AN EVALUATION

OF THE EFFECTS OF

PERMAFROST TREATMENT

ON THE R22 REFRIGERATION SYSTEM

AT

SA COLD STORES

JOHN SWIRE & SONS PTY LTD

Prepared by
Andrew Pang

November 2002

INTRODUCTION

This report was commissioned by Mr.Enrico Sgarbi of Polar Oil Company

The aim of the report was to examine the effects of a product known as PermaFrost upon the R-22 refrigeration system at S A Coldstore, Adelaide.

PermaFrost has previously been claimed to enhance the performance of refrigeration and air conditioning systems elsewhere. Literature from the Polar Oil Company (which markets the product) states that PermaFrost - a polarized refrigerant oil additive (PROA) -will improve heat transfer in the evaporator and condenser and increase lubricity of the refrigerant oil. It further states: "When the PROA is added to the refrigerant oil in a compressor, it blends with the oil and moves through the system. As each molecule attaches itself to metal surfaces within the system, it displaces dirt, carbon deposits, and lubricating oils, eventually forming a thin layer. As a result, the system can move more heat for the same amount of compressor action. Energy demand and consumption can be reduced."

METHODOLOGY

The testing procedure included an analysis of the system on two occasions:
1) before the addition of PermaFrost, and
2) after addition of the product.

To measure the performance of the refrigeration system, an "ETM" refrigeration system analyser was used to datalog the operating conditions of the systems during testing. For each test, the analyser collected the data on the following operating conditions over a one hour period at five seconds interval:

- Power input
- Cooling capacity
- Coefficient of performance (COP)
- Suction superheat
- Liquid subcooling
- Compressor discharge temperature
- Evaporating temperature & pressure
- Condensing temperature & pressure

TESTING

The R22 refrigeration system was first tested on August 26, 2002 before the product, PermaFrost was introduced into the system and then on September 21, 2002 after the treatment.

RESULTS OF TESTING

Detailed results of the operating conditions are provided in the following charts, all found in Appendix A:

1. Pre-treatment testing (August 26, 2002)

Chart 1A: Cooling Capacity & Power Input
Chart 2A: Coefficient of Performance & Liquid Subcooling
Chart 3A: Discharge, Evaporating & Condensing Temperatures & Superheat
Chart 4A: Condensing & Evaporating Pressures

2. Post-treatment Test (September 16, 2002)

Chart 1B: Cooling Capacity & Power Input
Chart 2B: Coefficient of Performance & Liquid Subcooling
Chart 3B: Discharge, Evaporating & Condensing Temperatures & Superheat
Chart 4B: Condensing & Evaporating Pressures

Observations

A comparison of the mean operating conditions for each of the tests are summarised in table below:

