



# Terminator technology improves supermarket refrigeration system

## Summary

*Since Terminators, or secondary internal condensers, were installed in the cooling system at IGA-Marché André Bilodeau supermarket in Montreal, Canada, optimisation of the system operating parameters has been possible, leading to a 43.5% reduction in refrigerant gas and savings in electricity consumption of 21.3%.*

*The modifications to the system resulted in an increased condensation capacity. As a result, the coefficient of performance (COP) was improved by 26%.*

*The Phenex Terminator increases the efficiency of refrigeration systems. It can also be applied in other air conditioning, cooling and industrial refrigeration sectors.*

## Highlights

- Reduction in CFCs
- COP improved by 26%
- Investment payback period 3.5 years

*Terminator installed in a freezer at IGA.*



## Aim of the Project

The objectives of this project were to demonstrate the operating performance and increased condensation capacity of the Phenex Terminator technology on an existing refrigeration system.

Since early 1994, tests have been carried out to evaluate actual performance in practice. The improvement in overall productivity of refrigeration systems and the beneficial effects to the environment are the two main characteristics of this technology. The Terminator makes it possible to:

- reduce the amount of CFC required for effective operation of refrigeration systems;
- reduce the power demand;
- lower operating costs;
- extend the life of the equipment.

## The Principle

In a refrigeration cycle, gas is compressed and then condensed at a higher temperature, forming a liquid. In the process, heat is removed from the object to be cooled. The pressure is relieved and, as a consequence, reduces causing the liquid to evaporate back

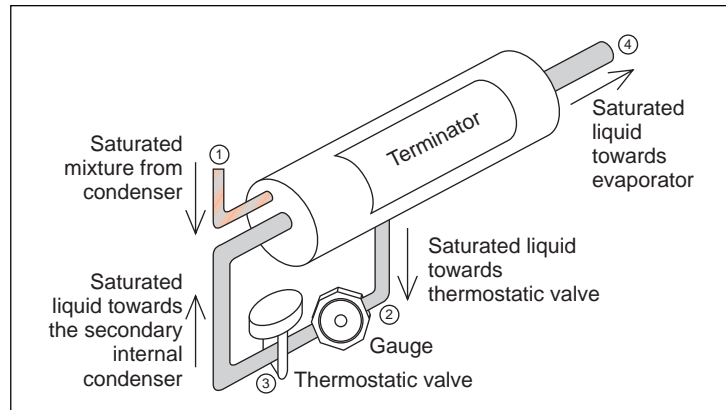


Figure 1: Secondary internal condenser (Terminator).

into a gas. Operating parameters are chosen with a relatively wide safety margin to prevent the liquid entering the compressor and causing damage. Installing the Terminator, which acts as a secondary internal condenser, is a way of reducing these parameter settings so that the refrigeration cycle is optimised. Figure 1 shows the main operating principles of the Terminator.

## The Situation

Installation of the Terminator required replacing the check valve which prevents the liquid from flowing down from the condenser. In addition, control of the condenser fans was

needed to cycle the fans, according to demand and the outside temperature. With the Terminator installed, the over-temperature settings of the pressure-release valves had to be read and adjusted to enable the evaporator performance to be improved under the new operating conditions. In practice, one pressure-release valve had to be replaced as it could not sustain the prescribed over-temperature. In addition, a malfunctioning oil pressure gauge was changed. The operating parameters were continually reset to obtain the desired level of cooling, about 32°C on average, in the freezers.

Table 1: Operating parameters before and after Terminator installation - 2221 system alone.

	Without Terminator	With Terminator	Reduction with Terminator
Average current (A)	18.58	15.72	15.4%
Average power used (kW)	4.62	4.02	13.0%
Average electrical power consumption (kWh)	110.83	96.43	13.0%
Refrigerant charge (kg)	30	23	23.1%

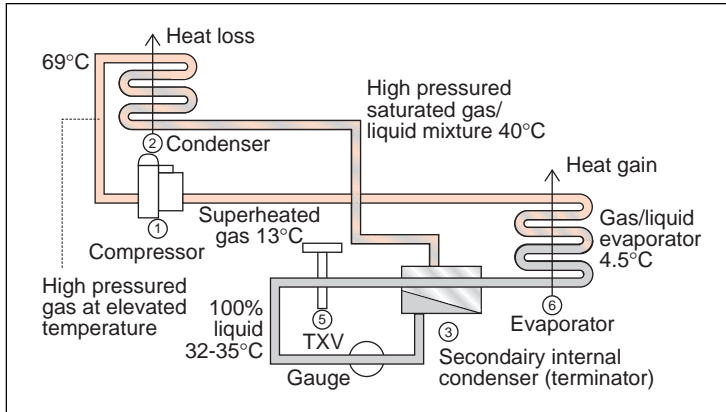


Figure 2: Liquid line system diagram.

The first system, No. 2221, consisted of a 5.6 kW (7.5 HP) compressor, developing a capacity of 15.5 kW (53,000 BTU/hour), and two 3.66 m (12-foot) freezers. The second system, No. 2222, used a 2.25 kW (3.0 HP) compressor developing 7.8 kW (26,600 BTU/hour), and an additional 3.66 m (12-foot) freezer. Both systems operated on CFC R-12 supplied by an exterior condenser.

