

GL8262BC Klystron Technical Specification

The Klystron operates in pulse mode, 5.0MW Peak, 45kW Average, S-band-2856MHz, Coaxial Input and Waveguide Output, Electromagnetically Focused, Liquid Cooled.

Physical Characteristics

Tuning: Fixed

Mounting: Vertical, Electron Gun downwards

RF Input Connector: N Type Coaxial UG-21 E/U(50Ω)

RF Output Connector⁽¹⁾:WR-284

Cooling⁽²⁾⁽³⁾:Liquid

Ground: Klystron Body

Operation: Cathode Pulsed

Cathode: Impregnated Barium Tungsten

Focusing⁽⁴⁾:Electromagnetic Coil GD8262FS

X-ray Shielding⁽⁵⁾:3mR/hr

Packaging and Transportation⁽⁶⁾:GL Standard Commercial Transport

Absolute Ratings ^{(7) (8)}

Parameters	Heater Voltage	Surge Current	Beam Voltage	Inverse Voltage	Emission Current	RF Drive	Input Power
Units:	Vac	A	kV	kV	Adc	W	kW
Max:	8.0	54	135	30	102	500	120
Min:	---	---	---	---	---	---	---
Notes:	3, 9		10, 11, 12		13	14	

General Data

Electrical	Min	Max	Units	
Frequency ⁽¹⁵⁾	2854	2856	2858	MHz
Peak RF Output Power	---	---	5.0	MW
Heater Voltage	---	7.5	---	Vac
Heater Current	--	30	---	A
Heater Warm-up Time	15	---	---	min
Peak Beam Voltage	---	---	135	kV
Peak Beam Current	---	---	102	A
RF Drive Power	---	---	500	W

Average RF Output Power	---	---	45	kW
Pulse Width (RF) ⁽¹⁶⁾	---	---	16.3	μs
Pulse Width (Beam Voltage)	---	---	18.0	μs
Duty Cycle	---	---	0.010	
Load VSWR ⁽¹⁷⁾	---	---	1.2	
Magnet Current	---	32	---	A
Capacitance (Anode to Cathode) ⁽¹⁸⁾	---	---	35	pF

Mechanical	Min	Max	Units
Dimensions and Connection	See Outline Drawing		
Height		Approx.1200	mm
Net Weight		Approx.120	kg
Ion Pump ⁽¹⁹⁾		2	L/s
Output Waveguide (Vacuum) ⁽²⁰⁾	---	---	1.0×10^{-5} Pa
Marking	See Outline Drawing		

Environmental	Min	Max	Units
Temperature	5	45	°C
Humidity	30	65	%

Cooling	Collector		Body		Window/Waveguide		Units
	Min	Max	Min	Max	Min	Max	
Coolant Pressure		0.85		0.85		0.85	MPa
Hydrostatic Pressure		1.0		1.0		1.0	MPa
Flow Rate	60		6		8		L/min
Pressure Drop		0.35		0.35		0.35	MPa
Inlet Coolant Temperature	10	50	10	50	10	50	°C

Product Test

Test Items	Conditions	Symbol	Min	Max	Units
Vacuum inspection	No Operating Voltages for 24 hours VacIon Pump Reading t=120s later	---	---	1	μA
Body and collector hydrostatic pressure	No Operating Voltages P= 1.0MPa Water t=15minutes	---	No visible leaks and no damage		---
Window/Waveguide hydrostatic pressure	NO Operating Voltages P= 1.0MPa Water t=15minutes	---	No visible leaks and no damage		---
Dimensions	See Outline Drawing	---	---	---	----
Waveguide Leakage ⁽²¹⁾	Leak rate (Helium leak detector)			1.0×10^{-10}	$\text{Pa} \cdot \text{m}^3/\text{s}$
Heater Current	Ef = NPV	If	26	33	A
Emission ⁽²²⁾	Cathode Current	$\Delta i_k / i_k$	---	2	%
Beam Current	eb=NPV Pd=0	ib	---	92	A
Pressure Drop, Collector	Water Flow = 60L/min	ΔP	---	0.35	MPa
Pressure Drop, Window/Waveguide	Water Flow = 8L/min	ΔP	---	0.35	MPa
Body Coolant Flow	$\Delta P = 0.35\text{MPa}$	---	6	---	L/min

Product Test (continue)

