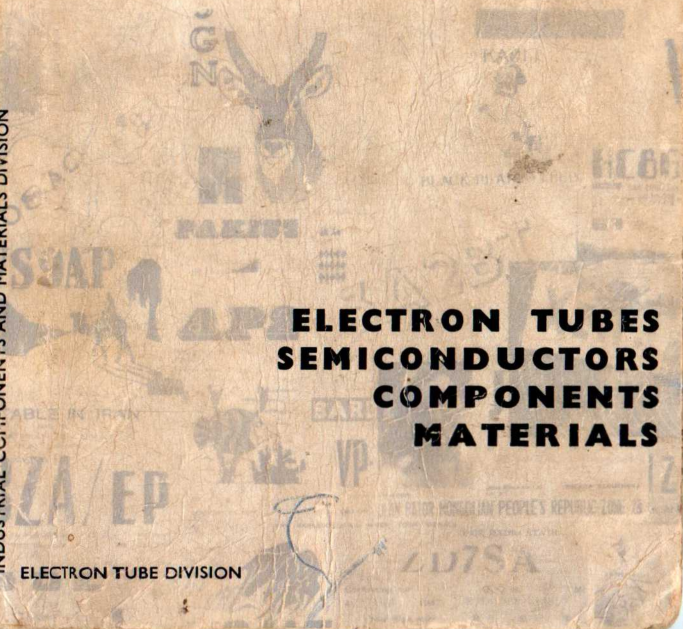
PHILIPS POCKETBOOK FOR HAMS



ELECTRON TUBES
SEMICONDUCTORS
COMPONENTS
MATERIALS

INDUSTRIAL COMPONENTS AND MATERIALS DIVISION

ELECTRON TUBE DIVISION

To better serve the interests of the amateur, we have compiled — the "POCKETBOOK FOR HAMS" which, while containing all the information given in the general issue of the Pocketbook, includes duplicates of the Electron Tube Handbook data and explanatory sheets of a series of transmitting tubes as well as general information of special interest for the amateur.

CONTENTS

All type numbers contained in this booklet are arranged in alphabetical-numerical order both in the section "Receiving and Amplifying tubes" and in the table of contents. For types not belonging to this group reference is made to the page where the data are given.

TYPE NUMBER SYSTEM AND SYMBOLS OF ELECTRON TUBES

TYPE NUMBER SYSTEM

Below the present type number system is given for tubes having type numbers which provide information concerning electrical data, principal uses, bases etc. of the tube.
It is pointed out, however, that in a few instances it has not been possible to adhere strictly to this system.

RECEIVING AND AMPLIFYING TUBES

The type number consists of a number of capital letters followed by either one or two figures (e.g. EF 6, UCH 81).

First letter: indicates the filament rating.
Second and subsequent letters: indicate the type classification.
Figures: indicate a serial number.

The key to this system is given in the following tables.

First letter

A — 4 V
C — 200 mA
D — 1.4 V battery
E — 6.3 V
G — 5 V
H — 150 mA
K — 2 V battery
P — 300 mA
U — 100 mA
X — 600 mA
Y — 450 mA
Z — Cold cathode

Second and subsequent letters

A — R.F. single diode
B — R.F. double diode
C — Triode (except output and gasfilled triodes)
D — Output triode
E — Tetrode (except output tetrodes)
F — Pentode (except output pentodes)
H — Hexode or heptode
K — Octode or heptode

L — Output tetrode or pentode
M — Tuning indicator
P — Tube with secondary emission system
Q — Enneode
T — Miscellaneous
X — Full-wave gasfilled rectifying tube
Y — Half-wave high-vacuum rectifying tube
Z — Full-wave high-vacuum rectifying tube

Figures

Serial number

SPECIAL TUBES

(reliable, ruggedized, long life tubes, etc.)

The system is similar to that of receiving and amplifying tubes, however, the figures are placed between the letters (e.g. E 80 F, E 90 CC).

CATHODE-RAY TUBES

The type number consists of two capital letters followed by two sets of figures (e.g. DG 13-2, MW 31-16).

First letter: indicates the method of focusing and deflection.
Second letter: indicates properties of the screen.
First group of figures: indicates dimensions of the screen.
Second group of figures: indicates a serial number.

The key to this system is given in the following tables.

First letter

A — Electrostatic focusing and electromagnetic deflection.
D — Electrostatic focusing and electrostatic deflection in two directions.
M — Electromagnetic focusing and electromagnetic deflection.

Second letter

B — Bluish fluorescence, short persistence (1% of max. brightness after 0.01 sec).
C — Blue-violet fluorescence and phosphorescence, very short persistence (35% of max. brightness after 0.5 μsec).

F — Orange fluorescence and phosphorescence, very long persistence (0.1% of max. brightness after 75 sec).
G — Green fluorescence and phosphorescence, medium persistence (1% of max. brightness after 0.05 sec).
H — Blue-green fluorescence and green-yellow phosphorescence, medium long persistence.
K — Blue-green fluorescence and phosphorescence, very short persistence (37% of max. brightness after 0.3×10^{-6} sec).
L — Orange fluorescence and phosphorescence, medium long persistence (1% of max. brightness after 0.5 sec).
P — Double layer screen, bluish fluorescence of short persistence followed by greenish-yellow phosphorescence of very long persistence (0.1% of max. brightness after 80 sec).
R — Greenish-yellow fluorescence, yellow phosphorescence, long persistence (0.1% of max. brightness after 20 sec).
W — White fluorescence, blue phosphorescence, medium persistence.
Direct-viewing tubes: colour temp. 8000 °K
Projection tubes : colour temp. 5500 °K

First group of figures

For round tubes : screen diameter in cm
For rectangular tubes: screen diagonal in cm

Second group in figures

Serial number

TRANSMITTING TUBES

The type number consists of two or three capital letters followed by two sets of figures. For some types a group of letters is added (e.g. TAL 12/10, DCG 4/1000 G).

First letter: indicates the tube classification.
Second letter: indicates type of filament or cathode.
First group of figures: indicates operating voltage.
Second group of figures: indicates power.
Added letters: indicate the tube base.
The key to this system is given in the following tables.

First letter

D — Rectifying tube (included grid-controlled tubes)
M — Triode (A.F. amplifying tube or modulator)
P — Pentode
Q — Tetrode
T — Triode (R.F., A.F. or oscillator tube)

For tubes having dual systems two of the above mentioned letters are used (e.g. QQC 04/15).

Second letter

(third letter for tubes having dual systems)

A — Directly-heated tungsten filament
B — Directly-heated thoriated tungsten filament
C — Directly-heated oxide-coated filament
E — Indirectly-heated oxide-coated cathode

Third letter

(fourth letter for tubes having dual systems)

G — Mercury-vapour filling
L — Forced air cooling
W — Water cooling
X — Xenon filling

When the type number does not contain a letter indicating the cooling, the tube is radiation cooled.

First group of figures

Rectifying tubes:	Approx. D.C. output voltage in kilovolts in a three-phase half-wave rectifying circuit.
Transmitting tubes:	Approx. max. anode voltage in kilovolts.

Second group of figures

Rectifying tubes:	Approx. D.C. output power in watts or kilowatts per tube in a three-phase half-wave rectifying circuit.

R.F. tubes: Approx. output power in watts or kilowatts in class C telegraphy.
Modulators: Approx. anode dissipation in watts or kilowatts.

Added letters

B — Cables
E — Medium 7p.-base
ED — Edison base
EG — Goliath base
G — Medium 4p.-base
GB — Jumbo 4p.-base
GS — Super jumbo 4p.-base
N — Medium 5p.-base
P — P-base

PHOTOTUBES

The type number consists of two figures followed by two letters (e.g. 90 AV).

First figure : indicates the tube base.
Second figure: indicates a serial number.
First letter : indicates the type of cathode.
Second letter : indicates the class of phototube.

The key for this system is given in the following tables.

First figure

2 — Loctal 8p.-base
3 — Octal 8p.-base
5 — Special base
8 — Noval 9p.-base
9 — Miniature 7p.-base

Second figure

Serial number

First letter

A — Caesium-antimony cathode (blue sensitive)
C — Caesium-on-oxidized-silver cathode (red sensitive)

Second letter

G — Gasfilled
V — High vacuum

VOLTAGE STABILIZERS

The type number consists of a number followed by a capital letter, a figure and in some cases by a second capital letter (e.g. 85A2 150 C 1K).

Number: indicates burning voltage.
First letter: indicates the current range.
Figure: indicates a serial number.
Second letter: indicates the tube base.

The key for this system is given in the following tables.

Number

Average burning voltage in volts

First letter

A — max. 10 mA
B — max. 22 mA
C — max. 40 mA
D — max. 100 mA
E — max. 200 mA

Figure

Serial number

Second letter

E — Edison
K — Octal 8p.-base
P — P-base

SYMBOLS

Electrodes

a	Anode
ah	Auxiliary anode
a_{ign}	Ignition anode
d	Anode of detection diode
D	Deflection plate or rod
f	Filament or resistance wire
f_c	Filament tap or tap of resistance wire
g	Grid
i.c.	Internal connection (not to be connected externally)
k	Cathode
$k_{(i)}$	Input cathode lead of U.H.F. tube
$k_{(o)}$	Output cathode lead of U.H.F. tube
l	Fluorescent screen
m	External conducting coating
pr	Primer (auxiliary electrode of cold cathode tubes to ensure safe triggering)
s	Internal shield
S	Switch
st	Starter or trigger electrode of cold cathode tubes

Electrode systems

D	Diode
H	Hexode or Heptode
P	Pentode
T	Triode

Voltages

V_a	Anode voltage Burning voltage of voltage stabilizer
$\triangle V_a$	Burning voltage variation of voltage stabilizer in stabilizing range
V_{arms}	A.C. anode voltage (r.m.s. value)
V_{ag}	Voltage between anode and grid
V_{ainvp}	Peak value of inverse anode voltage
V_{ap}	Peak value of anode voltage
V_{arc}	Arc voltage

V_b	Supply voltage
V_{ba}	Anode supply voltage
V_{bg2}	Supply voltage of second grid
V_{contr}	Voltage range of current regulator
V_d	Anode voltage of detection diode
$V_{d\mathrm{inv}}$	Inverse anode voltage of detection diode
$V_{d\mathrm{invp}}$	Peak value of inverse anode voltage of detection diode
V_{eff}	R.M.S. value of a voltage
V_f	Filament voltage
V_{fwd}	Forward voltage
V_g	Grid voltage
$V_{g(\mathrm{arc})}$	Grid voltage of conducting tube
$V_{g\mathrm{invp}}$	Peak value of inverse grid voltage
$V_{g\mathrm{p}}$	Peak value of grid voltage
V	A.C. input voltage per tube
V_{ign}	Voltage necessary for breakdown to the concerning electrode
V_{invp}	Peak value of inverse voltage
V_k	Voltage between cathode and chassis
V_{kf}	Voltage between cathode and filament
$V_{kf\mathrm{p}}$	Peak value of voltage between cathode and filament
V_l	Voltage of fluorescent screen
V_o	A.C. output voltage: D.C. output voltage
V_{osc}	Oscillator voltage
V_{pr}	Primer voltage of a cold cathode tube
V_{st}	Starter voltage of a cold cathode tube
V_{tr}	Secondary transformer voltage (without load)

Currents

I_a	Anode current
$I_{a\mathrm{max}}$	Anode current at full drive
$I_{a\mathrm{min}}$	Anode current without drive
$I_{a\mathrm{p}}$	Peak value of anode current
I_b	Supply current
I_{contr}	Current range of voltage stabilizer
I_d	Anode current of detection diode
$I_{d\mathrm{p}}$	Peak value of anode current of detection diode
I_f	Filament current
I_g	Grid current
$I_{g\mathrm{max}}$	Grid current at full drive

$I_{g\text{min}}$	Grid current without drive
$I_{g\text{p}}$	Peak value of grid current
I_k	Cathode current
I_l	Current of fluorescent screen
I_o	D.C. output current per tube
I_{pr}	Primer current of a cold cathode tube
I_{rec}	Recommended current
I_{reg}	Stabilized current of current regulator
I_{st}	Starter current
$I_{st\ \text{transf}}$	Starter current required to initiate the main discharge
I_{surge}	Surge current

Powers

W_a	Anode dissipation
W_{ig}	Driving power
W_o	Max. output power

Resistances

R_a	External anode resistor Matching resistance Total anode resistance of rectifying tube	
R_{aa}	Matching resistance of push-pull amplifier (anode to anode)	
R_{damping}	Damping resistance	
R_{eq}	Equivalent noise resistance	
R_E	Resistance of thermo-element	
R_f	Resistance of filament	
R_g	External resistance between grid and cathode	
R_g'	External resistance between grid and cathode of next tube	
R_i	Internal resistance	
R_{id}	Internal resistance of detection diode	
R_k	Resistance between cathode and chassis	
R_{kf}	External resistance between cathode and filament	
R_t	Total anode resistance of rectifying tube	
R_1	External resistance between $+ V_b$ and g_2	potentiometer
R_2	External resistance between g_2 and chassis	
R_3	External resistance between g_2 and k	
R_4	External resistance between k and chassis	

Capacitances

C_a	Anode to all other elements except control grid
C_{ag}	Anode to grid, all other elements earthed
C_{ak}	Anode to cathode, all other elements earthed
C_{dk}	Anode to cathode of detection diode, all other elements earthed
$C_{DD'}$	Deflection plate D to deflection plate D′, all other elements earthed
C_{filt}	Input capacitor of smoothing filter
C_g	Grid to all other elements except anode

Miscellaneous

d_{tot}	Total distortion
freq.	Frequency
g	Voltage gain per stage
m	Number of anodes of rectifying tube
N	Sensitivity
S	Mutual conductance
S_c	Conversion conductance
S_{eff}	Effective slope of oscillator tube
S_o	Mutual conductance of oscillator triode at $V_g = 0$ V and $V_{\text{osc}} = 0$ V
t_{amb}	Ambient temperature
t_{Hg}	Temperature of condensed mercury (at the cathode)
t_{rec}	Recommended temperature
T_{av}	Averaging time
T_{dion}	Deionization time
T_h	Heating time of tube
T_{ion}	Ionization time
T_{imp}	Pulse time
α	Shadow section on fluorescent screen
β	Light sector on a fluorescent screen
η	Efficiency
μ	Gain factor
μ_{g2g1}	Gain factor of grid No. 2 with respect to grid No. 1

SYMBOLS FOR SEMICONDUCTORS

Electrodes

d	Anode
k	Cathode
B	Base
E	Emitter
C	Collector

Voltages

V_{BE}	Base voltage in common emitter circuits D.C.
V_{BEM}	Base peak voltage in common emitter circuits
V_{CB}	Collector voltage in common base circuits D.C.
V_{CBM}	Collector peak voltage in common base circuits
V_{CE}	Collector voltage in common emitter circuits D.C.
V_{CEM}	Collector peak voltage in common emitter circuits
V_D	Diode voltage
V_{DM}	Diode peak voltage

Currents

I_C	Collector current D.C.
I_{CM}	Collector peak current
I_D	Diode current D.C.
I_{DM}	Diode peak current
I_E	Emitter current D.C.

Miscellaneous

C_D	Diode capacity
f_1	Frequency at which $\lvert h_{fe} \rvert = 1$
f_{ab}	Cut-off frequency in common base circuit
h_{fe}	Current gain factor of a transistor in common emitter circuit
h_{FE}	D.C. current gain factor of a transistor in common emitter circuit
K	Heat resistance
P_C	Collector dissipation
P_d	Diode dissipation
T_{amb}	Ambient temperature
T_j	Junction temperature
T_{mb}	Mounting base temperature

Operating notes

The semiconductors may be soldered directly into the circuit, but heat conductance to the junction should be kept to a minimum by the use of a thermal shunt.

Leads should not be soldered at a distance shorter than 5 mm from the glass seal.

Care should be taken not to bend the leads nearer than 1.5 mm to the glass seal.

New type designation *)

GROUP 1. For semiconductor types designed for use primarily in reproducing and recording equipment for domestic applications such as: radio and television receiving sets – record players, tape recorders and audio amplifiers – home cinema projectors – hearing acids – and similar equipment, the type designation is made up of two letters and three figures.

GROUP 2. For semiconductor types designed for use primarily in other applications than those mentioned under 1), the type designation consists of three letters and two figures.

First letter

The first letter indicates the semiconductor material

A — germanium
B — silicon

Second letter

The second letter indicates the type of semiconductor

A — diodes, inclusive of voltage dependent capacitors
C — transistors for audio frequency applications
D — power transistors for audio frequency applications
E — tunnel diodes
F — transistors for high frequency applications
L — power transistors for high frequency applications
P — photo – semiconductors
S — switching transistors
T — controlled rectifiers, pnpn transistors, shockley diodes

U — switching power transistors
Y — power diodes
Z — reference and zener diodes

Third letter and figures

These are to be considered as serial numbers.
The types of group 1 have numbers lying between 100 and 999 and are designed in the sequence of time of the type registration.
For the types of group 2 the letter and number Y10–Y99 to A10–A99 are used, commencing with Y10 going upwards through the alphabet and assigned in the sequence of time of the type registration (formerly the letter Z has been used as third letter).

---

*) This type designation is only valid for the new type numbers (for the type numbers not beginning with OA or OC).

RECEIVING
AND AMPLIFYING TUBES

(comprising a survey of type numbers in alphabetical-numerical order)

PREFERRED RECEIVING AND AMPLIFYING TYPES

type of tube		*diode*		*triode*				*triode-heptode*
		single rectifier	*double rectifier*		*single*		*double*	
					+ 2 diodes	*+ 3 diodes*		
heater voltage or current	1.4 V	**DY 86*** **DY 87***						
	5 V		**GZ 34**					
	6.3 V	**EY 88***	**EZ 80** **EZ 81**	**EC 86** **EC 88**	**EBC 81**	**EABC 80**	**ECC 81** **ECC 82** **ECC 83** **ECC 85** **ECC 189**	**ECH 81** **ECH 83**
	100 mA	**UY 85** **UY 89**			**UBC 81**	**UABC 80**	**UCC 85**	**UCH 81**
	300 mA	**PY 88***		**PC 86** **PC 88**		**PABC 80**	**ECC 82** **ECC 83** **PCC 189**	**ECH 81** **ECH 83**

type of tube				*pentode*				*tuning indicator*
		remote cut-off		*sharp cut-off*		*power*		
			+ 2 diodes		*+ triode*		*+ triode*	
heater voltage or current	1.4 V							**DM 70**
	6.3 V	**EF 89** **EF 183**	**EBF 89**	**EF 86** **EF 184**	**ECF 80** **ECF 86**	**EL 34** **EL 84** **EL 86** **EL 95** **EL 500**	**ECL 84** **ECL 85** **ECL 86**	**EM 84** **EM 87**
	100 mA	**UF 89**	**UBF 89**			**UL 84**	**UCL 82**	**UM 80**
	300 mA	**EF 183**	**EBF 89**	**EF 184**	**PCF 80** **PCF 86**	**PL 84** **PL 500**	**PCL 84** **PCL 85** **PCL 86**	**PM 84**

*** high voltage**

PREFERRED MISCELLANEOUS TYPES

tube type	*application*		*type number*
Diodes	Stabilising diode		56001
	High voltage surge limithing diode		1) 8020
	Noise diodes	3 cm band	1) K50A
		10 cm band	1) K51A
	Measuring		1) EA52
	diodes	special execution	1) EA53
Triodes	UHF triodes		1) EC80, EC81
	SHF triodes		1) EC55, EC157, EC158
Pentode	RF beam power ampl. 100 Mc/s		3B4

---

1) See also page G4

PREFERRED SPECIAL QUALITY TYPES

properties	*diode* *double*	*double triode* *μ ≦ 40*	 *μ ≧ 40*	*decade* *counter*
long life		**E 90 CC** (5920) **E 182 CC** (7119)	**E 180 CC** (7062)	***)**E 1 T** (6370)
long life; rugged construction		**E 80 CC** (6085) **E 188 CC** (7308)		
rugged construction	**5726**		**6201**	

properties	*pentode; sharp cut-off* *single*	 *+ triode*	 *power*	*gate tube*	*thyratron*
long life	**E 83 F** (6689) **18042** (6086)		**E 81 L** (6686) **18045**	**E 91 H** (6687)	
long life; rugged construction	**E 80 F** (6084) **E 186 F** (7737) *) **E 810 F** (7788)	**E 80 CF** (7643)	**E 80 L** (6227) **E 130 L** (7534)		
rugged construction	**5654**				**) **PL 5727**

---

*) very high slope **) see also page F2 ***) see also page G7

PREFERRED SUBMINIATURE TUBES

tube type			*triode*	*tetrode*	*pentode*	*power*	*indicator*
directly heated	RF ampl.				1 AD 4		
	RF, AF ampl.				5678		
	radiosonde 30 Mc/s					95108	
	AF ampl.					5672	
	electrometer		4065 4069	4066	4068		
	PH meters				4067		
	transistorized eq.						DM 160
indirectly heated	s.q. 1000 Mc/s		5718				
	1000 Mc/s		EC 71				
	HF. ampl. (remote cut off)	s.q.			5899		
					EF 731		
	H.F./A.F. ampl.	s.q.			5840		
					EF 732		

PREFERRED SINGLE DIODES

SINGLE DIODES		*HEATING*			
		heater voltage (volts)		*heater current (milliamps)*	
		1.4	6.3	100	300
low current (≦ 10 mA)	**low voltage** (detectors)		EA52 1)2) EA53 1)2)		EA52 1)2) EA53 1)2)
	high voltage (EHT rect. for TV receivers and oscill.)	DY86 DY87			
high current (50-200 mA)	**low voltage** (mains rectifiers)			UY89 UY85	
	high voltage (booster diodes for TV receivers)		EY88		PY88

Stabilizing diode 56001 3)
High voltage surge limiting diode (40 kV) 8020 2) 3)

---

1) UHF 2) see also page G4 3) filament voltage 5V

PREFERRED DOUBLE DIODES

DOUBLE DIODES		HEATING		
			Heater voltage (volts)	*Heater current (milliamps)*
		5	6.3	300
low current (≦ 10 mA)	**low voltage** (detector and A.V.C.)		**5726**[1]	**5726**[1]
high current (50-300 mA)	**low voltage** (mains rectifiers)	**GZ34**	**EZ80** **EZ81**	

[1] special quality

PREFERRED TRIODES

TRIODES			HEATING		
		Frequency	*filament voltage (volts)*	*heater voltage (volts)*	*heater current (milliamps)*
			1.25	6.3	300
Amplification factor	**low** (≦ 20)	**UHF**	**4065**[3] **4066**[4] **4069**[3]	**EC81**[2]	
	medium (20-40)	**UHF**		**EC55**[2]	
		SHF		**EC157**[2] **EC158**[2]	
		VHF		**5718**[1] **EC71**[1]	
	high (≧40)	**UHF**		**EC86**[5] **EC88**[6]	**PC86**[5] **PC88**[6]

[1] 150 mA series supply

[2] see also page G4

[3] electrometer triode

[4] electrometer tetrode

[5] tuners, mixer

[6] tuners, HF ampl.

PREFERRED TRIODES WITH DIODES

TRIODES WITH DIODES			*Frequency*	*HEATING*		
				heater voltage (volts)	*heater current (milliamps)*	
				6.3	100	300
Amplification factor	**high (≧ 40)**	**2 Diodes**	**AF**	**EBC81**	**UBC81**	
		3 Diodes		**EABC80**	**UABC80**	**PABC80**

PREFERRED DOUBLE TRIODES

DOUBLE TRIODES		*COMPUTER TYPES*	*Frequency*	*HEATING*		
		Heater voltage (volts)		*heater voltage (volts)*	*heater current (milliamps)*	
		6.3		6.3	100	300 2)3)
Amplification factor	**low (≧ 20)**			**ECC82 3)**		**ECC82 3)**
	medium (20-40)	**E182CC 4)** **E90CC 1)4)**	**AF**	**E80CC 2)4)**		**E80CC 2)4)**
	high (≧ 40)			**ECC81 3)** **ECC83 3)**		**ECC83 3)**
	low (≦ 20)			**ECC86 6)**		
	medium (20-40)	**E188CC 4)5)**	**HF**	**E188CC 4)5)** **ECC189 5)**		**PCC189 5)**
	high (≧ 40)	**E180CC 4)**		**ECC85 6)** **6201 3)4)**	**UCC85 6)**	**6201 3)4)**

1) 400 mA
2) 300/600 mA } **series supply**
3) 150 mA

4) special quality
5) cascode amplifier
6) R.F. ampl. and selfosc. mixer

PREFERRED PENTODES VOLTAGE AMPLIFIERS

PENTODES VOLTAGE AMPLIFIERS			*HEATING*			
			filament voltage (volts)	*heater voltage (volts)*	*heater current (milliamps)*	
			1.4	6.3	100	300
Mutual conductance mA/V	**remote cut-off**	**medium** (2-6)		**EF89** **5899**[2][3] **EF731**[3]	**UF89**	
		high (≧ 6)		**EF183**		**EF183**
	sharp cut-off	**low** (≦ 2)	**5678**[4][7] **4068**[1][7]	**EF86**[6] **E80F**[2]		**PF86** **E80F**[2]
		medium (2-6)	**1AD4**[5][7]	**5840**[2][3] **EF732**[3] **5654**[2]		
		high (≧ 6)		**EF184** **E83F**[2] **18042**[2][8] **E186F**[2] **E810F**[2]	**18042**[2][8]	**EF184** **E83F**[2]

[1] electrometer
[2] special quality
[3] 150 mA

[4] 50 mA
[5] 100 mA
[6] 200 mA
} series supply

[7] 1.25 V
[8] 18 V
filament or heater voltage

PREFERRED PENTODES VOLTAGE AMPLIFIERS
with diode(s) or triode

PENTODES VOLTAGE AMPLIFIERS with diode(s) or triode				*HEATING*		
				heater voltage (volts)	*heater current (milliamps)*	
				6.3	100	300
Mutual conductance (mA/V)	**remote cut-off**	**medium** (2-6)	with 2 diodes	**EBF89**	**UBF89**	**EBF89**
	sharp cut-off	**high** (≧ 6)	with triode	**ECF80** **ECF86**[2] **E80CF**[1]		**PCF80** **PCF86**[2]

[1] special quality **[2] VHF tuner**

PREFERRED PENTODES POWER AMPLIFIERS

PENTODES POWER AMPLIFIERS			*HEATING*			
			filament voltage (volts)	*heater voltage (volts)*	*heater current (milliamps)*	
			1.25	6.3	100	300
Output Class A	**low**	(≦ 0.1) (watts)	**4067[1]** **5672[2]**			
		(0.2-1.9) (watts)	**95108[10]** **3B4[6]**	**E81L[4][9]** **18045[3][7][9]**		
	medium	(2-6) (watts)		**EL95** **E80L[5][9]** **EL84** **EL86[8]**	**UL84**	**PL84**
			with triode	**ECL86**	**UCL82**	**PCL86**
	high	(11) (watts)		**EL34** **E130L[9]**		
Application	**Horizontal deflection**			**EL500**		**PL500**
	Vertical deflection		with triode	**ECL85**		**PCL85**
	Video output		with triode	**ECL84**		**PCL84**

---

[1] electrometer for use in pH-meters, fil. voltage 0.5 V
[2] 50 mA
[3] 0.135 A
[4] 0.375 A series supply
[5] 0.75 A
[6] RF ampl. osc. 100 Mc/s, fil. voltage 2.5 V
[7] 18 V heater voltage
[8] transformerless output stages
[9] special quality
[10] for use in radio sondes, 30 Mc/s

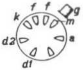
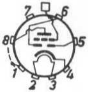
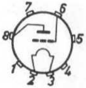
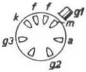
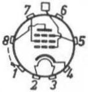
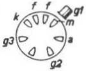
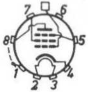
PREFERRED TRIODE HEPTODES, HEPTODES

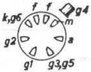
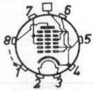
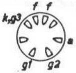
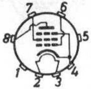
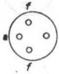
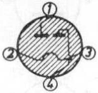
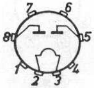
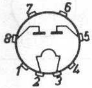
HEPTODES			HEATING		
			heater voltage (volts)	*heater current (milliamps)*	
			6.3	100	300
Conversion conductance (mA/V)	0.45	dual control	**E91H**[3][4]		
	0.22	**Heptode** with triode	**ECH83**[5]		**ECH83**[5]
	0.8		**ECH81**	**UCH81**	**ECH81**

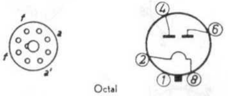
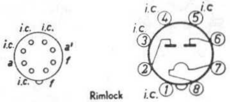
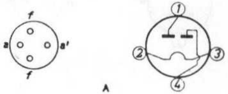
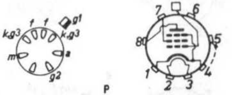
PREFERRED TUNING INDICATORS

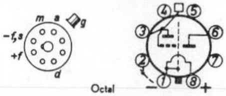
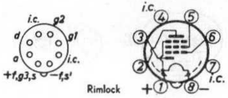
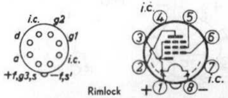
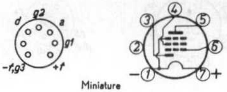
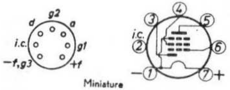
TUNING INDICATORS	HEATING			
	filament voltage (volts)	*heater voltage (volts)*	*heater current (milliamps)*	
	1.4	6.3	100	300
Single system	**DM70**[1] **DM160**[2]	**EM87** **EM84**	**UM80**	**PM84**

[1] 25 mA
[2] in transistorized eq., fil. voltage 1 V
[3] gate tube
[4] special quality
[5] low anode voltage

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
AAZ	See semiconductors				
ABC 1 Double diode triode Typical characteristics	$V_f = 4$ V $I_f = 0.65$ A	$V_a = 250$ V $V_g = -7$ V	$I_a = 4$	$S = 2.0$ mA/V $R_i = 13.5$ kΩ	 P 
AC 107	See semiconductors				
AD 1 Output triode Class A	$V_f = 4$ V $I_f = 0.95$ A	$V_a = 250$ V $V_g = -45$ V	$I_a = 60$	$S = 6$ mA/V $R_i = 670\ \Omega$ $R_a = 2.3$ kΩ $W_o = 4.2$ W $W_a =$ max. 15 W	 P 
AF 3 Variable mu pentode R.F. or I.F. amplifier	$V_f = 4$ V $I_f = 0.65$ A	$V_a = 250$ V $V_{g2} = 100$ V $V_{g1} = -3$ V $V_{g3} = 0$ V	$I_a = 8$ $I_{g2} = 2.6$	$S = 1.8$ mA/V $R_i = 1.2$ MΩ $C_{ag1} < 3$ mpF	 P 
AF 7 R.F. pentode R.F. amplifier	$V_f = 4$ V $I_f = 0.65$ A	$V_a = 250$ V $V_{g2} = 100$ V $V_{g1} = -2$ V $V_{g3} = 0$ V	$I_a = 3$ $I_{g2} = 1.1$	$S = 2.1$ mA/V $R_i = 2$ MΩ $C_{ag1} < 3$ mpF	 P 
AF 102	See semiconductors				

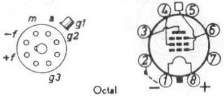
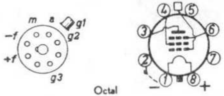
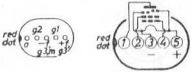
AK 2 Octode Frequency changer	V_f = 4 V I_f = 0.65 A	V_a = 250 V V_{g3+g5} = 70 V V_{g4} = —1.5 V V_{g2} = 90 V R_{g1} = 50 kΩ	I_a = 1.6 I_{g3+g5} = 3.8 I_{g2} = 2.0 I_{g1} = 0.19	S_c = 0.6 mA/V R_i = 1.6 MΩ		P	
AL	See radar tubes						
AL 4 Output pentode Class A final amplifier	V_f = 4 V I_f = 1.75 A	V_a = 250 V V_{g2} = 250 V R_k = 150 Ω	I_a = 36 I_{g2} = 4	S = 9 mA/V R_i = 50 kΩ R_a = 7 kΩ W_o = 4.5 W W_a = max. 9 W		P	
ASZ	See semi-conductors						
AW	See picture tubes and T.V. studio tubes						
AX 50 Gasfilled full-wave rectifying tube Rectifier	V_f = 4 V I_f = 3.75 A	V_{tr} = 2 × 500 V V_{arc} = max. 15 V	I_o = max. 275	R_t = min. 2 × 200 Ω C_{filt} = max. 64 μF		A	
AZ 1 Full-wave rectifying tube Rectifier	V_f = 4 V I_f = 1.1 A	V_{tr} = 2 × 500 V = 2 × 300 V	I_o = max. 60 = max. 100	R_t = min. 2 × 100 Ω = min. 2 × 60 Ω C_{filt} = max. 60 μF		P	
AZ 4 Full-wave rectifying tube Rectifier	V_f = 4 V I_f = 2.3 A	V_{tr} = 2 × 500 V = 2 × 300 V	I_o = max. 120 = max. 200	R_t = min. 2 × 100 Ω = min. 2 × 60 Ω C_{filt} = max. 60 μF		P	

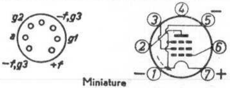
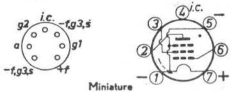
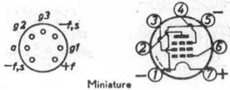
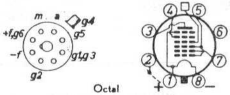
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
AZ 31 Full-wave rectifying tube Rectifier	V_f = 4 V I_f = 1.1 A	V_{tr} = 2 × 500 V = 2 × 300 V	I_o = max. 60 = max. 100	R_t = min. 2 × 100 Ω = min. 2 × 60 Ω C_{filt} = max. 60 μF	
AZ 41 Full-wave rectifying tube Rectifier	V_f = 4 V I_f = 0.72 A	V_{tr} = 2 × 500 V = 2 × 300 V	I_o = max. 60 = max. 70	R_t = min. 2 × 200 Ω = min. 2 × 100 Ω C_{filt} = max. 50 μF	
AZ 50 Full-wave rectifying tube Rectifier	V_f = 4 V I_f = 3 A	V_{tr} = 2 × 500 V = 2 × 300 V	I_o = max. 250 = max. 300	R_t = min. 2 × 150 Ω C_{filt} = max. 32 μF	
BA **BCZ** **BY** **BYZ**	See semi-conductors				
CF 50 A.F. pentode Typical characteristics	V_f = 30 V I_f = 0.2 A	V_a = 250 V V_{g2} = 100 V V_{g1} = —2 V	I_a = 1.5 I_{g2} = 0.3	S = 3.3 mA/V R_t = 2.5 mΩ μ_{g2g1} = 45	
DA 90	See 1 A 3				

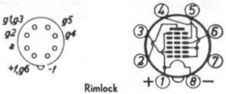
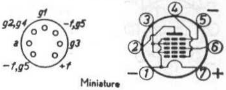
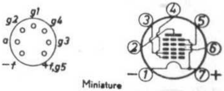
DAC 21 Diode triode Typical characteristics	V_f = 1.4 V I_f = 25 mA	V_a = 90 V V_g = 0 V	I_a = 0.45	S = 0.3 mA/V R_i = 0.13 mΩ	
DAF 40 Diode pentode R.F. or I.F. amplifier	V_f = 1.4 V I_f = 25 mA	V_a = 67.5 V V_{g2} = 67.5 V V_{g1} = 0 V	I_a = 0.85 I_{g2} = 0.20	S = 0.7 mA/V R_i = 1.6 MΩ C_{ag1} < 7 mpF	
DAF 41 Diode pentode A.F. amplifier	V_f = 1.4 V I_f = 25 mA	V_b = 67.5 V R_a = 0.22 MΩ R_{g2} = 0.82 MΩ V_{g1} = 0 V	I_a = 0.17 I_{g2} = 0.04	g = 60	
DAF 91 Diode pentode Typical characteristics A.F. amplifier	V_f = 1.4 V I_f = 50 mA	V_a = 67.5 V V_{g2} = 67.5 V V_{g1} = 0 V	I_a = 1.6 I_{g2} = 0.4	S = 0.62 mA/V R_i = 0.6 MΩ	
		V_b = 67.5 V R_a = 1 MΩ R_{g2} = 3.9 MΩ V_{g1} = 0 V R_{g1} = 10 MΩ1)	I_b = 0.06	g = 55	
DAF 96 Diode pentode A.F. amplifier	V_f = 1.4 V I_f = 25 mA	V_b = 85 V R_a = 1 MΩ R_{g2} = 2.7 MΩ R_{g1} = 10 MΩ $R_{g1'}$ = 2.2 MΩ	I_a = 0.064 I_{g2} = 0.021	g = 70	
DB	See instrument tubes				

---

1) R_{g1} connected to *-f*.

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
DC 70	See U.H.F. tubes				
DC 90	See V.H.F. tubes				
DCC 90	See 3 A 5				
DCG **DCX**	See rectifying tubes for transmitting purposes				
DF 21 Pentode R.F. or I.F. amplifier	V_f = 1.4 V I_f = 25 mA	V_a = 90 V V_{g2} = 90 V V_{g1} = 0 V V_{g3} = 0 V	I_a = 1.2 I_{g2} = 0.25	S = 0.7 mA/V R_i = 2 MΩ C_{ag1} < 6 mpF	
DF 22 Variable mu pentode R.F. or I.F. amplifier	V_f = 1.4 V I_f = 50 mA	V_a = 90 V V_{g2} = 90 V V_{g1} = —1.5 V V_{g3} = 0 V	I_a = 1.4 I_{g2} = 0.3	S = 1.1 mA/V R_i = 1.5 mΩ C_{ag1} < 5 mpF	
DF 61 N Pentode Typical charact.	V_f = 1.25 V I_f = 25 mA	V_a = 67.5 V V_{g2} = 67.5 V V_{g1} = 0 V	I_a = 1.7 I_{g2} = 0.45	S = 0.95 mA/V R_i = 1 MΩ μ_{g2g1} = 21	
DF 62	See 1 AD 4				
DF 64 to **DF 67**	See hearing-aid tubes				

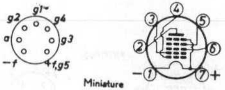
DF 91 Variable mu pentode R.F. or I.F. amplifier	V_f = 1.4 V I_f = 50 mA	V_a = 90 V V_{g2} = 45 V V_{g1} = 0 V	I_a = 1.8 I_{g2} = 0.65	S = 0.75 mA/V R_i = 0.8 MΩ $C_{ag1} < 0.01$ pF	 Miniature
DF 92 Pentode	See 1 L 4				
DF 96 R.F. pentode R.F. or I.F. amplifier	V_f = 1.4 V I_f = 25 mA	V_a = 45 V V_{g2} = 45 V V_{g1} = 0 V	I_a = 0.85 I_{g2} = 0.28	S = 0.65 mA/V R_i = 1 MΩ	 Miniature
		V_a = 85 V V_{g2} = 64 V V_{g1} = 0 V	I_a = 1.65 I_{g2} = 0.55	S = 0.85 mA/V R_i = 1.0 MΩ	
DF 97 Variable mu pentode I.F. amplifier Frequency changer (Oscillator voltage on $_{g3}$)	V_f = 1.4 V I_f = 25 mA	$V_a = V_b$ = 85 V R_{g2} = 33 kΩ V_{g1} = 0 V V_{g3} = 0 V	I_a = 1.7 I_{g2} = 0.7	S = 0.94 mA/V R_i = 0.45 MΩ $C_{ag1} <$ 10 mpF	 Miniature
		$V_a = V_b$ = 85 V R_{g2} = 47 kΩ R_{g3} = 0.3 MΩ V_{g1} = 0 V	I_a = 0.54 I_{g2} = 0.8	S_c = 0.265 mA/V R_i = 0.5 MΩ V_{osc} = 12 V_{eff}	
DG **DH** **DHM**	See instrument tubes				
DK 21 Octode Frequency changer	V_f = 1.4 V I_f = 50 mA	$V_a = V_b$ = 90 V V_{g5} = 90 V V_{g4} = 0 V R_{g2} = 12.5 kΩ R_{g1+g3} = 35 kΩ	I_a = 1.5 I_{g5} = 0.25 I_{g2} = 2.4 I_{g1+g3} = 0.2	S_c = 0.5 mA/V R_i = 1.2 MΩ	 Octal

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
DK 40[1]) Octode Frequency changer	$V_f = 1.4$ V $I_f = 50$ mA	$V_a = V_b = 67.5$ V $V_{g5} = 67.5$ V $V_{g4} = 0$ V $V_{g2} = 67.5$ V $R_{g1+g3} = 35$ kΩ	$I_a = 1.0$ $I_{g5} = 0.25$ $I_{g2} = 2.6$	$S_c = 0.42$ mA/V $R_i = 0.9$ mΩ $V_{osc} = 8$ V_{eff}	
DK 91 Heptode Frequency changer	$V_f = 1.4$ V $I_f = 50$ mA	$V_a = 90$ V $V_{g2+g4} = 67.5$ V $V_{g3} = 0$ V $R_{g1} = 0.1$ MΩ	$I_a = 1.6$ $I_{g2+g4} = 3.2$ $I_{g1} = 0.25$	$S_c = 0.30$ mA/V $R_i = 0.6$ MΩ	
		$V_a = 45$ V $V_{g2+g4} = 45$ V $V_{g3} = 0$ V $R_{g1} = 0.1$ MΩ	$I_a = 0.7$ $I_{g2+g4} = 1.9$ $I_{g1} = 0.15$	$S_c = 0.23$ mA/V $R_i = 0.6$ MΩ	
DK 92 Heptode Frequency changer	$V_f = 1.4$ V $I_f = 50$ mA	$V_a = V_b = 85$ V $V_{g3} = 0$ V $R_{g4} = 0.18$ MΩ $R_{g2} = 33$ kΩ $R_{g1} = 27$ kΩ	$I_a = 0.65$ $I_{g4} = 0.14$ $I_{g2} = 1.65$ $I_{g1} = 0.13$	$S_c = 0.32$ mA/V $S_{eff} = 0.4$ mA/V $R = 1$ MΩ $R_{eq} = 100$ kΩ $V_{osc} = 4$ V_{eff}	
		$V_a = V_b = 41$ V $V_{g4} = 41$ V $V_{g3} = 0$ V $R_{g2} = 6.8$ kΩ $R_{g1} = 27$ kΩ	$I_a = 0.25$ $I_{g4} = 0.09$ $I_{g2} = 1.75$ $I_{g1} = 0.08$	$S_c = 0.18$ mA/V $S_{eff} = 0.7$ mA/V $R_i = 0.75$ MΩ $R_{eq} = 115$ kΩ $V_{osc} = 2.5$ V_{eff}	

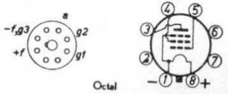
---

[1]) R_{g1+g3} connected to $+ f$.

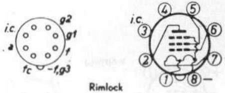
DK 96	V_f = 1.4 V	$V_a = V_b$ = 85 V	I_a = 0.6	S_c = 0.3 mA/V
Heptode	I_f = 25 mA	V_{g3} = 0 V	I_{g4} = 0.14	R_i = 0.8 MΩ
Frequency		R_{g4} = 0.12 MΩ	I_{g2} = 1.5	R_{eq} = 100 kΩ
changer		R_{g2} = 33 kΩ	I_{g1} = 0.085	V_{osc} = 4 V_{eff}
		R_{g1} = 27 kΩ		
		$V_a = V_b$ = 45 V	I_a = 0.56	S_c = 0.325 mA/V
		V_{g4} = 45 V	I_{g4} = 0.15	R_i = 0.55 MΩ
		V_{g3} = 0 V	I_{g2} = 1.3	V_{osc} = 4 V_{eff}
		R_{g2} = 12 kΩ	I_{g1} = 0.085	
		R_{g1} = 27 kΩ		



DL 21	V_f = 1.4 V	V_a = 90 V	I_a = 4	S = 1.3 mA/V
Output	I_f = 50 mA	V_{g2} = 90 V	I_{g2} = 0.7	R_i = 0.3 MΩ
pentode		V_{g1} = —3 V		R_a = 22.5 kΩ
Class A final				W_o = 0.16 W
amplifier				W_a = max. 0.7 W

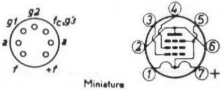


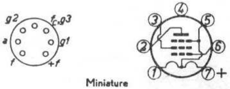
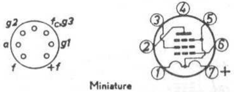
DL 41	V_f = 1.4 V	V_a = 90 V	I_a = 8	S = 2.45 mA/V
Output	I_f = 0.1 A	V_{g2} = 90 V	I_{g2} = 1.3	R_i = 90 kΩ
pentode	Pins 1-(7+8)	V_{g1} = —3.6 V		R_a = 11 kΩ
Class A final				W_o = 0.36 W
amplifier				W_a = max. 1.2 W



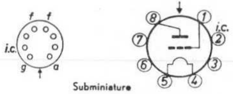
DL 64 to DL 71 See hearing-aid tubes

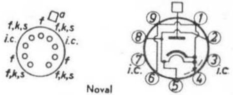
DL 92	V_f = 1.4 V	$V_a = V_b$ = 84 V	I_a = 8	S = 1.55 mA/V
Output	I_f = 0.1 A	V_{g1} = —6.5 V	I_{g2} = 1.7	R_i = 0.1 MΩ
pentode	Pins 5-(1+7)	R_{g2} = 10 kΩ		R_a = 7 kΩ
Class A final				W_o = 190 mW
amplifier				W_a = max. 0.7 W
		$V_a = V_b$ = 61 V	I_a = 6.6	S = 1.5 mA/V
		V_{g2} = 61 V	I_{g2} = 1.4	R_i = 0.1 MΩ
		V_{g1} = —6 V		R_a = 7 kΩ
				W_o = 125 mW



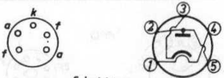
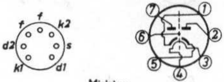
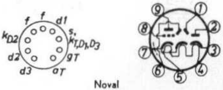
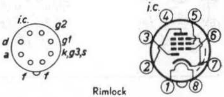
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
DL 93	See 3 A 4				
DL 94 Output pentode Class A final amplifier	V_f = 1.4 V I_f = 0.1 A Pins 5-(1+7)	V_a = 86 V V_{g2} = 86 V V_{g1} = —4.5 V	I_a = 8 I_{g2} = 1.8	S = 2.0 mA/V R_i = 0.11 MΩ R_a = 8 kΩ W_o = 0.29 W W_a = max. 1.2 W	
	V_f = 2.8 V I_f = 50 mA Pins 1-7	V_a = 86 V V_{g2} = 86 V V_{g1} = —4.3 V	I_a = 7.0 I_{g2} = 1.5	S = 1.9 mA/V R_i = 10 kΩ R_a = 0.12 MΩ W_o = 0.27 W	
DL 95	See 3 Q 4				
DL 96 Output pentode Class A Class A half filament Class A	V_f = 1.4 V I_f = 50 mA Pins 5-(1+7)	V_a = 85 V V_{g2} = 85 V V_{g1} = —5.2 V	I_a = 5 I_{g2} = 0.9	S = 1.4 mA/V R_i = 150 kΩ R_a = 13 kΩ W_o = 0.2 W W_a = max. 0.6 W	
	V_f = 1.4 V I_f = 25 mA Pins 5-7 or 1-5	V_a = 85 V V_{g2} = 85 V V_{g1} = —5.2 V	I_a = 2.5 I_{g2} = 0.45	R_a = 15 kΩ W_o = 0.1 W	
	V_f = 2.8 V I_f = 25 mA Pins 1—7	V_a = 90 V V_{g2} = 90 V V_{g1} = —6.3 V	I_a = 3.7 I_{g2} = 0.7	R_a = 20 kΩ W_o = 0.15 W	
DL 98	See 3 B 4				

DM 70 **Tuning** **indicator**	V_f = 1.4 V I_f = 25 mA	V_f = 1.4 V (Pin 5 positive) V_a = 85 V	I_a = 0.17 (V_g = 0 V)	V_g = —10 V for complete extinction
		V_f = 1.4 V V_a = 60 V (Pin 4 positive)	I_a = 0.105 (V_g = 0 V)	V_g = —7 V for complete extinction
DM 71	= DM 70 with short leads			
DM 160 **Indicator** **mainly** **for use in** **transistorized** **computers**	V_f = 1 V I_f = 30 mA	V_a = 50 V V_g = 0 V R_g = 100 kΩ	I_a = 0.585	
		V_g = —3 V	I_a = <0.005	
DN **DP** **DR** **DR**	See instrument tubes			
DY 86	See DY 87			
DY 87 **Half wave** **rectifier for** **T.V. receivers**	V_f = 1.4 V I_f = 0.55 A	V_o = 18 kV	I_o = 0.15 I_o = max. 0.5	C_a = 1.55 pF
E 1 T	See decade counting and indicating tubes			
E 80 CC **E 80 CF** **E 80 F** **E 80 L**	See reliable, ruggedized and long life tubes			
E 81 CC	See 6201			



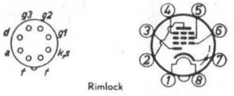
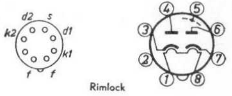
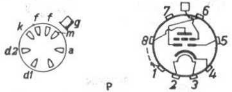
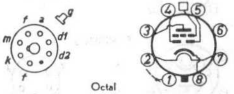


Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
E 81 L **E 83 F**	See reliable, long life tubes				
E 88 CC	See reliable, ruggedized and long life tubes				
E 90 CC	See tubes for computers				
E 90 F	See reliable, ruggedized tubes				
E 91 AA	See 5726				
E 91N	See PL 5727				
E 91 H **E 92 CC**	See tubes for computers				
E 95 F	See 5654				
E 99 F	See reliable, ruggedized tubes				
E 130 L	See reliable, ruggedized and long life tubes				
E 180 CC **E 182 CC**	See tubes for computers				
E 180 F **E 186 F** **E 188 CC** **E 810 F**	See reliable, ruggedized and long life tubes				
EA 52 **EA 53**	See measuring diodes				

EA 76 Diode	V_f = 6.3 V I_f = 0.15 A	$V_{d\,invp}$ = max. 420 V	I_d = max. 9 I_{dp} = max. 54	C_d = 2.5 pF	 Subminiature
EAA 91 Double diode Detector and A.G.C. (each section)	V_f = 6.3 V I_f = 0.3 A	$V_{d\,invp}$ = max. 420 V	I_d = max. 9 I_{dp} = max. 54	$V_{kfp}(k_{neg})$ = max. 150 V) $V_{kfp}(k_{pos})$ max. 330 V1)	 Miniature
EABC 80 Triple diode high mu triode Typical characteristics (diode section) (triode section)	V_f = 6.3 V I_f = 0.48 A	$V_{d1\,invp}$ = max. 350 V $V_{d2\,invp}$ = max. 350 V $V_{d3\,invp}$ = max. 350 V	I_{d1} = max. 1 I_{d1p} = max. 6 I_{d2} = max. 10 I_{d2p} = max. 75 I_{d3} = max. 10 I_{d3p} = max. 75	R_{id1} = 5 kΩ (V_{d1} = 10 V) R_{id2} = 200 Ω (V_{d2} = 5 V) R_{id3} = 200 Ω (V_{d3} = 5 V)	 Noval
		V_a = 250 V V_g = —3 V	I_a = 1.0	S = 1.4 mA/V R_i = 50 kΩ	
		V_a = 100 V V_g = —1 V	I_a = 0.8	S = 1.45 mA/V R_i = 48 kΩ	
EAC 91	See U.H.F. tubes				
EAF 41 Diode variable mu pentode R.F. or I.F. amplifier	V_f = 6.3 V I_f = 0.2 A	V_a = V_b = 250 V R_{g2} = 95 kΩ V_{g1} = —2 V	I_a = 5 I_{g2} = 1.6	S = 1.8 mA/V R_i = 1.2 MΩ C_{ag1} < 2 mpF	 Rimlock

---

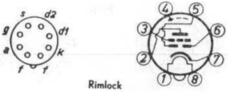
1) D.C. component max. 200 V, A.C. component max. 165 V (rms value)

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
EAF 42 Diode variable mu pentode R.F. or I.F. amplifier	V_f = 6.3 V I_f = 0.2 A	$V_a = V_b = 250$ V R_{g2} = 110 kΩ V_{g1} = -2 V V_{g3} = 0 V	I_a = 5 I_{g2} = 1.5	S = 2.0 mA/V R_i = 1.4 mΩ $C_{ag1} <$ 2 mpF	
EB 41 Double diode Detector and A.G.C.	V_f = 6.3 V I_f = 0.3 A	$V_{d\,\mathrm{invp}}$ = max. 420 V	I_d = max. 9 I_{dp} = max. 54	$V_{kfp}(k_{pos})$ = max. 330 V¹)	
EB 91	See EAA 91				
EBC 3 **EBC 33** Double diode triode Typical characteristics A.F. amplifier	V_f = 6.3 V I_f = 0.2 A	V_a = 100 V V_g = -2.1 V	I_a = 2	S = 1.6 mA/V R_i = 19 kΩ	
		V_b = 250 V R_a = 0.2 MΩ R_k = 4 kΩ	I_a = 0.75	g = 26	

---

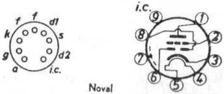
¹) D.C. component max. 200 V, A.C. component max. 165 V (rms value)

EBC 41	V_f = 6.3 V	V_a = 250 V	I_a = 1	S = 1.2 mA/V
Double diode	I_f = 0.23 A	V_g = —3 V		R_i = 58 kΩ
high mu triode				μ = 70
Typical				
characteristics				



Rimlock

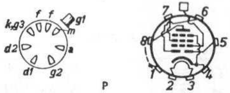
EBC 81	V_f = 6.3 V	V_a = 250 V	I_a = 1	S = 1.2 mA/V
Double diode	I_f = 0.23 A	V_g = —3 V		R_i = 58 kΩ
high mu triode				μ = 70
Typical				
characteristics		V_b = 250 V	I_a = 0.7	g = 51
A.F. amplifier		R_a = 22 kΩ		
		R_k = 1.8 kΩ		



Noval

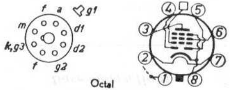
EBC 90	See 6 AT 6
EBC 91	See 6 AV 6

EBF 2	V_f = 6.3 V	$V_a = V_b$ = 250 V	I_a = 5	S = 1.8 mA/V
Double diode	I_f = 0.2 A	R_{g2} = 95 kΩ	I_{g2} = 1.6	R_i = 1.3 MΩ
variable mu		V_{g1} = —2 V		C_{ag1} < 2 mpF
pentode				
I.F. amplifier				

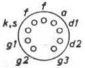
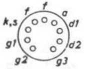
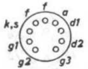


P

EBF 32	V_f = 6.3 V	$V_a = V_b$ = 250 V	I_a = 5	S = 1.8 mA/V
Double diode	I_f = 0.2 A	R_{g2} = 95 kΩ	I_{g2} = 1.6	R_i = 1.3 MΩ
variable mu		V_{g1} = —2 V		C_{ag1} < 2 mpF
pentode				
I.F. amplifier				

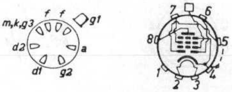
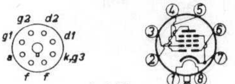
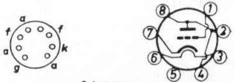


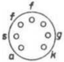
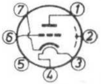
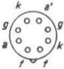
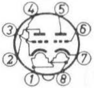
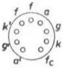
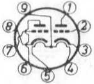
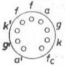
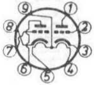
Octal

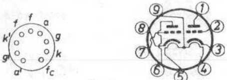
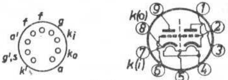
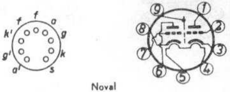
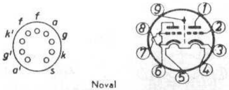
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
EBF 80 Double diode variable mu pentode R.F. or I.F. amplifier	V_f = 6.3 V I_f = 0.3 A	$V_a = V_b = 250$ V V_{g3} = 0 V R_{g2} = 95 kΩ R_k = 295 Ω	I_a = 5.0 I_{g2} = 1.75	S = 2.2 mA/V R_i = 1.4 MΩ C_{ag1} < 2.5 mpF	  Noval
A.F. amplifier		V_b = 250 V R_a = 0.22 MΩ R_{g2} = 0.82 MΩ R_k = 1.8 kΩ V_{g3} = 0 V	I_a = 0.75 I_{g2} = 0.30	g = 110	
EBF 83 Double diode variable mu pentode I.F. amplifier	V_f = 6.3 V I_f = 0.3 A	V_a = 12.6 V V_{g2} = 12.6 V V_{g3} = 0 V V_{g1} = 1) V	I_a = 0.45 I_{g2} = 0.14	S = 1mA/V R_i = 1MΩ C_{ag1} < 2.5 mpF	  Noval
		V_a = 6.3 V V_{g2} = 6.3 V V_{g3} = 0 V V_{g1} = 1) V	I_a = 0.12 I_{g2} = 0.04	S = 0.45 mA/V R_i = 0.65 MΩ	
EBF 89 Double diode variable mu pentode Typical characteristics	V_f = 6.3 V I_f = 0.3 A	V_a = 250 V V_{g2} = 100 V V_{g3} = 0 V V_{g1} = —2 V	I_a = 9 I_{g2} = 2.7	S = 3.8 mA/V R_i = 1 MΩ μ_{g2g1} = 20 C_{ag1} < 2.5 mpF	  Noval

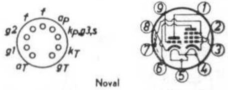
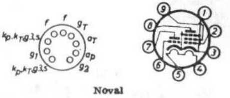
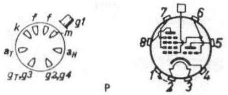
---

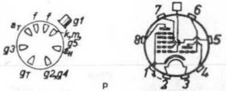
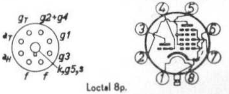
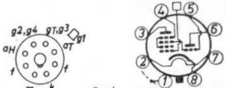
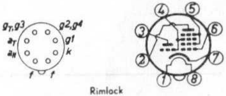
1) Obtained by grid current biasing $R_{g1} = 2.2$ MΩ

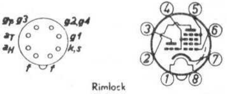
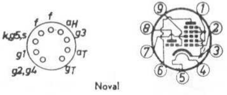
EBL 1 Double diode output pentode Class A final amplifier	V_f = 6.3 V I_f = 1.18 A	V_a = 250 V V_{g2} = 250 V R_k = 150 Ω	I_a = 36 I_{g2} = 4	S = 8 mA/V R_i = 50 kΩ R_a = 7 kΩ W_o = 4.5 W W_a = max. 9 W	 P
EBL 21 Double diode output pentode Class A final amplifier	V_f = 6.3 V I_f = 0.8 A	V_a = 250 V V_{g2} = 250 V R_k = 150 Ω	I_a = 36 I_{g2} = 4.5	S = 9 mA/V R_i = 50 kΩ R_a = 7 kΩ W_o = 4.5 W W_a = max. 11 W	 Loctal 8p.
EC 50	See thyratrons				
EC 55	See U.H.F. tubes				
EC 70 R.F. triode Typical characteristics	V_f = 6.3 V I_f = 0.15 A	V_a = 100 V V_g = —2 V	I_a = 13	S = 5.5 mA/V R_i = 3.6 kΩ	 Subminiature
EC 71	See 5718				
EC 80 **EC 81** **EC 86** **EC 88** **EC 91**	See U.H.F. tubes				
EC 90	See 6 C 4				

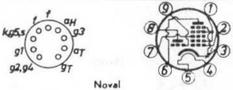
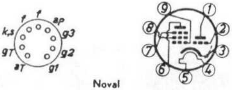
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
EC 92 R.F. triode Typical characteristics	V_f = 6.3 V I_f = 0.15 A	V_a = 250 V V_g = —2 V	I_a = 10	S = 5.5 mA/V R_i = 11 kΩ freq. = max. 300 Mc/s	  Miniature
		V_a = 170 V V_g = —1 V	I_a = 8.5	S = 5.9 mA/V R_i = 11 kΩ	
EC 157 **EC 158**	See S.H.F. tubes				
ECC 40 Double triode Class A final amplifier (each section)	V_f = 6.3 V I_f = 0.6 A	V_a = 250 V V_g = —5.6 V	I_a = 6	S = 2.9 mA/V R_i = 11 kΩ R_a = 15 kΩ W_o = 0.28 W W_a = max. 1.5 W	  Rimlock
ECC 81 Double triode Typical characteristics (each section)	V_f = 6.3 V I_f = 0.3 A Pins 9-(4+5)	V_a = 100 V V_g = —1 V	I_a = 3.0	S = 3.75 mA/V R_i = 16.5 kΩ	  Noval
	V_f = 12.6 V I_f = 0.15 A Pins 4—5	V_a = 250 V V_g = —2 V	I_a = 10	S = 5.5 mA/V R_i = 11 kΩ	
ECC 82 Double triode Typical characteristics (each section)	V_f = 6.3 V I_f = 0.3 A Pins 9-(4+5)	V_a = 250 V V_g = —8.5 V	I_a = 10.5	S = 2 2 mA/V R_i = 7.7 kΩ	  Noval
	V_f = 12.6 V I_f = 0.15 A Pins 4—5	V_a = 100 V V_g = 0 V	I_a = 11.8	S = 3.1 mA/V R_i = 6.25 kΩ	

ECC 83 Double high mu triode Typical characteristics (each section)	V_f = 6.3 V I_f = 0.3 A Pins 9-(4+5)	V_a = 250 V V_g = —2 V	I_a = 1.2	S = 1.6 mA/V R_i = 62.5 kΩ μ = 100	 Noval
	V_f = 12.6 V I_f = 0.15 A Pins 4—5	V_a = 100 V V_g = —1 V	I_a = 0.5	S = 1.25 mA/V R_i = 80 kΩ	
ECC 84 Double triode Typical characteristics (each section)	V_f = 6.3 V I_f = 0.33 A	V_a = 90 V V_g = —1.5 V	I_a = 12	S = 6 mA/V R_i = 4 kΩ	 Noval
ECC 85 Double triode Typical characteristics (each section)	V_f = 6.3 V I_f = 0.435 A	V_a = 250 V V_g = —2.3 V	I_a = 10	S = 5.9 mA/V R_i = 9.8 kΩ	 Noval
ECC 86 Double triode for use in carradio	V_f = 6.3 V I_f = 0.33 A	V_a = 6.3 V V_g = —0.4 V	I_a = 0.9	S = 2.6 mA/V μ = 14	 Noval
ECC 88 Double triode	V_f = 6.3 V I_f = 0.365 A	See PCC 88 (except for heater rating)			
ECC 91	See 6 J 6				
ECC 186	See tubes for computers				
ECC 189	See V.H.F. tubes				

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
ECF 80 Triode pentode Typ. charact.	V_f = 6.3 V I_f = 0.43 A	V_a = 170 V V_{g2} = 170 V V_{g1} = —2 V	I_a = 10 I_{g2} = 2.8	S = 6.2 mA/V R_i = 0.4 MΩ R_{eq} = 1.5 kΩ	
Pentode section Triode section		V_a = 100 V V_g = —2 V	I_a = 14	S = 5 mA/V R_i = 4 kΩ	 f f ap g2 kp,g3,s g1 kT aT gT Noval 9 1 8 2 7 3 6 5 4
Freq. changer		V_a = 170 V V_{g2} = 170 V R_{g1} = 0.1 MΩ R_k = 330 Ω	I_a = 6.5 I_{g2} = 2 I_{g1} = 0.02	S_c = 2.2 mA/V R_i = 800 kΩ V_{osc} = 3.5 V_{eff}	
ECF 86 Triode pentode Typ. charact.	V_f = 6.3 V I_f = 0.365 A	V_a = 170 V V_{g2} = 150 V V_{g1} = 1.2 V	I_a = 10 I_{g2} = 3.3	S = 12 mA/V R_i = > 350 kΩ R_{eq} = 1 k Ω	
Pentode section Triode		V_a = 100 V V_g = —3 V	I_a = 14	S = 5.5 mA/V μ = 17	 f f gT kp.kTg3s aT g1 ap kp.kTg3s g2 Noval 9 1 8 2 7 3 6 5 4
section Freq. changer		V_{ba} = 190 V V_{bg2} = 190 V R_{g2} = 18 kΩ R_{g1} = 100 kΩ	I_a = 8.5 I_{g2} = 2.7	S_c = 4.5 mA/V V_{osc} = 2.3 V_{eff}	
ECH 3 Triode hexode Frequency changer (hexode section)	V_f = 6.3 V I_f = 0.2 A	V_a = V_b = 250 V R_1 = 24 kΩ R_2 = 33 kΩ R_{g3+gT} = 50 Ω V_{g1} = —2 V	I_a = 3 I_{g2+g4} = 3 I_{g3+gT} = 0.2	S_c = 0.65 mA/V R_i = 1.3 MΩ	 f f g1 k m aT aH gT,g3 g2,g4 P 7 6 8 5 1 2 3 4
Oscillator (triode section)		V_b = 250 V R_a = 45 kΩ R_{g3+gT} = 50 kΩ	I_a = 3.3 I_{g3+gT} = 0.2	S_o = 2.8 mA/V μ = 24	

ECH 4 Triode heptode Freq. changer (heptode section)	V_f = 6.3 V I_f = 0.35 A	$V_a = V_b$ = 250 V R_{g2+g4} = 24 kΩ R_{g3+gT} = 50 kΩ V_{g1} = —2 V	I_a = 3.0 I_{g2+g4} = 6.2 I_{g3+gT} = 0.19	S_c = 0.75 mA/V R_i = 1.4 MΩ	 P
Oscillator (triode section)		V_b = 250 V R_a = 20 kΩ R_{g3+gT} = 50 kΩ	I_a = 4.5 I_{g3+gT} = 0.19	S_{eff} = 0.55 mA/V	
ECH 21 Triode heptode Freq. changer (heptode section)	V_f = 6.3 V I_f = 0.33 A	$V_a = V_b$ = 250 V R_{g2+g4} = 24 kΩ R_{g3+gT} = 50 kΩ V_{g1} = —2 V	I_a = 3.0 I_{g2+g4} = 6.2 I_{g3+gT} = 0.19	S_c = 0.75 mA/V R_i = 1.4 MΩ	 Loctal 8p.
Oscillator (triode section)		V_b = 250 V R_a = 20 kΩ R_{g3+gT} = 50 kΩ	I_a = 4.5 I_{g3+gT} = 0.19	S_{eff} = 0.55 mA/V	
ECH 35 Triode hexode Frequency changer (hexode section)	V_f = 6.3 V I_f = 0.2 A	$V_a = V_b$ = 250 V R_1 = 24 kΩ R_2 = 33 kΩ R_{g3+gT} = 50 kΩ V_{g1} = —2 V	I_a = 3.0 I_{g2+g4} = 3.0 I_{g3+gT} = 0.2	S_c = 0.65 mA/V R_i = 1.3 MΩ	 Octal
Oscillator (triode section)		V_b = 250 V R_a = 45 kΩ R_{g3+gT} = 50 kΩ	I_a = 3.3 I_{g3+gT} = 0.2	S_o = 2.8 mA/V μ = 24	
ECH 41 Triode hexode Frequency changer (hexode section)	V_f = 6.3 V I_f = 0.23 A	$V_a = V_b$ = 250 V R_1 = 33 kΩ R_2 = 47 kΩ R_{g3+gT} = 20 kΩ V_{g1} = —2 V	I_a = 3.0 I_{g2+g4} = 2.2 I_{g3+gT} = 0.35	S_c = 0.5 mA/V R_i = 2 MΩ V_{osc} = 8 V_{eff} R_{eq} = 170 kΩ	 Rimlock
Oscillator (triode section)		V_b = 250 V R_a = 30 kΩ R_{g3+gT} = 20 kΩ	I_a = 4.9 I_{g3+gT} = 0.35	S_o = 1.9 mA/V S_{eff} = 0.55 mA/V μ = 19	

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
ECH 42 Triode hexode Frequency changer (hexode section)	V_f = 6.3 V I_f = 0.23 A	V_a = V_b = 250 V R_1 = 27 kΩ R_2 = 27 kΩ R_{g3+gT} = 22 kΩ V_{g1} = —2 V	I_a = 3.0 I_{g2+g4} = 3.0 I_{g3+gT} = 0.35	S_c = 0.75 mA/V R_i = 1.7 MΩ R_{eq} = 100 kΩ	 Rimlock
Oscillator (triode section)		V_b = 250 V R_a = 33 kΩ R_{g3+gT} = 22 kΩ V_{osc} = 8 V	I_a = 5.1 I_{g3+gT} = 0.35	S_o = 2.8 mA/V S_{eff} = 0.6 mA/V μ = 22	
ECH 81 Triode heptode Freq. changer (heptode section)	V_f = 6.3 V I_f = 0.3 A	V_a = V_b = 250 V R_{g2+g4} = 22kΩ R_{g3+gT} = 47 kΩ V_{g1} = —2 V	I_a = 3.25 I_{g2+g4} = 6.7 I_{g3+gT} = 0.2	S_c = 0.775 mA/V R_i = 1 MΩ R_{eq} = 70 kΩ	
R.F. or I.F. amplifier (heptode section)		V_a = V_b = 250 V R_{g2+g4} = 39 kΩ V_{g1} = —2 V V_{g3} = 0 V	I_a = 6.5 I_{g2+g4} = 3.8	S = 2.4 mA/V R_i = 0.7 MΩ μ_{g2g1} = 20 R_{eq} = 8.5 kΩ	 Noval
Typical characteristics (triode section)		V_a = 100 V V_g = 0 V	I_a = 13.5	S = 3.7 mA/V R_i = 6 kΩ	
Oscillator (triode section)		V_b = 250 V R_a = 33 kΩ R_{g3+gT} = 47 kΩ	I_a = 4.5 I_{g3+gT} = 0.2	S_{eff} = 0.65 mA/V	

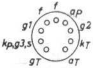
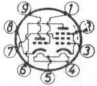
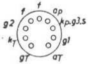
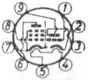
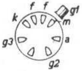
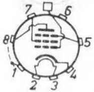
ECH 83 Triode heptode Freq. changer (heptode section)	V_f = 6.3 V I_f = 0.3 A	V_a = 12.6 V V_{g2+4} = 12.6 V V_{g1} = 1) V V_{g3} = 1.7 V_{eff} R_{g3} = 47 kΩ2)	I_a = 0.17 I_{g2+4} = 0.3 I_{g3} = 0.018	S_c = 220 μA/V R_i = 1.5 MΩ C_{ag1} < 6 mpF	
Typical characteristics (triode section)		V_a = 6.3 V V_{g2+4} = 6.3 V V_{g1} = 1) V V_{g2} = 1.1 V_{eff} R_{g3} = 47 kΩ2)	I_a = 0.05 I_{g2+4} = 0.08 I_{g3} = 0.007	S_c = 90 μA/V R_i = 1.3 MΩ	
		V_a = 12.6 V V_g = 3) V	I_a = 0.75	S = 1.4 mA/V μ = 18.3	
		V_a = 6.3 V V_g = 3) V	I_a = 0.3	S = 0.8 mA/V μ = 14.6	
ECL 80 Triode output pentode Class A final amplifier (pentode section)	V_f = 6.3 V I_f = 0.3 A	V_a = 170 V V_{g3} = 0 V V_{g2} = 170 V V_{g1} = —6.7 V	I_a = 15 I_{g2} = 2.8	S = 3.2 mA/V R_i = 0.15 MΩ R_a = 11 kΩ W_o = 1.0 W W_a = max. 3.5 W	
Sync separator (pentode section)		V_a = 20 V V_{g3} = 0 V V_{g2} = 12 V V_{g1} = 0 V	I_a = 2		
Typ. charact. (triode section)		V_a = 100 V V_g = 0 V	I_a = 8	S = 1.9 mA/V μ = 20	
A.F. amplifier (triode section)		V_b = 170 V R_a = 0.22 MΩ V_g = —3.5 V R_{g1} = 0.68 MΩ V_{g3} = 0 V	I_a = 0.5	g = 11	

---

1) Obtained by grid-current biasing, R_{g1} = 1 MΩ

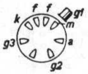
2) Grid nr. 3 capacitively coupled to oscillator

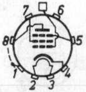
3) Obtained by grid-current biasing, R_{g1} = 47 MΩ

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
ECL 82 Triode output pentode Class A final amplifier (pentode section)	V_f = 6.3 V I_f = 0.78 A	V_a = 200 V V_{g2} = 200 V V_{g1} = —16 V	I_a = 35 I_{g2} = 7.8	S = 6.4 mA/V R_i = 20 kΩ R_a = 5.6 kΩ W_o = 3.5 W W_a = max. 7 W	 Noval 
Typical characteristics (triode section)		V_a = 100 V V_g = 0 V	I_a = 3.5	S = 2.2 mA/V μ = 70	
ECL 84	V_f = 6.3 V I_f = 0.72 A	See PCL 84 (except for heater rating)			
ECL 85	V_f = 6.3 V I_f = 0.86 A	See PCL 85 (except for heater rating)			
ECL 86 Triode output pentode Class A final amplifier (pentode section)	V_f = 6.3 V I_f = 0.7 A	V_a = 250 V V_{g2} = 250 V R_k = 170 Ω	I_a = 36 I_{g2} = 6	S = 10 mA/V R_i = 48 kΩ R_a = 7 kΩ W_o = 4 W W_a = max. 9 W	 Noval 
Typical characteristics (triode section)		V_a = 250 V V_g = —1.9 V	I_a = 1.2	S = 1.6 mA/V μ = 100 W_a = max. 0.5 W	
EF 6 Pentode R.F. amplifier	V_f = 6.3 V I_f = 0.2 A	V_a = 250 V V_{g2} = 100 V V_{g1} = —2 V V_{g3} = 0 V	I_a = 3.0 I_{g2} = 0.8	S = 1.8 mA/V R_i = 2.5 mΩ C_{ag1} < 3 mpF	 P 

EF 9
Variable mu pentode
R.F. or I.F. amplifier

$V_f = 6.3$ V $V_a = V_b = 250$ V $I_a = 6$ $S = 2.2$ mA/V
$I_f = 0.2$ A $R_{g2} = 90$ kΩ $I_{g2} = 1.7$ $R_i = 1.25$ MΩ
$V_{g1} = -2.5$ V $C_{ag1} < 2$ mpF
$V_{g3} = 0$ V

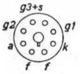


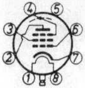


P

EF 22
Variable mu pentode
R.F. or I.F. amplifier

$V_f = 6.3$ V $V_a = 250$ V $I_a = 6$ $S = 2.2$ mA/V
$I_f = 0.2$ A $R_{g2} = 90$ kΩ $I_{g2} = 1.7$ $R_i = 1.2$ MΩ
$V_{g1} = -2.5$ V $C_{ag1} < 2$ mpF
$V_{g3} = 0$ V

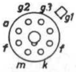


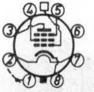


Loctal 8p.

EF 37 A
Low microphony pentode
R.F. amplifier

$V_f = 6.3$ V $V_a = 250$ V $I_a = 3.0$ $S = 1.8$ mA/V
$I_f = 0.2$ A $V_{g2} = 100$ V $I_{g2} = 0.8$ $R_i = 2.5$ MΩ
$V_{g1} = -2$ V $C_{ag1} < 20$ mpF
$V_{g3} = 0$ V

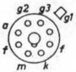


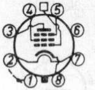


Octal

EF 39
Variable mu pentode
R.F. or I.F. amplifier

$V_f = 6.3$ V $V_a = 250$ V $I_a = 6$ $S = 2.2$ mA/V
$I_f = 0.2$ A $R_{g2} = 90$ kΩ $I_{g2} = 1.7$ $R_i = 1.2$ mΩ
$V_{g1} = -2.5$ V $C_{ag1} < 3$ mpF
$V_{g3} = 0$ V

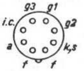


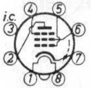


Octal

EF 40
Low noise preamplifier pentode characteristics

$V_f = 6.3$ V $V_a = 250$ V $I_a = 3.0$ $S = 1.85$ mA/V
$I_f = 0.2$ A $V_{g2} = 140$ V $I_{g2} = 0.55$ $R_i = 2.5$ MΩ
$V_{g1} = -2$ V $C_{ag1} < 0.04$ pF
$V_{g3} = 0$ V

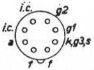


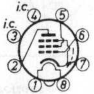


Rimlock

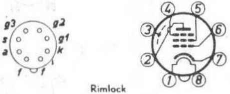
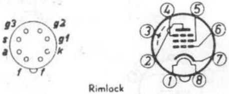
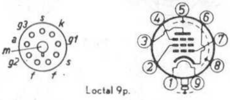
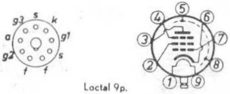
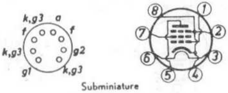
EF 41
Variable mu pentode
R.F. or I.F. amplifier

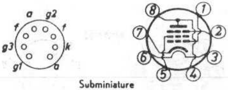
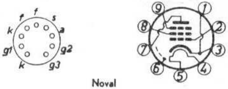
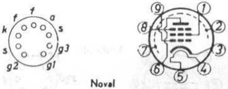
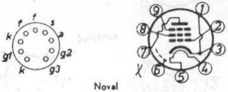
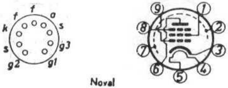
$V_f = 6.3$ V $V_a = V_b = 250$ V $I_a = 6$ $S = 2.2$ mA/V
$I_f = 0.2$ A $R_{g2} = 90$ kΩ $I_{g2} = 1.7$ $R_i = 1.0$ MΩ
$V_{g1} = -2.5$ V $C_{ag1} < 2$ mpF

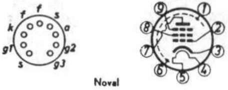
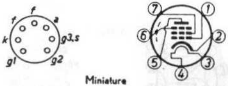
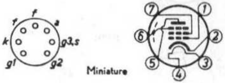
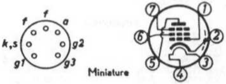


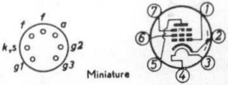
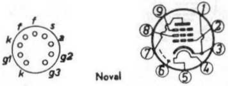


Rimlock

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
EF 42 R.F. pentode R.F. or I.F. amplifier	V_f = 6.3 V I_f = 0.33 A	V_a = 250 V V_{g2} = 250 V V_{g1} = —2 V V_{g3} = 0 V	I_a = 10 I_{g2} = 2.4	S = 9 mA/V R_i = 0.5 MΩ μ_{g2g1} = 83 R_{eq} = 840 Ω C_{ag1} < 6 mpF	
EF 43 Variable mu pentode Wide-band amplifier	V_f = 6.3 V I_f = 0.33 A	V_a = V_b = 250 V R_{g2} = 33 kΩ V_{g3} = 0 V V_{g1} = —2 V	I_a = 15 I_{g2} = 3.5	S = 6.4 mA/V R_i = 0.5 MΩ R_{eq} = 1.7 kΩ C_{ag1} < 6 mpF	
EF 50 R.F. pentode Wide-band amplifier	V_f = 6.3 V I_f = 0.3 A	V_a = 250 V V_{g2} = 250 V V_{g1} = —2 V V_{g3} = 0 V	I_a = 10 I_{g2} = 3	S = 6.5 mA/V R_i = 1 MΩ μ_{g2g1} = 75 R_{eq} = 1.4 kΩ C_{ag1} < 7 mpF	
EF 51	See U.H.F. tubes				
EF 55 R.F. pentode Typical characteristics	V_f = 6.3 V I_f = 1.0 A	V_a = 250 V V_{g2} = 250 V V_{g1} = —4.5 V V_{g3} = 0 V	I_a = 40 I_{g2} = 5.5	S = 12 mA/V R_i = 55 kΩ μ_{g2g1} = 28 C_{ag1} = 0.15 pF	
EF 72 R.F. pentode Typical characteristics	V_f = 6.3 V I_f = 0.15 A	V_a = 100 V V_{g2} = 100 V V_{g1} = —1.4 V	I_a = 7 I_{g2} = 2.2	S = 5 mA/V R_i = 250 kΩ μ_{g2g1} = 36 R_{eq} = 1.6 kΩ	

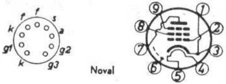
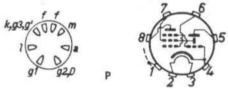
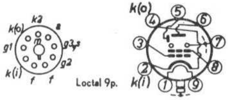
EF 73	V_f = 6.3 V	V_a = 100 V	I_a = 7.5	S = 5.25 mA/V	
A.F. pentode	I_f = 0.2 A	V_{g2} = 100 V	I_{g2} = 2.5	R_i = 250 kΩ	
Typical		V_{g1} = —2 V		μ_{g2g1} = 28	
characteristics		V_{g3} = 0 V			Subminiature
EF 80	V_f = 6.3 V	V_a = 170 V	I_a = 10	S = 7.4 mA/V	
R.F. pentode	I_f = 0.3 A	V_{g3} = 0 V	I_{g2} = 2.5	R_i = 0.5 MΩ	
R.F. or I.F.		V_{g2} = 170 V		C_{ag1} < 7 mpF	
amplifier		V_{g1} = —2 V		R_{eq} = 1 kΩ	Noval
EF 83	V_f = 6.3 V	V_a = 250 V	I_a = 4	S = 1.6 mA/V	
Variable mu	I_f = 0.2 A	V_{g2} = 50 V	I_{g2} = 1.15	R_i = 1.6 MΩ	
pentode		V_{g3} = 0 V		μ_{g2g1} = 10	
Typical		V_{g1} = —1.6 V		C_{ag1} < 0.05 pF	
characteristics					Noval
EF 85	V_f = 6.3 V	V_a = V_b = 250 V	I_a = 10	S = 6 mA/V	
R.F. variable	I_f = 0.3 A	R_{g2} = 60 kΩ	I_{g2} = 2.5	R_i = 0.6 MΩ	
mu pentode		V_{g1} = —2 V		R_{eq} = 1.4 kΩ	
R.F. or I.F.		V_{g3} = 0 V		C_{ag1} < 7 mpF	
amplifier					Noval
EF 86	V_f = 6.3 V	V_a = 250 V	I_a = 3	S = 2 mA/V	
Low noise	I_f = 0.2 A	V_{g2} = 140 V	I_{g2} = 0.6	R_i = 2.5 MΩ	
preamplifier		V_{g3} = 0 V		μ_{g2g1} = 38	
pentode		V_{g1} = —2 V			
Typical					
characteristics		V_b = 250 V	I_b = 2.1	g = 112	
A.F. amplifier		R_a = 0.1 MΩ			Noval
		R_{g2} = 0.39 MΩ			
		R_k = 1 kΩ			
		V_{g3} = 0 V			

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
EF 89 Variable mu pentode R.F. or I.F. amplifier	V_f = 6.3 V I_f = 0.2 A	V_a = V_b = 250 V R_{g2} = 50 kΩ R_k = 160 Ω V_{g3} = 0 V	I_a = 9 I_{g2} = 3	S = 3.5 mA/V R_i = 0.9 MΩ C_{ag1} < 2 mpF R_{eq} = 4.2 kΩ	 Noval
EF 91 R.F. pentode Wide-band amplifier	V_f = 6.3 V I_f = 0.3 A	V_a = 250 V V_{g3} = 0 V V_{g2} = 250 V V_{g1} = —2 V	I_a = 10 I_{g2} = 2.55	S = 7.65 mA/V R_i = 1 MΩ R_{eq} = 1.2 kΩ C_{ag1} < 10 mpF	 Miniature
EF 92 Variable mu pentode R.F. or I.F. amplifier	V_f = 6.3 V I_f = 0.2 A	V_a = 250 V V_{g3} = 0 V V_{g2} = 150 V V_{g1} = —0.65 V	I_a = 8 I_{g2} = 2	S = 2.5 mA V C_{ag1} < 7 mpF	 Miniature
EF 93	See 6 BA 6				
EF 94	See 6 AU 6				
EF 95	See 6 AK 5				
EF 97 Variable mu pentode R.F. or I.F. amplifier	V_f = 6.3 V I_f = 0.3 A	V_a = 12.6 V V_{g2} = 6.3 V V_{g3} = 0 V V_{g1} = —0.7 V1)	I_a = 3 I_{g2} = 1.1	S = 1.9 mA/V R_i = 150 kΩ C_{ag1} = 15 mpF	 Miniature
Frequency changer		V_a = 6.3 V V_{g2} = 3.2 V V_{g3} = 0 V V_{g1} = —0.7 V1)	I_a = 1 I_{g2} = 0.4	S = 1 mA/V R_i = 70 kΩ	

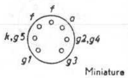
EF 97 (continued)		V_a = 12.6 V V_{g2} = 6.3 V R_{g3} = 0.1 MΩ V_{g1} = —0.7 V1)	I_a = 1.3 I_{g2} = 1.7	S_c = 0.55 mA/V R_i = 25 kΩ V_{osc} = 10 V_{eff}	
		V_a = 6.3 V V_{g2} = 3.2 V R_{g3} = 0.1 MΩ V_{g1} = —0.7 V1)	I_a = 0.45 I_{g2} = 0.6	S_c = 0.3 mA/V R_i = 30 kΩ V_{osc} = 5 V_{eff}	
EF 98 I.F. - A.F. amplifier and oscillator I.F. amplifier A.F. driver	V_f = 6.3 V I_f = 0.3 A	V_a = 12.6 V V_{g2} = 6.3 V V_{g3} = 0 V V_{g1} = 0.75 V1)	I_a = 2 I_{g2} = 0.7	S = 2 mA/V R_i = 0.2 MΩ μ_{g2g1} = 4.1 C_{ag1} = 15 mpF	
		V_a = 6.3 V V_{g2} = 3.2 V V_{g3} = 0 V V_{g1} = —0.8 V1)	I_a = 0.6 I_{g2} = 0.2	S = 1 mA/V R_i = 0.1 MΩ μ_{g2g1} = 3.2	 Miniature
		V_a = 12.6 V V_{g2} = 12.6 V V_{g3} = 12.6 V2) V_{g1} = —2.3 V1)	I_a = 2.1	R_a = 6 kΩ W_o = 11 mW	
		V_a = 6.3 V V_{g2} = 6.3 V V_{g3} = 6.3 V2) V_{g1} = —1.2 V1)	I_a = 1.1	R_a = 5.8 kΩ W_o = 1.2 mW	
EF 183 Variable mu pentode Typical characteristics	V_f = 6.3 V I_f = 0.3 A	V_a = 200 V V_{g2} = 90 V V_{g3} = 0 V V_{g1} = —2 V	I_a = 12 I_{g2} = 4.5	S = 12.5 mA/V R_i = 0.5 MΩ r_{g1}(40 Mc/s) = 13 kΩ	 Noval

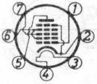
---

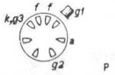
1) Nearly the same results can be obtained, when the neg. grid nr. 1 voltage is obtained by means of grid biasing with R_{g1} = 10 MΩ 2) Connection of g_3 to a is preferred

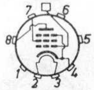
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
EF 184 Sharp cut-off pentode Typical characteristics	V_f = 6.3 V I_f = 0.3 A	V_a = 200 V V_{g2} = 200 V V_{g3} = 0 V V_{g1} = —2.5 V	I_a = 10 I_{g2} = 4.1	S = 15 mA/V R_i = 0.38 MΩ μ_{g2g1} = 60 r_{g1}(40 Mc/s) = 11 kΩ	
EF 731	See 5899				
EF 732	See 5840				
EFF 51	See U.H.F. tubes				
EFM 1 A.F. pentode and tuning indicator A.F. amplifier and tuning indicator	V_f = 6.3 V I_f = 0.2 A	V_b = V_l = 250 V R_a = 0.13 MΩ R_{g2} = 0.35 MΩ V_{g1} = —2/—20 V	I_a = 0.8/0.5 I_{g2} = 0.6/0.2 I_l = 0.65/0.8	g = 60/13 α = 70°/5°	
EFP 60 Secondary emission pentode R.F. or I.F. amplifier	V_f = 6.3 V I_f = 0.37 A	V_a = 250 V V_{g2} = 250 V V_{k2} = 150 V V_{g1} = —2 V V_{g3} = 0 V	I_a = 20 I_{g2} = 1.5 I_{k2} = —15.6	S = 25 mA/V R_i = 70 kΩ C_{ag1} < 4 mpF	

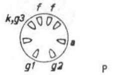
EH 90 Dual control heptode for television service	V_f = 6.3 V I_f = 0.3 A	V_a = 100 V V_{g2+4} = 30 V V_{g1} = 0 V V_{g3} = —1 V	I_a = 0.8 I_{g2+4} = 4	S_{g3} = 1.25 mA/V R_i = 0.7 MΩ
Operating characteristics		V_a = 100 V V_{g2+4} = 30 V V_{g1} = —1 V V_{g3} = 0 V	I_a = 0.75 I_{g2+4} = 1.1	S_{g1} = 0.95 mA/V R_i = 1 MΩ
		V_a = 10 V V_{g2+4} = 30 V V_{g1} = V_{g3} = 0 V	I_a = 1.2 I_{g2+4} = 4.1	
EL 2 Output pentode Class A final amplifier	V_f = 6.3 V I_f = 0.2 A	V_a = 250 V V_{g2} = 250 V R_k = 485 Ω	I_a = 32 I_{g2} = 5	S = 2.8 m/AV R_i = 70 kΩ R_a = 8 kΩ W_o = 3.6 W W_a = max. 8 W
EL 3 N Output pentode Class A final amplifier	V_f = 6.3 V I_f = 0.9 A	V_a = 250 V V_{g2} = 250 V R_k = 150 Ω	I_a = 36 I_{g2} = 4	S = 9 mA/V R_i = 50 kΩ R_a = 7 kΩ W_o = 4.5 W W_a = max. 9 W
EL 6 Output pentode Class A final amplifier	V_f = 6.3 V I_f = 1.35 A	V_a = 250 V V_{g2} = 250 V R_k = 90 Ω	I_a = 72 I_{g2} = 8	S = 14.5 mA/V R_i = 20 kΩ R_a = 3.5 kΩ W_o = 8 W W_a = max. 18 W
EL 33 Output pentode Class A final amplifier	V_f = 6.3 V I_f = 0.9 A	V_a = 250 V V_{g2} = 250 V R_k = 150 Ω	I_a = 36 I_{g2} = 4	S = 9 mA/V R_i = 50 kΩ R_a = 7 kΩ W_o = 4.5 W W_a = max. 9 W

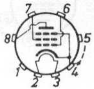


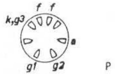


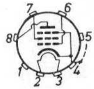


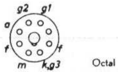


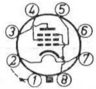


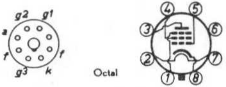
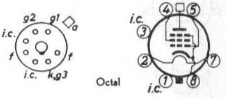
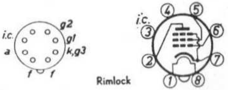
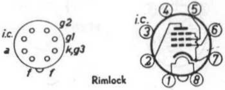










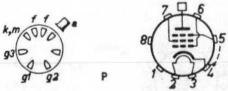
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
EL 34 Output pentode Class A final amplifier	V_f = 6.3 V I_f = 1.5 A	V_a = 250 V V_{g2} = 265 V V_{g1} = −13.5 V V_{g3} = 0 V	I_a = 100 I_{g2} = 15	S = 11 mA/V R_i = 15 kΩ R_a = 2 kΩ W_o = 11 W W_a = max. 25 W	
Class AB push-pull amplifier		V_b = 375 V R_{g2}1) = 470 Ω R_k2) = 130 Ω V_{g3} = 0 V	$I_{a\min}$ = 2 × 75 $I_{a\max}$ = 2 × 95 $I_{g2\min}$ = 2 × 11.5 $I_{g2\max}$ = 2 × 22.5	R_{aa} = 3.4 kΩ W_o = 35 W	
EL 36 Line-output pentode Typical characteristics	V_f = 6.3 V I_f = 1.27 A	V_a = 100 V V_{g2} = 100 V V_{g1} = −8.2 V	I_a = 100 I_{g2} = 7	S = 14 mA/V R_i = 5 kΩ μ_{g2g1} = 5.6	
Class B amplifier		V_a = 300 V V_{g2} = 150 V V_{g1} = −29 V	$I_{a\min}$ = 2 × 18 $I_{a\max}$ = 2 × 100 $I_{g2\min}$ = 2 × 0.5 $I_{g2\max}$ = 2 × 19	R_{aa} = 3.5 k W_o = 44.5 W W_a = max. 12 W	
EL 41 Output pentode Class A final amplifier	V_f = 6.3 V I_f = 0.71 A	V_a = 250 V V_{g2} = 250 V R_k = 170 Ω	I_a = 36 I_{g2} = 5.2	S = 10 mA/V R_i = 40 kΩ R_a = 7 kΩ W_o = 4.8 W W_a = max. 9 W	
EL 42 Output pentode Class A final amplifier	V_f = 6.3 V I_f = 0.2 A	V_a = 225 V V_{g2} = 225 V R_k = 360 Ω	I_a = 26 I_{g2} = 4.1	S = 3.2 mA/V R_i = 90 kΩ R_a = 9 kΩ W_o = 2.8 W W_a = max. 6 W	

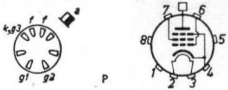
---

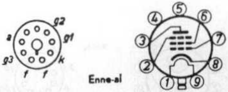
1) Common screen grid resistor; non decoupled

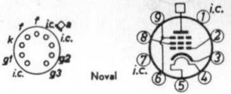
2) Common cathode bias resistor

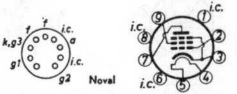
EL 50	V_f = 6.3 V	V_a = 800 V	I_a = 2×15	R_{aa} = 18 kΩ
Output pentode	I_f = 1.5 A	V_{g2} = 400 V	I_a = 2×70	W_o = 80 W
Class B		V_{g1} = −40 V	I_{g2} = 2× 1	W_a = max. 18 W
push-pull		V_{g3} = 0 V	I_{g2} = 2×24	
amplifier				
EL 51	V_f = 6.3 V	V_a = 750 V	I_a = 60	S = 8 mA/V
Output	I_f = 1.9 A	V_{g2} = 750 V	I_{g2} = 10	R_i = 50 kΩ
pentode		V_{g1} = −37.5 V		W_a = max. 45 W
Typical				
characteristics				
EL 60	= EL 34 with different base			
EL 81	V_f = 6.3 V	V_a = 250 V	I_a = 32	S = 4.6 mA/V
Line output	I_f = 1.05 A	V_{g2} = 250 V	I_{g2} = 2.4	W_a = max. 8 W
pentode		V_{g3} = 0 V		V_{ap} = max. 7 kV1)
Typical		V_{g1} = −38.5 V		
characteristics				
EL 82	V_f = 6.3 V	V_a = 170 V	I_a = 53	S = 9 mA/V
Frame and	I_f = 0.8 A	V_{g2} = 170 V	I_{g2} = 10	R_i = 20 kΩ
sound output		V_{g1} = −10.4 V		R_a = 3 kΩ
pentode				W_o = 4 W
Class A				W_a = max. 9 W
As sound				
output		V_a = 170 V	$I_{a\,min}$ = 2× 46	R_{aa} = 4 kΩ
Class A		V_{g2} = 170 V	$I_{a\,max}$ = 2× 50	W_o = 9 W
push-pull		R_k2) = 100 Ω	$I_{g2\,min}$ = 2×8.7	
(two tubes)			$I_{g2\,max}$ = 2× 17	





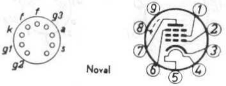
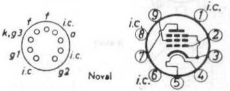
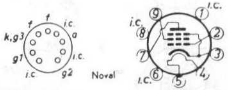






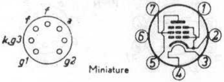
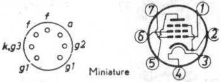
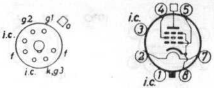
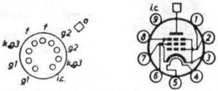
---

1) Max. pulse time 18% of one cycle with a max. of 18 μ sec. 2) Common cathode bias resistor

Type and Application	Filament data	Voltages Resistors	Currents (mA)	Characteristic data	Base connections
EL 83 Video amplifying pentode Typical characteristics	V_f = 6.3 V I_f = 0.71 A	V_a = 250 V V_{g2} = 250 V V_{g3} = 0 V V_{g1} = −5.5 V	I_a = 36 I_{g2} = 5.0	S = 10 mA/V R_i = 0.13 MΩ W_a = max. 9 W C_{g1} = 10.8 pF C_a = 6.6 pF	
EL 84 Output pentode Class A	V_f = 6.3 V I_f = 0.76 A	V_a = 250 V V_{g2} = 250 V V_{g1} = −7.3 V	I_a = 48 I_{g2} = 5.5	S = 11.3 mA/V R_i = 38 kΩ R_a = 5.2 kΩ W_o = 6 W W_a = max. 12 W	
Class B (two tubes)		V_a = 300 V V_{g2} = 300 V V_{g1} = −14.7 V	$I_{a\min}$ = 2×7.5 $I_{a\max}$ = 2×46 $I_{g2\min}$ = 2×0.8 $I_{g2\max}$ = 2× 11	R_{aa} = 8 kΩ W_o = 17 W	
Class AB (two tubes)		V_a = 250 V V_{g2} = 250 V R_k1) = 130 Ω	$I_{a\min}$ = 2× 31 $I_{a\max}$ = 2×37.5 $I_{g2\min}$ = 2× 3.5 $I_{g2\max}$ = 2× 7.5	R_{aa} = 8 kΩ W_o = 11 W	
EL 86 Output pentode class A	V_f = 6.3 V I_f = 0.76 A	V_a = 170 V V_{g2} = 170 V V_{g1} = −12.5 V	I_a = 70 I_{g2} = 3.5	S = 11 mA/V R_i = 26 kΩ R_a = 2.4 kΩ W_o = 5.6 W W_a = max. 12 W	
EL 90	See 6 AQ 5				

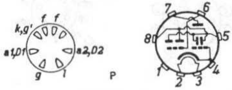
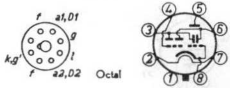
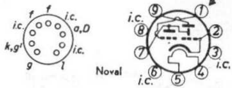
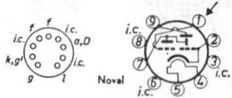
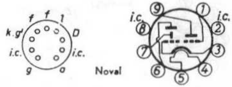
---

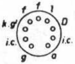
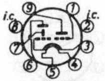
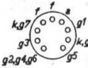
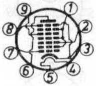
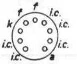
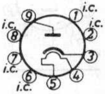
1) Common cathode bias resistor

EL 91 Output pentode Class A final amplifier	V_f = 6.3 V I_f = 0.2 A	V_a = 250 V V_{g2} = 250 V R_k = 740 Ω	I_a = 16 I_{g2} = 2.4	S = 2.6 mA/V R_i = 130 kΩ R_a = 16 kΩ W_o = 1.4 W W_a = max. 4 W	 Miniature
EL 95 Output pentode Class A Class A.B. (two tubes)	V_f = 6.3 V I_f = 0.2 A	V_a = 250 V V_{g2} = 250 V R_k = 320 Ω	I_a = 24 I_{g2} = 4.5	S = 5 mA/V R_i = 80 kΩ R_a = 10 kΩ W_o = 3 W W_a = max. 6 W	 Miniature
		V_a = 250 V V_{g2} = 250 V R_k1) = 180 Ω	$I_{a\,min}$ = 2 × 22 $I_{a\,max}$ = 2 × 26 $I_{g2\,min}$ = 2 × 4 $I_{g2\,max}$ = 2 × 7.5	R_{aa} = 10 kΩ W_o = 7 W	
EL 360 Output pentode Typical charact.	V_f = 6.3 V I_f = 1.27 A	V_a = 250 V V_{g2} = 250 V V_{g1} = −46 V	I_a = 48 I_{g2} = 5.5	S = 6.9 mA/V R_i = 13.5 kΩ μ_{g2g1} = 5	 Octal
EL 500 Beam-power pentode Typical dynamical charact.	V_f = 6.3 V I_f = 1.38 A	V_a = 75 V V_{g2} = 200 V V_{g1} = −10 V	$I_{a\,p}$ = 440 I_{g2p} = 30		 Magnoval

---

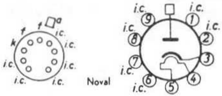
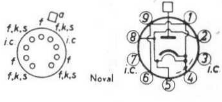
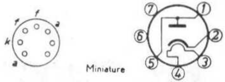
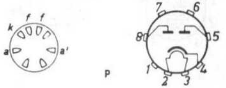
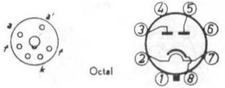
1) Common cathode bias resistor

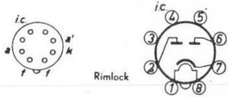
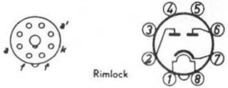
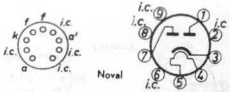
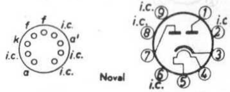
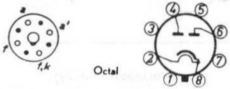
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
EM 4/EM 34 **Tuning indicators** **(sensitive system)** **(insensitive system)**	V_f = 6.3 V I_f = 0.2 A	$V_b = V_l$ = 250 V R_{a1} = 1 MΩ V_g = 0/−5 V	I_l = 2.0/2.5	α_1 = 90°/5°	
		$V_b = V_l$ = 250 V R_{a2} = 1 MΩ V_g = 0/−16 V	I_l = 2.0/2.7	α_2 = 90°/5°	
EM 80 **Tuning indicator**	V_f = 6.3 V I_f = 0.3 A	$V_b = V_l$ = 250 V R_a = 0.5 MΩ V_g = −1/−14 V R_g = 3 MΩ	I_a = 0.4/0.01 I_l = 2/2.3	β = 5°/50°	
EM 81 **Tuning indicator**	V_f = 6.3 V I_f = 0.3 A	$V_b = V_l$ = 250 V R_a = 0.5 MΩ R_g = 3 MΩ V_{g1} = −1/−10.5 V	I_a = 0.37/0.02 I_l = 2/2.3	α = 65°/5°	
EM 84 **Tuning indicator**	V_f = 6.3 V I_f = 0.21 A	$V_b = V_l$ = 250 V $R_{a,D}$ = 470 kΩ R_g = 3 MΩ V_{bg} = 0/−22 V	I_{a+D} = 0.45/0.06 I_l = 1/1.8	α = 21/0 mm	

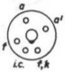
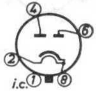
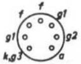
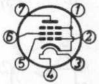
EM 87 Tuning indicator	V_f = 6.3 V I_f = 0.3 A	V_b = V_l = 250 V R_{a+D} = 100 kΩ R_g = 3 MΩ V_{bg} = 0/—15 V	I_{a+D} = 2/0.2 I_l = 1/2	α = 21/—1.5mm	 Noval 
EQ 80 Enneode F.M. detector A.F. amplifier	V_f = 6.3 V I_f = 0.2 A	V_b = 250 V R_a = 0.47 MΩ R_1 = 34 kΩ R_3 = 3.9 kΩ R_4 = 560 Ω	I_a = 0.28 I_{g2} = 1.5 I_{g3} = 0.09 I_{g5} = 0.03	R_t = 5 MΩ	 Noval 
		V_b = 250 V R_a = 0.47 MΩ $R_{g2+g3+g4}$ = 0.27 MΩ R_k = 2.2 kΩ	I_a = 0.4 $I_{g2+g3+g4}$ = 0.7	g = 150	
ET51	See decade selector tubes				
EY 51 E.H.T. rectifying tube Rectifier 50 c/s Rectifier 10-500 kc/s Pulse rectifier	V_f = 6.3 V I_f = 90 mA	V_{tr} = max. 5 kV $V_{a\,invp}$ = max. 17 kV $V_{a\,invp}$ = max. 17 kV	I_o = max. 3 I_o = max. 3 I_o = max. 0.35 I_{ap} = max. 80[1]	C_{filt} = max. 0.1 μF R_t = min. 0.1 MΩ C_{filt} = max. 0.01 μf R_t = min. 0.1 MΩ C_{filt} = max. 5000pF	EY51 
EY 81	V_f = 6.3 V I_f = 0.81 A	See PY 81 (except for heater rating)			
EY 82 Half-wave rectifying tube (Two tubes in a full-wave circuit)	V_f = 6.3 V I_f = 0.9 A	V_{tr} = 2 × 300 V V_{tr} = 2 × 250 V	I_o = 360 I_o = 360	R_t = 2 × 110 Ω R_t = 2 × 75 Ω C_{filt} = 60 μF	 Noval 

---

[1] Max. pulse time 1% of one cycle with a maximum of 5 μsec

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
EY 84 Half-wave rectifying tube (Two tubes in a full-wave circuit)	V_f = 6.3 V I_f = 1 A	V_{tr} = 2 × 625 V V_{tr} = 2 × 500 V	I_o = 250 I_o = 300	R_t = 2 × 250 Ω R_t = 2 × 150 Ω C_{filt} (f = 50 c/s) = 16 μF C_{filt} (f = 1600 c/s) = 0.5 μF	
EY 86	See EY 87				
EY 87 Half-wave rectifying tube for T.V. receivers	V_f = 6.3 V I_f = 90 mA	V_o = 18 kV	I_o = 0.15 I_o = max. 0.5	R_t (I_o = 1 mA) = 20 kΩ C_a = 1.55 pF	
EY 88	V_f = 6.3 V I_f = 1.55 A	See **PY 88** (except for heater rating)			
EY 91 Half-wave rectifying tube Rectifier	V_f = 6.3 V I_f = 0.42 A	V_{tr} = 250 V V_{tr} = 200 V	I_o = max. 75 I_o = max. 75	R_t = min. 100 Ω R_t = min. 70 Ω C_{filt} = 32 μF V_{kf} = max. 300 V	
EZ 2 Full-wave rectifying tube Rectifier	V_f = 6.3 V I_f = 0.4 A	V_{tr} = 2 × 350 V	I_o = max. 60	R_t = min. 2 × 500 Ω C_{filt} = max. 16 μF V_{kfp} = max. 500 V	
EZ 35 Full-wave rectifying tube Rectifier	V_f = 6.3 V I_f = 0.6 A	V_{tr} = 2 × 325 V	I_a = max. 70	R_t = min. 2 × 350 Ω C_{filt} = max. 16 μF V_{kfp} = max. 350 V	

EZ 40 Full-wave rectifying tube Rectifier	V_f = 6.3 V I_f = 0.6 A	V_{tr} = 2×250 V = 2×350 V	I_o = max. 90 = max. 90	R_t = min. 2×125 Ω = min. 2×300 Ω C_{filt} = max. 50 μF V_{kfp} = max. 500 F	
EZ 41 Full-wave rectifying tube Rectifier	V_f = 6.3 V I_f = 0.4 A	V_{tr} = 2×250 V	I_o = max. 60	R_t = min. 2×300 Ω C_{filt} = max. 32 μF V_{kfp} = max. 350 V	
EZ 80 Full-wave rectifying tube Rectifier	V_f = 6.3 V I_f = 0.6 A	V_{tr} = 2×350 V = 2×250 V	I_o = max. 90 = max. 90	R_t = min. 2×300 Ω = min. 2×125 Ω C_{filt} = max. 50 μF V_{kfp} = max. 500 V	
EZ 81 Full-wave rectifying tube Rectifier	V_f = 6.3 V I_f = 1 A	V_{tr} = 2×350 V V_{tr} = 2×250 V	I_o = 150 I_o = 160	$R_{t\,\text{min}}$ = 2×230 Ω $R_{t\,\text{min}}$ = 2×150 Ω C_{filt} = 50 μF	
EZ 90	See 6 X 4				
GZ 32 Full-wave rectifying tube Rectifier	V_f = 5 V I_f = 2 A	V_{tr} = 2×500 V = 2×350 V = 2×300 V	I_a = max. 125 = max. 250 = max. 300	C_{filt} = max. 32 μF R_t = min. 2×100 Ω	

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
GZ 34 Full-wave rectifying tube Rectifier	V_f = 5 V I_f = 1.9 A	V_{tr} = 2×550 V = 2×500 V = 2×400 V = 2×300 V V_{invp} = max. 1500 V	I_o = max. 160 = max. 200 = max. 250 = max. 250 I_{ap} = max. 750	R_t = min. 2×200 Ω = min. 2×175 Ω = min. 2×125 Ω = min. 2× 75 Ω C_{filt} = max. 60 μF	 Octal 
HCH 81 Triode-heptode	V_f = 12.6 V I_f = 0.15 A	See UCH 81 (except for heater rating)			
HL 94 Output pentode Class A final amplifier	V_f = 30 V I_f = 0.15 A	V_a = 100 V V_{g2} = 100 V V_{g1} = −6.7 V	I_a = 43 I_{g2} = 3	S = 9.2 mA/V R_i = 22 kΩ R_a = 2.4 kΩ W_o = 1.9 W W_a = max. 7.5 W	 Miniature 
JP9-7A **JP9-7D** **JP9-15** **JPT9-01**	See magnetrons				
K 50 A **K 51 A** **K 81 A**	See noise diodes				
MAW 12/15	See transmitting tubes				
MC 6-16 **MC 13-16** **MK 13-16**	See T.V. studio tubes				
MF	See radar tubes				
MW	See cathode ray tubes and T.V. studio tubes				

OA
OAP
OAZ
OC
OCP
See semi-conductors

OA 2
OA 2 WA
OB 2
OB 2 WA
See voltage stabilizers

ORP See photoconductive cells

PA
PB
PE
See transmitting tubes

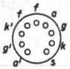
PABC 80 V_f = 9.5 V See UABC 80 (except for heater rating)
I_f = 0.3 A

PC 86 V_f = 3.8 V See EC 86 (except for heater rating)
I_f = 0.3 A

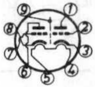
PC 88 V_f = 4 V See EC 88 (except for heater rating)
I_f = 0.3 A

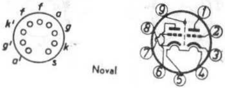
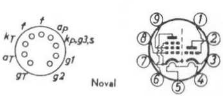
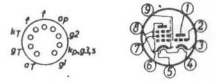
PCC 84 V_f = 7 V See ECC 84 (except for heater rating)
I_f = 0.3 A

PCC 85	V_f = 9 V	V_a = 200 V	I_a = 10	S = 5.8 mA/V
Double triode	I_f = 0.3 A	V_g = −2.1 V		R_i = 8.3 kΩ
Typical				
characteristics		V_a = 100 V	I_a = 4.5	S = 4.6 mA/V
(each section)		V_g = −1.1 V		R_i = 11 kΩ



Noval



Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
PCC 88	V_f = 7 V	V_a = 90 V	I_a = 15	S = 12.5 mA/V	
Double triode	I_f = 0.3 A	V_g = −1.3 V		μ = 33	
Typical				R_{eq} = ≈ 300 Ω	
characteristics					
(each section)					
PCC 189	V_f = 7.2 V	See ECC 189 (except for heater rating)			
	I_f = 0.3 A				
PCF 80	V_f = 9 V	See ECF 80 (except for heater rating)			
	I_f = 0.3 A				
PCF 86	V_f = 8 V	See ECF 86 (except for heater rating)			
	I_f = 0.3 A				
PCL 82	V_f = 16 V	See UCL 82 (except for heater rating)			
	I_f = 0.3 A				
PCL 84	V_f = 15 V	V_a = 200 V	I_a = 18	S = 10.4 mA/V	
Triode	I_f = 0.3 A	V_{g2} = 200 V	I_{g2} = 3	R_i = > 130 kΩ	
pentode		V_{g1} = −2.9 V		μ_{g2g1} = 36	
Typical				W_a = max. 4 W	
characteristics					
(pentode		V_a = 200 V	I_a = 3	S = 4 mA/V	
section)		V_g = −1.7 V		μ = 65	
triode section				W_a = max. 1 W	
PCL 85	V_f = 16.4 V	V_a = 50 V	I_{ap} = 200	W_a = max. 7 W	
Triode pentode	I_f = 0.3A	V_{g2} = 170 V	I_{g2p} = 35	W_{g2} = max. 1,5 W	
Typical charact.		V_{g1} = −1 V			
pentode section					
triode section		V_a = 100 V	I_a = 10	S = 5.5 mA/V	
		V_g = 0 V		μ = 50	Noval

PCL 86
Triode-
outp. pentode
Class A
final amplifier
Pentode
section
Typical
charact.
Triode section

V_f = 14.5 V
I_f = 0.3 A

V_a = 230 V
V_{g2} = 230 V
R_k = 125 Ω

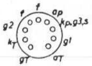
I_a = 39
I_{g2} = 6.5

S = 10.5 mA/V
R_i = 45 kΩ
R_a = 5.6 kΩ
W_o = 3.8 W
W_a = max. 9 W

V_a = 230 V
V_g = 1.7 V

I_a = 1.2

S = 1.6 mA/V
μ = 100
W_a = max. 0.5 W



Noval

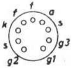
PF 86
Pentode
Typical
characteristics

V_f = 4.5 V
I_f = 0.3 A

V_a = 250 V
V_{g2} = 100 V
V_{g3} = 0 V
V_{g1} = −1.5 V

I_a = 2
I_{g2} = 0.4

S = 1.75 mA/V
R_i = 3 MΩ
μ_{g2g1} = 38



Noval

PL 2 D 21
PL 3 C 23
See thyratrons

PL 5
See relay tube

PL 10
See thyratrons

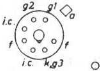
PL 36
Line output
pentode
Typical
characteristics

V_f = 25 V
I_f = 0.3 A

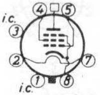
V_a = 100 V
V_{g2} = 100 V
V_{g1} = −8.2 V

I_a = 100
I_{g2} = 7

S = 14 mA/V
R_i = 5 kΩ
W_a = max. 10 W



Octal



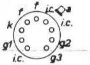
PL 81
Line output
pentode
Typical
characteristics

V_f = 21.5 V
I_f = 0.3 A

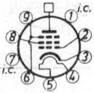
V_a = 170 V
V_{g3} = 0 V
V_{g2} = 170 V
V_{g1} = −22 V

I_a = 45
I_{g2} = 3.0

S = 6.2 mA/V
R_i = 10 kΩ
W_a = max. 8 W
V_{ap}[1] = max. 7 kV

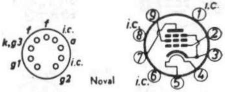
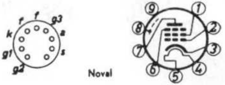
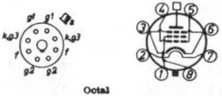


Noval



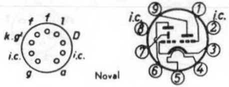
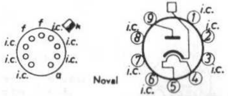
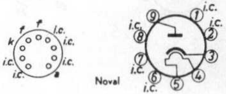
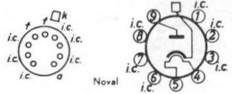
---

[1] Max. pulse time 18% of one cycle with a maximum of 18 μsec.

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
PL 82 Frame and sound output pentode Typical characteristics	V_f = 16.5 V I_f = 0.3 A	V_a = 170 V V_{g2} = 170 V V_{g1} = -10.4	I_a = 53 I_{g2} = 10	S = 9.0 mA/V R_i = 20 kΩ W_a = max. 9 W V_{ap}1)= max. 2.5 kV	
PL 83 Video amplifying pentode Typical characteristics	V_f = 15 V I_f = 0.3 A	V_a = 200 V V_{g3} = 0 V V_{g2} = 200 V V_{g1} = -3.5 V	I_a = 36 I_{g2} = 5	S = 10.5 mA/V R_i = 0.1 MΩ W_a = max. 9 W C_{g1} = 10.8 pF C_a = 6.6 pF C_{ag1} $<$ 0.1 pF	
PL 84	V_f = 15 V I_f = 0.3 A	See UL 84 (except for heater rating)			
PL 136 Line output pentode Typical charact.	V_f = 35 V I_f = 0.3 A	V_a = 100 V V_{g2} = 100 V V_{g1} = -8 V	I_a = 150 I_{g2} = 6	S = 20 mA/V μ_{g2g1} = 5 W_a = max. 16 W	
PL 105 **PL 106** **PL 150** **PL 255** **PL 260**	See thyratrons				
PL 500	V_f = 27 V I_f = 0.3 A	See EL 500 (except for heater rating)			
PL 1267	= Z 300 T, see trigger tubes				

---

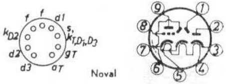
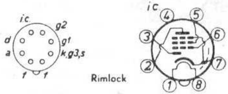
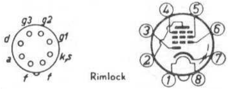
1) Max. pulse time 10% of one cycle with a maximum of 2000 μsec.

PL 1607 **to PL 6755**	See thyratrons				
PL 5551 A **to PL 5822 A**	See ignitrons				
PM 84 Tuning indicator	V_f = 4.2 V I_f = 0.3 A	V_b = V_l = 170 V $R_{a,D}$ = 470 kΩ R_g = 3 MΩ V_{bg} = 0/−15 V	I_{a+D} = 0.3/0.04 I_l = 0.6/1.05	α = 20/0 mm	
PY 81 Booster diode Booster	V_f = 17 V I_f = 0.3 A	V_{akp} = max. 5 kV1)2) (k_{pos})	I_a = max. 150 I_{ap} = max. 450	V_{kfp} = max. 5 kV1)2) C_a = 6.4 µF W_a = max. 3.5 W	
PY 82 Half-wave rectifying tube Rectifier	V_f = 19 V I_f = 0.3 A	V_{tr} = 220 V V_{tr} = 127 V	I_o = max. 180 I_o = max. 180	R_t = 65 Ω R_t = 0 Ω V_{ainvp} = max. 700 V V_{kfp} = max. 550 V3) C_{filt} = 60 µF	
PY 88 Booster diode Booster	V_f = 30 V I_f = 0.3 A	V_{akp} = max. 6 kV (k_{pos})	I_a = max. 220 1)2) I_{ap} = max. 550	V_{kfp} = max. 6.6 kV1)2) C_a = 8.6 pF W_a = max. 5 W	
QB **QE** **QEL** **QQC** **QQE** **TA** **TB**	See transmitting tubes				

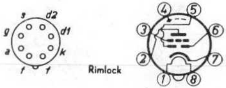
---

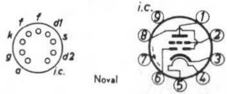
1) Max. pulse time 22% of a cycle with a max. of 18 µsec. 2) Design centre values

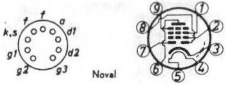
3) Max. 220 V (rms) A.C. + 250 V D.C. Cathode positive with respect to heater.

