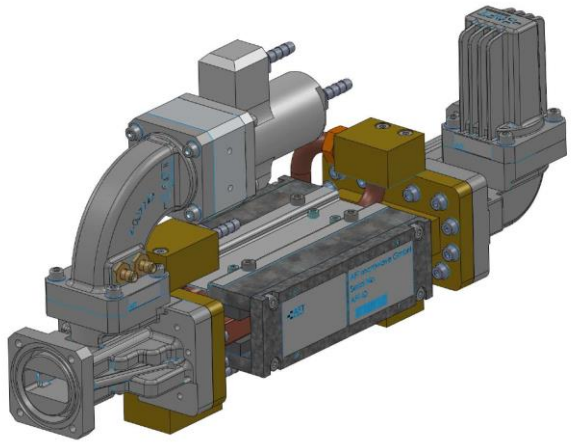

- 4-port ferrite phase shifter circulator with water load and dry load
- Low insertion loss
- High isolation
- Excellent power capability covering operation into short circuit
- Robust and reliable design
- RoHS compliant
- Designed for X-band LINACs

Parameter	Value		
Footprint Drawing No.	FP-10074170		
Product Type	Isolator		
Configuration	4-port ferrite phase shifter circulator with a full-power water-cooled RF water load at port 3 and a dry load at port 4.		
Orientation of Rotation	see footprint drawing for port labeling		
Center Frequency f_0	9300 MHz		
Bandwidth BW	± 10 MHz		
Forward Power	**Options:**	**Xp = 1**	**Xp = 2**
Forward Peak Power		2 MW	2.5 MW
Forward Average Power		2 kW	2.5 kW
Reverse Power	100% at any phase		
Insertion Loss	≤ 0.2 dB		
Return Loss	≥ 30 dB		
Isolation	≥ 30 dB		
RF Waveguide	WR112		
RF Flanges / Connectors	Input Flange :	UG-137 B/U (Al), choke flange	
	Output Flange :	UG-137 B/U (Al), choke flange	
RF Coupling Probes	Coupler type : Connector type : Coupling : Location :	non-directional E-probe SMA female, 50 Ω 60 dB ± 2 dB at port 3 (high-power water load)	

Cooling System	demineralized water	
Water Tube Materials	Copper or Stainless steel only	
Water Connectors	Circulator :	2x ¼" hose barb fitting, stainless steel
	Water Load :	2x ¼" hose barb fitting, stainless steel
Water Inlet Temperature (nominal)	selectable between 20°C and 40°C	
Water Inlet Temperature Range	± 5°C	
Water Flow Rate	≥ 500 l/h, for circulator and water load	
Water Pressure Drop	< 2 bar @ 500 l/h, valid for each part seperately	
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)	< $5 \cdot 10^{-4}$ mbar l/s,	
	device pressurized with He gas at 2.5 bar gauge	
Ambient Temperature	operational :	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, plain	
Surface Finish	none	
Dimensions	see footprint drawing	
Weight	6.5 kg ± 10%	
Mounting Orientation	any	

Ordering Code

I4-WR112-01-9300 - Xp - Xw

Variable	Description	Value Options	
Xp	Forward Power Option	**1** : 2 MW / 2 kW	**2** : 2.5 MW / 2.5 kW
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 same applies to port 4, in case of a 4-port device. 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 Pc = 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 (and port 4) 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.
The device itself is not protected against arcing that can occur as a consequence moisture or contamination inside the waveguide or under abnormal operating conditions. However, the use of an arc detector can reduce the risk of permanent damage by arcing significantly. 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.
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 about 10µs.

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. In case the separate cooling channels of circulator and load are connected in series, water inlet must be connected to the circulator in order to place it first in the loop. For reason of protection, the device requires sensorics with RF interlocks for specified water temperature, water flow, and water inlet pressure. The corresponding equipment is to be provided by the customer.

5 Low-Power Acceptance Tests: The following tests will be performed at the AFT factory before shipment, if applicable:
(1) small-signal network analyzer measurements of insertion loss, isolation, and return loss vs. frequency at room temperature and at the nominal water inlet temperature, for all ports and signal paths.
(2) Water leak test under static pressure.
(3) Helium gas leak rate test.
(4) Visual inspection.

6 Documentation: An owner´s manual is supplied for providing information on the installation, operation and maintenance of the device. The documentation will also include specification and footprint drawing.

As an *option to be ordered separately*, extended documentation is available in terms of a low-power RF test report (viewgraphs S-parameters vs. frequency) or written factory test protocol.

Rev.	Remark	Date	Name
00	Initial	27.06.2016	C. Weil