Bulletin 160-E Metric

evapco® for LIFE

eco-ATC-A

The NEW Family of Evaporative Condensers

Environmentally Conscious Operation Featuring Water & Energy Conserving Technology

375 till 11753 kW nominal capacity

ENVIRONMENTAL SOLUTIONS... CREATING A BETTER WORLD!

CERTIFIED EN ISO 9001

Mr. GoodTower® evapco

IARW International Association of Refrigerated Warehouses

ARI

CE PRESSURE EQUIPMENT DIRECTIVE 97/23/EC ASSESSED BY NOTIFIED BODY

MEMBER iiar International Institute of Ammonia Refrigeration

eurammon refrigerants delivered by mother nature

EAC

Advanced Design Smooth Flow Fans

- Totally Enclosed Fan Motors assures long life
- Power-Band Belts for Better Lateral Rigidity
- Advanced Design Aluminum Fan Blades
- Non-corroding Cast Aluminum Sheaves
- Heavy-Duty Fan Shaft Bearings with L-10 life of 75,000 - 135,000 hrs
- All Other Components Corrosion Resistant Materials

Low Sound Options available
Refer to page 15

Super Low Sound Fan (optional)

- Extremely wide sloped fan blades for sound sensitive applications
- One piece molded heavy duty construction
- 9-15 dB(A) sound reduction

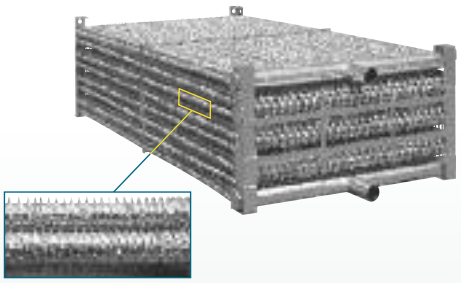
Elipti-Fin® Heat Transfer Technology

Features EVAPCO's exclusive CROSScool™

Features EVAPCO's exclusive ***CROSScool***™ tube enhancement for greater internal heat transfer.

- Thermal Pak® coil with extended surface.
- Water savings through extended periods of dry operation.
- High heat transfer efficiency.
- Low refrigerant charge.

Patent Pending



IBC Compliant Design
Refer to page 21

"Clean Pan" Basin Design

- Access from all four sides
- Large open area simplifies maintenance
- Basin may be inspected with pumps running
- Sloped basin design prevents sediment buildup, biological film and standing water
- Optional: full stainless steel welded basin

WST Air Inlet Louvers (Water and Sight Tight)

- Easily removable for access
- Patented design to keep sunlight out–preventing biological growth
- Keeps water in while keeping dirt and debris out

U.S. Patent No. 7927196

Louver Access Door

- Hinged access panel with quick release mechanism
- Allows easy access to perform routine maintenance and inspection of the make-up assembly, strainer screen and basin
- Available on larger models

Easy Field Assembly

- A new field assembly seam design which ensures easier assembly and reduced potential for field seam leaks
- Self-guided channels guide the fan casing section into position improving the quality of the field seam
- Eliminates up to 66% of fasteners *(Patent Pending)*

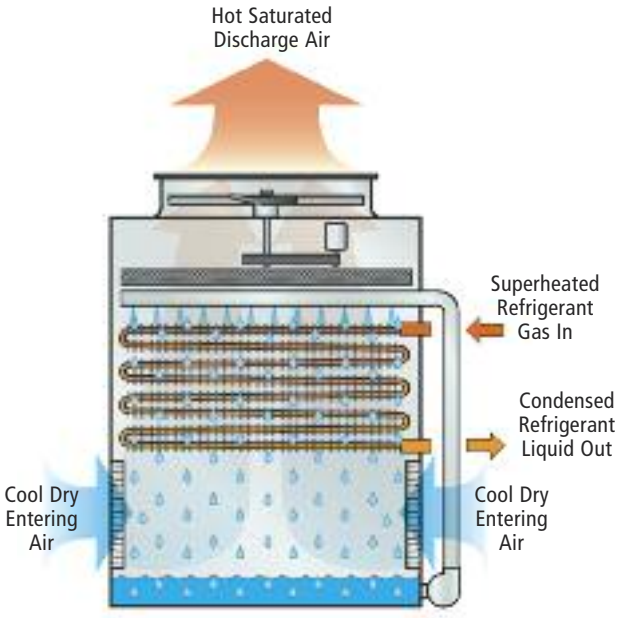
eco-ATC-A

DESIGN FEATURES
Proven Performance and Design Flexibility

Principle of Operation

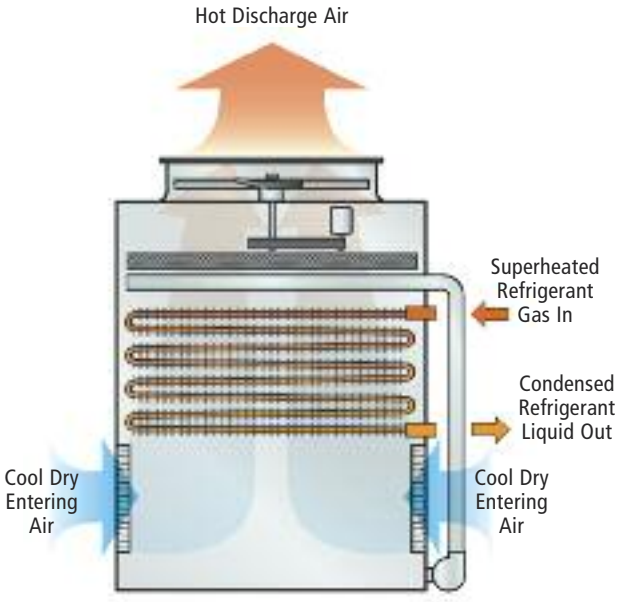
Evaporative Mode

The refrigerant gas is discharged from the compressor into the inlet connection of the eco-ATC-A condenser. Water from the condenser's sump is circulated over the condenser coil, while ambient air is simultaneously drawn into the unit. As the ambient air moves up through the coil section, a portion of the spray water is evaporated into the air stream. The evaporative process cools the spray water, which in turn cools the tubes containing the refrigerant gas. The cool tube walls cause the refrigerant gas to give up heat and condense into a liquid. The condensed liquid flows out of the coil to the high pressure liquid receiver for return to the system. The hot, saturated air is drawn through the drift eliminators, where any entrained water droplets are removed. The condenser's fan then discharges this air stream out of the top of the unit at a high velocity, where it can dissipate harmlessly into the atmosphere. The water which was not evaporated falls into the sump and is recirculated by the spray pump to the water distribution system above the condensing coil section.



