

WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

"Two energy saving devices were tested, ie: A Liquid Sub-Cooler and the Liquid Pressure Amplifier. (LPA). Both devices improve air conditioner performance by reducing / eliminating flash gas in the liquid line. The Liquid Pressure Amplifier (a Liquid Freon Pump) was found to provide better energy savings at all operating temperatures."

"We can expect savings on the order of 25% to 30% of the annual energy required to run our air conditioners fitted with the LPA pump. This will amount to \$60,000 to \$70,000 annually."

Jack Mandeville
Iolab Corporate Engineering
Johnson & Johnson Company

Johnson & Johnson



WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

"The HY-SAVE LPA has proven to be a very good investment for us. Not only are we saving energy, but also our maintenance costs have been practically eliminated.

Installation of these pumps virtually solved our refrigeration problems. The addition of a simple device in the liquid line of the system has done more than an entire service department accomplished before.

High pressures have been reduced by some 200 lb. Compressor capacities are increased by over 35%. Less than one-half of the compressors need to operate at any single time since installation. Before LPA, the whole banks of compressors were running just to keep up.

It is unusual in these days to find a product that actually pays you to use it. The costs for this equipment and installation will pay back in less than a year. Net energy costs will continue year after year.

Thank you for introducing us to this product. Even without the energy savings, the reduction in maintenance and downtime would justify the installation."

Harry B. Wilkinson
Technical Manager
General Mills Inc.



.....
GENERAL MILLS

WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

"The energy consumption of each of our air conditioning systems was markedly improved by the refrigerant pumps (24%). Savings to date exceeded projections and greater savings are expected during the off-peak cooling months when lower condenser inlet air temperatures prevail. Of greater interest are the reduced evaporator leaving temperatures (evidencing increased cooling capacity). The building's indoor air conditions have been noticeably improved."

Don Fiorino
Facility Engineer
Texas Instruments Inc.



WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

“Historically, (pre-pump installation), our two (2) 100 horsepower compressors operated for a total of 33 hours per day. Since the refrigerant pumps have been installed, our compressor operating time has dropped to 17-20 total hours per day. Thus, over a 33% reduction in compressor time has been realized. This translated into a first post-installation electrical bill of over \$4,500 less when compared to the same month last year.”

Andrew J. Carmichael
Director, Central Peninsula Sport Center
Soldotna, Alaska



WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

"I am writing to express my experience and confidence in the HY-SAVE Liquid Pressure Amplifier technology you provide."

"We demand that any technology we install on a performance contract be proven and reliable. The LPA, when properly applied and installed, meets those criteria. Honeywell has installed LPA projects all over the country, and in the South from Oklahoma City to Orlando, Ocala, and Clearwater. It has our confidence. "

"You frequently identify problems with the air conditioning equipment beyond your scope of work. These suggestions have greatly benefited both Honeywell and our customers."

"As a result of your product and knowledge, Honeywell recommends LPA technology as a good effective energy saving project."

Kevin K. McKenzie, P.E.
Professional Engineer
Performance Contract Engineer

Honeywell

WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?



"At present, our local power company calculates that we are saving on an average of \$800.00 per month in electricity costs. Add to this the reduced wear and tear on the refrigeration system, the increase in ice making efficiency and added refrigeration capacity and reduced water treatment cost. Needless to say, the City of Albert Lea is pleased with the results."

Dawn MH Thompson
Recreation Director
Parks and Recreation Department
City of Albert Lea, Minnesota

WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

"We ran the equipment 24 hours a day. We now start the equipment 1.5 hours prior to occupancy and stop the equipment immediately after the building is unoccupied. We have eliminated 14 hours a day in run time.

Due to the increase in capacity that the LPA has given this equipment in the form of lower KW per ton, we have projected that this project will pay for itself in less than 12 months."

Michael L. Lan
Assistant Foreman, HVAC Department
Marion County Public Schools
Ocala, Florida



WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

"I want to thank you for convincing me to attach your "liquid amplifier system" to our Carrier air conditioning unit and installing energy saving light fixtures through our building."

"I estimate that we are saving approximately \$ 3,000 per month, which corresponds to a 26% savings in our electrical bill."

Jack Previte
Building Manager
CGB INVESTMENTS



WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

"IES Utilities was glad to participate in the metering and evaluation of Liquid Pressure Amplifiers on our customer's 140-ton chillers. We were glad to present an incentive check to the customer for this technology and look forward to the next opportunity.

The metering data was collected with a data acquisition center at twenty different points at 5 minutes intervals. Since no factory produces the same quantity of goods from one week to the next, production data was coupled with the performance data to get a fair comparison. The results were surprising, yet accurately forecasted by the HY-SAVE representatives. The production for the post modification week of metering increased even though the energy consumption decreased. It has saved the customer approximately 30% based on the two weeks of metering."