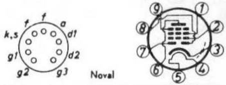
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
TH	See thermocouples				
UABC 80 Triple diode high mu triode Typical characteristics (diode section)	V_f = 28 V I_f = 0.1 A	V_{d1invp} = max. 350 V V_{d2invp} = max. 350 V V_{d3invp} = max. 350 V	I_{d1} = max. 1 I_{d1p} = max. 6 I_{d2} = max. 10 I_{d2p} = max. 75 I_{d3} = max. 10 I_{d3p} = max. 75	R_{id1} = 5 kΩ (V_{d1} = 10 V) R_{id2} = 200 Ω (V_{d2} = 5 V) R_{id3} = 200 Ω (V_{d3} = 5 V)	
(triode section)		V_a = 170 V V_g = −1.85 V	I_a = 1	S = 1.45 mA/V R_i = 48 kΩ μ = 70	
UAF 41 Diode variable mu pentode R.F. or I.F. amplifier	V_f = 12.6 V I_f = 0.1 A	V_a = V_b = 170 V R_{g2} = 44 kΩ V_{g1} = −2 V	I_a = 5 I_{g2} = 1.6	S = 1.8 mA/V R_i = 1.2 MΩ C_{ag1} < 2 mpF	
UAF 42 Diode variable mu pentode R.F. or I.F. amplifier	V_f = 12.6 V I_f = 0.1 A	V_a = V_b = 170 V R_{g2} = 56 kΩ V_{g1} = −2.0 V V_{g3} = 0 V	I_a = 5.0 I_{g2} = 1.5	S = 2.0 mA/V R_i = 0.9 MΩ C_{ag1} < 2 mpF	
UB 41	V_f = 19 V I_f = 0.1 A	See EB 41 (except for heater rating)			

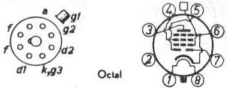
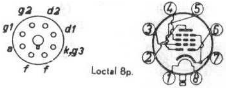
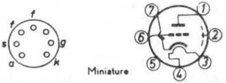
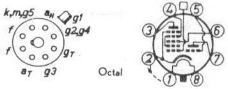
UBC 41 Double diode high mu triode Typical characteristics	V_f = 14 V I_f = 0.1 A	V_a = 170 V V_g = −1.55 V	I_a = 1.5	S = 1.65 mA/V R_i = 42 kΩ μ = 70
UBC 81 Double diode high mu triode Typical characteristics	V_f = 14 V I_f = 0.1 A	V_a = 170 V V_g = −1.55 V	I_a = 1.5	S = 1.65 mA/V R_i = 42 kΩ μ = 70
A.F. amplifier		V_b = 170 V R_a = 0.1 MΩ R_k = 3.9 kΩ	I_a = 0.45	g = 37
UBF 80 Double diode variable mu pentode R.F. or I.F. amplifier	V_f = 17 V I_f = 0.1 A	V_a = V_b = 170 V R_{g2} = 47 kΩ R_k = 295 Ω V_{g3} = 0 V	I_a = 5.0 I_{g2} = 1.75	S = 2.2 mA/V R_i = 0.9 MΩ C_{ag1} < 2.5 mpF
A.F. amplifier		V_b = 170 V R_a = 0.22 MΩ R_{g2} = 0.68 MΩ R_k = 2.7 kΩ V_{g3} = 0 V	I_a = 0.56 I_{g2} = 0.20	g = 85
UBF 89 Double diode variable mu pentode Typical characteristics	V_f = 19 V I_f = 0.1 A	V_a = 200 V V_{g2} = 100 V V_{g3} = 0 V V_{g1} = 1.5 V	I_a = 11 I_{g2} = 3.3	S = 4.5 mA/V R_i = 0.6 MΩ μ_{g2g1} = 20 C_{ag1} < 2.5 mpF



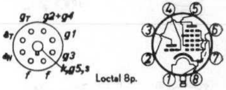


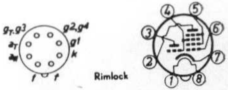


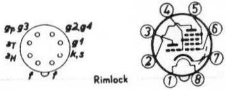


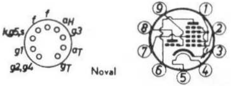
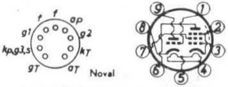
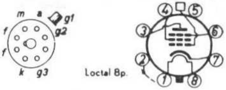
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
UBL 1 Double diode output pentode Class A final amplifier	V_f = 55 V I_f = 0.1 A	V_a = 185 V V_{g2} = 185 V R_k = 140 Ω	I_a = 59 I_{g2} = 11.3	S = 8.8 mA/V R_i = 23 kΩ R_a = 3 kΩ W_o = 5 W W_a = max. 11 W	
UBL 21 Double diode output pentode Class A final amplifier	V_f = 55 V I_f = 0.1 A	V_a = 180 V V_{g2} = 180 V R_k = 140 Ω	I_a = 61 I_{g2} = 10	S = 9 mA/V R_i = 22 kΩ R_a = 3 kΩ W_o = 4.8 W W_a = max. 11 W	
UC 92 R.F. triode Typical characteristics	V_f = 9.5 V I_f = 0.1 A	V_a = 100 V V_g = −1 V	I_a = 3	S = 3.75 mA/V R_i = 16.5 kΩ freq. = max. 300 Mc/s	
		V_a = 170 V V_g = −1 V	I_a = 8.5	S = 5.9 mA/V R_i = 11 kΩ	
UCC 85	V_f = 26 V I_f = 0.1 A	See PCC 85 (except for heater rating)			
UCH 4 Triode heptode Frequency changer (heptode section)	V_f = 20 V I_f = 0.1 A	V_a = V_b = 200 V R_{g2+g4} = 15.5 kΩ R_{g3+gT} = 50 kΩ V_{g1} = −2 V	I_a = 3.0 I_{g2+g4} = 6.5 I_{g3+gT} = 0.19	S_c = 0.75 mA/V R_i = 1.3 M	
Oscillator (triode section)		V_b = 200 V R_a = 20 kΩ R_{g3+gT} = 50 kΩ	I_a = 4.1 I_{g3gT} = 0.19	S_{eff} = 0.45 mA/V V_{osc} = 7.5 V_{eff}	

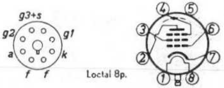
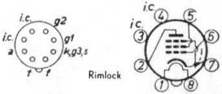
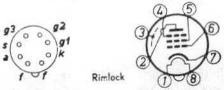
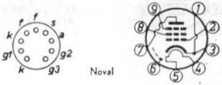
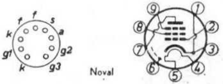
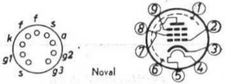
UCH 21 Triode heptode Frequency changer (heptode section)	V_f = 20 V I_f = 0.1 A	V_a = 200 V R_{g2+g4} = 15.5 kΩ R_{g3+gT} = 50 kΩ V_{g1} = −2 V	I_a = 3.5 I_{g2+g4} = 6.5 I_{g3+gT} = 0.19	S_c = 0.75 mA/V R_i = 1.0 MΩ
Oscillator (triode section)		V_b = 200 V R_a = 20 kΩ R_{g3+gT} = 50 kΩ	I_a = 4.1 I_{g3+gT} = 0.19	S_{eff} = 0.45 mA/V V_{osc} = 7.5 V_{eff}
UCH 41 Triode hexode Frequency changer (hexode section)	V_f = 14 V I_f = 0.1 A	V_a = V_b = 170 V R_1 = 22 kΩ R_2 = 47 kΩ R_{g3+gT} = 20 kΩ V_{g1} = −1.8 V	I_a = 2.2 I_{g2+g4} = 1.9 I_{g3+gT} = 0.32	S_c = 0.45 mA/V R_i = 1.2 MΩ
Oscillator (triode section)		V_b = 170 V R_a = 10 kΩ R_{g3+gT} = 20 kΩ	I_a = 4.9 I_{g3+gT} = 0.32	S_{eff} = 0.6 mA/V V_{osc} = 7 V_{eff}
UCH 42 Triode hexode Frequency changer (hexode section)	V_f = 14 V I_f = 0.1 A	V_a = V_b = 170 V R_1 = 18 kΩ R_2 = 27 kΩ R_{g3+gT} = 47 kΩ V_{g1} = −1.85 V	I_a = 2.1 I_{g2+g4} = 2.6 I_{g3+gT} = 0.20	S_c = 0.67 mA/V R_i = 1.0 MΩ
Oscillator (triode section)		V_b = 170 V R_a = 10 kΩ R_{g3+gT} = 47 kΩ V_{osc} = 8 V	I_a = 5.7 I_{g3+gT} = 0.20	S_{eff} = 0.65 mA/V

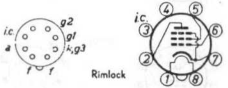
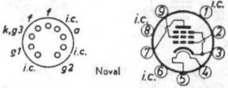
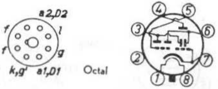
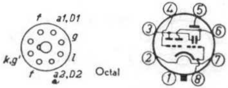


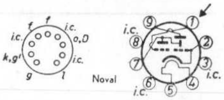
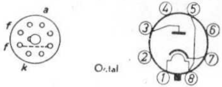
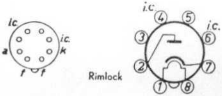
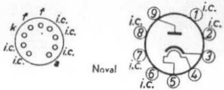
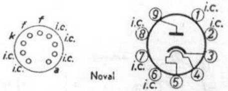
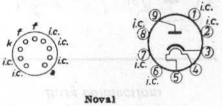


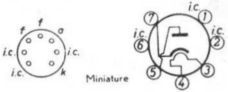


Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
UCH 81 Triode heptode Frequency changer	V_f = 19 V I_f = 0.1 A	V_a = V_b = 170 V R_{g2+g4} = 10 kΩ R_{g3+gT} = 47 kΩ V_{g1} = −2.2 V	I_a = 3.2 I_{g2+g4} = 6.8 I_{g3+gT} = 0.2	S_c = 0.75 mA/V R_i = 0.9 MΩ R_{eq} = 70 kΩ	
R.F. or I.F. amplifier (heptode section)		V_a = V_b = 170 V R_{g2+g4} = 18 kΩ V_g = −2.2 V V_{g3} = 0 V	I_a = 6.2 I_{g2+g4} = 3.8	S = 2.3 mA/V R_i = 0.6 MΩ R_{eq} = 8.8 kΩ	
Typical characteristics (triode section)		V_a = 100 V V_g = 0 V	I_a = 13.5	S = 3.7 mA/V R_i = 6 kΩ	
Oscillator (triode-section)		V_b = 170 V R_a = 15 kΩ R_{g3+gT} = 47 kΩ	I_a = 4.5 I_{g3+gT} = 0.2	S_{eff} = 0.65 mA/V	
UCL 82 Triode output-pent. Class A final amplifier (pent. section)	V_f = 50 V I_f = 0.1 A	V_a = 170 V V_{g2} = 170 V V_{g1} = −11.5 V	I_a = 41 I_{g2} = 9	S = 7.5 mA/V R_i = 16 kΩ R_a = 3.9 kΩ W_o = 3.3 W W_a = max. 7 W	
Typ. charact. (triode section)		V_a = 100 V V_g = 0 V	I_a = 3.5	S = 2.2 mA/V μ = 70	
UF 9 Variable mu pentode R.F. or I.F. amplifier	V_f = 12.6 V I_f = 0.1 A	V_a = V_b = 200 V R_{g2} = 60 kΩ V_{g1} = −2.5 V V_{g3} = 0 V	I_a = 6 I_{g2} = 1.7	S = 2.2 mA/V R_i = 1.2 MΩ C_{ag1} < 2 mpF	

UF 21 Variable mu pentode R.F. or I.F. amplifier	V_f = 12.6 V I_f = 0.1 A	$V_a = V_b$ = 200 V R_{g2} = 60 kΩ V_{g1} = −2.5 V V_{g3} = 0 V	I_a = 6 I_{g2} = 1.7	S = 2.2 mA/V R_i = 1.0 MΩ C_{ag1} < 2 mpF	
UF 41 Variable mu pentode R.F. or I.F. amplifier	V_f = 12.6 V I_f = 0.1 A	V_a = 170 V R_{g2} = 40 kΩ V_{g1} = −2.5 V	I_a = 6 I_{g2} = 1.75	S = 2.2 mA/V R_i = 1.0 MΩ C_{ag1} < 2 mpF	
UF 42 R.F. pentode Typical characteristics	V_f = 21 I_f = 0.1 A	V_a = 170 V V_{g2} = 170 V V_{g1} = −2 V V_{g3} = 0 V	I_a = 10 I_{g2} = 2.8	S = 8 mA/V R_i = 0.3 MΩ R_{eq} = 1060 Ω C_{ag1} < 6 mpF	
UF 80 R.F. pentode R.F. or I.F. amplifier	V_f = 19 V I_f = 0.1 A	V_a = 170 V V_{g3} = 0 V V_{g2} = 170 V V_{g1} = −2 V	I_a = 10 I_{g2} = 2.5	S = 7.4 mA/V R_i = 0.4 MΩ R_{eq} = 1 kΩ C_{ag1} < 7 mpF	
UF 85 R.F variable mu pentode R.F. or I.F. amplifier	V_f = 19 V I_f = 0.1 A	$V_a = V_b$ = 170 V R_{g2} = 27 kΩ V_{g1} = −2 V V_{g3} = 0 V	I_a = 9.7 I_{g2} = 2.6	S = 5.9 mA/V R_i = 0.3 MΩ R_{eq} = 1.4 kΩ C_{ag1} < 7 mpF	
UF 89 Variable mu pentode R.F. or I.F. amplifier	V_f = 12.6 V I_f = 0.1 A	V_a = 170 V V_{g2} = 100 V V_{g3} = 0 V V_{g1} = −1.2 V	I_a = 12 I_{g2} = 4.4	S = 4.4 mA/V R_i = 0.4 MΩ C_{ag1} < 2 mpF	

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
UL 41 Output pentode Class A final amplifier	V_f = 45 V I_f = 0.1 A	V_a = 170 V V_{g2} = 170 V V_{g1} = −10.4 V	I_a = 53 I_{g2} = 10	S = 9.5 mA/V R_i = 20 kΩ R_a = 3 kΩ W_o = 4 W W_a = max. 9 W	
UL 84 Output pentode Class A final amplifier	V_f = 45 V I_f = 0.1 A	V_a = 170 V V_{g2} = 170 V V_{g1} = −12.5 V	I_a = 70 I_{g2} = 3.5	S = 11 mA/V R_i = 26 kΩ R_a = 2.4 kΩ W_o = 5.6 W W_a = max. 12 W	
Class B (two tubes)		V_a = 170 V V_{g2} = 170 V V_{g1} = −20.5 V	$I_{a\,min}$ = 2 × 15 $I_{a\,max}$ = 2 × 57.5 $I_{g2\,min}$ = 2 × 0.7 $I_{g2\,max}$ = 2 × 20.5	R_{aa} = 3.5 kΩ W_o = 13.5 W	
UM 4/UM 34 Tuning indicators (sensitive system) (insensitive system)	V_f = 12.6 V I_f = 0.1 A	V_b = V_l = 200 V R_{a1} = 1.0 MΩ V_g = 0/−4.2 V	I_l = 1.4/1.8	α_1 = 90°/5°	
		V_b = V_l = 200 V R_{a2} = 1.0 MΩ V_g = 0/−12.5 V	I_l = 1.4/2.0	α_2 = 90°/5°	

UM 80	V_f = 19 V	V_b = V_l = 170 V	I_a = 03/0.01	β = 5°/50°	
Tuning	I_f = 0.1 A	R_a = 0.5 MΩ			
indicator		R_g = 3 MΩ			
		V_g = −1/−12 V			
UM 84	V_f = 12 V	See PM 84 (except for heater rating)			
	I_f = 0.1 A				
UY 1 N	V_f = 50 V	V_{tr} = 250 V	I_o = max. 140	R_t = min. 175 Ω	
Half-wave	I_f = 0.1 A	V_{tr} = 127 V	I_o = max. 140	R_t = 0 Ω	
rectifying tube				C_{filt} = max. 60 μF	
Rectifier					
UY 41	V_f = 31 V	V_{tr} = max. 250 V	I_o = max. 100	R_t = min. 210 Ω	
UY 42	I_f = 0.1 A	V_{tr} = max. 220 V	= max. 100	= min. 160 Ω	
Half-wave		V_{tr} = max. 127 V	= max. 100	= 0 Ω	
rectifying		V_{tr} = max. 110 V	= max. 100	= 0 Ω	
tubes			I_{ap} = max. 600	C_{filt} = max. 50 μF	
Rectifier					
UY 82	V_f = 55 V	V_{tr} = 250 V	I_o = max. 180	R_o = min. 100 Ω	
Half-wave	I_f = 0.1 A	V_{tr} = 220 V	= max. 180	= min. 40 Ω	
rectifier		V_{tr} = 127 V	= max. 180	= 0 Ω	
				C_{filt} = 60 μF	
UY 85	V_f = 38 V	V_{tr} = 250 V	I_o = max. 110	R_t = min. 100 Ω	
Half-wave	I_f = 0.1 A	= 220 V	= max. 110	= min. 90 Ω	
rectifier		= 127 V	= max. 110	= 0 Ω	
		= 110 V	= max. 110	= 0 Ω	
			I_{op} = max. 660	C_{filt} = 100 μF	
UY 89	V_f = 31 V	V_{tr} = 250 V	I_o = max. 100	R_t = min. 210 Ω	
Half-wave	I_f = 0.1 A	= 220 V	= max. 100	= min. 160 Ω	
rectifier		= 127 V	= max. 100	= 0 Ω	
		= 110 V	= max. 100	= 0 Ω	
			I_{ap} = max. 600	C_{filt} = 50 μF	

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
UY 92 Half-wave rectifier	V_f = 26 V I_f = 0.1 A	V_{tr} = 127 V V_{tr} = 110 V	I_o = max. 70	R_t = 0 Ω C_{filt} = 100 μF	
XCC 82	V_f = 3.5 V I_f = 0.6 A[1]	See ECC 82 (except for heater rating)			
XCC 189	V_f = 4.5 V I_f = 0.6 A[1]	See ECC 189 (except for heater rating)			
XCF 80	V_f = 4.6 V I_f = 0.6 A[1]	See ECF 80 (except for heater rating)			
XCH 81	V_f = 3.6 V I_f = 0.6 A[1]	$V_{a\,min}$ 25 V $V_{g2+g4\,min}$ = 25 V	For further data see ECH 81		
XCL 82	V_f = 8.2 V I_f = 0.6 A[1]	See ECL 82 (except for heater rating)			
XCL 84	V_f = 7.8 V I_f = 0.6 A[1]	See PCL 84 (except for heater rating)			
XCL 85	V_f = 8.6 V I_f = 0.6 A[1]	See PCL 85 (except for heater rating)			
XF 80	V_f = 3.4 V I_f = 0.6 A[1]	See EF 80 (except for heater rating)			
XF 85	V_f = 3.4 V I_f = 0.6 A[1]	See EF 85 (except for heater rating)			

---

[1] Warm-up time average 11 sec.

XF 86 V_f = 2.5 V See PF 86 (except for heater rating)
I_f = 0.6 A[1]

XF 183 V_f = 3.6 V See EF 183 (except for heater rating)
I_f = 0.6 A[1]

XF 184 V_f = 3.6 V See EF 184 (except for heater rating)
I_f = 0.6 A[1]

XL 36 V_f = 12.8 V See PL 36 (except for heater rating)
I_f = 0.6 A[1]

XL 84 V_f = 8 V See EL 84 (except for heater rating)
I_f = 0.6 A[1]

XL 86 V_f = 8 V See EL 86 (except for heater rating)
I_f = 0.6 A[1]

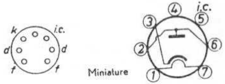
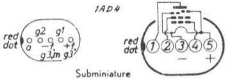
XY 88 V_f = 16 V See PY 88 (except for heater rating)
I_f = 0.6 A[1]

Z 50 T See trigger tubes
Z 70 U
Z 70 W
Z 71 U

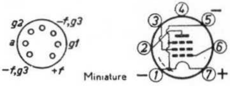
Z 302 C See decade counting, selector and indicating tubes
Z 303 C
Z 502 S
Z 503 M
Z 510 M
Z 520 M
Z 521 M
Z 550 M

---

[1] Warm-up time average 11 sec.

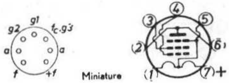
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
Z 803 U **Z 804 U** **Z 805 U** **Z 900 T**	See trigger tubes				
OA 2 **OA 2 WA** **OB 2** **OB 2 WA**	See voltage stabilizers				
OE 3	See 85 A 1				
OG 3	See 85 A 2				
1 A 3 Single diode Detector	V_f = 1.4 V I_f = 0.15 A	$V_{d\,inv\,p}$ = max. 330 V	I_d = max. 0.5 I_{dp} = max. 5	V_{kf} = max. 140 V	 Miniature
1 AB 6	See DK 96				
1 AC 6	See DK 92				
1 AD 4 Sharp cut-off pentode Typical characteristics	V_f = 1.25 V I_f = 0.1 A	V_a = 45 V V_{g2} = 45 V V_{g1} = 0 V R_{g1} = 2 MΩ	I_a = 3.3 I_{g2} = 0.9	S = 2.2 mA/V R_i = 0.4 MΩ μ_{g2g1} = 17.5	 Subminiature
1 AH 5	See DAF 96				
1 AJ 4	See DF 96				
1 AN 5	See DF 97				

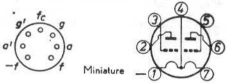
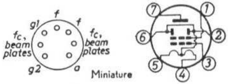
1 CP 11	See DB 3-91			
1 CP 31	See DH 3-91			
1 L 4 Pentode R.F. or I.F. amplifier	V_f = 1.4 V I_f = 50 mA	V_a = 90 V V_{g2} = 90 V V_{g1} = 0 V	I_a = 4.5 I_{g2} = 2.0	S = 1.025 mA/V R_i = 0.35 MΩ C_{ag1} < 8 mpF
		V_a = 90 V V_{g2} = 67.5 V V_{g1} = 0 V	I_a = 2.9 I_{g2} = 1.2	S = 0.925 mA/V R_i = 0.6 MΩ
1 M 3	See DM 70			
1 N 3	See DM 71			
1 N 87	See OA 70			
1 N 87 A	See OA 90			
1 N 119	See OA 86 C			
1 N 476	See OA 81			
1 N 478	See OA 85			
1 N 480	See OA 86			
1 N 541	See OA 79			
1 N 542	See 2-OA 79			
1 N 616	See OA 73			
1 N 617	See OA 91			



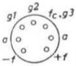
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
1 N 618	See OA 95				
1 N 698	See OA 47				
1 R 5	See DK 91				
1 S 2	See DY 86				
1 S 2 A	See DY 87				
1 S 5	See DAF 91				
1 T 4	See DF 91				
2 FY 5	$V_f = 2.4$ V $I_f = 0.6$ A	See 6 FY 5 except for heater rating			
2 HR 8	See XF 86				
2 J 42 to 2 J 56	See magnetrons				
2 K 25	See klystrons				
2 N 279	See OC 70				
2 N 280	See OC 71				
2 N 281	See OC 72				
2 N 282	See 2-OC 72				
2 N 284	See OC 76				

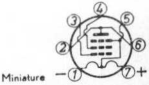
2 N 284 A	See OC 77			
2 N 1314	See OC 26			
2 N 1515	See OC 169			
2 N 1516	See OC 170			
2 N 1517	See OC 171			
2 N 1666	See ASZ 15			
2 N 1667	See ASZ 16			
2 N 1668	See ASZ 17			
2 N 1669	See ASZ 18			
2-OA72 **2-OA79** **2-OC16** **2-OC26** **2-OC72** **2-OC74**	See semi-conductors			
3 A 4	V_f = 1.4 V	V_f = 1.4 V	I_a = 14.8	S = 1.9 mA/V
Output	I_f = 0.2 A	V_a = 135 V	I_{g2} = 2.6	R_i = 90 kΩ
pentode	Pins 5-(1+7)	V_{g2} = 90 V		R_a = 8 kΩ
Class A, A.F.		V_{g1} = −7.5 V		W_o = 0.6 W
final amplifier				W_a = max. 2 W
R.F. final				
amplifier	V_f = 2.8 V	V_f = 1.4 V	I_a = 18.3	freq. = 50 Mc/s
(intermittent)	I_f = 0.1 A	V_a = 150 V	I_{g2} = 6.5	W_o = 1.2 W
operation)	Pins 1-7	V_{g2} = 135 V	I_{g1} = 0.13	
		R_{g1} = 0.2 MΩ		



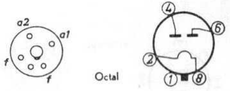
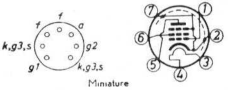
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
3 A 5 Double triode Typical characteristics (each section)	V_f = 1.4 V I_f = 0.22 A Pins 4-(1+7)	V_a = 90 V V_g = −2.5 V	I_a = 3.7	S = 1.8 mA/V R_i = 8.3 kΩ	
R.F. push-pull amplifier or oscillator (intermittent operation)	V_f = 2.8 V I_f = 0.11 A Pins 1-7	V_a = 135 V V_{g1} = −20 V V_{ip} = 2 × 45 V	I_a = 2 × 15 I_g = 2 × 2.5	freq. = 40 Mc/s W_o = 2 W	
3 AFP 31	See DH 7-91				
3 AJ 8	See XCH 81				
3 ALP 1	See DG 7-5				
3 ALP 7	See DP 7-5				
3 ALP 11	See DB 7-5				
3 AMP 1A	See DG 7-32/01				
3 B 4 R.F. Beam power amplifier	V_f = 2.5 V I_f = 0.165 A Pins 4-5 V_f = 1.25 V I_f = 0.33 A Pins 2-(4+5)	V_f = 2.5 V V_a = 200 V V_{g2} = 150 V V_{g1} = −25 V	I_a = 19 I_{g2} = <2	S = 1.7 m/AV μ = 4.1	
3 B 28	See DCX 4/1000				
3 BKP 31	See DH 7-78				

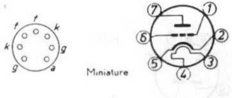
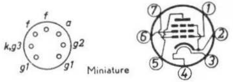
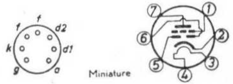
3 BX 6	See XF 80		
3 BY 7	See XF 85		
3 C 4	See DL 96		
3 C 45	See thyratrons		
3 EH 7	See XF 183		
3 EJ 7	See XF 184		
3 Q 4 Output pentode Class A final amplifier	V_f = 1.4 V V_a = 86 V I_f = 0.1 A V_{g2} = 86 V Pins 5-(1+7) V_{g1} = −4.5 V	I_a = 8 I_{g2} = 1.8	S = 2.0 mA/V R_i = 0.11 MΩ R_a = 8 kΩ W_o = 0.29 W W_a = max. 1.2 W
	V_f = 2.8 V V_a = 86 V I_f = 50 mA V_{g2} = 86 V Pins 1-7 V_{g1} = −4.3 V	I_a = 7.0 I_{g2} = 1.5	S = 1.9 mA/V R_i = 0.12 MΩ R_a = 10 kΩ W_o = 0.27 W
3 S 4	See DL 92		
3 V 4	See DL 94		
3 WP 11	See DB 7-36		
4-125 A	See QB 3/300 GA		
4-250 A	See QB 3.5/750 GA		
4-400 A	See QB 4/1100 GA		
4 B 32	See DCX 4/5000		

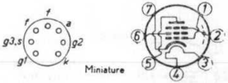
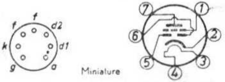
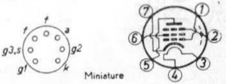
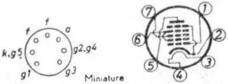


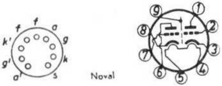
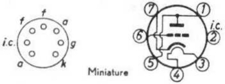
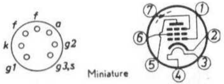


Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
4 BL 8	See XCF 80				
4 C 35 A	See thyratrons				
4 CM 4	See PC 86				
4 EP 31	See DH 10-94				
4 ES 8	See XCC 189				
4 J 47 to 4 J 78	See magnetrons				
4 LP 131	See DHM 10-93				
4 X 150 A	See QEL 1/150				
4 X 250 B	See QEL 2/250				
4 X 500 A	See QBL 4/800				
5 ADP 1	See DG 13-34				
5 ADP 11	See DB 13-34				
5 AQ 4	See GZ 32				
5 AR 4	See GZ 34				
5 BHP 2	See DN 13-78				
5 BHP 11	See DB 13-78				
5 BHP 31	See DH 13-78				

5 BKP 31	See DH 13-97				
5 C 22	See thyratrons				
5 CBP 2	See DN 13-76				
5 CBP 11	See DB 13-76				
5 CBP 31	See DH 13-76				
5 CLP 31	See DH 13-10				
5 FP 4 A	See MW 13-35				
5 FP 7 A	See MF 13-1				
5 J 26	See magnetrons				
5 Y 3 GT Full-wave rectifying tube	V_f = 5 V I_f = 2 A	V_{tr} = 2×500 V V_{tr} = 2×350 V	I_o = 84 I_o = 125	R_t = min. 2×140 Ω R_t = min. 2× 50 Ω C_{filt} = 10 μF	
6 AB 8	See ECL 80				
6 AJ 8	See ECH 81				
6 AK 5 R.F. pentode Typical characteristics	V_f = 6.3 V I_f = 0.175 A	V_a = 180 V V_{g2} = 120 V R_k = 180 Ω	I_a = 7.7 I_{g2} = 2.4	S = 5.1 mA/V R_i = 0.5 MΩ R_{eq} = 2 kΩ C_{ag1} < 0.02 pF	
6 AK 8	See EABC 80				
6 AL 3	See EY 88				

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
6 AL 5	See EAA 91				
6 AM 5	See EL 91				
6 AM 6	See EF 91				
6 AQ 4 Grounded-grid triode Typical characteristics	V_f = 6.3 V I_f = 0.3 A	V_a = 250 V V_g = −1.5 V R_k = 150 Ω	I_a = 10	S = 8.5 mA/V R_i = 12 kΩ μ = 100 W_a = max. 2.5 W R_{eq} = 400 Ω freq. = max. 250 Mc/s	
6 AQ 5 Output pentode Class A final amplifier	V_f = 6.3 V I_f = 0.45 A	V_a = 250 V V_{g2} = 250 V V_{g1} = −12.5 V	I_a = 45 I_{g2} = 4.5	S = 4.1 mA/V R_i = 52 kΩ R_a = 5 kΩ W_o = 4.5 W W_a = max. 12 W	
6 AQ 8	See ECC 85				
6 AT 6 Double diode high mu triode Typical characteristics	V_f = 6.3 V I_f = 0.3 A	V_a = 250 V V_g = −3 V	I_a = 1	S = 1.2 mA/V R_i = 58 kΩ μ = 70	
		V_a = 100 V V_g = −1 V	I_a = 0.8	S = 1.3 mA/V R_i = 54 kΩ	

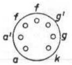
6 AU 6 R.F. pentode Typical characteristics	$V_f = 6.3$ V $I_f = 0.3$ A	$V_a = 250$ V $V_{g2} = 150$ V $V_{g1} = -1$ V $V_{g3} = 0$ V	$I_a = 10.6$ $I_{g2} = 4.3$	$S = 5.2$ mA/V $R_i = 1$ MΩ	
		$V_a = 100$ V $V_{g2} = 100$ V $V_{g1} = -1$ V $V_{g3} = 0$ V	$I_a = 5$ $I_{g2} = 2.1$	$S = 3.9$ mA/V $R_i = 0.5$ MΩ	
6 AV 6 Double diode high mu triode Typical characteristics	$V_f = 6.3$ V $I_f = 0.3$ A	$V_a = 250$ V $V_g = -2$ V	$I_a = 1.2$	$S = 1.6$ mA/V $R_i = 62.5$ kΩ $\mu = 100$	
6 BA 6 Variable mu pentode R.F. or I.F. amplifier	$V_f = 6.3$ V $I_f = 0.3$ A	$V_a = 250$ V $V_{g3} = 0$ V $V_{g2} = 100$ V $R_k = 68\,\Omega$	$I_a = 11$ $I_{g2} = 4.2$	$S = 4.4$ mA/V $R_i = 1$ MΩ $R_{eq} = 4$ kΩ $C_{ag1} < 3.5$ mpF	
6 BD 7 A	See EBC 81				
6 BE 6 Heptode Frequency changer	$V_f = 6.3$ V $I_f = 0.3$ A	$V_a = 250$ V $V_{g2+g4} = 100$ V $V_{g3} = -1.5$ V $R_{g1} = 20$ kΩ	$I_a = 2.9$ $I_{g2+g4} = 6.8$ $I_{g1} = 0.5$	$S_c = 0.475$ mA/V $R_i = 1$ kΩ	
6 BE 7	See EQ 80				
6 BL 8	See ECF 80				
6 BM 8	See ECL 82				
6 BQ 5	See EL 84				

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
6 BQ 7 A Double triode Typical characteristics (each section)	V_f = 6.3 V I_f = 0.4 A	V_a = 150 V R_k = 220 Ω	I_a = 9	S = 6.4 mA/V R_i = 6.1 kΩ μ = 39	
6 BR 5	See EM 80				
6 BT 4	See EZ 40				
6 BX 6	See EF 80				
6 BY 7	See EF 85				
6 C 4 Triode Typical characteristics	V_f = 6.3 V I_f = 0.15 A	V_a = 250 V V_g = −8.5 V	I_a = 10.5	S = 2.2 mA/V R_i = 7.7 kΩ	
		V_a = 100 V V_g = 0 V	I_a = 11.8	S = 3.1 mA/V R_i = 6.25 kΩ	
6 CA 4	See EZ 81				
6 CA 7	See EL 34				
6 CB 6 R.F. sharp-cut off pentode Typical characteristics	V_f = 6.3 V I_f = 0.3 A	V_a = 200 V V_{g2} = 150 V V_{g3} = 0 V R_k = 180 Ω	I_a = 9.5 I_{g2} = 2.8	S = 6.2 mA/V R_i = 0.6 MΩ	
6 CD 7	See EM 34				
6 CJ 5	See EF 41				

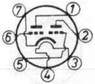
6 CJ 6	See EL 81
6 CK 5	See EL 41
6 CK 6	See EL 83
6 CM 4	See EC 86
6 CM 5	See EL 36
6 CQ 6	See EF 92
6 CS 6	See EH 90
6 CT 7	See EAF 42
6 CU 7	See ECH 42
6 CV 7	See EBC 41
6 CW 5	See EL 86
6 CW 7	See ECC 84
6 DA 5	See EM 81
6 DA 6	See EF 89
6 DC 8	See EBF 89
6 DJ 8	See ECC 88
6 DL 5	See EL 95
6 DR 8	See EBF 83

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
6 DS 8	See ECH 83				
6 DX 8	See ECL 84				
6 DY 5	See EL 82				
6 EH 7	See EF 183				
6 EJ 7	See EF 184				
6 ES 6	See EF 97				
6 ES 8	See ECC 189				
6 ET 6	See EF 98				
6 FG 6	See EM 84				
6 FV 5	See EL 136				
6 FY 5	See V.H.F. tubes				
6 GB 5	See EL 500				
6 GM 8	See ECC 86				
6 GV 8	See ECL 85				
6 GW 8	See ECL 86				
6 HG 8	See ECF 86				

6 J 6	$V_f = 6.3$ V	$V_a = 100$ V	$I_a = 8.5$	$S = 5.3$ mA/V
Double triode	$I_f = 0.45$ A	$R_k = 100\ \Omega$		$R_i = 7.1$ kΩ
Typical				
characteristics		$V_a = 150$ V	$I_a = 2 \times 15$	$W_{ig} = 0.35$ W
(each section)		$V_g = -10$ V	$I_g = 2 \times 8$	$W_o = 3.5$ W
R.F. class C		$R_g = 625\ \Omega$		
telegr.				
amplifier				
and oscillator				



Miniature



6 N 3 See EY 82

6 N 8 See EBF 80

6 Q 4 See EC 80

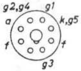
6 R 3 See EY 81

6 R 4 See EC 81

6 S 2 See EY 86

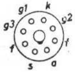
6 S 2 A See EY 87

6 SA 7 GT	$V_f = 6.3$ V	$V_a = 250$ V	$I_a = 3.5$	$S_c = 0.45$ mA/V
Heptode	$I_f = 0.3$ A	$V_{g2+g4} = 100$ V	$I_{g2+g4} = 8.5$	$R_i = 1$ MΩ
Frequency		$V_{g3} = 0$ V	$I_{g1} = 0.5$	
changer		$R_{g1} = 20$ kΩ		

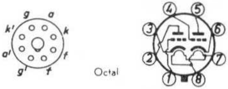
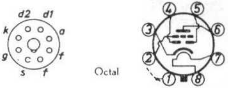
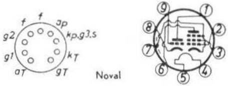
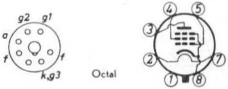


Octal

6 SK 7 GT	$V_f = 6.3$ V	$V_a = 250$ V	$I_a = 9.2$	$S = 2$ mA/V
Variable mu	$I_f = 0.3$ A	$V_{g2} = 100$ V	$I_{g2} = 2.6$	$R_i = 0.8$ MΩ
pentode		$V_{g1} = -3$ V		
Typical		$V_{g3} = 0$ V		
characteristics				

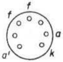


Octal

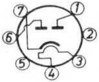
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
6 SN 7 GT Double triode Typical characteristics (each section)	V_f = 6.3 V I_f = 0.6 A	V_a = 250 V V_g = −8 V	I_a = 9	S = 2.6 mA/V R_i = 7.7 kΩ	
		V_a = 90 V V_g = 0 V	I_a = 10	S = 3 mA/V R_i = 6.7 kΩ	
6 SQ 7 GT Double diode high mu triode Typical characteristics	V_f = 6.3 V I_f = 0.3 A	V_a = 250 V V_g = −2 V	I_a = 0.9	S = 1.1 mA/V R_i = 91 kΩ μ = 100	
		V_a = 100 V V_g = −1 V	I_a = 0.4	S = 0.9 mA/V R_i = 110 kΩ	
6 U 8 Triode pentode Typ. charact. (pent. section)	V_f = 6.3 V I_f = 0.45 A	V_a = 250 V V_{g2} = 110 V R_k = 68 Ω	I_a = 10 I_{g2} = 3.5	S = 5.2 mA/V R_i = 0.4 MΩ	
(triode section)		V_a = 150 V R_k = 56 Ω	I_a = 18	S = 8.5 mA/V R_i = 5 kΩ	
6 V 4	See EZ 80				
6 V 6 GT Output pentode Class A final amplifier	V_f = 6.3 V I_f = 0.45 A	V_a = 250 V V_{g2} = 250 V V_{g1} = −12.5 V	I_a = 45 I_{g2} = 4.5	S = 4.1 mA/V R_i = 50 kΩ R_a = 5 kΩ W_o = 4.5 W W_a = max. 12 W	
6 X 2	See EY 51				

6 X 4
Full-wave
high vacuum
rectifying tube
Rectifier

V_f = 6.3 V V_{tr} = 2 × 325 V I_o = 70 R_t = 2 × 520 Ω
I_f = 0.6 A C_{filt} = 10 μF



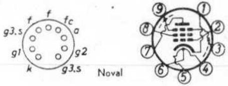
Miniature



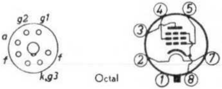
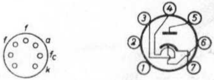
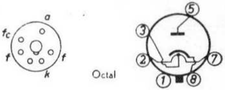
7 AHP 1	See DG 16-22
7 AHP 7	See DP 16-22
7 AHP 11	See DB 16-22
7 AN 7	See PCC 84
7 AU 7	See XCC 82
7 DJ 8	See PCC 88
7 ES 8	See PCC 189
7 HG 8	See PCF 86
8 B 8	See XCL 82
8 BQ 5	See XL 84
8 CW 5	See XL 86
8 DX 8	See XCL 84
9 A 8	See PCF 80
9 AB 4	See UC 92
9 AK 8	See PABC 80

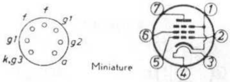
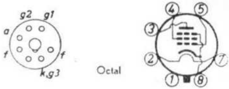
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
9 AQ 8	See PCC 85				
9 RP 33	See AL 22-10				
12 AC 5	See UF 41				
12 AJ 7	See HCH 81				
12 AQ 5	$V_f = 12.6$ V $I_f = 0.225$ A	See 6 AQ 5 (except for heater rating)			
12 AT 6	$V_f = 12.6$ V $I_f = 0.15$ A	See 6 AT 6 (except for heater rating)			
12 AT 7	See ECC 81				
12 AT 7 WA	See 6201				
12 AU 6	$V_f = 12.6$ V $I_f = 0.15$ A	See 6 AU 6 (except for heater rating)			
12 AU 7	See ECC 82				
12 AV 6	$V_f = 12.6$ V $I_f = 0.15$ A	See 6 AV 6 (except for heater rating)			
12 AX 7	See ECC 83				
12 BA 6	$V_f = 12.6$ V $I_f = 0.15$ A	See 6 BA 6 (except for heater rating)			
12 BE 6	$V_f = 12.6$ V $I_f = 0.15$ A	See 6 BE 6 (except for heater rating)			

12 BY 7 A	V_f = 12.6 V	V_a = 250 V	I_a = 25	S = 12 mA/V
Sharp-cut off	I_f = 0.3 A	V_{g2} = 150 V	I_{g2} = 6	R_i = 0.09 MΩ
pentode	Pins 4-5	R_k = 68 Ω		μ_{g2g1} = 28
Typical	V_f = 6.3 V			
characteristics	I_f = 0.6 A			
	Pins 6-(4+5)			
12 S 7	See UAF 42			
12 SA 7 GT	V_f = 12.6 V	See 6 SA 7 GT (except for heater rating)		
	I_f = 0.15 A			
12 SK 7 GT	V_f = 12.6 V	See 6 SK 7 GT (except for heater rating)		
	I_f = 0.15 A			
12 SN 7 GT	V_f = 12.6 V	See 6 SN 7 GT (except for heater rating)		
	I_f = 0.3 A			
12 SQ 7 GT	V_f = 12.6 V	See 6 SQ 7 GT (except for heater rating)		
	I_f = 0.15 A			
12 X 4	V_f = 12.6 V	See 6 X 4 (except for heater rating)		
	I_f = 0.3 A			
13 CM 5	See XL 36			
14 AHP 4 A	See AW 36-80			
14 GW 8	See PCL 86			
14 K 7	See UCH 42			
14 L 7	See UBC 41			
15 A 6	See PL 83			

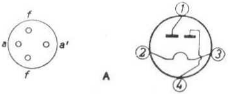
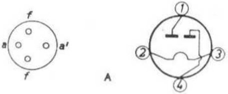


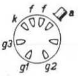
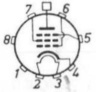
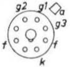
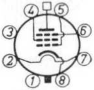
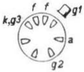
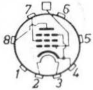
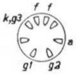
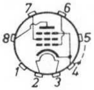
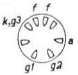
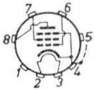
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
15 CW 5	See PL 84				
15 DQ 8	See PCL 84				
16 A 5	See PL 82				
16 A 8	See PCL 82				
16 AQ 3	See XY 88				
17 BQP 4	See MW 43-69				
17 BTP 4	See AW 43-80				
17 C 8	See UBF 80				
17 Z 3	See PY 81				
18 GV 8	See PCL 85				
19 BR 5	See UM 80				
19 D 8	See UCH 81				
19 FL 8	See UBF 89				
19 Y 3	See PY 82				
21 A 6	See PL 81				
21 CJP 4	See MW 53-20				
21 CLP 4	See AW 53-80				

25 E 5	See PL 36				
25 L 6 GT Output pentode Class A final amplifier	V_f = 25 V I_f = 0.3 A	V_a = 200 V V_{g2} = 125 V R_k = 180 Ω	I_a = 46 I_{g2} = 2.2	S = 8 mA/V R_i = 28 kΩ R_a = 4 kΩ W_o = 3.8 W W_a = max. 10 W	 Octal
28 GB 5	See PL 500				
30 A 5	See HL 94				
30 AE 3	See PY 88				
31 A 3	See UY 41				
31 AV 3	See UY 89				
35 W 4 Half-wave rectifying tube Rectifier	V_f = 35 V I_f = 0.15 A Pins 3-4	V_{tr} = 117 V	I_o = 100	R_t = min. 15 Ω C = 40 μF	 Miniature
35 Z 5 GT Half-wave rectifying tube Rectifier	V_f = 35 V I_f = 0.15 A Pins 2-7	V_{tr} = 117 V V_{tr} = 235 V	I_o = 100 I_o = 100	R_t = min. 15 Ω R_t = min. 100 Ω C = 40 μF	 Octal
38 A 3	See UY 85				
45 A 5	See UL 41				
45 B 5	See UL 84				

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
50 AVP **to** **60 AVP**	See photomultipliers				
50 BM 8	See UCL 82				
50 C 5 Output pentode Class A final amplifier	V_f = 50 V I_f = 0.15 A	V_a = 110 V V_{g2} = 110 V V_{g1} = −7.5 V	I_a = 49 I_{g2} = 4	S = 7.5 mA/V R_i = 14 kΩ R_a = 2.5 kΩ W_o = 1.9 W W_a = max. 5.5 W	
50 L 6 GT Output pentode Class A final amplifier	V_f = 50 V I_f = 0.15 A	V_a = 200 V V_{g2} = 110 V V_{g1} = −8 V	I_a = 50 I_{g2} = 2	S = 9.5 mA/V R_i = 30 kΩ R_a = 3 kΩ W_o = 4.3 W W_a = max. 10 W	
55 N 3	See UY 82				
58 CG **58 CV**	See phototubes				
61 SV	See photoconductive cells				
75 C 1 **83 A 1** **85 A 1** **85 A 2**	See voltage reference tubes				

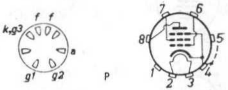
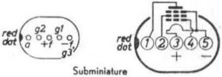
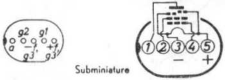
90 AG **90 AV** **90 CG** **90 CV** **92 AG** **92 AV**	See phototubes
90 C 1 **100 E 1** **150 A 1** **150 B 2** **150 C 1**	See voltage stabilizers
150 AVP **150 CVP** **152 AVP**	See photomultipliers
328	See industrial rectifying tubes
329 **340**	See current regulators
354 **367** **451**	See industrial rectifying tubes
723 AB	See klystrons
725 A	See magnetrons
866 A	See DCG 4/1000 G
872 A	See DCG 5/5000 GB
1010	See industrial rectifying tubes

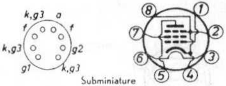
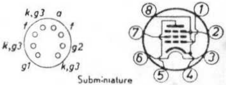
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
1037 to 1554	See industrial rectifying tubes				
1561 Full-wave rectifying tube Rectifier	V_f = 4 V I_f = 2 A	V_{tr} = 2 × 500 V = 2 × 300 V	I_o = max. 120 = max. 160	$C_{filt} > 32\ \mu F$ R_t = min. 2 × 50 Ω $C_{filt} > 60\ \mu F$ R_t = min. 2 × 100 Ω	
1564 to 1788	See industrial rectifying tubes				
1805 Full-wave rectifying tube Rectifier	V_f = 4 V I_f = 1 A	V_{tr} = 2 × 500 V = 2 × 300 V	I_o = max. 60 = max. 100	R_t = min. 2 × 100 Ω = min. 2 × 60 Ω C_{filt} = max. 60 μF	
1838 **1849** **1859**	See industrial rectifying tubes				
1904 to 1945	See current regulators				
3533 to 3554	See phototubes				
4065 to 4069	See electrometer tubes				
4152/02	See bimetal relay				

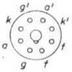
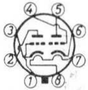
4349 to 4399	See surge arresters				
4654 Output pentode Class A final amplifier	V_f = 6.3 V I_f = 1.5 A	V_a = 250 V V_{g2} = 275 V R_k = 175 Ω V_{g3} = 0 V	I_a = 72 I_{g2} = 8	S = 8.5 mA/V R_i = 22 kΩ R_a = 3.5 kΩ W_o = 9.2 W W_a = max. 18 W	 P 
Class AB push-pull amplifier		V_{ba} = 425 V V_{bg2} = 425 V R_{g2} = 2 kΩ R_k = 265 Ω V_{g3} = 0 V	$I_{a\,min}$ = 2×46 $I_{a\,max}$ = 2×60 $I_{g2\,min}$ = 2×5.4 $I_{g2\,max}$ = 2×13	R_{aa} = 6.5 kΩ W_o = 27.5 W d_t = 5%	 Octal 
4682 Output pentode Class B	V_f = 4 V I_f = 1.1 A	V_a = 275 V V_{g2} = 250 V V_{g1} = −32 V	$I_{a\,min}$ = 2×20 $I_{a\,max}$ = 2×45 $I_{g2\,min}$ = 2× 3 $I_{g2\,max}$ = 2×5.5	R_{aa} = 9 kΩ W_o = 19 W W_a = max. 9 W	 P 
4687	See voltage stabilizers				
4688	V_f = 4 V I_f = 2 A	See 4689 (except for heater rating)			
4689 Output pentode Class AB push-pull amplifier	V_f = 6.3 V I_f = 1.35 A	V_a = 375 V V_{g2} = 275 V R_k1) = 165 Ω	$I_{a\,min}$ = 2×48 $I_{a\,max}$ = 2×62 $I_{g2\,min}$ = 2× 5 $I_{g2\,max}$ = 2× 9	R_{aa} = 6.5 kΩ W_o = 28.5 W W_a = max. 18 W	 P 
4694 Output pentode Class AB push-pull amplifier	V_f = 6.3 V I_f = 0.9 A	V_a = 375 V V_{g2} = 250 V R_k1) = 145 Ω	$I_{a\,min}$ = 2× 24 $I_{a\,max}$ = 2× 30 $I_{g2\,min}$ = 2×2.5 $I_{g2\,max}$ = 2× 5	R_{aa} = 13 kΩ W_o = 12 W W_a = max. 9 W	 P 

---

1) Common cathode bias resistor

Type and Application	Filament data	Voltages Resistors	Currents (mA)	Characteristic data	Base connections
4699 N **Output pentode** **Class A final amplifier**	V_f = 6.3 V I_f = 1.5 A	V_a = 250 V V_{g2} = 250 V R_k = 90 Ω	I_a = 72 I_{g2} = 8	S = 14.5 mA/V R_i = 20 kΩ R_a = 3.5 KΩ W_o = 8 W W_a = max. 18 W	
5586 **5609** **5657**	**See magnetrons**				
5644	**See voltage stabilizers**				
5654	**See reliable ruggedized tubes**				
5672 **A.F. power amplifier** **Typical characteristics class A**	V_f = 1.25 V I_f = 50 mA	V_a = 67.5 V V_{g2} = 67.5 V V_{g1} = −6.5 V	I_a = 3.1 I_{g2} = 0.95	S = 0.65 mA/V R_a = 20 kΩ W_o = 65 mW d_{tot} = 10 %	
5678 **R.F., M.F. or A.F. amplifier** **Typical characteristics**	V_f = 1.25 V I_f = 50 mA	V_a = 67.5 V V_{g2} = 67.5 V V_{g1} = 0 V	I_a = 1.8 I_{g2} = 0.48	S = 1.1 mA/V R_i = 1 MΩ	
		V_a = 45 V V_{2} = 45 V V_{g1} = 0 V	I_a = 0.8 I_{g2} = 0.22	S = 0.82 mA/V R_i = 1.2 MΩ	
5696	**See thyratrons**				
5718	**See V.H.F. tubes**				

5726	See reliable ruggedized tubes	
5823/Z 900 T	See trigger tubes	
5820 **5854**	See T.V. studio tubes	
5840 R.F. Pentode 8-lead sub-miniature	V_f = 6.3 V I_f = 0.15 A V_a = 100 V V_{g2} = 100 V R_k = 150 Ω I_a = 7.5 I_{g2} = 2.4 S = 5 mA/V R_i = 230 kΩ	
5861	See EC 55	
5866	See TB 2.5/300	
5867	See TB 3/750	
5868	See TB 4/1250	
5870	See DCG 12/30	
5876	See U.H.F. tubes	
5894	See QQE 06/40	
5895	See QQC 04/15	
5899 Semi-remote cut-off pentode	V_f = 6.3 V I_f = 0.15 A V_a = 100 V V_{g2} = 100 V R_k = 120 Ω I_a = 7.2 I_{g2} = 2 S = 4.5 m/AV R_i = 260 kΩ	
5920	See E 90 CC	
5923	See TBW 6/6000	

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
5924	See TBL 6/6000				
5949	See thyratrons				
6007	See DL 67				
6008	See DF 67				
6075	See QBW 5/3500				
6076	See QBL 5/3500				
6077	See TBW 12/100				
6078	See TBL 12/100				
6079	See QB 5/1750				
6080 Double low μ triode Typical characteristics (each section)	V_f = 6.3 V I_f = 2.5 A	V_a = 100 V R_k = 300 Ω	I_a = 100	S = 6.5 mA/V R_i = 300 Ω μ = 2 W_a = max. 13 W	 Octal 
6083	See PE/100				
6084	See E 80 F				
6085	See E 80 CC				
6086	See 18042				

6146	See QE 05/40
6155	See QB 3/300
6156	See QB 3.5/750
6159	See QE 05/40 H
6201	See reliable, ruggedized tubes
6211	See tubes for computers
6227	See E 80 L
6252	See QQE 03/20
6263 **6264**	See U.H.F. tubes
6267	See EF 86
6268	See 4 C 35 A
6279	See 5 C 22
6354	See 150 B 2
6360	See QQE 03/12
6370	See E 1 T
6374	See EY 84
6375	See DC 70
6463	See tubes for computers

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
6507 **6589**	See magnetrons				
6508	See DCG 9/20				
6617	See TBW 12/25				
6618	See TBL 12/25				
6686	See E 81 L				
6687	See E 91 H				
6688	See E 180 F				
6689	See E 83 F				
6693	See DCG 6/18				
6700	See ET 51				
6755	See PL 6755				
6779	See Z 803 U				
6786	See DCG 7/100 B				
6883	See QE 05/40 F				
6922	See E 88 CC				
6923	See EA 52				

6939	See QQE 02/5
6960	See TBW 7/8000
6961	See TBL 7/8000
6972 to 7292	See magnetrons
6977	See DM 160
7004	See TBL 2/300
7062	See E 180 CC
7092	See TB 5/2500
7119	See E 182 CC
7308	See E 188 CC
7316	See ECC 186
7377	See QQE 04/5
7378	See QE 08/200
7475	See voltage stabilizers
7527	See QB 4/1100
7534	See E 130 L
7537	See travelling wave tube
7585	See PL 2052 A

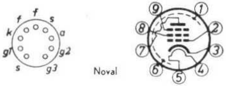
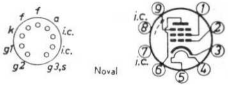
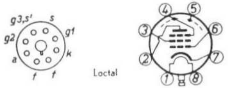
Type and Application	Filament data	Voltages Resistors	Currents (mA)	Characteristic data	Base connections
7632	See ORP 10				
7633	See ORP 11				
7634	See 61 SV				
7643	See E 80 CF				
7693	See E 90 F				
7694	See E 99 F				
7709	See Z 70 W				
7710	See Z 70 U				
7711	See Z 71 U				
7713	See Z 804 U				
7714	See Z 805 U				
7737	See E 186 F				
7753	See TBL 6/4000				
7788	See E 810 F				
7836	See QE 08/200 H				
8008	See DCG 5/5000 GS				
8020	See high vacuum diode				

13201	See voltage stabilizers
18040 **18042** **18045**	See reliable, long life tubes
18502 **to** **18552**	See radiation counter tubes
55008 **to** **55125**	See magnetrons
55334 **55335** **55395**	See klystrons
55340	See travelling wave tube
55807 **55809** **55850**	See T.V. studio tubes
56001	See saturated diode
56032	See dual T.R. switch
95108	See transmitting pentode
95322	See ionization vacuum gage

NOTES:

SPECIAL A.F.
AND
R.F. AMPLIFYING TUBES

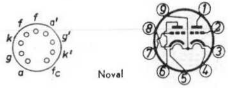
RELIABLE LONG LIFE TUBES

<table>
<tr><th><i>Type and Application</i></th><th><i>Filament data</i></th><th><i>Voltages Resistors</i></th><th><i>Currents (mA)</i></th><th><i>Characteristic data</i></th><th><i>Base connections</i></th></tr>
<tr><td>E 81 L
Output pentode
Class A final amplifier</td><td>V_f = 6.3 V
I_f = 0.375 A</td><td>V_a = 210 V
V_{g3} = 0 V
V_{g2} = 210 V
R_k = 120 Ω</td><td>I_a = 20
I_{g2} = 5.3</td><td>S = 11 mA/V
R_a = 15 kΩ
W_o = 1 W
d_{tot} = 5%
W_a = max. 4.5 W</td><td>
</td></tr>
<tr><td rowspan="2">E 83 F
Pentode
Typical characteristics
Class A final amplifier</td><td rowspan="2">V_f = 6.3 V
I_f = 0.3 A</td><td>V_a = 210 V
V_{g2} = 120 V
R_k = 165 Ω
V_{g3} = 0 V</td><td>I_a = 10
I_{g2} = 2.1</td><td>S = 9 mA/V
R_i = 0.5 MΩ
R_{eq} = 750 Ω</td><td rowspan="2">
</td></tr>
<tr><td>V_{ba} = 210 V
V_{bg2} = 120 V
R_{g2} = 5.6 kΩ
R_k = 180 Ω
V_{g3} = 0 V</td><td>I_a = 8.3
I_{g2} = 1.7</td><td>S = 8.2 mA/V
R_i = 0.44 MΩ
R_a = 20 kΩ
W_o = 0.87 W
W_a = max. 2.1 W</td></tr>
<tr><td>18040
Pentode
Final amplifier</td><td>V_f = 18 V
I_f = 0.20 A</td><td>V_a = 210 V
V_{g2} = 210 V
R_k = 120 Ω
V_{g3} = 0 V</td><td>I_a = 20
I_{g2} = 5.3</td><td>S = 11 mA/V
R_i = 0.3 MΩ
R_a = 15 kΩ
W_o = 1 W
d_{tot} = 5%
W_a = max. 4.5 W</td><td>
</td></tr>
<tr><td>18042</td><td>V_f = 18 V
I_f = 0.1 A</td><td colspan="4">See E 83 F (except for heater rating)</td></tr>
<tr><td>18045</td><td>V_f = 18 V
I_f = 0.130 A</td><td colspan="4">See E 81 L (except for heater rating)</td></tr>
</table>

RELIABLE, RUGGEDIZED AND LONG LIFE TUBES

E 80 CC
Double triode
Typical characteristics (each section)

V_f = 6.3 V
I_f = 0.6 A
V_f = 12.6 V
I_f = 0.3 A
V_a = 250 V
R_k = 920 Ω
I_a = 6
S = 2.7 mA/V
R_i = 10 kΩ
W_a = 2 W (abs. max.)

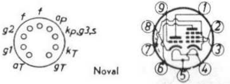


E 80 CF
Triode-pentode
Typical characteristics (pentode section) (triode section)

V_f = 6.3 V
I_f = 0.33 A

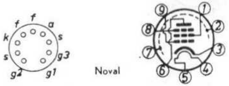
Pentode section:
V_a = 170 V
V_{g2} = 170 V
R_k = 155 Ω
I_a = 10
I_{g2} = 2.8
S = 6.2 mA/V
R_i = 0.4 MΩ
μ_{g2g1} = 40

Triode section:
V_a = 100 V
R_k = 120 Ω
I_a = 14
S = 5 mA/V
μ = 18



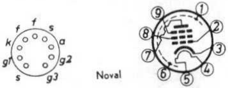
E 80 F
A.F. pentode
Typical characteristics

V_f = 6.3 V
I_f = 0.3 A
V_a = 250 V
V_{g2} = 100 V
R_k = 550 Ω
V_{g3} = 0 V
I_a = 3
I_{g2} = 0.65
S = 1.85 mA/V
R_i = 1.5 MΩ
μ_{g2g1} = 25



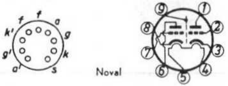
E 80 L
Output pentode
Class A final amplifier

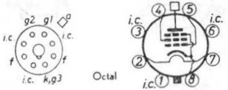
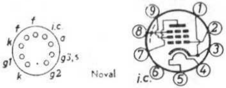
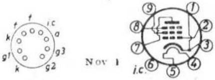
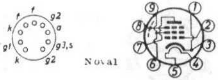
V_f = 6.3 V
I_f = 0.75 A
V_a = 200 V
V_{g2} = 200 V
R_k = 130 Ω
V_{g3} = 0 V
I_a = 30
I_{g2} = 4.1
S = 9.0 mA/V
R_a = 7 kΩ
W_o = 2.7 W
W_a = 8 W (abs. max.)



E 88 CC
Double triode
Typical characteristics (each section)

V_f = 6.3 V
I_f = 0.3 A
V_{ba} = 100 V
V_{bg} = +9 V
R_k = 680 Ω
I_a = 15
S = 12.5 mA/V
μ = 33
R_{eq} = 300 Ω

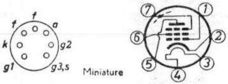


Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
E 130 L Output pentode Typical charact.	V_f = 6.3 V I_f = 1.7 A	V_a = 250 V V_{g2} = 150 V V_{g1} = −15.5 V	I_a = 100 I_{g2} = 4	S = 27.5 mA/V R_i = 10 kΩ μ_{g2g1} = 6.5 W_a = 27.5 W (abs. max.)	
E 180 F Broadband amplifier pentode Typical characteristics	V_f = 6.3 V I_f = 0.3 A	V_{ba} = 190 V 1) V_{bg2} = 160 V 1) V_{bg1} = +9 V R_k = 630 Ω V_{g3} = 0 V	I_a = 13 I_{g2} = 3.3	S = 16.5 mA/V R_i = 90 kΩ μ_{g2g1} = 50	
E 186 F Broadband amplifier Low micr. Typical charact.	V_f = 6.3 V I_f = 0.32 A	V_{ba} = 190 V 1) V_{bg2} = 160 V 1) V_{bg1} = +9 V R_k = 630 Ω V_{g3} = 0 V	I_a = 13 I_{g2} = 3.3	S = 16.5 mA/V R_i = 100 kΩ μ_{g2g1} = 53	
E 188 CC Double triode	V_f = 6.3 V I_f = 0.335 A	See E 88 CC (except for heater rating)			
E 810 F Wide band amplifier pentode Typical charact.	V_f = 6.3 V I_f = 0.34 A	V_{ba} = 135 V 1) V_{bg2} = 165 V 1) V_{bg1} = 12.5 V R_k = 360 Ω V_{g3} = 0 V	I_a = 35 I_{g2} = 5	S = 50 mA/V μ_{g2g1} = 58 R_{eq} = 100 Ω	

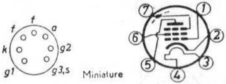
1) V_{ba} and V_{bg2} measured with respect to the grounded terminal of R_k

RELIABLE, RUGGEDIZED TUBES

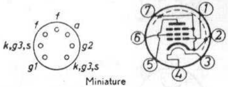
E 90 F	V_f = 6.3 V	V_{ba} = 250 V	I_a = 7.4	S = 4.6 mA/V
Sharp cut-off	I_f = 0.15 A	V_{bg2} = 150 V	I_{g2} = 2.9	R_i = 1.0 MΩ
pentode		V_{g3} = 0 V		μ_{g2g1} = 48
Typical		R_k = 100 Ω		
characteristics				



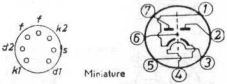
E 99 F	V_f = 6.3 V	V_{ba} = 250 V	I_a = 9.2	S = 3.8 mA/V
Var. slope	I_f = 0.15 A	V_{bg2} = 100 V	I_{g2} = 3.3	R_i = 1 MΩ
H.F. pentode		V_{g3} = 0 V		μ_{g2g1} = 25
Typical		R_k = 80 Ω		
characteristics				



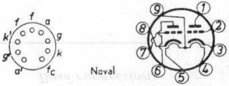
5654	V_f = 6.3 V	V_{ba} = 120 V	I_a = 7.5	S = 5 mA/V
Sharp cut-off	I_f = 0.175 A	V_{bg2} = 120 V	I_{g2} = 2.5	R_i = 0.34 MΩ
pentode		R_k = 200 Ω		
Typical				
characteristics		V_{g1} = −8.5 V	I_a = 0.01	



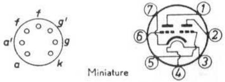
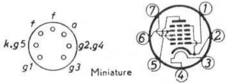
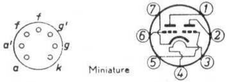
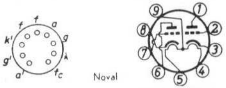
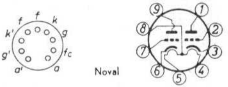
5726	V_f = 6.3 V	V_{tr} = 117 V	I_o = 9	R_t = 300 Ω
Reliable	I_f = 0.3 A			C = 8 μF
double diode				
Half-wave		$V_{d\,inv\,p}$ = max. 360 V	I_d = max. 10	
rectifier			I_{dp} = max. 60	
(each section)				



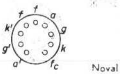
6201	V_f = 6.3 V	V_a = 100 V	I_a = 3.3	S = 4 mA/V
Double	I_f = 0.3 A	R_k = 270 Ω		R_i = 14.3 kΩ
triode	Pins 9-(4+5)			
Typical	V_f = 12.6 V	V_a = 250 V	I_a = 10	S = 5.5 mA/V
characteristics	I_f = 0.15 A	R_k = 200 Ω		R_i = 10.9 kΩ
(each section)	Pins 4-5			



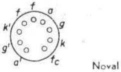
TUBES FOR COMPUTERS

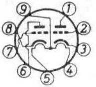
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
E 90 CC Double triode Typ. charact. (each section)	V_f = 6.3 V I_f = 0.4 A	V_a = 100 V V_g = −2.1 V	I_a = 8.5	S = 6 mA/V μ = 27	
E 91 H Dual control heptode Typical characteristics	V_f = 6.3 V I_f = 0.27 A	V_{ba} = 150 V V_{bg2+g4} = 75 V V_{bg1} = 0 V V_{bg3} = 0 V	I_a > 5.5 < 7	R_a = 20 kΩ R_{g2+g4} = 470 Ω R_{g1} = 47 kΩ R_{g3} = 47 kΩ	
E 92 CC Double triode Typ. charact. (each section)	V_f = 6.3 V I_f = 0.4 A	V_a = 150 V V_g = −1.7 V	I_a = 8.5	S = 6 mA/V μ = 45	
E 180 CC Double triode Typical characteristics (each section)	V_f = 6.3 V I_f = 0.4 A Pins 9-(4+5) V_f = 12.6 V I_f = 0.2 A Pins 4-5	V_a = 150 V V_g = −1.9 V	I_a = 8.5	S = 6.3 mA/V μ = 46	
E 182 CC Double triode Typical characteristics (each section)	V_f = 6.3 V I_f = 0.64 A Pins 8-(4+5) V_f = 12.6 V I_f = 0.32 A Pins 4-5	V_a = 120 V V_g = −2 V	I_a = 36	S = 15 mA/V μ = 24	

ECC 186	V_f = 6.3 V	V_a = 100 V	I_a = 11.8	S = 3.1 mA/V
Double triode	I_f = 0.3 A	V_g = 0 V		μ = 19.5
Typical	Pins 9-(4+5)			
characteristics	V_f = 12.6 V	V_a = 250 V	I_a = 10.5	S = 2.2 mA/V
(each section)	I_f = 0.15 A	V_g = −8.5 V		μ = 17
	Pins 4-5			

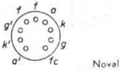


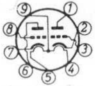
6211	V_f = 6.3 V	V_a = 100 V	I_a = 4.6	S = 3.6 mA/V
Double triode	I_f = 0.3 A	R_k = 470 Ω		μ = 28
Typical	Pins 9-(4+5)			
characteristics	V_f = 12.6 V			
(each section)	I_f = 0.15 A			
	Pins 4-5			





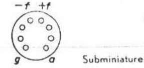
6463	V_f = 6.3 V	V_a = 250 V	I_a = 14.5	S = 5.2 mA/V
Double triode	I_f = 0.6 A	R_k = 620 Ω		μ = 20
Typical	Pins 9-(4+5)			
characteristics	V_f = 12.6 V			
(each section)	I_f = 0.3 A			
	Pins 4-5			

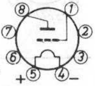


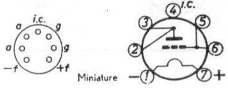
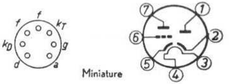
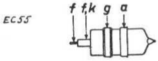
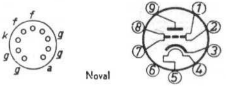
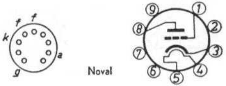


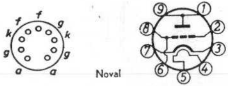
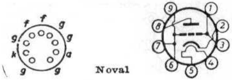
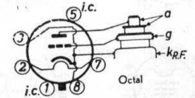
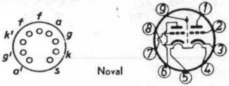
S.H.F., U.H.F. - AND V.H.F. TUBES

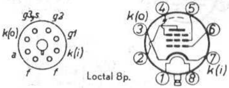
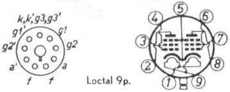
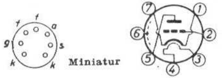
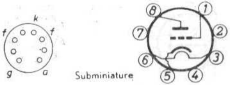
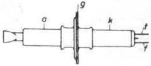
DC 70	V_f = 1.25 V	V_a = 150 V	I_a = 12	S = 3.4 mA/V
Triode	I_f = 0.2 A	V_g = –4.5 V		R_i = 4 kΩ
Typical				W_a = max. 2.4 W
characteristics				
Oscillator		V_a = 150 V	I_k = 20	freq. = 500 Mc/s
				W_o = 0.45 W

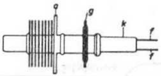
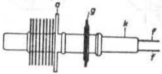




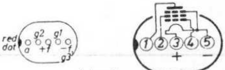
Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
DC 90 Triode Typical characteristics	V_f = 1.4 V I_f = 50 mA	V_a = 90 V V_g = −3 V	I_a = 3	S = 1.1 mA/V μ = 11.5	
Frequency changer		V_a = 90 V V_{osc} = 5.5 V	I_g = 0.006	R_g = 1 MΩ r_g (f = 100 Mc/s) = 12 kΩ	
EAC 91 Diode triode Typical characteristics	V_f = 6.3 V I_f = 0.3 A	V_a = 200 V V_g = −4 V	I_a = 5.5	S = 2.5 mA/V R_i = 12.4 kΩ freq. = max. 300 Mc/s	
EC 55 Disc seal triode Typical characteristics	V_f = 6.3 V I_f = 0.4 A	V_a = 250 V V_g = −3.5 V	I_a = 20	S = 6 mA/V μ = 30 freq. = max. 3000 Mc/s	
EC 80 Grounded-grid triode Typical characteristics	V_f = 6.3 V I_f = 0.48 A	V_a = 250 V V_g = −1.5 V	I_a = 15	S = 12 mA/V μ = 80 freq. = max. 500 Mc/s	
EC 81 Oscillator triode Typical characteristics	V_f = 6.3 V I_f = 0.2 A	V_a = 150 V V_g = −2 V	I_a = 30	S = 5.5 mA/V μ = 16 freq. = max. 1250 Mc/s	

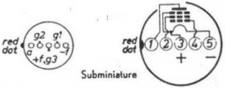
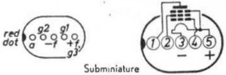
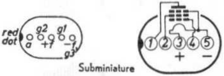
EC 86 Grounded-grid triode Typical characteristics	V_f = 6.3 V I_f = 0.2 A	V_a = 175 V V_g = —1.5 V	I_a = 12	S = 14 mA/V μ = 68 R_{eq} = 230 Ω	
EC 88 Grounded-grid triode Typical charact.	V_f = 6.3 V I_f = 0.18 A	V_a = 160 V V_g = —1.25 V	I_a = 12.5	S = 14 mA/V μ = 65 R_{eq} = 230 Ω	
EC 91 Grounded-grid triode	See 6 AQ 4				
EC 157 Disc seal triode Typical characteristics	V_f = 6.3 V I_f = 0.735 A	V_a = 180 V V_g = −1.25 V	I_a = 60 $I_{k\max.}$ = 70	S = 21 mA/V μ = 43 freq. = 4000 Mc/s	
		V_a = 180 V V_g = −2.8 V	I_a = 30	S = 18 mA/V μ = 43	
EC 158 Disc seal triode Typical charact.	V_f = 6.3 V I_f = 0.88 A	V_a = 180 V V_g = −3.8 V	I_a = 60 $I_{k\max.}$ = 140	S = 22 mA/V μ = 26 freq. = 4000 Mc/s	
ECC 189 Double triode Typical characteristics (each section)	V_f = 6.3 V I_f = 0.365 A	V_a = 90 V V_g = —1.4 V	I_a = 15	S = 12.5 mA/V μ = 32	

Type and Application	Filament data	Voltages Resistors	Currents (mA)	Characteristic data	Base connections
EF 51 Variable mu pentode Typical characteristics	$V_f = 6.3$ V $I_f = 0.35$ A	$V_a = 250$ V $V_{g2} = 250$ V $V_{g1} = -2$ V $V_{g3} = 0$ V	$I_a = 14$ $I_{g2} = 2.6$	$S = 9.5$ mA/V $R_i = 0.5$ MΩ $R_{eq} = 1$ kΩ $C_{ag1} < 7$ mpF	 Loctal 8p.
EFF 51 Double pentode Typical characteristics (each section)	$V_f = 6.3$ V $I_f = 0.75$ A	$V_a = 250$ V $V_{g2} = 200$ V $V_{g1} = -2$ V	$I_a = 6$ $I_{g2} = 1.2$	$S = 7.5$ mA/V $R_i = 0.35$ MΩ $R_{eq} = 800$ Ω $C_{ag1} < 0.04$ pF freq. = max. 500 Mc/s	 Loctal 9p.
6 FY 5 R.F. amplifier triode Typical charact.	$V_f = 6.3$ V $I_f = 0.2$ A	$V_a = 135$ V $V_g = -1$ V	$I_a = 11$	$S = 13$ mA/V $\mu = 70$	 Miniatur
5718 Medium mu triode 8-lead sub-miniature	$V_f = 6.3$ V $I_f = 0.15$ A	$V_a = 150$ V $R_k = 180$ Ω	$I_a = 13$	$S = 6.5$ mA/V $R_i = 4.2$ kΩ freq. = max. 1000 Mc/s	 Subminiature
5876 Pencil type High-mu triode	$V_f = 6.3$ V $I_f = 0.135$ A	$V_a = 250$ V $R_k = 75$ Ω	$I_a = 18$	$S = 6.5$ mA/V $\mu = 56$ freq. = max. 1700 Mc/s	

6263	V_f = 6.3 V	V_a = 200 V	I_a = 27	S = 7 mA/V	
Pencil type	I_f (at	R_k = 110 Ω		μ = 27	
Medium-mu	V_f = 6.0 V)			freq. =	
triode	= 0.28 A			max. 1700 Mc/s	
Typical					
charact.					
6264	V_f = 6.3 V	V_a = 200 V	I_a = 18.5	S = 6.8 mA/V	
Pencil type	I_f (at	R_k = 80 Ω		μ = 40	
Medium-mu	V_f = 6.0 V)			freq. =	
triode	= 0.28 A			max. 1700 Mc/s	
Typical					
charact.					

HEARING-AID TUBES

DF 64	V_f = 0.625 V	V_a = 15 V	I_a = 0.06	S = 0.1 mA/V	
Pentode	I_f = 10 mA	V_{g2} = 15 V	I_{g2} = 0.02	R_i = 1 MΩ	
Typical		V_{g1} = −0.62 V		μ_{g2g1} = 7.5	
characteristics					
A.F. amplifier		V_b = 15 V	I_k = 0.0064	g = 25	 Subminiature
		R_a = 2.2 MΩ			
		R_{g2} = 4.5 MΩ			
		V_{g1} = 0 V			
		R_{g1} = 10 MΩ			
		R_{g1}' = 5 MΩ			
DF 66	V_f = 0.625 V	V_a = 22.5 V	I_a = 0.05	S = 0.1 mA/V	 Subminiature
Pentode	I_f = 15 mA	V_{g2} = 22.5 V	I_{g2} = 0.015	R_i > 2 MΩ	
Typical		V_{g1} = −1.05 V		μ_{g2g1} = 11.5	
characteristics					

Type and Application	*Filament data*	*Voltages Resistors*	*Currents (mA)*	*Characteristic data*	*Base connections*
DF 67 Pentode Typical characteristics A.F. amplifier	V_f = 0.625 V I_f = 13.3 mA	V_a = 22.5 V V_{g2} = 18 V V_{g1} = −1.15 V	I_a = 0.05 I_{g2} = 0.01	S = 0.1 mA/V R_i = 4 MΩ μ_{g2g1} = 8.7	
		V_b = 22.5 V R_a = 1 MΩ R_{g2} = 3.9 MΩ V_{g1} = 0 V R_{g1} = 10 MΩ R_{g1}' = 5 MΩ	I_a = 0.0117 I_{g2} = 0.0025	g = 31	
DL 64 Output pentode Class A final amplifier	V_f = 1.25 V I_f = 10 mA	V_b = 15 V V_{g2} = 15 V V_{g1} = −1.5 V	I_a = 0.16 I_{g2} = 0.04	S = 0.18 mA/V R_i = 0.4 MΩ R_a = 100 kΩ W_o = 0.95 mW	
DL 66 Output pentode Class A final amplifier	V_f = 1.25 V I_f = 15 mA	V_b = 22.5 V V_{g2} = 22.5 V V_{g1} = −1.4 V	I_a = 0.30 I_{g2} = 0.075	S = 0.35 mA/V R_i = 0.3 MΩ R_a = 75 kΩ W_o = 2.7 mW	
		V_b = 45 V V_{g2} = 45 V V_{g1} = −3 V	I_a = 0.90 I_{g2} = 0.2	R_a = 50 kΩ W_o = 16.5 mW	

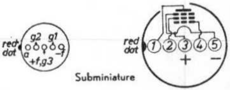
DL 67
Output pentode
Class A final amplifier

V_f = 1.25 V
I_f = 13 mA

V_a = 22.5 V
V_{g2} = 22.5 V
V_{g1} = −0.2 V

I_a = 0.475
I_{g2} = 0.1

S = 0.42 mA/V
R_i = 0.4 MΩ
μ_{g2g1} = 9



Subminiature

V_b = V_{g2} = 22.5 V
R_{g1} = 3 MΩ
R_k = 4 kΩ

I_a = 0.19
I_{g2} = 0.07

R_a = 0.1 MΩ
W_o = 1.6 mW
W_a = max. 25 mW

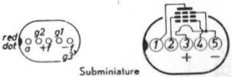
DL 68
Output pentode
Class A final amplifier

V_f = 1.25 V
I_f = 25 mA

V_b = 22.5 V
V_{g2} = 22.5 V
V_{g1} = −2.2 V

I_a = 0.6
I_{g2} = 0.15

S = 0.43 mA/V
R_i = 0.1 MΩ
R_a = 37.5 kΩ
W_o = 5 mW
W_a = max. 100 mW



Subminiature

NOTES:

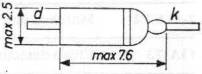
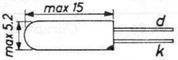
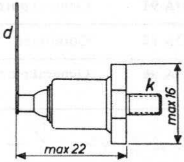
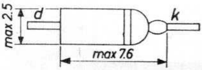
SEMICONDUCTORS

Type	Description	I_D at $V_D = 1\ V$	$-I_D$		I_{Dmax} at $-V_D$	
			$-V_D = 1.5\ V$	at max $-V_{DM}$	0	at max $-V_{DM}$
		mA	µA		mA	
		$T_{amb} = 25\ °C$				
AAY 11	Computer	8	1.3	130	35	10
AAZ 15	Gold bonded General purpose	65 $V_D = 0.5$ V	0.6	10	80	75
AAZ 17	Gold bonded switching	40 $V_D = 0.5$ V	1.5	30	45	45
AAZ 18	Gold bonded switching	90 $V_D = 0.5$ V	0.6	6	95	95
OA 5	Gold bonded General purpose	70 $V_D = 0.6$ V	0.8	8.0	130	115
OA 7	Gold bonded switching	65 $V_D = 0.6$ V	0.4	6.0	80	80
OA 9		100 $V_D = 0.5$ V	0.7	7.0	160	160
OA 31	Power Rectifier	12000 $V_D = 0.6$ V	25	40		12000
OA 47	Gold bonded switching	25 $V_D = 0.5$ V	0.6	10	45	45

---

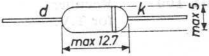
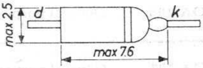
[1] The diode mounted on a copper heat sink of at least 120 × 120 × 1 mm.

DIODES

I_{DM} max	$-V_D$ max	$-V_{DM}$ max	T_{amb} max	T_j max	K max	Mechanical outline
mA		V		°C	°C/mW	
$T_{amb} \leqq T_{amb\ max}$	$T_{amb\ max}$					
150	90	90	+60			
250	75	75	+60		0.45	
150	50	50	+60		0.45	
300	20	20	+60		0.45	
350	50	50	+75			
250	25	25	+75		0.4	
500	25	25	+75		0.35	
12000	85	85		+75	0.012¹)	
150	25	25	+60		0.45	

Type	Description	I_D at	$-I_D$		I_{Dmax} at $-V_D$	
		$V_D = 1$ V	$-V_D = 1.5$ V	at $Max -V_{DM}$	0	at $max -V_{DM}$
		mA	µA		mA	
			$T_{amb} = 25$ °C			
OA 70	Video detector	8.5	5	150	50	15
OA 72	A.M. detector	5	0.8	130	35	10
2-OA 72	Matched pair	For ratio detector circuits				
OA 73	Video detector	15	5	280	50	15
OA 79	A.M. detector	4	0.8	90	35	10
2-OA 79	Matched pair	For ratio detector circuits				
OA 81	General purpose	5	1.5	75	50	15
OA 85	General purpose	8	1.2	75	50	15
OA 86	Computer	8	1.3	130	35	10
OA 90	Video detector	10	2.4	300	30	24
OA 91	General purpose	7	1.5	75	50	15
OA 92	Computer	13	0.5	20	16	16
OA 95	General purpose	9	1.2	80	50	15

BZZ 15 $V_Z = 6$ V

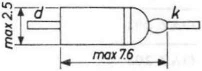
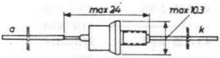
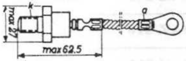
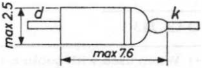
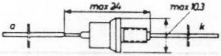
I_{DM} max	$-V_D$ max	$-V_{DM}$ max	T_{amb} max	T_j max	K max	Mechanical outline
mA		V		°C	°C/mW	
$T_{amb} \leqq T_{amb\ max}$	T_{amb} max					
150	15	22.5	+75			
100	30	45	+60			
150	20	30	+75			
100	30	45	+60			
150	75	100	+75			
150	75	100	+75			
150	60	90	+60			
45	20	30	+75			
150	75	100	+75		0.4	
50	15	15	+75		0.55	
150	75	100	+75		0.4	

Type	*Description*	I_D	$-I_D$		I_D
		at $V_D = 1$ *V*	*at* $-V_D = 5$ *V*	*at* *max* $-V_{DM}$	*at* *max* $-V_{DM}$
		A	*µA*	*µA*	*A*
		$T_{amb} = 25$ °C			
BA 100	General purpose	0.055			0.035
BA 102	Voltage dependent capacitor			0.10	C_D at $-V_D = 4$ V $f = 0.5$ Mc/s 30 pF
BY 100	Rectifier for T.V.	$T_j = 125$ °C			T_{amb} = 70 °C
		1.6	0.5	33	0.45
BYZ 14	Power rectifier	$T_j = 150$ °C			16[1]
		65	500	1300	
OA 200	General purpose	0.07		0.02	0.08
OA 202	General purpose	0.07		0.01	0.08
		$T_{amb} = 125$ °C			T_{amb} *max*
OA 210 (127 V)	Rectifiers for T.V.	0.4	10	45	0.5
OA 211 (250 V)		0.4	2.5	15	0.4
OA 214 (220 V)		0.4	10	65	0.5

---

[1] For six phase star, the value is 13 A.

DIODES

IDM *max*	*—VD* *max*	*—VDM* *max*	*Tamb* *max*	*Tj* *max*	*K* *max*	*Mechanical outline*
A		*V*		*°C*	*°C/mW*	
	Tamb max					
0.10	60	60	+90		0.4	
	20	20	+80		0.4	
*T*amb = 70 °C						
5	800	800	+70	+150		
100	200	200		+150		
0.125	50	50	+125		0.4	
0.125	150	150	+125		0.4	
5	400	400	+70			
4	800	800	+60			
5	700	700	+70			

SILICON ZENER

Type	*Description*	T_j	*K*	$-V_D$ at $-I_D = 5\ mA$	P_d
		max	*max*	$T_{amb} = 25\ °C$	$T_{amb} = 25\ °C$
		°C	°C/mW	V	mW
OAZ 200	Junction diodes for use as a low current stabilizer or as a voltage reference	150	0.4 0.3[1])	5.2	031 415[1])
OAZ 201				5.6	
OAZ 202				6.0	
OAZ 203				6.3	
OAZ 204				6.9	
OAZ 205				7.6	
OAZ 206				8.2	
OAZ 207				9.2	
OAZ 208				4.9	
OAZ 209				5.6	
OAZ 210				6.3	
OAZ 211				7.6	
OAZ 212				9.2	
OAZ 213				12.2	

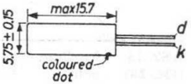
---

[1]) When used with cooling-fin, and mounted on a heat sink of at least 12.5 cm².

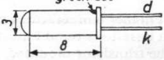
PHOTO

Type	*Description*	$-V_D$	$-I_D$	P_d	Dark current at $-V_D = 10\ V$
		V	mA	mW	µA
OAP 12	General purpose	30	3	30	max 15

DIODES

−I_D	*Reverse current*	*Forward voltage*	*Typical change in zener voltage with temp.*	*Mechanical outline*
max	*at* −V_D = 2 V	*at* I_D = 10 mA	−I_D = 20 mA	
mA	*µA*	*V*	*mV/°C*	
50	0.25	0.73	+0.2	
	0.1		+1.0	
	0.03		+1.9	
	0.04		+2.6	
	0.03		+3.6	
	0.02		+4.6	
	0.04		+5.4	
45	0.03		+6.6	
50	0.2		−0.5	
	0.1		+1.0	
	0.01		+2.6	
	0.02		+4.6	
40	0.03		+6.6	
35	0.025		+9.4	

DIODE

Light sensitivity I_D at − V_D = 10 V, and uniform illumination of 1000 lux.	*Spectral response*	*Mechanical outline*
µA	*µ*	
50	0.5—2	

Type	Description	$T_{amb} = 45\ °C$						
		$-V_{CB}$ $-V_{CBM}$ max	$-V_{CE}$ $-V_{CEM}$ max	$-V_{EB}$ $-V_{EBM}$ max	$-I_C$ $-I_{CM}$ max	P_C max	K1) max	T_j max
		V		V	mA	mW	°C/mW	°C
AC 107	Low noise	15	2) 15	5	5	50	0.6	+75
		15	2) 15	5	10			
AF 102	Ampl. oscillator and convertor	25		0.3	10	50	0.6	+75
		25		0.3	10			
ASZ 15 (OC 28)	Medium gain power	80	4) 60	40	6000	7500	0.006	+90
		80	4) 60	40	6000			
ASZ 16 (OC 29)	High gain power	60	4) 48	20	6000	7500	0.006	+90
		60	4) 48	20	6000			
ASZ 17 (OC 35)	Medium gain power	60	4) 48	20	6000	7500	0.006	+90
		60	4) 48	20	6000			
ASZ 18 (OC 36)	High gain power	80	4) 60	40	6000	7500	0.006	+90
		80	4) 60	40	6000			
OC 16	A.F. power	32	2) 32	10	1500	3) 6000	0.005	+75
		32	2) 32	10	3000			
2-OC 16	Matched pair for class B.							

---

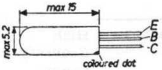
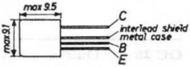
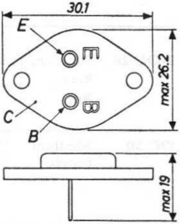
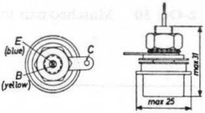
1) At higher temperatures the dissipation must be derated, according to the given K.

2) At base-to-ground impedance $< 300\ \Omega$. Stabilisation must be provided.

3) The transistor mounted on a copper heat sink of at least 200 × 200 × 1 mm.

4) At $-I_C \leqq 0.5$ A.

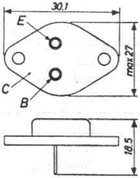
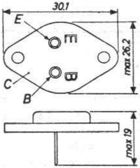
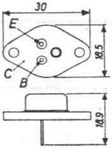
TRANSISTORS

$T_{amb} = 25\ °C$			Mechanical outline
h_{FE}	h_{fe}	$f_{\alpha b}$	
		Mc/s	
	80 at: $-I_C = 1$ mA $-V_{CE} = 6$ V	min 2	
		f_1 = 180 Mc/s	
40 at: $-I_C = 1$ A $-V_{CE} = 1$ V		0.2	
80 at: $-I_C = 1$ A $-V_{CE} = 1$ V		0.2	
50 at: $-I_C = 1$ A $-V_{CE} = 1$ V		0.2	
60 at: $-I_C = 1$ A $-V_{CE} = 1$ V		0.2	
25 at: $-I_C = 1.5$ A $-V_{CE} = 1$ V		0.2	

Type	Description	$T_{amb} = 45\,°C$						
		$-V_{CB}$ $-V_{CBM}$ max	$-V_{CE}$ $-V_{CEM}$ max	$-V_{EB}$ $-V_{EBM}$ max	$-I_C$ $-I_{CM}$ max	P_C max	K 1) max	T_j max
		V		V	mA	mW	°C/mW	°C
OC 22		36 47	4) 24 4) 32	12 15	1000 2000			
OC 23	High frequency powers	36 55	3) 24 4) 40	12 15	1000 2000	3) 6000	0.0075	+90
OC 24		36 47	4) 24 4) 40	12 15	1000 2000			
OC 26	Output power	40 40	5) 40 40	10 10	3500 3500	3) 7500	0.006	+90
2-OC 26	Matched pair for class B. $\frac{h_{FE1}}{h_{FE2}}$ at $-V_{CE} = 1$ V and $-I_C = 0.3$ A $= 1.15$							
OC 30	Medium power	16 32	2) 16 2) 32	10 10	1400 1400	3) 2500	0.012	+75
2-OC 30	Matched pair for A.F. class B.							

---

1) At higher temperatures the dissipation must be derated, according to the given K.
2) At base-to-ground impedance $< 300\,\Omega$. Stabilisation must be provided.
3) The transistor mounted on a copper heat sink of at least 200 × 200 × 1 mm
4) At base-to-ground impedance $< 100\,\Omega$. Stabilisation must be provided.
5) For $-I_C \leqq 0.5$ A and at base-to-ground impedance $< 30\,\Omega$. Stabilisation must be provided.

$T_{amb} = 25\,°C$			Mechanical outline
h_{FE}	h_{fe}	$f_{\alpha b}$	
		Mc/s	
125 at: $-I_C = 1$ A $-V_{CE} = 2$ V			
150 at: $-I_C = 1$ A $-V_{CE} = 2$ V	180 at: $-I_C = 400$ mA $-V_{CE} = 2$ V	2.5	
150 at: $-I_C = 1$ A $-V_{CE} = 2$ V			
35 at: $-I_C = 1$ A $-V_{CE} = 1$V		0.15	
28 at: $-I_C = 0.8$A $-V_{CE} = 1$ V		0.3	

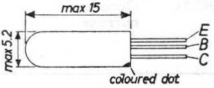
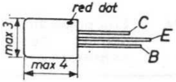
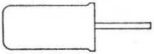
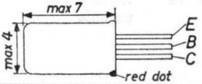
Type	*Description*	$T_{amb} = 45\,°C$						
		$-V_{CB}$ $-V_{CBM}$ *max*	$-V_{CE}$ $-V_{CEM}$ *max*	$-V_{EB}$ $-V_{EBM}$ *max*	$-I_C$ $-I_{CM}$ *max*	P_C *max*	*K* 1) *max*	T_j *max*
		V		*V*	*mA*	*mW*	*°C/mW*	*°C*
OC 44	Mixer oscillator	15 15	2) 15 2) 15	12 12	5 10	50	0.6	+75
OC 45	I.F. amplifier	15 15	2) 15 2) 15	12 12	5 10	50	0.6	+75
OC 46	High speed switching	20 20	3) 20 3) 20	15 15	100 125	50	0.6	+75
OC 47	High speed switching	20 20	3) 20 3) 20	15 15	100 125	50	0.6	+75
OC 57	Hearing aids sub-miniature	7 7	3 7	7 7	5 10	6.7	1.5	+55
OC 58		7 7	3 7	7 7	5 10	6.7	1.5	+55
OC 59		7 7	3 7	7 7	5 10	6.7	1.5	+55
OC 60		7 7	3 7	7 7	5 10	6.7	1.5	+55
OC 65	Hearing aids miniature	10 10	10 10	10 10	10 10	25	0.65	+65
OC 66		10 10	10 10	10 10	10 10	25	0.65	+65

---

1) At higher temperatures the dissipation must be derated, according to the given K.

2) At base-to-ground impedance $< 300\,\Omega$. Stabilisation must be provided.

3) Permissible at $+V_{BE} \geqq 0.2$ V.

$T_{amb} = 25\ °C$			Mechanical outline
h_{FE}	h_{fe}	f_{α}^{b}	
		Mc/s	
	100 at: $-I_C = 1$ mA $-V_{CE} = 6$ V	15	
	50 at: $-I_C = 1$ mA $-V_{CE} = 6$ V	6	
min 20 at: $-V_{CB} = 0$ V $I_E = 15$ mA		min 3	
min 50 at: $-V_{CB} = 0$ V $I_E = 15$ mA		min 4.5	
	35 at: $-I_C = 0.25$ mA $-V_{CE} = 2$ V	1.5	
	55 at: $-I_C = 0.25$ mA $-V_{CE} = 2$ V	2.2	
	80 at: $-I_C = 0.25$ mA $-V_{CE} = 2$ V	2.8	
	55 at: $-I_C = 0.25$ mA $-V_{CE} = 2$ V	2.2	
	30 at: $-I_C = 0.5$ mA $-V_{CE} = 2$ V	0.45	
	45 at: $-I_C = 3$ mA $-V_{CE} = 2$ V	0.45	

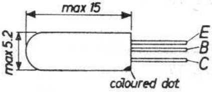
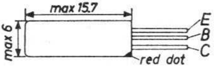
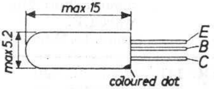
Type	Description	$T_a = 45\,°C$						
		$-V_{CB}$ $-V_{CBM}$ max	$-V_{CE}$ $-V_{CEM}$ max	$-V_{EB}$ $-V_{EBM}$ max	$-I_C$ $-I_{CM}$ max	P_C max	K1) max	T_j max
			V	V	mA	mW	°C/mW	°C
OC 70	General purpose		2) 30 2) 30		10 50	75	0.4	+75
OC 71	General purpose		2) 30 2) 30		10 50	75	0.4	+75
OC 72	Output transistor	32 32	2) 32 2) 32	10 10	50 125	75 3) 100	0.4 3) 0.3	+75
2-OC 72	Matched pair for A.F. class B. $\frac{h_{FE1}}{h_{FE1}}$ at $-V_{CE} = 0.7$ V and $-I_C = 80$ mA $= 1.15$							
OC 74	Low power output transistor	20 20	2) 20 2) 20	6 6	300 300	135 3) 330	0.22 3) 0.09	+75
2-OC 74	Matched pair for class B. $\frac{h_{FE1}}{h_{FE2}}$ at $-V_{CE} = 6$ V and $-I_C = 50$ mA $= 1.15$							
OC 75	General purpose		2) 30 2) 30		10 50	75	0.4	+75

---

1) At higher temperatures the dissipation must be derated, according to the given K.

2) At base-to-ground impedance $< 300\,\Omega$. Stabilisation must be provided.

3) When used with cooling-fin, and mounted on a heat sink of at least 12.5 cm^2

$T_{amb} = 25\ °C$			Mechanical outline
h_{FE}	h_{fe}	$f_{\alpha b}$	
		Mc/s	
	30 at: $-I_C = 0.5$ mA $-V_{CE} = 2$ V	0.6	
	45 at: $-I_C = 3$ mA $-V_{CE} = 2$ V	0.7	
50 at: $-V_{CE} = 0.7$ V $-I_C = 80$ mA		0.8	
			
100 at: $-I_C = 50$ mA $-V_{CE} = 6$ V		1.1	
	90 at: $-I_C = 3$ mA $-V_{CE} = 2$ V	0.8	

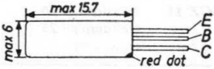
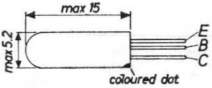
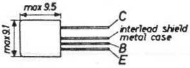
Type	Description	$T_{amb} = 45\,°C$						
		$-V_{CB}$ $-V_{CBM}$ max	$-V_{CE}$ $-V_{CFM}$ max	$-V_{EB}$ $-V_{EBM}$ max	$-I_C$ $-I_{CM}$ max	P_C max	K[1] max	T_j max
			V	V	mA	mW	°C/mW	°C
OC 76	Switching and pulse oscillator circuits	32 32	[2] 32 [2] 32	10 10	125 250	75 [3] 100	0.4 [3] 0.3	+75
OC 77		60 60	[2] 60 [2] 60	10 10	125 250	75 [3] 100	0.4 [3] 0.3	+75
OC 79	Output transistor	26 26	[2] 26 [2] 26	6 6	300 300	135 [3] 330	0.22 [3] 0.09	+75
OC 80	Switching and pulse oscillator circuits	32 32	[2] 32 [2] 32	20 20	300 600	135 [3] 330	0.22 [3] 0.09	+75
OC 139	N-P-N High speed switching	—20 —20	[2] —20 [2] —20	—20 —20	—200 —250	60	0.5	+75
OC 140		—20 —20	[2] —20 [2] —20	—20 —20	—200 —250	60	0.5	+75
OC 169	I.F. ampl. 10.7 Mc/s	20 20		0.5 0.5	10 10	50	0.6	+75
OC 170	Mixer-oscillator short wave I.F. ampl. 10.7Mc/s	20 20		0.5 0.5	10 10	50	0.6	+75
OC 171	Preampl. oscillator mixer for F.M.	20 20		0.5 0.5	10 10	50	0.6	+75

---

[1] At higher temperatures the dissipation must be derated, according to the given K.

[2] At base-to-ground impedance $< 300\,\Omega$. Stabilisation must be provided.

[3] When used with cooling-fin, and mounted on a heat sink of at least 12.5 cm^2.

T_{amb} = 25 °C			Mechanical outline
h_{FE}	h_{fe}	$f_{\alpha b}$	
		Mc/s	
	100 at: —I_C = 50 mA —V_{CE} = 1 V	0.9	
	100 at: —I_C = 50 mA —V_{CE} = 1 V	0.9	
60 at: —I_C = 50 mA —V_{CE} = 6 V		0.8	
	200 at: —I_C = 50 mA —V_{CE} = 1 V	2.0	
	40 at: —I_C = 50 mA —V_{CE} = 1 V	6.0	
	90 at: —I_C = 50 mA —V_{CE} = 1 V	12	
	100 at: —I_C = 1 mA —V_{CE} = 6 V	f_1 = 70 Mc/s	
	100 at: —I_C = 1 mA —V_{CE} = 6 V	f_1 = 70 Mc/s	
	100 at: —I_C = 1 mA —V_{CE} = 6 V	f_1 = 65 Mc/s	

SILICON

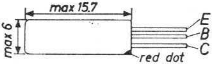
Type	*Description*	*T_{amb} = 45 °C*						
		$-V_{CB}$ *$-V_{CBM}$* *max*	*$-V_{CE}$* *$-V_{CEM}$* *max*	*$-V_{EB}$* *$-V_{EBM}$* *max*	*$-I_C$* *$-I_{CM}$* *max*	*P_C* *max*	*K*[1] *max*	*Tj* *max*
			V		*mA*	*mW*	*°C/mW*	*°C*
BCZ 10	AF transistor	25 25	25 25	20 20	50 50	210	0.5	+150
BCZ 11	Medium frequency transistor	25 25	25 25	20 20	50 50	210	0.5	+150
BCZ 12	A.F. transistor	60 60	60 60	30 30	50 50	210	0.5	+150

PHOTO

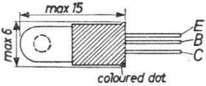
Type	*Description*	*T_{amb} = 45 °C*						*Dark current at*
		$-V_{CE}$	*$-V_{CEM}$*	*$-I_C$*	*$-I_{CM}$*	*P_C*	*K*[1]	*$-V_{CE}$ = 4.5 V*
		V	*V*	*mA*	*mA*	*mW*	*°C/mW*	*µA*
OCP 70	General purpose	7.5	7.5	20	20	25	0.4	<325

[1] At higher temperatures the dissipation must be derated, according to the given K.

TRANSISTORS

$T_{amb} = 25\ °C$			Mechanical outline
h_{FE}	L_{fe}	$f_{\alpha b}$	
		Mc/s	
	20 at: $-I_C = 1$ mA $-V_{CE} = 6$ V	1.0	
	35 at: $-I_C = 1$ mA $-V_{CE} = 6$ V	1.5	
	15 at: $-I_C = 1$ mA $-V_{CE} = 6$ V	1.0	

TRANSISTOR

Light current $- V_{CE} = 2$ V and uniform illumination of 75 ft candle	Spectral response	Mechanical outline
μA	μ	
>750	0.5 − 2	

NOTES:

CATHODE-RAY TUBES

PREFERRED INSTRUMENT TUBES

	Type number						
	Persistence of phosphors						
Screen diameter	*short*	*medium*	*long*	*very long*	*Heating*	*Deflection*	*Post-acceleration*
2½ cm (1'')		**DH3-91 3)**			6.3 V-0.55 A	asym.-sym.	none
7 cm (3'')	**DB7-5**	**DG7-5**	**DR7-5**	**DP7-5**	6.3 V 0.3 A	sym.-sym.	
	DB7-6	**DG7-6**	**DR7-6**	**DP7-6**		sym.-asym.	
		DG7-31/01					
	DB7-36 1) **DB7-78 1)5)**	**DG7-32/01** **DG7-36 1)** **DH7-78 1)5)**	**DN7-36 1)** **DN7-78 1)1)**			sym.-sym	with
	3WP11 1)	**3WP1 1)**	**3WP2 1)**		6.3 V 0.6 A		none
10 cm (4'')	**DB10-78 1)5)**	**DH10-78 1)5)**	**DN10-78 1)5)**	**DP10-78 1)5)**	6.3 V 0.3 A		with
		DHM10-93 7)			6.3 V 0.55 A		
13 cm (5'')	**DB13-34 1)**	**DH13-10** **DG13-34 1)**		**DP13-34 1)**	6.3 V 0.6 A		
	DB13-76 1)5) **DB13-78 1)4)5)6)**	**DH13-76 1)5)** **DH13-78 1)4)5)6)**	**DN13-76** **DN13-78**		6.3 V 0.3 A		
16 cm (5½'') (rectangular)	**DB16-22**	**DG16-22**		**DP16-22**	6.3 V 0.3 A	2) sym.-asym.	none

1) flat face 2) both pairs of plates are suitable for symmetrical or asymmetrical deflection 3) automatic focus 4) aluminized screen 5) helical post-deflection acceleration electrode 6) side contacts 7) the vertical deflection systems are intended for asymmetrical deflection, the horizontal system for symmetrical deflection

PREFERRED TYPES

TELEVISION PICTURE TUBES

Screen diameter	*Type number*
47 cm (19'')	**AW47-91**

Screen diameter	*Type number*
59 cm (23'')	**AW59-90**

Deflection angle 110°, electrostatic focusing, magnetic deflection. With outer coating, without ion trap, with filter glass, spherical face, aluminized screen

Tube type	*Screen diameter*	*Persistence of phosphors*			
		very short	*short*	*long*	*very long*
RADAR TUBES	**13 cm** (5″)			**AL 13-36 1)**	
	22 cm (9″)			**AL22-10 2)**	
	31 cm (12″)			**AL31-10 2)**	**MF31-55 1)**
	41 cm (16″)				**MF41-10 1)**
FLYING SPOT SCANNERS	**13 cm** (5″)	**MC13-16 3)** **MK13-16 3)**			
VIEWFINDER PROJECTION TUBE (large screen)			**MW13-35 1)** **MW13-38 1)**		
MONITOR	**21 cm** (8½″)		**AW21-80 5)**		
	36 cm (14″)		**MW36-67 4)** **AW36-48**		

1) No outer coating; no ion trap: clear glass spherical face.

2) Outer coating; no ion trap; clear glass spherical face.

3) Outer coating; no ion trap; flat face.

4) Outer coating; no ion trap; filter glass spherical face.
Heating — 6.3 V - 0.3 A. aluminized screen.

5) Outer coating; ion trap; clear glass spherical face.

PREFERRED 3'' IMAGE ORTHICONS

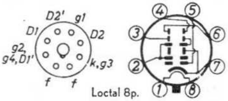
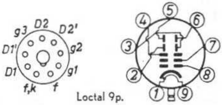
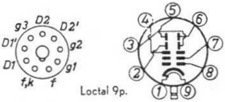
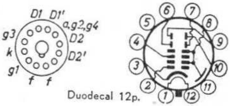
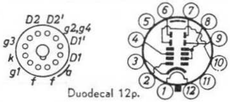
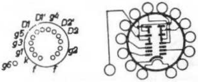
Type number	*Description*	*Specific properties*	*Applications*
[1]) 5820	General-purpose image orthicon.	1. High sensitivity.	1. Outdoor broadcast. 2. Studio operation. 3. Industrial TV.
[1]) 55807	General-purpose image orthicon identical to 5820 but equipped with additional fieldmesh and suppressor grid.	1. Same high sensitivity as 5820. 2. Simplified adjustment. 3. Improved blacklevel uniformity. 4. Practically no beampulling effect.	1. Outdoor broadcast. 2. Studio operation. 3. Industrial TV.
[1]) 55809	Low-noise image orthicon with high storage capacity relative to 5820 and 55807. Equipped with fieldmesh and suppressor grid.	1. High signal to noise ratio 2. Improved blacklevel uniformity. 3. Simplified adjustment. 4. No beam-pulling effect.	1. Studio operation. 2. Outdoor broadcast. 3. Video tape recording. 4. Colour TV with sequential or simultaneous pick up.

[1]) required scene brightness with f/5.6:5820 and 55807-100 lux; 55809-250 lux.

Type	*Screen*[1]	*Deflection system*	*Heater*		*Operating characteristics*				
	Max. diam. (mm)	*Double electrostatic*	V_f *(V)*	I_f *(A)*	V_{g7}	V_{g6}	V_{g5} *(V)*	V_{g4}	V_{g3}
DH 3-91	30	symmetrical or asymmetrical	6.3	0.55				500	
DB DG 4-1 DP	44	symmetrical	6.3	0.31					800
DB DG 4-2 DP	44	D_2D_2' asymmetrical							
DB DG 7-5 DP DR	71	symmetrical	6.3	0.31					800
DB DG 7-6 DP DR	71	D_2D_2' asymmetrical							
DG 7-31/01	71	D_2D_2' asymmetrical	6.3	0.3				500	0-120
DG 7-32/01		symmetrical							
DB DG 7-36 DN	77.8	symmetrical	6.3	0.3				1500	247-397
DB DH 7-78 DN	77.8	symmetrical	6.3	0.3		1200	300	300	20-150
						4000	1000	1000	35-165

---

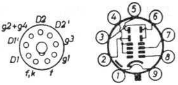
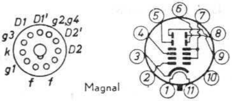
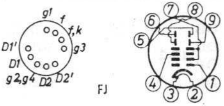
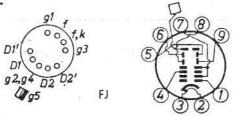
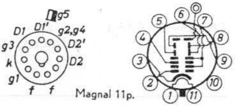
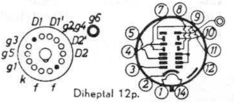
[1][2] See p. D20

Oper. charact.		*Deflect. factor*		*Capacitances*		*Overall length*	*Base connections*
V_{g2}	$-V_{g1}$²)	*M 1*	*M 2*	$C_{D1D1'}$	$C_{D2D2'}$	*max*	
(V)		*(V/cm)*		*(pF)*		*(mm)*	
500	8-27	45	52		1	105	 Loctal 8p.
200-300	0-50	40	62	0.6 0.7	0.8 0.9	160	 Loctal 9p.
20-300	0-50	40	62	0.6 0.7	0.8 0.9	160	 Loctal 9p.
500	50-100	21	37	1.1 1.0	1.8 1.7	172	 Duodecal 12p.
1500	40-80	19	27	1.7	1.9	296	 Duodecal 12p.
1200 1000	36-72 30-60	3.7 12	11 35	1.7	1.9	285	

Type	*Screen*1)	*Deflection system*	*Heater*		*Operating characteristics*				
	Max. diam. (mm)	*Double electro-static*	V_f (*V*)	I_f (*A*)	V_{g7}	V_{g6}	V_{g5} (*V*)	V_{g4}	V_{g3}
DB DH 7-91 DN	71	symm. or asymm.	6.3	0.55				1000	210-320
DB DG DP 10-2 DR	97.5	symmetrical	6.3	0.3				2000	400-720
DB DG 10-3 DR	97.5	D_2D_2' asymmetrical	4.0	0.56				1000	200-340
DB DG 10-5 DR	97.5	D_2D_2' asymm. with acceleration	4.0	0.56			$\frac{1000}{2500}$	1000	200-340
DB DG DP 10-6 DR	97.5	symm. with acceleration	6.3	0.3			$\frac{2000}{4000}$	2000	400-720
DG 10-74	97.5	symm. with acceleration	6.3	0.3			$\frac{2000}{4000}$	2000	400-720
DB DH DN 10-78 DP	102	Symmetrical	6.3	0.3		$\frac{2000}{4000}$	2000	2000	400-700

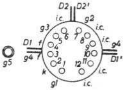
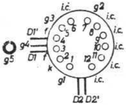
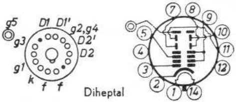
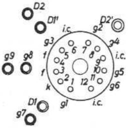
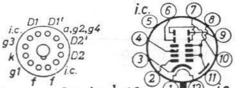
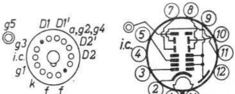
---

1) 2) see p. D20

Oper. charact.		*Deflect. factor*		*Capacitances*		*Overall length*	*Base connections*
V_{g2}	$-V_{g1}$2)	*M 1*	*M 2*	$C_{D1D1'}$	$C_{D2D2'}$	*max*	
(V)		*(V/cm)*		*(pF)*		*(mm)*	
1000	28-65	12	20	2.2	1.8	257	
2000	45- 100	28	37	1.9	2.5	341	
1000	18-46	15	18	1.9	2.6	344	
1000	18-46	15 27	18 31	1.9	2.6	344	
2000	45-100	29 36	37 45	1.9	2.5	341	
2000	45-100	29 36	37 45	1.9	2.5	341	
2000	45-75	16 18	38 48	1.7	2.1	305	

Type	*Screen*1)	*Deflection system*	*Heater*		*Operating characteristics*				
	Max. diam. (mm)	*Double electro-static*	V_f (V)	I_f (A)	V_{g7}	V_{g6}	V_{g5}	V_{g4}	V_{g3}
							(V)		
DHM 10-93	108	symm. or asymm.	6.3	0.55			3000	1500	320-420
DH 10-94	108	symmetrical	6.3	0.55			4000	2000	460-530
DB **DG 13-2** **DP** **DR**	135	symm. with acceleration	6.3	0.3			2000 4000	2000	400-720
DH 13-10	137	symm. or asymm.	6.3	0.55	3) 4)	3)	3)	1500	200-500
DG 13-32	135.4	symmetrical	6.3	0.6				2000	340-640
DB **DG 13-34** **DP**	134.5	symmetrical	6.3	0.6			3000 4000	1500 2000	300-515 400-690

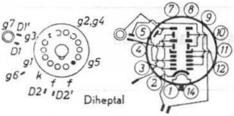
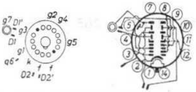
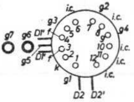
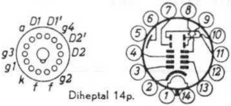
1)2) see p. D20 3) V_{g5}, V_{g6} and V_{g7} connected to $_{g4}$ 4) V_{g8} and $V_g{}^9 = 15$kV

Oper. charact.		Deflect. factor		Capacitances		Overall length	Base connections
V_{g2}	$-V_{g1}$2)	M 1	M 2	$C_{D1D1'}$	$C_{D2D2'}$	max	
(V)		(V/cm)		(pF)		(mm)	
1500	40-95	27	27	<0.1	<0.1	393	
2000	28-60	23	37	1.5	1.6	392	
2000	45-100	21 26	24 30	1.9	2.5	435	 Diheptal
1500	42-90	2.7	11	2	2	508	
2000	<90	21	26	1.5	2	384.5	 Duodecal 12 p.
1500	34-56	13	18	1.1	2.5	430	 Dihèptal 12p.
2000	45-75	18	23				

Type	Screen[1]	Deflection system	Heater		Operating characteristics				
	Max. diam. (mm)	Double electrostatic	V_f (V)	I_f (A)	V_{g7}	V_{g6}	V_{g5} (V)	V_{g4}	V_{g3}
DB **DH 13-76** **DN**	134.5	sym-metrical	6.3	0.3	4000	2000	2000	2000	220-710
DB **DH 13-78** **DN**					12000				
DB **DH 13-79** **DN**					10000	1670	1670	1670	180-590
DH 13-97	137	symm. or asymm.	6.3	0.55	10000	4000	1800	1800	440-560
DB **DG 16-22** **DP**	158 × 67.5	symm. or asymm.	6.3	0.3				5000	600-700

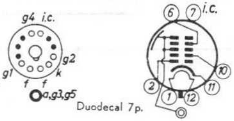
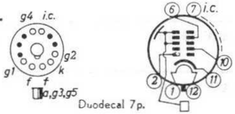
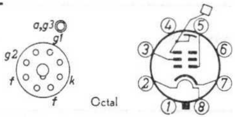
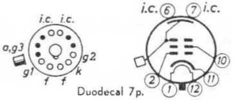
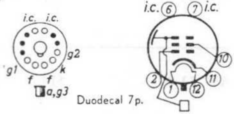
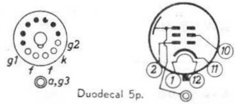
---

1) 2) See p D20

Oper. charact.		Deflect. factor		Capacitances		Overall length	Base connections
V_{g2}	$—V_{g1}$²)	M 1	M 2	$C_{D1D1'}$	$C_{D2D2'}$	max	
(V)		(V/cm)		(pF)		(mm)	
2000	60-96	6 8	22 36	1.5	2	468	 Diheptal
1670	50-80	6.5	30	1.5	1.9		
1400	45-90	12	26	1.7	2.3	452	
1800	25-70	48	53			430	 Diheptal 14p.

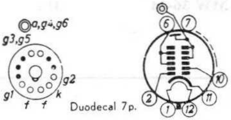
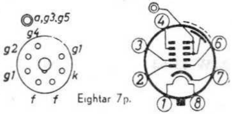
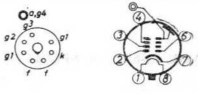
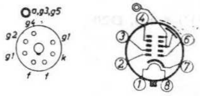
Type	*Screen*¹) *Round Useful diam.* (*mm*)	*Heater*		*Operating characteristics*				
		V_f (*V*)	I_f (*A*)	V_a	V_{g5}	V_{g4}	V_{g3}	V_{g2}
						(*V*)		
AL 13-36	108	6.3	0.3	12000	12000	—200/ +200	12000	300
AL 22-10	200							
AL 31-10	265							
MF 13-1	108	6.3	0.3	7000			7000	250
MF 31-22	287	6.3	0.3	9000			9000	300
MF 31-55	265	6.3	0.3	15000			15000	300
MF 41-10	368	6.3	0.3	15000			15000	300

¹)²) see p. D20.

Operating characteristics		*Capacitances*	*Overall length*		*Base connections*
—V_{g1}2) *(V)*	I_{g4} *(μA)*	C_{g1} *(pF)*	*max*	*min (mm)*	
30/70	—15/+15	<8	308	292	
			408	392	
			485	471	
28/63		<10	287	271	
32/81		<10	471	455	
30/90		<8	520		
30/70		<8	519	505	

Type	*Screen1)*				*Deflection system*	*Heater*		*Operating charact.*	
	Round	*Rectangular*							
	Useful diam.	*Useful diag.*	*Useful width*	*Useful height*	*Double magnetic*	V_f (V)	I_f (A)	V_{g4} (V)	V_{g3} (V)
	min. (mm)								
AW 36-80		330	306.5	241	With ion trap type 55402	6.3	0.3	10000	—100/ +200
								12000	—70/ +230
AW 43-80		390	362	273		6.3	0.3	14000	—103/ +203
AW 53-80		511	482	378				16000	75/ +235
AW 43-88		400	374.5	295	Without ion trap	6.3	0.3	0-400	14000 16000
AW 53-88		514.5	484	382.5					
AW 61-88		579.5	544.5	428.5					
AW 43-89		400	374.5	295	Without ion trap	6.3	0.3	16000	0-400
AW 53-89		514.5	484	382.5					
AW 47-91		446	384	305	Without ion trap	6.3	0.3	0-400	16000
AW 59-90		566	489	385					

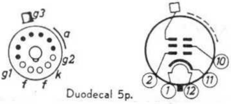
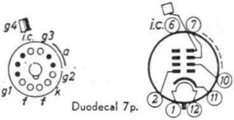
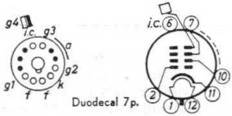
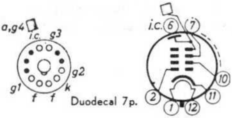
1)2) see page D20.

Operating characteristics		*Capacitances*	*Overall length*		*Base connections*
V_{g2} *(V)*	$-V_{g1}$ 2) *(V)*	C_{g1} *(pF)*	*max*	*min* *(mm)*	
300	40-80	7	368.5	352.5	
300	40-80	7	407	387	
			492	472	
			325.5	312.5	
300	30-72	6	381	365	
			411	395	
600	43-91	7	280.5	267.5	
			336	320	
500	38-81	6	304	291	
400	38-94		386	370	

Type	*Screen1)*				*Deflection system*	*Heater*		*Operating charact.*	
	Round	*Rectangular*							
	Useful diam.	*Useful diag.*	*Useful width*	*Useful height*	*Double magnetic*	I_f *(V)*	I_f *(A)*	V_{g4} *(V)*	V_{g3} *(V)*
	min. (mm)								
MW 36-24		318	288	217	With ion trap type 55402	6.3	0.3		1000
MW 36-44		318	288	217	With ion trap type 55402	6.3	0.3	12000	0-250
MW 43-64		390	362	273		6.3	0.3	14000	0-250

MW 43-69 = MW 43-64 (except for the metal backing)

1)2) see p, D20

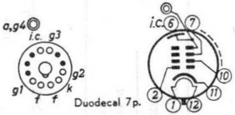
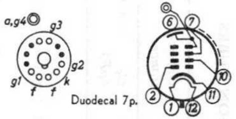
Operating characteristics		Capacitances	Overall length		Base connections
V_{g2} (V)	$-V_{g1}$2) (V)	C_{g1} (pF)	max	min (mm)	
250	33-72	6	433	413	
250	33-72	7	433	413	
300	40-86		495	475	
					

Type	*Screen*[1]				*Deflection system*	*Heater*		*Operating charact.*	
	Round	*Rectangular*							
	Useful diam.	*Useful diag.*	*Useful width*	*Useful height*	*Double magnetic*	V_f *(V)*	I_f *(A)*	V_{g4} *(V)*	V_{g3} *(V)*
	min. (mm)								
MW 53-20		506	485	360	With ion trap type 55402	6.3	0.3	14000 to 16000	0-300
MW 53-80		511	482	378					
MW 61-80		576.5	544.5	428.5					

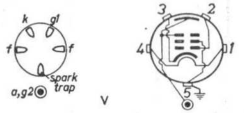
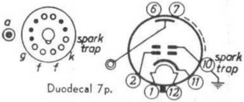
[1] The second letter of the typenumber indicates the colour of the luminescent screen:

B = blue, short persistence
F = orange, very long persistence
G = green, medium persistence
H = green, long persistence
L = orange, long persistence
N = green, long persistence
P = double layer screen. Blue of short persistence followed by greenish yellow of very long persistence
R = greenish-yellow, long persistence
W = white, medium persistence

[2] Grid voltage for visual cut-off

Operating characteristics		*Capacitances*	*Overall length*		*Base connections*
V_{g2} *(V)*	$-V_{g1}$²) *(V)*	C_{g1} *(pF)*	*max*	*min (mm)*	
			591	571	
300	40-80	7	514	494	
			542.5	522.5	

PROJECTION TUBES

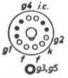
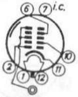
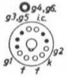
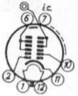
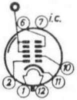
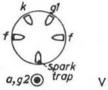
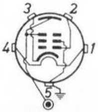
Type	*Screen*[1] *Round Useful diam*	*Heater*		*Operating characteristics*			*Capacitances*	*Overall length*		*Base connections*
	(mm)	V_f *(V)*	I_f *(A)*	V_a *(V)*	V_{g2} *(V)*	V_{g1}[2] *(V)*	C_g *(pF)*	*max*	*min* *(mm)*	
MG **MU 6-2** **MW** **MY**	55	6.3	0.3	25000	25000	40-90	6.3	268	256	
MG **MU** **MW 13-38** **MY**	72×96	6.3	0.66	50000		100- 170	<10	374	354	

---

[1] The second letter of the typenumber indicates the colour of the luminescent screen:
G = yellowish green; U = Blue; W = White; Y = Yellow

[2] Grid voltage for visual cut-off

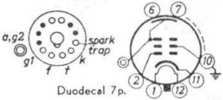
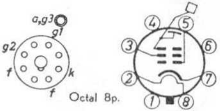
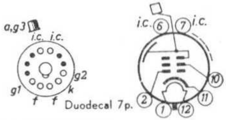
T.V. STUDIO TUBES

Type	Screen[1]) Round Useful diam.	Screen[1]) Rectangular Useful diag.	Useful width	Useful height	Heater V_f (V)	Heater I_f (A)	Operating characteristics V_a	V_{g3}	V_{g2}	$-V_{g1}$[2])	Cap. C_{g1} (pF)	Overall length max (mm)	min	Base connections
	min. (mm)						(V)							
AW 17-20 Monitor		155	124	93	6.3	0.3	V_{g4} = —200 to +400	12000	300	30-80	<8	347	331	 
AW 21-80 Monitor		195	180	135	6.3	0.3	$V_{g4,g6}$ =9000	—30 to +200	400	40-80	<8	274	256	 
AW 36-48 Monitor		318	288	217	6.3	0.3	V_{g4}= —200 to +200	14000	300	30-70	<8	457	437	 
MC 6-16 Flying spot scanner	57.5				6.3	0.3	25000		25000	40-90	6.3	278	266	 

---

[1]) The second letter of the typenumber indicates the colour of the luminescent screen: C = blue violet, very short persistence; K = green, very short persistence; W = white, medium persistence; [2]) Grid voltage for visual cut-off

T.V. STUDIO TUBES

Type	Screen[1]				Heater		Operating characteristics				Cap.	Overall length		Base connections
	Round	Rectangular												
	Useful diam.	Useful diag.	Useful width	Useful height	V_f (V)	I_f (A)	V_a	V_{g3}	V_{g2}	$-V_{g1}$[2]	C_{g1} (pF)	max	min	
	min. (mm)						(V)							
MC 13-16 MK 13-16 Flying spot scanners	108				6.3	0.3	25000		25000	50-100	6.5	347	329	
MW 13-35 View-finder tube	108				6.3	0.3	7000	7000	300	30-70	<10	287	271	
MW 36-67 Monitor		318	288	217	6.3	0.3	14000	14000	300	30-70	<8	457	437	

---

[1] The second letter of the typenumber indicates the colour of the luminescent screen: C = blue violet, very short persistence; K = green, very short persistence; W = white, medium persistence; [2] Grid voltage for visual cut-off

IMAGE ORTHICONS

Type	V_f *(V)*	I_f *(A)*	*Scanning system*	*Image system*	*Description*
5820	6.3	0.6	Focusing: magn. Deflection: magn.	Photocathode: Semi-transparent Rectangular image (4 × 3 aspect ratio) Useful diagonal min 40 mm	General-purpose image orthicon
55807					General-purpose image orthicon identical to 5820 but equipped with additional field-mesh and supressor grid
55809					Low-noise image orthicon with high storage capacity relative to 5820 and 55807. Equipped with field-mesh and suppressor grid

IMAGE ICONOSCOPE

5854	6.3	0.63	Focusing: magn. Deflection: magn. Cut-off voltage: —30 to —70 V	Photocath: 12 × 16 mm^2 Signal electrode: 45 × 60 mm^2	Required illumination for average scene, at F: 2 1500 Lux

VIDICON

55850	6.3	0.09	Focusing: magn. Deflection: magn.	Photocathode: Rectangular image (4 × 3 aspect ratio) Useful diagonal max. 16 mm	

NOTES:

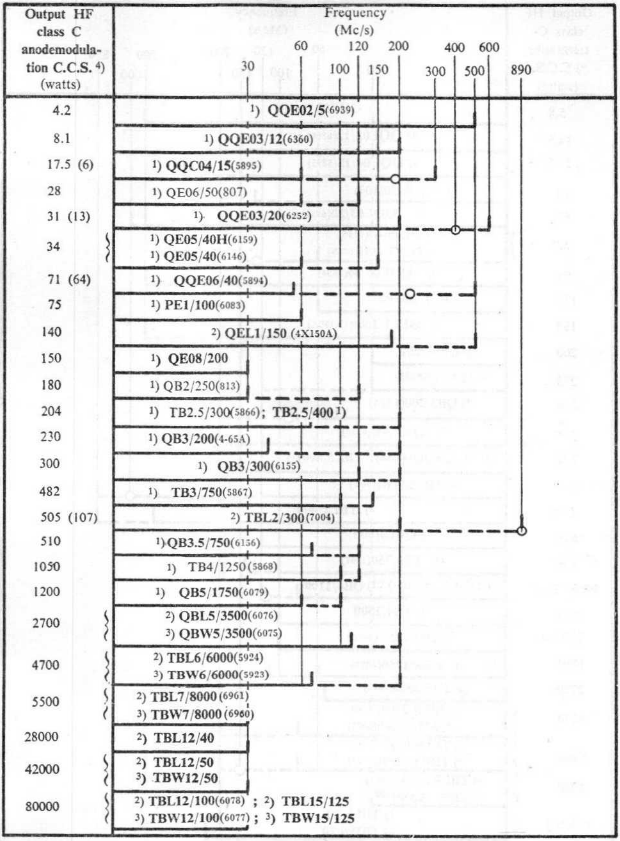
TRANSMITTING TUBES

PREFERRED HIGH TENSION RECTIFYING TUBES

Maximum peak inverse voltage		*3 kV*	*10 kV*	*13 kV/15 kV*	*21kV*	*27kV*
Maximum d.c. output current	0.25 A	**[2]DCG1/250**	**DCG4/1000G[2]** **DCX4/1000[3]**			
	1.25 A		**DCX4/5000[3]**			
	1.5 A			**DCG5/5000GB[2][4]** **DCG5/5000GS[2][4]**		
	2.5 A				**DCG9/20[2]**	**DCG12/30[1][2]**
	3.– A			**DCG6/18[2]**		
	15.– A			**DCG7/100[1][2]** **DCG7/100B[1][2]**		

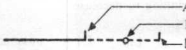
[1] Grid controlled. [2] Mercury vapour filled. [3] Xenon filled. [4] 13 kV.

