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26 - 29 NOVEMBER 2017 **Dubai World Trade Centre** 11:00 - 19:00 Daily www.thebig5.ae



HVACR Leadership Workshops

# **EVAPORATIVE** COOLING







# **Workshop Agenda**



Session 1 – 14:10 – 14:40

State of the art evaporative cooling and latest European and Eurovent standards in this field

Session 2 - 14:40 - 15:10

Case study: Combining evaporative cooling and water-cooled chiller system

Prayer Break

Session 3 - 16:30 - 17:00

Trouble-Free HVAC Cooling Towers - A Maintenance Guide

Session 4 – 17:00 – 17:30

In-depth introduction for consultants to the 'Eurovent Certified Performance' programme for cooling towers







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State of the art evaporative cooling and latest European and Eurovent standards in this field

Jelle Wagelmans Sales Manager Middle East **EVAPCO** 













Open type systems (open cooling towers)





### **Open cooling towers**

- Packaged type of towers >< field erected towers</li>
  - Cell size < 1250 ton : Packaged type</li>
  - Cell size > 1250 ton : Field erected (typical 3000 – 5000 ton/cell)



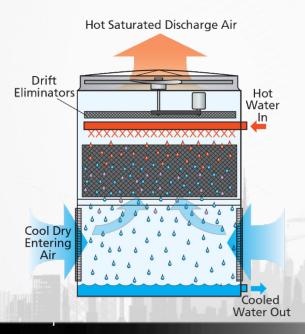


### **Open cooling towers**

- Packaged type of towers >< field erected towers</li>
- Forced draft

# Hot Saturated Discharge Air Hot Water In Cooled Water Out Cooled Water Out

### Induced draft











### **Open cooling towers**

- Packaged type of towers >< field erected towers
- Forced draft Induced draft:
  - Forced draft (with centrifugal fans):
    - Energy consumption plus 70% Normally more costly units
    - Excellent for extreme low noise applications For indoor installations







### **Open cooling towers**

- Packaged type of towers >< field erected towers</li>
- Forced draft Induced draft:
  - Forced draft (with centrifugal fans)
  - Induced draft:

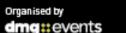


Noise (?)

No indoor installation



Low energy consumption
Easy maintenance
Lower first cost







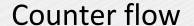
### **Open cooling towers**

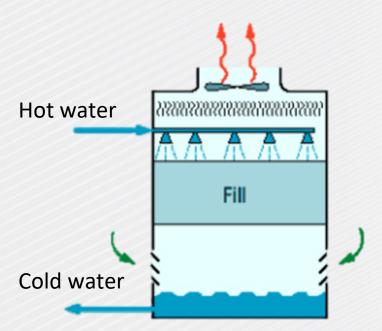
- Packaged type of towers >< field erected towers</li>
- Forced draft Induced draft:
  - Forced draft (with centrifugal fans)
  - Induced draft
  - Counter versus cross flow



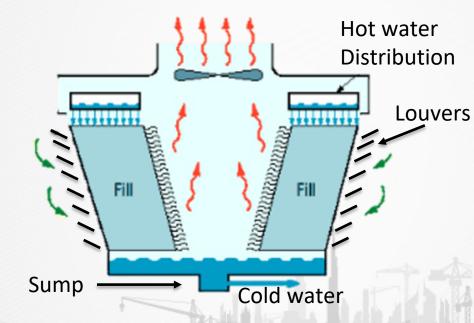


### **Open cooling towers**





### Cross flow











### **Open cooling towers**

- Packaged type of towers or field erected towers
- Forced draft induced draft
- Cross flow counterflow arrangement
- Materials of construction:
  - Galvanized steel
  - Stainless steel
  - FRP





