABLES AND REPORTING SCHEDULE

In addition to quarterly reports to UNIDO that should update on the progress made, the following set of deliverables is to be submitted:

- 1st progress report, containing commissioning workplan, copy of the full set of shipping documents and a copy of Consignee's e-mail confirming correctness and completeness of the shipping documents.
- 2nd progress report, describing the activities related to equipment delivery, installation and commissioning.
- Final Report (within three months from commissioning report) should include the results of training of personnel, provision of spare parts, operating instructions and manuals and the verification of production lines by UNIDO and the Tunisian beneficiary companies, including the collective Certificate of Acceptance of the goods received and the technical services provided, signed by the supplier, beneficiaries and UNIDO representative.

7. PAYMENT TERMS AS PER MODEL PURCHASE ORDER

- Payment of United States dollars xxxxx (USD xxxxx) corresponding to 15% of the Total Price of the Purchase Order upon contract countersignature;
- Payment of United States dollars xxxxx (USD xxxxx) corresponding to 20% of the Total Price of the Purchase Order upon receipt and acceptance by UNIDO of 1st progress report as referred to in Article 7 above;
- Payment of United States dollars xxxxxxxxxx (USD xxxxxx) corresponding to 35% of the Total Price of the Purchase Order upon receipt and acceptance by UNIDO of 2nd progress report on delivery, installation and commissioning of equipment, as referred in Article 7 above;
- Payment of United States dollars xxxxxxxxxx (USD xxxxxx) corresponding to 30% upon receipt and acceptance by UNIDO of the Final Report and of a (collective) Certificate of Inspection and Acceptance of the Goods and Installation, commissioning and training services (including operating instructions and manuals) signed by authorized representative(s) of the Contractor, UNIDO and the Project Beneficiaries confirming that the Goods and services conform to applicable specifications and the requirements of the Contract.

8. GUARANTEE REQUIREMENTS

24 months guarantee on all goods supplied and installed is required. A focal point should be assigned by the provider for the communication with UNIDO during the execution of the contract.

The provider should ensure the availability of local representation and after-sales service, including technical facilities in Tunisia or the region, once the installation and commissioning of the equipment is completed for at least 5 years after commissioning.

Reference list as well as evidence about the ability for a long-term guarantee service must be submitted together with the quotation.

9. TECHNICAL DOCUMENTATION TO BE PROVIDED WITH THE PROPOSAL

- Catalogues of equipment, including technical specifications, operation manual, etc. in English, should be part of offer. French and/or Arabic written brochures will be an asset.
- The list of equipment elements, spare parts and warranty services which might be required after 24 months of standard guarantee period should be specified based on the supplier's best experience in operating the equipment assemblies and subassemblies including its cost break down. Such list of equipment elements, spare parts and warranty services must be included in the offer.

10. TECHNICAL EVALUATION CRITERIA (also refer to Appendix 2 of the tender documents):

- Full compliance of proposed equipment with technical specs as outlined in Annexes I and II of the Technical Specifications including the required technical services;
- Conformity with required safety standards (ISO5149 (or EN378 which is harmonized with ISO5149), ISO12100 and ATEX 95);
- Quality and completeness of the proposal: the bidder shall include all required technical documentation;
- Compliance with language requirements;
- Availability of spare parts;
- Experience: the bidder shall provide list of minimum three reference of similar projects in past three years of business;
- Key personnel qualifications: the bidder shall provide list of key personnel including CVs;
- Availability of local/regional representation and after sales services: Availability of the representative office including technical facilities in the country or the region to be able to ensure long term services;
- Compliance with Warranty terms: Two years guaranty on critical technological parts to be ensured as a minimum;
- Compliance with required delivery terms.

NOTE: Partial bids are not acceptable. Bidders must provide a quotation for all required items.

