Innovative HVAC Feats to Enhance the Performance of Existing Buildings

DAIKIN

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13th March, 2015

DAIKIN

Daikin became **the world's number 1 in HVAC industry** in 2011.

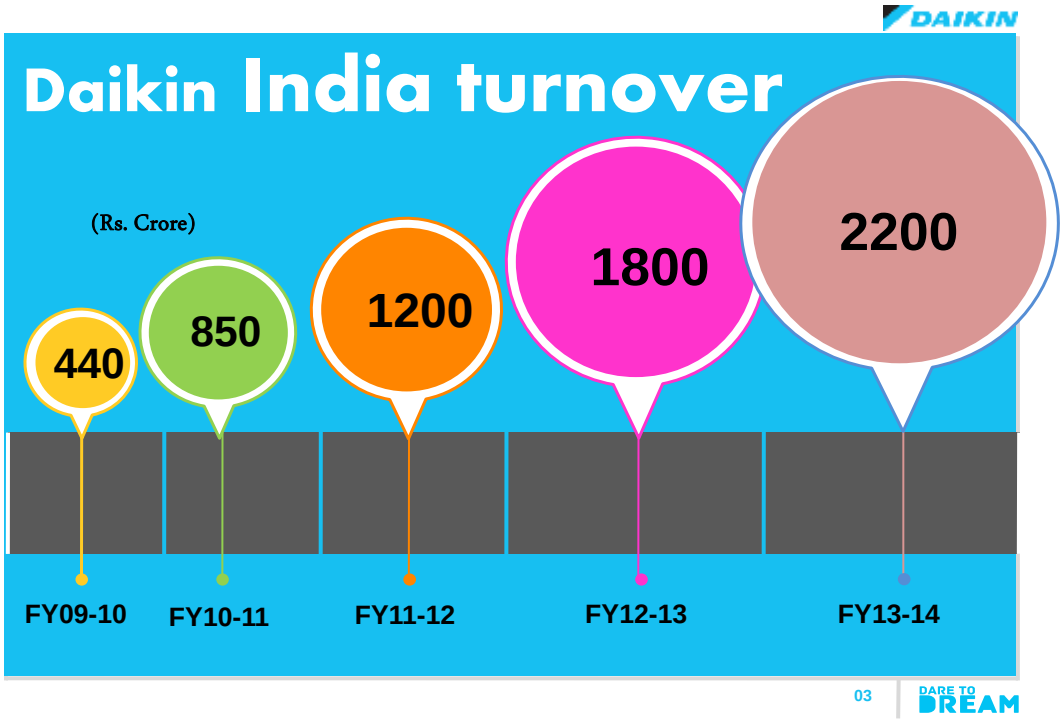
Global revenues touch **USD 19 Billion in** FY13

The road to achievement was never easy: **Diverse business landscapes.**

Economic volatilities. Discerning customers.

Yet. **We dared to dream,** strengthened the muscles to push through the odds. And **emerged victorious.**

(1 US$ = 80JY as on 31st March 2014)


DAIKIN
Daikin India turnover
(Rs. Crore)
440
850
1200
1800
2200
FY09-10
FY10-11
FY11-12
FY12-13
FY13-14
03
DARE TO DREAM


Ideas galore
Largest, widest and strongest product range

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Challenges/ Aspects

- Existing HVAC system
  - (Window A/c, Splits, Scroll, Reciprocating, Screw, Fixed Speed Centrifugal, Variable Speed Centrifugal, etc)
  - Pumping system (Primary, Secondary with VFD, Secondary without VFD)
- Proposed HVAC system
  - Part Replacement/ Complete renovation
  - Air Cooled/ Water Cooled
  - Plant Room Space & Shafts

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What is V.R.V. ?

V.R.V. is

Variable
Refrigerant
Volume

•Independent control of each room and zone's air conditioning according to thermal load.

•Energy conservation.
•Automatic control of each indoor unit

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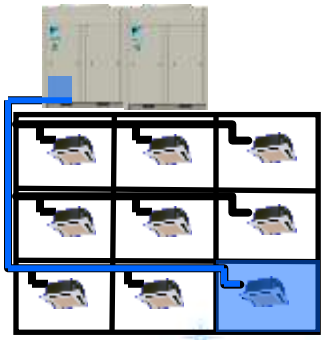
VRV Concept-Individual Operation

Ideal for Random Occupancy and after office hours operation



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Energy Conservation Opportunities

