

## Operational data of the SMARTD WA140 chiller

### at the Club Med Nusa Dua, Bali

15-21 April 2015

A Smardt 400TR water cooled chiller was installed to replace 3 old water cooled piston type chillers. Pumps and cooling tower were also replaced. The new system has been commissioned on the 15th December 2014.

#### SUMMARY:

- ✓ The change to a single SMARTD 400TR water cooled chiller and replacement of CHW and CDW pumps as well as a closed cooling tower **is saving 25-30% of TOTAL resort's power consumption**
- ✓ This impressive result is despite that the SMARTD chiller now producing much better quality cooling, with Chilled water out now being 3-5C colder than with the old chillers
- ⇒ The Club Med Bali is receiving better cooling while saving substantially, with a **payback on the investment of about 2.5 years.**

#### Summary from Club Med Bali's Chief Engineer (February 2015):

*Mr Yann Bazin*



- **Chilled water temperatures are now in range with expectations**
  - Best value before new installation was 12 to 15 C, return until 22C.
  - Actual value is 8 C, only return have fluctuation depending of the load, never over 12 C.
- **Efficiency is really much better**
  - During DTZ audit efficiency measured was 1.20kW/RT, with bad chilled water temperature,
  - Now we get 0.5 kW/RT with very good chilled water temperature.
- **Comfort improved**
  - Since the chilled water send temperature is 8C guest complaints " room too hot " had disappeared.
  - Globally all area with air conditioning have now correct temperatures, issue we can have are now only linked to old fan coil unit devices.
- **Investment done is around 400 k USD**
  - Improving the comfort delivered, the efficiency of this chiller also allow a fast payback, based on average electricity unit cost of past two years here is the amortization calculated with first two weeks of operation :

Daily Electrical consumption, old installation, CWS = 14 C :	20,841 kWh
Daily Electrical consumption, new installation, CWS = 8 C :	16,700 kWh
Daily difference, kWh :	4,141 kWh
Yearly difference :	1,511,465 kWh
Value of yearly difference with past 21 month average kWh unit cost :	1,883,836,345 IDR
Value in USD, yearly economy between old and new installation :	149,091 USD
Amortization calculation time, based on full cost new installation / yearly economy :	2.78 year

The 29-year old beach resort is located at PT Bali Holiday Village, Nusa Dua 80361, Bali Indonesia. The resort features 393 guest rooms in 5 buildings up to 4 floors. The village centre forms the main activity area and comprises a variety of facilities such as restaurants, retail shops, swimming pool, fitness area, bar and outdoor theatre.

