

ELECTRONIC TUBE REFERENCE

18F5P

Power - TV Vertical Output electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

PENTODE-TRIODE

Russian series-heater triode-pentode for television vertical-deflection circuitry, combining frame oscillator/driver and power-output functions.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	18 V / 315 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Dissimilar

SECTION RATINGS

SECTION1 Triode	
MAXIMUM PLATE VOLTAGE	250 V
MAXIMUM PLATE DISSIPATION	0.5 W
MAXIMUM CATHODE CURRENT	15 mA
Values promoted where clearly identifiable from Russian source.	

SECTION2 Pentode	
MAXIMUM PLATE VOLTAGE	250 V
MAXIMUM SCREEN VOLTAGE	250 V
MAXIMUM PLATE DISSIPATION	7 W
MAXIMUM SCREEN DISSIPATION	1.5 W
MAXIMUM CATHODE CURRENT	15 mA
Values promoted where clearly identifiable from Russian source.	

18F5P — Triode-Pentode Vacuum Tube

An indirectly heated, miniature glass triode-pentode designed for television receiver frame scanning and vertical deflection applications.

Overview

The **18F5P** (Cyrillic: **18Ф5П**) is a specialized multi-unit vacuum tube containing an independent triode and a power pentode within a single miniature glass envelope. The tube is designed primarily for television receivers with a 110° deflection angle, where the triode section serves as a master oscillator and the pentode section operates as the vertical deflection output stage.

Engineered for series-connected heater chains, the 18F5P features a controlled heater current. The European equivalent designation for this tube is the **PCL85**. The design combines a high-mu triode and a high-slope power pentode, allowing a single envelope to perform the complete vertical deflection function in television chassis.

Physical Construction and Base Configuration

The 18F5P is housed in a miniature glass envelope (type 21П) with a standard 9-pin Noval base. The physical dimensions and mechanical limits are as follows:

- **Maximum Diameter:** 22.5 mm
- **Maximum Seated Height:** 71.5 mm
- **Maximum Total Height:** 78.5 mm
- **Mass:** Approximately 20 g
- **Mounting Position:** Unrestricted

Pinout Connection

The 9-pin Noval base configuration provides independent connections for the triode and pentode sections, with the pentode's cathode internally tied to its suppressor grid (grid 3) and an internal shield.

Pin Number	Electrode Connection	Symbol
1	Triode Anode	aT
2	Triode Grid	gT
3	Triode Cathode	kT
4	Heater	p
5	Heater	p
6	Pentode Anode	aP

Pin Number	Electrode Connection	Symbol
7	Pentode Grid 2 (Screen Grid)	$g2P$
8	Pentode Cathode, Grid 3, and Shield	$kP, g3$, shield
9	Pentode Grid 1 (Control Grid)	$g1P$

Heater and Environmental Ratings

The heater is designed for series-string operation in television receivers. The nominal heater current is tightly controlled, while the heater voltage is allowed to vary within specified tolerances.

- **Nominal Heater Current:** 300 mA
- **Heater Current Limits:** 285 mA to 315 mA
- **Nominal Heater Voltage:** 18 V
- **Heater Voltage Limits:** 16.2 V to 19.8 V (18 V $\pm$ 1.8 V)

Environmental and Mechanical Limits

The tube is rated to operate under the following environmental conditions:

- **Ambient Temperature Range:** -45 °C to +70 °C (with some specifications permitting down to -60 °C)
- **Relative Humidity:** Up to 98% at temperatures up to 25 °C
- **Vibration Resistance:** Up to 50 Hz with acceleration up to 2.5 g
- **Maximum Bulb Temperature:** 240 °C

Electrical Characteristics and Typical Operation

The electrical characteristics of the 18F5P are measured independently for the triode and pentode sections under specified DC operating points.

Triode Section

The triode section is characterized by a high amplification factor and moderate transconductance, suitable for oscillator service.