TRIODES, TETRODES, PENTODES



1) Radiation cooled 2) Forced-air cooled 3) Water cooled 4) Commercial continuous service

Preferred types are shown in bold print



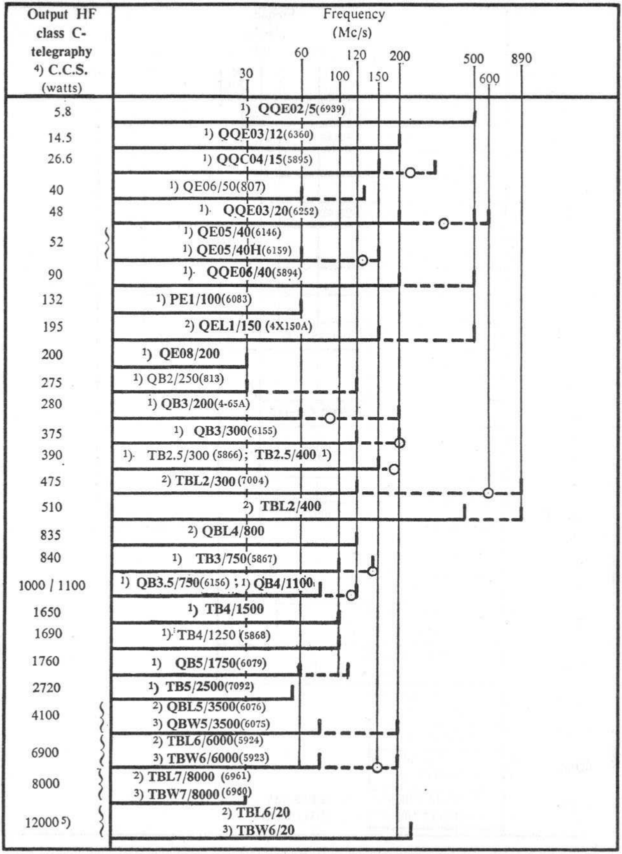
At this frequency output is beginning to decrease

Frequency for decreased output value as indicated between brackets

Maximum operating frequency

(....) E I A number

TRIODES, TETRODES, PENTODES



1) Radiation cooled 2) Forced-air cooled 3) Water cooled 4) Commercial contineous service

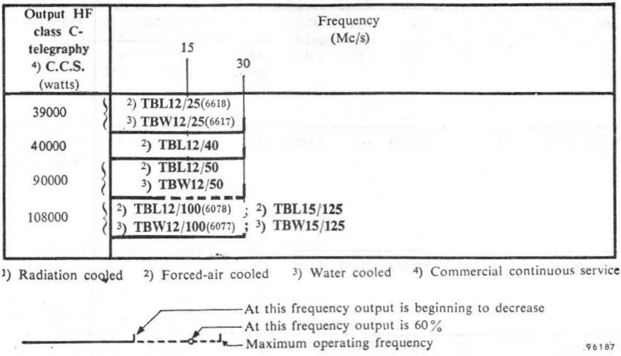
5) White level TV service **Preferred types are shown in bold print**

At this frequency output is beginning to decrease

At this frequency output is 60%

Maximum operating frequency (......) EIA number

96186



PREFERRED INDUSTRIAL GENERATING TUBES (TRIODES)

Output	*Frequency (Mc/s)*				
(kilowatts)	*30*	*50*	*100*	*150*	*470*
[1]0.29				TB2.5/400	
[1]0.48					TBL2/400
[1]0.665			TB3/750		
1.65		TB4/1500			
2.84		TB5/2500			
4.2		TBL6/4000			
6.—		TBL7/8000 TBW7/8000			
18.—	TBL6/14 TBW6/14				
28.—	TBL12/25 TBW12/25				
39.—	TBL12/38 TBW12/38				
108.—	TBL12/100 TBW12/100				

---

[1] Typical operating conditions for industrial H.F. generators.

Type	V_f *(V)*	I_f *(A)*	V_a *max (V)*	V_{g2} *max (V)*	W_a *max (W)*	*Full ratings*			*Operation*
						Max. freq. (Mc/s)	W_o *(W)*	η *(%)*	
MAW 12/15	21.5	79	12000	—	15000	20	20000	67	C telegr.
						—	42000	66	B mod.1)
PAL 12/15	22	80	12000	2000	8000	20	13000	62	C telegr.
						20	4000	33	B teleph.
						20	2900	37	C g_2g_3 mod.
						20	7500	70	C ag_2 mod.
PAW 12/15	22	80	12000	2000	12000	20	15900	61	C telegr.
						20	3500	33	B teleph.
						20	2900	37	C g_2g_3 mod.
						20	7500	70	C ag_2 mod.
PB 2/200	12	3.35	2000	400	110	20	270	71	C telegr.
						20	45	29	B teleph.
						20	147	72	C ag_2 mod
						20	124	69	C an. mod.
						20	43	32	C g_3 mod.
						—	400	70	B mod.1)
PB 2/500	12	7.3	2500	500	250	10	600	70	C telegr.
						20	90	26	B teleph.
						10	325	69	C ag_2 mod.
						20	100	28	C g_3 mod.
						—	1000	70	B mod.1)
PB 3/800	12	8.5	3000	600	450	10	1200	72	C telegr.2)
						10	190	30	B teleph.
						10	580	71	C ag_2 mod.
						10	200	35	C g_3 mod.
						—	1600	69	B mod.1)
PE 05/25	12.6	0.7	500	300	12	100	33	73	C telegr.
						100	6	33	B teleph.
						100	20	71	C ag_2 mod.
						55/165	9	43	C freq. mult.

1) Two tubes. 2) $V_{g2}=V_{g3}$.

Reduced ratings			*Base Socket*	*Accessories*		*Dimensions*	
Freq. (Mc/s)	*W_o (W)*	*η (%)*		*Type number*	*Description*	*max diam.*	*max length*
						(mm)	
—	—	—	—	K 707	Water jacket	104	811
—	—	—	—	40614	Grid brakcet		
				40632 (2×)	Protective cap for grid seal		
				62 960 53	Rubber washer		
				62 961 23 (2×)	Rubber washer		
50	—	—	—	K 500	Housing	234	525
50	—	—	—	40602	Supporting ring		
50	—	—		40632 (6×)	Protective cap for grid and filament seals		
50	—	—					
50	—	—	—	K 710	Water jacket	140	541
50	—	—	—	K 712	Filter		
50	—	—		40607	Key		
50	—	—		40632 (6×)	Protective cap for grid and filament seals		
				Z4 287 46	Rubber washer		
				62 960 81	Rubber washer		
60	152	58	Spec. 7p.	40600 (2×)	Clip	53	165
60	35	25	40207				
60	77	51					
60	75	50					
60	32	24					
—	—	—					
60	312	55	Special	40600 (2×)	Clip	82	276
60	50	22	40200				
60	175	51					
60	45	22					
—	—	—					
60	488	55	Special	40626 (2×)	Clip	106	293
60	67	21	40201				
—	—	—					
—	—	—					
—	—	—					
167	15	55	Spec. 8 p.	—		35.3	104
—	—	—	40210/02				
—	—	—					
—	—	—					

Type	V_f *(V)*	I_f *(A)*	V_a *max (V)*	V_{g2} *max (V)*	W_a *max (W)*	*Full ratings*			*Operation*
						Max. freq. (Mc/s)	W_o *(W)*	η *(%)*	
PE 06/40E	12.6	0.65				20	45	69	C telegr.
						20	11	31	B teleph.
						20	40	70	C ag$_2$ mod.
PE 06/40N	6.3	1.3	600	300	25	2/4	27	52	C freq. mult.
						—	100	71	B mod.1)
PE 06/40P	6.3	1.3							
PE 1/100	12.6	1.35	1000	300	45	60	132	74	C telegr.
						60	23	34	B teleph.
						60	75	78	C ag$_2$ mod.
						60	27	37	C g$_3$ mod.
						—	194	72	B mod.1)2)
QB 2/250	10	5	2250	1100	100	30	275	76	C telegr.
						30	50	33	B teleph.
						30	180	75	C ag$_2$ mod.
						—	490	68	B mod.1)
QB 3/200	6	3.5	3000	400	65	50	280	81	C telegr.
						—	230	84	C ag$_2$ mod.
						—	270	68	B mod.1)
QB 3/300	5	6.5	3000	600	125	120	375	75	C telegr.
						120	58	32	B teleph.
						120	300	79	C ag$_2$ mod.
						—	550	72	B mod.1)
QB 3/300GA	For further data see QB 3/300								
QB 3.5/750	5	14.1	4000	600	250	75	1000	80	C telegr.
				1000 3)		75	126	33	B teleph.
						75	510	75	C ag$_2$ mod.
						—	1240	75	B mod.1)2)
QB 3.5/750 GA	For further data see QB 3.5/750								
QBL 3.5/ 2000	4	60	3300	600	1200	600	1930 + 140 4)	65	C telegr.

---

1) Two tubes. 2) $I_{g1}=0$. 3) A.F. operation as cathode follower. Bottompinseal temp. max. 120 °C. 4) Power transferred from driving stage included.

Reduced ratings			Base Socket	Accessories		Dimensions	
Freq. (Mc/s)	W_o (W)	η (%)		Type number	Description	max diam.	max length
						(mm)	
60	36	62	Medium 7p.	28 906 022	Cap	51	146
60	6.5	20	40220				
60	20	55					
—	—	—	Medium 5p.	28 906 022	Cap	51	146
—	—	—	40219				
			P 5900/02	28 906 022	Cap	51	134
—	—	—	Septar	—		47	110
—	—	—	40202				
—	—	—					
—	—	—					
—	—	—					
120	126	70	Giant 7p.	40619	Cap	66	191
120	34	30					
120	80	67					
—	—	—					
220	110	63	Septar		Cap	60.5	111
220	75	63	40202				
—	—	—					
200	225	65	Giant 5p.	40624	Clip	62	130
—	—	—	40211/01				
—	—	—					
—	—	—					
			Metal-shell Giant 5p. 40211/01			69.1	144
120	500	67	Giant 5p.	40624	Clip	87	151
—	—	—	40211/01				
—	—	—					
—	—	—					
			Metal-shell Giant 5p. 40211/01			87	161
900	1360 + 140[4]	53				89	208

Type	V_f (V)	I_f (A)	V_a max (V)	V_{g2} max (V)	W_a max (W)	Full ratings			Operation
						Max. freq. (Mc/s)	W_o (W)	η (%)	
QB 4/1100	5	14.1	4000	800	400	75	1100	78	C telegr.
						75	630	76	C ag$_2$ mod.
						—	1540	66	B mod.1)2)
QB 4/1100 GA	For further data see QB 4/1100								
QB 5/1750	10	9.9	5000	700	500	60	1760	80	C telegr.
						60	1200	79	C ag$_2$ mod.
						—	2220	76	B mod.1)
QB 5/2000	7.5	22.6	5000	800	800	30	2240	80	C telegr.
QBL 4/800	5	13.5	4000	500	500	110	930	73	C telegr.
QBL 5/3500 **QBW 5/3500**	6.3	32.5	5500	800	3000	75	4100	74	C telegr.
						110	2700	75	C ag$_2$ mod.
QE 04/10	6.3	0.6	400	250	7.5	60	8	62	C telegr.
						75/150	2.3	25	C freq. mult.
						50/150	1.5	19	C freq. mult.
						60	5.8	60	C ag$_2$ mod.
QE 05/40	6.3	1.25	600	250	20	60	52	77	C telegr.
						60	34	75	C ag$_2$ mod.
						—	83	68	B mod.1)
QE 05/40F	12.6	0.625	See QE 05/40 except for heater rating and base						
QE 05/40H	26.5	0.3	See QE 05/40 except for heater rating						
QE 06/50	6.3	0.9	600	300	25	60	40	67	C telegr.
						60	12.5	33	B teleph.
						60	28	71	C ag$_2$ mod.
						—	80	67	B mod.1)

1) Two tubes. 2) $I_{g1}=0$.

Reduced ratings			*Base Socket*	*Accessories*		*Dimensions*	
Freq. (Mc/s)	*W₀ (W)*	*η (%)*		*Type number*	*Description*	*max diam.*	*max length*
						(mm)	
100	800	74	Giant 5p. 40211/01	40624	Clip	87	150
—	—	—					
—	—	—					
			Metal-shell Giant 5p. 40211/01			87	161
100	1300	72	Super Giant 40216	40626	Clip	118	209
—	—	—					
—	—	—					
—	—	—	Giant 5p. 40216	40665	Clip	153	248
—	—	—				67	120
220	2900	66		40622 40634 (4×) 40635	Grid connector Filament clip Insulating collar	97	169
			—	K 713 40622 40631 40634 (4×)	Water jacket Grid connector Key Filament clip	70	160
175	5.4	42	Loctal 9p. 40212	—		38	78
—	—	—					
—	—	—					
—	—	—					
175	25	55	Octal 5903/13	28 906 022	Cap	44	97
—	—	—					
—	—	—					
						44	96
125	20	60	Medium 5p. 40219	28 906 022	Cap	52.4	146
125	8	30					
125	14	65					
—	—	—					

Type	V_f *(V)*	I_f *(A)*	V_a *max (V)*	V_{g2} *max (V)*	W_a *max (W)*	*Full ratings*			*Operation*
						Max. freq. (Mc/s)	W_o *(W)*	η *(%)*	
QE 08/200	6.3	3.9	825	350	100	30	200	70	C telegr.
						30	130	72	C ag_2 mod.
						—	300	71	B mod.1)
QE 08/200H	26.5	0.7	For further data see QE 08/200						
QEL 1/150	6	2.6	1250	300	150	165	195	78	C telegr.
						—	425	72	B mod.
						165	140	70	C ag_2 mod.
QEL 1/150H	26.5	0.57	For further data see QEL 1/150						
QEL 2/250	6	2.6	2000	400	250	175	390	78	C telegr.
						175	235	78	C ag_2 mod.
						—	600	60	B mod.1)
QQC 04/15	3.15	1.36	600	250	2 × 6	186	33.6	70	C telegr.2)
	6.3	0.68			2 × 82)	186	7.8	59	C ag_2 mod.2)
						93/186	8	50	C freq. mult.2)3)
						62/186	10	38	C freq. mult.2)
						—	16	63	B mod.
QQE 02/5	6.3	0.6	250	200	2 × 3	500	5.8	58	C telegr.4)
	12.6	0.3				167-500	2.35	33	C freq. mult.4)
QQE 03/12	6.3	0.82	300	200	2 × 5	200	18.5	62	C telegr.2)
	12.6	0.41			2 × 72)	66.6/200	7.8	40	C freq. mult.2)
						200	8.8	57	C ag_2 mod.2)
QQE 03/20	6.3	1.3	600	250	2 × 10	200	48	80	C telegr.
	12.6	0.65				66.6/200	10	37	C freq. mult.
						200	31	77	C ag_2 mod.
QQE 04/5	6.3	0.6	400	250	2 × 8	960	7	40	C telegr.4)
	12.6	0.3				320/960	2.75	15	C freq. mult.2)4)
QQE 04/20	6.3	1.6	750	250	2 × 7.5	200	26	72	C telegr.
	12.6	0.8				200	17	79	C ag_2 mod.

---

1) Two tubes. 2) Intermittent operation. 3) Per system. 4) Two systems in push-pull.

Reduced ratings			*Base Socket*	*Accessories*		*Dimensions*	
Freq. (Mc/s)	*W_o (W)*	*η (%)*		*Type number*	*Description*	*max diam.* *(mm)*	*max length* *(mm)*
—	—	—	Giant 5p.	40619	Cap	72	150
—	—	—	40211/01				
—	—	—					
500	140	56	40222			42	63
—	—	—					
—	—	—					
500	225	75	40222			42	63
—	—	—					
—	—	—					
300	8	34	Loctal 8p.	—		32	100
—	—	—	40213				
—	—	—					
—	—	—					
—	—	—					
—	—	—	Noval			22	66.7
—	—	—					
—	—	—	Noval	40647	Tube retainer	22	78
			5908/36				
600	20	50	Septar	40623	Clip	46	86
133.3/ 400	8	30	40202				
400	13	54					
—	—	—	40213			46	65
—	—	—					
250	17	53	Septar	40615 (2×)	Clip	51	84
—	—	—	40202				

Type	V_f *(V)*	I_f *(A)*	V_a *max (V)*	V_{g2} *max (V)*	W_a *max (W)*	*Full ratings*			*Operation*
						Max. freq. (Mc/s)	W_o *(W)*	η *(%)*	
QQE 06/40	6.3	1.8	750	300	2 × 20	200	90	75	C telegr.
	12.6	0.9				250	64	71	C ag$_2$ mod.
						50/150	20	33	C freq. mult.
						—	86	71	B mod.
TAL 12/10	22	2 × 38	12000		4000	5	10500	72	C telegr.
						5	2000	33	B teleph.
						5	7700	77	C an. mod.
						—	17000	75	B mod.¹)
TAL 12/20	21.5	78	12000		18000	28	22000	68	C telegr.
						28	5000	27	B teleph.
						28	9500	68	C an. mod.
						—	42000	72	B mod.¹)
TAL 12/35	28.3	3 × 48.5	15000		18000	20	48500	77	C telegr.
						20	9000	33	B teleph.
						20	27000	77	C an. mod.
						—	80000	74	B mod.¹)
TAW 12/10	22	2 × 38	12000		7500	5	15000	73	C telegr.
						5	3700	33	B teleph.
						5	7700	77	C an. mod.
						—	30000	73	B mod.¹)
TAW 12/20	For further data see TAL 12/20								

---

¹) Two tubes. ²) In housing or jacket.

Reduced ratings			*Base Socket*	*Accessories*		*Dimensions*	
Freq. (Mc/s)	*W₀ (W)*	*η (%)*		*Type number*	*Description*	*max diam.*	*max length*
						(mm)	
500	60	60	Septar	40623 (2×)	Clip	49	110
—	—	—	40202				
75/225	12	23					
—	—	—					
20	10500	72	–	K 501 or	Foot	194	471
20	2000	33		40603	Supporting ring		
20	6000	75		40604 (2×)	Filament bracket		
—	—	—					
				40632 (2×)	Protective cap for grid seal		
—	—	—	—	K 503/01	Housing with canalized outlet	226	730
—	—	—					
—	—	—					
—	—	—		40614	Grid backet		
				40632 (2×)	Protective cap for grid and filament seals		
37.5	26000	62	—	K 505	Housing	226	618
—	—	—		40606	Filament bracket		
27	26000	74					
				40632 (6×)	Protective cap for grid and filament seals		
75	3500	51	—	K 700	Water jacket	194	440
20	3300	53		40604	Filament bracket		495[2]
20	6000	75					
—	—	—		40632	Protective cap for grid seal		
				R 1 366 43	Rubber washer		
				62 960 81(2×)	Rubber washer		
				K 707	Water jacket	226	741
				R 1 367 50	Contact washer		811[2]
				62 960 53	Rubber washer		
				62 960 81 (2×)	Rubber washer		
				62 961 23	Rubber washer		

Type	V_f (V)	I_f (A)	V_a max (V)	W_a max (W)	Full ratings			Operation
					Max. freq. (Mc/s)	W_o (W)	η (%)	
TAW 12/35G	For further data see TAL 12/35					107000	74	B mod.1)
TB 2/500	12	7.3	2000	300	20	635	68	C telegr.
					20	124	29	B teleph.
					20	430	71	C an. mod.
					—	900	71	B mod.1)
TB 2.5/300	6.3	5.4	2500	135	150	390	76	C telegr.
					150	65	34	B teleph.
					150	205	80	C an. mod.
					—	700	78	B mod.1)
TB 2.5/400	6.3	5.8	3000	150	For further data see TB 2.5/300			
TB 3/350	5	6.3	4000	100	40	400	80	C telegr.
					40	285	81	C an. mod.
					—	425	68	B mod.1)
TB 3/750	5	14.1	4000	250	100	840	77	C telegr.
					100	140	36	B teleph.
					100	482	77	C an. mod.
					—	1280	75	B mod.1)
TB 3/2000	12	17	3500	1100	2	2900	72	C telegr.
					2	600	35	B teleph.
					2	1625	75	C an. mod.
					—	3300	66	B mod.1)
TB 4/800	5	10.5	4000	250	40	1000	80	C telegr.
					40	435	72	C an. mod.
					—	1180	70	B mod.1)
TB 4/1250	10	9.9	4000	450	100	1690	79	C telegr.
					100	1050	78	C an. mod.
					—	2290	77	B mod.1)
TB 4/1500	5	32.5	7000	500	50	1650	77	Industr. osc.

1) Two tubes. 2) In housing or jacket.

Reduced ratings			Base Socket	Accessories		Dimensions	
Freq. (Mc/s)	W_o (W)	η (%)		Type number	Description	max diam. (mm)	max length (mm)
				K 715 80 039 63	Water jacket ("grip-o-matic) Rubber washer	245	650 $720^{2)}$
100	400	57	Spec. 2p. 40204	40608	Key	86	243
—	—	—		40626	Clip		
—	—	—					
—	—	—					
200	200	57	Giant 5p. 40211/01	40624	Clip	62	132
—	—	—					
—	—	—					
—	—	—					
—	—	—	Medium 4p. 40218/03			81	197
—	—	—					
—	—	—					
—	—	—	Giant 5p. 40211/01	40624	Clip	87	151
—	—	—					
—	—	—					
—	—	—					
20	2600	70	Spec. 2p. 40205	40608	Key	154	334
20	520	32		40626 (2 ×)	Clip		
20	1300	74					
—	—	—					
—	—	—	Jumbo 4p. 40408			95	256
—	—	—					
—	—	—					
100	1125	71	Super Giant 40216	40626	Clip	118	213
—	—	—					
—	—	—					
—	—	—	Special B 8 700 51	40626		130	240

Type	V_f (V)	I_f (A)	V_a max (V)	W_a max (W)	Full ratings			Operation
					Max. freq. (Mc/s)	W_o (W)	η (%)	
TB 5/2500	6.3	32.5	7000	800	50	2720	78	Industr. osc.
TBL 2/300	3.4	19	2500	300	175	475	74	C telegr.
					175	505	76	C an. mod.
TBL 2/400	3.4	19	2200	400	470	510+ 85 3)	63	C telegr.
TBL 2/500	3.4	19	2200	500	400	620 + 50 3)	65	C telegr.
TBL 6/14	6.3	130	8000	10000	30	17700	72	Industr. osc.
TBL 6/20	6.3	154	5500	10000	110	15000	62	C telegr.
TBL 6/4000	6.3	65	8000	1700	50	4850	77	Industr. osc.
TBL 6/6000	12.6	33	6000	5000	75	6900	76	C telegr.
					75	1900	32	B teleph.
					75	4700	78	C an. mod.
					—	13300	74	B mod. 1)
TBL 7/8000	12.6	33	7200	6000	30	9500	73	C telegr.
					—	20000	71	B mod. 1)

1) Two tubes. 2) In housing or jacket. 3) Power transferred from driving stage included.

Reduced ratings			*Base Socket*	*Accessories*		*Dimensions*	
Freq. (Mc/s)	W_o *(W)*	η *(%)*		*Type number*	*Description*	*max diam.*	*max length*
						(mm)	
			Special B 870051	40626		155	256
900	155	34	Coaxial			41.6	73
900	102	34					
810	328+ 80[3]	45	Coaxial			41.6	83
—	—	—	Coaxial			41.6	83
—	—	—		40662	Filament clips	115	309 (average)
				40664	Grid connector		
				K 508	Cooler housing		
—	—	—		40651 40652 40653	Grid and anode Inner fil. Outer fil. } connector	169	277
				40654	Insulating pedestal		
—	—	—	B8 700 51			86	177.5
220	2500	50		40622	Grid connector	122.6	195
—	—	—					
—	—	—		40630	Insulating collar		
—	—	—					
				40634 (3×)	Clip		
—	—	—		40622	Grid connector	122.6	195
—	—	—					
				40634	Filament clips		
				40630	Insulating pedestal		

Type	V_f *(V)*	I_f *(A)*	V_a *max (V)*	W_a *max (W)*	*Full ratings*			*Operation*
					Max. freq. (Mc/s)	W_o *(W)*	η *(%)*	
TBL 12/25	8	98	13000	15000	30	29000	75	Industr. osc.
TBL 12/38	8	130	13000	15000	30	39000	72	Industr. osc.
TBL 12/40	8	130	13000	15000	30	41000	76	C telegr.
					30	27500	78	C an. mod.
TBL 12/100	17.5	196	15000	45000	15	108000	75	C telegr.
					15	80000	76	C an. mod.
					—	202000	70	B mod.[1]
TBL 15/125	17.5 15.5	196[4] 131[5]		For further data see TBL 12/100				
TBW 6/14				15000	For further data see TBL 6/14			
TBW 6/20			For further data see TBL 6/20					
TBW6/6000				6000	For further data see TBL 6/6000			
TBW 7/8000			For further data see TBL 7/8000					
TBW 12/25				20000	For further data see TBL 12/25			
TBW 12/38				20000	For further data see TBL 12/38			
TBW 12/100	17.5	196	15000	50000[2]	15	108000	75	C telegr.
					15	51500	35	B teleph.
					15	80000	76	C an. mod.
					—	202000	70	B mod.[1]
TBW 15/125	17.5 15.5	196[4] 131[5]			For further data see TBW 12/100			

---

[1] Two tubes. [2] For B teleph. 100 kW. [3] In housing or jacket. [4] Single-phase filament energizing. [5] Three phase filament energizing.

Reduced ratings			*Base Socket*	*Accessories*		*Dimensions*	
Freq. (Mc/s)	*W_o (W)*	*η (%)*		*Type number*	*Description*	*max diam.*	*max length*
						(mm)	
—	—	—		40663	Grid connector	268	378
				40662	Filament clips		
				40648	Insulating pedestal		
—	—	—		40662	Filament clips	263	404
				40663	Grid connector		
				40648	Insulating pedestal		
—	—	—				225	392
—	—	—					
30	50000	75		K 506	Housing	286	635
30	31000	74		40628 (6×)	Filament clip	510$^{3)}$	1130$^{3)}$
—	—	—					
				K 720	Water jacket	163$^{3)}$	415$^{3)}$
				K 718	Water jacket	127	359$^{3)}$
				K 713	Water jacket	70.5	190
				40631	Key		260$^{3)}$
				R 1 158 11	Rubber washer		
				K 713	Water jacket	70.5	190 260$^{3)}$
				K 717	Water jacket	145 190$^{3)}$	376 465$^{3)}$
				K 722	Water jacket	145 190$^{3)}$	422 500$^{3)}$
30	50000	75		K 714	Water jacket	240$^{3)}$	710$^{3)}$
—	—	—		40628 (6×)	Filament clip		
30	31000	74		89 039 63	Rubber washer		

Type	V_f *(V)*	I_f *(A)*	$V_{a\,invp}$ *(kV)*	I_o *max (A)*	*Circuit*		*Nr of tubes*
					Number of secondary phases	*Rectification*	
DCG 1/250	4	2.5	3	0.25	2 3 3	half wave half wave full wave	2 3 6
DCG 1.5/250	4	2.5	4.25	0.25	2 3 3	half wave half wave full wave	2 3 6
DCG 4/1000 ED	2.5	4.8	10	0.25	2 3 3	half wave half wave full wave	2 3 6
DCG 4/1000 G							
DCG 4/5000	4	7	13	1.25	2 3 3	half wave half wave full wave	2 3 6
DCG 5/30	5	30	13	6	2 3 3	half wave half wave full wave	2 3 6
DCG 5/5000 EG	5	7	13	1.5	2 3 3	half wave half wave full wave	2 3 6
DCG 5/5000 GB							
DCG 5/5000 GS							
DCG 6/18	5	11.5	15	3	2 3 3	half wave half wave full wave	2 3 6
DCG 6/6000	5	6.5	13	1	2 3 3	half wave half wave full wave	2 3 6

TRANSMITTING PURPOSES

V_{tr} (kV)	V_o (kV)	I_o (A)	W_o tot. (kW)	Base Socket	Accessories		Dimensions	
					Type number	Description	max diam. (mm)	max length (mm)
1.1 1.2 2.1	0.96 1.4 2.8	0.5 0.75 0.75	0.48 1.1 2.2	A 40465	—		48	115
1.5 1.7 3.0	1.3 2.0 4.1	0.5 0.75 0.75	0.7 1.5 3.0		—		47	138
3.5 4.1 7.1	3.2 4.8 9.6	0.5 0.75 0.75	1.6 3.6 7.2	Edison E 300022	—		49	147
				Medium 4p. 40218/03	40619	Cap	49	157
4.6 5.3 9.2	4.1 6.2 12.4	2.5 3.75 3.75	10.3 23.3 46.6	Goliath 65909 BG/01	40619	Cap	53	225
4.6 5.3 9.2	4.1 6.2 12.4	12 18 18	50 112 224	— — —	40612 08 281 72	Anode cap Plug pin for grid connection	225	581
4.6 5.3 9.2	4.1 6.2 12.4	3 4.5 4.5	12.4 27.8 55.6	Goliath 65909 BG/01	40619	Cap	58.7	237
				Jumbo 4p. 40408	40619	Cap	58.7	215
				Super-Jumbo 4p. 40403	40619	Cap	58.7	222
5.3 6.1 10.6	4.8 7.2 14.4	6 9 9	28.8 65 130	Super-Jumbo 4p. 40403	40619	Medium Cap M6 screw	72	308
4.6 5.3 9.2	4.1 6.2 12.4	2 3 3	8.3 18.6 37.2	Jumbo 4p. 40408	40616	Anode cap	120	242

Type	V_f *(V)*	I_f *(A)*	$V_{a\,invp}$ *(kV)*	I_o *max (A)*	*Circuit*		*Nr of tubes*
					Number of secondary phases	*Rectification*	
DCG 7/100 **DCG 7/100B**	5	15	15	15	2	half wave	2
					3	half wave	3
					3	full wave	6
DCG 9/20	5	13.5	21	2.5	2	half wave	2
					3	half wave	3
					3	full wave	6
DCG 12/30	5	13.5	27	2.5	2	half wave	2
					3	half wave	3
					3	full wave	6
DCX 4/1000	2.5	5	10	0.25	2	half wave	2
					3	half wave	3
					3	full wave	6
DCX 4/5000	5	7.1	10	1.25	2	half wave	2
					3	half wave	3
					3	full wave	6

V_{tr} (kV)	V_o (kV)	I_o (A)	W_o tot. (kW)	Base Socket	Accessories		Dimensions	
					Type number	Description	max diam.	max length
							(mm)	
5.3 6.1 10.6	4.8 7.2 14.4	20 30 30	96 216 432	Special 4p. 40409	40620	20 mm Cap M8 screw	117	417
					40620	20 mm Cap M8 screw	117	387
7.4 8.6 14.8	6.7 10.0 20.0	5 7.5 7.5	34 75 150	Spec. 3p. 40209	40616 40620	Anode cap Cap	120	381
9.5 11 19.1	8.6 12.9 25.8	5 7.5 7.5	43 97 194	Spec. 3p. 40209	40616 40620	Anode cap Cap	120	384
3.5 4.1 7.1	3.2 4.8 9.6	0.5 0.75 0.75	1.6 3.6 7.2	Medium 4p. 40218/03	40619	Cap	53	156
3.5 4.1 7.1	3.2 4.8 9.6	2.5 3.75 3.75	8 18 36	Jumbo 4p. 40408	40619	Cap	59	216

NOTES:

INDUSTRIAL TUBES

PREFERRED THYRATRON TYPES

Max. permissible average output current (amperes)	*Max. anode peak forward voltage (volts)*							
	400	*500*	*650*	*900*	*1000*	*1500*	*2000*	*2500*
0.025		**5696**$^{2)}$						
0.1	**PL10**		**PL2D21**$^{2)}$ **PL5727**$^{2)4)}$					
0.3			**PL6574**$^{2)}$					
0.5			**PL1607**$^{2)}$					**PL5557**$^{1)}$
1.6						**PL3C23**$^{3)}$		
2.5				**PL5632**$^{2)}$	**PL5559**$^{1)}$ **PL5684**$^{2)}$			
3.2						**PL6755**$^{3)}$ **PL5544**$^{2)}$		
6.4						**PL5545**$^{2)}$	**PL106**	**PL105**$^{1)}$
12.5						**PL255**$^{1)}$		
25							**PL260**$^{1)}$	

$^{1)}$ mercury vapour filled

$^{2)}$ inert gas filled

$^{3)}$ mercury vapour and xenon filled

$^{4)}$ special quality

PREFERRED HYDROGEN THYRATRONS

Max peak anode forward voltage (kilovolts)	*Max peak anode forward current (amperes)*			
	35	*90*	*325*	*500*
3	**3C45**			
8		**4C35A**		
16			**5C22**	
25				**5949**

PREFERRED IGNITRON TUBES

RECTIFIER SERVICE

Anode current (amperes)		*Peak anode voltage (volts)*	*Type number*
average	*peak*		
200	1800	900	PL5555
150	1200	2100	

SINGLE PHASE WELDING SERVICE

(TWO TUBES IN ANTIPARALLEL CIRCUIT)

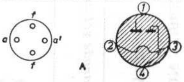
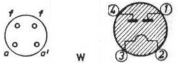
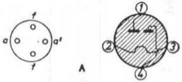
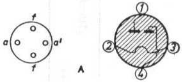
Maximum demand (kilovolts-amperes)	*Max. RMS line voltage (volts)*	*Type number*
600	600	[1]) PL5551A
1200	600	[1]) PL5552A
2400	600	[1]) PL5553B
2400	2400	PL5555

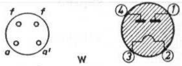
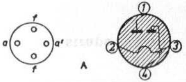
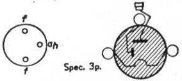
THREE PHASE WELDING SERVICE

Peak anode current (amperes)	*Peak anode voltage (volts)*	*Type number*
600	1200	[1]) PL5551A
480	1500	
1500	1200	[1]) PL5822A
1200	1500	
3000	1200	[1]) PL5553B
2400	1500	

[1]) with sensing plate for temperature control

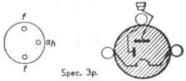
INDUSTRIAL RECTIFYING TUBES

Type	*m*	*Filament data*		*Voltages*		*Currents*			*Typical characteristics*		*Dimensions*		*Base connections*
		V_f *(V)*	I_f *(A)*	V_{tr}	V_{ainvp}	I_o	I_{ap}	R_t	V_{ign}	V_{arc}	*Diam.*	*Height*	
				max. (V)		*max. (A)*		*min (Ω)*	*(V)*		*max. (mm)*		
328	2	1.9	3.0	28	90	1.3	4	3	16	7	33	112	
354	1	1.9	5.5	20 130	65 400	2 0.25	10 1.25	4 50	16	8	62	120	Edison
367	2	1.9	8.0	45	140	6	18	1	16	9	81	170	
451	2	1.9	2.8	16	50	1.3	4	3	11	7	33	112	
1010	2	1.9	3.5	60	185	1.3	4	10	16	9	37	120	

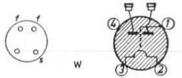
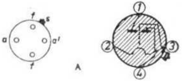
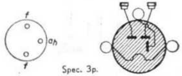
1037	2	1.9	11	60	185	6	18	1.75	16	9	85	240	**Goliath**
1039	2	1.9	20	60	185	15	45	0.75	16	9	94	264	**Goliath**
1048	2	1.9	7	60	185	6	18	1.75	16	9	81	170	
1049	2	1.9	28.5	60	185	25	75	0.3	16	9	101	280	**straps**
1054	2	1.9	68	48	150	40	120	0.18	16	9	111	350	**straps**
1069K[1])	2	3.25	70	55	170	60[2])	200	0.12	16	10	114	365	**straps**
1110	2	1.9	3.5	60	185	2	5	4	16	9	39	131	
1119	2	1.9	5.8	45	140	3	9	1.8	16	9	71	142	
1129	2	1.9	5.5	60	185	3	9	2.5	16	9	71	142	
1138	1	2.5	27	85	275	15	85	0.3	16	10	115	269	**Goliath**
1163	1	2.25	17	130	375	6	36	0.5	16	9	83	178	**Goliath**
1164	1	2.5	25	80	225	15	90	0.3	16	9	98	220	**Goliath**
1173	1	1.9	13	275 220	850 685	4	20 24	0.75	22[1])	12	62	189	

---

[1]) **For welding equipment.** [2]) **With fan cooling.**

Type	m	Filament data		Voltages		Currents		Typical characteristics			Dimensions		Base connections
		V_f (V)	I_f (A)	V_{tr}	V_{ainvp}	I_o	I_{ap}	R_i	V_{ign}	V_{arc}	Diam.	Height	
				max. (V)		max. (A)		min (Ω)	(V)		max. (mm)		
1174	1	1.9	12	275 220	850 685	6	30 36	0.5	22[1]	12	77	218	
1176	1	1.9	28	275 220	850 685	15	75 90	0.2	22[1]	12	92	301	straps
1177	1	1.9	60	275 220	850 685	25	135 150	0.1	28[1]	12	128	362	straps
1533	3	1.9	23	275	850	15	45	0.6	45[2]	15	192	270	straps
1534	2	1.9	23	275	850	15	45	—	45[2]	15	197	270	straps
1543	3	1.9	36	275	850	25	70	0.4	50[2]	15	207	265	cables
1544	2	1.9	36	275	850	25	70	—	50[2]	15	242	278	cables
1553	3	1.9	70	275	850	40	135	0.25	50[2]	15	297	355	cables
1554	2	1.9	70	275	850	40	135	—	50[2]	15	317	355	cables
1564	2	1.9	70	275	850	60	135	—	50[2]	15	372	390	cables

[1] With auxiliary ignition unit type 1289 (40 V, 10 mA). [2] With auxiliary ignition unit type E 3 108 03 (100 V, 25 mA).

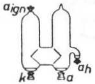
1710	2	1.9	8	150	470	3	9	2.5	22[3]	10	69.5	205	
1725A	2	1.9	3.5	150	470	1.3	4	5	22[3]	10	71	135	
1738	2	1.9	18	95	300	15	45	0.2	20	9	94	284	Goliath
1749A	2	1.9	25	95	300	25	75	0.1	22	10	101	290	straps
1788	2	1.9	11	95	300	10	30	0.3	22[1]	9	94	284	Goliath
1838	2	1.9	21.5	115	360	15	45	0.25	22[2]	10	97	262	
1849	2	1.9	29	115	360	25	75	0.2	22[2]	10	105	294	straps
1859	2	1.9	60	115	360	50	150	0.1	28	12	143	436	straps

[1] Screen connected with filament via resistor of 10000 Ω, 0.5 W.

[2] With auxiliary ignition unit type 1289 (40 V, 10 mA).

[3] Screen connected with filament via a resistor of 1000 Ω, 0.5 W.

RELAY TUBE

Type	*Voltages max (V)*	*Currents max (A)*	*Typical characteristics*	*Dimensions*		*Base connections*
				Max diam. (mm)	*Max height (mm)*	
PL 5 Triode with capacitive ignition	$V_{a\,\mathrm{invp}}$ = 1500 $V_{a\,\mathrm{rms}}$ = max 500 = min 20	I_a = 3.5 1) I_a = 0.5 I_{ap} = 1000	V_{arc} = 40 V T_{av} = max 1 sec V_{ign} = max 25 V freq. = max 300 c/s t_{Hg} = 10-40 °C	135	190	

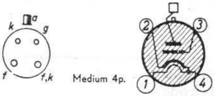
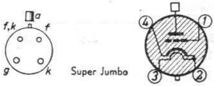
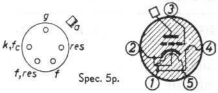
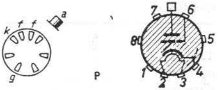
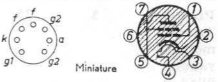
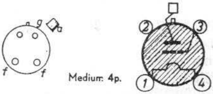
---

1) With fan cooling.

Type	*Filament data*			*Voltages max (V)*	*Currents max (A)*
	V_f *(V)*	I_f *(A)*	T_h *(sec)*		
3 C 45 Triode hydrogen filled	6.3	2.25	120	V_{ap} = 3000 $V_{a\,invp}$ = 3000 V_{gp} = min 175 $V_{g\,invp}$ = 200	I_a = 0.045 I_{ap} = 35
4 C 35 A Triode hydrogen filled	6.3	6.1	180	V_{ap} = 8000 $V_{a\,invp}$ = 8000 V_{gp} = min 175 $V_{g\,invp}$ = 200	I_a = 0.1 I_{ap} = 90
5 C 22 Triode hydrogen filled	6.3	10.6	300	V_{ap} = 16000 $V_{a\,invp}$ = 16000 V_{gp} = min 200 $V_{g\,invp}$ = 200	I_a = 0.2 I_{ap} = 325 1)
5949 Triode hydrogen filled	6.3	15-22	15 min	V_{ap} = 25000 $V_{a\,invp}$ = 25000 V_{gp} = min 550 $V_{g\,invp}$ = 450	I_a = 0.5 I_{ap} = 500
EC 50 Triode inert-gas filled	6.3	1.3	10	V_{ap} = 1000 $V_{g\,invp}$ = 1000	I_a = 0.01 I_{ap} = 0.75 1) I_g = 0.0002 I_{gp} = 0.0014
PL 2D 21/ PL 21 Tetrode inert-gas filled	6.3	0.6	20	V_{ap} = 650 $V_{a\,invp}$ = 1300 $-V_{g2}$ = 100 $-V_{g1}$ = 100	I_k = 0.1 I_{kp} = 0.5 I_{g2} = 0.01 I_{g1} = 0.01
PL 3 C 23 Triode mercury vapour and inert-gas filled	2.5	7	30	V_{ap} = 1500 $V_{a\,invp}$ = 1500 $-V_g$ = 500	I_k = 1.6 I_{kp} = 6.4 I_g = 0.01 I_{gp} = 0.05

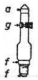
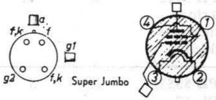
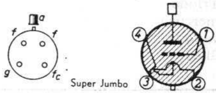
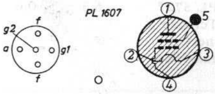
---

1) Freq. $\leqq$ 20 c/s. 2) Measured at half amplitude. 3) Freq. = pulse repetition frequency

Typical characteristics	*Dimensions*		*Base connections*
	Max diam. (mm)	*Max height (mm)*	
T_{imp} = max 6 μsec 2) $V_{ap} \times I_{ap} \times$ freq. $< 0.3 \times 10^9$ 3)	40	132	 Medium 4p.
T_{imp} = max 6 μsec 2) $V_{ap} \times I_{ap} \times$ freq. $< 2 \times 10^9$ 3)	65	178	 Super Jumbo
T_{imp} = max 6 μsec 2) $V_{ap} \times I_{ap} \times$ freq. $< 3.2 \times 10^9$ 3)	65	222	
$V_{ap} \times I_{a} \times$ freq. $< 6.25 \times 10^9$ 3)	84	317	 Spec. 5p.
V_{arc} = 33 V freq. = max 150 kc/s T_{dion} = 1 μsec	43	108	 P
V_{arc} = 8 V T_{av} = max 30 sec t_{amb} = —75/+90 °C	19	54	 Miniature
V_{arc} = 12 V T_{av} = max 5 sec t_{Hg} = —40/+80 °C I_{rec} = +40 °C	52	155	 Medium 4p.

Type	*Filament data*			*Voltages max (V)*	*Currents max (A)*
	V_f *(V)*	I_f *(A)*	T_h *(sec)*		
PL 10 Triode for pulse and relay circuits	1.85	3.4	—	$V_{ap} = 400$ $V_{ainvp} = 400$ $V_{gp} = +1800$ $V_{gp} = -1800$	$I_a = 0.1$ $I_{ap} = 4$
PL 105 Tetrode mercury-vapour filled	5	10	300	$V_{ap} = 2500$ $V_{ainvp} = 2500$ $-V_{g2} = 500$ $-V_{g1} = 1000$	$I_a = 6.4$ $I_{ap} = 40$ $I_{g2} = 0.5$ $I_{g1} = 0.25$
PL 106 Triode mercury-vapour and inert-gas filled	2.5	22	60	$V_{ap} = 2000$ $V_{ainvp} = 2000$ $-V_g = 500$	$I_a = 6.4$ $I_{ap} = 80$ $I_g = 0.25$
PL 150 Triode mercury-vapour and inert-gas filled	1.9	26	60	$V_{ap} = 240$ $V_{ainvp} = 500$ $-V_g = 150$1) $-V_g = 50$2)	$I_a = 15$ $I_{ap} = 90$ $I_{gp} = 1$ $I_g = 0.25$
PL 255 Triode mercury-vapour filled	5	14	300	$V_{ap} = 1500$ $V_{ainvp} = 2500$ $-V_g = 300$	$I_a = 12.5$ $I_{ap} = 80$ $I_g = 0.25$ $I_{gp} = 1$
PL 260 Triode mercury-vapour filled	5	25	600	$V_{ap} = 1500$ $V_{ainvp} = 2500$ $-V_g = 300$	$I_{ap} = 25$ $I_{ap} = 160$ $I_g = 0.25$ $I_{gp} = 1$
PL 1607 Tetrode inert-gas filled	2	2.6	30	$V_{ap} = 650$ $V_{ainvp} = 650$ $-V_{g2} = 100$ $-V_{g1} = 100$	$I_a = 0.5$ $I_{ap} = 2$ $I_{g2} = 0.05$ $I_{g1} = 0.05$

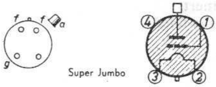
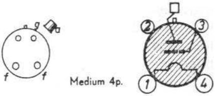
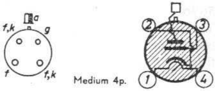
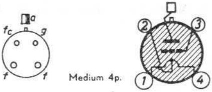
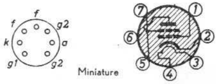
1) At negative anode voltage. 2) At positive anode voltage.

Typical characteristics	*Dimensions*		*Base connections*
	Max diam. (mm)	*Max height (mm)*	
V_{arc} = 20—35 V T_{av} = max 10 sec freq. = max 100 c/s t_{amb} = —75/+90 °C	21.5	105	 Mignon
V_{arc} = 12 V T_{av} = max 15 sec t_{Hg} = +40/+80 °C t_{rec} = +60 °C	123	288	 Super Jumbo
V_{arc} = 12 V T_{av} = max 15 sec t_{Hg} = +25/+80 °C	73	290	 Super Jumbo
V_{arc} = 12 V T_{av} = max 15 sec t_{Hg} = +40/+80 °C t_{rec} = +60/+70 °C	92	293	straps
V_{arc} = 10 V T_{av} = max 15 sec t_{Hg} = +40/+80 °C t_{rec} = +60 °C	102	334	straps
V_{arc} = 10 V T_{av} = max 15 sec t_{Hg} = +40/+80 °C t_{rec} = +60 °C	127	405	straps
V_{arc} = 15 V T_{av} = max 15 sec t_{amb} = —75/+90 °C	48	142	

Type	*Filament data*			*Voltages max (V)*	*Currents max (A)*
	V_f *(V)*	I_f *(A)*	T_h *(sec)*		
PL 5544 Triode inert-gas filled	2.5	12	60	$V_{ap} = 1500$ $V_{ainvp} = 1500$ $-V_g = 250$	$I_a = 3.2$ $I_{ap} = 40$ $I_g = 0.2$
PL 5545 Triode inert-gas filled	2.5	21	60	$V_{ap} = 1500$ $V_{ainvp} = 1500$ $-V_g = 250$	$I_a = 6.4$ $I_{ap} = 80$ $I_g = 0.2$
PL 5557/ **PL 17** Triode mercury- vapour filled	2.5	5	5	$V_{ap} = 2500$ $V_{ainvp} = 5000$ $-V_{g1} = 500$	$I_a = 0.5$ $I_{ap} = 2$ $I_g = 0.05$
PL 5559/ **PL 57** Triode mercury- vapour filled	5	4.5	300	$V_{gp} = 1000$ $V_{ainvp} = 1000$ $-V_g = 500$	$I_a = 2.5$ $I_{ap} = 15$ $I_g = 0.25$
PL 5632/ **C 3 J** Triode xenon-filled	2.5	9	30	$V_{gp} = 900$ $V_{ainvp} = 1250$ $-V_g = 300$	$I_k = 2.5$ $I_{kp} = 30$ $I_g = 0.1$ $I_{gp} = 0.5$
PL 5684/ **C 3 JA** Triode xenon-filled	2.5	9	30	$V_{ap} = 1000$ $V_{ainvp} = 1250$ $-V_g = 300$ 1)	$I_k = 2.5$ $I_{kp} = 30$ $I_g = 0.1$ $I_{gp} = 0.5$
PL 5727 Tetrode inert gas-filled	6.3	0.6	20	$V_{ap} = 650$ $V_{ainvp} = 1300$ $-V_{g2} = 100$ $-V_{g1} = 100$	$I_k = 0.1$ $I_{kp} = 0.5$ $I_{g2} = 0.01$ $I_{g1} = 0.01$

---

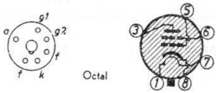
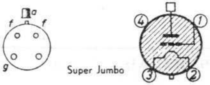
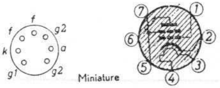
1) 400 V may be tolerated up to $V_a = 900$ V and $R_g = 50—100$ kΩ.

Typical characteristics	*Dimensions*		*Base connections*
	Max diam. (mm)	*Max height (mm)*	
V_{arc} = 12 V T_{av} = max 15 sec t_{amb} = —55/+70 °C	67	190	
V_{arc} = 12 V T_{av} = max 15 sec t_{amb} = —55/+70 °C	67	229	
V_{arc} = 12 V T_{av} = max 15 sec t_{Hg} = +35/+80 °C t_{rec} = +50 °C	52	155	
V_{arc} = 12 V T_{av} = max 15 sec t_{Hg} = +40/+80 °C t_{rec} = +60 °C	76	185	
V_{arc} = 10 V T_{av} = max 5 sec T_{amb} = —55/+75 °C	40	150	
V_{arc} = 10 V T_{av} = max 5 sec T_{amb} = —55/+75 °C	40	150	
V_{arc} = 8 V T_{av} = max 30 sec T_{amb} = —75/+90 °C	19	54	

Type	*Filament data*			*Voltages max (V)*	*Currents max (A)*
	V_f *(V)*	I_f *(A)*	T_h *(sec)*		
PL 6574 Tetrode inert gas-filled	6.3	0.95	15	$V_{ap} = 650$ $V_{ainvp} = 1300$ $-V_{g2} = 100$ $-V_{g1} = 250$	$I_k = 0.3$ $I_{kp} = 2$ $I_{g2} = 0.02$ $I_{g1} = 0.02$
PL 6755 Tetrode mercury-vapour and inert-gas filled	2.5	11	60	$V_{ap} = 1500$[1] $V_{ainvp} = 1500$[1] $-V_g = 300$	$I_a = 3.2$ $I_{ap} = 20$ $I_g = 0.25$ $I_{gp} = 1$
5696 Tetrode inert-gas filled	6.3	0.15	10	$V_{ap} = 500$ $-V_{g2} = 50$ $-V_{g1} = 100$	$I_k = 0.025$ $I_{kp} = 0.1$ $I_{g2} = 0.005$ $I_{g1} = 0.005$

---

[1] At $V_{ap} = V_{ainvp} = 1000$: $I_a = 3.6$ $I_{ap} = 15$ $V_g = -500$ V.

Typical characteristics	*Dimensions* *Max diam. (mm)*	 *Max height (mm)*	*Base connections*
$V_{\mathrm{arc}} = 10\text{ V}$ $V_a/V_{g1} \begin{pmatrix} V_{g2} = 0\text{ V} \\ R_{g1} = 0\,\Omega \end{pmatrix} = 275$ $V_a/V_{g2} \begin{pmatrix} V_g{}^1 = 0\text{ V} \\ R_{g2} = 0\,\Omega \end{pmatrix} = 370$ T_{av} = max 15 sec T_{amb} = —75/+90 °C	33	70	
$V_{\mathrm{arc}} = 12\text{ V}$ T_{av} = max 15 sec t_{Hg} = +20/+85 °C t_{amb} = 0-40 °C	59	228	
$V_{\mathrm{arc}} = 10\text{ V}$ T_{av} = max 30 sec T_{amb} = —55/+90 °C	19	54	

Type	*Ignitor requirement*		*A.C. control (two tubes in inverse parallel connection)*			
	V_{fwdp} (V) min.	*I_p (A)*	*V_{arms} max (V)*	*Demand max (kVA)*	*I_a max (A)*	*T_{av} max (sec)*
PL 5551 A[1]	200	12	220	530 180	30.2 56	18
			250	600 200	30.2 56	18
			600	600 200	30.2 56	7.5
PL 5552 A[1]	200	12	220	1060 350	75.6 140	14
			250	1200 400	75.6 140	14
			600	1200 400	75.6 140	5.8
PL 5553 B[1]	200	30	220	2120 705	192 355	11
			250	2400 800	192 355	11
			600	2400 800	192 355	4.6
PL 5555	150	40	2400	2400 1105	135 207	1.66
PL 5822 A[1]	200	25				

---

[1] With provisions for mounting a thermostatic control unit.

[2] Values apply to continuous operation.

Rectifier (intermittent operation, phase control angle = 0)					
V_{afwdp} max (V)	V_{ainvp} max (V)	I_{ap} max (A)	I_a corresp. (A)	T_{av} max (sec)	I_a/I_{ap} max ($T_{av} = 0.25$)
1200	1200	600 135	5 22.5	10	0.166
1500	1500	480 108	4 18		
500	500	1600	100	6	
600	600	4000 1140	54 190	6.25	0.166
1200	1200	3000 840	40 140		
1500	1500	2400 672	32 112		
900 2100 2)	900 2100 2)	1800 1200 2)	200 150 2)		
1200	1200	1500 420	20 70	6.25	0.166
1500	1500	1200 336	16 56		

NOTES:

PREFERRED TYPES
FOR
MICROWAVE TUBES
AND
MISCELLANEOUS

PREFERRED MAGNETRONS

Frequency (Mc/s)	*Minimum peak output PULSED TYPES (kW)*									*c.w. output C.W. TYPES (kW)*			
	2.5	7	15	25	50	65	70	225	400	0.01	0.2	2	5
1220-1350									**5J26** 1)				
2425-2475											**7090**	**7091** **7292**	**55125**
8500-9600					**2J1A** 1)								
9000-9085								**55032/01** 2)					
9085-9168								**55032/02** 2)					
9150-9600										**JPT9-01**			
9168-9260								**55031/01** 2)					
9210-9270		**JP9-7A**											
9260-9345								**55031/02** 2)					
9345-9405		**2J42** **JP9-7D**	**JP9-15**			**6972** **7181**		**4J50** **55030** 2)					
9345-9475	**7028**												
9350-9400							**4J52A**						
9405-9505								**55029** 2)					
34512-35208				**7093**		**55008**							

1) tunable 2) short pulse types.

PREFERRED VARIOUS TYPES

Frequency (Mc/s)	*Continuous output*						
	Diodes	*Triodes*	*Tetrode*	*Travelling wave*		*Reflex klystrons*	
				6 W	*8 W*	*min. 20 mW*	*min. 100 mW*
—	***)8020[2]**						
1000	**EA52[2]** **EA53[2]**	**EC55[2]**	**QBL3.5/2000**				
1250		**EC81[2]**					
3000	****)K51A[1][2]**						
3800-4200					**55340**		
4000		**EC157[2]** **EC158[2]**					
4400-5000				**7537**			
8500-9600						**6975**	
8500-9660						**2K25**	
10000	****)K50A[1][2]**						
31000-36000							**55335**

*) High voltage surge limiting diode **) Noise diode

[1] gasfilled [2] see also page B4

PREFERRED PHOTOMULTIPLIERS

Anode sensitivity amps/lm	*Ultraviolet 4000 Å cathode diam. (mm)*		*blue-ultraviolet 4200 Å cathode diameter (mm)*						*red-infrared 800 Å*
	32	*44*	*20*	*32*	*44*	*64*	*110*	*200*	*32*
30			**52 AVP**						
100									**150 CVP**
250								**57 AVP**	
300				**150 AVP**					
500	1) **51 UVP**	1) **53 UVP**		**50 AVP**	**53 AVP** **153 AVP**	**59 AVP**	**54 AVP**		
5000		1) **56UVP**			**56 AVP**		**58 AVP**		

1) quartz.

PREFERRED PHOTO CONDUCTIVE CELLS

Material Sensitivity	*Sensitive area*	*Max. current or load*	*top sensitivity*	*side sensitivity*
Indium antimonide infrared sensitive, spectral response 7.5 microns	3 mm^2	100 mA	**ORP 10**	
LEAD-SULPHIDE Spectral response range 0.3-3.5 microns	0.36 cm^2	0.5 mA	**61 SV**	
micro excecution s.q.	0.25 mm^2	1) 0.07 W	**ORP 60**	**ORP 61**
	20 mm^2	1) 0.2 W	**B 873103**	
CADMIUM-SULPHIDE red sensitive	0.5 cm^2	1) 0.25 W	**ORP 50**	**ORP 50**
	1.25 cm^2	2) 0.2 W	**ORP 11**	
	1.8 cm^2	1) 1 W		**ORP 90**
	4.5 cm^2	1) 1.2 W	**ORP 30**	

1) ambient temperature 25 °C 2) ambient temperature 60 °C.

PREFERRED PHOTO TUBES

Sensitivity		*Red sensitive*	*Projected area (cm^2)*	*Blue sensitive*
PHOTO TUBES	high vacuum	90CV	2.4	
			4	92AV
	gas filled	90 CG	2.4	
			4	92AG

PREFERRED VOLTAGE STABILIZING TUBES

Operating voltage	*Current range (miliamps)*						
(volts)	*1-10*	*4.5*	*5-15*	*5-30*		*1-40*	*2-60*
75							**75C1**
83		1) **83A1**					
85	1) **85A2**(5651)						
90						**90C1**	
108				**OB2**	**OB2WA**		
150			**150B2**	**OA2**	**OA2WA**		

1) voltage reference tube.

PREFERRED THERMOCOUPLES

filament *current (milliamps)*	1) *0- 5* *0-15*	1) *0-15* *0-30*	1) *0-20* *0-75*	1) *0-50* *0-150*	1) *0-100* *0-300*
Type number	**TH91**	**TH92**	**TH93**	**TH94**	**TH95**

1) in this range output voltage is proportional to the square of filament current.

PREFERRED COUNTING AND INDICATING TUBES

	Application		*counting*	*selecting*	*indicating*
high vacuum	decade counter		*) **E1T** **ET51**		
	decade counter and indicator		**Z 303 C**		
	idem and selector			**Z 502 S**	
gasfilled	decade figure indicator	numerical indicator			**Z 510 M**
		idem long life			*) **Z 520 M**
		in transistorized eq.			**Z 550 M**

*) special quality

PREFERRED RADIATION COUNTER TUBES*)

Description	*Radiation*	*Type*	*Max. dimensions (mm)*	
			Total length	*Diam.*
End-window counting tubes	α, β, γ	**18505**	57	26
		18526	57	34
	α, β	**18536**	34	34
	β, γ	**18504**	53	17
		18506	57	34
	α, β (low level)	**18515**	30	26
	β (low level)	**18516**	34	34
	x-ray 1.2-2.5 Å	**18537**	154	25.4
	x-ray 0.5-0.86 Å	**18538**		
Cylindric counting tubes	β, γ	**18550**	52	10
		18552	146	18
		18553	280	18
	γ, β (high energy)	**18509**	38	7
		18529	27	7
	γ, cosmic-ray	**18522**	460	41
	γ	**18503**	55	17
		18520	170	22.2
		18545	270	22.2
Cosmic-ray guard tubes		**18517**	90	80
		18518		
Liquid counters	γ, β	**18524**	235	32
	β	**18533**	143	34
		18510	92	24
Proportional counter	x-ray	**18511**	129	27

*) halogen quenched.

PREFERRED TRIGGER TUBES

Application		*Cathode current range (mA)*	*Anode voltage range (volts)*				
			125-165	*170-290*	*180-350dc* *180-275ac*	*200-310*	*250-450dc* *180-275ac*
Selecting Counting Automation		2-4			**) *)**)	**Z70U** **Z70 W**	
Telephone exchanges		3-7	*)**)**Z71U**				
Relay service	remote control 220 Va.c.	5-40dc 5-25ac			**Z 804U**		
	flame control 117 Va.c.	5-25					**Z 805U**
Timers		max. 25		**) **Z 803U**	**Z 900T**		

*) starters **) with primer.

NOTES:

MICROWAVE TUBES
AND
MISCELLANEOUS

MAGNETRONS

PULSED TYPES

Type	*Frequency (Mc/s)*	*Wave-length band (cm)*	*Peak output power min (kW)*
JP 9-7 A	9210—9270	3	7
JP 9-7 D1)	9345—9405		7
JP 9-15	9345—9405		15
2 J 42	9345—9405		7
2 J 512)	8500—9600		45
2 J 51 A2)	8500—9600		45
2 J 55	9435—9405		40
2 J 56	9215—9275		40
4 J 50	9345—9405	3	225
4 J 52	9345—9405		65
4 J 52 A	9350—9400		70
4 J 57	6475—6575	5	180
4 J 58	6375—6475		180
4 J 59	6275—6375		180
4 J 78	9003—9168	3	225
5 J 262)	1220—1350	23	400
725 A	9345—9405	3	40
55862)	2700—2900	10	700
56572)	2900—3100	10	700
6972	9345—9405	3	65
7028	9345—9475		2.5
7093	34512—35208	0.8	30
7181	9345—9405	3	65
55008	34512—35208	0.8	60
55029	9405—9505	3	at 1 μs
55030	9345—9405		225
55031/01	9168—9260		at 0.1 μs
55031/02	9260—9345		180
55032/01	9000—9085		
55032/02	9085—9168		

Type	*Frequency (Mc/s)*	*Wave-length band (cm)*	*Peak output power min (kW)*
55085-01	3570—3614	8.5	360
55085-02	3530—3570		
55085-03	3490—3530		
55085-04	3450—3490		
55100-01	3030—3060	10	400
55100-02	3005—3030		
55100-03	2980—3005		
55100-04	2940—2980		

[1] Short pulse version of 2J42. [2] Tunable.

C.W. TYPES

Type	*Frequency (Mc/s)*	*Wave-length band (cm)*	*Contin, wave output power (kW)*
7090	2425—2475	12.5	0.2
7091[1]			2
7292[2]			2
55125[2]			5
JPT 9-01[3]	9150—9600	3	0.01

[1] Air cooled. [2] Water cooled. [3] Tunable.

KLYSTRONS

Type	*Frequency (Mc/s)*	*Wave-length band (cm)*	*Output power (W)*
2 K 25 reflex tunable	8500—9660	3	min 0.02
723 A/B reflex tunable	9370 8702—9548	3	min 0.02 min 0.01
6975 reflex tunable	8500—9600	3	min 0.02
55334-01 **55334-02** **55334-03** multireflex fixed freq.	3336 3375 3414	8.8	min 10
55335 reflex tunable	31000—36000	0.8	min 0.1
55395 2-cavity tunable watercooled	8600—10000	3	max 200

TRAVELLING WAVE TUBES

Type	*Frequency (Mc/s)*	*Output power (W)*	*Low level gain (dB)*	*Helix voltage (V)*	*Collector current (mA)*	*R.F. connections*
7537	4400—5000	> 6	> 36	1100	50	Rectangular wave guide
55340	3800—4200	> 8	> 39	1100	50	Wave guide

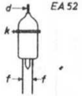
DUAL T.R. SWITCH

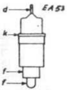
Type	Frequency (Mc/s)	Peak power (kW)
56032	8490—9580	2—250

MEASURING DIODE

EA 52
EA 53
Diode for frequencies up to 1000 Mc/s

$V_f = 6.3$ V
$I_f = 0.3$ A
$V_d = < 3$ V
$I_d = 0.5$ mA
$R_{dk} > 10.000$ MΩ
$C_d < 0.5$ pF





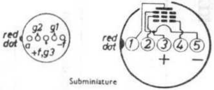
TRANSMITTING PENTODE FOR USE IN RADIO SONDES

95108
Typical characteristics

$V_f = 1.25$ V
$I_f = 45$ mA
$V_a = 45$ V
$V_{g2} = 45$ V
$V_{g1} = —2.75$ V
$I_a = 0.875$ mA
$I_{g2} = 0.2$ mA
$S = 0.65$ mA/V
$R_i = 0.75$ MΩ
$\mu_{g2g1} = 9.3$

As oscillator[1] (triode connected) for use in radio sondes

$V_f = 2$ V
$V_a = 120$ V
$V_{g2} = 120$ V
$I_k = 15$ mA
$I_g = 2$ mA
$R_g = 10$ kΩ
$W_o = 750$ mW
$f = 30$ Mc/s



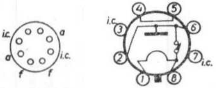
---

[1] Life expectancy 5 hours.

SATURATED DIODE FOR USE IN STABILISING CIRCUITS

56001

$V_f = 4.6$ V
$I_f = 0.155$ A
$V_a = 250$ V
$I_a = 150\,\mu$A
$V_f = 4.5$ V
$I_a = 122\,\mu$A



HIGH-VACUUM DIODE

Type	V_f *(V)*	I_f *(A)*	T_h *(sec)*	*Application*	*Typical characteristics*	
8020	5	6	5	Rectifier	V_{ainvp} = max 40 kV I_o = max 100 mA I_{ap} = max 750 mA	
				Limiter	V_f = 5.5 V V_{ap} = 10 kV I_{ap} = min 2 A	V_f = max 5.8 V V_{ap} = max 12.5 kV W_f = max 75 W

NOISE DIODES

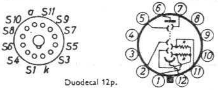
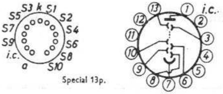
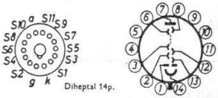
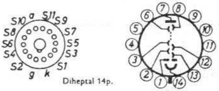
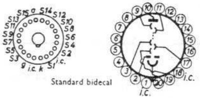
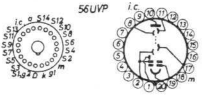
Type	V_f *(V)*	I_f *(A)*	λ *(cm)*	V_{ign} *(V)*	V_a *(V)*	I_a *(mA)*	*Noise level (d.b.)*
K 50 A Neon filled noise diode	2	2	3	min 6000	165	125	18.7
K 51 A Neon filled noise diode	2	3.5	10	min 6000	140	200	19.1
K 81 A Noise diode	1.85	2.5			100	15	13

Type	*Typical characteristics*			
	V_b *(V)*	N_k *(μA/lm)*	N_a *(A/lm) or gain*	*Number of stages*
50 AVP	1800	60	600	11
51 UVP¹⁾	1800	60	600	11
52 AVP	1800	60	100	10
53 AVP	1800	60	2500	11
53 UVP¹⁾	1800	60	2500	11
54 AVP²⁾	2000	60	600	11
55 AVP	2000	60	$\geq 10^8$	15
56 AVP **56 UVP**¹⁾	3500	60	$\geq 10^8$	14

---

1) Quarts window 2) Resolution for γ Cs ^{137} < 9%.

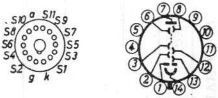
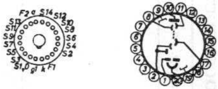
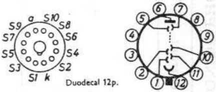
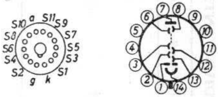
MULTIPLIERS

Dimensions		*Base connections*
Tot. length max (mm)	*Diam max (mm)*	
127	39.5	 Duodecal 12p.
127	42	
152	25.5	 Special 13p.
153	55	 Diheptal 14p.
153	55	
235	130	 Diheptal 14p.
170	55	 Standard bidecal
190	55	

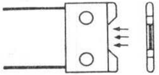
Type	*Typical characteristics*			
	V_b *(V)*	N_k *(μA/lm)*	N_a *(A/lm) or gain*	*Number of stages*
57 AVP	2500	50	600	11
58 AVP	3000	60	$> 10^8$	14
150 AVP	1800	50	400	10
150 CVP2)		30	100	
153 AVP1)	1800	70	500	11

1) Resolution for γ Cs^{137} $< 9\%$

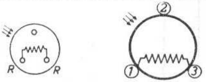
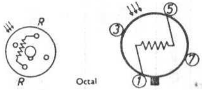
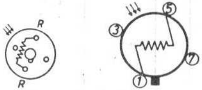
2) Red and near infra-red sensitive.

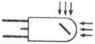
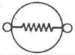
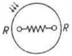
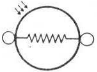
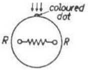
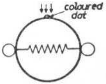
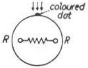
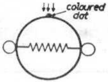
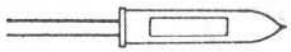
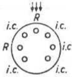
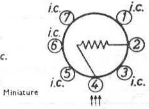
Dimensions		Base connections
Tot. length max (mm)	*Diam max (mm)*	
325	235	
282	133	
127	39.5	
153	55	

INFRA-RED SENSITIVE INDIUM ANTIMONIDE PHOTOCONDUCTIVE CELL

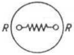
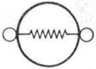
Type	*Spectral response range*	*Sensitive area*	*Max. current*	*Max. temp. case*	*Base connections*
ORP 10	0.6—8 μ	3 mm^2	100 mA	70°C	

CADMIUM-SULPHIDE PHOTOCONDUCTIVE CELLS

Type	*Cell current at 10 V d.c. 54 Lux and 2700 °K colour temp.*	*Dark current (temp. = 25 °C)*	*Sensitive area*	*Base connections*
ORP 11 top sensitivity	6 mA	max 5 μA (at 100 V d.c.)	1.25 cm^2	
ORP 30 top sensitivity	30 mA	max 5 μA (at 300 V d.c.)	4.5 cm^2	
ORP 31 top sensitivity	14.5 mA	max. 2.5 μA (at 300 V d.c.)	4.5 cm^2	

ORP 50 top and side sensitivity	8 mA (at 20 V d.c.)	max. 20 μA (at 175 V d.c.)	0.5 cm²		
ORP 60 top sensitivity	0.5 mA (at 30 V d.c.)	max. 1.5μA (at 300 V d.c.)	0.25 mm²		
ORP 61 side sensitivity					
ORP 62 side sensitivity	0.7 mA	max. 2 μA (at 300 V d.c.)	1.5 mm²		
ORP 63 side sensitivity	10 mA	max. 10 μA (at 100 V d.c.)	0.15 cm²		
ORP 90 side sensitivity	10 mA	max. 2.5 μA (at 300 V d.c.)	1.8 cm²		

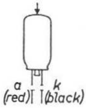
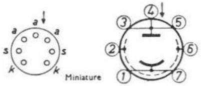
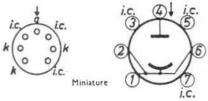
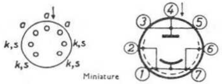
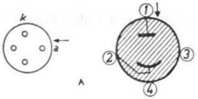
LEAD-SULPHIDE PHOTOCONDUCTIVE CELL

Type	*Spectral response range*	*Sensitive area*	*Max. applied voltage*	*Max. current*	*Max. amb. temp.*	*Base connections*
61 SV	0.3—3.5 μ	0.36 cm^2	250 V	0.5 mA	60 °C	 

Type	*Vacuum*	*Gas-filled*	*Radiation sensitivity*	*Cathode*		*Typical characteristics*			
				Type	*Projected area (cm^2)*	V_b *(V)*	*Dark current max (μA)*	*N*1) *(μA/1)*	R_a *(MΩ)*
58 CG	—	G	red	caesium on oxidized silver	1.1	85	0.1	108	1
58 CV	V	—				50	0.05	20	1
90 AG	—	G	blue	caesium on antimony	4	85	0.1	130	1
90 AV	V	—				85	0.05	45	1
90 CG	—	G	red	caesium on oxidized silver	2.4	85	0.1	125	1
90 CV	V	—				50	0.05	20	1
92 AG	—	G	blue	caesium on antimony	2.1	85	0.1	130	1
92 AV	V	—				85	0.05	45	1
3533	—	G	red	caesium on oxidized silver	2.25	85	0.1	120	1

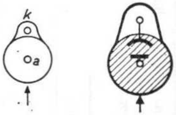
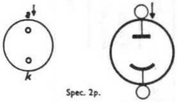
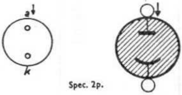
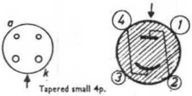
---

1) Measured with a lamp of colour temperature 2700 °K.

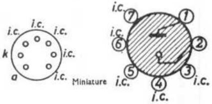
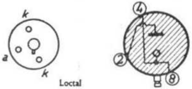
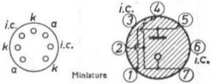
Max ratings				*Dimensions*		*Base connections*
V_b *(V)*	*I_k per cm²* *(μA)*	*t_amb* *(°C)*	*C_ak* *(pF)*	*Tot. height max* *(mm)*	*Dia- meter max* *(mm)*	
90 250	1.5 3	100	3.0	33	16	
90 100	0.6 1.25	70	0.7	54	19	
90 250	0.7 3	100	0.6	54	19	
90 100	1.25 2.5	70	0.9	54	19	
100	2	50	3.4	80	28	

Type	*Vacuum*	*Gas-filled*	*Radiation sensitivity*	*Cathode*		*Typical characteristics*			
				Type	*Projected area (cm²)*	V_b *(V)*	*Dark current max (μA)*	*N*1) *(μA/l)*	R_a *(MΩ)*
3538	—	G	red	caesium on oxidized silver	1.35	85	0.1	120	1
3545	V	—	red	caesium on oxidized silver	0.9	90	0.05	25	1
3546	—	G	red	caesium on oxidized silver	0.9	90	0.1	150	1
3554	—	G	red	caesium on oxidized silver	5.2	90	0.1	150	1

1) Measured with a lamp of colour temperature 2700 °K.

Max ratings			*Cak*	*Dimensions*		*Base connections*
Vb *(V)*	*Ik per cm²* *(μA)*	*tamb* *(°C)*	*(pF)*	*Tot. height max* *(mm)*	*Diameter max* *(mm)*	
100	2	50	2.5	73	23	
250	5	100	2	73 64 (PW)	16.5	
90	2	100		73 64 (PW)	16.5	
90	2	100	3.4	103	20	

VOLTAGE REFERENCE TUBES

Type	*V_a*	*$I_{a\,rec}$*	*V_{ign}*¹) *max*	*V_a*³) *spread*	*I_a*	*ΔV_a max*	*Dimensions*		*Base connections*
							Total height	*Diam.*	
	(V)	*(mA)*	*(V)*	*(V)*	*(mA)*	*(V)*	*max (mm)*		
83 A 1	83	4.5	130	82.6—84.1	3.5—6	1.5	54	19	
85 A 1	85²)	4	125	83—87	1—8	4	80	32	
85 A 2	85²)	5.5	125	83—87	1—10	4	54	19	

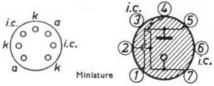
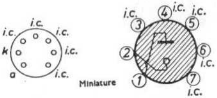
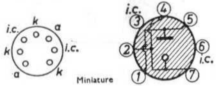
---

¹) In complete darkness V_{ign} may have a higher value.

²) Variation of V_a ($I_a = I_{a\,rec}$): max 0.3% during the first 300 hours of live
max 0.2% during the subsequent 1000 hours
max 0.1% in short term (100 hours max) after the first 1300 hours.

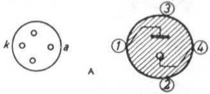
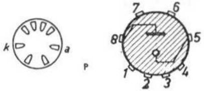
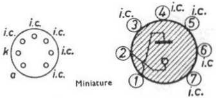
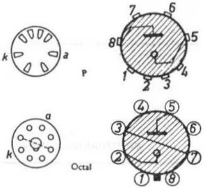
³) $I_a = I_{a\,rec}$.

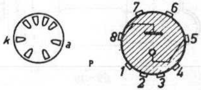
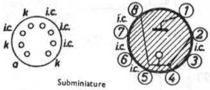
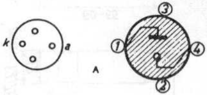
VOLTAGE STABILIZERS

Type	V_a	$I_{a\,rec}$	V_{ign}[1] max	V_a[2] spread	I_a	ΔV_a max	Dimensions		Base connections
							Total height	Diam.	
	(V)	(mA)	(V)	(V)	(mA)	(V)	max (mm)		
OA 2	150	17.5	180	144—160	5—30	6	66.7	19	
OA 2 WA[3]	150	17.5	165	144—153	5—30	5			
OB 2	108	17.5	133	106—111	5—30	3,5			
OB 2 WA[3]	108	17,5	130	105—111	5—30	3			
75 C 1	78	30	115	75—81	2—60	8	54.5	19	
90 C 1	90	20	125	86—94	1—40	14	54	19	

---

[1] In complete darkness V_{ign} may have a higher value. [2] $I_a = I_{a\,rec}$ [3] Ruggedized

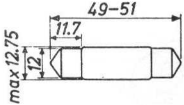
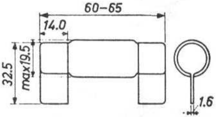
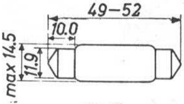
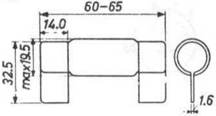
Type	V_a	$I_{a\,rec}$	V_{ign}[1] *max*	V_a[2] *spread*	I_a	ΔV_a *max*	*Dimensions*		*Base connections*
							Total height	*Diam.*	
	(V)	*(mA)*	*(V)*	*(V)*	*(mA)*	*(V)*	*max (mm)*		
100 E 1	100	125	125	90—105	50—200	4	168	55.5	
150 A 1	150	4	205	144—164	1—8	8	72	27	
150 B 2	150	10	180	146—154	5—15	5	54	19	
150 C 1	150	20	205	144—164	5—40	8	99 (P) 114 (K)	43 (P) 43 (K)	

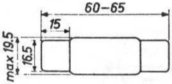
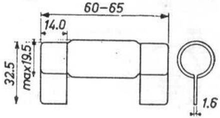
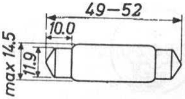
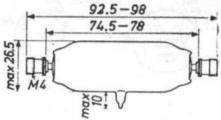
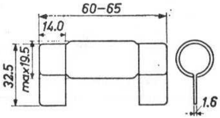
4687	90	20	130	85—100	10—40	10	94 (P) 109 (K)	29 (P) 29 (K)	
5644	95	15	120	85—105	5—25	5	50.8	10.1	
7475	100	4	140	90—110	1—8	8	84	27	
13201	100	100	140	90—110	15—200	20	154	54	

---

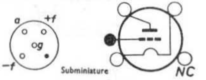
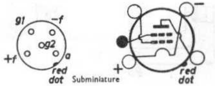
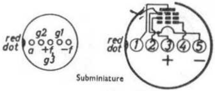
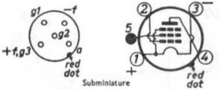
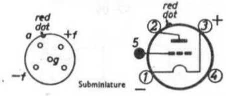
[1] In complete darkness V_{ign} may have a higher value. [2] $I_a = I_{a\ rec}$.

SURGE ARRESTERS

Type	*Ignition voltage*	*Extinguishing voltage (min.)*	*Max ratings*				*Mains voltage*		*Dimensions*
			Temporary		*Fuse in series*	*Capacitive discharge (repeatedly)*	*D.C. max*	*A.C. value r.m.s. max*	
	(V d.c.)	*(V d.c.)*	*I (A)*	*I (sec)*	*(A)*	*(Ws)*	*(V)*	*(V)*	
4349	130—180	110	5	3	6	10	70	75	
4369	150—200	110	10	3	10	10	70	75	
4370	80—120	60	10	3	10	10	36	50	
4371	150—200	110	5	3	6	10	70	75	
4372	280—300	250	2.5	1	6	10	200	180	

4378	80—120	60	10	3	10	10	36	50	
4379	280—350	130	10	3	10	10	50	180	
4383	280—350	130	5	3	6	10	50	180	
4390	700—910	200	25	3	25	500	175	300	
4397	400—500	200	5	1	6	10	150	230	

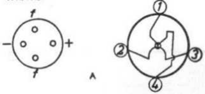
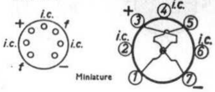
ELECTROMETER TUBES

Type	V_f *(V)*	I_f *(mA)*	V_a *(V)*	V_{g2} *(V)*	I_a *(μA)*	V_{g1} *(V)*	*S* *(μA/V)*	*μ*	I_{g2} *(A)*	I_{g1} *(A)*	*Base connections*
4065 Triode	1.25	13	9	—	100	—2.5	80	2	—	$< 12.5 \times 10^{-14}$	
4066 Tetrode	1.25	13	4.5	—3.2	20	3	17		2.5×10^{-15}	2.5×10^{-4}	
4067 1) Pentode	0.5	8	5	21	0.5	—1.7				2.5×10^{-11}	
4068 Pentode	1.25	8.2	10	6.5	5	—2.5	10.5	110		3×10^{-15}	
4069 Triode	1.25	14	9		100	—2.7	80	2		1.6×10^{-13}	

---

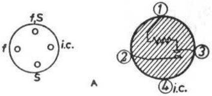
1) For pH meters only

THERMOCOUPLES

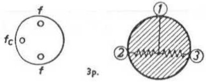
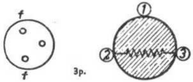
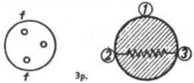
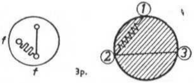
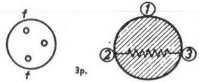
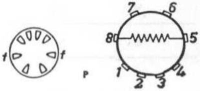
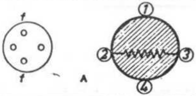
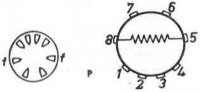
Type	*I_f (mA)*				*R_f*	*R_{Th}*	*Dimensions*		*Base connections*
	I_f	*I_f*1)	*I_f (E = 12 mV)*	*I_f*2) *(max)*	*(Ω)*	*(Ω)*	*Tot. length*	*Diam.*	
							(max. mm)		
TH 1/TH 91	0—15	0—5	10	20	68	6	63	24	TH1/TH5 
TH 2/TH 92	0—30	0—10	20	40	25	3.5			
TH 3/TH 93	0—75	0—20	40	100	7	3.5			
TH 4/TH 94	0—150	0—50	100	200	2.2	3.5	44.5	19	TH91/TH95 
TH 5/TH 95	0—300	0—100	200	350	1.2	3.5			

1) In this range V_o is proportional to the square of I_f. 2) During max. 1 min.

BIMETAL RELAY

Type	*Typical characteristics*	*Max current*			*Base connections*
		Mains	*At switching on*	*At switching off*	
4152/02	I_R = 85—115 mA R = 370 Ω Timing at t_{amb} = 25 °C: at 95 mA max 55—85 sec	220 V D.C.	1.5 A	0.25 A	
		220 V A.C.	1.5 A	0.25 A	
		380 V A.C.	0.7 A	0.075 A	

CURRENT REGULATORS

Type	V_{contr} *(V)*	I_{reg} *(A)*	*Base connections*
329	10—30	1.15	
340	3—10	5.9	**Edison**
1904	30—80	0.1	
1905	2—6	1	**Edison**
1908	5—15	0.8	
1909	15—45	0.625	
1909A	15—45	0.625	
1910	5—15	1.4	
1913	4—12	2	**Edison**
1918-01	4—10	0.1	**Edison** **Mignon**
1923	15—45	0.43	**Edison**
1926	8—26	0.18	
1927	40—120	0.18	
1928	80—240	0.18	
1941	80—200	0.3	
1945	80—120	0.275	

RADIATION COUNTER TUBES (halogen filled)

Type	Description	Radiation sensitivity	Wall thickness mg/cm²	Max. starting Voltage (V)	Plateau (V)	Max. Plateau slope (% per 100 V)	Max. Dead time (μsec)	Max. Background (counts/min)	Max dimensions	
									Tot. length	Diam.
									(mm)	
18502	Thin wall counter	β,γ	75	3000	300—400	15	150	40	118	19
18503	Cylinder counter	γ	250	325	425—675	2	100	10[2])	55	17
18504	Mica window counters	β,γ	2—3[1])	325	425—650	2	100	10[2])	55	17
18505		α,β,γ	1.5—2[1])	350	450—700	2	160	15[2])	57	26
18506		β,γ	2.5—3.5[1])	375	450—750	2	180	25[2])	57	34
18509	High flux counters	β,γ	80—100	335	375—550	15	60	2[2])	38	7
18509/02				375	500—650		30			
18510	Running liquid counter	β	30	375	500—650	7	125	15[2])	92	24
18511	Side window prop. counter	X ray	2—2.5						141	27
18513	Mica window counters	α,β	1.6—2.1[1])		575—825	15	70	6[2])	86	12.8
18514			3.5—4[1])		600—900		250	40[2])	99	33.5

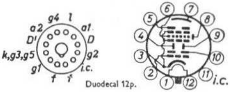
18515	Low level mica window counters	α,β	1.5—2[1]	350	500—700	3	70	5[2]	30	26
18516		β	10[1]	375	500—750			9[2]	34	34
18517	Guard counter for 18515	cosmic rays	1 mm	650	800—1200	3	1000	75[2]	90	80
18518	Guard counter for 18516							70[2]		
18520	Cylinder counters	γ	0.7 mm	345	375—475	15	200	90 40[2]	170	22.2
18522			0.5 mm	600	700—1000	3	500	110[2]	460	41
18524	Pour in counters	β,γ	25	350	400—500	15	100	12[2]	235	32
18525									182	30
18526	End window counter	α,β,γ	1.5—2[1]	375	450—750	2	200	20[2]	57	34
18529	High flux counter	γ	80—100	400	500—650	25		1[2]	27	7
18533	Dip counter	β,γ	30	350	400—500	15	100	12[2]	143	34
18536	Low level mica window counter	α,β	1.5—2	375	500—750	3	70	10[2]	34	34

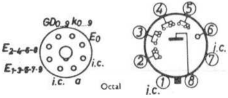
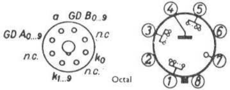
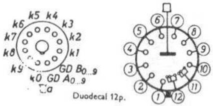
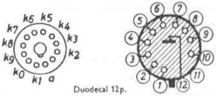
[1] Window thickness [2] Shielded

Type	*Description*	*Radiation sensitivity*	*Wall thickness mg/cm²*	*Max. starting voltage*	*Plateau*	*Max Plateau slope*	*Max Dead time*	*Max Background*	*Max dimensions*	
				(V)	*(V)*	*(% per 100 V)*	*(µsec)*	*(counts/min)*	*Tot. length (mm)*	*Diam. (mm)*
18537	End window counters	X ray	3.5—4[1]	1000	1100—1300	8	150	50[2]	154	25.4
18538				800	900—1100		400			
18545	Cylinder counter	γ	525	350	380—480	10	200	75[2]	270	22.2
18550	Thin wall counters	β,γ	32—40	380	500—650	4	50	4[2]	52	10
18552			40—60	400	450—800	2	70	30[2]	146	18
18553									280	18

[1] Window thickness [2] Shielded

DECADE COUNTING, SELECTOR AND INDICATING TUBES

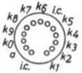
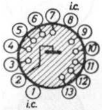
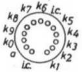
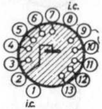
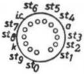
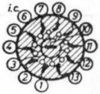
Type and Application	*Filament data*	*Voltages*	*Currents (mA)*	*Resistors*	*Base connections*
E 1 T counter tube	V_f = 6.3 V I_f = 0.3 A	V_b = 300 V V_{bg1} = 11.9 V V_{bD} = 156 V	I_k = 0.95	R_k = 15 kΩ R_{a1} = 39 kΩ R_{a2} = 1 MΩ R_{g1} = 47 kΩ	
ET 51 selector tube (long life)	V_f = 6.3 V I_f = 0.3 A	V_{btarg} = 100 V V_{bsp} = 100 V V_g = 25 V —V_g pulse = 60 V	I_{targ} = 5.5 I_{sp} = 1 I_g = 50 μA I_k = 6.5	R_{targ} = 3.3k Ω R_{sp} = 100 kΩ	

Type	*Typical characteristics*		*Max ratings*	*Dimensions*		*Base connections*
				Tot. length	*Diam.*	
				max (mm)		
Z 302 C counter tube	Maintaining voltage (at I_k = 400 μA) = 190 V V_{ign} = 400 V	V_b = 475 V E_o = —120 V R_a = 680 kΩ I_a = 400 μA	I_a = 550 μA	101.5	29.5	
Z 303 C counter tube	Counting rate (sine or pulse) = max 4 kc/s Maintaining voltage (at I_k = 300 μA) = 186 to 196 V Pulse required for forced resetting = min 120 V Output pulse = 35 V	V_b = 475 V . . V_{ko} = —12 V R_a = 820 kΩ R_k = 120 kΩ I_a = 340 μA	V_b = min 350 V Main and guide I_k = max 550 μA min 250 μA	101.5	29.5	
Z 502 S selector tube	See Z 303 C	See Z 303 C	See Z 303 C	90.5	33	
Z 503 M Indicating tube only	V_{ar} = 108 V	I_a = 60 μA	V_a = min 129 V[1]) V_{ba} = max 105 V I_a = min 50 μA I_a = max 25 0 μA	85.5	33.1	

---

[1]) Necessary for ignition

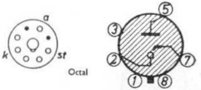
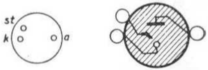
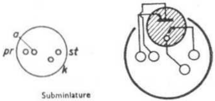
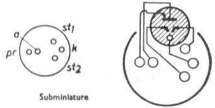
DECADE NUMERICAL INDICATING TUBES

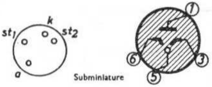
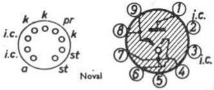
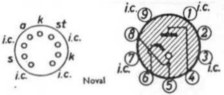
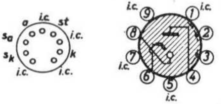
Type	*Typical characteristics*		*Maximum ratings*	*Dimensions*		*Base connections*	
				Tot. length	*Diam.*		
				max (mm)			
Z 510 M	V_{ba} = 170 V V_a = 127 V	I_k = 2 mA R_a = 15 kΩ	V_a = min 160 V¹) I_{kp} = max 15 mA²)	33	30		
Z 520 M (long life)	V_{ba} = 170 V V_a = 140 V	I_k = 2 mA R_a = 15 kΩ	V_a = min 160 V¹) I_{kp} = max 15 mA	35	30		
Z 550 M	V_{tr} = 110 Va.c. V_a = 82 V	I_k = 3 mA R_{st} = 330 kΩ R_k = 10 kΩ	V_a = max 130 Va.c. min 90 Va.c. (rectified) I_k = max 5 mA	35	30		

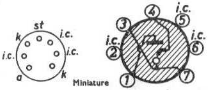
---

¹) Necessary for ignition ²) T_{av} = 0.02 sec.

TRIGGER TUBES

Type	*Typical characteristics*		*Maximum ratings*	*Dimensions*		*Base connections*
				Tot. length	*Diam.*	
				max (mm)		
PL1267/ Z300T	V_{ba} = 117 V_{eff} V_{aign}(V_{st} = 0 V) = 255 V = min 225 V = max 310 V V_a (I_a = 25 mA) = 70 V	$V_{st,ign}$ = min 73 V $V_{st,ign}$ = max 93 V V_{st} (burning voltage) = 60 V $I_{st,transt}$ (V_a = 140 V) = max 100 µA	I_a = max 25 mA I_{ap} = max 100 mA	99	33	
Z 50 T	$V_{st,ign}$ = 71 V = min 66 V = max 80 V V_{aign} = min 175 V	V_a (I_a = 2-6 mA) = 61 V = min 54 V = max 67 V	I_k = max 6 mA I_{kp} = max 24 mA	92	13	
Z 70 U	$V_{st,ign}$ (V_a = 250 Vd.c.) = 137-153 V $I_{st,transt}$ (V_a = 250 Vd.c.) = max 30 µA V_a (I_a = 3 mA) = 111-121 V	$V_{a\ ign}$ = 360 V = min 325 V $V_{pr-aign}$ = max 200 V V_{pr-a} (I_{pr} = 3 µA) = 155 V	V_{ba} = min 200 V = max 310 V I_k = max 4 mA I_{kp} = max 16 mA t_{amb} = max 70 °C	60	10.16	
Z 70 W	$I_{st,transt}$ (V_a = 250 Vd.c.) = max 50 µA	For further data see Z 70 U		60	10.16	

Z 71 U	$V_{st,ign}$ (V_a = 130 Vd.c.) = 73-90 V $I_{st,transt}$ (V_a = 130 Vd.c.) = 40 µA = max 1000 µA V_a (I_a = 5 mA) = 56-70 V	V_{aign} = 200 V = min 175 V V_a = 125-165 V Z (I_k = 8 mA) = 400 Ω = max 1000 Ω (freq. 300-3300 c/s)	V_{ba} = max 165 V I_k = max 7 mA I_{kp} = max 12 mA t_{amb} = max 70 °C	80	10.16	
Z 803 U	V_a = 170-290 V V_{aign} = min 290 V	$V_{st,ign}$ = 128-137 V V_{prign} = min 150 V	I_k = max 8 mA I_{kp} = max 50 mA	45	22	
Z 804 U	V_{st} (I_{st} = 100 µA) = 100 V V_a (I_a = 20 mA) = 106-115 V V_{aign} (pos. and neg.) = min 400 V	$V_{st,ign}$ (V_a = 180-350 Vd.c.) = -115/-131 V —$I_{st,transt}$ (V_a = 180 Vd.c.) = max 50 µA	$+I_{st}$ = max 400 µA —I_{st} = max 400 µA I_a = min 5 mA = max 25 mA I_{ap} = max 125 mA T_{av} = max 1 cycle	55.6	22	
Z 805 U	$V_{st\text{-}k}$(I_{st} = 100 µA) = 110 V $V_{a\text{-}k}$(I_a = 20 mA) = 118-128 V $V_{a\text{-}k}$(pos. and neg.) = 500 V min 475 V	$V_{st\text{-}k\ ign}$ (V_{ba} = 250-450 Vd.c.) = 137-155 Vd.c. $I_{st,transt}$ (V_a = 250 Vd.c.) = max. 100 µA	I_a = min 5 mA = max 25 mA I_{ap} = max 150 mA T_{av} = 1 cycle T_{amb} = —55/+70 °C	44.5	22	

Type	*Typical characteristics*		*Maximum ratings*	*Dimensions*		*Base connections*
				Tot. length	*Diam.*	
				max (mm)		
Z 900 T/ 5823	$V_{a\,ign}$ ($V_{st} \geq 0$ V) = 290 V V_a (I_a = 25 mA) = 62 V V_{st} ($V_a \geq 0$ V) = 80 V V_{st} (I_a = 25 mA) = 61 V	$V_{st,ign}$ = min 73 V $V_{st,ign}$ = max 105 V $I_{st,transt}$ (V_{ap} = 140 V) = max 400 μA	I_k = max 25 mA I_{kp} = max 100 mA	54	19	

IONIZATION VACUUM GAUGE

Type	*Supply voltage*	*Gas pressures*	*Field intensity of required permanent magnet*
95322 Cold cathode	2000 V_{dc}	10^{-3}—10^{-5} mm Hg	abt 370 Gauss

INTERCHANGEABILITY AND REPLACEMENT LIST

INTRODUCTION

In the first column of this interchangeability list those types of electron tubes and semiconductor devices for which equivalent types exist have been entered in numerical alphabetical order. In addition, a number of Miniwatt tube and semiconductor types for which no equivalents exist are tabulated. The second column lists the alternative CV numbers of the corresponding Miniwatt tubes and semiconductors and the third the type number(s) of these tubes or semiconductors.

It must be noted that in the third column the type numbers without brackets are **direct** equivalents, whereas those between brackets are **near** equivalents. It can be assumed, however, that in practically all cases the near equivalents can replace the type indicated in the first column.

This list also gives the most suitable replacement types for obsolete tube and semiconductor types. In a number of cases the replacement proposed can be carried out without important alterations being required in the equipment. In some cases, however, it will be necessary to rewire or change the socket, to use an adapter and/or to modify the circuit.

Since interchangeability of semiconductor devices of different make is not possible in the same way as with tubes, the types between brackets cannot be considered as near equivalents but as **comparable** types.

The fact that a tube or semiconductor is listed does not imply that it can always be supplied.

Type number	*Alternative CV number*	*Philips type*
003HO3		(OC72)
02DF		DF64
0517		PL5557
0A2	1832	OA2
0A2WA		0A2WA
0A4		(Z300T/PL1267)
0A4G	752	(Z300T/PL1267)
0B2	1833	OB2
0B2WA		0B2WA
0C3		(4687K)
0D3		(150C1K)
0E3	431	85A1; 0E3
0G3	449	85A2; 0G3
*0H3		90C1
1A3	753	1A3; DA90
1AB6		DK96; 1AB6
1AC6		DK92; 1AC6
1AD4	2237	1AD4
1AH5		DAF96; 1AH5
1AJ4		DF96; 1AJ4
1AN5		DF97; 1AN5
1C1		DK91; 1R5
1C2		DK92; 1AC6
1C3		DK96; 1AB6
1C21		(Z300T/PL1267)
1CP11		DB3-91; 1CP11
1CP31	2302	DH3-91; 1CP31
1D13	753	1A3; DA90
*1E3		DC70; 6375
1F1		DF96; 1AJ4
1F2		1L4; DF92
1F3		DF91; 1T4
1FD1		DAF96; 1AH5
1FD9		DAF91; 1S5
1L4	1758	1L4; DF92
1M1	2980	DM70; 1M3
1M3	2980	DM70; 1M3
1N3		DM71; 1N3
1)1N34		(OA85); (1N478)
1)1N34A		(OA85C); (1N479)
1)1N38		(OA85); (1N478)
1)1N38A/B		(OA85); (1N478)
1)1N43		(OA85); (1N478)
1)1N44		(OA85); (1N478)
1)1N45		(OA85); (1N478)
1)1N46		(OA85); (1N478)
1)1N47		(OA85); (1N478)
1)1N48		(OA85); (1N478)
1)1N50		(OA85); (1N478)
1)1N51		(OA85); (1N478)
1)1N52		(OA85); (1N478)
1)1N54		(OA85); (1N478)
1)1N54A		(OA85C); (1N479)
1N56		(OA85); (1N478)
1)1N57		(OA85); (1N478)
1)1N58		(OA85); (1N478)
1)1N58A		(OA85); (1N478)
1)1N60		(OA70); (1N87)
1)1N61		(OA85); (1N478)
1)1N62		(OA85); (1N478)
1)1N63		(OA85); (1N478)
1)1N64		(OA70); (1N87)
1)1N65		(OA81); (1N476)
1N66		(OA85); (1N478)
1)1N67		(OA85); (1N478)
1)1N67A		(OA95); (1N618)
1)1N68		(OA85); (1N478)
1)1N68A		(OA95); (1N618)
1)1N69		(OA85); (1N478)
1)1N70		(OA85); (1N478)
1)1N75		(OA85); (1N478)
1)1N81		(OA85); (1N478)
1N82A		—
1N86		(OA85); (OA81)
1N87		OA70; 1N87
1N87A		OA90; 1N87A
1N88		(OA81); (1N476)
1N89		(OA85); (OA95)
1N90		(OA95); (1N618)
1)1N95		(OA85); (OA95)
1)1N99		(OA85); (OA95)
1N111		(OA85); (1N478)
1N112		(OA85); (1N478)
1N113		(OA81); (1N476)
1N114		(OA81); (1N476)
1N115		(OA81); (1N476)

* Obsolete type with nearest replacement type.

1) *The G-versions are direct equivalents of the indicated Philips type e.g. 1N34G = OA85.*

Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

Type number	Alternative CV number	Philips type
1)1N116		(OA85); (OA95)
1)1N117		(OA85); (OA95)
1N119		OA86C/01; 1N119
1)1N126		(OA95); (1N618)
1)1N127		(OA95); (1N618)
1)1N128		(OA95); (1N618)
1N135		(OA85); (1N478)
1N191		(OA86)
1N192		(OA87); (1N490)
1N198		(OA5)
1N202		(OA200)
1N209		(OA200)
1N215		(OA202)
1N216		(OA202)
1N225		(OAZ212)
1N248A		(BYZ14)
1N249		(OA230)
1N250A		(BYZ14)
1N251		(OA200)
1N252		(OA200)
1N253		(OA210)
1N254		(OA210)
1N255		(OA210)
1N256		(OA214)
1N270		(OA5)
1N277		(OA5)
1N281		(OA5)
1N294		(OA81)
1N295		(OA70)
1N297		(OA81)
1N300A		(OA200)
1N338		(OA210)
1N342		(OA210)
1N343		(OA210)
1N344		(OA210)
1N345		(OA210)
1N347		(OA210)
1N380		(OA200)
1N429		(OAZ203)
1N432		(OA200)
1N433		(OA202)
1N434		(OA202)
1N456A		(OA200)
1N457		(OA202)
1N458		(OA202)
1N459		—
1N464A		(OA202)
1N468		(OAZ200)
1N470		(OAZ204)
1N476	1353	OA81; 1N476
1N477		OA81C; 1N477
1N478	1354	OA85; 1N478
1N479		OA85C; 1N479
1N480		OA86; 1N480
1N482		(OA200)
1N484		(OA202)
1N538		(OA210)
1N540		(OA210)
1N541		OA79; 1N541
1N542		2-OA79; 1N542
1N547		(BY100)
1N573		(OA210)
1N616	442	OA73; 1N616
1N617		OA91; 1N617
1N618		OA95; 1N618
1N649		(OA214)
1N698		OA47; 1N698
1N761		(OAZ200)
1N762		(OAZ209)
1N763		(OAZ211)
1N765		(OAZ212)
1N1052		(BYZ13)
1N1095		(OA214)
1N1096		(OA214)
1N1486		(OA214)
1N1695		(OA210)
1N2070		(OA210)
1N3182		BA102; 1N3182
1P1		DL96; 3C4
1P10		DL92; 3S4
1P11		DL94; 3V4
1P23		(3554)
1P32		(3546PW)
1R5	782	DK91; 1R5
1S2		DY86; 1S2

---

1) *The G-versions are direct equivalents of the indicated Philips type e.g. 1N34G = OA85.*

Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

Type number	Alternative CV number	Philips type
1S2A		DY87; 1S2A
1S4		(DL92); (DL94); (DL96)
1S5	784	DAF91; 1S5
1T4	785	DF91; 1T4
1U4	2507	1U4
1U5	3912	1U5; DAF92
1X2A		(DY86); (1S2)
1X2B		(DY86); (1S2)
2B29		(QQE06/40); (5894)
2B32		QQE04/20; 832A
2B35	1092	EA50
2B46		QE05/40; 6146
2B52		QQE03/20; 6252
2B94		QQE06/40; 5894
2D21	797	PL2D21; (PL5727)
2D21W	2876	PL5727; E91N
2D21WA	4018	PL5727; E91N
2FY5		2FY5
2G/402A		DCX4/1000; 3B28
2G/472B		DCX4/5000; 4B32
2H28		DCX4/1000; 3B28
2H66		DCG4/1000G; 866A
2HR8		XF86; 2HR8
2J42	3676	2J42
2J51		2J51
2J51A	3560	2J51A
2J55		2J55
2J56	2852	2J56
2K25	2792	2K25
2N34		(OC72)
2N34A		(OC72)
2N35		(OC140)
2N36		(OC72)
2N37		(OC72)
2N38/A		(OC72)
2N41		(OC58)
2N43		(OC77)
2N43A		(OC77)
2N44		(OC74)
2N44A		(OC74)

Type number	Alternative CV number	Philips type
2N45		(OC72)
2N46		(OC58)
2N47		(OC58)
2N48		(OC58)
2N49		(OC58)
2N54		(OC72)
2N55		(OC72)
2N56		(OC72)
2N59		(OC74)
2N62		(OC72)
2N63		(OC72)
2N64		(OC72)
2N65		(OC72)
2N76		(OC71)
2N77		(OC58)
2N78		(OC140)
2N79		(OC71)
2N85		(OC72)
2N86		(OC72)
2N87		(OC72)
2N88		(OC58)
2N89		(OC58)
2N90		(OC58)
2N94		(OC140)
2N94A		(OC140)
2N96		(OC71)
2N104		(OC71)
2N105		(OC58)
2N106		(OC71)
2N109		(OC72); (2N281)
2N113		(OC45)
2N114		(OC44)
2N115		(OC26); (2N1314)
2N116		(OC66)
2N123		(OC47)
2N128		(OC170)
2N129		(OC170)
2N130		(OC58)
2N131		(OC58)
2N132		(OC72)
2N133		(OC66)
2N135		(OC45)
2N136		(OC45)

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
2N137		(OC44)
2N138		(OC72)
2N138A		(OC72)
2N139		(OC46)
2N140		(OC44)
2N145		(OC139)
2N146		(OC139)
2N147		(OC140)
2N148		(OC45)
2N155		(OC26)
2N156		(OC26)
2N158		(OC26)
2N166		(OC140)
2N167		(OC140)
2N168		(OC139)
2N168A		(OC140)
2N169		(OC139)
2N169A		(OC139)
2N170		(OC140)
2N172		(OC140)
2N173		(OC29)
2N174A		(OC26)
2N175		(OC66)
2N176		(OC27)
2N180		(OC72)
2N181		(OC74)
2N182		(OC140)
2N183		(OC140)
2N184		(OC140)
2N185		(OC72)
2N186		(OC72)
2N186A		(OC74)
2N187		(OC72)
2N187A		(OC74)
2N188		(OC72)
2N188A		(OC74)
2N189		(OC71)
2N190		(OC71)
2N191		(OC75)
2N192		(OC75)
2N193		(OC139)
2N194		(OC139)
2N194A		(OC139)
2N195		(OC72)
2N196		(OC72)
2N197		(OC72)
2N198		(OC72)
2N199		(OC72)
2N200		(OC71)
2N204		(OC71)
2N205		(OC71)
2N206		(OC71)
2N207		(OC58)
2N207A		(OC58)
2N207B		(OC58)
2N215		(OC75)
2N216		(OC139)
2N217		(OC72)
2N218		(OC45)
2N219		(OC44)
2N220		(OC66)
2N223		(OC74)
2N224		(OC74)
2N225		(2-OC74)
2N226		(OC74)
2N227		(2-OC74)
2N229		(OC140)
2N230		(OC26)
2N231		(OC169)
2N232		(OC169)
2N233		(OC139)
2N233A		(OC139)
2N234		(OC26)
2N234A		(OC26)
2N235		(OC26)
2N235A		(OC26)
2N235B		(OC26)
2N236		(OC26)
2N236A		(OC26)
2N236B		(OC26)
2N237		(OC58)
2N238		(OC72)
2N241		(OC72); (OC74)
2N241A		(OC72); (OC74)
2N242		(OC28)
2N247		(OC170)

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	Alternative CV number	Philips type
2N248		(OC170)
2N249		(OC74)
2N250		(OC26)
2N251		(OC28)
2N252		(OC44)
2N253		(OC139)
2N254		(OC139)
2N255		(OC26)
2N256		(OC26)
2N257		(OC26)
2N265		(OC72)
2N266		(OC72)
2N267		(OC170)
2N268		(OC26)
2N268A		(ASZ15)
2N269		(OC47)
2N270		(OC74)
2N271		(OC44)
2N271A		(OC44)
2N274		(OC170)
2N279		OC70; 2N279
2N280	7005	OC71; 2N280
2N281	7006	OC72; 2N281
2N282		2-OC72; 2N282
*2N283		OC75
2N284		OC76; 2N284
2N284A		OC77; 2N284A
2N285		(ASZ15)
2N285A		(ASZ15)
2N291		(OC74)
2N292		(OC139)
2N293		(OC139)
2N296		(OC28)
2N297		(ASZ15)
2N297A		(ASZ15)
2N300		(OC171)
2N301		(ASZ16)
2N301A		(ASZ15)
2N302		(OC47)
2N303		(OC47)
2N307		(OC26)
2N307A		(OC26)
2N308		(OC45)
2N309		(OC45)
2N310		(OC44)
2N311		(OC47)
2N312		(OC140)
2N315		(OC47)
2N316		(OC47)
2N317		(OC47)
2N318		(OC170)
2N319		(OC74)
2N320		(OC74)
2N321		(OC74)
2N322		(OC72); (OC74)
2N323		(OC72); (OC74)
2N324		(OC72); (OC74)
2N325		(OC26)
2N326		—
2N327/A		(OC200)
2N328		(OC200)
2N328A		(OC201)
2N331		(OC74)
2N344		(OC171)
2N345		(OC171)
2N346		(AFZ12)
2N350		(OC26)
2N351		(OC26)
2N352		(OC26)
2N353		(OC26)
2N354		(OC201)
2N356		(OC139)
2N357		(OC140)
2N358		(OC141)
2N359		(OC72)
2N360		(OC72)
2N361		(OC72)
2N362		(OC70); (OC71)
2N363		(OC70); (OC71)
2N370		(OC170)
2N371		(OC170)
2N372		(OC170)
2N376		(OC27)
2N378		(OC28)

** Obsolete type with nearest replacement type.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
2N380		(OC28)
2N381		(OC74)
2N382		(OC74)
2N383		(OC74)
2N384		(OC171)
2N386		(ASZ15)
2N387		(ASZ16)
2N388		(OC141)
2N393		(ASZ20)
2N394		(OC76); (OC80)
2N395		(OC46); (OC47)
2N396		(OC46)
2N397		(OC47)
2N398		(OC77)
2N399		(OC26)
2N401		(OC26)
2N402		(OC71)
2N403		(OC72); (OC74)
2N404		(OC47)
2N405		(OC72)
2N406		(OC71); (OC72)
2N407		(OC72)
2N408		(OC72)
2N409		(OC45)
2N410		(OC45)
2N411		(OC44)
2N412		(OC44); (OC171)
2N413/A		(OC45)
2N414/A		(OC45)
2N415		(OC44)
2N415A		(OC45)
2N416		(OC44)
2N417		(OC44)
2N422		(OC66)
2N425		(OC47)
2N426		(OC47)
2N427		(OC47)
2N428		(OC47)
2N439		(OC142)
2N443		(ASZ16)
2N461		(OC80)
2N464		(OC71)
2N465		(OC58)
2N466		(OC75)
2N467		(OC75)
2N481		(OC44)
2N484		(OC45)
2N486		(OC44)
2N491		(BCZ11)
2N495		(OC201)
2N496		(OC201)
2N499		(OC171)
2N501/A		(ASZ21)
2N502/A		(AFZ12)
2N503		(OC170)
2N504		(OC170)
2N525		(OC72)
2N526		(OC72)
2N538		(OC26)
2N539		(ASZ15)
2N540		(OC27)
2N544		(OC169)
2N561		(ASZ15)
2N574A		(ASZ15)
2N575		(ASZ15)
2N575A		(ASZ16)
2N583		(AFZ12)
2N585		(OC139)
2N588		(AFZ12)
2N618		(ASZ15)
2N629		(ASZ16)
2N631		(OC72)
2N632		(OC74)
2N633		(OC74)
2N640		(OC170)
2N641		(OC170)
2N642		(OC170)
2N643		(ASZ21)
2N644		(ASZ21)
2N645		(ASZ21)
2N658		(OC76)
2N659		(OC76)
2N660		(OC76)
2N661		(OC76)
2N662		(OC76)
2N695		(ASZ21)
2N700		(ASZ12)

Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

Type number	Alternative CV number	Philips type
2N705		(ASZ21)
2N710		(ASZ21)
2N1014		(ASZ18)
2N1017		(OC47)
2N1023		(AFZ12)
2N1039		(OC26)
2N1041		(ASZ15)
2N1066		(AFZ12)
2N1122/A		(ASZ21)
2N1132		(BCZ11)
2N1142		(AFZ12)
2N1143		(AFZ12)
2N1177		(AFZ12)
2N1178		(AFZ12)
2N1179		(AFZ12)
2N1180		(AFZ12)
2N1195		(ASZ12)
2N1224		(OC169)
2N1225		(OC170)
2N1226		(OC171)
2N1300		(ASZ20)
2N1301		(ASZ20)
2N1314		OC26; 2N1314
2N1385		(ASZ21)
2N1397		(AFZ12)
2N1398		(AFZ12)
2N1399		(AFZ12)
2N1400		(OC171)
2N1401/A		(OC171)
2N1402		(OC171)
2N1411		(ASZ21)
2N1425		(OC169)
2N1426		(OC169)
2N1427		(ASZ20)
2N1515		OC169; 2N1515
2N1516		OC170; 2N1516
2N1517		OC171; 2N1517
2N1666		ASZ15; 2N1666
2N1667		ASZ16; 2N1667
2N1668		ASZ17; 2N1668
2N1669		ASZ18; 2N1669
2-OA72		2-OA72
2-OA79		2-OA79; 1N542

Type number	Alternative CV number	Philips type
*2-OC16		2-OC26
2-OC26		2-OC26
*2-OC30		—
2-OC72		2-OC72; 2N282
2-OC74		2-OC74
2S30		(OC44)
2S31		(OC45)
2S32		(OC72)
2S33		(OC72)
2S34		(OC74)
2S35		(OC45)
2S36		(OC45); (OC46)
2S37		(OC72)
2S38		(OC74)
2S39		(OC66)
2S40		(OC47)
2S41		(ASZ16); (OC170)
2S42		(ASZ15)
2S43		(OC170)
2S44		(OC72); (OC74)
2S45		(OC45)
2S52		(OC44)
2S56		(OC74)
2S91		(OC74)
2S109		(OC170)
2S110		(OC170)
2S112		(OC170)
2S141		(OC170)
2S142		(OC170)
2S143		(OC170)
2S145		(OC169); (OC170)
2S148		(OC44)
2T76		(OC141)
2V/400A	32	DCG4/1000G
2V/400B		(DCG4/1000G)
2V/470C		(DCG4/5000)
2V/471A		(DCG4/5000)
2V490C		(DCG4/5000)
2V/500C		(DCG4/5000)
2V530A		(DCG9/20); (6508)
2V530E		(DCG9/20); (6508)
2V531E		(DCG9/20); (6508)
3A4	807; 2390	3A4; DL93

***** *Obsolete type with nearest replacement type.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
3A5	808	3A5; DCC90
3AFP31		DH7-91;3 AFP31
3AJ8		XCH81; 3AJ8
3ALP1		DG7-5; 3ALP1
3ALP7		DP7-5; 3ALP7
3ALP11		DB7-5; 3ALP11
3AMP1		DG7-32; 3AMP1
3AMP1A		DG7-32/01; 3AMP1A
3AZP31		DHM9-11; 3AZP31
3B4	2240	3B4
3B28	1835	3B28; DCX4/1000
3BKP2		DN7-78; 3BKP2
3BKP31		DH7-78; 3BKP31
3BX6		XF80; 3BX6
3BY7		XF85; 3BY7
3C4		DL96; 3C4
3C23		PL3C23
3C45	372 6007	3C45
3DA		56001
3EH7		XF183; 3EH7
3EJ7		XF184; 3EJ7
3FY5		3FY5
3G/501A	2215	PL5545
3J/170E		(TBL6/6000); (5924)
3J/294E		(TBL12/100); (6078)
3N25/501		(OC171)
3NP4		(MW6-2)
3Q4	818	3Q4; DL95
3S4	820	DL92; 3S4
3V4	2983	DL94; 3V4
3V/340B		(PL5557)
3V/390A		PL5559
3V/490A		(PL105)
3V/531E		(DCG12/30); (5870)
3WP1	3946	3WP1; (DG7-36)
3WP11		3WP11; (DB7-36)
4-65A	1905	QB3/200; 4-65A
4/100BU		AZ50
4-125A		QB3/300GA; 4-125A
4-250A		QB3.5/750GA; 4-250A
4-400A		QB4/1100GA;4-400A

Type number	*Alternative CV number*	*Philips type*
4B13		QB2/250
4B26	1836	1163
4B32	2518	DCX4/5000; 4B32
4BL8		XCF80; 4BL8
4C35	1787	4C35
4C35A		4C35A
4CM4		PC86; 4CM4
4CX250B		QEL2/275; 4CX250B
4D21	2963	QB3/300GA; 4-125A
4DL4		PC88; 4DL4
4FS7		4FS7
4EH7		4EH7
4EJ7		4EJ7
4EP7		DP10-94; 4EP7
4EP11		DB10-94; 4EP11
4EP31		DH10-94; 4EP31
4ES8		XCC189; 4ES8
4F15K		QEL1/150; 4X150A
4F21		QB3/300; 6155
4G/280K		PL2D21
4GTP		(3546PW)
4H/135M	2519	QEL1/150; 4X150A
4H/136M		QEL1/150H
4H/160M		QEL2/250; 4X250B
4J50		4J50
4J52	3569	4J52
4J52A	5018	4J52A
4J57		4J57
4J58		4J58
4J59		4J59
4J78	3953	4J78
4LP31		DHM10-93; 4LP31
4X150A	2519	QEL1/150; 4X150A
4X250B		QEL2/250; 4X250B
4X500A		QBL4/800; 4X500A
5/04HM	1868	MF13-1
5/04J		(MF13-1)
5/04TM		MW13-35
5/62CM		DH13-78; 5BHP31
5/62PM		DB13-78; 5BHP11
5A/170K		E180F; 6688
5ADP1	5035	DG13-34; 5ADP1
5ADP7		DP13-34; 5ADP7
5ADP11		DB13-34; 5ADP11

* *Obsolete type with nearest replacement type.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	Alternative CV number	Philips type
5AQ4		GZ32; 5AQ4
5AR4	1377	GZ34; 5AR4
5B21		1164
5B/250A		QE06/50
5BHP2		DN13-78; 5BHP2
5BHP11		DB13-78;5BHP 11
5BHP31		DH13-78; 5BHP31
5BKP11		DB13-97; 5BKP11
5BKP31		DH13-97; 5BKP31
5C		(OAP12)
5C21		(PL5545)
5C22	2520	5C22
5C/100A		QB2/250; 813
5CBP2		DN13-76; 5CBP2
5CBP11		DB13-76; 5CBP11
5CBP31		DH13-76; 5CBP31
5CLP31		DH13-10; 5CLP31
5CP1A		(DG13-2)
5CP7A		(DP13-2)
5CP11A		(DB13-2)
5D22	2964	QB3.5/750GA; 4-250A
5ES8		5ES8
5F22A		QB3.5/750; 6156
5F23A		QB4/1100; 7527
5FP4A		(MW13-35)
5FP7A		(MF13-1)
5J26	3602	5J26
5P		(OAP12)
5T01A		MF13-1
5T4	1846	(GZ34)
5T33		(TB4/1250); 5868
5U4G		(GZ34)
5U8		5U8
5UP1		DG13-32
5V4G		(GZ34); (GZ32)
5X4G	1851	(GZ34)
5Y3		(5Y3GT)
5Y3GT	1856	5Y3GT
5Z4GT		(GZ34)
6AB4		(EC92)
6AB8		ECL80; 6AB8
6AD8		(6DC8); (EBF89)
6AF3		(EY81)
6AG5		(6BA6); (EF91)
6AJ8	2128	ECH81; 6AJ8
6AK5	850	6AK5; EF95; 2)(5654)
6AK5W		5654
6AK8		EABC80; 6AK8
6AL3		EY88; 6AL3
6AL5	283	EAA91; 6AL5; 2)(5726)
6AL5W	4007	5726
6AM5	136	EL91; 6AM5
6AM6	138	EF91; 6AM6
6AN7		(ECH81); (6AJ8)
6AQ5	1862	6AQ5
6AQ5W		1)(6AQ5)
6AQ8		ECC85; 6AQ8
6AS6W		5725
6AS7G		2)(6080)
6AT6	452	6AT6
6AU6/A	2524	6AU6
6AV6	2526	6AV6
6B3		(EY81)
6B8		(EBF32)
6B8G		(EBF32)
6BA6	454	6BA6
6BC5		(EF91)
6BD7/A		EBC81; 6BD7A
6BE6	453	6BE6
6BE7		EQ80; 6BE7
6BH5		(EF89); (6DA6)
6BH6		2)(E90F); (EF91); (6AM6)
6BJ6		2)(E99F); (6BA6)
6BL8		ECF80; 6BL8; 2)(E80CF)
6BM5		(6AQ5)
6BM8		ECL82; 6BM8
6BQ5	2975	EL84; 6BQ5
6BQ7A		(ECC84)
6BR5	1352	EM80; 6BR5
6BT4	3891	EZ40; 6BT4
6BT6		(6AT6); (6AV6)
6BW7		(EF80); (6BX6)

---

1) *No specially ruggedized construction.* 2) *Special quality.*
Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
6BX6		EF80; 6BX6
6BY6		(EH90); 1)(E91H)
6BY7	1375	EF85; 6BY7
6BZ7		(ECC84)
6C4	133	6C4; EC90
6C9		(ECH42)
6C10		ECH42
6C12		ECH81; 6AJ8
6C16		ECF80; 6BL8
6C31		(ECH33)
6CA4		EZ81; 6CA4
6CA7	1741	EL34; 6CA7
6CB6	3995	6CB6
6CD7	394	EM34; 6CD7
6CE5		(6CB6)
6CH6		(EL83)
6CJ5	3886	EF41; 6CJ5
6CJ6	2721	EL81; 6CJ6
6CK5	3889	EL41; 6CK5
6CK6	2726	EL83; 6CK6
6CM4		EC86; 6CM4
6CM5	2940	EL36; 6CM5
6CM6		(6AQ5)
6CQ6	131	EF92; 6CQ6
6CR4		(EC88)
6CS6		EH90; 6CS6
6CT7	3883	EAF42; 6CT7
6CU7	3888	ECH42; 6CU7
6CV7	3882	EBC41; 6CV7
6CW5	5094	EL86; 6CW5
6CW7		ECC84; 6CW7
6D1	1092	EL86; 6CW5
6D2	140	(6AL5); (EAA91)
6D4		EN93
6DA5		EM81; 6DA5
6DA6		EF89; 6DA6
6DC8		EBF89; 6DC8
6DJ8		ECC88; 6DJ8; 1)(E88CC)
6DL4		EC88; 6DL4
6DL5		EL95; 6DL5
6DR8		EBF83; 6DR8
6DS8		ECH83; 6DS8
6DT8		(ECC85)
6DX8		ECL84; 6DX8
6DY5		EL82; 6DY5
6E8G		(ECH33)
6EC7		(EF89); (6DA6)
6EH7		EF183; 6EH7
6EJ7		EF184; 6EJ7
6EQ7		(EBF89)
6ES5		(EC95); (6ER5)
6ES6		EF97; 6ES6
6ES8		ECC189; 6ES8
6ET6		EF98; 6ET6
6EU7		(ECC83)
6EW6		(EF184)
6F1		(EF42)
6F12	1839	EF91; 6AM6
6F13		(EF42)
6F16		EF41
6F18		(EF89); (6DA6)
6F19		EF85; 6BY7
6F20		(EF85); (6BY7)
6F21		EF92; 6CQ6
6F23		(EF80)
6FC7		ECC89; 6FC7
6FG6		EM84; 6FG6
6FH5		(EC95); (6ER5)
6FQ5		(EC97)
6FW8		(ECC88); (6DJ8)
6FY5		6FY5
6GB5		EL500; 6GB5
6GK6		(EL84)
6GM6		(EF183)
6GM8		ECC86; 6GM8
6GN8		(ECL84)
6GV8		ECL85; 6GV8
6GW8		ECL86; 6GW8
6H6G/GT		(EAA91)
6H51		(DCG6/18); (6693)
6HG8		ECF86; 6HG8
6J6	858	6J6; ECC91
6J7GT		(EF37A)
6J8G		(ECH33)

1) Special quality.

