USER MANUAL
COOLER CONFIGURATOR

Parker

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⚠️ **WARNING — USER RESPONSIBILITY**

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INTRODUCTION

Parker's Fluid Cooler Configurator allows user to select within a wide range of standard products, the one that would fit the best a specific application and its requirements.
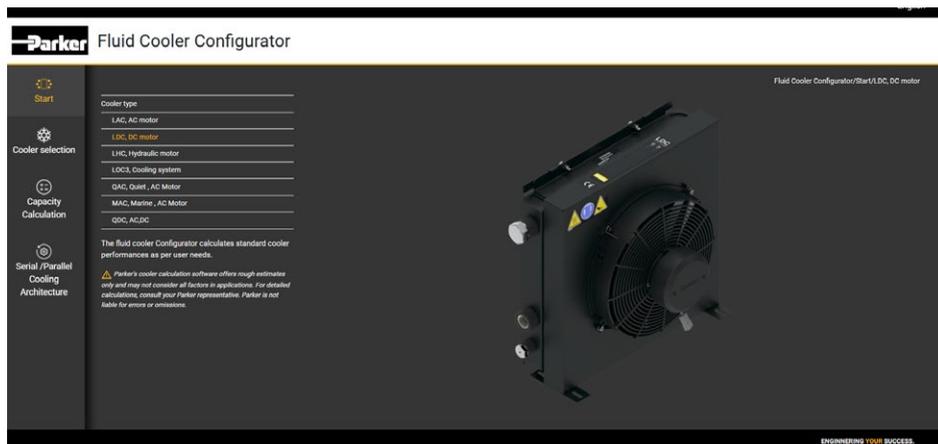
Standard Air blast cooler range available currently includes:

- LAC – with AC motor driven fan
- LDC – with DC motor/fan unit
- LHC – with hydraulic motor driven fan
- LOC3 – with integrated pump and fan driven by AC motor
- QAC – Quiet cooler with AC motor driven fan
- MAC – corrosion resistant cooler with AC motor driven fan
- QDC – Quiet cooler with brushless/ permanent magnet motor driven fan

New products and updates may be added to the configurator at any time.

The configurator has 3 built in tools:

1) Cooler Selection:
   Allows the selection of a cooler based on the application operating parameters relevant to the cooler.

2) Capacity Calculation:
   By measuring the fluid temperature in a working system, not fitted with a cooler, at two different occasions, required cooling capacity can be calculated, i.e. the heat that must be rejected to keep system fluid temperature stable.

3) Serial/Parallel Cooling Architecture:
   This section is dedicated to Electrified applications and allows to simulate the association of up to 8 sets of water cooled motors and inverters in serial or parallel architecture and also indicates within our QDC product range the recommended cooler to use to keep coolant temperature stable.

In the next pages we will explain how to use each one of the tools and how to correctly read the results.

WHY COOLING

Parker is global leader in motion and control technologies. Any motion transfer technology (hydraulic, mechanic, electric, pneumatic..) has an efficiency which is never 100 %.

· Mechanical: Friction
· Hydraulic: Pressure drop / frictions / accu
· Electric: Resistive losses

System Failure Risk

As a consequence system gets overheated and results can be:

· Overshooting maximum working temperature of a component (electric, hydraulic)

· Loose good lubrication properties and increase frictions and wear of a mechanical system

· For pressurized equipment mechanical properties are modified at high temperature:
 risk of burst, failure due to pressure.

Hydraulic Systems

Pump efficiency, fluid lamination, pressure drop, rod sealing friction, accumulator cycles.
All generates heat which is transferred directly or indirectly to the hydraulic fluid.
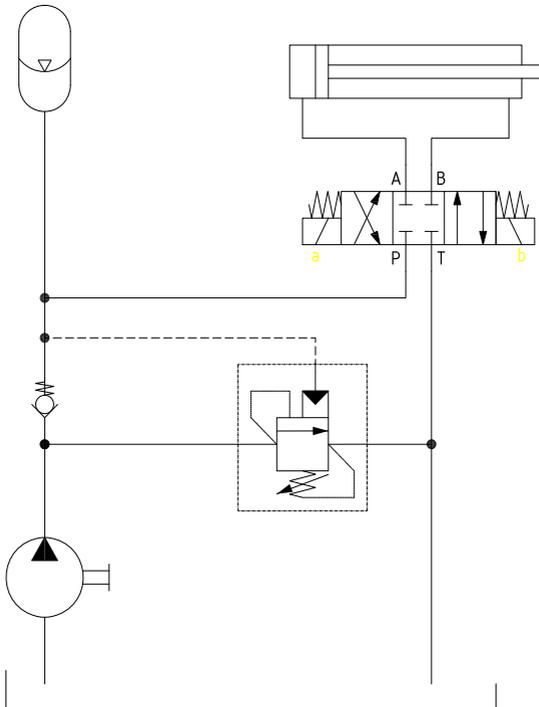
Lubrication systems

