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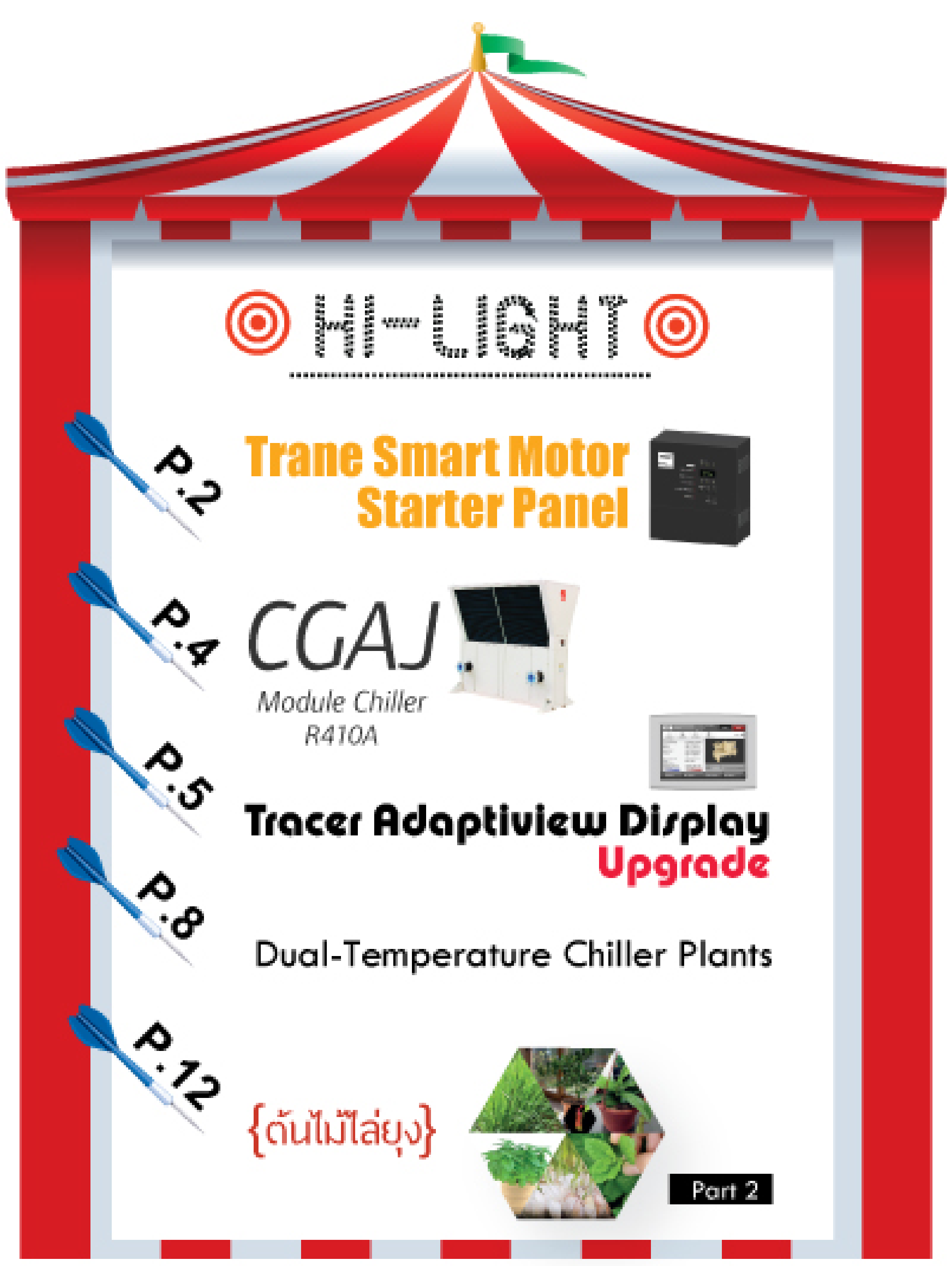
พิลลภ เตชะสุวรรณ์
Thailand Country
General Manager

สภาพเศรษฐกิจบ้านเราในเวลานี้มีแนวโน้มทางบวกหลายเรื่อง ไม่ว่าจะเป็นการที่รัฐบาลมีมาตรการกระตุ้นภาคอสังหาริมทรัพย์ ได้แก่ การเพิ่มโอกาสให้ผู้กู้ที่มีรายได้น้อยให้สามารถกู้ได้ง่ายขึ้นจากธนาคารอาคารสงเคราะห์ (ธอส.) การลดค่าธรรมเนียมการโอนจาก 2% เหลือ 0.01% การลดค่าจดจำนองจาก 1% เหลือ 0.01% หรือมาตรการทางภาษีที่ประชาชนผู้ซื้อที่อยู่อาศัยราคาไม่เกิน 3 ล้านบาท สามารถนำไปลดหย่อนภาษีบุคคลธรรมดาได้ 20% ของมูลค่าที่อยู่อาศัย ซึ่งเชื่อได้ว่ามาตรการเหล่านี้จะช่วยกระตุ้นยอดขาย และยอดโอนให้แก่โครงการที่พักอาศัยได้เป็นอย่างมาก นอกจากนี้ การประมูล 4G ที่ได้แข่งขันประมูลกันข้ามวันข้ามคืนนั้น ยังช่วยให้รัฐบาลมีรายได้เพิ่มอีกกว่าแสนล้านบาท ซึ่งจะช่วยรองรับการลงทุนของรัฐบาลในโครงการต่างๆที่กำลังจะเกิดขึ้นเพื่อพัฒนาประเทศให้ดีขึ้นต่อไป

ในขณะที่ 'เทรน' กำลังพัฒนาผลิตภัณฑ์หลายประเภทเพื่อรองรับการลงทุนของลูกค้า โดยมุ่งตอบสนองต่อความต้องการของลูกค้า ที่โดยส่วนใหญ่ยังคงมุ่งเน้นนวัตกรรมการประหยัดพลังงาน และรักษาสิ่งแวดล้อม และสิ่งที่เรายึดมั่นมาโดยตลอด คือ การบริการหลังการขาย และอะไหล่ที่จัดเตรียมไว้เพียงพอต่อการให้บริการท่านทุกเมื่อที่ต้องการ



สำหรับเนื้อหาภายในฉบับนี้ มีการนำเสนอสินค้า บริการ และอะไหล่ของเทรนอย่างครบถ้วน ได้แก่ Air-Cooled Chiller รุ่น *'CGAJ'* ที่มีประสิทธิภาพสูง ติดตั้งง่าย ประหยัดพื้นที่ในการติดตั้ง และใช้สารทำความเย็น R-410a ที่เป็นมิตรต่อสิ่งแวดล้อม ซึ่งสามารถใช้งานร่วมกับแฟนคอยล์ และ AHU พร้อมระบบควบคุมที่สะดวกต่อผู้ใช้งาน ชุดควบคุม *'Trane Smart Motor Starter Panel'* สำหรับควบคุมเครื่องปรับอากาศแบบแยกส่วนขนาดใหญ่ ขนาด 5-21 ตัน ที่มีดีไซน์ทันสมัย พร้อมฟังก์ชั่นการใช้งานที่เพิ่มความสะดวกสบาย และปลอดภัยมากยิ่งขึ้น และบริการอัพเกรดหน้าจอควบคุมเป็น Tracer AdaptiView Display Control สำหรับเครื่องชิลเลอร์ ที่จะช่วยให้การควบคุมระบบทำความเย็นมีประสิทธิภาพ และประหยัดพลังงานยิ่งขึ้น รวมถึงบทความตอนที่ 2 ของ *'Dual-Temperatur Chiller Plants'* สำหรับอาคารที่ต้องการใช้น้ำในอุณหภูมิที่แตกต่างกัน และส่งท้ายฉบับกันด้วยเกร็ดดีๆเรื่อง *'ต้นไม้ไล่ยุง'* เพื่อให้ทุกท่านได้ลองหามาปลูกไว้ในบริเวณบ้าน ในช่วงที่โรคไข้เลือดออกกำลังระบาดอยู่ในขณะนี้...

