Series-100
Hi-Rel Fuel and Coolant Pump

Contents

1. Scope

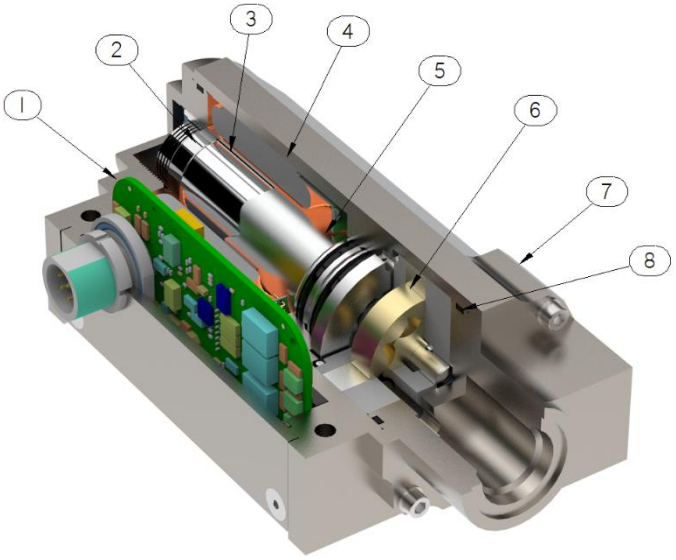
This Product Operating Guide helps the reader understand the options and features available witihin the Cascon Series-100 Hi-Rel Fuel and Coolant Pump product range. It also provides information and recommendations for operating the pump and successfully integrating it into the target system.

2. Overview

The Series-100 pump models are 28 Volt variable-speed, positive displacement pumps designed with technology developed by Cascon for its custom aerospace products used in military, manned space-flight and other aerospace applications.

This configure-to-order product is intended to serve a wide range of fuel supply and cooling applications. By standardizing many of the parts used across all models, this high-reliability pump is very economical compared to a fully custom solution. The Series-100 pump models can be configured for flows up to 6.5 liters per minute and pressures to 15 bar. An aerospace-grade 28V brushless DC motor is used to drive the pump at speeds up to 6,750 rpm. The motor is in turn driven by a compact, bespoke electronic control with an architecture proven in Cascon's custom aerospace products. The pump can be configured for variable or constant flow and can also be supplied without a control if desired.

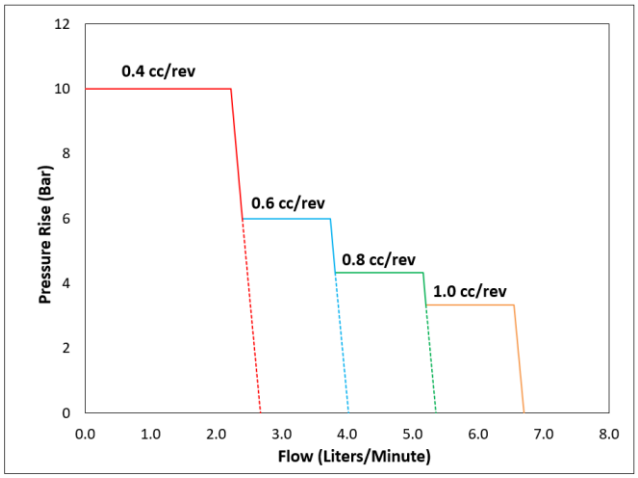
A cutaway with key product features can be seen on the next page.



1. Pump Control
2. Hybrid ceramic deep groove ball bearings
3. Motor Rotor w/Rare Earth Magnets
4. 28 V Brushless DC Motor Stator
5. Leak-Proof Canned Rotor
6. Gerotor Pump Element
7. Anodized Aluminum Housings
8. Static Elastomer O-Ring Seals

3. Pump Sizing

The Series-100 pump can be configured with a range of displacements from 0.4 cc/rev to 1 cc/rev. The pump is rated for 100W continuous input power so pressure capability is a function of the chosen displacement. The nominal performance envelope for each displacement option is shown in the figure following this paragraph. Flows and pressures to the left and under each plot are within the range of the corresponding displacement. For example, a pump configured for 0.6 cc/rev, is capable of output flows from zero up to 4.0 liters/minute at low pressure or approximately 3.75 liters/minute at 6 bar.



4. Pump Casings

The pump casings are constructed of 6061-T6 aluminum with an anodize finish per MIL-A-8625 Type II Class 1. The mounting surface has an annular area around one mounting hole that is finished per MIL-DTL-5541 Type II, Class 3 for chassis grounding. The pump casings are isolated from the electrical circuitry with a minimum of 1 MΩ resistance.

