



- 3-port T-junction ferrite circulator
- Low insertion loss
- High isolation
- Excellent power capability covering operation into continuous short circuit
- Compact & robust design
- High reliability
- RoHS compliant
- Designed for magnetron-based S-Band LINAC applications

Parameter	Value
Footprint Drawing No.	3-123502-FP
Product Type	Circulator
Configuration	3-port T-junction
Orientation of Rotation	clockwise
Center Frequency f_0	2998 MHz
Bandwidth BW	± 10 MHz
Forward Power	
Forward Peak Power	3.5 MW
Forward Average Power	4.5 kW
Reverse Power	100% at any phase
Insertion Loss	≤ 0.15 dB
Return Loss	≥ 30 dB @ f_0
	≥ 26 dB in BW
Isolation	≥ 30 dB @ f_0
	≥ 26 dB in BW
RF Waveguide	WR284
RF Flanges / Connectors	CPR284F, flat, 10x M6 thread with helicoil inserts
Cooling System	demineralized water
Water Tube Materials	Stainless steel, brass
Water Connectors	2x ½ hose barb fitting, stainless steel
Water Inlet Temperature (nominal)	selectable between 20°C and 40°C
Water Inlet Temperature Range	$\pm 2^\circ\text{C}$

Water Flow Rate	≥ 400 l/h	
Water Pressure Drop	< 2 bar @ minimum flow rate	
Water Inlet Pressure	≤ 10 bar	
Water Leak Test Pressure	15 bar for 10min	
Waveguide Dielectric Filling Gas	SF6	
Gas Pressure	nominal:	3 bar absolute
	maximum :	4 bar absolute
Gas Leak Rate (Helium)	< 5·10 ⁻⁴ mbar l/s	
	device pressurized with He gas at 2.5 bar gauge	
Ambient Temperature	operating :	10°C to 40°C
	storage :	0°C to 60°C
Relative Humidity	< 80%, non-condensing	
Magnetic Stray Field	< 5 G in 1m distance	
	No magnetic material is allowed within a distance of 10cm from the envelope of the device. The device must not be exposed to magnetic stray radiation of >5G.	
Body Material	Aluminium	
Surface Finish	none	
Dimensions	see footprint drawing	
Weight	9.2 kg ± 10%	
Mounting Orientation	any	
Mounting Threads	4x M6 on the backside of the vertical iron yoke	
Arc Viewport Connector	1x ¼"-36 UNS 2A male thread, located near circulator port 2	

Ordering Code

C3-WR284-02-2998 - Xw

Variable	Description	Value Options
Xw	Water Inlet Temp. [°C]	20 .. 40

Notes:

- 1 Characteristic Power Capability: The circulator is designed to operate above ferromagnetic resonance to offer lowest loss and highest peak power capability. The device is designed to handle full forward power into a 100% reflective short-circuit at port 2, covering all phase angles, without breakdown. The isolated port 3 of the circulator must be terminated with a reliable dummy load. The return loss of the dummy loads is required to maintain a match of > 28 dB over the full power range. Under these conditions the peak power capability of the device can be expressed by a “characteristic” power of about $P_c = 4x$ forward peak power.
- 2 Electrical Parameters: The specified values for insertion loss, return loss and isolation are valid for the circulator terminated with well-matched loads on all ports. The return loss of the circulator terminated with a short circuit at port 2 and a dummy load at port 3 may differ from these values, depending on the complex reflection coefficient (magnitude and phase) of these terminations.
- 3 Arc Detector Viewport: The device is equipped with one or more arc detector viewport connector(s) that allow(s) the connection of an AFT arc detector device via a low-loss fiber optical cable. AFT’s high-sensitivity arc detector systems detect light and provide an interlock output signal within a very short response time of a few microseconds. The interlock signal must be hard wired to the RF source in such a way that the RF source can be shut down within microseconds as well. Under these conditions, not only the device but also the entire RF system can be effectively protected from permanent damage, due to unwanted arcing as a consequence of moisture or contamination inside the waveguide. The use of at least one arc viewport in connection with a proper arc detector system is recommended for a safe operation of the present device.
- 4 Water quality, temperature, flow, and input pressure need to be controlled carefully according to the specified values. Air bubbles in the cooling channel have to be avoided. The device does not include any sensorics and interlocks for water temperature, flow or pressure.
- 5 Low-Power Acceptance Tests: The following tests will be performed at the AFT factory before shipment:
 - (1) small-signal network analyzer measurements of insertion loss, return loss and isolation of all ports/ signal paths vs. frequency at nominal water inlet temperature.
 - (2) water pressure and leak test
 - (3) He-gas leak rate testing.
- 6 Documentation: An owner’s manual is supplied for providing information on the installation, operation and maintenance of the device. The documentation also includes specification, footprint drawing, an inspection report and a test data plot (viewgraphs of measured S parameters vs. frequency).

Rev.	Remark	Date	Name
00	Initial	25.05.2021	C. Weil
	Formal update	01.04.2022	C. Weil