Annex I

List of equipment to be delivered, installed and commissioned in each company

Manufacturer 1		Region: SIDI BOUZID	
No.	Item	Quantity	Unit
1.	<p>Charging station for flammable gasses - Dual-gas charging station (HFC-32 and HC-600a) for mixed production</p> <p>Process: Vacuum, vacuum check and charging</p> <p>Two charging guns:</p> <ul style="list-style-type: none"> - Gun 1: Charging speed for HC-600a - 10gram/sec, accuracy ± 1g (for charges less than 100 grams) with automatic disconnection coupler - Gun 2: Charging speed for HFC-32 - minimum 150 gram/sec, accuracy ± 1g (for charges greater than 200 grams) with automatic disconnection coupler - Automatic shutoff of the inlet refrigerant valve when the gas sensor alarm is activated by the safety system - Vacuum pump min 16 m³/h - Working temperature 10 °C up to 45 °C - Equipment to be certified for A3/A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1	complete system
2.	<p>Safety system covering charging and supply area for A3 and A2L refrigerants, according to ISO 817 refrigerant safety classification and ISO 5149 regarding refrigeration systems and heat pumps - safety and environmental requirements</p> <ul style="list-style-type: none"> - Equipment to be certified for A3 and A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1	complete system
3.	<p>Supply refrigerant pump for flammable gasses (HFC-32) and accumulator for HFC-32</p> <ul style="list-style-type: none"> - max. working pressure up to 42 bars - capacity min. 160 g/s - safety valve 42 bars - shut off inlet refrigerant valve with gas sensor alarm activated from the safety system - Working temperature 10 °C up to 45 °C - inlet and outlet refrigerant hoses with accessories - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1	set
4.	<p>Supply refrigerant pump for flammable gasses (HC-600a) and accumulator for HC-600a</p> <ul style="list-style-type: none"> - max. working pressure up to 25 bars - capacity min. 100 g/s - safety valve 25 bars - shut off inlet refrigerant valve with gas sensor alarm activated from the safety system - Working temperature 10 °C up to 45 °C - inlet and outlet refrigerant hoses with accessories - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1	set
5.	<p>Industrial leak detection system - Multi gas HFC-32 and HC-600a</p> <ul style="list-style-type: none"> - Multi gas detection (HFC-32 and HC-600a) - Minimum two gas detectable simultaneously - Leakage rate capability minimum 0,1 g/a - Calibration leak test for HC-600a and HFC-32 (internal or external) is required with certification - Ex proof certification - CE certificate (CE marking) 	1	complete system

6.	Ultrasonic welding Ex-Proof system for flammable applications - Right cut - Rotation device providing possibility for left and right weld - Tube material specification: Cu (copper) - Tube thickness: from 0,1 up to 1 mm - Tube diameter: from 4 to 8 mm - Ex-Proof certification - CE certificate (CE marking)	1	complete system
7.	Performance test system - single phase 20A less than 24000 BTU including: - Data acquisition - Pressure sensor - Temperature sensor - Power - Amperage - Energy consumption watt/hour	5	set
8.	Performance test system - three phase 32A more than 24000 BTU including: - Data acquisition - Pressure sensor - Temperature sensor - Power - Amperage - Energy consumption watt/hour	1	set
9.	Recovery station HFC-32 including bottle and scale for repair area - Max. working pressure 38 bar - Recovery capacity (gas) 8 kg/h - Recovery capacity (liquid) 80 kg/h - Suitable for A2L safety class of refrigerant - Recovery cylinder 30 lb - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	set
10.	Blow off pump for HC-600a repair area - Pneumatic pump (min. blow of capacity 10gram/sec) - Equipment to be certified for A3 refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	set
11.	Industrial leak detection system for HC-600a - Detection of leakage for HC-600a - Leakage rate capability minimum 0,1 g/a - Calibration leak test for HC-600a (internal or external) is required with certification - Equipment to be certified for A3 refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	complete system
Additional information and requirements: <ul style="list-style-type: none"> ▪ Supply area will be in open space outside the building with sufficient natural ventilation and protection ▪ 680kg tank will be used for supply of HFC-32 and for HC-600a either 28kg bottle or 540kg tank will be used ▪ Provider will provide layout regarding ventilation system (Ex-Proof fan and piping). The manufacturer based on provider instructions will provide ventilation system (Ex-Proof fan and piping) locally. ▪ Two separate seamless stainless-steel refrigerant supply pipelines (R600a and R32) will be installed, each covering a distance of 50m from the supply with 5m elevation to the charging station. The manufacturer, based on instructions regarding pipe diameter and accumulator dimensions calculated by equipment provider in accordance with this specification will provide these pipelines. ▪ Air Conditioner HFC 32 cycle time: 60 second/unit ▪ Dispenser HC600a cycle time: 60 second/unit ▪ Voltage supply - 3-phase 380-440 VAC + N + PE, 50Hz 			

