



Muller Industries Australia



3C: The world's most efficient air-cooled condenser



BEFORE

WHY WOULD YOU?

Using a cooling tower like this is yesterday's thinking.

They can consume over 5000 litres of drinking water per day.

They carry the risk of the deadly Legionnaires' disease.



AFTER

WHY WOULDN'T YOU?

Choosing a 3C Cooler is a decision for now, and for the future.

They consume up to 80% less water.

They eliminate the risk of Legionnaires' disease.

3C: THE WORLD'S MOST EFFICIENT AIR-COOLED CONDENSER

General Description

Muller's 3C series of environmentally focused heat rejection technology consists of two models ranges:

SH08 Series with 8 models for capacities from 50kW HOR to 500kW HOR

H08 Series with 13 models for capacities from 300kW HOR to 1300kW HOR

Muller 3C Closed Circuit Coolers with air pre-cooling were developed to replace conventional cooling towers without the need to alter any existing water lines and pumps.

Muller 3C technology offers significant benefits over traditional water-cooled systems including:

- Eliminating the risk of Legionella
- Lower water consumption (reduced by 75%)
- No water treatment chemicals required
- Compliancy is no longer an issue (RMPs and regular audits).

Muller 3C units comprise of:

- Two vertical finned tube heat exchanger coils
- Two sets of evaporative pre-cooling pads
- Bank of low noise axial flow fans
- Water distribution system for air pre-cooling consisting of a water circulation pump, water make-up solenoid and motorized dump valve with spring return
- Programmable Logic Controller (PLC).

Heat Exchanger Coils

Standard coils are manufactured from copper tubes/ aluminium fins. The tubes are mechanically expanded into collared holes in the fins to ensure proper mechanical and thermal bonding for effective heat transfer.

The coils are a floating tube design. An alternative tube/fin combination is galvanized steel tubes/ aluminium fins.

Evaporative Pre-Cooling

CelPad Type 5090 evaporative cooling pads are used to pre-cool the incoming air.

The CelPads cover the entire air inlet faces on both sides of the unit, supported by water distribution trays on top and drain troughs at the bottom.

Pre-cooling is activated only when ambient air temperature exceeds the designated preset set-point (for lower ambient air temperature pre-cooling is not necessary). Water is pumped over the pads to saturate the pad. The system includes a dump valve which opens daily or when pre-cooling is not required to drain all the water from the unit to eliminate any potential risk of bacteria growth.

Axial Flow Fans

A bank of fans on top deck of the unit draws air through pre-cooling media and the heat exchangers. The fans are low speed axial flow fans with either winglet/bionic blade design (for SH08) or wide chord blades (for H08) to provide optimum performance and low noise.

PLC Controller

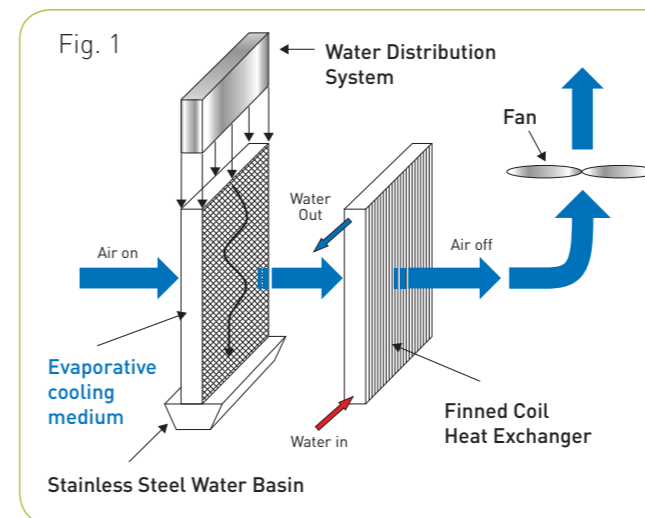
The PLC controller is used to control fan speed (to match cooling demand) and activate the pre-cooling function. Some of the features of the controller include:

- Full microprocessor control with real time clock
- Memory backup in case of power failure
- Multi-line LCD display of vital parameters and alarms
- User interface for set-point adjustment
- Analogue output for fan speed control
- Digital outputs including CelPad pump, water dump valve and water makeup valve
- Water dump and auto dry control
- Password protection of all set-points.

