

**HEY
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The operation and maintenance of the proposed Refrigerants Reclamation Plant.

By Hey Hey Firm Limited

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1. Background

Under the Montreal Protocol, refrigerants containing Ozone Depleting Substances such as HCFCs and CFCs have been banned from import in Hong Kong since 2020. Nowadays, the most commonly used alternative HFCs like R-410A and R-134A which are free of HCFCs and do not harm the ozone layer. However, these refrigerants are known to have high global warming potential (GWP) and cause global warming. In June 2021, China officially ratified the Kigali Amendment to the Montreal Protocol. According to the Kigali Amendment, Hong Kong must establish and implement an import and export licensing control system for HFCs and import quota control to progressively reduce the use of HFCs by 85 per cent from the baseline level by 2036. With limited import of HFCs, reclamation of used refrigerants seems to be one of the solutions to deal with the high demand.

Environment and Ecology Bureau (EEB) carried out a Regulate and Phase Down Hydrofluorocarbons (HFCs) Public Consultation on 19 July 2023.



Hey Hey Firm Limited has been following the Policy of EEB on Regulate and Phase Down HFCs and is applying a governmental vacant land to establish a proposed Refrigerants Reclamation Plant for the implementation on such policy.

受限制設備 Restricted Equipment

受限制設備的類別	GWP 上限	生效日期	
		禁止進口或生產	禁止出售、供應、要約出售或要約供應
室內冷氣機(分體式或窗式, 額定製冷量小於 7.5 千瓦)	750	2025 年 1 月 1 日	2026 年 1 月 1 日
家用雪櫃、冰櫃及雪櫃與冰櫃組合	150	2025 年 1 月 1 日	2026 年 1 月 1 日
商用冷凍設備 - 獨立系統	150	2025 年 1 月 1 日	2026 年 1 月 1 日
商用冷凍設備 - 冷凝機組	1500	2025 年 1 月 1 日	2026 年 1 月 1 日
	150	2028 年 1 月 1 日	2028 年 1 月 1 日
商用冷凍設備 - 超級市場系統	1500	2025 年 1 月 1 日	2026 年 1 月 1 日
	150	2028 年 1 月 1 日	2028 年 1 月 1 日
冷凍倉庫系統	1500	2025 年 1 月 1 日	2026 年 1 月 1 日
	150	2028 年 1 月 1 日	2028 年 1 月 1 日
風冷式冷水機	750	2025 年 1 月 1 日	2026 年 1 月 1 日
水冷式冷水機	150	2025 年 1 月 1 日	2026 年 1 月 1 日
私家車的汽車空調機 (私家車根據《道路交通條例》(第 374 章)的定義)	150	生產年份 2027 年	生產年份 2027 年
滅火系統	15	2025 年 1 月 1 日	2026 年 1 月 1 日

Category of Restricted Equipment	GWP Limit	Effective date	
		Prohibition of import or manufacture	Prohibition of sale, supply, offer for sale or offer for supply
Room air-conditioner (split type or window type, with rated cooling capacity < 7.5kW)	750	1 Jan 2025	1 Jan 2026
Household refrigerator, freezer and refrigerator combined with freezer	150	1 Jan 2025	1 Jan 2026
Commercial refrigeration - stand-alone system	150	1 Jan 2025	1 Jan 2026
Commercial refrigeration - condensing unit	1500	1 Jan 2025	1 Jan 2026
	150	1 Jan 2028	1 Jan 2028
Commercial refrigeration - supermarket system	1500	1 Jan 2025	1 Jan 2026
	150	1 Jan 2028	1 Jan 2028
Cold storage warehouse system	1500	1 Jan 2025	1 Jan 2026
	150	1 Jan 2028	1 Jan 2028
Air-cooled chiller	750	1 Jan 2025	1 Jan 2026
Water-cooled chiller	150	1 Jan 2025	1 Jan 2026
Motor vehicle air-conditioning - private car (as defined in the Road Traffic Ordinance, Cap.374)	150	Manufacture year 2027	Manufacture year 2027
Fire suppression system	15	1 Jan 2025	1 Jan 2026

In Public Consultation, EEB proposed the timetable for execution of HCFs' policy as below:
 Prohibition of import or manufacture : Effective date is 1 Jan 2025
 Prohibition of sale, supply, off for sale or offer for supply : Effective date is 1 Jan 2026

According to the proposal announced by EEB in public consultation. EMSD has taken action and sent an email for the preparation of tender to us, Hey Hey regarding our compliance list on reclaimed refrigerant R134a.

