

Economical Analysis of ReFreeX™ Method

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2. Introduction

2.1. What is ReFreeX™?

It is a new and improved refrigeration method described elsewhere in the document D133V.

2.2. What is the goal of the analysis?

To compare uniformly the monetary cost of a traditional refrigeration plant Vs. a modern refrigeration plant using the ReFreeX technology.

Analysis is limited to component costs; installation, maintenance and energy consumption are not covered.

2.3. Is this a theoretical analysis?

No. This is a real case. The ReFreeX refrigeration plant herein considered has been successfully installed, tested and used.

3. The application

3.1. Cold room structure

The cold room is built by 200 mm polyurethane panels, with density 38/40 kg/ m3.

Ground is insulated by 120 mm polyurethane under a 140 mm concrete floor.

Outer size is m 23.90 x 10.36 x 7.76 h. Outer volume is 1921 m3.

3.2. Cold room usage

The cold room is used for frozen food storage at -25° C. In summer outer temperature is +35° C during the day.

The contribute of product turnover to the thermal balance is low.

The door opening is moderate and the contribute to the balance is reduced by a strip curtain.

3.3. The refrigeration plants

Cooling is provided by two independent refrigeration plants, each of them with 30 hp compressors and R404A refrigerant. Nominal cooling capacity of each plant is 9350 watt at -35° C evaporation and +45° C condensation.

Both plants have been built with ReFreeX technology. *Unit cost analysis is performed for one plant versus one equivalent traditional plant.*

4. The comparison

4.1. The traditional refrigeration circuit

The dry-expansion refrigeration system includes a compressor, a condenser coil, and an evaporator coil. A receiver collects liquid refrigerant from the condenser and a thermostatic valve performs expansion between the receiver and the evaporator.

Part list is contained in attachment 1, drawing in attachment 2.

The plant has been sized on paper to be as uniform as possible with the ReFreeX plant.

4.2. The ReFreeX refrigeration circuit

The ReFreeX™ refrigeration system is also a dry-expansion refrigeration system and includes a compressor, a condenser coil, and an evaporator coil. No liquid receiver is installed and no thermostatic valve is provided. Expansion is performed in the piping connecting the condenser to the evaporator. Regulation is performed by a plain solenoid valve, periodically pulsed on and off.

Part list is contained in attachment 1, drawing in attachment 3.

4.3. The cost analysis method

Part lists are put on the same page of attachment 1. At the end the total price list difference is calculated. Price list is the estimated local distributor price list in Rome – Italy. Pricing of master and slave controllers used by the ReFreeX method is promotional and is to be maintained for a limited time.

Net prices are not shown. Indeed several Installers prefer to keep secret the net prices while Micheletti adopted the policy of showing net prices on the web site. Hopefully this analysis is not obscured by the net price lack, so we decided to respect the common feeling and we omitted net pricing.

Some components can be spared in the ReFreeX plant thanks to the core technology and some other components can be spared because the same function is performed by our controller hardware and/or software. Those components are shown on the balance of the traditional plant but not on the ReFreeX.

4.4. The cost analysis result

For one plant 30 hp as described above, the cost advantage of ReFreeX versus the traditional technology is 2330 euro (price list).

5. Patents, marks and contacts

5.1. Patents

European patent nr. 04425426.6 is pending.

USA patent nr. US10/956,297 is pending.

PCT patent deposited with international application number PCT/IT/2005/000268.

5.2. Marks

ReFreeX USA mark application filed with serial nr. 78509794 .

