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PermaFrost

Global Case Studies

DX Chillers

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DX

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1 DX → Citi Group (South Florida 51 locations)

Powertron Global™ in conjunction with AirTech Air Conditioning installed **PermaFrost®** in 51 of **Citi Groups** South Florida locations. All units installed were DX. The goal was to compare the baseline year of July 2007 - June 2008 to the post installation year of July 2008 – June of 2009. The results were broken down into 6 month totals. The first six months of the post yielded a total power bill reduction of 8%. The second six months realized a reduction of 9.9%. This case study provides a long term look at **PermaFrost®** working across a portfolio of buildings over time. The product has been installed for approximately 2 years and Citi's South Florida locations still continues to save year after year.

2 DX & CH → Whitney National Bank

Analysis of 110 locations containing calculated heat load for the years before and after the installation of **PermaFrost®**. A total of 2,828,602 kWh were saved in 2007 with estimated savings of $325,000. This is an excellent example of **PermaFrost®** working across a portfolio of buildings over time. **Whitney National Bank** continues to be one of our best references and is a continuing customer with **PermaFrost®** as it opens new locations and makes acquisitions (the chillers installed at the downtown New Orleans office are York Centrifugal). **Whitney National Bank** also recorded a 22% decrease in maintenance costs for 2007, which was the lowest seen in quite sometime.

3 DX/Heat Pumps → Andrews Air Force Base

In order to analyze the benefits of **PermaFrost®**, **Andrews Air Force Base** agreed to treat a number of buildings and monitor the effects over a 6 month period. The decision was made to pick facilities that had heat pumps and get performance data in both heating mode and the cooling mode. The goal was to examine pre & post kWh consumption for each building in order to trend the results for many sites over several months. The data shows a minimum of 3 months in heating mode and 3 months in cooling mode. **PermaFrost®** is applicable in both modes in heat pumps. The pilot was successful and the units at the sites performed exactly as expected. Total energy consumption for the sites was reduced 11.1% prior to weather adjustments and 12.5% after a slight adjustment for changes in weather. The performance measured is projected to provide an initial payback of approximately 9 to 11 months.

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4 CH → Southern Surgical Hospital

The purpose of this case study was to show the effects of **PermaFrost®** on two York chillers Model YCAL0134EC46XCADBT refrigerant type R-22 for over a 1 year period, demonstrating the products ability to reduce kWh consumption over time without any failures. This installation occurred on November 17, 2009 in Slidell, LA. The treated units cool the entire 59,854 square feet including all operating rooms that run year 'round due to operating room demands. The reduction in kWh was 10.3% for the year. The return on investment for SSH was under 6 months. Mike Maurin (CFO) was very pleased with the results and Cirrus Heath Group, who owns this hospital, is preparing to install **PermaFrost®** in other locations for 2011 across the country.

5 DX → Bell Foods

The aim of this report is to examine the effects of **PermaFrost®** on the HVAC systems and how it can directly impact kWh consumption. This test was performed at the Bell Foods Cold Food Storage Facility in Harahan, LA in October of 2008. Product was installed in Freezer, Cooler and A/C units manufactured by Hussman/Krack. 7 units total and the model numbers are HTSD100ILSKH (10 tons) and HTSD0752HVKF (7.5 tons). All units were equipped with R-22 and R-404 refrigerants. The average savings for the period was 9.6% in kWh. It made a significant difference in not only the power bill but in the case of the office A/C, an increase in overall output was achieved by lowering the overall temperature. Something the organization was never able to reach in our offices prior to the installation of **PermaFrost®**.

6 CH → BAA Glasgow

An independent study by Business Edge Ltd., was performed in Sept 14, 2009 on a Carrier Water Chiller 30GF145A1927EE. This unit was equipped with R-22 refrigerant. Business Edge is the first UK independent limited training company who writes engineering software and develops advanced electronic control systems for the air conditioning and refrigeration industry in the United Kingdom. Mike Creamer, a renowned refrigeration expert conducted the evaluation. ClimaCheck Analyzer was used to verify results. This device won the prestigious refrigeration product of the year award in 2009. The final results showed an average COP improvement of 9.52%.

