



Bahwan Engineering Group

Oman ♦ Dubai ♦ Abu Dhabi

BAHWAN ENGINEERING COMPANY LLC

Nomination for Oman Green Awards 2010

Category - Green Footprint Award

ATTACHMENT - 1



Bahwan Engineering Group

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The Flagship of Suhail Bahwan Group



For nearly three decades, Bahwan Engineering Group has been associated with nation-building projects, ushering change in Oman. Our core values of Synergy, Excellence and Commitment have enabled us to successfully execute numerous projects to exacting standards.

Engineering Change ... Changing Lives.



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FACTS

- ✓ Nearly 65% of the Electricity in a Building is consumed by air-conditioning
- ✓ Nearly 75 - 80 % of this energy is consumed by the Central Cooling Equipment – the Chillers.
- ✓ This means that nearly 50% of the total energy consumption in a building is on account of the chillers.
- ✓ A reduction of 15 to 20% on this account will result in 8 to 10% reduction in total energy consumption of a building.



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FACTS

- ✓ BEC represents Carrier in Sultanate of Oman for Air-conditioning Equipment/ Systems.
- ✓ BEC and Carrier are committed to meaningful reduction of Carbon Footprint.
- ✓ Carrier has been developing lower carbon foot print equipment worldwide
- ✓ BEC, in Oman, has been in the forefront of spreading knowledge about these equipments and making consultants/ clients aware about the benefits of using energy efficient equipment, thereby reducing their carbon footprint.



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FACTS

- ✓ Carrier Developed 30XA series air cooled screw chillers operating on environmentally sound refrigerant R134a in the year 2005

- ✓ BEC has sold 191 such chillers in the Sultanate of Oman since 2006 – the total installed capacity of these chillers is 44829 KW – total power consumption being 65438 KW.



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FACT

30XA Air Cooled Screw Chillers help in *reducing* the power consumption and hence *lowering the carbon footprint* of buildings where these are installed.



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MEASURING SUCCESS

- ✓ Carrier 30XA series air cooled screw chillers consume ***15 to 20% lower*** power compared to similar chillers available from other manufacturers – Please refer Attachment – 2, which explains how this reduction is achieved.

- ✓ Use of these chillers compared to alternate chillers available helps reduce power consumption at peak load to the extent of **11452 KW** (calculated based on an average of 17.5%)



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MEASURING SUCCESS

- ✓ Based on an annualized average of 2000 Hours operation at peak load, the total power savings by using these chillers would be **22.90 Million KWH** – Please refer Attachment – 3, which explains the calculation.
- ✓ Considering an average 20 year life expectancy for these chillers, the total savings achieved at current Chiller population level would be a staggering **458 Million KWH**.
- ✓ On an average 70 such chillers are being sold every year on various projects in Oman – savings achieved through these chillers in future can be estimated by extrapolation.



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MEASURING SUCCESS

- ✓ Based on an annualized average of 2000 Hours operation at peak load, the total power savings by using these chillers would be **22.90 Million KWH** – Please refer Attachment – 3, which explains the calculation.
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MEASURING SUCCESS

- ✓ The reduced power consumption of air-conditioning systems using these chillers means reduced need for power generation equipment at the power plant side – further reducing the carbon footprint.
- ✓ In addition to the direct reduction in carbon footprint, lower power consumption of these chillers results in further reduction in carbon footprint of facilities manufacturing components such as...
 - Power cables
 - Other electrical components.
 - Transformers/ sub-stations
 - Standby Generator Sets



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MEASURING SUCCESS

- ✓ Carrier 30XA series chillers help further in reduction of Environmental Impact of Air-conditioning equipment due to Reduced Refrigerant Charge - *Please refer Attachment – 2.*
- ✓ BEC has been in the forefront of maintaining Air-conditioning systems efficiently so that they continue to operate optimally throughout their life cycle.
- ✓ BEC has set up localized Service Centres in various places within the Capital area of Muscat as well as Cities in Oman such as Salalah, Sohar, Sur, Nizwa, etc., to name a few. This helps in reducing the environment impact by lesser travelling resulting in lesser fuel usage.



Bahwan Engineering Group

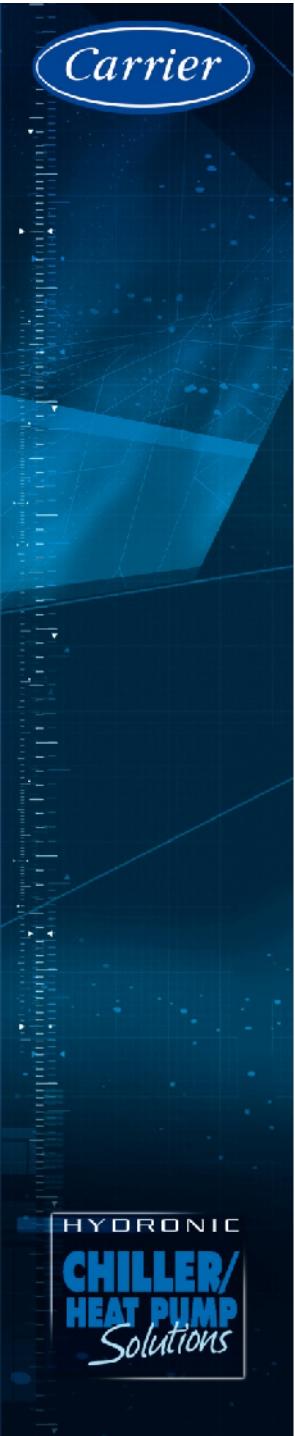
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MEASURING SUCCESS

✓ In addition to the Energy Efficient Carrier Products, BEC Group has been promoting use of other Energy Saving Products such as

- Heat Recovery Wheels (BryAir),
- Heat Pipes (SPC), Air and
- Water Ozone Systems (Ruks),

which help in reducing the requirement of outside air/load on air-conditioning system due to outside air. This results in lower Installed capacity of Air-conditioning systems and lower power consumption.



