

# WHAT'S NEW WITH THE ELECTRON

**1958**



**EITEL-McCULLOUGH, INC.**  
SAN BRUNO · CALIFORNIA  
The World's Largest Manufacturer of Transmitting Tubes





**WORLD'S LARGEST MANUFACTURER OF TRANSMITTING TUBES**



## WHAT'S NEW WITH THE ELECTRON 1958

The intensive program of research and development being carried on at Eitel-McCullough, Inc., continues to add important new tube types to the already broad line of Eimac power vacuum tubes. Important tube families such as the Eimac developed 4X150 series continue to evolve into more and more refined designs that bring you improved reliability, ruggedness, and performance. In addition, entirely new tube types are being developed to fill power needs across the RF spectrum. Today, over 40 tube types—more than one-third of the Eimac line—incorporate the advantages of ceramic-metal design. Eimac continues to emphasize the application of this advanced design to a broad range of important tube types. This copy of "WHAT'S NEW WITH THE ELECTRON . . . 1958" brings you information on these latest developments.

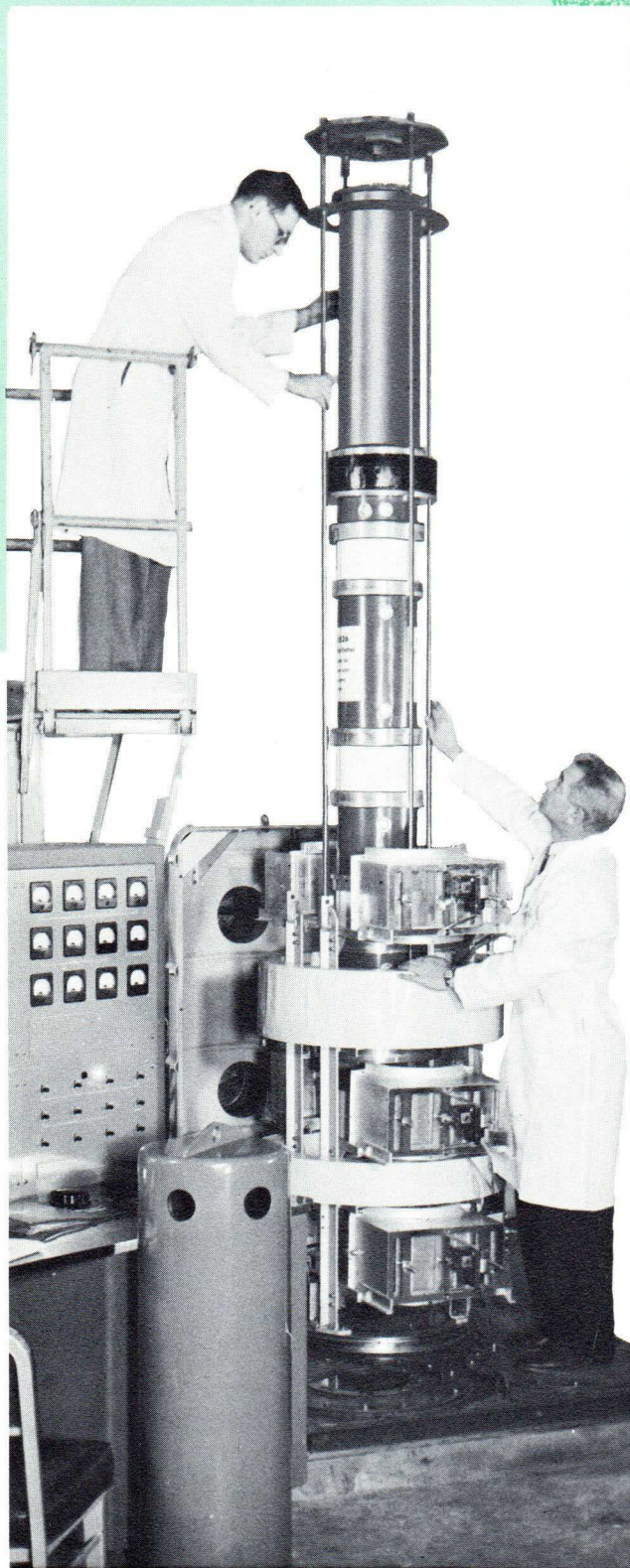
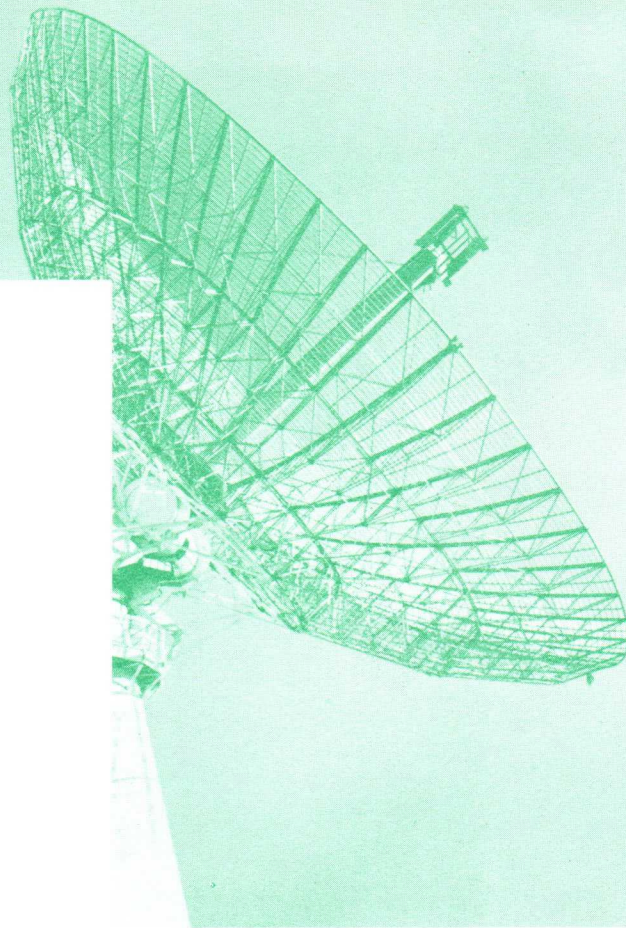
Many of the tubes presented are designated by "X" numbers. This signifies a development number, with a regular Eimac type number pending. Most of the tubes described are available today—and in quantity.