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	Alternative CV number	Philips type
6K7GT		(EF39)
6L6G/GB		(EL37); (EL34)
6L12		ECC85; 6AQ8
6L13		ECC83; 12AX7
6LD3		EBC41; 6CV7
6LD12		EABC80; 6AK8
6M2		EM34; 6CD7
6M5		(EL84); (6BQ5)
6N3		EY82; 6N3
6N8		EBF80; 6N8
6N8K		(6DC8); (EBF89)
6P8G		(ECH33)
6P15		EL84; 6BQ5
6P17	136	EL91; 6AM5
6P28		(EL38)
6Q4	1886	EC80; 6Q4
6Q7G/GT		(EBC33)
6R3		EY81; 6R3
6R4	1865	EC81; 6R4
6S2	2966	EY86; 6S2
6S2A		EY87; 6S2A
6SA7GT	1967	6SA7GT
6SK7GT	1982	6SK7GT
6SL7GT		(ECC35)
6SN7GT	1988	6SN7GT
6SQ7GT	1991	6SQ7GT
6T8		(EABC80); (6AK8)
6U3		EY80; 6U3
6U8		6U8; (ECF80)
6V3/A		(EY81)
6V4		6V4; EZ80
6V6GT	511	6V6GT
6W2		(EY51); (6X2)
6X2	426	EY51; 6X2
6X4	493	6X4
7AHP1	2352	DG16-22; 7AHP1
7AHP7		DP16-22; 7AHP7
7AHP11		DB16-22; 7AHP11
7AN7		PCC84; 7AN7
7D9	136	EL91; 6AM5
7DE7		(EF80); (6BX6)
7DJ8		PCC88; 7DJ8
7ES8		PCC189; 7ES8
7F16		EF41
7FC7		PCC89; (PCC189)
7G7		(EF22)
8A		(3554)
8A1		DG7-36
8B8		XCL82; 8B8
8BQ5		XL84; 8BQ5
8CW5		XL86; 8CW5
8D		(OC45)
8D3		EF91; 6AM6
8D8		(EF86)
8DX8		XCL84; 8DX8
8E; 8F		(OC45)
8GW8		8GW8
8HG8		PCF86; 8HG8
9/03LB		AL22-10; 9RP33
9A8		PCF80; 9A8
9AB4		UC92; 9AB4
9AK8		PABC80; 9AK8
9AQ8		PCC85; 9AQ8
9D6		EF92; 6CQ6
9D7		(EF85)
9GV8		9GV8
9Q205		(DCG6/18); (6693)
9RP33		AL22-10; 9RP33
9U8A		(PCF80); (9A8)
10A		(OAP12)
10C14		UCH81
10F1		(UF42)
10F3		(UF42)
10F9		(UF41)
10F18		(UF89)
10FD12		UBF89
10L14		UCC85
10LD3		UBC41
10LD12		UABC80
10LD14		UCC85
10M2		UM4
10P		(OAP12)
10P18		UL84
10PL12		UCL82
11A		(OAP12)

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
11E13		QQE03/12; 6360
12/03HB		AL31-10
12/04HM	429	MF31-55
12/04LK		MF31-22
12AC5		UF41; 12AC5
12AD5		(UF89)
12AJ7		HCH81; 12AJ7
12AQ5		12AQ5
12AT6		12AT6
12AT7	455	ECC81; 12AT7; 1)(6201)
12AT7WA	4024	6201
12AU6	1961	12AU6
12AU7	491	ECC82; 12AU7; (ECC186)
12AV6		12AV6
12AX7	492	ECC83; 12AX7
12BA6	1928	12BA6
12BE6		12BE6; (HCH81); (12AJ7)
12BY7A		12BY7A
12S7		UAF42; 12S7
12SA7GT	538	12SA7GT
12SK7GT	544	12SK7GT
12SN7GT	925	12SN7GT
12SQ7GT	547	12SQ7GT
12X4		12X4
13CM5		XL36; 13CM5
13EC7		(UF89)
14/04TB		MW36-67
14AHP4A		AW36-80; 14AHP4A
14G6		(UBC81)
14GB5		14GB5
14GW8		PCL86; 14GW8
14K7		UCH42; 14K7
14L7		UBC41; 14L7
14Y7		(UCH81); (19D8)
15A6		PL83; 15A6
15CW5		PL84; 15CW5
15DQ8		PCL84; 15DQ8
16/04HM		MF41-10
16A5		PL82; 16A5
16A8		PCL82; 16A8
16AQ3		XY88; 16AQ3
17	2957	PL5557
17BQP4		MW43-69; 17BQP4
17BTP4		AW43-80; 17BTP4
17C8		UBF80; 17C8
17CVP4		AW43-88
17DYP4		(AW43-89)
17Z3		PY81; 17Z3
18GV8		PCL85; 18GV8
19BD		PY80; 19X3
19BR5		UM80; 19BR5
19D8		UCH81; 19D8
19FL8		UBF89; 19FL8
19SU		PY82; 19Y3
19X3		PY80; 19X3
19Y3		PY82; 19Y3
20A3	797	PL2D21
20EQ5		(UBF89)
21A6		PL81; 21A6
21CJP4		MW53-20; 21CJP4
21CLP4		AW53-80; 21CLP4
21DKP4		AW53-88
21DKP4A		AW53-88
21EZP4		(AW53-89)
23ABP4		(AW59-90)
24AXP4		AW61-88
25E5		PL36; 25E5
25L6GT	553	25L6GT
28GB5		PL500; 28GB5
30A5		HL94; 30A5
30AE3		PY88; 30AE3
30C1		PCF80; 9A8
30F5		(EF80); (6BX6)
30F27		(EF184)
30L1		PCC84; 7AN7
30P4		(PL36)
30P16		PL82; 16A5
30P18		PL84; 15CW5
30PL1		(PCL82)
30PL13		(PCL82); (PCL85)
31A3		UY41; 31A3
31AV3		UY89; 31AV3

1) *Special quality.*

Type numbers between brackets are near equivalent types.

Type number	Alternative CV number	Philips type
34GD5		(UL84)
35C5		(HL94)
35W4		35W4
35Z5GT	568	35Z5GT
38A3		UY85; 38A3
45A5	1977	UL41; 45A5
45B5		UL84; 45B5
50AVP		50AVP
50BM8		UCL82; 50BM8
50C5	1959	50C5
50L6GT	571	50L6GT
51A		(3546PW)
51A3		3546PW/02
51AV		(3545PW)
51UVP		51UVP
52AVP		52AVP
52KU		(GZ32); (GZ34)
53AVP		53AVP
53KU	378	(GZ34); (5AR4)
53UVP		53UVP
54AVP		54AVP
54KU		GZ32; (GZ34)
55N3		UY82; 55N3
56AVP		56AVP
56UVP		56UVP
57 (thyr.)		PL5559
57AVP		57AVP
58AVP		58AVP
59A; 59A4		(3554)
59AVP		59AVP
61SV		61SV; 7634
62DDT		EBC41; 6CV7
62SV		62SV
62TH		ECH42
62VP		EF41
63SPT		EF50
63TP		ECL80; 6AB8
64CB		B8 731 03
64ME		EM34; 6CD7
64SPT		EF80; 6BX6
65ME		EM80; 6BR5
66KU		EZ40
67PT		EL41
75C		75C1

Type number	Alternative CV number	Philips type
*80		5Y3GT
83A1		83A1; 7980
85A1	431	85A1; 0E3
85A2	449	85A2; 0G3
90AG	2270	90AG
90AV	2132	90AV
90C1		90C1
90CG	2133	90CG
90CV	2134	90CV
92AG		92AG
92AV		92AV
100E1		100E1
100R		8020
100TH	2552	TB3/350; 100TH
105		PL105
*108C1		0B2
121K		(MW31-74)
121VP		UF41
141DDT		UBC41
141K		(MW36-44)
141TH		UCH42
150A1		150A1
150AVP		150AVP
150B2	2225	150B2; 6354
*150C1		0A2
150C1K		150C1K
150C1P		150C1P
150C2		0A2
150C3	1832	(150C1K)
150C4	216	(0A2)
150CVP		150CVP
153AVP		153AVP
163Pen		PL82; 16A5
171DDP		UBF80
172		(PL105)
172K		(MW43-69); (17BQP4)
173K		(MW43-69); (17BQP4)
206		(OC139)
207		(OC139)
208		(OC139)
212K		(MW53-80)

* *Obsolete type with nearest replacement type.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	Alternative CV number	Philips type
213Pen		PL81; 21A6
222		(OC45)
223		(OC140)
225		(OC45)
228		(OC44)
238B		PL5555
250TH	2589	TB4/800; 250TH
267B		(DCG5/5000GB); (872A)
272		PL5557
274B		(GZ34)
300		(OC72)
301		(OC72)
302		(OC72)
310		(OC72)
311SU		UY41
323B		(PL3C23)
328		328
329		329
332Pen		CL33
340		340
350		(OC72)
352		(OC72)
353		(OC72)
367	2634	367
*373		AZ1
393A		(PL3C23)
403B		(5654/E95F)
404A		5847
408BU		(AZ1)
417A		5842
451		451
451PT	1977	UL41
451U		AZ50
452		452
502A		(PL2D21)
*505		AZ1
*506		AZ1
*506K		AZ1
575A		(DCG6/18GB); (7136)
673		(DCG6/18); (6693)
676		(PL105)
710		PL5684/C3J

Type number	Alternative CV number	Philips type
723A/B	1795	723A/B
725A	722	725A
807	124	QE06/50; 807
813	26	QB2/250; 813
816	724	(DCG4/1000G); (866A)
829		(QQE06/40); (5894)
829B	2666	(QQE06/40); (5894)
830		(OC140)
832		QQE04/20; 832A
832A	788	QQE04/20; 832A
833A		(TB4/1250); (5868)
857B		(DCG7/100B); (6786)
866		DCG4/1000G; 866A
866A	32	DCG4/1000G; 866A
866AX	32	DCG4/1000G; 866A
866B		(DCG4/1000G); (866A)
868	2680	(3554)
869A		(DCG9/20); (6508)
869B	2723	(DCG9/20); (6508)
872		DCG5/5000GB; 872A
872A	642	DCG5/5000GB; 872A
872AX	642	DCG5/5000GB; 872A
873		(DCG6/6000)
884		(PL2D21)
885		(PL2D21)
891		(TAW12/10)
891R		(TAL12/10)
892		(TAW12/10)
892R		(TAL12/10)
918		(3554)
927		(3546PW)
966		DCG4/1000G; 866A
967		PL5557
1010		1010
1012		1012
1032		(OC72)
1033		(OC72)
1034		(OC72)
1035		(OC72)
1036		(OC72)
1037		1037

** Obsolete type with nearest replacement type.*

Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

Type number	*Alternative CV number*	*Philips type*
*1038		328
1039		1039
1048		1048
1049		1049
1069K		1069K
1110		1110
1119		1119
1138		1138
1163	1836	1163
1164		1164
1174		1174
1176		1176
1177		1177
1257		PL5559
1267/OA4G	1992	Z300T/PL1267
1295		(PL5559)
1320		(OC72)
1330		(OC72)
1340		(OC72)
1350		(OC72)
1360		(OC72)
1390		(OC45)
1400		(OC45)
1410		(OC45)
1554		1554
*1560		5Y3GT
1564		1564
1607		PL1607
1625		(PE06/40E)
1657		(PL2D21)
1665		(PL2D21)
1672		(PL105)
1701		PL5557
1710		1710
1725A		1725A
1738		1738
1749A		1749A
*1759		1859 + 1289
1788		1788
*1801		AZ1
*1802		AZ1
*1803		AZ1
*1805		AZ1
*1807		AZ1
*1815		AZ50
*1817		AZ50
*1821		AZ1
*1823		AZ1
1838		1838
1849		1849
1859		1859
1875		1875
1876		1876
1877	1134	1877
1878		1878
1904H		1904H
1905		1905
1908		1908
1909		1909H
1909A		1909A
1909H		1909H
1910		1910
1913		1913
1918		1918
1923		1923
1927		1927
1941A		1941A
2000		1163
2050		(PL6574)
2100A		8020
2183		1164
2273P		AL22-10
3069		DCG4/1000G; 866A
3070		DCG5/5000GB; 872A
3073Q		AL31-10
3078A		(DCG9/20); (6508)
*3534		3554
*3541		3533
3545		3545
3545PW		3545PW
3546		3546
3546PW		3546PW
3554		3554
3572		DCG4/1000G; 866A
3861B		QEL1/150; 4X150A
3874A	26	QB2/250; 813

***** *Obsolete type with nearest replacement type.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	Alternative CV number	Philips type
3885A		DCX4/1000; 3B28
4049D		(DCG4/5000)
*4060		—
4065		4065
4066		4066
4067		4067
4068		4068
4069		4069
4078A		(DCG9/20); (6508)
4078GA		(DCG9/20); (6508)
4078Z		(DCG9/20); (6508)
4152/02		4152/02
4260		PL5557
4261		PL5557
4349		4349
4369		4369
*4373		4369
4378		4378
4379		4379
4390		4390
4397		4397
4610		AF7
*4623		EA50
*4636		AF7
*4648		DCG1/250; DCG4/1000G; 866A
4649		DCG4/1000ED
*4652		AX50; AZ50
4662		4662
4683		4683
*4690		EC50
4699		4699
5021B		DCG4/1000G; 866A
5031		DCG5/5000GB; 872A
5121		DCX4/1000; 3B28
5544	2210	PL5544
5545	2215	PL5545
5551		PL5551A
5551A		PL5551A
5551A/652		PL5551A
5552		PL5552A
5552A		PL5552A
5552A/651		PL5552A

Type number	Alternative CV number	Philips type
5553A		PL5553B
5553B		PL5553B
5553B/655		PL5553B
5555		PL5555
5557/17	2957	PL5557
5559/57		PL5559
5560		(PL5559)
5561		(PL5559)
5586	3611	5586
5632		PL5632/C3J
5636		5636
5639		5639
5641		5641
5643		5643
5644		5644
5651	2573	5651; 1)85A2
5654	4010	5654; E95F
5657		5657
5668		(TAW12/10)
5669		(TAL12/10)
5672	2238	5672
5678	2254	5678
5684		PL5684/C3J/A
5696	3512	5696
5718	3930	5718
5719		5719
5725		5725
5726	4007	E91AA; 5726
5727	4018	PL5727; E91N
5749		1)(6BA6)
5750		1)(6BE6)
5751		1)(ECC83); 1)(12AX7)
5762/7C24		(TBL6/6000); (5924)
5763	2129	QE03/10; 5763
5796		(PL3C23)
5800/VX41		(4066)
5802/VX32B		(4065)
5814		1)ECC186
5820		5820
5822		PL5822A
5823		Z900T/5823
5840	3929	EF732; 5840
5842/417A		5842

** Obsolete type with nearest replacement type.*

1) *No specially ruggedized construction.*

Type numbers between brackets are near equivalents for semiconductors they are comparable types.

Type number	Alternative CV number	Philips type
5847/404A		5847
5861	273	EC55; 5861
5866	1924	TB2.5/300; 5866
5867	1350	TB3/750; 5867
5868	1351	TB4/1250; 5868
5869		5869; (DCG6/6000)
5870		DCG12/30; 5870
5876		5876
5879		(EF86); (6267)
5889		(4068)
5894	2797	QQE06/40; 5894
5895	1838	QQC04/15; 5895
5899		EF731; 5899
5915		(E91H)
5920	5214	E90CC; 5920
5923		TBW6/6000; 5923
5924	3926	TBL6/6000; 5924
5949	3521	5949
6005		1)(6AQ5)
6007		DL67; 6007
6008		DF67; 6008
6011		PL5684/C3JA
6046		1)(25L6GT)
6060	4024	E81CC; 6201
6065		1)(EF92); 1)(6CQ6)
6075		QBW5/3500; 6075
6076	5219	QBL5/3500; 6076
6077		TBW12/100; 6077
6078		TBL12/100; 6078
6079	3522	QB5/1750; 6079
6080	2984	6080
6083		PE1/100; 6083
6084	2729	E80F; 6084
6085		E80CC; 6085
6086		18042; 6086
6087		1)(5Y3GT)
6095		1)(6AQ5)
6096		5654
6097		(5726)
6097B		(53AVP)
6097E		(53AVP)
6097F		(153AVP)
6097G		(53AVP)

Type number	Alternative CV number	Philips type
6099B		(54AVP)
6100		1)(6C4)
6101		1)(6J6)
6111		6111
6112		6112
6136		1)(6AU6)
6146	3523	QE05/40; 6146
6153T		(ECH21)
6155	2130	QB3/300; 6155
6156	2131	QB3.5/750; 6156
6159		QE05/40H; 6159
6186		(E99F)
6199		150AVP; (50AVP)
6201	4024	E81CC; 6201
6202		1)(6X4)
6205		6205; 6206
6211		6211
6218		E80T; 6218
6227		E80L; 6227
6252	2799	QQE03/20; 6252
6255B		(56UVP)
6263		6263
6264		6264
6265		(E90F)
6267	2901	EF86; 6267
6268/4C35	1787	6268/4C35
6279/5C22	2520	6279/5C22
6291		150AVP
6292		(53AVP)
6334		(56032)
6342A		153AVP
6347		(PL5552A)
6348		PL5552A
6354	2225	150B2; 6354
6360	2798	QQE03/12; 6360
6362		(152AVP)
6363		(59AVP)
6364		(54AVP)
6365		(52AVP)
6370	5106	E1T; 6370
6374	2235	EY84; 6374
6375	2275	DC70; 6375
6463		6463

---

1) *No specially ruggedized construction.*

Type numbers between brackets are near equivalent types.

Type number	*Alternative CV number*	*Philips type*
6467		(50AVP); (150AVP)
6508		DCG9/20; 6508
6520		(6080)
6524		(QQE03/20); (6252)
6574	2253	PL6574
6617		TBW12/25; 6617
6618		TBL12/25; 6618
6655A		(53AVP)
6661		(E90F); (7693)
6662		(E99F); (7694)
6663		5726
6686		E81L; 6686
6687		E91H; 6687
6688	3998	E180F; 6688
6689		E83F; 6689
6693		DCG6/18; 6693
6700		ET51; 6700
6755		PL6755
*6778		EC71
6779	2434	Z803U; 6779
6786		DCG7/100B; 6786
6807		(PL5545)
6809		(PL5545)
6810A		(56AVP)
6844A		Z510M
6850		(QQE03/20); (6252)
6883		QE05/40F; 6883
6894		(DCG6/18GB); (7136)
6895		(DCG6/18); (6693)
6903		(53UVP)
6922	2492; 5231	E88CC; 6922
6923	5140	EA52; 6923
6935		(152AVP)
6939		QQE02/5; 6939
6960		TBW7/8000; 6960
6961		TBL7/8000; 6961
6972		6972
6975		6975
6977		DM160; 6977
7004		TBL2/300; 7004
7025		7025; 1)(ECC83)
7028		7028
7034		QEL1/150; 4X150A
7036		(E91H)
7044		(E182CC); (7119)
7046		(58UVP); (58AVP)
7062		E180CC; 7062
7064		(53AVP)
7065		(150AVP); (50AVP)
7090		7090
7091		7091
7092		TB5/2500; 7092
7093		7093
7102		(150CVP)
7119		E182CC; 7119
7136		DCG6/18GB; 7136
7181		7181
7203		QEL2/275; 4CX250B
7264		(56AVP)
7292		7292
7308		E188CC; 7308
7316		ECC186; 7316
7377		QQE04/5; 7377
7378		QE08/200; 7378
7459		(TBL6/6000); (5924)
7527		QB4/1100; 7527
7534		E130L; 7534
7537		7537
7561		1)(25L6GT)
7580		QEL2/200; 7580
7632		ORP10; 7632
7633		ORP11; 7633
7634		61SV; 7634
7643		E80CF; 7643
7693		E90F; 7693
7694		E99F; 7694
7696		(53AVP)
7704		QBL5/4000; 7704
7709		Z70W; 7709
7710		Z70U; 7710
7711		Z71U; 7711
7713		Z804U; 7713
7714		Z805U; 7714
7737		E186F; 7737
7746		(153AVP); (56AVP)
7753		TBL6/4000; 7753

** Obsolete type with nearest replacement type.*

1) No specially ruggedized construction.

Type numbers between brackets are near equivalent types.

Type number	Alternative CV number	Philips type
7767		(152AVP)
7788		E810F; 7788
7804		TBL6/14; 7804
7805		TBW6/14; 7805
7806		TBL12/38; 7806
7807		TBW12/38; 7807
7817		(153AVP)
7818		(59AVP)
7819		(54AVP)
7836		QE08/200H; 7836
7980		83A1; 7980
7983		QQC03/14; 7983
8008		DCG5/5000GS; 8008
8020	2967	8020
9514B		(56AVP)
9524B		(52AVP)
9530B		(54AVP)
9531B		(59AVP)
9536B		(53AVP)
9545B		(57AVP)
9552B		(53UVP)
9578B		(59AVP)
9579		(54AVP)
9583B		(54AVP)
9584B		(53AVP)
9593B		(56AVP)
12152		(OC72)
12153		(OC44)
12165		(OC45)
12166		(OC45)
12173		(OC45)
*18038		AZ1
18040		18040
18042		18042; 6086
18045		18045
18503		18503
18504		18504
18505		18505
18506		18506
18509		18509
18510		18510
18511		18511
18512		18512
18515		18515
18516		18516

Type number	Alternative CV number	Philips type
18517		18517
18518		18518
18520		18520
18522		18522
18524		18524
18525		18525
18526		18526
18529		18529
18533		18533
18536		18536
18537		18537
18538		18538
18545		18545
18550		18550
18552		18552
18553		18553
38116		1163
38166		DCG4/1000G; 866A
38172		DCG5/5000GB; 872A
38217		PL5557
38250		(150C1K)
38807		QE06/50; 807
40800		40800
40801		40801
40802		40802
55008		55008
55029		55029
55030		55030
55031/01		55031/01
55031/02		55031/02
55032/01		55032/01
55032/02		55032/02
*55035		2J42
*55040		725A
2)55085		55085
2)55100		55100
55125		55125
*55230		5J26
55317		55317
55318		55318
1)55334		55334
55335		55335
55340		55340

* *Obsolete type with nearest replacement type.*

1) *01-02-03 versions.* 2) *01-02-03-04 versions.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
55370		55370
*55390		2K25
*55391		723A/B
55395		55395
55807		55807
55809		55809
55850F		55850F
55850N		55850N
55850S		55850S
*56000		8020
56001		56001
56032		56032
68506	2775	1163
68508		1164
95108		95108
*95210		MW13-35
95322		95322
178148		1163
178149		1163
180238		1164
189048		1163
189049	1836	1163
217283		1164
289414		1163
289416		1163
766776		1164
815038		(OC72)
A1834		(6080)
A4051		QE06/50; 807
AA61		ECC40
AAY11		AAY11
AAZ17		AAZ17
AAZ18		AAZ18
AC107		AC107
ACS4		QBL5/3500; 6076
ACT100		(TBL6/14); (7804)
AF101		(OC44)
AF102		AF102
AF105		(OC170)
AF22-10		AF22-10
AF31-10		AF31-10
AG3B28	1835	DCX4/1000; 3B28
AG575A		(DCG6/18GB); (7136)

Type number	*Alternative CV number*	*Philips type*
AG866A	32	DCG4/1000G; 866A
AG869B		(DCG9/20); (6508)
AG872A	642	DCG5/5000GB
AG5004		(DCG4/1000G)
AG5005		(DCG7/100)
AG5006		(DCG6/18); (6693)
AG8008		DCG5/5000GS; 8008
AGR9950		(DCG6/6000); 5869
AGR9951		DCG12/30; 5870
AH201		(DCG4/1000G); (866A)
AH205		(DCG7/100)
AH213		(DCG9/20); (6508)
AH217		DCG5/5000GB; 872A
AH221		(DCG4/5000)
AH238		DCG4/5000
AJ5551		PL5551A
AJ5551A		PL5551A
AJ5552		PL5552A
AJ5552A		PL5552A
AJ5553B		PL5553B
AJ6346		4)(PL5551A)
AJ6347		4)PL5552A
*AK1		ECH42
*AL1		AL4
*AL2		AL4
AL4		AL4
AL13-36	5282; 5244	AL13-36
AL22-10	5300	AL22-10; 9RP33
AL31-10		AL31-10
*AM1		EM4
APP4Bs		(AL4)
AR10		(PL5552A)
AR10T		1)(PL5552A)
ART10TP		2)(PL5552A)
AR10TWS		3)(PL5552A)
AR14		PL5551A
AR14T		1)(PL5551A)
AR14TP		2)(PL5551A)
AR14TWS		3)(PL5551A)
ARP35	1091	EF50
ARTH2		(ECH33)

**** Obsolete type with nearest replacement type.***

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
ASG5007		(DCG12/30); (5870)
ASG5017		PL5557
ASG5023		PL3C23
ASG5044A		(PL5544); (PL6755)
ASG5045A		(PL5545)
ASG5055		PL2D21
ASG5121		(PL255)
ASG5155B		(PL255)
ASG5544		PL5544
ASG5545		PL5545
ASG5727		PL5727
ASG5830		(DCG7/100)
ASG6011		PL5684/C3JA
ASG6807		(PL5545)
ASG0A4		Z300T/PL1267
ASZ11		ASZ11
ASZ12		ASZ12
ASZ13		ASZ13
ASZ14		ASZ14
ASZ15		ASZ15; 2N1666
ASZ16		ASZ16; 2N1667
ASZ17		ASZ17; 2N1668
ASZ18		ASZ18; 2N1669
ASZ20		ASZ20
ASZ21		ASZ21
ATS25		QE06/50; 807
ATZ10		ATZ10
AU1		AZ50
AUY10		AUY10
AW17-20		AW17-20
AW21-80		AW21-80
AW36-48		AW36-48
AW36-80		AW36-80; 14AHP4A
AW43-80		AW43-80; 17BTP4
AW43-88		AW43-88
AW43-89		AW43-89
AW47-91		AW47-91
AW47-94		AW47-94
AW53-80		AW53-80; 21CLP4
AW53-88		AW53-88
AW53-89		AW53-89
AW59-90		AW59-90
AW61-88		AW61-88
*AX1		AX50; AZ50
AX3C23		PL3C23
AX4-125A	2130	QB3/300; 6155
AX4-250A	2131	QB3.5/750; 6156
AX50		AX50
AX105		PL105
AX224	1835	DCX4/1000; 3B28
AX228		(DCX4/5000); (4B32)
AX230	2518	DCX4/5000; 4B32
AX5551		PL5551A
AX5551A		PL5551A
AX5552		PL5552A
AX5552A		PL5552A
AX5553		PL5553A
AX5553B		PL5553B
AX5555		PL5555
AX5822		PL5822A
AX5822A		PL5822A
AX7585		PL5552A
AX9900	1924	TB2.5/300; 5866
AX9901		TB3/750; 5867
AX9902		TB4/1250; 5868
AX9903	2797	QQE06/40; 5894
AX9904		TBW6/6000; 5923
AX9904R		TBL6/6000; 5924
AX9905	1838	QQC04/15; 5895
AX9906		TBW12/100; 6077
AX9906R		TBL12/100; 6078
AX9907		QBW5/3500; 6075
AX9907R		QBL5/3500; 6076
AX9908	3522	QB5/1750; 6079
AX9909		PE1/100; 6083
AX9910	2799	QQE03/20; 6252
AX9911	1787	4C35
AX9912	2520	5C22
AZ1	2860	AZ1
AZ4		AZ4
AZ11		AZ11
AZ12		AZ12
*AZ21		AZ1; AZ41
AZ31		AZ31
AZ41	3892	AZ41
AZ50	1264	AZ50
B-2A		(PL6574)

***** *Obsolete type with nearest replacement type.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	Alternative CV number	Philips type
B6H		(18533)
B36		12SN7GT
B65		6SN7GT
B109		UCC85
B142	1927	(TB4/1250); (5868)
B152		ECC81; 12AT7
B309		ECC81; 12AT7
B319		(PCC84); (7AN7)
B329		ECC82; 12AU7
B339		ECC83; 12AX7
B719		ECC85; 6AQ8
B1135		TB3/750; 5867
BA100		BA100
BA102		BA102; 1N3182
BCY10		BCY10
BCY12		BCY12
BCZ10		BCZ10
BCZ11		BCZ11
BCZ12		BCZ12
BCZ13		BCZ13
BF61		EL41
BF62		EL42
BK24		PL5552A
BK24A		4)(PL5552A)
BK24B		1)(PL5552A)
BK34		PL5553B
BK34A		4)(PL5553B)
BK34B		1)(PL5553B)
BK42		PL5551A
BK42A		4)(PL5551A)
BK42B		1)(PL5551A)
BK46		PL5555
BK168B		1)(PL5822A)
BMS10/14		(152AVP)
BMS11/23		(52AVP)
BPM04		6AQ5
BR191B		(TBL6/6000); (5924)
BT5		PL5559
BT19		(PL5557)
BT27		(PL105)
BT29		(PL255)
BT69		DCG7/100B; 6786
BT77		PL5545
BT79		(3C45)

Type number	Alternative CV number	Philips type
BT91		PL5544
BTL2-1		(TBL6/6000); (5923)
BTL3-1		(TBL6/6000); (5923)
BTL15-1		(TBL12/40)
BVA274		ECH33
BVA275		ECH33
BVA276		ECH33
BY100		BY100
BYY15		BYY15
BYY22		BYY22
BYZ14		BYZ14
C3J		PL5632/C3J
C3JA		PL5684/C3JA
C3m	5232	C3m
C6A		(PL5545)
C6J		(PL5545)
C6JA		(PL5545)
C6L		(PL5545)
C6M		(PL5545)
C6P		(PL5545)
C12FM		(MW31-74)
C17/1A		(MW43-69)
C21KM		(MW53-80)
C36-24		(MW36-44)
C143	26	QB2/250; 813
C144	2666	(QQE06/40); (5894)
C178A		QQE06/40; 5894
C180	788	QQE04/20; 832A
C350		(QE06/50); (807)
*C443		AL4
*C453		AL4
C866A		DCG4/1000G; 866A
C872		DCG5/5000GB; 872A
C1108		QB3/300; 6155
C1112		QB3.5/750; 6156
C1134		QQE03/20; 6252
C1136		QB4/1100; 7527
CAG29		90AG
CAV29		90AV
*CB1		EBF2
*CB2		EBF2
*CBC1		EBC3

**** Obsolete type with nearest replacement type.*** ***Notes see page I 55.***

Type numbers between brackets are near equivalents.

Type number	*Alternative CV number*	*Philips type*
CBL1		CBL1
*CC2		EBC3; UBC41
CCa	2492; 5231	E88CC; 6922
CE1-AB		(3554)
CE1-C		(3554)
CE1-D		(3554)
CE-1P23		(3554)
CE-1P32		(3546PW)
CE5-AB		(3546PW)
CE5-C		(3546PW)
CE5-D		(3546PW)
CE20		(3546PW)
CE25-AB		(3546PW)
CE25-C		(3546PW)
CE25-D		(3546PW)
CE25-E		(3546PW)
CE25V-AB		(3545PW)
CE25V-C		(3545PW)
CE36-AB		(3546PW)
CE36-C		(3546PW)
CE36-D		(3546PW)
CE56		(3546PW)
CE57		(3546PW)
CE225		1163
CE226		1163
CE235		1164
CE306		(PL5545)
CE309		PL5557
CE311		PL3C23
CE866A		DCG4/1000G; 866A
CE868		(3554)
CE872A		DCG5/5000GB; 872A
CE918		(3554)
CE927		3546PW/02
CEA1		(3554)
CEB25-C		(3546PW)
CEB25-D		(3546PW)
CEB25V-AB		(3546PW)
CEB25V-C		(3545PW)
CEB36		(3546PW)
*CF1		EF6
*CF2		EF9; UF9
CF50		CF50

Type number	*Alternative CV number*	*Philips type*
CF61		(ECH42)
CF141		(UCH42)
CG1-E		(OA81); (1N476)
CG4-E		(OA81); (1N476)
CG12-E	442	(OA73); (OA90)
*CK1		ECH3
*CK3		ECH3
CK705		(OA85); (1N478)
CK706A		(OA70); (1N87A)
CK707		(OA85); (1N478)
CK708		(OA85); (1N478)
CK713A		(OA85); (1N478)
CK721		(OC71)
CK722		(OC71)
CK725		(OC71)
CK727		(OC71)
CK751		(OC72); (2N281)
CK759		(OC45)
CK760		(OC45)
CK761		(OC45)
CK762		(OC44)
CK766/A		(OC44)
CK790		(BCZ10)
CK791		(BCZ11)
CK872		(OC72)
CK878		(OC74)
CK882		(OC72)
CK888		(OC72)
CK896/A		(OC57)
CK897/A		(OC58)
CK898/A		(OC59)
CK5672	2238	5672
CK5678		5678
CK5726	4007	5726
CK5889		(4068)
CL4		CL4
CL1005		(150CVP)
CL1008		(53UVP)
CL1012		(150AVP); (50AVP)
CMG29		90CG
CMV29		90CV
CR1100	5219	QBL5/3500; 6076
CST2/12		(PL255)

** Obsolete type with nearest replacement type.*

Type numbers between brackets are **near equivalents,** for semiconductors they are **comparable** types.

Type number	*Alternative CV number*	*Philips type*
CT1/2500	1401	PL5559
CTP1003		(ASZ15)
CTP1004		(OC26)
CTP1005		(OC26)
CTP1006		(ASZ16)
CTP1104		(OC26)
CTP1108		(OC26)
CTP1109		(OC26)
CTP1111		(ASZ15)
CV numbers see page 50		
CW1100		QBW5/3500; 6075
*CY1		CY2
CY2		CY2
D2M9		EAA91; 6AL5
D61		(EAF42)
D77	140	(EAA91); (6AL5)
D121		(UAF42)
D152		EAA91; 6AL5
*D404		—
DA90	753	1A3; DA90
DAC21		DAC21
*DAC25		DAF91; DAF96
*DAC32		DAC21; DAF91
DAF40		DAF40
DAF41		DAF41
DAF91	784	DAF91; 1S5
DAF92	3912	1U5; DAF92
DAF96		DAF96; 1AH5
DAF191		(DAF91)
DB3-91		DB3-91; 1CP11
*DB7-1		DB7-5
*DB7-2		DB7-6
*DB7-3		DB7-5
*DB7-4		DB7-6
DB7-5		DB7-5; 3ALP11
DB7-6		DB7-6
DB7-36		DB7-36
DB7-91		DB7-91; 3AFP11
DB10-6		DB10-6
DB10-78		DB10-78
DB10-94		DB10-94
DB13-2		DB13-2
DB13-34		DB13-34; 5ADP11
DB13-76		DB13-76; 5CBP11
DB13-78		DB13-78; 5BHP11
DB13-97		DB13-97
DB16-22		DB16-22; 7AHP11
*DC25		DF91; DF96; DAC21
DC70	2275	DC70; 6375
*DC80		DC70; 6375
*DC90		—
DCC90	808	3A5; DCC90
DCG1/250	3667	DCG1/250
*DCG1.5/250		DCG4/1000G; 866A
DCG2/500		DCG2/500
DCG4/1000A		DCG4/1000A
DCG4/1000ED	1625	DCG4/1000ED
DCG4/1000G	32	DCG4/1000G; 866A
DCG4/5000	1629	DCG4/5000
DCG5/30		DCG5/30
DCG5/5000EG		DCG5/5000EG
DCG5/5000GB	642	DCG5/5000GB; 872A
DCG5/5000GS		DCG5/5000GS; 8008
DCG6/18		DCG6/18; 6693
DCG6/18GB		DCG6/18GB; 7136
DCG6/6000		DCG6/6000; (5869)
DCG7/100		DCG7/100
DCG7/100B		DCG7/100B; 6786
DCG9/20		DCG9/20; 6508
DCG12/30		DCG12/30; 5870
*DCH25		DK92; DK96
DCX4/1000	1835	DCX4/1000; 3B28
DCX4/5000	2518	DCX4/5000; 4B32
DCX6/5000		DCX6/5000
DD6 (Ferr. Cos.)		(EAA91); (6AL5)
DD6S		(EAA91); (6AL5)
DDPP6S		EBL1
DDPP39S		CBL1
DDR3	135	EY91
DDR7		EL91; 6AM5
DDT6S		EBC3
*DE2/200		DCG1/250; DCG4/1000G
DET22	273	EC55; 5861
DF11		(DF91)

** Obsolete type with nearest replacement type.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	Alternative CV number	Philips type
DF21		DF21
*DF26		DAF91; DAF96
*DF33		1L4; DF92
DF60	2254	5678
DF61N	2371	DF61N
DF62	2237	1AD4
DF64	2260	DF64
DF67		DF67; 6008
DF91	785	DF91; 1T4
DF92	1758	1L4; DF92
DF96		DF96; 1AJ4
DF97		DF97; 1AN5
DF191		(DF91)
DF904		1U4
*DG7-1		DG7-5
*DG7-2		DG7-6
*DG7-3		DG7-5
*DG7-4		DG7-6
DG7-5	2175	DG7-5; 3ALP1
DG7-6	5269	DG7-6
*DG7-31		DG7-31/01
DG7-31/01		DG7-31/01
*DG7-32		DG7-32/01; 3AMP1A
DG7-32/01		DG7-32/01; 3AMP1A
DG7-36	3946	DG7-36
DG10-6		DG10-6
DG10-74		DG10-74
DG13-2	2191	DG13-2; 5CP1A
DG13-32		DG13-32; 5UP1
DG13-34	5035	DG13-34; 5ADP1
DG13-58		DH13-78
DG16-22	2352	DG16-22; 7AHP1
DH3-91	2302	DH3-91; 1CP31
DH7-78		DH7-78; 3BKP31
DH7-91		DH7-91; 3AFP31
DH10-78		DH10-78
DH10-94		DH10-94; 4EP31
DH13-10		DH13-10; 5CLP31
DH13-76		DH13-76; 5CBP31
DH13-78		DH13-78; 5BHP31
DH13-97		DH13-97; 5BKP31
DH77		6AT6
DH109		UABC80
DH118		UBC41
DH119		UBC81
DH142		UBC41
DH150		EBC41; 6CV7
DH718		EBC41
DH719		EABC80; 6AK8
DHM9-11		DHM9-11; 3AZP31
DHM10-93		DHM10-93; 4LP31
DK21		DK21
*DK32		DK92; DK96
DK40		DK40
DK91	782	DK91; 1R5
DK92		DK92; 1AC6
DK96		DK96; 1AB6
DK97		(DK96); (1AB6)
DK192		(DK92)
DL21		DL21
*DL25		DL94; DL92; DL96
*DL33		DL94; DL96
*DL35		DL94; DL96
*DL36		DL94; DL96
DL41		DL41
DL64	2331	DL64
DL67		DL67; 6007
DL69		(5672)
DL73		DL73
*DL91		DL94; DL92; DL96
DL92	484; 820; 2370	DL92; 3S4
DL93	2300; 807; 2390	3A4; DL93
DL94	2983	DL94; 3V4
DL95	818	3Q4; DL95
DL96		DL96; 3C4
DL98	2240	3B4
DL192		(DL92)
DL193		(DL94); (3V4)
DL620	2238	5672
DLL21		DLL21
DM70	2980	DM70; 1M3
DM71		DM71; 1N3
DM160		DM160; 6977

**** Obsolete type with nearest replacement type.***

Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

Type number	Alternative CV number	Philips type
*DN7-1		DR7-5; DG7-5
*DN7-2		DG7-6; DR7-6
*DN7-3		DR7-5; DG7-5
*DN7-4		DR7-6; DG7-6
*DN7-5		DG7-5; DR7-5
DN7-36		DN7-36
DN7-78		DN7-78; 3BKP2
*DN9-3		DR10-3; DG10-3
*DN9-4		DR10-2; DG10-2
*DN9-5		DR10-5; DG10-5
*DN10-3		DR10-3
*DN10-5		DR10-5
*DN10-6		DG10-6; DR10-6
DN10-78		DN10-78
DN13-76		DN13-76; 5CBP2
DN13-78		DN13-78; 5BHP2
DN13-79		DN13-79
DN143		EBL21
DP6		(OA85); (1N478)
DP6C		(OA85); (1N478)
DP7-5		DP7-5; 3ALP7
DP7-6		DP7-6
DP10-6		DP10-6
DP10-78		DP10-78
DP10-94		DP10-94; 4EP7
DP13-2		DP13-2; 5CP7A
DP13-34		DP13-34; 5ADP7
DP16-22	2498	DP16-22; 7AHP7
DP61		6AK5; EF95
DQ2		DCG4/1000G; 866A
DQ2a		DCG4/1000ED
DQ4		DCG5/5000GB; 872A
DQ4a		DCG5/5000EG
DQ5		(DCG6/18); (6693)
DQ6		(DCG9/20); (6508)
DQ7		(DCG7/100B); (6786)
DR5		(OAZ201)
DR6		(OAZ201)
DR7		(OAZ205)
*DR7-3		DR7-5
*DR7-4		DR7-6
DR7-5		DR7-5
DR7-6		DR7-6

Type number	Alternative CV number	Philips type
DR10-6		DR10-6
DR13-2		DR13-2
DR126		(OC65); (OC66)
DR128		(OC65); (OC66)
DR313		(OA81)
DS60		(OA85); (1N478)
DS61		(OA85); (1N478)
DS61A		(OA85); (1N478)
DS62		(OA85); (1N478)
DS77		(EAA91); (6AL5)
DS604		(OA81); (1N476)
DS611		(OA81); (1N476)
DS621		(OA81); (1N476)
DW2		(AZ1)
DX2		DCX4/1000; 3B28
DX144		EC157
DX145		EC157
DX145A		EC157
DX155		7093
DX184		55335
DX187		55008
DY80		(DY86); (1S2)
DY86		DY86; 1S2
DY87		DY87; 1S2A
E1T	5106	E1T; 6370
E2dIII		AL4
E80CC		E80CC; 6085
E80CF		E80CF; 7643
E80F	2729	E80F; 6084
E80L		E80L; 6227
E80T		E80T; 6218
E81CC	4024	6201
E81L		E81L; 6686
E83F		E83F; 6689
E84L		1)(EL84)
E88CC	2492; 5231	E88CC; 6922
E90CC	5214	E90CC; 5920
E90F		E90F; 7693
E91AA	4007	5726; E91AA
E91H		E91H; 6687
E91N	4018	PL5727; E91N
E92CC		E92CC
E95F	4010	5654; E95F

** Obsolete type with nearest replacement type.* 1) *No special quality.*
Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
E99F		E99F; 7694
E125A		QB3/300; 6155
E130L		E130L; 7534
E180CC		E180CC; 7062
E180F	3998	E180F; 6688
E182CC		E182CC; 7119
E186F		E186F; 7737
E188CC		E188CC; 7308
E250A		QB3.5/750; 6156
*E463		AL4
E810F		E810F; 7788
E900		TB4/800; 250TH
E2385		(EY86); (6S2)
EA50	1092	EA50; 2B35
EA52	5140	EA52; 6923
EA53		EA53
EAA91	283	EAA91; 6AL5; (5726)
EAA171		(EAA91)
EAA901S		5726
*EAB1		EBC3; EBC81
EABC80		EABC80; 6AK8
EAC91	137	EAC91
*EAF41		EAF42
EAF42	3883	EAF42; 6CT7
*EB1		EBF2
EB4		EB4
*EB41		EAA91
*EB91	140	6AL5; EAA91
EBC3	1428	EBC3
EBC21		(EBC33)
EBC41	3882	EBC41; 6CV7
EBC80		(EBC81); (6BD7A)
EBC81		EBC81; 6BD7A
EBC90	452	6AT6
EBC91	2526	6AV6
EBF2	2925	EBF2
EBF32	501	EBF32
EBF35		EBF35
EBF80		EBF80; 6N8
EBF81		(EBF89); (6DC8)
EBF83		EBF83; 6DR8
EBF89		EBF89; 6DC8
EBF171		(EBF80); (6N8)

Type number	*Alternative CV number*	*Philips type*
EBF175		(EBF89); (6DC8)
EBL1		EBL1
EBL21		EBL21
*EC40		EC80
EC50	2927	EC50; EN31
EC55	273	EC55; 5861
*EC56		EC157
*EC57		EC157
*EC70		EC71
EC71		EC71
EC80	1886	EC80; 6Q4
EC81	1865	EC81; 6R4
EC86		EC86; 6CM4
EC88		EC88; 6DL4
EC90	133	6C4; EC90
EC91	417	EC91
EC92		EC92
EC98		EC98
EC157		EC157
EC158		EC158
ECC40	3884	ECC40
ECC81	455	ECC81; 12AT7; (6201)
ECC82	491	ECC82; 12AU7; (ECC186)
ECC83	492	ECC83; 12AX7
ECC84	5281	ECC84; 6CW7
ECC85		ECC85; 6AQ8
ECC86		ECC86; 6GM8
ECC88		ECC88; 6DJ8; (E88CC)
ECC89		ECC89
ECC91	858	6J6; ECC91
ECC186		7316; ECC186
ECC189		ECC189; 6ES8
ECC801S		6201; E81CC
ECC960		E90CC; 5920
ECC962		E92CC
ECF1		ECF1
ECF80	5215	ECF80; 6BL8
ECF82		(6U8); (ECF80); (6BL8)
ECF86		ECF86; 6HG8

*** *Obsolete type with nearest replacement type.***

Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

Type number	*Alternative CV number*	*Philips type*
*ECH2		ECH3
ECH3	2929	ECH3
ECH4		ECH4
ECH21		ECH21
ECH33/35		ECH33/35
*ECH41		(ECH42)
ECH42	3888	ECH42; 6CU7
ECH71		(ECH21)
ECH80		(ECH81); (6AJ8)
ECH81	2128	ECH81; 6AJ8
ECH83		ECH83; 6DS8
ECH113		ECH42
ECH171		(ECH81); (6AJ8)
ECL80		ECL80; 6AB8
ECL82		ECL82; 6BM8
ECL83		(ECL82); (6BM8)
ECL84		ECL84; 6DX8
ECL85		ECL85; 6GV8
ECL86		ECL86; 6GW8
EE17		PL5557
EE866		DCG4/1000G; 866A
*EF1		EF6
*EF2		EF9
*EF5		EF9; EF89
EF6		EF6
*EF8		EF9; EF89
EF9	1427	EF9
*EF13		EF9; EF89
EF22	303	EF22
EF40	3885	EF40
EF41	3886	EF41; 6CJ5
EF42	3887	EF42
EF50	1091	EF50
EF80		EF80; 6BX6
EF81		(EF89); (6DA6)
EF83		(EF86)
EF85	1375	EF85; 6BY7
EF86	2901	EF86; 6267
EF89	5156	EF89; 6DA6
EF91	138	EF91; 6AM6
EF92	131	EF92; 6CQ6
EF93	454	6BA6
EF94	2524	6AU6

Type number	*Alternative CV number*	*Philips type*
EF95	850	6AK5; EF95; (5654)
EF96		(EF91); (6BA6)
EF97		EF97; 6ES6
EF98		EF98; 6ET6
EF174		(EF80); (6BX6)
EF175		(EF85); (6BY7)
EF183		EF183; 6EH7
EF184		EF184; 6EJ7
EF731		5899; EF731
EF732		5840; EF732
EF804		(EF86); (6267)
EF804S		(E80F); (6084)
EF861	3998	E180F; 6688
EF905		5654; E95F
EFP60		EFP60
*EH2		ECH3; ECH4
EH90		EH90; 6CS6
EH900		(E91H); (6687)
*EK1		EK2
EK2	1426	EK2
*EK3		ECH3; EK2
EK32		EK32
EK90	453	6BE6
*EL1		EL2
EL2	1429	EL2
EL3N		EL3N
*EL5		4689
*EL6		4699
EL11		EL11
EL33		EL33
EL34	1741	EL34; 6CA7
EL36	2940	EL36; 6CM5
EL41	3889	EL41; 6CK5
EL42	3890	EL42
*EL43		EL83; 6CK6
*EL44		EL81; 6CJ6
EL80		(EL84); (6BQ5)
EL81	2721	EL81; 6CJ6
EL82		EL82; 6DY5
EL83	2726	EL83; 6CK6
EL84	2975	EL84; 6BQ5
EL86	5094	EL86; 6CW5
EL90	1862	6AQ5

**** Obsolete type with nearest replacement type.***

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
EL91	136	EL91; 6AM5
EL95		EL95; 6DL5
EL171		(EL84)
EL172		(EL12)
EL500		EL500; 6GB5
EL803		(EL83); (6CK6)
EL821		(EL83)
EL861		E81L; 6686
EL-C3J		(PL5544)
EL-C3JA		PL5684/C3JA
EL-C6A		(PL5545)
EL-C6J		(PL5545)
EL-C6JA		(PL5545)
EL-C6JK		(PL5545)
EL-C6L		(PL5545)
EL-C6M		(PL5545)
EM1		EM1
*EM3		EM4
EM4	1434	EM4
EM5		(EM4)
*EM11		EM34; 6CD7
EM34		EM34; 6CD7
EM35		(EM34); (6CD7)
EM80		EM80; 6BR5
EM81	5055	EM81; 6DA5
EM84		EM84; 6FG6
EM85		(EM81); (6DA5)
EM171		(EM34); (6CD7)
EN31		(EC50)
EN32	2253	PL6574
EN33		(PL6574)
EN91	797	PL2D21
EN92		(5696)
EN93	1949	EN93
EP1A		ORP62
EQ80		EQ80; 6BE7
ER21A		(Z805U)
ES85		(TB2.5/300); (5866)
ES204A		TB3/750; 5867
ES833A		(TB4/1250); (5868)
ESU103		DCX4/1000; 3B28
ESU150		(DCG4/5000)
ESU200		(DCG4/5000)
ESU575		(DCG6/18GB); (7136)

Type number	*Alternative CV number*	*Philips type*
ESU673		(DCG6/18); (6693)
ESU866	32	DCG4/1000G; 866A
ESU866ES		DCG4/1000ED
ESU872	642	DCG5/5000GB; 872A
ESU8008		DCG5/5000GS; 8008
ET51	5277	ET51; 6700
ET1000		TB4/800; 250TH
EW3H		(18505)
EY51	426	EY51; 6X2
EY80		EY80; 6U3
EY81		EY81; 6R3
EY82		EY82; 6N3
EY83		(EY86)
EY84	2235	EY84; 6374
EY86	2966	EY86; 6S2
EY87		EY87; 6S2A
EY88		EY88; 6AL3
EY91	135	EY91
*EZ1		EZ2
EZ2		EZ2
*EZ3		EZ80
*EZ4		EZ81
*EZ11		EZ2; EZ80
*EZ12		EZ81; GZ34
EZ40	3891	EZ40; 6BT4
EZ41		EZ41
EZ80	1535	EZ80; 6V4
EZ81	5072	EZ81; 6CA4
EZ90	493	6X4
F60		1163
F353		DCG5/5000GB; 872A
F353A		DCG5/5000GB; 872A
F366A		DCG4/1000G; 866A
F369A		(DCG9/20); (6508)
F369B		(DCG9/20); (6508)
F872B		DCG5/5000GB; 872A
FD3		(OA9)
FD4		(OA5)
FD5		(OA9)
FD6		(OA5)
FD7		(OA5)
FG17	2957	PL5557
FG27A		(PL5559)

***** ***Obsolete type with nearest replacement type.***
Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

Type number	*Alternative CV number*	*Philips type*
FG57		PL5559
FG67	742	(PL5559)
FG95		(PL5559)
FG97		(PL5557)
FG98A		(PL5557)
FG105		PL105
FG172		(PL105)
FS9A		(150AVP); (50AVP)
FS12-A47		(53AVP)
FS12-A70		(59AVP)
FTL3-2		(TBL7/8000); (6961)
FW4/500	1264	AZ50
FX219	2520	5C22
FX225	1787	4C35
FX227	372	3C45
FX229	3521	5949
*FZ1		EZ2
Fz12G		(3554)
Fz9011G		90AG
Fz9011V		90AV
Fz9012G		90CG
Fz9012V		90CV
G1		(3554)
G2		(150C1K)
G2 (diode)		(BYZ14)
G4		(3546PW); (3554)
G9		(3554)
G10/4d		(DCG5/5000GB); (872A)
G10/1d		DCG4/1000G; 866A; DCX4/1000; 3B28
G15F		(3546PW)
G16		(3546PW)
G16B		(3546PW)
G20/5d		(DCG9/20); (6508)
G23		(3554)
G24H		(18545)
G26		(OA85); (1N478)
G48		1163
G48 (semi-cond.)		OA85; 1N478
G49		1163
G63; G67		OA85; 1N478
G68; G89		OA85; 1N478
G180/2M		(150C1K)
G1050		OA210
G4120[1]		1561
GA1		(OA81)
GA50		90AG
GA90		Z510M
GC10BS		Z303C
GD1E		(OA85); (1N478)
GD1P		(2-OA79)
GD1Q		(OA85); (1N478)
GD2E		(OA85); (1N478)
GD2Q		(OA85); (1N478)
GD3		(OA70); (OA73)
GD3E		(OA85); (1N478)
GD4/E		(OA85); (1N478)
GD4S		(OA81); (OA85)
GD5		(OA79)
GD5E		(OA81)
GD6		(OA70)
GD6E		(OA79)
GD8		(OA81); (OA85)
GD8E		(OA5)
GD11E		(OA73); (OA81)
GD12E		(OA73); (OA81)
GD71E		(OA70)
GD71E2		(OA70)
GD71E3		(OA70)
GD71E4		(OA70)
GD71E5		(OA70)
GET106		(OC72)
GET874		(OC44)
GEX34		(OA91)
GEX35		(OA73)
GEX44		(OA81)
GEX45/1		(OA85); (1N478)
GEX45/2		(OA85); (1N478)
GEX54		(OA81); (1N476)
GFT20		(OC70)
GFT21		(OC71)
GFT26		(OC26)
GFT31		(OC75)
GFT32		(OC72)
GFT44		(OC44)

[1]) *Triotron.* * *Obsolete type with nearest replacement type.*
Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
GFT45		(OC45)
GFT2006		(OC26)
GFT4012		(OC26)
GL1		(PL3C23)
GL2D21		PL2D21
GL57		PL5559
GL414		(PL255)
GL502A		(PL2D21)
GL575A		(DCG6/18GB); (7136)
GL673		(DCG6/18); (6693)
GL807		QE06/50; 807
GL813		QB2/250; 813
GL829B		(QQE06/40); (5894)
GL832A		QQE04/20; 832A
GL866A		DCG4/1000G; 866A
GL868		(3554)
GL872A		DCG5/5000GB; 872A
GL884		(PL2D21)
GL885		(PL2D21)
GL918		(3554)
GL927	2210	3546PW/02
GL2050	2215	(PL2D21)
GL5544		PL5544
GL5545		PL5545
GL5551		PL5551A
GL5551/FG271		PL5551A
GL5551A		PL5551A
GL5552		PL5552A
GL5552/FG235A		PL5552A
GL5552A		PL5552A
GL5553		PL5553B
GL5553A		PL5553B
GL5553B		PL5553B
GL5555		PL5555
GL5555/FG238A		PL5555
GL5557		PL5557
GL5559		PL5559
GL5632		PL5632/C3J
GL5720		(PL5559)
GL5727		PL5727
GL5822		PL5822A
GL5822A		PL5822A
GL5855		(PL255)

Type number	*Alternative CV number*	*Philips type*
GL6011		(PL5684/C3JA)
GL6159		QE05/40H; 6159
GL6346		4)(PL5551A)
GL6347		4)(PL5552A)
GL6348		4)(PL5553B)
GL6511		4)(PL5822A)
GL6807		(PL5545)
GLE10000/025/1		DCG4/1000ED
GLE13000/1.5/6		DCG5/5000GB; 872A
GLE15000/1/4		(DCG5/5000GB); (872A)
GLE15000/3/12		DCG6/18; 6693
GLE20000/2.5/10		DCG9/20; 6508
GR16		(Z805U)
GS10C		Z502S
GS17		(3533)
GS10C		Z502S
GS47X		(3546PW)
GS50		90CG
GS146		(3554)
GSD2,5/9		(OA81); (OA85)
GSD4/10		(OA81)
GSD4/12		(OA85)
GSD5/2		(OA79)
GSD5/4		(OA79)
GSD5/6		(OA81)
GSD5/61		(OA81)
GSD5/62		(OA81)
GSD5/103		2-OA72
GSD5/104		2-OA72
GSD5/105		2-OA79
GSD5/106		2-OA79
GSD5/161		2-OA79
GT4A		(EC50)
GT14		(OC72)
GT14H		(OC58)
GT20		(OC72)
GT20H		(OC58)
GT38		(OC71); (OC58)
GT74		(OC75)
GT81		(OC72)
GT81H		(OC58)
GT88		(OC46)

* *Obsolete type with nearest replacement type.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
GT109		(OC72)
GT122		(OC76)
GT222		(OC71)
GT759		(OC45)
GT760		(OC45)
GT761		(OC45)
GT761R		(OC44)
GT762		(OC44)
GU1		(DCG1/250)
GU12		(DCG4/1000G); (866A)
GU18		(DCG4/5000)
GU20/21		(DCG4/5000)
GU21SP		(DCG4/5000)
GXU1	152	DCX4/1000; 866A
GXU2		DCX4/5000; 4B32
GZ30		(GZ34)
GZ32	593	GZ32; 5AQ4; (GZ34)
GZ33		(GZ34); (5AR4)
GZ34	1377	GZ34; 5AR4
GZ37		(GZ34); (5AR4)
HA1		(OC71)
HA2		(OC71); (OC58)
HA3		(OC71); (OC58)
HA8		(OC58)
HA9		(OC58)
HA10		(OC58)
HBC90		12AT6
HBC91		12AV6
HCH81		HCH81; 12AJ7
HD51		0A2
HD52		0B2
HD2053		(OA85); (1N478)
HD2057		(OA85); (1N478)
HD2060		(OA85); (1N478)
HD2063		(OA85); (1N478)
HD6005		(OA200)
HF61		EF41
HF62		EF42
HF93	1928	12BA6
HF94	1961	12AU6
HF121		UF41
HF258B		(DCG4/1000G); (866A)
HJ15		(OC71); (OC75)
HJ17D		(OC72); (OC74)
HJ22D		(OC45)
HJ23D		(OC44)
HJ32		(OC170)
HJ34		(OC74)
HJ34A		(OC74)
HJ35		(ASZ16)
HJ37		(OC170)
HJ50		(OC71); (OC75)
HJ51		(OC72); (OC74)
HJ55		(OC44)
HJ56		(OC45)
HJ57		(OC44)
HJ60		(OC44)
HJ70		(OC170)
HJ72		(OC170)
HK90		12BE6
HL92	1959	50C5
HL94		HL94; 30A5
HM04		6BE6
HP6		EF91; 6AM6
HS3		(OC47)
HS4		(OC47)
HT17		PL5557
HT415		5C22
HVR2		1877
HY60		(QE06/50); (807)
HY61	124	QE06/50; 807
HY90		35W4
IL861		18046
J1		(OC72)
J2		(OC72)
J3		(OC72)
J213AAA		1163
JN2-2.5A		7091
JN2-2.5W		7292
JN2-5W		55125
JNT1-500	3602	5J26
JP1		(OC72)
JP2-0.2		7090
JP9-2.5		7028
JP9-7	3676	2J42
JP9-7A	370	JP9-7A

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
JP9-7D		JP9-7D
JP9-15	3997	JP9-15
JP9-50	2852	2J56
JP9-75		6972
JP9-80	3569	4J52
JP9-250		4J50
JP9-250A	3953	4J78
JP35-30		7093
JP35-80		55008
JPT9-01	2420	JPT9-01
JPT9-60	3560	2J51A
K2		DCG4/1000ED
K50A		K50A
K51A		K51A
K81A		K81A
K322		(723A/B)
K1209		(54AVP)
K1213		(59AVP)
K1295		(53AVP)
K1306		(53UVP)
K1384		(57AVP)
K1390		(59AVP)
K1391		(54AVP)
K1430		(150CVP)
KB9-150W		55395
KD25	216	(150C1K)
KP104		(Z70U)
KS9-20	1795	723A/B
KS9-20A	2792	2K25
KS9-20D		723A/B
KS9-30		6975
KS35-50		55335
KS70-40		55370
KT8		(QE06/50); (807)
KT9-150W		55395
KT32		25L6GT
KT66		1)(EL34)
KU676		(PL105)
L77		6C4; EC90
LB4-8		55340
LN119		UCL82
LN152		ECL80; 6AB8
LN309		PCL82; 16A8
LN329		(PCL82)
LZ319		(PCF80); (9A8)
LZ329		PCF80; 9A8
M6H		(18524); (18525)
M34A/1N34A		(OA85)
M38A/1N38A		(OA85)
M51/1N51		(OA79)
M54A/1N54A		(OA86)
M56/1N56		(OA5)
M60/1N60		(OA73)
M69/1N69		(OA85)
M70/1N70		(OA85)
M81/1N81		(OA81)
M95/1N95		(OA86)
M501		(55100)
M501A/B		(55100)
M502		4J50
M503		7P9-7D
M508	370	JP9-7A
M511		4J78
M513		(JP9-15)
M519		(55085)
M526	3676	2J42
M541		5J26
M542		5586
M550		(OA81)
M550A		(OA85); (1N478)
M550B		(OA85); (1N478)
M551		4J52A
M820		(OA81)
M1230		(OA81)
M3100		(OA85); (1N478)
M6100		(OA81)
M8079	4025	5726; 2)(EAA91)
M8081	4031	2)6J6
M8082	4063	2)EL91; 6AM5
M8083		(EF91)
M8100		(5654)
M8162		(6201)
M8204	4018	PL5727; E91N
*MA4/500		QB3.5/750; TB3/750
MA12/15		MA12/15
MC6-16		MC6-16

** Obsolete type with nearest replacement type.*

1) For AF applications only. *2) No specially ruggedized construction.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
MC13-16		MC13-16
ME1001	273	EC55; 5861
ME1100		723A/B
ME1101		2J42
ME1101A		JP9-15
ME1101D		JP9-7D
ME1401	495	4065
ME1402	2730	4066
ME1403	2348	4068
ME1404		4069
ME1503		(4C35)
MF13-1	1868	MF13-1
MF13-39		MF13-1
MF31-22		MF31-22
MF31-55	429	MF31-55
MF31-95		MF31-95
MF41-10		MF41-10
MK13-16		MK13-16
ML4-125A		QB3/300GA; 4-125A
ML4-250A		QB3.5/750GA; 4-250A
ML4-400A		QB4/1100GA; 4-400A
ML813		QB2/250; 813
ML833A		(TB4/1250); (5868)
ML866A		DCG4/1000G; 866A
ML869B		(DCG9/20); (6508)
ML872A		DCG5/5000GB; 872A
ML8008		DCG5/5000GS; 8008
MN24		(OC26)
MN25		(OC26)
MN26		(OC26)
MO10		ET51
MT17	1144	PL5557
MT57	612	PL5559
MT105		PL105
MT5544	2210	PL5544
MT5545	2215	PL5545
MV6-5	1976	MV6-5
MW6-2	1737	MW6-2
*MW13-32		MW13-38
MW13-35		MW13-35
MW13-38		MW13-38
*MW22-14		MW22-16
MW22-16		MW22-16
MW22-22		(MW22-16)
*MW31-7		MW31-74
*MW31-14		MW31-74
*MW31-16		MW31-74
MW31-74		MW31-74
*MW36-22		MW36-44
*MW36-24		MW36-44
MW36-44		MW36-44
MW36-67		MW36-67
*MW43-40		MW43-69
*MW43-43		MW43-69
MW43-61		MW43-69
*MW43-64		MW43-69; 17BQP4
MW43-69		MW43-69; 17BQP4
MW53-20		MW53-20; 21CJP4
*MW53-43		MW53-20; 21CJP4
MW53-80		MW53-80
MW61-80		MW61-80
MX113		18513
MX114		18514
MX118		18537
MX120/01		18520
MX122		18538
MX124		18524
MX124/01		18525
MX133		18533
MX145		18545
MX146		18503
MX147		18504
MX148		18505
MX149		18506
MX150		18509
MX152		18515
MX153		18516
MX157		18515/17
MX158		18516/18
MX966B		DCG4/1000G; 866A
N17	820	DL92; 3S4
N18	818	3Q4; DL95
N19		DL94; 3V4
N25		DL96
N77		(EL91); (6AM5)

* *Obsolete type with nearest replacement type.*

Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

Type number	Alternative CV number	Philips type
N119		UL84
N142		UL41
N144		EL91; 6AM5
N150		EL41
N151		EL42
N152		PL81; 21A6
N153		PL83; 15A6
N154		PL82; 16A5
N308		(PL36); (25E5)
N309		(PL83); (15A6)
N329		PL82; 16A5
N339		(PL81); (21A6)
N359		PL81; 21A6
N369		PCL82; 16A8
N379		PL84; 15CW5
N709		EL84; 6BQ5
N727	1862	6AQ5
NL710		(PL5684/C3JA)
NL714		(PL3C23)
NL715		PL5557
NL730		(PL6755)
NL1022		PL5822A
NL1022A		PL5822A
NL1051		PL5551A
NL1051A		PL5551A
NL1052		PL5552A
NL1052A		PL5552A
NL1053		PL5553B
NL1053A		PL5553B
NL5551		PL5551A
NL5552		PL5552A
NL5822		PL5822A
NSZ13		NSZ13
NSZ14		NSZ14
NSZ15		NSZ15
NU1-AB		(3554)
NU1-C		(3554)
NU1-D		(3554)
NU5		(3546PW)
NU25-AB		(3546PW)
NU25-C		(3546PW)
NU25-D		(3546PW)
NU25V-AB		(3545PW)
NU25V-C		(3545PW)

Type number	Alternative CV number	Philips type
NU25V-D		(3545PW)
NU34		(OA85); (1N478)
NU36-AB		(3546PW)
NU36-C		(3546PW)
NU36-D		(3546PW)
NU38		(OA85); (1N478)
NU58		(OA85); (1N478)
NU807		QE06/50; 807
NU813		QB2/250; 813
NU832		QQE04/20; 832A
NU866A		DCG4/1000G; 866A
NU872A		DCG5/5000GB; 872A
OA2		see page 3
OA5	7047	OA5; (1N277)
OA7		OA7
OA9		OA9
OA31		OA31
OA47		OA47; IN698
*OA50		OA81; OA85
*OA51		OA81; OA85
*OA52		OA81; OA85
*OA53		OA81; OA85
*OA54		OA81; OA85
*OA55		OA81; OA85
*OA56		OA81; OA85
*OA57		OA81; OA85
*OA58		OA81; OA85
OA59		(OA70)
*OA60		OA70
*OA61		OA81
OA70		OA70; 1N87; (OA90)
*OA71		OA81
OA72		OA72
OA73	442	OA73; 1N616
*OA74		OA81; OA85
OA79		OA79; 1N541
OA80/10		(OA81); (OA85)
OA81	1353	OA81; 1N476
OA81C		OA81C; 1N477
OA85	1354	OA85; 1N478
OA85C		OA85C; 1N479
OA86		OA86; 1N480
OA86C		OA86C

** Obsolete type with nearest replacement type.*

Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

Type number	Alternative CV number	Philips type
OA86C/01		OA86C/01; 1N119
OA90		OA90; 1N87A
OA91		OA91; 1N617
OA92		OA92
OA95		OA95; 1N618
OA100/30		(OA81); (OA85)
OA126		(OAZ200 ... ... OAZ207)
OA127		(OA200)
OA128		(OA200)
OA129		(OA202)
OA130		1)(OA202)
OA150		(OA85)
OA159		(OA73)
OA160		(OA70); (OA90)
OA161		(OA85); (1N478); 2)(OA202)
OA172		(2-OA79)
OA173		(2-OA79)
OA174		(OA81)
OA179		(OA79)
OA180		(OA5)
OA182		(OA5)
OA186		OA86; 1N480
OA200		OA200
OA202	7040	OA202
OA210		OA210
OA211		OA211
OA214		OA214
*OA250		BYZ14
*OA251		BYZ14
*OA252		BYZ14
OAP12		OAP12
OAZ200		OAZ200
OAZ201		OAZ201
OAZ202		OAZ202
OAZ203		OAZ203
OAZ204		OAZ204
OAZ205		OAZ205
OAZ206		OAZ206
OAZ207		OAZ207
OAZ208		OAZ208
OAZ209		OAZ209
OAZ210		OAZ210
OAZ211		OAZ211
OAZ212		OAZ212
OAZ213		OAZ213
OB2		see page 3
*OC16		OC26; 2N1314
OC22		OC22
OC23		OC23
OC24		OC24
OC26		OC26; 2N1314
OC28		ASZ15; 2N1666
OC29		ASZ16; 2N1667
OC32		(OC57)
OC33		(OC70)
OC34		(OC71)
OC35		ASZ17; 2N1668
OC36		ASZ18; 2N1669
OC37		(OC76)
OC38		(OC72)
OC43		(OC47)
OC44	7003	OC44
OC45	7004	OC45
OC46		OC46
OC47		OC47
OC57		OC57
OC58		OC58
OC59		OC59
OC60		OC60
*OC65		(OC57)
*OC66		(OC58)
OC70		OC70; 2N279
OC71	7005	OC71; 2N280
OC72	7006	OC72; 2N281
*OC73		OC75
OC74		OC74
OC75		OC75
OC76		OC76; 2N284
OC77	7007	OC77; 2N284A
OC79		OC79
OC80		OC80
OC84		(OC74)
OC122		OC122
OC123		OC123

** Obsolete type with nearest replacement type.*

1) *Up to 150 V peak inverse.* 2) *Silicon.*

Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

Type number	*Alternative CV number*	*Philips type*
OC139		OC139
OC140		OC140
OC141		OC141
OC169		OC169; 2N1515
OC170		OC170; 2N1516
OC171		OC171; 2N1517
OC200	7043	BCZ10
OC201	7044	BCZ11
OC203		BCZ12
OC204		BCY10
OC205		BCY11
OC206		BCY12
OC302		(OC72); (OC74)
OC303		(OC70)
OC304		(OC71)
OC307		(OC76)
OC308		(OC72); (OC74)
OC309		(OC77)
OC320		(OC58)
OC330		(OC57)
OC340		(OC58)
OC350		(OC75)
OC360		(OC57)
OC390		(OC45)
OC400		(OC45)
OC410		(OC44)
OC430		(OC200)
OC440		(OC200)
OC460		(OC201)
OC470		(OC201)
OC601		(OC70)
OC602		(OC70)
OC602 spez.		(OC76)
OC603		(OC71)
OC604		(OC71)
OC604 spez.		(OC74)
OC612		(OC45)
OC613		(OC44)
OC614		(OC170)
OC615		(OC171)
OC622		(OC57)
OC623		(OC57)
OC624		(OC58)

Type number	*Alternative CV number*	*Philips type*
OC6015		(OC171)
OCP70		OCP70
OCP71		(OCP70)
OM10		(ECH33)
ORP10		ORP10; 7632
ORP11		ORP11; 7633
ORP30		ORP30
ORP50		ORP50
ORP60		ORP60
ORP61		ORP61
ORP62		ORP62
ORP63		ORP63
ORP90		ORP90
OS18/600		EL50
OT400		(TB4/1250); (5868)
OY241		(OA210); (OA211)
P2-12		QQE04/20; 832A
P2-40B		(QQE06/40); (5894)
P6		1163
P15		1164
P816		5820
PA5021		DCG4/1000G; 866A
PABC80		PABC80; 9AK8
PAL12/15		PAL12/15
PAW12/15		PAW12/15
PB2/200		PB2/200
PB2/500		PB2/500
PB3/800		PB3/800
PC86		PC86; 4CM4
PC88		PC88; 4DL4
PCC84		PCC84; 7AN7
PCC85		PCC85; 9AQ8
PCC88		PCC88; 7DJ8
PCC89		PCC89
PCC189		PCC189; 7ES8
PCF80		PCF80; 9A8
PCF82		(PCF80); (9A8); (9U8)
PCF86		PCF86; 7HG8
PCL41		(PCL82); (16A8)
PCL81		(PCL82); (16A8)
PCL82		PCL82; 16A8
PCL83		(PCL82); (16A8)
PCL84		PCL84; 15DQ8

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	Alternative CV number	Philips type
PCL85		PCL85; 18GV8
PCL86		PCL86; 14GW8
PE05/25		PE05/25
PE06/40E		PE06/40E
PE06/40N		PE06/40N
PE06/40P		PE06/40P
PE1/100		PE1/100; 6083
PF83		(PF86)
PF86		PF86
PHG1		(OAP12)
PJ23		(3554)
PL2D21	797	PL2D21; (PL5727)
PL3C23		PL3C23
PL10		PL10
*PL17		PL5557
*PL21		PL2D21
PL36		PL36; 25E5
*PL57		PL5559
PL81	5077	PL81; 21A6
PL82		PL82; 16A5
PL83		PL83; 15A6
PL84		PL84; 15CW5
PL105		PL105
PL106		PL106
PL150		PL150
PL255		PL255
PL260		PL260
*PL345	372	3C45
*PL435	1787	4C35
PL500		PL500; 28GB5
*PL522	2520	5C22
PL1267	1992	Z300T/PL1267
PL1607		PL1607
PL5544	2210	PL5544
PL5545	2215	PL5545
*PL5551		PL5551A
PL5551A		PL5551A
*PL5552		PL5552A
PL5552A		PL5552A
PL5553B		PL5553B
PL5555		PL5555
PL5557	2957	PL5557
PL5559		PL5559

Type number	Alternative CV number	Philips type
PL5632		PL5632/C3J
PL5649		(QB3/200)
PL5684		PL5684/C3JA
PL5727	4018	PL5727; E91N
PL5822A		PL5822A
PL6011		PL5684/C3JA
PL6549		(QB3/200)
PL6574	2253	PL6574
PL6755		PL6755
PM04		6BA6
PM05		6AK5; EF95
PM07	138	EF91; 6AM6
PM84		PM84
PP6Bs		EL3N
PT4416		(OC26)
PV30S		CY2
PV495		(AZ1)
PV4100		(AZ1)
PY80		PY80; 19X3
PY81		PY81; 17Z3
PY82		PY82; 19Y3
PY83		(PY81); (17Z3)
PY88		PY88; 30AE3
Q6		(OC72)
Q7		(OC72)
Q8		(OC72)
Q160-1		(QB3/300); (6155)
Q400-1		(QB4/1100); (7527)
QA2400		1)(EF92); (6CQ6)
QA2401		1)(6C4); (EC90)
QA2402		1)(EL91); (6AM5)
QA2403		1)(EF91); (6AM6)
QA2404		1)(EAA91)
QA2406		1)(ECC81); (12AT7)
QA2407		1)(6X4)
QA2408		1)(6SN7GT)
QB2/250	26	QB2/250
QB3/200	1905	QB3/200
QB3/300	2130	QB3/300; 6155
QB3/300GA	2963	QB3/300GA; 4-125A
QB3.5/750	2131	QB3.5/750; 6156
QB3.5/750GA	2964	QB3.5/750GA; 4-250A

* *Obsolete type with nearest replacement type.*

1) *No specially ruggedized construction.*

Type numbers between brackets are **near** equivalents, for semiconductors **they are comparable types.**

Type number	*Alternative CV number*	*Philips type*
QB4/1100		QB4/1100; 7527
QB4/1100GA		QB4/1100GA; 4-400A
QB5/1750	3522	6079; QB5/1750
QBL3.5/2000		QBL3.5/2000
QBL4/800		QBL4/800; 4X500A
QBL5/3500	5219	QBL5/3500; 6076
QBL5/4000		QBL5/4000; 7704
QBW5/3500		QBW5/3500; 6075
QC05/35		QC05/35
QE03/10		Q0E3/10; 5763
QE04/10	309; 1510	QE04/10
QE05/40	3523	QE05/40; 6146
QE05/40F		QE05/40F; 6883
QE05/40H		QE05/40H; 6159
QE06/50	124	QE06/50; 807
QE08/200		QE08/200; 7378
QE08/200H		QE08/200H
QEL1/150	2519	QEL1/150; 4X150A
QEL1/150H		QEL1/150H
QEL2/200		QEL2/200; 7580
QEL2/250		QEL2/250; 4X250B
QEL2/275		QEL2/275; 4CX250B
QQC03/14		QQC03/14; 7983
QQC04/15	1838	QQC04/15; 5895
QQE02/5		QQE02/5; 6939
QQE03/12	2798	QQE03/12; 6360
QQE03/20	2799	QQE03/20; 6252
QQE04/5		QQE04/5; 7377
QQE04/20	788	QQE04/20; 832A
QQE06/40	2797	QQE06/40; 5894
QQV02/6		QQE02/5; 6939
QQV03-10	2798	QQE03/12; 6360
QQV03-20A	2799	QQE03/20; 6252
QQV04-15	788	QQE04/20; 832A
QQV04-16		QQE04/5; 7377
QQV06-40A	2797	QQE06/40; 5894
QQV07-40	2666	(QQE06/40); (5894)
QQZ04-15	1838	QQC04/15; 5895
QS83/3		85A2; 0G3
QS150/15		(150B2); (6354)
QS150/40		(150C1K)
QS1200	2225	150B2; 6354
QS1206		(4687K); (0B2)
QS1207	1832	0A2
QS1208	1833	0B2
QV03-12	2129	QE03/10; 5763
QV04-7	309; 1510	QE04/10
QV05-25	124	QE06/50; 807
QV06-20	3523	QE05/40; 6146
QV06-20B		QE05/40F; 6883
QV06-20C		QE05/40H; 6159
QV08-100		QE08/200; 7378
QV1-150A	2519	QEL1/150; 4X150A
QV1-150D		QEL1/150H
QV2-250B		QEL2/250; 4X250B
QY2-100	26	QB2/250; 813
QY3-65	1905	QB3/200; 4-65A
QY3-125	2130	QB3/300; 6155
QY3-125B	2963	QB3/300GA; 4-125A
QY3-1000A		QBL3.5/2000
QY4-250B	2964	QB3.5/750GA; 4-250A
QY4-250	2131	QB3.5/750; 6156
QY4-400		QB4/1100; 7527
QY4-400B		QB4/1100GA; 4-400A
QY4-500A		QBL4/800; 4X500A
QY5-500	3522	QB5/1750; 6079
QY5-3000A		QBL5/3500; 6076
QY5-3000W		QBW5/3500; 6075
R1		(AZ1)
R6A		1163
R12		(EY51); (6X2)
R12A		EY51; 6X2
R15A		1164
R17		(EY82); (6N3)
R18	2235	EY84; 6374
R19		(DY86); (1S2)
R51A		(3546PW)
R51AV		(3545PW)
R52		(GZ34)
R58A		(3546PW)
R58AV		(3545PW)
R59A		(3554)
R120 (rect.)		(1725A)

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
R144	138	EF91; 6AM6
R243	273	EC55; 5861
R290		K81A
RG1-125		(DCG4/1000G); (866A)
RG1-250	3667	DCG1/250
RG3-250A	32	DCG4/1000G; 866A
RG3-1250		DCG4/5000
RG4-1250		(DCG4/5000)
RG4-3000		DCG6/18; 6693
RG250/1000		DCG1/250
RG250/3000		DCG4/1000G; 866A
RG1000/3000		DCG5/5000GB; 872A
RGN564		(AZ1)
RGN1064		(AZ1)
RGN4004		(AZ50)
RHK6332		723A/B
RK807		QE06/50; 807
RK866		DCG4/1000G; 866A
RL21		PL2D21
RL31		(OA81); (1N476)
RL32		(OA81); (1N476)
RL34		(OA81)
RL41		(OA70)
RL43		(OA81); (1N476)
RL44		(OA85); (1N478)
RL143		(OA81); (1N476)
RL231		(2-OA79)
RL232/B		(2-OA79); (2-OA72)
RL246		(2-OA79)
RL247		(2xOA85)
RL1267		Z300T/PL1267
RR3-250	1835	DCX4/1000; 3B28
RR3-1250	2518	DCX4/5000; 4B32
RR3-1250B		DCX4/5000
RS612		(TB2.5/400)
RS613		TB2.5/300; 5866
RS614		TB2.5/400
RS630		TB3/750; 5867
RS631		TB4/1250; 5868
RS683		(QB3/300); (6155)
RS685		QB3/300; 6155
RS686		QB3.5/750; 6156

Type number	*Alternative CV number*	*Philips type*
RS687		QB5/1750; 6079
RS1002A		QB4/1100; 7527
RS1003		(PE1/100)
RS1006B		TB2.5/400
RS1007		QB3/300; 6155
RS1009		QQE06/40; 5894
RS1011L		(TBL6/20)
RS1011W		(TBW6/20)
RS1016		TB4/1250; 5868
RS1019		QQE03/20; 6252
RS1026		TB3/750; 5867
RS1029		QQE03/12; 6360
RS1036		TB4/1500
RS1046		TB5/2500; 7092
RV120/500s		AZ4
RV200/600		(AZ50)
RX120A		1164
RY12-100	2967	8020
S1.5/80dV		PL5545
S15/5d		(DCG12/30); (5870)
S15/40i		(DCG7/100)
S21		(OA200)
S22		(OA200)
S23		(OA200)
S24		(OA202)
S32		(OA200)
S33		(OA200)
S34		(OA202)
S35		(OA202)
S856		0A2
S860		0B2
SBS		PL5551A
SCS		PL5552A
SCS3		PL5822A
SD5		(OA200)
SD7		(OA200)
SD15		(OA200)
SD30		(OA200)
SD50		(OA200)
SD61		EA50
SD80		(OA202)
SD220		(OA202)
SDR		PL5555

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
SDS		PL5553B
SFD106		(OA90)
SFR105/1		(OA31)
SFR105/2		(OA31)
SFR106		(OA31)
SFR106/01		(OA31)
SFR106/2		(OA31)
SFT101		(OC70)
SFT102		(OC71)
SFT103		(OC75)
SFT106		(OC169)
SFT107		(OC169)
SFT108		(OC170)
SFT109		(OC71)
SFT113		(OC26)
SFT114		(ASZ17)
SFT115		(OC169)
SFT116		(OC170)
SFT117		(OC171)
SFT118		(OC171)
SFT119		(OC169)
SFT120		(OC170)
SFT121		(OC79); (OC74)
SFT122		(OC72); (OC74)
SFT123		(OC72); (OC74)
SFT124		(OC79)
SFT125		(OC74)
SFT126		(OC45)
SFT127		(OC45)
SFT128		(OC44)
SFT130		(OC79)
SFT131		(OC74)
SFT150		(OC28)
SFT151		(OC70); (OC71)
SFT152		(OC71)
SI3		(OA211)
SK60		(3554)
SK63		(3554)
SP6		EF91; 6AM6
SRS360		TB3/750; 5867
SRS361		TB2.5/300; 5866
SRS362		TB4/1250; 5868
SRS455		QB3/300; 6155
SRS456		QB3.5/750; 6156
SRS457		QB5/1750; 6079
SRS4451		QQE06/40; 5894
SRS4452		QQE03/20; 6252
ST28C		(OC45)
ST90K		Z900T/5823
ST37D		(OC44)
ST162		(OC139)
ST163		(OC139)
ST173		(OC140)
Ste 1000/2.5/15		PL5559
Ste 1300/01/05		PL2D21
Ste 2500/6/40		PL105
Ste 15000/15/45		(DCG7/100)
StR108/30		0B2
StR150/30		0A2
STV85/10		85A2; 0G3
STV108/30		0B2
STV150/30		0A2
SU61		EY51; 6X2
SV9		(OAZ206)
SV124		(OAZ202)
SV128		(OAZ205)
SV133		(OAZ207)
SV134		(OAZ213)
SZ6		(OAZ203)
SZ7		(OAZ204)
SZ8		(OAZ206)
SZ9		(OAZ207)
T2MO5		6J6; ECC91
T6D		EA50
T34A		(OC65)
T34B		(OC65)
T34C		(OC65)
T34D		(OC72); (2N281)
T34E		(OC72); (2N281)
T34F		(OC72); (2N281)
T130-1		(TB2.5/400)
T249B		(DCG4/1000G); (866A)
T300-1		(TB4/1250); (5868)
T350-1		(TB3/750); (5867)
T813		QB2/250; 813

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
T866A		DCG4/1000G; 866A
T872A		DCG5/5000GB; 872A
T1040		(OC26)
T1041		(OC26)
T1360		(OC169)
T1361		(OC169)
T1675		(OC170)
T1690		(OC169); (OC170)
T1691		(OC169); (OC171)
T1692		(OC169)
T1693		(AFZ12)
T1694		(AFZ12)
T1695		(AFZ12)
T1696		(AFZ12)
T1737		(OC170)
T1814		(OC170)
*TA12/20000K		TAW12/20
TA18/100		TA18/100
TAL12/10		TAL12/10
TAL12/20		TAL12/20
TAL12/35		TAL12/35
TAW12/10		TAW12/10
TAW12/20		TAW12/20
TAW12/35G		TAW12/35G
TB2/500		TB2/500
TB2.5/300	1924	TB2.5/300; 5866
TB2.5/400		TB2.5/400
TB3/350	2552	TB3/350; 100TH
TB3/750	1350	TB3/750; 5867
*TB3/1000		TB4/1250; 5868
TB3/2000		TB3/2000
TB4/800	2589	TB4/800; 250TH
TB4/1250	1351	TB4/1250; 5868
TB4/1500		TB4/1500
TB5/2500		TB5/2500; 7092
TBL2/300		TBL2/300; 7004
TBL2/400		TBL2/400
TBL2/500		TBL2/500
TBL6/14		TBL6/14; 7804
TBL6/20		TBL6/20
TBL6/4000		TBL6/4000; 7753
TBL6/6000	3926	TBL6/6000; 5924
TBL7/8000		TBL7/8000; 6961
TBL7/9000		TBL7/9000
TBL12/25		TBL12/25; 6618
TBL12/38		TBL12/38; 7806
TBL12/40		TBL12/40
TBL12/100		TBL12/100; 6078
TBL15/125		TBL15/125
TBW6/14		TBW6/14
TBW6/20		TBW6/20
TBW6/6000		TBW6/6000; 5923
TBW7/8000		TBW7/8000; 6960
TBW7/9000		TBW7/9000
TBW12/25		TBW12/25; 6617
TBW12/38		TBW12/38; 7807
TBW12/100		TBW12/100; 6077
TBW15/125		TBW15/125
*TC2/250		TB3/750; 5867
*TC2/300		TB3/750; 5867
TD03-10	273	EC55; 5861
TD2-300A		TBL2/300; 7004
TD2-400A		TBL2/400
TD2-500A		TBL2/500
TD6		EA50
TF65		(OC71)
TF65/30		(OC71)
TF65/60		(OC77)
TF65M		(OC71)
TF65/30M		(OC71)
TF65/60M		(OC77)
TF68		(OC44)
TF70		(OC139)
TF71		(OC140)
TF72		(OC140)
TF75		(OC72)
TF77		(OC74)
TF77/30		(OC74)
TF77/60		(ASZ15)
TF78		(OC74)
TF78/30		(OC74)
TF78/60		(ASZ15)
TF80		(OC26)
TF80/30		(OC26)
TF80/60		(ASZ15)
TF85		(OC26)

***** *Obsolete type with nearest replacement type.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
TF90		(OC26)
TF90/30		(OC26)
TF90/60		(OC26)
TFZ103B		(PL5544); (PL6755)
TFZ106B		(PL5545)
TG30		3C45
TG57		PL5559
TG200B		4C35
TG1000		5C22
TG3000		5949
*TH1		TH91
*TH2		TH92
*TH3		TH93
*TH4		TH94
*TH5		TH95
TH91		TH91
TH92		TH92
TH93		TH93
TH94		TH94
TH95		TH95
TH100TH		TB3/350; 100TH
TH250TH		TB4/800; 250TH
TH813	26	QB2/250; 813
TH1450		4J50
TH1452		4J52
TH1478		4J78
TH1526		5J26
TH1725A		725A
TH2203		6975
TH2225		2K25
TH5021B	32	DCG4/1000G; 866A
TH5021V		DCG4/1000ED
TH5031B	642	DCG5/5000GB; 872A
TH5031V		DCG5/5000EG
TH5040		(DCG9/20); (6508)
TH5090		(DCG6/18GB); (7136)
TH5130		(DCG6/18); (6693)
TH5221V/B	1835	DCX4/1000; 3B28
TH6011		PL5557
TH6031		PL5559
TH6050		(PL5559)
TH6120		PL105
TH6220		PL5545

Type number	*Alternative CV number*	*Philips type*
TH6230		PL3C23
TH6345		3C45
TH6435		4C35
TH6522		5C22
TH6907		5949
TH7020		PL5551A
TH7021		5)(PL5551A)
TH7030		PL5552A
TH7031		5)(PL5552A)
TH7040		PL5553B
TH7041		5)(PL5553B)
TP50		(OAP12)
TQ1/2		PL3C23
TQ2		(PL5557)
TQ2/3		(PL6755)
TQ2/6		(PL106)
TQ2/12		(PL255)
TQ6		(DCG12/30); 5870
TQ7		(DCG7/100)
TR-722		(OC58)
TR-C76		(OC76)
TR-C77		(OC77)
TR-C360		(OC57)
TR-C601		(OC70)
TR-C602		(OC71)
TS49		C3M
TS51/EF95		6AK5; EF95
TS52/ECC91		6J6; ECC91
TS53/18042		18042
TS54/E83F		E83F; 6689
TS161		(2-OC72)
TS162		(OC71)
TS163		(OC71)
TS164		(OC71)
TS165		(OC72); (2N281)
TS166		(OC70)
TS620		(OC57); (OC58)
TS621		(OC70); (OC57)
TT10		QB2/250
TT15		(QQE04/20); (832A)
TT16		QB3/300GA; 4-125A
TT16D		QB3/300; 6155

***** *Obsolete type with nearest replacement type.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
TT17		PL5557
TT20		QQE03/20; 6252
TX2/3		PL5544
TX2/6		PL5545
TX12-20A		(TAL12/20)
TX12-20W		(TAW12/20)
TXM100		PL2D21
TY2-125	1924	TB2.5/300; 5866
TY2-150		TB2.5/400
TY3-250	1350	TB3/750; 5867
TY4-350		(TB4/1250); (5868)
TY4-500	1351	TB4/1250; 5868
TY5-500		TB4/1500
TY6-12A		TBL6/20
TY6-12W		TBW6/20
TY6-800		TB5/2500; 7092
TY6-5000A	3926	TBL6/6000; 5924
TY6-5000W		TBW6/6000; 5923
TY7-6000A		TBL7/8000; 6961
TY7-6000W		TBW7/8000; 6960
TY8-15A		TBL6/14; 7804
TY8-15W		TBW6/14; 7805
TY12-15A		TBL12/40
TY12-20A		TBL12/38; 7806
TY12-20W		TBW12/38; 7807
TY12-25A		TBL12/25; 6618
TY12-25W		TBW12/25; 6617
TY12-50A		TBL12/100; 6078
TY12-50W		TBW12/100; 6077
TY74		(PL5557)
TY76		(PL5559)
TY77		(PL5559)
TY78		(PL5559)
TY84		(PL5559)
TY85		(PL105)
TY6030		(PL5559)
TY6050		(PL5559)
TY6100		(PL5559)
TY6120		(PL105)
TY6220		(PL5545)
U9	1443	(AZ1)
U10		(AZ1)
U12		(1561)

Type number	*Alternative CV number*	*Philips type*
U18		AZ50
U18/20		(AZ50)
U26		EY86; 6S2
U30		(PY82); (19Y3)
U43		EY51; 6X2
U49		EY86; 6S2
U50		(5Y3GT)
U52		(GZ34)
U54		(GZ34)
U70		(EZ35)
U78		6X4
U119		UY85; (38A3)
U142		UY41
U145		(UY41)
U150		EZ40
U151		EY51; 6X2
U152		PY80; 19X3
U153		PY81; 17Z3
U154		PY82; 19Y3
U192		PY82; 19Y3
U309		(PY80); (PY86)
U319		(PY82); (19Y3)
U381		UY85; 38A3
U404		(UY41)
U709		EZ81; 6CA4
U2410/P		U30
UABC80		UABC80
*UAF41		UAF42; 12S7
UAF42		UAF42; 12S7
UBC41		UBC41; 14L7
UBC80		(UBC81)
UBC81		UBC81
*UBF11		UBF80
UBF80		UBF80; 17C8
UBF89		UBF89; 19FL8
UBL1		UBL1
UBL21		UBL21
UC92		UC92
UCC85		UCC85
UCH4		UCH4
*UCH11		UCH81
UCH21		UCH21
*UCH41		UCH42

***** *Obsolete type with nearest replacement type.*
Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Alternative CV number*	*Philips type*
UCH42		UCH42; 14K7
UCH71		(UCH21)
UCH80		(UCH81); (19D8)
UCH81		UCH81; 19D8
UCH171		(UCH81); (19D8)
UCL82		UCL82
UE966A		DCG4/1000G; 866A
UE967		PL5557
UE972A		DCG5/5000GB; 872A
*UF11		UF41
UF21		UF21
UF41		UF41; 12AC5
UF42		UF42
UF80		UF80
UF81		(UF89)
UF85		UF85
UF89		UF89
UF174		(UF80)
UF175		(UF85)
UL41	1977	UL41; 45A5
UL84		UL84; 45B5
UM4		UM4
UM11		(UM4)
UM80		UM80; 19BR5
UM84		UM84
UU9	1855	(EZ40)
UU12		EZ81; 6CA4
UX866		DCG4/1000G; 866A
*UY1		UY1N
UY1N		UY1N
UY11		UY11
*UY21		UY1N; UY85
UY41		UY41; 31A3
UY42		UY42
UY82		UY82; 55N3
UY85		UY85; 38A3
UY89		UY89; 31AV3
UY92		UY92
V2M70		6X4
V15F		(3545PW)
V30/20P		(OC26)
V30/30P		(OC26)
V40		8020
V41		AZ41
V61		EZ40
V100		(AZ50)
V208		(OC26)
V308		(OC26)
V311		(UY41); (31A3)
V312 (Mazda Fr.)		(UY42)
V741	133	6C4; EC90
V884		EF92; 6CQ6
V914		(AB2)
V1103		QQE03/12; 6360
VA50		90AV
VA203B		6975
VH550		DCG4/1000ED
VH550A		DCG4/1000G; 866A
VH7400		DCG5/5000GB; 872A
VH7400A		DCG5/5000EG
VJ5551		PL5551A
VJ5551A		PL5551A
VJ5552A		PL5552A
VJ5553		PL5553B
VJ5553B		PL5553B
VMP11/44A		(153AVP)
VMP11/44B		(53AVP)
VMP11/44C		(53AVP)
VMP11/111		(54AVP)
VMP11/170		(57AVP)
VMP13/23		(52AVP)
VMP13/44		(56AVP)
VMQ11/44		(53UVP)
VMQ13/44		(56UVP)
VP6 (Coss.)		EF92; 6CQ6
VR55	1055	EBC33
VR57	1057	EK32
VR91	1091	(EF50)
2)VR91A	1578	(EF50)
VR92	1092	EA50
VR150		(150C1K)
VR150/30	216	(150C1K)
VS34		(3545)
VS50	1070	90CV
1)VT39		(DCG9/20); (6508)
VT39A		(DCG9/20); (6508)

---

* *Obsolete type with nearest replacement type.*

1) *American Army VT-numbers unless otherwise stated.* 2) *British VR-number.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	Alternative CV number	Philips type
1)VT42A	642	(DCG5/5000GB); (872A)
VT46		(DCG4/1000G); (866A)
VT46A	32	DCG4/1000G; 866A
2)VT60A		(QE06/50); (807)
VT74	1864	(GZ34)
2)VT75	1075	(EL34)
2)VT79	1079	(QE06/50); (807)
VT80		(5Y3GT)
2)VT88	1088	(QQE04/20); (832A)
VT88A		QQE04/20; 832A
VT92	588	(EBC33)
VT92A	587	(EBC33)
VT93	1894	(EBF32)
VT93A	1893	(EBF32)
VT100		QE06/50; 807
VT100A		(QE06/50); (807)
VT103	1990	(6SQ7GT)
VT104		(12SQ7GT)
VT107	510	(6V6GT)
VT107A	511	(6V6GT)
VT107B	509	(6V6GT)
VT117	1981	(6SK7GT)
VT117A	1982	(6SK7GT)
VT118		QQE04/20; 832A
VT131	543	(12SK7GT)
VT139		(150C1K)
VT144		QB2/250
VT146	1825	DCG4/1000ED
VT150	1966	(6SA7GT)
VT150A	1967	6SA7GT
VT161	537	(12SA7GT)
VT171	782	DK91; 1R5
VT172	784	DAF91; 1S5
VT173	785	DF91; 1T4
VT174	820	DL92; 3S4
2)VT195	1863	(GZ34)
2)VT196	509	(6V6GT)
2)VT197	1629	(DCG4/5000)
VT197A	1856	5Y3GT
2)VT198	1075	(EL34); (6CA7)
2)VT199	124	QE06/50; 807
VT200		4687K
VT201	552	(25L6GT)
VT201C	553	25L6GT
VT206A	729	(GZ34)
2)VT207	1091	(EF50)
VT218	2552	TB3/350; 100TH
VT220	2589	TB4/800; 250TH
VT231	1988	6SN7GT
VT244	575	(GZ34)
VT245		(PL2D21)
VT250		(EF50)
VT259		(QQE06/40); (5894)
VT264	818	3Q4; DL95
VT267	2967	8020
VT286	788	QQE04/20; 832A
VT510	1510	QE04/10
VU134	1134	1877
VX32B		(4065)
VX41		(4066)
VX550A		DCX4/1000; 3B28
VX7400		DCX4/5000; 4B32
W17		DF91; 1T4
W25		DF96
W77		EF92; 6CQ6
W81		EF22
W101		(UF21); (UF41)
W142		UF41
W143		EF22
W148		(EF22)
W150		EF41
W719		EF85; 6BY7
W727		6BA6
W729		(EF85); (6BY7)
WD119		UBF89
WD142		UAF42
WD150		EAF42
WD709		EBF80; 6N8
WE12		EM4
WE17		PL5557
WE289A		1163
WL2D21		PL2D21
WL17		PL5557
WL105		PL105

1) *American Army VT-numbers unless otherwise stated.* 2) *British VT-number.* **Type numbers between brackets are near equivalents, for semiconductors they are comparable types.**

Type number	*Alternative CV number*	*Philips type*
WL172		(PL105)
WL414		(PL255)
WL502A		(PL2D21)
WL575A		(DCG6/18GB); (7136)
WL624		(PL105)
WL631		PL5559
WL632A		(PL5559)
WL676		(PL105)
WL735		(3554)
WL739		(3546PW)
WL807		QE06/50; 807
WL813		QB2/250; 813
WL866A		DCG4/1000G; 866A
WL868		(3554)
WL869B		(DCG9/20); 6508
WL872A		DCG5/5000GB; 872A
WL884		(PL2D21)
WL885		(PL2D21)
WL918		(3554)
WL927		(3546PW)
WL2050		(PL6574)
WL5551		PL5551A
WL5551/652		PL5551A
WL5551A		PL5551A
WL5551A/652		PL5551A
WL5552		PL5552A
WL5552/651		PL5552
WL5552A/651		PL5552
WL5552A		PL5552A
WL5553		PL5553B
WL5553/655		PL5553B
WL5553A/655		PL5553B
WL5553B/655		PL5553B
WL5555		PL5555
WL5555/653B		PL5555
WL5557/17		PL5557
WL5559/57		PL5559
WL5685		(PL5545)
WL5720		(PL5559)
WL5822		PL5822A
WL5822A		PL5822A
WL289416D		1163
WT210-0001		PL2D21

Type number	*Alternative CV number*	*Philips type*
WT210-0015		PL5557
WT210-0018		(150C1K)
WT210-0056		PL5559
WT210-0062		PL5557
WT210-0069		PL5557
WT210-0071		PL5551A
WT210-0072		PL5552A
WT210-0073		(PL5553B)
WT210-0074		PL105
WT210-0079		PL105
WT210-0091		(Z300T/PL1267)
WT272		PL5557
WT294		(150C1K)
WT606		PL2D21
WTT108		PL3C23
WTT111		PL5559
WTT117		PL5557
WTT118		PL105
X17		DK91; 1R5
X18		DK92; 1AC6
X20		DK92
X25		DK96
X61M		(ECH33)
X77		6BE6
X81		(ECH21)
X101		(UCH21)
X119		UCH81; 19D8
X142		UCH42
X143		ECH21
X150		ECH42
X719		ECH81; 6AJ8
X727		6BE6
XA101		(OC45)
XA102		(OC44)
XB103		(OC58); (OC71)
XB767A		(PL2D21)
XC101		(OC72)
XCC189		XCC189; 4ES8
XCF80		XCF80; 4BL8
XCH81		XCH81; 3AJ8
XCL82		XCL82; 8B8
XCL84		XCL84; 8DX8
XF80		XF80; 3BX6

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	Alternative CV number	Philips type
XF85		XF85; 3BY7
XF86		XF86; 2HR8
XF183		XF183; 3EH7
XF184		XF184; 3EJ7
XG1-2500	612	PL5559
XG2-12		PL255
XG2-25		PL260
XG2-500		(PL5557)
XG2-6400		(PL105)
XG5-500	2957	PL5557
XG15-10		DCG7/100B; 6786
XG15-12		(DCG7/100)
XGQ2-6400		PL105
XH3-045	372	3C45
XH8-100	1787	4C35
XH16-200	2520	5C22
XH25-500	3521	5949
XL36		XL36; 13CM5
XL84		XL84; 8BQ5
XL86		XL86; 8CW5
XR1-1600		(3C23)
XR1-1600A		(3C23)
XR1-3200	2210	PL5544
XR1-3200A		(PL5544)
XR1-6400	2215	PL5545
XR1-6400A		(PL5545)
XY88		XY88; 16AQ3
Y25		DM71; 1N3
Y119		UM80
Z6		(OAZ203)
Z7		(OAZ205)
Z8		(OAZ206)
*Z50T		Z71U
Z70U		Z70U; 7710
Z70W		Z70W; 7709
Z71U		Z71U; 7711
Z77		EF91; 6AM6
Z90		EF50
Z142		UF42
Z150		EF42
Z152		EF80; 6BX6
Z225		(DCG4/1000G)
Z300T	1992	Z300T/PL1267
Z302C		Z302C
Z303C	2271	Z303C
Z329		(EF80); (6BX6)
*Z500T		Z71U
Z502S	2325	Z502S
Z503M		Z503M
Z510M	5278	Z510M
Z520M		Z520M
Z521M		Z521M
Z550M		Z550M
Z700U		Z70U
Z700W		Z70W
Z701U		Z71U
Z719		EF80; 6BX6
Z729		EF86; 6267
Z803U	2434	Z803U; 6779
Z804U		Z804U; 7713
Z805U		Z805U; 7714
Z900T		Z900T/5823
Z5823		Z900T/5823
ZD17		DAF91; 1S5
ZD25		DAF96
ZD152		EBF80; 6N8
ZJ13$^{1)}$		(OC72)

** Obsolete type with nearest replacement type.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Philips type*	*Type number*	*Philips type*
CV5	(DCG4/5000)	CV509	(6V6GT)
CV12	(5C22)	CV510	(6V6GT)
CV26	QB2/250	CV511	6V6GT
CV32	DCG4/1000G; 866A	CV537	(12SA7GT)
CV124	QE06/50; 807	CV538	12SA7GT
CV131	EF92; 6CQ6	CV543	(12SK7GT)
CV133	6C4; EC90	CV544	12SK7GT
CV135	EY91	CV546	(12SQ7GT)
CV136	EL91; 6AM5	CV547	12SQ7GT
CV137	EAC91	CV551	(25L6GT)
CV138	EF91; 6AM6	CV552	(25L6GT)
CV140	(EAA91)	CV553	25L6GT
52	DCG4/5000	CV554	(EAA91)
16	(150C1K)	CV567	(35Z5GT)
273	EC55; 5861	CV568	35Z5GT
CV283	EAA91; 6AL5;1) (5726)	CV571	50L6GT
CV303	(EF22)	CV575	(GZ34)
CV309	QE04/10	CV580	(EK32)
CV370	JP9-7A	CV593	GZ32; (GZ34)
CV372	3C45	CV600	(DG13-2)
CV375	(EA50)	CV617	(5Y3GT)
CV378	(GZ34)	CV635	(TB4/1250); (5868)
CV394	EM34; 6CD7	CV642	DCG5/5000GB; 872A
CV417	EC91	CV647	(PL2D21)
CV424	QQE06/40; 5894	CV648	(PL2D21)
CV425	(OA81); (1N476)	CV659	(PE06/40E)
CV426	EY51; 6X2	CV684	(GZ34)
CV429	MF31-55	CV714	(PL5545)
CV431	85A1; 0E3	CV718	(MF13-1)
CV442	OA73; 1N616	CV722	725A
CV447	(5870); (DCG12/30)	CV729	(GZ34)
CV448	(OA81); (1N476)	CV742	(PL5559)
CV449	85A2; 0G3	CV752	(Z300T/PL1267)
CV452	6AT6	CV753	1A3; DA90
CV453	6BE6	CV782	DK91; 1R5
CV454	6BA6	CV783	(DL92)
CV455	ECC81; 12AT7;1) (6201)	CV784	DAF91; 1S5
CV468	(EC71)	CV785	DF91; 1T4
CV491	ECC82; 12AU7	CV788	QQE04/20; 832A
CV492	ECC83; 12AX7	CV797	PL2D21;1) (PL5727)
CV493	6X4	CV807	3A4; DL93
CV495	4065	CV808	3A5; DCC90
CV501	EBF32	CV818	3Q4; DL95

1) *Rugged.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Philips type*
CV820	DL92; 3S4
CV838	(DP13-2)
CV850	6AK5; EF95;1) (5654)
CV858	6J6; ECC91
CV877	(EF22)
CV925	12SN7GT
CV1029	(DCG4/5000)
CV1075	(EL34); (6CA7)
CV1079	(QE06/50); (807)
CV1091	EF50
CV1092	EA50
CV1134	1877
CV1144	(PL5557)
CV1261	(DCG4/1000G); (866A)
CV1262	(DCG1/250)
CV1264	AZ50
CV1301	(EAA91)
CV1350	TB3/750; 5867
CV1351	TB4/1250; 5868
CV1352	EM80
CV1353	OA81; 1N476
CV1354	OA85; 1N478
CV1375	EF85; 6BY7
CV1376	EF80; 6BX6
CV1377	GZ34; 5AR4
CV1420	(DCG9/20); (6508)
CV1427	EF9
CV1428	EBC3
CV1429	EL2
CV1434	EM4
CV1435	(DCG4/5000)
CV1438	(EL33)
CV1449	DCG5/5000GB; 872A
CV1479	(55100/01)
CV1480	(55100/02)
CV1481	(55100/03)
CV1482	(55100/04)
CV1510	QE04/10
CV1535	EZ80; 6V4
CV1570	(EK32)
CV1572	QE06/50; 807
CV1578	(EF50)
CV1625	DCG4/1000ED

Type number	*Philips type*
CV1629	DCG4/5000
CV1737	MW6-2
CV1741	EL34; 6CA7
CV1758	1L4; DF92
CV1787	6268/4C35
CV1795	723A/B
CV1798	(PL2D21)
CV1832	OA2
CV1833	OB2
CV1835	DCX4/1000; 3B28
CV1836	1163
CV1838	QQC04/15; 5895
CV1839	(EF42)
CV1846	(GZ34)
CV1851	(GZ34)
CV1854	(5Y3GT)
CV1855	(EZ40)
CV1856	5Y3GT
CV1862	6AQ5
CV1863	(GZ34)
CV1864	(GZ34)
CV1865	EC81; 6R4
CV1866	CV1866
CV1868	MF13-1
CV1886	EC80; 6Q4
CV1893	(EBF32)
CV1894	(EBF32)
CV1905	QB3/200; 4-65A
CV1924	TB2.5/300; 5866
CV1927	(TB4/1250); (5868)
CV1928	12BA6
CV1929	(EAA91)
CV1930	(EAA91)
CV1947	(EL34); (6CA7)
CV1949	EN93
CV1959	50C5
CV1961	12AU6
CV1966	(6SA7GT)
CV1967	6SA7GT
CV1971	(DF91)
CV1976	MV6-5
CV1977	UL41; 45A5
CV1981	(6SK7GT)

---

1) *Rugged.*

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Philips type*
CV1982	6SK7GT
CV1988	6SN7GT
CV1990	(6SQ7GT)
CV1991	6SQ7GT
CV1992	Z300T/PL1267
CV2128	ECH81; 6AJ8
CV2129	QE03/10; 5763
CV2130	QB3/300; 6155
CV2131	QB3.5/750; 6156
CV2132	90AV
CV2133	90CG
CV2134	90CV
CV2166	(4J50)
CV2175	DG7-5
CV2191	DG13-2
CV2195	(EF91)
CV2210	PL5544
CV2215	PL5545
CV2225	150B2; 6354
CV2235	EY84; 6374
CV2237	1AD4
CV2238	5672
CV2240	3B4
CV2253	PL6574
CV2254	5678
CV2260	DF64
CV2270	90AG
CV2271	Z303C
CV2275	DC70; 6375
CV2284	(4J50)
CV2302	DH3-91; 1CP1
CV2325	Z502S
CV2348	4068
CV2352	DG16-22; 7AHP1
CV2361	(5672)
CV2370	DL92; 3S4
CV2371	DF61
CV2389	(OC71)
CV2390	3A4; DL93
CV2400	(OC71)
CV2420	JPT9-01
CV2431	DG7-32; 3AMP1
CV2434	Z803U; 6779
CV2466	QQE02/5; 6939
CV2487	QEL2/250; 4X250B
CV2492	E88CC; 6922
CV2493	(E88CC)
CV2498	DP16-22
CV2507	1U4
CV2518	DCX4/5000; 4B32
CV2519	QEL1/150; 4X150A
CV2520	6279/5C22
CV2524	6AU6
CV2526	6AV6
CV2552	TB3/350; 100TH
CV2573	(85A2); (0G3)
CV2589	TB4/800; 250TH
CV2634	367
CV2666	(QQE06/40); (5894)
CV2680	(3554)
CV2721	EL81; 6CJ6
CV2723	(DCG9/20); (6508)
CV2726	EL83; 6CK6
CV2729	E80F; 6084
CV2730	4066
CV2748	(GZ34); (5AR4)
CV2753	PL5684/C3JA
CV2775	1163
CV2792	2K25
CV2797	QQE06/40; 5894
CV2798	QQE03/12; 6360
CV2799	QQE03/20; 6252
CV2852	2J56
CV2860	AZ1
CV2876	PL5727
CV2901	EF86; 6267
CV2925	EBF2
CV2927	EC50
CV2929	ECH3
CV2947	DCG4/5000
CV2957	PL5557
CV2958	(PL5559)
CV2963	QB3/300GA; 4-125A
CV2964	QB3.5/750GA; 4-250A
CV2966	EY86
CV2967	8020

Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

Type number	*Philips type*
CV2975	EL84; 6BQ5
CV2980	DM70; 1M3
CV2983	DL94; 3V4
CV2984	6080
CV3512	5696
CV3521	5949
CV3522	QB5/1750; 6079
CV3523	QE05/40; 6146
CV3560	2J51A
CV3569	4J52
CV3602	5J26
CV3611	5586
CV3659	(55100/01)
CV3660	(55100/02)
CV3661	(55100/03)
CV3662	(55100/04)
CV3667	DCG1/250
CV3676	2J42
CV3706	(PL3C23)
CV3879	QB4/1100GA; 4-400A
CV3882	EBC41; 6CV7
CV3883	EAF42
CV3884	ECC40
CV3885	EF40
CV3886	EF41
CV3887	EF42
CV3888	ECH42
CV3889	EL41
CV3890	EL42
CV3891	EZ40
CV3892	AZ41
CV3926	TBL6/6000; 5924
CV3929	5840
CV3930	5718
CV3934	(OA85); (1N478)
CV3946	3WP1; (DG7-36)
CV3953	4J78
CV3954	(DP13-2)
CV3959	(MF13-1)
CV3991	QEL1/150H
CV3995	6CB6
CV3997	JP9-15
CV3998	E180F; 6688
CV4007	5726; E91AA
CV4010	5654; E95F
CV4018	PL5727; E91N
CV4024	6201; E81CC
CV4025	(5726)
CV4031	6J6; ECC91
CV4063	EL91; 6AM5
CV5018	4J52A
CV5035	DG13-34; 5ADP1
CV5055	EM81; 6DA5
CV5063	(OA85); (1N478)
CV5072	EZ81; 6CA4
CV5077	PL81; 21A6
CV5080	EF37A
CV5094	EL86; 6CW5
CV5105	(OC45)
CV5106	E1T; 6370
CV5131	DG4-1
CV5140	EA52; 6923
CV5156	EF89; 6DA6
CV5214	E90CC; 5920
CV5215	ECF80; 6BL8
CV5219	QBL5/3500; 6076
CV5231	E88CC; 6922
CV5232	C3m
CV5234	(3C23); (5796)
CV5244	AL13-36
CV5277	ET51
CV5278	Z510M
CV5300	AL22-10
CV6007	3C45
CV7003	OC44
CV7004	OC45
CV7005	OC71; 2N280
CV7006	OC72; 2N281
CV7007	OC77
CV7010	OC26; 2N1314
CV7040	OA202
CV7041	(OA95)
CV7043	BCZ10
CV7044	OC201
CV7047	OA5
CV7048	(OA5)

Type numbers between brackets are near equivalents, for semiconductors they are comparable types.

Type number	*Philips type*
CV7054	(OC23)
CV7075	(BCZ11)
CV7076	(OA41)
CV7083	ASZ15
CV7084	ASZ16

Type number	*Philips type*
CV7086	ASZ18
CV7089	(OC170)
CV7111	(OC139)
CV7112	(OC140)

Type numbers between brackets are **near** equivalents, for semiconductors they are **comparable** types.

NOTES FOR REPLACEMENT OF IGNITRON TYPES

Note 1) **Direct** equivalent if internationally dimensioned thermostat mounting material is used.

For tube types:
AR10T
AR14T
BK24B
BK34B
BK42B
BK168B

Note 2) **Direct** equivalent if internationally dimensioned thermostat mounting material and protective thermostat no. 55306 is used.

For tube types:
AR10TP
AR14TP

Note 3) **Direct** equivalent if internationally dimensioned thermostat mounting material and water saving thermostat 55305 is used.

For tube types:
AR10TWS
AR14TWS

Note 4) **Direct** equivalent if internationally dimensioned thermostat material is used and all the tubes in the same equipment are replaced.

For tube types:
AJ6346
AJ6347
BK24A
BK34A
BK42A
GL6346
GL6347
GL6348
GL6511

Note 5) **Direct** equivalent if waterflow switch and thermostat material are replaced.

For tube types:
TH7021
TH7031
TH7041

NOTES:

COMPONENTS FOR RADIO, TV AND AUDIO

TUBULAR POLYESTER CAPACITORS

Capacitance	*125 V D.C. type Type number C 296 AA/A . . .*			*400 V D.C. type Type number C 296 AC/A . . .*		
	Dimensions (mm)		*Last part of type number*	*Dimensions (mm)*		*Last part of type number*
	Thickness	*Length*		*Thickness*	*Length*	
1,000 pF				8	19	1K
1,200 pF				8.5	19	1K2
1,500 pF				9	19	1K5
1,800 pF				9	19	1K8
2,200 pF				8	19	2K2
2,700 pF				8.5	19	2K7
3,300 pF				8	19	3K3
3,900 pF				8	19	3K9
4,700 pF				8.5	19	4K7
5,600 pF				9	19	5K6
6,800 pF				7.5	19	6K8
8,200 pF				7.5	19	8K2
10,000 pF	7	19	10K	7.5	19	10K
12,000 pF	7.5	19	12K	7.5	19	12K
15,000 pF	7.5	19	15K	7.5	19	15K
18,000 pF	7	19	18K	8	19	18K
22,000 pF	7	19	18K	8.5	19	22K
27,000 pF	7	19	27K	9.5	19	27K
33,000 pF	7.5	19	33K	10	19	33K
39,000 pF	7.5	19	39K	10.5	19	39K
47,000 pF	8	19	47K	11.5	19	47K
56,000 pF	8.5	19	56K	9	32	56K
68,000 pF	9	19	68K	9.5	32	68K
82,000 pF	10	19	82K	10	32	82K
0.1 μF	10.5	19	100K	11	32	100K
0.12 μF	11.5	19	120K	11.5	32	120K
0.15 μF	12	19	150K	12.5	32	150K
0.18 μF	10	32	180K	13.5	32	180K
0.2 μF	9.5	32	200K*)			
0.22 μF	10	32	220K	14.5	32	220K

*) Special value for S-correction in 23″ T.V. line output stage.

TUBULAR POLYESTER CAPACITORS (continued)

Capacitance	*125 V D.C. type* *Type number C 296 AA/A . . .*			*400 V D.C. type* *Type number C 296 AC/A . . .*		
	Dimensions (mm)		*Last part of type number*	*Dimensions (mm)*		*Last part of type number*
	Thickness	*Length*		*Thickness*	*Length*	
0.27 μF	12	32	270K	15.5	32	270K
0.33 μF	12	32	330K	17	32	330K
0.39 μF	13	32	390K	18.5	32	390K
0.47 μF	14	32	470K	19.5	32	470K
0.56 μF	15	32	560K			
0.68 μF	16	32	680K			
0.82 μF	17.5	32	820K			
1 μF	18.5	32	1M			

For detailed information and full type range, see data sheet **EP 2029.**

METALLIZED-PAPER FEED-THROUGH CAPACITORS

Type number	*B8 002 03*	*B8 002 02*
Diameter	21 mm	28 mm
Height	42 mm	60 mm
Capacitance	min. 0.5 μF	min. 2 μF
Insulation resistance	min. 4,000 MΩ	min. 1,000 MΩ
R at 100 mc/s	max. 0.3 Ω	max. 0.5 Ω
X at 100 Mc/s	max. 2.5 Ω	max. 3.3 Ω
Mounting bracket	B1 020 06	B1 020 07

For detailed information see data sheet **EP 2027.**

STANDARD-TYPE ELECTROLYTIC CAPACITORS

Capacitances	Permissible voltages		Type number	Diameter	Height	Ripple current	Leakage current	Impedance
	E_{max}	E_{peak}				I_r	I_l	Z
µF	V	V		mm	mm	mA	µA	Ω
2 × 8	350	395	AC 5208/8 + 8	18	33	max. 50(80)	max. 140	max. 7.5
	450	500	AC 5210/8 + 8	18	49	max. 50(80)	max. 175	max. 16
	500	550	AC 5211/8 + 8	21	49	max. 50(80)	max. 190	max. 50
16	450	500	AC 5110/16	18	49	max. 100	max. 320	max. 8
2 × 16	300	340	AC 5207/16 + 16	18	49	max. 80(100)	max. 220	max. 4.8
	350	395	AC 5208/16 + 16	21	49	max. 80(100)	max. 250	max. 3.7
	450	500	AC 5210/16 + 16	25	49	max. 80(100)	max. 320	max. 8
25	300	340	AC 5107/25	18	49	max. 140	max. 330	max. 3
	350	395	AC 5108/25	18	49	max. 140	max. 380	max. 2.4
	450	500	AC 5110/25	21	49	max. 140	max. 480	max. 5
2 × 25	300	340	AC 5307/25 + 25	25	51	max. 100(140)	max. 330	max. 3
	350	395	AC 5308/25 + 25	25	51	max. 125(140)	max. 380	max. 2.4
	500	550	AC 5311/25 + 25	25	80	max. 125(140)	max. 530	max. 16
32	300	340	AC 5107/32	18	49	max. 160	max. 410	max. 2.4
	350	395	AC 5108/32	21	49	max. 160	max. 480	max. 1.9
	450	500	AC 5110/32	25	49	max. 180	max. 600	max. 4
2 × 32	300	340	AC 5307/32 + 32	25	51	max. 150(160)	max. 410	max. 1.2
	350	395	AC 5308/32 + 32	25	80	max. 150(160)	max. 480	max. 1.8
	400	450	AC 5309/32 + 32	25	80	max. 150(160)	max. 540	max. 3
50	300	340	AC 5107/50	25	49	max. 200	max. 630	max. 1.5
	300	340	AC 5307/50	25	51	max. 200	max. 630	max. 1.5
	350	395	AC 5108/50	25	49	max. 250	max. 730	max. 1.2
	350	395	AC 5308/50	25	51	max. 250	max. 730	max. 1.2
	450	500	AC 5310/50	25	80	max. 250	max. 930	max. 2.5
2 × 50	300	340	AC 5307/50 + 50	25	80	max. 200(250)	max. 630	max. 1.5
	350	395	AC 5308/50 + 50	25	80	max. 200(250)	max. 730	max. 1.2
	400	450	AC 5409/50 + 50	30	80	max. 200(250)	max. 830	max. 1.5
	450	500	AC 5410/50 + 50	35	80	max. 200(250)	max. 930	max. 2.5

Capacitances	*Permissible voltages*		*Type number*	*Dia-meter*	*Height*	*Ripple current*	*Leakage current*	*Impedance Z*
	E_{max}	E_{peak}				I_r	I_l	
µF	*V*	*V*			*mm*	*mA*	*µA*	*Ω*
3 × 50	**300**	**340**	AC 5407/50+50+50	30	80	max. 200(250)	max. 630	max. 1.5
	350	395	AC 5408/50+50+50	35	80	max. 200(250)	max. 730	max. 1.2
64	**300**	**340**	AC 5307/64	25	51	max. 300	max. 800	max. 1.2
	350	395	AC 5308/64	25	80	max. 300	max. 925	max. 0.9
	400	450	AC 5309/64	25	80	max. 300	max. 1030	max. 1.5
100	**300**	**340**	AC 5307/100	25	80	max. 400	max. 1230	max. 0.8
	350	395	AC 5308/100	25	80	max. 400	max. 1430	max. 0.6

For detailed information and full type range, see data sheet EP 2201 (3).

ELECTROLYTIC CAPACITORS WITH SCREW BASE

Capacitances	*Permissible voltages*		*Type number*	*Diameter*	*Height*	*Ripple current*	*Leakage current*	*Impedance Z*	t_{min}	*Weight*
	E_{max}	E_{peak}				I_r	I_l			
μF	*V*	*V*			*mm*	*mA*	*μA*	*Ω*	*°C*	*g*
2 × 12.5	500	550	AC 6011/12.5 + 12.5	25	54	max. 70(90)	max. 280	max. 32	−5	38
2 × 16	450	500	AC 6010/16 + 16	25	54	max. 90(100)	max. 320	max. 8	−10	38
25	350	395	AC 6008/25*	25	54	max. 140	max. 380	max. 2.4	−30	38
	500	550	AC 6011/25	25	54	max. 140	max. 530	max. 16	−5	38
2 × 25	300	340	AC 6007/25 + 25	25	54	max. 100(140)	max. 330	max. 3	−40	38
	350	395	AC 6008/25 + 25	25	54	max. 125(140)	max. 380	max. 2.4	−30	38
	500	550	AC 6011/25 + 25	25	83	max. 125(140)	max. 530	max. 16	−5	58
2 × 32	500	550	AC 6011/32 + 32	30	83	max. 150(180)	max. 670	max. 12	−10	84
50	350	395	AC 6008/50	25	54	max. 250	max. 700	max. 1.2	−30	38
	450	500	AC 6010/50	25	83	max. 250	max. 900	max. 2.5	−10	58
2 × 50	100	100	AC 6003/50 + 50*)	25	54	max. 150	max. 230	max. 1	−40	38
	200	225	AC 6005/50 + 50	25	54	max. 200(225)	max. 430	max. 1	−40	38
	300	340	AC 6007/50 + 50	25	83	max. 200(250)	max. 600	max. 1.5	−40	58
	350	395	AC 6008/50 + 50	30	83	max. 200(250)	max. 700	max. 1.2	−30	84
	400	450	AC 6009/50 + 50	30	83	max. 200(250)	max. 800	max. 1.5	−20	84
	450	500	AC 6010/50 + 50	30	83	max. 200(250)	max. 900	max. 2.5	−10	84
2 × 125	64	64	AC 6002/125 + 125*)	25	54	max. 300	max. 280	max. 1	−40	38
2 × 250	64	64	AC 6002/250 + 250*)	25	83	max. 500	max. 530	max. 1	−40	58

*) Non-preferred types.

For detailed information and full type range, see data sheet EP 2206 (2).

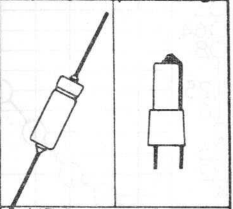
MIDGET ELECTROLYTIC CAPACITORS

CODE	A	B	C	D	E	F	G	H
VOLT:	2,5	4	6,4	10	16	25	40	64
0,5								
0,64								3
0,8								
1							3	
1,25								
1,6						3		
2								
2,5					3			
3,2								
4								3
5								
6,4							3	
8								
10						3		4
12,5								
16					3		4	
20								5
25				3		4		
32			3				5	
40		3			4			
50						5		
64				4				
80			4		5			
100		4						
125				5				
160			5					
200		5						

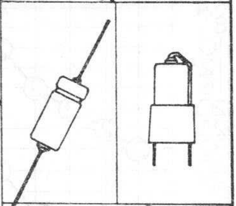
↑ µF

70/85 °C.