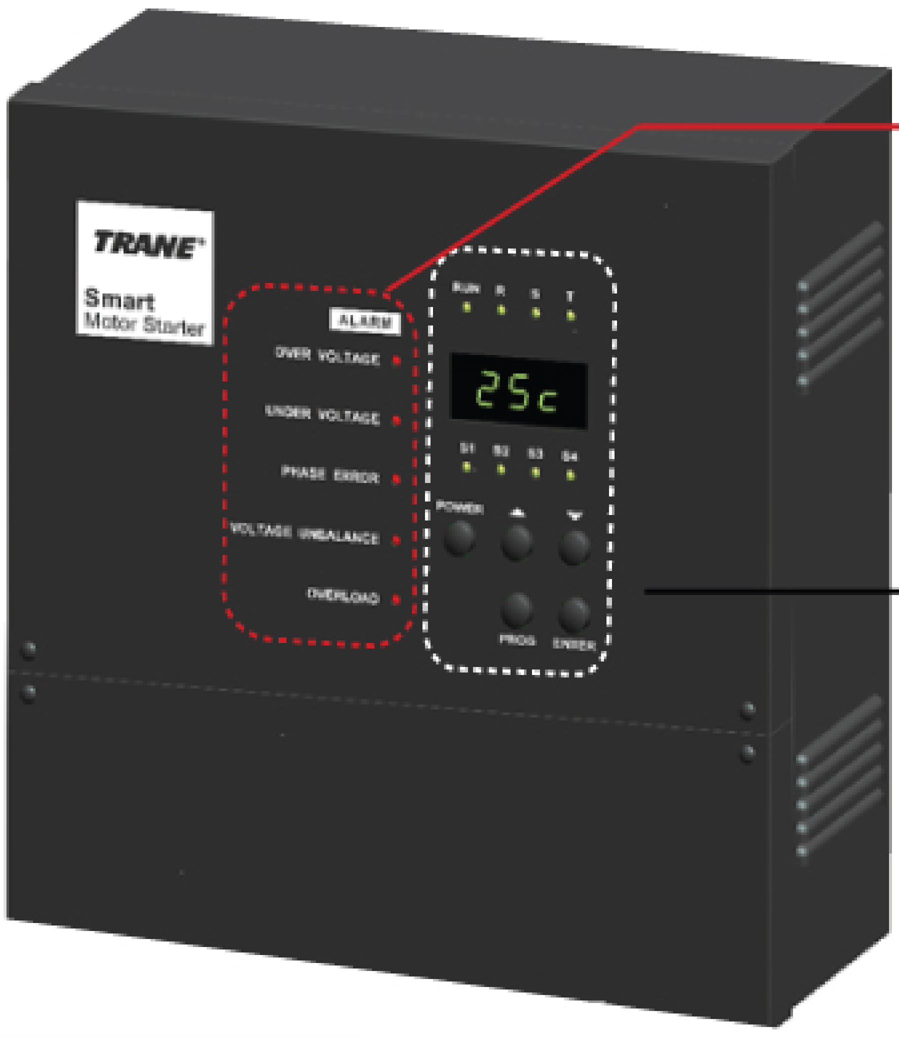
Spare Parts *Updated*

Trane Smart Motor Starter Panel
(SMS – 3P – 1F – 10)

ชุดควบคุมเครื่องปรับอากาศแบบแยกส่วนขนาดใหญ่ ขนาด 5-21 ตัน ของระบบปรับอากาศ DX/Chilled water system ที่ใช้งานกับ มอเตอร์ AHU ขนาด 0.75 HP ถึง 5.0 HP แบบ Direct on line (DOL) ซึ่งได้รับการออกแบบมาเป็นพิเศษให้มีขนาดกะทัดรัดและสวยงามง่ายต่อการใช้งาน พร้อมด้วยฟังก์ชั่นการป้องกันความผิดปกติทางไฟฟ้าที่จ่ายให้กับมอเตอร์นอกจากนี้ยังรองรับexternal input for remote start สำหรับการควบคุมจากระยะไกลแบบ ON/OFF ทำงานร่วมกับ AHU motor

Trane Smart Motor Starter Panel
ประกอบด้วยอุปกรณ์มาตรฐานดังนี้

- Magnetic contactor x 1
- Main board x 1
- Terminal blocks
- Fuse box x 1
- Display board x 1



Power failure LED indicators :
Over Voltage LED, Under Voltage LED, Phase Error LED, Voltage Unbalance LED, Overload LED

7-segment display on-board Thermostat & Operating Status LED indicators

Features of On – board Thermostat

- **Temperature setting**
- **4-stage output operation**
- **Auto restart** : เมื่อไฟฟ้าดับแล้วกลับมาทำงานปกติ ระบบจะทำงานตามคำสั่งเดิมที่ตั้งไว้
- **Time delay** : กรณีเลือกการทำงานเป็น DX system ระบบจะมีการหน่วงเวลาการทำงานของคอมเพรสเซอร์เป็นเวลา 3 นาที และไม่มีระบบหน่วงเวลาสำหรับการทำงานเป็น Chilled water system
- **Sensor error alarm** : ระบบแจ้งเตือนความผิดปกติ (self-diagnostic)
- **External input for remote start** : รองรับ external start input จากการควบคุมระยะไกลแบบ ON/OFF
- **Watchdog** : ระบบจะ reset ทันทีเมื่อมีการทำงานผิดพลาดจากระบบคอมพิวเตอร์
- **Remote room sensor** *(option)* : รองรับการเชื่อมต่อ remote room sensor ชนิด epoxy type หรือ temperature module ได้ 1 จุด
- **Remote freeze sensor** *(option)* : สามารถต่อ remote freeze sensor ชนิด pipe type เพื่อตรวจสอบการเป็นน้ำแข็งที่คอยล์
- **Remote display unit** *(option)*

Remote display unit
(option)

TRANE
HVAC Parts & Supplies

Comparison of features between Trane STANDARD AHU Starter Panel and Trane SMART AHU Starter Panel		
Features of Starter Panel	**Standard Starter DOL**	**Smart Starter**
Compatible with DX	only DX system	✓
Compatible with Chilled water system (ON/OFF operation only)	X	✓
Temperature setting	✓	✓
4 stage output operation	✓	✓
External input for remote start	X	✓
Auto restart	✓	✓
Sensor error alarm	by Trane thermostat	✓
Watchdog	by Trane thermostat	✓
Remote room sensor (*option*)	✓	✓
Remote freeze sensor (*option*)	X	✓
Remote display unit (*option*)	X	✓
Power failure LED indicators: *Over Voltage, Under Voltage, Phase Error, Voltage Unbalance, Overload*	X	✓
Max. capacity of AHU motor (HP)	5	5
Ambient operating temperature	15 °C - 30 °C	10 °C - 50 °C
Dimension in mm. (H x W x D)	500 x 350 x 200	322 x 322 x 93

Rating			
Model	**Motor**		
	Voltage	*HP*	*KW*
SMS – 3P – 1 F – 10	380, 400, 415	0.75 – 5.0	0.55 – 3.7

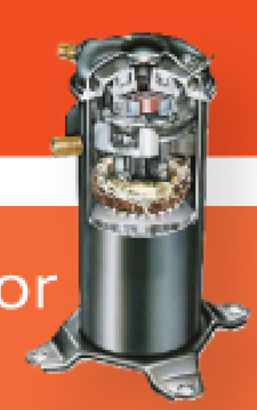
Specification	
Power consumption	20 W
Input voltage	220 – 240 VAC
Frequency	50/60 Hz
Accuracy	± 1%
% Over voltage	5 – 20%
% Under voltage	5 – 20%
% Voltage unbalance	3 – 20%
Output rated power AC-3 @ 400W	3.7 kW
Contact rating (AC-1)	30 A
Phase protection mode	Auto / Manual
Ambient operating temperature	10 – 50 C
Wire fixing	Screw terminal block
Indicator	7-segment LED Display
Dimension in mm.	322 x 322 x 93 mm. (H x W x D)

CGAJ

Module Chiller
R410A

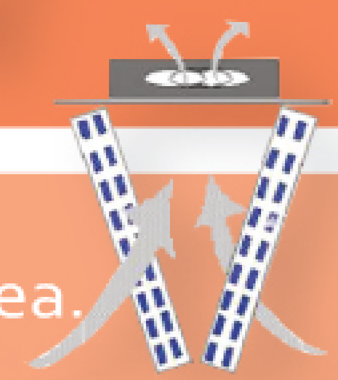
Environmental friendly, high efficient and supreme multiple protection system

Module Design | Various combinations are available for different cooling capacity need.



Efficient & Stable | Having COP up to 3.19 w/w. high efficiency scroll compressor is used and be capable of multilevel energy adjustment.

Shell & Tube Evaporator | High quality and reliability.



V-type and Cooled Condenser | Help expand heat exchange area.

Easy Installation | Identical dimensions of the same series ensures orderly and neat installation.