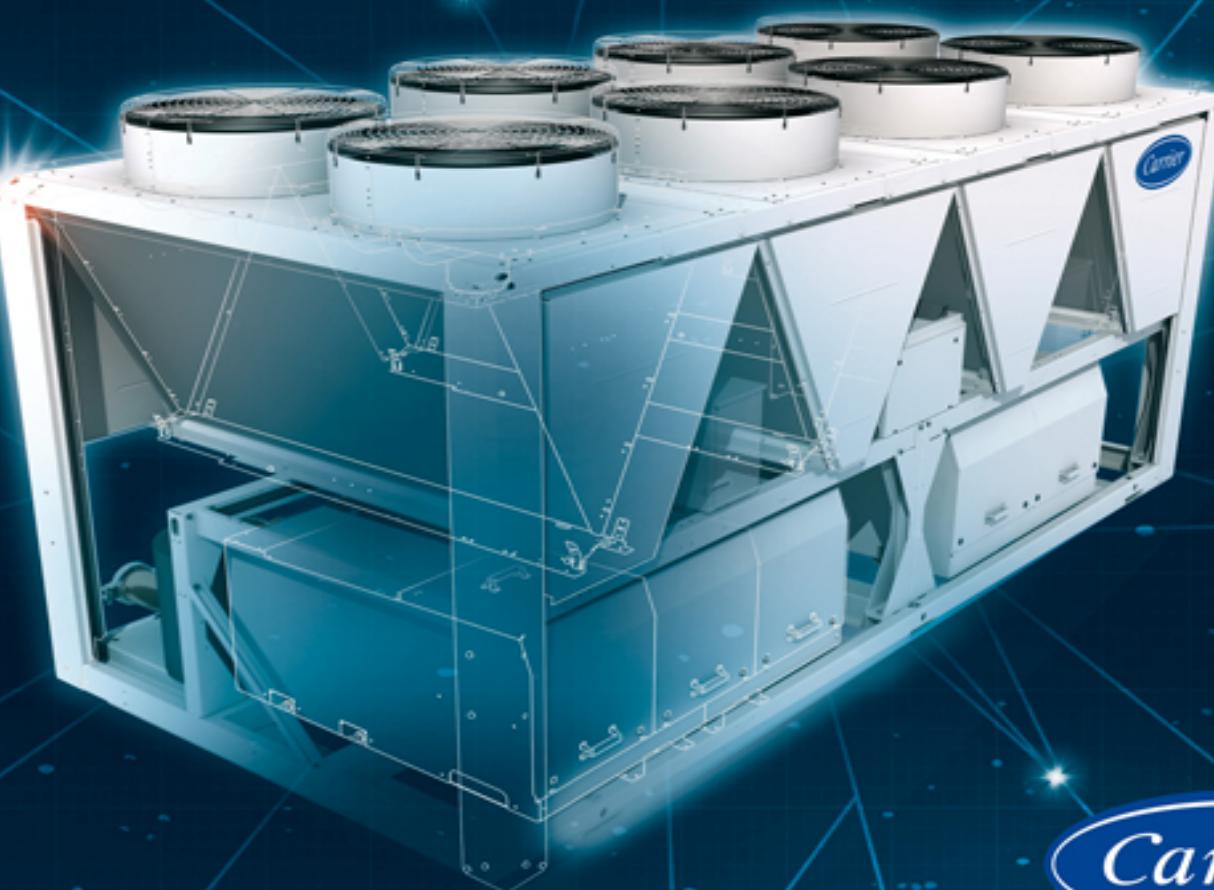
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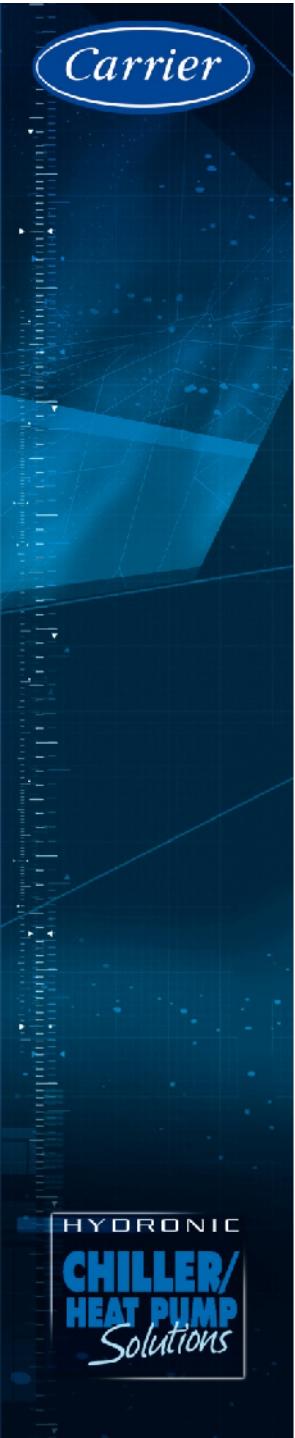
Category - Green Footprint Award