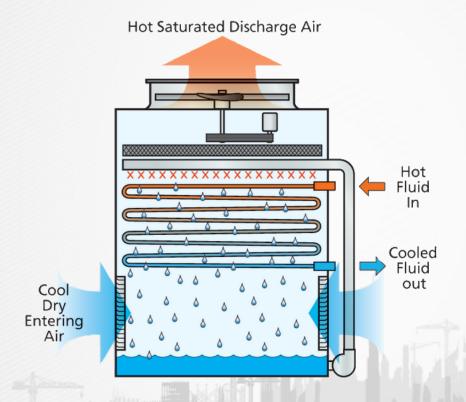
- Open type systems (open cooling towers)
- Closed type systems (closed circuit coolers)





### **Close Type Coolers**

Principle of operation









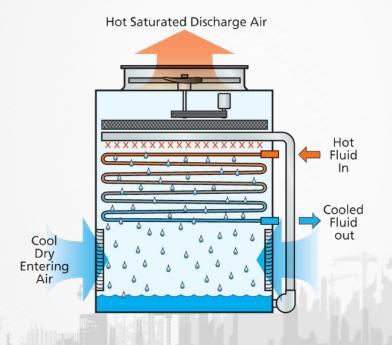


### **Close Type Coolers**

### Forced draft

# Prift Eliminators Fluid In Fan & Fan Motors Hot Saturated Discharge Air Water Distribution System Coil Entering Air

### Induced draft





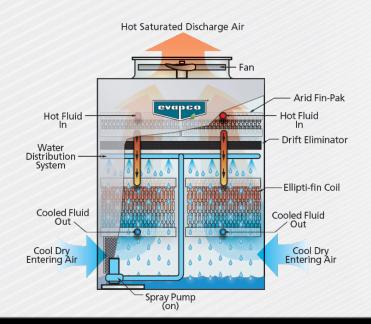






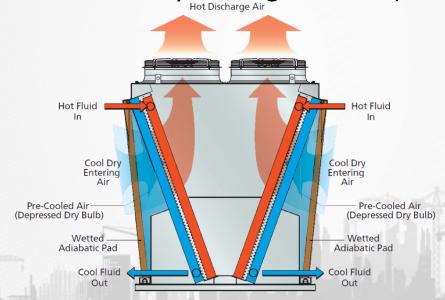
### **New Developments**

Hybrid solutions
Save water and plume abatement



Adiabatic solutions

Save water and energy (compared to 100% dry cooling solutions)













### **Climate and Energy package**

- A set of binding legislation to meet the energy targets of 2020 (=the "20-20-20" targets).
- Key objectives for 2020:
  - A 20% reduction in EU greenhouse gas emissions from 1990 levels
  - Raising the share of EU energy consumption produced from renewable resources to 20%
  - A 20% improvement in the EU's energy efficiency.

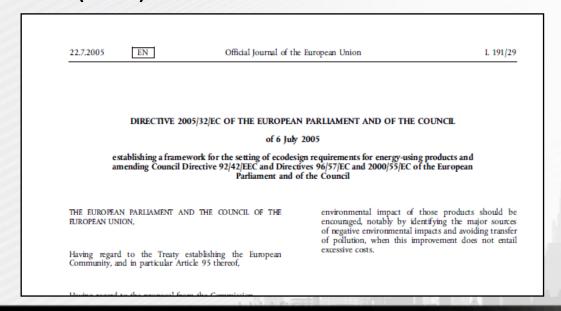






### **Achievement the targets**

Publication of Directive 2005/32/EC:
 A framework for the eco-design requirements of energy-using products (EUP)





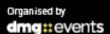




### **Achievement the targets**

Publication of Directive 2009/125/EC:
 Recast of the 2005/32/EC and extents the scope of application to all energy related products (ERP).