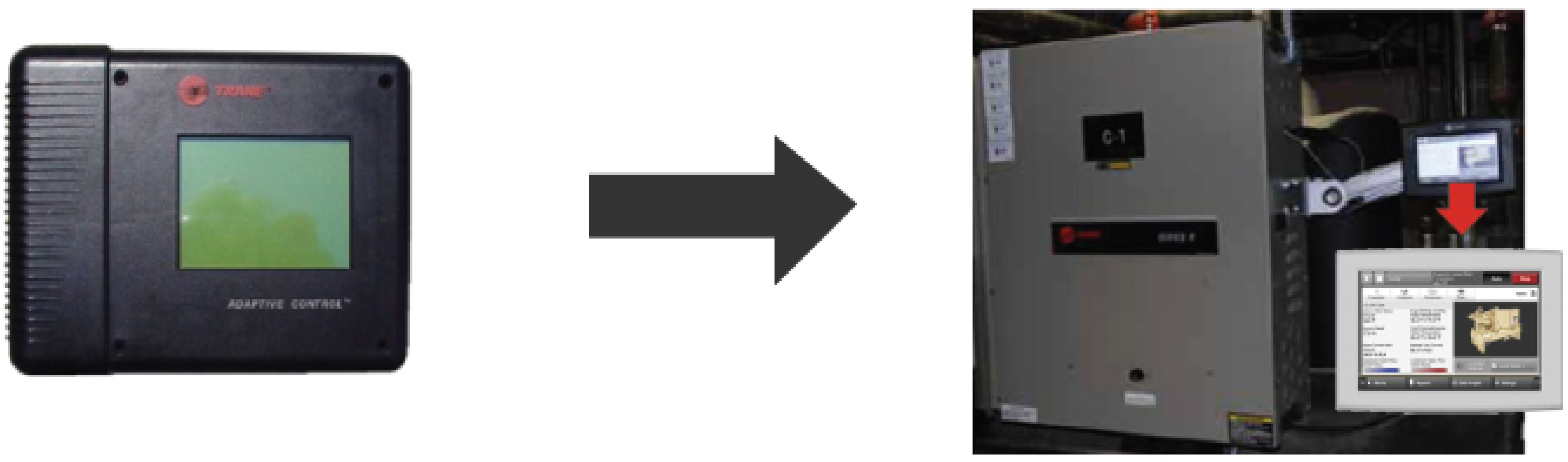
System Backup Running | Two individual circuits in a single module helps back up when one circuit is out of order.

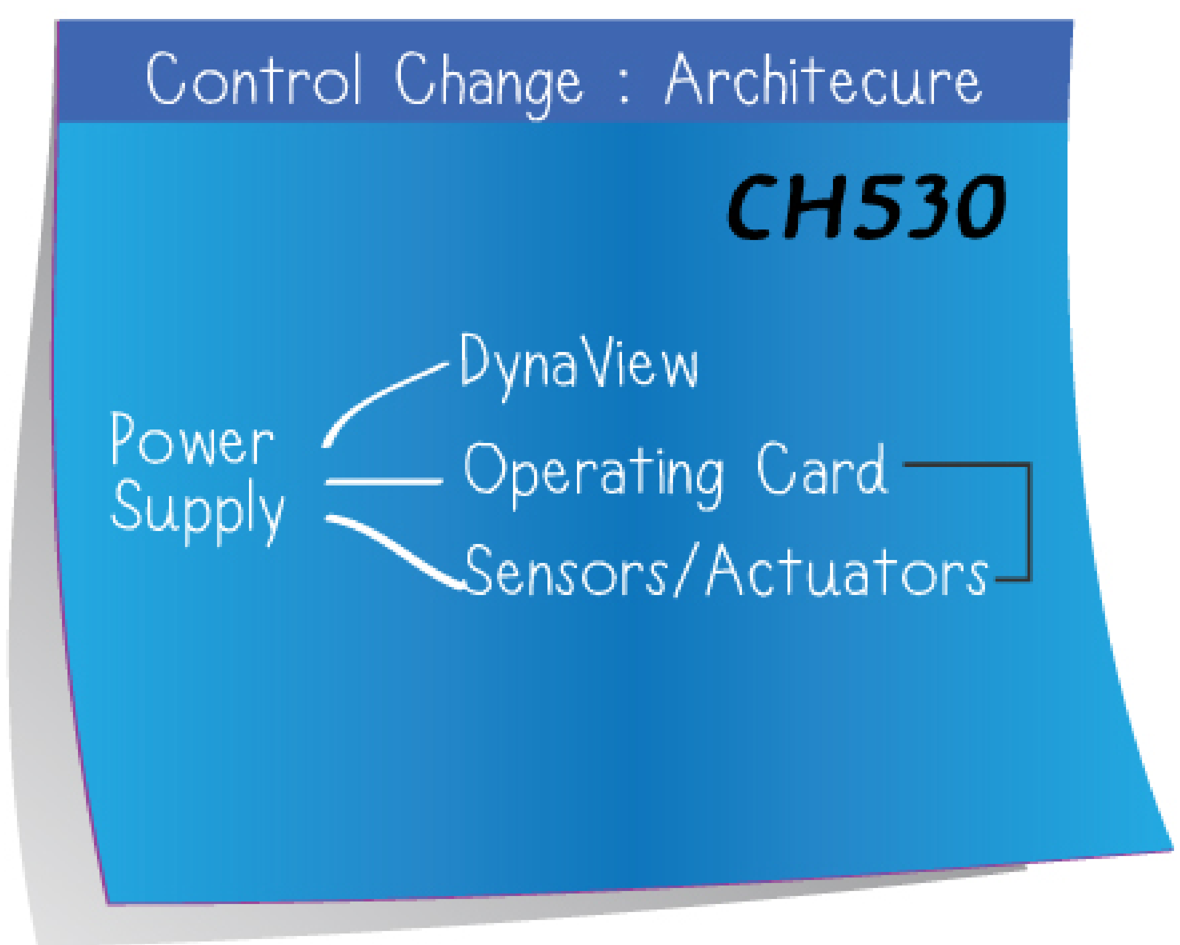
Capacity | Up to 160 ton/module and up to 480 tons/multi module.