5. Other Wetted Materials

In addition to the anodized aluminum casings, wetted metallic materials may include 316, 416, and 440c stainless steels, bronze, and wear-resistant alloy steel depending on the pump configuration. Fluoroelastomer (Viton) and HNBR materials are among the available static O-ring seal options (there are no rotary seals in the pump).

6. Approved Fluids

The Series-100 pump models are suitable for use with a wide range of fluids including:

- Avgas
- Jet Propellants (e.g., JetA/JP-1A, JP-5. JP-8, etc.)
- Water/Glycol Mixtures
- Heat Transfer Fluids (e.g., Galden, Fluorinert, etc.)
- Low viscosity oils

In general, fluids used with the pump should have a viscosity less than 50 centistokes over the range of expected operating temperatures.

The Series-100 pump models are not designed for operation on water (Potable, distilled or deionized) and are subject to corrosion if operated on water.

Contact a Cascon Sales Engineer (1-207-846-6202 x114, sales@casconpump.com) to further discuss your application requirements.

7. Pump Control Options

The pump can be factory-configured for either variable or constant speed operation. It can also be configured for use with a remotely located control for applications where the pump must operate in an environment that exceeds the control thermal rating of 85 °C.

8. Electrical Connection

The pump is fitted with a Glenair Mighty Mouse 800-012-07M8-28PN connector with the following pin connections.

Pin	Function
1	22-32 VDC
2	N/C
3	N/C
4	22-32 VDC Return
5	N/C
6	Speed Feedback
7	N/C
8	Speed Command

While there are a variety of mating options available on the market, Glenair part number 800-006-16ZR8-28SN is a common choice. Contact a Cascon Sales Engineer for more information.

9. Input Power

Series-100 pump models require 28VDC power input (22 V minimum, 32 V maximum). The pump has been tested for use with power quality defined by RTCA/DO-160 Section 16, Cat Z, 28 VDC equipment. The design is rated for 100 W of continuous input power at maximum temperature but can accommodate 150 Watts for intermittent periods.

10. Speed Feedback Signal

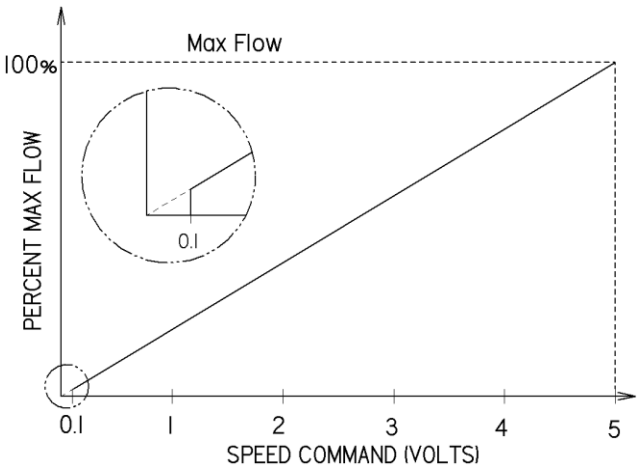
The Speed Feedback signal is a 0-5V square wave that completes (3) full cycles per revolution of the pump shaft. To convert the signal frequency (Hz) to revolutions per minute simply multiply by the number 20.

Pump Speed (RPM) = F (Hz) x 20

A minimum impedance of 250kΩ is required for electrical connection to the speed feedback pin. While pump speed information can be used as a valuable part of system monitoring, connection is not required.

11. Speed Command Signal

Pump output flow is controlled with a 0-5V signal applied to the Speed Command pin. Pump rotation starts when the Speed Command signal reaches 0.1V corresponding to a flow rate of approximately 2% of maximum. For a constant pressure rise, speed and flow then increase linearly in proportion to the signal voltage level to full rated flow. Use care to limit this signal to 5V (5.5 V intermittent) or the pump control can be damaged. A 1kHz or higher 0-5V PWM signal can also be used to control speed but be aware that many PWM controllers (e.g., an engine control unit or ECU) cannot provide a true “zero” PWM signal.



Note: The Speed Command Signal must be referenced to the Input Power return (ground). If separate supplies are used for Input Power and Speed Command, connect the returns (grounds).

12. Fluid Connection

Connection to the pump inlet and outlet is made via straight thread O-ring ports conforming to the SAE J1926-06. There are a wide variety of compatible adapter options available as commercial-off-the-shelf items.

Other options may be accommodated in the pump on an engineer-to-order basis.

