



DEDICATED HEAT RECOVERY UNIT (DHRC)



AHRI CERTIFICATION

Air-Conditioning, Heating, and Refrigeration Institute



Multistack is AHRI Certified and continues to certify products as they are developed

AHRI Certification provides real performance data

Multistack has AHRI approved and certified test stands in-house

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COMPLETE MULTISTACK MODULAR CHILLER ARRAY



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Theory of Modular Chillers

- Multiple smaller chillers connected in parallel allow array to meet building demands at peak times, but shut down modules when demand is lower. Modules use screw, scroll and centrifugal compressors
- Modular systems can easily be expanded for future building growth
- Redundancy is built-in. No need for a back-up chiller system when you have multiple compressors in parallel
- Installation is easy—individual units fit through office doorways and on elevators. No need for a crane or demolition
- Small footprint, low sound signature, ASHRAE 15 compliance and more
- Dedicated Heat Recovery Chillers and Water-to-Water Heat Pumps integrate into arrays

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Water-To-Water Heat Pump Chiller

- 20,30, 50 & 70 Ton Modules
- Arrays from 20-600 Tons
- Single Point Water Connection
- Single Point Power Connection
- EER'S > 17 at 45 Degrees
- COP'S > 4.0 at 120 Degrees



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DEDICATED HEAT RECOVERY CHILLERS DHRC

- Simultaneous Chilled and Hot Water
- Easy Addition to any Hydronic System
- One to Four Year Payback
- 75% Reduction in CO2 Emissions
- 10 Tons to 1000 Tons
- Use Heat Created Cooling Your Process and Facilities To Make Hot Water

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Reverse Heating & Cooling Systems

By Dennis Greeley, PE, Member ASHRAE, and Mark Platt, Member ASHRAE

Large mechanical renovations are always a challenge, especially when a building transitions into a new use. Add to that the invariable space and budget limitations associated with such projects and the challenge becomes even more difficult.

This was the case at Howard Regional Health Systems in Hickory, NC. The hospital had purchased an existing three-level, off-campus building to house a new outpatient behavioral health and disaster recovery data center that would serve as backup to the hospital's main data center. A \$20 per sq ft (\$215 per sq m) budget for the mechanical HVAC system with other critical owner requirements forced designers to consider some less than conventional alternatives to a traditional VAV scheme.

Thinking Outside of the VAV Box Formerly a facility for the use of 1700 sq ft of space, the building was purchased by Howard Regional Health Systems to house a new outpatient behavioral health and disaster recovery data center. The new mechanical design solution was a dedicated heat recovery chiller (DHRC). In addition, the design had to meet the client's need for an operable system within the physical parameters of the existing mechanical floor space.

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Above the Authors: Dennis Greeley, PE, is a former HVAC engineer in Hickory, NC. Mark Platt is a former HVAC engineer in Hickory, NC.

ASHRAE Journal ashrae.org October 2005

Heat Recovery

hospital

Dedicated Heat Recovery

By Thomas H. Durkin, PE, Member ASHRAE, and James B. (Bert) Bihari, PE, Fellow Member ASHRAE

The advent of the small scroll or screw chiller, capable of producing condenser water as high as 140°F (60°C), created an opportunity for recovering heat from a dedicated heat recovery chiller's condenser water circuit for heating or domestic water systems while providing beneficial cooling for the chilled water system. These systems are called "dedicated" heat recovery because 100% of the heat generated by the dedicated heat recovery chiller (DHRC) can be used for hot water heating applications. Also, the DHRC can be piped and controlled to produce the desired evaporator or condenser temperature. Transfer of the recovered heat in this article is limited to clean water applications, such as preheating, heating, reheating, domestic, pool water heating, or snow melting.

The following article was published in ASHRAE Journal, October 2005. © Copyright 2005 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. This document is a technical publication only. This article may not be copied, stored, distributed, reprinted, or printed in paper form without permission or consent.

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CRITICAL COOLING APPLICATIONS

Anywhere Redundancy is
Required

- Data Centers
- Industrial Process Applications
- Manufacturing Applications
- Telecommunications
- Pharmaceutical

Multiple Modules in Array Eliminate the Possibility of Single Point Failure

N-1 is Always Greater than Zero

N+1 is an Additional Module, Not Another Chiller System

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Reason to Recover Energy

- **Model Energy Code**

“...do not reheat with new energy...”