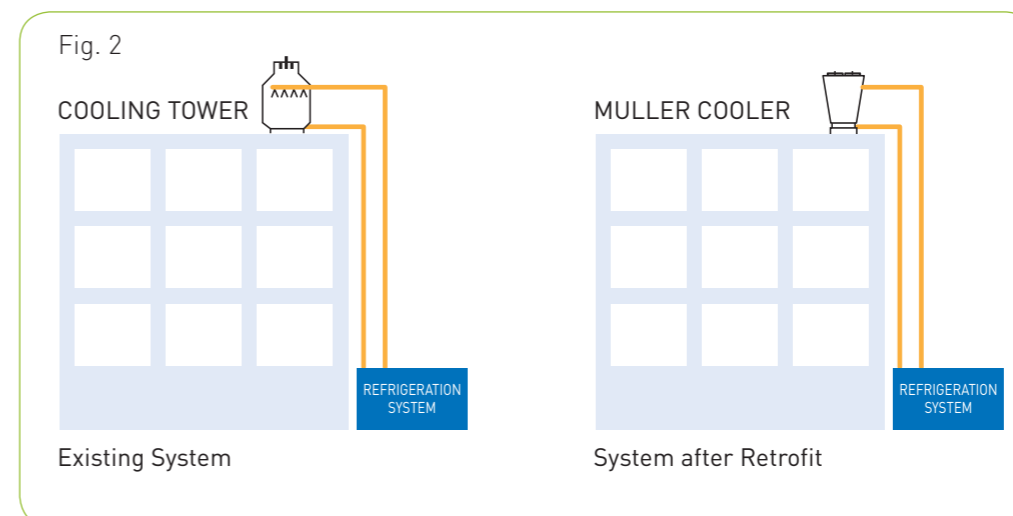
The Muller Industries Alternative Principle of Operation

The 3C system significantly reduces the health risks and operating costs associated with cooling towers, and by comparison, also offers substantially improved energy efficiencies when compared to air-equivalent cooled systems.

The system works on the adiabatic principle of heat rejection. By extracting energy from the air to provide energy to evaporate water, the resulting reduction in air temperature can then be used in turn to cool a conventional radiator type heat exchanger (Fig 1).



The heat exchanger would in turn contain a fluid requiring cooling. In a retrofit scenario, the fluid requiring cooling would be the water that used to run through the pre-existent cooling tower (Fig 2). Where heat rejection is required for a chiller compressor, greater efficiency is achieved by running the refrigerant through the heat exchanger.



Why is the 3C system so water efficient?

The 3C system uses the evaporative cooling process only under high ambient conditions (typically greater than 20°C). It is in high ambient conditions that energy efficiency rapidly deteriorates in air-cooled systems. Clever design allows the air temperature to be reduced to near wet bulb temperatures. This has enabled Muller Industries to simulate water-cooled conditions in a safe and commercial way.

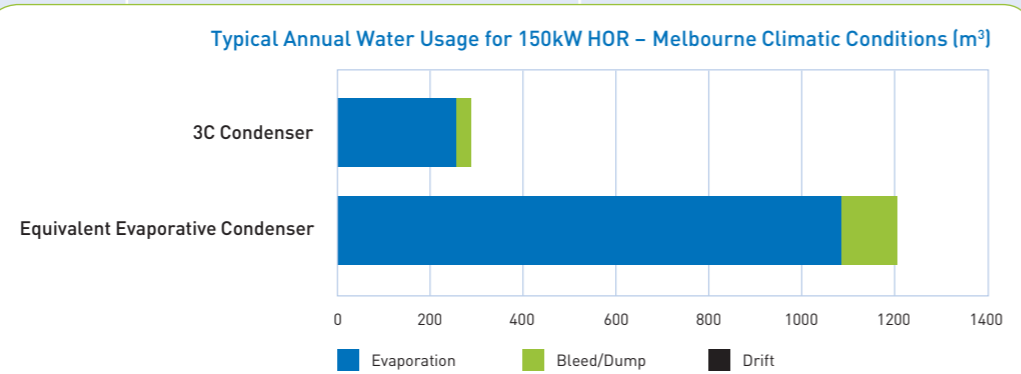
Isn't this the same as other adiabatic coolers?