ATTACHMENT - 2

AQUAForce™



Carrier



AQUAFORCE™



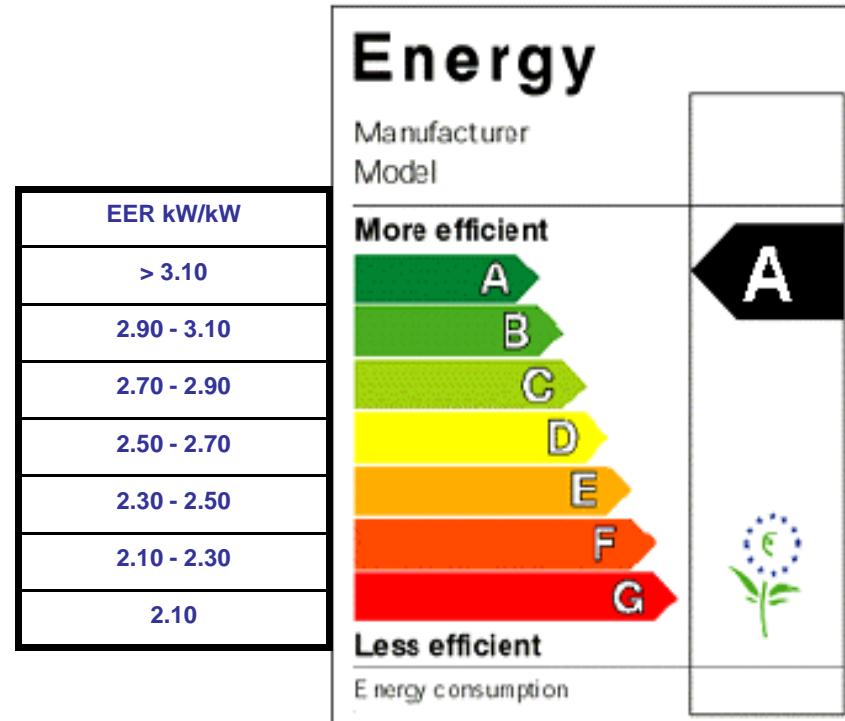
Low operating costs

Carrier

LOW OPERATING COSTS

Record energy efficiency

AQUAFORCE



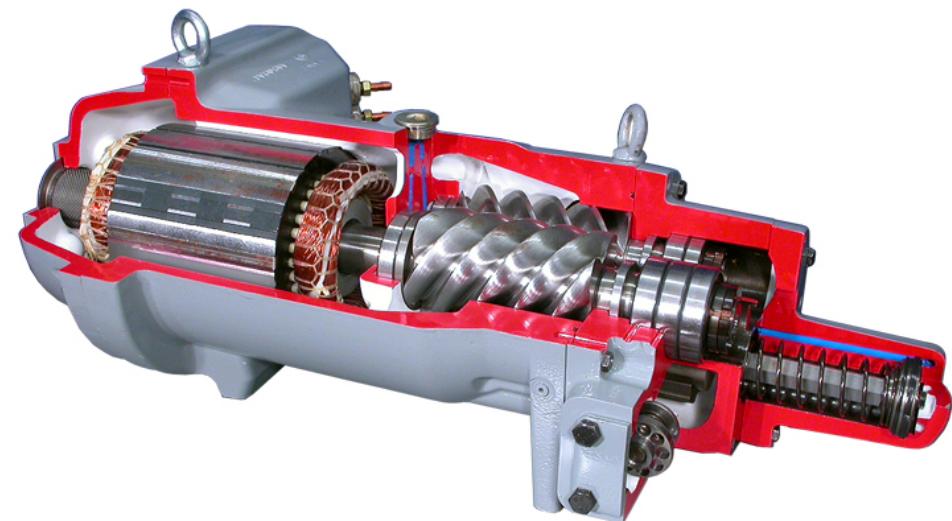
Aquaforce high efficiency units
Average EER 3.15 kW/kW/Eurovent class A

HYDRONIC
**CHILLER/
HEAT PUMP**
Solutions

LOW OPERATING COSTS

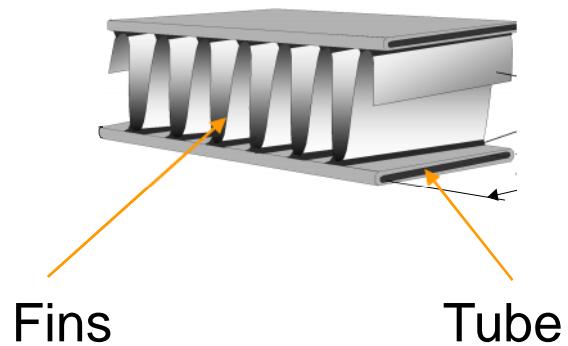
Compressor

- Top efficiency motor
- Latest 5/6 lobe rotor design optimized for R134a
- Low pressure drop design
- Long stroke capacity control valve from 25 to 100%

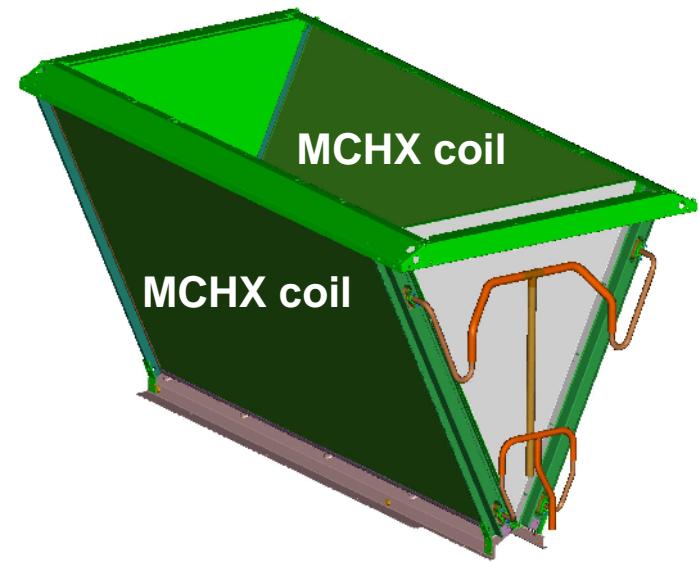


LOW OPERATING COSTS

Micro Channel Heat Exchanger “MCHX”



Refrigerant micro channels



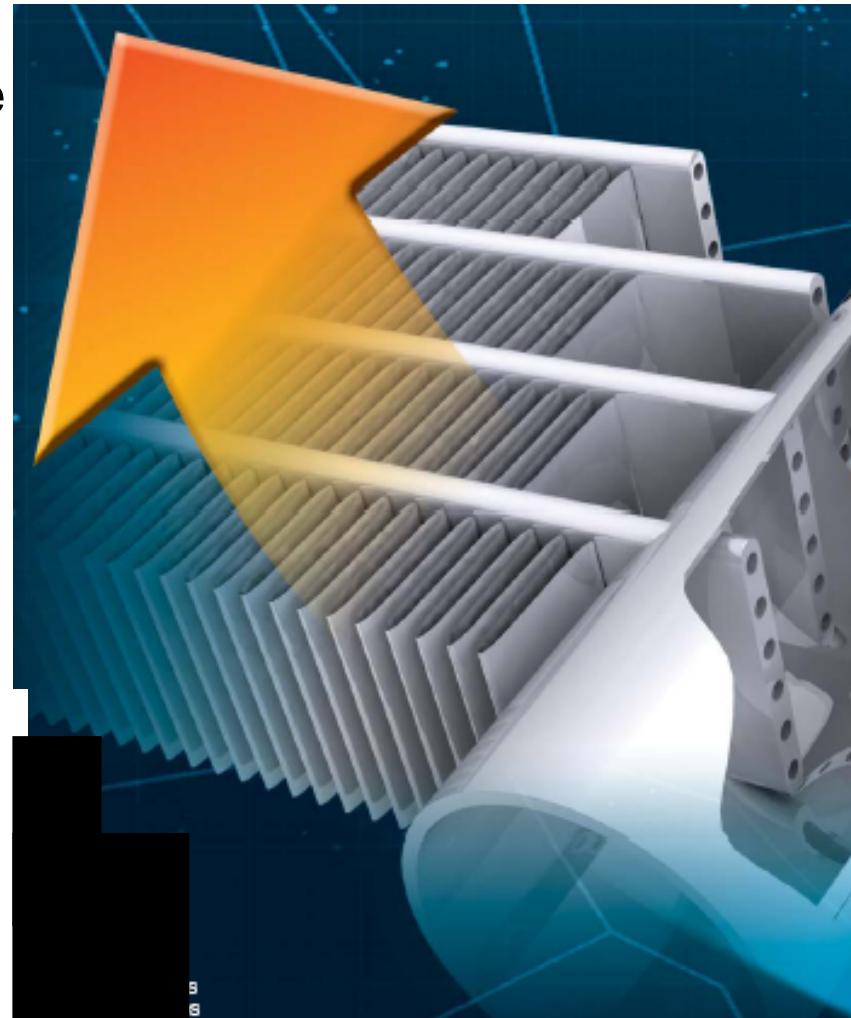
10% more efficient than standard coils

LOW OPERATING COSTS

Micro Channel Heat Exchanger “MCHX”