- ASHRAE Std. 90.1 - 2001

6.3.2.1 prohibits “reheating” and “recooling” except when...

- **Cost of Energy**

- Electric = \$2.92 per 100 MBH
- Conventional Boiler = \$1.30 per 100 MBH
- Condensing Boiler = \$1.10 per 100 MBH
- Recovered Heat = \$0.53 per 100 MBH

- **Emissions**

- Reduce 2.5 Kg CO₂ per 100 MBH vs. Conventional Boiler

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Concurrent Heating/Cooling Load Evaluation:

Scenario 1

Chiller Cooling = 0.6 kw/Ton @ \$0.10/kwh
= \$0.51/100 MBTU

Boiler Heating = \$1.00 THERM Natural Gas @ 80% Efficiency
= \$1.25/100 MBTU

Total = \$1.76

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Concurrent Heating/Cooling Load Evaluation:

Scenario 2

Economizer Cooling = Free (outside air)

Boiler Heating = \$1.00 THERM Natural Gas @ 80% Efficiency
= \$1.25/100 MBTU

Total = \$1.25

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Concurrent Heating/Cooling Load Evaluation:

Scenario 3

HR Chiller Cooling = @0.85 kw/Ton @ \$0.10/kwh
= \$0.71/100 MBTU

HR Chiller Heating = 125 MBH of Free Heat

Total = \$0.71

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Concurrent Heating/Cooling Load Evaluation:

Totals

Scenario 1 = \$1.76

Scenario 2 = \$1.25

Scenario 3 = \$0.71

10 Ton DHRC @ Multistack Headquarters

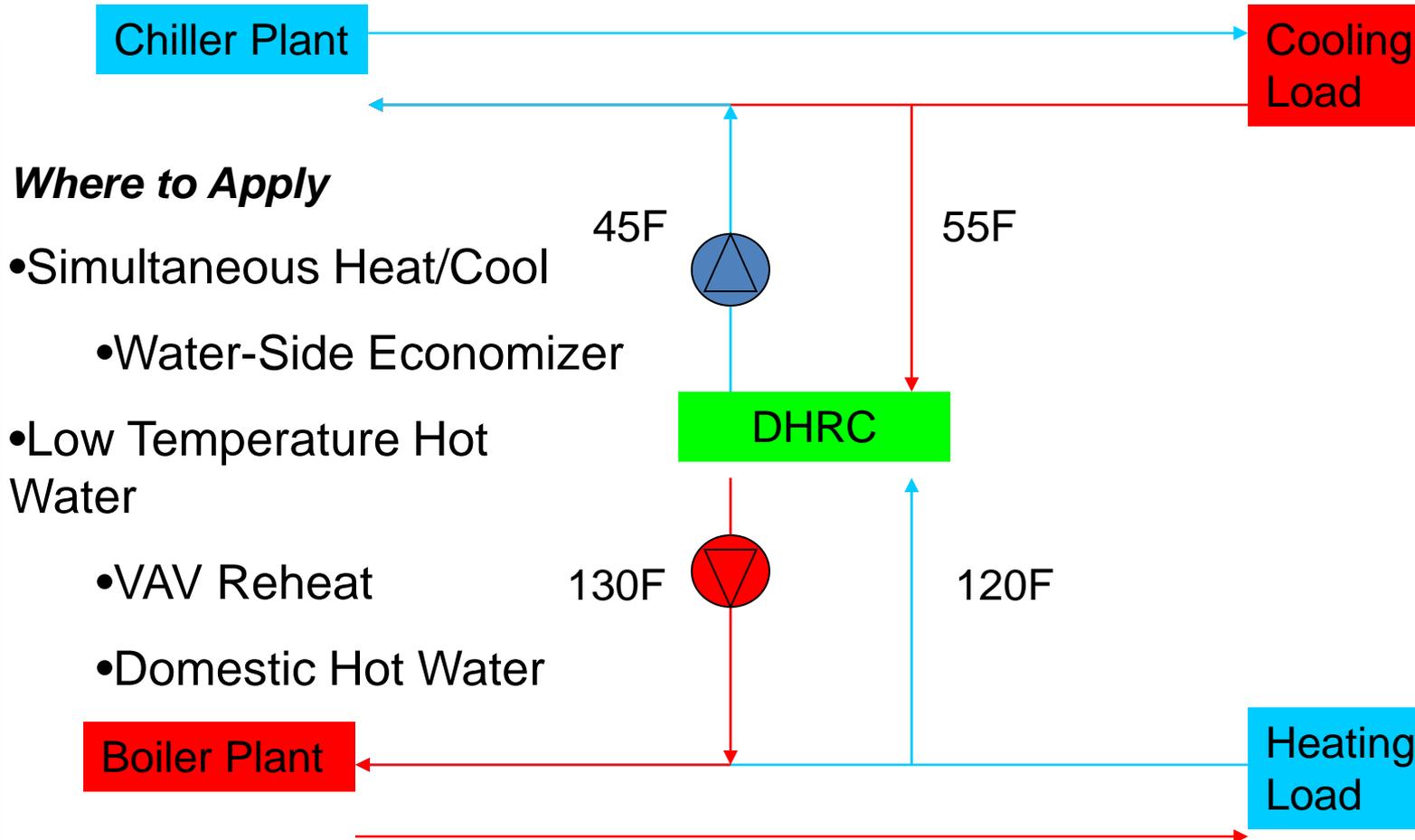
- 1,300 EFLH Summer
 - 2,000 EFLH Winter
- \$5,430 Annual Savings