For a sound approach to reliable, high power transmitting equipment and rugged receiving equipment, investigate the incomparable qualities of performance-proved Eimac tubes.

EITEL-McCULLOUGH, INC.  
SAN BRUNO, CALIFORNIA



Antenna and supporting structure of high-power long-range radar at M.I.T. Lincoln Laboratory on Millstone Hill in Westford, Massachusetts.



## **X626**

### **Super-Power Klystron**

The Eimac X626 is an air- and water-cooled klystron designed expressly for pulse operation in linear accelerator or high-power radar applications. This three-cavity klystron will deliver one and one-quarter megawatts of peak pulse power and 100 kilowatts average output power with a pulse length of 2000 microseconds. The X626 shows an operating efficiency of 40% or more under these conditions. It incorporates a rugged efficient EMA cathode, developed by Eimac specifically for long-pulse applications.

This super-power tube, the world's largest electron tube, exemplifies the advantages of klystrons over negative grid tubes in generating high RF power at UHF and above. The high gain achieved with the klystron approach and hence the low driving power requirement greatly reduces the cost and complexity of the associated circuitry. The Eimac modulating anode permits smooth, simple, continuous control of input power from zero to maximum rating.

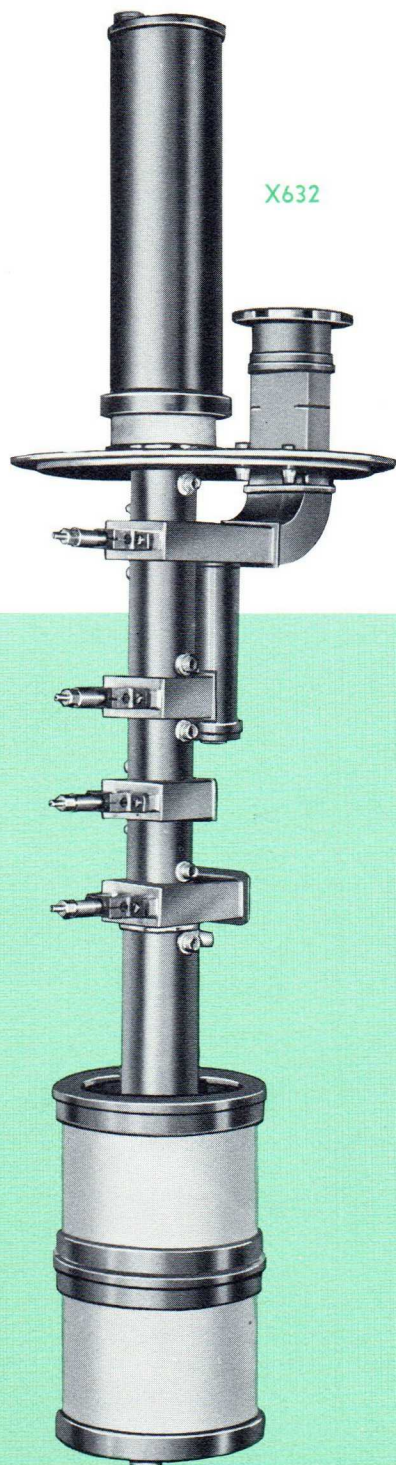
The X626 was developed and manufactured for Continental Electronics Company under the sponsorship of the United States Air Force's Rome Air Development Center of the Air Research and Development Command.





**First for high power amplifier klystrons**

# 1958



X632

## **X632**

### **Pulse Klystron**

Designed for use in linear accelerator applications, the X632 is a four-cavity water-cooled pulse klystron. It covers a frequency range of 2845 to 2865 megacycles and achieves a peak pulse output power of 10 megawatts and an average output power of 20 kilowatts. The X632 operates at a pulse length of 6 to 10 microseconds and a duty cycle of .167%. It incorporates an Eimac EMA long-life cathode, and a modulating anode. The X632 is a waveguide output tube.



## **4KM170,000LA**

### **Power Amplifier Klystron**

Specifically designed for tropospheric scatter use, the 4KM170,000LA klystron covers the 300 to 500 megacycle range. This four-cavity water-cooled tube is capable of developing 75 kilowatts CW power or 200 kilowatts peak pulse power. Power gains of 50 db are possible and an efficiency of 45% is achieved. The 4KM170,000LA incorporates an Eimac modulating anode which allows shaped-pulse and amplitude modulation, and permits simple, continuously variable control of beam current. Eimac's rugged, highly efficient matrix cathode is used to assure exceptional reliability. The 4KM170,000LA is 9 inches in diameter and 88 inches long.

4KM170,000LA







**First for high power amplifier klystrons**

# 1958

## **X576**

### **Pulse Klystron**

Eimac's X576 pulse klystron will deliver 200 kilowatts peak power and 4 kilowatts average output power in the 555 to 670 megacycle range. With a bandwidth of one megacycle, the efficiency is 40% with a power gain of over 60 db. This four-cavity air-cooled klystron incorporates Eimac's newly developed long-pulse cathode. Ceramic and metal construction plus the practical Eimac system of completing the resonant cavities outside the vacuum envelope makes the X576 ideal for medium-power radar applications.

## **6K50,000LQ**

### **New Broadband Amplifier Klystron**

The 6K50,000LQ is a new six-cavity water-cooled amplifier klystron designed for use in the 720 to 980 megacycle range. It is rated to deliver 10 kilowatts CW output power at 10 megacycle bandwidth with a driving power of only 5 watts, at an efficiency of 40%. A 20 megacycle bandwidth may be obtained from the 6K50,000LQ at 25% efficiency.

Formerly the developmental X631, this tube was selected for use in O/H tropospheric equipment that now spans the gap between Florida and Cuba, transmitting color or black-and-white TV programs simultaneously with multi-channel telephone service.

The 6K50,000LQ incorporates the performance-proved advantages of Eimac ceramic-metal external-cavity klystron design.