- 1-phase 230 VAC + N + PE, 50Hz

- Air Pressure: 6,5 bars

Manufacturer 2		Region: BEN AROUS	
No.	Item	Quantity	Unit
1.	<p>Charging station for flammable gasses - One gas charging station for HFC-32 Process: Vacuum, vacuum check and charging One charging gun and one backup gun installed: Charging speed for HFC-32 - minimum 150gram/sec, accuracy $\pm 1g$ (for charges greater than 200 grams) with automatic disconnection coupler</p> <ul style="list-style-type: none"> - Automatic shutoff of the inlet refrigerant valve when the gas sensor alarm is activated by the safety system - Vacuum pump min 16 m³/h - Working temperature 10 °C up to 45 °C - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	2	complete system
2.	<p>Safety system covering charging and supply area for A2L refrigerants, according to ISO 817 refrigerant safety classification and ISO 5149 regarding refrigeration systems and heat pumps - safety and environmental requirements</p> <ul style="list-style-type: none"> - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	2	complete system
3.	<p>Supply refrigerant pump for flammable gasses (HFC-32) and accumulator for HFC-32</p> <ul style="list-style-type: none"> - max. working pressure up to 42 bars - capacity min. 160 g/s - safety valve 42 bars - shut off inlet refrigerant valve with gas sensor alarm activated from the safety system - Working temperature 10 °C up to 45 °C - inlet and outlet refrigerant hoses with accessories - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	2	set
4.	<p>Supply line for HFC-32</p> <ul style="list-style-type: none"> - two separated seamless stainless steel refrigerant supply line for HFC-32 with heat insulation sheet. - Each line covering a distance of 25m from the supply with 5m elevation to each charging station - all accessories included - equipped with an inlet manual valve for each line - pipe diameter and accumulator dimensions calculated by equipment provider in accordance with this specification 	(2x25) 50	meter
5.	<p>Industrial leak detection system for HFC-32</p> <ul style="list-style-type: none"> - Detection of leakage for HFC-32 - Leakage rate capability minimum 0,1 g/a - Calibration leak test for HFC-32 (internal or external) is required with certification - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1	complete system
6.	<p>Ultrasonic welding Ex-Proof system for flammable applications</p> <ul style="list-style-type: none"> - Right cut - Rotation device providing possibility for left and right weld - Tube material specification: Cu (copper) - Tube thickness: from 0,1 up to 1 mm - Tube diameter: from 4 to 8 mm - Ex-Proof certification - CE certificate (CE marking) 	1	complete system
7.	<p>Performance test system - single phase 20A less than 24000 BTU including:</p>	5	set

	- Data acquisition - Pressure sensor - Temperature sensor - Power - Amperage - Energy consumption watt/hour		
8.	Performance test system - three phase 32A more than 24000 BTU including: - Data acquisition - Pressure sensor - Temperature sensor - Power - Amperage - Energy consumption watt/hour	1	set
9.	Recovery station HFC-32 including bottle and scale for repair area - Max. working pressure 38 bar - Recovery capacity (gas) 8 kg/h - Recovery capacity (liquid) 80 kg/h - Suitable for A2L safety class of refrigerant - Recovery cylinder 30 lb - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	set
Additional information and requirements:			
<ul style="list-style-type: none"> ▪ Supply area will be in open space outside the building with sufficient natural ventilation and protection ▪ 680kg tank will be used for supply of HFC-32 for each line ▪ Air Conditioner HFC 32 cycle time: 60 second/unit ▪ Voltage supply <ul style="list-style-type: none"> - 3-phase 380-440 VAC + N + PE, 50Hz - 1-phase 230 VAC + N + PE, 50Hz ▪ Air Pressure: 6,5 bars 			