Emissions Reduction of 22 Metric Tons of CO₂/Year

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Dedicated Heat Recovery Chiller



Where to Apply

- Simultaneous Heat/Cool
 - Water-Side Economizer
- Low Temperature Hot Water
 - VAV Reheat
 - Domestic Hot Water

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Domestic Water Heating

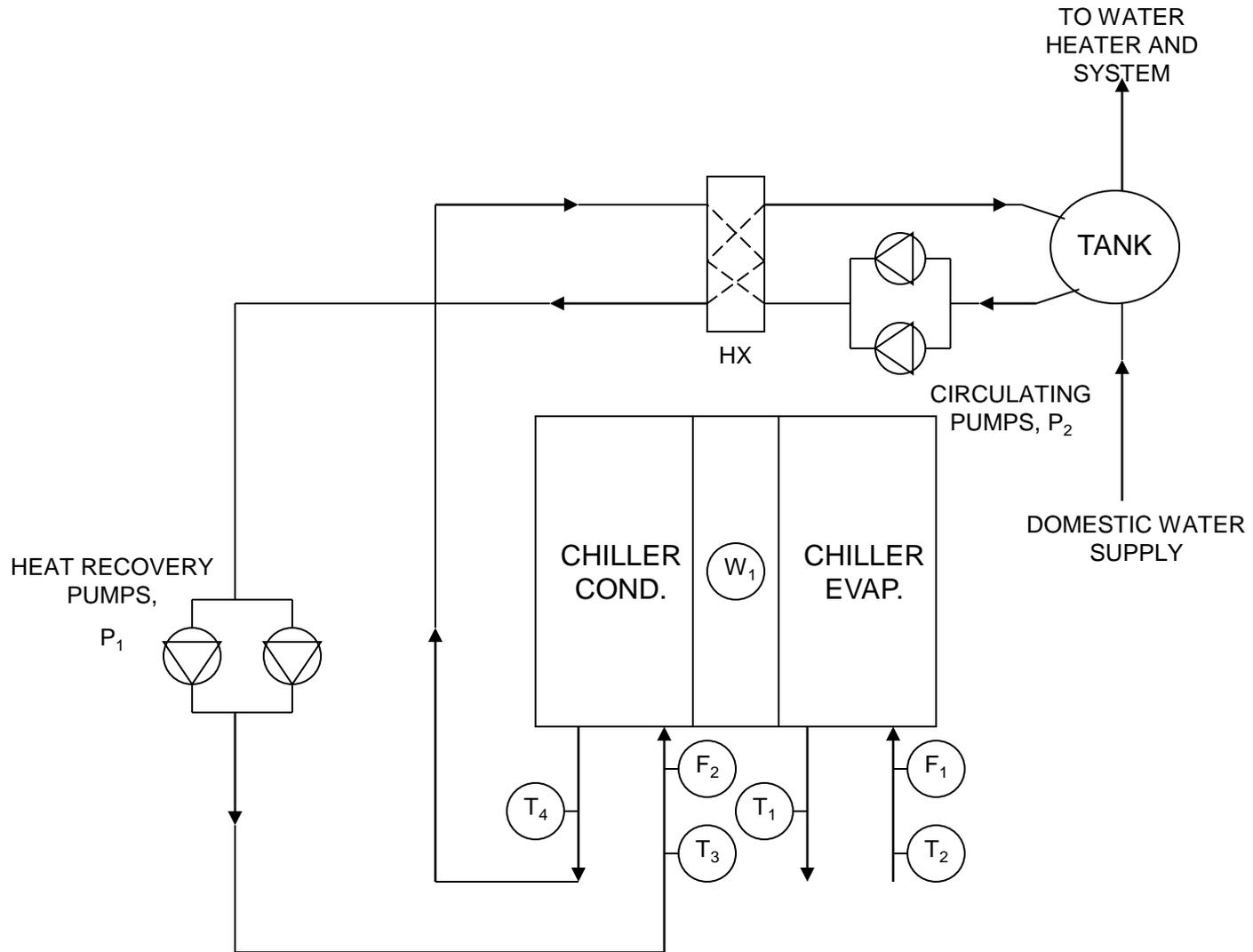


FIGURE 2

Space Hot Water Heating

