

uสึน ฟูนิค ดริฟ
TINAMICS Co., Ltd.

Introduction
Basic HVAC
Application
Chiller control
AHU Controller
Cooling Tower
Control System

TINAMICS Co., Ltd
252085
Ramkhamhaeng 124
Sapansong,
Bangkok 10240


T : (+66) 0 2728-2902
F : (+66) 0 2728-1779
M : (+66) 086 751-6781
E : sapansong@tinamics.com

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Energy Saving


by using Variable Speed Drives

for HVAC and Cooling Tower



Energy Saving Application for HVAC

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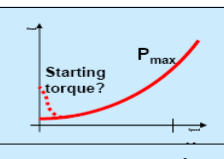
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Ramkhamhaeng 124
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Affinity Laws for Pump & Fan



Flow ∝ Speed
Head ∝ Speed²
Power ∝ Speed³

Head ∝ Speed²


Speed(rpm) = (1-S) * (120f/P) ≈ 120f/P

- Pumps
- Fans
- Blowers
- Compressors
- Turbo compressors

จากสูตร Affinity Laws จะเห็นได้ว่ากำลังงานไฟฟ้าแปรผันตามความเร็วรอบยกกำลังสาม เมื่อความเร็วรอบมีการเปลี่ยนแปลงจะทำให้กำลังงานไฟฟ้าเปลี่ยนแปลงอย่างมาก

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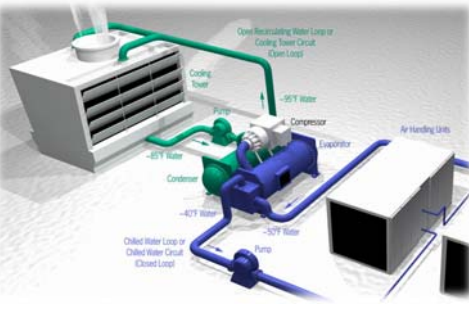
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252085
Ramkhamhaeng 124
Sapansong,
Bangkok 10240

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F : (+66) 0 2728-1779
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E : sapansong@tinamics.com

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What is HVAC ?

HVAC = Heating Ventilation and Air Conditioning



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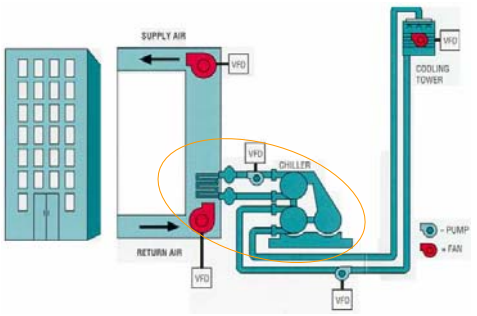
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252085
Ramkhamhaeng 124
Sapansong,
Bangkok 10240

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F : (+66) 0 2728-1779
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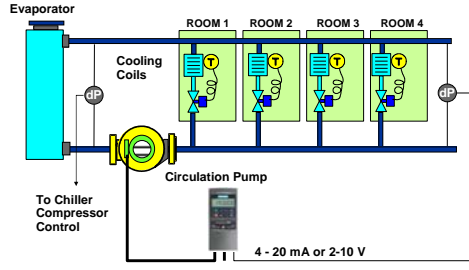
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252085
Ramkhamhaeng 124
Sapansong,
Bangkok 10240

T : (+66) 0 2728-2902
F : (+66) 0 2728-1779
M : (+66) 086 751-6781
E : sapansong@tinamics.com


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Variable Flow Chilled Water System



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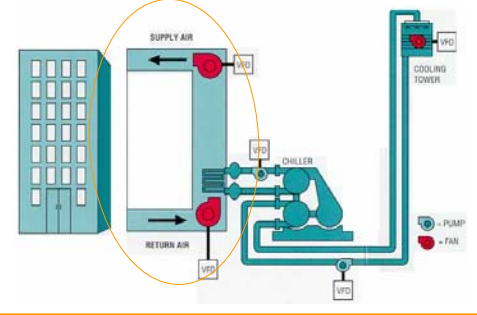
TINAMICS Co., Ltd
252085
Ramkhamhaeng 124
Sapansong,
Bangkok 10240

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F : (+66) 0 2728-1779
M : (+66) 086 751-6781
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Variable air volume By Variable Speed Fans

A.H.U. = Air Handling Unit

4 - 20 mA

Line

Filter Heating Cooling

Supply fan

Return fan

ROOM 1 ROOM 2 ROOM 3 ROOM 4

Damper

Exhaust air

Recirculation

Outside air

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252285
RamKhamhaeng 124
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T : (+66) 0 2728-2902
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M : (+66) 086 751-6781
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Cooling Tower & Pump

Line supply 380 - 440 VAC 50 Hz

Pressure sensor (04...20 mA or 0...10 V or 0...5 KOhm)

Temperature sensor (04...20 mA or 0...10 V or 0...5 KOhm)

Hot Water

Cool Water

Water pump

Condenser

Discharge Liquid Refrigerant

Exhaust hot air

Warm dry air

Warm wet air

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Cooling Tower Application

Line supply 3 Phase 380-440 VAC

Temperature sensor (04...20 mA or 0...10 V or 0...500 Ohm)

Exhaust hot air

Warm dry air

Warm wet air

Cool ambient air

Output Adjust speed by adjust frequency to matching of Temperature

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Cooling Tower Application

Water pump

Water pump

Water pump

Cool Water

Hot Water

Discharge Liquid Refrigerant

Text

เดิมระบบปรับอากาศ (HVAC) เหมือนระบบโดยทั่วไปมี Cooling tower 3 ตัว ต่อแบบขนานมีการทำงานแยกอิสระตัวใครตัวมัน ในแต่ละตัวจะมีมอเตอร์พัดลมระบายความร้อน ด้านบนของ Cooling tower ทำหน้าที่ระบายความร้อน โดยใช้ร่อนเข้าและออกรวมกัน การออกแบบในขั้นต้นทางวิศวกรจะได้ออกแบบ Cooling tower ให้ใหญ่เพียงพอต่อความต้องการที่แท้จริง แต่ในกรณีที่ออกแบบไม่เพียงพอหรือมีการใช้งานเกินพิกัด ทำให้ในกรณีที่มีการใช้งานตามปกติจะเปิดเพียง 2 ตัวก็เพียงพอ อีก 1 ตัวทำหน้าที่เป็นตัวสำรองยามฉุกเฉิน หรือ ในกรณีที่อากาศร้อนจนผิดปกติ

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Bypass Control System

Mains

Inverter

Motor Starters

A B C D

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Sapansong,
Bangkok 10240
T : (+66) 0 2728-2902
F : (+66) 0 2728-1779
M : (+66) 086 751-6781
E : sapansong@tinamics.com

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Staging Control System

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TINAMICS Co., Ltd
 252385
 RamKhamhaeng 124
 Sapsansong,
 Bangkok 10240
 T : (+66) 0 2728-2902
 F : (+66) 0 2728-1779
 M : (+66) 086 751-6781
 E : g.purason@tinamics.com

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Staging control

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TINAMICS Co., Ltd
 252385
 RamKhamhaeng 124
 Sapsansong,
 Bangkok 10240
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 F : (+66) 0 2728-1779
 M : (+66) 086 751-6781
 E : g.purason@tinamics.com

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Cooling Tower Application

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TINAMICS Co., Ltd
 252385
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 Sapsansong,
 Bangkok 10240
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