Manufacturer 3		Region: SFAX	
No.	Item	Quantity	Unit
1.	Charging station for flammable gasses - One gas charging station for HFC-32 Process: Vacuum, vacuum check and charging One charging gun and one backup gun installed: Charging speed for HFC-32 - minimum 150gram/sec, accuracy $\pm 1g$ (for charges greater than 200 grams) with automatic disconnection coupler - Automatic shutoff of the inlet refrigerant valve when the gas sensor alarm is activated by the safety system - Vacuum pump min 16 m ³ /h - Working temperature 10 °C up to 45 °C - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	complete system
2.	Safety system covering charging and supply area for A2L refrigerants, according to ISO 817 refrigerant safety classification and ISO 5149 regarding refrigeration systems and heat pumps - safety and environmental requirements - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	complete system
3.	Supply refrigerant pump for flammable gasses (HFC-32) and accumulator for HFC-32 - max. working pressure up to 42 bars - capacity min. 160 g/s - safety valve 42 bars - shut off inlet refrigerant valve with gas sensor alarm activated from the safety system - Working temperature 10 °C up to 45 °C	1	set

	<ul style="list-style-type: none"> - inlet and outlet refrigerant hoses with accessories - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 		
4.	<p>Supply line for HFC-32</p> <ul style="list-style-type: none"> - one separate seamless stainless steel refrigerant supply line for HFC-32 with heat insulation sheet. - line is covering a distance of 50m from the supply with 5m elevation to charging station - all accessories included - equipped with an inlet manual valve - pipe diameter and accumulator dimensions calculated by equipment provider in accordance with this specification 	50	meter
5.	<p>Ultrasonic welding Ex-Proof system for flammable applications</p> <ul style="list-style-type: none"> - Right cut - Rotation device providing possibility for left and right weld - Tube material specification: Cu (copper) - Tube thickness: from 0,1 up to 1 mm - Tube diameter: from 4 to 8 mm - Ex-Proof certification - CE certificate (CE marking) 	1	complete system
6.	<p>Performance test system - single phase 20A less than 24000 BTU</p> <p>including:</p> <ul style="list-style-type: none"> - Data acquisition - Pressure sensor - Temperature sensor - Power - Amperage - Energy consumption watt/hour 	5	set
7.	<p>Performance test system - three phase 32A more than 24000 BTU</p> <p>including:</p> <ul style="list-style-type: none"> - Data acquisition - Pressure sensor - Temperature sensor - Power - Amperage - Energy consumption watt/hour 	1	set
8.	<p>Recovery station HFC-32 including bottle and scale for repair area</p> <ul style="list-style-type: none"> - Max. working pressure 38 bar - Recovery capacity (gas) 8 kg/h - Recovery capacity (liquid) 80 kg/h - Suitable for A2L safety class of refrigerant - Recovery cylinder 30 lb - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1	set
9.	<p>Industrial leak detection system for HFC-32</p> <ul style="list-style-type: none"> - Detection of leakage for HFC-32 - Leakage rate capability minimum 0,1 g/a - Calibration leak test for HFC-32 (internal or external) is required with certification - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	2	complete system
<p>Additional information and requirements:</p> <ul style="list-style-type: none"> ▪ Supply area will be in open space outside the building with sufficient natural ventilation and protection ▪ 680kg tank will be used for supply of HFC-32 ▪ Air Conditioner HFC 32 cycle time: 60 second/unit ▪ Voltage supply <ul style="list-style-type: none"> - 3-phase 380-440 VAC + N + PE, 50Hz - 1-phase 230 VAC + N + PE, 50Hz 			