6K50,000LQ



## **4KM50,000SG**

### **Power Amplifier Klystron**

Important design innovations have led to the selection of the 4KM50,000SG for use in a number of important high-power tropospheric scatter systems. This klystron is conservatively rated at 10 kilowatts CW output power with less than 1 watt drive—a power gain of 40 db at an efficiency of 35 to 40%. The 4KM50,000SG has been tested at CW output powers up to 24 kilowatts without damage to the tube. Simple continuous tuning from 1700 to 2400 megacycles is made possible by Eimac external tuning cavities.

An Eimac modulating anode permits smooth, continuously variable control of beam power without expensive variable transformers or complicated power supplies. It also greatly increases the flexibility of the tube by permitting shaped-pulse, long-pulse and amplitude modulation as well as CW operation. A new Eimac matrix cathode combining the ruggedness of a metal cathode with the high efficiency of an oxide-coated cathode eliminates the expensive power supply required for a bombarded cathode. Other advanced design features, incorporated for the first time, greatly increase reliability, simplify tuning and keep the output cavity cool at maximum voltage.

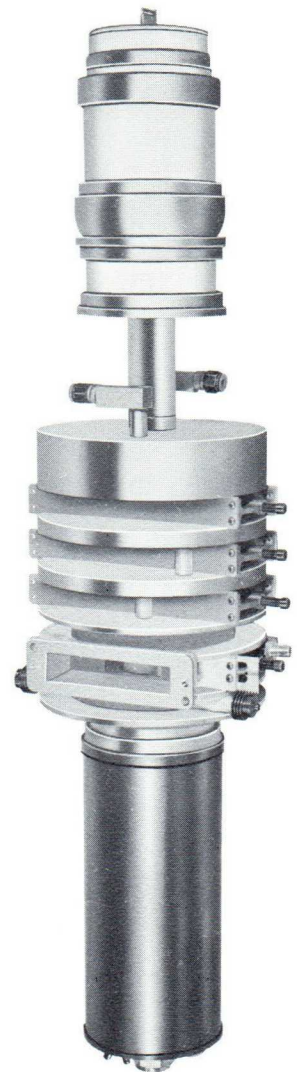
Smooth adjustment for optimum coupling is made possible by a newly developed adjustable waveguide output coupler.

## **X700**

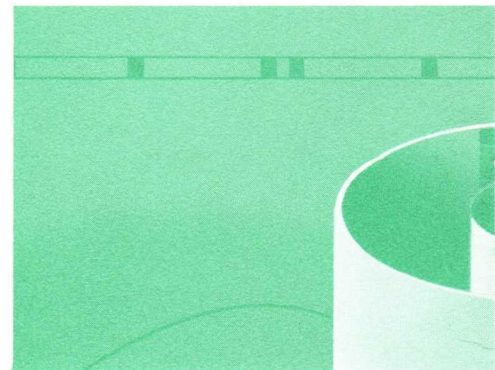
### **Pulse Klystron**

The X700 is a modern, air-cooled external-cavity pulse klystron designed for medium power radar use or pulse communication applications. Covering a frequency range of 2400 to 3000 megacycles the X700 will deliver 20 kilowatts peak output power and 1 kilowatt average output power. It achieves a power gain of 30 db and an efficiency of 40%. An Eimac modulating anode is incorporated in this tube, permitting shaped- and long-pulse modulation and allowing smooth, continuous control of beam power without expensive or complicated power supplies.

The X700 is only 22 inches long, 5½ inches in diameter and weighs 27½ pounds. It has a waveguide output.



4KM50,000SG







**First for high power amplifier klystrons**

# 1958

## **3KM2500LT**

### **Modulating Anode Klystron**

Specifically designed for TACAN air navigational systems, the Eimac 3KM2500LT three-cavity air-cooled klystron will deliver 30 kilowatts peak output power in the 955 to 1220 megacycle range. With a power gain of 35 db, this tube has an efficiency of 40%.