Dry Mode

The refrigerant gas is discharged from the compressor into the inlet connection of the eco-ATC-A condenser. Ambient air is drawn into the unit and moves over the heat transfer coil. The air is warmed while the tubes containing the refrigerant gas are cooled. The cool tube walls cause the refrigerant gas to give up heat and condense into a liquid. The condensed liquid flows out of the coil to the high pressure liquid receiver for return to the system. The hot discharge air is drawn through the drift eliminators and the fan then discharges the air stream out of the top of the unit where it can dissipate harmlessly into the atmosphere.



DESIGN FEATURES

Proven Performance and Design Flexibility

eco-ATC-A

Water and Energy Saving with eco-ATC-A Technology

Low Fan Motor kW

The eco-ATC-A features the new EVAPCO **Ellipti**–*fin*™ coil, which utilizes elliptical spiral fin coil technology. This technology allows a 10% to 30% increase in thermal performance depending on the coil configuration, when operating in the wet or evaporative mode. This will results in significant energy savings throughout the year.

Reduced Plan Area

Due to the increased thermal performance, new eco-ATC-A also minimizes the footprint required for a given capacity thereby reducing the space required for an evaporative condenser. A smaller footprint means less steel and lower installation costs.

Significant Water Savings

The **Ellipti**–*fin*™ coil technology enables the eco-ATC-A to be operated in a 100% Dry Mode at a significantly higher switchover temperature than that of a typical bare tube coil evaporative condenser. This leads to a significant increase in the number of hours per year the condenser can operate in dry mode (spray pumps off), thus increasing your water savings.
This combination of features allows the eco-ATC-A to be operated with both energy and water efficiency in mind, making it the ideal choice for many installations.

Consider a meat processing plant application near Köln (Germany), where the unit is required to reject a constant heat load of 3000 kW of refrigeration at a 35°C condensing temperature and a summer design wet bulb temperature of 21°C. The process operates 24 hours a day 7 days a week. The eco-ATC-A evaporative condenser and an ATC-E evaporative condenser are compared as follows:

EVAPCO Model	ATC-XC775E	eco-ATC-779A	Difference*(%)
Plan Area (m^2)	22,2	19,8	-10%
Fan Motor (kW tot)	30	22	-28%
Pump Motor (kW tot)	8	5,5	

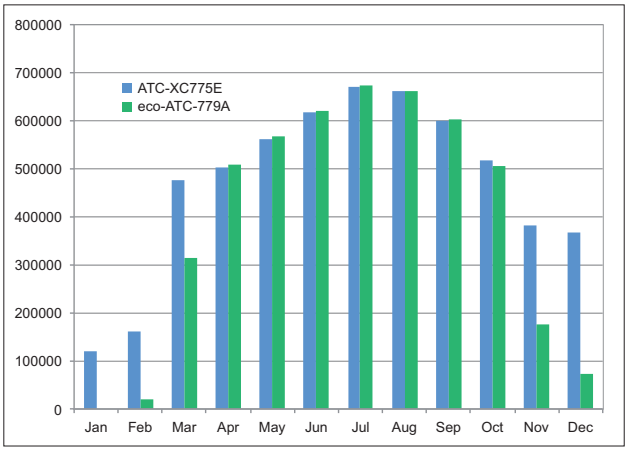
* eco-ATC-A compared to ATC

Model Comparison

In the previous example, the eco-ATC-A model requires lower fan motor horsepower and smaller plan area than the equivalent ATC-E. The potential for reduced kW during wet operation is only one of the eco-ATC-A benefits. The enhanced performance of the eco-ATC-A can be illustrated by the following diagrams.

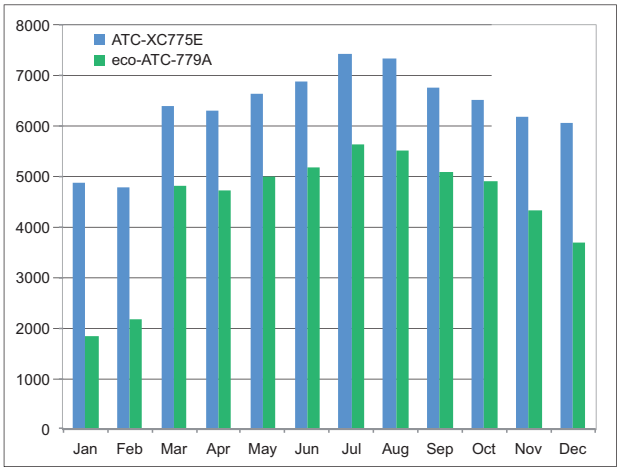
Assuming a load profile requiring full 70% heat rejection requirement for a full time operation of the refrigeration system yields the following comparison between the eco-ATC-A and the ATC.

In the following diagram it is possible to appreciate the lower water consuption of eco-ATC-A compared to ATC: during the cold season the water consuptionof eco-ATC-A is no present or extremely low.



ATC vs eco-ATC-A
Annual water use

In the next diagram, it is possible to see that the energy consuption is lower during all the year thanks to the high thermal performance of the EVAPCO **Ellipti**–*fin*™ coil.



ATC vs eco-ATC-A
Annual energy use

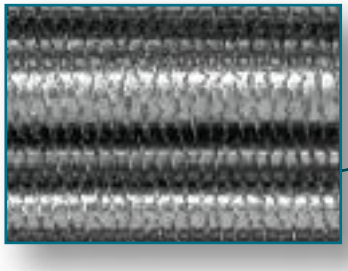
eco-ATC-A

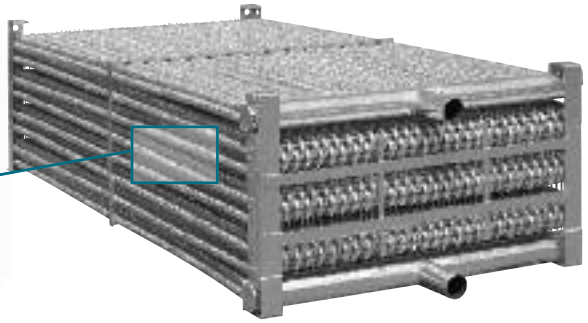
DESIGN FEATURES

Ellipti–*fin*™ Heat Transfer Coil

NEW

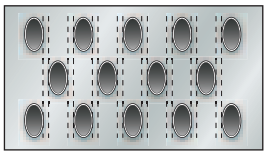
- Elliptical Tubes with Spiral Wound Fins
- Improved Dry and Wet Operation
- All Rows Finned



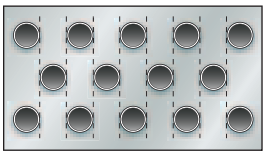


Evolution of Heat Transfer Technology

EVAPCO has a long standing commitment to heat transfer research and development. This commitment has resulted in a number of advancements in heat transfer coil design. Up until the mid-1980's, evaporative condensers were manufactured with tightly packed round tube coils. Through thousands of hours of testing and research, EVAPCO developed the Thermal-Pak® coil.