Dear Derek,

Further to preceding emails, please find the draft technical specification of reclaimed refrigerant R134a as attached for your information. Grateful if you could provide the (1) compliance list of the draft specification with counter-proposal for non-compliance item(s), and 2) indicative price for our consideration on or before 15 January 2024.

Many thanks.

Regards,
 FUNG Lai-shan, Joanna
 Engineer/Gas Standards B4/2
 Electrical and Mechanical Services Department
 Tel: 2808 3836
 Fax: 2576 5945

機電工程署
EMSD



2. Operation logistics

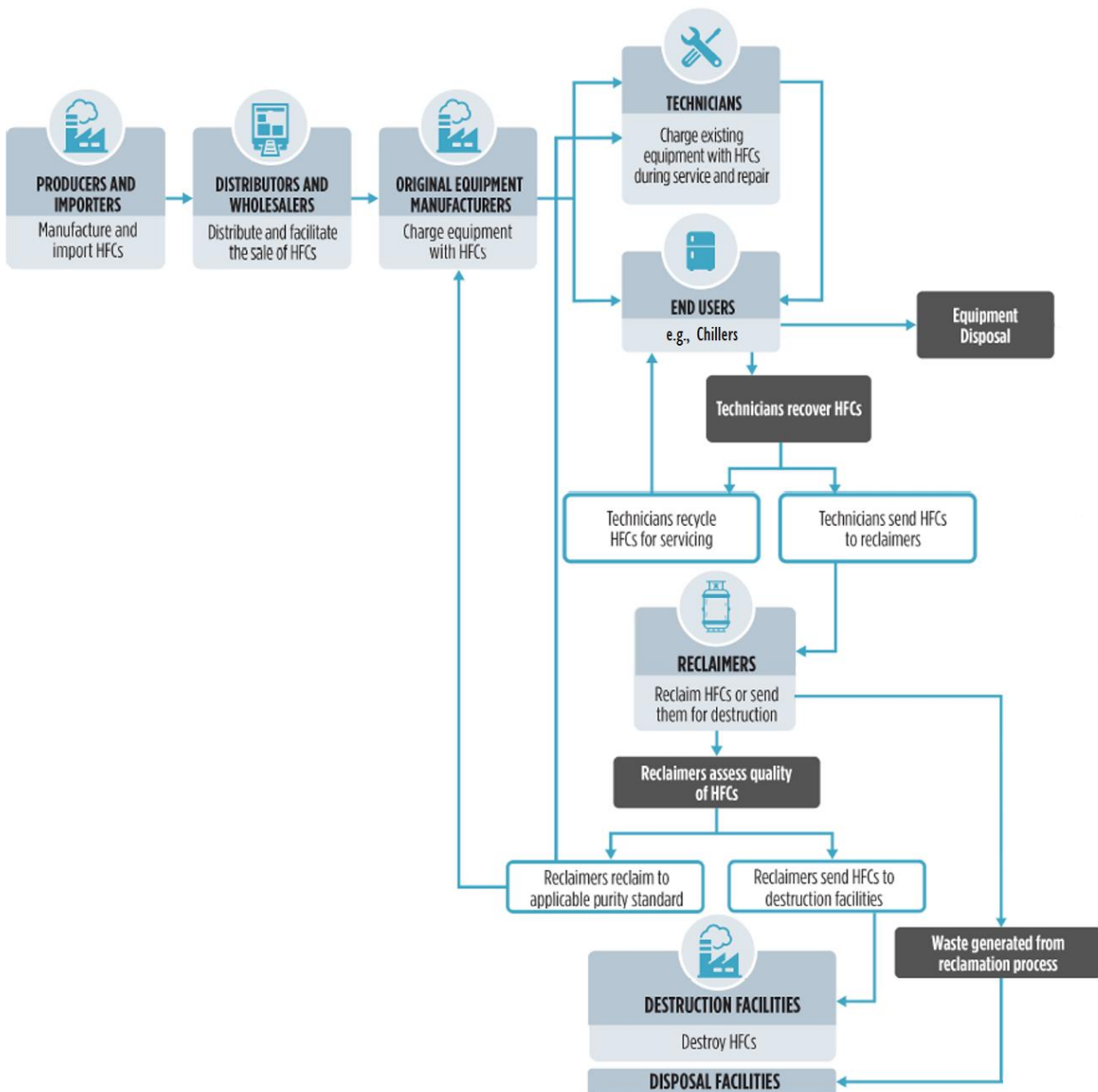
The idea of reclamation and reuse of refrigerant would not succeed without comprehensive supporting services including the collection of used refrigerant and retail sale. The whole logistic is illustrated as below in Figure 1. Maintenance work is keeping the equipment operating safely and efficiently.