- System Type
  - A/c Scroll Chillers or Reciprocating Chillers 34 TR nominal capacity with R22 / R407C refrigerant x 3 Nos. (2 W + 1 S) – 1.2 kW/ TR app
  - Connected to 2 AHUs (16000 cfm, 50 mm SP) – 6 kW
  - Chilled Water Pumps -2.2 kW / pump
    - Auditoriums
    - G + 1 type installations

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Scroll – Modules (17/18 TR)

High Efficiency Scroll Chillers/ Heat Pumps (R410A)

- IkW/ TR Cooling at full load 1.1
- Cooling/ Heating both modes available
- Designed for space savings

Configuration (60 TR - Actual Load)

- Standard Scroll (34TR x 3Nos.)
- 2W+1S (Installed TR – 102 TR)

Configuration (60 TR - Actual Load)

- MODULAR Scroll (17TR x 5Nos.)
- 4W+1S (Installed TR – 85 TR)

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Electrical Load Comparison

Equipment R 407 C Scroll	kW	Qty	Total kW
Chillers 45 TR @ 1.2 kw/ TR	54	2	108
AHUs	6	2	12
Chilled Water Pumps	2.2	2	4.4
SYSTEM kW			124.4
Total TR	45	2	90
		kW/ TR	1.382

Equipment R 410 Scroll	kW	Qty	Total kW
Chillers 45 TR @ 1.1 kw/ TR	49.5	2	99
AHUs	6	2	12
Chilled Water Pumps	2.2	2	4.4
SYSTEM kW			115.4
Total TR	45	2	90
		kW/ TR	1.282
SAVINGS			**7.2 %**

New product Inverter Modular Scroll heat pump MAC (UAL-V)

•Nominal Cooling Capacity 66 kW – 18.7 TR

•Nominal Heating Capacity 64 kW

•Modular Configuration

Combinations

- Full inverter

Inv(Master) + N* Inv (Slave)

- Mixed

Inv(Master) + N* fixed speed (Slave)

FEATURES

•New design DC modulation with Daikin compressor, more efficient

• Efficient heat exchanger

• High COP up to 3.38, IPLV 4.36

• R410A refrigerant

• Low starting current, reduce the impact on the power network

• 15%~100% stepless load control

• LWT control

• Low noise, lowest 58 dB(A)

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Electrical Load Comparison – 24 Hrs operation

System Types		R 407C Scroll & HWG/ Heaters	R 410A Heat Cool Scroll
System TR	Cooling Mode	90	90
Average Running TR		63	63
kW/ TR		1.2	1.1
Running Hours/ day		24	24
Running days/ Year		275	275
kWh Consumption	A	498960	457380
Output kW	Heating Mode	90	90
Average Output kW		63	63
Running Hours/ day		24	24
Running days/ Year		90	90
Energy Consumption for 1 kW Output		1.18	0.33
kWh Consumption	B	160094	44906.4
Energy Consumption kWh per annum	A+B	659054	502286.4
Energy kWh Savings			**23.8%**
Estimated Average Energy Cost INR / kWh (80% Utility @ INR 6.5/ kwh/ 20% DG @ INR 18/ kwh)		8.8	8.8
Energy Bill INR		5,799,676	4,420,120
Energy Savings INR			**1,379,556**

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Water Heaters

Environment Temperature -20 to 43 Deg C /

Water Tank Water Temperature 25 to 55 Deg C

- Environmental friendly R410 refrigerant
- High efficiency design COP up to 4.59
- Intelligent control
- Modular design (1–16 units) for phased investment
- 30/40/80 kW option at 20 Deg C DBT ambient & 55 Deg C Hot Water Out Temperature
- Unique “Spray Liquid” Compressor Design

Can also be used for Fan coil units, Radiator, Floor heating and other hot water demands such as bathing, swimming pool heating, etc according to different customer requirements.

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Calculation for a Hotel having 80 kW Boiler

Flexibility: Small investment; can be used with existing thermal storage tanks, gas and oil-fired boilers in combination.

Whole year operation: Running throughout the year; unaffected by changes of weather.

System Types	Electric Boilers	MHA Water Heater
Output kW	80	80
Running Hours/ day	6	6
Running days/ Year	300	300
Energy Consumption for 1 kW Output	**1.18**	**0.3**
kWh Consumption	169920	43200
Energy kWh Savings		74.58%
Estimated Average Energy Cost INR / kWh (80% Utility @ INR 6.5/ kwh/ 20% DG @ INR 18/ kwh)	8.8	8.8
Energy Bill INR	1,495,296	380,160
Energy Savings INR Per Year		**1,115,136**

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Water Cooled Scroll Chiller (Heat Pumps)

