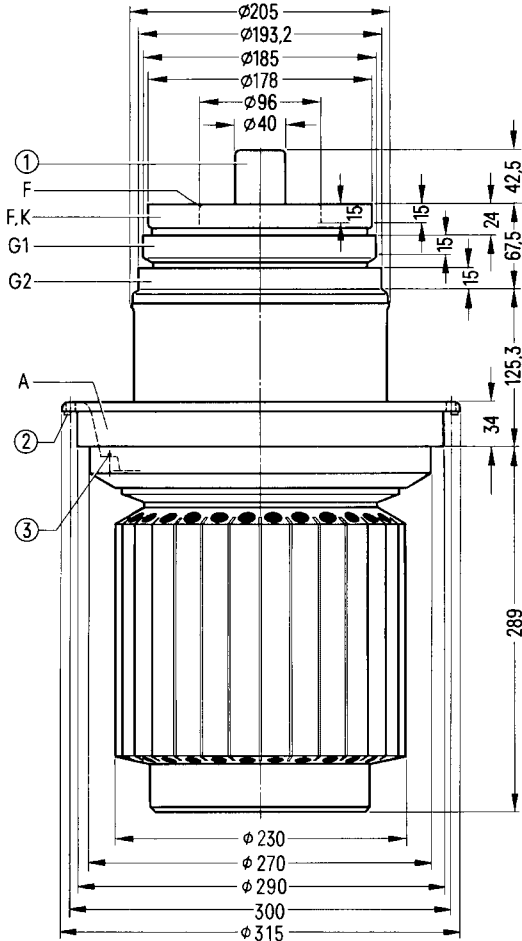**For power transmitters**   Ordering code Q53-X2002

Coaxial tetrode in metal-glass-ceramic technology, vapor-cooled, suitable for single-sideband communications transmitters up to 100 kW, broadcast transmitters up to 200 kW medium and short wave, and for modulators in transmitters up to 400 kW.

Dimensions in mm

RSE0488-Y

① Do not use as terminal
② Taphole M8 for screw-in handle RöZub41V or RöZub202V
③ Taphole M5 for tube fuse RöSich4

Approx. weight 51 kg

Heating

Heater voltage	U_F	21	V
Heater current	I_F	≈ 350	A
Heating: direct			
Cathode: thoriated tungsten			

Characteristics

Emission current at $U_A = U_{G2} = U_{G1} = 700$ V	I_{em}	280	A

Amplification factor of screen grid
at $U_A = 3$ kV,
       $U_{G2} = 800$ to 1200 V,
       $I_A = 10$ A
	μ_{g2g1}	4,0	

Transconductance
at $U_A = 3$ kV,
       $U_{G2} = 1000$ V,
       $I_A = 10$ A
	s	130	mA/V

Capacitances

Cathode/control grid	c_{kg1}	≈ 265	pF
Cathode/screen grid	c_{kg2}	≈ 35	pF
Cathode/anode	c_{ka}	$\approx 1,9$	pF [1]
Control grid/screen grid	c_{g1g2}	≈ 360	pF
Control grid/anode	c_{g1a}	$\approx 9,0$	pF [1]
Screen grid/anode	c_{g2a}	≈ 118	pF

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[1] Measured by means of a 50 cm diameter screening plate in the screen grid terminal plane.