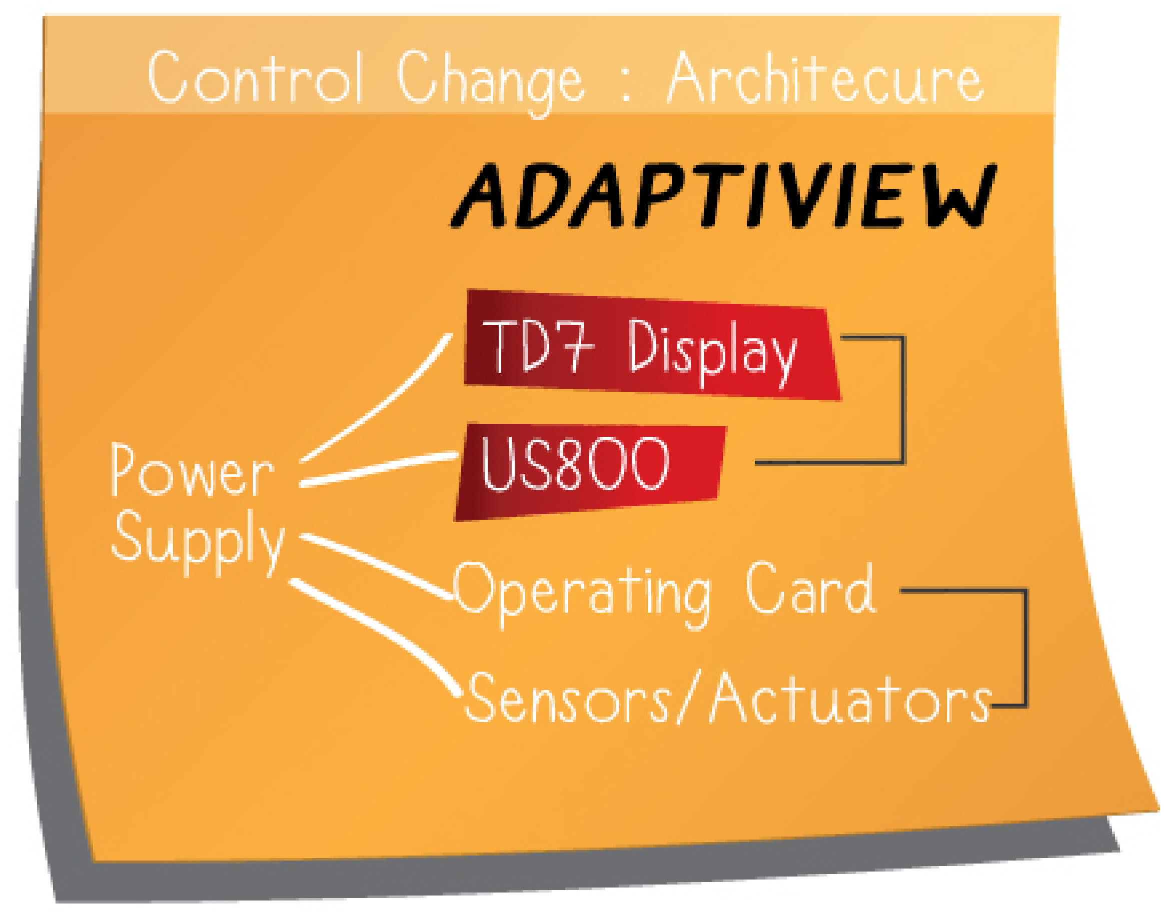
Tracer Adaptiview Display Upgrade

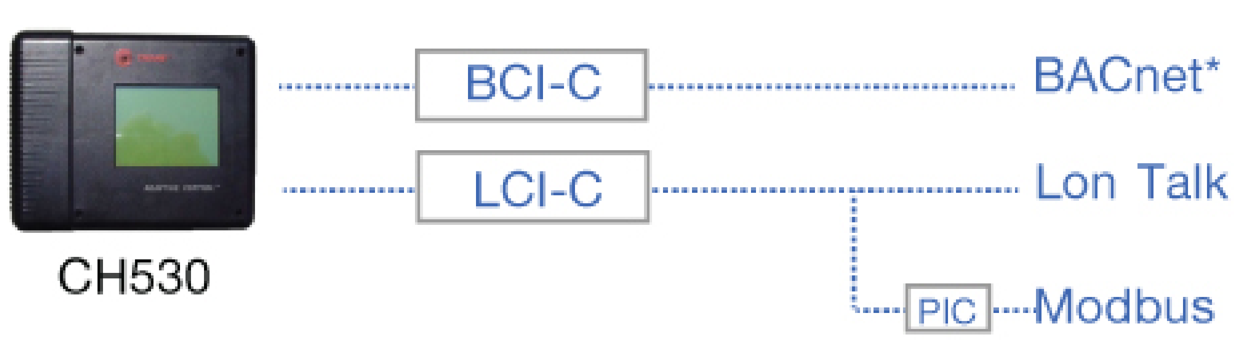
การอัพเกรดหน้าจอควบคุมเป็น Tracer AdaptiView Display Control สำหรับเครื่องชิลเลอร์เทรน ซีรีย์ R ที่มีการติดตั้งหน้าจอควบคุมรุ่น CH530 มาจากโรงงานโดยตรง ซึ่งในชุดอัพเกรดหน้าจอควบคุมจะประกอบไปด้วยอุปกรณ์ที่สำคัญ เช่น หน้าจอ Tracer AdaptiView, UC800 Controller, Hardware, Cables และ Mounting Swing Arm

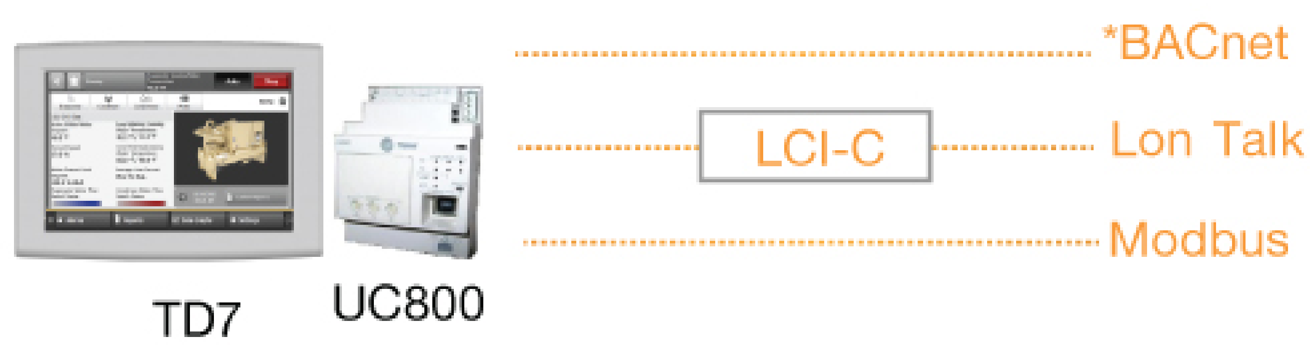
TRANE CHILLER SERIES R CH530	TRACER ADAPTIVIEW™ RTHD ROTARY CHILLER DISPLAY UPGRADE KIT











*BACnet communitcation to be reconfigured

By Technical Support and Training Department

AdaptiView™ Chiller Control Comparison

Tracer™ CH530

AdaptiView™

Trane® Tracer™ CH530 control panels were offered on water-cooled Series R, model RTHD chillers built from 2003 through 2014. These panels have many of the control features of new AdaptiView™ panels. However, they have limited communications and service interface capabilities. For improved user communications, logging and servicing capabilities, and compatibility with Trane Intelligent Services (TIS), Trane Service recommends that these panels be upgraded to new Trane Tracer AdaptiView™ control panels.

Features	Tracer CH530 Control Panel	Tracer AdaptiView Control Panel	AdaptiView Benefits
Base Technology	Networked digital sensors and display, controlled by Tracer DynaView™ controller with monochrome graphic display.	Networked digital sensors and display, controlled by Tracer UC800 digital controller and Tracer OD color graphic display.	Provides unit control flexibility and monitoring not possible with early generation digital controls.
Primary Repair Components	Modular digital component design that minimizes cost of individual service parts and all components are used in Trane present production equipment.	Modular digital component design that minimizes cost of individual service parts and all components are used in Trane present production equipment. AdaptiView uses pluggable-style connectors for easy component replacement.	Repair components are in stock and affordable. Cable kits available as an option when upgrading to AdaptiView.
Trane Communications Capability	Same capabilities as AdaptiView.	Compatible with current Tracer Summit™ building automation system.	Communicates with Tracer systems which allows advanced energy saving strategies such as Tracer chiller plant optimization.
Facility Communications Capability	Native LonTalk™. Requires Tracer Summit for Modbus and BACnet communications capability with facility communications systems.	Native LonTalk™, BACnet, and Modbus® communications capability.	Communicates with leading commercial and industrial building management systems. No intermediate panel needed.
Temperature Control Strategy	Same Feedforward control as AdaptiView.	Feedforward Adaptive Control uses open-loop, PID predictive control strategy designed to anticipate and compensate for load changes. It uses evaporator entering-water temperature as an indication of load change.	Responds faster and maintains stable leaving-water temperatures. It also eliminates the inherent proportional error seen with deadband controls.
Variable Primary Flow Compensation	The Tracer CH530 chiller controller uses a patented, variable water-flow compensation algorithm to maintain stable, precise capacity control under changing flow conditions. Variable-flow compensation is a new, optional, control feature that includes water differential pressure-sensor transducers. Variable-flow compensation improves the ability of the chiller to accommodate variable flow.	Tracer AdaptiView uses the same control algorithms as CH530, with an enhanced component set to provide even more precise control. This is an option when upgrading to AdaptiView from CH530, even if your chiller previously did not have this feature.	Varying the water flow reduces the energy consumed by pumps, which can be a significant source of energy savings, depending on the application.

Features	Tracer CH530 Control Panel	Tracer AdaptiView Control Panel	AdaptiView Benefits
Chiller Protective Control Strategy	Same adaptive protection strategies as AdaptiView™.	Adaptive protection strategies - The Tracer™ controller monitors chiller refrigerant temperatures, refrigerant pressures and electrical phase imbalances and adjusts chiller operation when conditions approach alarm limits. An example of such a condition is when there is a partial failure of a cooling tower, limiting total capacity.	Helps to maximize the ability to keep the chiller running under adverse phase imbalance and refrigerant conditions.
Motor/Power Protective Control Strategy	Same advanced starter protections as AdaptiView.	Advanced motor/power protection - Digital control protection from current overload, phase imbalance, phase loss, momentary power loss, and over and under voltage variations.	Digital controls are more accurate and faster than analog overload controls. Also, AdaptiView provides voltage imbalance and dry run protections that address important causes of chiller failures.
Power Failure Recovery Strategy	Same adaptive fast restart method as AdaptiView.	Fast Restart - The controller allows the chiller to restart during the postlube process. If the chiller shuts down on a nonlatching diagnostic, the diagnostic has 30–60 seconds to clear itself and initiate a fast restart. This includes momentary power losses.	Typically restarts 30-60 seconds after a power failure.
Performance Monitoring Capability	Same performance monitoring parameters as AdaptiView.	Capable of measuring entering and leaving water, oil temperature, tons, power consumption, power factor (uncorrected), compressor phase amps, and compressor phase voltage.	Allows users to monitor and diagnose chiller operation trends.
Logging and Reporting	Current status and alarms are indicated on monochrome LCD display.	Recorded data logs include ASHRAE 3 report, Custom report, Graphical custom historical data log, and 100 alarm log.	Allows users to monitor and diagnose chiller operation trends.
Setpoint Saving and Backup	Setpoints can be edited and stored for backup using Tracer TechView™.	All unit configurations and setpoints are recorded digitally via Tracer TU and KestrelView™ allowing complete backup and restoring of unit operating parameters.	Speeds replacement and assures accuracy in case the panel requires repair.

providing insights for today's hvac system designer
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Dual-Temperature Chiller Plants Part 2

Plant with Two Chillers

Many chiller plants are designed to include more than one chiller to improve plant efficiency and to provide redundancy if one of the chillers were to fail or require service.