Test Items	Conditions	Symbol	Min	Max	Units
Working Condition (1) Output Power	Ef = NPV Imag = NPV eb = 125 kv, max. F0 (23)= 2856 MHz Pd (24)= 200 W max. Load VSWR = 1.20:1 max tp (RF) = 16.3 μsec Duty Cycle (RF)(25) = 0.009	Po	5.0	---	MW
Working Condition (2) Output Power	Ef = NPV Imag = NPV eb = 125 kv, max. F0 (23) = 2856 MHz Pd (24)= 200 W max. Load VSWR = 1.20:1max. tp (RF) = 16.3 μsec Duty Cycle (RF) (25) = 0.009	Po	4.0	---	MW
Working Condition (3) Output Power	Ef = NPV Imag = NPV eb = 125 kv, max. F0(23) = 2856 MHz Pd(24) = 200 W max. Load VSWR = 1.20:1 max. tp (RF) = 16.3 μsec Duty Cycle (RF) (25) = 0.009	Po	3.0	---	MW

NOTES

- Note 1: A flexible waveguide must be provided between the klystron output flange and output waveguide system to prevent excessive forces from being applied to the output flange.
- Note2: Distilled water shall be used along with a filter in the cooling system to limit particle size to 100 microns.
- Note3: It is recommended that a current-regulated power supply be used when applying heater power to a klystron. Body coolant flow must be operating whenever heater power is applied for an extended period of time. Interlocks in the liquid-coolant system shall prevent the application of heater voltage unless the liquid-coolant flow in the body is at or above the specified minimum flow rate. The electron gun must be immersed in oil to maintain the gun base plate at a temperature below 60°C whenever heater power is applied. If a DC heater supply is used, the positive terminal of the supply must be connected to the heater-cathode terminal.
- Note4: Interlocks shall be provided to prevent application of beam voltage unless solenoid coil currents are within ± 5 percent of the specified values and all coolants are at normal flow.
- Note5: It is the responsibility of the klystron manufacturer to provide sufficient X-ray shielding to reduce radiation to 3 mR/hr at a distance of 3 meter from the surface of any integral part of the klystron above the plane of the bottom of the focusing-solenoid base plate.
- Note6: The klystron shall be capable of withstanding transportation over rough roads by truck when suitably crated.
- Note 7: The absolute ratings are limiting values that are not to be exceeded under any service conditions, or the serviceability of any individual unit may be impaired. Design values for systems should include a safety factor to maintain operation within ratings under voltage and environmental variations. A single rating may be the limitation, and simultaneous operation at another rating may not be possible. The Life Warranty is predicated on product operation under the specified test conditions given in this Product Specification.
- Note 8: All voltages except the heater voltage are referenced to the cathode.
- Note 9: Interlocks shall be provided to prevent application of beam voltage unless the heater voltage is within ± 5 percent of NPV.
- Note 10: The electron gun insulators shall be operated in an insulating oil such as 35# or equivalent.
- Note 11: Interlocks shall be provided to prevent the application of beam voltage greater than 5 percent above the nameplate value and prevent the absolute ratings from being exceeded.
- Note 12: Maximum operating voltage for each klystron shall be limited to its nameplate value as specified in the accompanying Test Performance Sheet.

Note 13: Interlocks shall be provided to prevent the beam current from exceeding values greater than 10 percent above normal operating values and prevent the Absolute Ratings from being exceeded.

Note 14: The klystron shall not be damaged when operated at maximum rated RF drive when the beam voltage is removed. The klystron shall not be damaged when operated at operating beam voltage when RF drive is removed.

Note 15: The frequency is set at the factory and is specified as 2856 MHz.

Note 16: The beam voltage pulse width maximum is 18 microseconds at the 70% level.

Note 17: The load VSWR must not exceed 1.2:1 in the operating range for rated performance. A VSWR up to 1.5:1 will cause damage to the klystron.

Note 18: The anode-to-cathode capacitance shall be measured in air without heater and cathode-voltage leads connected.

Note 19: One 2L/s VacIon pump shall be an integral part of each klystron. This ion pump shall operate at an open-circuit voltage of $+3500 \text{ Vdc} \pm 300 \text{ Vdc}$ from a high-impedance power supply capable of delivering 1.5 milliamperes. For normal klystron operation, the ion-pump current shall be less than $10 \mu\text{A}$.