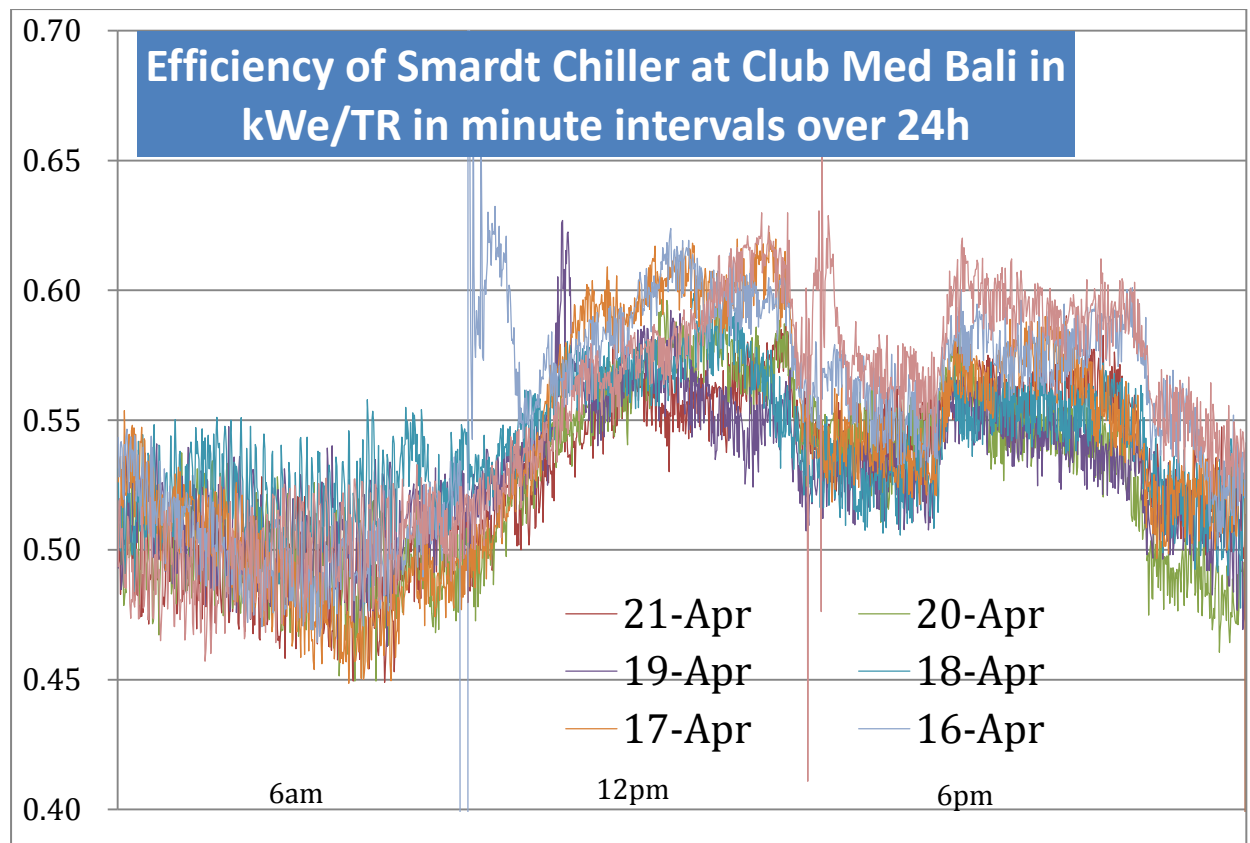
Audit report by DTZ consultants from Singapore calculated the old chiller 3 efficiency between 1.21 and 1.67kW/TR and chiller 4 efficiency between 0.75 and 3.48kW/TR; while the cooling produced was insufficient with leaving temperatures of 11-14C only.

The new SMARTD chiller has been set at 9C chilled water leaving, as such is producing more cooling, yet saving >50% electricity.

This data presented is derived from the SMARTD chiller's controller, recorded in minute intervals. The following parameters are recorded:

*CW\_Inlet\_Temp ; CW\_Outlet\_Temp ; CHW\_Inlet\_Temp ;*  
*CHW\_Outlet\_Temp*  
*EXV\_%\_Sys1; Refrig\_Level\_Sys1; Refrig\_Level\_Sys2 ; EXV\_%\_Sys2;*  
*System\_Demand*  
*Comp\_Total\_Input\_kWs ; CHW\_%\_Flow; %\_Of\_Capacity; #\_Comps\_On*      *Sys\_1\_Dis\_Sat\_Te*  
*Sys\_1\_Suc\_Sat\_Temp*      *mp*  
*Sys\_1\_Discharge | Sys\_2\_Discharge*      *Sys\_2\_Suction*

From this data the efficiency in kW/TR was derived and the below charts generated:



## Old chiller plant information:

AMCROTECH PTE LTD carried out an audit in April 2014, as well as another audit by DTZ, extracts of which are presented here as reference to the old chiller's performance before the replacement with the SMARTD chiller:

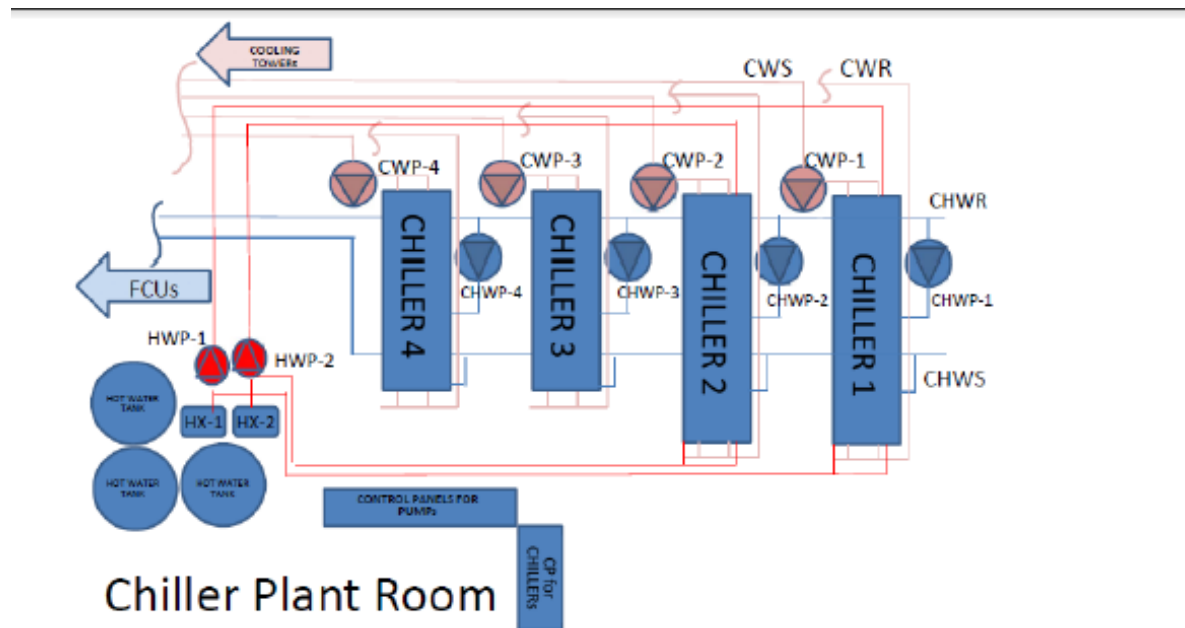


Figure 2.1.1: Existing Chiller Plant Room Layout

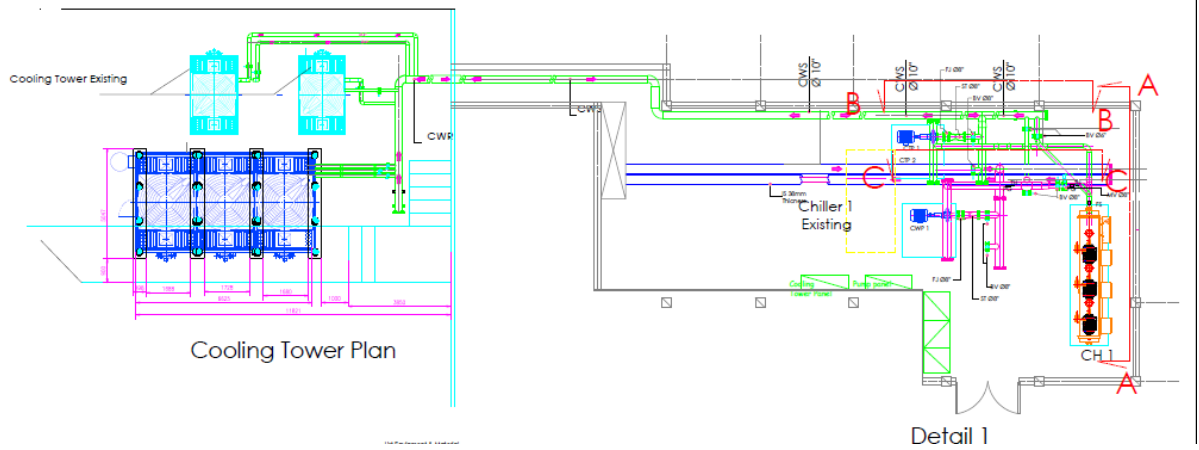
Visual site inspection was carried out in the plant room on 14 and 15 April 2014. Chiller 1, 3 & 5 (air-cooled) were running. As 2 out of 4 cooling towers were down, only 2 nos. of water-cooled chillers can be in operation at the same time. The air-cooled chiller was always running to support the cooling demand. It was also noted that 1 of the 5 compressors for chiller 1 was faulty.