3.5 times more
resistant to
corrosion



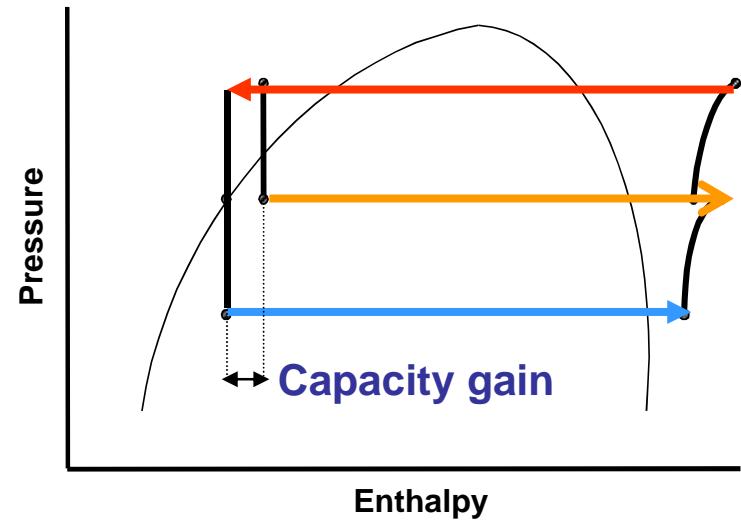
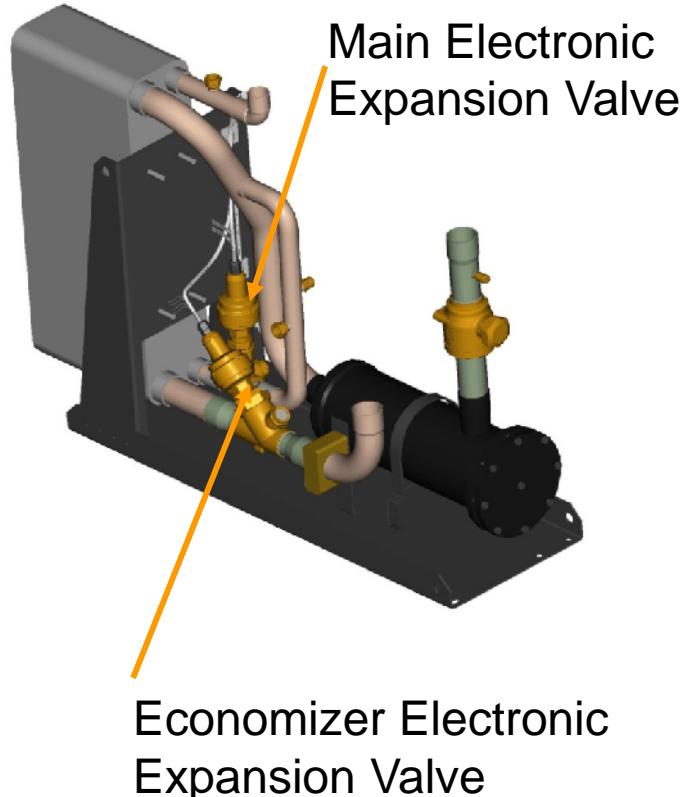
30% less
refrigerant

Reduced
maintenance

10% More
efficient

LOW OPERATING COSTS

Economizer with EXV

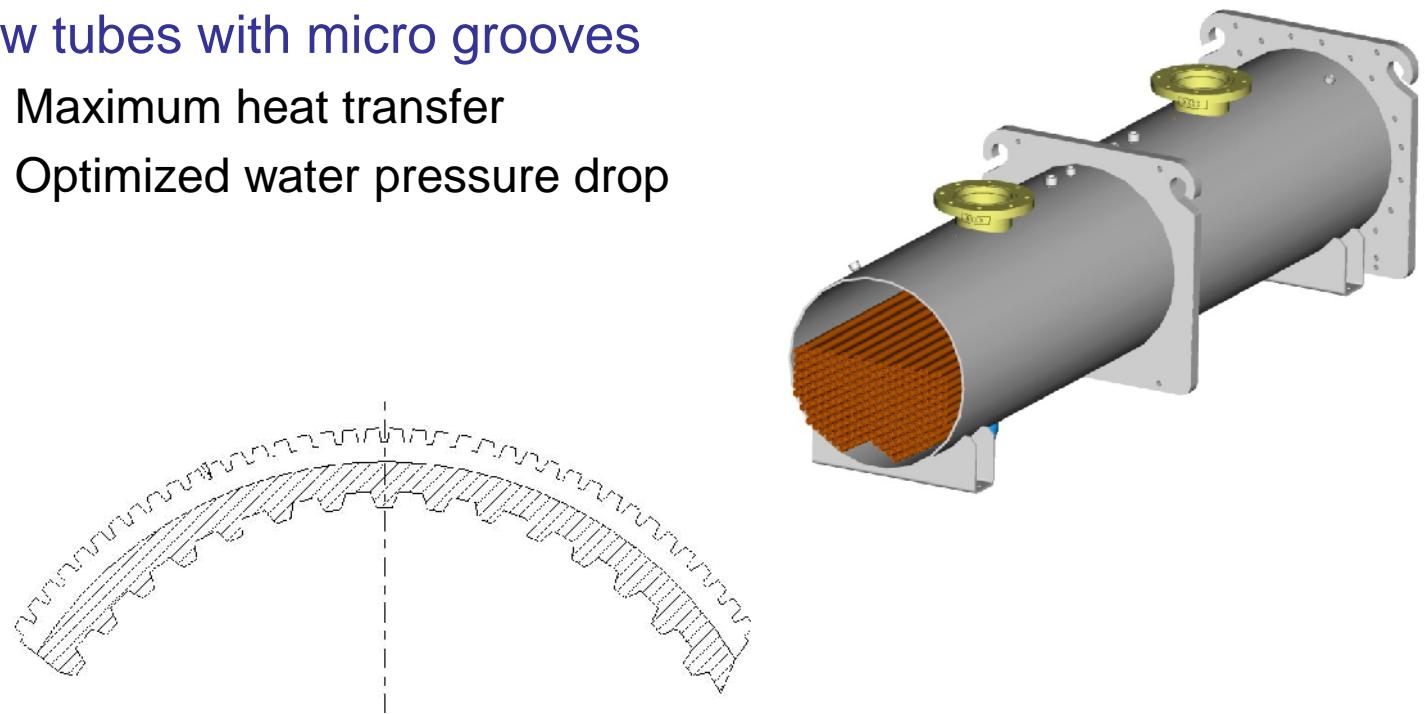


10% gain in capacity, improved efficiency

LOW OPERATING COSTS

Evaporator

- Flooded technology
 - Tube submersed in refrigerant
- New tubes with micro grooves
 - Maximum heat transfer
 - Optimized water pressure drop