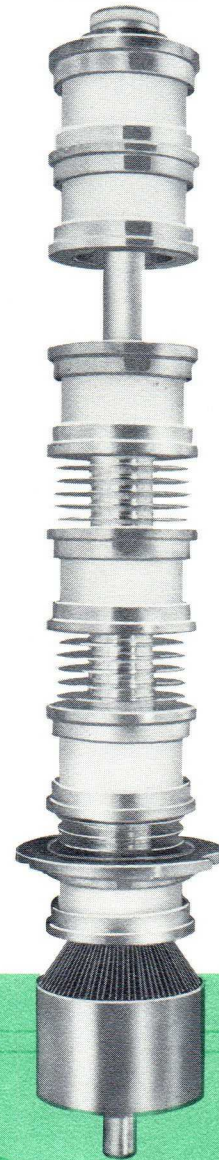
A typical air navigation systems requirement is a shaped RF pulse output to eliminate spectrum interference in adjacent channels. The Eimac modulating anode incorporated in this tube simplifies generating these shaped pulses. It permits pulsing the beam current while keeping the accelerating voltage constant, greatly simplifying systems design.

## **3K2500LX**

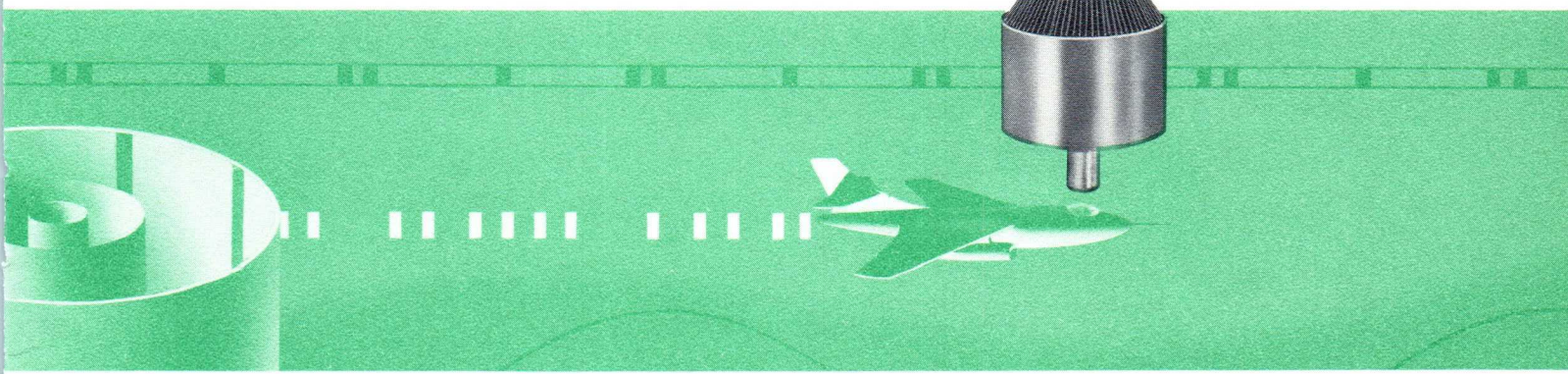
### **1 KW CW Amplifier Klystron**

The new 3K2500LX extends the coverage of Eimac 1 kilowatt power amplifier klystrons to include the 980 to 1200 megacycle range. Designed for communications use, the 3K2500LX is an air-cooled three-cavity klystron with a high efficiency oxide-coated cathode. Eimac ceramic-metal construction throughout assures you of high reliability, ruggedness and long life.

