TRUCK REFRIGERATION UNIT

OPERATING INSTRUCTION MANUAL

POWERSTAR

1. Safety instruction

The operation procedure of safety and maintenance are included in this instruction. Users should obev it to avoid accident occurring. Some of thefollowing labels are pasted on products to point OUt safety information.

Read the instruction and the safety, information marked on products before using refrigeration units. Before using this refrigeration unit safely,all the operators should be trained.

The safety,matters should be paid attention to during using and maintenance procedure.

Personal protective equipment :

Wear protective equipment before operating the refrigeration units.
Put on hearing protective equipment when refrigeration units run.

Working at heights :

Take all protective steps when approaching the refrigeration units.
Apply protective safertyladder and acrial work platform.

Automatic start :

With function of automatic start/stop. this refrigeration units can save fuel effectively.

Make sure the power switch off before repairing and maintenance to avoid refrigeration units starting again.

Switch off or close down the following parts, outage, lock and mark should be remembered.
-Batter cathode cable under the Diesel engine drive mode
-Pull the plug under the electric drive mode.

Electric :

Some parts. especially the electric cabinet can be with electric when the refrigeration units run with electric.

Proper tools, personal protective equipment,safety gloves and protective glasses should be used and wore when operating the electric equipment.

Be sure the power Switch is off before repairing and maintenance.
Be sure the refrigeration units are disconnected to any power supply unit. As above,power should be locked and marked.
Be sure the control cabinet is without electric belbre operating inside.

Before repairing the capacitor. discharge capacitor avoid electric shock

Operating personnel must have certification of operating under the lowrer/high tension when operation have to be done while the control cabinet iS with electric.

Refrigeration oil :

-Avoid prolonged or frequent exposure to skin.
-Wash carefully after dealing with refrigeration oil.

Belt and fan :

With the function of automatic start/stop, the refrigeration units Can start at any time without warning.

Take care of running belt and fan when the unit runs. Be sure the power switch is off before repairing and maintenance to avoid refrigeration unit starting again.
As the above. the power of refrigeration unit should be locked and marked.

If there are protective structures leg. fan grid or protective equipments). make sure whether they are at the right position.
Please don't move the protective structure when the unit runs.

Operating personnel's hands, body,clothes. hair and tools should be far away from running parts

Refrigerant :

Refrigerant of this refrigeraion unit can cause cold injury,scrious bums or blindness in case of exposure tO skin or eyes.

Refrigerant can produce poisonous gas if it is contacted with fire to heat source Any fire. burning object or flame should befar away fiom the refrigeration unlit.

When dealing with refigerant, please wear PPE：protective clothes. gloves and glasses.

Only qualitied personnel are allowed to refrigerant handling.

Burn and cold injury :

During the period of refrigeration unit is running and after it, temperature of all kinds of pars is still veryhigh or low(such as exhaust pipe. pipe. coil pipe. 1iquid reservoir. gas-liquid separator and engine, etc).

Be careful when operate around these high／low temperature parts.

Maintenance work is being done ; appropriate protective gloves should be Worn.

Side cut :

Be careful when operate around pars with sharp edge(such as coil pipe, evaporator,cannula clamp, etc.)

Maintenance work is being done, appropriate protective gloves should be Worn.

Storage battery. :

Lead-acid batterymay be included in this refrigeration unit. A small quantity of flammable explosive hydrogen Can be released when battery is charging.

Acid spouted onto skin and eyes can cause serious burns.
Any flame or lit object should be far away from element of storage battery.

When dealing with or charging, personalprotective equipment should be worn. such as protective clothes, gloves and glasses.

Polarity of storage batteryshould be connected correctly.

Cautions for electric standby use:
Shall wear insulating gloves when connect to AC power.
Electric standby power cable dia. shall meet national standards. See the tables as below:

Power	Voltage	Frequency	Cable material	Cable dia.
5.0KW	3P(380V/220V)	50Hz/60Hz	Copper	⩾4.0mm²
4.0KW	3P(380V/220V)	50Hz/60Hz	Copper	⩾4.0mm²
3.0KW	3P(380V/220V)	50Hz/60Hz	Copper	⩾2.5mm²
3.0KW	1P(380V/220V)	50Hz/60Hz	Copper	⩾4.0mm²
2.2KW	1P(380V/220V)	50Hz/60Hz	Copper	⩾2.5mm²

Cable dia. for electric standby shall same or larger that the data required in the above table.
And ensure it must be earth grounded.