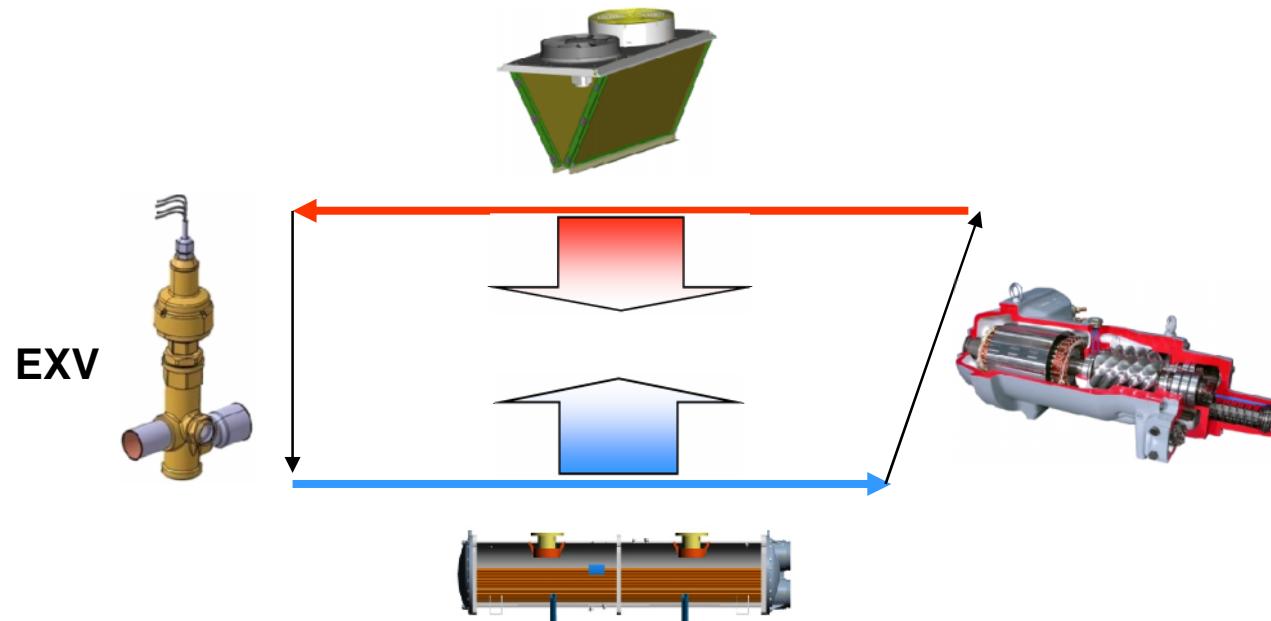


Flooded evaporator for optimum heat transfer

LOW OPERATING COSTS

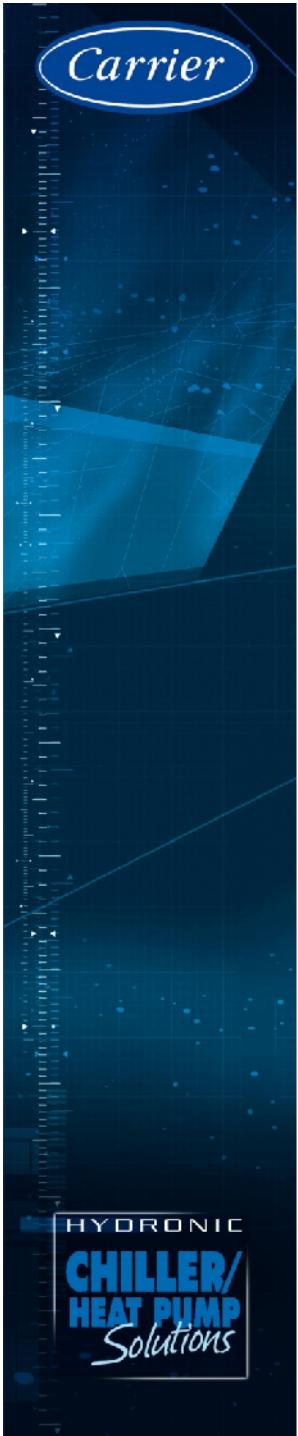
Unique control algorithms*

- Condensing pressure with floating set point
- Superheat control



* Carrier patented

Improved efficiency at part load operation

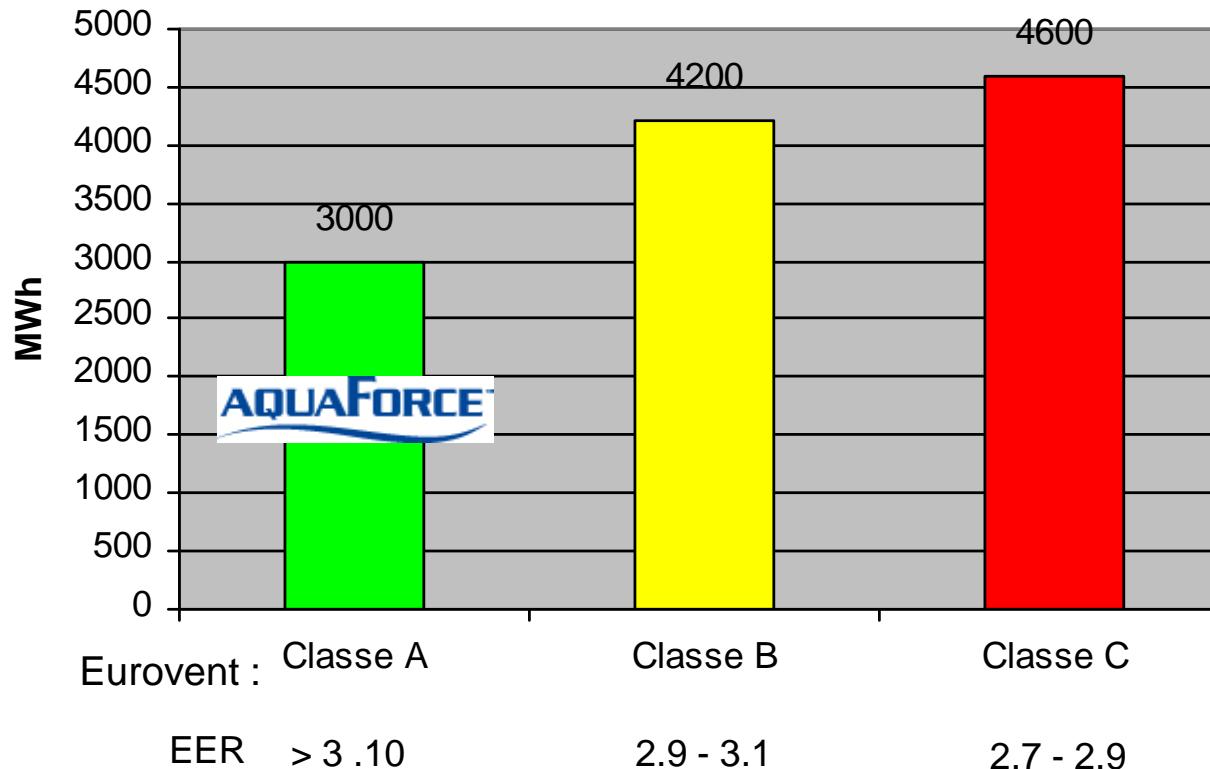


LOW OPERATING COSTS

Quick pay back on your energy bill

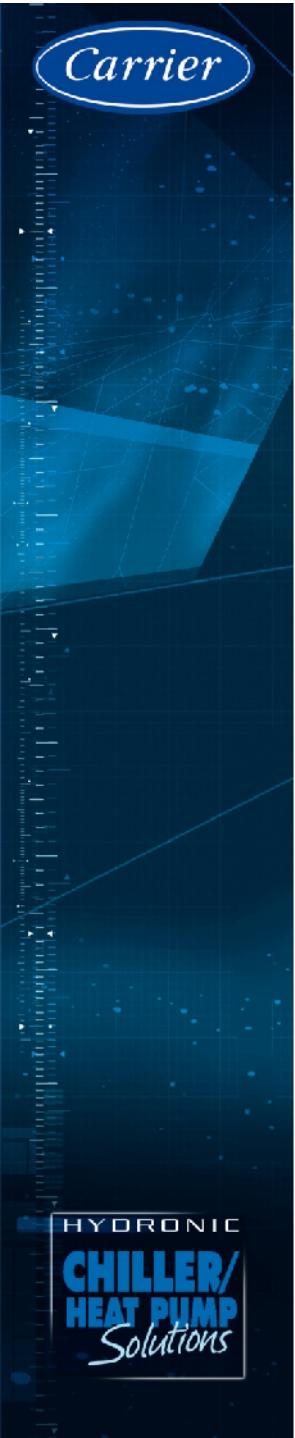
AQUAFORCE

Energy consumption after 15 years (M Wh)



Assumptions: office building in London ,900 kW chiller, 5000 hours/year

Up to 35% less kWh than Class B/Class C chillers



AQUAFORCE™



Minimum environmental impact

MINIMUM ENVIRONMENTAL IMPACT