Accessories		Ordering code
Mounting instruction	RöMo14	
Mounting instruction	RöMo95	
Cathode terminal	RöKat202	C65055-A805-A61
Cathode connecting strip (4 for each tube)	RöKat221	Q81-X1136
Control grid terminal	RöGit202a	Q81-X952
Screen grid terminal	RöGit202b	Q81-X953
SW header socket with, symmetrical cathode blocking	RöKpf202KS	Q81-X1806
MW header socket without blocking	RöKpf202MO	Q81-X1805
Socket wrench for tube fuse	RöZub10	Q81-X2110
Handle	RöZub41V	Q81-X2141
Handle	RöZub202V	Q81-X2156
Tube fuse	RöSich4	Q81-X1404
Pull switch for tube fuse	RöKt11	Q81-X1311
Boiler	RöKüV41	Q81-X1641
Insulating pipe at vapor outlet	RöKüV41Zub3	Q81-X1643
Insulating pipe at water inlet	RöKüV41Zub4	Q81-X1644
Insulator	RöKüV41Zub5K	Q81-X1646
Union at water inlet	RöKüV41Zub7	Q81-X1647
Gasket at vapor outlet	RöKüV41Zub8	Q81-X1648
Water level stabilizer with control electrodes	RöZubV4	Q81-X2105
LL electrolytic target	RöEl23	C65055-A667-A23
Gasket ring for boiler	RöN9374	C65051-A202-C553

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

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	11,5	kV
Screen grid voltage (dc)	U_{G2}	1000	V
Control grid voltage (dc)	U_{G1}	– 800	V
Cathode current (dc)	I_K	60	A
Peak cathode current	I_{KM}	280	A
Anode dissipation	P_A	150	kW
Screen grid dissipation	P_{G2}	2400	W [4])
Control grid dissipation	P_{G1}	1200	W

Operating characteristics

Frequency	f	≤ 30	≤ 30	≤ 30	MHz
Carrier power	P_{trg}	220	165	110	kW [1])
Anode voltage (dc)	U_A	11	10	9	kV
Screen grid voltage (dc)	U_{G2}	800	800	800	V
Control grid bias (dc), fixed	$U_{G1\,fix}$	– 590	– 400	– 350	V
Control grid resistance	R_{G1}	60	320	600	Ω
Peak control grid voltage (ac)	$U_{g1\,m}$	960	960	800	V
Anode current (dc)	I_A	25	20	14,5	A
Screen grid current (dc)	I_{G2}	2,5	2,2	1,2	A
Control grid current (dc)	I_{G1}	1,6	1,0	0,5	A
Anode input power	P_{BA}	275	200	130	kW
Drive power	P_1	1400	870	360	W [1])
Anode dissipation	P_A	55	35	20	kW [2])
Screen grid dissipation	P_{G2}	2000	1750	960	W
Control grid dissipation	P_{G1}	300	150	35	W
Efficiency	η	80	83	84	%
Anode load resistance	R_A	237	255	306	Ω
Modulation factor	m	100	100	100	%
Peak screen grid voltage (ac)	$U_{g2\,m}$	700	500	400	V [3])
Modulation power	P_{mod}	140	100	65	kW
Control grid current (dc)	I_{G1}	2,3	2,5	1,0	A [5])
Drive power	P_1	2200	2200	800	W [1]) [5])
Anode dissipation at modulation	$P_{A\,mod}$	82,5	53	30	kW [6])
Screen grid dissipation at modulation	$P_{G2\,mod}$	2200	2200	1200	W [6])

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[1] Circuit losses are not included.
[2] 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.
[3] Modulation of screen grid via separate transformer winding.
[4] 2700 W are permitted for medium wave.
[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, $I_{G1} = 0$

Maximum ratings

Anode voltage (dc)	U_A	12	kV
Screen grid voltage (dc)	U_{G2}	1600	V
Control grid voltage (dc)	U_{G1}	− 800	V
Cathode current (dc)	I_K	50	A
Peak cathode current	I_{KM}	280	A
Anode dissipation	P_A	150	kW
Screen grid dissipation	P_{G2}	2700	W
Control grid dissipation	P_{G1}	1200	W
Control grid resistance	R_{G1}	2,0	kΩ