Thermco Canada carried out two case studies, firstly by installing the Terminator on the existing 2221 system alone, and secondly with the addition of the freezer from the 2222 system. Tables 1 and 2 show

changes to the operating parameters, after optimisation, for the two cases.

The addition of the extra freezer increased the load on the 2221 system somewhat, although it remained under its limit of 5.6 kW (7.5 HP). In theory, a power of 5.28 kW corresponds to a 7.08 HP compressor, which means that, without the technology, the compressor would have had an induced overload of more than 5.6 kW (7.5 HP).

As the motor is now operating near its maximum load, it is more efficient. Prior to installation of the system, the COP for the refrigeration

system was 4.47. After installation, however, this increased to 5.62, an increase of 26%, which means improved efficiency and a higher performance system. Consequently, installation of the Phenex Terminator technology increases the condensation capacity of the system to a significant degree and in a beneficial way.

Additionally, the 2.25 kW (3.0 HP) compressor of the 2222 system could be shut down, resulting in savings in energy and maintenance.

Figure 2 shows a diagram of the liquid line system with the Terminator installed.

Originally marketed as the Thermco Terminator, Phenex Refrigeration Inc. acquired all rights to the product which now carries the name Phenex Terminator

### The Company

Founded in 1926, IGA (International Grocers Alliance) is the world's largest supermarket network. Through its global alliance of 3,600 supermarkets, IGA has an annual turnover of CAD 16.8 billion. IGA currently has operations in

Table 2: Operating parameters before and after Terminator installation - 2221 system + 2222 system cabinet.

	Without Terminator	With Terminator	Reduction with Terminator
Average current (A)	26.58	20.37	21.3%
Average power used (kW)	6.71	5.28	21.3%
Average electrical power consumption (kWh)	161.24	126.71	21.4%
Refrigerant charge (kg)	52	29	43.5%

50 states and 21 other countries, commonwealths and territories. IGA Inc. is owned by 19 marketing and distribution companies.

The André Bilodeau IGA supermarket has a sales area of 13,500 m<sup>2</sup> and employs approximately 50 people.

### Economics

The investment required to install the Terminator technology at IGA was CAD 49,000 for 37 units. The savings generated by the installation are about CAD 22,000 for the first year and approximately CAD 15,000 for each year thereafter. The savings from this project will make the investment profitable in 3.5 years.

Element	Savings (CAD per year)
Refrigerant	7,500
Equipment	6,000
Energy	1,200
<b>Total</b>	<b>14,700</b>

Table 3: Savings generated by the installation of the Terminator.

**Host Company**  
**IGA-Marché André**  
**Bilodeau**  
**5000 Beaubien EST**  
**Montreal, Quebec**  
**H1T 1V5 Canada**  
**Tel.: +1-514-259-8281**  
**Contact: Mr A. Bilodeau**

**Monitoring Agent/  
 Main Contractor**  
**Multi Energies Inc.**  
**1, Place du Commerce**  
**(Room 500)**  
**Ile des Soeurs, Quebec**  
**H3E 1A2 Canada**  
**Tel.: +1-514-769-6048**  
**Fax: +1-514-766-4236**  
**Contact: Mr R. Ross/Mr M-  
 A. Lamarre**

Please write to the address below if you require more information.



Swentiboldstraat 21,  
 6137 AE Sittard,  
 P.O. Box 17, 6130 AA Sittard,  
 The Netherlands,  
 Telephone: +31-46-420-2224,  
 Telefax: +31-46-451-0389,  
 E-mail: nlnoyce@ibmmail.com  
 Internet: http://www.caddet-ee.org

\* IEA: International Energy Agency  
 OECD: Organisation for Economic  
 Co-operation and Development

#### IEA

The IEA was established in 1974 within the framework of the OECD to implement an International Energy Programme. A basic aim of the IEA is to foster co-operation among the 23 IEA Participating Countries to increase energy security through energy conservation, development of alternative energy sources, new energy technology, and research and development (R&D).

This is achieved, in part, through a programme of energy technology and R&D collaboration currently within the framework of 39 Implementing Agreements, containing a total of over 70 separate collaboration projects.

#### The Scheme

CADET functions as the IEA Centre for Analysis and Dissemination of Demonstrated Energy Technologies. Currently, the Energy Efficiency programme is active in 15 member countries.

This project can now be repeated in CADEET Energy Efficiency member countries. Parties interested in adopting this process can contact their National Team or CADEET Energy Efficiency.

Demonstrations are a vital link between R&D or pilot studies and the end-use market. Projects are published as a CADEET Energy Efficiency 'Demo' or 'Result' respectively, for on-going and finalised projects.

Neither CADEET Energy Efficiency, nor any person acting on their behalf:

- (a) makes any warranty or representation, express or implied, with respect to the information contained in this brochure; or
- (b) assumes any liabilities with respect to the use of this information.

It is permissible to make a copy of this publication as long as the source is acknowledged.