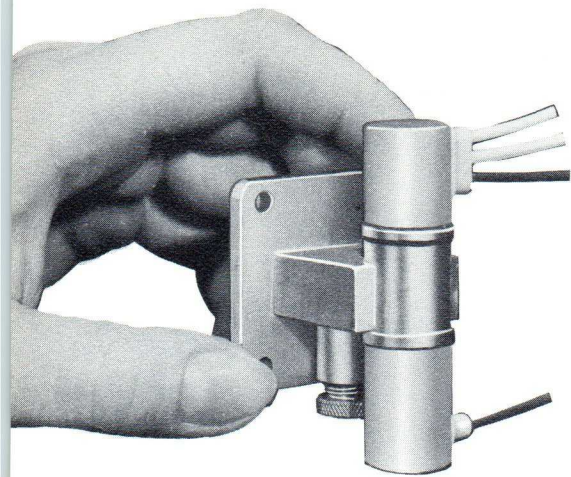
3KM2500LT



3K2500LX



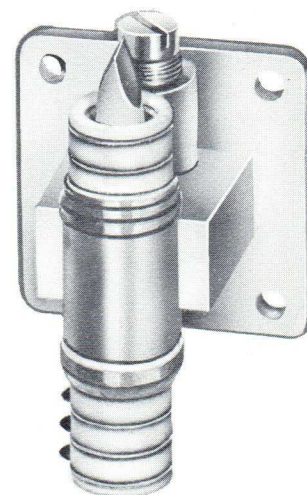




## New Rugged Ceramic Reflex Klystrons For C-, X-, and K-Band

### 1K20 Series for Extreme Environment X- and K-Band Use

The new 1K20 series consists of four rugged ceramic-metal reflex klystrons that cover the 8500 to 11,700 megacycle range at output power levels up to 50 milliwatts. Specifically designed for use in the severe environment of air-borne and missile radar systems, these tubes incorporate the many advantages of Eimac ceramic-metal construction and integral external tuning cavities. They will withstand vibration levels of 15G in any reference plane, with less than 100 kilocycle frequency deviation. Low beam voltage requirement and simple radiation-cooling minimize the weight and complexity of associated equipment. Tuning is conveniently adjusted by a single screw in the external cavity. This simplified external-cavity system allows repeated tuning of each tube over its entire frequency range without problems of metal fatigue or loss of vacuum.



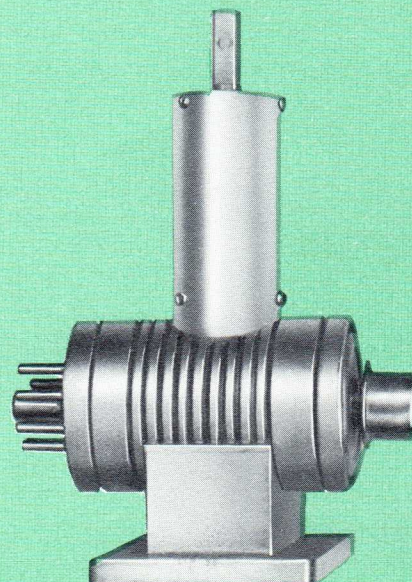
1K20XS	8500-9300 Mc.
1K20XK	9200-10,000 Mc.
1K20XD	10,000-10,800 Mc.
1K20KA	10,700-11,700 Mc.

### 1K125CA and 1K125CB High Power Reflex Klystrons for C-Band

These new ceramic-metal reflex klystrons cover a frequency range of 3700 to 5000 megacycles. Capable of output powers up to 2 watts, these tubes are ideal for reliable broadband point-to-point communications.

They are tuned by an adjustable dielectric slug rather than a variable RF gap, thus minimizing sensitivity to shock and vibration. Higher temperature ratings made possible by the use of ceramics, and an integral-finned cooler, keep cooling requirements at a minimum.

The 1K125CB was developed under the sponsorship of the U.S. Army Signal Corps for Philco Corporation.



#### 1K125 Series

1K125CA	3700-4400 Mc.
1K125CB	4400-5000 Mc.





