



ELECTRONIC TUBE REFERENCE

12BE3

Rectifier - Damper Diode electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

RECTIFIER

High-voltage television damper diode for horizontal-deflection service, with approximately 5 kV peak-inverse capability and controlled heater warm-up.

GENERAL CHARACTERISTICS

BASE DESIGNATION	26E	BASE PINS	12
NOMINAL HEATER	12.6 V / 600 mA	PARALLEL HEATER	– / –
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Rectifier	
MAXIMUM PLATE DISSIPATION	6.5 W
PEAK INVERSE VOLTAGE	5000 V
NOMINAL OUTPUT CURRENT	200 mA
PEAK FORWARD CURRENT	1.2 A
FORWARD VOLTAGE DROP	25 V
MAXIMUM HEATER-CATHODE VOLTAGE	5000 V
WARM-UP TIME	11 s
<i>Rectifier section; ratings and characteristics retained in parameter rows where not safely promotable.</i>	

12BE3 — Half-Wave Vacuum Rectifier

An indirectly heated, single-diode Compactron/Duodecar envelope designed for television damper service in horizontal-deflection circuits.

Overview

The **12BE3** is a specialized half-wave vacuum rectifier designed for use as a damper diode in the horizontal-deflection circuits of both color and black-and-white television receivers. Constructed in a Compactron (or Duodecar) configuration, the tube features a coated unipotential cathode and is housed in a T-9 glass envelope with a 12-pin button base.

The 12BE3 is electrically identical to the **6BE3** (and its companion designation **6BE3/6BZ3**) and the **17BE3** (and **17BE3/17BZ3**), differing only in its heater ratings. Specifically, the 12BE3 is designed with a controlled heater warm-up characteristic, making it highly suited for television receivers that employ series-connected heater strings. This design minimizes transient voltage surges across individual heaters during the warm-up phase.

Mechanical Specifications and Basing

The 12BE3 utilizes a T-9 glass bulb with a 12-pin button base (EIA designation **E12-70**) and conforms to the **JEDEC 9-60** outline. The physical dimensions of the tube are as follows:

Dimension	Value
Maximum Overall Length	3.110 inches
Maximum Seated Height	2.735 inches
Minimum Diameter	1.062 inches
Maximum Diameter	1.188 inches

The tube can be mounted in **any position**. It utilizes the **EIA 12GA** basing arrangement, which provides the following pin connections when viewed from the bottom of the base:

Pin	Connection
Pin 1	Heater (H)
Pin 2	No Connection (NC)
Pin 3	No Connection (NC)
Pin 4	Plate (P)
Pin 5	Internal Connection (IC) — Do Not Use
Pin 6	No Connection (NC)
Pin 7	Cathode (K)
Pin 8	No Connection (NC)
Pin 9	Internal Connection (IC) — Do Not Use

Pin	Connection
Pin 10	Plate (P)
Pin 11	No Connection (NC)
Pin 12	Heater (H)

Socket Wiring Recommendations

Because pins 5 and 9 are designated as Internal Connections (IC), and pins 6 and 8 are No Connection (NC) pins, manufacturers explicitly warn that **socket terminals 5, 6, 8, and 9 must not be used as tie points** for external circuit wiring. Furthermore, to prevent accidental contact or voltage breakdown, it is recommended that the socket clips corresponding to these pins be physically removed from the tube socket.

Heater Characteristics and Series-String Design

The 12BE3 is engineered for series-string heater applications, where the heater of the damper tube is connected in series with the picture-tube heater and other receiving tubes. To prevent damaging voltage surges when the receiver is first turned on, the heater is manufactured with a controlled warm-up characteristic.

Heater Parameter	Value
Nominal Heater Voltage (AC or DC)	12.6 V
Nominal Heater Current	0.60 ± 0.04 A
Average Heater Warm-up Time	11 seconds

Heater Calculations

- **Calculated Nominal Heater Power:** Using the nominal voltage of 12.6 V and nominal current of 0.60 A, the nominal power consumption is calculated as: $\text{Power} = 12.6 \text{ V} \times 0.60 \text{ A} = 7.56 \text{ W}$
- **Calculated Nominal Heater Operating Resistance:** The hot resistance of the heater during normal operation is calculated as: $\text{Resistance} = \frac{12.6 \text{ V}}{0.60 \text{ A}} = 21.0 \Omega$

Heater Warm-up Time Definition

The average heater warm-up time of 11 seconds is defined under specific test conditions. It represents the time required for the voltage across the heater to reach 80% of its rated value (10.08 V) when a voltage equal to 4 times the rated heater voltage (50.4 V) is applied to a series circuit. This test circuit consists of the tube heater connected in series with an external resistance equal to 3 times the nominal heater operating resistance (calculated as $3 \times 21.0 \Omega = 63.0 \Omega$).