Lubrication of mechanical system is critical. Mechanical losses are transformed into heat given to the lubricant. This lubricant must be cooled down no to exceed recommended maximum temperature.
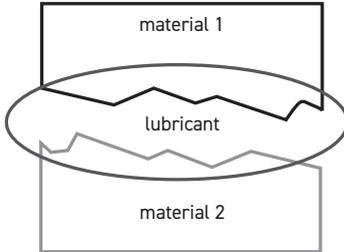
Electrical installations

On big electrical cabinet water cooling system are put in place. The heat generated by the electrical resistances is absorbed by the water glycol. Then a cooler is requested to cool the water again.

Thermal Engines

General efficiency on a diesel engine is appr. 45 % (looking at the amount of fuel going in to the engine).

Electrified systems

Batteries, motors, inverters, pumps, all have power losses that need to be cooled down to ensure optimal operation of the systems.

For mobile machinery, we cool electric motors, inverters, charge controllers, and batteries using a water-glycol circuit with air-to-liquid coolers. The basis is heat losses, target temperatures, and ambient conditions. From this follow required mass flow, pump selection based on pressure drop, line sizing, and heat exchanger area including fan power.
Key points: temperature margin, cavitation avoidance, suitable antifreeze and corrosion protection, proper deaeration, and service access. Correct mixing ratio and filtration are important; an expansion tank stabilizes pressure.
Batteries require uniform temperatures and low gradients. A thermostat and bypass support cold start and part-load operation.

Parker sizing software precisely calculates the circuit, validates temperature profiles, and sizes the heat exchangers. Result: efficient, robust, and maintenance-friendly cooling.
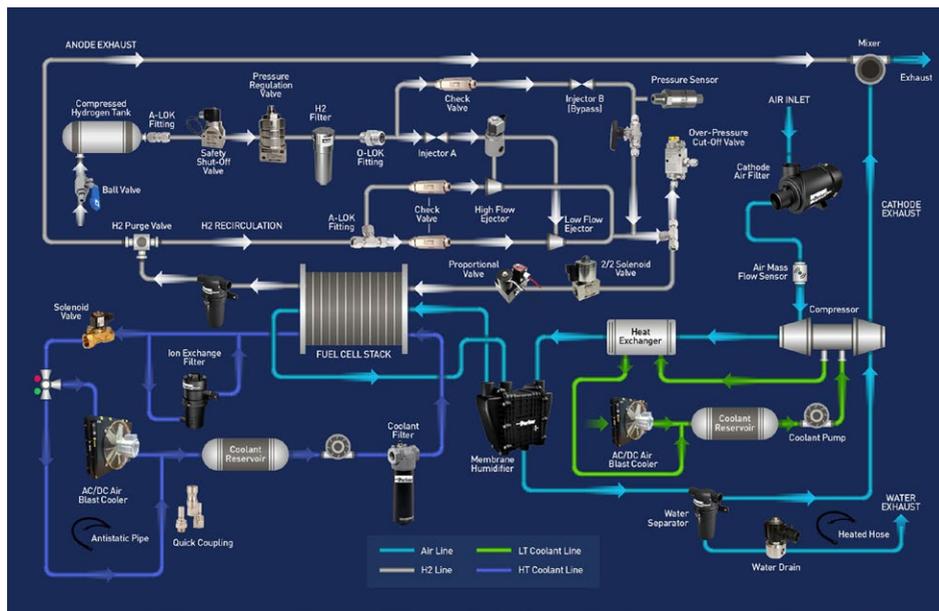
The correct sizing of the required cooling capacity of the Parker QDC air-fluid cooler is critical for PEM fuel cells: it maintains the stack's temperature window, minimizes ΔT, prevents degradation, and ensures efficiency and service life. The Parker design software precisely sizes based on heat load, flow rate, and allowable pressure drop.

CAPACITY CALCULATION

Capacity calculation allows through the measurements of the fluid temperature in a working system, **not fitted with a cooler**, at two different occasions, the cooling capacity required to keep the system running at a steady state.

The input data are:

- Type of fluid, choose from the drop down menu from a variety of ISO VG oil grades or 3 different mixtures of water and Ethylene Glycol
- Fluid Volume, total volume of fluid running in the system (tank included)
- Density and specific heat are automatically filled when type of fluid is selected
- Initial fluid temperature
- Final fluid temperature
- Time interval beween the two measurements

Once all input data is entered click on calculate. The result will be displayed in the "Required cooling capacity" field.