**First covering the spectrum with ceramic tubes**

# 1958

## **X686**

### **Ruggedized Ceramic Traveling Wave Tube**

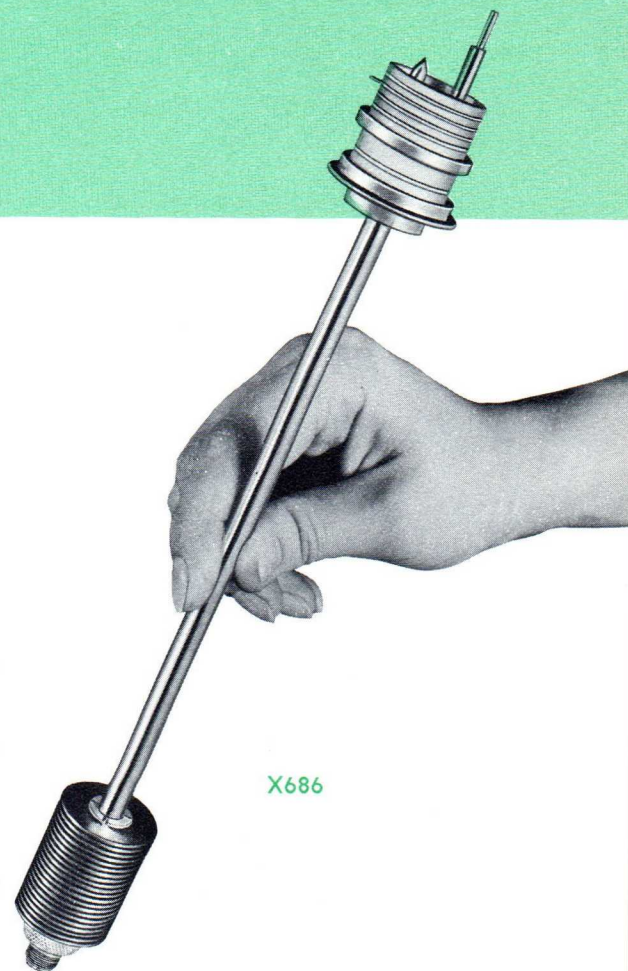


The Eimac X686 is a ruggedized, ceramic-metal traveling wave tube designed specifically for use in severe environment air-borne applications. This high altitude tube covers a frequency range of 4000 to 7000 megacycles with an output power of 1 watt and a gain of 50 db. It achieves a 66% bandwidth at the 3 db power points.

The X686 is ideal for applications where light weight and compactness are important since a design objective is the development of a suitable system of periodic permanent-magnet focusing which will eliminate the need for electromagnets and associated power supplies. It will operate over its entire frequency range without tuning or other adjustment.

It is suitable for use in multiple-channel point-to-point communications and other broadband applications, as well as air and missile applications where its extreme ruggedness and simplicity are decided advantages.

The traveling wave tube, X686, was developed under the sponsorship of Sperry Gyroscope Company and the U.S. Air Force's Air Research and Development Command, Wright Air Development Center.



X686

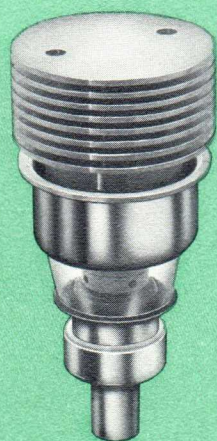


# 3CX100A5

## Premium Quality UHF Triode

Eimac ceramic-metal design makes this 100 watt UHF planar triode far superior to glass tubes of the 2C39 series. Among the advantages gained by Eimac's advanced manufacturing techniques are: greatly increased life, 10% more output power at 2500 megacycles, maximum ratings to 60,000 feet, higher temperature rating, lower interelectrode conductances, tighter capacitance limits and greatly improved dimensional uniformity. The 3CX100A5 consistently achieves these high standards through a series of rigorous production tests that include long-pulse cathode evaluation, a fixed-tuned cold cavity test, a positive grid-voltage and current-division test and closer mechanical tolerance tests.

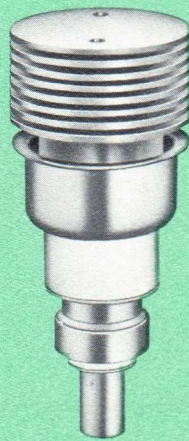
The 3CX100A5 is mechanically and electrically interchangeable in most cases with tubes of the 2C39 series.



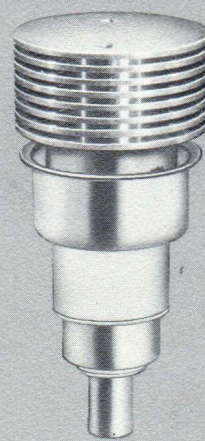
3X100A5



3CPN10A5



3CX100A5



X685C

# 3CPN10A5

## UHF Pulse Triode

The Eimac 3CPN10A5 is a ceramic-metal, UHF pulse triode intended for use in air navigational and other pulsed systems. It is designed to perform reliably at altitudes to 70,000 feet without pressurization, and will operate at full ratings to 2500 megacycles. Similar to the 3CX100A5 in electrical characteristics, the 3CPN10A5 has a long-path, grid-anode ceramic which allows it to conservatively withstand high pulse voltages without flash-over when operated under high altitude conditions. A knurled handle in place of the standard anode cooler permits easy insertion in equipment and results in a lighter, more compact tube.