Applying and treatment method of refrigerant

Combustibility:
Refrigerant HCFC and high concentration air with high tension mix to become flammable matter. R134a and R404a are included in this refrigerant.
Therefore, these refrigerant cannot be mixed with high tension air when do leak test or any other purpose.

Harmful to breath:
Any refrigerant is harmful, if breath in refrigerant with concentration over safe limited quantity (recommended), the following symptom can be displayed: headache, vomit, sleepy, drowsy, dizziness, etc. Also it may cause arrhythmia, unconsciousness even death.
The appropriate method which can eliminate or reduce the harmfulness to human body under the refrigerant environment should be applied.

Flame becomes big:
When weld with refrigerant vapor, if the color or size of flame changes, task should be stopped immediately and make it ventilate. Change of flame occurs only when the concentration of refrigerant vapor reaches dangerous value. And this change can cause asphyxia, etc. as above.

Protect skin and eyes
Refrigerant of liquid state can curdle on the skin, then cause permanent damage. When refrigerant of liquid state is dealt with, appropriate personal protective equipment should be worn. Don't cut over refrigerant pipe under pressure regimes. Don't open valve or air regenerating device, or else refrigerant of liquid will be spouted onto the operating personnel's body.

2. Cargo loading instruction

Advisable ventilation inside carriages or flowing air around or through cargos (foods) is key to preservation of cargos (foods) quality during transportation. Inadequate flowing air around or through cargos may cause overheating or frozen top of cargos or foods.

We strongly recommend you to use pallets, through which air can return to evaporator freely, therefore, the pallets will help protect cargos from influence of heat of truck floor. When using pallets, be careful not to squeeze extra packages on to back part of truck floor, which might stop air from flowing.

Correct piling method is another factor to protect cargos. For example, foods like fruit and vegetables that may generate heat should be piled allowing ventilation. This method is called "air stacking". And meat and other frozen food generating no heat should be piled closely in the center of carriage.

All products should be piled with distance from carriage walls to assure ventilation between products and walls to avoid cargos getting damaged with heat from outside the walls.

Temperature measurement of loaded cargos is very important to guarantee correct temperature during transportation. The refrigeration units are designed to maintain chilled cargo temperature at the level when the cargos loaded rather than to bring temperature down from high level.

Some suggestion:

-Pre-loading
·15 minutes pre-cool inside carriage.
·Purge moisture inside carriage by manual forced defrosting. Automatic defrost functions only when defrost controller shut down (at 3deg. C inside under cooling mode and 8deg. C under heating mode).
·Evaporator fans are protected by protective grids. Grids get frozen when the unit is under condition of heavy load. Hence it is recommended that grids be cleaned regularly with small brushes and cleaning must be done when the unit stops working.

Some suggestion：

-Loading

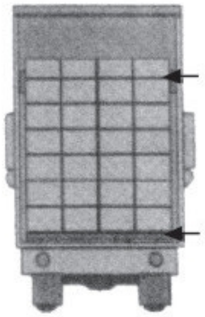
.load cargo after refrigeration unit stops working.

Keep carriage doors least open during loading to keep heat and moisture from entering.

.Set temperature controller with appropriate temperature according to cargos loaded.

.Measure temperature inside cargos with probe-type thermlometer.

.Be careful that air intake and outlet of evaporator not be obstructed with anything.



.Leave flexible spaces as following：

—6～8cm between loaded cargo and front wall of carriage

—20cm between top ofcargo and ceiling of carriage

～Space between bottom ofcargo(pallet/grids)and carriage floor

Note：

Keep the Car in cool space when not using refrigeration unit.

IMPORTANT：

Spare units must run at least 15 minutes evrery month.

3. Recommended transportation temperature

Table below lists set temperature during transportation of some common cargos. This table is for reference only, specified temperature setting should follow request of carrier or consignee. More information, please consult distributors or service outlets of Zhengzhou Kaixue Transport Refrigeration Equipment Co., Ltd.