The unique design of the 3C system avoids the use of sprays or deliberate generation of an aerosol. This is in fact an improvement on conventional adiabatic coolers which utilize direct sprays onto the air-cooled radiator. This has numerous advantages including:

- The transmission of pathogenic bacteria through aerosols is totally avoided
- The closed circuit heat exchanger remains dry and negates the need for water treatment
- The corrosive effect of water in fins is removed
- Deposition and external fouling is dramatically reduced.

MULLER 3C COOLERS: BENEFIT ANALYSIS

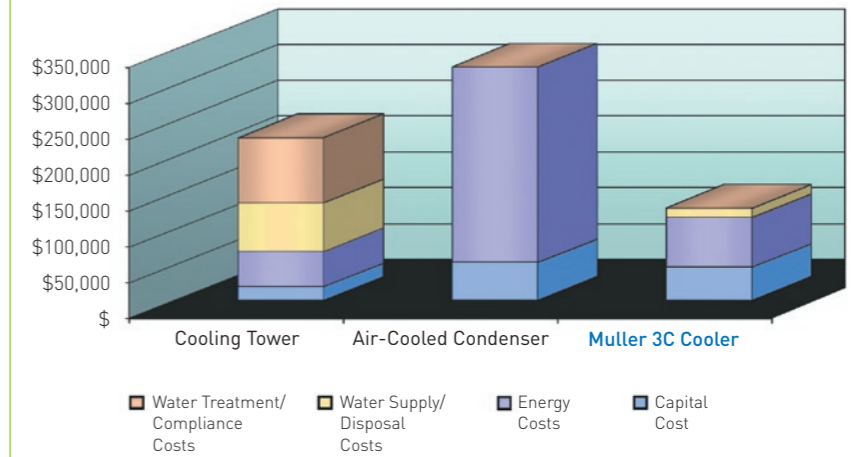
FEATURES	ADVANTAGES	BENEFITS
<ul style="list-style-type: none"> Closed circuit cooler with evaporative precooler 	<ul style="list-style-type: none"> Not classified as a cooling tower in the Building Act 	<ul style="list-style-type: none"> Savings as no requirement for risk management plan and regular audits
<ul style="list-style-type: none"> Dedicated microprocessor controller 	<ul style="list-style-type: none"> Automatic control for wet/dry operation, water dumping & fan dry out cycles, sump wash cycles and displays maintenance reminders 	<ul style="list-style-type: none"> Inhibits survival of microbial growths and maintains overall hygiene
<ul style="list-style-type: none"> Wetted sections constructed from stainless steel 	<ul style="list-style-type: none"> No corrosion 	<ul style="list-style-type: none"> Reduced maintenance cost and longevity of equipment
<ul style="list-style-type: none"> Precool water is not heated 	<ul style="list-style-type: none"> Operates at temperature where Legionella bacteria is not pathogenic 	<ul style="list-style-type: none"> Savings as expensive water treatment chemicals (biocides & corrosion inhibitors) and regular servicing not required
<ul style="list-style-type: none"> Precooler water is dumped daily 	<ul style="list-style-type: none"> Avoids any build-up of contaminants 	<ul style="list-style-type: none"> Maintain high standard of hygiene
<ul style="list-style-type: none"> Low air velocities thru precool section 	<ul style="list-style-type: none"> No moisture carryover & aerosol production 	<ul style="list-style-type: none"> Avoids potential health risk of spreading legionella
<ul style="list-style-type: none"> Heat exchanger recirculated water remains in a closed circuit 	<ul style="list-style-type: none"> No fouling of the heat exchanger ensures constant high efficiency heat transfer 	<ul style="list-style-type: none"> Lower operating costs due to lower condensing temperatures
<ul style="list-style-type: none"> Wet operation at higher ambient 	<ul style="list-style-type: none"> Cooling plant operates at higher coefficient of performance 	<ul style="list-style-type: none"> Lower operating costs due to reduced power consumption
<ul style="list-style-type: none"> Wet operation only required during higher ambient 	<ul style="list-style-type: none"> Low water consumption 	<ul style="list-style-type: none"> Saving in water usage and cost
<ul style="list-style-type: none"> Water is free of chemicals 	<ul style="list-style-type: none"> No requirement for plumbing into trade waste or sewage 	<ul style="list-style-type: none"> Savings in cost of disposal
<ul style="list-style-type: none"> Ideal replacement for cooling tower 	<ul style="list-style-type: none"> Water-cooled efficiency Easy retrofit by reusing existing chiller, pumps, electrical switchgear & water pipework 	<ul style="list-style-type: none"> Lower operating costs due to lower condensing temperatures (compared to air cooled option) Savings on capital cost