The isolation valve for each of the chilled water pumps were throttled to partially shut-off, otherwise, the motor for the respective pump will have a shorter life span and has to be replaced more frequently according to the maintenance team.

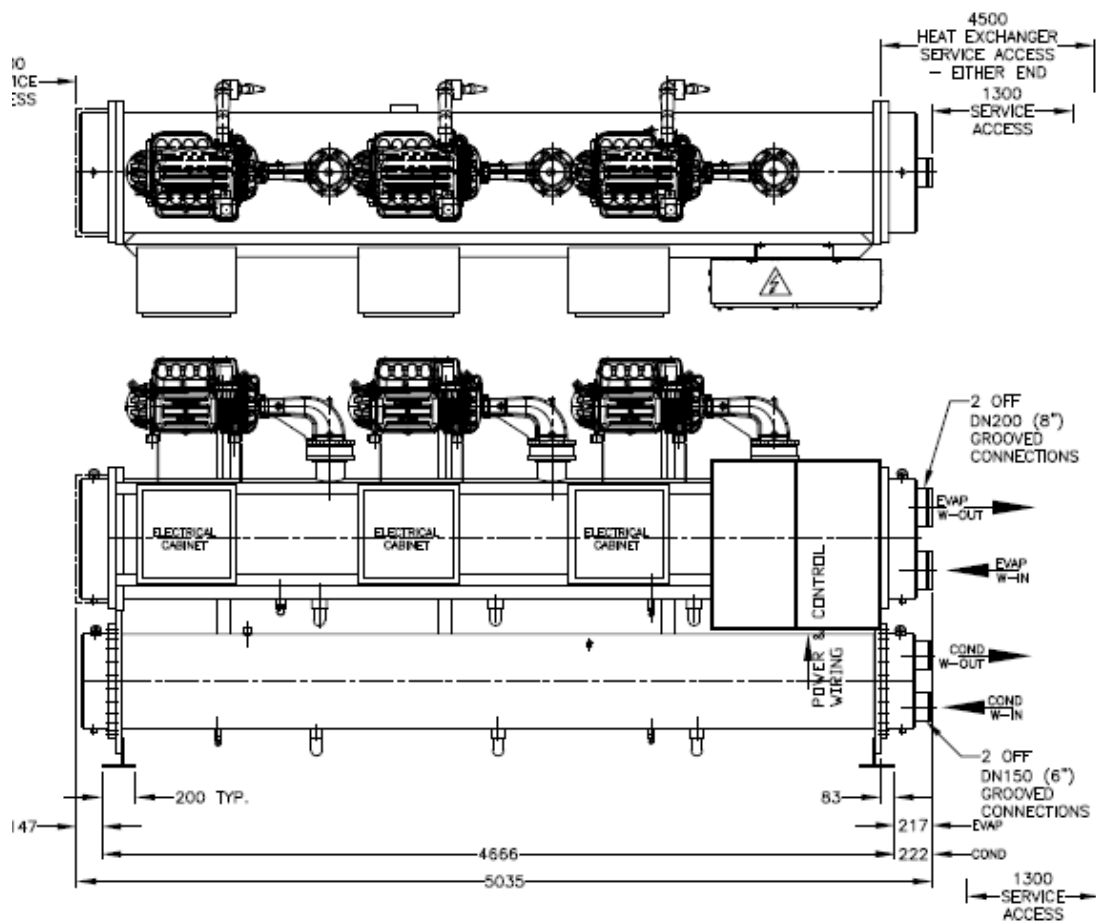
The thermometers at the main chilled water supply/return temperature read the outgoing chilled water temperature at 12°C and incoming chilled water temperature at 18°C. However, the supply temperature display in the maintenance office was 14°C. Monitoring of the chilled water flow rates was not available.