OPERATING MODES
- **COOLING MODE**
- **HEATING MODE**
- **HEAT RECOVERY MODE**

- Modular Concept (Up to 16 modules in a set) for Design flexibility and inbuilt Redundancy (Module options – 30/ 40 TR Nominal Cooling Capacity)
- High COP for Energy Efficient operation
- Environment Friendly R 410A refrigerant (ODP = 0)
- IP 54 Water Proof Enclosure – Rain Proof Design
- Shell and Tube Heat Exchangers – Maintenance Friendly Design

Lowest CEWT can be 10℃ at Cooling, 6℃ at Heating

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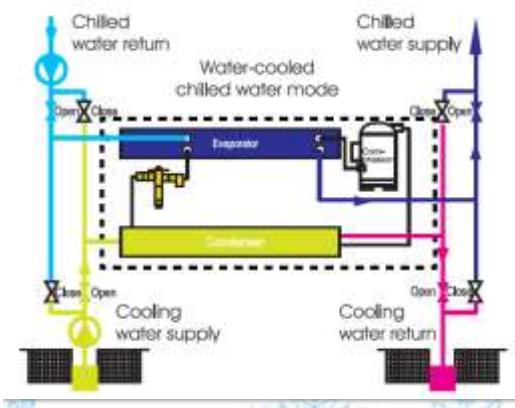
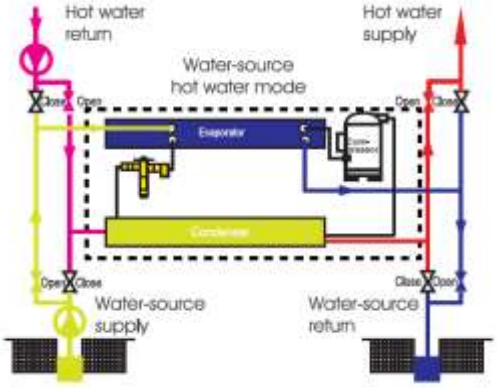
Dual Mode – Cooling /Heating Switchover

Switch over between water-cooled chilled water and water-source hot water modes can be achieved easily by the opening and closing of valves





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Ultra High Efficiency Air Cooled Chiller

Less than 1 KW/TR including condenser fans

- Wide Range170 to 570 TR
- Inverter option available
- Heat Recovery (optional)

Centrifugal Chillers

WSC 250 – 1500 TR

WDC 320 – 2600 TR

WCC 1200 – 2700 TR

- Green Refrigerant R134a
- Entire Range LEED Compliant
- Positive Pressure Design
- No Purge Unit: No contamination to environment
- Unique Surge Guard feature
- Unique 3 Tier Control Architecture
- Quiet Operation, Quieter at part loads
- Close Control: ± 0.1 ^{o}C
- Unique Power Loss Damage Protection

