


SIEMENS

RS 3002 CL 2 kW Power Triode



A new forced-air cooled power triode
for RF heating up to 500 MHz

Properties

The forced-air cooled, metal-ceramic triode RS 3002 CL has been designed for use at frequencies up to 500 MHz. It features coaxial control grid and cathode terminals, and is especially suitable as grounded grid oscillator for RF heating applications at 433 MHz. The high plate-to-cathode capacitance C_{ak} assures almost complete freedom from phase shift in oscillator operation. The power output at 433 MHz is 2 kW from the tube and 1.5 kW at the cavity output terminal.

The RS 3002 CL embodies a thoriated tungsten wire mesh cathode of the type successfully field-proven in Siemens power tubes for many years.

Insulators of ceramic are used in the RS 3002 CL for optimum mechanical and electrical stability. The low dielectric losses of the ceramic used keep the insulator temperature below the limit of 220°C. Its thermal conductivity is sufficiently high so that even with uneven heating of the tube parts thermal equilibrium is attained relatively quickly. This reduces danger of thermal stresses damaging the tube.

As the possible variations in dimensions of ceramic tubes is very small, the spreads in characteristics can be kept within close limits.

**Oscillator for RF heating applications,
class C operation,
grounded grid circuit,
plate voltage from three-phase bridge circuit**
Preliminary data

Maximum ratings

F	=	450 MHz
E_b	=	3.2 kV
E_{c1}	=	-500 V
I_{kpk}	=	7 A
I_k	=	2 A
P_p	=	3 kW
P_{g1}	=	50 W

Operating data

F	=	433 MHz
P_0	=	1.5 kW ¹⁾
E_b	=	3 kV
E_{c1}	=	-220 V
e_{c1s}	≈	390 V
I_b	=	1.2 A
I_{c1}	=	0.28 A
R_g	=	780 Ω ²⁾
P_a	=	3.6 kW
P_i	≈	100 W
P_p	≈	1.6 kW
P_g	≈	38 W
η_{osc}	≈	41.5 %
R_a	≈	1200 Ω

¹⁾ Power at oscillator output with 75% circuit efficiency

²⁾ Lamp resistance 6×220 V/60 W, 3 parallel pairs

General data

Filament Characteristic parameters

$E_f = 3.2 V$; $I_e = 7 A$ at $E_b = E_{c1} = 250 V$
 $I_f = 85 A$; $\mu = 25$ at $E_b = 1.5$ to $2.5 kV$, $I_b = 1 A$
 $S = 24,000 \mu mhos$ at $E_b = 2 kV$, $I_b = 1 A$

Cathode: Directly heated, thoriated tungsten

Capacitances

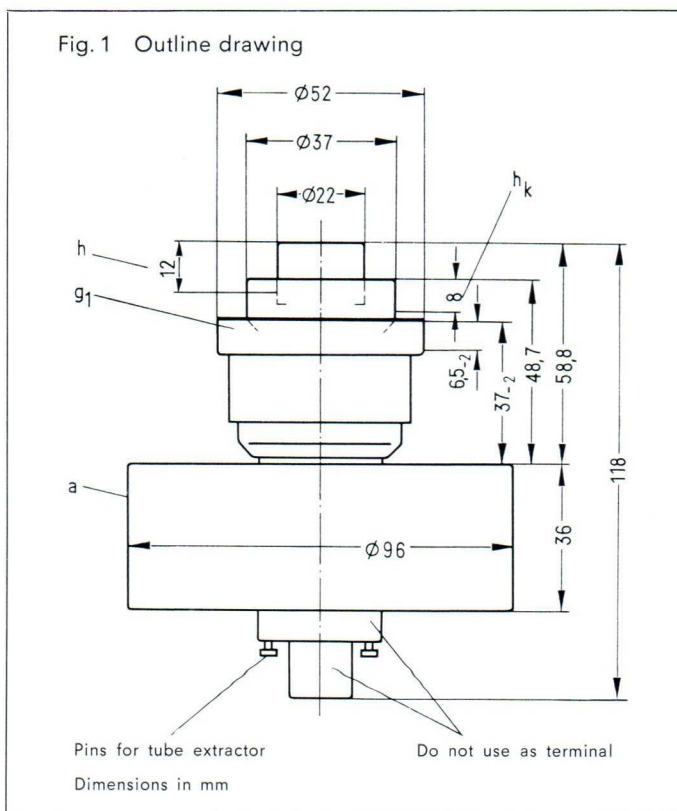
$C_{ag} = \text{approx. } 9.5 \text{ pF}$
 $C_{kg} = \text{approx. } 28 \text{ pF}$
 $C_{ak} = \text{approx. } 1.6 \text{ pF}$