The SMARTD replaced chillers 1,2 and 3, with a provision to install a second chiller later. However, currently the SMARTD is running as only chiller, and delivering sufficient cooling for the resort, while having improved the efficiency significantly:

New Chiller plant design: implemented:



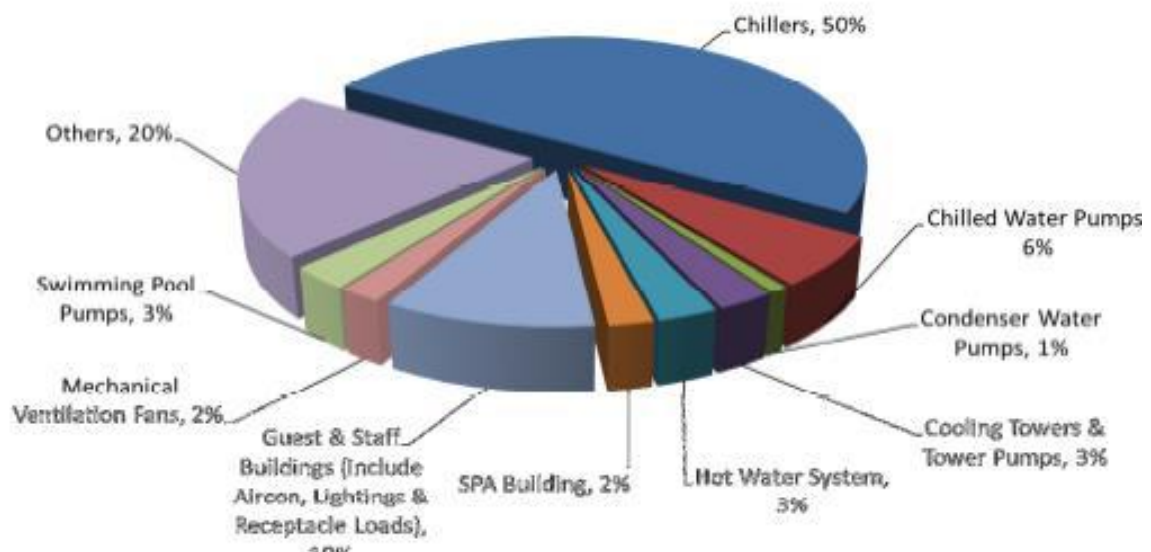
Dimensional Drawing SMARTD Powerpax WA140:



Parameter	Design	CH1	CH2
<b>Chilled Water</b>			
Supply Temperature (°C)	6.0	11.9 - 20.3	10.4 - 15.3
Return Temperature (°C)	10.9 <sup>2</sup>	13.5 - 22.2	13.9 - 18.5
Average Flowrate (GPM)	330	270	230
<b>Condenser Water (To Cooling Tower)</b>			
Supply Temperature (°C)	30	27.0 - 32.9	28.7 - 32.2
Return Temperature (°C)	36	38.6 - 42.9	33.4 - 38.0
Average Flowrate (GPM)	422	60	195
<b>Operating Performance</b>			
Capacity (RT)	124 <sup>3</sup>	28 - 43	53 - 68
Power (kW)	168	108 - 115	107 - 116
Efficiency (kW/RT)	1.35	2.59 - 3.99	1.64 - 2.10

Table 2.3 Water-Cooled Heat Recovery Chiller Performance (Chillers 1 & 2)

### Club Med Bali Energy Consumption Breakdown



The new SMARTD WA140 at Club Med Bali:



Closed type cooling tower Kuken brand we installed at Club Med Bali

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Please contact us if you require the underlying data set in xls format



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CASE STUDY SMARTD – Club Med Bali Chiller plant overhaul