- Air Pressure: 6,5 bars

Manufacturer 4		Region: BIR KASAA-EN AROUS	
No.	Item	Quantity	Unit
1.	<p>Charging station for flammable gasses - One gas charging station for HFC-32 Process: Vacuum, vacuum check and charging One charging gun and one backup gun installed: Charging speed for HFC-32 - minimum 150gram/sec, accuracy $\pm 1g$ (for charges greater than 200 grams) with automatic disconnection coupler</p> <ul style="list-style-type: none"> - Automatic shutoff of the inlet refrigerant valve when the gas sensor alarm is activated by the safety system - Vacuum pump min 16 m3/h - Working temperature 10 °C up to 45 °C - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1	complete system
2.	<p>Safety system covering charging and supply area for A2L refrigerants, according to ISO 817 refrigerant safety classification and ISO 5149 regarding refrigeration systems and heat pumps - safety and environmental requirements</p> <ul style="list-style-type: none"> - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1	complete system
3.	<p>Supply refrigerant pump for flammable gasses (HFC-32) and accumulator for HFC-32</p> <ul style="list-style-type: none"> - max. working pressure up to 42 bars - capacity min. 160 g/s - safety valve 42 bars - shut off inlet refrigerant valve with gas sensor alarm activated from the safety system - Working temperature 10 °C up to 45 °C - inlet and outlet refrigerant hoses with accessories 	1	set
4.	<p>Supply line for HFC-32</p> <ul style="list-style-type: none"> - one separate seamless stainless steel refrigerant supply line for HFC-32 with heat insulation sheet. - line is covering a distance of 24m from the supply with 4m elevation to charging station - all accessories included - equipped with an inlet manual valve - pipe diameter and accumulator dimensions calculated by equipment provider in accordance with this specification 	24	meter
5.	<p>Ultrasonic welding Ex-Proof system for flammable applications</p> <ul style="list-style-type: none"> - Right cut - Rotation device providing possibility for left and right weld - Tube material specification: Cu (copper) - Tube thickness: from 0,1 up to 1 mm - Tube diameter: from 4 to 8 mm - Ex-Proof certification - CE certificate (CE marking) 	1	complete system
6.	<p>Recovery station HFC-32 including bottle and scale for repair area</p> <ul style="list-style-type: none"> - Max. working pressure 38 bar - Recovery capacity (gas) 8 kg/h - Recovery capacity (liquid) 80 kg/h - Suitable for A2L safety class of refrigerant - Recovery cylinder 30 lb - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1	set
<p>Additional information and requirements:</p> <ul style="list-style-type: none"> ▪ Supply area will be in open space outside the building with sufficient natural ventilation and protection 			

- 680kg tank will be used for supply of HFC-32
- Air Conditioner HFC 32 cycle time: 100 second/unit
- Voltage supply
 - 3-phase 380-440 VAC + N + PE, 50Hz
 - 1-phase 230 VAC + N + PE, 50Hz
- Air Pressure: 6,5 bars

Manufacturer 5		Region: BIR KASAA-EN AROUS	
No.	Item	Quantity	Unit
1.	Charging station for flammable gasses - One gas charging station for HFC-32 Process: Vacuum, vacuum check and charging One charging gun: Charging speed for HFC-32 - minimum 150gram/sec, accuracy ±1g (for charges greater than 200 grams) with automatic disconnection coupler - Automatic shutoff of the inlet refrigerant valve when the gas sensor alarm is activated by the safety system - Vacuum pump min 16 m3/h -Working temperature 10 °C up to 45 °C - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	complete system
2.	Safety system covering charging and supply area for A2L refrigerants, according to ISO 817 refrigerant safety classification and ISO 5149 regarding refrigeration systems and heat pumps - safety and environmental requirements - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	complete system
3.	Supply refrigerant pump for flammable gasses (HFC-32) and accumulator for HFC-32 - max. working pressure up to 42 bars - capacity min. 160 g/s - safety valve 42 bars - shut off inlet refrigerant valve with gas sensor alarm activated from the safety system -Working temperature 10 °C up to 45 °C - inlet and outlet refrigerant hoses with accessories - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	set