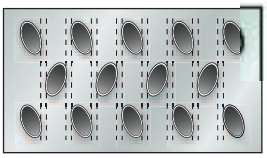


Thermal-Pak® Coil by EVAPCO



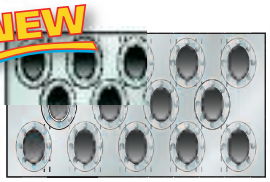
Round Tube Coil by Others

The Thermal-Pak® coil was patented in 1987 and changed the thinking of system design engineers by changing the shape of the coil tubes. The elliptical tube design maximized the effective tube surface are while lowering airside pressure drop and allowing for higher water loading. The combination of the elliptical shape tube in the Thermal-Pak® orientation increased heat transfer efficiency and resulted in one of the highest capacities per plan area of evaporative condensers available today.



Thermal-Pak® Coil II by EVAPCO

NEW



Ellipti–*fin*™ Finned Eliptical Tube by EVAPCO

Throughout the late 1980's and into the 1990's EVAPCO was continuously looking for ways to improve heat transfer efficiency. This research resulted in the development of the Thermal-Pak® II heat transfer coil. The Thermal-Pak® II coil utilized the same elliptical shape tube introduced in the original Thermal-Pak® coil, but changed the orientation of the tubes to improve the tubes air to water interface for increased heat transfer efficiency.

The development of the Thermal-Pak® II coil resulted in a reduction in refrigerant charge as well as a reduction in operating weight through reduced coil volume while maintaining the same thermal performance as the original Thermal-Pak® coil design.

Research and development is an on-going process at EVAPCO. Through the success of the Thermal-Pak® II coil, EVAPCO saw the potential for new coil configurations and the need for new manufacturing technology to improve processes and efficiency. During this same time, it became evident that a need exists for more environmentally conscious evaporative cooling products.

EVAPCO used the experience gained through the development of the Thermal-Pak® and Thermal-Pak® II heat transfer coils and combined with new manufacturing procedures to develop the **Ellipti**–*fin*™ heat transfer coil. The **Ellipti**–*fin*™ coil utilizes elliptical shape tube with extended surface fins for maximum heat transfer efficiency. **The extended surface increases the heat transfer efficiency in the evaporative or wet mode as well as the dry mode of operation.**

The **Ellipti**–*fin*™ coil incorporates features of both the Thermal Pak and Thermal Pak II coils as the tubes are oriented vertically yet spaced so as not to increase the airside pressure drop. As such, eco-ATC-A condensers are not subject to the performance penalties normally associated with round tube extended surface coils.

Ellipti–*fin*™ coils are manufactured from high quality internally enhanced ***CROSS*coolTM** carbon steel tubing following the most stringent quality control procedures. Each circuit is inspected to assure the material quality and then tested before being assembled into a coil. Finally, the assembled coil is tested in accordance with the "Pressure Equipment Directive" (PED) 97/23/EC. To protect the coil against corrosion, it is placed in a heavy-duty steel frame and the entire assembly is dipped in molten zinc (hot dip galvanized) at a temperature of approximately 430°C.

EVAPCO'S new **Ellipti**–*fin*™ condensing coils are designed for maximum heat transfer efficiency. This unique coil design utilizes counterflow heat transfer. The rows of the finned elliptical tubes are positioned vertically in the direction of airflow to enhance turbulence, which increases heat transfer while minimizing airside pressure drop. The design features of EVAPCO's **Ellipti**–*fin*™ condensing coils ensure the end user will receive maximized evaporative heat transfer efficiency wet or dry. These characteristics and other engineering advancements of the **Ellipti**–*fin*™ have been proven in EVAPCO'S world-class research and development laboratory.

DESIGN FEATURES

eco-ATC-A

EVAPCOAT Corrosion Protection System

EVAPCO, long known for using premium materials of construction, has developed the ultimate system for corrosion protection in galvanized steel construction – the EVAPCOAT Corrosion Protection System. Marrying corrosion free materials with heavy gauge mill hot-dip galvanized steel construction to provide the longest life product with the best value.

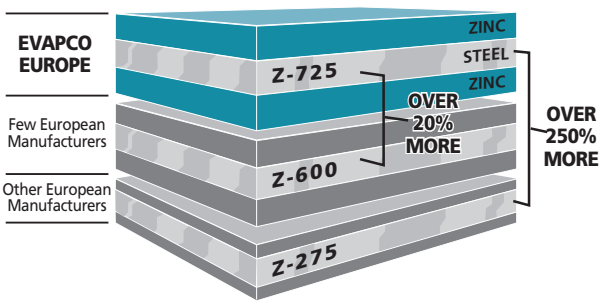
The Evapcoat Corrosion Protection System consist of:

• Z-725 Mill Hot-Dip Galvanized Steel Construction

Mill hot-dip galvanized steel has been successfully used for over 25 years for the protection of evaporative condensers against corrosion. There are various grades of mill galvanized steel each with differing amounts of zinc protection. EVAPCO has been a leader in the industry in developing heavier galvanizing, and was the first to standardize on Z-600 mill hot-dip galvanized steel. Now, EVAPCO is, once again, increasing the level of corrosion protection by being the first and only manufacturer in Europe to use Z-725 mill hot-dip galvanized steel.

Z-725 designation means there is a minimum of 725 g of zinc per m^2 of surface area present on the steel. Z-725 is the heaviest level of galvanizing available for manufacturing evaporative condensers and has over 2.5 times more zinc protection than competitive designs using Z-275 steel. With Z-725 mill hot-dip galvanized steel construction, EVAPCO provides galvanized steel panels with corrosion protection that approaches the level of the hot-dip galvanized heat exchanger coils.

During fabrication, all panel edges are coated with a 95% pure zinc-rich compound for extended corrosion resistance.