Test Results : Operating Mean Values

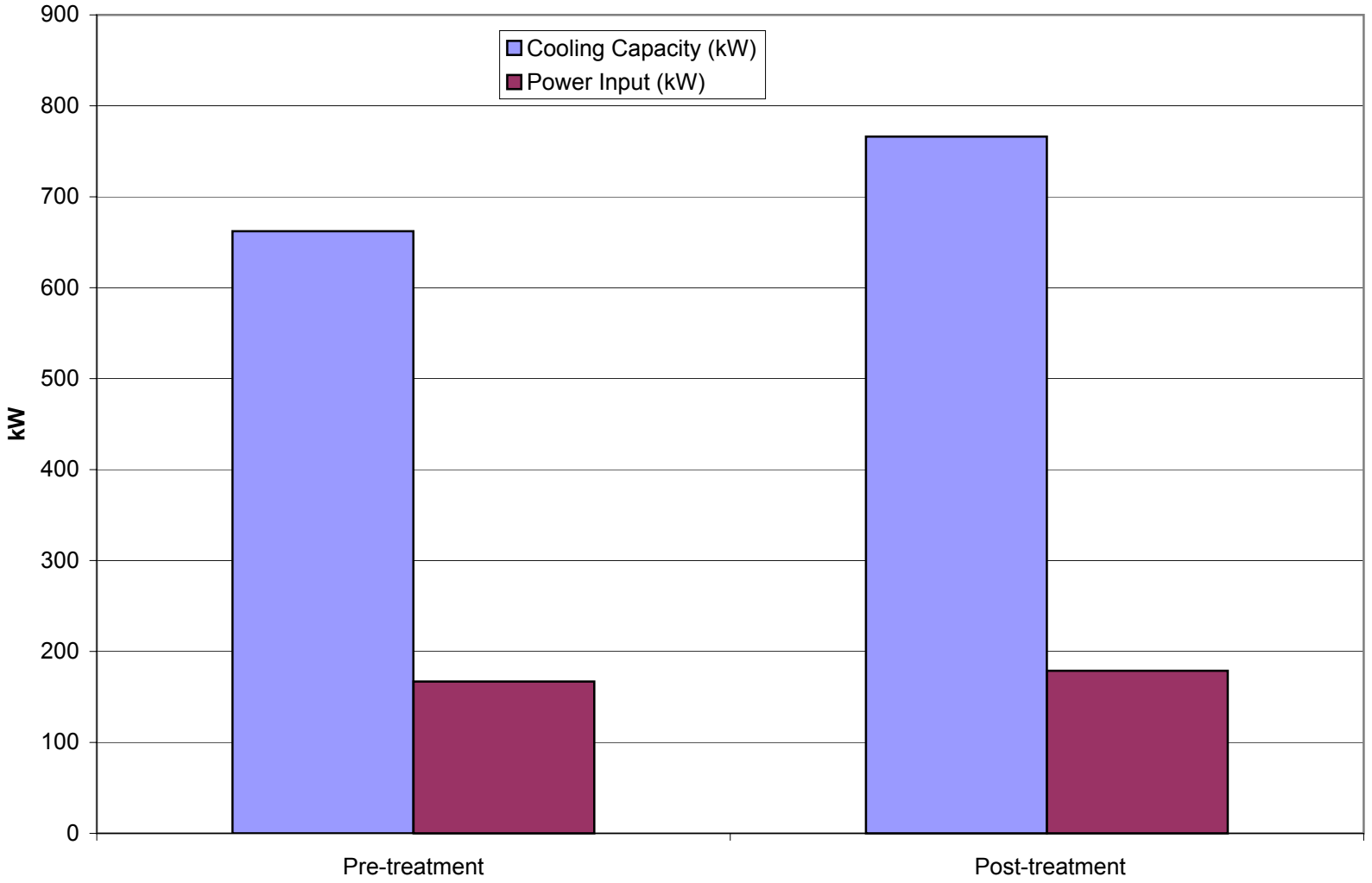
	Pre-treatment	Post-treatment	% change
Cooling Capacity (kW)	662.16	766.25	15.72
Power Input (kW)	166.9	178.72	7.08
Coefficient of Performance, COP	3.97	4.27	7.56
Discharge Temperature (°C)	66	64.03	-2.98
Evaporating Temperature (°C)	-33.7	-28.74	-14.72
Condensing Temperature (°C)	26.85	27.44	2.20
Liquid Subcooling (K)	3.9	3.42	-12.31
Suction Superheat (K)	21.35	19.35	-9.37
Condenser Cooling Water Inlet Temp (°C)	23.64	23.69	0.21
Condensing Pressure (kPa)	996	1015	1.91
Evaporating Pressure (kPa)	40	75	87.50