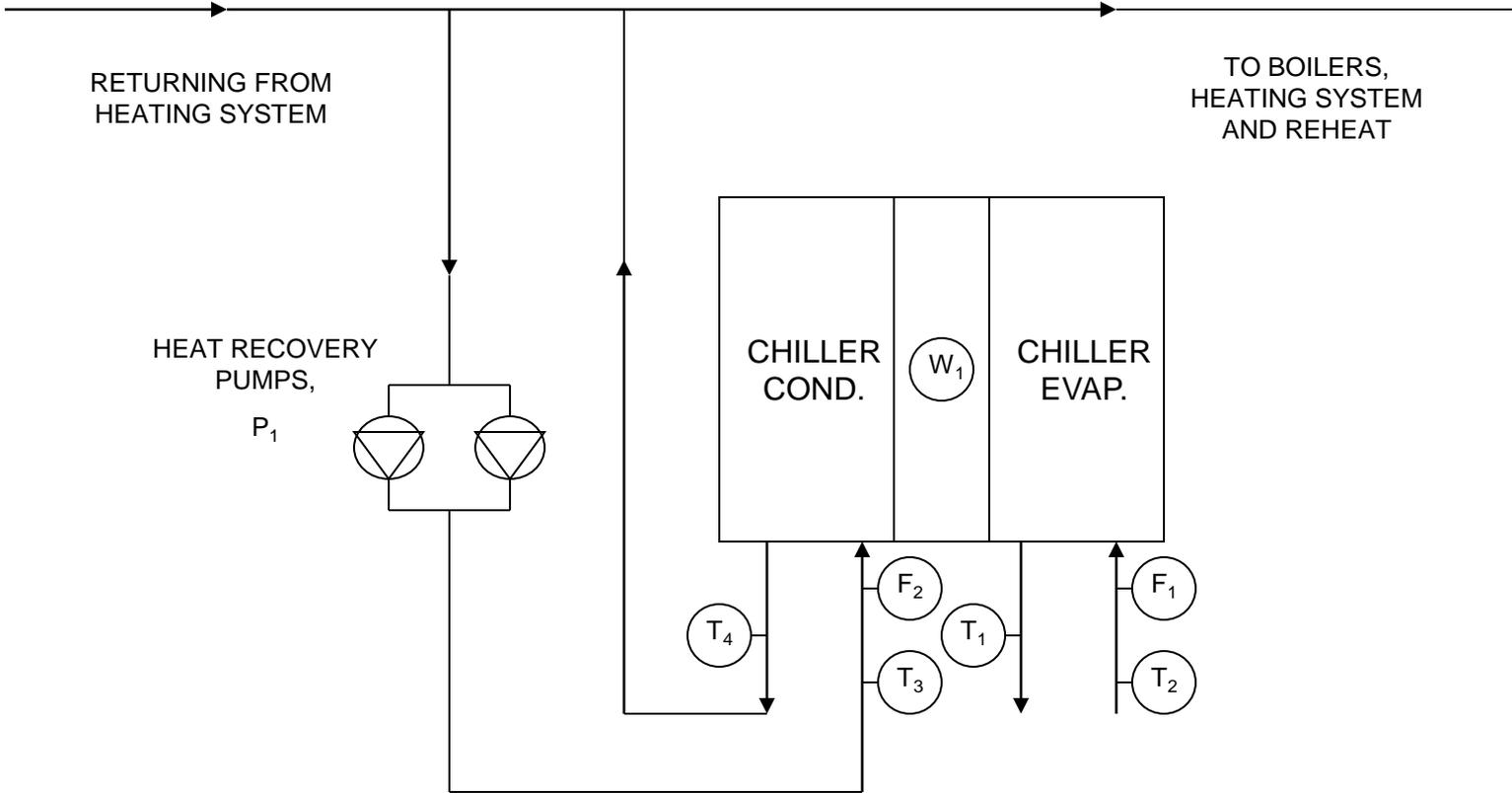


FIGURE 3

Chiller Cooling Load

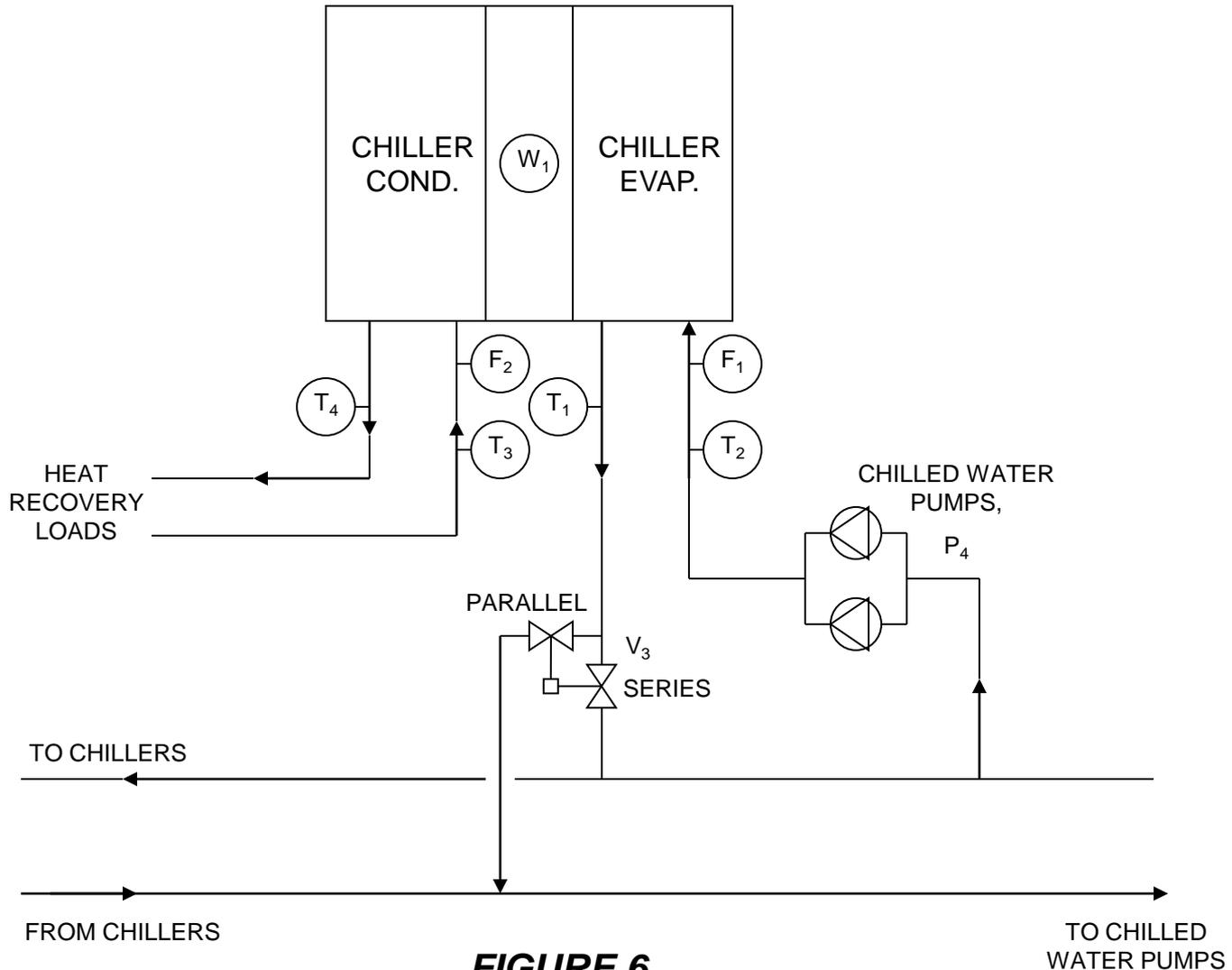
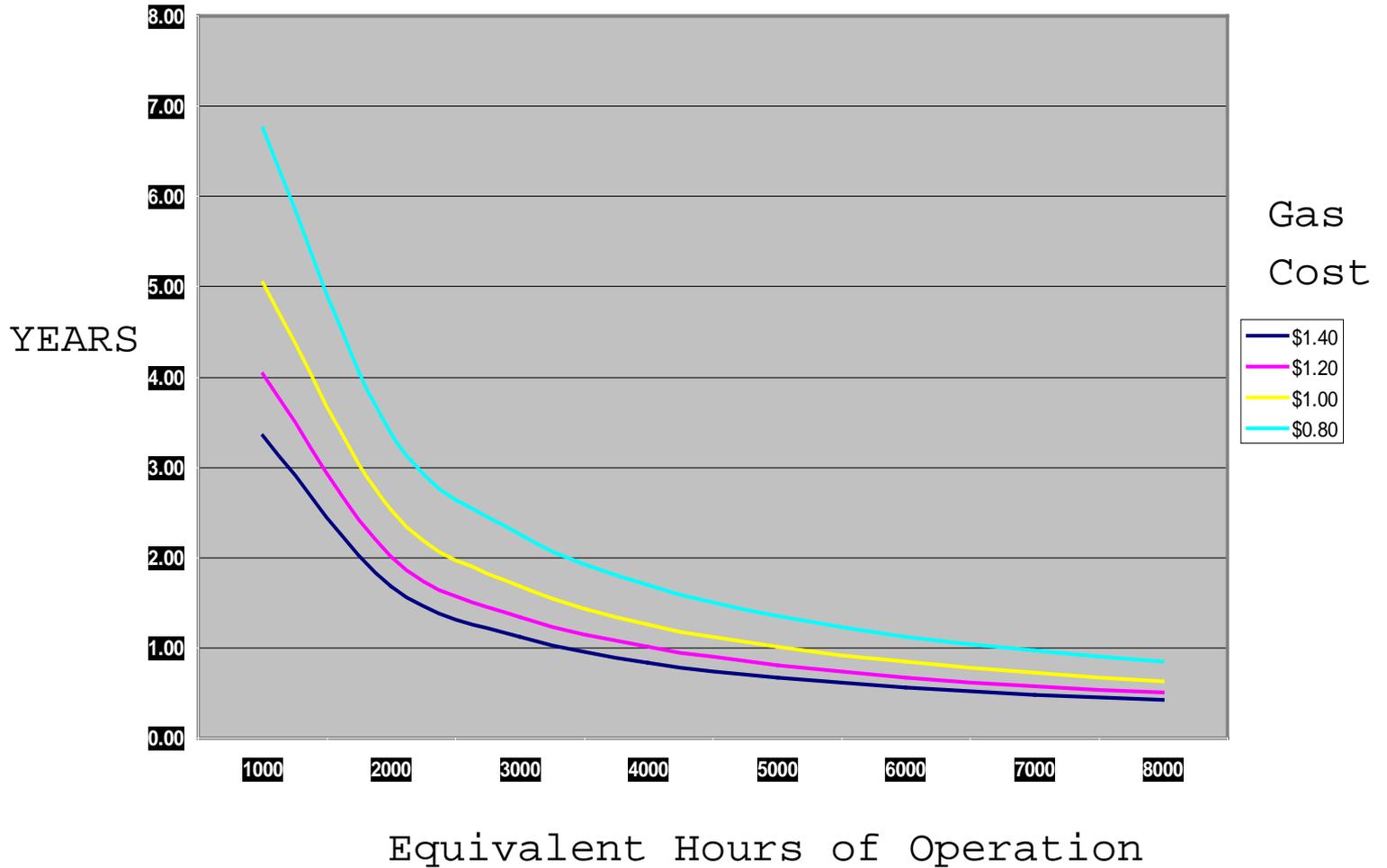