• Type 304 Stainless Steel Strainers

Subjected to excessive wear and corrosion, the sump strainer is critical to the successful operation of the condenser. EVAPCO uses only stainless steel for this very important component.

• PVC Air Inlet Louvers

The innovative design uses corrosion free materials while effectively eliminating splash out and reducing the potential for algae formation inside the condenser.

• PVC Drift Eliminators

The final elements in the upper part of the condenser are moisture eliminators which strip the entrained water droplets from the leaving air stream.

EVAPCO eliminators are constructed entirely of inert, corrosion-free PVC. This PVC material has been specially treated to resist damaging ultraviolet light. The eliminators are assembled in easily handled sections to facilitate removal thereby exposing the upper portion of the unit and water distribution system for periodic inspection.

• PVC Water Distribution System, *ZM II*™ Spray Nozzle

The fixed position *ZM II*™ Spray Nozzles are mounted in corrosion-free PVC water distribution pipes. Together, these elements combine to provide unequaled coil coverage, scale prevention and make the industries best performing non-corrosive, maintenance-free water distribution system.

• Totally Enclosed Motors

EVAPCO uses totally enclosed motors for all fan and pump motors as standard. These superior motors help to assure longer equipment life without motor failures, which result in costly downtime.

• Alternate Materials of Construction

EVAPCO induced draft condensers have a modular design which allows for specific areas to be enhanced for increased corrosion protection. For particularly corrosive environments, EVAPCO condensers are available with Stainless Steel construction for the basin and/or casing.

• Stainless Steel Basin - Welded Execution

The basin area of a condenser is often subjected to high concentrations of impurities and silt. In addition to the EVAPCOAT Corrosion Protection System, EVAPCO offers optional **welded** stainless steel construction for superior corrosion resistance. This option provides Type 304 or Type 316 stainless steel for the entire basin section - including the support columns and air inlet louver frames.

eco-ATC-A

DESIGN FEATURES

Belt Drive Units – 2.3 m and 2.4 m Wide Models

eco-ATC-122A to eco-ATC-M906A

The fan motor and drive assembly on these units are designed to allow easy servicing of the motor and adjustment of the belt tension from the exterior of the unit. The T.E.F.C. fan motor is mounted on the outside of these models.

A large hinged access door with a "quick release" latch provide access to the fan section for maintenance.

External Motor Mount (with optional ladder)

Belt Drive Units – 3 m and 3.6 m Wide Models

eco-ATC-300A to eco-ATC-3846A

Designed as the ideal replacement condenser, these models provide both cost effective and energy efficient alternatives to obsolete centrifugal fan designs. The 3 m wide plan areas are also well suited for new installations and provide more layout flexibility. The unique belt drive design features are detailed below.

Motor Base Assembly

The fan motor and drive assembly is designed to allow easy servicing of the motor and adjustment of the belt tension from the exterior of the unit. The T.E.A.O. fan motor is located inside the fan casing on a rugged heavy duty motor base. The innovative motor base also features a unique locking mechanism for a positive adjustment.

The motor base is designed to swing out through a very large 1.3 m^2 access opening. This allows for easy servicing of the motor.

Motor Access

Power- Band Drive Belt: The Power-Band is a solid-back, multigroove belt system that has high lateral rigidity. The belt is constructed of neoprene with polyester cords. The drive belt is designed for 150 percent of the motor nameplate kW for long life and durability.

Fan Shaft Bearings: The fan shaft bearings in ATC units are specially selected for long, trouble-free life. They are rated for an L-10 life of 75.000 to 135.000 hours and are the heaviest pillow block bearings available.

Aluminum Alloy Pulleys: Fan pulleys are constructed of corrosion free aluminum for long life. The aluminum also helps belts last longer.

DESIGN FEATURES

eco-ATC-A

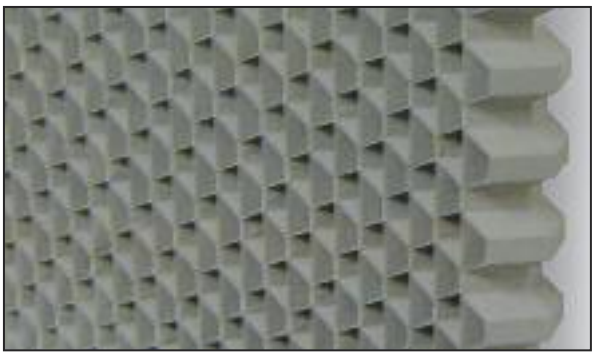
Water Management
High Efficient Water Saver Drift Eliminators

An extremely efficient drift eliminator system is standard on EVAPCO condensers. The patented system removes entrained water droplets from the air stream to limit the drift rate to less than 0.001% of the recirculating water rate. With a low drift rate, EVAPCO condensers save valuable water and water treatment chemicals. The drift eliminators are constructed of an inert polyvinyl chloride (PVC) plastic material which effectively eliminates corrosion of these vital components. They are assembled in sections to facilitate easy removal for inspection of the water distribution system.

Superior WST Air Inlet Louver and Screen Design

EVAPCO's patented WST Inlet Louvers keep water in and sunlight out of the basins of induced draft products. The unique non-planar design is made from light-weight PVC sections which easily fit together and have no loose hardware, enabling easy basin access.

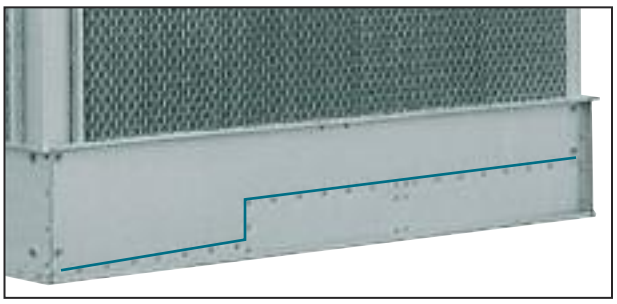
Developed with computational fluid dynamics (CFD) software, the louver's air channels are optimized to maintain fluid dynamic and thermodynamic efficiency and block all line-of-sight paths into the basin eliminating splash-out; even when the fans are off. Additionally, algae growth is minimized by blocking all sunlight.



The combination of easy basin access, no splash-out and minimized algae growth saves the end user money on maintenance hours, water consumption and water treatment costs.

"Clean Pan" Basin Design

EVAPCO condensers features a completely sloped basin from the upper to lower pan section. This "Clean Pan" design allows the water to be completely drained from the basin. The water will drain from the upper section to the depressed lower basin section where the dirt and debris can be easily flushed out through the drain. This design helps prevent buildup of sedimentary deposits, biological films and minimizes standing water.