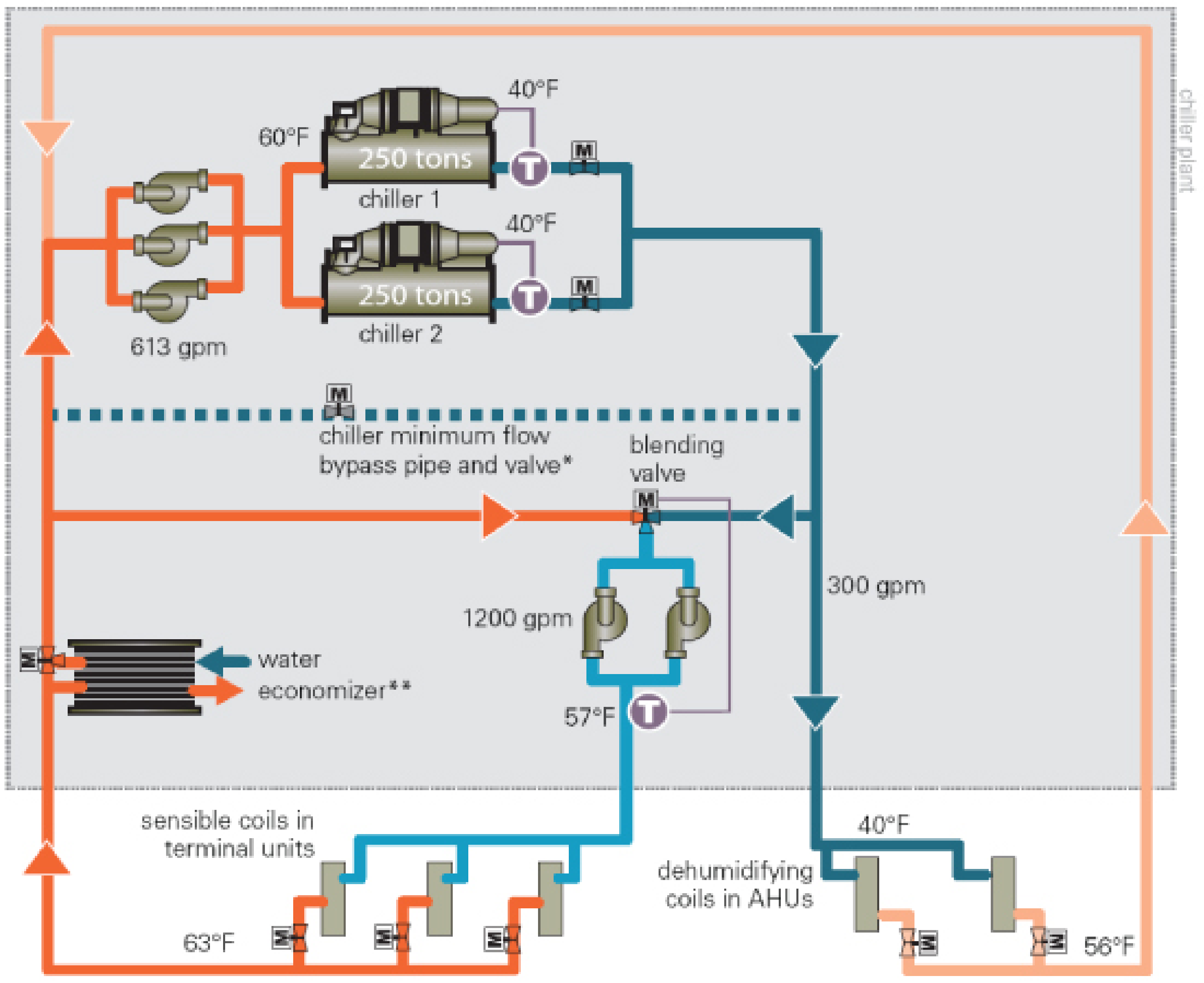
When the plant is designed with two chillers, there are several configurations that might be used to provide the two different water temperatures. While either air- or water-cooled chillers can be used in a two-chiller plant, our example will assume water-cooled chillers.

Blending valve with loads in parallel (chillers in parallel or series). The first two-chiller configuration (Figure 3) uses the same blending valve concept described previously. The water chillers, with **evaporators piped in parallel**, both produce 40°F water. Some of this cold water is distributed directly to the dehumidifying coils in the air-handling units, while the rest is blended with warm water (63°F) returning from the terminal units to produce 57°F water.

Because of the large delta T across the chillers, however, this is typically a good application for configuring the chiller **evaporators in series** (Figure 4), rather than in parallel. In this example, the upstream chiller cools the water from 60°F to 50°F, while the downstream chiller cools it the rest of the way to 40°F.

One benefit of configuring chiller evaporators in series is lower overall plant energy use. In this example system (see Table 1), the upstream chiller operates much more efficiently (0.462 kW/ton) since it need only cool the water to 50°F, resulting in less total chiller power. Since the full water flow rate (613 gpm) is pumped through both chiller evaporators, the incremental pump power is higher (4.4 kW compared to 1.1 kW with chillers in parallel). But the total power for both chillers plus incremental pumping power is still 9 percent lower with the chillers configured in series (261.2 kW versus 285.9 kW with chillers in parallel).

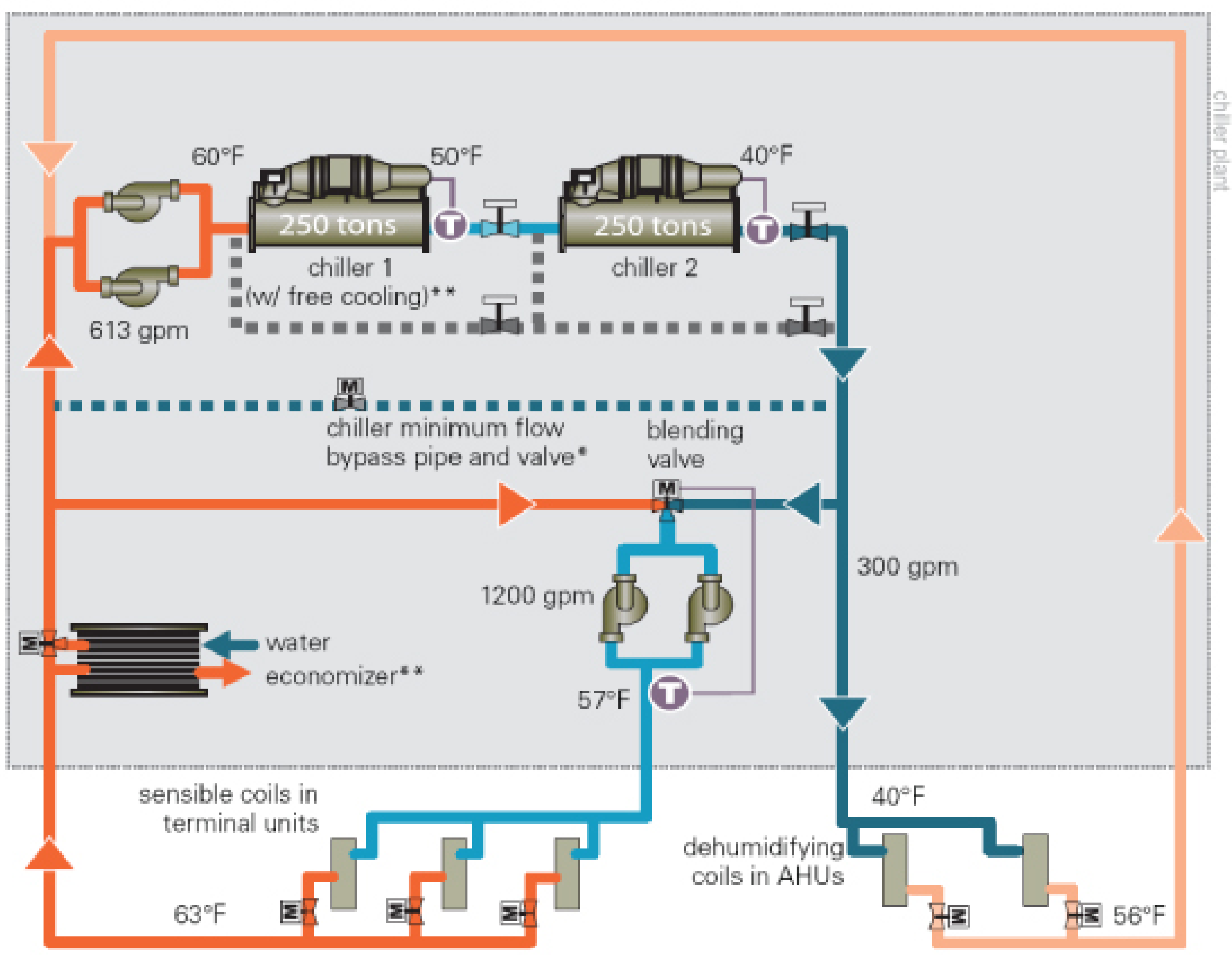
Figure 3. Two-chiller plant (loads in parallel, chillers in parallel)



* included if variable-flow chiller pumps are used

** some systems configure one chiller as a "free-cooling" chiller, while others include a separate plate-and-frame heat exchanger for water economizing