Cargo	Set temp. range		Running mode
Banana	15℃	60℉	Continuous running
Fruit & vegetables	4℃~6℃	39℉~43℉	Continuous running
Fresh meat/ seafood	2℃	36℉	Auto start/stop or continuous running
Dairy products	2℃~6℃	36℉~43℉	Auto start/stop or continuous running
Ice	-20℃	-4℉	Auto start/stop
Frozen fruit/vegetables	-18℃	0℉	Auto start/stop
Frozen meat/seafood	-20℃	-4℉	Auto start/stop
Ice cream	-25℃	-13℉	Auto start/stop

*We suggest “continuous running” mode under condition of frequent open and shutdown operation during transportation to assure cargo quality, but shutdown operation when opening the doors to unload cargos to guarantee unit functioning.

4. Cab controller

4.1 Product features

1. Refrigeration unit with dependent system follows ARI standard, with microcomputer processor to assure safety and reliability of unit.
2. All components of the unit are imported to guarantee long-term, secure and reliable functioning.
3. Standby power unit is available on request.
4. 3 work patterns: refrigeration, defrost and drip (heating pattern available on request).
5. Automatic control over circulation of refrigeration and defrost at regular intervals.
6. Defrost intervals settable.
7. Defrost performance period settable.
8. Terminated defrost temperature settable (according to defrost sensor).
9. Pro-defrost dripping time settable.
10. Return difference temperature control.
11. Temperature display and compensation.
12. Defrost temperature visible.
13. Vehicle power system voltage visible.
14. Total working time of refrigeration unit visible.
15. Temperature sensor failure, line pressure failure and standby failure detect function.
16. Impeccable failure warning indicator and failure handling mechanism.

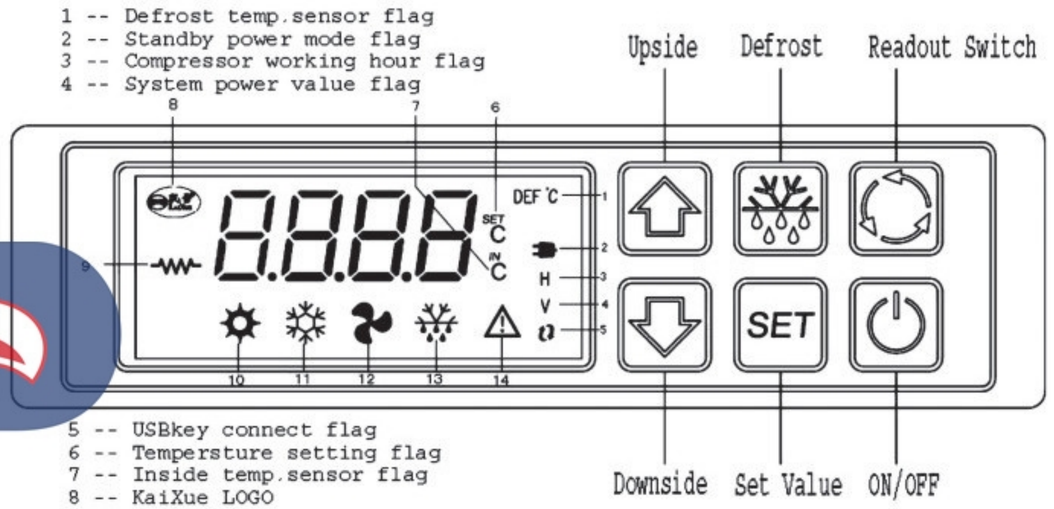
4.2 Technical parameters

Rated operating voltage:	DC12V/DC24V
Allowable operating voltage range:	DC10V/DC28V
Voltage detection range:	DC0V/DC50V
Electric standby voltage range:	AC220V±10% 1PH/3PH(50Hz/60Hz) AC380V±10% 3PH 50Hz(Optional)
Using temperature range:	-20℃~85℃
Temperature setting accuracy:	1℃
Temperature setting range:	-40℃~40℃
Temperature display accuracy:	0.1℃&1℃ optional
Temperature display range:	-50℃~85℃
Temperature measurement and control standard:	-Temperature inside carriage subject to sensor at return air outlet; -Defrost temperature subject to sensor at air returning pipe.