Parameter	Typical Value (18F5P)	Equivalent Value (PCL85)
Anode Voltage (U_a)	100 V	100 V
Cathode Bias Resistor (R_k)	100 Ω or 160 Ω	—
Anode Current (I_a)	5 mA (+2 / -1.5 mA)	10 mA

Parameter	Typical Value (18F5P)	Equivalent Value (PCL85)
Transconductance (S)	5.5 mA/V (± 1.3 mA/V)	5.5 mA/V
Amplification Factor (μ)	40 to 60 (60 ± 20)	50
Grid Cutoff Voltage (at $I_a \leq 30 \mu\text{A}$)	≤ -1.3 V	—
Reverse Grid Current	$\leq 0.6 \mu\text{A}$	—

Pentode Section

The pentode section is designed to deliver high peak currents during the flyback and scan intervals of vertical deflection.

Parameter	Typical Value (18F5P)	Equivalent Value (PCL85)
Anode Voltage (U_a)	185 V	185 V
Grid 2 Voltage ($U_{[g2]}$ (/tubes/G2))	185 V	185 V
Cathode Bias Resistor (R_k)	340 Ω	340 Ω
Anode Current (I_a)	45 mA (± 9 mA)	45 mA
Grid 2 Current ($I_{[g2]}$ (/tubes/G2))	2.7 mA (± 1.8 mA)	2.7 to 4.5 mA
Transconductance (S)	7.5 mA/V (± 1.5 mA/V)	7.5 mA/V
Grid 1 Cutoff Voltage (at $I_a \leq 0.3$ mA)	≤ -1.3 V	—
Reverse Grid 1 Current	$\leq 1.2 \mu\text{A}$	—

Peak and Pulse Characteristics (Pentode)

Under pulsed conditions representing the peak demand of frame scanning (measured at $U_a = 50$ V, $U_{[g2]}$ (/tubes/G2) = 170 V, and $U_{g1} = -1$ V):

- **Peak Anode Current:** 165 mA to 200 mA (PCL85: 200 mA nominal; 18F5P minimum limit of 165 mA)
- **Peak Grid 2 Current:** 50 mA maximum (PCL85: 35 mA maximum)

Interelectrode Capacitances

The internal shielding and physical layout minimize capacitive coupling between the high-voltage pentode anode and the sensitive triode grid.

- **Pentode Feedback Capacitance (C_{g1-a}):** ≤ 0.6 pF
- **Triode Anode to Pentode Grid 1 Capacitance:** ≤ 0.08 pF
- **Pentode Anode to Triode Grid Capacitance:** ≤ 0.03 pF
- **Triode Grid to Heater Capacitance:** ≤ 0.15 pF (up to 0.2 pF maximum)
- **Pentode Grid 1 to Heater Capacitance:** ≤ 0.2 pF

Absolute Maximum Ratings

The absolute maximum ratings define the operating boundaries beyond which tube reliability and service life are severely compromised.

General Limits

- **Heater-to-Cathode Voltage (Triode and Pentode):** 200 V maximum

Triode Section Limits

- **Anode Voltage (U_a):** 250 V maximum (550 V maximum during cold start)
- **Anode Dissipation (P_a):** 0.7 W maximum ([PCL85](#): 0.5 W maximum)
- **Cathode Current (I_k):** 15 mA maximum
- **Peak Cathode Current (Pulsed):**
 - **For pulse duration ≤ 0.8 ms (duty cycle ≥ 25):** 100 mA maximum
 - **For pulse duration ≤ 0.4 ms (duty cycle ≥ 50):** 200 mA maximum
- **Grid Circuit Resistance (R_g):**
 - **With Automatic Bias:** 3.3 M Ω maximum
 - **With Fixed Bias:** 1.0 M Ω maximum

Pentode Section Limits

- **Anode Voltage (U_a):** 300 V maximum ([PCL85](#): 250 V maximum; 550 V maximum during cold start)
- **Peak Anode Voltage (Pulsed, in frame scanning circuits):** 2.0 kV maximum
- **Grid 2 Voltage ($U_{[g2]}$ (/tubes/G2)):** 250 V maximum (550 V maximum during cold start)
- **Anode Dissipation (P_a):** 9.0 W maximum ([PCL85](#): 7.0 W maximum)
- **Grid 2 Dissipation ($P_{[g2]}$ (/tubes/G2)):** 2.0 W maximum ([PCL85](#): 1.5 W maximum)
- **Cathode Current (I_k):** 75 mA maximum
- **Grid 1 Circuit Resistance (R_{g1}):**
 - **With Automatic Bias:** 2.2 M Ω maximum
 - **With Fixed Bias:** 1.0 M Ω maximum