Sloped Basin

ZM II™ Spray Nozzle Water Distribution System

Even and constant water distribution is paramount for reliable, scale-free evaporative cooling. EVAPCO's Zero Maintenance *ZM II*™ Spray Nozze, mounted in a PVC distribution pipe remains clog-free under the toughest conditions to deliver approximately 4 l/s to every square meter of coil plan area.

The heavy-duty ABS *ZM II*™ Spray nozzles have a 33 mm diameter opening and a 38 mm splash plate clearance, enabling EVAPCO to use 75% fewer nozzles.

ZM II™ *Nozzle*

eco-ATC-A

OPTIONAL EQUIPMENT

Two Speed Motors

Two speed fan motors can provide an excellent means of capacity control. In periods of lightened loads or reduced wet bulb temperatures, the fans can operate at low speed, which will provide about 60% of full speed capacity, yet consume only about 15% of the power compared with high speed. In addition to the energy savings, the sound levels of the units will be greatly reduced at low speed.

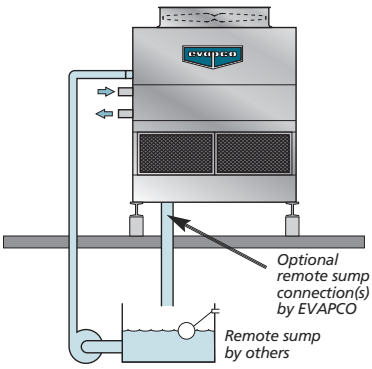
Inverter Duty Motors

Inverter Duty motors are available for condenser applications which utilize variable frequency drive systems for capacity control. Inverter Duty motors offer totally enclosed premium efficiency construction which is designed for variable frequency drive applications.

Note: Other special motor configurations are available to meet specific proper requirements. Contact your local EVAPCO sales representative for application assistance and motor availability.

Remote Sump Configuration

For units operating in areas where temperatures may be very low, or where low temperatures may occur during periods when the unit is not operating, a sump located inside the building is the preferred means of ensuring that the basin water will not freeze. For these applications, the condenser will be supplied without the spray pump, suction strainers and all associated piping, but with an oversize bottom outlet.



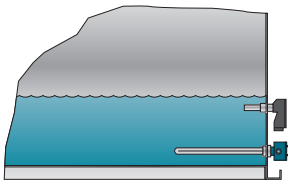
Dual Fan Option

Evapco now offers a Dual Fan arrangement on 10x18, 12x18 and 12x20 nominal box sizes.

The Dual Fan option gives users redundancy in large box sizes by providing independant motors, fans, and drives that previously only had a single fan and motor.

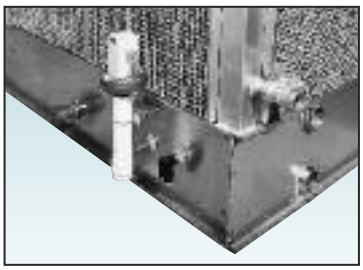
Basin Heater Package

If a remote sump configuration is not practical, electric basin heater packages are available to help prevent freeze-up of the basin water. The packages include electric heater elements and a combination with thermostat and low water cut-off. (Consult EVAPCO for heater size and application)



Electric Water Level Control

Evaporative condensers may be ordered with an electric water level control in lieu of the standard mechanical float and make-up assembly. This package provides accurate control of water levels and does not require field adjustment.



Multiple Circuit Coils

Condensers may be supplied with multiple circuit coils to match various system requirements such as split systems.

Self Supporting Service Platforms

Condensers are available with self-supporting service platforms that include access ladders which are designed for easy field installation. This option offers significant savings in comparison to field constructed, externally supported catwalks. The EVAPCO service platform option will be installed in front of the fan access doors.

Motor Davit

In the event that a fan and/or fan motor should need to be replaced, a motor davit is available from which a chain fall can be mounted to easily lower the motor/fan to the ground.

eco-ATC-A Condenser with Optional Service Platform and Motor Davit

OPTIONS

eco-ATC-A

APPLICATION

Piping

Evaporative condensers are used in refrigeration systems as an efficient means of heat rejection. Their installation and specifically the installation of the piping to and from the evaporative condenser has a direct effect on their operation and the overall energy efficiency of the refrigeration system. In this manual, we will explore the principles of piping evaporative condensers, beginning with single condensers and exploring multiple condenser installations as well as thermosiphon and sub-cooling piping systems.

Background

Evaporative condensers came into common use for nearly all refrigeration systems because of their operating advantages over the combination of cooling towers and condensers. They, of course, have also replaced the old "once through" water cooled condensing systems which are obsolete today because of the restrictions on the unlimited use of water coupled with its high cost.

Although, shell and tube condensing systems performed the same job of condensing the hot discharge gas into a saturated liquid as evaporative condensers; a small difference in the operating characteristics, namely pressure drop, requires some modification in the refrigerant piping hookup to and from the evaporative condenser. These changes are particularly important when dealing with multiple unit installations. In order to understand why the piping hookup is important, let's first take a brief look at the basic design differences of the two types of condensers to see why there is a difference in the pressure drop characteristics.

TYPICAL SHELL AND TUBE WATER COOLED CONDENSER

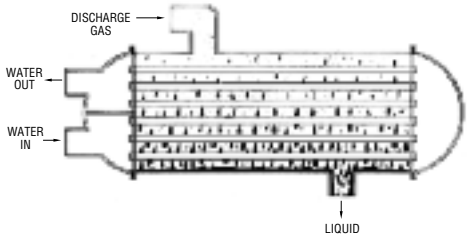


Figure 1

The shell type refrigerant condensers allow the refrigerant to flow around and condense on the outside of the water tubes. (See Figure 1) The refrigerant flow is almost entirely unimpeded resulting in a very low or nearly zero pressure drop through the condenser.

TYPICAL EVAPORATIVE CONDENSER COIL

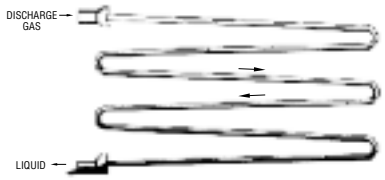


Figure 2

Contrasting, most evaporative condensers (See Figure 2) utilize some type of serpentine coil design where the hot refrigerant gas enters the top of the coil traveling back and forth through several rows as it is cooled and changed from a hot superheated gas to a saturated liquid. This longer travel path generally produces a small pressure drop which, though insignificant to the overall operation of the refrigeration system, does require proper attention be given to the condenser piping. Most of this attention needs to be focused on the liquid drain line from the outlet of the evaporative condenser to the high pressure receiver. The reason for this is described in the "Piping Brochure".