To erase all entered values click on reset. You can also print the results if needed.

COOLER SELECTION

Input application data

Please follow below steps (order is not mandatory)

1. Select **Cooler type**
2. Choose between calculation or performance check modes:
   a. Click on **"Select all"** if best fit within chosen product range is desired, and jump to step 4.
   b. Don't click or unselect "Select all" if the assessment of a specific cooler model is desired, then go to step 3.
3. Choose the specific **cooler model** that is to be assessedfrom the dropdown menu.
4. Choose **type of fluid**, choose from the drop down menu from a variety of ISO VG oil grades or 3 different mixtures of water and Ethylene Glycol
5. Enter **fluid flow**, please observe and select correct unit
6. Enter desired F**luid maximum temperature,** please observe and select correct unit.
7. Enter Ambient **Air Temperature**, please observe and select correct unit
8. Enter **Heat to dissipate**, please observe and select correct unit
   (you can use capacity calculation tool if heat to dissipate is unknown)
9. Enter altitude at which cooler will operate (default value is 0 m).

Click on reset to erase all values or click on Calculate to proceed with cooler selection/assessment.

Results are displayed in two different ways.

1. When selection is required from the complete product range, results are displayed in a table, even if only one cooler is proposed.

Result

Cooler type	Inlet fluid temperature **	Outlet fluid temperature	Outlet air temperature	Spec. heat dissipation	Fluid PressureDrop	Air flow	Motor Capacity	Sound pressure in LPA, 1 m	Protected standard motor
LAC2 023 4 D	97 °C	72 °C	56 °C	0.53 kW/°C	0.09 bar	1.5 m³/s	0.75 kW	76.0 dB(A)	IP 55
LAC 033-6-A	96 °C	71 °C	56 °C	0.54 kW/°C	0.08 bar	1.52 m³/s	0.55 kW	74.0 dB(A)	IP 55

** Inlet coolant temperature will be different from the maximum inlet temperature requested, it will vary according to specific heat dissipation of the proposed cooler.

2. When a specific cooler performance is assessed, results will be displayed as below

Result

Cooler type: LAC 033-4-A

Inlet fluid temperature: 87.27 °C

Outlet fluid temperature: 62.02 °C

Outlet air temperature: 52.1 °C

Spec. heat dissipation: 0.63 kW/°C

Fluid PressureDrop: 0.09 bar

Air flow: 2.41 m³/s

Motor Capacity: 2.2 kW

Sound pressure in LPA: 84.0 dB(A)

Protected standard motor: IP 55

Please note that the Inlet fluid temperature displayed in the results usually does not match the required maximum fluid temperature.

That happens because inlet fluid temperature will change according to the performance of each cooler model.

If cooler is oversized, inlet fluid temperature will stabilize at a lower value than requirement. If the cooler is undersized, inlet fluid temperature will stabilize at a higher temperature than was required in the input data.

SERIAL/PARALLEL COOLING ARCHITECTURE

First of all you must choose the desired architecture between Serial and Parallel
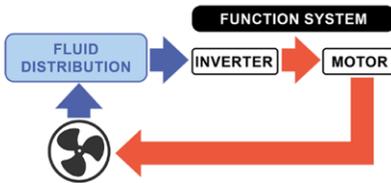

Serial

In serial architecture, GVM (motor) and GVI (inverter) share the same coolant flow.

Why choose Serial Architecture?

- Reduction of Leak points/Pipework/ Complexity of flow control/Risk of contamination

- Increase of Flow restrictions/Pressure drop/Complexity of thermal calculations

Parallel

In Parallel architecture, GVM and GVI have individual coolant flows.
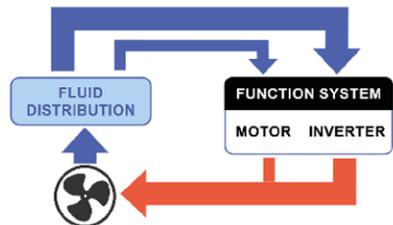
Why choose Parallel Architecture?

- Reduction of Flow restrictions/Pressure drop/Complexity of thermal calculations

- Increase of Leak points/Pipework/ Complexity of flow control/ Risk of contamination

COOLER SELECTION

In both architecture modes we can select a cooler for a system built with up to 8 GVM/GVI circuits.

The checkboxes must checked for each of the circuits to be considered in the calculation.

Uncheck circuits won't be considered in the calculation, even if input data is entered.