14.11.2012 EN	Official Journal of the European Union	L 315/1
	1	
	(Legislative acts)	
	DIRECTIVES	
DIR	ECTIVE 2012/27/EU OF THE EUROPEAN PARLIAMENT AND OF TH	HE COUNCIL
	of 25 October 2012	
on energy	efficiency, amending Directives 2009/125/EC and 2010/30/EU and re 2004/8/EC and 2006/32/EC	epealing Directives
	(Text with EEA relevance)	
THE EUROPEAN PARLL EUROPEAN UNION,	accelerate the spread	rgy-efficient economy should also d of innovative technological the competitiveness of industry







### **Application example: Buildings**

 Energy performance requirements for technical building systems as described in the Directive 2010/31/EU

EN 18.6.2010 Official Journal of the European Union L 153/13 DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 May 2010 on the energy performance of buildings (recast) THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE Together with an increased use of energy from renewable EUROPEAN UNION. sources, measures taken to reduce energy consumption in the Union would allow the Union to comply with the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), and to Having regard to the Treaty on the Functioning of the European honour both its long term commitment to maintain Union, and in particular Article 194(2) thereof, the global temperature rise below 2 °C, and its commitment to reduce, by 2020, overall greenhouse gas emissions by at least 20 % below 1990 levels, and Having regard to the proposal from the European Commission, by 30 % in the event of an international agreement being reached. Reduced energy consumption and an increased use of energy from renewable sources also have an important part to play in promoting security of energy Having regard to the opinion of the European Economic and supply, technological developments and in creating Social Committee (1), opportunities for employment and regional development, in particular in rural areas. Having regard to the opinion of the Committee of the Regions (2), Management of energy demand is an important tool enabling the Union to influence the global energy market and hence the security of energy supply in the Acting in accordance with the ordinary legislative procedure (3), medium and long term.





### **Application example:**

### Multitude of specific eco-design directives for machinery: Fans

Commission regulation (EU) No 327/2011: eco-design requirements for fans driven by motors with an electric input power between 125W and 500kW = cooling tower fans

L 90/8 Official Journal of the European Union 6.4.2011

### REGULATIONS

### COMMISSION REGULATION (EU) No 327/2011

of 30 March 2011

implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for fans driven by motors with an electric input power between 125 W

(Text with EEA relevance)

THE EUROPEAN COMMISSION.

Having regard to the Treaty on the Functioning of the European

Having regard to Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (1) and in particular Article 15(1)

Total electricity consumption of fans driven by motors with an electric input power between 125 W and

covered by Regulation (EC) No 640/2009.

500 kW is 344 TWh per year, rising to 560 TWh in 2020 if current Union market trends persist. The costefficient improvement potential through design is about 34 TWh per year in 2020, which corresponds to 16 Mt

of the European Parliament and of the Council with regard to ecodesign requirements for electric motors (2), including electric motors equipped with variable speed drives. They also apply to those motors which are part

of a motor-fan system. However, many fans covered by this Regulation are used in combination with motors not





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### What is Eurovent



- **Eurovent Association:** 
  - Keep members informed of relevant legislation
  - National trade associations for each country
  - Development of product certification programs
- **Eurovent Certification Company (E.C.C.)** 
  - Independent from Eurovent Association
  - Certification of cooling equipment / components







# **ECC-CTI Partnership**



# **ECC-CTI Memorandum of Understanding Mutual** recognition Eurovent-CTI

"CTI and ECC endeavor to work together in the area of cooling tower certification in an effort to advance the certification programs of both groups, be it therefore resolved, that CTI and ECC pledge to work cooperatively on all matter of mutual interest in the area of cooling tower certification"

Europe / Middle East / India

CONTRACT BETWEEN
COOLING TECHNOLOGY INSTITUTE
AND
EUROVENT CERTIFICATION COMPANY

Whereas Cooling Technology Institute (CTI) and Eurovent Certification Company (ECC) endeavor to work together in the area of cooling tower certification in an effort to advance the certification programs of both groups, be it therefore resolved, that CTI and ECC pledge to work cooperatively on all matters of mutual inferent in the area of cooling tower certification. Further, CTI and ECC pledge to resolve any reasonable differences in the most professional and timely manner possible.

This contract is entered into this day, day, month, year, by and between the CTI whose address is 2611 FM1960 West, Suite A-101, Houston, Texas 77068, United States of America and ECC, whose registered address is La Kenweverstaral 21, 1050 Brussels, Belgium and whose office address is 62 Boulevard de Sebastopol, 75003 Paris, France.