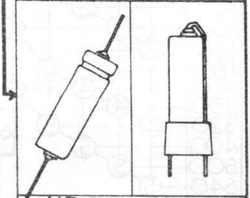
C 425 .. /. ...cap.		
AF Not ins.	AL insul.	C.F. pr.wiring



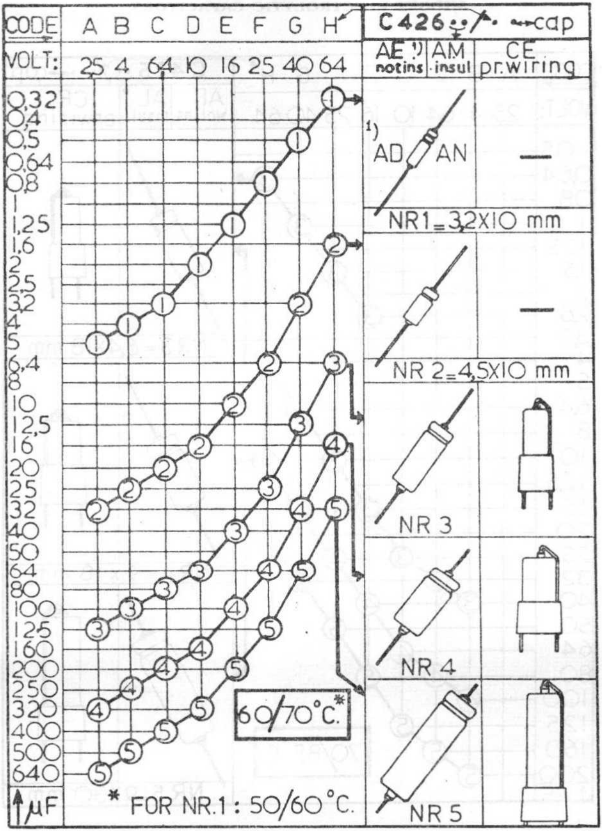
NR3 = 6,4X18 mm



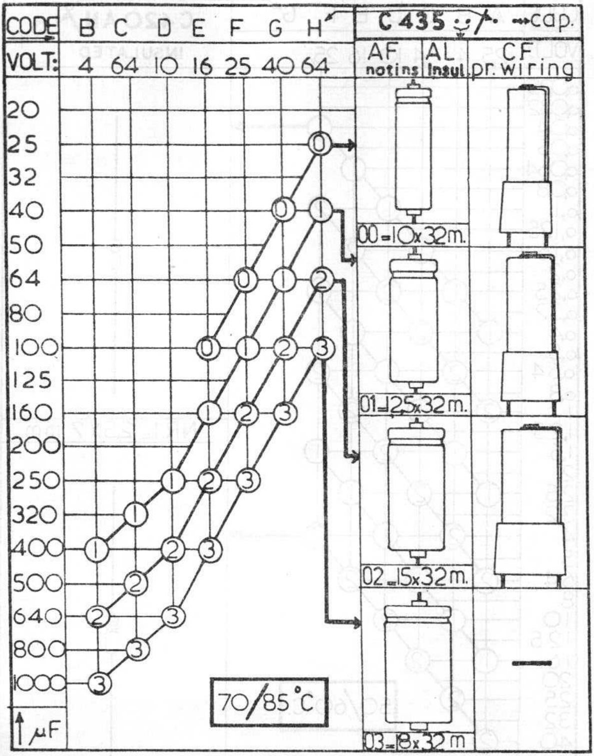
NR4 = 9 X 18 mm.



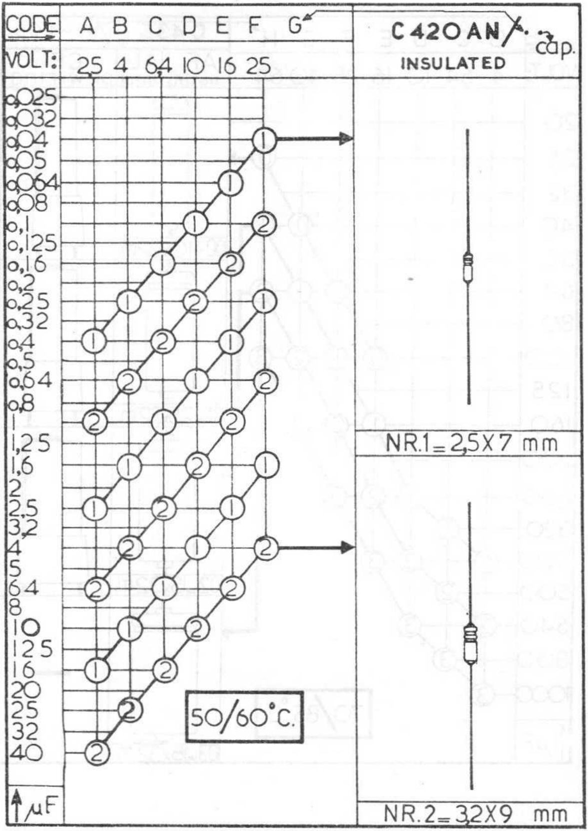
NR5 = 9X30 mm


CODE
A B C D E F G H
VOLT:
25 4 64 10 16 25 40 64
0,32
0,4
0,5
0,64
0,8
1
1,25
1,6
2
2,5
3,2
4
5
6,4
8
10
12,5
16
20
25
32
40
50
64
80
100
125
160
200
250
320
400
500
640
µF
1
2
3
4
5
60/70°C.*
* FOR NR.1 : 50/60°C.
C426
cap
AE 1) notins
AM ·insul
CE pr.wiring
1)
AD
AN
—
NR1 = 3,2X10 mm
—
NR 2 = 4,5X10 mm
NR 3
NR 4
NR 5

MIDGET ELECTROLYTIC CAPACITORS WITH HIGH CAPACITANCES



MIDGET TANTALUM CAPACITORS



CODE	A	B	C	D	E	F	G
VOLT:	2,5	4	6,4	10	16	25	
0,025							
0,032							
0,04						1	
0,05							
0,064					1		
0,08							
0,1				1		2	
0,125							
0,16			1		2		
0,2							
0,25		1		2		1	
0,32							
0,4	1		2		1		
0,5							
0,64		2		1		2	
0,8							
1	2		1		2		
1,25							
1,6		1		2		1	
2							
2,5	1		2		1		
3,2							
4		2		1		2	
5							
6,4	2		1		2		
8							
10		1		2			
12,5							
16	1		2				
20							
25		2					
32							
40	2						
↑μF							

50/60°C.

C420AN/... cap.

INSULATED

NR.1 = 2,5X7 mm

NR.2 = 3,2X9 mm

CLASS-IB CERAMIC CAPACITORS

C_n pF	*Tolerance*	*N 750 temp. coeff.* $(-500/-870)\times 10^{-6}$	*Length mm*	*N 150 temp. coeff.* $(-90/-190)\times 10^{-6}$	*Length mm*	*NPO temp. coeff.* $\pm 40\times 10^{-6}$	*Length mm*
0.8	± 0.25 pF	C304AH/NE8	12				
1	,,	/N1E	12				
1.2	,,	/N1E2	12				
1.5	,,	/N1E5	12				
1.8	,,	/N1E8	12			C304AB/N1E8	12
2.2	,,	/N2E2	12			/N2E2	12
2.7	± 0.5 pF	/L2E7	12			/L2E7	12
3.3	,,	/L3E3	12			/L3E3	12
3.9	,,	/L3E9	12			/L3E9	12
4.7	,,	/L4E7	12			/L4E7	12
5.6	,,	/L5E6	12	C304AC/L5E6	12	/L5E6	12
6.8	,,	/L6E8	12	/L6E8	12	/L6E8	12
8.2	,,	/L8E2	12	/L8E2	12	/L8E2	12
10	,,	/L10E	12	/L10E	12	/L10E	12
12	± 5%	/B12E	12	/B12E	12	/B12E	12
15	,,	/B15E	12	/B15E	12	/B15E	12
18	,,	/B18E	12	/B18E	12	/B18E	12
22	,,	/B22E	12	/B22E	12	/B22E	12
27	,,	/B27E	12	/B27E	12	/B27E	12
33	,,	/B33E	12	/B33E	12	/B33E	12
39	,,	/B39E	12	/B39E	12	/B39E	12
47	,,	/B47E	12	/B47E	12	/B47E	14
56	,,	/B56E	12	/B56E	14	/B56E	14
68	,,	/B68E	12	/B68E	14	/B68E	16
82	,,	/B82E	12	/B82E	16	/B82E	18

CLASS - IB CERAMIC CAPACITORS (continued)

C_n pF	*Tolerance*	*N 750 temp. coeff. $(-500/-870)\times 10^{-6}$*	*Length mm*	*N 150 temp. coeff. $(-90/-190)\times 10^{-6}$*	*Length mm*	*NPO temp. coeff. $\pm 40\times 10^{-6}$*	*Length mm*
100	± 5%	C304AH/B100E	12	C304AC/B100E	18	C304AB/B100E	20
120	,,	/B120E	14	/B120E	20	/B120E	22
150	,,	/B150E	16	/B150E	24	/B150E	26
180	,,	/B180E	18	/B180E	28	/B180E	30
220	,,	/B220E	20	/B220E	32	/B220E	34
270	,,	/B270E	22	/B270E	38		
330	,,	/B330E	26				
390	,,	/B390E	28				
470	,,	/B470E	34				
560	,,	/B560E	38				
680	,,	/B680E	44				
820	,,	/B820E	52				

For detailed information and full type range, see data sheet EP 2304/2.

CLASS - IB MIDGET TUBULAR CERAMIC CAPACITORS

Capacitance pF	*Tolerance*	*Type number*	*Length*	*Diameter*
			mm	
3.9	± 0.5 pF	C302AB/L3E9	12	1.8
4·7		/L4E7	12	
5.6	± 10%	/A5E6	12	
6.8		/A6E8	12	
1.2		/A8E2	12	
80	± 1 pF	/M10E	9	
11		/M11E	10	
12		/M12E	11	
13		/M13E	12	
15		/M15E	13.5	
16		/M16E	14.5	
18		/M18E	16	
20		/M20E	11	
22		/M22E	12	
24		/M24E	13	
27		/M27E	14.5	
30		/M30E	16	
33		C302AC/M33E	10.5	
36		/M36E	11.5	
39		/M39E	12.5	
43		/M43E	14	
47	± 2%	/C47E	15	
51		/C51E	16	
56		/C56E	11	
62		/C62E	12	
68		/C68E	13	
75		/C75E	11	
82		/C82E	12	
91		/C91E	13	
100		/C100E	14.5	
110		/C110E	16	
120		/C120E	13.5	
130		/C130E	14.5	
150		/C150E	16.5	
160		/C160E	17.5	
180		/C180E	20	
200		/C200E	22	

For detailed information see data sheet EP 2306.

CLASS-II CERAMIC CAPACITORS

Cₙ *pF*	*Tolerance*	*Type number*	*Length* *(mm)*	*Diameter* *(mm)*
1.5	± 1 pF	C322BD/M1E5	max. 6.5	max. 5.5
2	± 1	BD/M2E	max. 8.5	
3	± 1	BD/M3E	max. 8.5	
4	± 1	BD/M4E	max. 6.5	
5	± 1	BD/M5E	max. 8.0	
6	± 1	BD/M6E	max. 7.5	
7	± 1	BD/M7E	max. 8.5	
8	± 1	BD/M8E	max. 9	
9	± 1	BD/M9E	max. 6.5	
10	± 1	BD/M10E	max. 7	
15	± 20%	BD/P15E	max. 9	
22	± 20	BD/P22E	max. 7.5	
33	± 20	BD/P33E	max. 8.5	
47	± 20	BC/P47E	max. 6.5	
68	± 20	BC/P68E	max. 7	
100	± 20	BC/P100E	max. 9	
150	± 20	BC/P150E	max. 7.5	
220	± 20	BC/P220E	max. 8	
330	± 20	BC/P330E	max. 11	
470	± 20	BC/P470E	max. 8	
680	± 20	BC/P680E	max. 8.5	
1,000	± 20	BC/P1K	max. 13	
1,000	−20/+50	BA/H1K	max. 8	
1,500	± 20	BC/P1K5	max. 15	
1,500	−20/+50	BA/H1K5	max. 9	
2,200	± 20	BC/P2K2	max. 19	
2,200	−20/+50	BA/H2K2	max. 12	
3,300	−20/+50	BA/H3K3	max. 15	
4,700	−20/+50	BA/H4K7	max. 19	
6,800	−20/+50	BA/H6K8	max. 23	
10,000	−20/+50	BA/H10K	max. 29	

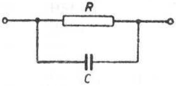
For detailed information and full type-range, see data sheet EP 2305.

TRIPLE CERAMIC BY-PASS CAPACITOR

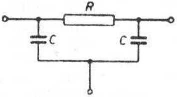
Type number: B8 600 01/02.
Capacitance: 3 × 1,500 pF (−20/+100% at 20 °C).
Working voltage: max. 250 V D.C.

Max. dimensions: 15 mm long
4.5 mm Δ.
For detailed information see data sheet EP 7803 (2).

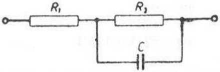
TUBULAR RC COMBINATIONS



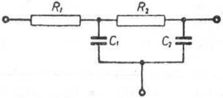
Circuit I



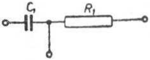
Circuit II



Circuit III



Circuit IV



Circuit V

TUBULAR R.C. COMBINATIONS

STANDARD COMBINATIONS

Circuit	*Type number*	*Resistances*		*Capacitances*		*Weight*
		R_1 (± 10%)	R_2 (± 10%)	C_1 (pF)	C_2 (pF)	g
I	**E551AA/24+40**	100 Ω	—	2,200 −20/+50%	—	0.75
	/24+44	100	—	4,700 −20/+50%	—	
	/26+38	150	—	1,500 −20/+50%	—	
	/26+40	150	—	2,200 −20/+50%	—	
	/27+38	180	—	1,500 −20/+50%	—	
	/27+40	180	—	2,200 −20/+50%	—	
	/28+38	220	—	1,500 −20/+50%	—	
	/28+40	220	—	2,200 −20/+50%	—	
	/29+38	270	—	1,500 −20/+50%	—	
	/51+20	18 kΩ	—	47 ± 10%	—	
	/51+38	18	—	1,500 −20/+50%	—	
	/52+32	22	—	470 ± 20%	—	
	/60+20	100	—	47 ± 10%	—	
	/60+24	100	—	100 ± 10%	—	
	/60+28	100	—	220 ± 20%	—	
	/68+20	470	—	47 ± 10%	—	
	/68+24	470	—	100 ± 10%	—	
	/68+32	470	—	470 ± 20%	—	
	/68+40	470	—	2,200 −20/+50%	—	
	/72+24	1 MΩ	—	100 ± 10%	—	

II	E553AA/36+38	1 kΩ	—	1,500 −20/+50%	1,500 −20/+50%	0.8
	/48+38	10	—	1,500 −20/+50%	1,500 −20/+50%	
	/56+35	47	—	820 −20/+50%	820 −20/+50%	
	/56+20	47	—	47 ± 10%	47 ± 10%	
	/56+24	47	—	100 ± 10%	100 ± 10%	
	/56+26	47	—	100 ± 20%	100 ± 20%	
	/60+24	100	—	100 ± 10%	100 ± 10%	
	/64+20	220	—	47 ± 10%	47 ± 10%	
III	E555AA/01	47 Ω ± 20%	$R_1+R_2=$150 Ω	2,700 −20/+50%	—	0.85
	/02	47	120	1,000 −20/+50%	—	
	/03	39	180	1,500 −20/+50%	—	
	/04	39	120	2,700 −20/+50%	—	
	/05	47	120	2,700 −20/+50%	—	
	/06	39	150	2,700 −20/+50%	—	
	/07	39	180	2,700 −20/+50%	—	
	/08	47	180	2,700 −20/+50%	—	
	/09	39	220	2,700 −20/+50%	—	
	/10	47	220	2,700 −20/+50%	—	
IV	E556AA/56+35	47 kR	47 kΩ	820 −20/+50%	820 −20/+50%	0.85
V	E554AA/24+38	100 Ω	—	1,500 −20/+50%	—	0.95
	/24+44	100	—	4,700 −20/+50%	—	
	/28+38	220	—	1,500 −20/+50%	—	
	/28+44	220	—	4,700 −20/+50%	—	
	/32+38	470	—	1,500 −20/+50%	—	
	/32+44	470	—	4,700 −20/+50%	—	
	/36+38	1 kΩ	—	1,500 −20/+50%	—	

STANDARD RANGE (continued)

Circuit	*Type number*	*Resistances*		*Capacitances*		*Weight* *g*
		*R*₁ *(± 10%)*	*R*₂ *(± 10%)*	*C*₁ *(pF)*	*C*₂ *(pF)*	
V	**E554AA/36+44**	1 kΩ	—	4,700 −20/+50%	—	0.95
	/40+38	2.2	—	1,500 −20/+50%	—	
	/40+44	2.2	—	4,700 −20/+50%	—	
	/44+38	4.7	—	1,500 −20/+50%	—	
	/44+44	4.7	—	4,700 −20/+50%	—	
	/48+38	10	—	1,500 −20/+50%	—	
	/48+44	10	—	4,700 −20/+50%	—	
	/52+38	22	—	1,500 −20/+50%	—	
	/52+44	22	—	4,700 −20/+50%	—	
	/56+38	47	—	1,500 −20/+50%	—	
	/56+44	47	—	4,700 −20/+50%	—	
	/60+38	100	—	1,500 −20/+50%	—	
	/60+44	100	—	4,700 −20/+50%	—	
	/64+38	220	—	1,500 −20/+50%	—	
	/64+44	220	—	4,700 −20/+50%	—	
	/68+38	470	—	1,500 −20/+50%	—	
	/68+44	470	—	4,700 −20/+50%	—	
	/72+38	1 MΩ	—	1,500 −20/+50%	—	
	/72+44	1	—	4,700 −20/+50%	—	

For detailed information see data sheet EP 7804.

VARIABLE CAPACITORS

Type number	Version	Variable capacitance (pF)		Zero capacitance (pF)		Torque (gcm)	Test voltage (V D.C.)	Dimensions $l \times d \times h$ (mm)
		Aerial section	*Oscillator section*	*Aerial section*	*Oscillator section*			
5127/00	2 gang AM	488	488	12.5	12.5	225	300	46 × 28 × 43.5
AC 1010	3 gang AM1)	2 × 489	511.8	2 × 10	13	225	300	46 × 28 × 43.5
AC 1014	3 gang AM1)	489	511.8	10	12.5	225	300	46 × 28 × 43.5
AC 1022	3 gang AM2)	326	126	12	11.5	150-500	300	46 × 28 × 43.5

1) Gear transmission: 1:3.

2) Gear transmission: 1:2 with higher torque for direct dial mounting.
Angle of rotation: $\alpha = 172.5°$.
Temp. range: -40 to $+85$ °C.
Temp. coeff.: $\Delta C/C = 10^{-4}/°C$.

For detailed information and full type-range, see data sheet EP 2637.

VARIABLE CAPACITOR FOR FM TUNING

Dimensions	*30 × 25 × 23 mm*
Type number	**AC 1020**
Frame	**cadmium-plated steel casing**
Vanes	**aluminium plates pressed in slotted brass spindle**
Variable capacitance	**2 × 10 pF**
Variation	**linear**
Tolerance	**± 0.25%**
Zero capacitance	**2 × 3.5 pF**
Test voltage	**300 V D.C.**
Insulation resistance	**min. 10^4 MΩ**
Parallel damping at 1.5 Mc/s	**min. 10 MΩ**
Torque	**max. 125 gcm**
Angle of spindle rotation	**517.5°**

For detailed information, see data sheet EP 2636.

VARIABLE CAPACITOR FOR TRANSISTORIZED POCKET-RADIOS

	Oscillator section	*Aerial section*
Variable capacitance	54 pF	180 pF
Zero capacitance	max. 10 pF	max. 10 pF
Trimming capacitance	9 pF	9 pF
Test voltage	300 V D.C.	
Insulation resistance	min. 10^4 MΩ	
Parallel damping at 1.5 Mc/s	min. 10 MΩ	
Torque	max. 100-350 gcm	
Angle of rotation	180°	
Type number	AC 1023	
Weight	45 g	

For detailed information, see data sheet EP 2637.

AIR-GAP TRIMMERS

Type number	*7864/01*	*AC 2011/60*
Variable capacitance	min. 27 pF	min. 58 pF
Zero capacitance	max. 3 pF	max. 3.5 pF
Parallel damping	min. 10 MΩ	min. 3 MΩ
Test voltage	300 V D.C.	300 V D.C.
Insulation resistance	min. 5,000 MΩ	min. 5,000 MΩ
Torque	min. 300 gcm	min. 300 gcm
Max. total length	38.5 mm	50 mm

For detailed information, see EP sheet EP 2635 (2).

TUBULAR CERAMIC TRIMMERS

Type number	*C004AA/12E*	*C004AA/3E*	*C004AA/6E*
Maximum length (mm) (including panel)	35	19	25
Capacitance (pF)	1-13	0.7-3.7	0.8-6.8
Temp. coeff. $\Delta C/C$	$-300 \times 10^{-6}/^\circ\mathrm{C}$	$-200 \times 10^{-6}/^\circ\mathrm{C}$	$-250 \times 10^{-6}/^\circ\mathrm{C}$
Test voltage (V D.C.)	1000	1000	1000
Insulation resistance	min. 10,000 MΩ		
Parallel damping	min. 3 MΩ		
Torque	max. 400 gcm		

For detailed information, ask for complete documentation.

INSULATED CRACKED-CARBON RESISTORS

TABLE 1

Resistance range: from 10 Ω to R_{max}, according to the tables below.

W_{max} at 40 °C W	W_{max} at 70 °C W	Type number xxx: see table 2	Tolerance %	R_{max} MΩ	E_{peak} V	Diameter max.	Length mm max.
0.5	0.25	B8 305 05B/xxx	± 5	0.82	500	3.9	10.9
		B8 305 05A/xxx	± 10	10			
1.0	0.5	B8 305 06B/xxx	± 5	1.3	700	5.3	16.1
		B8 305 06A/xxx	± 10	10			
1.5	1	B8 305 07B/xxx	± 5	2.2	1,000	7	25.5
		B8 305 07A/xxx	± 10	10			
3.0	2	B8 305 08B/xxx	± 5	10	1,400	9.3	36
		B8 305 08A/xxx	± 10	10			

For detailed information and colour code, see data sheet EP 1112 (3).

TABLE 2

R_{nom} *Ω*	*Indication xxx*	R_{nom} *Ω*	*Indication xxx*	R_{nom} *Ω*	*Indication xxx*	R_{nom} *Ω*	*Indication xxx*	R_{nom} *Ω*	*Indication xxx*	R_{nom} *Ω*	*Indication xxx*
10	10E	100	100E	1,000	1K	10,000	10K	100,000	100K	1	1M
12	12E	120	120E	1,200	1K2	12,000	12K	120,000	120K	1.2	1M2
15	15E	150	150E	1,500	1K5	15,000	15K	150,000	150K	1.5	1M5
18	18E	180	180E	1,800	1K8	18,000	18K	180,000	180K	1.8	1M8
22	22E	220	220E	2,200	2K2	22,000	22K	220,000	220K	2.2	2M2
27	27E	270	270E	2,700	2K7	27,000	27K	270,000	270K	2.7	2M7
33	33E	330	330E	3,300	3K3	33,000	33K	330,000	330K	3.3	3M3
39	39E	390	390E	3,900	3K9	39,000	39K	390,000	390K	3.9	3M9
47	47E	470	470E	4,700	4K7	47,000	47K	470,000	470K	4.7	4M7
56	56E	560	560E	5,600	5K6	56,000	56K	560,000	560K	5.6	5M6
68	68E	680	680E	6,800	6K8	68,000	68K	680,000	680K	6.8	6M8
82	82E	820	820E	8,200	8K2	82,000	82K	820,000	820K	8.2	8M2

For detailed information and colour code, see data sheet EP 1112 (3).

MIDGET INSULATED CRACKED-CARBON RESISTORS

Length Diameter	7 mm 1.6 mm
Resistance range	from 10 Ω up to 10 MΩ, ± 10% or ± 5% (see "Insulated cracked-carbon resistors")
Permissible load	max. 0.20 W at an ambient temperature of 40 °C, and max. 0.10 W at an ambient temperature of 70 °C
E_{peak}	max. 100 V
Type number	B8 305 00A/xxx (tolerance = ± 10%), or B8 305 00B/xxx (tolerance = ± 5%).

For detailed information and colour code, see data sheet EP 1109 (3).

LOAD RESISTORS 5.5 - 16 W

TABLE 1

W_{max} at 40 °C W	*Type number xxx: see table 2*	*Tolerance %*	*R_{min} Ω*	*R_{max} Ω*	*E_{peak} V*	*Length mm*
5.5	83540B/xxx	± 5	4.7	15,000	400	19
8	83541B/xxx	± 5	4.7	33,000	725	28
10	83542B/xxx	± 5	10	56,000	1,050	42
16	83543B/xxx	± 5	15	100,000	1,800	65

TABLE 2

R_{nom} Ω	*Indication xxx*	*R_{nom} Ω*	*Indication xxx*	*R_{nom} Ω*	*Indication xxx*
4.7	4E7	150	150E	4,700	4K7
5.6	5E6	180	180E	5,600	5K6
6.8	6E8	220	220E	6,800	6K8
8.2	8E2	270	270E	8,200	8K2
10	10E	330	330E	10,000	10K
12	12E	390	390E	12,000	12K
15	15E	470	470E	15,000	15K
18	18E	560	560E	18,000	18K
22	22E	680	680E	22,000	22K
27	27E	820	820E	27,000	27K
33	33E	1,000	1K	33,000	33K
39	39E	1,200	1K2	39,000	39K
47	47E	1,500	1K5	47,000	47K
56	56E	1,800	1K8	56,000	56K
68	68E	2,200	2K2	68,000	68K
82	82E	2,700	2K7	82,000	82K
100	100E	3,300	3K3	100,000	100K
120	120E	3,900	3K9		

For detailed information and full type-range, see data sheet EP 1018/1 (2).

CARBON POTENTIOMETERS 23 mm ø

Standard resistance values (± 20%):

Linear (0.25 W)	*Linear (0.25 W)*	*Logarithmic (0.125 W)*	*Logarithmic (0.125 W)*
300 Ω	100 kΩ	1 kΩ	50+450 kΩ
1 kΩ	200	2	1 MΩ
2	500	5	0.1+0.9
5	1 MΩ	10	0.2+0.8
10	0.4+0.6	20	2
20	2	4+16	0.2+1.8
50		50	0.4+0.6
		100	
		200	
		40+160	
		500	

For detailed information and full type-range, see data sheet EP 1305.

CARBON TRIMMING POTENTIOMETERS

Standard resistance (± 20%)	*Type number*	*Standard resistance (± 20%)*	*Type number*
0.5 kΩ	E097AA/500E	50 kΩ	E097AA/50K
1	/1K	100	/100K
2	/2K	200	/200K
5	/5K	500	/500K
10	/10K	1 MΩ	/1M
20	/20K	2	/2M

For detailed information see data sheet EP 1307.

NTC RESISTORS FOR RADIO AND TELEVISION

Type number	*R at 25 °C (Ω)*	*W_{max} W*	*Normal operating conditions*		*Dissipation constant mW/°C*	*Recovery time sec*	*Weight g*
			mA	*Ω*			
VA 1026	300-500	2.5	300	25-32	30	350	10
VA 1015	645-1,210	6	300	35-48	60	450	15
VA 1006	820-1,315	2	200	36-52	16	150	2.6
100026/01	1,750-3,250	3	100	200-250	20	190	4.6
100102	2,470-5,370	4	300	38-50	24	285	6
83922	3,870-7,750	3	200	60-90	10	110	1.2
100092	6,700-12,600	3	100	200-280	10	140	1.6
VA 1008	107,000-168,000	2	10	7,200-10,800	14	90	1.1
B832020	0.55-1.35	1	2.2 A	0.15-0.25	14	70	2

For detailed information and full type-range, see data sheet EP 1510 (3).

LIGHT DEPENDENT RESISTOR

Type number	B8 731 03.
Dark value	R_D = min. 10 MΩ (measured in total darkness).
Light value	R_L = 75-300 Ω (measured at 1,000 lux).
Recovery rate	v = min. 200 kΩ/sec (i.e. the resistance drop per sec at fading light-intensity).
Permissible load	W_{max} = 0.2 W at an ambient temperature of 40 °C.
Permissible voltage	E_{max} = 110 V_{peak} (provided that W_{max} is not exceeded).
Ambient temperature	−20/+60 °C.
Capacitance	max. 6 pF.

VOLTAGE DEPENDENT RESISTORS (VDR - "VARISTORS")

Type number	*Electrical characteristics*	*Coding*	*Version*	*Application*)*
E298ED/P268	$i = 10$ mA at 1200 V ± 20% $\beta = 0.16\text{-}0.21$	grey dot	rod; lacquered	1
E298GD/A258	$i = 10$ mA at 470 V ± 10% $\beta = 0.18\text{-}0.25$	green dot	rod; not lacquered	1
E298GD/A260	$i = 10$ mA at 560 V ± 10% $\beta = 0.18\text{-}0.25$	blue dot	idem	1
E298GD/A262	$i = 10$ mA at 680 V ± 10% $\beta = 0.18\text{-}0.25$	violet dot	idem	1
E298GD/A265	$i = 10$ mA at 910 V ± 10% $\beta = 0.16\text{-}0.21$	white dot	idem	1 and 6
E298GD/A269	$i = 10$ mA at 1300 V ± 10% $\beta = 0.16\text{-}0.21$	red dot	idem	3 and 6
E298ZZ/01	$i = 2$ mA at 950 V ± 10% $\beta = 0.16\text{-}0.21$	tan dot	idem	3 and 6
E299CC/P340	$i = 1$ mA at 82 V ± 20% $\beta = 0.18\text{-}0.25$	yellow dot	7.5 mm disc; not lacquered	5
E299CC/P342	$i = 1$ mA at 100 V ± 20% $\beta = 0.16\text{-}0.21$	red dot	idem	2 and 5
E299DD/A334	$i = 1$ mA at 47 V ± 10% $\beta = 0.16\text{-}0.21$	orange orange yellow	12.5 mm disc; lacquered	8
VD9010	$60\ \mu A < i < 120\ \mu A$ at 100 V $\beta = 0.16\text{-}0.21$	—	7.5 mm disc; not lacquered	4 and 7

For detailed information see our data sheet EP 1526.

*) 1: Damping the primary of the frame output transformer in television circuits to suppress ringing and flashovers.
2: Stabilization of the 110° line timebase.
3: Stabilization of the 110° line timebase without triode.
4: Frequency stabilization of the line oscillator.
5: Protection circuit against catastrophic increase of the EHT when the stabilization circuit falls out.
6: Rectifier for asymmetric pulses (negative voltage for A.G.C.)
7: Linearization of frame deflection.
8: S-correction.

TUBE SOCKETS

If more than one type of socket is available for a given base, the choice depends on the application of the tube.

Tube base	*Cat. sheet*	*Type number of socket*	*Number of contacts*	*Material*
Diheptal (B14A)	EP 3412 (3)	5914/20	14	Synthetic resin
Duodecal (B12A)	EP 3412 (3)	5912/01	7	Resin-bonded paper
	EP 3412 (3)	5912/20	12	Synthetic resin
	EP 3412 (3)	5912/22	7	Synthetic resin
Edison-E14	EP 3413/5	88168/01	Screw + centre contact	Synthetic resin
-E27	EP 3413/5	40418		Synthetic resin
-E40	EP 3413/5	65909BG/01		Ceramic
FJ	EP 3412 (3)	5915/00	9	Resin-bonded paper
Giant (B5F)	EP 3413/3	40211/01	5	Ceramic
Jumbo (B4F)	EP 3413/2 (2)	40408	4	Ceramic
Loctal (B8G)	EP 3411/2 (2)	5902/02	8	Synthetic resin
	EP 3411/2 (2)	40213	8	Ceramic
	EP 3413/4 (2)	40210/02	8	Ceramic
(B9G)	EP 3411/2	5906/20	9	Synthetic resin
	EP 3411/2	40202	9	Ceramic
Magnal (B11A)	EP 3412 (3)	5911/20	11	Synthetic resin
Medium (G)	EP 3413/2 (2)	40218/03	4	Ceramic
(N)	EP 3413/3	40219	5	Ceramic
Miniature (B7G)	EP 3410/1 (6)	B8 700 00	7	Resin-bonded paper
	EP 3410/1 (6)	5909/36	7	Ceramic
	EP 3410/1 (6)	B8 700 04	7	Ceramic
	EP 3410/1 (6)	5905/35	7	Ceramic
	EP 3410/1 (6)	B8 700 05	7	Ceramic
Cans $H = 34.9$ mm	EP 3410/1 (6)	56900		Nickel-plated brass
$= 44.5$	EP 3410/1 (6)	56901		Nickel-plated brass
$= 57.2$	EP 3410/1 (6)	56902		Nickel-plated brass
		B8 700 26	7	Ceramic
		B8 700 27	7	Ceramic

Noval (B9A)	EP 3410/3 (5)	5908/01	9	Resin-bonded paper
	EP 3410/3 (5)	B8 700 19	9	Ceramic
	EP 3410/3 (5)	B8 700 20	9	Ceramic
Cans $H=41$ mm	EP 3410/3 (5)	B8 700 10		Nickel-plated brass
$=52$	EP 3410/3 (5)	B8 700 11		Nickel-plated brass
$=57.5$	EP 3410/3 (5)	B8 700 12		Nickel-plated brass
$=63$	EP 3410/3 (5)	B8 700 13		Nickel-plated brass
$=74$	EP 3410/2 (5)	B8 700 14		Nickel-plated brass
		B8 700 28	9	Ceramic
		B8 700 29	9	Ceramic
O	EP 3413/3	40465	5	Synthetic resin
Octal	EP 3411/1 (2)	5903/12	8	Synthetic resin
	EP 3411/1 (2)	5903/13	8	Ceramic
		B8 700 43	8	Ceramic
	EP 3413/4 A	40222	7	Special plastic
P	EP 3413/4 A	5900/02	8	Synthetic resin
Rimlock (B8A)	EP 3410/2	5904/01	8	Resin-bonded paper
	EP 3410/2	5904/36	8	Ceramic
	EP 3410/2	B8 700 39	8	Ceramic
		B8 700 30	8	Ceramic
Septar (B7A)	EP 3413/4 A	40202	7	Ceramic
Special	EP 3413/1 (3)	40407	2	Resin-bonded paper
	EP 3413/1 (3)	1285	2	Ceramic
(B3A)	EP 3413/1 (3)	40406	3	Synthetic resin
	EP 3413/1 (3)	1287	3	Resin-bonded paper
	EP 3413/1 (3)	40209	3	Resin-bonded fabric
Subminiature (B8D)	EP 3410/1 (6)	5907/23	8	Synthetic resin
Super giant	EP 3413/3	40216	5	Ceramic
Super jumbo (B4D)	EP 3413/2 (2)	40403	4	Ceramic
Transistor	EP 3415	B8 700 01/00	3	Synthetic resin
V	EP 3412 (3)	5900/20	5	Synthetic resin
W	EP 3413/2 (2)	02214	4	Resin-bonded paper

Bulletin with complete data on application.

LOUDSPEAKERS

ALL LOUDSPEAKERS ARE PROVIDED WITH TICONAL MAGNET SYSTEMS

M = Twin-cone loudspeakers to be used up to 18,000 c/s
X = Increased sensitivity for frequencies of 2,000-5,000 c/s
Y = Increased sensitivity for frequencies of 2,000-4,000 c/s
Z = Increased sensitivity for frequencies of 1,000-3,500 c/s

Type number	*Max. permissible load*	*Output at 400 c/s*	*Voice coil impedance at 1,000 c/s*	*Cone diameter (sound board hole)*	*Resonance frequency*
	watt	%	*ohm*	*mm*	*(about) c/s*
AD 1300 Z	2	1.6	3	72	275
AD 1400 Z	3	2	3	96	185
AD 2200 Z	1	1.5*)	3	60	350
AD 2218 Z	0.3	1.8*)	3	43	350
AD 2300	2	2	3	72	230
AD 2300 CZ	2	3.5	150	72	275
AD 2500	3	1.8	3	105	130
AD 2700	3	2	5	141	90
AD 2700 M	3	2	5	141	90
AD 2800	6	3	5	179	75
AD 2800 M	6	3	5	179	75
AD 3500	3	4	5	105	130
AD 3500 M	3	4	5	105	130
AD 3500 AM	3	4	800	105	130
AD 3500 BM	3	4	400	105	130
AD 3700	3	6	5	141	90
AD 3700 M	3	6	5	141	90
AD 3800	6	6	5	179	75
AD 3800 M	6	6	5	179	75
AD 3800 AM	6	6	800	179	75

*) Efficiency at 800 c/s.
For detailed information see our data sheet EP 7501 (2).

Frequency limit	*Magnetic induction in the air gap*	*Total magnetic flux*	*Outer diameter*	*Distance between centre of mounting holes*	*Mounting depth*
c/s	*gauss*	*maxwell*	*mm*	*mm*	*mm*
7,000	6,800	9,500	80	92	44
6,000	6,800	9.500	105	119	50
11,000	6,500	12,100	63.5	74	23
4,500	6,000	6,000	52	60	17
20,000	8,500	15,800	80	92	55
6,500	8,500	15,800	80	92	55
15,000	8,500	15,800	121	119	64.5
15,000	8,500	15,800	155	156	73
19,000	8.500	15,800	155	156	73
12,000	8,500	15,800	191.5	194	83
18,000	8.500	15,800	191.5	194	83
16,000	11,000	26,200	121	119	69.5
20,000	11,000	26,200	121	119	69.5
20,000	11,000	26,200	121	119	69.5
20,000	11,000	26,200	121	119	69.5
15,000	11,000	26,200	155	156	79
18,000	11,000	26,200	155	156	79
12,000	11,000	26,200	191.5	194	89
18,000	11,000	26,200	191.5	194	89
18,000	11,000	26,200	191.5	194	89

SPACE ECONOMY LOUDSPEAKERS

Type number	*Max. permissible load*	*Output at 400 c/s*	*Voice coil impedance at 100 c/s*	*Cone diameter (sound board hole)*	*Resonance frequency*
	watt	%	*ohm*	*mm*	*(about) c/s*
AD 3460	**3**	**4**	**5**	**141 × 89¹)**	**130**
AD 3460 M	**3**	**4**	**5**	**141 × 89¹)**	**130**
AD 3690	**6**	**5.5**	**5**	**219 × 146¹)**	**80**
AD 3690 M	**6**	**5.5**	**5**	**219 × 146¹)**	**80**
AD 3721	**3**	**6**	**3**	**148**	**110**
AD 3414 Z	**3**	**7**	**3**	**100**	**185**

¹) Oval types; maximum dimensions.

For detailed information see our data sheet EP 7511 (2).

Frequency limit	*Magnetic induction in the air gap*	*Total magnetic flux*	*Outer diameter*	*Distance between centres of mounting holes*	*Mounting depth*
c/s	*gauss*	*maxwell*	*mm*	*mm*	*mm*
18,000	11,000	26,000	155 × 103	117.5 × 92	70
19,000	11,000	26,000	155 × 103	117.5 × 92	70
14,000	11,000	26,000	234 × 161	167 × 118	90
18,000	11,000	26,000	234 × 161	167 × 118	90
14,000	12,000	22,300	169	156	35.5
8,000	12,000	22,300	106	119	42.5

HI-FI LOUDSPEAKERS

Type number	*Max. permissible load*	*Output at 400 c/s*	*Voice coil impedance at 1,000 c/s*	*Cone diameter (sound board hole)*	*Resonance frequency*
	watt	*%*	*ohm*	*mm*	*(about) c/s*
9710	10	5	7	195	50
9710 M	10	5	7	195	50
9710 A	10	5	800	195	50
9710 B	10	5	400	195	50
9710 AM	10	5	800	195	50
9710 BM	10	5	400	195	50
AD 4000 M	10	6	7	242	50
AD 4200 M	20	7	7	300	45
AD 4800 M	6	10	5	195	60
AD 5200 M	20	14	7	300	45

Of the loudspeakers AD 4000 M, AD 4200 M, AD 4800 M and AD 5200 M are also single cone versions available.

For detailed information see our data sheet EP 7521 (2).

Frequency limit	*Magnetic induction in the air gap*	*Total magnetic flux*	*Outer diameter*	*Distance between centres of mounting holes*	*Mounting depth*
c/s	*gauss*	*maxwell*	*mm*	*mm*	*mm*
15,000	8,000	97,600	216	—	116
20,000	8,000	97,600	216	—	116
15,000	8,000	97,600	216	—	116
15,000	8,000	97,600	216	—	116
20,000	8,000	97,600	216	—	116
20,000	8,000	97,600	216	—	116
18,000	8,000	97,600	262	244	138
18,000	8,000	97,600	315	294	156
18,000	13,000	58,300	206	194	124
18,000	11,000	134,000	315	294	166

Type number	*Primary impedance*	*Secondary impedance*	*Power*	*Efficiency at 400 c/s*	*Transformer ratio*	*Primary inductance*
	Ω	*Ω*	*W*	%		*H*
AD 9008	5,400	3-5	3	75	45-34	10
AD 9010	9,000	3-5	3	76	60-42	10
AD 9014	—	—	—	70	1	10
AD 9015	360	3	0.2	85	11	0.6
AD 9018	2,400	3-5	6	75	31-22	6.5
AD 9020	5,400	3-5	6	76	46-33	10
AD 9022	2,400	3-5	3	82	29-22	2.5
AD 9032	6,600	7-14	15	88	30-22	28
AD 9030/03	9,000	7-14	15	90	36-25	28
AD 9046	5,400	3-5	6	85	46-33	11
AD 9047	6,600	7-14	35	86	31-22	70
AD 9048	—	—	—	7.0	0.65	1.1
AD 9049	52	3	0.3	85	4.2	0.3
AD 9050	—	—	—	75	1.15	3.4
AD 9051	98	3	0.75	80	5.7	0.48

For detailed information see our data sheet EP 7301 (2)

TRANSFORMERS

D.C. bias magnetisation	*Primary resistance*	*Frequency response between —3 dB points (reference 1,000 c/s)*	*Distortion is 1% at*	*Core height*	*Core width*	*Core depth*	*Weight*
mA	*Ω*	*c/s*	*c/s*	*mm*	*mm*	*mm*	*g*
36	550	50-100,000	60	32	40	16	190
25	600	100-16,000	110	32	40	16	190
1	400	20-40,000	70	16	21	7.5	20
—	16	45-35,000	160	16	21	7.5	20
70	320	45-10,000	55	40	50	20	350
70	540	40-20,000	65	40	50	20	350
65	200	60-15,000	75	32	40	16	190
5	335	20-60,000	60	62.5	75	25	1025
5	350	20-60,000	60	62.5	75	25	1025
50	190	50-50,000	75	50	55	55	
—	180	10-60,000	30	108	90	45	3050
4.5	106			20	16	6.5	
—	2.6			25.6	20.5	8	
4	123			31.2	25	12.5	
—	9.5			25	31.2	12.5	

F.M. TUNERS

	AP 2110/00	AP 2110/01
Wave range	87-100.5 Mc/s ± 150 kc/s	87-108.5 Mc/s ± 150 kc/s
Padding deviation	max. 0.5 Mc/s	max. 0.5 Mc/s
Total gain	min. 140 ×	min. 100 ×
IF band width	180-220 kc/s (3 dB)	180-220 kc/s (3 dB)
Frequency drift	max. 30 kc/s	max. 30 kc/s
Radiation: fundamental oscillation (measured at 30 m) second harmonic	max. 50 μV/m max. 10 μV/m	max. 50 μV/m max. 10 μV/m

IF BAND-PASS FILTER AP 1001

Type number	*Normal IF frequency in kc/s*	*Frequency limit in kc/s*
AP 1001/41	441	435-454
AP 1001/52	452	446-464
AP 1001/70	470	464-483

IF BANDPASS-FILTERS

AP 1014/52 AND AP 1014/70

Type number	AP 1014/52	AP 1014/70
Frequency limits	446-464 kc/s	464-483 kc/s
Quality factor Q	140	140
kQ	1.05	1.05
Capacitance across primary	110 pF	110 pF
Capacitance across secondary	110 pF	110 pF
Average frequency drift	6 c/s/°C	6 c/s/°C
Max. working temperature	85 °C	85 °C

MAINS TRANSFORMERS

Type AD 9027

Primary: 90, 110, 127, 145, 190, 220 V.
Secondary: 560 V with central tap (65 mA);
6.3 V with tap at 4 V (1.1 A); 6.3 V (2.5 A).

Type AD 9028

Primary: 90, 110, 125, 145, 200, 225, 245 V.
Secondary: 560 V with central tap (90 mA);
4 V (1.1 A); 2-4-6.3 V (3.5 A); 6.3-4 V (1.1 A).

Type AD 9029

Primary: 90, 110, 125, 145, 200, 220, 245 V.
Secondary: 650 V with central tap (130 mA); 4-6.3 V (1.2 A); 6.3 V (4.5 A)

TV COMPONENTS

110° Deflection

Deflection unit AT 1009/02
Line-output transformer AT 2021/21
Frame-output transformer AT 3507
Frame-blocking transformer AT 3002 - Linearity control AT 4008

Channel Selector

VHF :	AT	3538
	AT	3539
	AT	3540
	AT	3541
UHF:	AT	6322

INDUSTRIAL COMPONENTS

INDUSTRIAL COMPONENTS

CAPACITORS

Hermetically-sealed paper capacitors, tubular and box-type
- High-tension capacitors
- Power-factor capacitors
- Smoothing capacitors

Mica capacitors
Polystyrene capacitors
Electrolytic capacitors
Fixed air-gap and variable capacitors
Air-gap and ceramic trimmers

RESISTORS AND POTENTIOMETERS

Wire-wound precision resistors
Precision cracked-carbon resistors
Load resistors
Wire-wound low-power potentiometers
Load potentiometers
VDR, NTC and LDR resistors

ELECTROMECHANICAL COMPONENTS

Holders for lamps, tubes and fuses
Components for mounting and control

VARIABLE TRANSFORMERS

QUARTZ-CRYSTAL UNITS

DIRECTIONAL ISOLATORS

COUNTING UNITS FOR PROGRAMMED CONTROL

PRINTED-WIRING BOARDS

UNITS FOR COMPUTERS AND AUTOMATION EQUIPMENT

TELEPHONE CAPSULES

TROPIC-PROOF PAPER CAPACITORS

Type	*Cat. sheet*	*Working voltage at 40 °C*	*Capacitance*	*Tolerance*	*Instability*
Tubular rubber-sealed metal casing	EP 2007 (2)	Max. 180, 350, 700, 1,000 V D.C.	1,000 pF-1 μF	± 10%	Max. ± 5%
Tubular ceramic casing	EP 2010 (2)	Max. 2,000-10,000 V D.C.	470 pF-0.1 μF	± 10%	Max. ± 2%
D.C. all-metal box-type	EP 2105 (2)	Max. 250, 500, 1,000, 2,000, 3,400 V D.C.	0.1-25 μF	± 10%	Max. ± 5%
D.C. all-metal box-type (metallized paper)	EP 2113	Max. 125, 500 V D.C.	1-100 μF	± 20%	Max. ± 5%
Smoothing capacitors	EP 2107 EP 2123	Max. 2-27 kV D.C.	1-16 μF	± 10%	Max. ± 5%
Can-type for fluorescent lamps	EP 2128	Max. 500 V (50 c/s)	0.8-12.7 μF	± 5%	Max. ± 5%
Power-factor capacitors	EP 2103	Nom. 220, 380, 400, 440, 500 V (50 c/s)	7-924 μF	—5 to + 10%	Max. ± 5%
Power factor capacitors with chlorinated impregnant	EP 2120 (2)	Nom. 220, 380, 500 V (50 c/s)	8-1,320 μF	—5 to + 15%	Max. ± 5%
High-tension capacitors	EP 2102	Max. 20-225 kV D.C.	up to 0.4 μF	± 10%	

Type	*Capacitive power*	*Losses*	*Ambient temp.*	*Insulation resistance at 20 °C*	*Remarks*
Tubular rubber-sealed metal casing		Max. 0.80% at 1 kc/s	—40 to +85 °C	R = min. 10,000 MΩ ($C < 0.2\ \mu$F) RC = min. 2,000 sec ($C \lesssim 0.2\ \mu$F)	Available with insulating coat and extra-sealed
Tubular ceramic casing		Max. 0.80% at 1 kc/s	—40 to +70 °C	R = min. 20,000 MΩ ($C < 0.1\ \mu$F) RC = min. 2,000 sec ($C \lesssim 0.1\ \mu$F)	Suitable at high altitudes
D.C. all-metal box-type		Max. 0.40% at 50 c/s	—40 to +70 °C	R = min. 10,000 MΩ ($C < 0.2\ \mu$F) RC = min. 2,000 sec ($C \leq 0.2\ \mu$F)	Glass or ceramic bushing insulators
D.C. all-metal box-type (metallized paper)		Max. 0.40% at 50 c/s	—40 to +70 °C	RC = min. 1,000 sec (125 V) = min. 2,000 sec (500 V)	Glass bushing insulators
Smoothing capacitors		Max. 0.40% at 50 c/s	—40 to +70 °C	RC = min. 2,000 sec	Ceramic bushing insulators
Can-type for fluorescent lamps		Max. 0.40% at 25 °C	—20 to +70 °C	RC = min. 2,000 sec	Complies with Underwriters Test
Power-factor capacitors	1-20 kvar	Max. 0.33% at 20 °C	—40 to +40 °C		Single-phase or three-phase; discharge resistors built in
Power-factor capacitors with chlorinated impregnant	1.25-25 kvar	Max. 0.33% at 20 °C	—20 to +40 °C		Single-phase or three-phase; discharge resistors between terminals
High-tension capacitors	Output: 15-2,800 Wsec			RC = min. 2,000 sec	Non-listed units to specification

FIXED AIR-GAP AND VARIABLE CAPACITORS

Type	*Cat. sheet*	*Peak voltage*[1] *stator-rotor (V)*	*Variable capacitance (pF)*	*Tolerance*	*Max. zero cap. (pF)*
Air-gap trimmers	EP 2614 (2)- 2620/3	150-500 (350-1,000)	2.5-250 (1-40)	+ 10% (min. 1 pF)	3-11.5 (2-5.5)
Concentric air-gap trimmers	EP 2631 (3)	150-350	6.4-25	+ 20%	4
Tubular ceramic trimmers	EP 2633	800	Min. 2.5, 5, 10		0.65-1
Correcting capacitors	EP 2602/1 (2)- 2602/3 (2)	200-500 (500-1,300)	2.5-100 (1.6-10)	+ 10% (min. 1 pF)	2-4 (1-2)
Tuning capacitors (single to quadruple)	EP 2621 (2)- 2623 (2)	150-800 (250-1,500)	1-4 × 16 (6.4) to 1-4 × 640 (125)	+ 4% (min. 1 pF)	9-15 (4.5-11)
Transmitting capacitors	EP 2607-2612	250-3,500 (500-5,000)	16-250 (16-100)	+ 10%	13-85 (5-22)

---

[1] Relative air humidity max. 80%, pressure min. 700 mm mercury
The values between brackets apply to split-stator types.

Type	*Apparent power*	*Ambient temp.*	*Temp. coeff.*	*Insulation resistance*	*Torque gcm*	*Remarks*
Air-gap trimmers		—40 to +85 °C	Max. 150 to 250×10^{-6}	Min. 1,000 MΩ	200-600	Available with split stator and in differential design
Concentric air-gap trimmers		—40 to +85 °C	Max. 50 to 200×10^{-6}	Min. 10,000 MΩ	100-500	Highly stable Suitable for V.H.F.
Tubular ceramic trimmers		—40 to +85 °C	Max. 1.5 to 4×10^{-4}	Min. 10,000 MΩ	100-500	Small cross section Suitable for V.H.F.
Correcting capacitors		—40 to +85 °C	Max. 200×10^{-6}	Min. 1,000 MΩ	150-350	Available with split stator and in differential design
Tuning capacitors (single to quadruple)		—40 to +85 °C	Max. 100 to 150×10^{-6}	Min. 5,000 MΩ	50-800	Available with split stator and in differential design
Transmitting capacitors	5, 25, 60 kVA at 20 Mc/s	—40 to +60 °C	Max. 100×10^{-6}	Min. 1,000 MΩ	200-2,000	Available with split packs

MICA, POLYSTYRENE AND ELECTROLYTIC CAPACITORS

Type	*Cat. sheet*	*Max. working voltage*	*Capacitance*	*Tolerance*	*Instability*
Moulded midget mica capacitors	EP 2417	500 V D.C.	5.6-2,700 pF	± 10, 5, 2, 1% or 1 pF	Max. ± 0.5%
Moulded precision mica capacitors (low values)	EP 2401	250, 500 V D.C.	10-12,000 pF	± 5, 1, 0.5% or 1 pF	Max. ± 0.5 pF or 0.2-0.4%
Moulded precision mica capacitors (high values)	EP 2403	500 V D.C.	7,500 pF-0.3 μF	± 10, 5, 2, 1, 0.5%	Max. ± 0.15%
Tubular high-precision mica cap/ glass casing	EP 2406	200 V D.C.	10-25,000 pF	± 1, 0.5, 0.1% or 0.5 pF	Max. ± 0.10%
Low-power stacked mica transmitting capacitors	EP 2405	750, 1,500, 2,250 V D.C.	33-47,000 pF	± 10, 5%	Max. ± 5%
Cable-balancing mica capacitors	EP 2407 (2)	500 V D.C., 350 V A.C.	10-1,000 pF, 4 × (30-140)	± 5%	Max. ± 2%
Tubular polystyrene capacitors	EP 2017 (2)	50, 350, 700 V D.C.	1,000 pF-0.18 μF	± 5, 2%	Max. ± 0.5%
Tubular polyst. cap. rubber-sealed metal casing	EP 2003	50, 250, 700 V D.C.	1,000 pF-0.18 μF	± 5, 2%	Max. ± 0.5%
Polyst. cap. all-metal box-type	EP 2117	125, 350, 500 V D.C.	22,000 pF-3.3 μF	± 5, 1%	Max. ± 0.5%
Electrolytic cap. with octal base	EP 2202 (3)	25-500 V D.C.	2 × 12.5-2 × 500 μF	—10 to +30/50%	Max. —25 to + 30%

Type	*Losses*	*Ambient temp.*	*Temp. coeff.*	*Insulation resistance at 20 °C*	*Remarks*
Moulded midget mica capacitors	Max. 0.10-0.20% at 1.5 Mc/s	—40 to +85 °C	0 to +60 $\times 10^{-6}$	Min. 100,000 MΩ	silver-plated mica sheets
Moulded precision mica capacitors (low values)	Max. 0.04-0.10% at 100 kc/s	—40 to +85 °C	8 to 75 $\times 10^{-6}$	Min. 50,000 MΩ	For telephony filters, measuring and control equipment
Moulded precision mica capacitors (high values)	Max. 0.04% at 1.8 kc/s	—20 to +85 °C	Max. 50×10^{-6}	Min. 50,000 MΩ	
Tubular high-precision mica cap. glass casing	Max. 0.03% at 100 kc/s	—55 to +100 °C	Max. 35×10^{-6}	Min. 100,000 MΩ	For measuring and calibrating equipment
Low-power stacked mica transmitting capacitors	Max. 0.10-0.20% at 1.8 kc/s	—40 to +70 °C		Min. 50,000-100,000 MΩ	Up to 3 kVA
Cable-balancing mica capacitors	Max. 0.15% at 1 Mc/s	Max. 85 °C		Min. 100,000 MΩ	For cross-talk reduction
Tubular polystyrene capacitors	Max. 0.05% at 1 kc/s	—40 to +85 °C	—50 to —200×10^{-6}	R=min. 100,000 MΩ ($C \lesssim 0.1$ μF) RC=min. 10,000 sec ($C > 0.1$ μF)	For use in sealed units
Tubular polyst. cap. rubber-sealed metal casing	Max. 0.05% at 1 kc/s	—40 to +85 °C	—50 to —200×10^{-6}	R=min. 100,000 MΩ ($C \lesssim 0.1$ μF) RC=min. 10,000 sec ($C > 0.1$ μF)	Available with insulating coat
Polyst. cap. all-metal box-type	Max. 0.05% at 1 kc/s	—40 to +85 °C	—100 to —150×10^{-6}	R=min. 750,000 MΩ ($C \lesssim 0.33$ μF) RC=min. 250,000 sec ($C > 0.33$ μF)	Glass bushing insulators
Electrolytic cap. with octal base	Max. 0.10-0.15% at 50-100 c/s and 20 °C	—40/10 to +70 °C		I_{leak}=max. 230-800 μA	Shock-resistant; suitable at high altitudes

PROFESSIONAL RESISTORS AND POTENTIOMETERS

Type	*Cat. sheet*	*Resistance*	*Tolerance*	*Instability*	*Rating at 40 °C ambient temp.*	*Temperature coefficient*	*Remarks*
Wire-wound precision resistors	**EP 1001**	**1-56,000 Ω**	**± 5, 2, 1, 0.5, 0.25%**	**Max. ± 0.25%**	**0.4-1.8 W**	**Max. 0.05 or 0.14%/10 °C**	**Dependable, accurate, consistent**
Low-reactive wire-wound precision resistors	**EP 1003**	**10-3,200 Ω**	**± 5, 2, 1, 0.5%**	**Max. ± 0.25%**	**0.8-1.8 W**	**Max. 0.05 %/10 °C**	**For high frequencies**
Bobbin resistors	**EP 1007**	**135-120,000 Ω**	**± 2, 1, 0.5, 0.25%**	**Max. ± 0.25%**	**1.2 W**	**Max. 0.025 %/10 °C**	**For measuring equipment**
Load resistors with wire-terminals	**EP 1018/1 (2)**	**4.7-100,000 Ω**	**± 10, 5%**		**3.5-10 W**	**—0.5 to +1.4 %/100 °C**	**Vitreous enamelled wire-wound**
Load resistors with side-terminals	**EP 1018/2 (2)**	**1-330,000 Ω**	**± 10, 5%**		**8-250 W**	**—0.5 to +1.4 %/100 °C**	**Vitreous enamelled wire-wound, adjustable or non-adjustable**
Non-adjustable load resistors	**EP 1018/3**	**0.12-27 Ω**	**± 10%**		**40-400*)**		
Precision cracked-carbon resistors	**EP 1114**	**10 Ω-1.5 MΩ**	**± 2, 1%**	**Max. 1-4%**	**0.125-2 W at 70 °C**	**Max. —0.3 to —0.6%/10 °C**	**Noise potential: max. 0.5-1 μV/V**
Wire-wound trimming potentiometers	**EP 1201**	**50-200 Ω**	**± 10%**		**1 W**		**For casual adjustments**
Dust-proof wire-wound potentiometers	**EP 1202**	**10-50,000 Ω**	**± 10, 5%**		**3 W**		**Reliability and long life**
Load potentiometers	**EP 1209 (2)**	**0.35-10,000 Ω**	**± 10%**		**25-630 W**		**Vitreous enamelled wire-wound**

***) At 0 °C ambient temperature.**

HOLDERS FOR LAMPS AND FUSES

Telephone pilot lamp holders (cat. sheet EP 3401)
Permissible wattage: 2 W.
Red, white, green or blue window.

Midget pilot lamp holders E10 (cat. sheet EP 3405)
Red, white, green, blue or colourless window.

Holders for incandescent pilot lamps (cat. sheet EP 3403/1)
Suited to switchboard lamps 24 V/5 W or tubular lamps 125 V/15 W and 220 V/15 W, all lamps with base B15.
Red, white or green window.

Holders for neon pilot lamps (cat. sheet EP 3403/2)
Suited to neon pilot lamps 9512 W: 125 V/2-3 mA and 220 V/2-3 mA, with base B15.
With ornamental flange or colourless window.

Holders for screw bases E14 (cat. sheet EP 3404)
Peak voltage: 500 V; max. current: 6 A.
Suitable for either surface-mounting or flush-mounting.

Fuse-carriers E27-33 for semi-enclosed fuses (cat. sheet EP 5502 (2))
Suited to fuses of 2-60 A, max. 500 V_{rms}.
Available with synthetic-resin fuse holder and ornamental flange.

Fuse-carriers E16 for semi-enclosed fuses (cat. sheet EP 5503)
Suited to fuses of 1.6-25 A, peak voltage: max. 800 V.
Available as flush-carriers and as surface-carriers.

Fuse-carriers for glass cartridge fuses (cat. sheet EP 5504)
Suited to cartridges 5Ø × 20 mm, or having a diameter between 5 mm and ¼", and a length of ¾" (20 mm), 1" (25 mm) or 1¼".
Peak voltage: 750 V; max. current: 6 A.

Fuse-carrier for H.T. cartridge-fuses (cat. sheet EP 5505)
Suited to cartridges appr. 6.5Ø × 80 mm.
Max. voltage: 6 kV_{rms}; max. current: 2 A.

Miniature fuse-carrier for glass cartridge-fuses (cat. sheet EP 5508)
Suited to cartridges appr. 5Ø × 20 mm.
Max. voltage: 500 V_{rms}; max. current 6.3 A.

COMPONENTS FOR MOUNTING AND CONTROL

Single-pole plugs and sockets (cat. sheet EP 4011)
Peak voltage: 500 V; max. current: 10 A.
Contact resistance: max. 3 mΩ.

Screened plugs and sockets (cat. sheet EP 4002 (2))
Two sizes, three-pole or six-pole.
Peak voltage: 500 V.
Max. current: 6 or 15 A.
Breaking power: 0.25 or 1 kW.
Contact resistance: max. 3 mΩ.

Connecting combinations (cat. sheet EP 4007)
8-, 12-, 16- and 20-pole standard combinations.
Peak voltage: 500-1,000 V.
Max. current: 15 A per contact.
Breaking power: 1.5 kW per contact.
Contact resistance: max. 3 mΩ.

Synthetic resin lead-ins (cat. sheet EP 4101)
Single or double soldering tag at each side.
Peak voltage: 1,000 V.
Max. current: 10 A.
Insulation resistance: appr. 500,000 MΩ.

Glass lead-ins (cat. sheet EP 4102 (3))
13 different standard types.
Peak voltage: up to 4,500 V.
Max. current: 2-10 A.
Insulation resistance: min. 10,000-100,000 MΩ.

Terminals (cat. sheet EP 4103 (2))
Insulated and non-insulated types with black or red knob.
Peak voltage: 500-1,000 V.
Max. current: 16 A.

Mounting brackets (cat. sheet EP 4202)
38 types in 3 lengths for max. 4, 6 and 8 soldering tags respectively.
Peak voltage: 500 V between adjacent tags.
Max. current: 10 A per tag.

Connecting blocks (cat. sheet EP 4203)
2, 3, 4, 6 or 8 contact strips.
Peak voltage: 500-1,000 V between adjacent strips.
Max. current: 15 A per strip.

Midget connecting blocks (cat. sheet EP 4205 (2))
2-12 contact strips.
Peak voltage: 500-1,000 V between adjacent strips.
Max. current: 25 A per strip.

Contact blocks for plug-in printed circuits (cat. sheet EP 4208 (2))

One or two rows of 54 contacts each, or to order.
Board thickness 1.5-1.8, or up to 2.5 mm.
Peak voltage: 500 V.
Max. current: 3 A per contact.

Ceramic mounting brackets (cat. sheet EP 4209)

Either for level mounting (10 contacts) or upright mounting (16 contacts).
Peak voltage: 1,400 V between adjacent contacts.
Max. current: 6 A per contact.

Control knobs (cat. sheet EP 8401 (2))

Large range of round (14-80 mm Ø) and arrow-shaped knobs, available with flange or arrow-pointer, all with clamping-cone attachment.

Vernier control knob (cat. sheet EP 8402 (2))

Double knob with reduction drive 1:9 for shafts 6 mm Ø.

VARIABLE TRANSFORMERS

(cat. sheet EP 0406)

Nominal primary voltage (50-60 c/s) V	*Output rating VA*	*Nominal secondary voltage V*	*Nominal secondary current A*	*Maximum no-load losses W*	*Panel mounting*				*Bench mounting*			
					Type number	*Fig.*	*H mm*	*Weight kg*	*Type number*	*Fig.*	*H mm*	*Weight kg*
130 **(110)**	345 (318)	0-150 (0-127)	2.3 (2.5)	6.5 (5.5)	84525	1	100	3	84524	3	150	3.8
	675 (635)		4.5 (5)	7 (6)	84529	1	120	4	84528	3	170	4.9
	1,350 (1,270)		9 (10)	18 (16)	84533	2	150	9	84532	4	215	10.3
220	260	0-260	1	5.5	84527	1	100	3	84526	3	150	3.8
	520		2	8	84531	1	120	4	84530	3	130	4.9
	1,040		4	16	84535	2	150	9	84534	4	215	10.3
	2,080		8	27	84537	2	175	12	84536	4	240	13.4
	5,200		20	40	—	—		—	E401AB/200	—	187	21
	6,000		23	40	E401BB/200	—	141	20.2	—	—	—	—

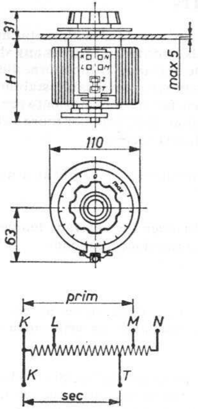


Fig. 1

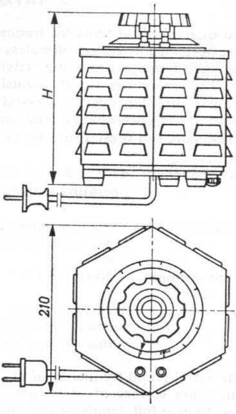


Fig. 3

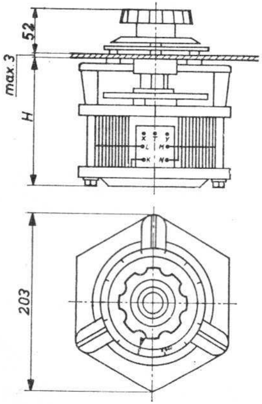


Fig. 2

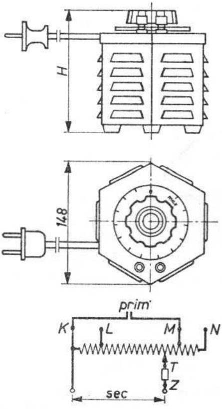


Fig. 4

QUARTZ-CRYSTAL UNITS

Standard quartz-crystal units for frequency stabilization are provided with metal holders which are hermetically sealed with glass-to-metal terminals in order to prevent any shifting from the rated frequency and any activity drop due to the entrance of moisture, dust and suchlike. The resonators are distinguished by a high accuracy, remarkable stability and small temperature dependency. Crystal units are supplied for frequencies between some 50 kc/s and 75 Mc/s according to any reasonable specification. If differing or more stringent requirements are not prescribed, the following specification is preferred.

Nominal frequency: defined for an effective parallel capacitance of 30 pF at a nominal operating temperature of 20 ± 5 °C.

Frequency tolerance: ± 0.01%, being the frequency drift over the relevant temperature range added to the tolerance on the nominal frequency.

Temperature range: —20 to + 70 °C.

Activity: according to the nominal frequency, defined either as equivalent parallel resistance, effective series resistance or grid current in a standard oscillator.

Since the activity and frequency of crystal resonators depend on the oscillator circuit to which they are connected, it is recommended when ordering crystal units, or making enquiries, to give full details of the conditions in which they will have to operate.

MATERIALS

Ferroxcube
Ferroxdure
Ferroxplana
Dielectrics
Insulating materials
Ticonal
Reco
Piezo-electric ceramics
Peltier elements

FERROXCUBE

FERROXCUBE is the name given to the ceramic soft magnetic core material produced by our factories. Owing to its excellent properties, this material more and more supersedes metallic core materials in high frequency applications. Thanks to the high electrical resistivity the eddy current losses in the material are extremely low, even at high frequencies, so the troublesome process of laminating the core can be avoided. Hence ferroxcube is supplied as ready shaped piece parts the forms of which have been adapted to the required magnetic circuit.

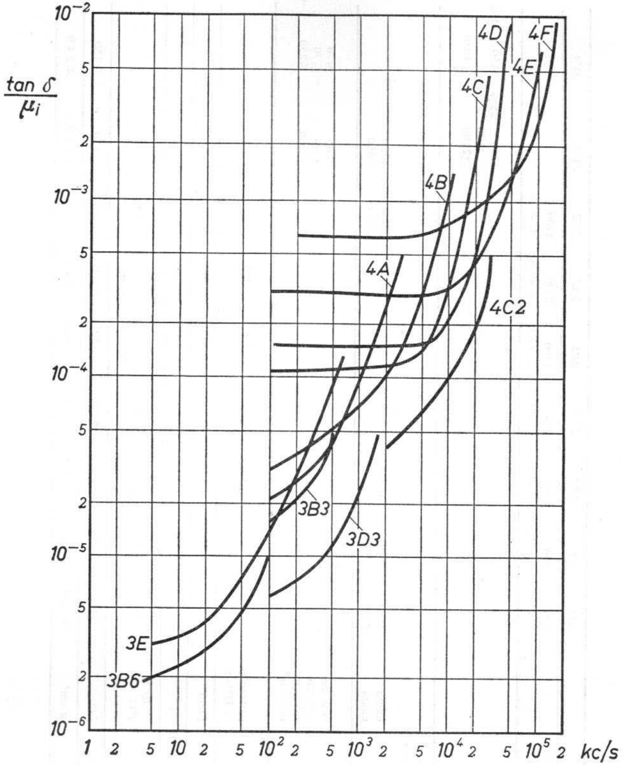
Application

Ferroxcube is used as a core material in an abundance of applications in radio-, television- and telecommunication technique and in various other branches of the electronic domain. A few examples are:

Radio and television:	Rod aerials
	I.F. band pass filters
	R.F. transformers
	Permeability tuning
	Variable inductors
	Line-output transformers
	Deflection units
	Linearity correctors
	Amplitude adjustors
	Antenna coils
Telecommunication:	Loading coils
	Filter coils
	H.F. chokes
	Wideband transformers
	Telecommunication transformers
	Power transformers
	Pulse transformers
	Delay lines
Other uses:	Tape recorder heads
	Computer elements
	Magnetostrictive applications
	Noise suppressors
	Microwave modulator
	High frequency heating
	Frequency modulation
	Ignition coils
	Ultrasonic generators

Grades of ferroxcube

Ferroxcube is made in several grades, which should be used according to the application. Table I gives the various grades with their main properties; table II will help in selecting the right grade for some typical applications.



Losses as a function of frequency for all grades of ferroxcube.

Grade of ferroxcube		*3A1*	*3B*	*3B2*	*3B3*	*3B5*	*3B7*	*3C2*	*3C3*	*3C4*
Initial permeability μ_i at 20 °C		1400 ± 15%	900 ± 20%	900 ± 20%	900 ± 20%	1400 ± 25%	2300 ± 20%	1100 ± 20%		
Amplitude permeability μ_{ap}										
at 1000 G, 25 °C									3750 ± 25%	3150 ± 25%
at 1000 G, 85 °C									≥2100	
at 2000 G, 85 °C									≥2100	≥1050
at 2000 G, 100 °C										
Flux density in gauss, ballistically measured at a field intensity of 10 Oe										
at 20 °C	gauss	3650	3450	4500			3400	3500	4250	
at 100 °C	gauss	2350	2300					2450	2850	
Dissipation at 15 kc/s,										
1000 G, 25 °C	mW/cm³								≤45	≤70
1000 G, 85 °C	mW/cm³								≤55	≤70
2000 G, 85 °C	mW/cm³								≤200	≤250
2000 G, 100 °C	mW/cm³									
Hysteresis factor $q_{2(24-100)}$										
at 4 kc/s	$\Omega/H^{3/2}$ mA			≤12	≤12	≤2.5	≤1.8			
at 100 kc/s	$\Omega/H^{3/2}$ mA									
Specific D.C. resistance	Ωcm	≥20	≥20	≥80	≥120	≥20	≥100	≥80		
Disaccommodation (1 min-24 h)	%		≤2.5	≤2.5	≤2.5	≤2.5	≤2.5			
Temperature factor $\triangle\mu/\mu_i^2$	$\times 10^{-6}$									
between +20 and 50 °C	/°C	≤4.5	≤3	≤2	≤2			≤4.5		
between +20 and 70 °C						0.5-2.3	± 0.5			
Curie point	°C	≥150	≥150	≥150	≥150	≥150	≥170	≥150	≥150	≥150
Specific weight	g/cm³	4.7-4.9	4.7-4.9	4.7-4.9	4.7-4.9	4.7-4.9	4.7-4.9	4.7-4.9	4.7-4.9	4.7-4.9

Grade of ferroxcube	*3C5*	*3D2*	*3D3*	*3E1*	*3H1*	*4A*	*4B*	*4C1*	*4C2*	*4D*	*4E*	*4F*
Initial permeability μ_i at 20 °C		750 ± 20%	750 ± 20%	2700 ± 20%	2300 ± 20%	600 ± 20%	250 ± 20%	125 ± 20%	150 ± 20%	50 ± 20%	15 ± 20%	7 ± 20%
Amplitude permeability μ_{ap}												
at 1000 G, 25 °C	≥3000											
at 1000 G, 85 °C												
at 2000 G, 85 °C												
at 2000 G, 100 °C	≥4000											
Flux density in gauss, ballistically measured at a field intensity of 10 Oe							at 20 Oe	at 30 Oe	at 30 Oe	at 60 Oe	at 80 Oe	at 180 Oe
at 20 °C		3500		3500	3400	2900	3300	2800	2800	2500	1750	2000
at 100 °C		2800				1750	2700	2450	2450	2300	1650	2800
Dissipation at 15 kc/s,												
1000 G, 25 °C												
1000 G, 85 °C												
2000 G, 85 °C												
2000 G, 100 °C	≤170											
Hysteresis factor $q_{2(24-100)}$												
at 4 kc/s				≤4	≤1.8							
at 100 kc/s			≤3									
Specific D.C. resistance		≥80	≥150	≥30	≥100	1000	1000	1000	1000	1000	1000	1000
Disaccommodation (1 min-24 h)			≤3	≤4	≤2.5							
Temperature factor $\Delta\mu/\mu i^2$												
between +20 and 50 °C		≤4.5		≤4		6	8	12	4	15	15	35
between +20 and 70 °C			0-2		½-1½							
Curie point	≥200	≥210	≥150	≥100	≥170	125	250	350	300	400	500	600
Specific weight	4.8-4.9	4.7-4.9	4.7-4.9	4.7-4.9	4.7-4.9	4.6-5	4.4-4.8	4.2-4.6	4.2-4.6	4-4.4	3.5-4	3-3.2

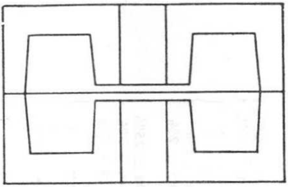
TABLE 2

Suggestions for selecting the right grade of ferroxcube[1]

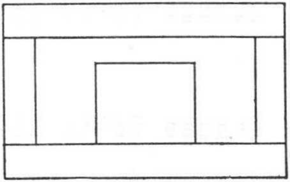
			Frequency region	*Shape of fxc. parts*	*Grade of fxc.*	*Example of application*
no power application Low induction (B<1 gauss)	tuned circuit	high Q (300)	up to 100 kc/s	potcores	3B2-3H1	filter coils
			up to 700 kc/s	potcores	3B3-3D3	filter coils
			up to 12 Mc/s	potcores	4C2	filter coils
			450 kc/s	rods	3B	I.F. transformers
			10 Mc/s	rods, tubes	4C	I.F. transformers for F.M.
		medium Q (100)	500-2,000 kc/s	rods, tubes	4B-3D3	antennarods
			up to 5 Mc/s	rods, tubes	4C1	filter coils, chokes, slug-tuned coils
			up to 10 Mc/s	rods, tubes	4C2	filter coils, chokes, slug-tuned coils
			up to 20 Mc/s	rods, tubes	4D	filter coils, chokes, slug-tuned coils
			up to 100 Mc/s	rods, tubes	4F	filter coils, chokes, slug-tuned coils
	no tuning		above 1 Mc/s	beads	3B-4B	screening
			up to 100 kc/s	hooks	3C	recording heads
			0.3-3.5 kc/s	E-cores	3A1-3E1	communication transformers
			0.1-10 Mc/s	E-cores	3A1-3E1	wide-band transformers
inductions between 1 and 200 gauss			0.3-12 kc/s	potcores	3B5	loading coils
			up to 1 Mc/s	E-cores, U-cores	3C3-3C5	transductors
			up to 50 Mc/s	toroids, rods	4A-4B	chokes
power applications (B > 200 gauss)			up to 100 kc/s	U-cores	3C3-3C4-3C5	line output transformers
				yoke rings; split yoke rings	3C2	TV deflection yokes
				rods and plates	3C2-4B	pulse transformers
			pulses from 0.1 µsec and longer	toroids	3E	increductors
				U-cores, rods, slugs	3C2-3D2	ignition coils
			up to 1 Mc/s	rods, tubes, plates	3C2-3D2	general high induction application

---

[1] For various applications the grades can be used outside the given frequency ranges.



S-type pot core



D-type pot core

Shapes available

Ferroxcube is made in the shape of pot cores, E-, I- and U-cores, rings and in an ample choice of rods and tubes.

TABLE 1

Pre-adjusted pot cores (preferred types)

Type of pot core	*Type number*	*Grade of FXC*	*Air-gap approx. (mm)*	*Number of turns per mH α*	*Equivalent permeability μ_e*	*Application*
S 14/8	K3 000 29	3E1	0	21.4	1230 ± 25%	pulse coils transformers
	40	3B	0	30.6	574 ± 25%	
	41	3B	0.1	85	74 ± 3%	coils in filters and equalizers
	42	3B	0.2	106	49 ± 2%	
	43	3B	0.3	122.5	36 ± 2%	
	44	3B	0.4	135	29.5 ± 2%	
	K3 000 30	4B1	0	48.5	204 ± 25%	pulse coils transformers
	31	4B1	0.1	94.4	55.6 ± 3%	coils in filters and equalizers
	32	4B1	0.2	115.2	35.9 ± 2%	
	33	4B1	0.3	128.5	29 ± 2%	
	34	4B1	0.4	141.4	23.9 ± 2%	
	K3 000 35	4C1	0	64.5	115 ± 25%	pulse coils transformers
	36	4C1	0.1	102	46 ± 3%	coils in filters and equalizers
	37	4C1	0.2	118	34.4 ± 2%	
	38	4C1	0.3	133	27.1 ± 2%	
	39	4C1	0.4	144	23.1 ± 2%	
S 18/12	K3 000 48	3E1	0	20.4	1500 ± 25%	transformers
	46	3B2	0.3	96	65 ± 1%	filter coils and chokes
	47	3B3	0.5	113	46 ± 1.5%	
	45	3B3	1.0	142	28.5 ± 1.5%	
	49	3B2	0.16	79	100 ± 2%	

TABLE 1 (continued)

Pre-adjusted pot cores (preferred types)

Type of pot core	*Type number*	*Grade of FXC*	*Air-gap approx. (mm)*	*Number of turns per mH α*	*Equivalent permeability μ_e*	*Application*
S 25/16	K3 000 60	3E1	0	14.2	1820 ± 25%	transformers and chokes
	61	3B2	0.14	49	150 ± 3%	filter coils and chokes
	62	3B2	0.23	60	100 ± 2.5%	
	63	3B2	0.32	67	80 ± 2%	
	64	3B3	0.47	77.5	60 ± 1.5%	
	65	3B3	0.7	89.4	45 ± 1.0%	
	66	3B3	2.1	134	20 ± 1%	
S 35/23	K3 001 06	3E1	0	9.7	2250 ± 25%	chokes and transformers
	04	3B5	0.18	32	220 ± 3%	loading coils and chokes
	03	3B5	0.26	37	150 ± 2%	
	02	3B5	0.33	41	125 ± 2%	
	01	3B5	0.45	46	100 ± 1.5%	
	00	3B5	0.58	51	80 ± 1%	
S 45/25	K3 001 26	3E1	0	9	2250 ± 25%	chokes and transformers
	24	3B5	0.28	30	200 ± 3%	loading coils and chokes
	23	3B5	0.35	33	160 ± 2%	
	22	3B5	0.5	38	125 ± 2%	
	21	3B5	0.65	42.5	100 ± 1.5%	
	20	3B5	0.85	47.5	80 ± 1%	

TABLE 2

The following types are still included in our present range:

Type of pot core	*Type number*	*Grade of FXC*	*Air-gap approx. (mm)*	*Number of turns per mH α*	*Equivalent permeability* μ_e	*Application*
D 25/12	K3 000 22	3B2	0.35	65	60 ± 1.5%	filter coils
D 25/16	K3 000 01	3B2	0.15	53	115 ± 2.5%	filter coils and chokes
	02	3B2	0.25	62	83 ± 2.5%	
	05	3B2	0.45	72	60 ± 1.5%	
	06	3B3	0.85	96	35 ± 1.5%	
	08	3B3	1.8	122	20 ± 1.5%	
D 36/22N	K3 000 80	3B2	0.21	38.0	150 ± 3%	filter coils and chokes
	81	3B2	0.34	47.0	100 ± 2.5%	
	82	3B2	0.45	52.0	80 ± 2%	
	83	3B3	0.65	61	60 ± 1.5%	
	84	3B3	0.94	70	45 ± 1.5%	
	85	3B3	2.1	105	20 ± 1.5%	

Type number	*Fig.*	*Main dimensions (mm)*		
		l	*h*	*d*
56 907 45/3E1	1	20	10.2	5.3
56 907 47/3E1	1	30	15.2	7.3
56 907 49/3E1	1	42	21.2	15.5
56 907 85/4A1	2	34	10	12
56 907 86/4B1	2	34.6	10	12.2
56 908 01/3E1	2	34	10	12
K5 400 40/3E1	3	40	23.9	15
K5 400 60/3E1	1	65	32.8	13.7
K5 400 75/3E1	1	40.6	22.5	8.85

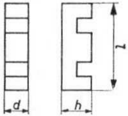


Fig. 1

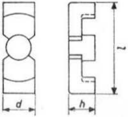


Fig. 2

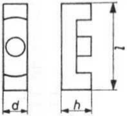


Fig. 3

Ferroxcube rings for T.V. deflection coils

Type number

56 591 88/3C2	90°
K5 280 35/3C2	110°
K5 280 70/3C2	110° (flared ring)

All rings consist of two matched halves which are supplied together.

U cores

Type number	*Main dimensions (mm)*		
	l	*h*	*d*
K5 450 40/3C4	56.7	29.35	13.85
K5 450 41/3C3			
K5 450 42/3C5			
K5 450 60/3C4	60.35	31.75	15.9
K5 450 61/3C3			
K5 450 62/3C5			
K5 452 00/3C4	60.35	28.75	15.9
VK 235 52/3C5			
K5 452 05/3C4	49.8	28.4	15.7
K5 452 06/3C3			
K5 452 07/3C5			

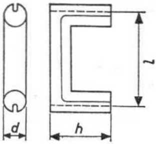


Fig. 1.

Ferroxcube cores for erasing heads. Three standard types according to fig. 2.

Type number	*Dimension A*
56 907 73/3C1	7.1 mm
56 907 97/3C1	3.5 mm
K5 500 15/3C1	1.4 mm

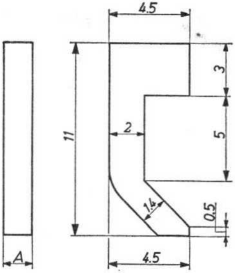


Fig. 2

RODS AND TUBES

Small ferroxcube rods and tubes are used in various coils, such as I.F. coils, oscillator coils. Most rods and tubes are supplied in ferroxcube grades 3B and 4B, but other grades can be made on request.
Preferred dimensions are:

Rods

diameter: 1-1.1-1.3-1.5-1.7-2-2.2-2.7-3.2-3.8-4.3-4.8-5.4-5.9-6.4-7.0-7.5-8.0-8.5-9.1-9.6-10.1 mm
length: <10 mm: 2-3-4- . . . 9 mm
10-30 mm: 10-12-14 . . . 30 mm
>30 mm: 35-40-45 . . . 200 mm

Tubes

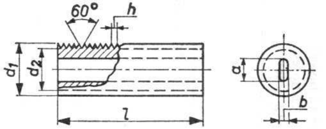
outer diameter: 2.2-2.7-3.2-3.8-4.3-4.8-5.4-5.9-6.4-7.0-8.0-8.5-9.1-10.1 mm
inner diameter: 0.7-0.8-0.9-1.0-1.2-1.4-1.6-1.8-2.0-2.5-3.0-3.5-4.0-4.5-5.0-5.5-6.0 mm
length: <10 mm: 2-3-4- . . . 9 mm
10-30 mm: 10-12-14 . . . 30 mm
>30 mm: 35-40-45- . . . 200 mm

For preferred types of aerial rods see page L 15.

PREFERRED TYPES OF AERIAL RODS

Type number	*Diameter*	*Length*
56 681 55/4B1	6.55-0.4	168.5-7
56 681 85/4B1	8-0.4	102-4
56 681 03/4B1	8-0.4	143-6
56 681 26/4B1	8-0.4	207-8
56 681 25/4B1	9.8-0.6	103-6
56 681 31/4B1	9.8-0.6	164-8
56 680 99/4B1	9.8-0.6	207-8
56 681 75/4B1	10-0.6	132-4
56 681 22/4B1	10-0.6	145-10
56 681 24/4B1	10-0.6	180-10
56 681 23/4B1	10-0.6	209-12

SCREW CORES



Type number	h *(mm)*	d_1 *(mm)*	d_2 *(mm)*	l *(mm)*	a *(mm)*	b *(mm)*
VK 220 37	0.5	3.65+0.05	<3.25	12 ± 0.2	1.6+0.2	0.7+0.2
VK 220 38	0.75	4.55+0.05	<3.9	12 ± 0.2	2.0+0.3	0.8+0.2
VK 220 39	0.75	5.55+0.05	<4.9	13 ± 0.2	2.5+0.5	1.0+0.2
VK 220 40	0.75	5.55+0.05	<4.9	25 ± 0.5	2.5+0.5	1.0+0.2
VK 220 41	1	6.45+0.05	<5.55	12 ± 0.2	2.5+0.3	1.2+0.2
VK 220 42	1	6.45+0.05	<5.55	18 ± 0.3	2.5+0.3	1.2+0.2
VK 220 43	0.75	7.55+0.05	<6.9	16 ± 0.3	3.0+0.3	1.2+0.2
VK 220 44	1.25	7.35+0.05	<6.2	16 ± 0.3	3.5+0.3	1.2+0.2
VK 220 45	1.25	7.35+0.05	<6.2	25 ± 0.5	3.5+0.3	1.2+0.2
VK 220 28[1]	0.5	5.90+0.05	<5.5	12 ± 0.2	2.5+0.3	1.2+0.2

All cores are available in grades 3B and 4B.

[1] For this core a special coilformer can be supplied made of low loss synthetic resin. Type number 23 660 48.

Ferroxcube screening beads and complete chokes

Beads

Type number and grade	*Outer diameter (mm)*	*Diameter of hole (mm)*	*Length (mm)*
56 590 65/3B	3.5 ± 0.2	1.2+0.2	3+0.5
56 590 65/4A	3.5 ± 0.2	1.2+0.2	3+0.5
56 590 65/4B	3.5 ± 0.2	1.2+0.2	3+0.5
56 390 28/4B	5.6 + 0.3	0.75 ± 0.15 (2 holes)	12 ± 0.4
56 390 31/4B	5.6 ± 0.3	0.90 ± 0.15 (2 holes)	12 ± 0.4
56 390 30/4B	6.3 ± 0.3	1.2 ± 0.15 (2 holes)	12 ± 0.4

Complete chokes

Type number and grade	*Number of turns*	*Max. impedance*		*Decrease of impedance in the frequency range*	
		Z max. (kΩ)	*at f (Mc/s)*	*Mc/s*	*(dB)*
VK 200 01/3B	1½	0.35 ± 20%	appr. 120	10-300	≤7
VK 200 01/4B	1½	0.45 ± 20%	appr. 250	80-300	≤3
VK 200 02/3B	2½	0.75 ± 20%	appr. 50	10-220	≤7
				30-100	≤3
VK 200 02/4B	2½	0.85 ± 20%	appr. 180	50-300	≤6
				80-220	≤3
VK 200 03/3B	2×1½	0.9 ± 20%	appr. 50	10-220	≤7
				30-100	≤3
VK 200 03/4B	2×1½	1.0 ± 20%	appr. 110	50-300	≤7
				80-220	≤3

These chokes consist of a bead of ferroxcube with 3 or 5 holes, through which a piece of copper wire is threaded.

FERROXCUBE 6

A range of memory cores is available for use in magnetic memories. The table gives the dimensions and main electrical data. More extensive data will be supplied on request.

	6E1	*6B1*	*6D3*	*6C1*	*6D5*	*6F1*
Dimensions (mm)						
O.D.	3.8	1.95	1.95	1.27	1.27	1.35
I.D.	2.2	1.30	1.25	0.75	0.80	0.80
height	1.5	0.60	0.60	0.30	0.40	0.30
Nominal drive current						
I_{nom} at 40 °C (mA)	350	450	800	500	420	1,170
Rise time (μs)	1	0.3 exp.	0.2 exp.	0.2 lin.	0.2 exp.	0.1 lin.
Read-disturbed output uV1 (mV)	90	80	90	35	39	63
Disturbed zero output dVz (mV)	30	20	30	12	13	22
Switch time t_s (μs)	9	2.5	1.3	0.9	1.6	0.4
Peak time (μs)	4	1.0	0.6	0.45	0.7	0.17

The figures for rV1 are representative data at 40 °C and nominal drive-current, with a disturb-current of ½ nominal value.
The cores are 100% tested on limiting values for rV1 and dVz under marginal operating conditions. This is done by introducing a 10% deviation of the drive-currents in the unfavourable directions.

FERROXDURE

Ferroxdure is the name given to a class of permanent magnet materials which in recent years were developed by our Laboratories. In Great Britain the name "Magnadur" has been adopted.

The outstanding properties of this material are:

Very high electrical resistivity
Very high coercive force.

The first property opens the possibility of using the magnets in high frequency fields, e.g. for biassing ferromagnetic circuits, without introducing eddy current losses.

The second property makes it possible to use very short magnets or magnet systems with a wide air-gap or even without any yoke at all; the high coercivity prevents the magnets from being demagnetized.

Ferroxdure 1 is isotropic, which means that the magnetic properties are the same in each direction.

The other grades are anisotropic and show their high quality in one preferred direction only.

Properties of Ferroxdure

Grade of ferroxdure	*Fxd 100*	*Fxd 300^R*	*Fxd 250^k*
Remanence B_r (gauss)			
min.	1800	3700	3200
average	2000	3850	3400
Coercivity H_c	1500	1600	2200
(oersted) min. average	1700	1800	2300
BH_{max}	0.8×10^6	3×10^6	2.3×10^6
(gauss oersted) min. average	0.95×10^6	3.2×10^6	2.4×10^6
Recoil permeability approx.	1.20	1.0	1.0
B_{sat} (gauss) approx.	18000	18500	18500
H_{sat} (oersted) approx.	14000	14000	14000
Electrical resistivity Ω cm	$>10^8$	$>10^8$	$>10^8$
Curie temp. °C approx.	450	450	450
Temp. coefficient of remanence %/°C	—0.2	—0.2	—0.2

Applications

Ferroxdure magnets can be used in most cases where up to now metallic magnets have been used, especially when very short magnets are required or systems with a large air-gap. Furthermore they can be used in high frequency fields without giving eddy current trouble. A few applications are:

- T.V. focusing magnets
- Loudspeaker magnets
- Telephone magnets
- Biassing magnets in
  - pulse transformers
  - relays
  - inductance coils.
- Bicycle dynamo's
- Oilfilters
- De-ironing systems
- Chucks
- Magneto-mechanical couplings
- Toys
- Door latches

Ferroxdure being a ceramic material, all shapes are formed by extrusion or pressing in dies. Commercial shapes are blocks, slugs, discs, rings, rods and tubes.

"TICONAL" AND RECO

Reco is the name given to the isotropic materials, i.e. magnets without preferred direction of magnetization. These magnets are suited for multi-polar magnetization.
"Ticonal" magnets are anisotropic, that means they have a preferred direction of magnetization, which is imposed during the manufacturing process.

	Remanence Br (gauss)		*Coercivity Hc (oersted)*		*$(BH)_{max}$ ($10^6 \times$ gauss $\times$ oersted)*		*Required field for saturation H_{sat} (oersted)*	*Reversible permeability (μ_{rev})*	*Electrical resistivity (μ Ω cm)*	*Curie-point (°C)*
	min.	*max.*	*min.*	*max.*	*min.*	*average*				
Reco 1	5,800	6,500	460	510	1.0	1.3	2,500	4-6.5	70	730
Reco 1A	6,200	6,800	530	580	1.3	1.5	2,500	5-6	75	770
Reco 2	6,000	7,000	600	700	1.5	1.8	2,500	4-5	65	810
Reco 2B	5,200	5,800	730	830	1.5	1.8	3,000	3-4	60	790
"Ticonal" C	10,500	11,000	680	740	3.2	3.8	2,500	4-5	50	860
"Ticonal" E	11,200	12,000	610	670	3.6	4.2	2,500	4-5	50	860
"Ticonal" G	12,300	13,000	600	640	4.5	5.2	2,500	4-5	45	860
"Ticonal" Gg	13,000	13,400	630	670	5.5	6.0	2,500	3-4	45	860
"Ticonal" L	13,000	13,700	550	600	4.5	5.2	2,500	3-4	45	850
"Ticonal" Lg	13,000	13,800	580	620	5.5	6.0	2,500	2.5-3	45	850
"Ticonal" X	8,000	9,000	1,200	1,400	4.0	4.5	5,000	2.5-3	50	850

It should be noted that maximum values for the remanence never coincide with maximum values for the coercivity.

NOTES:

PHILIPS TECHNICAL LIBRARY

comprises 4 series of books:

(a) Electron tubes
(b) Light and Lighting
(c) Various Topics
(d) Popular series

The series (a), (b) and (c) are 6" × 9" in size, cloth bound, gilt. The dimensions of the popular series are 5¾" × 8¼", bound in varnished boards.

PHILIPS TECHNICAL LIBRARY
stands for up-to-the minute information on most aspects of electronics, based on the experience of actual production in many countries. The authors are men who do the job as members of the world's biggest and most progressive international electrical and radio concern. Their knowledge is placed at your disposal in well-printed and neatly produced books and booklets, most of which are published in several languages. Brief details as to the publications relating to electronics and allied subjects are given.

PHILIPS BOOKS ON ELECTRON TUBES — INDISPENSABLE FOR EVERY RADIO ENGINEER

Series (a) on **electron tubes**, at present comprises the following books:

BOOK I. Fundamentals of radio valve technique, by J. Deketh, 547 pages, 384 illustrations. Out of print.

BOOK II. Data and circuits of receiving and amplifying valves, 1933/39, 405 pages, 532 illustrations, 22/—. A very few copies English and French available,

BOOK III. Ditto, 1940/41, 220 pages, 167 illustrations, 13/6. English out of print, French German and Dutch editions available.

BOOK III A. Ditto, 1946/50, 480 pages, 505 illustrations, 42/—.
The books "Data and Circuits" II - III and III A give a complete survey of all receiver and amplifier valves turned out by Philips from 1933 to 1950 regardless whether any particular types are still produced or not or are available in all countries.

BOOK III C. Data and circuits of television valves, by J. Jager, 228 pages, 246 illustrations This book deals with a complete series of modern valves for television receivers. Out o print, German, French and Dutch editions available.

BOOK IV. Applications of the electronic valve in radio receivers and amplifiers (Vol. 1), by B. G. Dammers, J. Haantjes, J. Otte and Ir. H. van Suchtelen, 67 pages, 256 illustrations. A book for engineers and technicians engaged in the development of receivers and amplifiers. Out of print.

BOOK V. Applications of the electronic valve in radio receivers and amplifiers (Vol. 2) 450 pages, 343 illustrations. Out of print, French and German editions available.

BOOK VII. Transmitting valves, by J. P. Heyboer and P. Zijlstra, 300 pages with 256 illustrations, 12 tables, 37/—.

BOOK VIII A. Television receiver design, 1st. Monograph: I. F. Stages by A. G. W. Uitjens, 188 pages, 123 illustrations. Out of print. French and German editions available.

BOOK VIII B. Television receiver design, 2nd. Monograph: Flywheel synchronization of saw-tooth generators by P. A. Neeteson, 160 pages, 120 illustrations. Out of print. French and German editions available.

BOOK IX. Vacuum valves in pulse technique, by P. A. Neeteson, second revised and enlarged edition, 202 pages, 155 illustrations, 28/6.
In this book a method is developed to analyse networks containing vacuumtubes and subjected to large, suddenly applied signals, thereby treating the tube as a non-linear network element. It makes the new insights and methods of calculating and designing pulse circuits with vacuum tubes accessible to everyone interested as it covers the wide field of such electronic equipment as computers, scalers, pulse-modulation systems, radar, television, telemetering, telephony, telegraphy, and so on.

BOOK X. Analysis of bistable multivibrator operation, by P. A. Neeteson, second revised and enlarged edition, 100 pages, 40 illustrations, 18/6.
Extended analysis of the transient behaviour of the bistable multivibrator circuits. To this second enlarged edition some new bistable multivibrator circuits are added together with their application in binary or decimal counters.

BOOK XI. UHF Tubes for communication and measuring equipment, 70 pages, 76 illustrations, 10/—.
The use of electronic apparatus operating at frequencies of 300 Mc/s and higher is extending in radio and radar for communication and navigation, balloon sondes, etc. This book describes in detail the tube range for UHF and SHF waves.

BOOK XII. Tubes for computers, 63 pages, 59 illustrations, 10/—.
The electronic tube, in its function of inertialess switch, is one of the essential component parts of an electronic computer. Though the fundamental operation and set-up of these tubes are the same as those for amplifying purposes, this particular application is rather unconventional. The computer tubes described in this book are specially designed for this use and consequently answer the specific demands that are imposed on them.

BOOK XIII. Industrial rectifying tubes, 126 pages, 100 illustrations, 16/—.
It is well-known that for charging batteries and, in many cases, for feeding arc lamps, welding and various other industrial apparatus, direct current is required. Since, however, most mains are A.C., the power required for such purpose has to be converted into D.C. This is done most reliably and most efficiently with the aid of electronic tubes rectifiers. In this book details are given of a range of rectifying tubes specially developed to meet the highest requirements.

To this series also belong the following new books:

BOOK XIV. Television deflection systems, by A. Boekhorst and J. Stolk, 236 pages, 145 illustrations, 5 photos on art paper.
Following an introductory first chapter, some attention is paid to the picture tube itself and to its auxiliary components, including focusing and ion trap magnets.
More detailed attention is given to the picture faults which may occur. Mathematical analysis of these faults would lead us too far from our subject and has, therefore, been omitted, only a physical interpretation having been given. After a short analysis of a deflection unit for 110° deflection, which has been developed in the Mullard Research Laboratory at Salfords, the greater part of this work is devoted to the theory and design of the line-deflection and frame-deflection circuits.

BOOK XV. Magnetrons, by K. Hinkel, 104 pages, 55 illustrations, and 4 pages photographs on art paper, 23/6.

The book is meant as an introduction for technologists and students to the applications of microwaves in general and magnetrons in particular; especially to the physical background and properties of this kind of tube. It is short, clear, and well-illustrated with both photographs and circuit diagrams.

Some interesting books in the field of electronics and allied subjects which are published in series (c) follow here:

Dry-battery receivers with miniature valves, by E. Rodenhuis, 242 pages, 227 illustrations, 34/—.

The design of receivers for use with directly-heated valve types differs in many respects from that of sets intended to work with indirectly-heated valves, and designers of the former who are not sufficiently acquainted with the appropriate circuits will necessarily encounter a number of problems.

This book was written primarily in order to help the designer in solving such problems; one chapter has been devoted exclusively to the question of the current supply.

This book may also be of value to service technicians. The different makes of dry-battery receivers are all very much alike, as far as their circuitry is concerned and the circuits given in the last chapter may be regarded as representative for the whole field. The data given include sensitivity values for nominal and reduced supply voltages, in order to provide a complete picture of what may be expected from a given circuit. This book is written in simple language, with a minimum of mathematics so that the hobbyist and amateur set builder may have no difficulties with the contents.

From the electron to the superhet, by J. Otte, Ph. F. Salverda and C. J. van Willigen.

A simplified course for the radioservice man; 42 lessons with a summary, questions and answers, 700 pages, 11″ × 7½″, 722 illustrations and 11 circuit diagrams, bound in one luxurious volume, 57/6.

Industrial electronics handbook, by R. Kretzmann, 3rd enlarged edition, 2nd print, 310 pages, 326 illustrations, 44/—.

This authoritative technical manual is distinguished from other books in the field in that it is largely devoted to a detailed descriptive study of successful modern devices of many types, with numerous circuit diagrams and photographs.

It will thus appeal to the engineer who is already responsible for the maintenance of such plants and wants to extend his mastery of the detail and his knowledge of other devices using electronic principles.

Industrial electronics circuits, by R. Kretzmann, 200 pages, 206 illustrations, 37/—.

An indispensable sequel volume to the author's Handbook on electronics.

The book contains, for all branches of industry, electronic circuits, that have been proved in practice. Those circuits that have not proved worth their while in actual use, have rigidly been excluded.

The cathode ray oscilloscope, by J. Czech, 352 pages, 405 illustrations, 60/—.

This book describes in great detail the construction, use and applications of the oscilloscope. Some 704 original oscillograms, all the work of the author, give a highly impressive view of its capabilities. An authoritative book for students at technical colleges and universities, for engineers and scientists in the laboratories and factories in the fields of electronics, acoustics, optics, mechanics, etc. The text covers, in an extremely lucid manner, theory and design techniques relating to modern oscilloscopes and ample information is provided on means of using the instruments.

To this series also belong the following new books:

Junction transistors in pulse circuits, by P. A. Neeteson, 152 pages, 105 illustrations, 28/6.
The transistor with all its advantages will play a dominant part in the development of such applications, for which numerous electronic switches are required; especially where bulky equipment is concerned.
This book studies the behaviour of networks in which junction transistors are used as switches, with a view to efficient use and new applications. The introductory chapters on the different types switches and fundamental pulse circuits are followed by a thorough study of the junction transistor in various circuits.
The treatment will be acceptable to a very large circle of readers, since in describing the potentialities of the new semiconductor device, mathematics and circuit analysis have been kept to a minimum.

From microphone to ear. Modern sound-recording and reproduction technique by G. Slot, third enlarged edition, 268 pages, 110 illustrations and 31 photos on art paper, 22/—.
As the title suggests, the entire chain from microphone to loudspeaker is discussed and ample attention is paid to all factors, on both the recording and play-back side, which ultimately affect the quality of reproduction or which are of importance when new equipment is bought. There are chapters devoted to recording and record manufacture and to the principal features and utilization of pick-ups, record players, record changers, tape recorders, amplifiers and loudspeakers, and in this enlarged edition special attention has been paid to the applications of stereophonic recording and reproduction. Simple and inexpensive test methods for evaluating the quality of an installation have been included, while the importance of room acoustics has not been overlooked.

Ferrites. Physical properties of ferromagnetic oxides in relation to their application. By J. Smit and H. P. J. Wijn, 373 pages, 244 illustrations, 75/—.
The most important development in ferromagnetism in recent years has taken place in the area of magnetic oxides, the term "ferrites" being used to refer to all those containing iron as the major metallic component.
This book provides the reader with an insight into the properties of ferrites, on an intermediate level. The characteristics of ferrites that are of importance for application purposes are presented and discussed and, whenever possible, explained in terms of intrinsic properties.
Since many properties of the ferrites strongly depend on their exact chemical composition and microscopic physical structure, a thorough familiarity such as the authors possess, with the experimental details, is of special importance. The authors deal with many theoretical problems of phenomena occurring in these materials during processes of magnetization, and make greater use of simple physical models than of rigorous mathematical derivations.
These artificial magnetic materials are now of first-rate economic importance and are used throughout the electronics industry, e.g. radio, television, telephone and telegraph services, recording apparatus, measuring apparatus, ultrasonic apparatus, proton accelerators, motors and generators and magnetic couplings. All scientists and technicians engaged in these, as well as metallurgists and inorganic chemists will be glad of such an authoritative but readable study.

Magnetic sound recording, by D. A. Snel, 230 pages, 162 illustrations, 16 photographs on art paper with 37 photos, 26/6.
Magnetic recorders are used not only for recording and playback in the home but also to provide sound effects for plays on the radio and on the stage, to record talking letters, radar and television images, to record messages to and from aircraft and even to record, and playback at predetermined intervals, the readings of instruments in satellites far out in space.

Despite the fact that magnetism, as a natural phenomenon, was known to the ancients, the how and why of magnetic recording is still to some extent shrouded in mystery. The object of this book is partly to dispel some of the mystery and partly to focus more attention on the variety of possible uses for recorders.

Principal attention is given to the mechanical and electrical design of simple recorders.

Tube and semiconductor selection guide, 1960/61 by Th. J. Kroes, 200 pages, many illustrations. Publication: September 1960. Price 13/6.

The 1960/61 edition is much more practical in that the complete interchangeability list is included which makes the use of the book so much easier that really it will prove indispensable to anyone who has to handle tubes in practice. Another valuable feature is that also are included the base connections of all preferred types. Indispensable is the book also for a service dealer who cannot very well keep stocks of all types of tubes, even if it were only one tube per type. Therefore this book which ranges the tubes and semiconductors in order of their function and characteristics, so that with a minimum of stocks the requirements can still be filled, is exactly what he needs.

To this series also belong the following new books:

Diodes and transistors. Theory, by G. Fontaine, 475 pages, $5\frac{1}{4}'' \times 8\frac{1}{8}''$, 445 illustrations in multi-colour print.

In a capable and very efficient manner the author succeeded in exposing the mechanism and functioning of transistors and their applications. In explaining this more use is made of drawings and characteristics rather than mathematical treatment. A very original way of instruction, which has proved its practical value.

In another volume, which is in active preparation, the same author deals with the use of semiconductors in practice.

Large signal behaviour of transistors, by C. le Can, K. Hart and C. de Ruyter, 236 pages, 105 illustrations and 4 pages with high quality photographs on art paper.

This book deals with the steady state and transient behaviour of junction diodes and transistors and gives a detailed description of the kind of behaviour that may be expected from a junction diode and transistor, respectively, in an electric circuit once the various specifications (ratings, characteristics, etc.) are known.

In this study a compromise has been attempted between the simplification and idealisation of the physical picture to such an extent that an exact mathematical treatment is possible, and the pure experimental approach. In this way both a calculation of some basic phenomena and a qualitative explanation of most others which are encountered in practice, are possible.

Dosemeters for X-ray diagnostics, by K. Reinsma, 102 pages, 40 illustrations and 18 tables.

In a recent report of the United Nations much attention has been paid to the use of X-rays and the radiation danger which is related with it.

In this book measuring instruments are described which make it possible to determine, both rapidly and relatively simply, the total energy absorbed by a patient during a medical examination with X-rays.

In this connection the results with their conclusions of measurements executed with the described dosemeters on about one thousand patients of two Dutch hospitals are further to be found and in a separate chapter attention is paid to the calibration of dosemeters.

Electrical breakdown of insulating liquids, by J. A. Kok, 164 pages, 47 illustrations and 9 photos on art paper.

This study describes a view on the mechanism of electrical breakdown of liquids serving as insulation or dielectrics and may explain many of the features encountered in breakdowns and breakdown tests.

It aims at opening a direct and useful road towards a more complete understanding of the various problems connected with oil breakdown and deterioration.

Photo-electric devices in theory and practice, by Harley Carter and M. Donker, abt. 200 pages, 90 illustrations. In active preparation.

The literature of Photo-electricity at the present time is not extensive. Almost all the available material either assumes that the reader is well acquainted with all the scientific principles involved in photo-electric phenomena or is only based on the quantitative data and other practical information.

In order to reduce the risk of "text-book" treatment and to prevent the more advanced reader from becoming bored by too many simple explanations in the main text, a number of such explanations, and also some definitions of technical terms will be given in footnotes throughout the book.

In the book the operation of the photo-electric devices is linked with the basic scientific principles and the descriptions of practical applications are given in the light of the latest experience and developments.

Television, by F. Kerkhof and W. Werner, 450 pages, 404 illustrations, 18 pages photographs and 1 folded chart. Second edition, revised and enlarged.

During the past few years we have witnessed very rapid developments in the field of television and its associated techniques. In this new edition the recent advances are fully discussed.

In the very near future a second volume will be published by the same authors, partly handling about a few diagrams and circuits of black-white television receivers. The greater part of this second volume, however, deals in full detail with colour-television.

Introduction to TV-servicing, by H. L. Swaluw and J. v. d. Woerd. Second edition, completely revised and brought up-to-date by W. Hartwich and G. Kroll, 292 pages, 345 illustrations, including 95 pages of photographs showing screen pictures of faulty or incorrectly adjusted receivers, and 2 folding diagrams.

The great demand and the positive reception of the first edition have encouraged the editors to revise this book completely. The circuit descriptions are entirely based on the latest model of a TV receiver and an up to date list of the latest test instruments with a detailed description of their uses is given. This book lists only those fundamental aspects of television and test instrument technique that are of importance to the service technician.

Recommended to radio and television technicians, to students in Technical Colleges and Radio Schools and to all interested in television who wish to acquire a sound practical knowledge of television servicing with special reference to the 525 and 625 – line system.

How television works, by W. Holm. An illustrated non-mathematical account of its principles, 325 pages, 5¾″ × 8⅓″, 260 illustrations and 8 full-page photographs. Second, enlarged edition.

Here an attempt is made to bring the essence of television nearer to the great mass of readers and to explain it, in a comprehensive way and starting from first principles. It is not a dry text-book, but aims at giving an approach to all the problems, even the difficult ones, in a lively and entertaining way.

In a separate volume the author will describe with the same well-known clarity the problems concerning the colour-television. This book is well-illustrated with some 4-colour illustrations and is in a very active state of preparation.

Mechanical vibration, by G. W. van Santen, 3rd enlarged edition, 360 pages with 251 illustrations.

This is a book that will be of interest to a very wide circle of readers concerned with problems arising from vibration, or whose work entails the measurement of vibration. It is a guide to the solution of problems encountered in daily practice in research and engineering laboratories and will be welcomed by designers of machines, automobiles, aircraft, ships, all kinds of instruments; by architects and sound and acoustics engineers; by physicists and material research workers, and by seismologists.

POPULAR SERIES

The "Popular Series" presents books of rather wider interest, examples being:

Valves for A.F. amplifiers, by E. Rodenhuis, 140 pages, 94 illustrations and 5 double-size schematic diagrams. In colourful binding.

A practical handbook for the construction of amplifiers, with full descriptions and details of 8 circuits. Out of print, a few copies French available.

Remote control by radio, by A. H. Bruinsma, 104 pages, 74 illustrations, 9/—.

An amplitude modulation and an impulse modulation system.

Germanium diodes, by S. D. Boon, 90 pages, 72 illustrations.

As an initial example of the introduction of semiconductors, this booklet deals with the germanium diode, whose properties, simplicity, small size and reliability are shown to the full. Out of print, a few copies German available,

An introduction to the cathode-ray oscilloscope, by Harley Carter, A.M.I.E.E., second reset and enlarged edition, 132 pages, 99 illustrations and 3 folded circuits, 16/—.

A masterly treatment in simple language with no offense to the expert and highly interesting to all who have a nodding acquaintance with electronic circuits.

In this new enlarged edition a section about phase distortion is added to amplifiers for vertical voltage and the last chapter is fully revised. It describes together with their circuit diagrams three complete cathode-ray oscilloscopes. In each case the circuits are fairly simple and the designs are based as far as possible on the use of commercially available components of normal tolerances. The construction of these instruments should be well within the capacity of the serious experimenter or hobbyist.

The various chapters deal with the principles and construction of the cathode-ray tube itself, and with the subsidiary apparatus and circuits which, with the tube, comprise the cathode-ray oscilloscope. A number of practical applications of the oscilloscope are briefly described. Technical information and data on commercial cathode-ray tubes suitable for use in oscilloscopes are given, and the final chapter contains the design, circuits and specifications of several complete instruments.

Hi-Fi amplifier circuits, by E. Rodenhuis, 116 pages, 64 illustrations, 16/—.

Until a few years ago, "Hi-Fi" (high fidelity sound reproduction) was an ideal which could only be approached by a few amateurs who could afford to pay large sums for their equipment. Nowadays the situation is very different.

The quality of available "signal sources" (long-playing records, FM broadcasts and magnetic recording tape) and of reproduction equipment (amplifiers, pick-ups, turntables, loudspeakers, etc.) has been strikingly improved; growing interest has led to rapid increase in sales, and this in turn has had a most welcome effect on the prices at which makers can offer these devices.

This book describes a number of pre-amplifier circuits which give high-quality results and can be built at a reasonable price by anyone who has acquired the minimum skills. Besides the choice of set-ups the book contains just the practical information and tips necessary for the best results. The book is intended for those who are interested in building and experimenting with high-quality amplifiers; for the manufacturer of Hi-Fi equipment on a modest scale; for sound engineers and service engineers; in short for all whose business or pleasure it is to make use of these exciting new techniques.

Practical robot circuits, by A. H. Bruinsma, 2nd edition, 144 pages, 53 illustrations, 8 photographs on art paper, 4 folded circuit diagrams, 18/6, and

Multivibrator circuits, by A. H. Bruinsma, 2nd edition, 76 pages, 41 illustrations, 10/—.

The book **Practical Robot Circuits** offers the reader a detailed description of two robot systems that have been developed as demonstration models. It shows clearly how robot circuits operate and gives an impression of the tremendous possibilities dormant in such circuits.

A "robot" is generally defined as a machine with an external resemblance to man or beast, and which is able to perform (usually limited) actions associated with living beings. This conception differs from the author's point of view: a robot is a circuit or machine capable of reacting independently and unfailingly to certain stimuli applied from without. It goes without saying with such a wide definition there are many kinds of circuits that have to be considered for application.

In practice it appears that almost any problem that arises in the so-called electronic brains and nerve systems can be solved, or solved better, by making use of different kinds of multivibrator circuits and auxiliary gate circuits.

The rather new field of square-wave voltages and of pulse voltages derived therefrom offers so many possibilities that a detailed discussion of them is given in the book **Multivibrator Circuits.**

Both books can be read independently, but even those who are already familiar with the principles may wish to read both of them so as to follow this discussion of the way in which they are applied in practice. The books offer a wealth of very practical information.

Industrial electronics apparatus. Steps in design and maintenance by **P. van der Ploeg,** 116 pages, 22 illustrations, 33 photographs on art paper, 10/—.

Through the fast development of industry fresh fields of applications are discovered almost daily and new construction elements continually widen the scope of industrial electronics in our daily life. The business of ensuring that the equipment is always in efficient working order will remain one of the most important aspects of both construction and general maintenance.

The object of this book is to show both the designer and the service-engineer the extent to which troublefree operation of electronic equipment is dependent on the little things that matter in the design, production, use and maintenance. The development of a typical item of electronic equipment is traced step by step in a logical classification from the first experiment in the laboratory to the production and subsequent maintenance of the final unit. Throughout the book practical tips and hints are given.

For convenience' sake the second part of the book contains some general remarks on the interpretation of tube data with particular reference to gasfilled rectifiers and thyratrons, which are often used in industrial control equipment.

Thyratrons, by C. M. Swenne, 100 pages, 68 illustrations, 4 photo-pages on art-paper, 13/6.

The growing importance of electronics in industry has necessitated the design of tubes specially suitable for industrial use. Control or switching operations on comparatively large currents or high frequencies are often needed; for these purposes high vacuum tubes are less suitable and gas-filled tubes of various kinds are employed. This book deals with one of these gas-filled tubes, the thyratron.

The great advantage of a thyratron is its use as a fast switching device: it combines the functions of a pulse-controlled fast switcher and a regulator.

In a simple way construction, operation and electrical characteristics of thyratrons are here explained. Chapters are devoted to the basic circuits of these tubes and their application in simple industrial devices, for instance relay circuits, timing circuits, d.c./a.c. convertors and automatic circuits to regulate the speed of electric motors and to stabilise rectifiers: applications in which thyratrons show to full advantage.

The book employs only the most elementary mathematical expressions and operations; it is intended for those who want to get a general impression of one currently rather important field of industrial electronics.

Using transistors, by D. J. W. Sjobbema, 134 pages, 138 illustrations, 16/—. Second enlarged edition.

Since the introduction of semiconductors as circuit elements the transistor has passed through a period of radical and rapid development, which even to-day has by no means come to an end. Like the electron tube, the transistor is suitable for amplifying input signals, but it differs from them in a number of essential properties. These properties, such as small dimensions, low weight and low losses, justify its application in preference to electron tubes in devices subject to shocks and vibrations, in portable apparatus, etc.

This book provides a simplified summing up of facts about transistors and their circuits, gives a sound background on electron theory and shows exactly how the junction transistor works. It then describes circuits with transistors as amplifying elements. Only those circuits have been chosen, which have proved their worth in practice.

In the last chapter some simple examples, which the amateur experimenter can build without difficulty, are discussed.

Without undue mathematics, the author has succeeded in explaining practically all the arrangements frequently used in practice.

Descriptive, illustrated leaflets available. Orders can be placed through any bookseller.
In case of difficulty please apply to the publishers:

CENTREX PUBLISHING COMPANY,

2, Cederlaan,

EINDHOVEN — Holland

NOTES:

DETAILED INFORMATION
ON
TRANSMITTING TUBES
FOR HAMS

N2

EXPLANATION OF THE TECHNICAL DATA OF PHILIPS TRANSMITTING TUBES.

I. GENERAL

I-1. In this section of the Electronic Tube Handbook, data and curves are given for transmitting tubes and associated rectifying tubes.

I-2. The tubes of this section may be classified in three groups:

a. preferred types,	recommended for use in newly designed equipment.
b. maintenance types,	although in production, these tubes are not recommended for newly designed equipment.
c. stock-only types;	in general these types can only be delivered from stock. After some time they may no longer be available.

In this Handbook full particulars are given of preferred and maintenance types; data of stock-only types are given only in condensed form, omitting operating conditions. Data on obselete types are not submitted at all.

A list of preferred, maintenance and stock-only types is to be found on a separate sheet following the index. This list will be compiled and published again at regular intervals.

I-3. Classification of the technical data

The technical data of the transmitting tubes may be classified under three headings:

a. characteristic data
b. operating conditions and limiting values
c. characteristic curves

We have tried to word the necessary information concerning the operation of the tubes so as to ensure quick handling of the corresponding data.

II. CHARACTERISTIC DATA

II-1. The characteristic data on the first pages corresponding to each type comprise various general information independent of any specific kind of operation. These data, e.g. that on filament current, amplification factor, mutual conductance, capacitances, etc. should be regarded as pertaining to an average tube representative of that particular type.

II-2. Filaments, heaters

The published nominal value of the filament (heater) voltage is generally the value to which the voltage should be adjusted.

The published filament current is an average value, consequently deviations from this value may occur in practice.

If series feed of the filaments of transmitting tubes is desired, the user is invited to apply to us for the necessary information.

In the case of D.C. fed cathodes the polarity of the filament voltage must be changed regularly for instance each month. This ensures uniform wear of the filament and consequently longer life. This change-over is necessary especially in the case of tubes with external anode.

II-2a. Pure tungsten cathodes (A-cathodes)
The published filament voltage is the maximum voltage that can be required for a new tube to supply the rated output power. But in most cases a lower filament voltage will suffice and this of course will result in a correspondingly longer life. In order to facilitate the adjustment of the filament voltage, every tube with tungsten cathode is supplied with a list stating the emission of that tube as a function of the filament voltage. Provided the necessary emission current is known, the filament voltage can be simply adjusted to the exact value required in each particular case.

Another method of adjusting the filament voltage of each tube with pure tungsten cathode is to decrease the voltage until the desired output power or the maximum permissible distortion is reached. When modulation is applied the voltage should be adjusted so as to obtain the peak output power.

Adjustment of the filament voltage will have to be repeated regularly, for instance monthly, or as soon as the output has reached too low a value or the distortion becomes inadmissibly high.

The nominal value of the filament voltage should on no account be exceeded, as otherwise the life guarantee will be void. If, however, the emission current becomes too low after the expiry of the guarantee period, the filament voltage can be raised above the nominal value.

The meter for measuring the filament voltage should be connected directly to the filament terminals of the tube and should have an accuracy of ± 1% in the voltage range concerned. In general it will be necessary to check the meter monthly with a precision instrument.

In order to allow for mains voltage fluctuations it will be necessary to apply automatic control or control by hand of the filament voltage when the tube is used with nominal filament voltage at nominal mains voltage. When the tube is used with lower filament voltage without control, this will be permissible only when the mains voltage fluctuations do not cause the nominal filament voltage to be exceeded.

II-2b. Thoriated tungsten cathodes (B-cathodes)
In order to attain the maximum life of these cathodes, the filament voltage should be as near as possible to its nominal

value. Both under and overheating may be harmful. The deviation from the published nominal filament voltage must never exceed ± 5%. For measuring the filament voltage see section II-2a

II-2c. Directly heated oxide coated cathodes (C-cathodes)

For maximum life the filament voltage should be as near as possible to its nominal value. The maximum permissible temporary deviation is ± 10%, for mercury-vapour filled valves ± 5%

II-2d. Indirectly heated oxide coated cathodes (E-cathodes)

For adjustment of the heater voltage see section II-2c. The occurrence of H.F. voltages between heater and cathode may give rise to faulty H.F. insulation and high H.F. losses, necessitating high driving power and increased cathode temperature. These voltages should therefore be avoided by by-passing the heater to cathode insulation and decoupling the heater at V.H.F. and U.H.F. The D.C. voltage between heater and cathode should be as low as possible and definitely below the relevant limiting value.

II-2e. Switching on the filament voltage

If a maximum switching-on value of the filament current is not stated in the publications, switching on at full filament voltage is permissible.

It should be stressed that the published values of the maximum permissible filament current during switching on, refer to the absolute maximum of the instantaneous value under the most unfavourable conditions. In the case of A.C. feed this will exist when switching on is performed at the instantaneous peak voltage of the highest mains voltage that may occur. Calculation of the filament circuit, having regard to the maximum current during switching on, is possible when the cold resistance and the filament current to voltage curve are given. The most use in practice is a filament transformer with high magnetic leakage or a series choke or resistor in the primary of the transformer. This choke or resistor may be short-circuited, or not, by means of a relay after a delay of, say, 15 seconds. Generally one switching stage will suffice.

A simple check as to whether the filament current is not exceeded during switching on can be made with the aid of a calibrated cathode-ray oscilloscope connected directly to the filament terminals, the maximum permissible voltage during switching on being found by the product of the published maximum value of the current during switching on and the cold resistance.

II-2f. By-passing of the filament

Where tubes with directly heated cathodes are concerned provision has to be made for the filament terminals to have the same H.F. potential. In the V.H.F. and U.H.F. range by-passing with capacitors will, therefore, be particularly necessary.

II-2g. Position of the filament

If necessary, the mounting position of the tube is stated under the characteristic data.

II-3. Switching on of the anode voltage

Unless prescribed otherwise, simultaneous switching on of filament and anode, grid and screen-grid voltages is permissible for tubes with internal anode. Where tubes with external anode are concerned the positive voltages should be applied only when the cathode has reached its operating temperature, which can be checked by means of the filament current. For rectifying tubes the necessary minimum delay between the switching on of the filament and of the anode voltage is given under the characteristic data. The actual delay required depends on the ambient temperature during starting and can be read from the curve giving the temperature increase of the condensed mercury against time.

