



## USE OF EIMAC<sup>(r)</sup> YC-292 / 3CPX800A7 TUBES IN LA-Series RF AMPLIFIERS

### DESCRIPTION OF THE YC-292 / 3CPX800A7

Lunar-Link Systems LA-Series VHF / UHF RF amplifiers are compatible with both the CPI -EIMAC<sup>(r)</sup> 3CX800A7 and the 3CPX800A7 electron tubes.

The differences in the 3CPX800A7 compared to the standard 3CX800A7 tube are:

A taller grid to plate ceramic insulator is used.

The anode radiator is located approximately .070" higher.

These changes are incorporated in the 3CPX800A7 to raise the plate voltage handling capability of the tube, primarily to allow higher peak power output in RF pulse and pulse modulator service. The internal tube geometry including cathode to grid and grid to plate spacing are essentially identical to the standard 3CX800A7 tube giving the pulse rated tube similar performance in CW and SSB RF service.

The YC-292 is a selected 3CPX800A7. After manufacturing Eimac tests all tubes under static (DC) conditions. Lunar-Link Systems purchases selected 3CPX800A7 tubes that have tighter tolerances and lower grid current than is required for a regular 3CPX800A7 tubes to pass final inspection. YC-292 is the part # that Eimac assigned to these selected tubes. And the answer is, yes, we do pay more for the YC-292 selected tubes.

### WHAT ARE THE ADVANTAGES OF THE YC-292 / 3CPX800A7 TUBES?

There are several reasons to use the YC-292 / 3CPX800A7 tubes.

1. The higher flash over voltage of the 3CPX800A7, 7,000 VDC verses 5,000 VDC for the 3CX800A7. This provides a substantial safety margin over tube damaging arcs. In RF amplifier service the Peak to Peak RF voltage will approach 2 times the DC plate voltage. A RF amplifier that has 2,500 VDC plate voltage will have Peak-to-Peak RF voltages that approach 5,000 V, which is at the limit of what a 3CX800A7 can handle without risking a tube destroying arc across the ceramic grid to anode insulator. The 3CPX800A7's 7,000 volt rating allows it to be run at 3,000 VDC plate voltage and still have an adequate safety margin.

2. Due to a number of factors, at 432 MHz amplifier efficiency is 50%-54% which is substantially lower than the 60%-65% efficiency the LA-Series amplifiers have at 50, 144 and 222 MHz. This means a LA-72A, LA-72 or LA-70B that is using a pair of 3CX800A7s at 2350 VDC will typically require approximately 1.25 amperes of plate current to achieve 1500 watts output, exceeding the recommended 1.2 amperes of plate current. By using 3CPX800A7 tubes in LA-72A, LA-72 & LA-70B amplifiers, 1,500 watts of RF output can be obtained with less than 1.2 amperes of plate current by running the plate voltage above 2,500 VDC. By operating with lower plate (& cathode) current tube life will be increased.
  
3. Lower drive power at higher plate voltages. Running higher plate voltages reduces driver requirements. With popular transceivers such as the FT-847 and TS-2000 having 50 watts of output, a LA-72A running 2,700 VDC under load will typically deliver over 1,300 watts output with 50 watts of drive. With 3CX800A7 tubes at their rated 2,350 VDC, 50 watts of drive will normally deliver about 1,100 watts or RF output at 432 MHz. On 222 MHz and 144 MHz, the 3CPX800A7 tubes will deliver 1,500 watts output with as little as 35 watts drive, allowing them to be driven to full power output with many transverters.
  
4. Because the YC-292 is selected with tighter tolerances, the tubes are usually closely matched which improves performance in LA-Series amplifiers.

In RF linear amplifier service, SSB voice and CW modes, the maximum recommended plate voltage is:

TUBE	IDLE	FULL LOAD
3CX800A7	2600 VDC	2350 VDC
YC-292 / 3CPX800A7	3400 VDC	3100 VDC

Note that "idle" voltage is specified. This is the voltage on the tubes when the amplifier is in transmit and the tubes are drawing idling current. It is not the standby voltage (tubes not drawing any current).