Total Equivalent Warming Impact



TEWI



DIRECT



INDIRECT

→ Refrigerant impact 5%

→ Energy use impact 95%

MINIMUM ENVIRONMENTAL IMPACT

Industry responsible solutions



TEWI



DIRECT



INDIRECT



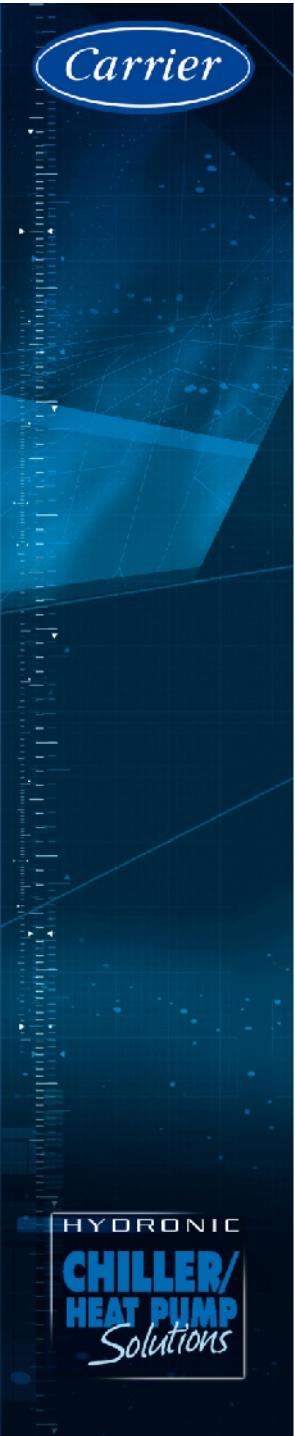
Reduce refrigerant charge

Reduce potential refrigerant leaks



Improve energy efficiency

**No energy waste: Free cooling
/Heat recovery**



MINIMUM ENVIRONMENTAL IMPACT

Carrier solutions: direct impact

AQUAFORCE

- 30% less refrigerant
 - Thanks to Micro Channel Heat Exchanger
- Less risk of refrigerant leaks
 - Elimination of 50 % of manual brazed joins
 - Elimination of capillary tubing & “flare” connections
 - Very precise factory leak detection (5 mg/an)