II-4. If the filament is fed with D.C. the anode return lead should be connected to the negative end of the filament. If the filament is fed with A.C. the anode return lead should be connected to the transformer mid-tap or to a tapped resistor shunted over the filament.

II-5. Inter-electrode capacitances

The published values of the various capacitances are average values measured on the cold tube, without operating voltages; individual deviation may, however, occur.

The meaning of the various symbols for capacitances can be found in the appertaining list.

The capacitances of each system, as well as the inter-electrode capacitances across the anode and grid circuits in push-pull connection are published in respect of tubes with double electrode systems intended specially for push-pull operation. These latter capacitances are indicated by C_o and C_i respectively.

II-6. Amplification factor μ and mutual conductance S

The published values are average values, and individual deviations may occur. Normally the anode current at which the values have been measured, is mentioned.

II-7. Saturation current I_{sat}

Each one of the large tubes with pure Tungsten cathode is marked with the value of the filament voltage at which the saturation current has a specific value.

II-8. Accessories

Proper functioning of the transmitting tubes can be quaranteed only if accessories have been supplied by the tube manufacturer or have approved by same. This applies to sockets, cooling clips, etc.

III. LIMITING VALUES

III-1. By limiting values are meant the maximum permissible values of the various tube data. They are given either for all operating conditions together, or for each particular application. In the former case the limiting values should be considered as general physical maxima, in the latter case the maxima have been fixed with reference to the particular kind of operation. If for instance the limiting value of the anode dissipation for anode modulation is in question then a value that refers to the unmodulated condition is given. This value is, however, lower than the physical maximum, since at 100% modulation the anode dissipation is higher than that in the unmodulated state.

III-2. The limiting values are applicable only up to a maximum frequency mentioned in each case. When operating at higher frequencies the limiting values should be decreased to correspond with the curves published for each type of tube.

III-3. Derating of the limiting values

If no limiting values have been published for a specific application use can be made of the following table, mentioning the derating factors which have to be applied in each case.

The values valid for class C telegraphy have been expressed as unity; the limiting values for other applications have been expressed as the ratio to this unity.

Wo = tungsten filament

Th = thoriated tungsten filament

		V_a	I_a	I_g	W_{ia}	W_a	W_{g2}
H.F. class C telegraphy		1	1	1	1	1	1
Anode modulation	Th	0.8	0.833	1	0.67	0.67	0.67
	Wo	0.8	0.5	1	0.4	0.4	0.4
H.F. class B	Th	1	0.833	1	0.833^{+})	1	0.67
	Wo	1	0.5	1	0.5	1	0.5
L.F. class B		1	1	1	1	1	1
L.F. class AB		1	1	1	1	1	1
L.F. class A		1	1		W_a	1	1
Self-rectifying oscillator	Th	1.13	0.53	0.53	0.665	1	
	Wo	1.13	0.32	0.32	0.4	1	
Two-phase half-wave without filter	Th	0.9	0.89	0.89	1	1	
	Wo	0.9	0.6	0.6	1	1	

$^{+}$) or 1.5 W_a

The voltage supply with the aid of a 3-phase rectifier with or without filter is equivalent to D.C. supply.

The above-mentioned derating factors are determined only by the special conditions appertaining to the physical limits of the tube, and do not therefore contain any safety margins. Where mains voltage fluctuations can be expected the actual derating must go on, until the derated values are not exceeded at maximum mains voltage (see section III-4). The nature of operation, e.g. the industrial application of H.F.heating generators,may also require a further safety derating because of the rough nature of the operation (see section V-5).

III-4. Following common practice the limiting values of transmitting tubes have been given as <u>absolute maxima</u>. This means that the maxima should never on any account be exceeded for instance by mains voltage fluctuations, deviations in the values of the circuit parts, tolerances in the tube properties or meter deviations. Each "limiting value" should be regarded independently of other values, so that under no circumstances it is permitted that any "limiting value" be exceeded. If, for instance, the anode voltage is decreased to a value lower than its "limiting value", it is unpermissible to exceed the "limiting value" of anode current or anode dissipation.

Unless explicitly mentioned otherwise, the "limiting values" are referred to D.C.

III-5. The voltages (V_a, V_g, V_{g2}, etc.) mentioned under "limiting values" should not be exceeded, not even with the cold valve. Special attention should be paid to this point in regard to screen-grid supply with a series resistor.

When designing equipment intended for non-stabilized mains voltages, the maximum mains voltage occurring will determine the nominal operating voltages of the tubes; these have to be lower than the "limiting values".

Should it occur that the transmitting tubes, and thus, too, the voltage supply unit, are temporarily under a lower load, their voltages will increase and these increased values occurring at the highest mains voltage will determine the nominal operating voltages.

The "limiting values" of the voltages are D.C. values. If A.C. voltage supply is used or supply with unsmoothed voltage, the "limiting values" must be decreased in accordance with the derating factors shown in the table in section III-3. The publications re some types of tube contain a special table with "limiting values" for these (industrial) applications.

III-6. The "limiting values" of the anode dissipation should not be exceeded when for instance mains voltage fluctuations occur, or when the grid drive fails. In order to prevent damage to the tube, in the case of the latter, adequate fixed bias or a quick action relay in the anode lead should be provided for instance. When forced-air or water-cooling is applied for an anode dissipation smaller than the absolute maximum, the smaller value should of course be regarded as the "limiting value".

III-7. In some cases the published "limiting values" of the input power W_{ia} are smaller than the product of the "limiting values" of anode voltage and anode current; the latter should not then occur simultaneously.

The input power W_{ia} is not always the product of the D.C. values of I_a and V_a. For pulsating supply voltage the form factor should be taken into account.

III-8. For the screen-grid dissipation the product of screen-grid voltage and current can always be taken. When secondary emission occurs, this can be ignored.

III-9. The control grid dissipation W_g or W_{g1} can be calculated by taking the power supplied to the grid bias source ($-V_g \times I_g$) from the driving power ($0.9 \times V_{gp} \times I_g$). When A.C. voltage supply or supply with unsmoothed voltage is used the form factor should be taken into account. Secondary emission of the control grid can be ignored.

III-10. By the maximum permissible grid resistance, R_g, is meant the D.C. resistance in the grid circuit. A higher value may cause instability.

IV. OPERATING CONDITIONS

IV-1. General

Tables of operating conditions for the current applications of transmitting tubes such as for instance class C telegraphy, H.F. class B, L.F. class B, etc., have been published. The values for these tables have been measured or calculated from average tubes under optimum conditions. The values measured from a particular tube may therefore show small deviations from the published data. Some of the voltages or currents have to be adjusted to the published values, while others have to be considered as the outcome of measurements and may therefore show deviations from the published data. The published value of the output power, for instance, will be an average value, which, however, can be approximated in practice by correcting e.g. the H.F. or L.F. input voltage V_{gp} when the published value of the output power is not obtained at the nominal value of V_{gp} In connection with the preceding paragraphs it will be useful when designing a transmitter with several stages to leave a margin in the output power and the input voltages.

The published output power of transmitting tubes is the tube output, which means the anode dissipation W_a taken from the anode input W_{ia}; losses in the anode circuit and coupling losses are thus not taken into account.

The quoted driving power is assumed to be $0.9 \times$ the product of the average grid current I_g and the peak value of the grid voltage V_{gp}. If present, input losses and losses in the grid circuit and the bleeder are not included.

On short wavelengths, where reduced ratings will have to be applied, the required driving power will often be considerably higher than the published value, and in some cases it may even be determined almost exclusively by circuit losses.

In the published data for transmitting tubes operating conditions for the various applications have been given. The first column of each table generally gives the maximum performance which may be obtained without exceeding any of the limiting values. Moreover, each column mentions the maximum frequency at which the anode voltage concerned and other data are permitted to be applied. These maximum frequencies and data for each tube appear on a chart which usually companies the publication. For application of a tube at frequencies, higher than those mentioned on this chart, the tube manufacturer should be contacted. Should the above-mentioned chart not have been published, linear interpolation between the data given in the tables can be applied.

IV-2. Rectifying tubes

Under the heading "Operating Conditions" in the publications on rectifying tubes, the operational data have been given for 7 rectifying circuits at transformer-voltages at which the stated inverse peak voltage is reached. It should be observed that the average value of the direct voltage supplied to the smoothing filter (V_o) is published without taking the transformer regulation or the voltage drops in the tubes into account. For single-phase full-wave rectification the form factor has not been considered.

V. APPLICATION OF THE "OPERATING CONDITIONS"

V-1. The published "Operating Conditions" cannot be applied in all circumstances, the nature of some services being such, that deviations from the required values will occur, resulting in an infringement of the limiting values. Depending on the kind of service the following classification can be made:

a. Fixed transmitters for broadcasting and telecommunication service operated by a trained staff.
b. Mobile transmitters.
c. Devices for industrial applications, diathermy, supersonics, etc.
d. Amateur transmitters and special applications.
e. Pulsed operation.

V-2. Fixed transmitters

With fixed transmitters it is in general permissible to use the tube under optimum operating conditions at values of V_a, W_a, etc. equaling the limiting values. The main reasons applying in most cases for this may be summarized as follows: stabilization of the mains voltage automatically or by hand, only very small deviations in the mains voltage owing to the supply being effected via a special high tension line, transmitter load which is practically constant and optimum, the presence of a well-trained staff for immediate repair of faults which might damage the tube, or the presence of automatically functioning safety devices preventing damage to the tube in any circumstances arising in practice.

V-3. Mobile transmitters are transmitters operating in circumstances affected by this mobility. This category includes ship, portable, motorcycle, car and aircraft transmitters. These transmitters will very often have to function with strongly varying supply voltages and with a load that is neither constant nor optimum. Safety devices will be only very imperfect, especially in the smaller types of mobile transmitters, and therefore use of the tube with the published maximum operating conditions is not at all desirable.

The actual operating conditions chosen will depend upon the performance of the transmitter and upon the specific circumstances such as for instance the safety devices, the voltage constancy, the desired life, duty cycle, etc. Because of the inconstancy and uncontrolled operation of transmitters in mobile devices, it will generally be impossible to guarantee the tubes, except for factory defects unrelated to the nature of operation of the tube.

The smaller transmitting tubes with oxide-cathode have been designed especially for mobile devices. The oxide cathode is rather insensitive to heater voltage variations, and the high specific emission permits of rather low anode voltages. The cathode and the electrode system have been constructed so as to form a rugged unit that can be used in non-resilient apparatus.

The vibrations occurring in normal vehicles are of the order of 1 g, whereas shocks of 2.5 g will very seldom occur. In aircraft and in vehicles used over rough ground it will as a rule be necessary to install the tubes in a resilient fitting.

In general, when installed in vehicles, tubes with thoriated tungsten cathode will require a resilient installation. In some cases such an installation will also be required in ships. In movable apparatus such as H.F. generators when a special clamping device is used for preventing the tube from falling out of the socket, care should be taken that no metal parts touch the bulb and that the maximum permissible temperature is not exceeded in any part of the bulb.

V-4. Intermittent service

When data concerning intermittent service are published on a transmitting tube, it is understood that the on-period of operation does not last longer than 5 minutes and that every on-period is followed by an equally long or longer off-period. The cathode, however, may be heated continuously during this kind of operation. Generally only the published or lower adjustments for intermittent service are permissible.

V-5. Industrial application for diathermy, supersonics, etc.

Industrial electronic apparatus may in many respects be distinguished from fixed broadcast and telecommunication transmitters in so far as the use of the tubes is involved. The differences result from:

1. The personnel servicing the equipment being, as a rule, untrained.
2. The variable and, mostly, adjustable load.

3. The mains voltage fluctuations, which normally are considerable and not compensated.
4. The voltage supply without provision against hum.
5. The relative unimportance of the frequency.
6. The intermittent service.

The design for industrial apparatus will for these reasons differ fundamentally from that of normal transmitting apparatus, and generally demands the application of self-oscillating triodes.

In order to obtain a fool-proof apparatus, that cannot be damaged internally by faulty manipulation, the nominal anode voltage has to be so chosen that the limiting values are not exceeded at the maximum occurring mains voltage.

In the case of voltage supply without rectifier or of two-phase half-wave rectification without filter, the positive voltages will be of a pulsating character and the average values of voltages and currents will therefore have to be chosen lower than in the case of normal D.C. supply.

In general the design of industrial apparatus should be such that the limiting values at the highest occurring mains voltage are not exceeded. Special attention should be paid to the grid dissipation and the grid current, since in most cases these values are critical.

In special cases of intermittent service it will be possible to increase the limiting values. Information concerning these possibilities will be supplied on request by the tube manufacturer.

Preference is given to one tube in each H.F. generator. If one tube does not give sufficient output two tubes in parallel can be used. Push-pull operation is not recommended as equal load of the tubes is barely obtained when load and earth capacitance are variable. When two tubes are operated in parallel the use of separate grid resistors and a common grid fuse is recommended.

V-6. Amateur transmitters and special adjustments

The maximum permissible load of a tube is naturally determined by the physical maxima of the tube, incorporated in the limiting values. No guarantee in respect of the tube life can be given if the limiting values are exceeded. This does not imply that exceeding the limiting values will always result in an immediate breakdown of the tube, and in the case of I.C.A.S. (Intermittent Commercial and Amateur Service), for instance, higher operating conditions have been given (see section V-4). As a rule no guarantee of tube life is given in these cases.

Information with regard to special circuits, adjustments and operating conditions will willingly be supplied on request.

V-7. Pulsed operation

When a tube is used with pulsed operation the pulse time has to be so short that neither will any part of the tube reach an abnormal temperature nor the contingency of flashing-over have any opportunity to develop into an actual flashing-over. In general the average load will be considerable lower than the maximum load, according to the limiting values

General information on this kind of operation is not yet available. Information, however, will gladly be given on each specific case.

V-8. H.F. class C telegraphy

A class C amplifier or oscillator is an amplifier in which the grid bias is appreciably greater than the cut-off voltage of the I_a/V_g-characteristic concerned, so that plate current flows only for less than one half of each cycle of the alternating grid voltage. In practice, a grid bias of 2 to 2.5 times the cut-off voltage will give good results.

The data published are such as will ensure favourable results as to output power and efficiency.

If a grid resistor is used for obtaining automatic grid bias, care should be taken that the anode current does not become too high when the H.F. driving power fails. A safety device in the anode or screen-grid lead will be desirable for this purpose.

V-9. H.F. class C anode modulation

For H.F. class C anode modulation the anode voltage of an H.F. class C amplifier is modulated with L.F. For 100 % modulation the anode voltage is varied from zero to twice the D.C. value of the voltage. With screen-grid tubes the screen grid should also be modulated to prevent it from being overloaded. The average value of the grid bias and the H.F. driving voltage remain constant during the modulation. With 100 % modulation the average anode dissipation is 1.5 times its value without modulation.

The published limiting value of the anode dissipation refers to the value without modulation. The higher dissipation with modulation is, however, taken into consideration.

In this application automatic grid bias by means of a grid leak can be applied. In order to prevent damage to the tube when the driving voltage fails, partly fixed bias is recommended.

The modulation power published in the data sheets is the power supplied to the modulated H.F. stage. When the modulating stage is being calculated, 5 to 10 % will have to be added for losses in transformer and choke.

V-10. H.F. class B telephony

A class B amplifier is an amplifier in which the grid bias is approximately equal to the cut-off voltage of the relative I_a/V_g-characteristic, so that plate current flows for approximately one half of each cycle of the alternating grid voltage. If a telephony amplifier is concerned, a modulated H.F. signal will have to be amplified.

In order to obtain a straight modulation characteristic the published data for H.F. class B telephony have been determined by the method of trial and error.

V-11. L.F. class B amplifier

With this amplifier the anode dissipation is dependent on the input signal voltage, so that maximum anode dissipation is obtained at a signal strength of about 60 % of the value at full drive. When this signal strength of 60 % is not present continuously, as is the case e.g. in broadcast and telephony service, it is permissible for the limiting value of the anode dissipation to be exceeded by 10 % at the point of maximum dissipation. To suppress the occurrence of even harmonics separate controllable grid bias for both tubes can be applied or use can be made of a balancing circuit.

The published data in L.F. class B amplifier service normally give one table for maximum output and other tables for modulating the same type of tube in a published anode-modulation circuit. These published data are rather arbitrary, i.e., the same output can also be obtained with less modulation of the anode current (with smaller load resistance and lower peak grid current), although the efficiency is then smaller. It depends on the circuit of the entire L.F. amplifier which kind of operation is to be preferred.

V-12. Industrial operating conditions

In section V-5 some general remarks have been given concerning the application of transmitting tubes in industrial apparatus (diathermy, inductive and capacitive heating, supersonics, etc.). With single-phase mains connection a hum filter will sometimes be omitted; this omission is usual with three-phase mains connection. Operating conditions have therefore been published giving derating factors for this kind of operation (see chapter III-3).

The operating conditions are divided over two columns, the first giving data which are limited only by the limiting values. Care must be taken that under these operating conditions the limiting values are not exceeded by fluctuations in the mains voltage, or in the load, or by tolerances in the circuit elements.

In the second column the anode voltage and the anode current have been taken at 85 % of the maximum value, and the efficiency has also been reduced to some extent. Under these conditions normal deviations of voltages and load are permissible. The limiting values of the tube should not be exceeded, even under the most unfavourable conditions.

The published value of the output power is the tube output, and where a self-oscillating circuit is in operation, this value should be diminished by the losses in the input circuit, the quoted driving power and, if present, the losses in the input circuit, in order to obtain the actual output in the load.

A favourable load-output characteristic may be obtained by a method of automatic control of the grid voltage and grid current, depending on the matching. Since the grid current is limited in this type of circuit, it may at the same time serve for preventing overloading of the grid. A non-linear element in the grid circuit, e.g. a tungsten lamp or an N.T.C. resistor may help in preventing overloading in the grid.

Moreover, where self-oscillating circuits are concerned, measures may be taken to maintain the frequency within the available frequency band. These measurements may consist of a large circuit capacitance, small stable self-inductance, undercritical inductive coupling with the output circuit, electrostatic screening between generator and output circuit, etc.

If the frequency of industrial generators has to be limited to a small frequency band, crystal-controlled driving stages may be used. Then,, however, matching between the tube input and output is rather difficult to obtain. A higher safety margin in the tube load will be necessary with still a high dependence of the output on the load, or special measures such as automatic tuning and/or matching control will have to be taken.

For smaller tubes operating conditions for industrial applications have been given for supply from a two-phase, half-wave rectifier, for supply with raw A.C. voltage and for supply with three-phase half-wave rectifier. The latter case practically coincides with D.C. supply for this purpose.

A.C. supply without rectifier will give about 0.6 times the output obtained with D.C. supply. It should be taken into account that supply without rectifier results in a peak inverse voltage equal to the full anode voltage. This is of special importance when the grid voltage is in counterphase to the anode voltage.

With two-phase, half-wave rectification of the supply voltage, the useful output is about equal to that with D.C. supply. In order to obtain a favourable loading of the mains when using a self-rectifying oscillator, a quasi push-pull circuit can be used, in which two tubes function alternately on each half wave. A favourable loading of the mains for three-phase, self-rectification will be obtained by the use of 6 tubes in a triple push-pull circuit.

APPLICATION DIRECTIONS FOR MERCURY-VAPOUR AND GAS-FILLED HIGH-VOLTAGE RECTIFYING TUBES

The following instructions apply in general to all types of high-voltage rectifying tubes. If there are additional instructions for any type of tube it will be indicated on the technical data sheets of the concerning type.

MOUNTING

The mercury-vapour filled types must be mounted vertically with the base or filament strips at the lower end. The mounting position of the gas-filled types is in general arbitrary.

The tubes must be mounted so that air can circulate freely around them. Therefore the clearance between the tubes and other components of the circuit and between the tubes and the cabinet walls should be at least half the maximum bulb diameter. The minimum clearance between tubes should be 3/4 the maximum bulb diameter.

It should be realised that a minimum clearance is also required for reasons of high voltage insulation.

When a tube is operating and the cooling is only obtained by natural convection the temperature distribution along the bulb will be such that the lowest temperature occurs at the bottom. This distribution is of special importance in the case of mercury-vapour filled types in order to condense the mercury-vapour in the lower part of the tube. Where additional cooling is necessary this cooling should not disturb this normal temperature distribution along the bulb.

Generally if shock or vibration exceeds 0.5 g a shock absorbing device should be used.

The electrode connections, except those of the tube socket, must be flexible. The nuts (e.g. of the anode connections) should be well tightened but care must be taken to ensure that no undue forces are exerted on the tube. The contacts must be checked at regular intervals and their surfaces kept clean in order to avoid excessive heating of the glass-metal seals. The cross section of the conductors should be sufficient not to be heated by the current and to conduct the heat away from the tube. (It should be noted that in rectifier circuits the r.m.s. value of the anode current may reach 2.5 times the average value).

FILLAMENT SUPPLY

In order to obtain the maximum life of a directly heated cathode, a filament transformer with centre-tap and a phase shift of $90^0 \pm 30^0$ between V_a and V_f is recommended. Series connection of filaments is not allowable.

The filament voltage at nominal mains voltage must be measured at the terminals of the tube. Permanent deviations up to 2.5% from the published value can be accepted. It is therefore recommended that the filament transformer be equipped with suitable tappings. Temporary variations should not exceed 5%.

However to ensure maximum life it is important to keep the filament voltage as near as possible to the nominal value.

In calculating the rating of the filament transformer a spread in the filament current of ± 10% from tube to tube should be taken into account, whilst for directly heated tubes the DC current flowing through the heater winding should also be considered. It is recommended to furnish the filament transformer with several taps on the primary especially in case of HT-insulated high magnetic leakage transformers.

TEMPERATURE

1. Tubes filled with mercury vapour

In the technical data of these tube types temperature limits for the condensed mercury are given. During operation the condensed mercury should only be visible in the neighbourhood of the socket or the lowest part of the bulb. Care should be taken to ensure that the condensed mercury temperature during operation is between the published temperature limits. Too low a temperature gives low gas pressure which results in a low current carrying capability, high arc drop and consequently shortening of life. Too high a temperature gives high gas pressure which results in a reduction of the permissible peak inverse and forward voltage.

Accurate values of the condensed mercury temperature can be measured by means of a thermocouple placed against the envelope, but good technique and instruments are necessary for this measurement. In general temperature values of sufficient accuracy can be obtained by using a normal mercury thermometer the mercury vessel of which is wrapped in staniolstrips and that can be fixed against the bulb by means of a cotton thread.

The temperature measurements should be made at the coldest part of the bulb where the mercury vapour condenses which in general will be just above the base or the lower connections.

In addition to the temperature limits for the condensed mercury sometimes limits for the ambient temperature are given. For each type there is a specific difference between ambient and condensed mercury vapour temperature. High ambient temperature can make it desirable to decrease this difference, which can be obtained by directing a low velocity air flow of ambient temperature or less to the glass just above the base.

The condensed mercury vapour temperature is decisive in all cases.

The ambient temperature can be measured by a thermometer which has been screened against direct heat radiation. The measurement should be carried out at various points around the lower part of the tube.

2. Tubes with inert gas filling

For these tubes only the limits of the ambient temperature are given. These limits are in general minimum -55°C and maximum +75°C.

SWITCHING ON

If switching on of the rectifier takes place twice a day or less the allowable peak anode current when switching on may amount up to twice the maximum published value for I_{a_p}

1. Tubes filled with mercury vapour

It is necessary to allow time for the cathode to reach its operating temperature before drawing anode current. Therefore the minimum cathode heating time is given in the published data sheets of each type. After the cathode heating time the high voltage may be switched on provided the temperature of the condensed mercury vapour is not too low and all the condensed mercury is confined to the lower part of the bulb.

Sometimes a heat conserving hood is prescribed for the tube. The purpose of this hood is to avoid condensation of the mercury vapour on the electrodes and upper part of the bulb whilst the tube is cooling.

Switching on (not after transport) may be done at a condensed mercury temperature which lies 5 to 10°C below the published minimum temperature (minimum waiting time required). However, it is good practice to switch on after the temperature has reached its minimum published value (recommended waiting time).

The waiting times, the minimum required and the recommended one can be read from the curve representing the condensed mercury temperature rise as a function of time with only the filament voltage applied to the tube.

Switching on after transport or after a considerable interruption of operation should be done according to the instructions on the published data sheets.

In order to avoid long preheating times it is recommended to leave the filament supply on during standby periods (e.g. overnight)at 60 to 80% of the nominal value.

Stand by position for mercury vapour filled tubes

In order to have a spare tube always ready for immediate operation it is recommended to have a spare position where a tube stands with continuously a filament voltage of 60-80% of the nominal voltage applied.

When for a certain type a heat conserving hood is prescribed this hood should be fitted on the tube.

2. Tubes with inert gas-filling

It is necessary to allow the cathode to reach operating temperature before drawing anode current. The relevant minimum cathode heating time is given in the technical data sheets of each type. After warming up the anode voltage may be applied provided that the ambient temperature is not below the minimum published value.

No other delays apart from the cathode heating delay are required.

LIMITING VALUES

It should be realised that these values are given as absolute maxima; i.e. maxima which should not be exceeded under any condition (either on account of mains voltage fluctuations, load variations, tolerances on components, overvoltages etc.).

For some ratings of maximum average current a maximum averaging time is quoted. This is to ensure that an anode current greater than the maximum continuously permissible average value is not drawn for such a length of time as would give rise to an excessive temperature within the tube.

The maximum peak anode current is determined by the available safe cathode emission whereas the average current is limited by its heating effects. During normal operation or frequent switching the peak current should not exceed its maximum published value.

For the determination of the actual value of the peak inverse voltage and the peak anode current, the measured values with an oscilloscope or otherwise are decisive.

The I_{surge} is the maximum fault current which should ever be allowed to pass through the tube. (See section "Short circuit protection").

DESIGN VALUES

1. V_{arc}

The value published for V_{arc} applies to average operating conditions.

2. Frequency

Unless otherwise stated the maximum frequency at which the tubes may run under full load is 150 c/s. Under special conditions (derating of voltage and current) higher frequencies may be used; details should be obtained from the manufacturer.

TYPICAL OPERATING CONDITIONS

Sometimes 2 columms of operating conditions are given viz. one giving theoretical values based on the absolute maxima and one giving more practical values in which mains fluctuations of max. 10% and a voltage drop in tube, transformer, filter etc. of max. 8% are incorporated.

SHORT CIRCUIT PROTECTION

In order to prevent the tube from being damaged by passing too high a fault current a value for the maximum permissible surge current is given.

The figure given for the maximum surge current is intended as a guide to equipment designers. It indicates the maximum value of a transient current resulting from a sudden overload or short circuit which the rectifier can pass for a period not exceeding 0.1 second without resulting in its immediate destruction. Several overloads of this nature will, however, considerably reduce the life of the tube.

The equipment designer has to take into account this maximum surge current rating when calculating the short-circuit impedance of the equipment. This surge current value is not intended as a peak current that may occur on switching or during operation.

A simple method to limit the surge current to the maximum rating is to put a series resistance in the anode circuit which in most cases will also be necessary because the relation between the ohmic and the inductive resistance of the short circuit path should be at least 0.3

SCREENING AND INTERFERENCE

In order to prevent unwanted ionisation of the gas filling (and consequent flash over) due to strong R.F. fields, it may be necessary to enclose the rectifier in a separate earthed screening box. Of course R.F. should be prevented from reaching the rectifier by R.F. chokes and condensers.

In circuits with gas filled tubes oscillation in the transformer windings can occur especially in grid controlled circuits. These oscillations should be reduced by suitable circuits as excessive peak inverse voltages may occur, causing arc back. The use of two parallel R.C. circuits is advisable.

An air choke in the order of 100 µH should be connected in series with and close to the anode connection. This choke can advantageously be wound from resistance wire in order to help short circuit protection.

Special attention should be paid to the damping circuits if the primary of the H.T. transformer is connected to a H.T. mains.

SMOOTHING CIRCUITS

In order to limit the peak anode current in a rectifying tube it is necessary to use a choke-input filter.

If switching on of the rectifier takes place twice a day or less the allowable peak anode current when switching on may reach a value of twice the published max. value for I_{a_p}

To ensure good voltage regulation on fluctuating loads the inductance value of the choke should be large enough to give uninterrupted current at minimum load. The choke and capacitor must not resonate at the supply or ripple frequency. Damping of this choke will be necessary.

In grid controlled rectifier circuits under "phased back" conditions the harmonic content of the d.c. output will be large unless the inductance is adequate.

PARALLEL OPERATION OF MERCURY-VAPOUR OR GAS FILLED TUBES

As individual gas- or mercury-vapour filled tubes may have slightly different characteristics two or more tubes must not be connected directly in parallel.

Parallel operation is permissible when series resistances are used and the peak voltage drop over this series resistance is at least the ignition voltage. Coupling transformers in the anode leads of parallel connected tubes can serve the same purpose.

GRID CONTROLLED RECTIFIERS

When a thyratron is conducting, a positive ion current of a magnitude proportional to the cathode current is generated. This current will, in general, flow to that electrode which is at the most negative potential during conduction (e.g. the grid). In order to prevent damage to the tube it is necessary to ensure that the voltage of this electrode is more positive than -10 volts during this phase. This precaution will prevent an increase in electrode emission due to excessive electrode dissipation, sputtering of electrode material, changes in the control characteristics caused by shift in contact potential and, in the case of inert gas-filled tubes, a rapid gas clean-up The minimum allowable value of the grid resistor is 0.1 x the recommended one.

In circuits where the anode potential changes from a positive to a negative value and the control grid is at a positive potential, thereby drawing grid current, a small positive ion current flows to the anode. At high negative anode voltages it is therefore essential to limit the magnitude of the positive ion current by severely restricting the current flowing from cathode to grid.

This may be effected by using fixed negative grid bias and narrow positive firing pulses.

However, for bridge circuits the minimum width of these pulses should be sufficiently large to secure safe "take-over" of the discharge.

In those circuits where the anode potential changes very rapidly from a positive to a high negative value, such as with inductive loads fed from polyphase supplies, there will be residual positive ions within the tube which will be drawn towards the anode with considerable energy. In the case of an inert gas-filled tube this would result in excessive gas clean-up and it is therefore necessary to observe the limitations imposed by the commutation factor.

CONTROL CHARACTERISTICS

In most cases the control characteristic given on the data sheets is shown by upper and lower boundary curves within which all tubes may be expected to remain at all temperatures of the published range and during life.

In multitube circuits where the tubes are operating under the same conditions the spread will in general be smaller.

The published boundaries are therefore to be considered as extreme limits. This should be taken into consideration when designing grid excitation circuits.

GRID EXCITATION CIRCUITS

To keep the instant of ignition as constant as possible a large value of excitation voltages is recommended.

The use of a negative grid bias (50 to 120 volts) and a sharp positive grid pulse is recommended. The magnitude of the grid pulse should be 100 to 200 volts with a grid series resistor of 10 kΩ and a maximum impedance of the peaking transformer of 10 kΩ. If a sinusoidal grid voltage is used r.m.s. values of 50 to 120 volts in combination with a negative grid bias of 50 to 120 volts are recommended.

BRIDGE CIRCUITS (diagrams b, e and g)

For output voltages of more than 6 kV bridge circuits are recommended because of the lower peak inverse anode voltage and the larger range of applicable ambient temperatures.

The current angle of the grid should be for 2 phase bridge circuits › 90°, for 3 phase › 60°, and for 4 phase › 45°.

SINGLE ANODE MERCURY VAPOUR RECTIFYING VALVE
TUBE REDRESSEUR MONOPLAQUE A VAPEUR DE MERCURE
EINANODIGE GLEICHRICHTERRÖHRE MIT QUECKSILBERDAMPF-FÜLLUNG

Filament : oxide-coated
Filament : oxyde
Heizfaden: Oxyd

Heating : direct
Chauffage: direct
Heizung : direkt

V_f = 4 V [1][2]
I_f = 2,5 A

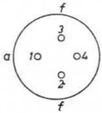
Typical characteristics
Caractéristiques types
Kenndaten

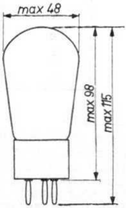
V_{arc} (I_a=250mA) = 12 V

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 500 c/s
V_{inv_p} = max. 3000 V [3]
V_{inv_p} = max. 2550 V [4]
I_o = max. 250 mA
I_{a_p} = max. 1250 mA
t_{amb} = 10 - 40 °C

Dimensions in mm
Dimensions en mm
Abmessungen in mm





Base, culot, Sockel: A

---

[1] In order to ameliorate the life of the tube a preheating time of the filament of at least 15 sec. is recommended. Pour améliorer la durée de vie du tube il est recommandé de préchauffer le filament pendant 15 sec. au moins. Zur Verbesserung der Lebensdauer der Röhre wird eine Vorheizung der Katode während mindestens 15 Sek. Empfohlen.

[2] See page 2; voir page 2; siehe Seite 2

[3] f = 150 c/s [4] f = 500 c/s

Socket Support de tube Röhrenhalter	40465

Mounting position: vertical with base down
Montage : vertical avec le culot en bas
Einbau : senkrecht mit Sockel unten

Net weight Poids net Nettogewicht	45 g
Shipping weight Poids brut Bruttogewicht	70 g

Operating conditions
Caractéristiques d'utilisation[5]
Betriebsdaten

V_{inv_p} = 3 kV				
Circuit[6] Schaltung	V_{tr} (V_{eff})	V_o (V)	I_o (A)	W_o (kW)
a	1060	950	0,5	0,48
b	2120	1910	0,5	0,95
c	1220	1430	0,75	1,07
d	2120	2870	0,75	2,15
e	1060	1240	1,5	1,86
f	1060	1350	1,0	1,35
g	2120	2700	1,0	2,70

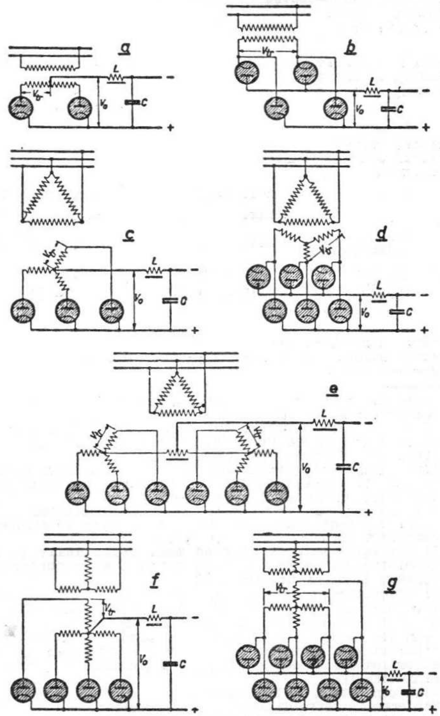
---

[2] Phase shift of 90° ± 30° between V_a and V_f and use of a centre-tapped filament transformer is recommended
Il est recommandé d'opérer le tube avec un décalage de phase entre V_a et V_f de 90° ± 30° et d'utiliser un transformateur de chauffage à prise médiane
Eine Phasenverschiebung von 90° ± 30° zwischen V_a und V_f und die Verwendung eines Heiztransformators mit Mittelanzapfung wird empfohlen

[5] Transformer regulation and voltage drops in the tubes are neglected
Les chutes de tension du transformateur et des tubes ont été négligées
Mit Spannungsverlusten im Transformator und in den Röhren ist keine Rechnung getragen

[6] For circuits see page 3
Pour les circuits voir page 3
Für die Schaltungen siehe Seite 3

Rectifying valve circuits
Circuits des tubes redresseurs
Schaltungen von Gleichrichterröhren



7R51054

SINGLE ANODE MERCURY VAPOUR RECTIFYING VALVE
TUBE REDRESSEUR MONOPLAQUE A VAPEUR DE MERCURE
EINANODIGE GLEICHRICHTERRÖHRE MIT QUECKSILBERDAMPFFÜLLUNG

Filament : oxide-coated
Filament : oxyde
Heizfaden: Oxyd

Heating : direct
Chauffage: direct
Heizung : direkt

V_f = 2,5 V 1)
I_f = 4,8 A
T_w = min. 30 s 2)

Limiting values
Caractéristiques limites
Grenzdaten

I_o	= max. 0,25 A	max. 0,5 A
I_{a_p}	= max. 1 A	max. 2 A
V_{inv_p} (max. 150 c/s)	= max. 10 kV	max. 2 kV
t_{Hg} 3)	= 25 - 60 °C	25 - 70 °C
tamb 4)	= 15 - 40 °C	15 - 50 °C

General characteristics
Caractéristiques générales
Allgemeine Daten

V_{arc} (I_o =0,25 A) = 12 V

---

1) Phase shift of 90° ± 30° between V_a and V_f and use of a centre-tapped filament transformer is recommended
Il est recommandé d'opérer le tube avec un décalage de phase entre V_a et V_f de 90° ± 30° et d'utiliser un transformateur de chauffage à prise médiane
Eine Phasenverschiebung von 90° ± 30° zwischen V_a und V_f und die Verwendung eines Heiztransformators mit Mittelanzapfung wird empfohlen

2) Waiting time after transport at least 30 minutes
Délai d'attente après le transport au moins 30 minutes
Wartezeit nach Transport mindestens 30 Minuten

3) If the equipment is started max. twice daily it is permitted to apply the high tension at a condensed mercury temperature of 20°C
Si l'équipement est mis en circuit deux fois au max. par jour, il est permis d'appliquer la haute tension à une température du mercure condensé de 20°C
Wenn die Anlage nicht mehr als zweimal täglich eingeschaltet wird, ist es gestattet die Hochspannung bei einer Temperatur des kondensierten Quecksilbers von 20°C einzuschalten

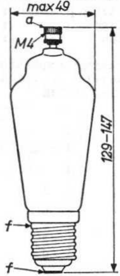
4) With convection cooling only
Seulement à refroidissement par convection
Nur mit Kühlung durch Konvektion

DCG 4/1000

Dimensions in mm
Dimensions en mm
Abmessungen in mm

DCG 4/1000 ED

Base, culot, Sockel: Edison
Socket, support, Fassung: E3 000 22



Net weight
Poids net 65 g
Nettogewicht

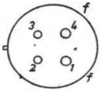
Shipping weight
Poids brut 155 g
Bruttogewicht

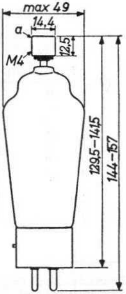
DCG 4/1000 G

Base : Medium 4p with bayonet
Culot : Medium 4p à baionnette
Sockel: Medium 4p mit Bajonett

Socket :
Support: 40218 - 03 [1]
Fassung:

Cap, capot, Haube: 40619





Net weight
Poids net 80 g
Nettogewicht

Shipping weight
Poids brut 125 g
Bruttogewicht

---

[1] At voltages above 2 kV the socket must be insulated from the chassis
A des tensions au-dessus de 2 kV le support faut être isolé du châssis
Bei Spannungen über 2 kV muss die Fassung vom Chassis isoliert werden

Mounting position: vertical with base down
Montage : vertical avec le culot en bas
Einbau : senkrecht mit dem Sockel unten

Operating conditions
Caractéristiques d'utilisation 1)
Betriebsdaten

V_{inv_p} = 10 kV				
Circuit 2) Schaltung	V_{tr} (kV_{eff})	V_o (kV)	I_o (A)	W_o (W)
a	3,5	3,2	0,5	1590
b	7,1	6,4	0,5	3180
c	4,1	4,8	0,75	3600
d	7,1	9,6	0,75	7200
e	3,5	4,1	1,5	6200
f	3,5	4,5	1	4500
g	7,1	9,0	1	9000

V_{inv_p} = 2 kV				
Circuit 2) Schaltung	V_{tr} (kV_{eff})	V_o (kV)	I_o (A)	W_o (W)
a	0,71	0,63	1	630
b	1,41	1,27	1	1270
c	0,82	0,96	1,5	1430
d	1,41	1,91	1,5	2870
e	0,71	0,83	3	2480
f	0,71	0,90	2	1800
g	1,41	1,80	2	3600

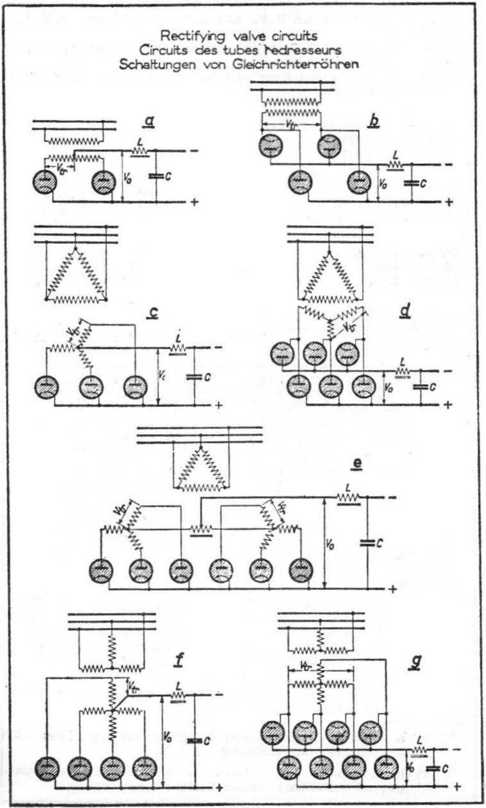
---

1) Transformer regulation and voltage drops in the valves are neglected

Les chutes de tension du transformateur et des tubes ont été négligées

Mit Spannungsverlusten im Transformator und in den Röhren ist keine Rechnung getragen

2) For circuits see page 4
Pour les circuits voir page 4
Für die Schaltungen siehe Seite 4


Rectifying valve circuits
Circuits des tubes redresseurs
Schaltungen von Gleichrichterröhren
a
b
c
d
e
f
g
L
C
V_o
V_{tr}
V_c
−
+

7R51054

PE 05/25

PENTODE for use as H.F. and L.F. amplifier and oscillator
PENTHODE pour utilisation comme amplificatrice H.F. et B.F. et oscillatrice
PENTHODE zur Verwendung als H.F. und N.F. Verstärker und Oszillator

Cathode : oxide-coated
Cathode : oxyde
Kathode : Oxyd

Heating : indirect
Chauffage: indirect
Heizung : indirekt

Vf = 12,6 V
If = 0,7 A

Capacitances
Capacités
Kapazitäten

Ca = 7,8 pF
Cg1 = 14,5 pF
Cag1 = 0,15 pF

Typical characteristics
Caractéristiques typiques
Kenndaten

μ_{g2g1} = 7,6
S (Ia=30 mA)= 3,3 mA/V

λ	Freq.	C telegr.		B teleph.		C ag2 mod.	
m	Mc/s	Va (V)	Wo (W)	Va (V)	Wo (W)	Va (V)	Wo (W)
>3	<100	500 400 300	33 28 24	500 400	6 5,4	400 300	20 16

λ	Freq.	C fr.mult.	
m	Mc/s	Va (V)	Wo (W)
5,4/1,8	55/165	400	9

Limiting values
Caractéristiques limites
Grenzdaten

Va = max. 500 V
Wa = max. 12 W
Vg2 = max. 300 V
Wg2 = max. 5 W
Wg1 = max. 0,5 W

Rg1 = max. 50 kΩ 1)
Rg1 = max. 100 kΩ 2)
Ik = max. 130 mA
Ikp = max. 800 mA
Vfk = max. 75 V

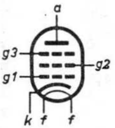
bottomtemperature }
température du fond } = max. 180 °C
Bodentemperatur }

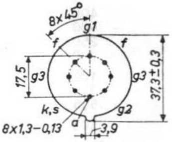
---

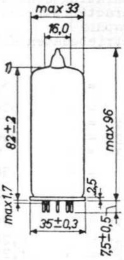
1) With fixed grid bias; à polarisation fixe; mit fester Gittervorspannung

2) With automatic grid bias; à polarisation automatique; mit automatischer Gittervorspannung

Dimensions in mm
Dimensions en mm
Abmessungen in mm







Socket Support Fassung	40210/02

Mounting position: arbitrary
Montage : arbitrairement
Einbau : willkürlich

Net weight Poids net Nettogewicht	50 g
Shipping weight Poids brut Bruttogewicht	65 g

---

[1] Reference line
Ligne de référence
Bezugslinie

Operating conditions H.F. class C telegraphy
Caractéristiques d'utilisation H.F. classe C télégraphie
Betriebsdaten H.F. Klasse C Telegraphie

λ	=	>3	>3	>3	m
V_a	=	500	400	300	V
V_{g1}	=	−80	−80	−80	V
V_{g2}	=	250	250	250	V
V_{g3}	=	0	0	0	V
I_a	=	90	100	117	mA
I_{g1}	=	3	3,5	4,5	mA
I_{g2}	=	5	5,5	8	mA
V_{g1p}	=	96	103	110	V
W_{ig1}	=	0,26	0,33	0,45	W
W_{g2}	=	1,25	1,4	2	W
W_{ia}	=	45	40	35,1	W
W_a	=	12	12	11,1	W
W_o	=	33	28	24	W
η	=	73,5	70	68	%

Operating conditions H.F. class B telephony
Caractéristiques d'utilisation H.F. classe B téléphonie
Betriebsdaten H.F. Klasse B Telephonie

λ	=	>3	>3	m
V_a	=	500	400	V
V_{g1}	=	−28	−28	V
V_{g2}	=	250	250	V
V_{g3}	=	0	0	V
I_a	=	36	42,5	mA
I_{g2}	=	3	3,5	mA
V_{g1p}	=	17,5	21,25	V
W_{g2}	=	0,75	0,9	W
W_{ia}	=	18	17	W
W_a	=	12	11,6	W
W_o	=	6	5,4	W
η	=	33,5	32	%
m	=	100	100	%
I_{g1}	=	2	3,4	mA
W_{ig1}	=	0,07	0,13	W

Operating conditions H.F. class C anode- and screen grid modulation
Caractéristiques d'utilisation H.F. classe C modulation d'anode et de grille-écran
Betriebsdaten H.F.Klasse C Anoden- und Schirmgittermodulation

λ	=	>3	>3	m
V_a	=	400	300	V
V_{g1}	=	−80	−80	V
V_{g2}	=	200	200	V
V_{g3}	=	0	0	V
I_a	=	70	77	mA
I_{g1}	=	2,5	3,5	mA
I_{g2}	=	4,5	7	mA
V_{g1p}	=	100	105	V
W_{ig1}	=	0,25	0,35	W
W_{g2}	=	0,9	1,4	W
W_{ia}	=	28	23	W
W_a	=	8	7	W
W_o	=	20	16	W
	=	71	69,5	%

m	=	100	100	%
V_{g2p}	=	190	190	V
W_{mod}	=	15	13	W

Operating conditions as class C frequency multiplier
Caractéristiques d'utilisation comme multiplicatrice de fréquence classe C
Betriebsdaten als Klasse C Frequenzvervielfacher

λ	=	5,4/1,8	5,4/1,8	5,4/1,8	m
V_a	=	400	400	400	V
V_{g1}	=	−175	−200	−250	V
V_{g2}	=	250	250	250	V
V_{g3}	=	0	0	0	V
I_a	=	47	50	52,5	mA
I_{g1}	=	0,9	1	1,2	mA
I_{g2}	=	2	2,5	3	mA
V_{g1p}	=	200	220	270	V
W_{ig1}	=	0,16	0,2	0,3	W
W_{g2}	=	0,5	0,65	0,75	W
W_{ia}	=	18,8	20	21	W
W_a	=	12	12	12	W
W_o	=	6,8	8	9	W
η	=	36	40	43	%

Operating conditions as L.F. class B amplifier and modulator, two valves
Caractéristiques d'utilisation comme amplificatrice et modulatrice B.F. classe B, deux tubes
Betriebsdaten als NF - Klasse B Verstärker und Modulator, zwei Röhren

V_a	=	500		400		V
V_{g1}	=	-24		-18,5		V
V_{g2}	=	250		200		V
V_{g3}	=	0		0		V
R_{aa}	=	9		5,5		kΩ
V_{g1g1p}	=	0	70	0	82	V
I_a	=	2x18	2x71	2x15	2x89	mA
I_{g1}	=	0	2x1,8	0	2x4,4	mA
I_{g2}	=	2x0,6	2x11,2	2x0,5	2x10,5	mA
W_{ig1}	=	0	2x57	0	2x165	mW
W_{g2}	=	2x0,15	2x2,8	2x0,1	2x2,1	W.
W_{ia}	=	2x9	2x35,5	2x6	2x35,5	W
W_a	=	2x9	2x11	2x6	2x11	W
W_o	=	0	49	0	49	W
d_{tot}	=	-	5	-	5	%
η	=	-	69	-	69	%

V_a	=	300		V
V_{g1}	=	-18		V
V_{g2}	=	200		V
V_{g3}	=	0		V
R_{aa}	=	3		kΩ
V_{g1g1p}	=	0	100	V
I_a	=	2x15	2x108	mA
I_{g1}	=	0	2x6	mA
I_{g2}	=	2x0,5	2x13	mA
W_{ig1}	=	0	2x270	mW
W_{g2}	=	2x0,1	2x2,6	W
W_{ia}	=	2x4,5	2x32,5	W
W_a	=	2x4,5	2x12,5	W
W_o	=	0	40	W
d_{tot}	=	-	5	%
η	=	-	62	%

PENTODE for use as H.F. or L.F. amplifier
PENTHODE pour utilisation en amplificatrice H.F. ou B.F.
PENTODE zur Verwendung als HF- oder NF-Verstärker

Cathode : oxide-coated
Cathode : oxyde
Katode : Oxyd

Heating : indirect
Chauffage: indirect
Heizung : indirekt

PE 06/40 P Vf = 6,3 V
PE 06/40 N If = 1,3 A
PE 06/40 E Vf = 12,6 V
If = 0,65 A

Capacitances
Capacités
Kapazitäten

Ca = 8,7 pF
Cg1 = 15 pF
Cag1 = 0,1 pF

Typical characteristics
Caractéristiques types
Kenndaten

μg2g1 = 5,5
S (Ia=40 mA)= 4 mA/V

λ	Freq.	C telegr.		B teleph.		Cag2 mod.	
m	Mc/s	Va (V)	Wo (W)	Va (V)	Wo (W)	Va (V)	Wo (W)
>15	<20	600	45	600	11	500	40
5	60	600	36	600	6,5	500	20

λ	Freq.	C fr.mult.	
m	Mc/s	Va (V)	Wo (W)
150/75	2/4	600	27

B mod. 1)	
Va (V)	Wo (W)
600	100

Limiting values
Caractéristiques limites
Grenzdaten

Va = max. 600 V
Wa = max. 25 W
Vg2 = max. 300 V
Wg2 = max. 5 W
Wg1 = max. 1 W

Rg1 = max. 100 kΩ 2)
Rg1 = max. 200 kΩ 3)
Ik = max. 130 mA
Ikp = max. 520 mA
Vfk = max. 75 V

---

1) Two tubes ; deux tubes; zwei Röhren

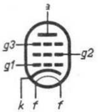
2) With fixed grid bias; à polarisation fixe; mit fester Gittervorspannung

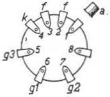
3) With automatic grid bias; à polarisation automatique; mit automatischer Gittervorspannung

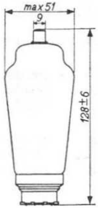
Dimensions in mm
Dimensions en mm
Abmessungen in mm

PE 06/40 P

Base
Culot P
Sockel

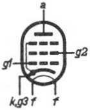


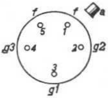


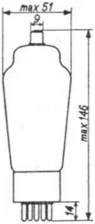


PE 06/40 N

Base
Culot N
Sockel

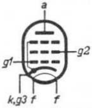


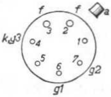


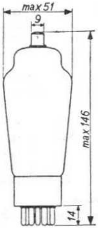


PE 06/40 E

Base
Culot E
Sockel







Socket for	PE 06/40 P	5900/02
Support pour	PE 06/40 N	40219
Fassung für	PE 06/40 E	40220

Cap; capot; haube 28 906 022

Mounting position: arbitrary
Montage : arbitrairement
Einbau : willkürlich

Net weight Poids net Nettogewicht	65 g
Shipping weight Poids brut Bruttogewicht	90 g

Operating conditions H.F. class C telegraphy
Caractéristiques d'utilisation H.F. classe C télégraphie
Betriebsdaten H.F. Klasse C Telegraphie

λ	=	>15	>15	5[1]	m
Va	=	600	600	600	V
Vg1	=	-75	-40	-75	V
Vg2	=	300	300	300	V
Vg3	=	0	0	0	V
Ia	=	109	109	195	mA
Ig1	=	2	0	0	mA
Ig2	=	11,5	11	20	mA
Vg1p	=	90	40	75	V
Wig1	=	0,2	0	0	W
Wg2	=	3,5	3,3	6	W
Wia	=	65	65	117	W
Wa	=	20	25	45	W
Wo	=	45	40	72	W
η	=	69	62	62	%

---

[1] Two tubes ; deux tubes; zwei Röhren

Operating conditions H.F. class B telephony
Caractéristiques d'utilisation H.F. classe B téléphony
Betriebsdaten H.F. Klasse B Telephonie

λ	=	>15	5 1)	m
Va	=	600	600	V
Vg1	=	−40	−38	V
Vg2	=	250	250	V
Vg3	=	0	0	V
Ia	=	60	104	mA
Ig2	=	3	5,5	mA
Vg1p	=	20	17,5	V
Wg2	=	0,75	1,4	W
Wia	=	36	63	W
Wa	=	25	50	W
Wo	=	11	13	W
η	=	30,5	20,5	%
m	=	100	100	%
Ig1	=	0	0	mA
Wig1	=	0	0	W

Operating conditions as class C frequency multiplier
Caractéristiques d'utilisation comme multiplicatrice de fréquence classe C
Betriebsdaten als Klasse C Frequenzvervielfacher

λ	=	150/75	m
Va	=	600	V
Vg1	=	−100	V
Vg2	=	300	V
Vg3	=	0	V
Ia	=	87	mA
Ig1	=	1	mA
Ig2	=	11	mA
Vg1p	=	110	V
Wig1	=	0,1	W
Wg2	=	3,3	W
Wia	=	52	W
Wa	=	25	W
Wo	=	27	W
η	=	52	%

---

1) Two valves; deux tubes; zwei Röhren

Operating conditions H.F. class C anode- and screen grid modulation
Caractéristiques d'utilisation H.F. classe C modulation d'anode et de grille-écran
Betriebsdaten H.F.Klasse C Anoden- und Schirmgittermodulation

λ	=	>15	5$^{1)}$	m
Va	=	500	500	V
Vg1	=	-75	-55	V
Vg2	=	300$^{2)}$	160$^{3)}$	V
Vg3	=	0	0	V
Ia	=	114	146	mA
Ig1	=	1,4	2	mA
Ig2	=	10	10	mA
Vg1p	=	90	75	V
Wig1	=	0,1	0,15	W
Wg2	=	3	1,6	W
Wia	=	57	73	W
Wa	=	17	33	W
Wo	=	40	40	W
η	=	70	55	%
m	=	100	100	%
Vg2p	=	300	160	V
Wmod	=	30	40	W

$^{1)}$ Two valves; deux tubes; zwei Röhren

$^{2)}$ Rg2 = 20 kΩ

$^{3)}$ Rg2 = 34 kΩ

Operating conditions as L.F. class B amplifier and modulator, two valves

Caractéristiques d'utilisation comme amplificatrice et modulatrice B.F. classe B, deux tubes

Betriebsdaten als N.F. Verstärker und Modulator Klasse B, zwei Röhren

Va	=	600		V
Vg1	=	-45		V
Vg2	=	300		V
Vg3	=	0		V
Raa	=	6		kΩ
Vg1g1p	=	0	90	V
Ia	=	2x34	2x115	mA
Ig1	=	0	0	mA
Ig2	=	2x3	2x18	mA
Wig1	=	0	0	W
Wg2	=	2x0,9	2x5,4	W
Wia	=	2x20,4	2x70	W
Wa	=	2x20,4	2x20	W
Wo	=	0	100	W
d_{tot}	=	-	4	%
η	=	-	71	%

PENTODE for use as H.F. and L.F. amplifier
PENTHODE pour utilisation en amplificatrice H.F. et B.F
PENTODE zur Verwendung als H.F. und N.F. Verstärker

Cathode : oxide-coated
Cathode : oxyde
Kathode : Oxyd

Heating : indirect
Chauffage: indirect
Heizung : indirekt

V_f = 12,6 V
I_f = 1,35 A

Capacitances
Capacités
Kapazitäten

C_a = 11 pF
C_{g1} = 20,5 pF
C_{ag1} = 0,1 pF

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} = 6,7
S (I_a=40 mA)= 6 mA/V

λ	Freq.	C telegr.		B teleph.	
m	Mc/s	V_a (V)	W_o (W)	V_a (V)	W_o (W)
>5	<60	1000	132	1000	23
		800	107	800	23
		600	78	600	23
		C_{ag2} mod.		C_{g3} mod.	
>5	<60	800	75	1000	27
		600	51	800	26
				600	22

B mod.1)	
V_a (V)	W_o (W)
1000	194
800	110
600	82

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 1000 V
W_a = max. 45 W
V_{g2} = max. 300 V
W_{g2} = max. 7 W
W_{g1} = max. 0,5 W

R_{g3} = max. 50 kΩ
R_{g1} = max. 25 kΩ 2)
R_{g1} = max. 50 kΩ 3)
I_k = max. 240 mA
I_{kp} = max. 1,5 A
V_{kf} = max. 100 V

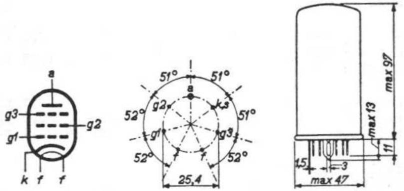
---

1) Two valves; deux tubes; zwei Röhren

2) With fixed grid bias; à polarisation fixe; mit fester Gittervorspannung

3) With automatic grid bias; à polarisation automatique; mit automatischer Gittervorspannung

Dimensions in mm
Dimensions en mm
Abmessungen in mm



Base, culot, Sockel: Septar

Socket Support Fassung	40202

Mounting position: arbitrary
Montage : arbitrairement
Aufstellung : willkürlich

Net weight Poids net Nettogewicht	80 g
Shipping weight Poids brut Bruttogewicht	125 g

Operating conditions H.F. class C telegraphy
Caractéristiques d'utilisation H.F. classe C télégraphie
Betriebsdaten H.F. Klasse C Telegraphie

λ	=	>5	>5	>5	m
V_a	=	1000	800	600	V
V_{g1}	=	-120	-110	-100	V
V_{g2}	=	250	250	250	V
V_{g3}	=	0	0	0	V
I_a	=	177	190	205	mA
I_{g1}	=	5	6	7,5	mA
I_{g2}	=	28	28	28	mA
V_{g1p}	=	144	134	124	V
W_{ig1}	=	0,65	0,73	0,84	W
W_{g2}	=	7	7	7	W
W_{ia}	=	177	152	123	W
W_a	=	45	45	45	W
W_o	=	132	107	78	W
η	=	74,5	70,5	63,5	%

Operating conditions H.F. class B telephony
Caractéristiques d'utilisation H.F. classe B téléphonie
Betriebsdaten H.F. Klasse B Telephonie

λ	=	>5	>5	>5	m
V_a	=	1000	800	600	V
V_{g1}	=	-34	-33	-30,5	V
V_{g2}	=	250	250	250	V
V_{g3}	=	0	0	0	V
I_a	=	68	85	114	mA
I_{g2}	=	4,5	6	7,5	mA
V_{g1p}	=	20,5	22,5	26,5	V
W_{g2}	=	1,15	1,5	1,9	W
W_{ia}	=	68	68	68,4	W
W_a	=	45	45	45	W
W_o	=	23	23	23,4	W
η	=	34	34	34	%

m	=	100	100	100	%
I_{g1}	=	2	4	8	mA
W_{ig1}	=	0,08	0,17	0,38	W

Operating conditions H.F. class C
Caractéristiques d'utilisation H.F. classe C
Betriebsdaten HF- Klasse C

		anode and screen grid modulation modulation d'anode et de grille-écran Anoden- und Schirmgitter-modulation		suppressor grid modulation modulation de grille d'arrêt Fanggittermodulation	
λ	=	>5	>5	>5	m
V_a	=	800	600	1000	V
V_{g1}	=	-120	-120	-100	V
V_{g2}	=	250	250	150	V
V_{g3}	=	0	0	-100	V
I_a	=	120	120	72	mA
I_{g1}	=	6,5	6,5	10	mA
I_{g2}	=	23	23	24	mA
V_{g1p}	=	150	150	140	V
W_{ig1}	=	0,9	0,9	1,3	W
W_{g2}	=	5,8	5,8	3,6	W
W_{ia}	=	96	72	72	W
W_a	=	21	21	45	W
W_o	=	75	51	27	W
η	=	78	71	37,5	%
m	=	100	100	100	%
V_{g2p}	=	250	250	-	V
V_{g3p}	=	-	-	100	V
W_{mod}	=	48	36	0	W

Operating conditions as L.F. class B amplifier and modulator, two valves
Caractéristiques d'utilisation comme amplificatrice et modulatrice B.F. classe B, deux tubes
Betriebsdaten als N.F. Verstärker und Modulator Klasse B, zwei Röhren

V_a	=	1000		800		V
V_{g1}	=	-34		-33,5		V
V_{g2}	=	250		250		V
V_{g3}	=	0		0		V
R_{aa}	=	8800		7560		Ω
V_{g1g1p}	=	0	84	0	68	V
I_a	=	2x26	2x134	2x28	2x108	mA
I_{g1}	=	0	2x0,8	0	0	mA
I_{g2}	=	2x5	2x28	2x8	2x27	mA
W_{ig1}	=	0	2x0,03	0	0	W
W_{g2}	=	2x1,3	2x7	2x2	2x6,8	W
W_{ia}	=	2x26	2x134	2x22,4	2x86,4	W
W_a	=	2x26	2x37	2x22,4	2x31,4	W
W_o	=	0	194	0	110	W
d_{tot}	=	-	5	-	4,5	%
η	=	-	72	-	63,5	%

V_a	=	600		V
V_{g1}	=	-33		V
V_{g2}	=	250		V
V_{g3}	=	0		V
R_{aa}	=	6320		Ω
V_{g1g1p}	=	0	66	V
I_a	=	2x28	2x102	mA
I_{g1}	=	0	0	mA
I_{g2}	=	2x11	2x28	mA
W_{ig1}	=	0	0	W
W_{g2}	=	2x2,8	2x7	W
W_{ia}	=	2x16,8	2x61,2	W
W_a	=	2x16,8	2x20,2	W
W_o	=	0	82	W
d_{tot}	=	-	3,3	%
η	=	-	67	%

QB 2/250

BEAM POWER TETRODE for use as A.F. or R.F. amplifier or oscillator
TUBE AMPLIFICATEUR A FAISCEAUX pour utilisation en amplificateur B.F. ou H.F. ou oscillateur
BÜNDELRÖHRE zur Verwendung als NF- oder HF-Verstärker oder Oszillator

Cathode: thoriated tungsten
Cathode: tungstène thorié
Katode : thoriertes Wolfram

Heating : direct
Chauffage: direct
Heizung : direkt

V_f = 10 V
I_f = 5 A

Capacitances
Capacités
Kapazitäten

C_{g1} = 16,3 pF
C_a = 14,0 pF
C_{ag1} < 0,25 pF

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} = 8,5
$S(I_a = 50\text{ mA})$ = 3,75 mA/V

λ	Freq.	C telegr.			B teleph			C_{ag2} mod		
m	Mc/s	V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS
10	30	2000	275		2000	50		1600	180	
		1500	210		1500	50		1250	140	
		1250	170							
		2250		375	2250		70	2000		300

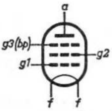
λ	Freq.	C_{g1} mod			AB mod[1]		
m	Mc/s	V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS
10	30	2000	50		2250	380	
		1500	40		2000	335	
		2250		75	1500	260	
					2500		490

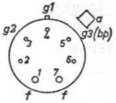
---

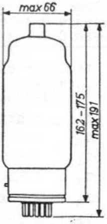
[1] Without grid current; two tubes
Sans courant de grille; deux tubes
Ohne Gitterstrom; zwei Röhren

Dimensions in mm
Dimensions en mm
Abmessungen in mm

Cap; capot; Haube 40619







Base, culot, Sockel: Giant 7-pin

Mounting position: Vertical, base up or down
Horizontal, pins 2 and 6 in 1 vertical plane
Montage: Vertical, culot en haut ou en bas
Horizontal, broche 2 et 6 dans un plan vertical
Einbau: Senkrecht, Sockel oben oder unten
Waagerecht, Stifte 2 und 6 in einer senkrechten Fläche

Net weight Poids net Nettogewicht	230 g	Shipping weight Poids brut Bruttogewicht	600 g

---

[2] from pages 5 and 6; des pages 5 et 6; von Seiten 5 und 6

Obtained preferably from a separate source modulated with the plate supply or from the modulated plate supply through a series resistor of

27 kΩ at V_a = 1250 V
43 kΩ at V_a = 1600 V
41 kΩ at V_a = 2000 V

Obtenu de préférence d'une source séparée modulée avec l'alimentation anodique, ou de l'alimentation anodique modulée à travers une résistance série de

27 kΩ à V_a = 1250 V
43 kΩ à V_a = 1600 V
41 kΩ à V_a = 2000 V

Vorzugsweise erhalten von einer separaten Spannungsquelle, moduliert mit der Anodenspeisung oder von der modulierten Anodenspeisung mittels eines Serienwiderstandes von

27 kΩ bei V_a = 1250 V
43 kΩ bei V_a = 1600 V
41 kΩ bei V_a = 2000 V

H.F. class C telegraphy
H.F. classe C télégraphie
HF-Klasse C Telegraphie

Limiting values, continuous service
C.C.S. Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 30 Mc/s
V_a = max. 2000 V
W_{ia} = max. 360 W
W_a = max. 100 W
I_a = max. 180 mA
V_{g2} = max. 400 V
W_{g2} = max. 22 W
$-V_{g1}$ = max. 300 V
I_{g1} = max. 25 mA
R_{g1} = max. 30 kΩ

f = max. 60 Mc/s
V_a = max. 1500 V
W_{ia} = max. 270 W

f = max. 120 Mc/s
V_a = max. 1000 V
W_{ia} = max. 180 W

Operating conditions, continuous service
C.C.S. Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

V_a	=	2000	1500	1250 V
V_{g1}	=	-120	-90	-75 V 1)
V_{g2}	=	400	300	300 V
V_{g3}	=	0	0	0 V
I_a	=	180	180	180 mA
I_{g1}	=	10	12	12 mA
I_{g2}	=	45	30	35 mA
V_{g1p}	=	205	175	160 V
W_{ig1}	=	1,9	1,9	1,7 W
W_{g2}	=	18	9,0	10,5 W
W_{ia}	=	360	270	225 W
W_a	=	85	60	55 W
W_o	=	275	210	170 W
η	=	76,5	78	75,5 %

---

1) For A.C. filament supply
Pour chauffage du filament par courant alternatif
Für Wechselstromspeisung des Heizfadens

QB 2/250

H.F. class C telegraphy
H.F. classe C télégraphie
HF-Klasse C Telegraphie

Limiting values, intermittent service
I.C.A.S. Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 30 Mc/s
V_a = max. 2250 V
W_{ia} = max. 500 W
W_a = max. 125 W
I_a = max. 225 mA
V_{g2} = max. 400 V
W_{g2} = max. 22 W
$-V_{g1}$ = max. 300 V
I_{g1} = max. 30 mA
R_{g1} = max. 30 kΩ

f = max. 60 Mc/s
V_a = max. 1700 V
W_{ia} = max. 375 W

f = max. 120 Mc/s
V_a = max. 1125 V
W_{ia} = max. 250 W

Operating conditions, intermittent service
I.C.A.S. Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

V_a = 2250 V
V_{g1} = -155 V[1]
V_{g2} = 400 V
V_{g3} = 0 V
I_a = 220 mA
I_{g1} = 15 mA
I_{g2} = 40 mA
V_{g1p} = 275 V
W_{ig1} = 4 W
W_{g2} = 16 W
W_{ia} = 495 W
W_a = 120 W
W_o = 75 W
η = 16 %

---

[1] For A.C. filament supply
Pour chauffage du filament par courant alternatif
Für Wechselstromspeisung des Heizfadens

H.F. class C anode and screen grid modulation
H.F. classe C modulation d'anode et de grille-écran
HF-Klasse C Anoden- und Schirmgittermodulation

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 30 Mc/s
V_a = max. 1600 V
W_{ia} = max. 240 W
W_a = max. 67 W
I_a = max. 150 mA
V_{g2} = max. 400 V
W_{g2} = max. 15 W
$-V_{g1}$ = max. 300 V
I_{g1} = max. 25 mA
R_{g1} = max. 30 kΩ

f = max. 60 Mc/s
V_a = max. 1200 V
W_{ia} = max. 180 W

f = max. 120 Mc/s
V_a = max. 800 V
W_{ia} = max. 120 W

C.C.S. Operating characteristics, continuous service
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

V_a	=	1600	1250 V
V_{g1}	=	-160	-160 V 1)
V_{g2}	=	300	300 V 2)
V_{g3}	=	0	0 V
I_a	=	150	150 mA
I_{g1}	=	12	13 mA
I_{g2}	=	30	35 mA
V_{g1p}	=	250	250 V
W_{ig1}	=	2,7	2,9 W
W_{g2}	=	9	10,5 W
W_{ia}	=	240	187,5 W
W_a	=	60	47,5 W
W_o	=	180	140 W
η	=	75	74,5 %
m	=	100	100 %
W_{mod}	=	120	94 W

---

1) See page 4; voir page 4; siehe Seite 4

2) See page 2; voir page 2; siehe Seite 2

H.F. class C anode and screen grid modulation
H.F. classe C modulation d'anode et de grille-écran
HF-Klasse C Anoden- und Schirmgittermodulation

I.C.A.S.
Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 30 Mc/s
V_a = max. 2000 V
W_{ia} = max. 400 W
W_a = max. 100 W
I_a = max. 200 mA
V_{g2} = max. 400 V
W_{g2} = max. 20 W
$-V_{g1}$ = max. 300 V
I_{g1} = max. 30 mA
R_{g1} = max. 30 kΩ

f = max. 60 Mc/s
V_a = max. 1500 V
W_{ia} = max. 300 W

f = max. 120 Mc/s
V_a = max. 1000 V
W_{ia} = max. 200 W

I.C.A.S.
Operating characteristics, intermittent service
Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

V_a = 2000 V
V_{g1} = -175 V[1]
V_{g2} = 350 V[2]
V_{g3} = 0 V
I_a = 200 mA
I_{g1} = 16 mA
I_{g2} = 40 mA
V_{g1_p} = 300 V
W_{ig1} = 4,3 W
W_{g2} = 14 W
W_{ia} = 400 W
W_a = 100 W
W_o = 300 W
η = 75 %
m = 100 %
W_{mod} = 200 W

---

[1] For A.C. filament supply
Pour chauffage du filament par courant alternatif
Für Wechselstromspeisung des Heizfadens

[2] See page 2; voir page 2; siehe Seite 2

H.F. class C grid modulation
H.F. classe C modulation de grille
HF-Klasse C Gittermodulation

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 60 Mc/s
V_a = max. 1760 V
W_{ia} = max. 132 W

f = max. 120 Mc/s
V_a = max. 1520 V
W_{ia} = max. 114 W

f = max. 30 Mc/s
V_a = max. 2000 V
W_{ia} = max. 150 W
W_a = max. 100 W
I_a = max. 100 mA
V_{g2} = max. 400 V
W_{g2} = max. 15 W
$-V_{g1}$ = max. 200 V
R_{g1} = max. 30 kΩ

C.C.S. Operating characteristics, continuous service
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

V_a	=	2000	1500 V
V_{g1}	=	-120	-140 V[3])
V_{g2}	=	400	400 V
V_{g3}	=	0	0 V
I_a	=	75	70 mA
I_{g1}	=		[4])
I_{g2}	=	3	3 mA
V_{g1p} (H.F.)	=	120	145 V
V_{g1p} (A.F.,B.F.,N.F.)	=	60	60 V
W_{ig1}	=		[5])
W_{g2}	=	1,2	1,2 W
W_{ia}	=	150	105 W
W_a	=	100	65 W
W_o	=	50	40 W
η	=	33	38 %

---

3) Fixed supply or cathode resistor bias, unbypassed for A.F., is recommended
Il est recommandé d'utiliser polarisation fixe ou polarisation par une résistance cathodique, ne pas shuntée pour B.F.
Feste Vorspannung oder Vorspannung mittels eines für NF nicht überbrückten Katodenwiderstandes wird empfohlen

4) Usually negligible
Ordinairement à négliger
Gewöhnlich zu vernachlässigen

5) See page 8; voir page 8; siehe Seite 8

H.F. class C grid modulation
H.F. classe C modulation de grille
HF-Klasse C Gittermodulation

Limiting values, intermittent service
I.C.A.S. Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 60 Mc/s
V_a = max. 1980 V
W_{ia} = max. 176 W

f = max. 120 Mc/s
V_a = max. 1710 V
W_{ia} = max. 152 W

f = max. 30 Mc/s
V_a = max. 2250 V
W_{ia} = max. 200 W
W_a = max. 125 W
I_a = max. 125 mA
V_{g2} = max. 400 V
W_{g2} = max. 20 W
$-V_{g1}$ = max. 200 V
R_{g1} = max. 30 kΩ

Operating characteristics, intermittent service
I.C.A.S. Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

V_a = 2250 V
V_{g1} = -110 V 3)
V_{g2} = 400 V
V_{g3} = 0 V
I_a = 85 mA
I_{g1} = 4)
I_{g2} = 2,5 mA
V_{g1p} (H.F.) = 135 V
V_{g1p} (A.F., B.F., N.F.) = 55 V
W_{ig1} = 5)
W_{g2} = 1,0 W
W_{ia} = 191 W
W_a = 116 W
W_o = 75 W
η = 39 %

---

3) 4) See page 7; voir page 7; siehe Seite 7

5) H.F. driving power is never more than 2 W
A.F. driving power is usually not more than 1 W
La puissance de commande H.F. n'est jamais plus de 2 W
Généralement la puissance de commande B.F. n'est plus de 1 W
Die H.F. Steuerleistung ist nie mehr als 2 W
Die NF-Steuerleistung ist gewöhnlich nicht mehr als 1 W

H.F. class B telephony
H.F. classe B téléphonie
HF-Klasse B Telephonie

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 30 Mc/s
V_a = max. 2000 V
W_{ia} = max. 150 W
W_a = max. 100 W
I_a = max. 100 mA
V_{g2} = max. 400 V
W_{g2} = max. 15 W

f = max. 60 Mc/s
V_a = max. 1760 V
W_{ia} = max. 132 W

f = max. 120 Mc/s
V_a = max. 1520 V
W_{ia} = max. 114 W

C.C.S. Operating characteristics, continuous service
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

V_a	=	2000	1500 V
V_{g1}	=	-75	-60 V[1]
V_{g2}	=	400	400 V
V_{g3}	=	0	0 V
I_a	=	75	100 mA
I_{g2}	=	3	4 mA
V_{g1p}	=	80	70 V
W_{g2}	=	1,2	1,6 W
W_{ia}	=	150	150 W
W_a	=	100	100 W
W_o	=	50	50 W
η	=	33	33 %
m	=	100	100 %
W_{ig1}	=	≤ 2	≤ 2 W

---

[1] For A.C. filament supply
Pour chauffage du filament par courant alternatif
Für Wechselstromspeisung des Heizfadens

H.F. class B telephony
H.F. classe B téléphonie
HF-Klasse B Telephonie

I.C.A.S.
Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f	= max. 30 Mc/s	f	= max. 60 Mc/s
V_a	= max. 2250 V	V_a	= max. 1980 V
W_{ia}	= max. 200 W	W_{ia}	= max. 176 W
W_a	= max. 125 W		
I_a	= max. 125 mA	f	= max. 120 Mc/s
V_{g2}	= max. 400 V	V_a	= max. 1710 V
W_{g2}	= max. 20 W	W_{ia}	= max. 152 W

I.C.A.S.
Operating characteristics, intermittent service
Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

V_a = 2250 V
V_{g1} = -60 V[1])
V_{g2} = 400 V
V_{g3} = 0 V
I_a = 85 mA
I_{g2} = 3 mA
V_{g1p} = 70 V
W_{g2} = 1,2 W
W_{ia} = 191 W
W_a = 121 W
W_o = 70 W
n = 36,5 %
m = 100 %
W_{ig1} $\leq$ 2 W

---

[1]) For A.C. filament supply
Pour chauffage du filament par courant alternatif
Für Wechselstromspeisung des Heizfadens

10.10.1956

A.F. class AB amplifier and modulator
Amplificatrice et modulatrice B.F. classe AB
NF-Verstärker und Modulator Klasse AB

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

V_a	= max.	2250 V	W_a	= max.	100 W
I_a	= max.	180 mA	V_{g2}	= max.	1100 V
W_{ia}	= max.	360 W	W_{g2}	= max.	22 W
			R_{g1}	= max.	30 kΩ 6)

C.C.S. Operating characteristics, continuous service; two tubes
Caractéristiques d'utilisation, service continu; deux tubes
Betriebsdaten, Dauerbetrieb; zwei Röhren

V_a	=	2250		2000		V
V_{g1}	=	-95		-90		V 1)
V_{g2}	=	750		750		V
V_{g3}	=	0		0		V
R_{aa}	=	20		16		kΩ
V_{g1g1p}	=	0	170	0	160	V
I_a	=	2x25	2x127,5	2x25	2x132,5	mA
I_{g2}	=	2x1,0	2x26,5	2x1,0	2x21,5	mA
W_{ig1}	=	0	0	0	0	W
W_{g2}	=	2x0,75	2x19,9	2x0,75	2x16,1	W
W_{ia}	=	2x56	2x287	2x50	2x265	W
W_a	=	2x56	2x97	2x50	2x97,5	W
W_o	=	0	380	0	335	W
η	=		66	-	63	%

V_a	=	1500		V
V_{g1}	=	-85		V 1)
V_{g2}	=	750		V
V_{g3}	=	0		V
R_{aa}	=	9,3		kΩ
V_{g1g1p}	=	0	160	V
I_a	=	2x25	2x152,5	mA
I_{g2}	=	2x1,0	2x22,5	mA
W_{ig1}	=	0	0	W
W_{g2}	=	2x0,75	2x16,9	W
W_{ia}	=	2x37,5	2x229	W
W_a	=	2x37,5	2x99	W
W_o	=	0	260	W
η	=	-	57	%

---

1) 6) See page 12; voir page 12; siehe Seite 12

A.F. class AB amplifier and modulator
Amplificatrice et modulatrice B.F. classe AB
NF-Verstärker und Modulator Klasse AB

I.C.A.S.
Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

V_a = max. 2500 V
I_a = max. 225 mA
W_{ia} = max. 450 W
W_a = max. 125 W
V_{g2} = max. 1100 V
W_{g2} = max. 22 W
R_{g1} = max. 30 kΩ[6]

I.C.A.S.
Operating characteristics, intermittent service; two tubes
Caractéristiques d'utilisation, service intermittent deux tubes
Betriebsdaten, aussetzender Betrieb; zwei Röhren

V_a	=	2500		V
V_{g1}	=	-95		V[1]
V_{g2}	=	750		V
V_{g3}	=	0		V
R_{aa}	=	19		kΩ
V_{g1g1p}	-	0	180	V
I_a	=	2x25	2x145	mA
I_{g2}	=	2x1,0	2x27	mA
W_{ig1}	=	0	0	W
W_{g2}	=	2x0,75	2x20,3	W
W_{ia}	=	2x62,5	2x362,5	W
W_a	=	2x62,5	2x117,5	W
W_o	=	0	490	W
η	=		67,5	%

---

[1] For A.C. filament supply
Pour chauffage du filament par courant alternatif
Für Wechselstromspeisung des Heizfadens

[6] With fixed grid bias. Cathode bias is not recommended
Avec polarisation de grille fixe. Polarisation de cathode n'est pas recommandée
Mit fester Gittervorspannung. Vorspannung mittels eines Katodenwiderstandes wird nicht empfohlen

QB 3/300

TETRODE for use as H.F. or L.F. amplifier
TETRODE pour utilisation en amplificatrice H.F. ou B.F.
TETRODE zur Verwendung als HF- oder NF-Verstärker

Cooling : radiation/low velocity air flow
Refroidissement: radiation/léger courant d'air
Kühlung : Strahlung/schwacher Luftstrom

Filament : thoriated tungsten
Filament : tungstène thorié
Heizfaden: thoriertes Wolfram

Heating : direct
Chauffage: direct
Heizung : direkt

V_f = 5 V
I_f = 6,5 A

Capacitances
Capacités
Kapazitäten

C_a = 3,5 pF
C_{g1} = 10,8 pF
C_{ag1} = 0,05 pF

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} = 6,2
S (I_a=40 mA) = 2,2 mA/V

λ	Freq.	C telegr.		B teleph.		C ag2 mod.		B mod. [1]	
m	Mc/s	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
2,5	120	3000	375	3000	58	2500	300	2500	550
		2500	375	2500	55	2000	225	2000	550
		2000	275	2000	54	1500	157	1500	455
		1500	110						
2	150	2500	360						
1,5	200	2000	225						

---

[1] Two tubes; deux tubes; zwei Röhren

Temperatures and cooling
Températures et refroidissement
Temperaturen und Kühlung

Temperature of anode seal Température de la sortie de l'anode Temperatur der Anodendurchführung	= max.220 °C
Temperature of pin seals Température des scellements des broches Temperatur der Stiftendurchführungen	= max.180 °C
Bulb temperature Température de l'ampoule Kolbentemperatur	= max.350 °C

In general cooling of the tube is not necessary at normal ambient temperature at frequencies below 50 Mc/s. When the tube is used at or near maximum ratings at frequencies above 50 Mc/s, it will be necessary to direct a low velocity air flow on the anode seal and the bottom of the envelope.

In order to prevent overheating of the screen-grid pins by high-frequency current it is recommended to include both screen-grid socket connections in the circuit.

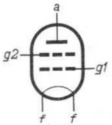
En général il ne faut pas refroidir le tube à la température normale de l'ambiance à des fréquences au-dessous de 50 Mc/s. Si le tube est utilisé à ou près des caractéristiques maximum admissibles au-dessus de 50 Mc/s, il faut diriger un léger courant d'air sur le scellement de la sortie de l'anode et sur le fond du tube.

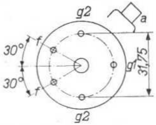
Il est recommandé d'incorporer les deux bornes de raccordement de la grille-écran dans le circuit pour éviter le surchauffage des broches de la grille-écran par le courant haute fréquence.

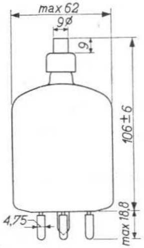
Im allgemeinen braucht die Röhre bei normaler Umgebungstemperatur bei Frequenzen unterhalb 50 MHz nicht gekühlt zu werden. Wird die Röhre bei den maximalen Betriebsdaten bei Frequenzen höher als 50 MHz betrieben, so ist ein schwacher Luftstrom auf die Anodendurchführung und den Boden der Röhre notwendig.

Es empfiehlt sich, zur Vermeidung einer Überhitzung der Schirmgitterstifte vom Hochfrequenzstrom, beide Anschlussklemmen des Schirmgitters an der Schaltung zu beteiligen.

Dimensions in mm
Dimensions en mm
Abmessungen in mm







←

Base, culot, Sockel: GIANT 5p.

Socket Support Fassung	40211/01
Clip Borne de connexion Anschlussklemme	40624

Mounting position: vertical with base up or down
Montage : vertical avec le pied en haut ou en bas
Einbau : senkrecht mit dem Sockel oben oder unten

Net weight Poids net Nettogewicht	120 g
Shipping weight Poids brut Bruttogewicht	850 g

H.F. class C telegraphy
H.F. classe C télégraphie
HF - Klasse C Telegraphie

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 120 Mc/s
V_a = max. 3000 V
I_a = max. 225 mA
W_{ia} = max. 625 W
W_a = max. 125 W1)
V_{g2} = max. 400 V
W_{g2} = max. 20 W
$-V_{g1}$ = max. 500 V
I_{g1} = max. 15 mA

f = max. 170 Mc/s
V_a = max. 2500 V
W_{ia} = max. 560 W

f = max. 200 Mc/s
V_a = max. 2200 V
W_{ia} = max. 435 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	=	<120	<120	<120	<120 Mc/s
V_a	=	3000	2500	2000	1500 V
V_{g2}	=	350	350	350	350 V
V_{g1}	=	-150	-150	-100	-150 V
I_a	=	167	200	200	110 mA
I_{g2}	=	30	40	50	56 mA
I_{g1}	=	6,5	9	9	8 mA
V_{g1_p}	=	300	330	260	225 V
W_{ig1}	=	2	3	2,4	1,7 W
W_{g2}	=	10,5	14	17,5	19,6 W
W_{ia}	=	500	500	400	165 W
W_a	=	125	125	125	55 W
W_o	=	375	375	275	110 W
η	=	75	75	69	67 %

---

1) Anode red hot, temperature = 850 °C
Anode portée au rouge, température = 850 °C
Anode rotheiss, Temperatur = 850 °C

H.F. class B telephony
H.F. classe B téléphonie
HF - Klasse B Telephonie

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 120 Mc/s
V_a = max. 3000 V
I_a = max. 135 mA
W_{ia} = max. 200 W
W_a = max. 125 W 1)
V_{g2} = max. 400 V
W_{g2} = max. 14 W

f = max. 170 Mc/s
V_a = max. 2500 V
W_{ia} = max. 190 W

f = max. 200 Mc/s
V_a = max. 2200 V
W_{ia} = max. 150 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f =	< 120	< 120	< 120	Mc/s
V_a =	3000	2500	2000	V
V_{g2} =	350	350	350	V
V_{g1} =	-50	-50	-50	V
I_a =	60	70	83	mA
I_{g2} =	1	1	1,5	mA
V_{g1_p} =	50	55	65	V
W_{g2} =	0,35	0,35	0,52	W
W_{ia} =	180	175	166	W
W_a =	122	120	112	W
W_o =	58	55	54	W
η =	32	31,5	32,5	%
m =	100	100	100	%
I_{g1} =	4,5	4	4	mA
W_{ig1} =	0,45	0,44	0,52	W

---

1) See page 4
Voir page 4
Siehe Seite 4

H.F. class C anode and screen grid modulation
H.F. classe C modulation d'anode et de grille-écran
HF - Klasse C Anoden- und Schirmgittermodulation

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 120 Mc/s
V_a = max. 2500 V
I_a = max. 200 mA
W_{ia} = max. 415 W
W_a = max. 83 W
V_{g2} = max. 400 V
W_{g2} = max. 20 W
$-V_{g1}$ = max. 500 V
I_{g1} = max. 15 mA

f = max. 170 Mc/s
V_a = max. 2100 V
W_{ia} = max. 375 W

f = max. 200 Mc/s
V_a = max. 1800 V
W_{ia} = max. 290 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	=	<120	<120	<120 Mc/s
V_a	=	2500	2000	1500 V
V_{g2}	=	350	350	300 V
V_{g1}	=	-210	-220	-150 V
I_a	=	152	150	160 mA
I_{g2}	=	30	33	33 mA
I_{g1}	=	4,5	5	10 mA
V_{g1_p}	=	380	390	250 V
W_{ig1}	=	1,7	2	2,5 W
W_{g2}	=	10,5	11,5	10 W
W_{ia}	=	380	300	240 W
W_a	=	80	75	83 W
W_o	=	300	225	157 W
η	=	79	75	65 %
m	=	100	100	100 %
V_{g2_p}	=	300	300	255 V
W_{mod}	=	190	150	120 W

L.F. class B amplifier and modulator)
Amplificatrice et modulatrice B.F.classe B) $I_{g1} = 0$
NF - Verstärker und Modulator Klasse B)

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 3000 V
I_a = max. 225 mA
W_a = max. 125 W [1]
V_{g2} = max. 600 V
W_{g2} = max. 20 W
$-V_{g1}$ = max. 500 V
R_{g1} = max. 150 kΩ

Operating conditions, two valves
Caractéristiques d'utilisation, deux tubes
Betriebsdaten, zwei Röhren

V_a	=	2500		2000		1500		V
V_{g1}	=	-97		-95,5		-94		V
V_{g2}	=	600		600		600		V
R_{aa}	=	25		17,6		12		kΩ
V_{g1g1_p}	=	0	190	0	186	0	185	V
Ia	=	2x30	2x108	2x30	2x111	2x30	2x109	mA
I_{g2}	=	2x0,1	2x13	2x0,1	2x12	2x0,15	2x13,5	mA
W_{g2}	=	2x0,1	2x7,8	2x0,1	2x7,2	2x0,1	2x8,1	W
W_{ia}	=	2x75	2x270	2x60	2x222	2x45	2x163	W
W_a	=	2x75	2x97,5	2x60	2x92	2x45	2x78	W
W_o	=	0	345	0	260	0	170	W
η	=	-	64	-	58,5	-	52	%
dtot	=	-	4,0	-	3,6	-	3,5	%

---

[1] Anode red hot, temperature = 850 °C
Anode portée au rouge, température = 850 °C
Anode rotheiss, Temperatur = 850 °C

L.F. class B amplifier and modulator
Amplificatrice et modulatrice B.F. classe B $I_{g1} > 0$
NF - Verstärker und Modulator Klasse B

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 3000 V
I_a = max. 225 mA
W_a = max. 125 W 1)
V_{g2} = max. 400 V
W_{g2} = max. 20 W
$-V_{g1}$ = max. 500 V

Operating conditions, two valves
Caractéristiques d'útilisation, deux tubes
Betriebsdaten, zwei Röhren

V_a	=	2500		2000		1500		V
V_{g1}	=	-51		-50		-48		V
V_{g2}	=	350		350		350		V
R_{aa}	=	20		12		7,2		kΩ
V_{g1g1_p}	=	0	240	0	296	0	330	V
I_a	=	2x30	2x151	2x30	2x197,5	2x30	2x227,5	mA
I_{g1}	=	0	2x8,5	0	2x12	0	2x16	mA
I_{g2}	=	2x0,1	2x18	2x0,15	2x32	2x0,25	2x42	mA
W_{ig1}	=	0	2x0,9	0	2x1,6	0	2x2,4	W
W_{g2}	=	0	2x6,3	2x0,1	2x11,2	2x0,1	2x15	W
W_{ia}	=	2x75	2x377,5	2x60	2x395	2x45	2x341,5	W
W_a	=	2x75	2x102,5	2x60	2x120	2x45	2x114	W
W_o	=	0	550	0	550	0	455	W
η	=	-	72,5	-	69,5	-	66,5	%
dtot	=	-	5	-	5	-	5	%

---

1) Anode red hot, temperature = 850 °C
Anode portée au rouge, température = 850°C
Anode rotheiss, Temperatur = 850 °C

QB 3.5/750

TETRODE for use as H.F. amplifier and oscillator
TETRODE pour utilisation en amplificatrice H.F. et en oscillatrice
TETRODE zur Verwendung als HF-Verstärker und Oszillator

Cooling : radiation/low velocity air flow
Refroidissement: radiation/léger courant d'air
Kühlung : Strahlung/schwacher Luftstrom

Filament : thoriated tungsten
Filament : tungstène thorié
Heizfaden: thoriertes Wolfram

Heating : direct
Chauffage: direct
Heizung : direkt

V_f = 5 V
I_f = 14,1 A

Capacitances
Capacités
Kapazitäten

C_a = 4,5 pF
C_{g1} = 12,7 pF
C_{ag1} = 0,12 pF

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} = 5,1
S (I_a=100 mA) = 4 mA/V

λ	Freq.	C telegr.		B teleph.		C_{ag2}·mod.		B_{mod} 1)	
m	Mc/s	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
>4	<75	4000	1000	4000	126	3000	510	3000	1240
		3000	800	3000	125	2500	375	2500	1140
		2500	575	2500	125			2000	974
2,5	120	2500	500					1500	660

---

1) Two tubes; deux tubes; zwei Röhren

Temperatures and cooling
Températures et refroidissement
Temperaturen und Kühlung

Temperature of anode seal Température du scellement de l'anode Temperatur der Anodeneinschmelzung	= max. 220 °C
Temperature of pin seals Température des scellements des broches Temperatur der Stifteneinschmelzungen	= max. 180 °C
Bulb temperature Température de l'ampoule Kolbentemperatur	= max. 350 °C

In order to keep the temperatures below the maximum permitted values a low velocity air flow has to be directed onto the anode seal and the bottom of the envelope.

In order to prevent overheating of the screen-grid pins by high-frequency current it is recommended to include both screen-grid socket connections in the circuit.

Afin de maintenir les températures au-dessous des valeurs maximum admissible, il sera nécessaire de diriger un léger courant d'air vers le scellement de l'anode et vers le fond de l'ampoule.

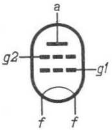
Il est recommandé d'incorporer les deux bornes de raccordement de la grille-écran dans le circuit pour éviter le surchauffage des broches de la grille-écran par le courant haute fréquence.

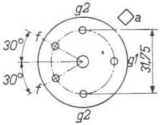
Damit die Temperaturen unterhalb der höchstzulässigen Werte bleiben, soll ein schwacher Luftstrom auf die Anodeneinschmelzung und auf den Boden des Kolbens gerichtet werden.

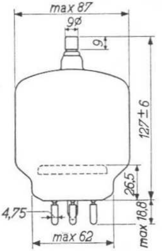
Es empfiehlt sich, zur Vermeidung einer Überhitzung der Schirmgitterstifte vom Hochfrequenzstrom, beide Anschlussklemmen an der Schaltung zu beteiligen.

Net weight Poids net Nettogewicht	185 g
Shipping weight Poids brut Bruttogewicht	910 g

Dimensions in mm
Dimensions en mm
Abmessungen in mm







Base, culot, Sockel: GIANT 5-PIN.

Socket Support Fassung	40211/01
Clip Borne de connexion Anschlussklemme	40624

Mounting position: vertical with base up or down
Montage : vertical avec le culot en haut ou en bas
Einbau : senkrecht mit dem Sockel oben oder unten

H.F. class C telegraphy
H.F. classe C télégraphie
HF - Klasse C Telegraphie

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 75 Mc/s

V_a = max. 4000 V
W_{ia} = max. 1250 W
W_a = max. 250 W
I_a = max. 350 mA
V_{g2} = max. 600 V
W_{g2} = max. 35 W
$-V_{g1}$ = max. 500 V
I_{g1} = max. 20 mA

f = max. 100 Mc/s

V_a = max. 3300 V
W_{ia} = max. 1000 W

f = max. 120 Mc/s

V_a = max. 2500 V
W_{ia} = max. 750 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	=	75	75	75	Mc/s
V_a	=	4000	3000	2500	V
V_{g2}	=	500	500	500	V
V_{g1}	=	-225	-180	-150	V
I_a	=	312	345	300	mA
I_{g2}	=	45	60	60	mA
I_{g1}	=	9	10	9	mA
V_{g1_p}	=	303	265	220	V
W_{ig1}	=	2,5	2,4	1,8	W
W_{g2}	=	22,5	30	30	W
W_{ia}	=	1248	1035	750	W
W_a	=	248	235	175	W
W_o	=	1000	800	575	W
η	=	80	77	77	%

H.F. class B telephony
H.F. classe B téléphonie
HF Klasse B Telephonie

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 75 Mc/s

V_a = max. 4000 V
W_{ia} = max. 400 W
W_a = max. 250 W
I_a = max. 250 mA
V_{g2} = max. 600 V
W_{g2} = max. 23 W

f = max. 100 Mc/s

V_a = max. 3300 V
W_{ia} = max. 320 W

f = max. 120 Mc/s

V_a = max. 2500 V
W_{ia} = max. 240 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	=	75	75	75	Mc/s
V_a	=	4000	3000	2500	V
V_{g2}	=	500	500	500	V
V_{g1}	=	-100	-90	-84	V
I_a	=	94	125	150	mA
I_{g2}	=	0	0	0	mA
V_{g1_p}	=	55,5	61	66	V
W_{ia}	=	376	375	375	W
W_a	=	250	250	250	W
W_o	=	126	125	125	W
η	=	33,5	33	33	%

m	=	100	100	100	%
I_{g1}	=	0,5	2	5,5	mA
W_{ig1}	=	0,06	0,25	0,75	W
W_{g2}	=	4	3,8	6	W

H.F. class C anode and screen grid modulation
H.F. classe C modulation d'anode et de grille-écran
HF Klasse C Anoden- und Schirmgittermodulation

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 75 Mc/s
V_a = max. 3200 V
W_{ia} = max. 825 W
W_a = max. 165 W
I_a = max. 275 mA
V_{g2} = max. 600 V
W_{g2} = max. 35 W
$-V_{g1}$ = max. 500 V
I_{g1} = max. 20 mA

f = max. 100 Mc/s
V_a = max. 2600 V
W_{ia} = max. 660 W

f = max. 120 Mc/s
V_a = max. 2000 V
W_{ia} = max. 500 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	=	75	75	Mc/s
V_a	=	3000	2500	V
V_{g2}	=	400	400	V
V_{g1}	=	-310	-200	V
I_a	=	225	200	mA
I_{g2}	=	30	30	mA
I_{g1}	=	9	9	mA
V_{g1_p}	=	400	280	V
W_{ig1}	=	3,3	2,3	W
W_{g2}	=	12	12	W
W_{ia}	=	675	500	W
W_a	=	165	125	W
W_o	=	510	375	W
η	=	75,5	75	%
m	=	100	100	%
V_{g2_p}	=	350	350	V
W_{mod}	=	344	256	W

---

[1]) V_{g2} = max. 1000 V, when the temperature of the pin seals is max. 120 °C

V_{g2} = max. 1000 V, si la température des scellements des broches est de 120°C aux max.

V_{g2} = max. 1000 V, wenn die Temperatur der Stiftendurchführungen max. 120°C ist.

H.F. class B amplifier, single side band
Amplificatrice H.F. classe B à une bande latérale
HF Einseitenbandverstärker, Klasse B

Limiting values
Caractéristiques limites
Grenzdaten

W_{ap} = max. 275 W 1)
W_a = max. 250 W
T_{av} = max. 5 sec
f = max. 30 Mc/s
V_a = max. 4 kV
I_a = max. 350 mA
W_{ia} = max. 1250 W
V_{g2} = max. 600 V
W_{g2} = max. 35 W
R_{g1} = max. 250 kΩ

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	=	30		30		Mc/s
V_a	=	4		3,5		kV
V_{g1}	=	-105		-110		V
V_{g2}	=	550		600		V
V_{g1p}	=	0	105	0	110	V
I_a	=	50	182	50	207	mA
I_{g1}	=	0	0	0	0	mA
I_{g2}	=	0	9	0	12	mA
W_{ig1}	=	0	0	0	0	W
W_{g2}	=	0	5	0	7,2	W
W_{ia}	=	200	730	175	725	W
W_a	=	200	220	175	235	W
W_o	=	-	510	-	490	W
η	=	-	69	-	67	%

f	=	30		30		30		30		Mc/s
V_a	=	4		3,5		3		2,5		kV
V_{g1}	=	-105		-98		-94		-91		V
V_{g2}	=	500		500		500		500		V
V_{g1p}	=	0	105	0	98	0	94	0	91	V
I_a	=	50	164	50	164	50	164	50	164	mA
I_{g1}	=	0	0	0	0	0	0	0	0	mA
I_{g2}	=	0	8	0	9	0	10	0	10,5	mA
W_{ig1}	=	0	0	0	0	0	0	0	0	W
W_{g2}	=	0	4	0	4,5	0	5	0	5,3	W
W_{ia}	=	200	660	175	575	150	490	125	410	W
W_a	=	200	200	175	175	150	157	125	140	W
W_o	=	-	460	-	400	-	333	-	270	W
η	=	-	70	-	69	-	68	-	66	%

---

1)Max. value during a modulation cycle
Valeur max. pendant un cycle de modulation
Max. Wert während eines Modulationszyklus

L.F. class B amplifier and modulator. $I_{g1} > 0$
Amplificatrice et modulatrice B.F. classe B. $I_{g1} > 0$
NF-Verstärker und Modulator Klasse B. $I_{g1} > 0$

Limiting values. See page 9
Caractéristiques limites. Voir page 9
Grenzdaten. Siehe Seite 9

Operating conditions, two tubes
Caractéristiques d'utilisation, deux tubes
Betriebsdaten, zwei Röhren

V_a	=	3000		2500		V
V_{g2}	=	300		300		V
V_{g1}	=	-55		-51		V
R_{aa}	=	14		9,2		kΩ
V_{g1g1_p}	=	0	280	0	306	V
I_a	=	2x50	2x275	2x50	2x312	mA
I_{g2}	=	0	2x34,5	0	2x44	mA
I_{g1}	=	0	2x15	0	2x21	mA
W_{ig1}	=	0	2x1,9	0	2x2,9	W
W_{g2}	=	0	2x10,5	0	2x13	W
W_{ia}	=	2x150	2x825	2x125	2x780	W
W_a	=	2x150	2x205	2x125	2x210	W
W_o	=	0	1240	0	1140	W
d_{tot}	=	-	5	-	5	%
η	=	-	75	-	73	%

V_a	=	2000		1500		V
V_{g2}	=	300		300		V
V_{g1}	=	-49		-45		V
R_{aa}	=	6,6		4,55		kΩ
V_{g1g1_p}	=	0	328	0	323	V
I_a	=	2x50	2x347	2x50	2x347	mA
I_{g2}	=	0	2x55	0	2x58	mA
I_{g1}	=	0	2x27	0	2x28	mA
W_{ig1}	=	0	2x4	0	2x4	W
W_{g2}	=	0	2x16,5	0	2x17,5	W
W_{ia}	=	2x100	2x694	2x75	2x520	W
W_a	=	2x100	2x207	2x75	2x190	W
W_o	=	0	974	0	660	W
d_{tot}	=	-	5	-	5	%
η	=	-	70	-	63,5	%

QB 3.5/750

L.F. class B amplifier and modulator. $I_{g1} = 0$
Amplificatrice et modulatrice B.F. classe B. $I_{g1} = 0$
NF-Verstärker und Modulator Klasse B. $I_{g1} = 0$

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 4000 V
W_a = max. 250 W

I_a = max. 350 mA 1)
V_{g2} = max. 600 V
W_{g2} = max. 35 W
$-V_{g1}$ = max. 500 V
I_{g1} = max. 30 mA
R_{g1} = max. 250 kΩ

Operating conditions, two tubes
Caractéristiques d'utilisation, deux tubes
Betriebsdaten, zwei Röhren

V_a	=	3000		2500		V
V_{g2}	=	500		500		V
V_{g1}	=	-94		-91		V
R_{aa}	=	22		18		kΩ
V_{g1g1p}	=	0	184	0	178	V
I_a	=	2x50	2x155	2x50	2x155	mA
I_{g2}	=	0	2x10	0	2x10,5	mA
W_{g2}	=	0	2x5	0	2x5,3	W
W_{ia}	=	2x150	2x465	2x125	2x387	W
W_a	=	2x150	2x147	2x125	2x132	W
W_o	=	0	635	0	510	W
d_{tot}	=	-	2,8	-	2,6	%
η	=	-	68	-	66	%

V_a	=	2000		1500		V
V_{g2}	=	500		500		V
V_{g1}	=	-88		-85		V
R_{aa}	=	14,5		10		kΩ
V_{g1g1p}	=	0	173	0	167	V
I_a	=	2x50	2x150	2x50	2x150	mA
I_{g2}	=	0	2x14,5	0	2x15,5	mA
W_{g2}	=	0	2x7,3	0	2x7,8	W
W_{ia}	=	2x100	2x300	2x75	2x225	W
W_a	=	2x100	2x105	2x75	2x91	W
W_o	=	0	390	0	268	W
d_{tot}	=	-	3,2	-	3	%
η	=	-	65	-	60	%

---

1) See page 6; voir page 6; siehe Seite 6

QB 4/1100

Tetrode for use in A.M. and F.M. transmitters
Tétrode pour utilisation dans des émetteurs A.M. et F.M.
Tetrode zur Verwendung in AM- und FM-Sendern

Cooling : radiation and forced air
Refroidissement: radiation et ventilation forcée
Kühlung : Strahlung und Pressluftkühlung

Filament : thoriated tungsten
Filament : tungstène thorié
Heizfaden: thoriertes Wolfram

Heating : direct
Chauffage: direct
Heizung : direkt

V_f = 5 V
I_f = 14,1 A

Capacitances
Capacités
Kapazitäten

C_a = 4,9 pF
C_{g1} = 12,7 pF
C_{ag1} = 0,12 pF

Typical characteristics
Caractéristiques types
Kenndaten

V_a = 2500 V
V_{g2} = 500 V
I_a = 100 mA
S = 4,0 mA/V
μ_{g2g1} = 5,1

Freq	C telegr.		C_{ag2} mod.		B S.S.B.	
Mc/s	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
30			3650	765[1]		
75	4000	1100	3000	630		
	3000	800	2500	510		
	2500	640	2000	380		
100	4000	800				
	3500	650				
110					4000	650
					3500	600
					3000	500

B AF;BF;NF		
V_a (V)	W_o (W)[2]	
	I_{g1}>0	I_{g1}=0
4000	1750	1540
3500	1650	1330
3000	1375	1110
2500	1110	850

---

[1] Intermittent service, ICAS
Service intermittent, ICAS
Aussetzender Betrieb, ICAS

[2] Two tubes; deux tubes, zwei Röhren

Tentative data. Vorläufige Daten
Caractéristiques provisoires

Cooling. At W_a < 250 W a low velocity air flow directed on the anode seal and the base will be sufficient. At W_a > 250 W the glass chimney should be used for circulating forced air along the bulb. At W_a = 400 W at least 0.4 m^3/min. air will be necessary, which is obtained by a static pressure of min. 5 mm water below the chassis (see drawing page 3)

Refroidissement. À Wa < 250 W un léger courant d'air dirigé vers le scellement de l'anode et le fond suffira. À Wa > 250 W la cheminée de verre doit être utilisée pour faire circuler l'air forcé le long de l'ampoule. À Wa = 400 W 0,4 m^3/min. d'air sera nécessaire au moins, cequi est obtenu par une pression de 5 mm d'eau au moins au-dessous du châssis (voir le croquis page 3)

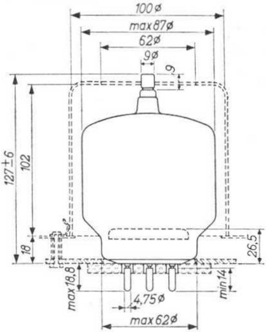
Kühlung. Bei Wa < 250 W genügt ein schwacher auf die Anodeneinschmelzung und den Boden gerichteter Luftstrom. Bei Wa > 250 W soll der gläserne Luftführungszylinder zur Führung von Pressluft entlang des Kolbens verwendet werden. Bei Wa = 400 W ist mindestens 0,4 m^3/min erforderlich, was durch einen Druck von mindestens 5 mm Wasser unter dem Chassis erhalten werden kann (siehe Skizze Seite 3)

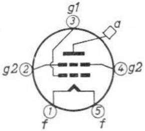
Temperatures
Températures
Temperaturen

Anode seal temperature Température du scellement de l'anode Anodeneinschmelzungstemperatur	max. 220 °C
Temperature of pin seals Température des scellements des broches Temperatur der Einschmelzungen der Stifte	max. 180 °C
Bulb temperature Température de l'ampoule Kolbentemperatur	max. 350 °C
Net weight Poids net Nettogewicht	190 g
Shipping weight (9 tubes) Poids brut (9 tubes) Bruttogewicht (9 Röhren)	6,5 kg

QB 4/1100

Dimensions in mm
Dimensions en mm
Abmessungen in mm





Base Culot Sockel	Giant 5p·	Socket Support Fassung	40211/01
Top cap Capot superieur Kolbenanschluss	Small	Cap Capot Haube	40624
Chimney Cheminée Luftführungsring	40666		

Mounting position: Vertical with base up or down
Montage : Vertical avec le pied en haut ou en bas
Einbau : Senkrecht mit dem Sockel oben oder unten

H.F. class C telegraphy
H.F. classe C télégraphie
HF-Klasse C Telegraphie

Limiting values (Absolute limits)
Caractéristiques limites (Limites absolues)
Grenzdaten (Absolute Grenzwerte)

f	=		110	Mc/s
V_a	=	max.	4000	V
W_{ia}	=	max.	1400	W
W_a	=	max.	400	W
I_a	=	max.	350	mA
V_{g2}	=	max.	600	V
W_{g2}	=	max.	35	W
$-V_{g1}$	=	max.	500	V
I_{g1}	=	max.	25	mA

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	=	75	75	75	100	100	Mc/s
V_a	=	4000	3000	2500	4000	3500	V
V_{g2}	=	500	500	500	500	500	V
V_{g1}	=	-220	-220	-200	-170	-170	V
I_a	=	350	350	350	270	250	mA
I_{g2}	=	25	30	35	16	17	mA
I_{g1}	=	6	6	6,5	9,5	9	mA
V_{g1p}	=	305	305	290	240	235	V
W_{ig1}	=	1,8	1,8	1,8	2	1,8	W
W_{g2}	=	12,5	15	17,5	8	8,5	W
W_{ia}	=	1400	1050	875	1080	875	W
W_a	=	300	250	235	280	225	W
W_o	=	1100	800	640	800	650	W
η	=	78,5	76	73	74	74	%

H.F. class C anode and screen grid modulation
H.F. classe C modulation d'anode et de grille-écran
HF-Klasse C Anoden- und Schirmgittermodulation

Limiting values (Absolute limits; carrier conditions with m = max. 100 %)
Caractéristiques limites (Limites absolues; caractéristiques de l'onde porteuse à m = max. 100 %)
Grenzdaten (Absolute Grenzwerte; Trägerdaten mit m = max. 100 %)

CCS = continuous service / service continu / Dauerbetrieb

ICAS = intermittent service / service intermittent / aussetzender Betrieb

		CCS	ICAS	
f	=	75	30	Mc/s
V_a	= max.	3200	4000	V
W_{ia}	= max.	880	1100	W
W_a	= max.	270	270	W
I_a	= max.	275	275	mA
V_{g2}	= max.	600	600	V
W_{g2}	= max.	35	35	W
$-V_{g1}$	= max.	500	500	V
I_{g1}	= max.	25	25	mA

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

		CCS			ICAS	
f	=	75	75	75	30	Mc/s
V_a	=	3000	2500	2000	3650	V
V_{g2}	=	500	500	500	500	V
V_{g1}	=	-220	-220	-220	-225	V
I_a	=	275	275	275	275	mA
I_{g2}	=	36	38	40	30	mA
I_{g1}	=	6	6	6	6	mA
V_{g1p}	=	305	308	305	308	V
W_{ig1}	=	1,6	1,7	1,6	1,7	W
W_{g2}	=	18	19	20	15	W
W_{ia}	=	825	688	550	1000	W
W_a	=	195	178	170	235	W
W_o	=	630	510	380	765	W
η	=	76	74	69	76,5	%
m	=	100	100	100	100	%
V_{g2p}	=	400	400	400	400	V 1)
W_{mod}	=	413	344	275	500	W

---

1) g_2 modulated with transformer; g_2 modulée par transformateur; g_2 moduliert mittels Transformators

H.F. class B amplifier, single side band
Amplificatrice H.F. classe B à une bande latérale $I_{g_1} = 0$
HF-Einseitenbandverstärker Klasse B

Limiting values (Absolute limits)
Caractéristiques limites (Limites absolues)
Grenzdaten (Absolute Grenzwerte)

f = 110 Mc/s
V_a = max. 4000 V
W_{ia} = max. 1400 W
W_a = max. 400 W
I_a = max. 350 mA
V_{g2} = max. 850 V
W_{g2} = max. 35 W

Operating conditions (two tubes)
Caractéristiques d'utilisation (deux tubes)
Betriebsdaten (zwei Röhren)

f	=		110			110		Mc/s
V_a	=		4000			3500		V
V_{g1}	=		-130			-135		V
V_{g2}	=		705			750		V
			1)	2)		1)	2)	
V_{g1p}	=	0	130		0	135		V
I_a	=	65	250	175	75	280	200	mA
I_{g2}	=		10	7		12	8,4	mA
W_{g2}	=		7,05	4,95		9	6,3	W
W_{ia}	=	260	1000	700	263	980	700	W
W_a	=	260	350	375	263	380	400	W
W_o	=		650	325		600	300	W
η	=		65	46,5		61,2	43	%

---

1) Single tone
Signal monofréquence
Einzelton

2) Double tone
Signal difréquence
Doppelton

H.F. class B amplifier, single side band (continued)
Amplificatrice H.F. classe B à une bande latérale (suite)
HF-Einseitenbandverstärker Klasse B (Fortsetzung)

Operating conditions (two tubes)
Caractéristiques d'utilisation (deux tubes)
Betriebsdaten (zwei Röhren)

f	=		110		Mc/s
V_a	=		3000		V
V_{g1}	=		-140		V
V_{g2}	=		810		V
			1)	2)	
V_{g1p}	=	0	140		V
I_a	=	90	300	215	mA
I_{g2}	=		15	10,5	mA
W_{g2}	=		12,2	8,5	W
W_{ia}	=	270	900	645	W
W_a	=	270	400	395	W
W_o	=		500	250	W
η	=		55,5	38,8	%

A.F. class B amplifier
Amplificatrice B.F. classe B
NF-Klasse B-Verstärker
$I_{g1} > 0$

Limiting values (Absolute limits)
Caractéristiques limites (Limites absolues)
Grenzdaten (Absolute Grenzwerte)

V_a = max. 4000 V
W_a = max. 400 W
I_a = max. 350 mA
V_{g2} = max. 800 V [3]
W_{g2} = max. 35 W
$-I_{g1}$ = max. 25 mA

---

[1][2] See page 6; voir page 6; siehe Seite 6

[3] V_{g2} = max. 1000 V if the temperature of the pin seals is kept below 120 °C
V_{g2} = max. 1000 V si la température des scellements des broches est au-dessous de 120 °C
V_{g2} = max. 1000 V wenn die Temperatur der Einschmelzungen der Stifte unterhalb 120 °C ist

Tentative data. Vorläufige Daten
Caractéristiques provisoires

A.F. class B amplifier (continued)
Amplificatrice B.F. classe B (suite)
NF-Klasse B-Verstärker (Fortsetzung)

Operating conditions (two tubes)
Caractéristiques d'utilisation (deux tubes)
Betriebsdaten (zwei Röhren)

V_a	=	4000		3500		V
V_{g2}	=	500		500		V
V_{g1}	=	-90		-85		V
$R_{aa\sim}$	=	15000		11300		Ω
V_{g1g1p}	=	0	290	0	305	V
I_a	=	2x80	2x319	2x80	2x350	mA
I_{g2}	=		2x20		2x20	mA
I_{g1}	=		2x6		2x6,5	mA
W_{g2}	=		2x10		2x10	W
W_{ig1}	=		2x0,8		2x0,9	W
W_{ia}	=	2x320	2x1275	2x280	2x1225	W
W_a	=	2x320	2x400	2x280	2x400	W
W_o	=		1750		1650	W
η	=		68,5		67,5	%

V_a	=	3000		2500		V
V_{g2}	=	500		500		V
V_{g1}	=	-80		-75		V
$R_{aa\sim}$	=	10000		8000		Ω
V_{g1g1p}	=	0	292	0	290	V
I_a	=	2x90	2x350	2x95	2x350	mA
I_{g2}	=		2x20		2x30	mA
I_{g1}	=		2x6,5		2x7	mA
W_{g2}	=		2x10		2x15	W
W_{ig1}	=		2x0,85		2x0,91	W
W_{ia}	=	2x270	2x1050	2x238	2x875	W
W_a	=	2x270	2x362	2x238	2x320	W
W_o	=		1375		1110	W
η	=		65,5		63,5	%

A.F. class B amplifier
Amplificatrice B.F. classe B
NF-Klasse B-Verstärker

$I_{g1} = 0$

Limiting values (Absolute limits)
Caractéristiques limites (Limites absolues)
Grenzdaten (Absolute Grenzwerte)

V_a	=	max.	4000	V
W_a	=	max.	400	W
I_a	=	max.	350	mA
V_{g2}	=	max.	800	V 3)
W_{g2}	=	max.	35	W
I_{g1}	=	max.	25	mA

Operating conditions (two tubes)
Caractéristiques d'utilisation (deux tubes)
Betriebsdaten (zwei Röhren)

V_a	=	4000		3500		V
V_{g2}	=	750		750		V
V_{g1}	=	-150		-145		V
$R_{aa\sim}$	=	14500		11500		Ω
V_{g1g1p}	=	0	300	0	290	V
I_a	=	2x60	2x293	2x70	2x305	mA
I_{g2}	=		2x15		2x13,5	mA
W_{g2}	=		2x11,2		2x10,4	W
W_{ia}	=	2x240	2x1170	2x245	2x1065	W
W_a	=	2x240	2x400	2x245	2x400	W
W_o	=		1540		1330	W
η	=		66		62,5	%

---

1) V_{g2} = max. 1000 V if the temperature of the pin seals is kept below 120 °C
V_{g2} = max. 1000 V si la température des scellements des broches est au-dessous de 120 °C
V_{g2} = max. 1000 V wenn die Temperatur der Einschmelzungen der Stifte unterhalb 120 °C ist

Tentative data. Vorläufige Daten
Caractéristiques provisoires

A.F. class B amplifier (continued)
Amplificatrice B.F. classe B (suite)
NF-Klasse B-Verstärker (Fortsetzung)

$I_{g1} = 0$

Operating conditions (two tubes)
Caractéristiques d'utilisation (deux tubes)
Betriebsdaten (zwei Röhren)

V_a	=	3000		2500		V
V_{g2}	=	750		750		V
V_{g1}	=	-137		-130		V
$R_{aa\sim}$	=	8900		6800		Ω
V_{g1g1p}	=	0	274	0	260	V
I_a	=	2x80	2x318	2x95	2x318	mA
I_{g2}	=		2x11		2x11,6	mA
W_{g2}	=		2x10,3		2x8,7	W
W_{ia}	=	2x240	2x955	2x238	2x795	W
W_a	=	2x240	2x400	2x238	2x370	W
W_o	=		1110		850	W
η	=		58		53,5	%

QB 5/1750

TETRODE for use as H.F.amplifier,frequency multiplier or modulator
TETRODE pour utilisation en amplificatrice H.F., multiplicatrice de fréquence ou modulatrice
TETRODE zur Verwendung als HF-Verstärker, Frequenzvervielfacher oder Modulator

Cooling : radiation/low velocity air flow
Refroidissement: radiation/léger courant d'air
Kühlung : Strahlung/schwacher Luftstrom

Filament : thoriated tungsten
Filament : tungstène thorié
Heizfaden: thoriertes Wolfram

Heating : direct
Chauffage: direct
Heizung : direkt

V_f = 10 V
I_f = 9,9 A

Capacitances
Capacités
Kapazitäten

C_{g1} = 24 pF
C_a = 8,3 pF
C_{ag1} = 0,25 pF

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} (I_a = 120 mA)= 9,5
S (I_a = 120 mA)= 7 mA/V

λ	Freq.	C telegr.		C_{ag2} mod		C_{g1} mod	
(m)	(Mc/s)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
5	60	5000	1760	4000	1200	4500	400
		4000	1410			4000	330

λ	Freq.	B Single side band Une bande latérale Ein Seitenband	
(m)	(Mc/s)	V_a (V)	W_o (W)
5	60	5000	900

B mod [1]	
V_a (V)	W_o (W)
5000	2220
4000	2250

Industrial application, H.F. class C
Application industrielle, H.F. classe C
Industrielle Anwendung, HF-Klasse C

λ	Freq.	∿ 2)		⌒⌒ 3)	
(m)	(Mc/s)	V_{tr} (V_{eff})	W_o (W)	V_{tr} (V_{eff})4)	W_o (W)
5	60	4800	750	4250	1110

1)2)3)4) See page 3; voir page 3; siehe Seite 3

Cooling
Refroidissement
Kühlung

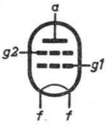
In order to keep the temperatures below the maximum permitted values it may be necessary to direct an air flow to the seals

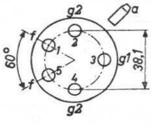
Afin de maintenir les temperatures au-dessous des valeurs maximum admissible il peut être nécessaire de diriger un courant d'air vers les scellements

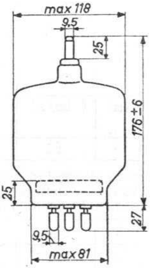
Damit die Temperaturen unterhalb der höchstzulässigen Werte bleiben, kann ein Luftstrom auf die Einschmelzungen notwendig sein

Bulb temperature Température de l'ampoule Kolbentemperatur	= max. 250 °C
Temperature of anode seal Température du scellement de l'anode Temperatur der Anodeneinschmelzung	= max. 220 °C
Temperature of pin seals Température des scellements des broches Temperatur der Stifteneinschmelzungen	= max. 180 °C

Dimensions in mm
Dimensions en mm
Abmessungen in mm







QB 5/1750

Mounting position: vertical with base up or down
Montage : verticale avec le culot en haut ou en bas
Einbau : senkrecht mit dem Sockel oben oder unten

Accessories Accessoires Zubehörteile	Socket Support Fassung	40216
	Clip for ande connection Borne de connexion de l'anode Anodenanschlussklemme	40626
Net weight Poids net Nettogewicht	375 g	
Shipping weight Poids brut Bruttogewicht	1,35 kg	

---

[1] Two tubes
Deux tubes
Zwei Röhren

[2] ∿ = selfrectification
= auto-redressement
= Selbstgleichrichtung

[3] ⌒⌒ = two phase half wave rectification without filter
= redressement biphasé à une alternance sans filtre
= Zweiphasen-Einweggleichrichtung ohne Filter

[4] Each phase
Chaque phase
Jede Phase

Mounting position: vertical with base up or down
Montage : verticale avec le culot en haut ou en bas
Einbau : senkrecht mit dem Sockel oben oder unten

Accessories Accessoires Zubehörteile	Socket Support Fassung	40216
	Clip for ande connection Borne de connexion de l'anode Anodenanschlussklemme	40626
Net weight Poids net Nettogewicht	375 g	
Shipping weight Poids brut Bruttogewicht	1,35 kg	

---

[1] Two tubes
Deux tubes
Zwei Röhren

[2] ∿ = selfrectification
= auto-redressement
= Selbstgleichrichtung

[3] ⌒⌒ = two phase half wave rectification without filter
= redressement biphasé à une alternance sans filtre
= Zweiphasen-Einweggleichrichtung ohne Filter

[4] Each phase
Chaque phase
Jede Phase

H.F. class C telegraphy
H.F. classe C télégraphie
HF- Klasse C Telegraphie

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 75 Mc/s
V_a = max. 5 kV
W_{ia} = max. 2250 W
W_a = max. 500 W
I_a = max. 450 mA
V_{g2} = max. 700 V
W_{g2} = max. 65 W
$-V_{g1}$ = max. 500 V
W_{g1} = max. 25 W

f = max. 110 Mc/s[1]
V_a = max. 4,5 kV
W_{ia} = max. 1800 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	$\leq$	60	60	60	60	Mc/s
V_a	=	5	5	4	4	kV
V_{g2}	=	600	700	600	700	V
V_{g1}	=	-200	-200	-200	-200	V
I_a	=	440	440	450	450	mA
I_{g2}	=	80	75	90	85	mA
I_{g1}	=	35	25	39	27	mA
V_{g1_p}	=	350	340	350	340	V
W_{ia}	=	2200	2200	1800	1800	W
W_{ig1}	=	12	8	14	8,5	W
W_{ig2}	=	48	52,5	54	59,5	W
W_a	=	440	440	390	390	W
W_o	=	1760	1760	1410	1410	W
η	=	80	80	78	78	%

---

[1] See page N; voir page N; siehe Seite N

H.F.class C anode and screen grid modulation
H.F.classe C modulation d'anode et de grille écran
HF- Klasse C Anoden- und Schirmgittermodulation

Screen grid modulated via a choke of 2 H
La grille-écran modulée à travers une bobine de 2 H
Schirmgitter moduliert über eine Drosselspule von 2 H

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 75 Mc/s
V_a = max. 4 kV
W_{ia} = max. 1600 W
W_a = max. 330 W
I_a = max. 400 mA
V_{g2} = max. 700 V
W_{g2} = max. 50 W
$-V_{g1}$ = max. 500 V
W_{g1} = max. 25 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

$f \leq$ 60 Mc/s
V_a = 4 kV
V_{g2} = 600 V
V_{g1} = -240 V
V_{g2p} = 340 V
V_{g1p} = 415 V
I_a = 380 mA
I_{g2} = 80 mA
I_{g1} = 20 mA
W_{ia} = 1520 W
W_{ig1} = 7,5 W
W_{ig2} = 48 W
W_a = 320 W
W_o = 1200 W
η = 79 %
m = 100 %
W_{mod} = 760 W

H.F. class C control grid modulation
H.F. classe C modulation de grille de commande
HF-Klasse C Steuergittermodulation

Limiting values
Caractéristiques limites
Grenzdaten

f	= max.	75	Mc/s
V_a	= max.	5000	V
W_{ia}	= max.	1000	W
W_a	= max.	500	W
I_a	= max.	225	mA
V_{g2}	= max.	700	V
W_{g2}	= max.	50	W
$-V_{g1}$	= max.	500	V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	≤	60	60	Mc/s
V_a	=	4500	4000	V
V_{g2}	=	600	600	V
V_{g1}	=	$-180^{1)}$	$-180^{1)}$	V
R_{g1}	=	1400	1400	Ω
$V_{g1\,p}$	=	220	210	V
I_a	=	200	200	mA
I_{g2}	=	5	5	mA
I_{g1}	=	6,5	6,5	mA
W_{ig1}	=	1,3	1,2	W
W_{ia}	=	900	800	W
W_a	=	500	470	W
W_{g2}	=	3	3	W
W_o	=	400	330	W
η	=	44,5	41	%

m	=	100	100	%
$V_{g1\,mod\,p}$	=	100	100	V
I_{g1} $^{2)}$	=	26	27	mA
$W_{ig1}$$^{2)}$	=	5	5	W

$^{1)}$$^{2)}$See page 7; voir page 7; siehe Seite 7

H.F. class B amplifier single side band
H.F. classe B amplificateur à une bande latérale
HF-Klasse B Einseitenbandverstärker

Limiting values
Caractéristiques limites
Grenzdaten

f	= max.	75	Mc/s
V_a	= max.	5000	V
W_{ia}	= max.	2250	W
W_a	= max.	500	W
I_a	= max.	450	mA
V_{g2}	= max.	700	V
W_{g2}	= max.	65	W
R_{g1}	= max.	50	kΩ

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	$\leq$		60		Mc/s
V_a	=		5000		V
V_{g2}	=		700		V
V_{g1}	=		-90		V
V_{g1p}	=	0		130	V
I_a	=	56		280	mA
I_{g2}	=	0		25	mA
I_{g1}	=	0		1	mA
W_{ig1}	=	0		1	W
W_{ia}	=	280		1400	W
W_a	=	280		500	W
W_{g2}	=	0		18	W
W_o	=	0		900	W
η	=			64,5	%

---

[1] With -170 V from fixed bias supply included
Y compris une tension de polarisation fixe de -170 V
Einschliesslich einer festen Vorspannung von -170 V

[2] At crest of modulation
A la crête de modulation
Beim Scheitel der Modulation

Operating conditions as H.F. class C amplifier for industrial use with self rectification
Caractéristiques d'utilisation en amplificatrice H.F. classe C pour des applications industrielles à auto redressement
Betriebsdaten als HF-Klasse C Verstärker für industrielle Anwendungen mit Selbstgleichrichtung

Limiting values (absolute values)
Caractéristiques limites (valeurs absolues)
Grenzdaten (absolute Werte)

f = max. 75 Mc/s
$V_{tr\,a}$ [1]) = max. 5600 V_{eff}
W_{ia} = max. 1460 W
W_a = max. 500 W
I_a = max. 240 mA

$V_{tr\,g2}$ [1]) = max. 780 V_{eff}
W_{g2} = max. 65 W
$-V_{g1}$ = max. 500 V
I_{g1} = max. 25 mA
R_{g1} = max. 50 kΩ

Operating conditions
Caractéristiques d'utilisation [2])
Betriebsdaten

f $\leqq$ 60 Mc/s
$V_{tr\,a}$ [1]) = 4800 V_{eff}
$V_{tr\,g2}$ [1]) = 670 V_{eff}
R_{g1} = 16 kΩ
V_{g1_p} = 350 V
I_a = 200 mA
I_{g2} = 32 mA
I_{g1} = 11 mA
W_{ig1} = 3,5 W
W_{ia} = 1060 W
W_a = 310 W
W_{g2} = 24 W
W_o = 750 W
η $\doteq$ 71 %

---

[1]) See page 9; voir page 9; siehe Seite 9

[2]) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded
Dans cettes conditions des déviations normales des tensions et de la charge sont permises. Il ne faut cependant pas dépasser les caractéristiques limites absolues
Unter diesen Bedingungen sind normale Abweichungen der Spannungen und der Belastung gestattet. Die absoluten Grenzwerte dürfen jedoch nicht überschritten werden

Operating conditions as H.F. class C amplifier for industrial use with anode voltage from two-phase half-wave rectifier without filter

Caractéristiques d'utilisation en amplificatrice H.F. classe C pour des applications industrielles avec tension anodique dérivée d'un redresseur biphasé à une alternance sans filtre

Betriebsdaten als HF-Klasse C Verstärker für industrielle Anwendungen mit der Anodenspannung abgenommen von einem Zweiphasen-Einweggleichrichter ohne Filter

Limiting values (absolute limits)
Caractéristiques limites (valeurs absolues)
Grenzdaten (absolute Werte)

f = max. 75 Mc/s
$V_{tr\,a}$ 1) = max. 5000 V_{eff}
W_{ia} = max. 2250 W
W_a = max. 500 W
I_a = max. 400 V_{eff}

$V_{tr\,g2}$ 1) = max. 700 V_{eff}
W_{g2} = max. 65 W
$-V_{g1}$ = max. 500 V
W_{g1} = max. 25 W
I_{g1} = max. 45 mA
R_{g1} = max. 50 kΩ

Operating conditions
Caractéristiques d'utilisation 2)
Betriebsdaten

f $\leq$ 60 Mc/s
$V_{tr_3 a}$ 1) = 4250 V_{eff}
V_a 3) = 3825 V
$V_{tr_3 g2}$ 1) = 600 V
V_{g2} 3) = 540 V
R_{g1} = 14 kΩ
V_{g1p} = 300 V
I_a = 325 mA
I_{g2} = 20 mA
I_{g1} = 15 mA
W_{ig1} = 4 W
W_{ia} = 1535 W
W_a = 425 W
W_{g2} = 13,3 W
W_o = 1110 W
η = 72 %

---

1) $V_{tr\,a}$ und $V_{tr\,g2}$ are the anode transformer secondary voltage per phase and the screen grid transformer secondary voltage per phase respectively
$V_{tr\,a}$ et $V_{tr\,g2}$ sont les tensions secondaires par phase des transformateurs d'anode respectivement de la grille-écran
$V_{tr\,a}$ und $V_{tr\,g2}$ sind die Sekundärspannungen pro Phase des Anoden-bzw. Schirmgittertransformators.