FIGURE 6

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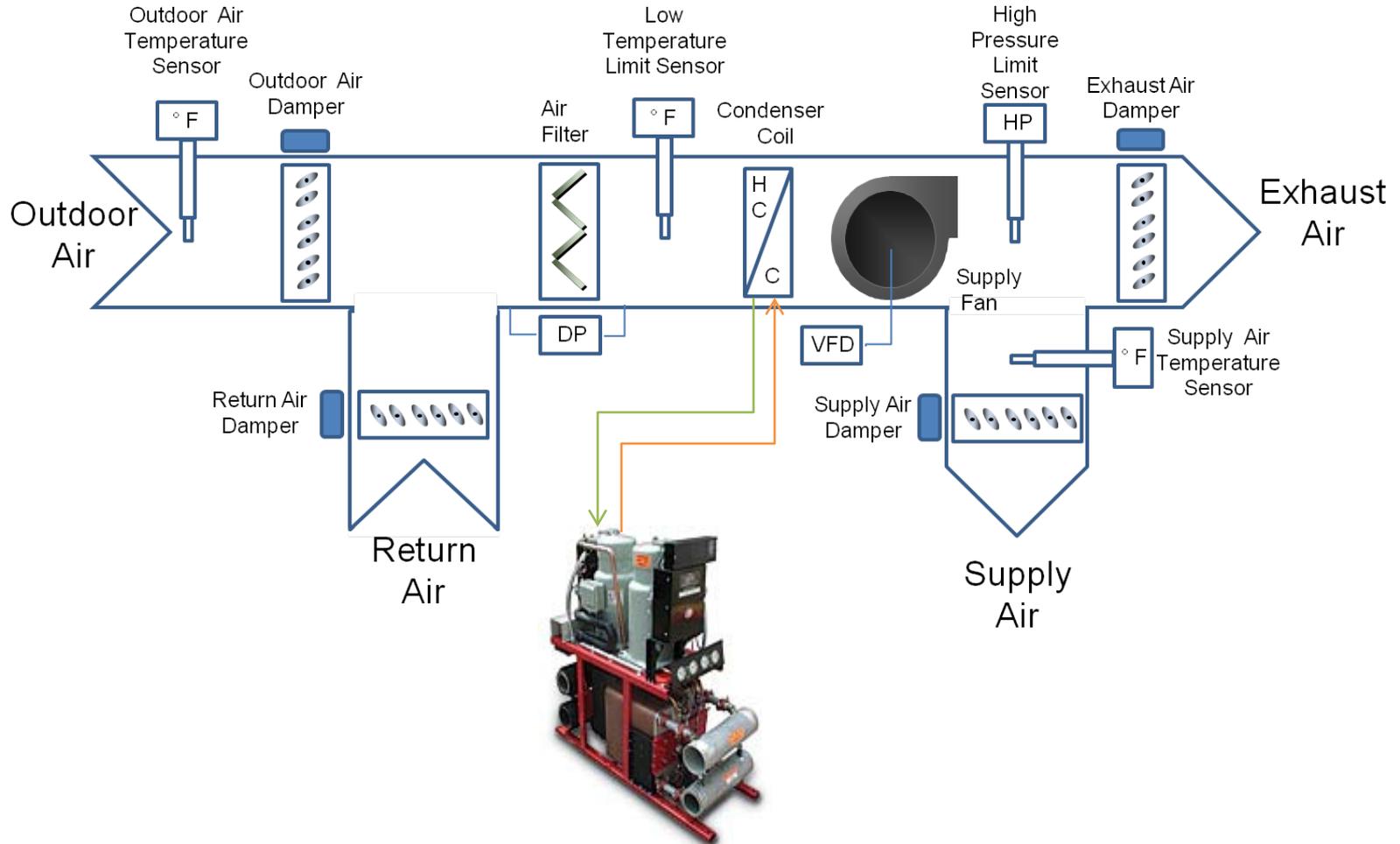
DHRC Payback



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Case Studies - Extruder Heat Recovery



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Case Studies- Grand Falls Casino



700 tons of Geothermal WSHP Chillers with heat recovery

<http://www.grandfallscasinoresort.com/construction.asp>

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REDUCE INSTALLATION COSTS WITH MODULAR CHILLERS

- **Multistack Modules fit Through Standard Doorway**
- **Multistack Modules Designed to Ride Elevator**
- **No Crane Needed for Installation of Individual Modules**
- **Demolition and Construction Avoidance**
- **ASHRAE-15 Compliant Without Costly Mechanical Room Upgrades**
- **Single Point Power and Water Connections Standard**

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