Additional information and requirements:

- Supply area will be in open space outside the building with sufficient natural ventilation and protection
 - 680kg tank will be used for supply of HFC-32
 - One separate seamless stainless-steel refrigerant supply pipeline (HFC-32) will be installed, covering a distance of 24m from the supply with 4m elevation to the charging station. The manufacturer, based on instructions regarding pipe diameter and accumulator dimension calculated by equipment provider in accordance with this specification will provide this pipeline.
 - Air Conditioner HFC 32 cycle time: 100 second/unit
 - Voltage supply
 - 3-phase 380-440 VAC + N + PE, 50Hz
 - 1-phase 230 VAC + N + PE, 50Hz
- Air Pressure: 6,5 bars

Manufacturer 6		Region: Djebel Oust (Zaghuan)	
No.	Item	Quantity	Unit
1.	Charging station for flammable gasses - One gas charging station for HFC-32 Process: Vacuum, vacuum check and charging One charging gun: Charging speed for HFC-32 - minimum 150gram/sec, accuracy $\pm 1g$ (for charges greater than 200 grams) with automatic disconnection coupler - Automatic shutoff of the inlet refrigerant valve when the gas sensor alarm is activated by the safety system - Vacuum pump min 16 m ³ /h - Working temperature 10 °C up to 45 °C - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	complete system
2.	Safety system covering charging and supply area for A2L refrigerants, according to ISO 817 refrigerant safety classification and ISO 5149 regarding refrigeration systems and heat pumps - safety and environmental requirements - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	complete system
3.	Supply refrigerant pump for flammable gasses (HFC-32) and accumulator for HFC-32 - max. working pressure up to 42 bars - capacity min. 160 g/s - safety valve 42 bars - shut off inlet refrigerant valve with gas sensor alarm activated from the safety system - Working temperature 10 °C up to 45 °C - inlet and outlet refrigerant hoses with accessories - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	set
Additional information and requirements: <ul style="list-style-type: none"> ▪ Supply area will be in open space outside the building with sufficient natural ventilation and protection ▪ 680kg tank will be used for supply of HFC-32 ▪ One separate seamless stainless-steel refrigerant supply pipeline (HFC-32) will be installed, covering a distance of 15m from the supply with 4m elevation to the charging station. The manufacturer, based on instructions regarding pipe diameter and accumulator dimension calculated by equipment provider in accordance with this specification will provide this pipeline. ▪ Air Conditioner HFC 32 cycle time: 100 second/unit ▪ Voltage supply <ul style="list-style-type: none"> - 3-phase 380-440 VAC + N + PE, 50Hz - 1-phase 230 VAC + N + PE, 50Hz Air Pressure: 6,5 bars			

Manufacturer 7		Region: KAIROUAN	
No.	Item	Quantity	Unit
1.	Charging station for flammable gasses - One gas charging station for HFC-32 Process: Vacuum, vacuum check and charging One charging gun: Charging speed for HFC-32 - minimum 150gram/sec, accuracy $\pm 1g$ (for charges greater than 200 grams) with automatic disconnection coupler - Automatic shutoff of the inlet refrigerant valve when the gas sensor alarm is activated by the safety system - Vacuum pump min 16 m ³ /h - Working temperature 10 °C up to 45 °C - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	complete system