Step 1: On-site collecting and transporting the used refrigerant to the plant

Step 2: Purification and reclamation of used refrigerant

Step 3: Testing and certification of reclaimed refrigerant

Figure 1. The operation logistic of refrigerant reclamation business



2.1 Step 1: On-site collecting and transporting the used refrigerant to the plant

The liquid state and vapor state refrigerant in the recovered unit is directly sucked by the compressor of Refrigerant Recovery Station. During the discharging process, it will go through the condenser of Refrigerant Recovery Station and then filled into the cylinder for storage.

System flow diagram as below: *Figure 2. Refrigerant recycle system*

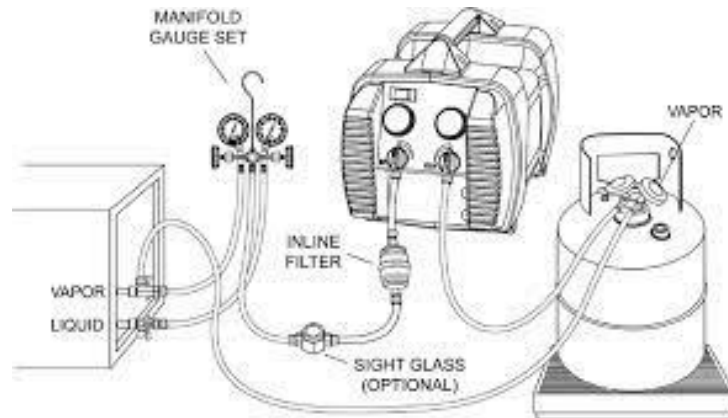


Figure 3. Application of refrigerant recycle system on chillers



Figure 4. Application of refrigerant recycle system on vehicles

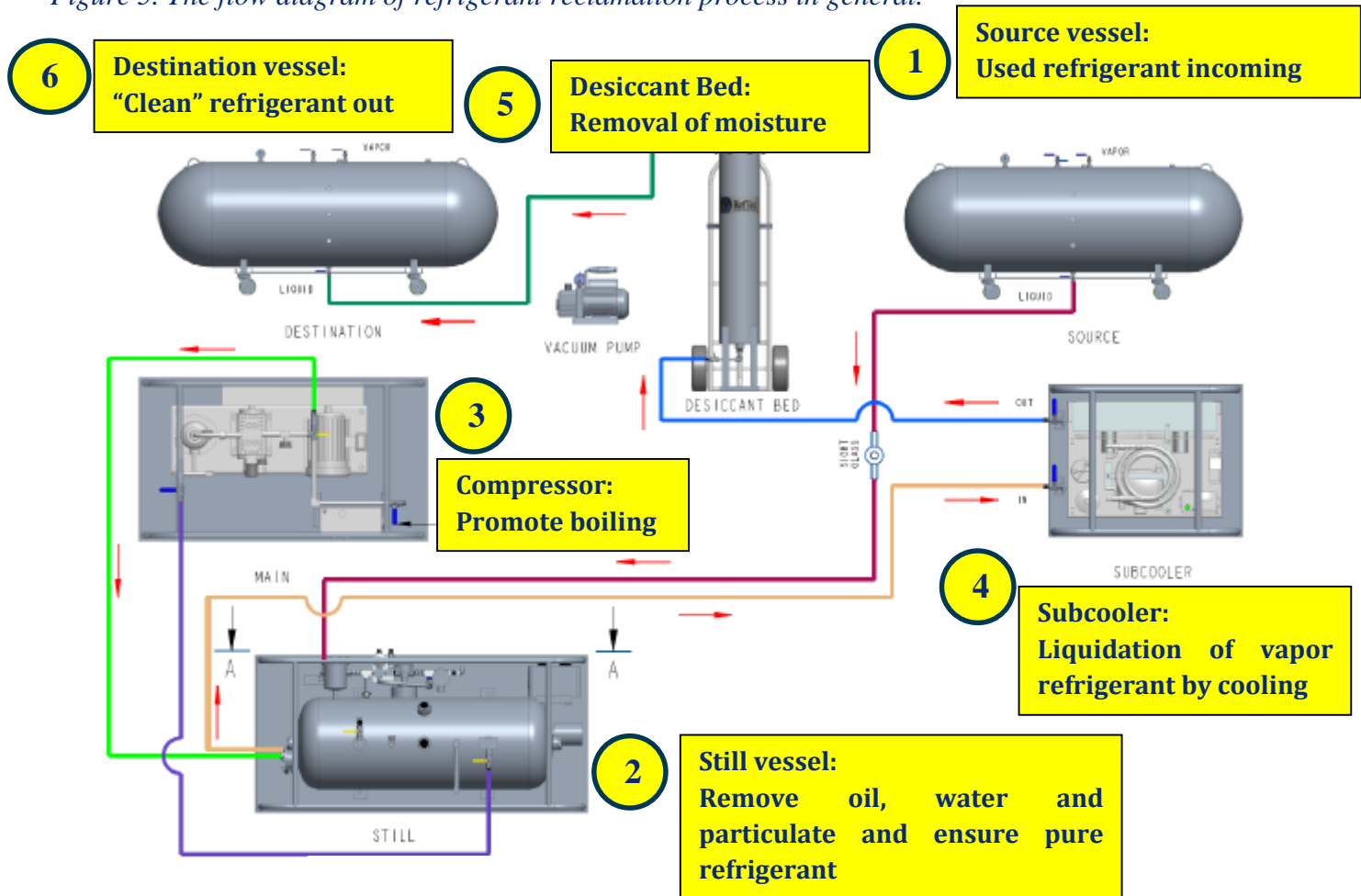


2.2 Step 2: Purification and reclamation of used refrigerant

On-site collecting used refrigerant would then transport to Refrigerant Reclamation Plant.

To restore the used refrigerant to AHRI Standards (American National Standards) or GB Standards (China National Standards), it must pass through a series of reclamation process. The general principle of the reclamation process is illustrated in Figure 5 below.

Figure 5. The flow diagram of refrigerant reclamation process in general.



List of equipment:

- Equipment 1 - Source vessel