Procedure of starting vehicle and refrigeration unit:
Under engine mode, start refrigeration unit after 2 minutes idle run, turn to high speed mode after another 2~3 minutes.

Procedure of stopping vehicle and refrigeration unit:
Under engine mode, stop vehicle engine after shut down refrigeration unit.

4.3 Diagram of keyboard of control panel



NUMBER	COLOUR	EXPLAIN
9	Red	Heater strip for high temp
10	Yellow	Waitting for heat
	Red	Heating
11	Yellow	Waitting for Refrigerate
	Blue	Refrigerating
12	Red	Evaporator Fan is working
13	Yellow	1.Always means Defrost
		2. Scintillation means Dropping water
14	Red	Waring

ATTENTION:Number2、9 and 10 ,These Options are client specific.

4.4 Function description of control panel keys

ON/OFF key:

Starting up: Short press the ON/OFF key to start refrigeration unit when control panel is in power-on state. The unit begins with refrigeration or heating mode according to set temperature and temperature inside carriage.
Shut down: press the ON/OFF key for 1 second and the system is under shut down procedure and components stops working step by step.

Defrost key:

Press defrost key for 3 seconds under refrigeration mode, defrost indicator lit and switch to defrost mode.
The premise of switching to defrost mode is temperature of defrost sensor lower than terminated defrost temperature. It's impossible to switch to defrost mode otherwise and there will be 3 times buzzer alarm.
Controller carries out defrost function continuously as per set defrost interval, defrost period as well as post-defrost dripping time. When temperature of defrost sensor goes over terminated defrost temperature during defrost process, the unit can switch to dripping or refrigeration mode automatically.

Readout switch:

Under condition that temperature inside carriage displayed, short press readout switch to readout defrost temperature, air outlet temperature, system voltage, total working time of refrigeration unit and so on. When data of different item displayed, its icon on the screen is lit.

Set key: SET

Short press set key can switch between inner temperature and set temperature with corresponding icon lit.
In advanced setup menu, set key works as confirm key; short press set key to confirm set parameter and automatically switch to setting of next parameter option.

Up key:

Press up key under temperature display condition, "Hi" can be seen on the screen. Long press the key and not release, highest temperature from start up of the unit will be displayed on the screen and this max value reset after 3sec. Display returns to temperature inside carriage automatically when release the key.
Against interface of other setting or options, short press the up key will increase amount or value of corresponding parameters.

Down key:

Press down key under temperature display condition, "Lo" can be seen on the screen. Long press the key and not release, lowest temperature from start up of the unit will be displayed on the screen and this min value reset after 3sec. Display returns to temperature inside carriage automatically when release the key.
Against interface of other setting or options, short press the up key will decrease amount or value of corresponding parameters.

Key combination: SET + or

Set button + down button: long press this key combination 3sec or more to enter password input interface of advanced menu. Input password with up, down and set button to enter advanced menu and correct values of options with the 3 buttons.
Set button + up button: short press this key combination to exit password input interface or advanced menu interface.

Refrigeration unit working mode instruction

1. Following identifier mean (when there is no particular explain):
Tset: set temperature Tin: temperature inside carriage (air outlet temp.)
Tdef: defrost temperature Tdzr: return difference temperature of refrigeration
Tdzh: return difference temperature of heating

Refrigeration mode

Controller starts or stops refrigeration automatically with changing of temperature relation as following:

Tin – Tset ⩾Tdzr	Start refrigeration
Tin – Tset ⩽0	Stop refrigeration
Tin – Tset ⩽−Tdzh	Switch to heating mode

Other essential conditions for compressor start up:

1. Min compressor downtime longer than 1min.
2. Normal refrigerant line pressure.
3. Vehicle power voltage under normal range.

