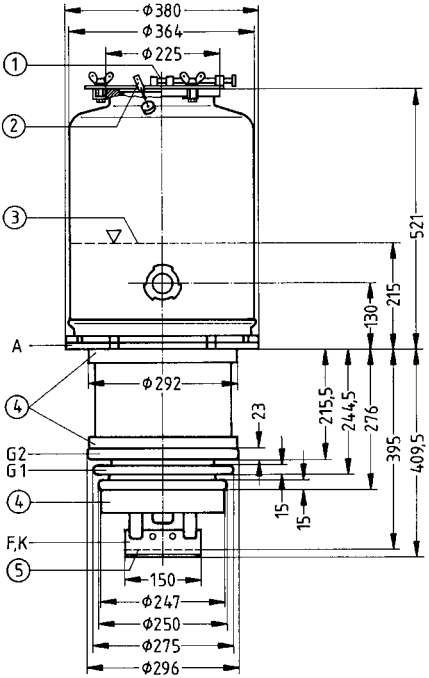
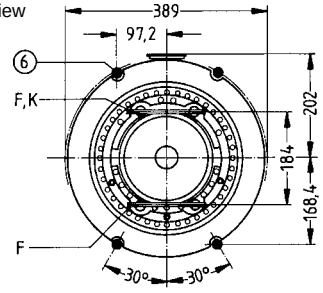
Ordering code Q53-X1490

Coaxial metal-ceramic tetrode, vapor-cooled, with integrated boiler, particularly suitable for anode-modulated MW and SW transmitters up to 250 kW.



Bottom view



RSE0585-F

Dimensions in mm

① Crane suspension
② Terminal of tube fuse RöSich490
③ Max. water level
④ Do not use as terminal
⑤ Contact surface
⑥ Slide rods in the transmitter, 20 mm dia.

Approx. weight 120 kg

Heating

Heater voltage	U_F	7,2	V
Heater current	I_F	≈ 1025	A
Permissible starting current	I_{FM}	≤ 2500	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 700$ V	I_{em}	380	A
Amplification factor at $U_A = 5$ kV, $U_{G2} = 800$ to 1200 V, $I_A = 20$ A	μ	4,3	
Transconductance at $U_A = 5$ kV, $U_{G2} = 1200$ V, $I_A = 20$ A	s	200	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 460	pF
Cathode/screen grid	c_{kg2}	≈ 50	pF
Cathode/anode	c_{ka}	≈ 2	pF [1]
Control grid/screen grid	c_{g1g2}	≈ 440	pF
Control grid/anode	c_{g1a}	≈ 7	pF [1]
Screen grid/anode	c_{g2a}	≈ 170	pF

Accessories		**Ordering code**
Cathode terminal	RöKat490	Q1001-X25
Control grid terminal	RöGit490	Q1001-X20
Screen grid terminal	RöGit491	Q1001-X19
Socket wrench for tube fuse	RöZub09	Q81-X2109
Pressure piece for water inlet	RöZub101	Q1001-X110
Locking piece for water inlet	RöZub102	Q1001-X111
Gasket ring for water inlet	RöZub103	C65055-A670-C503
Gasket ring for vapor outlet	RöZub104	C65055-A670-C504
Tube fuse	RöSich490	C65055-A870-A99
Pull switch for tube fuse	RöKt11	Q81-X1311
LL anti-electrolytic coupling (250 kW)	RöEl31	C65055-A667-A31
Flange with LL antielectrolytic coupling (500 kW)	RöEl32	Q1001-X129
Flange		Q1001-X82
Gasket ring for boiler		C65051-A410-C538

1) Measured by means of a 60 cm diameter screening plate in the screen grid terminal plane.

Anode and screen grid modulation, class C operation, grounded cathode circuit

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	13	kV
Screen grid voltage (dc)	U_{G2}	2200	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	50	A
Peak cathode current	$I_{K\,M}$	380	A
Anode dissipation	P_A	200	kW
Screen grid dissipation	P_{G2}	6,6	kW
Control grid dissipation	P_{G1}	1,4	kW

Operating characteristics

Frequency	f	≤ 30	MHz
Carrier power	P_{trg}	270	kW [1]
Anode voltage (dc)	U_A	12,5	kV
Screen grid voltage (dc)	U_{G2}	1200	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 570	V
Control grid resistance	R_{G1}	125	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	940	V
Anode current (dc)	I_A	28	A
Screen grid current (dc)	I_{G2}	4,0	A
Control grid current (dc)	I_{G1}	1,2	A
Anode input power	$P_{B\,A}$	350	kW
Drive power	P_1	1,0	kW [1)2)]
Anode dissipation	P_A	80	kW [3]
Screen grid dissipation	P_{G2}	4,8	kW
Control grid dissipation	P_{G1}	0,14	kW
Efficiency	η	77	%
Anode load resistance	R_A	225	Ω
Modulation factor	m	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	800	V [4]
Modulation power	P_{mod}	175	kW
Control grid current (dc)	I_{G1}	2,5	A [5]
Drive power	P_1	2,1	kW [1)5)]
Anode dissipation at modulation	$P_{A\,mod}$	150	kW [6]
Screen grid dissipation at modulation	$P_{G2\,mod}$	5,9	kW [6]

1) Circuit losses are not included.
2) Approx. 8 kW drive power at an initial load of 65 Ω on the tube input.
3) Even during modulation the indicated maximum ratings must not be exceeded. It has to be observed that during 100 % modulation the anode dissipation increases to about 1,5 times the power dissipation stated for the carrier value.
4) Modulation of screen grid via separate transformer winding.
5) Maximum values at U_A = 0 V.
6) Average values at m = 100 %.