This vessel contains and supplies used refrigerant to the still vessel.
- Equipment 2 – Still vessel
The still vessel holds the refrigerant as they are heated via the heat exchanger in the bottom of the still vessel. During the process, the oil-less vapors will be pulled away by the compressor.
- Equipment 3 – Compressor
The oil-less vapors will be compressed and go directly to the heat exchanger for boiling.
- Equipment 4 – Sub-cooler
The refrigerant from the still vessel will travel to the sub-cooler to be further cooled to liquid state.

- Equipment 5 – Desiccant bed

The refrigerant will pass through the desiccant and moisture will be removed.

- Equipment 6 – Destination vessel

The clean refrigerant will be collected in destination vessel. The size of the vessel can vary depending on the demand.

2.3 Selected sample equipment for purification and reclamation of used refrigerant

RefTec International Systems, LLC is a USA equipment manufacturer. Its products complied with AHRI 700 standard, named “Bull Dog System”. Quotation is shown in Appendix C - RefTec quote: Reclaimed refrigerant equipment prices.



Equipment 2– Still vessel and Equipment 3 – Compressor. Model: Bull Dog 460v 15Hp 8"-5" SS Vessel w/ D391 Corken Compressor w/ 3/4" connections, as below.



Equipment 4 – Sub-cooler. Model: Large Bull Dog Sub Cooler 208/230V 1ph-5 Tons, as below.



Equipment 5 – Desiccant bed, Model: Desiccant Bed 3/4" Connections w/ Flange Top, as below.