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7 Lab → Texas Oil Tech

In July 2002, **PermaFrost®** was put through a comprehensive lab tests at Texas Oil Tech Laboratories are a World Class, independent Petroleum, Petrochemical and Environmental Testing Laboratory. Texas Oil Tech Laboratories has qualified as a certified testing laboratory according to ISO-9001:2000. All analyses are performed using QA/QC protocols that include blanks, standards, controls, duplicates, and spikes appropriate for each test. All OEM refrigerant oils are put through this comprehensive series of tests. These are designed to demonstrate such things as a products compatibility with seals, bearings, and different refrigerants. It also measures a products heat transfer ability and lubricity. **PermaFrost®** went above and beyond in all categories thus proving its claims.

8 CH → Bristol Myers-Squibb

In November of 2008, **Powertron Global™** in conjunction with NYSERDA, (New York State Energy Research and Development Authority), Bristol Myers Squibb, Air Products Inc., and Resource Energy Systems Technologies, Inc. conducted testing of **PermaFrost®** in a 10 year old Trane chilled water HVAC system model number CVHE450 (450 ton), owned by Bristol Myers Squibb. There was a 10.7% increase in the difference between input and output temperatures between baseline and **PermaFrost®** datasets. A 5.3% improvement in Coefficient of Performance was also achieved but this evaluation was performed during the month of November when ambient temperatures averaged 39 F. As the ambient temperature rises and the load on the chiller increases, the COP will also increase proportionally and more savings will be achieved. These results lead to Bristol Myers Squibb treating more units with **PermaFrost®**.

9 DX/Ice Machine → NSF

NSF International helps protect the public by certifying products and writing standards for food, water and consumer goods. As an independent, not-for-profit organization their ongoing public health commitment is to encourage everyone to live safer. In a lab, **PermaFrost®** was evaluated on a Manitowac GR0150 ice machine in September 2004. The ice cycle time on the ice machine used for the test decreased from 20 minutes to 13 minutes. A 25% reduction in ice production time was attributed to the additive itself. The energy consumption decreased by approximately 6% after the addition of **PermaFrost®**.

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10 DX / Lab → HGMRI China

HGMRI, (Hefei General Machinery Research Institute), China is the National Quality Supervision and Inspection Center for Compressor and Refrigeration Equipment Products which is a third-party organ for comprehensive inspection, certification and evaluation (examination) with independent legal entity status evaluated **PermaFrost®**. Tests were supervised in 8 different conditions in July of 2009. On a brand-new system **PermaFrost®** was able to gain 3% improvement in COP.

11 CH → ANZ Bank

This evaluation examines the effects of **PermaFrost®** on Carrier Reciprocating Air Conditioning Chiller Plant at the ANZ Data Centre, Adelaide, SA. Australia in October of 2002. The results obtained clearly demonstrated that the efficiency of the machine increased 26% and a marked improvement in the co-efficient of performance was achieved. This test led to a commitment from the largest bank in Australia, operating in 31 countries with more than 1300 branches worldwide.

12 CH → Investa Group

This evaluation examines the effects of **PermaFrost®** on a water-cooled Sanyo Air Conditioning unit model CK800HW compressor at the New South Wales Department of Health, North Sydney Australia in the summer of 2005. This evaluation was overseen by Johnson Controls, one of the top four control companies in the world. The COP (a ratio of the cooling capacity and power input) increased by 16.77 % in the post-treatment test. This indicates a significant improvement in the overall system performance.

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13 CH → Hysan Properties

An Evaluation of the effects of **PermaFrost®** was conducted on a Carrier Model 30HS100 Water Chiller for Hysan Properties, Hong Kong. This was conducted in July 2004. The COP increased by 24.19 % in the post-treatment test. This indicates a significant improvement in the overall system performance. The decrease in power input and increase in system performance will result in the compressor using less energy to achieve the same cooling effect on the chilled water as prior to treatment with **PermaFrost®**. The decrease in energy usage by the compressor will correspond approximately to the increase in the system performance. This is achieved by a reduction of the compressor run time to produce the same cooling effect on the chiller.