Operating characteristics   at modulator operation for

		400 kW carrier power		300 kW carrier power		
Output power	P_2	0	280	0	210	kW
Anode voltage (dc)	U_A	11	11	11	11	kV
Screen grid voltage (dc)	U_{G2}	1500	1500	1500	1500	V
Control grid voltage (dc)	U_{G1}	− 520	− 520	− 520	− 520	V
Peak control grid voltage (ac) between the 2 tubes	U_{ggm}	0	1000	0	900	V
Anode current (dc)	I_A	2×3	2×20	2×3	2×15	A
Screen grid current (dc)	I_{G2}	0	$2 \times 0,5$	0	$2 \times 0,4$	A
Anode input power	P_{BA}	2×33	2×220	2×33	2×165	kW
Drive power	P_1	0	2×125	0	2×100	W [1]
Anode dissipation	P_A	2×33	2×80	2×33	2×60	kW
Screen grid dissipation	P_{G2}	0	2×750	0	2×600	W
Efficiency	η	−	63,5	−	63,5	%
Effective load resistance (anode to anode)	R_{AA}	−	550	−	750	Ω

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1) Drive power at 1 kΩ grid resistance.

Transmitter Tetrode

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RS 2002 V

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RF linear amplifier,
single-sideband modulation, grounded cathode circuit, $I_{G1} = 0$

Maximum ratings

Frequency	f	30	MHz
Anode voltage (dc)	U_A	15	kV
Screen grid voltage (dc)	U_{G2}	1600	V
Control grid voltage (dc)	U_{G1}	– 800	V
Cathode current (dc)	I_K	60	A
Peak cathode current	I_{KM}	280	A
Anode dissipation	P_A	150	kW
Screen grid dissipation	P_{G2}	2400	W
Control grid dissipation	P_{G1}	1200	W

Operating characteristics

		I	II [1]	III [1]	
Output power	P_2	0	110	55	kW [2]
Anode voltage (dc)	U_A	10	10	10	kV
Screen grid voltage (dc)	U_{G2}	1500	1500	1500	V
Control grid voltage (dc)	U_{G1}	– 440	– 440	– 440	V
Peak control grid voltage (ac)	$U_{g1\,m}$	0	420	420	V
Anode current (dc)	I_A	7,0	18,3	11,6	A
Screen grid current (dc)	I_{G2}	0	0,7	0,4	A
Anode input power	P_{BA}	70	183	116	kW
Anode dissipation	P_A	70	73	61	kW
Screen grid dissipation	P_{G2}	0	1050	600	W
Efficiency	η	–	60	47,5	%

I	No modulation
II	1-tone modulation
III	2-tone modulation

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1) Carrier suppressed.
2) Circuit losses are not included.

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Tube mounting

Axis vertical, anode down. For connection of the tube use the terminals listed under "Accessories". The complete header sockets are intended for transmitter operation in medium and short-wave range and can be selected corresponding to the required circuit. The individual connectors can be used for modulator operation.

Maximum tube surface temperature

The temperature of the glass bulb and of the glass-metal seals must not exceed 180 °C at any point. In SW transmitters using single-sideband resonant circuits, the glass bulb will be unilaterally heated by RF reactive currents. A unilateral air stream must be provided to ensure that the temperature on this side will not exceed 180 °C.

The maximum temperature of the metal-ceramic seals is 220 °C. When using the individual connectors for modulators, a slight air stream is required in order to maintain these maximum temperatures.

The header sockets for transmitter operation are provided with a centrally located cooling air terminal allowing uniform cooling air distribution over the terminal parts. The cooling air amount necessary for keeping below the specified temperatures lies between 0,5 and 1 m^3/min, according to the operating frequency. The pressure drop is approx. 3,5 mbar.