Once significant interest is indicated by the above companies requesting the cooling tower certification program, the program will commence per the agreement indicated below.

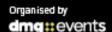
In consideration of the promises of the parties contained in this contract, the parties agree as follows:

- CTI and ECC each agrees, under the conditions specified herein, to cooperate with the certification of the other party with respect to covered product.
- For the purposes of this Agreement:
   (a) Covered product means all products covered for certification in ECC publication OM-4-2008, which is a subset of the products covered in CTI STD-201.
- 3. Both CTI and ECC deaire to affiliate per this contract. The ECC cooling tower certification program involves certification of published ratings on covered products by CTI. ECC will, in addition to the certification of published ratings using the CTI to the CTI official product data of record in the manufacturing facilities that may produce product for delivery or sain in Europe.

Many benefits will be derived by all parties including the following:

• Identical standards for cooling tower certification will be in use throughout the world;

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# **Scope of the Certification**



### **General Purpose**

- Encourage honest competition
- Assure correctly rated equipment on the market
  - Separate and specific certification programs for each product type
  - Product performance tests through an independent third-party
  - Application and participation open to all manufacturers





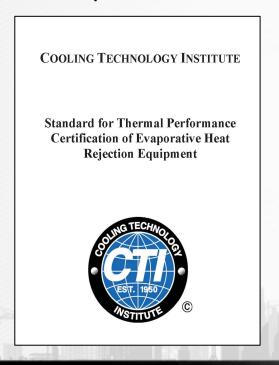


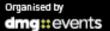
# Scope of the Certification



- ECC Rating Standard (RS):
  - Reference to CTI STD-201
  - CTI STD-201 will be used for thermal performance testing









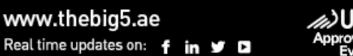


# Scope of the certification



### Important steps in operational manual

- Thermal Performance Testing:
  - Manufacturers own lab Independent test agency (lab / on site)
  - CTI approved test equipment
- Factory Audits:
  - Verify the equipment is built conform as per registered data
  - Identity issues which may arise with regard to differences in regional sourcing of components
  - ⇒ Audit agency will send audit report to ECC:
    - Compliance
    - Non-compliance





# **Eurovent Certification Program**



### Value add

- Honest and fair competition
- Correctly rated equipment on the market
- Enables accurate energy comparison calculations
- Enforceable, specifiable and available for all manufacturers
- Energy consumption of the system. Underrated cooling towers will result in higher condensing temperature and increased power consumption









 Eurovent thermal performance certification for open and closed type cooling towers

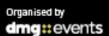








- Eurovent thermal performance certification for open and closed type cooling towers:
  - Not applicable and available yet for adiabatic solutions
  - Not applicable and valid for field erected towers!!







# **Drift Eliminator Efficiency**



- Eurovent certification program for Drift Eliminators Efficiency:
  - Drift losses are a concern with regard to spread of Legionella bacteria
  - Eurovent set up a certification program for DE efficiency
  - Details: RS 9/C/003 & OM-14







# **Drift Eliminator Efficiency**



### **Scope of the Certification**

Eurovent has a certification program for:



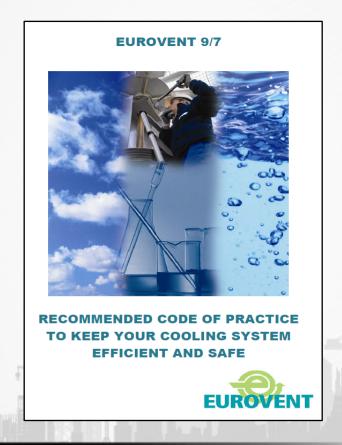








- Recommended code of practice to keep your cooling system efficient and safe
- This guideline gives specific recommendations to operate the cooling tower safe with regard to Legionella













### **Eurovent 9/7 Guideline (2011)**

Specific recommendations with regard to evaporative cooling equipment:

- 1. Access for inspection and maintenance:
  - Drift eliminators, water distribution system, drives, air inlet louvers, basin, strainers, fill, sound baffles and bleed lines.
  - Appropriate sized access doors or hatches min. 500 x 500 mm or min. 600 mm dia.
  - Larger equipment: Interior walkways, platforms, ladders and handrails.