Damper Service Ratings and Electrical Characteristics

In television horizontal-deflection circuits, the damper diode experiences extremely high peak voltages and currents during the retrace interval. The 12BE3 is rated under the Design-Maximum System (conforming to EIA Standard RS-239) for operation in a standard 525-line, 30-frame television system.

Maximum Ratings (Design-Maximum Values)

Parameter	Maximum Limit
Peak Inverse Plate Voltage	5000 V
Steady State Peak Plate Current	1200 mA
DC Plate Current (DC Output Current)	200 mA
Plate Dissipation	6.5 W

Note on Peak Inverse Voltage: The peak inverse plate voltage rating of 5000 V is a pulsed rating. The duration of this voltage pulse must not exceed 15% of a single horizontal scanning cycle. In a standard 525-line, 30-frame system, this 15% duty cycle corresponds to a maximum pulse duration of 10 microseconds.

Heater-Cathode Voltage Ratings

Because the cathode of a damper diode is typically connected to the high-voltage deflection circuit while the heater is referenced near ground, the insulation between the heater and cathode must withstand severe electrical stress. The 12BE3 features robust heater-cathode insulation with the following limits:

- **Heater Negative with Respect to Cathode:**
 - DC Component: 900 V max.
 - Total DC and Peak: 5000 V max.
- **Heater Positive with Respect to Cathode:**
 - DC Component: 100 V max.
 - Total DC and Peak: 300 V max.

Tube Voltage Drop

The efficiency of a damper diode is partly determined by its internal voltage drop during conduction. The typical instantaneous tube voltage drop for the 12BE3 is **25 V** when conducting a DC plate current of **350 mA**.

Direct Interelectrode Capacitances

The direct interelectrode capacitances of the 12BE3, measured without an external shield, are approximately:

Capacitance Parameter	Value
Cathode to Plate and Heater: K to $(P + H)$	10 pF
Plate to Cathode and Heater: P to $(K + H)$	8.0 pF
Heater to Cathode: H to K	3.4 pF

These low capacitances help minimize loading on the horizontal deflection coils and prevent unwanted high-frequency ringing in the deflection waveform.

Related Designations and Family Comparison

The 12BE3 belongs to a family of identical damper diodes designed to accommodate different heater supply configurations:

- **6BE3 / 6BE3/6BZ3:** Designed for parallel heater circuits or 6.3 V transformer-powered systems. It has a nominal heater rating of **6.3 V at 1.2 A**.
- **12BE3:** Designed for 600 mA series-wired heater strings. It has a nominal heater rating of **12.6 V at 0.60 A**.
- **17BE3 / 17BE3/17BZ3:** Designed for 450 mA series-wired heater strings. It has a nominal heater rating of **16.8 V at 0.45 A**.

All three types share the same T-9 Compactron envelope, 12GA basing diagram, 6.5 W plate dissipation rating, 5000 V peak inverse voltage rating, and 25 V typical voltage drop. They are fully interchangeable in terms of physical mounting and electrical performance, provided the heater supply is adjusted to match the specific tube's requirements.

Technical Summary

The **12BE3** is a **12-pin Compactron/Duodecar half-wave vacuum rectifier** engineered specifically for **television damper service** in horizontal-deflection circuits. Operating with a **12.6 V, 0.60 A heater** featuring an **11-second controlled warm-up time**, it is optimized for series-connected heater strings where it prevents transient voltage surges. The tube is rated for a **5000 V peak inverse plate voltage** (with a maximum 15% pulse duty cycle of 10 microseconds), a **1200 mA peak plate current**, and a **6.5 W plate dissipation**. Its high heater-cathode insulation rating allows it to withstand up to **5000 V peak** when the heater is negative with respect to the cathode. With a low typical **25 V voltage drop** at 350 mA, the 12BE3 provides highly efficient damping performance in a compact, versatile T-9 glass package.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1961 Tung Sol

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

1961 TUNG SOL

Section 1 · Rectifier

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Service	Television damper diode	—



SOURCE OPERATING CONDITIONS

1965 Sylvania Electronic Tubes Vol3

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

1965 SYLVANIA ELECTRONIC TUBES VOL3

Section 1 · Rectifier

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak inverse voltage	5000 V	—
Peak plate current	1200 mA	—
DC plate current	200 mA	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1965 Westinghouse Data Book