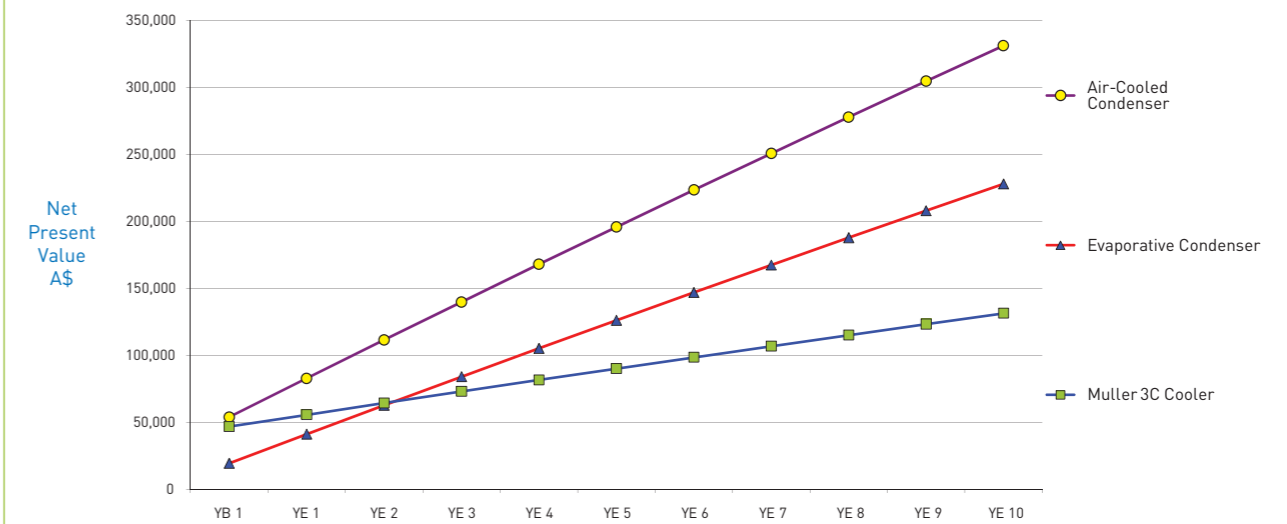
Cost savings and payback periods are highly dependent on heat rejection loads, operational and typical ambient conditions. Typically, significant cost savings are available over most air-cooled systems over 25kW and water-cooled systems under 3MW.

The true comparative cost savings associated with the 3C system are best illustrated by doing a Life Cycle Cost Analysis. Sophisticated life cycle cost modeling software is available from Muller Industries. A simplified life cycle model proforma is also provided in this brochure.