Air cooling (sea level, 25°C ambient temperature)

	Tube alone	Tube and cavity
Dissipation	3.0 kW ¹⁾	2.4 kW ²⁾
Air flow rate	3.3 m ³ /min (117 cfm)	2.5 m ³ /min (88 cfm)
Pressure drop	23 mm H ₂ O (1 in.)	40 mm H ₂ O (1.6 in.)

¹⁾ Plate dissipation

²⁾ Plate dissipation + filament power + circuit losses when operated as oscillator with normal data



Application

Fig. 2 shows the equivalent circuit of an oscillator with the RS 3002 CL. The RF heating output stage consists of the cavity type TK 4495 (60Ω) and tube RS 3002 CL.

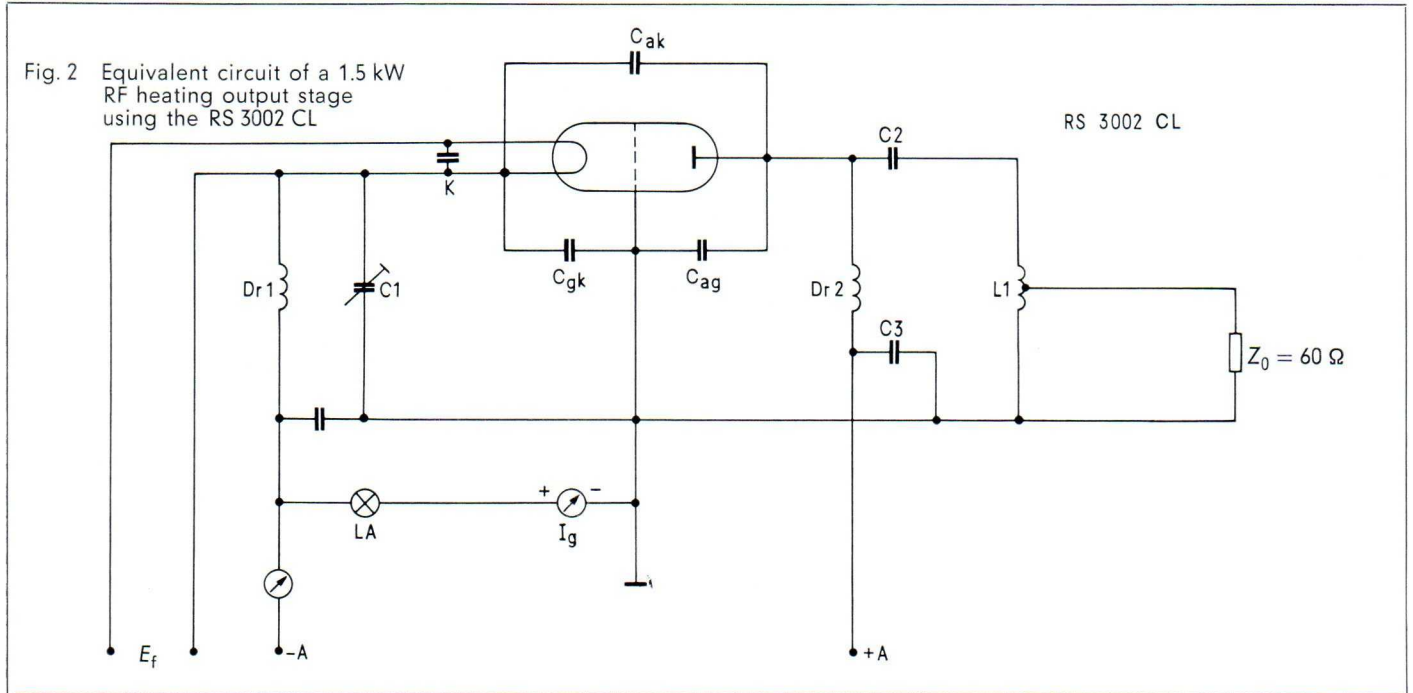
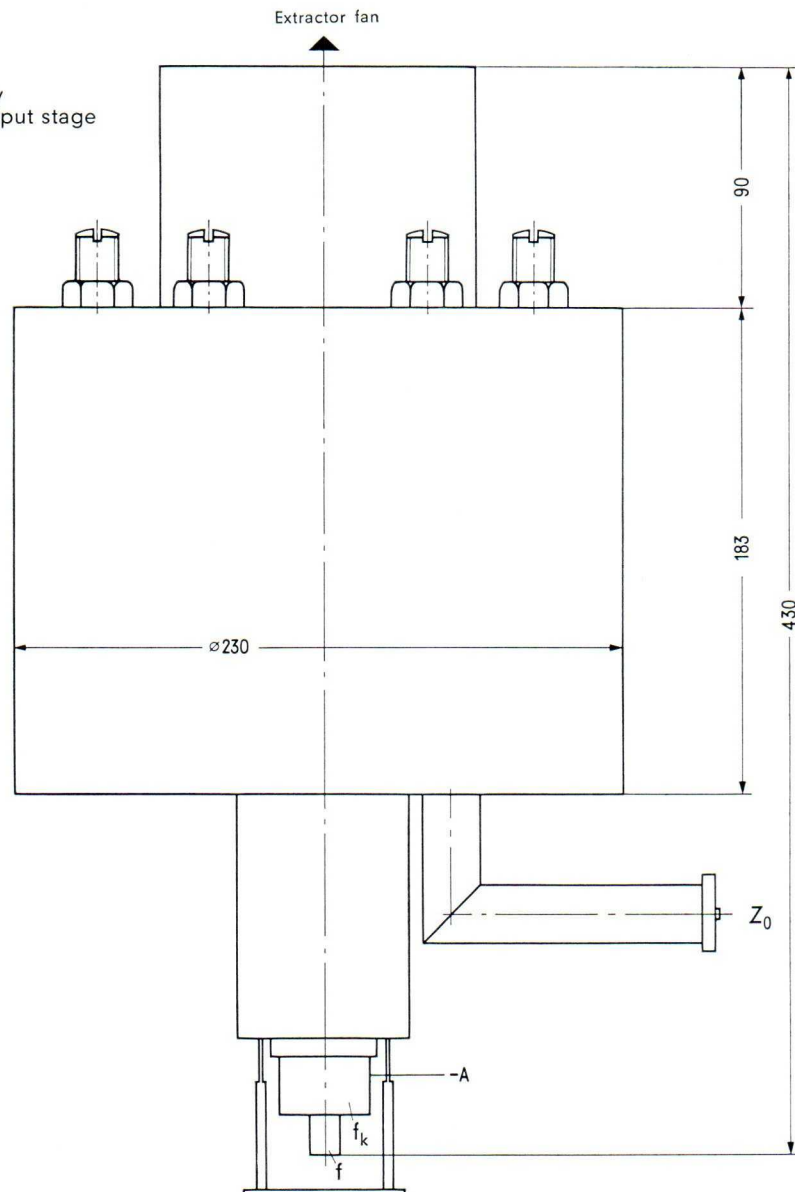


Fig. 3 Outline drawing of a cavity for a 1.5 kW RF heating output stage using the RS 3002 CL



The cavity shown in figs. 3 and 4 is based on the Huth-Kühn circuit; the tube operates in the grounded grid configuration.

To assure freedom from phase shift in operation, the tube capacitance C_{ak} is intentionally increased inside the tube. The power at the output terminal is 1.5 kW.

The cavity can be tuned with six trimmer screws to the operating frequency of 433.92 ± 0.87 MHz. It has been designed such that with load variations the frequency shift remains below ± 0.87 MHz.

The plunger visible at the bottom of the cavity is used to correct the feedback, and affects the grid-cathode circuit.

Fig. 4 Frequency stabilized cavity for a 1.5 kW RF heating output stage using the tube type RS 3002 CL

