Testing and Commissioning Reports

Automatic Condenser Tube Cleaning System for Chiller No. CH-A1-G-01

System	:	Ball Technic BMS-10SW
System Number	:	1
Location	:	G/F., A/C Plant Room, Cathay Pacific City
Chiller Model	:	Carrier 19XRT6362
Chiller No.	:	CH-A1-G-01
Date of Measurement	:	9 January 2004

Compressor Operating Voltage	:	385 V.
Compressor Operating Current	:	440 Amp.
Loading Amp %	:	78%
Rated Capacity	:	298KVA
Power Factor	:	0.9
Chilled Water Flow Rate	:	0.0774 m^3/s
Oil Pressure	:	156.5 KPa
Oil Temperature	:	49 ^oC
Saturated Evap. Refrigerant Temperature	:	6.3 ^oC
Saturated Cond. Refrigerant Temperature	:	25.6 ^oC
Condenser Water Entering Temperature	:	19.7 ^oC
Condenser Water Leaving Temperature	:	23.7 ^oC
Condenser Differential Pressure	:	134 KPa
Condenser Water Flow Rate	:	0.1637 m^3/s
Chilled Water Entering Temperature	:	12.5 ^oC
Chilled Water Leaving Temperature	:	7.1 ^oC
Number of Balls added into the system	:	90
Operation of Injection Valve	:	Normal
Operation of Drain Valve	:	Normal
Number of Balls return to the injector	:	Normal

Flow Rate measured by Tokimec Inc. Ultrasonic Flowmeter UFP-10

Results and Conclusion

(a) Data taken before tube cleaning and ATC installation on 15 July 2003

Chiller Loading 104%
Cooling Capacity $Q = m \times 4.19\ KJ/Kg/^oC \times (T\ out - T\ in)$
$= 0.0774\ m^3/s \times 4190\ J/Kg.^oC \times (13.8\ ^oC - 8\ ^oC)$
$= 1881\ kW$ or 535 ton
Active Power $P = \sqrt{3} \times U_L \times I_b \times \cos\theta$
$= \sqrt{3} \times 376 \times 611 \times 0.9$
$= 358\ kW$
Chiller efficiency = measured as 0.67 kW/ton

(b) Data taken after tube cleaning and ATC installed on 24 February 2004

Chiller Loading 102%
Cooling Capacity $Q = m \times 4.19\ KJ/Kg/^oC \times (T\ out - T\ in)$
$= 0.0774\ m^3/s \times 4190\ J/Kg.^oC \times (14.4\ ^oC - 8\ ^oC)$
$= 2076\ kW$ or 590 ton
Active Power $P = \sqrt{3} \times U_L \times I_b \times \cos\theta$
$= \sqrt{3} \times 389 \times 576 \times 0.9$
$= 350\ kW$
Chiller efficiency = measured as 0.59 kW/ton

Data taken after the Ball Technic installation between 26 Feb. 04 to 18 Mar. 04

Date : 26 Feb 2004: Ch water in : 13.2C Ch water out : 7C Q=572 TR
391V, 565A, 344KW, P.F. 0.9, loading 100%, 0.6KW/TR

Date : 1 Mar 2004: Ch water in : 13.8C Ch water out : 7.8C Q=553 TR
391V, 588A, 356KW, P.F.0.9 loading 104%, 0.64KW/TR

Date : 10 Mar 2004: Ch water in : 13.8C Ch water out : 7.2C Q=609 TR
389V, 561A, 358KW, P.F.0.9, loading 101%, 0.55KW/TR

Date : 16 Mar 2004: Ch water in : 14C Ch water out : 7.8C Q=572 TR
376V, 605A, 351KW, P.F.0.89, loading 103%, 0.61KW/TR

Date : 18 Mar 2004: Ch water in : 14.2C Ch water out : 8.2C Q=553 TR
376V, 608A, 356KW, P.F.0.899, loading 103%, 0.64KW/TR

Use the average KW/TR from the above readings with loading ranging from 100% to 104%{ (0.59 + 0.6 + 0.64 + 0.55 + 0.61 + 0.64) / 6 }= 0.605 to calculate the saving,
(0.67 - 0.605) / 0.67 = 9.7%.

With the Ball Technic System installed on Chiller 1, the chiller now consumes 9.7% less electrical energy.