Refrigeration start up procedure:
open stop valve – open defrost magnetic valve – startup compressor - shutdown defrost magnetic valve – start up evaporator fan
Refrigeration shut down procedure:
shutdown compressor - shutdown stop valve – shutdown evaporator fan

Heating mode (optional)

Controller starts or stops heating automatically with changing of temperature relation as following:

Tin – Tset ≤ –Tdzh	Start heating
Tin – Tset ≥0	Stop heating
Tin – Tset ≥Tdzr	Switch to refrigeration mode

Other essential conditions for compressor start up:

1. Min compressor downtime longer than 1min.
2. Normal refrigerant line pressure.
3. Vehicle power voltage under normal range.

Heating start up procedure:

open defrost magnetic valve – open stop valve - startup compressor - sec - shutdown stop valve – start up evaporator fan

Heating shut down procedure:

shutdown compressor - shutdown defrost magnetic valve – [shutdown heater wire and stop valve] – shutdown evaporator fan

Defrost mode

Controller starts and stops defrosting automatically with set defrost interval, defrost period, terminated defrost temperature, post-defrost dripping time etc.

Users can also short press defrost button to enter manual defrost mode under premise of:

1. Defrost sensor temperature lower than terminated defrost temperature.
2. Normal refrigerant line pressure.
3. Vehicle power voltage under normal range.

Continuous automatic defrost function:

waiting during defrost interval→startup defrost procedure→waiting during defrost period→ startup dripping procedure→waiting during dripping period→waiting during defrost interval

Startup defrost procedure:

startup defrost magnetic valve – [heater wire] – open stop valve – startup compressor – shutdown stop valve

Shutdown defrost procedure:

shutdown compressor –shutdown defrost magnetic valve

Startup dripping procedure:

shutdown compressor – shutdown stop valve – shutdown defrost magnetic valve

Shutdown dripping procedure: stop all output

4.5 Advanced menu value setting

CH	Item	Range	Defailure value	CH	Item	Range	Defailure value
Set	Set value	LS-US	-10	dtE	Terminated defrost temp.	-50~50℃	8
Hy	Temp. difference	0.1-25.5	3	IdF	Defrost interval	1-120hr	3
LS	Lowerst set value	-50℃-set temp.	-30	MDF	Max defrost cycle	0-255min	30
US	Largest set value	150℃-set temp.	1~5	Fdt	Water discharge time	0-120min	3
AC	Compressor protection pending	0-50min	1	dPO	Whether or not startup defrost after startup	N=after Idf Y=right away	N
Con	Compressor working time after probe fails	0-255min	20	Fnd	Evap. fan pending after defrost	0-255min	2
COF	Compressor stopping time after probe fails	0-255min	10	FSt	Evap. fan shutdown pending after refrigeration/heating	0-10min	1
CF	Temp. ID	℃/℉	℃	ALU	Heat alarm	-160	10
Res	Display accuracy	In=integer DE=decimal	DE	ALL	Low alarm	-160	10
LOd	Display probe	P1=carriage temp. P2=defrost temp.	P1	DAO	Temp. alarm pending on	0-30hr	12
tdF	Defrost type	RE=electricheat IN=hot gas	In	Ot	Defrost probe adjust	-12-12℃	0
HDF	Heating type	IN=hot gas ALL=electricheat	In	OE	Inner temp. probe adjust	-12-12℃	0
dtE	Terminated defrost temp.	-50~50℃	8	UST	Optional voltage	U12=DC12V U24=DC24V	U24
IdF	Defrost interval	1-120hr	3	vEr	Software version no.		
MDF	Max defrost cycle	0-255min	30	REG	Register info.		
Fdt	Water discharge time	0-120min	3				

Quick factory reset

Press up and down buttons simultaneously for 3sec, all data of controller become factory reset after two buzzer alarms.

Data retention at sudden power cut

All options of this controller with function of data retention at sudden power cut. Loading mentioned data automatically when startup to reserve users' changed settings.

Data record function

Controller of this unit with data logging interface thus data logger is available on request to record real-time conditions of the unit including inner temperature sensor, defrost temperature sensor, various failure alarm, voltage and so on.

Note:

1. The unit have to run at least one time(no less than 15min) every month.
2. Remove clutters on top of condenser timely to assure air intake unobstructed.
3. Run the unit at least one time(no less than 20min) under electric standby mode every month.

Vehicle power voltage abnormal range:

Symbol "U" represents vehicle power voltage.