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

1965 WESTINGHOUSE DATA BOOK

Section 1 · Rectifier

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage	12.6 V	—
Heater Current	600 mA	—
ControlledWarmupHeater	1 boolean	—
Heater Warmup Time	11 s	—
VoltageDrop	25 V	PlateCurrent=350mA

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
PeakInverseVoltageMaximum	5000 V	—
PeakPlateCurrentMaximum	1200 mA	—
DCPlateCurrentMaximum	200 mA	—
Plate Dissipation Maximum	6.5 W	—
HeaterCathodeVoltageMaximum	5000 V	HeaterNegative;TotalDCPlusPeak



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1966 Tung Sol Electronic Tubes 2 of 4

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

1966 TUNG SOL ELECTRONIC TUBES 2 OF 4

Section 1 · Rectifier

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
CATHODE TO PLATE AND HEATER: K TO (P+H)	10 pF	Published datasheet
PLATE TO CATHODE AND HEATER: P TO (K+H)	8 pF	Published datasheet

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
HEATER TO CATHODE: (H TO K)	3.4 pF	Published datasheet

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
AVERAGE CHARACTERISTICS	12.6 mA	Published datasheet; operating column 1
AVERAGE CHARACTERISTICS	600 mA	Published datasheet; operating column 2
HEATER WARM-UP TIME 'A	11 s	Published datasheet
DC COMPONENT	900 V	Published datasheet
TOTAL DC AND PEAK	5000 V	Published datasheet
DC COMPONENT	100 V	Published datasheet
TOTAL DC AND PEAK	300 V	Published datasheet
PEAK INVERSE PLATE VOLTAGE	5000 V	Published datasheet
PLATE DISSIPATION	6.5 W	Published datasheet
Maximum plate dissipation	6.5 W	Published datasheet; promoted section value
Maximum peak inverse voltage	5000 V	Published datasheet; promoted section value
DC output current	200 mA	Published datasheet; promoted section value
Peak forward current	1.2 A	Published datasheet; promoted section value

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
CURRENT	0 mA	Published datasheet; operating column 1
CURRENT	600 mA	Published datasheet; operating column 2
CURRENT	40 mA	Published datasheet; operating column 3
STEADY STATE PEAK PLATE CURRENT	1200 mA	Published datasheet
TUBE VOLTAGE DROP, $I_b =$	350 V	Published datasheet; operating column 1
TUBE VOLTAGE DROP, $I_b =$	25 V	Published datasheet; operating column 2



SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1971 RCA HB3 Binder 5 of 7

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

Section 1 · Rectifier

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Voltage (AC or DC) t	6.3 V	PublishedColumn1
Voltage (AC or DC) t	0.6 V	PublishedColumn2
Heater negative with respect to cathodee b max	5000 V	—
Heater positive with respect to cathode. c max	300 V	—
The do component must not exceed	900 V	—
The tic component must not exceed	100 V	—
Heater voltage nominal	12.6 V	—
Heater current	600 mA	—
Heater warm-up time	11 s	Average

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
P to (K, H)	10 pF	—
K to (P, H)	8 pF	—
H to K	3.4 pF	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Inverse Plate Voltages max	5000 V	—
Peak Plate Current max	1200 mA	—
DC Plate Current max	200 mA	—
Plate Dissipation max	6.5 W	—



SOURCE DATA APPENDIX

1975 RCA RC30

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

1975 RCA RC30
Section 1 · Rectifier

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater Voltage (ac/dc) «	16.8 volts	Published value from supplied target entry
Heater Current	0.46 ampere	Published value from supplied target entry
Heater Warm-up Time (Average)	11 seconds	Published value from supplied target entry
Peak Inverse Plate Voltage*	5000 volts	Published value from supplied target entry
Peak Plate Current	1200 mA	Published value from supplied target entry
Average Plate Current	200 mA	Published value from supplied target entry
Plate Dissipation	6.6 watts	Published value from supplied target entry
Tube Voltage Drop for dc plate current of	26 mA	Published value from supplied target entry
Heater Voltage (ac/dc)	12.6 volts	Published value from supplied target entry
Heater Current	0.16 ampere	Published value from supplied target entry

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate to Cathode, and Heater	10 pF	Published value from supplied target entry
Cathode to Heater, and Plate	8 PF	Published value from supplied target entry
Heater to Cathode	3.4 pF	Published value from supplied target entry