AF amplifier and modulator,
class B operation, 2 tubes in push-pull circuit

Maximum ratings

Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	2200	V
Control grid voltage (dc)	U_{G1}	– 1000	V
Cathode current (dc)	I_K	50	A
Peak cathode current	$I_{K\,M}$	300	A
Anode dissipation	P_A	200	kW
Screen grid dissipation	P_{G2}	6,0	kW
Control grid dissipation	P_{G1}	1,4	kW

Operating characteristics at modulator operation for

		500 kW carrier power				
		$I_{G1} = 0$		$I_{G1} > 0$		
Output power	P_2	0	350	0	350	kW
Anode voltage (dc)	U_A	12,5	12,5	12,5	12,5	kV
Screen grid voltage (dc)	U_{G2}	2000	2000	1200	1200	V
Control grid voltage (dc)	U_{G1}	– 550	– 550	– 350	– 350	V
Peak control grid voltage (ac) between the 2 tubes	$U_{gg\,m}$	0	2×500	0	2×525	V
Anode current (dc)	I_A	$2 \times 2,5$	2×22	2×3	2×22	A
Screen grid current (dc)	I_{G2}	0	$2 \times 0,6$	0	$2 \times 2,1$	A
Control grid current (dc)	I_{G1}	0	0	0	$2 \times 0,6$	A
Anode input power	$P_{B\,A}$	2×31	2×275	2×38	2×275	kW
Drive power	P_1	0	0	0	2×290	W
Anode dissipation	P_A	2×31	2×100	2×38	2×100	kW
Screen grid dissipation	P_{G2}	0	$2 \times 1,1$	0	$2 \times 2,5$	kW
Control grid dissipation	P_{G1}	0	0	0	2×80	W
Efficiency	η	—	64	—	64	%
Effective load resistance (anode to anode)	R_{AA}	—	570	—	570	Ω

Tube mounting

Axis vertical, anode up.

For connection of the tube use the terminals listed under “Accessories”.

When joining the connection rings to form a fixed socket, care has to be taken that the center deviation with respect to the common axis is less than 0,3 mm.

The transmitter is equipped with sliding rods, 20 mm in diameter, which ensure that the tube guided by the anode flange slips centrically into the socket. The contact blades for the heater current have to get into the right position with respect to the clamping jaws installed in the transmitter.

Before transporting the tube it has to be ensured that the water has been removed from the integrated boiler.

Maximum tube surface temperature

The temperature of the metal-ceramic seals must not exceed 200 °C at any point.

The maximum temperature difference at the circumference of the anode ceramic is 50 °C, whereas 80 °C are permissible in axial direction. The temperature gradient must not exceed 10 °C/cm. The surface temperature will remain below these maximum values if the air stream required for cooling of the terminals is directed along the anode ceramic.

In order to keep the temperature limit of 200 °C at the metal-ceramic seals, additonal cooling of the tube terminals is necessary. For this purpose an air stream of at least 6 m^3/min at a normal air pressure of 1 bar and 20 °C ambient temperature is conducted through the tube socket. At higher sea levels and ambient temperatures the minimum air flow rate must be increased proportionally.

After disconnecting the heater voltage, the tube terminals need an aftercooling time of 10 minutes. Thus the heat flow coming from the tube interior cannot cause impermissible heating up of the terminals and of the spring finger contacts of the connection rings. The aftercooling time can be cut to 5 minutes if the cooling air rate for ventilating the tube socket is increased to 8 m^3/min. The temperature of the curved part of the copper-beryllium spring finger contacts must not exceed 140 °C.

Vapor cooling

Cooling specification for maximum anode dissipation	$P_{A\,max}$ = 200 kW
Total power to be dissipated by the cooling system ($P_A + P_G + 0{,}8\ P_F$)	213 kW
Equivalent thermal output	12800 kJ/min (3060 kcal/min)
Flow rate of returning water	
at returning water temperature of 20 °C	approx. 4,9 l/min
at returning water temperature of 90 °C	approx. 5,6 l/min
Volume of generated vapor	
at returning water temperature of 20 °C	approx. 8,3 m^3/min
at returning water temperature of 90 °C	approx. 9,4 m^3/min

Detailed information on vapor cooling upon request. Please observe instructions on vapor cooling given under „Explanations on Technical Data“.

Safety precautions

The section “Safety precautions” under “Explanations on Technical Data” describes how the tube is to be protected against damage due to electric overload or insufficient cooling. A copper wire with 0,30 mm diameter should be used to test the anode overcurrent trip circuit.

For protection against thermal anode overload the tube fuse RöSich4 is recommended. In conjunction with pull switch RöKt11 it disconnects the voltages at the tube in case of overload (accessories).

$U_{G1} = f(U_A)$ Parameter = I_A
U_{G2} = 1200 V Parameter = I_{G2}
Parameter = I_{G1}