13. Filtration

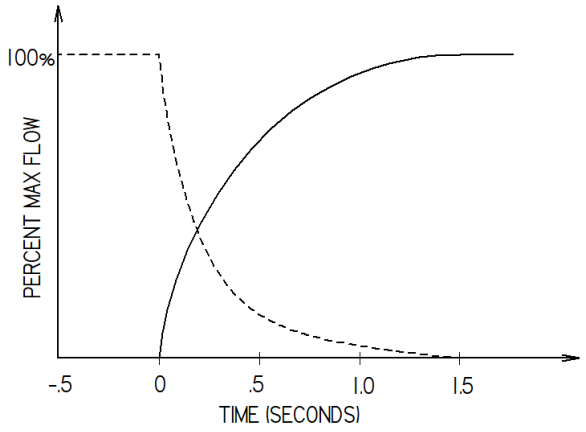
The Series 100 pump is based on Gerotor technology, a rotor type that is very reliable and quite debris tolerant compared to other types of positive-displacement pumps. Nonetheless, 10-micron nominal inlet filtration is recommended to insure reliable system operation and long life. Cascon offers a 10-micron filter as an accessory.

14. NPSHR and Cavitation

Net positive suction head required (NPSHR) is a function of pump speed, rotor displacement (thickness), and fluid properties. Generally, the Series-100 models require only about 5 psia at the pump inlet to prevent cavitation unless the operating fluid viscosity is high (e.g., >25 cSt) or is of particularly high density (e.g., Galden heat transfer fluids). Cascon Engineering can assist with system design if your application is expected to include low inlet pressures (e.g. operation at altitude).

15. Response Time

Pump responsiveness to changes in command signal depend on the size of the commanded change, operating pressure, and fluid viscosity. For a pump operating on fuel or other low-viscosity fluids with a fixed outlet restriction representing a 100-psi pressure rise at full flow, the figure below demonstrates that the pump will reach full flow approximately 1.5 seconds after the command signal is increased from 0 to 5V (solid trace). Similarly, flow returns to zero approximately 1.5 seconds after the command is reduced from 5 to 0 V (dashed trace).



16. Cold Start Operation

The Series-100 pump models are rated for operation at -55 °C. However, some fluids become highly viscous in this temperature range which can prevent the pump from achieving full rated speed until the pump and fluid warm up from operation.

17. Dry Operation

The pump is capable of dry running for periods of up to one minute without damage. This should be more than adequate for priming the pump most applications. Running the pump for extended periods of time without fluid is not recommended.

18. Maintenance

Field maintenance should never be required and is not recommended.

19. Weight

Depending on configuration, the pump weight is approximately 675 grams.

20. Environmental Capability

The pump has been designed to be suitable for operation in a wide variety of environments within the following limits.

Description	Unit	Value
Fluid Temperature, Maximum	°C	85
Fluid Temperature, Minimum	°C	-55
Ambient Temp., Operating, Maximum	°C	85

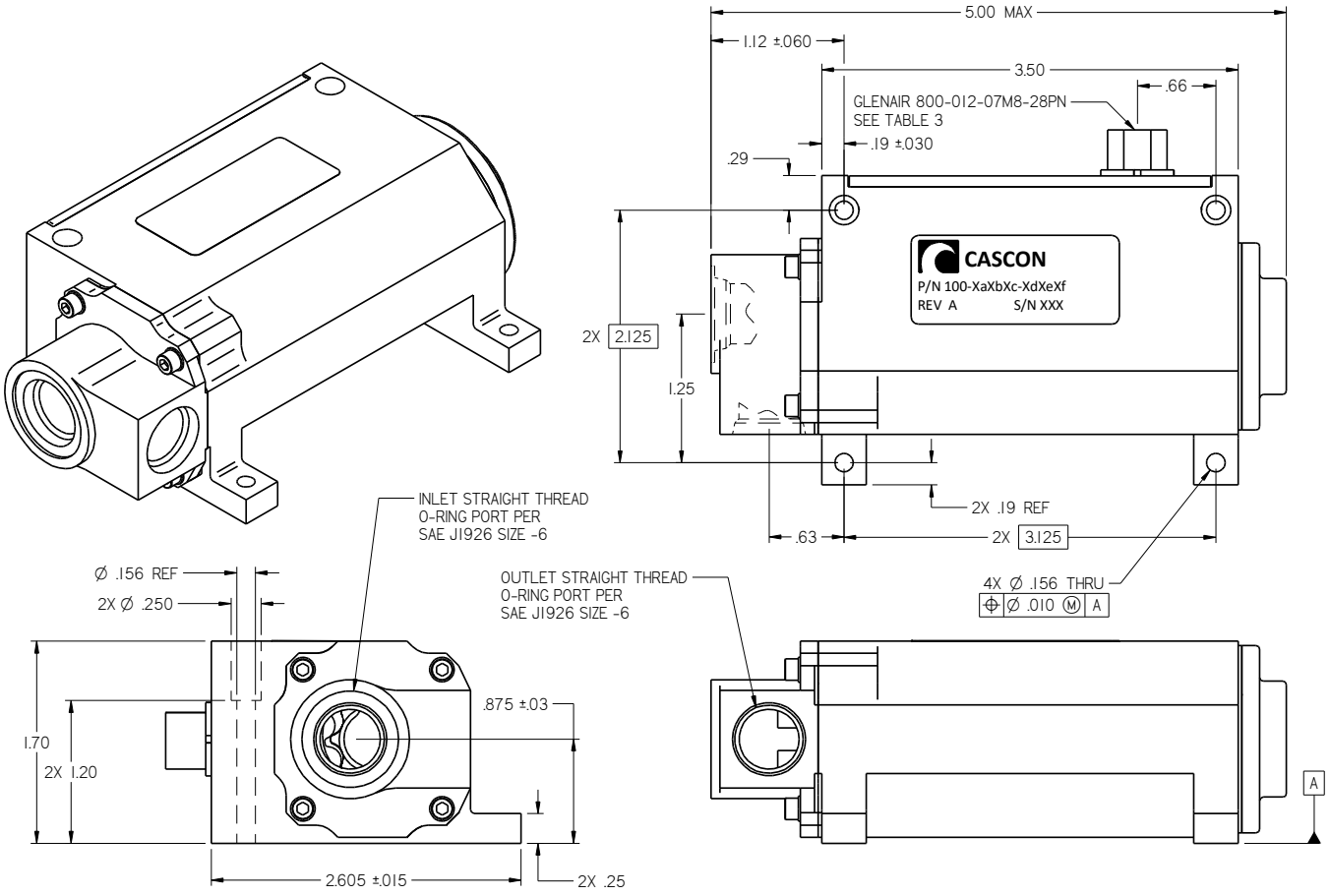
Ambient Temp., Operating, Minimum	°C	-55
Storage Temperature, Maximum	°C	100
Storage Temperature, Minimum	°C	-55
Fluid Ingress Rating, Mated, 1 Meter H_2O	hour	1
System Design Pressure, Maximum	psia	500