2) See page 8; voir page 8; siehe Seite 8

3) D.C. value; valeur moyenne; mittlerer Wert

L.F. class B amplifier and modulator
Amplificatrice et modulatrice B.F. classe B
NF-Verstärker und Modulator Klasse B

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 5000 V
W_{ia} = max. 2250 W
W_a = max. 500 W
I_a = max. 450 mA
V_{g2} = max. 700 V
W_{g2} = max. 65 W
$-V_{g1}$ = max. 500 V
I_{g1} = max. 45 mA
R_{g1} = max. 50 kΩ

Operating conditions, two tubes
Caractéristiques d'utilisation, deux tubes
Betriebsdaten, zwei Röhren

V_a	=	5000		4000		4000		V
V_{g2}	=	600		600		600		V
V_{g1}	=	-62,5		-62,5		-60		V
$R_{aa\sim}$	=	26		20		16		kΩ
V_{g1g1_p}	=	0	260	0	254	0	305	V
I_a	=	2x50	2x290	2x45	2x285	2x55	2x366	mA
I_{g2}	=	0	2x43	0	2x40	0	2x60	mA
I_{g1}	=	0	2x13	0	2x13,5	0	2x18	mA
W_{ig1}	=	0	2x1,5	0	2x1,5	0	2x2,5	W
W_{ia}	=	2x250	2x1450	2x180	2x1140	2x220	2x1465	W
W_a	=	2x250	2x340	2x180	2x300	2x220	2x340	W
W_{g2}	=	0	2x26	0	2x24	0	2x36	W
W_o	=	0	2220	0	1680	0	2250	W
d_{tot}	=	-	5	-	4,7	-	5	%
η	=	-	76,5	-	74	-	76,5	%

QE 04/10

TETRODE for use as H.F. amplifier, oscillator or frequency multiplier
TETRODE pour utilisation comme amplificatrice ou oscillatrice H.F. ou multiplicatrice de fréquence
TETRODE zur Verwendung als HF-Verstärker oder Oszillator oder Frequenzvervielfacher

Cathode : oxide-coated
Cathode : oxyde
Katode : Oxyd

Heating : indirect
Chauffage: indirect
Heizung : indirekt

V_f = 6,3 V
I_f = 0,6 A
T_{hk} = 22 s

Capacitances
Capacités
Kapazitäten

C_a = 5,4 pF
C_{g1} = 8 pF
C_{ag1} < 0,1 pF

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} = 5,6
S (I_a=25 mA)= 1,9 mA/V
R_i = 67 kΩ

λ	Freq.	C telegr.	
m	Mc/s	V_a (V)	W_o (W)
>5	<60	300	8
3	100	300	7,4
2	150	300	6,3
1,7	175	280	5,4
		C ag2 mod.	
>5	<60	250	5,8

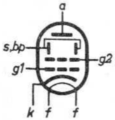
λ	Freq.	C fr.mult.	
m	Mc/s	V_a (V)	W_o (W)
8/4	37,5/75	300	5,6
6/3	50/100	300	4,4
4/2	75/150	250	2,3
12/4	25/75	300	3,2
9/3	33,3/100	275	2,8
6/2	50/150	225	1,5

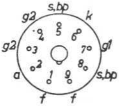
Limiting values
Caractéristiques limites
Grenzdaten

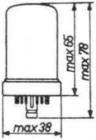
V_a = max. 400 V
W_a = max. 7,5 W
V_{g2} = max. 250 V
W_{g2} = max. 2 W

W_{g1} = max. 0,25 W
R_{g1} = max. 0,1 MΩ
I_{g1} = max. 6 mA
I_k = max. 50 mA
V_{kf} = max. 100 V

Dimensions in mm
Dimensions en mm
Abmessungen in mm







Base, culot, Sockel: B9G

Socket Support Fassung	40212

Mounting position: arbitrary
Montage : arbitrairement
Einbau : beliebig

Net weight Poids net Nettogewicht	40 g
Shipping weight Poids brut Bruttogewicht	55 g

Operating conditions H.F. class C telegraphy
Caractéristiques d'utilisation H.F. classe C télégraphie
Betriebsdaten HF – Klasse C Telegrafie

λ	=	>5	>5	3	2	2	1,7^{1})	m
V_a	=	300	300	300	300	300	280	V
V_{g1}	=	-60	-35	-60	-50	-30	-50	V
V_{g2}	=	250	150	250	250	150	250	V
I_a	=	43	40	44,5	46	44	2x46	mA
I_{g1}	=	0,5	2,8	0,4	0,4	1,5	2x0,3	mA
I_{g2}	=	6,7	7,2	5,3	4	4,5	2x3,5	mA
V_{g1p}	=	68	58	68	57	52	55	V
W_{ig1}	=	31	150	25	21	70	2x15	mW
W_{g2}	=	1,7	1,1	1,4	1	0,7	2x0,9	W
W_{ia}	=	12,9	12	13,4	13,8	13,2	2x12,9	W
W_a	=	4,9	4,9	6	7,5	6,9	2x7,5	W
W_o	=	8	7,1	7,4	6,3	6,3	10,8	W
η	=	62	59	55	46	48	42	%

Operating conditions H.F. class C anode- and screen grid modulation
Caractéristiques d'utilisation H.F. classe C modulation d'anode et de grille-écran
Betriebsdaten HF- Klasse C Anoden- und Schirmgittermodulation

λ	=	>5	m
V_a	=	250	V
V_{g1}	=	-50	V
V_{g2}	=	200	V
I_a	=	38,5	mA
I_{g1}	=	1,5	mA
I_{g2}	=	10	mA
V_{g1p}	=	72	V
W_{ig1}	=	0,1	W
W_{g2}	=	2	W
W_{ia}	=	9,6	W
W_a	=	3,8	W
W_o	=	5,8	W
η	=	60	%
m	=	100	%
V_{g2p}	=	176	V
W_{mod}	=	5	W

---

^{1}) Two valves in push-pull; deux tubes en push-pull; zwei Röhren in Gegentakt

Operating conditions as class C frequency doubler
Caractéristiques d'utilisation comme doubleur de fréquence classe C
Betriebsdaten als Frequenzverdoppler Klasse C

λ	=	8/4	6/3	4/2	m
V_a	=	300	300	250	V
V_{g1}	=	-120	-120	-120	V
V_{g2}	=	250	200	200	V
I_a	=	43,3	38,4	36,8	mA
I_{g1}	=	1,2	1,5	1,1	mA
I_{g2}	=	5,5	2,6	2,1	mA
V_{g1p}	=	124	120	144	V
W_{ig1}	=	134	162	143	mW
W_{g2}	=	1,4	0,52	0,42	W
W_{ia}	=	13	11,5	9,2	W
W_a	=	7,4	7,1	6,9	W
W_o	=	5,6	4,4	2,3	W
η	=	43	38	25	%

Operating conditions as class C frequency tripler
Caractéristiques d'utilisation comme tripleur de fréquence classe C
Betriebsdaten als Frequenzverdreifacher Klasse C

λ	=	12/4	9/3	6/2[1])	m
V_a	=	300	275	225	V
V_{g1}	=	-140	-140	-140	V
V_{g2}	=	250	200	200	V
I_a	=	34,3	36	2x36	mA
I_{g1}	=	0	1,5	2x1,3	mA
I_{g2}	=	2,8	2,5	2x2,5	mA
V_{g1p}	=	130	142	152	V
W_{ig1}	=	0	192	2x180	mW
W_{g2}	=	0,7	0,5	2x0,5	W
W_{ia}	=	10,3	9,9	2x8,1	W
W_a	=	7,1	7,1	2x6,6	W
W_o	=	3,2	2,8	3	W
η	=	31	28,5	18,5	%

---

[1]) Two valves in push-pull; deux tubes en push-pull; zwei Röhren in Gegentakt

QE 05/40

BEAM POWER TETRODE for use as R.F. amplifier, oscillator and frequency multiplier and as A.F. amplifier and modulator in mobile and fixed equipment

TETRODE A FAISCEAU pour utilisation en amplificatrice, oscillatrice et multiplicatrice de fréquence H.F. et en amplificatrice et modulatrice B.F. dans installations mobiles et fixes

BÜNDELTETRODE zur Verwendung als HF-Verstärker, Oszillator und Frequenzvervielfacher und als NF-Verstärker und Modulator in beweglichen und festen Geräten

Cathode : oxide-coated
Cathode : oxyde
Katode : Oxyd

Heating : indirect
Chauffage: indirect
Heizung : indirekt

V_f = 6,3 V
I_f = 1,25 A

Capacitances
Capacités
Kapazitäten

C_a = 8,5 pF
C_{g1} = 13,5 pF
C_{ag1} < 0,24 pF

Typical characteristics
Caractéristiques types
Kenndaten

$$\left.\begin{matrix}\mu_{g2g1} \\ S\end{matrix}\right.\left\{\begin{matrix}V_a = 200\ \text{V} \\ V_{g2} = 200\ \text{V} \\ I_a = 100\ \text{mA}\end{matrix}\right\}\begin{matrix}= 4{,}5 \\ = 7\ \text{mA/V}\end{matrix}$$

λ	Freq.	C telegr.			Cag2 mod.		
m	Mc/s	Va	Wo (W)		Va	Wo (W)	
		(V)	CCS	ICAS	(V)	CCS	ICAS
5	60	750		70	600		52
		600	52	66	475	34	
		500	48		400	32	
1,7	175	400		35			
		320	25				

AB mod.[1][2]			AB mod.[1][3]			AB mod.[1][4]		
Va	Wo (W)		Va	Wo (W)		Va	Wo (W)	
(V)	CCS	ICAS	(V)	CCS	ICAS	(V)	CCS	ICAS
750		120	750		131	400	22	22
600	82	95	600	90	113	250	10	
500	70		500	83				
400	55		400	62				

---

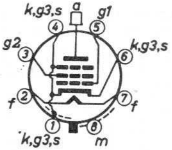
[1] Two tubes
Deux tubes
Zwei Röhren

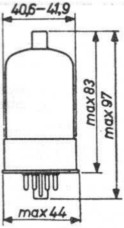
[2] Without grid current
Sans courant de grille.
Ohne Gitterstrom

[3] With grid current
Avec courant de grille
Mit Gitterstrom

[4] In triode connection
En montage triode
In Triodenschaltung

Dimensions in mm
Dimensions en mm
Abmessungen in mm





Base, culot, Sockel: Octal 8-pin

Socket, support, Fassung: 5903/13
Cap , capot , Haube : 28 906 022

Mounting position: arbitrary
Montage : arbitrairement
Einbau : willkürlich

Net weight Poids net Nettogewicht	57g	Shipping weight Poids brut Bruttogewicht	85 g

Bulb temperature Température de l'ampoule Kolbentemperatur	max. 220 °C

---

[1] For operation at maximum ratings
Pour opération aux caractéristiques limites
Für Betrieb bei den Grenzwerten

[3] V_{g1} may be obtained from a separate supply, or from R_{g1} or R_k, or by combination methods
V_{g1} peut être obtenue d'une source séparée, ou par moyen de R_{g1} ou R_k, ou par une combinaison de ces méthodes
V_{g1} kann von einer eigenen Quelle, oder mittels R_{g1} oder R_k, oder mittels einer Kombination dieser Methoden erhalten werden

[9] For values of R_{g1} exceeding 100 kΩ, cathode bias is required
Pour des valeurs de R_{g1} dépassant 100 kΩ il faut utiliser polarisation de cathode
Für Werte von R_{g1} oberhalb 100 kΩ ist Gittervorspannung mittels Katodenwiderstand erforderlich

---

[4] Obtained preferably from a separate source, or from the anode supply with a voltage divider or through a series resistor
When the tube is keyed, a series screen resistor should not be used. V_{g2} must not exceed 400 V under key-up conditions
Obtenu de préférence d'une source séparée, ou de l'alimentation anodique par moyen d'un potentiomètre ou à travers une résistance série
Si le tube est manié, une résistance série de grille-écran ne sera pas utilisée. V_{g2} ne dépassera pas une valeur de 400 V dans le cas de manipulateur levé.
Vorzugsweise von einer eigenen Quelle oder mittels eines Spannungsteilers oder über einen Serienwiderstand von der Anodenspeisung erhalten
Wenn die Röhre mit Tastung betrieben wird, soll kein Schirmgitterserienwiderstand verwendet werden. V_{g2} soll im Falle gehobener Taste einen Wert von 400 V nicht überschreiten

[5] V_{g1} may be obtained by means of a grid resistor or from a combination of grid resistor with either fixed supply or cathode resistor
V_{g1} peut être obtenu par moyen d'une résistance de grille ou d'une combinaison d'une résistance de grille et ou bien une polarisation fixe ou bien une résistance cathodique
V_{g1} kann mittels eines Gitterwiderstandes oder von einer Kombination eines Gitterwiderstandes und entweder einer festen Vorspannung oder eines Katodenwiderstandes erhalten werden

[6] Obtained preferably from a separate source modulated with the anode supply or from the modulated anode supply through a series resistor
Obtenu de préférence d'une source séparée modulée par l'alimentation anodique ou bien de l'alimentation anodique modulée à travers une résistance série
Vorzugsweise von einer eigenen mit der Anodenspeisung modulierten Spannungsquelle oder von der Anodenspeisung über einen Serienwiderstand erhalten

[7] Under these conditions only fixed bias is recommended
Dans ces conditions seulement une polarisation fixe est recommandée
Unter diesen Umständen wird nur eine feste Vorspannung empfohlen

[8] Obtained preferably from a separate source or from the anode supply using a voltage divider
Obtenu de préférence d'une source séparée ou bien de l'alimentation anodique en utilisant un potentiomètre
Vorzugsweise von einer eigenen Quelle oder von der Anodenspeisung mit Verwendung eines Spannungsteilers erhalten

H.F. class C telegraphy and H.F. class C anode and screen grid modulation
H.F. classe C télégraphie et H.F. classe C modulation d'anode et de grille-écran
HF-Klasse C Telegraphie und HF-Klasse C Anoden- und Schirmgittermodulation

---

DERATING TABLE of the limiting values of V_a and W_{ia} (in %) as a function of the operating frequency

TABLEAU D'ABAISSEMENT des caractéristiques limites de V_a et W_{ia} (en %) en fonction de la fréquence d'opération.

REDUKTIONSTABELLE der Grenzwerte von V_a und W_{ia} (in %) als Funktion der Betriebsfrequenz

Freq. (Mc/s)	V_a (%)	W_{ia} (%)
60	100	100
80	84	92
125	65	78
150	58	72
160	56	70
175	53	67

H.F. class C telegraphy
H.F. classe C télégraphie
H.F. Klasse C Telegrafie

Limiting values
Caractéristiques limites
Grenzdaten

See page 4 for Derating table

Voir page 4 pour Tableau d'abaissement

Für Reduktionstabelle siehe Seite 4

		C.C.S.	I.C.A.S.	
f	= max.	60	60	Mc/s
V_a	= max.	600	750	V
W_{ia}	= max.	67,5	90	W
W_a	= max.	20	25	W
I_a	= max.	140	150	mA
V_{g2}	= max.	250	250	V
W_{g2}	= max.	3	3	W
$-V_{g1}$	= max.	150	150	V
I_{g1}	= max.	3,5	4	mA
$V_{kf\,p}$	= max.	135	135	V
R_{g1} 1)	= max.	30	30	kΩ

C.C.S. = Continuous service
Service continu
Dauerbetrieb

I.C.A.S. = Intermittent service
Service intermittent
Aussetzender Betrieb

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

		C.C.S.			I.C.A.S.			
f	=	60	60	175	60	60	175	Mc/s
V_a	=	600	500	320	750	600	400	V
V_{g1} 3)	=	-58	-66	-51	-62	-71	-54	V
V_{g2} 4)	=	150	170	180	160	180	190	V
I_a	=	112	135	140	120	150	150	mA
I_{g1}	=	2,8	2,5	2,0	3,1	2,8	2,2	mA
I_{g2}	=	9	9	10	11	10	10,4	mA
V_{g1p}	=	73	84	64	79	91	68	V
W_{ig1}	=	0,2	0,2	3	0,2	0,3	3	W
W_{g2}	=	1,4	1,6	1,8	1,8	1,8	2,0	W
W_{ia}	=	67,5	67,5	45	90	90	60	W
W_a	=	15,5	19,5	20	20	24	25	W
W_o	=	52	48	25	70	66	35	W
η	=	77	71	55,5	78	73,5	58	%

---

1)3)4) See page 2 and 3; voir page 2 et 3; siehe Seite 2 und 3

H.F. class C anode and screen grid modulation
H.F. classe C modulation d'anode et de grille-écran
HF-Klasse C Anoden- und Schirmgittermodulation

Limiting values
Caractéristiques limites
Grenzdaten

See page 4 for Derating table

Voir page 4 pour Tableau d'abaissement

Für Reduktionstabelle siehe Seite 4

		C.C.S.	I.C.A.S.	
f	= max.	60	60	Mc/s
V_a	= max.	480	600	V
W_{ia}	= max.	45	67,5	W
W_a	= max.	13,3	16,7	W
I_a	= max.	117	125	mA
V_{g2}	= max.	250	250	V
W_{g2}	= max.	2	2	W
$-V_{g1}$	= max.	150	150	V
I_{g1}	= max.	3,5	4	mA
V_{kfp}	= max.	135	135	V
R_{g1} 1)	= max.	30	30	kΩ

C.C.S. = Continuous service / Service continu / Dauerbetrieb

I.C.A.S. = Intermittent service / Service intermittent / Aussetzender Betrieb

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

		C.C.S.		I.C.A.S.	
f	=	60	60	60	Mc/s
V_a	=	475	400	600	V
V_{g1} 5)	=	-77	-87	-87	V
V_{g2} 6)	=	135	150	150	V
I_a	=	94	112	112	mA
I_{g1}	=	2,8	3,4	3,4	mA
I_{g2}	=	6,4	7,8	7,8	mA
V_{g1p}	=	95	107	107	V
W_{ig1}	=	0,3	0,4	0,4	W
W_{g2}	=	1,0	1,2	1,2	W
W_{ia}	=	45	45	67,5	W
W_a	=	11	13	15,5	W
W_o	=	34	32	52	W
η	=	75,5	71	77	%
m	=	100	100	100	%
W_{mod}	=	23	23	34	W

---

1)5)6) See page 2 and 3; voir page 2 et 3; siehe Seite 2 und 3

A.F. class AB amplifier and modulator (I_{g1} = 0)
Amplificatrice et modulatrice B.F. classe AB (I_{g1} = 0)
NF-Klasse AB Verstärker und Modulator (I_{g1} = 0)

Limiting values; continuous service
C.C.S. Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

V_a	= max. 600 V	V_{g2}	= max. 250 V
W_{ia}	= max. 60 W	W_{g2}	= max. 3 W
W_a	= max. 20 W	V_{kf_p}	= max. 135 V
I_a	= max. 125 mA	R_{g1}	= max. 100 kΩ

Operating conditions, continuous service; two tubes
C.C.S. Caractéristiques d'utilisation, service continu; deux tubes
Betriebsdaten, Dauerbetrieb; zwei Röhren

V_a =	600		500		V
V_{g2} 8) =	180		185		V
V_{g1} 7) =	-45		-40		V
R_{aa} =	7000		5500		Ω
V_{g1g1_p} =	0	90	0	80	V
I_a =	2x13	2x100	2x29	2x108	mA
I_{g2} =	2x0,5	2x12	2x1	2x13	mA
W_{ig1} =	0	0	0	0	W
W_{g2} =	2x0,1	2x2	2x0,2	2x2,4	W
W_{ia} =	2x7,8	2x60	2x14,5	2x54	W
W_a =	2x7,8	2x19	2x14,5	2x19	W
W_o =	0	82	0	70	W
η =	-	68		65	%

V_a =	400		V
V_{g2} 8) =	190		V
V_{g1} 7) =	-40		V
R_{aa} =	4000		Ω
V_{g1g1_p} =	0	80	V
I_a =	2x32	2x114	mA
I_{g2} =	2x1,3	2x13	mA
W_{ig1} =	0	0	W
W_{g2} =	2x0,25	2x2,5	W
W_{ia} =	2x12,8	2x45,5	W
W_a =	2x12,8	2x18	W
W_o =	0	55	W
η =	-	60	%

---

7)8) See page 8; voir page 8; siehe Seite 8

A.F. class AB amplifier and modulator (I_{g1} = 0)
Amplificatrice et modulatrice B.F. classe AB (I_{g1} = 0)
NF-Klasse AB Verstärker und Modulator (I_{g1} =0)

I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

V_a = max. 750 V		V_{g2} = max. 250 V	
W_{ia} = max. 85 W		W_{g2} = max. 3 W	
W_a = max. 25 W		V_{kf_p} = max. 135 V	
I_a = max. 135 mA		R_{g1} 7) = max. 100 kΩ	

I.C.A.S. Operating conditions, intermittent service;two tubes
Caractéristiques d'utilisation, service intermittent; deux tubes
Betriebsdaten, aussetzender Betrieb; zwei Röhren

V_a	=	750		600		V
V_{g2} 8)	=	195		200		V
V_{g1} 7)	=	-50		-50		V
R_{aa}	=	8000		6000		Ω
V_{g1g1_p}	=	0	100	0	100	V
I_a	=	2x12	2x110	2x14	2x115	mA
I_{g2}	=	2x0,5	2x13	2x0,5	2x13,5	mA
W_{ig1}	=	0	0	0	0	W
W_{g2}	=	2x0,1	2x2,5	2x0,1	2x2,7	W
W_{ia}	=	2x8,7	2x82,5	2x8,4	2x69	W
W_o	=	0	120	0	95	W
η	=	-	72,5	-	69	%

---

7)Under these conditions only fixed bias is recommended
Dans ces conditions seulement une polarisation fixe est recommandée
Unter diesen Umständen wird nur eine feste Vorspannung empfohlen

8)Obtained preferably from a separate source or from the anode supply using a voltage divider
Obtenu de préférence d'une source séparée ou bien de l'alimentation anodique en utilisant un potentiomètre
Vorzugsweise von einer eigenen Quelle oder von der Anodenspeisung mit Verwendung eines Spannungsteilers erhalten

A.F. class AB amplifier and modulator ($I_{g1} > 0$)
Amplificatrice et modulatrice B.F. classe AB ($I_{g1} > 0$)
NF-Klasse AB Verstärker und Modulator ($I_{g1} > 0$)

Limiting values, continuous service
C.C.S. Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

V_a	= max.	600 V	V_{g2}	= max.	250 V
W_{ia}	= max.	62,5 W	W_{g2}	= max.	3 W
W_a	= max.	20 W	V_{kfp}	= max.	135 V
I_a	= max.	125 mA	R_{g1} 7)	= max.	30 kΩ

Operating conditions, continuous service; two tubes
C.C.S. Caractéristiques d'utilisation, service continu; deux tubes
Betriebsdaten, Dauerbetrieb; zwei Röhren

V_a	=	600		500		V
V_{g2} 8)	=	165		175		V
V_{g1} 7)	=	-44		-44		V
R_{aa}	=	6800		4600		Ω
V_{g1g1p}	=	0	97	0	102	V
I_a	=	2x11	2x103	2x13	2x121	mA
I_{g2}	=	2x0,3	2x8,5	2x0,3	2x9	mA
I_{g1}	=	0	2x0,5	0	2x1,0	mA
W_{ig1}	=	0	2x0,1	0	2x0,15	W
W_{g2}	=	2x0,05	2x1,4	2x0,06	2x1,6	W
W_{ia}	=	2x6,6	2x62	2x6,5	2x60,5	W
W_a	=	2x6,6	2x17	2x6,5	2x19	W
W_o	=	0	90	0	83	W
η	=	-	72,5		68,5	%

V_a	=	400		V
V_{g2} 8)	=	175		V
V_{g1} 7)	=	-41		V
R_{aa}	=	3700		Ω
V_{g1g1p}	=	0	95	V
I_a	=	2x16	2x116	mA
I_{g2}	=	2x0,5	2x9	mA
I_{g1}	=	0	2x0,8	mA
W_{ig1}	=	0	2x0,1	W
W_{g2}	=	2x0,1	2x1,6	W
W_{ia}	=	2x6,4	2x46,5	W
W_a	=	2x6,4	2x15,5	W
W_o	=	0	62	W
η	=		66,5	%

---

7)8)See page 8; voir page 8; siehe Seite 8

A.F. class AB amplifier and modulator ($I_{g1} > 0$)
Amplificatrice et modulatrice B.F. classe AB ($I_{g1} > 0$)
NF-Klasse AB Verstärker und Modulator ($I_{g1} > 0$)

I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

V_a = max. 750 V
W_{ia} = max. 90 W
W_a = max. 25 W
I_a = max. 135 mA

V_{g2} = max. 250 V
W_{g2} = max. 3 W
V_{kf_p} = max. 135 V
R_{g1} 7) = max. 30 kΩ

I.C.A.S. Operating conditions, intermittent service; two tubes
Caractéristiques d'utilisation, service intermittent; deux tubes
Betriebsdaten, aussetzender Betrieb; zwei Röhren

V_a	=	750		600		V
V_{g2} 8)	=	165		190		V
V_{g1} 7)	=	-46		-48		V
R_{aa}	=	7400		5000		Ω
V_{g1g1p}	=	0	108	0	109	V
I_a	=	2x11	2x120	2x14	2x135	mA
I_{g2}	=	2x0,15	2x10	2x0,6	2x10	mA
I_{g1}	=	0	2x1,3	0	2x1,0	mA
W_{ig1}	=	0	2x0,2	0	2x0,15	W
W_{g2}	=	2x0,03	2x1,7	2x0,1	2x1,9	W
W_{ia}	=	2x8,3	2x90	2x8,4	2x81	W
W_a	=	2x8,3	2x24,5	2x8,4	2x24,5	W
W_o	=	0	131	0	113	W
η	=	-	73	-	70	%

---

7) Under these conditions only fixed bias is recommended
Dans ces conditions seulement une polarisation fixe est recommandée
Unter diesen Umständen wird nur eine feste Vorspannung empfohlen

8) Obtained preferably from a separate source or from the anode supply using a voltage divider
Obtenu de préférence d'une source séparée ou bien de l'alimentation anodique en utilisant un potentiomètre
Vorzugsweise von einer eigenen Quelle oder von der Anodenspeisung mit Verwendung eines Spannungsteilers erhalten

A.F. class AB amplifier and modulator in triode connection (g_2 connected to anode; $I_{g1}= 0$)
Amplificatrice et modulatrice B.F. classe AB en montage triode (g_2 connecté à a; $I_{g1} = 0$)
NF-Klasse AB Verstärker und Modulator in Triodenschaltung (g_2 verbunden mit a; $I_{g1} = 0$)

Limiting values
Caractéristiques limites
Grenzdaten

		C.C.S.	I.C.A.S.	
V_a	= max.	400	400	V
I_a	= max.	90	90	mA
W_{ia}	= max.	35	35	W
W_a	= max.	20	25	W
V_{kf_p}	= max.	135	135	V
R_{g1} 9)	= max.	100	100	kΩ
R_{g1} 9)	= max.	500	500	kΩ

C.C.S. = continuous service / service continu / Dauerbetrieb

I.C.A.S. = intermittent service / service intermittent / aussetzender Betrieb

Operating conditions, two tubes
Caractéristiques d'utilisation, deux tubes
Betriebsdaten, zwei Röhren

C.C.S.	V_a	=	400		250		V
	V_{g1} 9)	=	-100		-50		V
	R_{aa}	=	8000		5000		Ω
	V_{gg_p}	=	0	200	0	100	V
	I_a	=	2x20	2x50	2x60	2x62	mA
	W_{ia}	=	2x8	2x20	2x15	2x15,5	W
	W_a	=	2x8	2x9	2x15	2x10,5	W
	W_o	=	0	22	0	10	W
	η	=	-	55	-	32	%

I.C.A.S.	V_a	=	400		V
	V_{g1} 9)	=	-100		V
	R_{aa}	=	8000		Ω
	V_{gg_p}	=	0	200	V
	I_a	=	2x20	2x50	mA
	W_{ia}	=	2x8	2x20	W
	W_a	=	2x8	2x9	W
	W_o	=	0	22	W
	η	=	-	55	%

---

[9] See page 2; voir page 2; siehe Seite 2

QE 06/50

BEAM POWER TETRODE for use as A.F. and R.F. amplifier and oscillator
TETRODE A FAISCEAU pour utilisation en amplificatrice B.F. et H.F. et oscillatrice
BÜNDELTETRODE zur Verwendung als NF- und HF-Verstärker und Oszillator

Cathode : oxide-coated
Cathode : oxyde
Katode : Oxyd

Heating : indirect
Chauffage: indirect
Heizung : indirekt

V_f = 6,3 V
I_f = 0,9 A

Capacitances
Capacités
Kapazitäten

C_a = 7 pF
C_{g1} = 12 pF
C_{ag1} < 0,2 pF 1)

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} = 8
S (I_a = 72 mA) = 6 mA/V

λ	Freq.	C telegr.			B teleph.			C_{ag2} mod.		
		V_a	W_o (W)		V_a	W_o (W)		V_a	W_o (W)	
m	Mc/s	(V)	CCS	ICAS	(V)	CCS	ICAS	(V)	CCS	ICAS
5	60	600	40		600	12,5		475	28	
		500	32		500	11		400	22	
		400	25		400	9		325	17	
		750		54	750		15	600		44

AB mod 2) 3)			AB mod 2) 4)		
V_a	W_o (W)		V_a	W_o (W)	
(V)	CCS	ICAS	(V)	CCS	ICAS
600	56		600	80	
500	46		500	75	
400	36		400	55	
750		72	750		120
400	15 5)	15 5)			

---

1) With external shield connected to cathode
Avec blindage extérieur connecté à la cathode
Mit äusserer Abschirmung verbunden mit Katode

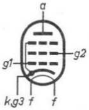
2) Two tubes; deux tubes; zwei Röhren

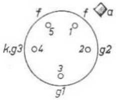
3) Without grid current
Sans courant de grille
Ohne Gitterstrom

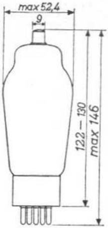
4) With grid current
Avec courant de grille
Mit Gitterstrom

5) Two tubes in triode connection
Deux tubes en montage triode
Zwei Röhren in Triodenschaltung

Dimensions in mm
Dimensions en mm
Abmessungen in mm







Base, culot, Sockel: Medium 5-pin

Socket, support, Fassung: 40219
Cap , capot , Haube : 28 906 022

Mounting position: arbitrary
Montage : arbitrairement
Einbau : willkürlich

Net weight Poids net Nettogewicht	60 g	Shipping weight Poids brut Bruttogewicht	85 g

---

[1] Page 5 and 6; page 5 et 6; Seite 5 und 6
Obtained preferably from a separate source modulated with the plate supply or from the modulated plate supply through a series resistor of
12.5 kΩ at V_a = 325 V
25 kΩ at V_a = 400 V
28 kΩ at V_a = 475 V
37.5 kΩ at V_a = 600 V

Obtenu de préférence d'une source séparée modulée avec l'alimentation anodique, ou de l'alimentation anodique modulée à travers une résistance série de
12,5 kΩ à V_a = 325 V
25 kΩ à V_a = 400 V
28 kΩ à V_a = 475 V
37,5 kΩ à V_a = 600 V

Vorzugsweise erhalten von einer separaten Spannungsquelle, moduliert mit der Anodenspeisung oder von der modulierten Anodenspeisung mittels eines Serienwiderstandes von
12,5 kΩ bei V_a = 325 V
25 kΩ bei V_a = 400 V
28 kΩ bei V_a = 475 V
37,5 kΩ bei V_a = 600 V

H.F. class C telegraphy
H.F. classe C télégraphie
HF-Klasse C Telegraphie

Limiting values, continuous service
C.C.S.Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 60 Mc/s
V_a = max. 600 V
W_{ia} = max. 60 W
W_a = max. 25 W
I_a = max. 100 mA
V_{g2} = max. 300 V
W_{g2} = max. 3,5 W
$-V_{g1}$ = max. 200 V
I_{g1} = max. 5 mA
V_{kf} = max. 135 V
R_{g1} = max. 30 kΩ

f = max. 80 Mc/s
V_a = max. 480 V
W_{ia} = max. 48 W

f = max. 125 Mc/s
V_a = max. 330 V
W_{ia} = max. 33 W

Operating conditions, continuous service
C.C.S.Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

V_a	=	600	500	400	V
V_{g1}	=	-45	-45	-45	V
V_{g2}	=	250	250	250	V
I_a	=	100	100	100	mA
I_{g1}	=	4	4	4	mA
I_{g2}	=	8	8	8	mA
V_{g1_p}	=	65	65	65	V
W_{ig1}	=	0,3	0,3	0,3	W
W_{g2}	=	2	2	2	W
W_{ia}	=	60	50	40	W
W_a	=	20	18	15	W
W_o	=	40	32	25	W
η	=	66,5	64	62,5	%

H.F. class C telegraphy
H.F. classe C télégraphie
HF-Klasse C Telegraphie

Limiting values, intermittent service
I.C.A.S. Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 60 Mc/s
V_a = max. 750 V
W_{ia} = max. 75 W
W_a = max. 30 W
I_a = max. 100 mA
V_{g2} = max. 300 V
W_{g2} = max. 3,5 W
$-V_{g1}$ = max. 200 V
I_{g1} = max. 5 mA
V_{kf} = max. 135 V
R_{g1} = max. 30 kΩ

f = max. 80 Mc/s
V_a = max. 600 V
W_{ia} = max. 60 W

f = max. 125 Mc/s
V_a = max. 415 V
W_{ia} = max. 41,5 W

Operating conditions, intermittent service
I.C.A.S. Caractéristiques d'utilisation, service intermittent
Grenzdaten, aussetzender Betrieb

V_a = 750 V
V_{g1} = -45 V
V_{g2} = 250 V
I_a = 100 mA
I_{g1} = 4 mA
I_{g2} = 8 mA
V_{g1_p} = 65 V
W_{ig1} = 0,3 W
W_{g2} = 2 W
W_{ia} = 75 W
W_a = 21 W
W_o = 54 W
η = 72 %

H.F. classe C anode and screen grid modulation
H.F. classe C modulation d'anode et de grille écran
HF-Klasse C Anoden- und Schirmgittermodulation

Limiting values, continuous service
C.C.S. Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 60 Mc/s
V_a = max. 475 V
W_{ia} = max. 40 W
W_a = max. 16,5 W
I_a = max. 83 mA
V_{g2} = max. 300 V
W_{g2} = max. 2,5 W
$-V_{g1}$ = max. 200 V
I_{g1} = max. 5 mA
V_{kf} = max. 135 V
R_{g1} = max. 30 kΩ

f = max. 80 Mc/s
V_a = max. 380 V
W_{ia} = max. 32 W

f = max. 125 Mc/s
V_a = max. 260 V
W_{ia} = max. 22 W

Operating conditions, continuous service
C.C.S. Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

V_a	=	475	400	325	V
V_{g1}	=	-85	-75	-75	V
V_{g2} 1)	=	250	250	250	V
I_a	=	83	80	80	mA
I_{g1}	=	4	3,5	3,5	mA
I_{g2}	=	8	6	6	mA
V_{g1_p}	=	108	95	95	V
W_{ig1}	=	0,4	0,3	0,3	W
W_{g2}	=	2	1,5	1,5	W
W_{ia}	=	39,5	32	26	W
W_a	=	11,5	10	9	W
W_o	=	28	22	17	W
η	=	71	69	65,5	%
m	=	100	100	100	%
W_{mod}	=	20	16	13	W

---

1) See page 2; voir page 2; siehe Seite 2

H.F. class C anode and screen grid modulation
H.F. classe C modulation d'anode et de grille écran
HF-Klasse C Anoden- und Schirmgittermodulation

I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 60 Mc/s
V_a = max. 600 V
W_{ia} = max. 60 W
W_a = max. 25 W
I_a = max. 100 mA
V_{g2} = max. 300 V
W_{g2} = max. 2,5 W
V_{g1} = max. 200 V
I_{g1} = max. 5 mA
V_{kf} = max. 135 V
R_{g1} = max. 30 kΩ

f = max. 80 Mc/s
V_a = max. 480 V
W_{ia} = max. 48 W

f = max. 125 Mc/s
V_a = max. 330 V
W_{ia} = max. 33 W

I.C.A.S. Operating conditions, intermittent service
Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

V_a = 600 V
V_{g1} = -85 V
V_{g2}[1] = 300 V
I_a = 100 mA
I_{g1} = 4 mA
I_{g2} = 8 mA
V_{g1p} = 107 V
W_{ig1} = 0,4 W
W_{g2} = 2,4 W
W_{ia} = 60 W
W_a = 16 W
W_o = 44 W
η = 73 %

m = 100 %
W_{mod} = 30 W

---

[1] See page 2; voir page 2; siehe Seite 2

H.F. class B telephony
H.F. classe B téléphonie
HF-Klasse B Telefonie

Limiting values, continuous service
C.C.S. Caractéristiques limites; service continu
Grenzdaten, Dauerbetrieb

f = max. 60 Mc/s
V_a = max. 600 V
W_{ia} = max. 37,5 W
W_a = max. 25 W
I_a = max. 80 mA
V_{g2} = max. 300 V
W_{g2} = max. 2,5 W
V_{kf} = max. 135 V
R_{g1} = max. 30 kΩ

f = max. 80 Mc/s
V_a = max. 540 V
W_{ia} = max. 34 W

f = max. 125 Mc/s
V_a = max. 450 V
W_{ia} = max. 28 W

Operating conditions, continuous service
C.C.S. Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

V_a	=	600	500	400	V
V_{g1}	=	-40	-40	-40	V
V_{g2}	=	300	300	300	V
I_a	=	62,5	70	75	mA
I_{g2}	=	4	4	5	mA
V_{g1_p}	=	36	38	40	V
W_{g2}	=	1,2	1,2	1,5	W
W_{ia}	=	37,5	35	30	W
W_a	=	25	24	21	W
W_o	=	12,5	11	9	W
η	=	33	31,5	30	%
m	=	100	100	100	%
W_{ig1}	=	0,2	0,3	0,4	W

H.F. class B telephony
H.F. classe B téléphonie
HF-Klasse B Telefonie

Limiting values, intermittent service
I.C.A.S. Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 60 Mc/s
V_a = max. 750 V
W_{ia} = max. 45 W
W_a = max. 30 W
I_a = max. 90 mA
V_{g2} = max. 300 V
W_{g2} = max. 2,5 W
V_{kf} = max. 135 V
R_{g1} = max. 30 kΩ

f = max. 80 Mc/s
V_a = max. 675 V
W_{ia} = max. 40,5 W

f = max. 125 Mc/s
V_a = max. 562 V
W_{ia} = max. 34 W

Operating conditions, intermittent service
I.C.A.S. Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

V_a = 750 V
V_{g1} = -40 V
V_{g2} = 300 V
I_a = 60 mA
I_{g2} = 3 mA
V_{g1_p} = 35 V
W_{g2} = 0,9 W
W_{ia} = 45 W
W_a = 30 W
W_o = 15 W
η = 33 %

- - - - - - - - - - - -

m = 100 %
W_{ig1} = 0,2 W

A.F. class AB amplifier and modulator ($I_{g1} > 0$)
Amplificatrice et modulatrice B.F. classe AB ($I_{g1} > 0$)
NF-Klasse AB Verstärker und Modulator ($I_{g1} > 0$)

Limiting values, continuous service
C.C.S. Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

V_a = max. 600 V V_{g2} = max. 300 V
W_{ia} = max. 60 W W_{g2} = max. 3,5 W
W_a = max. 25 W V_{kf} = max. 135 V
I_a = max. 120 mA R_{g1} = max. 30 kΩ 1)

Operating conditions, continuous service; two tubes
C.C.S. Caractéristiques d'utilisation, service continu ; deux tubes
Betriebsdaten, Dauerbetrieb; zwei Röhren

V_a	=	600		500		V
V_{g2}	=	300		300		V
V_{g1}	=	-32		-30		V
R_{aa}	=	6900		4600		Ω
V_{g1g1p}	=	0	90	0	86	V
I_a	=	2x24	2x100	2x30	2x120	mA
I_{g2}	=	2x0,35	2x9	2x0,45	2x10	mA
W_{ig1}	=	0	0,1	0	0,2	W
W_{g2}	=	2x0,11	2x2,7	2x0,14	2x3	W
W_{ia}	=	2x14,4	2x60	2x15	2x60	W
W_a	=	2x14,4	2x20	2x15	2x22,5	W
W_o	=	0	80	0	75	W
η	=	-	66,5	-	62,5	%
d	=	-	2	-	2	% 2)

V_a	=	400		V
V_{g2}	=	300		V
V_{g1}	=	-28		V
R_{aa}	=	3700		Ω
V_{g1g1p}	=	0	80	V
I_a	=	2x36	2x120	mA
I_{g2}	=	2x1	2x10	mA
W_{ig1}	=	0	0,2	W
W_{g2}	=	2x 0,3	2x3	W
W_{ia}	=	2x14,4	2x48	W
W_a	=	2x14,4	2x20,5	W
W_o	=	0	55	W
η	=	-	57	%
d	=	-	2	% 2)

---

1),2) See page 10, voir page 10, siehe Seite 10

A.F. class AB amplifier and modulator ($I_{g1} > 0$)
Amplificatrice et modulatrice B.F. classe AB ($I_{g1} > 0$)
NF-Klasse AB Verstärker und modulator ($I_{g1} > 0$)

I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

V_a	= max. 750 V	V_{g2}	= max. 300 V
W_{ia}	= max. 90 W	W_{g2}	= max. 3,5 W
W_a	= max. 30 W	V_{kf}	= max. 135 V
I_a	= max. 120 mA	R_{g1}	= max. 30 kΩ 1)

I.C.A.S. Operating conditions, intermittent service; two tubes
Caractéristiques d'utilisation, service intermittent; deux tubes
Betriebsdaten, aussetzender Betrieb; zwei Röhren

V_a	=	750		V
V_{g2}	=	300		V
V_{g1}	=	-35		V
R_{aa}	=	7300		Ω
V_{g1g1p}	=	0	96	V
I_a	=	2x15	2x120	mA
I_{g2}	=	2x0,25	2x10	mA
W_{ig1}	=	0	0,2	W
W_{g2}	=	2x0,08	2x3	W
W_{ia}	=	2x11,25	2x90	W
W_a	=	2x11,25	2x30	W
W_o	=	0	120	W
η	=	-	66,5	%
	=	-	2	% 2)

---

1) With fixed bias. Cathode bias is not recommended
Avec polarisation fixe. Polarisation de cathode n'est pas recommandée
Mit fester Vorspannung. Vorspannung mittels Katodenwiderstand wird nicht empfohlen

2) Distortion with zero-impedance driver
Distorsion avec un pré-amplificateur sans résistance interne
Verzerrung bei Verwendung eines Vorverstärkers ohne inneren Widerstand

A.F. class AB amplifier and modulator (I_{g1} = 0)
Amplificatrice et modulatrice B.F. classe AB (I_{g1} = 0)
NF-Klasse AB Verstärker und Modulator (I_{g1} = 0)

Limiting values, continuous service
C.C.S. Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

V_a	= max.	600 V	V_{g2}	= max.	300 V
W_{ia}	= max.	60 W	W_{g2}	= max.	3,5 W
W_a	= max.	25 W	V_{kf}	= max.	135 V
I_a	= max.	120 mA	R_{g1}	= max.	100 kΩ[1]

Operating conditions, continuous service; two tubes
C.C.S. Caractéristiques d'utilisation, service continu; deux tubes
Betriebsdaten, Dauerbetrieb; zwei Röhren

V_a	=	600		500		V
V_{g2}	=	300		300		V
V_{g1}	=	-34		-32		V
R_{aa}	=	10000		8200		Ω
V_{g1g1p}	=	0	68	0	64	V
I_a	=	2x18	2x69,5	2x22	2x70,5	mA
I_{g2}	=	2x0,3	2x7,5	2x0,5	2x7,5	mA
W_{ig1}	=	0	0	0	0	W
W_{g2}	=	2x0,09	2x2,25	2x0,15	2x2,25	W
W_{ia}	=	2x10,8	2x41,7	2x11	2x35,3	W
W_a	=	2x10,8	2x13,7	2x11	2x12,3	W
W_o	=	0	56	0	46	W
η	=	-	67	-	65	%

V_a	=	400		V
V_{g2}	=	300		V
V_{g1}	=	-30		V
R_{aa}	=	6800		Ω
V_{g1g1p}	=	0	60	V
I_a	=	2x28	2x71,5	mA
I_{g2}	=	2x1	2x8	mA
W_{ig1}	=	0	0	W
W_{g2}	=	2x0,3	2x2,4	W
W_{ia}	=	2x11,2	2x28,6	W
W_a	=	2x11,2	2x10,6	W
W_o	=	0	36	W
η	=	-	63	%

---

[1] See page 10; voir page 10; siehe Seite 10

A.F. class AB amplifier and modulator ($I_{g1} = 0$)
Amplificatrice et modulatrice B.F. classe AB ($I_{g1} = 0$)
NF-Klasse AB Verstärker und Modulator ($I_{g1} = 0$)

I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

V_a	= max.	750 V	V_{g2}	= max.	300 V
W_{ia}	= max.	90 W	W_{g2}	= max.	3,5 W
W_a	= max.	30 W	V_{kf}	= max.	135 V
I_a	= max.	120 mA	R_{g1}	= max.	100 kΩ[1]

I.C.A.S. Operating conditions, intermittent service; two tubes
Caractéristiques d'utilisation, service intermittent; deux tubes
Betriebsdaten, aussetzender Betrieb; zwei Röhren

V_a	=	750		V
V_{g2}	=	300		V
V_{g1}	=	-35		V
R_{aa}	=	12000		Ω
V_{g1g1_p}	=	0	70	V
I_a	=	2x15	2x69,5	mA
I_{g2}	=	2x0,25	2x8	mA
W_{ig1}	=	0	0	W
W_{g2}	=	2x0,075	2x2,4	W
W_{ia}	=	2x11,25	2x52	W
W_a	=	2x11,25	2x16	W
W_o	=	0	72	W
η	=	-	69	%

---

[1] With fixed bias. Cathode bias is not recommended
Avec polarisation fixe. Polarisation de cathode n'est pas recommandée
Mit fester Vorspannung. Vorspannung mittels Katodenwiderstand wird nicht empfohlen

A.F. class AB amplifier and modulator in triode connection (g_2 connected to a; I_{g1} = 0)
Amplificatrice et modulatrice B.F. classe AB en montage triode (g_2 connecté à a; I_{g1} = 0)
NF-Klasse AB Verstärker und Modulator in Triodenschaltung (g_2 verbunden mit a; I_{g1} = 0)

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

V_a = max. 400 V
I_a = max. 125 mA
W_{ia} = max. 50 W
W_a = max. 25 W
V_{kf} = max. 135 V
R_{g1} = max. 0,1 MΩ[1]
R_{g1} = max. 0,5 MΩ[2]

C.C.S. Operating conditions,continuous service; two tubes
Caractéristiques d'utilisation, service continu; deux tubes
Betriebsdaten, Dauerbetrieb; zwei Röhren

V_a	=	400		V
V_{g1}	=	-45		V
R_{aa}	=	3		kΩ
V_{gg_p}	=	0	90	V
I_a	=	2x32	2x70	mA
W_{ia}	=	2x12,8	2x28	W
W_a	=	2x12,8	2x20,5	W
W_o	=	0	15	W
η	=	-	27	%

---

[1] With fixed bias
Avec polarisation fixe
Mit fester Gittervorspannung

[2] With cathode bias
Avec polarisation de cathode
Mit Vorspannung mittels Katodenwiderstand

A.F. class AB amplifier and modulator in triode connection (g2 connected to a; $I_{g1} = 0$)
Amplificatrice et modulatrice B.F. classe AB en montage triode (g2 connecté à a; $I_{g1} = 0$)
NF-Klasse AB Verstärker und Modulator in Triodenschaltung (g2 verbunden mit a; $I_{g1} = 0$)

I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

V_a = max. 400 V
I_a = max. 125 mA
W_{ia} = max. 50 W
W_a = max. 30 W
V_{kf} = max. 135 V
R_{g1} = max. 0,1 MΩ1)
R_{g1} = max. 0,5 MΩ2)

I.C.A.S. Operating conditions, intermittent service; two tubes
Caractéristiques d'utilisation, service intermittent; deux tubes
Betriebsdaten, aussetzender Betrieb; zwei Röhren

V_a	=	400		V
V_{g1}	=	-45		V
R_{aa}	=	3		kΩ
V_{gg_p}	=	0	90	V
I_a	=	2x32	2x70	mA
W_{ia}	=	2x12,8	2x28	W
W_a	=	2x12,8	2x20,5	W
W_o	=	0	15	W
η	=	-	27	%

---

1) With fixed bias
Avec polarisation fixe
Mit fester Vorspannung

2) With cathode bias
Avec polarisation de cathode
Mit Vorspannung mittels Katodenwiderstand

BEAMPOWER TETRODE for use as amplifier, oscillator, frequency multiplier or modulator in A.M., S.S.B. and F.M. transmitters

TÉTRODE À FAISCEAUX pour utilisation comme amplificatrice, oscillatrice, multiplicatrice de fréquence ou modulatrice dans des émetteurs A.M., à une bande latérale ou F.M.

BÜNDELTETRODE zur Verwendung als Verstärker, Oszillator, Frequenzvervielfacher oder Modulator in AM-, Einseitenband- oder FM-Sendern

Cathode : oxide coated
Cathode : oxyde
Katode : Oxyd

Heating : indirect
Chauffage: indirect
Heizung : indirekt

V_f = 6,3 V
I_f = 3,9 A

Capacitances
Capacités
Kapazitäten

C_a = 12,7 pF
C_{g1} = 30 pF
C_{ag1} < 0,9 pF

Typical characteristics
Caractéristiques types
Kenndaten

V_a = 750 V
V_{g2} = 250 V
I_a = 100 mA
S = 9 mA/V
μ_{g2g1} = 5,7

Freq.	C telegr.		C_{ag2} mod.		B S.S.B.		B mod.[2]	
Mc/s	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o [1] (W)	V_a (V)	W_o (W)
30	750	200	600	130	750	220	750 600	300 200

Net weight
Poids net 220 g
Nettogewicht

Shipping weight
Poids brut 400 g
Bruttogewicht

---

[1] Peak envelope power with double tone
Puissance à la crête de l'enveloppe avec signal d'entrée difréquence
Leistung beim Scheitelwert der Hüllkurve mit Doppeltonverfahren

[2] Two tubes
Deux tubes
Zwei Röhren

Cooling : Radiation and convection
Refroidissement: Rayonnement et convection
Kühlung : Strahlung und Konvektion

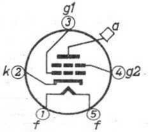
Temperatures
Températures
Temperaturen

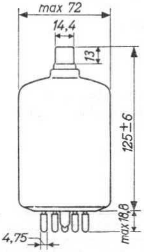
Anode seal temperature
Température du scellement de l'anode max. 220 °C
Anodeneinschmelzungstemperatur

Pin temperature
Température des broches max. 180 °C
Stiftentemperatur

Bulb temperature
Température de l'ampoule max. 300 °C
Kolbentemperatur

Dimensions in mm
Dimensions en mm
Abmessungen in mm





Base
Culot Giant 5p.
Sockel

Socket
Support 40 211/01
Fassung

Top cap
Capot supérieur Medium
Kolbenanschluss

Cap
Capot 40.619
Haube

Mounting position: Vertical, or horizontal with plane of anodes vertical
Montage Vertical, ou horizontal avec le plan des anodes vertical
Einbau Senkrecht, oder waagerecht mit der Fläche der Anoden senkrecht

R.F. class C telegraphy
H.F. classe C télégraphie
HF-Klasse C Telegraphie

Limiting values
Caractéristiques limites
Grenzdaten

f = 30 Mc/s
V_a = max. 825 V
W_{ia} = max. 300 W
W_a = max. 100 W
I_a = max. 400 mA
V_{g2} = max. 300 V
W_{g2} = max. 12 W
$-V_{g1}$ = max. 150 V
I_{g1} = max. 30 mA
R_{g1} = max. 25 kΩ
V_{kf} = max. 125 V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f = 30 Mc/s
V_a = 750 V
V_{g2} = 250 V
V_{g1} = -90 V
I_a = 385 mA
I_{g2} = 20 mA
I_{g1} = 7 mA
V_{g1p} = 120 V
W_{ia} = 285 W
W_{ig1} = 1,0 W
W_{g2} = 5 W
W_a = 85 W
W_o = 200 W
η = 70 %

R.F. class C anode and screen-grid modulation
H.F. classe C modulation d'anode et de grille-écran
HF-Klasse C Anoden- und Schirmgittermodulation

Limiting values
Caractéristiques limites
Grenzdaten

f = 30 Mc/s
V_a = max. 650 V
W_{ia} = max. 200 W
W_a = max. 67 W
I_a = max. 350 mA

V_{g2} = max. 300 V
W_{g2} = max. 10 W
$-V_{g1}$ = max. 150 V
I_{g1} = max. 30 mA
R_{g1} = max. 25 kΩ
V_{kf} = max. 125 V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f = 30 Mc/s
V_a = 600 V
V_{g2} = 250 V
V_{g1} = -100 V
I_a = 300 mA
I_{g2} = 20 mA
I_{g1} = 4 mA
V_{g1p} = 110 V
W_{ia} = 180 W
W_{ig1} = 0,4 W
W_{g2} = 5 W
W_a = 50 W
W_o = 130 W
η = 72 %
m = 100 %
V_{g2p} = 220 V ¹)
W_{mod} = 90 W

---

¹) Obtained from a separate winding on the modulation transformer
Obtenu d'un enroulement séparé du transformateur de modulation
Von einer getrennten Wicklung des Modulationstransformators erhalten

R.F. class B single sideband amplifier
Amplificateur H.F. classe B à une bande latérale
HF-Klasse B Einseitenbandverstärker

Limiting values
Caractéristiques limites
Grenzdaten

f = 30 Mc/s

V_a = max. 825 V
W_{ia} = max. 250 W
W_a = max. 100 W

I_a = max. 400 mA
V_{g2} = max. 350 V
W_{g2} = max. 12 W
R_{g1} = max. 25 kΩ
V_{kf} = max. 125 V

Operating conditions with double-tone modulation
Caractéristiques d'utilisation avec modulation difréquence
Betriebsdaten mit Doppeltonmodulation

The R.F. voltage is modulated with two sinusoidal A.F. signals of equal strength but different frequency
La tension H.F. est modulée avec deux signaux B.F. sinusoïdaux d'intensité égale mais de fréquence différente
Die HF-Spannung ist mittels zweier sinusförmigen NF-Signale gleicher Stärke aber verschiedener Frequenz moduliert

f	=	30		Mc/s	
V_a	=	750		V	
V_{g2}	=	310		V	
V_{g1}	=	-45		V	1)
V_{g1p}	=	0	45 2)	V	
I_a	=	130	270	mA	
I_{g2}	=	<5	26	mA	
I_{g1}	=	0	0	mA	
W_{ia}	=	98	200	W	
W_{g1}	=	0	0	W	
W_{g2}	=	1,5	8	W	
W_a	=	98	90	W	
W_o	=	0	220	W	3)
η	=	-	55	%	

---

1) To be adjusted so that I_a = 130 mA at V_{g1p} = 0
A régler jusqu'à ce que I_a = 130 mA à V_{g1p} = 0
Einzustellen bis I_a = 130 mA wenn V_{g1p} = 0

2) To be adjusted so that I_{g1} = 0
A régler jusqu'à ce que I_{g1} = 0
Einzustellen bis I_{g1} = 0

3) Peak envelop power; puissance à la crête de l'enveloppe; Leistung beim Scheitelwert der Hüllkurve

A.F. class B amplifier
Amplificatrice B.F. classe B
NF-Klasse B Verstärker

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 825 V
W_a = max. 100 W
I_a = max. 400 mA
V_{g2} = max. 300 V
W_{g2} = max. 12 W
$-V_{g1}$ = max. 150 V
I_{g1} = max. 30 mA
R_{g1} = max. 15 kΩ
V_{kf} = max. 125 V

Operating conditions, two tubes
Caractéristiques d'utilisation, deux tubes
Betriebsdaten, zwei Röhren

V_a	=	750		600		V
V_{g2}	=	250		250		V
V_{g1}	=	-45		-45		V
$R_{aa\sim}$	=	3600		3500		Ω
V_{g1g1p}		0	110	0	105	V
I_a	=	2x45	2x280	2x25	2x235	mA
I_{g2}	=	0	2x40	2x0,5	2x24	mA
I_{g1}	=	0	2x1	0	2x0,5	mA
W_{ia}	=	2x34	2x210	2x15	2x140	W
W_{g2}	=	0	2x10	0	2x6	W
W_a	=	2x34	2x60	2x15	2x40	W
W_o	=	0	300	0	200	W
d_{tot}	=	-	6,5	-	5	%
η	=	-	71,5	-	71,5	%

V.H.F./U.H.F. TETRODE for use as H.F. amplifier, oscillator, frequency-multiplier and modulator at frequencies up to 500 Mc/s

TETRODE V.H.F./U.H.F. pour utilisation en amplificatrice et oscillatrice H.F., multiplicatrice de fréquence et modulatrice à des fréquences jusqu'à 500 MHz

VHF/UHF-TETRODE zur Verwendung als HF-Verstärker und Oszillator, Frequenzvervielfacher und Modulator bei Frequenzen bis zu 500 MHz

Cathode : oxide-coated
Cathode : oxyde
Katode : Oxyd

Heating : indirect
Chauffage: indirect
Heizung : indirekt

V_f = 6,0 V
I_f = 2,6 A
T_h = min. 30 sec

Capacitances
Capacités
Kapazitäten

C_a = 4,5 pF
C_{g1} = 15,5 pF
C_{ag1} = 0,03 pF

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} = 5

$$S \left\{\begin{matrix} V_a = 500\ \mathrm{V} \\ V_{g2} = 250\ \mathrm{V} \\ I_a = 200\ \mathrm{mA} \end{matrix}\right\} = 12\ \mathrm{mA/V}$$

λ	Freq.	C telegr.		Cag2 mod.		AB mod		
		V_a	W_o	V_a	W_o	V_a	W_o 3)	W_o 4)
(cm)	(Mc/s)	(V)	(W)	(V)	(W)	(V)	(W)	(W)
182	165	1250	195	1000	140	1250	310	425
		1000	150	800	100	1000	240	315
		750	110	600	80	800	195	240
		600	85	400	55	600	140	170
60	500	1250	140 1)					
		1000	110 1)					
		800	90 1)					
		600	65 1)	Telev.class B				
140	216			1250	250 2)			
				1000	200 2)			
				750	135 2)			

---

1)Useful output power in load
Puissance de sortie dans la charge
Nützliche Ausgangsleistung in der Belastung

2)3)4)See page 3; voir page 3; siehe Seite 3

Cooling

Forced air through the radiator and in general to the base end of the tube. Air flow and heater voltage must be applied simultaneously.

Seal temperature	max. 150°C
Air-system socket (air-system chimney included)	40222[5])
Air-system chimney (See page 4)	56 590 81/40

The use of this air-system socket with chimney is recommended, since a standard Loctal socket does not ensure an adequate cooling of the base.
All four cathode connections should be used.

---

5)Socket type 40222 is intended for circuits where the cathode is at chassis potential.

Refroidissement

Air forcé par le radiateur et en général à la partie inférieure du tube. Le courant d'air et la tension de chauffage seront appliqués simultanément.

Température des scellements	max. 150°C
Support de tube pour le système de ventilation (y incluse la cheminée)	40222[5])
Cheminée pour le système de ventilation (voir page 4)	56 590 81/40

L'usage du support de tube 40222 avec la cheminée 56 590 81/40 est recommandé, un support Loctal normal n'assurant pas un refroidissement adéquat du culot du tube.
Il faut utiliser toutes les quatre connexions de cathode

---

5)Le support de tube 40222 est destiné pour des circuits dont la cathode a le potentiel du châssis.

Kühlung

Pressluft durch den Kühler und im allgemeinen auf die Unterseite der Röhre. Luftströmung und Heizspannung müssen gleichzeitig eingeschaltet werden.

Temperatur der Einschmelzungen	max. 150°C
Röhrenfassung für die Ventilationsanlage (Lüftführungsring einbegriffen)	40222[5])
Luftführungsring für die Ventilationsanlage (siehe Seite 4)	56 590 81/40

Da eine richtige Kühlung des Röhrenbodens von einem normalen Loctalfassung nicht gesichert ist, wird die Verwendung der Röhrenfassung 40222 mit dem Führungsring 56 590 81/40 empfohlen.
Alle vier Katodenanschlüsse müssen verwendet werden.

---

5)Die Fassung 40222 ist bestimmt für Schaltungen in denen die Katode das Chassispotential hat.

Cooling characteristics
Caractéristiques de refroidissement
Kühlungsdaten

The figures in this table apply to the simultaneous cooling of the radiator and the base, making use of the socket 40222 with chimney 56 590 81/40

Les nombres de cette liste s'appliquent au refroidissement simultané du radiateur et de la côté inférieure du tube, en utilisant le support 40222 avec la cheminée 56 590 81/40

Die Zahlen dieser Tafel gelten bei gleichzeitiger Kühlung des Kühlers und des Röhrenbodens, mit Verwendung der Fassung 40222 mit dem Schornstein 56 590 81/40

W_a (W)	h (m)	ti (°C)	q (m^3/min)	pi (mm H_2O)
150	0	35	0,220	15,0
	0	45	0,258	19,8
	1500	35	0,264	18,3
	3000	25	0,278	17,5

Mounting position: arbitrary
Montage : arbitrairement
Einbau : willkürlich

Net weight Poids net Nettogewicht	130 g	Shipping weight Poids brut Bruttogewicht	300 g

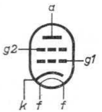
---

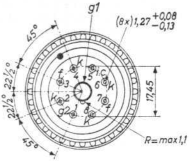
[2] During sync-pulse peak
Pendant la crête de l'impulsion de synchronisation
Während des Scheitels des Synchronisierungsimpulses

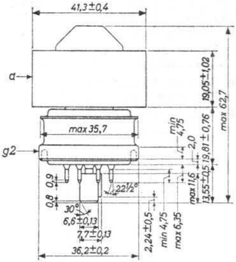
[3] Two tubes. Without grid current
Deux tubes. Sans courant de grille
Zwei Röhren. Ohne Gitterstrom

[4] Two tubes. With grid current
Deux tubes. Avec courant de grille
Zwei Röhren. Mit Gitterstrom

Dimensions in mm
Dimensions en mm
Abmessungen in mm



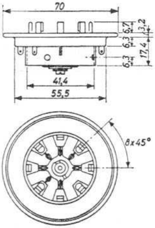




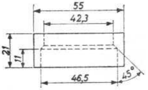
At higher frequencies the ring-surface terminal should be used for connecting the screen grid

A des fréquences élevées la connexion superficielle annulaire sera utilisée pour connecter la grille-écran

Bei höheren Frequenzen muss zum Anschliessen des Schirmgitters der Oberflächenkontaktring benutzt werden



Socket, support, Fassung
40222



Chimney, cheminée, Luftführungsring
56 590 81/40

H.F. class C telegraphy
H.F. classe C télégraphie
HF-Klasse C Telegraphie

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 500 Mc/s

V_a = max. 1250 V

W_{ia} = max. 300 W

W_a = max. 150 W

I_a = max. 250 mA

V_{g2} = max. 300 V

W_{g2} = max. 12 W

$-V_{g1}$ = max. 250 V

W_{g1} = max. 2 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

λ	$\geqq$	180	180	180	180	cm
f	$\leqq$	165	165	165	165	Mc/s
V_a	=	1250	1000	750	600	V
V_{g2}	=	250	250	250	250	V
V_{g1}	=	-90	-80	-80	-75	V
V_{g1p}	=	105	95	95	90	V
I_a	=	200	200	200	200	mA
I_{g2}	=	20	30	37	37	mA
I_{g1}	=	10	10	10	10	mA
W_{ig1}[1])	=	0,8	0,7	0,7	0,7	W
W_{g2}	=	5	7,5	9,3	9,3	W
W_{ia}	=	250	200	150	120	W
W_a	=	55	50	40	35	W
W_o	=	195	150	110	85	W
η	=	78	75	73,5	71	%

---

[1])Driver output, circuit losses not included
Puissance de l'excitateur, ne pas y compris les pertes du circuit
Leistung der Steuerstufe, Kringverluste nicht einbegriffen

H.F. class C telegraphy (continued)
H.F. classe C télégraphie (continuation)
HF-Klasse C Telegraphie (Fortsetzung)

Operating conditions, single tube, coaxial cavity
Caractéristiques d'utilisation, tube simple, cavité coaxiale
Betriebsdaten, eine Röhre, koaxialer Hohlraum

λ	$\geq$	60	60	60	60 cm
f	$\leq$	500	500	500	500 Mc/s
V_a	=	1250	1000	800	600 V
V_{g2}	=	250	250	250	250 V
V_{g1}	=	-80	-80	-80	-80 V
I_a	=	200	200	200	200 mA
I_{g2}	=	7	7	7	7 mA
I_{g1}	=	10	10	10	10 mA
W_{ig1}	=	10	10	10	10 W
W_{g2}	=	1,8	1,8	1,8	1,8 W
W_{ia}	=	250	200	160	120 W
W_o	=	140	110	90	65 W
η.	=	56	55	56	54 %

H.F. class C anode and screen-grid modulation
H.F. classe C modulation de l'anode et de la grille écran
HF-Klasse C Anoden- und Schirmgittermodulation

Screen-grid modulation 55% at 100% anode modulation. Self-modulation of the screen-grid by means of a series resistor or choke should not be applied

Modulation de la grille écran 55% à 100% modulation de l'anode. Auto-modulation de la grille écran au moyen d'une résistance ou d'une bobine n'est pas recommandée

Schirmgittermodulation 55% bei einer Anodenmodulation von 100%. Selbstmodulation des Schirmgitters mittels eines Reihenwiderstandes oder einer Reihendrossel wird nicht empfohlen

H.F. class C anode and screen-grid modulation (continued)
H.F. classe C modulation de l'anode et de grille écran (continuation)
HF-Klasse C Anoden- und Schirmgittermodulation (Fortsetzung)

Limiting values
Caractéristiques limites
Grenzdaten

V_a	= max.	1000 V	V_{g2}	= max.	300 V
W_{ia}	= max.	200 W	W_{g2}	= max.	12 W
W_a	= max.	100 W	$-V_{g1}$	= max.	250 V
I_a	= max.	200 mA	W_{g1}	= max.	2 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

λ	$\geqq$	180	180	180	180	cm
f	$\leqq$	165	165	165	165	Mc/s
V_a	=	1000	800	600	400	V
V_{g2}	=	250	250	250	250	V
V_{g1}	=	-105	-100	-95	-90	V
V_{g1_p}	=	125	120	120	110	V
I_a	=	200	200	200	200	mA
I_{g2}	=	20	25	35	40	mA
I_{g1}	=	15	10	8	7	mA
W_{ig1}	=	2	1,5	1	1	W
W_{g2}	=	5	6,3	8,8	10	W
W_{ia}	=	200	160	120	80	W
W_a	=	60	60	40	25	W
W_o	=	140	100	80	55	W
η	=	70	63	66	69	%
m	=	100	100	100	100	%
V_{g2_p}	=	170	160	150	140	V
W_{mod}	=	100	80	60	40	W

QEL 1/150

H.F. class B amplifier for television service, negative modulation, positive synchronisation
Amplificatrice H.F. classe B pour télévision, modulation négative, synchronisation positive
HF-Klasse B Verstärker für Fernsehsender, negative Modulation, positive Synchronisierung

Limiting values
Caractéristiques limites
Grenzdaten

f	= max.	220 Mc/s	I_a	= max.	250 mA
V_a	= max.	1250 V	W_a	= max.	150 W
V_{g2}	= max.	400 V	W_{g2}	= max.	12 W
$-V_{g1}$	= max.	250 V	W_{g1}	= max.	2 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f		=	216	216	216 Mc/s
B		=	5	5	5 Mc/s
V_a		=	1250	1000	750 V
V_{g2}		=	300	300	300 V
V_{g1}		=	-70	-65	-60 V
V_{g1p}	sync	=	100	95	85 V
	black, noir, schwarz	=	75	70	65 V
I_a	sync	=	305	330	335 mA
	black, noir, schwarz	=	230	240	245 mA
I_{g2}	sync	=	45	45	50 mA
	black, noir, schwarz	=	10	15	20 mA
I_{g1}	sync	=	25	20	15 mA
	black, noir, schwarz	=	4	4	4 mA
W_{ig1}	sync	=	9	8	7 W
	black, noir, schwarz	=	5,5	4,7	4,25 W
W_{ia}	black, noir, schwarz	=	290	240	185 W
W_o	sync	=	250	200	135 W
	black, noir, schwarz	=	140	110	75 W

L.F.class AB amplifier and modulator
Amplificatrice et modulatrice B.F. classe AB
NF-Verstärker und Modulator Klasse AB

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 1250 V
W_{ia} = max. 300 W
W_a = max. 150 W
I_a = max. 250 mA
V_{g2} = max. 400 V

W_{g2} = max. 12 W
W_{g1} = max. 2 W
R_{g1} = max. 100 kΩ[1]

Operating conditions, two tubes without grid current
Caractéristiques d'utilisation, deux tubes sans courant de grille
Betriebsdaten, zwei Röhren ohne Gitterstrom

V_a	=	1250		1000		V
V_{g2}	=	300		300		V
V_{g1}	=	-48		-47		V
R_{aa}	=	7200		5850		Ω
V_{g1g1_p}	=	0	96	0	94	V
I_a	=	2x57,5	2x195	2x60	2x190	mA
I_{g2}	=	0	2x20	0	2x30	mA
W_{g2}	=	0	2x6	0	2x9	W
W_{ia}	=	2x72	2x244	2x60	2x190	W
W_a	=	2x72	2x89	2x60	2x70	W
W_o	=	0	310	0	240	W
η	=	-	63,5	-	63	%

---

[1] Each tube
Chaque tube
Jede Röhre

L.F.class AB amplifier and modulator (continued)
Amplificatrice et modulatrice B.F. classe AB(continuation)
NF-Verstärker und Modulator Klasse AB(Fortsetzung)

Operating conditions, two tubes without grid current
Caractéristiques d'utilisation, deux tubes sans courant de grille
Betriebsdaten, zwei Röhren ohne Gitterstrom

V_a	=	800		600		V
V_{g2}	=	300		300		V
V_{g1}	=	-47		-44		V
R_{aa}	=	4625		3550		Ω
V_{g1g1p}	=	0	94	0	88	V
I_a	=	2x60	2x190	2x80	2x190	mA
I_{g2}	=	0	2x32,5	0	2x32,5	mA
W_{g2}	=	0	2x9,8	0	2x9,8	W
W_{ia}	=	2x48	2x152	2x48	2x114	W
W_a	=	2x48	2x55	2x48	2x44	W
W_o	=	0	195	0	140	W
η	=	-	64	-	61	%

Operating conditions, two tubes with grid current
Caractéristiques d'utilisation deux tubes à courant de grille
Betriebsdaten, zwei Röhren mit Gitterstrom

V_a	=	1250		1000		V
V_{g2}	=	300		300		V
V_{g1}	=	-44		-43		V
R_{aa}	=	5600		4600		Ω
V_{g1g1p}	=	0	100	0	98	V
I_a	=	2x90	2x238	2x82,5	2x247	mA
I_{g2}	=	0	2x32,5	0	2x35	mA
I_{g1p}	=	0	10	0	10	mA
W_{ig1}	=	0	2x0,037	0	2x0,037	W
W_{g2}	=	0	2x10	0	2x10	W
W_{ia}	=	2x112	2x297	2x82,5	2x247	W
W_a	=	2x112	2x85	2x82,5	2x90	W
W_o	=	0	425	0	315	W
η	=	-	72	-	64	%

L.F.class AB amplifier and modulator (continued)
Amplificatrice et modulatrice B.F. classe AB(cont.)
NF-Verstärker und Modulator Klasse AB (Fortsetzung)

Operating conditions, two tubes with grid current
Caractéristiques d'utilisation, deux tubes à courant de grille
Betriebsdaten, zwei Röhren mit Gitterstrom

V_a	=	800		600		V
V_{g2}	=	300		300		V
V_{g1}	=	-43		-41		V
R_{aa}	=	3500		2600		Ω
V_{g1g1_p}	=	0	96	0	94	V
I_a	=	2x80	2x245	2x92,5	2x243	mA
I_{g2}	=	0	2x37,5	0	2x42,5	mA
I_{g1_p}	=	0	10	0	10	mA
W_{ig1}	=	0	2x0,037	0	2x0,037	W
W_{g2}	=	0	2x11	0	2x12,7	W
W_{ia}	=	2x64	2x196	2x55,5	2x146	W
W_a	=	2x64	2x76	2x55,5	2x61	W
W_o	=	0	240	0	170	W
η	=	-	61	-	58	%

V.H.F./U.H.F. TETRODE for use as H.F. amplifier, oscillator, frequency-multiplier and modulator at frequencies up to 500 Mc/s

TETRODE V.H.F./U.H.F. pour utilisation en amplificatrice et oscillatrice H.F., multiplicatrice de fréquence et modulatrice à des fréquences jusqu'à 500 MHz

VHF/UHF-TETRODE zur Verwendung als HF-Verstärker und Oszillator, Frequenzvervielfacher und Modulator bei Frequenzen bis zu 500 MHz

Cathode : oxide-coated
Cathode : oxyde
Katode : Oxyd

V_f = 6,0 V 1)

Heating : indirect
Chauffage: indirect
Heizung : indirekt

I_f = 2,6 A
T_w = min. 30 sec

Capacitances
Capacités
Kapazitäten

C_a = 4,5 pF
C_{g_1} = 15,7 pF
C_{ag_1} < 0,06 pF

Typical characteristics
Caractéristiques types
Kenndaten

V_a = 500 V
V_{g_2} = 250 V
I_a = 200 mA
S = 12 mA/V
$\mu_{g_2g_1}$ = 5,2

Freq	C telegr		C_{ag_2} mod		B teleph		B teleph SSB	
(Mc/s)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
175	2000	390	1500	235	2000	65	2000	300
	1500	280	1000	145	1500	50	1500	215
	1000	190	500	60	1000	30	1000	120
	500	70						
500	2000	225 2)						

AB mod	
V_a (V)	W_o 3) (W)
2000	600
1500	430
1000	240

---

1) See page 3; voir page 3; siehe Seite 3

2) Useful output power in the load
Puissance de sortie utile dans la charge
Nützliche Ausgangsleistung in der Belastung

3) Two tubes
Deux tubes
Zwei Röhren

Temperatures; températures; Temperaturen

Temperature of ceramic to metal seals Température des joints céramique-métal Temperatur des Keramik zu Metalleinschmelzungen	max. 250 °C
Temperature of glass to metal seals Température des joints verre-métal Temperatur der Glas zu Metalleinschmelzungen	max. 175 °C
Temperature of anode core Température du noyau anodique Temperatur des Anodenkerns	max. 250 °C

Socket; support; Fassung

Air system socket (Air system chimney included) Support de tube pour le système de ventilation (y incluse la cheminée) Röhrenfassung für die Ventilationsanlage (Luftführungsring einbegriffen)	40222 1)
Air system chimney (see page 4) Cheminée pour le système de ventilation (voir page 4) Luftführungsring (siehe Seite 4)	56 590 81/40

Cooling; refroidissement; Kühlung

Forced air through the radiator and in general to the base end of the tube.
The use of the socket 40222 with chimney is recommended since a standard loctal socket does not ensure an adequate cooling of the base.
Air flow and heater voltage must be applied simultaneously.
All four cathode connections should be used

Air forcé par le radiateur et, en général, à la partie inférieure du tube.
L'utilisation du support 40222 avec la cheminée est recommandée, un support loctal normal n'assurant pas un refroidissement adéquat du culot.
Le courant d'air et la tension de chauffage seront appliqués simultanément.
Il faut utiliser toutes les quatre connexions de cathode

Pressluft durch den Kühler und im allgemeinen auf die Unterseite der Röhre. Da eine richtige Kühlung des Röhrenbodens von einem normalen Loctalfassung nicht gesichert ist, wird die Verwendung der Fassung 40222 mit Luftführungsring empfohlen.
Luftkühlung und Heizspannung müssen gleichzeitig eingeschaltet werden.
Alle vier Katodenanschlüsse müssen verwendet werden

---

1) Intended for circuits where the cathode is at chassis potential
Destiné pour des circuits dont la cathode a le potentiel du châssis
Bestimmt für Schaltungen in denen die Katode das Chassispotential hat

Cooling characteristics
Caractéristiques de refroidissement
Kühlungsdaten

The figures apply to the simultaneous cooling of the radiator and the base, making use of the socket 40222 with chimney

Les nombres s'appliquent au refroidissement simultané du radiateur et le culot du tube en utilisant le support 40222 avec la cheminée

Die Zahlen gelten bei gleichzeitiger Kühlung des Kühlers und des Röhrenbodens, mit Verwendung der Fassung 40222 mit dem Luftführungsring

W_a (W)	h (m)	t_i (^oC)	q (m^3/min)	p_i (mm H_2O)
250	0	20	0,11	6,4

Mounting position: arbitrary
Montage : arbitrairement
Einbau : willkürlich

Net weight Poids net Nettogewicht	120 g	Shipping weight Poids brut Bruttogewicht	300 g

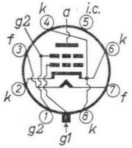
---

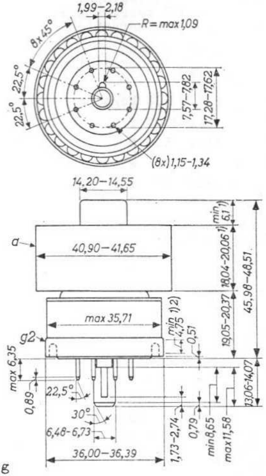
Page 1; Seite 1

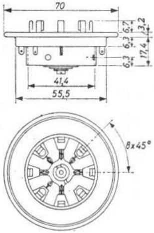
[1] When the tube is driven to max. input as a class C amplifier, but not as a frequency multiplier, the heater voltage should be reduced according to the table below
Lorsque le tube est utilisé en amplificateur classe C (mais ne pas en multiplicateur de fréquence)avec puissance d'entrée max., la tension de chauffage doit être dimenuée selon la table sous-mentionnée
Wenn die Röhre als Klasse C Verstärker (aber nicht als Frequenzvervielfacher) mit max. Eingangsleistung verwendet wird, muss die Heizspannung nach untenstehender Tabelle verringert werden

f	$\leqq$ 300 Mc/s	300-400 Mc/s	400-500 Mc/s
V_f	6 V	5,75 V	5,5 V

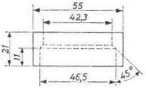
Dimensions in mm
Dimensions en mm
Abmessungen in mm







Socket, support, Fassung
40222



Chimney
Cheminée
Luftführungsring

56 590 81/40

---

[1] Contact surface
Surface de contact
Kontaktfläche

[2] Screen grid contact at the outer cylindrical surface only
Contact de la grille écran seulement à la surface cylindrique extérieure
Schirmgitterkontaktfläche nur an der Aussenseite

H.F. class C telegraphy
H.F. classe C télégraphie
HF-Klasse C Telegraphie

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 500 Mc/s

V_a = max. 2000 V V_{g_2} = max. 300 V
W_{ia} = max. 500 W W_{g_2} = max. 12 W
W_a = max. 250 W $-V_{g_1}$ = max. 250 V
I_a = max. 250 mA W_{g_1} = max. 2 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	=	175	175	175	175	500	Mc/s
V_a	=	2000	1500	1000	500	2000	V
V_{g_2}	=	250	250	250	250	300	V
V_{g_1}	=	-90	-90	-90	-90	-90	V
V_{g_1p}	=	112	112	114	114	-	V
I_a	=	250	250	250	250	250	mA
I_{g_2}	=	19	21	38	45	10 1)	mA
I_{g_1}	=	26	28	31	35	25 1)	mA
W_{ig_1}	=	2,9	3,2	3,5	4	-	W
W_{g_2}	=	4,75	5,25	9,5	8,75	3	W
W_{ia}	=	500	375	250	125	500	W
W_a	=	110	95	60	55	-	W
W_o	=	390	280	190	70	225 1)	W
η	=	78	75	76	56	-	%

---

1) Measured values for a typical circuit having an efficiency of about 75 %
Valeurs mesurées dans un circuit avec un rendement d'environ 75 %
Werte gemessen in einer Schaltung mit einem Wirkungsgrad von etwa 75 %

H.F. class C anode and screen-grid modulation
H.F. classe C modulation d'anode et de grille-écran
HF-Klasse C Anoden-und Schirmgittermodulation

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 1500 V
W_{ia} = max. 300 W
W_a = max. 165 W
I_a = max. 200 mA

V_{g_2} = max. 300 V
W_{g_2} = max. 12 W
$-V_{g_1}$ = max. 250 V
W_{g_1} = max. 2 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	=	175	175	175 Mc/s
V_a	=	1500	1000	500 V
V_{g_2}	=	250	250	250 V
V_{g_1}	=	-100	-100	-100 V
$V_{g_{1p}}$	=	117	117	118 V
I_a	=	200	200	200 mA
I_{g_2}	=	20	22	31 mA
I_{g_1}	=	14	14	15 mA
W_{ig_1}	=	1,7	1,7	1,8 W
W_{g_2}	=	5	5,5	7,75 W
W_{ia}	=	300	200	100 W
W_a	=	65	55	40 W
W_o	=	235	145	60 W
η	=	78	72,5	60 %
m	=	100	100	100 %
W_{mod}	=	150	100	50 W

H.F. class B telephony
H.F. classe B téléphonie
HF-Klasse B Telephonie

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 2000 V
W_{ia} = max. 500 W
W_a = max. 250 W
I_a = max. 250 mA

V_{g_2} = max. 400 V
W_{g_2} = max. 12 W
W_{g_1} = max. 2 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	=	175	175	175	Mc/s
V_a	=	2000	1500	1000	V
V_{g_2}	=	350	350	350	V
V_{g_1}	=	-55	-55	-55	mA
$V_{g_{1p}}$	=	25	25	25	V
I_a	=	100	100	100	mA
I_{g_2}	=	-4	-3	-3	mA
W_{g_2}	=	1,4	1	1	W
W_{ia}	=	200	150	100	W
W_a	=	135	100	70	W
W_o	=	65	50	30	W
η	=	32,5	33	30	%

H.F. class B telephony single side band
H.F. classe B téléphonie à une bande latérale
HF-Klasse B Einseitenband

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 2000 V
W_{ia} = max. 500 W
W_a = max. 250 W
I_a = max. 250 mA

V_{g_2} = max. 400 V
W_{g_2} = max. 12 W
W_{g_1} = max. 2 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

f	=	175		175		175		Mc/s
V_a	=	2000		1500		1000		V
V_{g_2}	=	350		350		350		V
V_{g_1}	=	-55		-55		-55		V
$V_{g_{1p}}$	=	0	50	0	50	0	50	V
I_a	=	100	250	100	250	100	250	mA
I_{g_2}	=	-	5	-	8	-	10	mA
W_{g_2}	=	-	1,8	-	2,8	-	3,5	W
W_{ia}	=	200	500	150	375	100	250	W
W_a	=	200	200	150	160	100	130	W
W_o	=	0	300	0	215	0	120	W
η	=		60	-	57		48	%

L.F. class AB amplifier and modulator
Amplificatrice et modulatrice B.F. classe AB
NF-Verstärker und Modulator Klasse AB

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 2000 V
W_{i_a} = max. 500 W
W_a = max. 250 W
I_a = max. 250 mA

V_{g_2} = max. 400 V
W_{g_2} = max. 12 W
W_{g_1} = max. 2 W
R_{g_1} = max. 100 kΩ [1]

Operating conditions (two tubes)
Caractéristiques d'utilisation (deux tubes)
Betriebsdaten (zwei Röhren)

V_a	=	2000		1500		V
V_{g_2}	=	350		350		V
V_{g_1}	=	-55		-55		V
$R_{aa\sim}$	=	9500		6200		Ω
$V_{g_1g_1p}$	=	0	100	0	100	V
I_a	=	2x100	2x250	2x100	2x250	mA
I_{g_2}	=	0	2x5	0	2x8	mA
W_{g_2}	=	0	2x1,75	0	2x2,8	W
W_{i_a}	=	2x200	2x500	2x150	2x375	W
W_a	=	2x200	2x200	2x150	2x160	W
W_o	=	0	600	0	430	W
η	=	-	60	-	57	%

---

[1] Each tube
Chaque tube
Jede Röhre

L.F. class AB amplifier and modulator (continued)
Amplificatrice et modulatrice B.F. classe AB (suite)
NF-Verstärker und Modulator Klasse AB (Fortsetzung)

Operating conditions (continued)
Caractéristiques d'utilisation (suite)
Betriebsdaten (Fortsetzung)

V_a	=		1000	V
V_{g_2}	=		350	V
V_{g_1}	=		-55	V
$R_{aa\sim}$	=		3500	Ω
$V_{g_1g_{1p}}$	=	0	100	V
I_a	=	2x100	2x250	mA
I_{g_2}	=	0	2x10	mA
W_{g_2}	=	0	2x3,5	W
W_{i_a}	=	2x100	2x250	W
W_a	=	2x100	2x130	W
W_o	=	0	240	W
η	=	-	48	%

DOUBLE TETRODE for use as H.F. amplifier or oscillator, frequency multiplier or modulator
DOUBLE TETRODE pour utilisation en amplificatrice ou oscillatrice H.F., multiplicatrice de fréquence ou modulatrice
DOPPELTETRODE zur Verwendung als HF-Verstärker oder Oszillator, Frequenzvervielfacher oder Modulator

Filament : oxide-coated
Filament : oxyde
Heizfaden: Oxyd

V_f = 3-3,15 1) 6-6,3 V 1)
I_f = 1,36 0,68 A

Heating : direct
Chauffage: direct
Heizung : direkt

Pins
Broches 3-(1+5) 1-5
Stifte

Capacitances
Capacités
Kapazitäten

per system par système pro System	in push-pull en push-pull in Gegentakt
C_a = 3,3 pF	C_o = 1,7 pF
C_{g1} = 8,5 pF	C_i = 5,7 pF
C_{ag1} = 0,05 pF	

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} = 7,5
S3) (I_a= 20 mA) = 2 mA/V

λ	Freq.	C telegr.			C_{ag2} mod.		
m	Mc/s	V_a (V)	W_o (W) 2)		V_a (V)	W_o (W) 2)	
			CCS	ICAS		CCS	ICAS
5	60	600	26,6	35	450	17,5	
		400	17,6	23,2	400	15,4	
		250	10,6	14,0	250	6,2	8,2
1,6	186	600	25,6	33,6	250	6,0	7,8
		400	16,8	22,0			
		250	10,2	13;2			
		C fr.mult.					
4,8/1,6	62/186	400	7,2	10	tripler tripleur Verdreifacher		
		250	4,6	6,2			
3,2/1,6	93/186	400	6,5	8,0	doubler doubleur 3) Verdoppler		
		250	4,0	4,9			

B mod	
V_a (V)	W_o (W)
C.C.S	
450	18
400	17
350	16
250	9
I.C.A.S	
600	28,2

1) Nominal values; valeurs nominales; Nennwerte

2) CCS = continous service; service continu; Dauerbetrieb

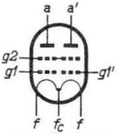
ICAS = intermittent service; service intermittent; aussetzender Betrieb

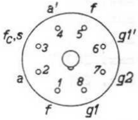
3) One system; un système; ein System

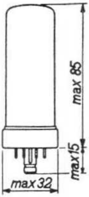
Pin temperature
Temp. des broches = max. 100 °C
Stiftentemperatur

Bulb temperature
Temp. de l'ampoule = max. 200 °C
Kolbentemperatur

Dimensions in mm
Dimensions en mm
Abmessungen in mm







Base, culot, Sockel: Loctal

Socket
Support 40213
Fassung

Mounting position: vertical with base up or down
Horizontal with pins 1 and 5 in one horizontal plane

Montage : vertical avec le culot en haut ou en bas
Horizontal avec les broches 1 et 5 situées dans le même plan horizontal

Einbau : senkrecht mit Sockel oben oder unten
Waagerecht mit den Stiften 1 und 5 in einer waagerechten Ebene

Net weight
Poids net 40 g
Nettogewicht

Shipping weight
Poids brut 55 g
Bruttogewicht

H.F. class C telegraphy, two systems in push-pull
H.F. classe C télégraphie, deux systèmes en push-pull
HF Klasse C Telegraphie, zwei Systeme in Gegentakt

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f	= max. 186 Mc/s	f	= max. 300 Mc/s
V_a	= max. 600 V	V_a	= max. 450 V
W_{ia}	= max. 2x18 W	W_{ia}	= max. 2x9 W
W_a	= max. 2x6 W		
I_a	= max. 2x30 mA		
V_{g2}	= max. 250 V		
W_{g2}	= max. 7 W		
$-V_{g1}$	= max. 200 V		
I_{g1}	= max. 2x5 mA		

C.C.S. Operating conditions; continuous service
Caractéristiques d'utilisation; service continu
Betriebsdaten; Dauerbetrieb

f	= 60	60	60	Mc/s
V_a	= 600	400	250	V
V_{g2}	= 200	200	175	V
V_{g1}	= -80	-80	-70	V
I_a	= 2x30	2x30	2x30	mA
I_{g2}	= 6	6	6,5	mA
I_{g1}	= 2x1,0	2x1,2	2x1,8	mA
$V_{g1g1'p}$	= 210	210	210	V
W_{ig1}	= 2x0,1	2x0,11	2x0,17	W
W_{g2}	= 1,2	1,2	1,1	W
W_{ia}	= 2x18	2x12	2x7,5	W
W_a	= 2x4,7	2x3,2	2x2,2	W
W_o	= 26,6	17,6	10,6	W
η	= 74	73	71	%

H.F. class C telegraphy, two systems in push-pull; continued
H.F. classe C télégraphie, deux systèmes en push-pull; continuation
HF Klasse C Telegraphie, zwei Systeme in Gegentakt; Fortsetzung

C.C.S.
Operating conditions; continuous service
Caractéristiques d'utilisation; service continu
Betriebsdaten; Dauerbetrieb

f	=	186	186	186	Mc/s
V_a	=	600	400	250	V
V_{g1}	=	-80	-80	-70	V
V_{g2}	=	200	200	175	V
I_a	=	2x30	2x30	2x30	mA
I_{g1}	=	2x1,0	2x1,0	2x1,5	mA
I_{g2}	=	3,0	3,5	4,5	mA
$V_{g1g1'p}$	=	210	210	220	V
W_{ig1}	=	2x0,1	2x0,1	2x0,15	W
W_{g2}	=	0,6	0,7	0,8	W
W_{ia}	=	2x18	2x12	2x7,5	W
W_a	=	2x5,2	2x3,6	2x2,4	W
W_o	=	25,6	16,8	10,2	W
η	=	71 1)	70	68	%

I.C.A.S.
Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

<u>f = max. 186 Mc/s</u>
V_a = max. 600 V
W_{ia} = max. 2x24 W
W_a = max. 2x8 W
I_a = max. 2x40 mA
V_{g2} = max. 250 V
W_{g2} = max. 7 W
$-V_{g1}$ = max. 200 V
I_{g1} = max. 2x5 mA

<u>f = max. 300 Mc/s</u>
V_a = max. 450 V
W_{ia} = max. 2x12 W

---

1) In order to prevent overheating a low velocity air flow should be directed on the bulb and the base
Afin de prévenir le surchauffage il faut diriger un léger courant d'air sur l'ampoule et le culot
Zur Vermeidung einer Überhitzung ist ein schwacher Lufstrom auf den Kolben und den Sockel notwendig

H.F. class C telegraphy, two systems in push-pull; continued
H.F. classe C télégraphie, deux systèmes en push-pull; continuation
HF Klasse C Telegraphie, zwei Systeme in Gegentakt; Fortsetzung

I.C.A.S. Operating conditions; intermittent service
Caractéristiques d'utilisation; service intermittent
Betriebsdaten; aussetzender Betrieb

f	=	60	60	60	Mc/s
V_a	=	600	400	250	V
V_{g2}	=	200	200	175	V
V_{g1}	=	-80	-80	-70	V
I_a	=	2x40	2x40	2x40	mA
I_{g2}	=	5,5	6,0	7,5	mA
I_{g1}	=	2x1,2	2x2,0	2x2,5	mA
$V_{g1g1'p}$	=	220	220	230	V
W_{ig1}	=	2x0,12	2x0,22	2x0,26	W
W_{g2}	=	1,1	1,2	1,3	W
W_{ia}	=	2x24	2x16	2x10	W
W_a	=	2x6,5	2x4,4	2x3,0	W
W_o	=	35	23,2	14,0	W
η	=	73	72,5	70	%
f	=	186	186	186	Mc/s
V_a	=	600	400	250	V
V_{g2}	=	200	200	175	V
V_{g1}	=	-80	-80	-70	V
I_a	=	2x40	2x40	2x40	mA
I_{g2}	=	4,5	5,0	7,5	mA
I_{g1}	=	2x1,3	2x1,5	2x2,0	mA
$V_{g1g1'p}$	=	220	220	230	V
W_{ig1}	=	2x0,13	2x0,15	2x0,26	W
W_{g2}	=	0,9	1,0	1,3	W
W_{ia}	=	2x24	2x16	2x10	W
W_a	=	2x7,2	2x5	2x3,4	W
W_o	=	33,6	22	13,2	W
η	=	70 1)	69	66	%

---

1) See page 4; voir page 4; siehe Seite 4

H.F. class C anode and screen grid modulation, two systems in push-pull
H.F. classe C modulation d'anode et de grille-écran, deux systèmes en push-pull
HF Klasse C Anoden- und Schirmgittermodulation, zwei Systeme in Gegentakt

Limiting values, continuous service
C.C.S. Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f	= max.	186 Mc/s	f	= max.	300 Mc/s
V_a	= max.	480 V	V_a	= max.	360 V
W_{ia}	= max.	2x11,5 W	W_{ia}	= max.	2x5,25 W
W_a	= max.	2x4 W			
I_a	= max.	2x25 mA			
V_{g2}	= max.	250 V			
W_{g2}	= max.	4,5 W			
$-V_{g1}$	= max.	200 V			
I_{g1}	= max.	2x5 mA			

Operating conditions, continuous service
C.C.S. Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

f	=	60	60	60	186	Mc/s
V_a	=	450	400	250	250	V
R_{g2}	=	18	18	10	10	kΩ
V_{g1}	=	-80	-80	-70	-70	V
I_a	=	2x25	2x25	2x19,5	2x19,5	mA
I_{g2}	=	14	11	11	11	mA
I_{g1}	=	2x1,0	2x0,8	2x1,5	2x1,5	mA
V_{g1_p}	=	83	83	110	110	V
W_{ig1}	=	2x0,08	2x0,06	2x0,15	2x0,15	W
W_{g2}	=	2,8	2,2	1,6	1,6	W
W_{ia}	=	2x11,25	2x10	2x4,9	2x4,9	W
W_a	=	2x2,5	2x2,3	2x1,8	2x1,9	W
W_o	=	17,5	15,4	6,2	6,0	W
η	=	77,5	77	63	61	%
m	=	100	100	100	100	%
W_{mod}	=	11,5	10	5	5	W

H.F. class C anode and screen grid modulation, two systems in push-pull; continued
H.F. classe C modulation d'anode et de grille-écran, deux systèmes en push-pull; continuation
HF Klasse C Anoden- und Schirmgittermodulation, zwei Systeme in Gegentakt; Forsetzung

I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f	= max.	186 Mc/s	f	= max.	300 Mc/s
V_a	= max.	480 V	V_a	= max.	360 V
W_{ia}	= max.	2x15,5 W	W_{ia}	= max.	2x7 W
W_a	= max.	2x5 W			
I_a	= max.	2x32 mA			
V_{g2}	= max.	250 V			
W_{g2}	= max.	4,5 W			
$-V_{g1}$	= max.	200 V			
I_{g1}	= max.	2x5 mA			

I.C.A.S. Operating conditions, intermittent service
Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

f	=	60	186	Mc/s
V_a	=	250	250	V
R_{g2}	=	10	10	kΩ
V_{g1}	=	-70	-70	V
I_a	=	2x26,5	2x26,5	mA
I_{g2}	=	9	9	mA
I_{g1}	=	2x1,8	2x1,5	mA
V_{g1_p}	=	110	110	V
W_{ig1}	=	2x0,18	2x0,15	W
W_{g2}	=	1,5	1,5	W
W_{ia}	=	2x6,6	2x6,6	W
W_a	=	2x2,5	2x2,7	W
W_o	=	8,2	7,8	W
η	=	62	59	%
m	=	100	100	%
W_{mod}	=	7	7	W

Class C frequency tripler, two systems in push-pull
Classe C tripleur de fréquence, deux systèmes en push-pull
Klasse C Frequenzverdreifacher, zwei Systeme in Gegentakt

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 186 Mc/s
V_a = max. 600 V
W_{ia} = max. 2x12 W
W_a = max. 2x6 W
I_a = max. 2x30 mA
V_{g2} = max. 250 V
W_{g2} = max. 7 W
$-V_{g1}$ = max. 200 V
I_{g1} = max. 2x5 mA

f = max. 300 Mc/s
V_a = max. 450 V
W_{ia} = max. 2x9 W

C.C.S. Operating conditions, continuous service
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

f	=	62/186	62/186 Mc/s
V_a	=	400	250 V
V_{g2}	=	200	200 V
V_{g1}	=	-175	-175 V
I_a	=	2x24	2x30 mA
I_{g2}	=	3	6 mA
I_{g1}	=	2x0,6	2x1,1 mA
$V_{g1g1'p}$	=	430	430 V
W_{ig1}	=	2x0,12	2x0,22 W
W_{g2}	=	0,6	1,2 W
W_{ia}	=	2x9,6	2x7,5 W
W_a	=	2x6	2x5,2 W
W_o	=	7,2	4,6 W
η	=	37,5	31 %

Class C frequency tripler, two systems in push-pull; continued
Classe C tripleur de fréquence, deux systèmes en push-pull; continuation
Klasse C Frequenzverdreifacher, zwei Systeme in Gegentakt; Fortsetzung

---

Limiting values, intermittent service
I.C.A.S. Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 186 Mc/s	f = max. 300 Mc/s
V_a = max. 600 V	V_a = max. 450 V
W_{ia} = max. 2x16 W	W_{ia} = max. 2x12 W
W_a = max. 2x8 W	
I_a = max. 2x40 mA	
V_{g2} = max. 250 V	
W_{g2} = max. 7 W	
$-V_{g1}$ = max. 200 V	
I_{g1} = max. 2x5 mA	

Operating conditions, intermittent service
I.C.A.S. Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

f	=	62/186	62/186 Mc/s
V_a	=	400	250 V
V_{g2}	=	200	200 V
V_{g1}	=	−175	−175 V
I_a	=	2x32,5	2x40 mA
I_{g2}	=	4	6,5 mA
I_{g1}	=	2x1,1	2x1,5 mA
$V_{g1g1'p}$	=	430	430 V
W_{ig1}	=	2x0,22	2x0,3 W
W_{g2}	=	0,8	1,3 W
W_{ia}	=	2x13	2x10 W
W_a	=	2x8	2x6,9 W
W_o	=	10	6,2 W
η	=	38,5	31 %

Class C frequency doubler
Classe C doubleur de fréquence
Klasse C Frequenzverdoppler

C.C.S.
Limiting values, per tube
Caractéristiques limites, par tube
Grenzdaten, pro Röhre

f = max. 186 Mc/s
V_a = max. 600 V
W_{ia} = max. 2x12 W
W_a = max. 2x6 W
I_a = max. 2x30 mA
V_{g2} = max. 250 V
W_{g2} = max. 7 W
$-V_{g1}$ = max. 200 V
I_{g1} = max. 2x5 mA

f = max. 300 Mc/s
V_a = max. 450 V
W_{ia} = max. 2x9 W

C.C.S.
Operating conditions, one system, continuous service
Caractéristiques d'utilisation, un système, service continu
Betriebsdaten, ein System, Dauerbetrieb

f	=	93/186	93/186 Mc/s
V_a	=	400	250 V
V_{g1}	=	-175	-175 V
V_{g2}	=	200	200 V
I_a	=	30	30 mA
I_{g1}	=	1,2	1,5 mA
I_{g2}	=	1,5	2 mA
V_{g1_p}	=	210	220 V
W_{ig1}	=	0,23	0,3 W
W_{g2}	=	0,3	0,4 W
W_{ia}	=	12	7,5 W
W_a	=	5,5	3,5 W
W_o	=	6,5	4 W
η	=	54	53 %

Class C frequency doubler
Classe C doubleur de fréquence
Klasse C Frequenzverdoppler

I.C.A.S. Limiting values, per tube
Caractéristiques limites, par tube
Grenzdaten, pro Röhre

f = max.	186 Mc/s	f = max.	300 Mc/s
V_a = max.	600 V	V_a = max.	450 V
W_{ia} = max.	2x16 W	W_{ia} = max.	2x12 W
W_a = max.	2x8 W		
I_a = max.	2x40 mA		
V_{g2} = max.	250 V		
W_{g2} = max.	7 W		
$-V_{g1}$ = max.	200 V		
I_{g1} = max.	2x5 mA		

I.C.A.S. Operating conditions, one system, intermittent service
Caractéristiques d'utilisation, un système, service intermittent
Betriebsdaten, ein System, aussetzender Betrieb

f	= 93/186	93/186 Mc/s
V_a	= 400	250 V
V_{g2}	= 200	200 V
V_{g1}	= -175	-175 V
I_a	= 40	40 mA
I_{g2}	= 2,5	3 mA
I_{g1}	= 1,5	2 mA
V_{g1_p}	= 220	230 V
W_{ig1}	= 0,3	0,42 W
W_{g2}	= 0,5	0,6 W
W_{ia}	= 16	10 W
W_a	= 8	5,1 W
W_o	= 8	4,9 W
η	= 50	49 %

L.F. class B amplifier and modulator, two systems in push-pull
Amplificatrice et modulatrice B.F. classe B, deux systèmes en push-pull
NF-Verstärker und Modulator Klasse B, zwei Systeme in Gegentakt

---

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

V_a = max. 600 V
W_{ia} = max. 2x18 W
W_a = max. 2x6 W
I_a = max. 2x30 mA
V_{g2} = max. 250 V
W_{g2} = max. 7 W
$-V_{g1}$ = max. 200 V

C.C.S. Operating conditions, continuous service
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

V_f	=	6,3[1]		6,3[1]		V
V_a	=	450		400		V
V_{g2}	=	200		200		V
V_{g1}	=	-24		-24		V
$R_{aa'}$	=	20		16		kΩ
$V_{g1g1'p}$	=	0	94	0	94	V
I_a	=	2x2,8	2x32,5	2x2,7	2x35	mA
I_{g2}	=	2x0,16	2x5	2x0,15	2x5,3	mA
I_{g1}	=	0	2x1,1	0	2x1,3	mA
W_{ia}	=	2x1,3	2x14,6	2x1,1	2x14	W
W_a	=	2x1,3	2x5,6	2x1,1	2x5,5	W
W_o	=	-	18	-	17	W
d_{tot}	=	-	5	-	5	%
η	=	-	61,5	-	60,5	%

---

[1] D.C. voltage
Tension directe
Gleichspannung

L.F. class B amplifier and modulator, two systems in push-pull; continued
Amplificatrice et modulatrice B.F. classe B, deux systèmes en push-pull; continuation
NF-Verstärker und Modulator Klasse B, zwei Systeme in Gegentakt; Fortsetzung

---

C.C.S. Operating conditions, continuous service
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

V_f	=	6,3 1)		6,3 1)		V
V_a	=	350		250		V
V_{g2}	=	200		175		V
V_{g1}	=	-24		-20		V
R_{aa}	=	12		8		kΩ
$V_{g1g1'p}$	=	0	104	0	100	V
I_a	=	2x2,5	2x37,5	2x2,9	2x36	mA
I_{g2}	=	2x0,14	2x5,5	2x0,2	2x5	mA
I_{g1}	=	0	2x1,4	0	2x1,5	mA
W_{ia}	=	2x0,88	2x13,1	2x0,71	2x9	W
W_a	=	2x0,88	2x5,1	2x0,71	2x4,5	W
W_o	=	-	16	-	9	W
dtot	=	-	5	-	5	%
η	=	-	61	-	50	%

---

1) Direct voltage
Tension directe
Gleichspannung

L.F. class B amplifier and modulator, two systems in push-pull; continued
Amplificatrice et modulatrice B.F. classe B, deux systèmes en push-pull; continuation
NF-Verstärker und Modulator Klasse B, zwei Systeme in Gegentakt; Fortsetzung

---

I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

V_a = max. 600 V
W_{ia} = max. 2x24 W
W_a = max. 2x8 W
I_a = max. 2x40 mA
V_{g2} = max. 250 V
W_{g2} = max. 7 W
$-V_{g1}$ = max. 200 V

I.C.A.S. Operating conditions, intermittent service
Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

V_f	=	6,3 1)		V
V_a	=	600		V
V_{g2}	=	200		V
V_{g1}	=	-24		V
$R_{aa'}$	=	25		kΩ
$V_{g1g1'p}$	=	0	85	V
I_a	=	2x3,0	2x33,5	mA
I_{g2}	=	2x0,18	2x4,5	mA
I_{g1}	=	0	2x1,2	mA
W_{ia}	=	2x1,8	2x20,1	W
W_a	=	2x1,8	2x6	W
W_o	=	0	28,2	W
d_{tot}	=	-	5	%
η	=	0	70	%

DOUBLE TETRODE for use as H.F. amplifier, oscillator and frequency multiplier
DOUBLE TETRODE pour utilisation en amplificatrice, oscillatrice et multiplicatrice de fréquence H.F.
DOPPELTETRODE zur Verwendung als HF-Verstärker, Oszillator und Frequenzvervielfacher

Cathode: oxide-coated
Cathode: oxyde
Katode : Oxyd

V_f = 6,3 12,6 V [1]
I_f = 0,6 0,3 A

Heating : indirect
Chauffage: indirect
Heizung : indirekt

Pins
Broches 9-(4+5) 4-5
Stifte

Capacitances
Capacités
Kapazitäten

per system par système pro System	in push-pull en push-pull in Gegentakt
C_a = 1,6 pF	C_o = 0,95 pF
C_{g1} = 6,4 pF	C_i = 3,8 pF
C_{ag1} = 0,16 pF	

The tube is internally neutralized
Le tube est neutrodyné internement
Die Röhre ist innerlich neutrodynisiert

Typical characteristics per system
Caractéristiques types par système
Kenndaten pro System

V_a = 150 V
V_{g2} = 150 V
I_a = 25 mA
μ_{g2g1} = 31
S = 10,5 mA/V

λ	Freq	C telegr.			Cag2 mod.		
(m)	(Mc/s)	V_a (V)	W_o (W) [2]		V_a (V)	W_o (W)[2]	
			CCS	ICAS		CCS	ICAS
0,6	500	180	5,8		180	4,2	5,8
		200		7,2			

λ	Freq	C fr.mult.		
(m)	(Mc/s)	V_a (V)	W_o (W) [2]	
			CCS	ICAS
1,8/0,6	167/500	180	2,35	
		200		2,95

---

[1] See page 2; voir page 2; siehe Seite 2

[2] Two systems; deux systèmes; zwei Systeme

Cooling: Radiation and convection. The use of a closed can is not allowed
Refroidissement: Rayonnement et convection. Il n'est pas permis d'utiliser un écran fermé
Kühlung: Strahlung und Konvektion. Die Verwendung einer geschlossenen Buchse ist nicht gestattet

Bulb temperature (at hottest point)
Température de l'ampoule (au point le plus chaud) max. 225°C
Kolbentemperatur (an der wärmsten Stelle)

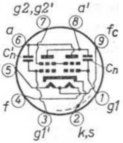
Pin seal temperature
Température des scellements des broches max. 120 °C
Temperatur der Stifteneinschmelzungen

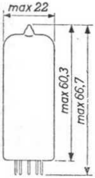
Mounting position: arbitrary
Montage: arbitrairement
Einbau : willkürlich

Base :
Culot : Noval
Sockel:

Socket :
Support: B8 700 19
Fassung:

Dimensions in mm
Dimensions en mm
Abmessungen in mm





Low loss socket without collar is recommended. At high frequencies use of a metal retaining device is not recommended due to loss of output power

Un support à faibles pertes sans manchon est recommandé A hautes fréquences l'utilisation d'un dispositif métallique pour retenir le tube n'est pas recommandée à cause de la perte de puissance de sortie

Eine verlustarme Fassung ohne Metallring wird empfohlen. Bei hohen Frequenzen wird eine metallene Vorrichtung zum festhalten der Röhre der Ausgangsleistungsverluste wegen nicht empfohlen

---

1) A temporary deviation of 10 % of V_f is permissible; e.g. when the tube is fed from an accumulator, the actual V_f should not exceed 7 V or 14 V and the accumulator may be used until its voltage has decreased to such an extent that V_f is 5.7 V or 11.4 V

Une déviation temporaire de V_f de 10% est admissible; par exemple si le tube est alimenté d'un accumulateur, le V_f actuel ne surpassera pas 7 V ou 14 V et l'accumulateur peut être utilisé jusqu'à sa tension est diminuée de telle manière que V_f = 5,7 V ou 11,4 V

Eine vorübergehende Abweichung von V_f von 10 % ist zulässig; wenn z.B. die Röhre von einem Akkumulator gespeist wird, so soll die an der Röhre gemessene Heizspannung 7 V oder 14 V nicht überschreiten und kann der Akkumulator verwendet werden bis die Spannung so weit verringert ist dass V_f = 5,7 V oder 11,4 V

H.F. class C telegraphy; two systems in push-pull
H.F. classe C télégraphie; deux systèmes en push-pull
HF-Klasse C Telegraphie; zwei Systeme in Gegentakt

Limiting values (absolute values)
Caractéristiques limites(valeurs absolues)
Grenzdaten (absolute Werte)

		C.C.S.		I.C.A.S.	
f	= max.	500	max.	500	Mc/s
V_a	= max.	250	max.	250	V
W_{ia}	= max.	2x6	max.	2x7	W
W_a	= max.	2x3	max.	2x3,75	W
I_a	= max.	2x45	max.	2x50	mA
V_{g2}	= max.	200	max.	200	V
W_{g2}	= max.	2x1,5	max.	2x1,75	W
$-V_{g1}$	= max.	50	max.	50	V
I_{g1}	= max.	2x3	max.	2x4	mA
V_{kf}	= max.	100	max.	100	V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

		C.C.S.	I.C.A.S.	
f	=	500	500	Mc/s
V_a	=	180	200	V
V_{g2}	=	180	200	V
V_{g1}	=	-20	-20	V
R_{g1}	=	27	27	kΩ 1)
$V_{g1g1'p}$	=	50	50	V
I_a	=	2x27,5	2x31	mA
I_{g2}	=	12,5	14	mA
I_{g1}	=	2x0,75	2x0,75	mA
W_{ia}	=	2x5	2x6,2	W
W_a	=	2x2,1	2x2,6	W
W_{g2}	=	2,25	2,8	W
W_{ig1} 2)	=	1,2	1,2	W
W_o	=	5,8	7,2	W
η	=	58	58	%
W_ℓ 3)	=	5	6	W

---

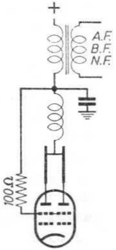
1)...3) See page 6; voir page 6. siehe Seite 6

H.F. Class C anode and screen grid modulation, two systems in push-pull
H.F. classe C modulation d'anode et de grille-écran, deux systèmes en push-pull
HF-Klasse C Anoden- und Schirmgittermodulation, zwei Systeme in Gegentakt

Limiting values (absolute values)
Caractéristiques limites (valeurs absolues)
Grenzdaten (absolute Werte)

		C.C.S.		I.C.A.S.		
f	=	max.	500	max.	500	Mc/s
V_a	=	max.	200	max.	200	V
W_{ia}	=	max.	2x4	max.	2x5	W
W_a	=	max.	2x2	max.	2x2,5	W
I_a	=	max.	2x32	max.	2x40	mA
V_{g2}	=	max.	200	max.	200	V
W_{g2}	=	max.	2x1,0	max.	2x1,15	W
$-V_{g1}$	=	max.	50	max.	50	V
I_{g1}	=	max.	2x3	max.	2x4	mA
V_{kf}	=	max.	100	max.	100	V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten



		C.C.S.	I.C.A.S.		
f	=	500	500	Mc/s	
V_a	=	180	180	V	
V_{g2}	=				4)
V_{g1}	=	-20	-20	V	
R_{g1}	=	68	27	kΩ	1)
$V_{g1g1'p}$	=	45	50	V	
I_a	=	2x20	2x27,5	mA	
I_{g2}	=	9,5	12,5	mA	
I_{g1}	=	2x0,3	2x0,75	mA	
W_{ia}	=	2x3,6	2x5,0	W	
W_a	=	2x1,5	2x2,1	W	
W_{g2}	=	1,7	2,25	W	
W_{ig1}	=	1,0	1,2	W	2)
W_o	=	4,2	5,8	W	
η	=	58	58	%	
W_ℓ	=	3,5	5,0	W	3)
m	=	100	100	%	
W_{mod}	=	4,5	6,1	W	

---

4) See circuit diagram
Voir le schéma
Siehe Schaltbild

1)...3) See page 6; voir page 6; siehe Seite 6

H.F. class C frequency tripler, two systems in push-pull
H.F. classe C tripleur de fréquence, deux systèmes en push-pull
HF-Klasse C Frequenzverdreifacher, zwei Systeme in Gegentakt

Limiting values (absolute values)
Caractéristiques limites (valeurs absolues)
Grenzdaten (absolute Werte)

		C.C.S.		I.C.A.S.	
f	= max.	500	max.	500	Mc/s
V_a	= max.	250	max.	250	V
W_{ia}	= max.	2x4	max.	2x5	W
W_a	= max.	2x3	max.	2x3,75	W
I_a	= max.	2x30	max.	2x40	mA
V_{g2}	= max.	200	max.	200	V
W_{g2}	= max.	2x1,5	max.	2x1,75	W
$-V_{g1}$	= max.	100	max.	100	V
I_{g1}	= max.	2x3	max.	2x4	mA
V_{kf}	= max.	100	max.	100	V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

		C.C.S.	I.C.A.S.	
f	=	167/500	167/500	Mc/s
V_a	=	180	200	V
V_{bg2}	=	180	200	V
R_{g2}	=	1200	1200	Ω
R_{g1}	=	82	82	kΩ1)5)
$V_{g1g1'p}$	=	165	165	V
I_a	=	2x20	2x22,5	mA
I_{g2}	=	9,7	11,0	mA
I_{g1}	=	2x0,9	2x0,9	mA
W_{ia}	=	2x3,6	2x4,5	W
W_a	=	2x2,45	2x3,05	W
W_{g2}	=	1,65	2,05	W
W_{ig1} 2)	=	1,1	1,1	W
W_o	=	2,35	2,95	W
η	=	33	33	%
W_{ℓ} 3)	=	1,8	2,2	W

---

1)...5) See page 6; voir page 6; siehe Seite 6

---

1) Each system; chaque système; jedes System

2) Driver output power
Puissance de sortie du préamplificateur
Ausgangsleistung der Treiberstufe

3) Output power in load
Puissance dans la charge
Leistung in der Belastung

4) See circuit diagram
Voir le schéma
Siehe das Schaltbild

5) Fixed bias or a combination of fixed bias and grid current biasing is not recommended

Polarisation fixe ou une combinaison de polarisation fixe et polarisation par courant de grille n'est pas recommandée

Feste Gittervorspannung oder eine Kombination von fester Gittervorspannung und Gittervorspannung mittels Gitterstromes wird nicht empfohlen

QQE 03/12

DOUBLE TETRODE for use as H.F. amplifier and oscillator, frequency multiplier and modulator
DOUBLE TETRODE pour utilisation en amplificatrice et oscillatrice H.F.. multiplicatrice de fréquence et modulatrice
DOPPELTETRODE zur Verwendung als HF-Verstärker und Oszillator, Frequenzvervielfacher und Modulator

Cathode: oxide-coated
Cathode: oxyde
Katode : Oxyd

V_f = 6,3 12,6 V1)
I_f = 0,82 0,41 A

Heating : indirect
Chauffage: indirect
Heizung : indirekt

Pins
Broches 9-(4+5) 4-5
Stifte

Capacitances Capacités Kapazitäten	per system par système pro System	in push-pull en push-pull in Gegentakt
The tube is internally neutralized Le tube est neutrodyné internement Die Röhre ist innerlich neutrodynisiert	C_a = 2,6 pF	C_o = 1,4 pF
	C_{g_1} = 6,2 pF	C_i = 5,1 pF
	C_{ag_1} < 0,1 pF	

Typical characteristics per system
Caractéristiques types par système
Kenndaten pro System

$\mu_{g_2g_1}$ (I_a = 30 mA) = 7,5
S (I_a = 30 mA) = 3,3 mA/V

λ	Freq	C telegr			C_{ag_2} mod		
		V_a	W_o(W)2)		V_a	W_o(W)2)	
(m)	(Mc/s)	(V)	CCS	ICAS	(V)	CCS	ICAS
1,5	200	300	12	16	200	7,1	8,8
		250	9,0	11,2			
		200	7,4	9,0			

λ	Freq	C fr.mult.		
		V_a	W_o(W)2)	
(m)	(Mc/s)	(V)	CCS	ICAS
4,5/1,5	67/200	300	3,5	4,8
		250	3,0	4,2
		200	2,8	3,5

B mod	
V_a	W_o2)
(V)	(W)
300	17,5
250	14
200	8,7

---

1) See page 2; voir page 2; siehe Seite 2

2) Two systems in push-pull, useful power output in load
Deux systèmes en push-pull, puissance de sortie utile dans la charge
Zwei Systeme in Gegentakt, nützliche Ausgangsleistung in der Belastung

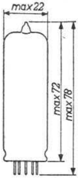
Cooling: Radiation and convection. The use of a closed can is not allowed
Refroidissement: Rayonnement et convection. Il n'est pas permis d'utiliser un écran fermé
Kühlung: Strahlung und Konvektion. Die Verwendung einer geschlossenen Buchse ist nicht gestattet

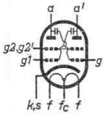
Bulb temperature
Temp. d'ampoule max. 225°C
Kolbentemperatur

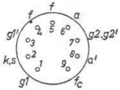
Pin temperature
Temp. des broches max. 120°C
Stiftentemperatur

Dimensions in mm
Dimensions en mm
Abmessungen in mm

Base
Culot NOVAL
Sockel







Socket
Support 5908/36
Röhrenhalter

Tube retainer
Ressort pour retenir le tube 40647
Feder zum Festhalten der Röhre

Mounting position: arbitrary; if the tube is mounted horizontally, it is recommanded that pins 2 and 7 are placed in a vertical plane
Montage: arbitrairement; si le tube est monté horizontalement, il est recommandé que les broches 2 et 7 sont montées dans un plan vertical
Einbau : willkürlich; wenn die Röhre waagerecht aufgestellt ist, wird empfohlen die Stifte 2 und 7 in einer senkrechten Ebene aufzustellen

Net weight, poids net, Nettogewicht : 16 g
Shipping weight, poids brut, Bruttogewicht: 23 g

---

[1] Occasional operation at 5.3 V or 7.8 V (resp. 10.6 V or 15.6 V) is acceptable. The tube may be used with only half the heater energized during the stand-by period of a transmitter in order to reduce heater current consumption during this time.