Piping Brochure

For additional information refer to EVAPCO Bulletin 131-E "Piping Evaporative Condensers" or consult your nearest Representative.

Other Useful Manuals available on EVAPCO Web-site

APPLICATIONS

ADVANCED TECHNOLOGY LOW SOUND SOLUTIONS

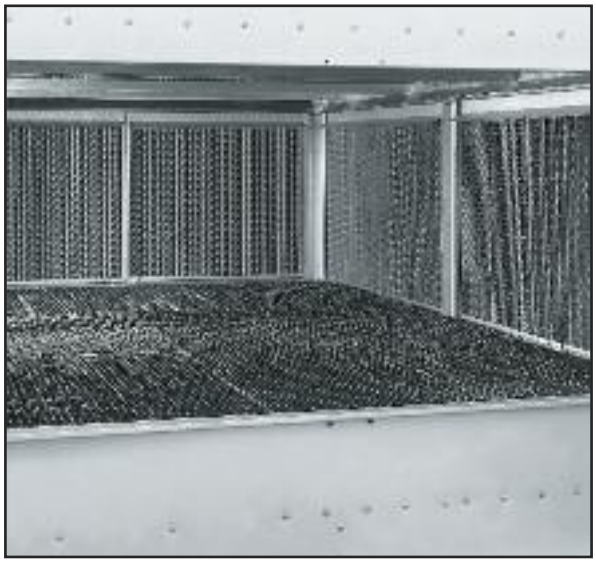
eco-ATC-A

Additional Solutions for Sound Sensitive Applications

Low Sound Fan *4 – 7 dB(A) Reduction!*

The Low Sound Fan offered by EVAPCO is a wide chord blade design for sound sensitive applications where low sound levels are desired. The Low Sound Fan shall utilize a unique soft-connect blade-to-hub design that is compatible with Variable Speed Drives.

The Low Sound Fan is capable of reducing the unit sound pressure levels 4 dB(A) to 7 dB(A), depending upon specific unit selection and measurement location. The fans are high efficiency axial propeller type and are available on 2.4 m wide and larger eco-ATC-A Evaporative Condensers.



Water Silencer

Reduces Water Noise in the Cold Water Basin up to 7 dB(A)!

The water silencer option is available for all induced draft models and is located in the falling water area of the cold water basin. The water silencer will reduce the high frequency noise associated with the falling water and is capable of reducing overall sound levels **4 dB(A) to 7 dB(A)** measured at 1.5 m from the side or end of the unit. The water silencers reduce overall sound levels **9 dB(A) to 12 dB(A)** (depending on water loading and louver height) measured 1.5 m from the side or end of the unit when water is circulated with fans off.

The water silencers are constructed of lightweight PVC sections and can be easily removed for access to the basin area. *The water silencer will have no impact on unit thermal performance.*

The Water Silencer is available on ALL eco-ATC-A Evaporative Condensers.

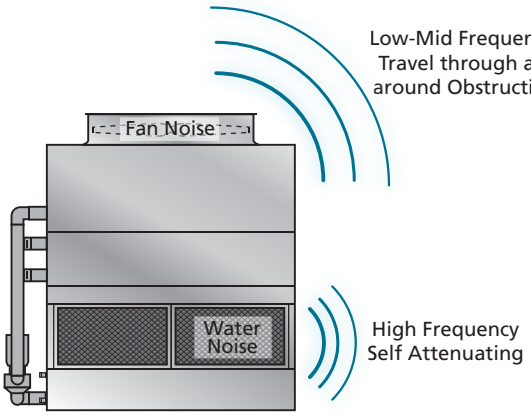
Consult EVAPCO's **Evap*Select*™** selection software for unit sound levels. If a detailed analysis or full octave band data sheet is required for your application, please consult your EVAPCO Sales Representative.

SOUND BASIC

eco-ATC-A

Sound Science and Evaporative Condensers

Sound Frequency



Fan Noise

- Low / Mid frequencies that travel long distances, through walls, and around obstructions.
- Very difficult to attenuate. Reduce fan noise by using Low Sound Fans.
- Dominates what is measured and heard at the Closed Circuit Cooler and at the sound sensitive location.

Water Noise

- High frequencies that attenuate naturally with distance. Attenuated easily by walls, trees or other obstructions.
- Totally masked and drowned out by fan noise at a short distance away from the Condenser.

Sound Pressure – The A-Weighted Scale

The A-weighted scale, dB(A) is a means to translate what a sound meter microphone measures to how the human ear perceives the sound.

dB(A) Formula and Conversions:

$$dB(A) = 10 \log_{10} \sum_{f=63}^{f=8000} 10^{((dB+Cf)/10)}$$

where: C_f = correction factor per band
dB = measured sound pressure
let: $Z_f = (dB + Cf)/10$

Band	Center Freq. (Hz)	Frequency Range (Hz)	Sample Data (dB)	Cf (dB)	Z_f
1	63	44-88	68	-26.2	4.18
2	125	89-175	76	-16.1	5.99
3	250	176-350	77	-8.6	6.84
4	500	351-700	73	-3.2	6.98
5	1000	701-1400	70	0	7.00
6	2000	1401-2800	68	+1.2	6.92
7	4000	2801-5600	71	+1.0	7.20
8	8000	5601-11200	73	-1.1	7.19

Typical Sound Pressure Levels of Well Known Noises:

Jet Airplane, 45 meters away	140 dB(A)
Painful	130 dB(A)
Very Uncomfortable	120 dB(A)
Circular Saw	110 dB(A)
Nightclub	100 dB(A)
Semi Truck	90 dB(A)
Sidewalk of a Busy Road	80 dB(A)
Household Vacuum, 1 meter away	70 dB(A)
Normal Conversation	60 dB(A)
Inside Average Home	50 dB(A)
Quiet Library	40 dB(A)
Bedroom at Night	30 dB(A)

Notable Facts about Sound:

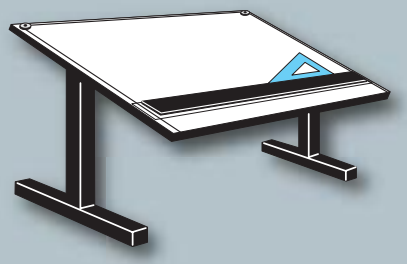
- +/- 1 dB(A) is inaudible to the human ear
- Decreasing a noise source by 10 dB(A) sounds half as loud to the human ear

Example calculation of the dB(A) formula using the Sample Data above.