Figure 4. Two-chiller plant (loads in parallel, chillers in series)



* included if variable-flow chiller pumps are used

** some systems configure one chiller as a "free-cooling" chiller, while others include a separate plate-and-frame heat exchanger for water economizing

Table 1. Comparison on dual-temperature plant configurations that include two chillers

		chiller evaporator flow rate, gpm	evaporator entering water temperature, °F	evaporator leaving water temperature, °F	chiller load, tons	chiller efficiency[1], kW/ton	chiller power, kW	evaporator pressure drop, ft. H_2O	incremental pumping power[2], kW	
loads in parallel, chillers in parallel (Figure 3)	Chiller 1	306.5	60	40	250	0.569	142.4	6.9	0.57	
	Chiller 2	306.5	60	40	250	0.569	142.4	6.9	0.57	
	Totals				**500**		**284.8**	**+**	**1.1**	**= 285.9 kW**
loads in parallel, chillers in series (Figure 4)	Chiller 1 (upstream)	613	60	50	250	0.462	115.6	12.9	2.13	
	Chiller 2 (downstream)	613	50	40	250	0.564	141.2	13.4	2.22	
	Totals				**500**		**256.8**	**+**	**4.4**	**= 261.2 kW**
loads in series, chillers in parallel	Chiller 1	261	63	40	250	0.570	142.6	5.1	0.36	
	Chiller 2	261	63	40	250	0.570	142.6	5.1	0.36	
	Totals				**500**		**285.2**	**+**	**0.7**	**= 285.9 kW**
loads in series chillers in series (Figure 5)	Chiller 1 (upstream)	522	63	51.5	250	0.445	111.3	9.7	1.36	
	Chiller 2 (downstream)	522	51.5	40	250	0.565	141.3	10.1	1.42	
	Totals				**500**		**252.6**	**+**	**2.8**	**= 255.4 kW**
loads in series (split flow) (Figure 7)	Chiller 1 (upstream)	1500	62	57	288	0.399	114.7	16.8	6.79	
	Chiller 2 (downstream)	300	57	40	212	0.586	124.2	6.7	0.54	
	Totals				**500**		**238.9**	**+**	**7.3**	**= 246.2 kW**
dedicated chillers (Figure 8)	Chiller 1 (warm)	1200	63	57	300	0.401	120.3	11.1	3.59	
	Chiller 2 (cold)	300	56	40	200	0.592	118.4	6.6	0.54	
	Totals				**500**		**238.7**	**+**	**4.1**	**= 242.8 kW**

[1] Full-load efficiency based on a 2.0 gpm/ton condenser water flow rate and 85°F water entering the condenser.

[2] This is the incremental power required to pump the water through the chiller's evaporator, assuming 70% pump efficiency [incremental pump kW = (0.746 kW/hp) x (evaporator flow rate, gpm x evaporator pressure drop, ft. H_2O) / (3960 x pump efficiency)].

Another benefit of configuring the chiller evaporators in series is that it simplifies sequencing (turning chillers on and off) in a variable-primary flow (VPF) system.[3]

The drawback of configuring chillers in series is that it is more challenging to provide redundancy if one chiller is not operational. With the chillers in parallel, both chillers are likely to be identical, and can be selected for a little extra capacity so that one chiller operating alone can provide a 60 or 70 percent of the design capacity while the other chiller is serviced.

To provide redundancy with chillers in series, the upstream chiller may need to be selected for "less-than-optimal" performance so that it is capable of producing 40°F water if the downstream chiller is not operational. Unless the upstream chiller is a free-cooling chiller (see p.9), arranging the condensers in a series-counterflow configuration can provide this redundancy without sacrificing performance.[4]

In addition, a set of bypass pipes and shutoff valves need to be added to the plant to enable either of the chillers to operate while the other chiller is serviced (see Figure 4).

Blending valve with loads in series (chillers in parallel or series). When the temperature of the water returning from the dehumidifying coils (56°F in this example) is colder that the water being supplied to the sensible-only terminal units (57°F), some designers consider configuring these **loads in series** (Figure 5). In this configuration, 40°F water from the chiller plant is first distributed to the dehumidifying coils. The 56°F water returning from these coils is then blended with warm water (63°F) returning from the terminal units (and maybe some additional 40°F water from the chiller plant) to produce 57°F water for the terminals.

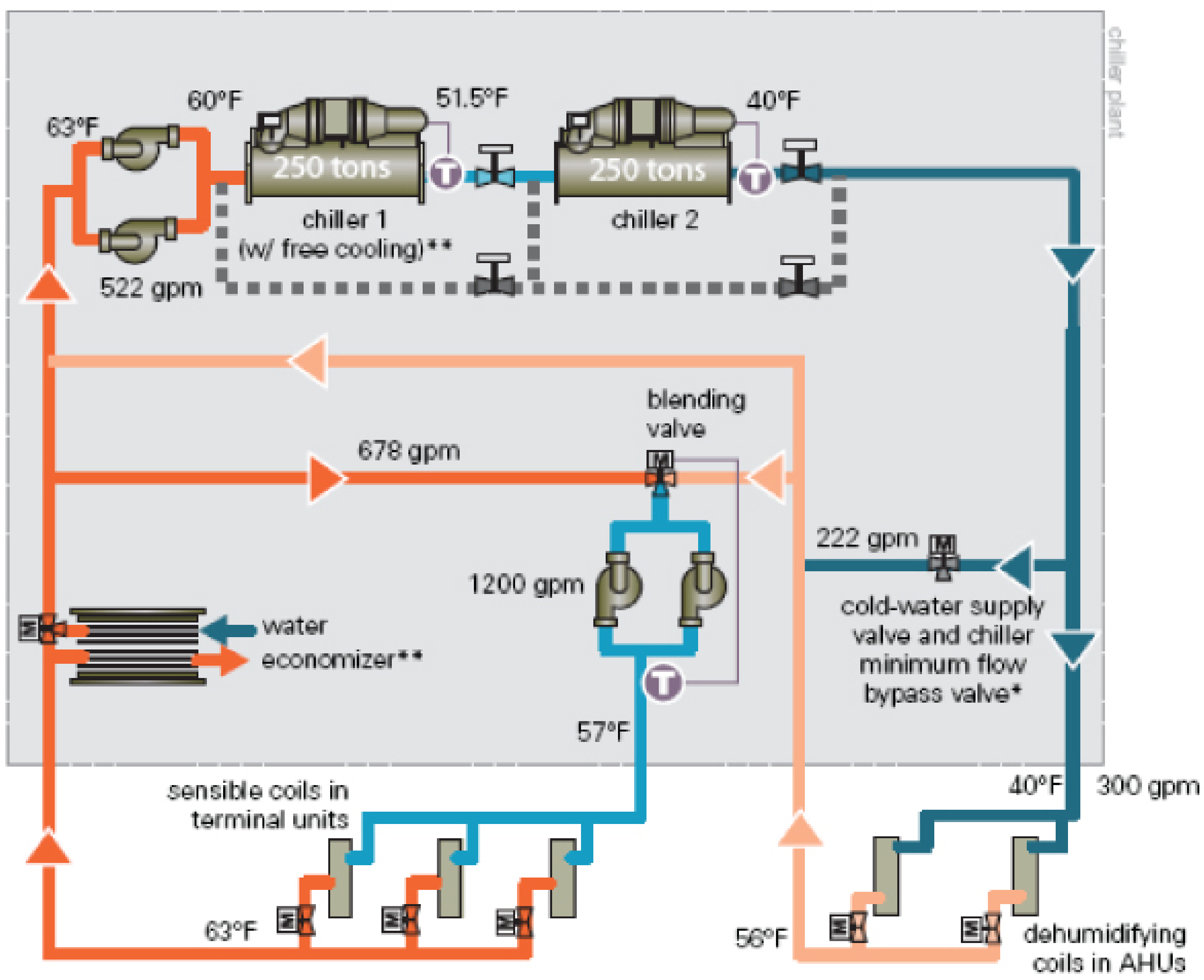
Configuring the loads in series offers an efficiency benefit compared to the loads in parallel (255.4 kW with chillers in series, versus 261.2 kW with the loads in parallel and chillers in series), since the chiller plant flow rate is lower (522 gpm compared to 613 gpm with loads in parallel) and the larger plant delta T allows the upstream chiller to be selected for a warmer leaving-water temperature.

However, this configuration does introduce some added control complexity. The chiller minimum flow bypass valve now has a second purpose. In addition to ensuring minimum evaporator flow through any operating chiller, it must also ensure an adequate supply of cold water at the blending valve.

At design load for this example, 300 gpm of 40°F water is supplied to the dehumidifying coils, which returns at 56°F. Blending only this 300 gpm of 56°F water with 63°F water returning from the terminal units results in a 61°F supply temperature to the terminals (Figure 6, top).