Residual Pentode Anode Voltage Limits

To prevent excessive screen grid dissipation and maintain linear deflection, the minimum instantaneous anode voltage (residual voltage) during the scan cycle must be restricted:

- At $U_{[g2]}(/tubes/G2) = 150 \text{ V}$: $\geq 40 \text{ V}$
- At $U_{[g2]}(/tubes/G2) = 190 \text{ V}$: $\geq 52 \text{ V}$

Lifetime and Reliability

The 18F5P is rated for a minimum service life of **800 hours** under nominal operating conditions. The end-of-life criteria are defined by the following parameter degradation limits:

- **Peak Pentode Anode Current:** $\geq 130 \text{ mA}$ (reduced from the nominal 165–200 mA range)
- **Triode Transconductance:** $\geq 3.3 \text{ mA/V}$ (reduced from the nominal 5.5 mA/V)
- **Pentode Reverse Grid 1 Current:** $\leq 2.0 \mu\text{A}$ (increased from the initial $\leq 1.2 \mu\text{A}$ limit)
- **Triode Reverse Grid Current:** $\leq 1.0 \mu\text{A}$ (increased from the initial $\leq 0.6 \mu\text{A}$ limit)

Qualitative Curve Observations

The graphical characteristics of the 18F5P illustrate the performance of both sections across their operating ranges:

- **Triode Anode Characteristics (I_a vs. U_a):** The triode curves display standard, evenly spaced triode behavior plotted up to an anode voltage of 300 V. The curves cover grid bias voltages ranging from a positive bias of +1 V down to a cutoff bias of -4.5 V.
- **Triode Transfer Characteristics (I_a vs. U_g):** Plotted across anode voltages from 75 V to 250 V, demonstrating a smooth transition to cutoff and consistent transconductance in the linear region.
- **Pentode Anode Characteristics (I_a vs. U_a):** Plotted at a screen grid voltage ($U_{[g2]}(/tubes/G2)$) of 170 V, these curves show a sharp knee below 50 V, transitioning into flat plateaus up to 300 V. This sharp knee is critical for minimizing residual anode voltage during peak deflection current demands. The curves are plotted for control grid voltages (U_{g1}) from +0.8 V down to -20 V.
- **Pentode Transfer Characteristics (I_a vs. U_{g1}):** Plotted at an anode voltage of 170 V for screen grid voltages ($U_{[g2]}(/tubes/G2)$) of 150 V, 170 V, and 200 V, illustrating the control of plate current and cutoff behavior under varying screen potentials.

Technical Summary

The **18F5P** is a high-performance, miniature 9-pin triode-pentode designed specifically for series-string television vertical deflection systems. Combining a high- μ triode ($\mu \approx 50$) and a robust 9-watt power pentode in a single envelope, it provides a compact solution for frame scanning. With a nominal 18 V, 300 mA heater, low interelectrode coupling, and high peak current capabilities (up to 200 mA in the pentode section), the 18F5P and its equivalent **PCL85** represent a highly optimized design for consumer television electronics of its era.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

195X Russian

Published test conditions and operating points. Values on this page are preserved as reported by this source.