Vapor cooling

Cooling specifications for maximum anode dissipation	$P_{A\,max}$ = 150 kW
Total power to be dissipated by the cooling system $(P_A + P_{G2} + P_{G1} + 0,8\ P_F)$	160 kW
Equivalent thermal output	9600 kJ/min (2300 kcal/min)
Flow rate of returning water at returning water temperature of 20 °C at returning water temperature of 90 °C	approx. 3,7 l/min approx. 4,2 l/min
Volume of generated vapor at returning water temperature of 20 °C at returning water temperature of 90 °C	approx. 6,2 m^3/min approx. 7,0 m^3/min

Detailed information on vapor cooling upon request. Please observe the 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 (see accessories).
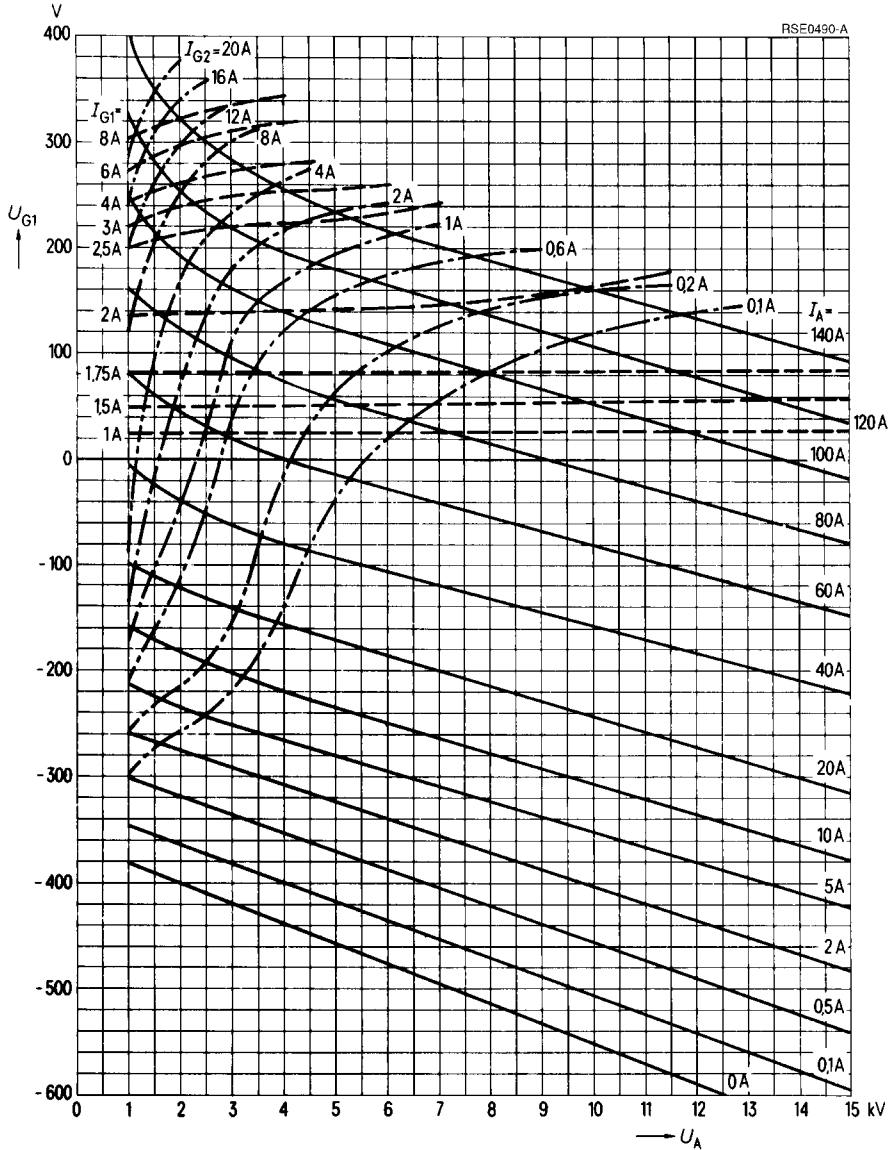
The protective gap required between screen grid and cathode is already included in the MW header sockets available for this tube.