Additionally, the pump has been qualified through laboratory tests to portions of the following RTCA/DO-160 standards.

Temperature	RTCA/DO-160 Section 4, Cat F2
Operational Shock	RTCA/DO-160 Section 7.2, Cat B
Crash Safety	RTCA/DO-160 Section 7.3.1, Cat B
Vibration	RTCA/DO-160 Section 8.2.2, Cat R
Power Input	RTCA/DO-160 Section 16, Cat Z, 28 VDC equipment
Lightening	RTCA/DO-160 Section 22, Cat A2 and B2
Radiated Radio Frequency Emissions	RTCA/DO-160 Section 21.5, Cat M

21. Mounting

Series-100 model pumps are intended to be mounted using (2) #6-32 x .50 and (2) #6-32 x 1.50 inch socket head cap screws. Mounting dimensions are shown below.



22. Ordering Information

The Series-100 Hi-Rel Fuel and Coolant Pump is available in a variety of configurations. These options are specified in the part number for each unique configuration. The chart and paragraphs below can be used to configure a part number. A Cascon Sales Engineer can assist you and provide pump performance estimates for your application.

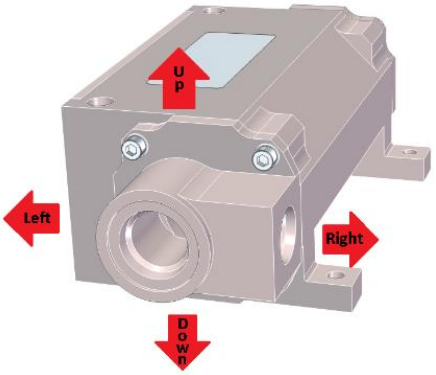
Xa - Bearing Type: Hybrid ceramic deep grove ball bearings are standard and suitable for most applications but other options are available on a manufacture-to-order basis.

XbXc: Displacement: See Section 3 for Pump Sizing.

Xd: Outlet Orientation: The outlet can be configured in one of four orientations as shown below to help with system interconnect.

Xe: Control Option: The pump can be configured for variable speed of fixed speed operation. It can also be provided with an interface card for customers who wish to use their own BLDC control.

Xf: Elastomer Type: A variety of elastomer seal materials are available depending on the fluid.



100 - Xa	Xb Xc - Xd	Xe	Xf
Model /Power Class	Displsplacement	Control Option	Elastomer Type
			F FKM/Viton (Standard)
			E EPDM
			N NBR
			X Custom
		0 No Control (interface board only)	
		1 Variable-Speed Control (Standard)	
		2 Fixed-Speed Control	
	R Right		
	D Down		
	L Left		
	U Up		
	X Custom		
	0 4 0.4 cc/rev		
	0 6 0.6 cc/rev		
	0 8 0.8 cc/rev		
	1 0 1.0 cc/rev		
A Ball Bearing, 440C (Standard)			
B Ball Bearing, Hybrid Ceramic			
C Journal Bearings, Bronze			
D Journal Bearings, SiC			