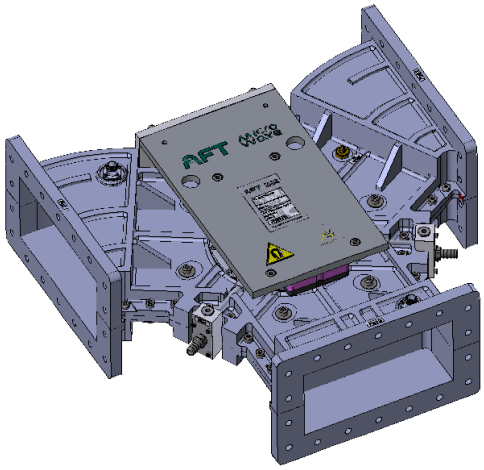

- 3-port T-junction ferrite circulator
- High performance ferrites from in-house production
- Lowest insertion loss and high isolation
- Excellent power capability covering operation into 100% reflective load, any phase
- Robust and reliable design
- RoHS compliant
- Designed to protect and stabilize high-power generators for industrial microwave application.

Parameter	Value				
Footprint Drawing No.	3-125626-FP				
Product Type	Circulator				
Configuration	3-Port T-Junction				
Center Frequency f_0	915 MHz				
Bandwidth BW	± 20 MHz				
Input Power	Options:	5 kWcw	30 kWcw	75 kWcw	100 kWcw
Reverse Power	100% at any phase				
Insertion Loss	≤ 0.10 dB at f_0				
	≤ 0.15 dB within f_0 ± 10 MHz				
	≤ 0.20 dB within f_0 ± 20 MHz				
Isolation	≥ 26 dB at f_0				
	≥ 23 dB within f_0 ± 10 MHz				
	≥ 20 dB within f_0 ± 20 MHz				
Return Loss	≥ 26 dB at f_0				
	≥ 23 dB within f_0 ± 10 MHz				
	≥ 20 dB within f_0 ± 20 MHz				
RF Waveguide	WR975				
RF Flanges / Connectors	3x CPR975 flat				
RF Coupling Probes	2x N-type female, located at port 1 and port 3, respectively				
	-60 dB ± 2 dB				
Cooling System	demineralized water				
Water Tube Materials	stainless steel, copper				
Water Connectors	2x 1/2" hose barb fitting, stainless steel				
Water Inlet Temperature (nominal)	20°C				
Water Inlet Temperature Range	± 5°C				

Water Flow Rate	≥ 200 l/h	≥ 300 l/h	≥ 600 l/h	≥ 900 l/h
	@ 5 kW	@ 30 kW	@ 75 kW	@ 100 kW
Water Pressure Drop	≤ 2 bar at 900 l/h			
Water Inlet Pressure	≤ 10 bar			
Water Leak Test Pressure	15 bar for 10 min.			
Ambient Temperature	operating :	10°C to 40°C, non-condensing		
	storage :	0°C to 60°C, non-condensing		
Relative Humidity	< 80%, non-condensing			
Magnetic Stray Field	< 5 G in 1m distance. No magnetic material is allowed in a			
	distance of 10 cm from the envelope of the device. The device			
	must not be exposed to magnetic stray radiation of >5G.			
Body Material	Aluminium			
Dimensions	see Fig.1 for interface dimensions			
Weight	65 kg ± 10%			
Mounting Orientation	any			
Mounting and Lifting	crane lifting via slings			
Arc Viewport Connector	1x FSMA, 1/4"-36 UNS-2A male thread, located at port 2			
Accessories	Set of magnetic shims for optional tuning, see note 3			

Ordering Code

C3-WR975-00-915 - Xp

Variable	Description	Value Options			
Xp	Forward Power cw [kW]	5	30	75	100

Notes:

1 Circulator Characteristic Power Capability: The circulator is designed to operate above ferromagnetic resonance to offer lowest loss and highest peak power capability by using AFT premium microwave ferrites. 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 ≥ 30 dB over the full power range.
The peak power capability of the device can also be expressed by a “characteristic” power of Pc = 4x forward peak power operated into matched loads at port 2 and port 3.

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 input reflection coefficient 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 superposing vectors of (1) circulator return loss, (2) circulator isolation and (3) load match.

For example:
If a 3-port circulator is specified with a return loss and isolation of 30dB and the dummy load is matched at 30dB, the worst case input return loss of the shorted isolator is about 20.46 dB, which is 9.54 dB (!) less than the circulator values. It occurs at worst case phase condition when the magnitudes of all three vectors add up in phase.

3 Magneto-Static Tuning (optional): The circulator is designed for lowest insertion loss and thermal stability. It is factory-tuned for showing best performance under high-power. A magneto-static tuning with magnetic shims allows a further optimization of the circulator performance for specific operating conditions or applications, even if not required in most cases. The tuning procedure can easily be carried out at the customer site during the high-power commissioning. Detailed instructions can be found in the owner´s manual.

4 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 of 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 *strongly recommended* for a safe operation of the present device and the entire RF system.
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.