14 CH → Carrier, Hong Kong

In September 2003, Carrier Hong Kong conducted several performance tests on a Carrier chiller with the implementation of **PermaFrost®**. All tests were conducted using sophisticated, state of the art monitoring equipment. An improvement of 11.06% in cooling capacity and 12.85% in COP was achieved and recorded. Although we have success with Carrier, Hong Kong, Carrier, USA has refused to complete any testing in the US.

15 DX → Baskin-Robbins

An Evaluation of the effects of **PermaFrost®** on HVAC systems as it pertains to kWh consumption for Baskin Robbins was performed in summer of 2007. The study was completed on two store locations. The average savings for both locations is 9.3% which is in line with our expectations of **PermaFrost®**. All DX units ranged from 2 to 5 tons.

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16 CH → Kaplans Department Store

An evaluation of the effects of **PermaFrost®** on a 40 HP Trane Chiller was conducted at Kaplan's Ben Hur Department Store. The test was conducted by Honeywell engineers to evaluate **PermaFrost®**. The post treatment data was compared to the baseline, resulting in an overall performance improvement of 19.8%.

17 CH → City of Tea Tree Gully

The results obtained were from data logger's measuring kW, kWh, Average kW and Peak Average kW. The benchmark for the results was based on 5 days of Pre-Testing data compared to 18 days of Post-Testing data after treatment. The results have shown generally an increase and at times erratic consumption patterns in the 7 to 28 days after treatment. This can occur as **PermaFrost®** establishes itself within the system. If systems are used 24 hours per day then there shows a shorter time for consistent savings to occur, as opposed to units that are only running during working hours and not used on weekends can take up to a month to show some consistent results. This evaluation has shown an 18% reduction in kWh per day during the period. This evaluation was performed in August 2001.

18 DX → City of Playford

The results obtained were from data logger's measuring kW, kWh, Average kW and Peak Average kW. The benchmark for the results was based on 7 weeks of Pre-Testing data, compared to 5 weeks of Post-Testing data after treatment. The time period in the day for testing and recording data was between 9 AM to 4:30 PM each day, Monday to Friday (excluding weekends). This period was selected as the system for the Councils Offices had consistent usage patterns. The consistent savings produced by **PermaFrost®** started to appear in the 2nd week after treatment. Then in the following 3rd to 5th week the savings tended to increase. The average savings was 18.5% as compared to the baseline. This case study was performed in September of 2001.

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19 CH → Broken Hill Hospital

In July of 2005 an Evaluation of the effects of **PermaFrost®** on a Carrier Screw Water Chiller Model 30 HXC106RY at the Broken Hill Base Hospital for Honeywell. This unit is equipped with R-134A. The cooling capacity increased by 39.10 % in the post-treatment test. This indicates a significant improvement in heat transfer in the evaporator. The COP increased by 16.94 % in the post-treatment test. This indicates a significant improvement in the overall system performance.

20 CH → Gold Field's House

An Evaluation of the effects of **PermaFrost®** on a York Centrifugal Water Chiller YTDL - E2 - JCL for Multiplex Property Trust at Gold Field's House, a high-rise facility in Sydney, Australia. This case study was performed in the first quarter of 2005. The COP increased by 25.58 % in the post-treatment test. This indicates a significant improvement in the overall system performance. The improvement in the heat transfer in both the evaporator and condenser has resulted in a marked increase of 15 % in the cooling capacity and a decrease of 8 % in the compressor power input. The decrease in power input and increase in system performance will result in the compressor using less energy to achieve the same cooling effect on the chilled water as prior to treatment with **PermaFrost®**. The decrease in energy usage by the compressor will correspond approximately to the increase in the system performance. This is achieved by a reduction of the compressor run time to produce the same cooling effect on the chiller.

21 DX → Leading Hotel in Dubai

This Case Study focuses on the Refrigeration Systems and Cold Storage Facility of a large Dubai based hotel. An overall 11.85% reduction in kWh consumed was realized after comparing pre and post-installation data sets. This represents a significant gain in heat transfer rates within the coils allowing the system to achieve set temperatures faster, thus reducing the number of times the compressors cycle during a 24 hour period. This case study was performed in May of 2008.