Innovation
Frictionless wonder

Frictionless Centrifugal Chiller

WMC

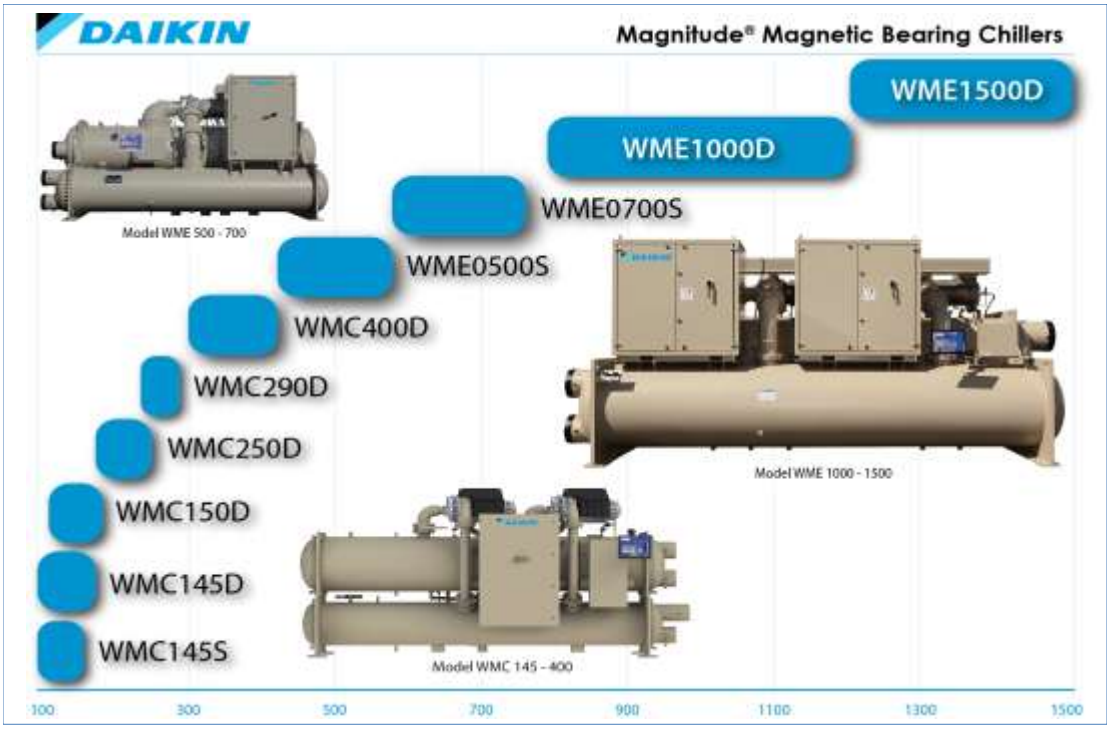
WME

- Magnetic Bearings: 40 % more efficiency than conventional chiller
- Frictionless : Infinite life
- Frictionless : Ultra Quiet Operation
- Oil free: Sustainable performance
- Oil free technology: Lower maintenance, less moving components
- Green refrigerant R134a
- Entire range LEED Compliant

ASHRAE/AHR Expo Energy Innovation Award

U.S. EPA Climate Protection Award

Canada Energy Award



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Industry-Leading Performance

Model	Capacity tons	Full load, kW/ton	IPLV
WME1500D	1500	0.531	0.293
WME1500D	1400	0.520	0.310
WME1500D	1200	0.509	0.302
WME1000D	1000	0.531	0.309
WME700S	700	0.532	0.306
WME500S	570	0.570	0.335
WME500S	500	0.532	0.312
WMC400D	390	0.604	0.329
WMC400D	360	0.571	0.327
WMC290D	290	0.545	0.326
WMC250D	250	0.614	0.350
WMC150D	150	0.611	0.355
WMC145D	145	0.629	0.367
WMC145S	145	0.661	0.360

14% Energy Savings Over Comparable Standard Centrifugal Chiller w/ VFD

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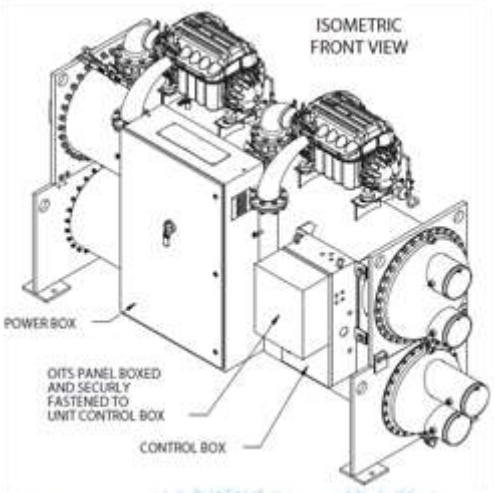
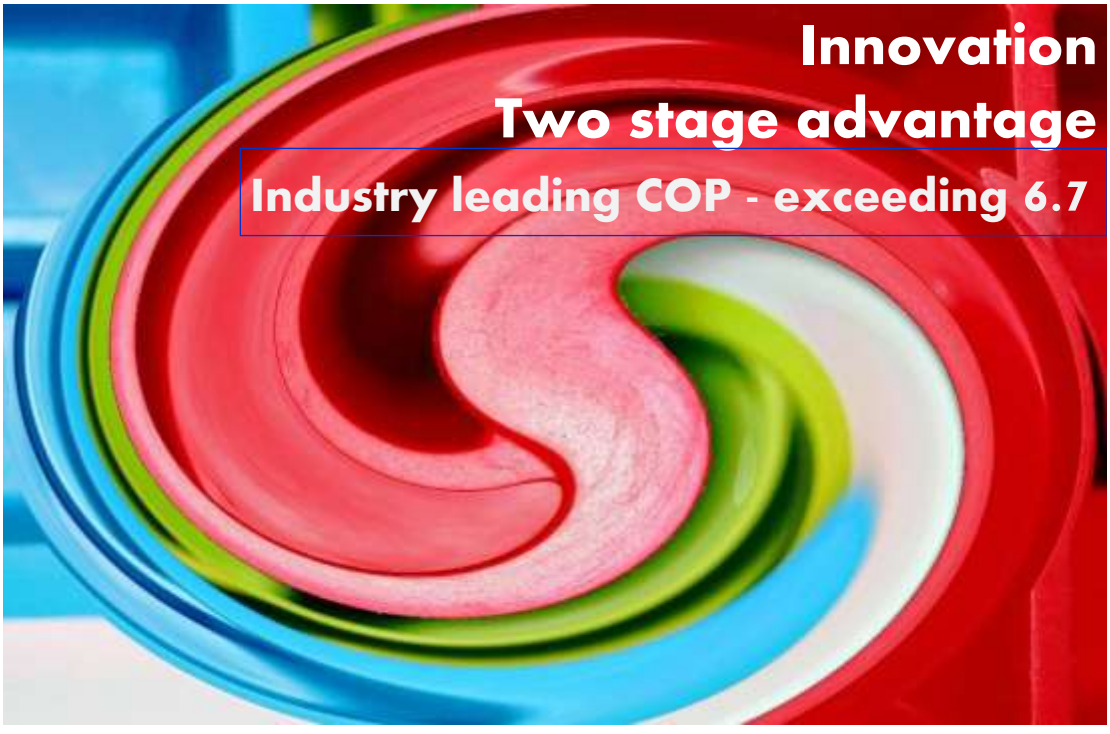
Retrofit Knockdown – Complete Disassembly