### **Eurovent 9/7 Guideline (2011)**

Specific recommendations with regard to evaporative cooling equipment:

- 2. Access for cleaning:
  - Mechanical cleaning of the basin should be possible.
  - Access to basin through access door or air inlet louvers.
  - Easy flushing basins to one or more central points: sloped basin design (no flat basins)
  - Mechanical cleaning water distribution system: Removable nozzles are preferred.







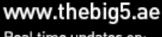
### **Eurovent 9/7 Guideline (2011)**

Specific recommendations with regard to evaporative cooling equipment:

- Design tower without water stagnation:
  - Tower casing:
    - Should avoid stagnation
    - No slopes opposite water flow direction
  - Water distribution: Drain when water circulation is stopped
  - Basins: Have a drain connection in the lower part
  - Piping: No deadlegs and (self)drainable











### **Eurovent 9/7 Guideline (2011)**

Specific recommendations with regard to evaporative cooling equipment:

- 3. Design tower without water stagnation (cont'd):
  - Equalizing lines:
    - With sufficient shut off valves to isolate individual basins
    - Should have a drain connection
    - If possible the blow down should be installed in equalizing line to ensure regular flow through the piping





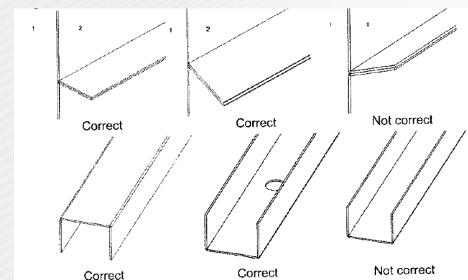






### **Eurovent 9/7 Guideline (2011)**

- 3. Design tower without water stagnation (cont'd):
  - Casing: Shall comply with the below figures (theory)



Legend:

1 = external panel

2 = internal panel

Internal assembly of the tower's vertical panels







### **Eurovent 9/7 Guideline (2011)**

- 3. Design tower without water stagnation (cont'd):
  - Casing: Shall comply with the below figures (in practice)



External panel





### **Eurovent 9/7 Guideline (2011)**

- Design tower without water stagnation (cont'd):
  - Casing: Shall comply with the below figures (in practice)



Internal panel

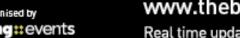








- Design tower without water stagnation (cont'd):
  - Water distribution:
    - Self drainable
    - Maximum 0.5 bar operating pressure
    - Nozzles selected for large water droplets, low pressure nozzles
    - Efficient drift eliminators









- 4. Design tower shielding from sunlight and other external influences:
  - Exposure to sunlight enhances the development of many bacteria in particular algae
  - Development of algae, which is a nutricient for Legionella, needs to be avoided at all cost
  - Casing: Must be impervious for sun rays





- 4. Design tower shielding water from sunlight and other external influences (cont'd):
  - The basin should be shielded from exposure of direct sunlight by the use of louvers









- 5. Small droplets create a risk for Legionella to be spread out:
  - Water spray system: Avoid high pressure, small droplet nozzles
  - Material drift eliminators : PVC or PP
  - Drift eliminators: To be high efficient and air velocity not to exceed the breakthrough velocity of the eliminator (3.5 – 6.0 m/sec)
  - Drift rate : certified by Eurovent
  - Achievable drift loss rates: 0.01 % of circulation rate





### **Eurovent 9/7 Guideline (2011)**

### 6. Splash out:

- Splash droplets are usually thick and cannot be inhaled.
- Less concern for Legionella proliferation.
- Splash should be avoided:
  - Louvers
  - Windwalls
  - Situation with pump On and fans Off to be avoided









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