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22 CH → AMP

An Evaluation of the effects of **PermaFrost®** for AMP on Chiller2, A York YT-D3-E3 Centrifugal Chiller at AMP Bourke Place in Melbourne, Australia was conducted in December of 2003. The tests carried out on the chiller indicated a significant overall improvement in the system performance and a marked decrease in the power input. The COP (a ratio of the cooling capacity and power input) increased by 16.3 % in the post-treatment test. This indicates significant improvement in the overall system performance. The significant increase in system performance and the marked decrease in power input attributed to the treatment with **PermaFrost®** will result in substantial reduction in energy consumption by the chiller.

23 DX → Swire

An Evaluation of the effects of **PermaFrost®** on the R22 DX refrigeration system (Howden compressor) at SA Cold Stores John Swire & Sons Pty Ltd in South Australia in August 2002. C.O.P. increased significantly by 8% in the post-treatment data. Energy costs were reduced by 13% even though the business had increased by an average of 7.6%.

24 DX/Heat Pump → Tafe SA

In July 2008, an evaluation of the effects of **PermaFrost®** treatment on a Fujitsu Heat Pump 12LCC High Wall Split System was conducted. This test was conducted in a laboratory under control conditions. The aim of this report is to examine the effects of **PermaFrost®** upon the refrigeration system of a 2-year old Fujitsu Heat Pump, Model # AOT12LSAC. The unit is an inverter type using R-410A. The tests carried out improvement in the cooling capacity of 17.4%, a decrease in power output of 9.7% and an overall increase in system performance of 31% after treatment with **PermaFrost®**. The increase in cooling capacity and system performance will result in the compressor using less energy to achieve the same cooling effect.

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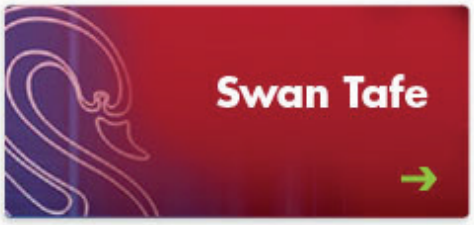
25 DX → Bold Endurance

In May 2009, **Powertron Global™** and **Uni Americas** installed **PermaFrost®** on a 30 year old 45 ton DX unit aboard the vessel "Bold Endurance". The ship has problems with humidity and getting its internal environment down to a more comfortable level. Our average worldwide in field Delta T test data yields a 3-4 degree Fahrenheit improvement in supply air with the installation of **PermaFrost®**. After treating the system there was a 5 degree Fahrenheit improvement in the supply air which equates to approximately a 15% improvement. This Case Study is an excellent example of **PermaFrost's** versatility.

26 CH → Tsingtao Asahi

In October of 2007, an evaluation of the effects of **PermaFrost®** was conducted on Chiller No. 4 at Tsingtao-Asahi Brewery Factory at Shenzhen, China. This unit was equipped with Ammonia refrigerant. The report was prepared by, enAcon Holdings Pty Ltd Asia-Pacific. Honeywell had also participated in this evaluation. An 8.3% improvement on the Coefficient of Performance (COP) has been achieved for Chiller No.4 after the treatment by our thermal-conductive product, **PermaFrost®**. The effect of **PermaFrost®** on improving the COP for chillers could also be visualized indirectly by looking at the sight glass of the lubricating oil system whereby substantial amount of stagnant oil which had been previously deposited on the surfaces of the condensers and evaporators was washed out under the effect of **PermaFrost®**. The decrease in Evaporating Temperature indicates further improvement in the heat-transfer in the evaporator. Taking into account of the fact that the condensing temperature during the post-treatment test was much higher than that during the pre-treatment test, the actual % of improvement on the COP should be much higher than 8.3%.

27 CH → SWAN Tafe



This case study was performed in December of 2005 on a Trane CGAB080S reciprocating chiller equipped with R-22 refrigerant. A Refrigeration Performance Analyzer was used to determine the performance levels prior to and post **PermaFrost®** retro-fit, under the supervision of the site technician the system was programmed to operate a full load conditions; data was recorded over a period of 1-2 hours.