So the bypass valve must open to mix 222 gpm of 40°F water with the 300 gpm of 56°F water returning from the dehumidifying coils, to ensure that the blending valve has enough cold water

Figure 5. Two-chiller plant (loads in series, chillers in series)



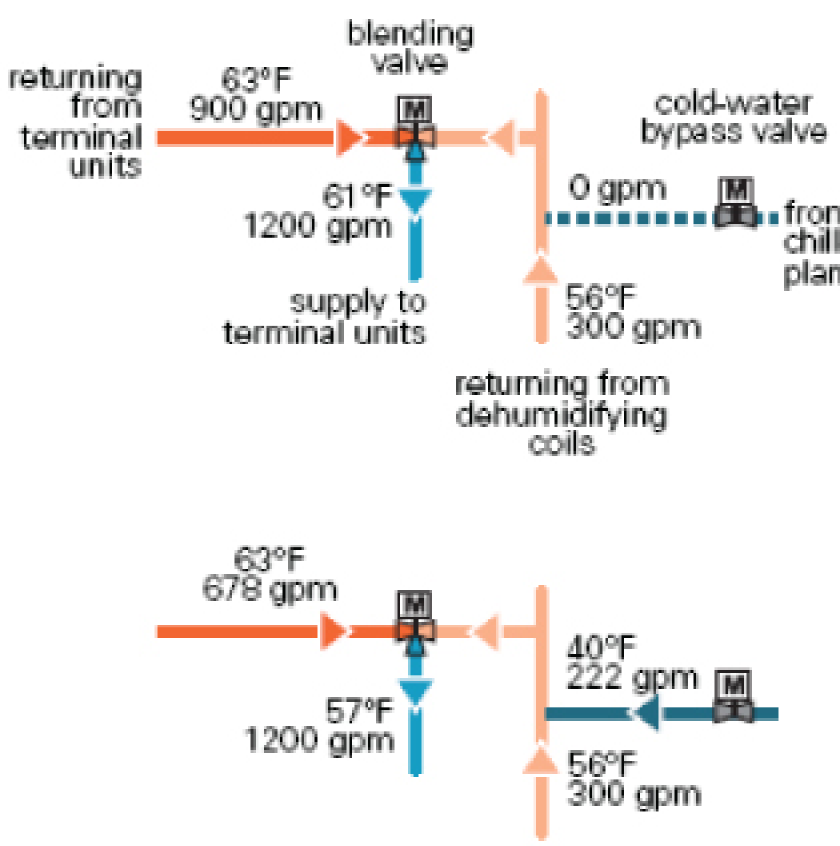
* used to ensure adequate supply of cold water for sensible coils when dehumidification AHU coil control valves are modulating or closed AND also used to ensure minimum evaporator flow if variable-flow chiller pumps are used

** some systems configure one chiller as a "free-cooling" chiller, while others include a separate plate-and-frame heat exchanger for water economizing

to deliver the required 57°F water to the terminals (Figure 6, bottom). This amount of bypass varies as the control valves on the dehumidifying coils modulate or close, and may require the bypass pipe to be larger than if it were only needed to ensure minimum evaporator flow.

For this loads-in-series configuration, the chiller evaporators can be piped either in parallel or series. Similar to the previous example, configuring the chiller evaporators in series results in 11 percent less total power (255.4 kW versus 285.9 kW with the chiller evaporators in parallel, see Table 1). But as mentioned, configuring the chillers in series makes it more challenging to provide redundancy in case one chiller is not operational.

Figure 6. Cold-water bypass when loads in series



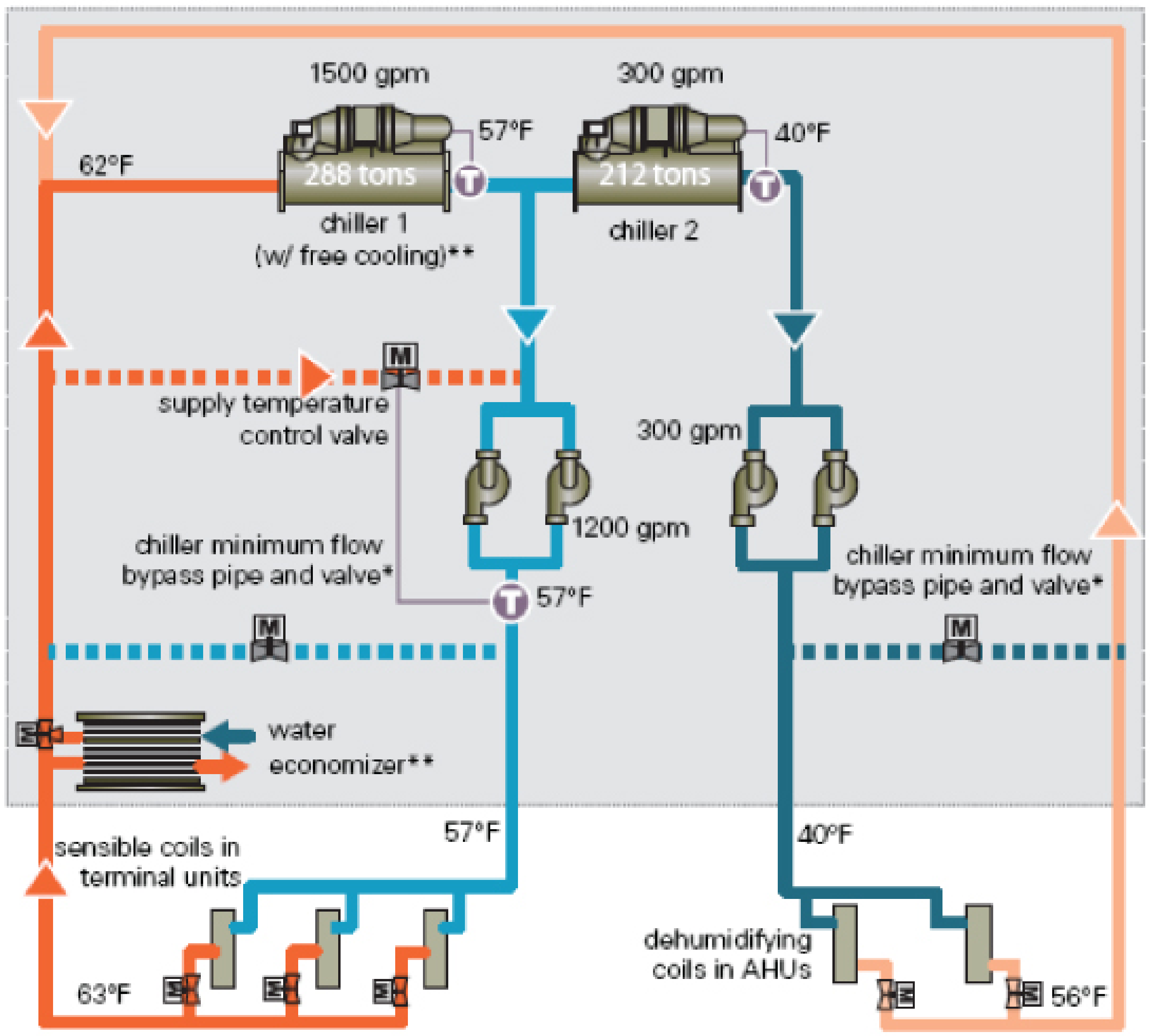
Chillers in series with split flow. With the chiller evaporators configured in series, some designers consider splitting the flow between the two chillers (Figure 7). In this example, the upstream chiller cools all the water to 57°F. Some of this water is then distributed directly to the terminal units for space sensible cooling, while the rest passes through the downstream chiller and is cooled to 40°F for the dehumidifying coils.

Since the upstream chiller operates at an even warmer leaving-water temperature (57°F), it is more efficient (0.399 kW/ton). However, because there is no blending, the full flow rate required by the terminal units (1200 gpm) plus the flow rate required by the dehumidifying coils (300 gpm) passes through the upstream chiller, resulting in a higher evaporator pressure drop and pump energy penalty.

This configuration is an attempt to maximize the efficiency of the upstream chiller, since it does not cool the water intended for the terminal units any more than needed. However, if the water returning from the dehumidifying coils (at 56°F in this example) is cooler than the water leaving the upstream chiller (57°F), there is energy wasted. The 56°F return water is mixed with 63°F water returning from the terminal units and passes through the upstream chiller. Rather, it would be more efficient to simply direct that 56°F return water right into the downstream chiller.

So splitting the flows provides an efficiency benefit for the upstream chiller, but directing all of the flow through the upstream chiller is inefficient unless the water returning from the dehumidifying coils is significantly warmer than the water leaving the upstream chiller…which is unlikely.

Figure 7. Two-chiller plant (chillers in series with split flow)



* included if variable-flow chiller pumps are used

** some systems configure one chiller as a "free-cooling" chiller, while others include a separate plate-and-frame heat exchanger for water economizing

For this example, the total power for both chillers plus incremental pumping power is 6 percent lower than the loads-in-parallel/chillers-in-series configuration, and 4 percent lower than the loads-in-series/chillers-in-series configuration (Table 1). Splitting the flows does avoid the complication of controlling the chiller minimum flow bypass valve to also bypass cold water if needed, but the interaction of the two pumping systems may be difficult to balance and control. Plus, it provides very little redundancy since the chiller flow rates and water temperatures are drastically different.