$U_{G1} = f(U_A)$ Parameter = I_A

$U_{G2} = 800$ V   Parameter = I_{G2}

                       Parameter = I_{G1}

RSE0489-7
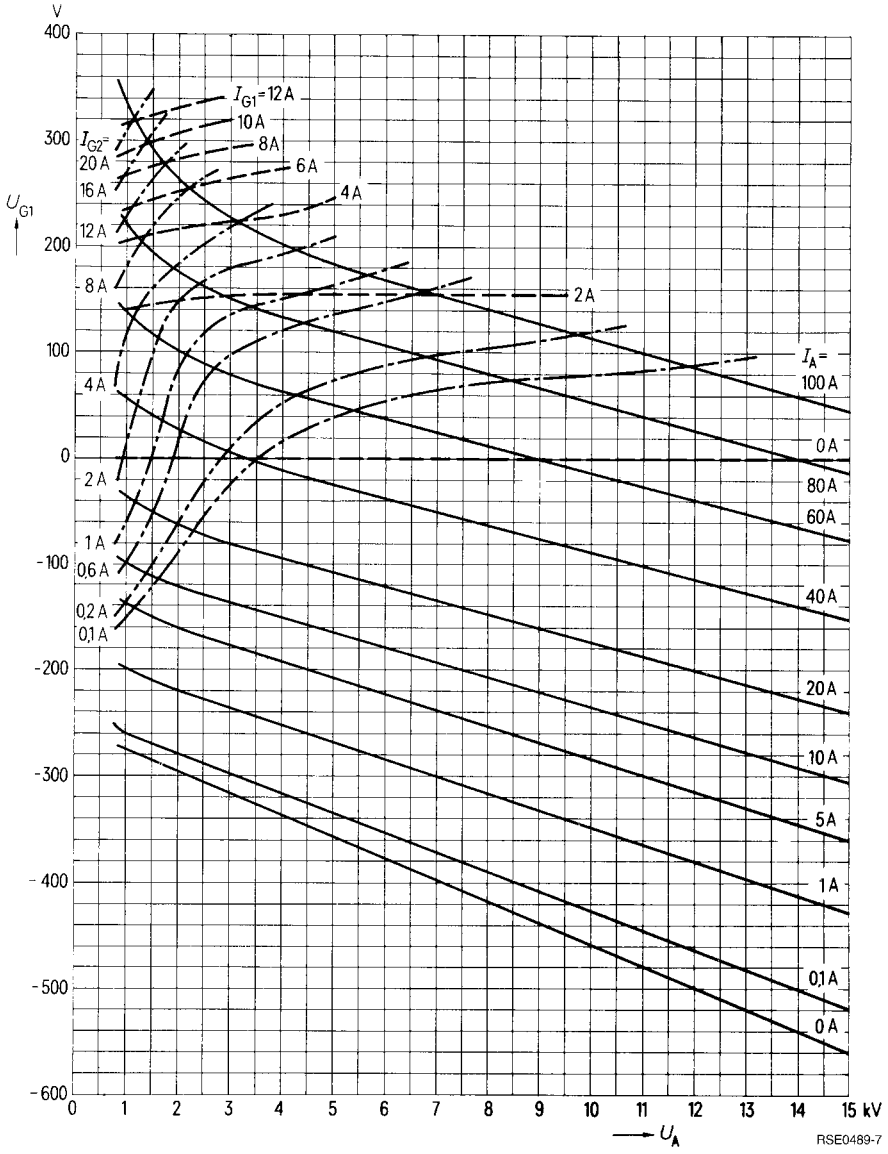
$U_{G1} = f(U_A)$ Parameter = I_A
$U_{G2} = 1100$ V   Parameter = I_{G2}
                        Parameter = I_{G1}

$U_{G1} = f(U_A)$ Parameter $= I_A$ ⎯⎯⎯⎯
$U_{G2} = 1500$ V   Parameter $= I_{G2}$ —·—·—·—·—·—
             Parameter $= I_{G1}$ — — — — — — —

RSE0491-I