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SWAN Tafe

The tests carried out on this chiller indicated an improvement in the cooling capacity of 6.32% and an overall increase in system performance of 12.57% after treatment with **PermaFrost®**. The increase in cooling capacity and system performance will result in the compressor using less energy to achieve the same cooling effect on the conditioned space as prior to treatment with **PermaFrost®**. The decrease in energy usage by the compressor will correspond approximately to the increase in the system performance. This is achieved by a reduction of the compressor run time to produce the same cooling effect on the chiller.

28 CH

CSL

An evaluation of the effects of **PermaFrost®** on Chiller 1B York LC3H 300 Chiller JS84F Compressor at CSL Bioplasma, in Victoria, Australia was conducted in September of 2003. A number of observations can be made about the effects of **PermaFrost®** on the chiller when it was on the water-chilling mode: Cooling capacity increased by 3.86 % & 8.2 % in the first and second post-treatment test respectively. This indicates some improvement in heat transfer in the evaporator. Power input decreased by 1.5 % & 0.3% in the first and second post-treatment test respectively. The COP (a ratio of the cooling capacity and power input) increased by 5.6 % & 8.6% in the first and second post-treatment test respectively.

29 CH

AMP; Parabanks Shopping Center

This case study occurred in Sidney, Australia at a shopping mall in September of 2003. The equipment treated with **PermaFrost®** was a Carrier 5H66 Reciprocating Compressor (Air Cooled) charged with R-22. A Refrigeration Performance Analyzer was used to determine the performance levels prior to and post **PermaFrost®** retro-fit, under the supervision of the site technician the system was programmed to operate a full load conditions; data was recorded for the following operating conditions over a period of 6-8 hours. The tests carried out on this chiller indicated an overall improvement in the cooling capacity of 24.7% and system performance of 18.16%. The decrease in energy usage by the compressor will correspond approximately to the increase in the system performance. This is achieved by a reduction of the compressor run time to produce the same cooling effect on the chiller. Consequently, energy savings for similar conditions will be in the order of 18.1%. This test is a great example of **PermaFrost®** working in a shopping mall environment.

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30 DX → Austin Community College

An evaluation of the effects of **PermaFrost®** for Austin Community College on a rooftop unit air conditioning system was performed in July of 2003 in Austin, Texas. The monitoring was performed by a third party engineering firm. Energy consumption of the unit was monitored for one week after treatment with **PermaFrost®**. The results are based energy consumption during the monitoring period. Total energy consumption before **PermaFrost®** was 1545 kWh. Total energy consumption before **PermaFrost®** was 1138 kWh. The net reduction in energy consumption was 26.34% for the period. Results clearly show reduced run-time and energy draw despite the increase in the load. The unit is now cycling and reaching set temperatures faster because of better thermo-conductivity and increase in capacity.

31 CH → Deutsche Bank

This case study took place in Melbourne, Australia in June of 2005. The equipment was a Copeland reciprocating compressor model number 66H7000 charged with R-22 refrigerant. The tests carried out on this chiller indicated an overall improvement in the cooling capacity of 11.3% and system performance of 13.1%. The increase in cooling capacity and system performance will result in the compressor using less energy to achieve the same cooling effect on the chilled water as prior to treatment with **PermaFrost®**. The decrease in energy usage by the compressor will correspond approximately to the increase in the system performance. This is achieved by a reduction of the compressor run time to produce the same cooling effect on the chiller. Consequently, energy savings for similar conditions will be in the order of 13.1%. This test was conducted on a high-rise facility.

32 CH → Tops

An evaluation of the effects of **PermaFrost®** on a Sanyo chiller Model LCU-100P-BEA freezer room refrigeration system for Tops Supermarket in Pinklao, Thailand was conducted in February of 2005. This chiller was charged with R-22. Prior to the injection of **PermaFrost®** into the unit, it could not achieve a suitable coil temperature to maintain a constant room temperature and allow the unit to off cycle. The injection of **PermaFrost®** has improved the system