Fifteen percent of retrofit applications require partial or complete disassembly of the chiller

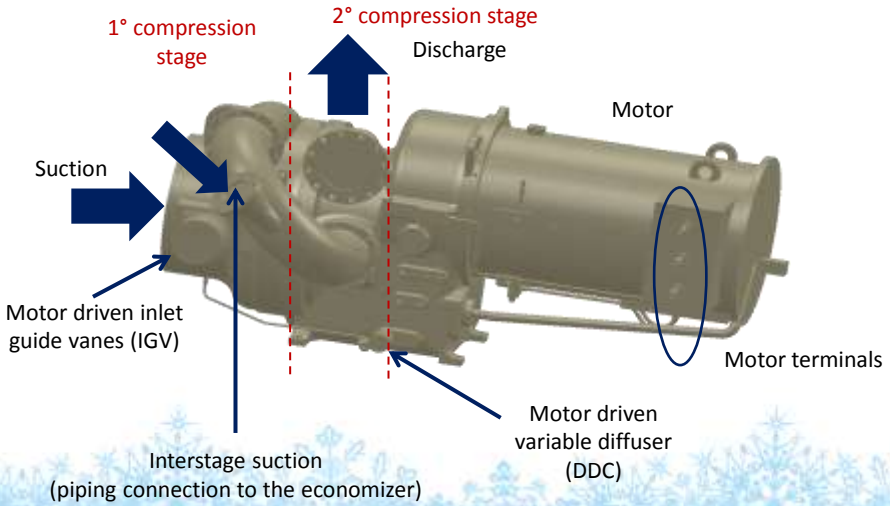
Type A Knockdown, "Bolt-Together Construction"

Chillers are built and shipped completely assembled with bolt-together construction



Two Stage centrifugal chiller

Two-stage compressor



Two Stage centrifugal chiller

Two-stage compressor

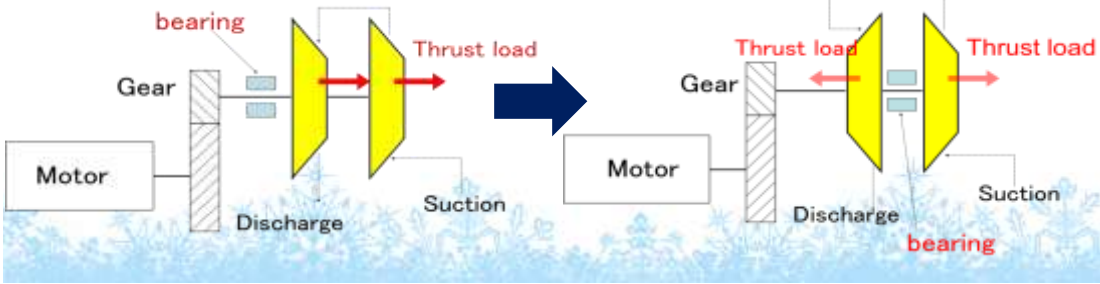
Unique innovative '**back-to-back' impeller design**, resulting in:

- thrust load reduction by 67%
- improved reliability
- longer bearing life

UNIQUE

Industry leading COP - exceeding 6.7

Conventional 2-stage impeller | **New back-to-back 2-stage impeller**



Centrifugal Chillers

- Magnetic Centrifugal : WMC :100 – 400 TR
- Magnetic Centrifugal : WME :400 – 1500 TR
- Two stage Centrifugal : WTC : 600 – 1500 TR
- COP 6.7
- Two stage Centrifugal : WCT : 3000- 6200 TR