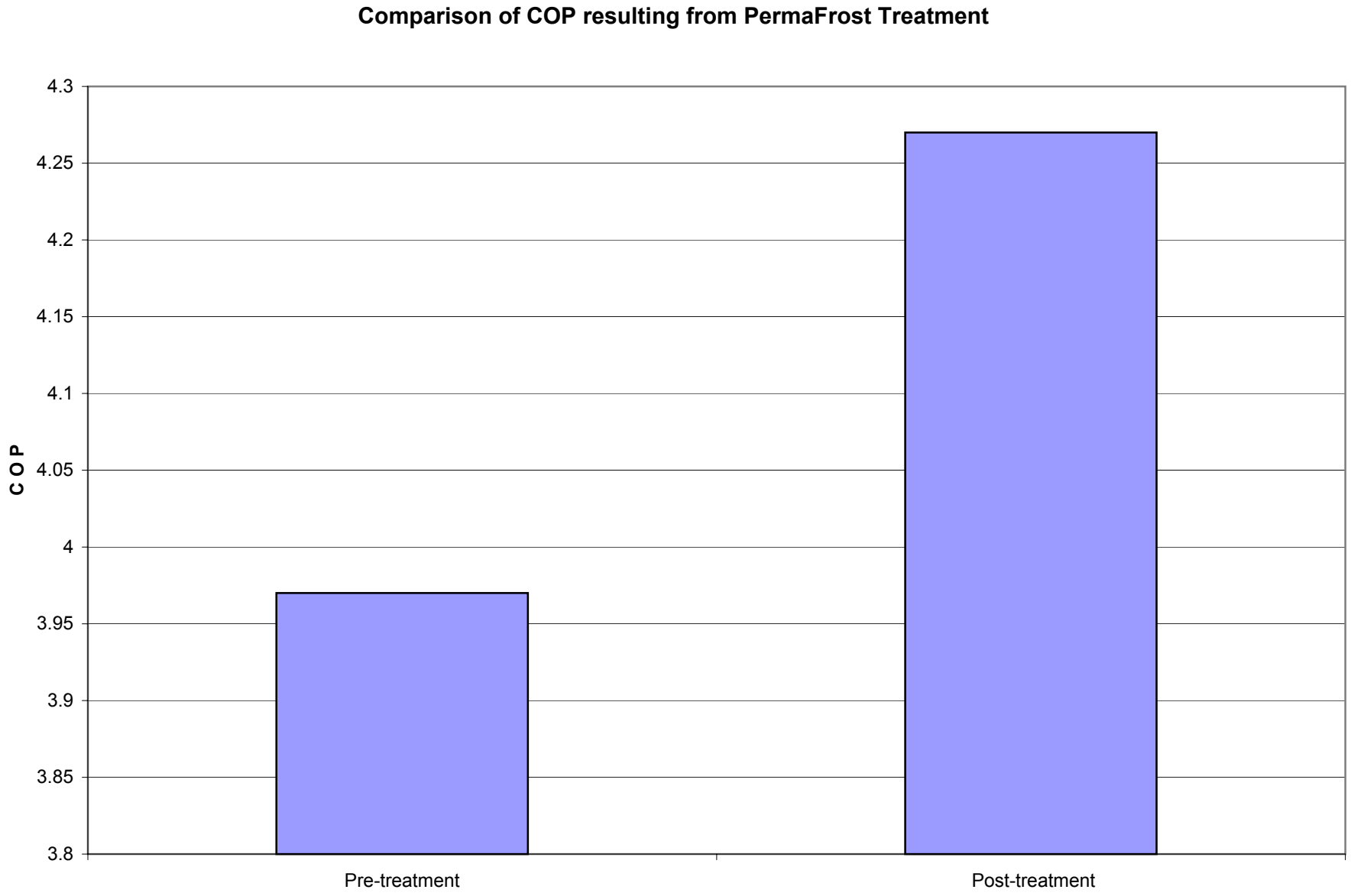
From this table, a number of observations can be made about the effects of PermaFrost on the R22 ystem :

- Cooling capacity increased significantly by 16 % in the post-treatment test. ***This indicates a significant improvement in heat transfer in the evaporators*** if the heat load in the store were similar during both tests.
- Power input increased marginally by 7% in the post-treatment test.
- The COP (a ratio of the cooling capacity and power input) increased by 8% in the post-treatment test. ***This indicates an improvement in the overall system performance.***
- Liquid subcooling decreased by 12% in the post-treatment test.
- The compressor discharge temperature was reduced by 3% in the post-treatment test. This may indicate a marginal improvement in the lubricity of the refrigerant oil in the compressor.
- The evaporating temperature and pressure increased significantly by 15% and 88%. These may indicate an increase in the heat load in the cold store in the post test.
- There were insignificant changes in the condensing temperature and pressure in the post-treatment.

CONCLUSION

The tests carried out on the R22 Refrigeration System, indicated an improvement in performance of 8% after treatment with PermaFrost. The salient results are summarised in the bar graphs in Appendix B.


Comparison of Performance resulting from PermaFrost Treatment
900
800
700
600
500
400
300
200
100
0
kW
Cooling Capacity (kW)
Power Input (kW)
Pre-treatment
Post-treatment


Comparison of COP resulting from PermaFrost Treatment
COP
4.3
4.25
4.2
4.15
4.1
4.05
4
3.95
3.9
3.85
3.8
Pre-treatment
Post-treatment