10 YEAR LIFE CYCLE COST COMPARISON



10 YEAR LIFE CYCLE ESTIMATOR for AIR-COOLED CONDENSER vs EVAPORATIVE CONDENSER vs MULLER 3C COOLER



Water Consumption Comparison: Muller 3C Cooler vs Cooling Tower

Annual Operation 12 hours/day – 5 days/week

3C Cooler Model H07-3C36			
EWT/LWT	°C	35/29.5	
Design Capacity	kW	541	
Pre cooler Annual Operating Hours	hrs	999	
No. of Precooling Days	days	98	
Annual Evaporation	m ³	633	89.5%
Annual Bleed	m ³	70	9.9%
Annual Dump Volume	m ³	4	0.6%
Annual Water Consumption	m³	708	100%
Equivalent Cooling Tower			
Annual Operating hours	hrs	3120	
Design Capacity	kW	541	
Diversity Factor		0.75	
Calculated Flow Rate	l/s	23.5	
Cycles of Concentration		10	
Annual Evaporation (rate 1%)	m ³	1979	89.8%
Annual Drift (0.002%)	m ³	4	0.2%
Annual Bleed	m ³	220	10%
Annual Water Consumption	m³	2203	100%
Annual Water Saving with 3C Cooler	m³	1495	67.9%



MAINTENANCE MADE EASY



PAD REMOVAL

Access to valves, pump, storage basket, sump is as simple as opening the door.



WATER TRAY CLEANING

Cleaning the drainage system is simple with the "drop down" water tray.



PUMP MAINTENANCE

Access to valves, pumps, strainers, basket and sump is as simple as opening the door.



ACCESS PANELS

The Muller 3C unit is equipped with a large access point allowing full access into the unit.

Award winning systems from Muller Industries

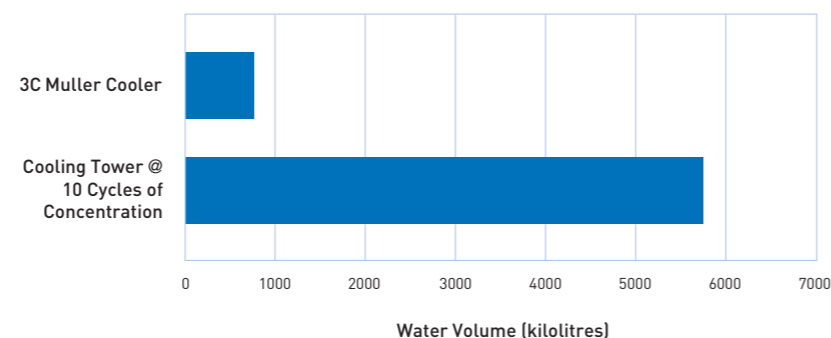
In the driest continent, and in what is looking to become more a "carbon constrained" world, the selection of Heat Rejection systems has never been so paramount.

Over the past decade engineers have been searching for viable and sustainable alternatives to traditional water-cooled systems. This has been driven largely by Legionnaires Disease and an increasing awareness of the high rates of water consumption from water-cooled systems.

The impact of chemically treated cooling water has also become an issue for environmentally sensitive locations.

The prevalent trend has been to convert water-cooled systems to air-cooled, so much so that it has become almost an industry standard. Although water is conserved, committing to these high energy consumption solutions is an environmental and financial cost that should be avoided wherever possible. It is also an area, that building owners, if made aware, would no doubt wish to avoid.

Annual Water Consumption of 500kW Heat Rejection Systems



RECOGNISING A WORLD LEADER

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Muller Industries Australia and its environmentally responsible heat rejection technology have received wide acclaim, both by industry, government and private enterprise.

The company has won numerous awards recognizing the environmental benefits of the 3C system.



Achieving even greater efficiency

Many chiller manufacturers have combined with Muller Industries to produce a new generation water-cooled packaged chiller. Contact us for more information on achieving even greater efficiency.





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