Opération occassionelle à 5,3 V ou 7,8 V (10,6 ou 15,6 resp.) est acceptable. Afin de réduire la consommation de courant de chauffage pendant le temps d'attente d'un émetteur, le tube peut être utilisé avec la moitié du filament seulement chauffée pendant ce temps.

Gelegentliche Wirkung bei 5,3 V oder 7,8 V (bzw. 10,6 V oder 15,6 V) ist akzeptabel. Zur Verringerung des Heizstromverbrauches während der Ruhezeit eines Senders darf die Röhre während dieser Zeit mit nur der Hälfte des Heizfadens geheizt gebraucht werden.

H.F. class C telegraphy; two systems in push-pull
H.F. classe C télégraphie; deux systèmes en push-pull
HF- Klasse C Telegraphie; zwei Systeme in Gegentakt

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f	= max.	200	Mc/s
V_a	= max.	300	V
W_a	= max.	2x5	W
W_{ia}	= max.	2x11,25	W
I_a	= max.	2x45	mA
V_{g_2}	= max.	200	V
W_{g_2}	= max.	2x1	W
$-V_{g_1}$	= max.	150	V
W_{g_1}	= max.	2x0,2	W
I_{g_1}	= max.	2x3	mA
I_k	= max.	2x50	mA
I_{k_p}	= max.	225	mA
V_{kf}	= max.	100	V

C.C.S. Operating characteristics, continuous service
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

f	=	200	200	200	Mc/s
$V_a = V_b$	=	300	250	200	V
V_{g_2}	=	175	-	-	V
R_{g_2}	=	-	47	22	kΩ
V_{g_1}	=	-40	-	-	V
R_{g_1} 1)	=	-	18	15	kΩ
$V_{g_1g_1'p}$	=	110	110	115	V
I_a	=	2x37,5	2x33.5	2x35	mA
I_{g_2}	=	2,3	1,8	2,2	mA
I_{g_1}	=	2x0,9	2,2	2,7	mA
W_{ia}	=	2x11,25	2x8,4	2x7	W
W_a	=	2x4	2x2,9	2x2,8	W
W_{g_2}	=	0.4	0,3	0,33	W
W_{ig_1}	=	2x0,05	0.12	0,14	W
W_o	=	14,5	11	8,4	W
η	=	65	65	60	%
W_o 2)	=	12	9	7,4	W

---

1) 2) See page 4; voir page 4, siehe Seite 4

H.F.class C telegraphy, two systems in push-pull; continued
H.F.classe C télégraphie,deux systèmes en push-pull;continuation
HF-Klasse C Telegraphie,zwei Systeme in Gegentakt;Fortsetzung

I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 200 Mc/s
V_a = max. 300 V
W_a = max. 2x7 W
W_{ia} = max. 2x15 W
I_a = max. 2x55 mA
V_{g_2} = max. 200 V
W_{g_2} = max. 2x1 W
$-V_{g_1}$ = max. 150 V
W_{g_1} = max. 2x0,2 W
I_{g_1} = max. 2x4 mA
I_k = max. 2x65 mA
I_{k_p} = max. 2x300 mA
V_{kf} = max. 100 V

I.C.A.S. Operating conditions, intermittent service
Caractéristiques d'utilisation,service intermittent
Betriebsdaten, aussetzender Betrieb

f	=	200	200	200	Mc/s
$V_a = V_b$	=	300	250	200	V
V_{g_2}	=	200	-	-	V
R_{g_2}	=	-	27	8,2	kΩ
V_{g_1}	=	-45			V
R_{g_1} 1)	=	-	18	15	kΩ
$V_{g_1 g_1' p}$	=	130	120	130	V
I_a	=	2x50	2x40	2x42	mA
I_{g_2}	=	3,0	2,4	3,1	mA
I_{g_1}	=	2x1,5	2,5	3,0	mA
W_{ia}	=	2x15	2x10	2x8,4	W
W_a	=	2x6	2x3,5	2x3,4	W
W_{g_2}	=	0,6	0,45	0,55	W
W_{ig_1}	=	2x0,1	0,15	0,18	W
W_o	=	18,5	13	10	W
η	=	62	65	60	%
W_o 2)	=	16	11,2	9	W

---

1) Common resistor for both systems
Résistance commune pour les deux systèmes
Gemeinsamer Widerstand für beide Systeme

2) Useful power output in load
Puissance utile dans la charge
Nützliche Leistung in der Belastung

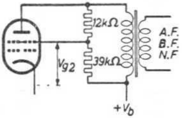
H.F. class C anode and screen grid modulation, two systems in push-pull
H.F. classe C modulation d'anode et de grille-écran, deux systèmes en push-pull
HF- Klasse C Anoden- und Schirmgittermodulation, zwei Systeme in Gegentakt

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 200 Mc/s
V_a = max. 240 V
W_a = max. 2x3.3 W
W_{ia} = max. 2x7,5 W
I_a = max. 2x37,5 mA
V_{g2} = max. 200 V
W_{g2} = max. 1.3 W
$-V_{g1}$ = max. 150 V
W_{g1} = max. 2x0,2 W
I_{g1} = max. 2x3 mA
I_k = max. 2x40 mA
I_{k_p} = max. 2x180 mA
V_{kf} = max. 100 V

C.C.S. Operating conditions, continuous service
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

f = 200 Mc/s
$V_a=V_b$ = 200 V
V_{g2} 3) =
R_{g1} 1) = 33 kΩ
$V_{g1g1'p}$ = 130 V
I_a = 2x33,5 mA
I_{g2} = 2,6 mA
I_{g1} = 1,5 mA
W_{ia} = 2x6.7 W
W_a = 2x2.65 W
W_{g2} = 0,46 W
W_{ig1} = 0,1 W
W_o = 8.1 W
η = 60 %
W_o 2) = 7,1 W
m = 100 %
W_{mod} = 6,7 W



---

1) 2) See page 4, voir page 4; siehe Seite 4

3) See diagram; voir le schéma; siehe das Schaltbild

H.F. class C anode and screen grid modulation, two systems in push-pull; continued
H.F. classe C modulation d'anode et de grille-écran, deux systèmes en push-pull; continuation
HF-Klasse C Anoden- und Schirmgittermodulation, zwei Systeme in Gegentakt; Fortsetzung

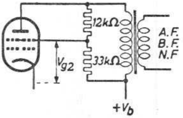
I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 200 Mc/s
V_a = max. 240 V
W_a = max. 2x4,6 W
W_{ia} = max. 2x10 W
I_a = max. 2x46 mA
V_{g_2} = max. 200 V
W_{g_2} = max. 1,3 W
$-V_{g_1}$ = max. 150 V
W_{g_1} = max. 2x0,2 W
I_{g_1} = max. 2x4 mA
I_k = max. 2x52 mA
I_{k_p} = max. 2x240 mA
V_{kf} = max. 100 V

I.C.A.S. Operating conditions, intermittent service
Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

f = 200 Mc/s
$V_a = V_b$ = 200 V
V_{g_2} 3)
R_{g_1} 1) = 15 kΩ
$V_{g_1 g_1' p}$ = 130 V
I_a = 2x43 mA
I_{g_2} = 3,1 mA
I_{g_1} = 3,3 mA
W_{ia} = 2x8,6 W
W_a = 2x3,7 W
W_{g_2} = 0,54 W
W_{ig_1} = 0,2 W
W_o = 9,8 W
η = 57 %
W_o 2) = 8,8 W

m = 100 %
W_{mod} = 8,6 W



---

1) 2) See page 4; voir page 4; siehe Seite 4
3) See diagram; voir le schéma; siehe das Schaltbild

H.F. class C frequency tripler, two systems in push-pull
H.F. classe C tripleur de fréquence, deux systèmes en push-pull
HF-Klasse C Frequenzverdreifacher, zwei Systeme in Gegentakt

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 200 Mc/s
V_a = max. 300 V
W_a = max. 2x5 W
W_{ia} = max. 2x7,5 W
I_a = max. 2x30 mA
V_{g2} = max. 200 V
W_{g2} = max. 2 W
$-V_{g1}$ = max. 150 V
W_{g1} = max. 2x0,2 W
I_{g1} = max. 2x2 mA
I_k = max. 2x35 mA
I_{kp} = max. 2x225 mA
V_{kf} = max. 100 V

C.C.S. Operating conditions, continuous service
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

f	=	67/200	67/200	67/200	Mc/s
$V_a = V_b$	=	300	250	200	V
V_{g2}	=	150	161	155	V
R_{g2}	=	-	47	15	kΩ
V_{g1}	=	-100	-	-	V
R_{g1} 1)	=	-	47	33	kΩ
$V_{g_1 g_1 p}$	=	230	230	230	V
I_a	=	2x24	2x25	2x28,5	mA
I_{g2}	=	2,0	1,9	3,0	mA
I_{g1}	=	2x1,0	2x1,0	2x1,6	mA
W_{ia}	=	2x7,2	2x6,25	2x5,7	W
W_a	=	2x4,0	2x3,75	2x3,8	W
W_{g2}	=	0,30	0,31	0,46	W
W_{ig1}	=	0,23	0,23	0,35	W
W_o	=	6,5	5,0	3,8	W
η	=	45	40	33,5	%
W_o 2)	=	3,5	3,0	2,8	W

---

1) 2) See page 4; voir page 4; siehe Seite 4

H.F. class C frequency tripler, two systems in push-pull; continued

H.F. classe C tripleur de fréquence, deux systèmes en push-pull; continuation

HF-Klasse C Frequenzverdreifacher, zwei Systeme in Gegentakt; Fortsetzung

I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 200 Mc/s
V_a = max. 300 V
W_a = max. 2x7 W
W_{ia} = max. 2x10 W
I_a = max. 2x42 mA
V_{g_2} = max. 200 V
W_{g_2} = max. 2 W
$-V_{g_1}$ = max. 150 V
W_{g_1} = max. 2x0,2 W
I_{g_1} = max. 2x3 mA
I_k = max. 2x45 mA
I_{k_p} = max. 2x300 mA
V_{kf} = max. 100 V

I.C.A.S. Operating conditions, intermittent service
Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

f	=	67/200	67/200	67/200	67/200	Mc/s
$V_a = V_b$	=	300	300	250	200	V
V_{g_2}	=	150	175	176	175	V
R_{g_2}	=	-	-	18	4,7	kΩ
V_{g_1}	=	-100	-100	-	-	V
R_{g_1} 1)	=	-	-	27	22	kΩ
$V_{g_1 g_1 p}$	=	240	230	230	230	V
I_a	=	2x32,5	2x32,5	2x36	2x39	mA
I_{g_2}	=	3,5	2,7	4,1	5,2	mA
I_{g_1}	=	2x1,9	2x1,2	2x1,9	2x2,3	mA
W_{ia}	=	2x9,7	2x9,7	2x9	2x7,8	W
W_a	=	2x5,8	2x6,1	2x5,9	2x5,55	W
W_{g_2}	=	0,53	0,47	0,72	0,91	W
W_{ig_1}	=	0,45	0,28	0,43	0,52	W
W_o	=	7,8	7,2	6,2	4,5	W
η	=	40	37	34,5	29	%
W_o 2)	=	4,8	4,2	4,2	3,5	W

---

1) 2) See page 4; voir page 4; siehe Seite 4

L.F. class AB amplifier and modulator without grid current
Amplificatrice et modulatrice B.F. classe AB sans courant de grille
NF-Verstärker und Modulator Klasse AB ohne Gitterstrom

Limiting values; only for speech and music
Caractéristiques limites; seulement pour parole et musique
Grenzdaten; nur für Sprache und Musik

V_a = max. 300 V
W_a = max. 2x7 W
W_{ia} = max. 2x15 W
I_a = max. 2x50 mA
V_{g2} = max. 200 V
W_{g2} = max. 2x1 W
W_{g2p} = max. 2x2 W
$-V_{g1}$ = max. 150 V
W_{g1} = max. 2x0,2 W
I_{g1} = max. 2x4 mA
I_k = max. 2x60 mA
I_{kp} = max. 2x300 mA
V_{kf} = max. 100 V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

V_a	=	300		250		200		V
V_{g2}	=	200		200		200		V
V_{g1} 1)	=	-21,5		-21,5		-21,5		V
$R_{aa'}$	=	10		8		6,5		kΩ
$V_{g1g1'p}$	=	0	43,5	0	44,5	0	43,5	V
I_a	=	2x15	2x36	2x15	2x34,5	2x15	2x33	mA
I_{g2}	=	1,2	12,6	1,4	12,4	2,4	14	mA
W_{g2}	=	0,24	2,5	0,28	2,5	0,48	2,8	W
W_{ia}	=	2x4,5	2x10,8	2x3,75	2x8,65	2x3,0	2x6,6	W
W_a	=	2x4,5	2x4,8	2x3,75	2x4,0	2x3,0	2x3,1	W
W_o	=	0	12	0	9,3	0	7,0	W
η	=	-	56	-	54	-	53	%
d_{tot}	=	-	2,5	-	2,7	-	3,2	%

---

1) Individual adjustment of the grid bias of each system is recommended
Il est recommandé de régler la polarisation négative de chaque système individuellement
Es wird empfohlen die Gittervorspannung jedes Systems einzeln zu regeln

L.F. class AB amplifier and modulator with grid current
Amplificatrice et modulatrice B.F. classe AB avec courant de grille
NF-Verstärker und Modulator Klasse AB mit Gitterstrom

Limiting values; only for speech and music
Caractéristiques limites; seulement pour parole et musique
Grenzdaten; nur für Sprache und Musik

V_a = max. 300 V
W_a = max. 2x7 W
W_{ia} = max. 2x15 W
I_a = max. 2x50 mA
V_{g_2} = max. 200 V
W_{g_2} = max. 2x1 W
$W_{g_{2}p}$ = max. 2x2 W
$-V_{g_1}$ = max. 150 V
W_{g_1} = max. 2x0,2 W
I_{g_1} = max. 2x4 mA
I_k = max. 2x60 mA
I_{kp} = max. 2x300 mA
V_{kf} = max. 100 V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

V_a	=	300		250		200		V
V_{g_2}	=	200		200		200		V
V_{g_1} [1]	=	-21,5		-21,5		-21,5		V
Raa'	=	6,5		5,0		5,0		kΩ
$V_{g_1 g_1' p}$	=	0	64	0	67	0	54	V
I_a	=	2x15	2x50	2x15	2x50	2x15	2x41,1	mA
I_{g_2}	=	1,2	11,4	1,4	13	2,4	19	mA
I_{g_1}	=	0	2x0,56	0	2x0,62	0	2x0,22	mA
W_{g_2}	=	0,24	2,3	0,28	2,6	0,48	3,8	W
W_{ig_1}	=	0	2x0,02	0	2x0,02	0	2x0,01	W
W_{ia}	=	2x4,5	2x15	2x3,75	2x12,5	2x3,0	2x8,22	W
W_a	=	2x4,5	2x6,25	2x3,75	2x5,5	2x3,0	2x3,87	W
W_o	=	0	17,5	0	14	0	8,7	W
η	=	-	58	-	56	-	53	%
d_{tot}	=	-	5,0	-	5,5	-	6,0	%

---

[1] See page 9; voir page 9; siehe Seite 9

DOUBLE TETRODE for use as R.F. class C amplifier at frequencies up to 600 Mc/s or as L.F. amplifier
DOUBLE TETRODE pour utilisation en amplificatrice H.F. classe C à des fréquences jusqu'à 600 Mc/s ou en amplificatrice B.F.
DOPPELTETRODE zur Verwendung als H.F. Klasse C Verstärker bei Frequenzen bis 600 MHz oder als NF-Verstärker

Cathode: oxide coated
Cathode: oxyde
Katode : Oxyd

V_f = 6,3 12,6 V
I_f = 1,3 0,65 A

Pins
Broches 5-(1+7) 1-7
Stifte

Heating : indirect, series or parallel supply
Chauffage: indirect, alimentation en série ou en parallèle
Heizung : indirekt, Serien- oder Parallelspeisung

Capacitances / Capacités / Kapazitäten — per system / par système / pro System — in push-pull / en push-pull / in Gegentakt

See page 2 for internal neutralisation (C_n, C_n')
Voir page 2 pour neutralisation interne (C_n, C_n')
Für Neutrodynisierung siehe Seite 2 (C_n, C_n')

C_a = 2,6 pF C_o = 1,6 pF
C_{g1} = 7,0 pF C_i = 4,4 pF
C_{ag1} < 0,08 pF
$C_{ag1}-C_n$ < 0,035 pF

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} (I_a=20 mA) = 8
S (I_a=20 mA) = 2,5 mA/V

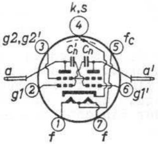
Two systems; deux systèmes; zwei Systeme

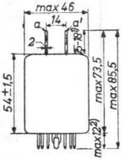
λ	Freq.	C telegr.		C_{ag2} mod	
		V_a	W_o	V_a	W_o
m	Mc/s	(V)	(W)	(V)	(W)
1,5	200	600	48	500	31
		400	30	300	17
		300	21		
		200	13		
0,75	400	400	24	300	13
		300	17		
		200	11		
0,5	600	400	20		

λ	Freq.	Cfr.mult	
		V_a	W_o
m	Mc/s	(V)	(W)
4,5/1,5	67/200	300	10
2,25/0,75	133/400	300	8

B mod.	
V_a (V)	W_o (W)
500	23,5
400	13,2

Dimensions in mm
Dimensions en mm
Abmessungen in mm





Base, culot, Sockel: SEPTAR

Socket
Support 40202
Fassung

Clips
Bornes de connexion 40623
Anschlussklemmen

Mounting position: arbitrary
Montage : arbitrairement
Einbau : willkürlich

<u>Cooling</u> Temperature of seals max. 180 °C

Generally natural cooling is sufficient with:
V_a = 600 V up to 150 Mc/s
V_a = 500 V up to 200 Mc/s
V_a = 300 V up to 430 Mc/s

Above these limits or with high ambient temperatures it may be necessary to direct an air flow of about 15 l/min. on top of the bulb to keep the seal temperature within the stated limit.

<u>Refroidissement</u> Température des scellements max. 180 °C

En général refroidissement naturel est suffisant à:
V_a = 600 V jusqu'à 150 MHz
V_a = 500 V jusqu'à 200 MHz
V_a = 300 V jusqu'à 430 MHz

A des fréquences plus élevées ou à des températures élevées il peut être nécessaire de diriger un courant d'air d'environ 15 l/min. sur la partie supérieure de l'ampoule afin de ne pas passer la limite de température mentionnée

---

[1] Max. 3 mm glass included
Y inclus 3 mm de verre au max.
Einschliesslich max. 3 mm Glas

[2] Max. 2.5 mm glas included
Y inclus 2,5 mm de verre au max.
Einschliesslich max. 2,5 mm Glas

Kühlung Temperatur der Einschmelzungen max. 180°C

Im allgemeinen wird natürliche Kühlung genügen wenn:

V_a = 600 V bis 150 MHz
V_a = 500 V bis 200 MHz
V_a = 300 V bis 430 MHz

Oberhalb dieser Grenzen oder bei hohen Umgebungstemperaturen kann ein Luftstrom von etwa 15 l/min. auf die Obenseite des Kolbens nötig sein, damit die genannte Temperaturgrenze der Einschmelzungen nicht überschritten wird.

Net weight
Poids net
Nettogewicht
55 g

Shipping weight
Poids brut
Bruttogewicht
140 g

H.F. class C telegraphy
H.F. classe C télégraphie
H.F. Klasse C Telegrafie

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 600 V
W_a = max. 2x10 W
V_{g2} = max. 250 V
W_{g2} = max. 2x1,5 W
$-V_{g1}$ = max. 75 V
I_k = max. 2x55 mA
R_{g1} 1) = max. 50 kΩ
R_{g1} 2) = max. 100 kΩ
I_{g1} = max. 2x2,5 mA
V_{kf} = max. 100 V

---

1) Fixed bias
Polarisation de grille fixe
Feste Gittervorspannung

2) Automatic bias
Polarisation de grille automatique
Automatische Gittervorspannung

H.F. class C telegraphy (continued)
H.F. classe C télégraphie (continuation)
HF Klasse C Telegraphie (Fortsetzung)

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

λ	=	1,5	1,5	1,5	1,5	m
f	=	200	200	200	200	Mc/s
V_a	=	600	400	300	200	V
V_{g2}	=	250	250	250	200	V
V_{g1}	=	−60	−50	−40	−30	V
I_a	=	2x50	2x50	2x50	2x50	mA
I_{g2}	=	2x4	2x4	2x4,5	2x4	mA
I_{g1}	=	2x0,7	2x0,7	2x0,7	2x1	mA
W_{ia}	=	2x30	2x20	2x15	2x10	W
W_a	=	2x6	2x5	2x4,5	2x3,5	W
W_{g2}	=	2x1,0	2x1,0	2x1,1	2x0,8	W
W_{ig}	=	1,5	1	<1	<1	W
W_o	=	48	30	21	13	W
η	=	80	75	70	65	%

λ	=	0,75	0,75	0,75	0,5	m
f	=	400	400	400	600	Mc/s
V_a	=	400	300	200	400	V
V_{g2}	=	250	250	200	250	V
V_{g1}	=	−50	−40	−30	−50	V
I_a	=	2x50	2x50	2x50	2x50	mA
I_{g2}	=	2x2,5	2x2,5	2x3,0	2x2,5	mA
I_{g1}	=	2x0,7	2x0,6	2x0,5	2x0,7	mA
W_{ia}	=	2x20	2x15	2x10	2x20	W
W_a	=	2x8	2x6,5	2x4,5	2x10	W
W_{g2}	=	2x0,6	2x0,6	2x0,6	2x0,63	W
W_{ig1}	=	2	1,5	1		W
W_o	=	24	17	11	20	W
η	=	60	57	55	50	%

H.F. class C anode and screen-grid modulation
H.F. classe C modulation d'anode et de grille-écran
HF Klasse C Anoden- und Schirmgittermodulation

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 500 V
W_a = max. 2x10 W
V_{g2} = max. 250 V
W_{g2} = max. 2x1,5 W
$-V_{g1}$ = max. 100 V
I_k = max. 2x50 mA
I_{g1} = max. 2x2,5 mA
V_{kf} = max. 100 V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

λ	=	1,5	1,5	0,75 m
f	=	200	200	400 Mc/s
V_a	=	500	300	300 V
V_{g2}	=	250	250	250 V
V_{g1}	=	-80	-50	-50 V
I_a	=	2x40	2x40	2x40 mA
I_{g2}	=	2x4	2x4	2x3 mA
I_{g1}	=	2x1,0	2x1,0	2x1,0 mA
W_{ia}	=	2x20	2x12	2x12 W
W_a	=	2x4,5	2x3,5	2x5,5 W
W_{g2}	=	2x1	2x1	2x0,75 W
W_{ig1}	=	2x5	2x2,5	W
W_o	=	31	17	13 W
η	=	77,5	71	54 %
m	=	100	100	100 %
W_{mod}	=	20	12	12 W

H.F. class C frequency trebler
H.F. classe C tripleur de fréquence
HF Klasse C Frequenzverdreifacher

Limiting values
Caractéristiques limites
Grenzdaten

V_a	= max.	600 V
W_a	= max.	2x10 W
V_{g2}	= max.	250 V
W_{g2}	= max.	2x1,5 W
$-V_{g1}$	= max.	200 V
I_k	= max.	2x50 mA
R_{g1} 1)	= max.	50 kΩ
R_{g1} 2)	= max.	100 kΩ
I_{g1}	= max.	2x2,5 mA
V_{kf}	= max.	100 V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

λ	=	4,5/1,5	2,25/0,75 m
f	=	66,7/200	133/400 Mc/s
V_a	=	300	300 V
V_{g2}	=	250	250 V
V_{g1}	=	-175	-175 V
I_a	=	2x45	2x45 mA
I_{g2}	=	2x3,0	2x2,8 mA
I_{g1}	=	2x1,5	2x1,2 mA
W_{ia}	=	2x13,5	2x13,5 W
W_a	=	2x8,5	2x9,5 W
W_{g2}	=	2x0,75	2x0,7 W
W_{ig1}	=	2x1	2x2 W
W_o	=	10	8,0 W
η	=	37	29,5 %

---

1) Fixed bias
Polarisation de grille fixe
Feste Gittervorspannung

2) Automatic bias
Polarisation de grille automatique
Automatische Gittervorspannung

L.F. class B amplifier and modulator
Amplificatrice et modulatrice B.F. classe B
NF Klasse B Verstärker und Modulator

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 600 V
W_a = max. 2x10 W
V_{g2} = max. 250 V
W_{g2} = max. 2x1,5 W
$-V_{g1}$ = max. 75 V
I_k = max. 2x55 mA
R_{g1} = max. 50 kΩ[1])
R_{g1} = max. 100 kΩ[2])
V_{kf} = max. 100 V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

V_a	=	500		300		V
V_{g2}	=	250		250		V
V_{g1}	=	-26		-25		V
R_{aa}	=	20		11		kΩ
$V_{g1g1'p}$	=	0	52	0	50	V
I_a	=	2x12,5	2x36,5	2x12,5	2x35	mA
I_{g2}	=	2x0,35	2x8,1	2x0,6	2x9,5	mA
W_{g2}	=	0,18	4,05	0,3	4,75	W
W_{ia}	=	2x6,25	2x18,25	2x3,75	2x10,5	W
W_a	=	2x6,25	2x6,5	2x3,75	2x3,9	W
W_o	=	0	23,5	0	13,2	W
d_{tot}	=	-	3,5	-	3,5	%
η	=	-	63,5	-	63	%

---

[1])Fixed bias
Polarisation de grille fixe
Feste Gittervorspannung

[2])Automatic bias
Polarisation de grille automatique
Automatische Gittervorspannung

DOUBLE TETRODE with internal neutralisation for use as oscillator, frequency tripler and amplifier
TETRODE DOUBLE avec neutralisation interne pour utilisation en oscillatrice, tripleuse de fréquence et amplificatrice
DOPPELTETRODE mit Innenneutrodynisierung zur Verwendung als Oszillator, Frequenzverdreifacher und Verstärker

Cathode: oxide coated V_f = 6,3 V ± 10 % 12,6 V ± 10 %
Cathode: oxyde
Katode : Oxyd I_f = 0,6 A 0,3 A

Pins
Broches 7-(1+8) 1-8
Stifte

Heating : indirect
Chauffage: indirect
Heizung : indirekt

Capacitances (each system)
Capacités (chaque système)
Kapazitäten (jedes System)

C_a = 1,35 pF
C_{g1} = 4,5 pF
C_{ag1} = 0,145 pF

Typical characteristics
Caractéristiques types
Kenndaten

V_a = 350 V
V_{g2} = 200 V
I_a = 25 mA
S = 10,5 mA/V
μ_{g2g1} = 26

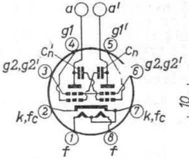
Freq.	C telegr.				C freq. tripler			
	C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
Mc/s	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
960	250	7	250	8				
320/960					250	2,75	250	3

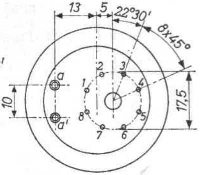
Temperatures
Températures
Temperaturen

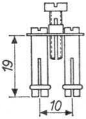
Pin seals
Scellements des broches max.220°C
Stifteneinschmelzungen

Bulb, ampoule, Kolben max.220°C

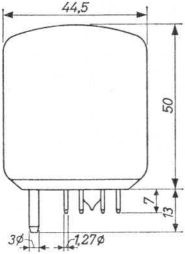
QQE 04/5







Example of anode-tank circuit connector at 960 Mc/s
→ Exemple d'un connecteur anode-circuit accordé à 960 MHz
Beispiel einer Verbindung Anode-abgestimmter Kreis bei 960 MHz



Dimensions in mm
Dimensions en mm
Abmessungen in mm

Socket assembly
→ Assemblage du support B8 700 71
Zusammenstellung Fassung

Mounting position: arbitrary
Montage : arbitrairement
Einbau : beliebig

Net weight Poids net Nettogewicht	35 g	Shipping weight Poids brut Bruttogewicht	55 g

H.F. class C telegraphy; two systems in push-pull
H.F. classe C télégraphie; deux systèmes en push-pull
HF-Klasse C Telegraphie; zwei Systeme in Gegentakt

Limiting values
Caractéristiques limites
Grenzdaten

		C.C.S.		I.C.A.S.	
f	= max.	960	max.	960	Mc/s
V_a	= max.	400	max.	400	V
I_a	= max.	2 x 45	max.	2 x 50	mA
W_a	= max.	2 x 8	max.	2 x 10	W
W_{ia}	= max.	2 x 10	max.	2 x 12	W
V_{g2}	= max.	225	max.	225	V
W_{g2}	= max.	2 x 1,5	max.	2 x 1,75	W
$-V_{g1}$	= max.	100	max.	100	V
I_{g1}	= max.	2 x 4	max.	2 x 5	mA

Operating characteristics
Caractéristiques d'utilisation
Betriebsdaten

		C.C.S.	I.C.A.S.	
f	=	960	960	Mc/s
V_a	=	250	250	V
V_{g2}	=	160 ¹)	170 ²)	V
V_{g1}	=	-15	-15	V
R_{g1}	=	20	20	kΩ
I_a	=	2 x 35	2 x 40	mA
I_{g2}	=	15	15	mA
I_{g1}	=	2 x 0,75	2 x 0,75	mA
W_{ia}	=	2 x 8,8	2 x 10	W
W_a	=	2 x 5,4	2 x 5,4	W
W_{g2}	=	2,5	2,9	W
W_{dr} ³)	=	1,4	1,4	W
W_o	=	7	8	W
W_ℓ ⁴)	=	4	5	W
η	=	40	40	%

---

¹) Adjust V_{g2} until I_a = 2x35 mA at W_o max.
Régler V_{g2} jusqu'à ce que I_a = 2x35 mA à W_o max.
V_{g2} einstellen bis I_a = 2x35 mA wenn W_o max. ist.

²) Adjust V_{g2} until I_a = 2x40 mA at W_o max.
Régler V_{g2} jusqu'à ce que I_a = 2x40 mA à W_o max.
V_{g2} einstellen bis I_a = 2x40 mA wenn W_o max. ist

³) See page 4; voir page 4; siehe Seite 4

H.F. class C frequency tripler (two systems in push-pull)
H.F. classe C tripleur de fréquence (deux systèmes en push-pull)
HF-Klasse C Frequenzverdreifacher (zwei Systeme in Gegentakt)

Limiting values
Caractéristiques limites
Grenzdaten

		C.C.S.		I.C.A.S.	
f	= max.	960	max.	960	Mc/s
V_a	= max.	400	max.	400	V
I_a	= max.	2 x 40	max.	2 x 40	mA
W_a	= max.	2 x 8	max.	2 x 10	W
W_{ia}	= max.	2 x 10	max.	2 x 12	W
V_{g2}	= max.	225	max.	250	V
W_{g2}	= max.	2 x 1,5	max.	2 x 1,75	W
$-V_{g1}$	= max.	100	max.	100	V
I_{g1}	= max.	2 x 4	max.	2 x 5	mA

Operating characteristics
Caractéristiques d'utilisation
Betriebsdaten

		C.C.S.	I.C.A.S.	
f	=	320/960	320/960	Mc/s
V_a	=	250	250	V
V_{g2}	=	150	170	V
R_{g1}	=	20	20	kΩ
I_a	=	2 x 37,5	2 x 40	mA
I_{g2}	=	15	16	mA
I_{g1}	=	2 x 2,25	2 x 2,25	mA
W_{ia}	=	2 x 9,5	2 x 10	W
W_a	=	2 x 8	2 x 8,5	W
W_{g2}	=	2,25	2,8	W
W_{dr} 3)	=	3	3	W
W_o	=	2,75	3	W
W_ℓ 4)	=	1,5	1,8	W
η	=	14,7	15	%

---

3) Driver output power
Puissance de sortie du tube d'attaque
Ausgangsleistung der Treiberstufe

4) Useful power in the load
Puissance utile dans la charge
Nutzleistung in der Belastung

QQE 04/20

DOUBLE TETRODE for use as H.F. amplifier and oscillator
DOUBLE TETRODE pour utilisation en amplificatrice et oscillatrice H.F.
DOPPELTETRODE zur Verwendung als HF-Verstärker und Oszillator

Cathode : oxide coated
Cathode : oxyde
Katode : Oxyd

V_f = 6,3 12,6 V
I_f = 1,6 0,8 A

Heating : indirect
Chauffage: indirect
Heizung : indirekt

Pins
Broches 5-(1+7), 1-7
Stifte

Capacitances
Capacités
Kapazitäten

per system C_a = 3,8 pF
par système C_{g1} = 8 pF
pro System C_{ag1} < 0,07 pF
C_{g2k} = 65 pF1)

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} = 6,5
$S(I_a=30mA)$2) = 3 mA/V

λ	Freq.	C telegr.3)			Cag2 mod.3)		
(m)	(Mc/s)	V_a (V)	W_o (W)		V_a (V)	W_o (W)	
			CCS	ICAS		CCS	ICAS
1,5	200	750	26	35	600	17	26
		500	26		425	16	
1,2	250	500	23				

Temperature of anode and pin seals
Température des scellements de l'anode et des broches
Temperatur der Anoden- und Stifteneinschmelzungen
max.180 °C

bulb temperature
Température de l'ampoule
Kolbentemperatur
max.220 °C

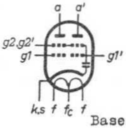
---

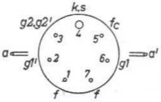
1) Including internal capacitor between grid No.2 and cathode
Y compris le condensateur interne entre grille No.2 et la cathode
Einschliesslich des inneren Kondensators zwischen Gitter 2 und Katode

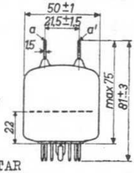
2) Per system; par système; pro System

3) Two systems in push-pull; deux systèmes en push-pull; zwei Systeme in Gegentakt

Dimensions in mm
Dimensions en mm
Abmessungen in mm







Base, culot, Sockel: SEPTAR

Socket Support Fassung	40202
Anode clips Bornes de connexion de l'anode Anodenanschlussklemmen	40615

Mounting position: arbitrary
Montage : arbitrairement
Aufstellung : willkürlich

Net weight Poids net Nettogewicht	60 g
Shipping weight Poids brut Bruttogewicht	150 g

H.F. class C telegraphy, two systems in push-pull
H.F. classe C télégraphie, deux systèmes en push-pull
HF Klasse C Telegraphie, zwei Systeme in Gegentakt

C.C.S.
Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 200 Mc/s
V_a = max. 750 V
W_{ia} = max. 2x18 W
W_a = max. 2x7,5 W
I_a = max. 2x45 mA
V_{g2} = max. 250 V
W_{g2} = max. 5 W
$-V_{g1}$ = max. 175 V
I_{g1} = max. 2x5 mA
R_{g1} = max. 50 kΩ 1)
R_{g1} = max. 25 kΩ 2)
V_{kf} = max. 100 V

f = max. 250 Mc/s
V_a = max. 670 V
W_{ia} = max. 2x16 W

C.C.S.
Operating conditions, continuous service.
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

f	=	200	200	200	250	250 Mc/s
V_a	=	750	500	400	500	400 V
V_{g2}	=	200	200	200	200	200 V
V_{g1}	=	-65	-65	-65	-65	-65 V
I_a	=	2x24	2x36	2x45	2x32	2x40 mA
I_{g2}	=	15	14	14	12	14 mA
I_{g1}	=	2x1,4	2x1,3	2x1,4	2x0,9	2x1,0 mA
$V_{g1g1'p}$	=	150	150	150	140	140 V
W_{ig1}	=	2x0,10	2x0,09	2x0,10	2x0,06	2x0,07 W
W_{g2}	=	3,0	2,8	2,8	2,4	2,8 W
W_{ia}	=	2x18	2x18	2x18	2x16	2x16 W
W_a	=	2x5	2x5	2x5,25	2x7,0	2x7,5 W
W_o	=	26	26	25,5	18	17 W
η	=	72	72	71	56	53 %

---

1) Per system; par système; pro System

2) Per tube; par tube; pro Röhre

H.F. class C telegraphy, two systems in push-pull; continued
H.F. classe C télégraphie, deux systèmes en push-pull; continuation
HF Klasse C Telegraphie, zwei Systeme in Gegentakt; Fortsetzung

---

I.C.A.S.
Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 200 Mc/s
V_a = max. 750 V
W_{ia} = max. 2x25 W
W_a = max. 2x10 W
I_a = max. 2x57,5 mA
V_{g2} = max. 250 V
W_{g2} = max. 5 W
$-V_{g1}$ = max. 175 V
I_{g1} = max. 2x5 mA
R_{g1} = max. 50 kΩ 1)
R_{g1} = max. 25 kΩ 2)
V_{kf} = max. 100 V

f = max. 250 Mc/s
V_a = max. 670 V
W_{ia} = max. 2x22 W

I.C.A.S.
Operating conditions, intermittent service
Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

f = 200 Mc/s
V_a = 750 V
V_{g2} = 200 V
V_{g1} = -50 V
I_a = 2x32,5 mA
I_{g2} = 22 mA
I_{g1} = 2x2,0 mA
$V_{g1g1'p}$ = 130 V
W_{ig1} = 2x0,12 W
W_{g2} = 4,4 W
W_{ia} = 2x24,4 W
W_a = 2x6,9 W
W_o = 35 W
η = 72 %

---

1) Per system; par système; pro System
2) Per tube; par tube; pro Röhre

H.F. class C anode and screen grid modulation, two systems in push-pull
H.F. classe C modulation d'anode et de grille-écran, deux systèmes en push-pull
HF Klasse C Anoden- und Schirmgittermodulation, zwei Systeme in Gegentakt

---

C.C.S. Limiting values, continuous service
Caractéristiques d'utilisation, service continu
Grenzdaten, Dauerbetrieb

f	= max.	200 Mc/s	f	= max.	250 Mc/s
V_a	= max.	600 V	V_a	= max.	530 V
W_{ia}	= max.	2x11 W	W_{ia}	= max.	2x10 W
W_a	= max.	2x5 W			
I_a	= max.	2x37,5 mA			
V_{g2}	= max.	250 V			
W_{g2}	= max.	3,4 W			
$-V_{g1}$	= max.	175 V			
I_{g1}	= max.	2x5 mA			
R_{g1}	= max.	50 kΩ 1)			
R_{g1}	= max.	25 kΩ 2)			
V_{kf}	= max.	100 V			

C.C.S. Operating conditions, continuous service
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

f	=	200	200 Mc/s
V_a	=	600	425 V
V_{g2}	=	200	200 V
V_{g1}	=	-65	-60 V
I_a	=	2x18	2x26 mA
I_{g2}	=	16	16 mA
I_{g1}	=	2x1,3	2x1,2 mA
$V_{g1g1\ p}$	=	150	140 V
W_{ig1}	=	2x0,09	2x0,075 W
W_{g2}	=	3,2	3,2 W
W_{ia}	=	2x10,8	2x11 W
W_a	=	2x2,3	2x3 W
W_o	=	17	16 W
η	=	79	72 %
m	=	100	100 %
W_{mod}	=	13,5	13,5 W

---

1) Per system; par système; pro System

2) Per tube; par tube; pro Röhre

H.F. class C anode and screen grid modulation, two systems in push-pull; continued
H.F. classe C modulation d'anode et de grille-écran, deux systèmes en push-pull; continuation
HF Klasse C Anoden- und Schirmgittermodulation, zwei Systeme in Gegentakt; Fortsetzung

---

Limiting values, intermittent service
I.C.A.S. Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 200 Mc/s
V_a = max. 600 V
W_{ia} = max. 2x18 W
W_a = max. 2x7,5 W
I_a = max. 2x47,5 mA
V_{g2} = max. 250 V
W_{g2} = max. 5 W
$-V_{g1}$ = max. 175 V
I_{g1} = max. 2x5 mA
R_{g1} = max. 50 kΩ[1]
R_{g1} = max. 25 kΩ[2]
V_{kf} = max. 100 V

Operating conditions, intermittent service
I.C.A.S. Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

f = 200 Mc/s
V_a = 600 V
V_{g2} = 200 V
V_{g1} = -70 V
I_a = 2x30 mA
I_{g2} = 20 mA
I_{g1} = 2x1,5 mA
$V_{g1g1'p}$ = 160 V
W_{ig1} = 2x0,105 W
W_{g2} = 4,0 W
W_{ia} = 2x18 W
W_a = 2x5 W
W_o = 26 W
η = 72 %
m = 100 %
W_{mod} = 20 W

---

[1] Per system; par système; pro System

[2] Per tube; par tube; pro Röhre

DOUBLE TETRODE for use as H.F. amplifier and oscillator, frequency multiplier and modulator (internally neutralised)

DOUBLE TETRODE pour utilisation en amplificatrice et oscillatrice H.F., multiplicatrice de fréquence et modulatrice (avec neutralisation interne)

DOPPELTETRODE zur Verwendung als HF-Verstärker und Oszillator, Frequenzvervielfacher und Modulator (mit innerer Neutralisation)

Cathode : oxide-coated
Cathode : oxyde
Katode : Oxyd

V_f	6,3	12,6 V
I_f	1,8	0,9 A
pins broches Stifte	5-(1+7)	1-7

Heating : indirect
Chauffage: indirect
Heizung : indirekt

Capacitances
Capacités
Kapazitäten

See page 2 for internal neutralisation (C_n, C_n')
Voir page 2 pour neutralisation interne (C_n,C_n')
Für Neutrodynisierung siehe Seite 2 (C_n, C_n')

per system par système pro System	in push-pull en push-pull in Gegentakt
C_a = 3,2 pF	C_o = 2,1 pF
C_{g1} = 10,5 pF	C_i = 6,7 pF
C_{ag1} < 0,09 pF	
$C_{ag1}-C_n$ < 0,035 pF	

Typical characteristics
Caractéristiques types
Kenndaten

μ_{g2g1} = 8,2
S[1]) (I_a= 30 mA) = 4,5 mA/V

λ	Freq.	C telegr.				C_{ag2} mod.			
		C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
(m)	Mc/s	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
5	60					600	71	600	79
1,5	200	600	90						
1,2	250	750	85	750	96	600	64	600	71
0,7	430	520	66						
0,6	500	500	60						

λ	Freq.	Cfr.mult.		B mod.	
(m)	(Mc/s)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
6/2	50/150	500	20	600	86
		400	18	450	60
4/1,3	75/225	400	12	300	37

---

[1]) Per system; par système; pro System

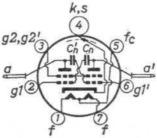
QQE 06/40

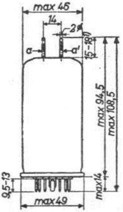
Cooling: radiation. When the tube is used at frequencies above 150 Mc/s it may be necessary to direct a low velocity air flow on the bulb and the anode seals.
Temperature of bulb and anode seals max. 250 °C
Temperature of bottom pin seals max. 180 °C

Refroidissement:radiation. Si le tube est utilisé aux fréquences supérieures à 150 Mc/s, il peut être nécessaire de diriger un léger courant d'air sur l'ampoule et sur les scellements des sorties d'anode.
Température de l'ampoule et des scellements des sorties d'anode max. 250 °C
Température des scellements des broches du fond max. 180 °C

Kühlung: Strahlung. Wenn die Röhre bei Frequenzen höher als 150 MHz benutzt wird, kann ein Luftstrom auf den Kolben und die Anodenverschlüsse notwendig sein.
Temperatur des Kolben und der Anodenverschlüsse max. 250 °C
Temperatur der Bodenstiftverschlüsse max. 180 °C

Dimensions in mm
Dimensions en mm
Abmessungen in mm





Base, culot, Sockel : Septar
Socket, support, Fassung : 40202
Clips, bornes de connexion, Anschlussklemmen : 40623

Mounting position: vertical with base up or down.
horizontal with anode pins in one horizontal plane
Montage : vertical avec le pied en haut ou en bas.
horizontal avec les broches des anodes situées dans le même plan horizontal.
Aufstellung: senkrecht mit Sockel oben oder unten
waagerecht mit der Fläche durch beide Anodenstifte waagerecht.

Net weight
Poids net 60 g
Nettogewicht

Shipping weight
Poids brut 155 g
Bruttogewicht

---

[1] Max. 3 mm glass included
3 mm de verre au max. y inclus
Einschliesslich max. 3 mm Glas

H.F. class C telegraphy, two systems in push-pull
H.F. classe C télégraphie, deux systèmes en push-pull
HF Klasse C Telegraphie, zwei Systeme in Gegentakt

Limiting values, continuous service
C.C.S. Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 250 Mc/s
V_a = max. 750 V
W_{ia} = max. 2x60 W
W_a = max. 2x20 W
I_a = max. 2x110 mA
V_{g2} = max. 300 V
W_{g2} = max. 2x3,5 W
$-V_{g1}$ = max. 175 V
I_{g1} = max. 2x5 mA
R_{g1} = max. 50 kΩ
V_{kf} = max. 100 V

f = max. 500 Mc/s
V_a = max. 600 V
W_{ia} = max. 2x50 W

Operating conditions, continuous service
C.C.S. Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

f	=	200	250	430	500 Mc/s
V_a	=	600	750	520	500 V
V_{g1}	=	-80	-80	-80	- V
R_{g1}	=	-	-	-	20 kΩ
V_{g2}	=	250	250	250	250 V
I_a	=	2x100	2x80	2x100	2x100 mA
I_{g1}	=	2x2,5	2x1,5	2x2,8	2x3 mA
I_{g2}	=	16	17	18	20 mA
$V_{g1g1'p}$	=	200	250	-	- V
W_{g2}	=	4	4,25	4,5	5 W
W_{ia}	=	2x60	2x60	2x52	2x50 W
W_a	=	2x15	2x17,5	2x19	2x20 W
W_o	=	90	85	66	60 W
η	=	75	71	64	60 %

H.F. class C telegraphy, two systems in push-pull; continued
H.F. classe C télégraphie, deux systèmes en push-pull; continuation
HF Klasse C Telegraphie, zwei Systeme in Gegentakt; Fortsetzung

---

I.C.A.S

Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 250 Mc/s
V_a = max. 750 V
W_{ia} = max. 2x75 W
W_a = max. 2x22,5 W
I_a = max. 2x120 mA
V_{g2} = max. 300 V
W_{g2} = max. 2x4 W
$-V_{g1}$ = max. 175 V
I_{g1} = max. 2x5 mA
R_{g1} = max. 50 kΩ
V_{kf} = max. 100 V

f = max. 500 Mc/s
V_a = max. 600 V
W_{ia} = max. 2x60 W

I.C.A.S

Operating conditions, intermittent service
Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

f = 250 Mc/s
V_a = 750 V
V_{g1} = -80 V
V_{g2} = 250 V
I_a = 2x90 mA
I_{g1} = 2x1,7 mA
I_{g2} = 14 mA
$V_{g1g1'p}$ = 260 V
W_{g2} = 3,5 W
W_{ia} = 2x67,5 W
W_a = 2x19,5 W
W_o = 96 W
η = 71 %

H.F. class C anode and screen grid modulation, two systems in push-pull
H.F. classe C modulation d'anode et de grille-écran, deux systèmes en push-pull
HF Klasse C Anoden- und Schirmgittermodulation, zwei Systeme in Gegentakt

C.C.S. Limiting values, continuous service
Caractéristiques limites, service continu
Grenzdaten, Dauerbetrieb

f = max. 250 Mc/s
V_a = max. 600 V
W_{ia} = max. 2x45 W
W_a = max. 2x14 W
I_a = max. 2x92 mA
V_{g2} = max. 300 V
W_{g2} = max. 2x3,5 W[1])
W_{g2} = max. 2x2,3 W[2])
$-V_{g1}$ = max. 175 V
I_{g1} = max. 2x5 mA

R_{g1} = max. 50 kΩ[3])
R_{g1} = max. 25 kΩ[4])
V_{kf} = max. 100 V

f = max. 500 Mc/s
V_a = max. 480 V
W_{ia} = max. 2x33,5 W

C.C.S. Operating conditions, continuous service
Caractéristiques d'utilisation, service continu
Betriebsdaten, Dauerbetrieb

f	=	60	250	Mc/s
V_a	=	600	600	V
V_{g2}	=	250	250	V
V_{g1}	=	-80	-80	V
I_a	=	2x75	2x75	mA
I_{g2}	=	20	18	mA
I_{g1}	=	2x3,8	2x1,6	mA
V_{g1_p}	=	105	130	V
W_{g2}	=	5	4,5	W
W_{ia}	=	2x45	2x45	W
W_a	=	2x9,5	2x13	W
W_o	=	71	64	W
η	=	79	71	%
m	=	100	100	%
V_{g2_p}	=	90	90	V
W_{mod}	=	45	45	W

---

[1])Screen grid modulated via a choke
La grille-écran modulée à travers une bobine de choc
Schirmgitter moduliert über eine Drosselspule

2),3),4) See page 6; voir page 6; siehe Seite 6

H.F. class C anode and screen grid modulation, two systems in push-pull
H.F. classe C modulation d'anode et de grille-écran, deux systèmes en push-pull
HF Klasse C Anoden- und Schirmgittermodulation, zwei Systeme in Gegentakt

I.C.A.S. Limiting values, intermittent service
Caractéristiques limites, service intermittent
Grenzdaten, aussetzender Betrieb

f = max. 250 Mc/s
V_a = max. 600 V
W_{ia} = max. 2x50 W
W_a = max. 2x15 W
I_a = max. 2x100 mA
V_{g2} = max. 300 V
W_{g2} = max. 2x4 W 1)
W_{g2} = max. 2x2,6 W 2)
$-V_{g1}$ = max. 175 V
I_{g1} = max. 2x5 mA

R_{g1} = max. 50 kΩ 3)
R_{g1} = max. 25 kΩ 4)
V_{kf} = max. 100 V

f = max. 500 Mc/s
V_a = max. 480 V
W_{ia} = max. 2x40 W

I.C.A.S. Operating conditions, intermittent service
Caractéristiques d'utilisation, service intermittent
Betriebsdaten, aussetzender Betrieb

f	=	60	250	Mc/s
V_a	=	600	600	V
V_{g2}	=	250	250	V
V_{g1}	=	-80	-80	V
I_a	=	2x83	2x83	mA
I_{g2}	=	16	16	mA
I_{g1}	=	2x4	2x1,7	mA
V_{g1_p}	=	105	130	V
W_{g2}	=	4	4	W
W_{ia}	=	2x50	2x50	W
W_a	=	2x10,5	2x14,5	W
W_o	=	79	71	W
η	=	79	71	%
m	=	100	100	%
V_{g2_p}	=	90	90	V
W_{mod}	=	50	50	W

---

1) See page 5, voir page 5; siehe Seite 5
2) For all other modulation methods
Pour toutes les autres méthodes de modulation
Für alle andere Modulationsarten
3) Per system; par système; pro System
4) Per tube; par tube pro Röhre

H.F. class C frequency tripler, two systems in push-pull
H.F. classe C tripleur de fréquence, deux systèmes en push-pull
HF - Klasse C Frequenzverdreifacher, zwei Systeme in Gegentakt

---

Limiting values
Caractéristiques limites
Grenzdaten

f = max. 250 Mc/s

V_a = max. 750 V

W_{ia} = max. 2x60 W

W_a = max. 2x20 W

I_a = max. 2x110 mA

V_{g2} = max. 300 V

W_{g2} = max. 2x3,5 W

$-V_{g1}$ = max. 175 V

I_{g1} = max. 2x5 mA

R_{g1} = max. 50 kΩ

V_{kf} = max. 100 V

f = max. 500 Mc/s

V_a = max. 600 V

W_{ia} = max. 2x 50 W

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

λ	=	6/2	6/2	4/1,3	m
V_a	=	500	400	400	V
V_{g1}	=	-150	-150	-150	V
V_{g2}	=	250	250	250	V
I_a	=	2x60	2x73	2x65	mA
I_{g1}	=	2x 3	2x2,5	2x 1,5	mA
I_{g2}	=	10	16	20	mA
$V_{g1g1'p}$	=	360	360	360	V
W_{ig1}	=	2x0,6	2x0,5	2x 0,3	W
W_{g2}	=	2,5	4	5	W
W_{ia}	=	2x30	2x29	2x26	W
W_a	=	2x20	2x20	2x20	W
W_o	=	20	18	12	W
η	=	33	31	23	%

Pulse modulator
Modulateur par impulsion
Impulsmodulator

Limiting values
Caractéristiques limites
Grenzdaten

V_a 1) = max. 7 kV
V_{a_p} 2) = max. 8 kV
W_a = max. 2x7,5 W
W_{ia} = max. 2x30 W
V_{g_2} 1) = max. 850 V

$I_{g_2 p}$ = max. 2x1 A
W_{g_2} = max. 2x1,5 W
$-V_{g_1}$ 1) = max. 200 V
$V_{g_1 p}$ = max. 450 V
$I_{g_1 p}$ = max. 2x1 A
W_{g_1} = max. 2x0,5 W
V_{kf} = max. 100 V
T_{imp} = max. 1,2 μsec

I_{a_p} (T_{imp} = max. 1,2 μsec) = max. 5 A
I_{a_p} (T_{imp} = max. 0,2 μsec) = max. 6 A

Pulse repetition rate
Fréquence des impulsions = max. 1250 c/s
Impulsfrequenz

Duty cycle
Cycle d'opération = max. 0,0015
Arbeitsperiode

Operating conditions
Caractéristiques d'opération
Kenndaten

V_a	=	7	7 kV
V_{g_2}	=	850	650 V
V_{g_1}	=	-200	-200 V
$V_{g_1 p}$	=	450	450 V
R_a	=	400	1000 Ω
I_{a_p}	=	5	6 A
T_{imp}	=	1,2	0,13 μsec
Pulse repetition rate Fréquence des impulsions Impulsfrequenz	=	1250	500 c/s
Duty cycle Cycle d'opération Arbeitsperiode	=	0,0015	0,000 065
Time of rise Temps de montée Ansteigzeit	=		0,01 μsec

---

1) See page 9; voir page 9; siehe Seite 9
2) Due to transients
Pour des tensions transitoires
Für Ausgleichsspannungen

---

[1] The tube should be protected by sufficient DC resistance in the supply circuit of the anode, the screen grid and the control grid, so that in case of short-circuit the current is limited to 0.5 A in each circuit

Le tube doit être protégé par des résistances ohmiques de valeur suffisante dans les circuits de l'anode, de la grille-écran et de la grille de commande, de sorte qu'en cas de court-circuit le courant soit limité dans chaque circuit à 0,5 A

Die Röhre soll mittels ohmscher Widerstände genügender Grösse in den Anoden-, Schirmgitter- und Steuergitterleitungen geschützt werden, so dass bei Kurzschluss der Strom in jeder Leitung auf 0,5 A begrenzt wird

L.F. class B amplifier and modulator without grid current
Amplificatrice et modulatrice B.F. classe B sans courant de grille
NF-Verstärker und Modulator Klasse B ohne Gitterstrom

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 600 V
W_{ia} = max. 2x60 W
W_a = max. 2x20 W
I_a = max. 2x110 mA
V_{g2} = max. 300 V
W_{g2} = max. 2x3,5 W
R_{g1} = max. 50 kΩ
V_{kf} = max. 100 V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

V_a	=	600		450		300	V
V_{g1} [1]	=	-27,5		-27,5		-26	V
V_{g2}	=	250		250		250	V
$R_{aa'}$	=	12,5		10		6,5	kΩ
$V_{g1g1'p}$	=	0	55	0	55	0	52	V
I_a	=	2x20	2x62	2x20	2x58	2x20	2x56	mA
I_{g2}	=	0,9	23	1,4	27	2,2	28	mA
W_{g2}	=	0,2	5,8	0,4	6,7	0,6	7,0	W
W_{ia}	=	2x12	2x37	2x9,0	2x26	2x6,0	2x16,8	W
W_a	=	2x12	2x12	2x9,0	2x8,5	2x6,0	2x5,6	W
W_o	=	0	50	0	35	0	22,5	W
d_{tot}	=	-	2,4	-	3.1	-	2,9	%
η	=	-	67,5	-	67,5	-	67	%

---

[1] Individual adjustment of the grid bias of each system is recommended
Il est recommandé de régler la polarisation négative de chaque système individuellement
Es wird empfohlen die Gittervorspannung jedes Systems einzeln zu regeln.

QQE 06/40

L.F. class B amplifier and modulator with grid current
Amplificatrice et modulatrice B.F. classe B avec courant de grille
NF-Verstärker und Modulator Klasse B mit Gitterstrom

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 600 V
W_{ia} = max. 2x60 W
W_a = max. 2x20 W
I_a = max. 2x110 mA
V_{g2} = max. 300 V
W_{g2} = max. 2x3,5 W
I_{g1} = max. 2x5 mA
R_{g1} = max. 50 kΩ
V_{kf} = max. 100 V

Operating conditions
Caractéristiques d'utilisation
Betriebsdaten

V_a	=	600		450		300		V
V_{g1} 1)	=	-25		-25		-25		V
V_{g2}	=	250		250		250		V
$R_{aa'}$	=	8,0		6,0		4,0		kΩ
$V_{g1g1'p}$	=	0	78	0	76	0	75	V
I_a	=	2x25	2x100	2x25	2x97	2x25	2x94	mA
I_{g1}	=	0	2x2,6	0	2x2,6	0	2x2,6	mA
I_{g2}	=	1,2	26	1,9	28	2,8	28	mA
W_{ig1}	=	0	2x0,1	0	2x0,1	0	2x0,1	W
W_{g2}	=	0,3	6,5	0,5	7,0	0,7	7,0	W
W_{ia}	=	2x15	2x60	2x11,2	2x43,5	2x7,5	2x28,2	W
W_a	=	2x15	2x17	2x11,2	2x13,5	2x7,5	2x9,7	W
W_o	=	0	86	0	60	0	37	W
d_{tot}	=	-	5	-	5	-	5	%
η	=	-	71,5	-	69	-	65,5	%

---

1) Individual adjustment of the grid bias of each system is recommended
Il est recommandé de régler la polarisation négative de chaque système individuellement
Es wird empfohlen die Gittervorspannung jedes Systems einzeln zu regeln

TRIODE for use as H.F. and L.F. amplifier and oscillator, suitable for grounded-grid circuits
TRIODE pour utilisation comme amplificatrice H.F. et B.F. et oscillatrice, propre aux circuits "grounded-grid"
TRIODE zur Verwendung als H.F. und N.F. Verstärker und Oszillator, geeignet für Gitterbasisschaltungen

Cooling : radiation/low velocity air flow
Refroidissement: radiation/léger courant d'air
Kühlung : Strahlung/schwacher Luftstrom

Filament : thoriated tungsten
Filament : tungstène thorié
Heizfaden: thoriertes Wolfram

Heating : direct
Chauffage: direct
Heizung : direkt
V_f = 6,3 V
I_f = 5,4 A

Capacitances
Capacités
Kapazitäten
C_a = 0,1 pF
C_g = 4,3 pF
C_{ag} = 5,2 pF

Typical characteristics
Caractéristiques typiques
Kenndaten
μ = 25
S (I_a = 44 mA) = 2,8 mA/V

λ	Freq.	C. telegr.		C osc.		B teleph.		Can. mod.	
m	Mc/s	Va (V)	Wo (W)	Va (V)	Wo (W)	Va (V)	Wo (W)	Va (V)	Wo (W)
4	75	2500	390			2500	65	2000	204
		2000	295			2000	64	1500	153
		1500	210			1500	59	1000	95
		1000	126						
2	150			2500	376				
				2000	282				
1,5	200			2000	198				

Limiting values
Caractéristiques limites
Grenzdaten

Va = max. 2500 V
Wa = max. 135 W 1)
Wg = max. 16 W
Rg = max. 0,1 MΩ 2)
Rg = max. 0,2 MΩ 3)
Ik = max. 250 mA
Ikp = max. 1,6 A

temperature of anode seal
temp. de la sortie supérieure
Temp. des Anodenverschlusses
= max. 220 °C

bottomtemperature
température du fond
Bodentemperatur
= max. 180 °C

It is necessary to direct a low velocity air flow on bottom and top seal if the valve is used at or near maximum ratings at frequencies above 50 Mc/s

Il faut diriger un léger courant d'air sur le fond et la partie supérieure du tube, lorsqu'il est utilisé à ou près de ses caractéristiques limites aux fréquences supérieures à 50 Mc/s

Ein schwacher Luftstrom auf den Boden und den Anodenverschluss ist notwendig, wenn die Röhre bei oder nahe den Grenzdaten bei Frequenzen höher als 50 MHz benutzt wird

Mounting position: vertical with base up or down
Montage : vertical avec le pied en haut ou en bas
Aufstellung : senkrecht mit Fuss oben oder unten

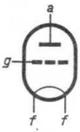
---

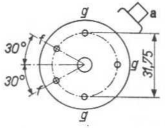
1) Anode red hot, temperature = 850 °C
Anode portée au rouge, température = 850 °C
Anode rot glühend, Temperatur = 850 °C

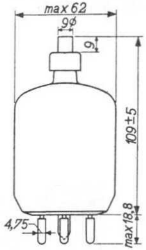
2) With fixed grid bias; à polarisation fixe; mit fester Gittervorspannung

3) With automatic grid bias; à polarisation automatique; mit automatischer Gittervorspannung

Dimensions in mm
Dimensions en mm
Abmessungen in mm







Base, culot, Sockel: GIANT 5p.

Clip Borne de connexion Anschlussklemme	40624
Socket Support Fassung	40211/01
Socket with grid connections grounded Support avec les connexions de la grille mise à la terre Fassung mit geerdeten Gitteranschlüssen	40215/01
Net weight Poids net Nettogewicht	110 g
Shipping weight (5 valves) Poids brut (5 tubes) Bruttogewicht (5 Röhren)	3,5 kg

Operating conditions H.F. class C telegraphy
Caractéristiques d'utilisation H.F. classe C télégraphie
Betriebsdaten H.F. Klasse C Telegraphie

λ	=	4	4	4	4	m
Va	=	2500	2000	1500	1000	V
Vg	=	-200	-150	-110	-80	V
Ia	=	205	205	205	205	mA
Ig	=	40	40	40	40	mA
Vgp	=	390	340	300	260	V
Wig	=	14	13	11	10	W
Wia	=	512	410	308	205	W
Wa	=	122	115	98	79	W
Wo	=	390	295	210	126	W
η	=	76	72	68	61,5	%

Operating conditions H.F. class B telephony
Caractéristiques d'utilisation H.F. classe B téléphonie
Betriebsdaten H.F. Klasse B Telephonie

λ	=	4	4	4	m
Va	=	2500	2000	1500	V
Vg	=	-87	-67	-45	V
Ia	=	77	97	120	mA
Vgp	=	100	100	100	V
Wia	=	193	194	180	W
Wa	=	128	130	121	W
Wo	=	65	64	59	W
η	=	34	33	33	%

m	=	100	100	100	%
Ig	=	20	28	52	mA
Wig	=	3,6	5,1	9,4	W

Operating conditions H.F. class C anode modulation
Caractéristiques d'utilisation H.F. classe C modulation d'anode
Betriebsdaten H.F. Klasse C Anodenmodulation

λ	=	4 1)	4 1)	4 1)	m
Va	=	2000	1500	1000	V
Vg	=	-225	-180	-130	V
Ia	=	255	255	255	mA
Ig	=	80	80	80	mA
Vgp	=	415	370	320	V
Wig	=	30	27	23	W
Wia	=	510	382	255	W
Wa	=	102	76	65	W
Wo	=	408	306	190	W
η	=	80	80	74,5	%

m	=	100	100	100	%
Wmod	=	255	191	126	W

Operating conditions as H.F. class C oscillator
Caractéristiques d'utilisation comme oscillatrice H.F. classe C
Betriebsdaten als H.F. Klasse C Oszillator

λ	=	2 1)	2 1)	1,5 1)	m
Va	=	2500	2000	2000	V
Ia	=	410	410	346	mA
Ig	=	80	80	80	mA
Rg	=	2500	1875	1875	Ω
Wia	=	1025	820	692	W
Wa	=	245	230	270	W
Wig	=	28	26	26	W
Wo	=	752	564	396	W
η	=	73	69	57	%

---

1) Two valves; deux tubes; zwei Röhren

Operating conditions as H.F. class C oscillator for high frequency heating and diathermy generators
Caractéristiques d'utilisation comme oscillatrice H.F. classe C pour chauffage à haute fréquence et générateurs H.F. pour diathermie
Betriebsdaten als H.F. Klasse C Ossillator für Hochfrequenzheizung und Diathermiegeneratoren

A. With anode voltage from single phase full wave rectifier without filter
Avec tension anodique de redresseur monophasé deux tubes sans filtre
Mit Anodenspannung von Einphasen-Vollweggleichrichter ohne Filter

λ = 7,3 m
Va = 2000 V 1)
Ia = 170 mA
Ig = 34 mA
Rg = 3750 Ω
Wia = 420 W
Wa = 120 W
Wig = 10 W
Wo = 290 W
η = 69 %

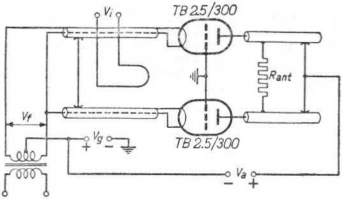
B. With anode and grid alternating voltage. Phaseshift 180° between Va and Vg
Avec tension alternative de l'anode et de la grille. Décalage de phase entre Va et Vg = 180°
Mit Anoden- und Gitterwechselspannung. Phasenverschiebung zwischen Va und Vg = 180°

λ = 7,3 m
Va = 2500 Veff
Ia = 90 mA
Ig = 20 mA
Rg = 1700 Ω
Vg = 85 Veff
Wia = 255 W
Wa = 85 W
Wo = 170 W
η = 67 %

---

1) Mean value; valeur moyenne; Mittelwert

Operating conditions H.F. class C telegraphy, grounded grid
Caractéristiques d'utilisation H.F. classe C télégraphie, circuit "grounded-grid"
Betriebsdaten H.F. Klasse C Telegraphie, Gitterbasisschaltung



λ	=	3 1)	3 1)	3 1)	3 1)	m
Va	=	2500	2000	1500	1000	V
Vg	=	−200	−150	−110	−80	V
Ia	=	410	410	410	410	mA
Ig	=	80	80	80	80	mA
Vgp	=	390	340	300	260	V
Wig	=	158	136	118	100	W
Wia	=	1025	820	615	410	W
Wa	=	245	230	195	158	W
Wo 2)	=	780+130	590+110	420+96	252+80	W
η 3)	=	76	72	68	61,5	%

---

1) Two valves; deux tubes; zwei Röhren

2) Power transferred from driving stage included
Y compris l'énergie transmise de l'étage préamplificateur
Einschliesslich der vom Vorverstärker übertragenen Leistung

3) Pure valve efficiency; rendement net du tube; reiner Röhrenwirkungsgrad

TB 2.5/300

L.F. class B amplifier and modulator
Amplificatrice et modulatrice B.F. classe B
N.F.-Verstärker und Modulator Klasse B

Limiting values
Caractéristiques limites
Grenzdaten

V_a = max. 2500 V
W_a = max. 135 W
W_g = max. 16 W
I_k = max. 250 mA
I_{k_p} = max. 1,6 A

Operating conditions, two valves
Caractéristiques d'utilisation, deux tubes
Betriebsdaten, zwei Röhren

V_a	=	2500		2000		V
V_g	=	-86		-65		V
R_{aa}	=	18,2		12,0		kΩ
V_{gg_p}	=	0	412	0	394	V
I_a	=	2x30	2x178	2x30	2x208	mA
I_g	=	0	2x42	0	2x42	mA
W_{ig}	=	0	2x7,8	0	2x7,3	W
W_{ia}	=	2x75	2x445	2x60	2x416	W
W_a	=	2x75	2x95	2x60	2x101	W
W_o	=	0	700	0	630	W
d_{tot}	=	-	5,0	-	3,7	%
η	=	-	78,5	-	76	%

V_a	=	1500		1000		V
V_g	=	-46		-23		V
R_{aa}	=	8,5		5,0		kΩ
V_{gg_p}	=	0	340	0	295	V
I_a	=	2x30	2x210	2x30	2x210	mA
I_g	=	0	2x40	0	2x40	mA
W_{ig}	=	0	2x6,1	0	2x5,4	W
W_{ia}	=	2x45	2x315	2x30	2x210	W
W_a	=	2x45	2x90	2x30	2x73	W
W_o	=	0	450	0	274	W
d_{tot}	=	-	2,9	-	2,2	%
η	=	-	71,5	-	65	%

NOTES:

EXPLANATION OF FREQUENCY DISTRIBUTION DIAGRAM

The diagram printed here of the radio spectrum has been drawn in accordance with the official "Table of Frequency Allocations" of the International Telecommunications Union, as a result of the convention held in Atlantic City in 1947.

From the map of the world that goes with this article it can be seen that the distribution is in three Regions for which there are separate frequency divisions.

Since only slight differences exist between the frequency distributions of Reg. 2 and Reg. 3, both are combined in one column which holds good for the whole of Reg. 2. It has been possible to give the majority of the differences for Reg. 3 in the list of special regulations (figures in frequency diagram refer to the article of the same number). The remainder for Reg. 3 are:

A. 3 500 . . . . 3 900 kc/s Amateurs, Fixed and Mobile Service; 3 900 . . . . 4 000 kc/s Broadcasting; in addition: 3 900 . . . . 3 950 kc/s Mobile Airtraffic Service, and 3950 . . . . 4 000 kc/s Fixed Service.

B. 4 438 . . . . 4 650 kc/s Fixed and Mobile Service with the exception of mobile Air-traffic.

C. 5 430 . . . . 5 480 kc/s: the same as Reg. 1.

At the right of the diagram the colour code is given. The notations used and the differences between the various services are to be explained as follows: —

Fixed Service: this includes stations for telegraph and telephone communications, facsimile, telex, etc.

Mobile Service: this includes traffic between ships, aeroplanes and vehicles with land stations.

Radio Navigation Service: this includes DF apparatus, beacon stations, Decca, Loran, etc., electronic altimeters, radar, etc.

These services are further sub-divided into various kinds of stations, as shown by the colour code.

TV stations also belong to the Broadcasting Service. The Amateur Service includes fixed as well as mobile amateur stations.

ARTICLES BELONGING TO THE DISTRIBUTION OF FREQUENCIES RESULTING FROM "ATLANTIC CITY 1947"*)

The figures refer at the same time to the radio spectrum diagram.

N.B. By "part of Africa" are understood the following countries:

Union of South Africa, the Territory of S.W. Africa, Northern-Rhodesia and Southern-Rhodesia.
UK = United Kingdom (England, N. Ireland, Scotland and Wales).

1) Limited to coastal telegraph stations using unmodulate emissions (A 1 only).

2) In Region 1, Australia and New Zealand, the frequency bands 70-72 kc/s and 84-86 kc/s are reserved for the exclusive use of continuous wave systems of radio navigation.

3) The development of long-distance radio navigation systems is authorized in this band, which will become exclusively allocated wholly or in part for the use of any one such

---

*) The new regulations as applicable to the Amateur Service resulting from the 1959 Administrative Radio Conference in Geneva effective from May 1st 1961 can be found on page O17

system as soon as it is internationally adapted. Other considerations being equal, preference should be given to the system requiring the minimum band-width for worldwide service and causing the least harmful interference to other services. If a pulse radio navigation system is employed, the pulse emissions must nevertheless be confined within the band, and must not cause harmful interference outside the band to stations operating in accordance with the Regulations.
During the experimental period prior to the international adaptation of any long-distance radio navigation system in this band, the rights of existing stations operating in this band will continue to be recognized.

[4]) In Region 1, Australia and New-Zealand, the frequency bands 112-115 kc/s and 126-129 kc/s are reserved for the exclusive use of continuous wave systems of radio navigation.

[5]) The frequency 143 kc/s is the calling frequency for stations in the maritime mobile service using the band 110-160 kc/s. The conditions for its use are prescribed in article 33.

[6]) Limited to ship stations (telegraphy exclusively).

[7]) The fixed service is authorized, provided no harmful interference is caused to ship telegraphy in the North Atlantic and the Mediterranean areas.

[8]) By special arrangement.

[9]) The maritime mobile service must not cause harmful interference to the reception of broadcasting stations within the boundaries of the national territories in which the broadcasting stations are situated.

[10]) In the Union of South Africa, the territory under mandate of Southwest Africa, Northern-Rhodesia and Southern-Rhodesia, the band 160-200 kc/s is allocated for the fixed service and the band 200-285 kc/s is allocated for the aeronautical radio navigation and aeronautical mobile services.

[11]) The necessary special arrangements which will be made by an Administrative Conference for the European Area of Region 1 will take into account the following considerations:
a. In the western part of the European Area, the band 255-285 kc/s will be used for the aeronautical radio navigation service. Additionally the United Kingdom will share portions of the band with the maritime mobile service.
b. In the U.S.S.R. the band 255-285 kc/s will be shared between the broadcasting and maritime mobile services.
c. The Norwegian broadcasting stations at present working in the band 255-285 kc/s may continue to do so if authorized by the above-mentioned Conference.

[12]) Priority is given to the aeronautical fixed service in northern areas which are subject to auroral disturbances.

[13]) Priority is given to the aeronautical radio navigation service in Region 2, China, India and Pakistan.

[14]) In the U.S.S.R., the band 315-325 kc/s is used for the maritime radio navigation service, while the remainder of Region 1 uses this band for the aeronautical radio navigation

service. The maritime radio navigation service will be operated so as not to interfere with the aeronautical radio navigation service in the North Sea area.

The aeronautical radio navigation service will be operated so as not to interfere with the maritime radio navigation service in the Black Sea and White Sea areas.

The maritime radio navigation and aeronautical radio navigation services will be operated in accordance with a frequency assignment plan agreed by the various interested administrations to avoid interference in the Baltic Sea area.

15) In Region 2, the aeronautical radio navigation service is permitted in the band 285-325 kc/s, provided that no harmful interference is caused to the maritime radio navigation service.

16) In Region 3, the maritime radio navigation service has priority.

17) The aeronautical radio navigation has priority, except in New-Zealand.

18) In Regions 1 and 3, the frequency 333 kc/s is the general calling frequency for aircraft stations in the band 325-405 kc/s.

19) This band is allocated exclusively to the aeronautical mobile and aeronautical radio navigation services. Nevertheless, in the European Area, subject to authorization by the regional agreement concluded by the next European Regional Broadcasting Conference and the conditions specified in that agreement, the administrations concerned may place in the bands 325-365 kc/s and 395-405 kc/s those of the following broadcasting stations which will not cause harmful interference to the aeronautical mobile and aeronautical radio navigation services.

The broadcasting stations now in operation in the whole of the band 325-405 kc/s are:

Banska Bystrica
Bergen
Finnmark
Lulea

20) The fixed stations in Scandinavia now operating in the band 385-395 kc/s may continue to do so by special arrangement.

21) The frequency 410 kc/s is designated for the maritime radio navigation service (radio direction-finding). Other services shall not cause harmful interference to radio direction-finding.

22) The use of the band 405-415 kc/s by the radio navigation services is limited to radio direction-finding, except as indicated in a. and b. below:

a. in the Baltic and North Sea areas this band may also be used for the maritime radio navigation service for radiobeacon stations of mean power not exceeding 10 watts and subject to not causing harmful interference to radio direction-finding;

b. in the U.S.S.R. this band may also be used for the aeronautical radio navigation service on the basis of not causing harmful interference to the service provided by the existing radio direction-finding stations and the radiobeacon stations referred to in subsection a. above.

23) In Region 2, in addition to the provisions of Note 21, the aeronautical radio navigation service has priority over the aeronautical mobile service.

24) The band 415-490 kc/s is allocated exclusively to the maritime mobile service on a world-wide basis, and the band 510-525 kc/s is allocated exclusively to that service in Region 1. Nevertheless, in the European Area, subject to authorization by the regional agreement concluded by the next European Regional Broadcasting Conference and

to the conditions specified in that agreement, the administrations concerned may place in the bands 415-485 kc/s and 515-525 kc/s such of the following broadcasting stations as will not cause harmful interference to the maritime mobile service

Geneva Oestersund
Hamar Innsbrück Oulu

25) Limited to telegraphy.

26) The frequency 500 kc/s is the international distress and calling frequency. The conditions for its use are prescribed in article 33 of the Atlantic City 1947, Radio Regulations.

27) In Region 3, the maritime mobile service has priority in the band 510-525 kc/s.

28) In the Union of South Africa, the territory under mandate of Southwest Africa, Northern-Rhodesia and Southern-Rodesia, the band 525-535 kc/s is used for mobile service.

29) In the territory of the U.S.S.R., the band 1 560-1 605 kc/s is shared with the fixed service. In the European Area, the fixed service in the U.S.S.R. and the broadcasting service in the neighbouring countries operate subject to the condition of avoiding harmful interference on a reciprocal basis.

30) Special arrangements will determine the conditions of operation of stations of the fixed and mobile services in order to protect these services from mutual-harmful interference, having special regard to the difficulties of operation of the maritime mobile service.

31) In the band 1 715-2 000 kc/s, Austria, Ireland, the Netherlands, Northern-Rhodesia, Southern-Rhodesia, Switzerland, the Union of South Africa and the United Kingdom may assign up to 200 kc/s for the amateur service, provided that the mean power of any amateur station does not exceed 10 watts and that no harmful interference is caused to the authorized services of other countries.

32) The operation of Loran radionavigation stations is authorized temporarily on 1 950 kc/s (the band occupied being 1 925-1 975 kc/s) provided that, except for the stations comprising the North-East Atlantic Loran System (north of latitude 55° N), the establishment and operation of specific Loran stations shall be the subject of special arrangements among administrations having operations that would be affected. All practicable measures shall be taken to reduce harmful interference from Loran transmissions to other services to which this band or adjacent bands are allocated.

33) In any particular area the Loran system of radio navigation operates either on 1 850 or 1 950 kc/s, the band occupied being 1 800-1 900 kc/s or 1 900-2 000 kc/s.
Any of the authorized services may employ whichever of these two bands is not required for Loran, on condition that they do not cause harmful interference to Loran.

34) The frequency 2 182 kc/s is the distress and calling frequency for the maritime mobile service (telephony). The interested administrations will ensure, by special arrangement where necessary, that an adequate guardband is provided. The conditions for the use of this frequency are prescribed in article 34.

35) For the explanation of the terms "Aeronautical Mobile (R)" and "Aeronautical Mobile (OR)" see G and H. (The text of these sections commences on page 12 of this booklet under Atlantic City Footnotes.)

36) For the conditions of use of this band by the broadcasting service see A, B, and C-F. (The text of these sections commences on page 12 of this booklet under Atlantic City Footnotes.)

37) In Region 2, provision will be made for coastal telegraphy in the maritime mobile service by special arrangement.

38) The standard frequency is 2 500 kc/s.

39) Special arrangements will determine the conditions of operation of stations of the fixed and mobile services in order to protect these services from mutual harmful interference having special regard to the difficulties of operation of the maritime mobile service and also to the needs of the fixed service in certain areas.

40) In the U.S.S.R., in the bands 4 063 - 4 133 kc/s and 4 408 - 4 438 kc/s, fixed stations of limited power may operate provided that, in order to minimize the possibility of causing harmful interference to the maritime mobile service, they are situated at least 600 km from the coast. A limited power station is one whose power and antenna characteristics are so adjusted that the field strength established at any point in any direction does not exceed that obtainable with a non-directive antenna and a peak power of 1 kilowatt.

41) In addition to the provisions of 40, the band 4 063 - 4 438 kc/s may be used, exceptionally and on the essential condition that harmful interference is not caused to the maritime mobile-service, by fixed stations of mean power not exceeding 50 watts communicating only within the national boundaries of the countries concerned. At the time of notification of these cases, the attention of the International Frequency Registration Board is drawn to the above condition.

42) The standard frequency is 5 000 kc/s.

43) The band 6 200 - 6 525 kc/s may be used, exceptionally and on the essential condition that harmful interference is not caused to the maritime mobile service, by fixed stations of mean power not exceeding 50 watts communicating only within the national boundaries of the countries concerned. At the time of notification of these cases the attention of the International Frequency Registration Board is drawn to the above condition.

44) In Region 1, the use of the band 7 100 - 7 150 kc/s by the amateur servise is authorized provided that no harmful interference is caused to the broadcasting service. However, in the Union of South Africa and the territory under mandate of Southwest Africa, the band 7 100 - 7 150 kc/s will be used exclusively for the amateur service.

45) In Australia and Indonesia, the band 7 100 - 7 150 kc/s and in China and New Zealand, the band 7 100 - 7 300 kc/s may be allocated to the amateur service. The administrations of the countries mentioned in this note shall take all practicable steps to avoid causing any harmful interference to the broadcasting service and will ensure that amateur stations do not use a peak power exceeding 100 watts. If, however, harmful interference to the broadcasting service is experienced, these administrations will consider reducing the use of these bands by the amateur service.

46) Between 8 615 and 8 815 kc/s, the U.S.S.R. will meet their special requirements for the fixed service with due regard to technical provisions (power, location, antenna, etc.) with a view to minimizing the possibility of harmful interference with the maritime mobile service. Coast stations in the maritime mobile service will also have due regard

to technical provisions (power, location, antenna, etc.) with a view to minimizing the possibility of harmful interference with the fixed service in the U.S.S.R. The International Frequency Registration Board will be consulted regarding these arrangements.

(47) The standard frequency is 10 000 kc/s.

(48) In the U.S.S.R., the band 11 400-11 450 kc/s is used for the aeronautical mobile (OR service on a shared basis.

(49) Between 12 925 and 13 200 kc/s, the U.S.S.R. will meet their special requirements for the fixed service with due regard to technical provisions (power, location, antenna, etc.) with a view to minimizing the possibility of harmful interference with the maritime mobile service. Coast stations in the maritime mobile service will also have due regard to technical provisions (power, location, antenna, etc.) with a view to minimizing the possibility of harmful interference with the fixed service in the U.S.S.R. The International Frequency Registration Board will be consulted regarding these arrangements.

(50) The frequency 13 560 kc/s is designated for industrial, scientific and medical purposes. Emissions must be confined within the limits of ± 0.05% of this frequency. Radio communication services operating within these limits must accept any harmful interference that may be experienced from the operation of industrial, scientific and medical equipment.

(51) In the U.S.S.R., the band 14 250-14 350 kc/s is also allocated to the fixed service.

(52) The standard frequency is 15 000 kc/s.

(53) Between 17 160 and 17 360 kc/s, the U.S.S.R. will meet their special requirements for the fixed service with due regard to technical provisions (power, location, antenna, etc.) with a view to minimizing the possibility of harmful interference with the maritime mobile service. Coast stations in the maritime mobile service will also have due regard to technical provisions (power, location, antenna, etc.) with a view to minimizing the possibility of harmful interference with the fixed service in the U.S.S.R. The International Frequency Registration Board will be consulted regarding these arrangements.

(54) The standard frequency is 20 000 kc/s.

(55) Inter-ship telegraphy in the maritime mobile service is permitted in the band 23 350-24 000 kc/s.

(56) The standard frequency is 25 000 kc/s

(57) The frequency 27 120 kc/s is designated for industrial, scientific and medical purposes. Emissions must be confined within the limits of ± 0.6% of that frequency. Radio communication services operating within these limits must accept any harmful interference that may be experienced from the operation of industrial, scientific and medical equipment.

(58) In Region 2, Australia, New Zealand, the Union of South Africa and the territory under mandate of Southwest Africa, the amateur service will operate within the band 26 960-27 230 kc/s.

[59] In the U.S.S.R., the band 29.7-30 Mc/s is allocated additionally to the aeronautical mobile service.

[60] In Australia, the band 29.7-31.7 Mc/s is allocated to the aeronautical radio navigation service.

[61] In the U.S.S.R., the band 30-31.7 Mc/s is allocated to the radio navigation service.

[62] The frequency 40.68 Mc/s is designated for industrial, scientific and medical purposes. Emissions must be confined within the limits of ± 0.05% of that frequency. Radio communication services operating within those limits must accept any harmful interference that may be experienced from the operation of industrial, scientific and medical equipment.

[63] In Region 1, the aeronautical radio navigation service may be accommodated in the band 31.7-41 Mc/s. The operation of standard beam approach equipment, as described in J, is to be protected by special arrangement. (The text of this section commences on page 12 of this booklet under Atlantic City footnotes.)

[64] In the Union of South Africa, the territory under mandate of Southwest Africa, Northern-Rhodesia and Southern-Rhodesia, the band 41-44 Mc/s is allocated to the aeronautical radio navigation, fixed and mobile services; the bands 44-50 Mc/s and 54-68 Mc/s are allocated for the fixed and mobile services in addition to the broadcasting service, the band 50-54 Mc/s being used exclusively for the amateur service.

[65] In the United Kingdom, the band 66.5-68 Mc/s may be used for the fixed and land mobile services under local arrangement with France, in order to avoid mutual harmful interference.

[66] In the U.S.S.R., the band 68-72 Mc/s is allocated for the broadcasting service. The aeronautical radio navigation service in other countries and the broadcasting service in the U.S.S.R. are subject to local arrangement, in order to avoid mutual harmful interference.

[67] In China, the bands 68-72 Mc/s and 76-88 Mc/s are allocated to the broadcasting, fixed and mobile services.

[68] In France and the U.S.S.R., the band 72-72.8 Mc/s is allocated to the amateur service.

[69] In India, the bands 70-72.8 Mc/s and 76-85 Mc/s are allocated exclusively to the broadcasting service.

[70] The frequency 75 Mc/s is designated for aeronautical marker beacons. In Region 1, the guardband is ± 0.2 Mc/s; in Regions 2 and 3, ± 0.4 Mc/s.

[71] In the U.S.S.R., the band 76-108 Mc/s is allocated to the broadcasting service.

[72] The broadcasting service in the U.S.S.R. and the radio navigation service in neighbouring countries are subject to local arrangement as regards avoiding mutual harmful interference.

[73] In the United Kingdom, the band 85-90 Mc/s is allocated to the maritime radio navigation service on a share basis.

[74] In Australia and New Zealand, the band 85-90 Mc/s is allocated to the maritime radio navigation service.

[75] In China, the band 88-108 Mc/s is allocated to the broadcasting and fixed services.

[76] In France, India and the United Kingdom, the meteorological aids service may be operated in the band 94.5-95 Mc/s.

[77] In the United Kingdom, the fixed and land mobile services may be operated in the band 95-100 Mc/s.

[78] In India, the band 95-97.5 Mc/s is allocated to the fixed and mobile services.

[79] In the Union of South Africa, the territory under mandate of Southwest Africa, Northern-Rhodesia and Southern-Rhodesia, the band 100-108 Mc/s is allocated to the broadcasting service and the bands 132-144 Mc/s and 146-174 Mc/s for the fixed and mobile services.

[80] In Australia, the band 100-108 Mc/s is allocated to the aeronautical mobile (OR) service until required for the broadcasting service, and in New Zealand it is allocated for the broadcasting and mobile services.

[81] The frequency 121.5 Mc/s is the aeronautical emergency frequency in this band.

[82] In Australia and New Zealand, the bands 132-144 Mc/s and 148-156 Mc/s are allocated exclusively to the aeronautical mobile (OR) service.

[83] In Region 1, the meteorological aids service may be operated in the band 151-154 Mc/s.

[84] The frequency 156.80 Mc/s is designated for world-wide use for safety, calling and intership and harbour control communications in the maritime mobile service (simplex telephony). Any other use of this frequency should be avoided in areas where such other use is liable to cause harmful interference to the maritime mobile service. The interested administrations will ensure, by special arrangements where necessary, that an adequate guard-band is provided. In Region 2, its use for this purpose will be restricted to the frequency-modulated type of transmission (F3), and it is strongly recommended that the same type of transmission be adapted for this purpose in Regions 1 and 3.

[85] In France, the band 162-174 Mc/s is allocated to the broadcasting service.

[86] In Australia, the band 170-178 Mc/s is allocated to the aeronautical radio navigation service.

[87] In the United Kingdom, the band 174-200 Mc/s is also allocated to the fixed service, and the band 200-216 Mc/s is allocated to the aeronautical radio navigation service.

[88] In the Union of South Africa, the territory under mandate of Southwest Africa, Northern-Rhodesia and Southern-Rhodesia, the band 174-216 Mc/s is also allocated to the fixed and land mobile services.

[89] In the United Kingdom, distance measuring equipment will be operated in the band 200-235 Mc/s until such time as world standardization at 1 000 Mc/s has been accomplished.

[90] In the U.S.S.R., the band 216-260 Mc/s is allocated to the radio navigation service.

[91] In the Union of South Africa, the territory under mandate of Southwest Africa, Northern-Rhodesia and Southern-Rhodesia, the band 220-225 Mc/s is allocated to the amateur service.

[92] In China, the band 200-216 Mc/s is allocated to the broadcasting, fixed and mobile services, and the bands 216-220 Mc/s and 225-235 Mc/s for the fixed and mobile services, the band 220-225 Mc/s being allocated to the amateur service.

[93] In Region 2, distance measuring equipment in the aeronautical radio navigation service may be operated in the band 220-231 Mc/s until the 1st January 1952, in accordance with appropriate bilateral or multilateral arrangements.

[94] The meteorological aids service (radio-sonde) may be operated in the band 400-420 Mc/s.

[95] In the U.S.S.R., the band 412-460 Mc/s is allocated to the radio navigation service.

[96] In the band 420-460 Mc/s, the aeronautical radio navigation service has priority. The other services are admitted to this band only on condition that harmful interference is not caused to the aeronautical radio navigation service.

[97] In Region 2, the allocation to the aeronautical radio navigation service in the band 420-460 Mc/s is temporary and is exclusively for altimeters.

[98] In Region 2, the frequency 915 Mc/s is designated for industrial scientific and medical purposes. Emissions must be confined within the limits of ± 25 Mc/s of that frequency. Radiocommunication services operating within those limits must accept any harmful interference that may be experienced from the operation of industrial, scientific and medical equipment.

[99] In France and Italy, the band 585-685 Mc/s is allocated to the fixed and broadcasting services.

[100] In Region 2, the fixed service may operate in the band 890-940 Mc/s.

[101] In the U.S.S.R., the band 1 215-1 300 Mc/s is allocated to the fixed service, primarily for relaying television.

[102] In Region 2, the band 1 300-1 600 Mc/s is intended for an integrated system of electronic aids to air navigation and traffic control. Administrations of the other Regions should envisage the possibility of the future application of such a system on a worldwide basis.

[103] In the U.S.S.R., the band 1 300-1 600 Mc/s is allocated to the aeronautical radio navigation service.

[104] In Region 2 and the United Kingdom, the use of the band 1 300-1 365 Mc/s is restricted to surveillance radar.

[105] In Regions 1 and 3, the meteorological aids service may be operated in the band 1 700-1 750 Mc/s

[106] In Region 2, Australia, New Zealand, Northern-Rhodesia, Southern-Rhodesia, the Union of South Africa, the territory under mandate of Southwest Africa, and the United Kingdom, the frequency 2 450 Mc/s is designated for industrial, scientific and medical purposes. Emissions must be confined within the limits of ± 50 Mc/s of that frequency. Radiocommunication services operating within these limits mus- accept any harmful interference that may be experienced from the operation of industrial, scientific and medical equipment.

[107] In the U.S.S.R., the band 2 450-2 700 Mc/s is allocated to the aeronautical mobile and the aeronautical radio navigation services.

[108] The meteorological aids service may be operated in the band 2 700- 2 900 Mc/s.

[109] The band 3 246-3 266 Mc/s is designated for racons.

[110] In the band 2 900-3 300 Mc/s shipborne radar in merchant ships is confined with the band 3 000-3 246 Mc/s.

[111] In China, the band 4 200-4 400 Mc/s may be used for the fixed service provided that harmful interference is not caused to the aeronautical radio navigation service.

[112] The band 5 440-5 460 Mc/s is designated for racons.

[113] In the band 5 440-5 650 Mc/s, shipborne radar in merchant ships is confined within the band 5 460-5 650 Mc/s.

[114] In Region 2, Australia, New Zealand, Northern-Rhodesia, Southern-Rhodesia, the Union of South Africa, the territory under mandate of Southwest Africa, and the United Kingdom, the frequency 5 850 Mc/s is designated for industrial, scientific and medical purposes. Emissions must be confined within the limits of ± 75 Mc/s of that frequency. Radio communication services operating within those limits must accept any harmful interference that may be experienced from the operation of industrial, scientific and medical equipment.

[115] In the U.S.S.R., the band 6 900-7 050 Mc/s may be used for the meteorological aids service.

[116] The band 9 300-9 320 Mc/s is designated for racons.

[117] In the band 8 500-9 800 Mc/s shipborne radar in merchant ships is confined within the band 9 320-9 500 Mc/s.

A In principle, the power of broadcasting stations which employ frequencies below 5 060 kc/s must not exceed (except in the band 3 900- 4 000 kc/s) a value which permits of maintaining economically an effective national service of good quality within the limits of the country concerned.

B The use by the broadcasting service of the bands listed below is restricted to the Tropical Zone as defined in E:

2 300-2 498 kc/s (Region 1)
2 300-2-495 kc/s (Regions 2 and 3)
3 200-3 400 kc/s (All Regions)
4 750-4 995 kc/s (All Regions)
5 005-5 060 kc/s (All Regions)

C *Broadcasting in the Tropical Zone.*

D In these Regulations, the expression "broadcasting in the Tropical Zone" indicates a type of broadcasting, for internal national use in countries in the zone defined in E, where it may be shown that because of difficulty of high atmospheric noise level and propagation it is not possible to furnish economically a more satisfactory service through the use of low, medium or very high frequencies.

E The Tropical Zone (see appendix 16) is defined as:

a) the whole of that area in Region 2 contained between the Tropics of Cancer and Capricorn;

b) the whole of that area in Regions 1 and 3 contained between the parallels 30° North and 35° South, with the addition of the area contained between the meridians 40° East and 80° East of Greenwich and the parallels 30° North and 40° North;

c) the zone may be extended, in Region 2, to parallel 33° North, subject to appropriate special arrangements between the countries concerned in that Region.

F The broadcasting service operating inside the Tropical Zone, and other services operating outside the Zone, are subject to the provision of 90.

G Frequencies in any band allocated to the aeronautical mobile (R) service are reserved for communications between any aircraft and those aeronautical stations primarily concerned with the safety and regularity of flight along national or international civil air routes.

H Frequencies in any band allocated to the aeronautical mobile (OR) service are reserved for communications between any aircraft and aeronautical stations other than those primarily concerned with flight along national or international civil air routes.

Standard beam approach equipment, to be accommodated in the band 31.7-41 Mc/s in Region 1, consists of a localizer and markers used to assist aircraft in making landing approach.

For the allocation of frequencies the world has been subdivided into three Regions:

Region 1

Region 1 includes the area limited on the East by line A (lines A, B and C are defined below) and on the West by line B, excluding any of the territory of Iran which lies between these limits. It also includes that part of the territory of Turkey and the Union of Soviet Socialist Republics lying outside of these limits, the territory of the Mongolian People's Republic, and the area to the North of the U.S.S.R. which lies between lines A and C.

Region 2

Region 2 includes the area limited on the East by line B and on the West by line C.

Region 3

Region 3 includes the area limited on the East by line C and on the West by line A, except the territories of the Mongolian People's Republic, Turkey, the territory of the U.S.S.R. and the area to the North of the U.S.S.R. It also includes that part of the territory of Iran lying outside of those limits.

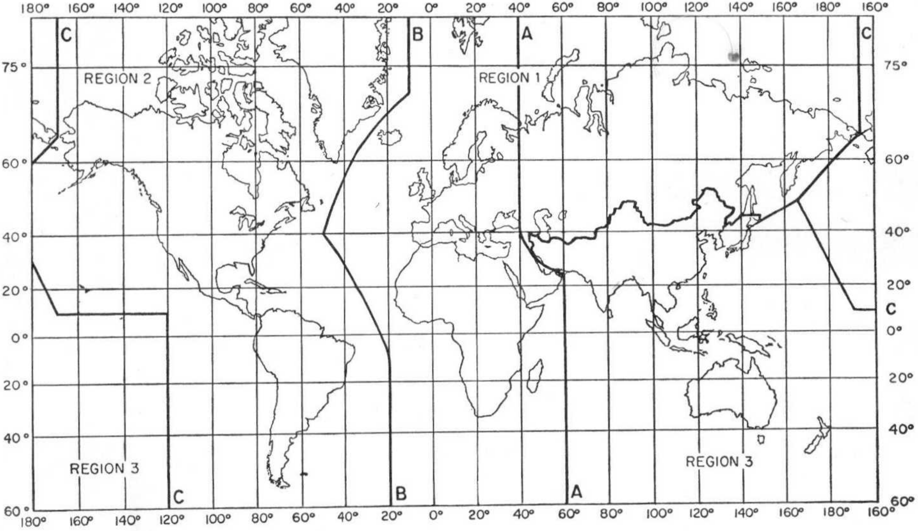
The lines A, B, and C are defined as follows:

Line A: Line A extends from the North Pole along meridian 40° East of Greenwich to parallel 40° North; thence by great circle arc to the intersection of meridian 60° East and the Tropic of Cancer; thence along the meridian 60° East to the South Pole.

Line B: Line B extends from the North Pole along meridian 10° West of Greenwich to its intersection with parallel 72° North; thence by great circle arc to the intersection of meridian 50° West and parallel 40° North; thence by great circle arc to the intersection of meridian 20° West and parallel 10° South; thence along meridian 20° West to the South Pole.

Line C: Line C extends from the North Pole by great circle arc to the intersection of parallel 65° 30′ North with the international boundary in Behring Strait; thence by great circle arc to the intersection of meridian 165° East of Greenwich and parallel 50° North; thence by great circle arc to the intersection of meridian 170° West and parallel 10° North; thence along parallel 10° North to its intersection with meridian 120° West, thence along meridian 120° West to the South Pole.

Chart of Regions as Defined in Table of Frequency Allocations



NOTE:

The new regulations as applicable to the Amateur Service resulting from the 1959 Administrative Radio Conference in Geneva effective from May 1st 1961 are tabulated below.

Region 1	Region 2	Region 3
1800-2000 Kc/s In Austria, Denmark, Finland, Ireland, Netherlands, F.R of Germany, Rhodesia and Nyasaland, United Kingdom, Switzerland, Czechoslavakia and the Union of South Africa and Territory of South West Africa, administrations may allocate up to 200 Kc/s to their amateur service within the band 1715-2000 Kc/s. However, when allocating bands within this range to their amateur service, administrations shall, after prior consultation with administrations of neighbouring countries, take such steps as may be necessary to prevent harmful interference from their amateur service to the fixed and mobile services of other countries. The means power of any amateur station shall not exceed 10 watts.	1800-2000 Kc/s Amateur, fixed, Mobile except aeronautical mobile Radio Navigation In Region 2 the LORAN system has priority. Other services to which the band is allocated may use any frequency in this band provided that they do not cause harmful interference to the LORAN system. In Region 3 the LORAN system in any particular area operates either on 1850 or 1950 Kc/s, the bands occupied being 1825-1875 Kc/s and 1925-1975 Kc/s respectively. Other services to which the band 1800-2000 Kc/s is allocated may use any frequency therein on condition that no harmful interference is caused to the LORAN system operating on 1850 or 1950 Kc/s	
3500-3800 Kc/s Amateur fixed, mobile except aeronautical mobile	8500-4000 Kc/s Amateur, fixed, mobile except aeronautical mobile (R)	3500-3900 Kc/s Amateur, fixed, mobile In Australia the band 3500-3700 Kc/s is allocated to the amateur service; the band 3700-3900 is allocated to the fixed and mobile services. In India, the band 3500-3890 Kc/s is allocated to the fixed and mobile services; the band 3890-3900 Kc/s is allocated to the amateur service.

<table>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>7000-7100 Kc/s
Amateur</td><td>7000-7300 Kc/s
Amateur</td><td>7000-7100 Kc/s
Amateur</td></tr>
<tr><td>14000-14350 Kc/s
Amateur
In the U.S.S.R., the band 14250-14350 Kc/s is also allocated to the fixed service.</td><td>14000-14350 Kc/s
Amateur</td><td>14000-14350 Kc/s
Amateur</td></tr>
<tr><td>21000-21450 Kc/s
Amateur</td><td>21000-21450 Kc/s
Amateur</td><td>21000-21450 Kc/s
Amateur</td></tr>
<tr><td>28000-29700 Kc/s
Amateur</td><td>28000-29700 Kc/s
Amateur</td><td>28000-29700 Kc/s
Amateur</td></tr>
<tr><td>50-54 Mc/s
Only allocated to amateurs in Rhodesia, Nyasaland, Congo, Ruanda Urundi, Union of South Africa and Territory of of South West Africa</td><td colspan="2">50-54 Mc/s
Amateur
In Australia, the band 50-54 Mc/s is allocated to the fixed, mobile and broadcasting services; the band 56-58 Mc/s is allocated to the amateur service.</td></tr>
<tr><td colspan="3">144-146 Mc/s
In Australia, the band 132-144 Mc/s is allocated to the aeronautical mobile service until 1st July 1963, after which date, the band 132-146 Mc/s will be allocated to the broadcasting service and the band 148-150 Mc/s will be allocated to the amateur service.</td></tr>
<tr><td></td><td colspan="2">146-148 Mc/s
Amateur</td></tr>
<tr><td>220-225 Mc/s
Only allocated to amateurs in Rhodesia and Nyasaland</td><td colspan="2">220-225 Mc/s
Amateur
Radiolocation</td></tr>
<tr><td>430-440 Mc/s
Amateur
Radiolocation
In the United Kingdom the band 420-450 Mc/s is allocated on a primary basis to the radiolocation service and on a secondary basis to the amateur service</td><td colspan="2">420-450 Mc/s
Radiolocation
Amateur</td></tr>
</table>

Region 1	Region 2	Region 3
1215-1300 Mc/s Radiolocation Amateur In the F.R. of Germany, the band 1250-1300 Mc/s is allocated to the amateur service.		
2300-2450 Mc/s Fixed Amateur Mobile Radiolocation In the United Kingdom the band 2300-2450 Mc/s is allocated on a primary basis to the radiolocation service and on a secondary basis to the amateur, fixed and mobile services. In the F.R. of Germany, the band 2300-2350 Mc/s is allocated to the amateur service and this service is excluded from the band 2350-2450 Mc/s	2300-2450 Mc/s Radiolocation Amateur Fixed Mobile In India, Japan and Pakistan the band 2300-2450 Mc/s is allocated on a primary basis to the fixed mobile and radiolocation services and on a secondary basis to the amateur service.	
3400-3475 Mc/s In Austria, Israel, Netherlands, F.R. of Germany and the United Kingdom this band is allocated on a secondary basis to amateurs.	3300-3500 Mc/s Radiolocation Amateur	
5650-5850 Mc/s Radiolocation Amateur In the F.R. of Germany, the band 5650-5775 Mc/s is allocated to the amateur service and the band 5775-5850 Mc/s is allocated to the fixed service.		
	5850-5925 Mc/s Radiolocation Amateur	
10.000-10.500 Mc/s Radiolocation Amateur In the F.R. of Germany and Switzerland, the band 10.000-10.250 Mc/s is also allocated to the fixed and mobile services; the band 10.250-10.500 Mc/s is allocated to the amateur service.		
21.000-22.000 Mc/s Amateur		

INTERNATIONAL RADIO AMATEUR PREFIXES IN ALPHABETICAL ORDER

(This list is not valid for DXCC)

AC3	SIKKIM
AC4	TIBET
AC5	BHUTAN
AP	PAKISTAN
BV	FORMOSA
BY, (C)	CHINA
C9	MANCHURIA
CE	CHILE
CM-CO	CUBA
CN	MOROCCO
CN9	MOROCCO (Zona Norte)
CP	BOLIVIA
CR4	CAPE VERDE ISLANDS
CR5	PORTUGUESE GUINEA
CR6	ANGOLA
CR7	MOZAMBIQUE
CR8	GOA (Portuguese India)
CR9	MACAO
CR10	TIMOR ISLAND (Port.)
CT1	PORTUGAL
CT2	AZORES ISLANDS
CT3	MADEIRA ISLANDS
CX	URUGUAY
DL	GERMANY
DU	PHILIPPINE ISLANDS
EA	SPAIN
EA6	BALEARIC ISLANDS
EA8	CANARY ISLANDS
EA9	SPANISH SAHARA
EA0	SPANISH GUINEA
EI	IRELAND
EL	LIBERIA
EP	IRAN
ET2	ERITREA
ET3	ETHIOPIA
F	FRANCE
FA	ALGERIA
FB8	MADAGASCAR
FC	CORSICA
FD8	TOGO
FE8	CAMEROONS
FF4	IVORY COAST
FF5	DAHOMEY
FF6	UPPER VOLTA
FF7	MAURITANIA
FF8	MALI REPUBLIC
FF9	NIGER
FG7	GUADELOUPE
FK8	NEW CALEDONIA
FL8	FRENCH SOMALILAND
FM7	MARTINIQUE
FO8	FRENCH OCEANIA
FP8	MIQUELON & ST. PIERRE IS.
FQ8	MIDDLE CONGO
FR7	REUNION ISLAND
FS7	SAINT MARTIN
FU8	NEW HEBRIDES
FW8	WALLIS & FUTUNA ISLANDS
FY7	FRENCH GUIANA
G	ENGLAND
GC	CHANNEL ISLANDS
GD	ISLE OF MAN
GI	NORTHERN IRELAND
GM	SCOTLAND
GW	WALES
HA	HUNGARY
HB	SWITZERLAND
HC	ECUADOR
HC8	GALAPAGOS ISLANDS
HE9L	LIECHTENSTEIN
HH	HAITI
HI	DOMINICAN REPUBLIC
HK	COLOMBIA
HM, HL9	KOREA
HP	PANAMA
HR	HONDURAS
HS	THAILAND
HV	VATICAN CITY
HZ	SAUDI ARABIA
I	ITALY
IS	SARDINIA
IT	SICILY
JA	JAPAN
JTI	MONGOLIA
JY	JORDAN
JZ0	NETHERLANDS NEW GUINEA
K	UNITED STATES
KA	U.S. PERSONNEL IN JAPAN
KA0	IWO JIMA ISLAND
KB6	BAKER, CANTON, ENDERBURY, HOWLAND & PHOENIX ISLANDS
KC4US	ANTARTICA
KC6	CAROLINE ISLANDS
KG1	U.S. PERSONNEL IN GREENLAND

KG4	GUANTANAMO BAY, CUBA
KG6	MARIANAS ISLANDS (Guam)
KG6I	BONIN ISLANDS
KG6S	SAIPAN ISLAND
KG6T	TINIAN ISLAND
KH6	HAWAIIAN ISLANDS
KJ6	JOHNSTON ISLAND
KL7	ALASKA
KM6	MIDWAY ISLAND
KP4	PUERTO RICO
KP6	PALMYRA & JARVIS ISLANDS
KR6	RYUKYU ISLANDS
KS4	SWAN ISLAND
KS6	U.S. SAMOA
KV4	VIRGIN ISLANDS
KW6	WAKE ISLAND
KX6	MARSHALL ISLANDS
KZ5	CANAL ZONE
LA	NORWAY, JAN MAYEN
LU	ARGENTINA
LX	LUXEMBOURG
LZ	BULGARIA
MI	SAN MARINO
MP4	MASQAT & OMAN
OA	PERU
OD5	LEBANON
OE	AUSTRIA
OH	FINLAND
OH0	ALAND ISLANDS
OK	CZECHOSLOVAKIA
ON	BELGIUM
OX	GREENLAND
OY	FAEROER ISLANDS
OZ	DENMARK
PA, PI	NETHERLANDS
PJ	NETHERLANDS ANTILLES
PK	INDONESIA
PX	ANDORRA
PY	BRAZIL
PY0	TRINIDAD & MARTIM ISLANDS
PZ	SURINAM
SL, SM	SWEDEN
SP	POLAND
ST	SUDAN
SU	EGYPT
SV	CRETE & GREECE
SV5	DODECANESE ISLANDS
TA	TURKEY
TF	ICELAND
TG	GUATEMALA
TI	COSTA RICA
TI9	COCOS ISLAND
TL8	CENTRAL AFRICAN REPUBLIC
TT8	TSCHAD REPUBLIC
TN8	CONGO REPUBLIC (BRAZZAVILLE)
TR8	GABUN REPUBLIC
UAI-3-4-6	EUROPEAN RUSSIAN SOCIALIST FEDERATED SOVIET REPUBLIC
UA90	ASIATIC RUSSIAN S.F.S.R.
UB5	UKRAINE
UC2	WHITE RUSSIAN S.S.R.
UD6	AZERBAIJAN
UF6	GEORGIA
UG6	ARMENIA
UH8	TURKOMAN
UI8	UZBEK
UJ8	TADZHIK
UL7	KAZAKH
UM8	KIRGHIZ
UN1	KARELO-FINNISH REPUBLIC
UO5	MOLDAVIA
UP	LITHUANIA
UQ	LATVIA
UR	ESTONIA
VE	CANADA
VK	AUSTRALIA
VK2	LORD HOWE ISLAND
VK7	TASMANIA
VK9	PAUA TERRITORY
VO1	NEWFOUNDLAND
VO2	LABRADOR
VP1	BRITISH HONDURAS
VP2	FEDERATION OF BRITISH TERRITORIES IN THE CARIBBEAN
VP3	BRITISH GUIANA
VP4	TRINIDAD & TOBAGO IS.
VP5	JAMAICA, CAYMAN, TURKS & CAICOS IS.
VP6	BARBADOS
VP7	BAHAMA ISLANDS
VP8	FALKLAND ISLANDS, South Georgia, South Orkney and South Shetland Is.
VP9	BERMUDA ISLANDS

VQ1	ZANZIBAR
VQ2	NORTHERN RHODESIA
VQ3	TANGANYIKA
VQ4	KENYA
VQ5	UGANDA
VQ8	CHAGOS & MAURITIUS ISLANDS
VQ9	SEYCHELLES
VR1	GILBERT, ELLICE & OCEAN ISLANDS
VR2	FIJI ISLANDS
VR3	LINE ISLANDS
VR4	SOLOMON ISLANDS
VR5	TONGA(Friendly)ISLAND
VR6	PITCAIRN ISLAND
VS1	SINGAPORE
VS4	SARAWAK
VS5	BRUNEI
VS6	HONG KONG
VS9	ADEN & SOCOTRA ISLANDS
VU	INDIA
VU4	LACCADIVE ISLANDS
VU5	ANDAMAN ISLANDS
W	UNITED STATES
XE	MEXICO
XW8	LAOS
XZ	BURMA
YA	AFGHANISTAN
YI	IRAQ
YJ	NEW HEBRIDES
YK	SYRIA
YN	NICARAGUA
YO	RUMANIA
YS	EL SALVADOR
YT, YU	YUGOSLAVIA
YV	VENEZUELA
ZA	ALBANIA
ZB1	MALTA
ZB2	GIBRALTAR
ZC3	CHRISTMAS ISLAND
ZC4	CYPRUS
ZC5	BRITISH NORTH BORNEO
ZD1	SIERRA LEONE
ZD3	GAMBIA
ZD6	NYASALAND
ZD7	SAINT HELENA
ZD8	ASCENSION ISLAND
ZD9	TRISTAN DA CUNHA & GOUGH ISLANDS
ZE	SOUTHERN RHODESIA
ZK1	COOK ISLANDS
ZK2	NIUE
ZL	NEW ZEALAND
ZL1	KERMADEC
ZM	WESTERN SAMOA
ZP	PARAGUAY
ZS	UNION OF SOUTH AFRICA
ZS3	SOUTHWEST AFRICA
ZS7	SWAZILAND
ZS8	BASUTOLAND
ZS9	BECHUANALAND
3A2	MONACO
3V8	TUNISIA
3W8	VIETNAM
4S7	CEYLON
4W1	YEMEN
4X4	ISRAEL
5A	LIBYA
5N	NIGERIA
6O	SOMALI REPUBLIC
6W	SENEGAL
7G1	REPUBLIC OF GUINEA
9G1	GHANA
9K2	KUWAIT
9M2	FEDERATION OF MALAYA
9N1	NEPAL
9Q5	CONGO REPUBLIC
9U5	RUANDA-URUNDI

THE R-S-T SYSTEM

READABILITY

1. Unreadable
2. Barely readable, occasional words distinguishable
3. Readable with considerable difficulty
4. Readable with practically no difficulty
5. Perfectly readable

SIGNAL STRENGTH

1. Faint signals, barely perceptable
2. Very weak signals
3. Weak signals
4. Fair signals
5. Fairly good signals
6. Good signals
7. Moderately strong signals
8. Strong signals
9. Extremely strong signals

Note : On most "s" meters S9 equals 100 microvolts at the antenne terminals. As each "S" point is equivalent to 6 dB, "S"8 will be 50 microvolts at the antenne terminals.

TONE

1. Extremely rough hissing note
2. Very rough a.c. note, no trace of musicality.
3. Rough low-pitched a.c. note, slightly musical.
4. Rather rough a.c. note, moderately musical
5. Musically modulated note.
6. Modulated note, slight trace of whistle
7. Near d.c. note, smooth ripple
8. Good d.c. note, just a trace of ripple
9. Purest d.c. note

If the signal has the characteristic steadiness of crystal control, add the letter x to the RST report. If there is a chirp, the letter c may be added, while for click a k is added.

The RST system of reporting is used on both CW and telephony, leaving out the tone report on voice.

WORD LIST FOR RADIOTELEPHONY

When clarifying genuinely doubtful expressions and in getting your call identified positively the use of one of the phonetic lists below is suggested. Limit such use to really necessary clarification.

A.R.R.L.	**I.C.A.O.**	**English**	**International**
Adam	Alfa	Able	Amsterdam
Baker	Bravo	Baker	Baltimore
Charlie	Charlie	Charlie	Casablanca
David	Delta	Dog	Dänemark
Edward	Echo	Easy	Edison
Frank	Foxtrott	Fox	Florida
George	Golf	George	Gallipoli
Henry	Hotel	How	Havanna
Ida	India	Item	Italia
John	Juliett	Jig	Jerusalem
King	Kilo	King	Kilogram
Lewis	Lima	Love	Liverpool
Mary	Mike	Mike	Madagaskar
Nancy	November	Nan	New York
Otto	Oscar	Oboe	Oslo
Peter	Papa	Peter	Paris
Queen	Quebec	Queen	Quebec
Robert	Romeo	Roger	Roma
Sudan	Sierra	Sugar	Santiago
Thomas	Tango	Tare	Tripoli
Union	Uniform	Uncle	Upsala
Victor	Victor	Victor	Valencia
William	Wisky	William	Washington
X-ray	X-ray	X-ray	Xanthippe
Young	Yankee	Yoke	Yokohama
Zebra	Zulu	Zebra	Zürich

ABBREVIATIONS FOR TELEGRAPHY (C.W.) WORK

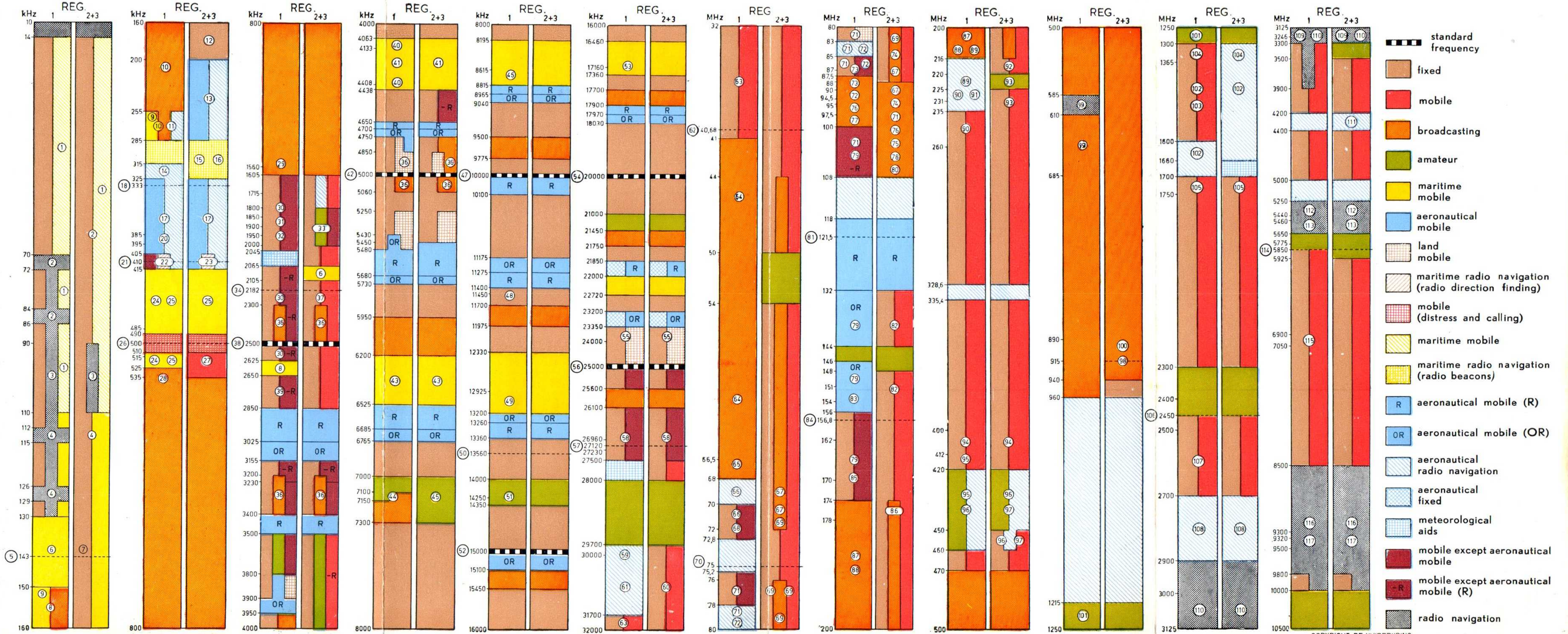
AA	All after
AB	All before
AC	Alternating current
ABT	About
ADR	Address
AGN	Again
ANT	Antenna
BA	Buffer amplifier
BCI	Broadcast interference
BFO	Beat frequency oscillator
BFR, B4	Before
BTWN	Between
BK	Break, break-in
CFM	Confirm
CK	Check
CL	I am closing my station; Call
CLD-CLG	Called; calling
CUAGN	See you again
CUD	Could
CUL	See you later
DX	Distance
ECO	Electron-coupled oscillator
FB	Fine business
GA	Go ahead
GB	Good-by
GE	Good evening
GM	Good morning
GN	Good night
GND	Ground
GUD	Good
HI	The telegraphic laugh
HR	Here, hear
HV	Have
HW	How
LSN	Listen
LTL	Little
LTR	Letter
LW	Low
MSG	Message
N	No
NIL	Nothing; I have nothing for you
NR	Number
NW	Now

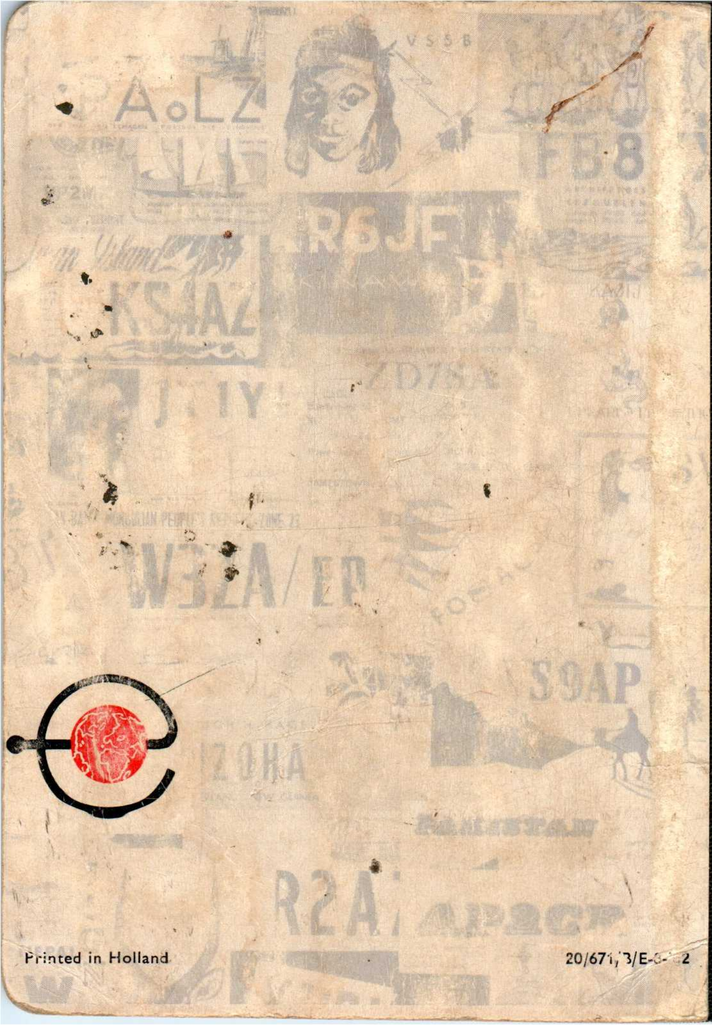
OB	Old boy
OM	Old man
OC	Old chap
OP-OPR	Operator
OSC	Oscillator
OT	Old timer; old top
PSE	Please
PWR	Power
PA	Power amplifier
R	Received solid; all right; OK; are
RCD	Received
RCVR	Receiver
RPT	Repeat; I repeat
RX	Receiver
SED	Said
SEZ	Says
SIG	Signature; signal
SKED	Schedule
SRI	Sorry
TFC	Traffic
TIL	Till
TMW	Tomorrow
TNX-TKS	Thanks
TT	That
TU	Thank you
TXT	Text
TX	Transmitter
UR-URS	Your; you're; yours
VFO	Variable frequency oscillator
VY	Very
WA	World(s) after
WB	World(s) before
WD-WDS	Word; words
WKD-WKG	Worked; working
WL	Well; will
WUD	Would
WX	Weather
XMTR	Transmitter
XTAL	Crystal
XYL	Wife
YL	Young lady
YR	Your
73	Best regards
88	Love and kisses

NOTES:

GENERAL INFORMATION FOR HAMS

FREQUENCY-ALLOCATIONS FOR RADIO SERVICES





Printed in Holland

20/671/3/E-8-62