Russell J. Eimers
Marketing Program Manager
An IES INDUSTRIES Company

WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

"With respect to floating head pressure, there is no adverse effect on reliability when pressure is reduced below 90°F. In fact, reducing the condensing pressure reduces the compression ratio and generally has a positive effect on both energy consumption and life expectancy. The LPA will not conflict with Copeland Warranty."

Richard E. Turner
Copeland Corporation
Refrigeration Technical Support



WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

"This is to advise that Liebert's standard warranty would not be violated when the system is equipped with a HY-SAVE Liquid Pressure Amplifier, provided the pump is installed in accordance with installation recommendations provided by HY-SAVE."

David F. Planitzer
Liebert Corporation
Heat Transfer Products



WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

“The addition of the Hy-Save pump to the systems that we are building for you will have no impact whatsoever on our standard product warranty.”

“It is well documented that reduced discharge pressures and the corresponding reduction of compression ratios are beneficial both in terms of system longevity as well as reduced operating costs. The addition of the Hy-Save pump to our systems should help to accomplish both of these goals”

Bob McDonough
Larkin Coils
Applied Products Division





WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

*"On May 18, 1993, pre-installation tests were conducted on two 100-ton multi—
circuit Trane Air Cooled Chillers at Dunnellon High School."*

*"Not only did the HY-SAVE LPA technology save the cost of an \$80,000.00 chiller, it
will pay for itself."*

*"I highly recommend to anyone who needs to increase capacity or obtain more
efficient operation of inefficient equipment that in lieu of costly equipment
replacement, the HY-SAVE LPA alternative should be considered. I am so pleased
with this application that plans to retrofit all applicable facilities are now being
considered, as well as mandating that all new equipment have this technology
installed by the manufacturer."*

Michael L. Lane
HVAC Department
Dunnellon High School

WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

"A thermostatic expansion valve will operate with as little as 40 pounds pressure drop across it. If, however, the liquid temperature was at 100°F, the valve's capacity would certainly suffer."

"If the liquid temperature is reduced along with the pressure drop, the valves capacity will suffer very little, provided that the valve is supplied with 100% liquid."

Jeffrey S. Warren
Sporlan Valve Company Ltd.



WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

"The LRP is a simple, reliable means of converting a refrigeration system to floating-head operation, which is the efficient operation obtained by allowing the condenser to operate at lower pressure and temperature when ambient conditions permit.

"To endorse LRP (by some equipment manufacturers.) is to acknowledge that one's equipment is not as efficient as it could be. Approval of LRP by component manufacturers is well documented. Since large package equipment manufacturers exercise considerable control over the flow of information, the user acceptance and application concerns we have encountered are not surprising."

"Annual energy savings typically range from 10 to 30% and paybacks of under two years are usually realized."

[Federal Technology Alert](#)
Federal Energy Management Program
DOD, EPA, DOE # RVI 1295





WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?



“LIQUID PRESSURE AMPLIFICATION:

Liquid pressure amplification (LPA) involves the installation of a fractional horsepower pump in the liquid line between the outlet of the condenser and the expansion valve. This pump adds 5-12 psi of pressure to the refrigerant in the liquid line, ensuring its remaining in a liquid state.

Since pure liquid is delivered to the thermal expansion valve (TXV), the TXV can introduce pure liquid into the evaporator. Air-to-liquid heat transfer is ensured, and there is more liquid to evaporate.

Now the evaporator can operate at maximum efficiency.

Now that the LPA pump ensures pure liquid in the liquid line, the main compressor(s) are no longer required to maintain the design head pressure. The head pressure can be floated with ambient temperature.”

“SUPERHEAT SUPPRESSION:

Superheat suppression involves the installation of a small copper line after the LPA pump and run to the entrance of the condenser. The introduction of subcooled refrigerant prior to the condenser eliminates superheat. The entire condenser can then be utilized for the expulsion of heat.

Fermi Labs applied both of these techniques to three 160-ton reciprocating chillers.”

The combined effect of these patented techniques is;

- increased efficiency and capacity in the evaporator and condenser,*
- a reduction in energy consumption and*
- a reduction in wear of the compressor.*

The increased capacity is particularly important as new refrigerants are introduced with lower ozone depletion potential. While these refrigerants are environmentally safe they are less efficient than chlorofluorocarbons (CFCs). The effect of the LPA pump compensate for the reduction in capacity.”

**Johnson Controls - Fermi Lab
Energy Saving Project Report**

WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

“The Hy-Save Liquid Pressure Amplifier (LPA) is a device for improving air conditioning and refrigeration system efficiency on systems with a reciprocating compressor and an expansion valve. The device was installed and tested on a packaged chiller to verify manufacture's claim and predict energy savings.”

“Based on these results, the Hy-Save Liquid Pressure Amplifier was found to be an effective means of reducing compressor power consumption when properly applied. Testing showed a significant improvement in COP at each evaporator temperature as the condenser temperature decreased.”

“The Hy-Save Liquid Pressure Amplifier was installed and tested on a nominal 40-ton Acme Package Chiller which utilizes domestic cold water to remove condenser heat. Both the evaporator load and the condenser water temperature were controlled during testing.”