$dB(A) = 10 \log_{10} \sum 10^{(Z1)} + 10^{(Z2)} + 10^{(Z3)} + 10^{(Z4)} + 10^{(Z5)} + 10^{(Z6)} + 10^{(Z7)} + 10^{(Z8)}$
$= 10 \log_{10} (67114245.2) = 78.3$ dB(A)

SOUND

eco-ATC-A



Engineering Data & Dimensions

Engineering & Data Dimensions Notes:

*** The family models refer to the plan area dimensions (Width (ft) x Lenght (ft)).**

(1) Heaviest section is the fan-coil section. Weight shown are for 1g seismic design

(2) Refrigerant charge is shown for R-717. Multiply by 1.93 for R22, 1.98 for R134A and 1.7 for R404A, R410A and R507A.

(3) Liters shown is water in suspension in unit and piping. Allow for additional water in bottom of remote sump to cover pump suction and strainer during operation (300 mm would normally be sufficient)

(4) When a remote sump arrangement is selected, the spray pump(s), suction strainer and associated piping are omitted; the unit is provided with an oversized outlet to facilitate drainage to the remote sump

(5) Dimensions are subject to change. Do not use for pre-fabrication. Quantity of coil connections subject to change based on refrigerant and design conditions

eco-ATC-A Heater Sizes (kW)			
eco-ATC-A *	**-18 °C**	**-29 °C**	**-40 °C**
8.5' x 7.5'	(1) 6	(1) 8	(1) 12
8' x 9'	(1) 6	(1) 9	(2) 6
8' x 10.5'	(1) 7	(2) 5	(2) 8
8' x 12'	(2) 4	(2) 6	(2) 8
8' x 14'	(2) 5	(2) 7	(2) 9
8' x 18'	(2) 6	(2) 9	(4) 6
8' x 21'	(2) 7	(4) 5	(4) 8
8' x 24'	(4) 4	(4) 6	(4) 8
8' x 28'	(4) 5	(4) 7	(4) 9
8' x 36'	(4) 6	(4) 9	(8) 6
8' x 42'	(4) 7	(8) 5	(8) 8
16' x 10.5'	(2) 7	(4) 5	(4) 8
16' x 12'	(4) 4	(4) 6	(4) 8
16' x 14'	(4) 5	(4) 7	(4) 9
10' x 12'	(2) 5	(2) 8	(2) 10
10' x 18'	(2) 7	(2) 12	(2) 15
10' x 24'	(4) 5	(4) 8	(4) 10
10' x 36'	(4) 7	(4) 12	(4) 15
12' x 12'	(2) 6	(2) 9	(2) 12
12' x 14'	(2) 7	(2) 10	(2) 15
12' x 18'	(2) 9	(2) 15	(2) 18
12' x 20'	(2) 10	(2) 15	(3) 15
12' x 24'	(4) 6	(4) 9	(4) 12
12' x 28'	(4) 7	(4) 10	(4) 15
12' x 36'	(4) 9	(4) 15	(4) 18
12' x 40'	(4) 10	(4) 15	(6) 15
24' x 12'	(4) 6	(4) 9	(4) 12
24' x 14'	(4) 7	(4) 10	(4) 15
24' x 18'	(4) 9	(4) 15	(4) 18
24' x 20'	(4) 10	(4) 15	(4) 20
24' x 24'	(4) 12	(4) 18	(6) 15
24' x 28'	(4) 15	(4) 20	(6) 18
24' x 36'	(4) 18	(6) 18	(8) 18
24' x 40'	(4) 20	(6) 20	(8) 20

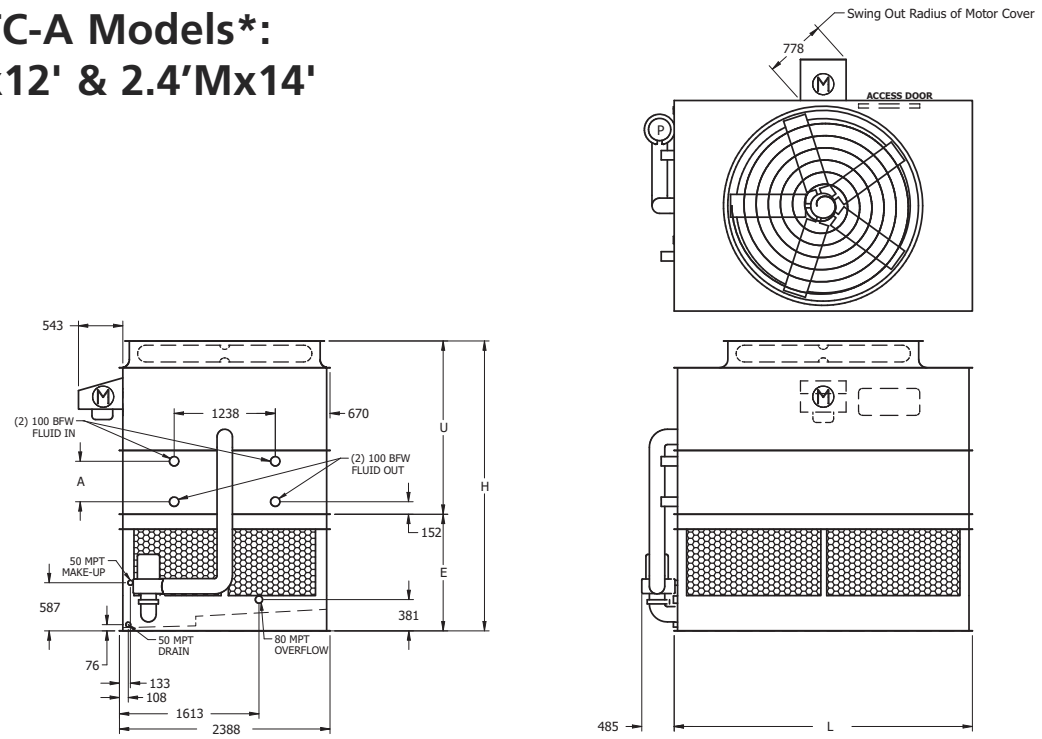
*The family models refer to the plan area dimensions (Width (ft) x Lenght (ft)).