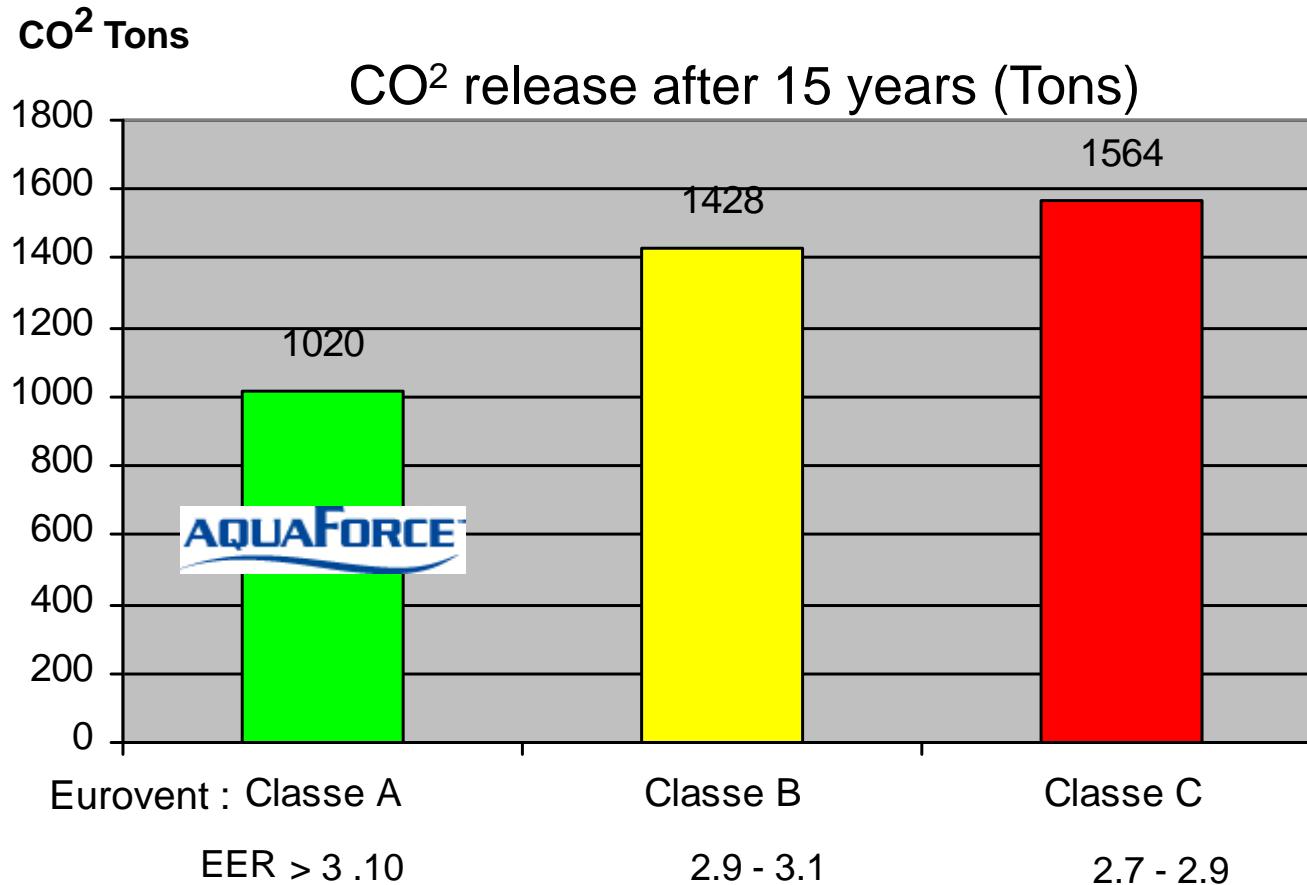


Automatic coil brazing

MINIMUM ENVIRONMENTAL IMPACT

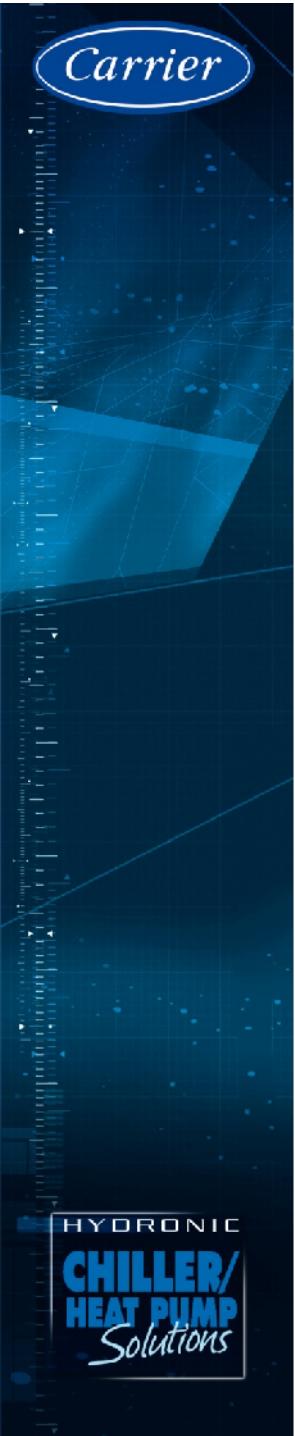


Carrier solutions: indirect impact



Assumptions: office building in London ,900 kW chiller, 5000 hours/year, 340 g CO₂/kWh (Europe average)

Up to 35% less CO₂ release than class B/C chillers



RELIABILITY, LOW MAINTENANCE

Micro channel heat exchanger



- 100% aluminium design eliminates galvanic corrosion
 - Elimination of bi metallic galvanic couple
- Excellent for coastal and urban environments