“Based on the test results, the Hy-Save Liquid Pressure Amplifier was found to:

- *Provide an effective means of reducing compressor power consumption when properly applied.*
- *Provide a significant improvement in COP as the condenser temperature decreased for each evaporator temperature.*
- *Be a predictable method of saving energy. The power reduction factor method of estimating energy consumption seems to be an effective way in determining whether a particular application should be implemented.”*

Technical Assessment HY-SAVE LIQUID PRESSURE AMPLIFIER

IOWA STATE UNIVERSITY

Dr. Howard Shapiro

Lee Vannoy

Patrick Loegering

Iowa State University Abstract

WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

REFRIGERATION IMPROVEMENT BY LIQUID PRESSURE AMPLIFICATION Bulletin 871

“Two problems commonly occur with regard to the operation of a vapor-compression refrigeration cycle.

1) The compressor is set to operate at a pressure sufficient to meet the worst conditions during the summer period when the average ambient temperature is high, and ...

2) refrigerant vapor (flash gas) is formed prior to entering the expansion valve. The pressure drop required to “push” vapor is much greater than that needed for liquid. The liquid pressure amplifier was developed to prevent the occurrence of these problems. The prevention of these refrigeration problems can result in energy savings of up to 50% of the system’s energy consumption.

It has been found that there is approximately a 1 % energy saving per 1 deg. F. condensing temperature reduction.”

**University of Kansas
Energy Analysis and Diagnostic Center**



WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

REFRIGERATION ENERGY SAVINGS WITH FLOATING HEAD PRESSURE

"Most refrigeration systems operate at higher pressure than necessary. Several systems are available that allow head pressure and therefore condensing temperatures to float. The purpose of this study was to determine if one system that used a liquid pump is a viable technology in reducing energy use of a supermarket refrigeration system.

This paper reports the results of monitoring two supermarkets using this system with a 1/5horsepower liquid pump. In one supermarket 103 horsepower of compressors were sub-metered for 1105 days before installation and 233 days after installation. Results showed an average 23% compressor energy savings as well as a 4.2 deg F. reduction in case temperatures. The savings were observed from August, 1987 thru March, 1988. Metered energy use for a full year will be available in August 1988, In the other supermarket six refrigeration system parameters, including suction and discharge pressures and temperatures, were measured continuously for two weeks. A 7.5 horsepower compressor serving 135 feet of produce case was monitored under a range of operating conditions.

Results show savings between 14 and 42% depending on ambient temperatures."

University of Oregon - Greg Wheeler
Oregon Department of Energy - Gayland Smith



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EFFECTS OF LIQUID PRESSURE AMPLIFICATION AND SUPERHEAT SUPPRESSION

"The average net improvements showed are reduction of .5 kW per ton or a savings of 41.7% for the compressor only. These savings were achieved with a recorded average increase of 4.0 deg. in outdoor temperatures while conducting test with LPA and liquid injection.

The savings including the increased use of the tower fan was .506kW/ton. This is a net saving of 37.3% at 85.6 ambient. At lower ambients, fan horsepower would be reduced."

University of Nevada, Reno



University of Nevada, Reno
Statewide • Worldwide

WHAT OTHERS ARE SAYING ABOUT HY-SAVE TECHNOLOGY?

Second Stage Evaluation of Hy-Save LPA. Recommendation #472

"...shows that of every 100 inventions submitted for evaluation, about 2 are recommended to DOE."

"Our evaluation has been completed and we recommend Mr. Hyde's invention as technically valid and worthy of consideration for appropriate Government support."

"Three consultants reviewed this invention at the first-stage level. The invention was entered into second-stage evaluation on January 10, 1989. The second-stage review was conducted by Dr. H.M. Curran, a consulting engineer from St. Petersburg Beach, FL."

"The invention has been successfully tested at two supermarkets in western Oregon. The tests were monitored by Gregory Wheeler of Oregon State University and Gayland Smith of the Oregon Department of Energy."

"This invention will also save energy in air conditioning systems for commercial buildings since interior rooms need cooling throughout the year."

"There is no question that this invention has significant potential to save energy in commercial freezers and refrigerators with their condensers located outside the building."

"For each 2,000 such systems out of the thousands of potential sites that are equipped with this invention, the overall energy savings equivalent would be about 0.756 million barrels of oil per year."

"The invention also has the potential to save energy in commercial air conditioning systems. Assuming full market penetration the overall energy savings could be in the millions of barrels of oil per year on the national scale."

"Because this invention has the potential to lower peak electric demand for summer peaking utilities, the power companies have shown interest."

"This invention is technically sound..."

"Like other new products, there may be initial resistance from established equipment manufacturers"

"This invention is technically feasible and cost-effective."

"This invention is technically valid with respect to thermodynamic principles and physical implementation"

H.M. CURAN, PhD, P.E.

OERI # 012839

Office of Energy Related Inventions