Engineering Data & Dimensions

eco-ATC-A

ENGINEERING

eco-ATC-A Models*: 2.4'Mx12' & 2.4'Mx14'



Model No.	Fans		Weights (kg) (1)			Refrigerant Operating Charge (2) (kg)	Coil Volume (l)	Spray Pump (kW)	Remote Pump (4)			Dimensions (mm) (5)				
	kW	m³/s	Shipping	Operating	Heaviest Section				Liters Req'd (3)	Conn. Size (DN)	Operating Weight	Height H	Upper U	Lower E	Coil A	Length L
eco-ATC-M210A-1g	5,5	21,6	4.260	5.915	3.455	61	521	2,2	1210	250	5.175	3248	1930	1318	305	3651
eco-ATC-M226A-1g	7,5	23,8	4.270	5.925	3.465	61	521	2,2	1210	250	5.185	3248	1930	1318	305	3651
eco-ATC-M245A-1g	11	27,2	4.325	5.980	3.520	61	521	2,2	1210	250	5.240	3248	1930	1318	305	3651
eco-ATC-M260A-1g	15	30,0	4.350	6.005	3.545	61	521	2,2	1210	250	5.265	3248	1930	1318	305	3651
eco-ATC-M256A-1g	5,5	21,3	5.115	6.825	4.315	89	756	2,2	1210	250	6.085	3439	2121	1318	495	3651
eco-ATC-M274A-1g	7,5	23,5	5.125	6.835	4.325	89	756	2,2	1210	250	6.095	3439	2121	1318	495	3651
eco-ATC-M299A-1g	11	26,9	5.180	6.890	4.375	89	756	2,2	1210	250	6.150	3439	2121	1318	495	3651
eco-ATC-M318A-1g	15	29,2	5.205	6.915	4.405	89	756	2,2	1210	250	6.180	3439	2121	1318	495	3651
eco-ATC-M290A-1g	5,5	20,8	6.035	7.800	5.235	117	991	2,2	1210	250	7.060	3629	2311	1318	686	3651
eco-ATC-M310A-1g	7,5	22,9	6.045	7.810	5.245	117	991	2,2	1210	250	7.070	3629	2311	1318	686	3651
eco-ATC-M338A-1g	11	26,1	6.100	7.865	5.300	117	991	2,2	1210	250	7.125	3629	2311	1318	686	3651
eco-ATC-M359A-1g	15	28,4	6.130	7.895	5.325	117	991	2,2	1210	250	7.155	3629	2311	1318	686	3651
eco-ATC-M329A-1g	7,5	22,2	6.965	8.780	6.160	144	1227	2,2	1210	250	8.040	3820	2502	1318	876	3651
eco-ATC-M360A-1g	11	25,2	7.015	8.835	6.215	144	1227	2,2	1210	250	8.095	3820	2502	1318	876	3651
eco-ATC-M381A-1g	15	27,5	7.045	8.865	6.240	144	1227	2,2	1210	250	8.125	3820	2502	1318	876	3651
eco-ATC-M397A-1g	18,5	29,2	7.060	8.875	6.255	144	1227	2,2	1210	250	8.135	3820	2502	1318	876	3651
eco-ATC-M335A-1g	7,5	21,6	7.915	9.785	7.110	172	1462	2,2	1210	250	9.045	4010	2692	1318	1067	3651
eco-ATC-M365A-1g	11	24,5	7.970	9.840	7.165	172	1462	2,2	1210	250	9.100	4010	2692	1318	1067	3651
eco-ATC-M388A-1g	15	26,7	7.995	9.865	7.195	172	1462	2,2	1210	250	9.125	4010	2692	1318	1067	3651
eco-ATC-M405A-1g	18,5	28,3	8.010	9.880	7.210	172	1462	2,2	1210	250	9.140	4010	2692	1318	1067	3651
eco-ATC-M252A-1g	7,5	26,7	4.780	6.710	3.855	71	601	4	1365	250	5.830	3359	1930	1429	305	4261
eco-ATC-M275A-1g	11	30,5	4.835	6.765	3.910	71	601	4	1365	250	5.885	3359	1930	1429	305	4261
eco-ATC-M292A-1g	15	33,4	4.865	6.790	3.935	71	601	4	1365	250	5.910	3359	1930	1429	305	4261
eco-ATC-M307A-1g	7,5	26,2	5.840	7.835	4.915	103	876	4	1365	250	6.955	3550	2121	1429	495	4261
eco-ATC-M336A-1g	11	30,0	5.895	7.890	4.970	103	876	4	1365	250	7.010	3550	2121	1429	495	4261
eco-ATC-M357A-1g	15	32,5	5.925	7.915	5.000	103	876	4	1365	250	7.035	3550	2121	1429	495	4261
eco-ATC-M347A-1g	7,5	25,4	6.910	8.965	5.985	135	1152	4	1365	250	8.085	3740	2311	1429	686	4261
eco-ATC-M377A-1g	11	29,1	6.965	9.015	6.035	135	1152	4	1365	250	8.135	3740	2311	1429	686	4261
eco-ATC-M402A-1g	15	31,6	6.990	9.045	6.065	135	1152	4	1365	250	8.165	3740	2311	1429	686	4261
eco-ATC-M415A-1g	18,5	28,2	7.005	9.060	6.080	135	1152	4	1365	250	8.180	3740	2311	1429	686	4261
eco-ATC-M368A-1g	7,5	24,6	7.970	10.090	7.045	168	1427	4	1365	250	9.210	3931	2502	1429	876	4261
eco-ATC-M423A-1g	15	27,4	8.050	10.170	7.125	168	1427	4	1365	250	9.290	3931	2502	1429	876	4261
eco-ATC-M444A-1g	18,5	30,7	8.065	10.185	7.140	168	1427	4	1365	250	9.305	3931	2502	1429	876	4261
eco-ATC-M374A-1g	7,5	23,9	9.075	11.255	8.150	200	1702	4	1365	250	10.375	4121	2692	1429	1067	4261
eco-ATC-M407A-1g	11	29,7	9.130	11.310	8.205	200	1702	4	1365	250	10.430	4121	2692	1429	1067	4261
eco-ATC-M433A-1g	15	32,7	9.160	11.335	8.235	200	1702	4	1365	250	10.455	4121	2692	1429	1067	4261
eco-ATC-M451A-1g	18,5	31,6	9.170	11.350	8.245	200	1702	4	1365	250	10.470	4121	2692	1429	1067	4261
eco-ATC-M461A-1g	22	33,3	9.195	11.370	8.270	200	1702	4	1365	250	10.490	4121	2692	1429	1067	4261

Please refer to the notes at page 24

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