4000 h test: salt + acid

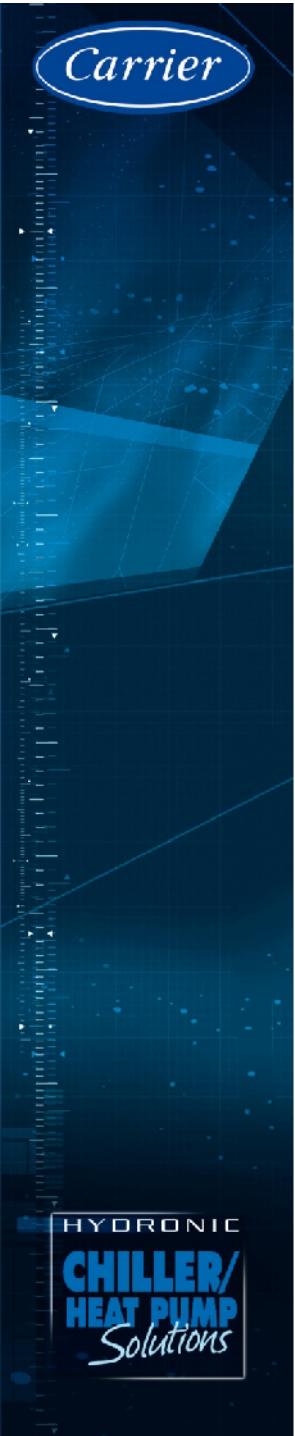


MCHX coil



Cu/Al coil

3.5 X TIME MORE RESISTANT TO CORROSION



AQUAFORCE™



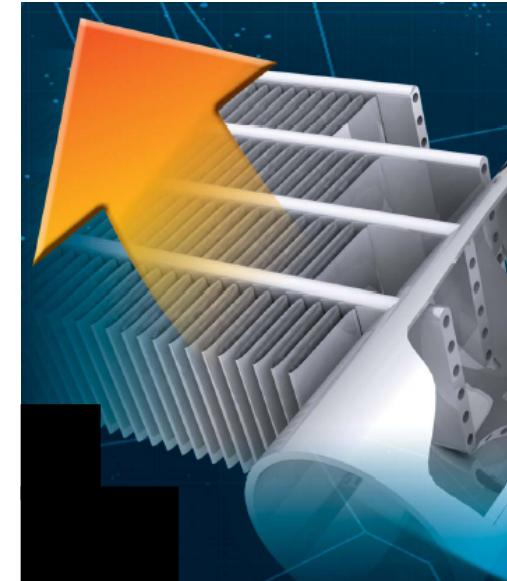
Reliability and Maintenance

RELIABILITY, LOW MAINTENANCE

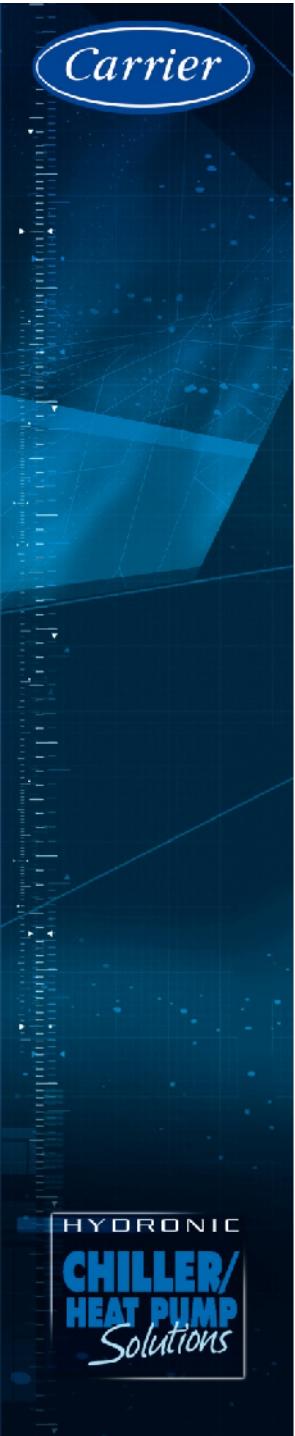
Micro channel heat exchanger

AQUAFORCE

- Less sensitive to clogging
 - One row with 25 mm only thickness
 - 50% less air pressure drop
- Quick cleaning
 - High pressure cleaner



Cu/Al coil



SUMMARY

AQUAFORCE™

AQUAFORCE™

- Innovative
- Low operating costs
- Minimum environmental impact
- Quiet
- Economical to install
- Reliable and low maintenance costs
- Easy to operate
- Customizable

THE FORCE IS WITHIN

**List of Carrier 30XA Series Air-cooled Screw Chillers in Oman**

Sl. No.	Project	Model	Qty	Unit cooling capacity, TR	Total cooling capacity, TR	Power, KW
1	Sohar Fertiliser Plant	30XA0352	3	83	249	364
2	Central Prison at Sumail	30XA0852	16	218	3488	5092
3	Sohar Aluminium, Power Plant	30XA0602	2	161	322	470
		30XA0502	4	132	528	771
		30XA0402	2	103	206	301
		30XA0302	2	77	154	225
4	Bait Bahjat Al Andaar, Sohar	30XA0702	1	176	176	257
5	Oman Cable	30XA0752	1	190	190	277
6	Hisn A'Shumookh - Nizwa	30XA0702	1	176	176	257
7	AFH Hospital for MOD	30XA0502	3	132	396	578
8	HQ Building for MOD at MAM	30XA0852	2	218	436	636
9	Sheraton Hotel	30XA0902	5	235	1175	1715
10	Mazoon College	30XA0852	2	218	436	636
11	Royal Cavalry, Seeb	30XA0452	2	117	234	342
12	Muna Noor	30XA0402	1	103	103	150
13	Gulf Mushroom	30XA1352	1	375	375	547
14	Royal Garage Workshop	30XA0852	3	218	654	955
15	Sohar Multiplex	30XA1002	2	261	522	762
16	Sohar Aromatics	30XA0602	2	161	322	470
17	Central Banking and Financial School	30XA0252	2	71	142	207
18	QLNG HQ Building	30XA0502	2	132	264	385
19	Bait Al Reem, Al Khuwair	30XA1202	5	325	1625	2372
20	RAFO, Musannah	30XA0402	1	103	103	150
21	ABA School	30XA0502	1	132	132	193
22	Sur IWPP	30XA0402	2	103	206	301

**List of Carrier 30XA Series Air-cooled Screw Chillers in Oman**

Sl. No.	Project	Model	Qty	Unit cooling capacity, TR	Total cooling capacity, TR	Power, KW
23	Al Mustaqbal Properties, Comm. Building	30XA1102	4	299	1196	1746
		30XA1402	4	383	1532	2236
		30XA0802	1	207	207	302
24	Muna Noor Factory at Rusayl	30XA0402	1	103	103	150
25	Commercial Building for Al Seer	30XA0702	3	176	528	771
26	Safeer Hypermarket at Azaiba	30XA0802	3	207	621	907
27	New Diwan Offices - 4	30XA0852	2	218	436	636
28	Lulu Hypermarket, Salalah	30XA1302	5	353	1765	2577
29	NH 90 Helicopter Facilities at Musanah	30XA0802	5	207	1035	1511
30	SQU Female Accommodation	30XA0752	3	190	570	832
31	Psychiatric Hospital	30XA1002	11	261	2871	4191
32	MOD Pension Fund	30XA1102	2	299	598	873
33	SQU New Teaching Block	30XA1002	3	261	783	1143
34	RGO	30XA1102	1	299	299	436
35	Salalah Touristic Complex	30XA1202	6	325	1950	2847
36	Ministry of Higher Education	30XA1202	4	325	1300	1898
37	Hisn A'Shumookh - Nizwa - Phase 4	30XA1302	6	353	2118	3092
38	Oncology Centre, Royal Hospital	30XA1002	3	261	783	1143
39	Muscat Intercontinental	30XA1302	1	353	353	515
40	PDO	30XA1102	2	299	598	873
41	International Maritime College	30XA1102	4	299	1196	1746



List of Carrier 30XA Series Air-cooled Screw Chillers in Oman

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42	Genetic Centre, Bausher	30XA1002	3	261	783	1143
43	C&R Building at Qurum	30XA1302	6	353	2118	3092
44	SQU Hospital Medical Store	30XA0702	2	176	352	514
45	Oman Dental College	30XA0902	2	235	470	686
46	Gulf Mushroom	30XA1352	1	375	375	547
47	Bait Al Madrasa, Salalah	30XA0352	2	83	166	242
48	Public Technical Library for PDO	30XA0402	1	103	103	150
49	Awqad Villa at Salalah	30XA0352	1	83	83	121
50	Ministry of Tourism	30XA1002	5	261	1305	1905
51	Dana House	30XA0602	2	161	322	470
52	Silver House	30XA0402	2	103	206	301
53	Lulu Hypermarket, Nizwa	30XA1202	4	325	1300	1898
54	Oman Botanic Garden	30XA1002	3	261	783	1143
55	Sohar Pelletizing Plant (Vale)	30XA0502	2	132	264	385
		30XA0602	3	161	483	705
		30XA1402	3	383	1149	1677
56	Haya Water HQ	30XA0902	2	235	470	686
57	Royal Suites at Sohar Hospital	30XA0252	2	71	142	207
58	PDO, Yibal	30XA0502	2	132	264	385
59	Oman Residence	30XA0902	1	235	235	343

191

44829

65438

Savings compared to other chillers @ 17.5%
Average Savings based on a 2000 HR operation at peak load per year

KW 11,452
KWH 22,903,300