1.For vehicles with 24VDC system:

U≥32VDC – high voltage failure – U≤29VDC – recover

U≤19VDC – low voltage failure – U≥21VDC – recover

2.For vehicles with 12VDC system:

U≥16VDC – high voltage failure – U≤15VDC – recover

U≤10VDC – low voltage failure – U≥11VDC – recover

5. Failure instruction

Item	failure code	Diagram	Display mode
Inner temp. sensor	Inner temp. sensor open circuit Inner temp. sensor short-circuit	P1-H P1-L	Refrigeration mode when set temperature is under 0℃ and vice versa. failure code flashes every 1sec.
Defrost temp. sensor	Defrost temp. sensor open circuit Defrost temp. sensor short-circuit	P2-H P2-L	Defrosting according to defrost temperature shut down. failure code and inner temperature alternate display every 1sec.
Refrigerant line pressure	High pressure failure Low pressure failure	HP LP	All shut down. failure code and inner temperature alternate display every 1sec.
Power voltage	Under DC19V/DC10V Over DC32V/DC16V	LUER HUER	All shut down. failure code and inner temperature alternate display every 1sec.
Temp. abnormal alarm	Heat alarm Low temp. alarm	HA LA	No variation in output.
Fuse problem	Compressor fuse failure Condenser fans fuse failure Evaporator fans fuse failure Defrost valves fuse failure Stop valve fuse failureFU01	Fu02 FU03 FU04 FU05	All stop output except evaporator fans fuse failure
Electric standby power	Can find the AC power under electric standby mode	nosp	All stop working Have to restart the controller if need road running
Comments: When failure happens, the codes and return air temp. with alternate display, and buzzer alarms 6 times, can cancel with any button; If more than 2 failures happen, there will be Er r2/ Er r3 display on the screen; The failure codes won't display after been canceled, but the light is always on, then can check the failure code.			

5.1 Failure judgment

Failure specification	Possible cause	Solution
Fail to start	Controller fuse problem Controller problem	Check controller fuse Change controller
P1L/P2L alarm	Sensor loose contact	Check sensor connector
P1H/P2H alarm	Sensor broken	Check the circuit or change sensor
LP alarm, unit stop working	System low pressure Pressure switch broken	Check if there is leakage or blocked in system Change pressure switch
HP alarm, unit stop working	System high pressure Pressure switch broken	Check condenser fans if work Change pressure switch
Compressor abnormal sound	Belt loosen	Tense the belt
No refrigeration when start	Check set point temp.	Re-set set point temp.
Super low voltage	Check alternator/unit " - " pole	Change or maintain alternator Re-connect " - " pole
Unit work normal but no refrigerator	Check compressor if works Check if lack of refrigerant	Change fuse,belt Check leakage, refill refrigerant
Fuse problem	Electrical fuse broken	Check and change fuse
nosp	Electric standby mould broken Signal from electric standby to controller interrupts	Check electric standby mould Check electric standby signal feedback circuit

6. Maintenance instruction

Complex maintenance practices will ensure continual and reliable function of users refrigeration units.
The practices can also help control function cost, prolong life-span of refrigeration unit and enhance its function.
Note: All maintenance work should be operated by personnel finishing all standard training relating to product quality and security of Zhengzhou Kaixue Transport Refrigeration Equipment Co., Ltd.

Check the following conditions when emergency operation is necessary:

·Shut down vehicle engine (control device in cab).

·Refrigeration unit should not start up automatically during maintenance.