Item Name:
Desiccant Bed
Item #:
BDDB001

Product Image Gallery



- Dehydrate chiller charges
- Removes moisture to meet ARI 700 Standards
- Portable
- Capable of being vacuumed down to reuse desiccant

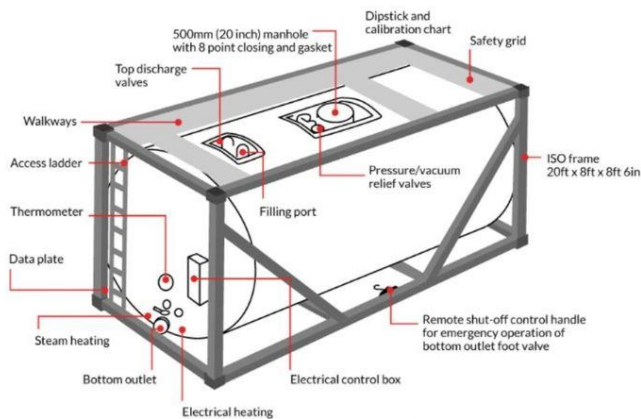


Equipment 5a – Vacuum Pump. Model: Mini Purge 240 Volt, as below.



RefTec International Systems, LLC is a USA equipment manufacturer does not have the product of large size of Refrigerant Storage Tank. We have sourced a tank manufacture named WOBO Industrial Group Corp. and its product “ISO Tank” is compatible with Bull Dog System after getting the confirmation from RefTec International Systems.

Equipment 1 –Source vessel and Equipment 6 – Destination vessel, Model: ISO Tank; Type: T50 High Pressure Tank for Refrigerant. Ranged size of tank are from 1000L (1 Ton) to 300000L (300 Tons), as below.



WOBO Industrial Group Corp.



2.3 Step 3: Testing and certification of reclaimed refrigerant

Certifying all reclaimed refrigerants after processing are costly and not feasible. Sample of reclaimed refrigerant to be tested are common practice in USA and European countries. Sample achieving any of below standards is considered to be passed the level of clean quality of reclaimed refrigerant.

- AHRI standard 700 (Practicing in USA)
- Eurovent Certita Certification Standard (Practicing in European countries)
- Relevant reclaiming refrigerant standard in Mainland China.

AHRI 700 Specifications

The table below summarizes the maximum allowable levels of contaminants for the common refrigerants.

Table 2. Maximum allowable levels of various contaminants as stipulated in AHRI 700 standard

	Reporting Units	R-22	R-134a	R410-a
Characteristics				
Refrigerant components	N/A	-	-	R-32/125
Nominal composition	% by weight	-	-	50.0/50.0
Allowable composition	% by weight	-	-	48.5-50.5/ 49.5-51.5
Bubble point	°C @ 101.3 kPa	-	-	-51.4
Dew point	°C @ 101.3 kPa	-	-	-51.4
Boiling point	°C at 101.3 kPa	-40.8	-26.1	-
Boiling point range	K	±0.3	±0.3	-
Critical temperature	°C	96.2	101.1	71.4
Isomer content Isomer	% by weight	-	0-0.5 R-134	-
Vapor Phase Contaminates:				
Air and other non-condensable, (max.)	% by weight at 25.0 °C	1.5	1.5	1.5
Liquid Phase Contaminates:				
Water, (max.)	ppm by weight	10	10	10
All other volatile impurities, (max.)	% by weight	0.5	0.5	0.5
High boiling residue, (max.)	% by volume	0.01	0.01	0.01
Particulates/solids	Pass / Fail	Visually clean	Visually clean	Visually clean
Acidity (max.)	Ppm by weight (as HCl)	1	1	1
Chloride	Pass / Fail	No visible turbidity	No visible turbidity	No visible turbidity

3. Storage and Wholesaling Types of HFC refrigerants

There are no reclaimed refrigerant gases selling in Hong Kong nowadays. Retailers only sell new gases or named virgin gases. Common HFCs include: R-22, R-134A, R-407C, R-404A & R-600A.

R-134A and R-410A are the most common HFC refrigerants adopted for Chillers and large cooling capabilities equipment.

Proposed Storage and Wholesaling Sizes of HFC refrigerant gases cylinder include:

6.2lbs, 7.2lbs, 22lbs, 25lbs, 30lbs, 50lbs.

Figure 5. Storage and wholesaling HFC refrigerant gases cylinder in A-Gas, a Refrigerants Reclamation Plant in UK