5.3. Contacts

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Traditional plant					ReFreeX plant							Partial
Code	Component	Qty	Unit	Description	List €	Code	Component	Qty	Unit	Description	List €	diff €
252	compressor	1	pc	Bitzer 4G-30.2Y - 30 hp	=	=	=	=	=	=	=	-
214	vibration isolator	1	pc	vibration isolator D22 mm	=	=	=	=	=	=	=	-
215	vibration isolator	1	pc	vibration isolator D42 mm	=	=	=	=	=	=	=	-
212	oil pressure control	1	pc	Danfoss MP55 kit	250	472	oil probe	1	pc	4...20 mA pressure probe	70	180
210	hp-lp pressure control	1	pc	Danfoss KP15 kit	90	470	lp probe	1	pc	4...20 mA pressure probe	70	20
217	hp condenser fan control	1	pc	Danfoss KP5 kit	50	471	hp probe	1	pc	4...20 mA pressure probe	70	- 20
-	-	-	-	-	-	473	fixed hp switch	1	pc	Danfoss minipr ACB 28/21 bar	40	- 40
235	discharge line	15	m	copper piping D22 mm	=	=	=	=	=	=	=	-
201	condenser	1	pc	LU-VE SHVN 38/1	=	=	=	=	=	=	=	-
531	liquid line from condenser	15	m	copper piping D22 mm	8	531	liquid line from condenser	15	m	copper piping D12 mm	4	60
256	liquid receiver	1	pc	horizontal receiver 24 lit	120	-	-	-	-	-	-	120
424	shut-off	2	pc	ball shut-off D22 mm	60	481	shut-off	1	pc	ball shut-off D12 mm	30	90
218	filter drier	1	pc	Danfoss DML417S D22 mm	70	218	filter drier	1	pc	Danfoss DML84S D12 mm	20	50
219	sight glass	1	pc	Danfoss SGN22S D22 mm	60	219	sight glass	1	pc	Danfoss SGN12S D12 mm	30	30
247	liquid solenoid valve	1	pc	EVR15 NC D22	150	=	=	1	pc	EVR6 NC D12	70	80
221	shut-off	1	pc	ball shut-off D22 mm	60	483	shut-off	1	pc	ball shut-off D16 mm	40	20
-	-	-	-	-	-	482	shut-off	1	pc	ball shut-off D16 mm	40	- 40
-	-	-	-	-	-	264	hot gas solenoid	1	pc	EVR10 NC D16	100	- 100
236	liquid line to the evaporator	30	m	copper piping D22 mm	7	484	liquid/hot gas line	30	m	copper piping D16 mm	5	60
-	-	-	-	-	-	485	pipe insulation	30	m	armaflex-like mm 16 x 9	1	- 30
225	thermostatic valve	1	pc	Danfoss TES5-B-MOP-or 03	300	466	suction temp probe	1	pc	NTC with 3m silicon cable	30	270
-	-	-	-	-	-	527	net filter	1	pc	Y filter - D16 mm	10	- 10
224	evaporator with el defrost	1	pc	LU-VE S3HC 284 E80	3 800	224	evaporator without defrost	1	pc	LU-VE S3HC 284 N80	3 300	500
305	evaporator fan shroud heater	4	pc	fan collar resistance kit	80	-	<i>the equivalent function is performed by the ReFreeX controller software</i>					320
233	suction line	30	m	copper piping D42x2 mm	25	233	suction line	30	m	copper piping D42x1 mm	13	360
237	refrigerant gas	20	kg	R404A refrigerant	15	237	refrigerant gas	4	kg	R404A refrigerant	15	240
238	lubricating oil	4	kg	ester oil	25	237	lubricating oil	0.4	kg	ester oil	25	90
232	mc side electric board	1	pc	30 hp standard electric board	1 300	232	mc side electric board	1	pc	30 hp ReFreeX electric board	1 000	300
-	-	-	-	-	-	461	master controller	1	pc	ReFreeX master controller	500	- 500
-	-	-	-	-	-	460	slave controller (mc side)	1	pc	ReFreeX slave controller	140	- 140
532	room side electric board	1	pc	room side board with el defrost	500	460	slave controller (room side)	1	pc	ReFreeX slave controller	140	360
401	electric wiring materials	1	pc	30 hp traditional wiring	840	401	electric wiring materials	1	pc	30 hp ReFreeX wiring	780	60
Total difference = cost of traditional plant - cost of ReFreeX plant = Euro											2 330	

SCHEMA FRIGORIFERO TRADIZIONALE TIPO A TRADITIONAL REFRIGERATING CIRCUIT - A KIND

Attachment nr. 2 of doc D133W1