2.	Safety system covering charging and supply area for A2L refrigerants, according to ISO 817 refrigerant safety classification and ISO 5149 regarding refrigeration systems and heat pumps - safety and environmental requirements - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	complete system
3.	Supply refrigerant pump for flammable gasses (HFC-32) and accumulator for HFC-32 - max. working pressure up to 42 bars - capacity min. 160 g/s - safety valve 42 bars - shut off inlet refrigerant valve with gas sensor alarm activated from the safety system -Working temperature 10 °C up to 45 °C - inlet and outlet refrigerant hoses with accessories - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	set
Additional information and requirements: <ul style="list-style-type: none"> ▪ Supply area will be in open space outside the building with sufficient natural ventilation and protection ▪ 680kg tank will be used for supply of HFC-32 ▪ One separate seamless stainless-steel refrigerant supply pipeline (HFC-32) will be installed, covering a distance of 15m from the supply with 4m elevation to the charging station. The manufacturer, based on instructions regarding pipe diameter and accumulator dimension calculated by equipment provider in accordance with this specification will provide this pipeline. ▪ Air Conditioner HFC 32 cycle time: 100 second/unit ▪ Voltage supply <ul style="list-style-type: none"> - 3-phase 380-440 VAC + N + PE, 50Hz - 1-phase 230 VAC + N + PE, 50Hz Air Pressure: 6,5 bars			

Annex II

Summary list of equipment to be delivered, installed and commissioned

No.	Item	Quantity							Unit	TOTAL
		Man. 1	Man. 2	Man. 3	Man. 4	Man. 5	Man. 6	Man. 7		
1.	<p>Charging station for flammable gasses - Dual-gas charging station (HFC-32 and HC-600a) for mixed production</p> <p>Process: Vacuum, vacuum check and charging</p> <p>Two charging guns:</p> <ul style="list-style-type: none"> - Gun 1: Charging speed for HC-600a - 10gram/sec, accuracy $\pm 1g$ (for charges less than 100 grams) with automatic disconnection coupler - Gun 2: Charging speed for HFC-32 - minimum 150 gram/sec, accuracy $\pm 1g$ (for charges greater than 200 grams) with automatic disconnection coupler - Automatic shutoff of the inlet refrigerant valve when the gas sensor alarm is activated by the safety system - Vacuum pump min 16 m3/h - Working temperature 10 °C up to 45 °C - Equipment to be certified for A3/A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1							complete system	1
2.	<p>Charging station for flammable gasses - One gas charging station for HFC-32</p> <p>Process: Vacuum, vacuum check and charging</p> <p>One charging gun and one backup gun installed: Charging speed for HFC-32 - minimum 150gram/sec, accuracy $\pm 1g$ (for charges greater than 200 grams) with automatic disconnection coupler</p> <ul style="list-style-type: none"> - Automatic shutoff of the inlet refrigerant valve when the gas sensor alarm is activated by the safety system - Vacuum pump min 16 m3/h - Working temperature 10 °C up to 45 °C - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 		2	1	1				complete system	4
3.	<p>Charging station for flammable gasses - One gas charging station for HFC-32</p> <p>Process: Vacuum, vacuum check and charging</p> <p>One charging gun: Charging speed for HFC-32 - minimum 150gram/sec, accuracy $\pm 1g$ (for charges greater than 200 grams) with automatic disconnection coupler</p> <ul style="list-style-type: none"> - Automatic shutoff of the inlet refrigerant valve when the gas sensor alarm is activated by the safety system - Vacuum pump min 16 m3/h 					1	1	1	complete system	3