6.1 Maintenance schedule

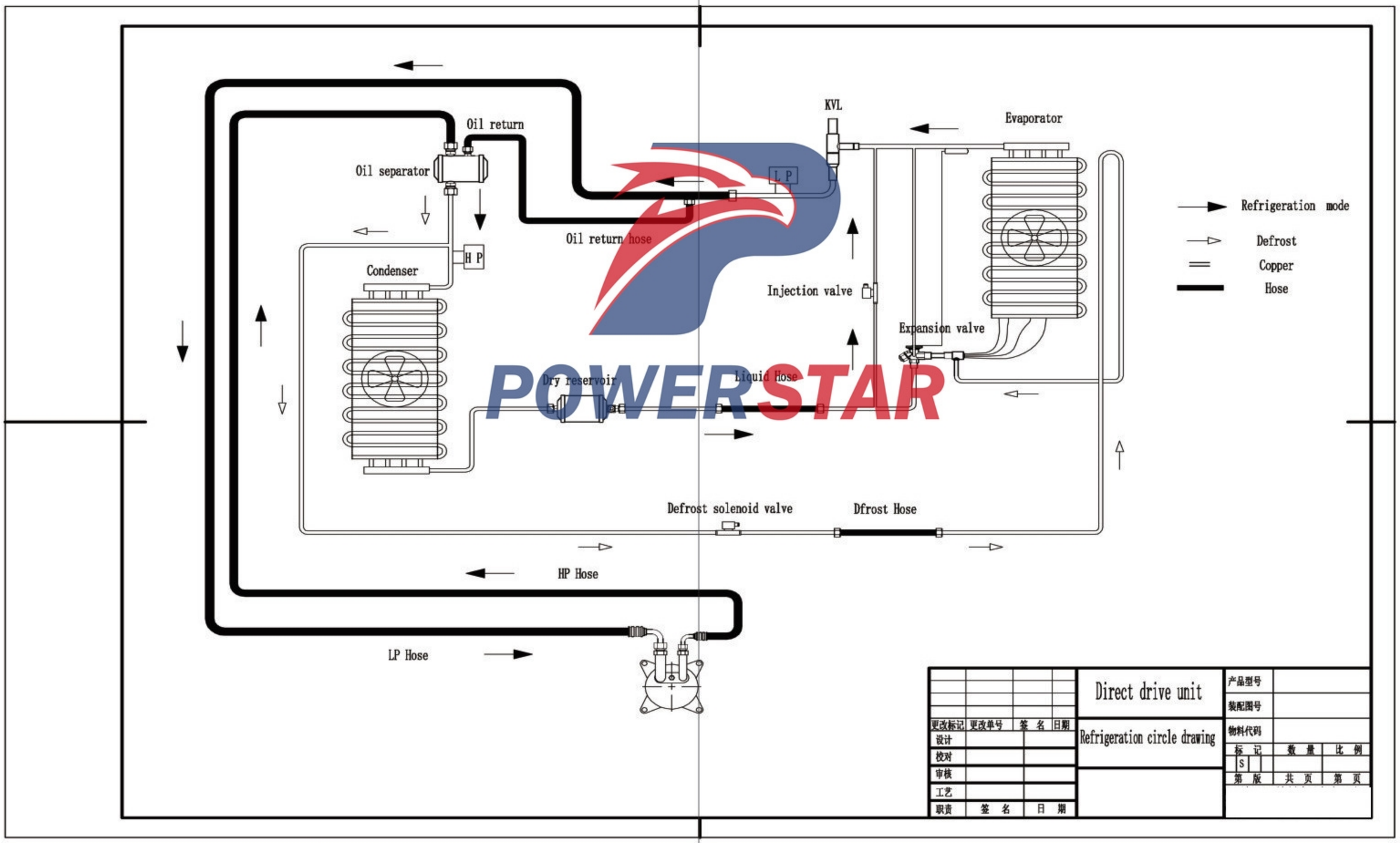
km	miles	1st maintenance	Maintenance A	Maintenance B
5,000	3,000	■		
30,000	18,000		■	
60,000	36,000		■	■
90,000	54,000		■	
120,000	72,000		■	■
150,000	90,000		■	
180,000	108,000		■	■
210,000	126,000		■	