Note 20: Interlock must be provided to prevent RF drive application when the vacuum greater than $1.0 \times 10^{-5} \text{ Pa}$ in the waveguide system of the klystron during power output.

Note 21: The RF output transmission line needs to confirm that the leakage rate is less than $1.0 \times 10^{-10} \text{ Pa} \cdot \text{m}^3/\text{s}$.

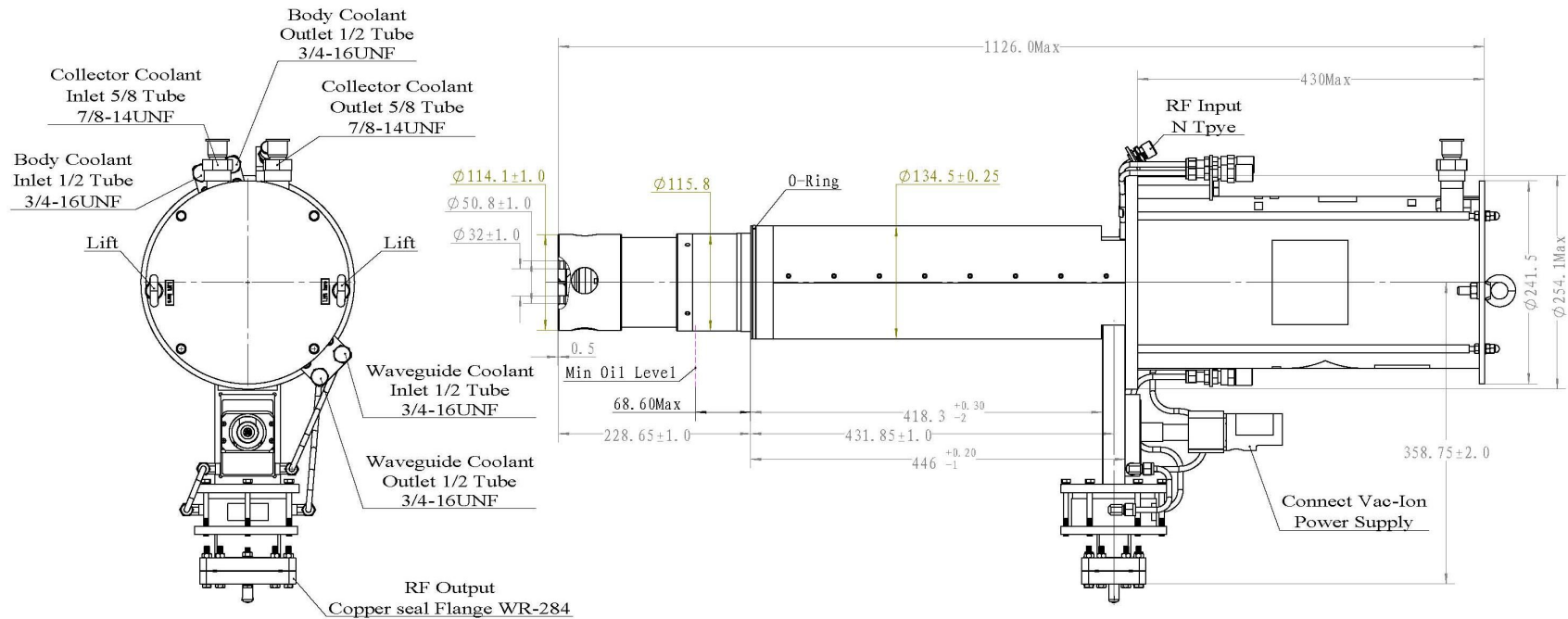
Note 22: The filament voltage is decreased from NPV to 5 percent less than NPV, and the cathode emission is allowed to stabilize. The percent change in the peak cathode current shall not exceed the value specified.

Note 23: When operating under power-output conditions, power output shall be measured at 2856 MHz. Power output shall be within the limits specified. Drive power shall be 200 watts or less under all conditions. The beam voltage and drive power shall be recorded.

Note 24: Drive power is defined as the power incident at the RF input coupler of the klystron.

Note 25: Power-output test conditions may use combinations of t_p (video), t_p (RF), and pulse repetition rate other than these specified to accomplish the required duty cycle for factory testing.

Outline Drawing



Note: Keep the environment dry before opening the RF flange and the exposed time as short as possible.