## OPERATION OF YC-292 / 3CPX800A7 TUBES IN LA-Series AMPLIFIERS

### INSTALLATION

The YC-292 / 3CPX800A7 tubes are installed in LA-Series amplifiers in the same manor as the 3CX800A7 tubes. When the plate stripline is installed and is in its proper position, the 3CPX800A7 anode radiator will protrude .070" (approximately 1/16") above the top of the plate stripline due to the higher position that the anode cooler is mounted on the pulse tube.

## OPERATION

Operation with YC-292 / 3CPX800A7 tubes will be nearly identical to the 3CX800A7 tubes at the same plate voltage. Cathode and plate tuning controls may be in slightly different positions due to the small differences in input and output capacitance in the 3CPX800A7 tubes.

## OPERATION WITH HIGHER PLATE VOLTAGES

YC-292 / 3CPX800A7 tubes have been tested in LA-Series amplifiers at elevated plate voltages, given their substantially higher plate voltage rating. It has been found that LA-62A, LA-22A, LA-12A amplifiers can be used at a *loaded* plate voltage of up to 3,000 VDC with proper, stable and linear operation. Drive power will be lower for equal power output at higher plate voltages. Linearity may be improved due to the lower cathode current. For the same power output tube life is increased due to the lower cathode current, typically only 900 ma. for 1,500w output with 2,700 VDC full load plate voltage.

LA-72A, LA-72 and LA-70B amplifiers have demonstrated satisfactory operation at a *full load* plate voltage of up to 2,700 VDC. Slightly higher efficiency has been observed at the higher plate voltage in the LA-72A & LA-70B. Extended life testing of 3CX800A7 and 3CPX800A7 tubes in LA-72A & LA-70B amplifiers has shown that if 1,500w power output is desired, it is preferable to keep the plate current to less than 1.2 A and run a higher plate voltage, up to 2,700 VDC.

At the same power output with higher plate voltage, less loading capacitance will be required and more plate tuning capacitance is required. For example when running 2,700 VDC full load plate voltage vs. 2,350 VDC plate voltage the Plate Load control will be about 1 division more clockwise (e.g.. at #6 instead of #5). The Plate Tune control will typically be about ½ division more counterclockwise (e.g.. at # 3-½ instead of #4).

## DO NOT USE A 3CPX800A7 AND A 3CX800A7 IN THE SAME AMPLIFIER

It is recommended that 3CX800A7 and 3CPX800A7 tubes *not* be mixed in a LA-Series amplifier (that is do not use one of each type tube at the same time in the same amplifier). The 3CPX800A7 tube has slightly lower input capacitance (25.5 pf. vs. 26.0 pf. for the 3CX800A7). Although both tubes have the same rated output capacitance (6.1 pf.), in LA-Series amplifiers the higher anode radiator position lowers stray capacitance. This makes the 3CPX800A7 tubes operate as if they have lower output capacitance. For this reason if the tubes are mixed in the same amplifier there will be some imbalance in the tubes. That is, one tube may run substantially more cathode current than the other. If it is needed to run mixed tubes for any reason it is recommended that the mixed tubes be used in the lowest frequency amplifier and that power output be reduced. Maximum plate current with mixed tubes should be kept below 1.0 ampere.

## BIAS VOLTAGE

The LA-Series amplifiers use cathode bias. The grid is operated at both RF and DC ground and a positive bias voltage is applied to the cathode. A pass transistor bias circuit is used in the cathode (B-) DC connection to the HV power supply. The actual LA-Series amplifier bias voltage will be approximately 0.7 VDC higher than the diode voltage due to the voltage drop in the pass transistor. The bias voltage is set via a small 1 watt 1N47xxA series zener diode. 1N47xxA series zener diodes are available from electronic component distributors or from Lunar-Link Systems.

The table below gives recommended bias diodes for different plate voltages.

DIODE	VOLTAGE	NET BIAS	NOTES
1N4737A	7.5 V	8.2 V	Standard in LA-Series, 2500-2700 VDC unloaded plate.
1N4738A	8.2 V	8.9 V	Use with 2700-3000 VDC unloaded plate.
1N4739A	9.1 V	9.8 V	Use with 3000 - 3250 VDC unloaded plate.
1N4740A	10. 0V	10.7 V	Use with 3250-3500 VDC unloaded plate.
1N4742A	12.0 V	12.7 V	Use for class B operation - CW / FM only.

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