GVM and GVI selection is done through a dropdown list.

In Serial mode the input data are (must be entered for each circuit):

- Heat Losses in the GVM;
- Heat Losses in the GVI;
- Flow rate (it's the same for GVM and GVI in Serial architecture);
- Inlet temperature in the GVI (it comes first in the circuit);

Remember to check the circuits!

Additionally we need to inform:

- Coolant (to be selected from type of fluid dropdown list)
- Ambient temperature
- Altitude (default value is 0 meters)

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After all the required data is entered, they need to be submitted (by clicking button submit), this will perform preliminary temperature calculations, and will allow cooler selection to be made (after clicking on QDC Coolers button), but only from QDC product range.

The results of the preliminary calculations will be summarized on the right side of the input fields for eah of the selected circuits, please verify that all circuits have been considered in the calculation.

Circuit #1

Motor :

Motor Inlet Coolant Temperature: 68.17 °C

Motor Outlet Coolant Temperature: 71.35 °C

PressureDrop: 1.23 Bar

GVI:

GVI Outlet Coolant Temperature: 68.17 °C

PressureDrop: 0.69 Bar

Cooler Matrix Segment :

Global Power to be Dissipated : 11 kW

Flow Rate : 28 l/min

Temperature After Cooler : 65 °C

Temperature Before Cooler : 71.35 °C

The calculation also consider the mixing of all cooling circuits prior to reaching the cooler.

Recommended coolers will be displayed in a table.

Cooler Matrix Segment :

Global Power to be Dissipated : 4 kW

Flow Rate : 18 l/min

Temperature After Cooler : 60 °C

Temperature Before Cooler : 63.74 °C

Cooler	Inlet Coolant Temperature **	Outlet Coolant Temperature	Outlet Air Temperature	Spec. heat dissipation	PressureDrop	Air flow	Power Consumption	Motor Speed
QDC 025 3000 RPM 1S	67 °C	61 °C	61 °C	0.81 kW/°C	0.01 bar	1.06 m3/s	0.42 kW	3,000 RPM

** Inlet coolant temperature will be different from the maximum inlet temperature requested, it will vary according to specific heat dissipation of the proposed cooler.

The most important value is the outlet coolant temperature, it shows the cooler is capable of delivering the coolant at the correct temperature to the GVMs and GVIs connected to the application circuit.

In Parallel mode the input data are:

· Heat Losses in the GVM;
· Flow rate in the GVM;
· Heat Losses in the GVI;
· Flow rate in the GVI;

Remember to check the circuits!

Additionally we need to inform:

· Coolant (to be selected from type of fluid dropdown list)
· Ambient temperature
· Altitude (default value is 0 meters)

After all the required data is entered, they need to be submitted (by clicking button submit), this will perform preliminary temperature calculations, and will allow cooler selection to be made (after clicking on QDC Coolers button), but only from QDC product range.

The results of the preliminary calculations will be summarized on the right side of the input fields for eah of the selected circuits, please verify that all circuits have been considered in the calculation.

Function System #1

Motor :

Motor Outlet Coolant Temperature: 71.74 °C

PressureDrop: 1.29 Bar

GVI:

GVI Outlet Coolant Temperature: 71.74 °C

PressureDrop: 0.68 Bar

The calculation also consider the mixing of all cooling circuits prior to reaching the cooler.

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Cooler Matrix Segment :

    Global Power to be Dissipated : 6 kW

    Flow Rate : 56 l/min

    Temperature Before Cooler : 71.74 °C

    Temperature After Cooler : 70 °C
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Recommended coolers will be displayed in a table, see example below.

Cooler Matrix Segment :

Global Power to be Dissipated : 6 kW

Flow Rate : 56 l/min

Temperature Before Cooler : 71.74 °C

Temperature After Cooler : 70 °C

Cooler	Inlet Coolant Temperature **	Outlet Coolant Temperature	Outlet Air Temperature	Spec. heat dissipation	PressureDrop	Air flow	Power Consumption	Motor Speed
QDC 012 3000 RPM	74.8 °C	71 °C	70 °C	0.51 kW/°C	0.05 bar	0.59 m3/s	0.21 kW	3,000 RPM
QDC 011 4750 RPM	71.5 °C	68 °C	67 °C	0.52 kW/°C	0.09 bar	1 m3/s	0.93 kW	4,750 RPM

** Inlet coolant temperature will be different from the maximum inlet temperature requested, it will vary according to specific heat dissipation of the proposed cooler.

The most important result is the outlet coolant temperature, it shows cooler is capable of delivering coolant at the correct temperature for the GVMs and GVIs connected to the application circuit.