	<ul style="list-style-type: none"> -Working temperature 10 °C up to 45 °C - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 									
4.	<p>Safety system covering charging and supply area for A3 and A2L refrigerants, according to ISO 817 refrigerant safety classification and ISO 5149 regarding refrigeration systems and heat pumps - safety and environmental requirements</p> <ul style="list-style-type: none"> - Equipment to be certified for A3 to A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1						complete system	1	
5.	<p>Safety system covering charging and supply area for A2L refrigerants, according to ISO 817 refrigerant safety classification and ISO 5149 regarding refrigeration systems and heat pumps - safety and environmental requirements</p> <ul style="list-style-type: none"> - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 		2	1	1	1	1	1	complete system	7
6.	<p>Supply refrigerant pump for flammable gasses (HC-600a) and accumulator for HC-600a</p> <ul style="list-style-type: none"> - max. working pressure up to 25 bars - capacity min. 100 g/s - safety valve 25 bars - shut off inlet refrigerant valve with gas sensor alarm activated from the safety system -Working temperature 10 °C up to 45 °C - inlet and outlet refrigerant hoses with accessories - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1						set	1	
7.	<p>Supply refrigerant pump for flammable gasses (HFC-32) and accumulator for HFC-32</p> <ul style="list-style-type: none"> - max. working pressure up to 42 bars - capacity min. 160 g/s - safety valve 42 bars - shut off inlet refrigerant valve with gas sensor alarm activated from the safety system -Working temperature 10 °C up to 45 °C - inlet and outlet refrigerant hoses with accessories - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1	2	1	1	1	1	1	set	8
8.	<p>Industrial leak detection system - Multi gas HFC-32 and HC-600a</p> <ul style="list-style-type: none"> - Multi gas detection (HFC-32 and HC-600a) - Minimum two gas detectable simultaneously - Leakage rate capability minimum 0,1 g/a - Calibration leak test for HC-600a and HFC-32 (internal or external) is required with certification 	1						complete system	1	

	<ul style="list-style-type: none"> - Ex proof certification - CE certificate (CE marking) 								
9.	Industrial leak detection system for HC-600a <ul style="list-style-type: none"> - Detection of leakage for HC-600a - Leakage rate capability minimum 0,1 g/a - Calibration leak test for HC-600a (internal or external) is required with certification - Equipment to be certified for A3 refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 	1						complete system	1
10.	Industrial leak detection system for HFC-32 <ul style="list-style-type: none"> - Detection of leakage for HFC-32 - Leakage rate capability minimum 0,1 g/a - Calibration leak test for HFC-32 (internal or external) is required with certification - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking) 		1	2				complete system	3
11.	Supply line for HFC-32 <ul style="list-style-type: none"> - seamless stainless steel refrigerant supply line for HFC-32 with heat insulation sheet. - all accessories included - equipped with an inlet manual valve for each line - pipe diameter and accumulator dimensions calculated by equipment provider in accordance with this specification 		50	50	24			meter	124
12.	Ultrasonic welding Ex-Proof system for flammable applications <ul style="list-style-type: none"> - Right cut - Rotation device providing possibility for left and right weld - Tube material specification: Cu (copper) - Tube thickness: from 0,1 up to 1 mm - Tube diameter: from 4 to 8 mm - Ex-Proof certification - CE certificate (CE marking) 	1	1	1	1			complete system	4
13.	Performance test system - single phase 20A less than 24000 BTU <p>including:</p> <ul style="list-style-type: none"> - Data acquisition - Pressure sensor - Temperature sensor - Power - Amperage - Energy consumption watt/hour 	5	5	5				set	15

14.	Performance test system - three phase 32A more than 24000 BTU including: - Data acquisition - Pressure sensor - Temperature sensor - Power - Amperage - Energy consumption watt/hour	1	1	1					set	3
15.	Recovery station HFC-32 including bottle and scale for repair area - Max. working pressure 38 bar - Recovery capacity (gas) 8 kg/h - Recovery capacity (liquid) 80 kg/h - Suitable for A2L safety class of refrigerant - Recovery cylinder 30 lb - Equipment to be certified for A2L refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1	1	1	1				set	4
16.	Blow off pump for HC-600a repair area - Pneumatic pump (min. blow of capacity 10gram/sec) - Equipment to be certified for A3 refrigerant class appliances according to ATEX regulations - CE certificate (CE marking)	1							set	1
17.	Equipment transportation on DAP basis including insurance and unloading	1	1	1	1	1	1	1	complete service	7
18.	Installation and commissioning, and product testing and optimization	1	1	1	1	1	1	1	complete service	7
19.	Training of personnel on equipment use, and on maintenance and servicing of the equipment	1	1	1	1	1	1	1	complete service	7
20.	Operating instructions and manuals (in English and preferably French)	1	1	1	1	1	1	1	set	7