195X RUSSIAN

Section 1 · Triode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Published electrical parameter	71.5 mA	71,5 max
Published electrical parameter	78.5 mA	78,5 max
Published electrical parameter	22.5 mA	L@22,5max
Source symbol to	50 Hz	Bubpauuonssle Harpysku npu yacrote no 50 [y ¢ Vibration: at frequencies up to 50 Hz with acceleration
Source symbol B0	31 V	oT —45 g0 + 70 °C. OTHOCHTeNbHAS BNAXHOCTL BO31VXA
Published electrical parameter	18+1.8 h	Hanpsixenue vaxana, B 18+1.8 Heater voltage, V 18+1.8
Published electrical parameter	300 h	Tok Hakama, MA 300 Heater current, mA 300
Source symbol ot	100 A	AHOHA . ..ot 100 anode ... 100
Source symbol f	5 A	AHOMR S:f 5 anode ... 5715
Published electrical parameter	30-1073 A	@HOJ2 B HAYAJIC XaPAKTEPHYCTHKH =30-1073 anode, cutoff =30-1074
Source symbol 00	6 pA	OO6paTHbBI Tok CETKH, MKA 0o. ... =0,6 Inverse grid current, LA
Published electrical parameter	59 A	KodhpuunenT yeHHeHHs 60_59 Amplification factor
Source symbol NenToanan	4 A	[NenToanan 4acTo Pentode section
Source symbol N	185 A	T30 - N 185 anode L. 185
Published electrical parameter	-1.3 V	fa u ceTku sTopoit 0 B), e Gonee -1,3 voltage, at moOSt o -1.3

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Published electrical parameter	300 mA	aHOAQ B Havane XapaKTePHUCTHKH =0,3 anode,cutoff =0.3
Published electrical parameter	35 A	AHORA B HMIOYJBCE .ot vvevnnee e 200_35 anode (pulse) t 200-35
Source symbol KpYTH	3 h	KpYTH3HA XapaKTepUCTYKH Tproda, MA/B =33 triode transconductance, mA/V =33
Source symbol Ipeneabubie	3 h	Ipeneabubie 3HAYEHHA JOMYCTHMBIX Limit Values of Operating
Source symbol veeeneens	75 A	MEHTOMA .+ - v oo vt veeeneens 75 at pulse duration at most
Source symbol KaTo	4 A	KaTo4a TPHOAA B HMIIyJbCE: 0.8 ms and pulse duty cycle
Source symbol OcTaTo	4 h	OcTaTo4HOe HaOpshKEHHE aHOaAd MeH-
Source symbol grid	2 V	TOa2, B: at grid 2 voltage 150V 40
Screen voltage	50 V	TOa2, B: at grid 2 voltage 150V 40
Source symbol atgrid	2 V	DU HaMpPsUKEHWHM CETKH BTOpOH atgrid 2 voltage 190V 52
Screen voltage	190 V	DU HaMpPsUKEHWHM CETKH BTOpOH atgrid 2 voltage 190V 52
Source symbol e	700 mA	TPUOHA « o v oo e 0,7 atgrid2 ... oo 2
Source symbol P	2.2 W	97 S P 2,2 with fixed bias 1
Source symbol S	33 W	67 S 33 with fixed bias 1
Source symbol Temnepatypa	6 A	Temnepatypa 6annona,°C 240 Bulb temperature, °C



SOURCE OPERATING CONDITIONS

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1981 Russian Tubes Katsnelson and Larionov

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1981 RUSSIAN TUBES KATSNELSON AND LARIONOV

Section 1 · Triode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate current	10 mA	Published Russian-source value; OCR-normalized.
Transconductance	5.5 μ S	Published Russian-source value; OCR-normalized.
Amplification factor	50	Published Russian-source value; OCR-normalized.
Plate current	9 mA	Published Russian-source value; OCR-normalized.
Plate current	0.3 mA	Published Russian-source value; OCR-normalized.
Transconductance	1.5 V	Published Russian-source value; OCR-normalized.
Transfer capacitance	0.6	Published Russian-source value; OCR-normalized.
Service life	800	Published Russian-source value; OCR-normalized.
Plate current	130 mA	Published Russian-source value; OCR-normalized.
Transconductance	3.3 μ S	Published Russian-source value; OCR-normalized.
Heater voltage	18 V	Nominal/published heater value.
Heater current	315 mA	Nominal/published heater value.

1981 RUSSIAN TUBES KATSNELSON AND LARIONOV

Section 2 · Pentode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Screen current	4.5	Published Russian-source value; OCR-normalized.

TUBE TINKER

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