5 Water Cooling: There is a water cooling circuit with a designated water inlet and outlet connector. 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 requirement for demineralized water is based on the exclusion of deposition and agglomeration of mineral salts, calcium carbonate or rust in the cooling channels. There are no specific requirements for the water resistivity.
The cooling channels must not be contaminated by sealants such as PTFE tape or hemp fibers. These can decrease cooling significantly or even block cooling channels.
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.
Note: Water has to be carefully drained from the cooling circuit before transport and storage, in order to avoid possible damage by freezing of water.

6 Low-Power Factory Tests: The circulator is specially tuned for optimum electrical performance at high-power conditions (warm ferrites). The following tests will be performed at the AFT factory before shipment:
(1) Electrical tests: small-signal network analyzer measurements of insertion loss, isolation, and return loss vs. frequency at an elevated water inlet temperature (high-power simulation) and at an ambient room temperature of 22°C ± 4°C, for all ports and signal paths.
(2) Water leak test at specified test pressure.
(3) Visual inspection.

7 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, footprint drawing, an inspection report, and the RF test results as viewgraphs of S-parameters vs. frequency.
The documentation is limited to digital format (no hardcopy) and is available on request.

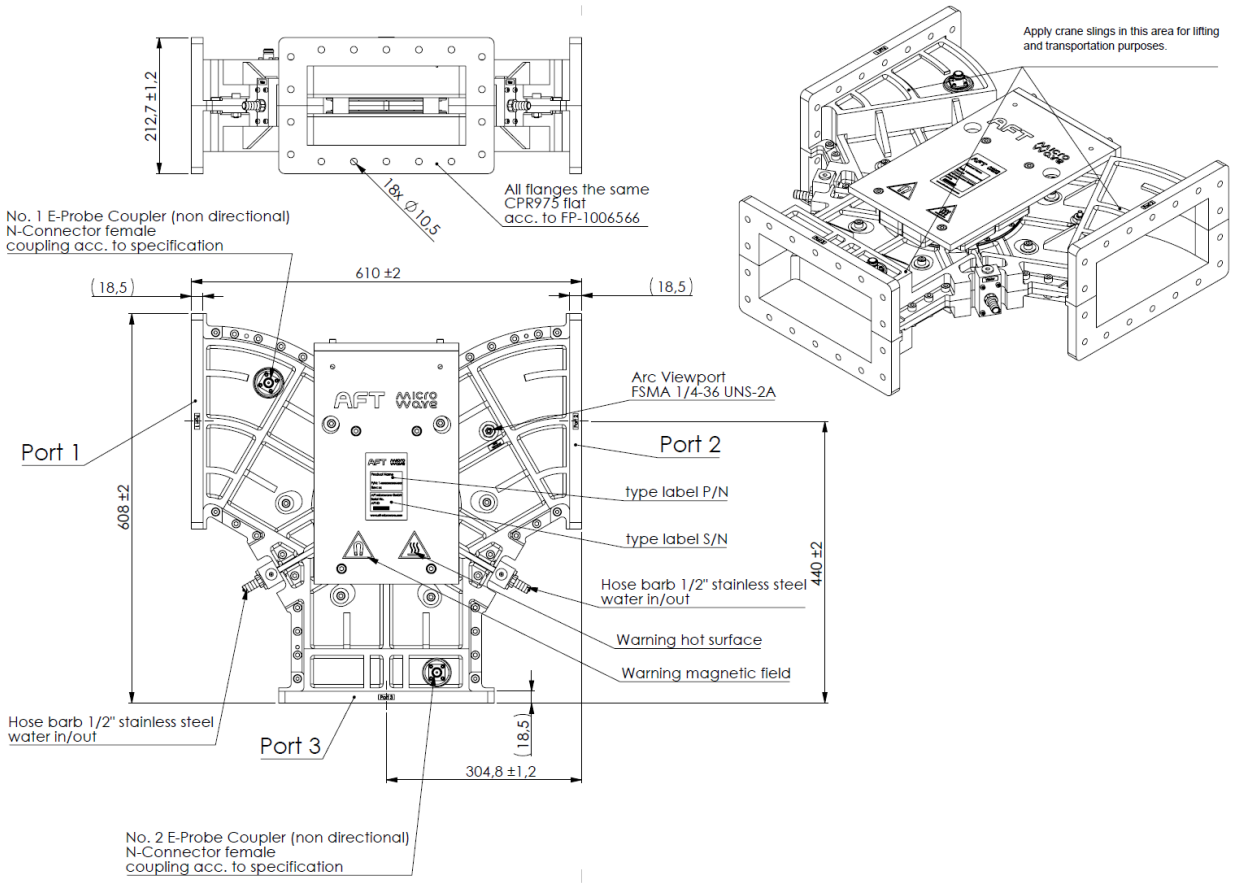

Fig. 1: Interface dimensions, all dimensions in mm.

Rev.	Remark	Date	Name
00	Initial	16.01.2024	C. Weil
00	Note 3 and 6	14.06.2024	C. Weil