6.2 Maintenance instruction

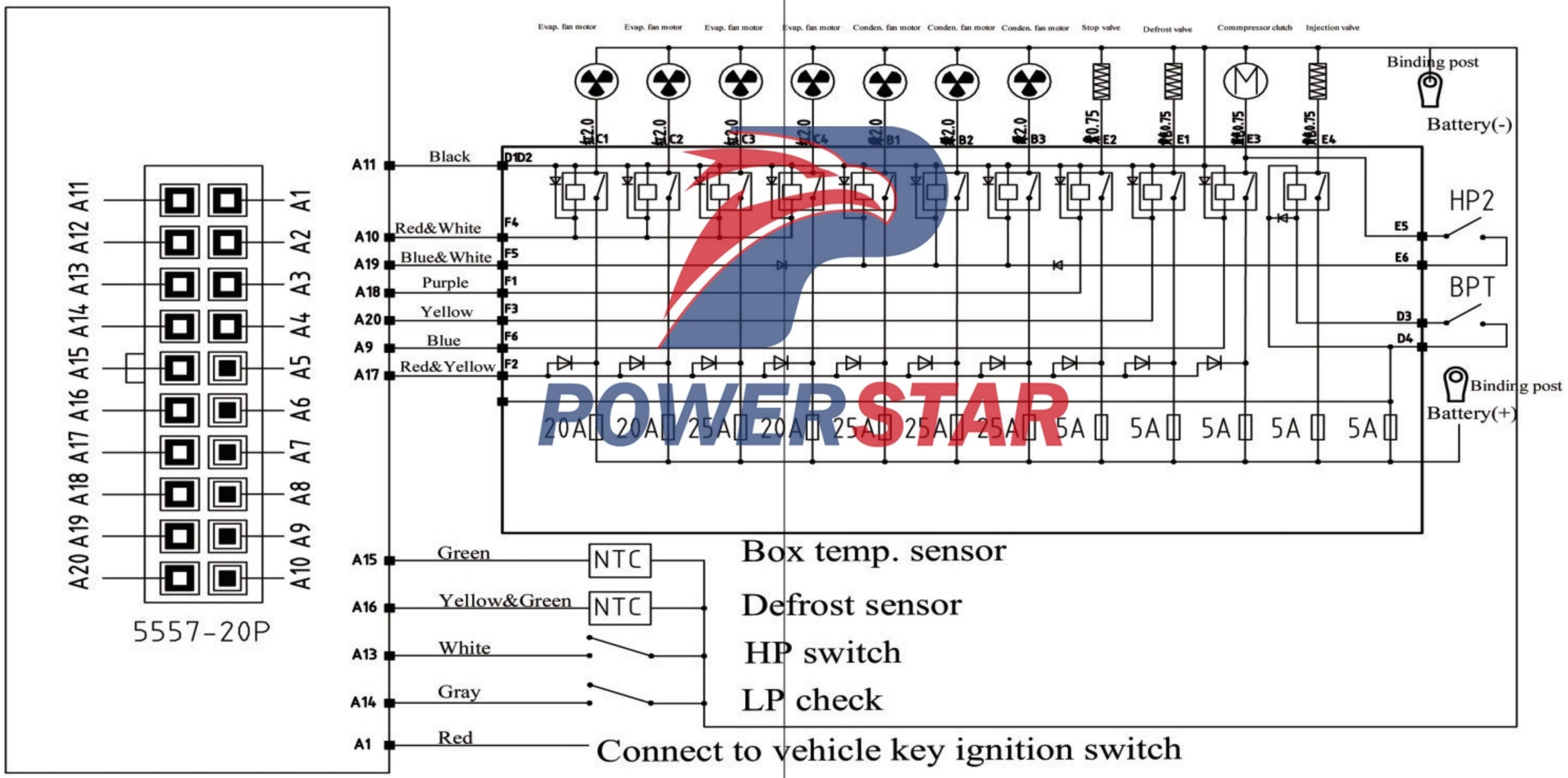
1st maintenance	·Tightness of bolt and screw. Whether the unit is correctly fixed to the vehicle body. ·Leakage. ·RPM of road compressor correct or not. ·Tension of compressor belt.
Maintenance A	·Clear storage battery and batter clamp. ·Tension of compressor belt. ·Change compressor belt every 3000 hours. ·Check whether there is leakage of refrigerant. ·Check all electric connections. ·Test refrigeration mode. ·Test defrost mode. ·Check condition of controlling device in driver's cab. ·Clean condenser coil.
Maintenance B	·Change bearing of tensioner pulley if there is.
Annually	·Change drier filter. ·Clean filtrating screen of expansion valve.
Biennially	·Change compressor oil (using only POE oil authorized by Kaixue. ·Change refrigerant.

7. Memorandum

8. Refigeration circuit diagram



9. Electrical circuit schematic diagram



Electrical circuit schematic diagram