This configuration requires two separate chiller bypass pipes with minimum flow control valves. Figure 7 also shows an additional temperature control valve for the 57°F water loop. Since most sensible-only terminal units cannot allow condensation, the water supplied to them must always remain at a temperature above the space dew point temperature. Depending on how accurate and stably the upstream chiller is able to control its leaving-water temperature, the designer may want to include this additional valve to ensure that too cold of water is never distributed to the terminal units. Under low load conditions, if the chiller has reached its minimum stage of capacity and begins to produce water that is colder than the desired 57°F setpoint, this valve will blend in a small amount of warm return water.

Dedicated chillers. In this final configuration, one chiller supplies 57°F water directly to the terminal units, while a separate chiller supplies 40°F water directly to the dehumidifying coils (Figure 8).

The benefit of this configuration is that it maximizes the efficiency of the 'warm-water' chiller. Only the flow rate required by the terminal units passes through it and this water is only cooled to the required 57°F setpoint (not over-cooled). The "cold-water" chiller handles only the flow required by the dehumidifying coils.

The total power for both chillers plus incremental pumping power is the lowest of all the configurations analyzed—242.8 kW (Table 1).

In order to provide redundancy, two interconnecting pipes and shutoff valves can be added to the plant to enable either of the chillers to operate while the other chiller is being serviced (Figure 8). The plant can still supply both water temperatures with just the remaining chiller operating:

- If the 'warm-water' chiller (chiller 1) fails, valve V-1 is closed, valves V-3 and V-4 are opened, the "cold-water" chiller (chiller 2) continues operating to produce 40°F water, and the supply temperature control valve blends in warm return water to deliver 57°F water to the terminal units.
- If the 'cold-water" chiller (chiller 2) fails, valve V-2 is closed, valves V-3 and V-4 are opened, the "warm-water" chiller (chiller 1) continues operating with a leaving-water setpoint reset to 40°F, and the supply temperature control valve ensures that 57°F water is delivered to the terminal units.

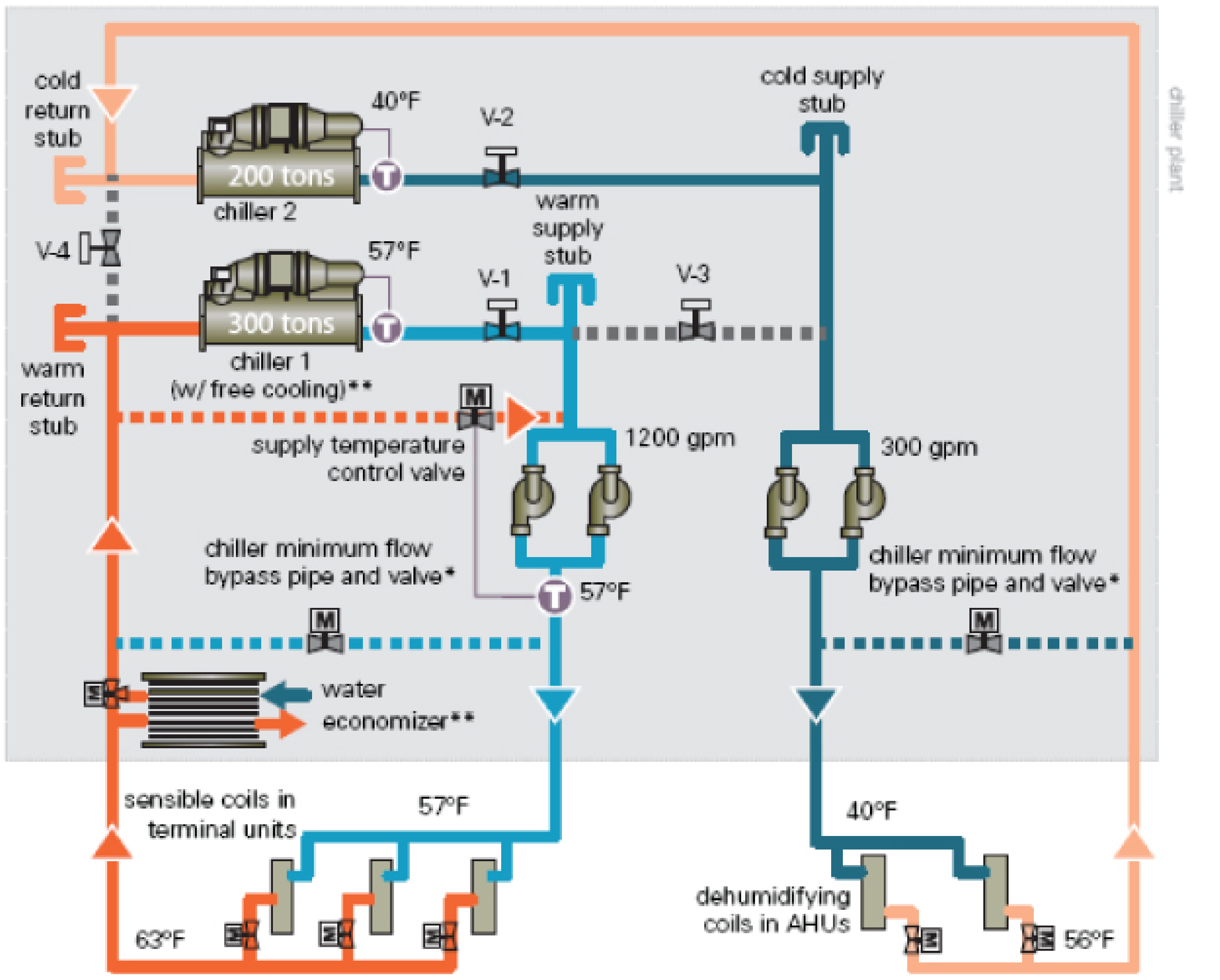
Another option could be to include pipe stubouts in the chiller plant to enable quick connection of an emergency rental chiller, if needed (see Figure 8). The interconnecting pipes and shutoff valves would allow the chiller plant to 'limp along' and provide partial capacity until the emergency chiller arrives (often within 24 hours).

The interconnecting pipes also provide the opportunity to operate only one of the chillers if the combined loads are very low, which may improve overall plant efficiency.

As in the previous configurations with chillers in series, the "warm-water' chiller may need to be selected at 'less-than-optimal" performance so that it is capable of producing 40°F water if the 'cold-water" chiller is not operational. This might be a good application for a chiller with a positive-displacement compressor (e.g., helical-rotary or scroll) or a centrifugal chiller with a VFD; both of which would be well-suited for operating at either water temperature, if required.

Like with the previous split-flow configuration, this configuration also requires two separate chiller bypass pipes with minimum flow control valves, and the temperature control valve for the 57°F water loop is probably also a good idea. But it does not have the added complication of controlling the chiller minimum flow bypass valve to also bypass cold water (as required in the loads-in-series configuration). While the two sets of pumps are hydraulically separated when both chillers are operational, selection of the pumps should also ensure that the pumps will properly operate in an emergency mode.

Figure 8. Two-chiller plant (dedicated chillers with hydraulic connections)



* included if variable-flow chiller pumps are used

** some systems configure one chiller as a "free-cooling" chiller, while others include a separate plate-and-frame heat exchanger for water economizing

to be continued...

Trane Tips

{ต้นไม้ไล่ยุง}

มะกรูด

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ปลูกโดยใช้เมล็ดจากลูกมะกรูดที่ร่วงจากต้น
ตากแดด 1-2 วัน นำไปเพาะลงในดินที่มีปุ๋ยคอกผสม
เมื่อใบเริ่มงอก ให้แยกไปปลูกในกระถาง
ยุงไม่ชอบน้ำมันหอมระเหยในมะกรูด

ตะไคร้หอม

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ปลูกง่ายแค่ใช้เหง้าฝังดินเพื่อขยายพันธุ์
จะปลูกใส่กระถาง หรือในสวนก็ได้
ยุงทนกลิ่นของน้ำมันหอมระเหยของตะไคร้หอมไม่ได้

หม้อข้าวหม้อแกงลิง

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นำก้านหม้อข้าวหม้อแกงลิงมาปักลงใน
กาบมะพร้าว ภายใน 6 เดือนจะออกหม้อ

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ยุงไม่สามารถทนทานต่อกลิ่นฉุนของโหระพาได้

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บริษัท แอร์โค จำกัด ชั้น 30-31 อาคารวานิช 2
เลขที่ 1126/2 ถนนเพชรบุรีตัดใหม่ แขวงมักกะสัน เขตราชเทวี กรุงเทพฯ 10400
โทร. 0 2704 9999, 0 2704 9797
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