# 3X100A5

## Planar Triode

This premium quality 100 watt UHF glass triode may be used as a power amplifier, multiplier, or oscillator at frequencies up to 2500 megacycles. The Eimac 3X100A5 is interchangeable in most cases with the 2C39A, and is intended for use where the advantages of ceramic design are not required.

# X685C

## Pulse Triode

Similar to the 3CX100A5, the X685C is a UHF triode designed specifically for high-duty pulse applications. It is designed to operate efficiently and reliably at maximum ratings under high altitude conditions. Eimac ceramic construction makes the X685C rugged and compact.





**First with ceramic tubes that can take it**

# 1958

## **3W5000A1 3W5000F1**

### **New 5000 Watt Water-Cooled Triodes**

The 3W5000A1 and the 3W5000F1 are new audio amplifier or modulator low-mu triodes with 5000 watt plate dissipation. They are water-cooled versions of the well-known 3X3000A1 and 3X3000F1, and have higher plate dissipation ratings than the air-cooled versions.

The 3W5000A1 has rugged concentric contact surfaces for efficient socketing, while the 3W5000F1 is supplied with flexible filament and grid leads.

Both tubes are recommended for use when water cooling is preferred or when reserve anode dissipation is required. They are well suited for industrial applications where the load encountered may be reactive as in vibration table drivers and ultrasonic transducers. They also may be used as regulator tubes in electronically regulated power supplies.



3W5000A1



3W5000F1



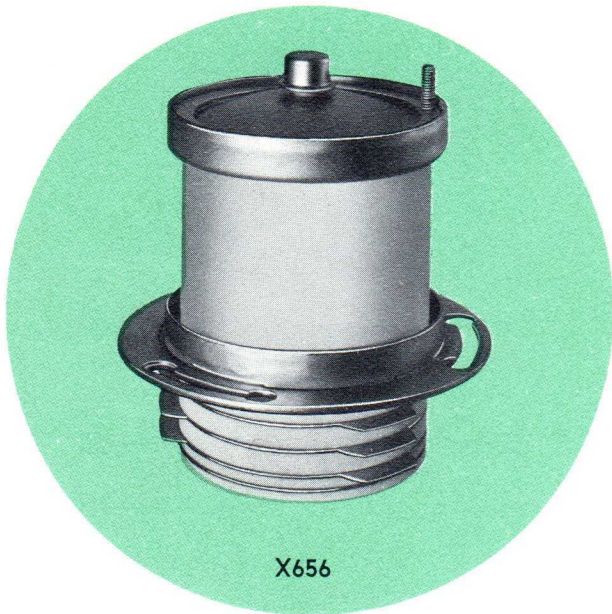
## **X556**

### **Pulse Modulator Tetrode**

Eimac's X556 can be utilized with either reactive or resistive loads. In the latter category it will deliver 4 amperes pulse plate current from a 50 kilovolt supply with a tube drop of 1.5 kilovolts. The forced-air and radiation-cooled X556 has a plate dissipation capability of 250 watts, and has been designed for use with pulse-modulated klystrons which are equipped with the exclusive Eimac modulating anode. In this application, it will switch on or off a typical load of 120 uuf with a rise or fall time of 1 microsecond at a pulse voltage of 50 kilovolts.



X556



X656

### **X656 . . . Ruggedized Pulse Modulator Tetrode**

Designed for use in severe mechanical environments, the X656 is a ceramic-metal pulse modulator tetrode exhibiting high power gain and low tube drop. It has a DC plate voltage capability of 20 kilovolts and a pulse plate current capability of 18 amperes. The X656 is convection-cooled and has a high efficiency oxide-coated cathode.

Eimac ceramic design makes this tube ideal for use when compactness, ruggedness, high performance and exceptional reliability are needed.





**First with ceramic tubes that can take it**

# 1958

## **X629 Beam Pulse Modulator**

The X629 is a ceramic-metal high voltage beam switch tube designed specifically for switching the high modulating anode voltages encountered in Eimac super-power klystrons.

This tube departs radically from the conventional design of a glass triode or tetrode by utilizing an advanced axial-beam structure. The rugged X629 successfully combines low tube drop and high voltage hold-off capability.

Structurally, the tube consists of a modified Pierce electron gun, a modulating anode in the form of a tubular aperture and an efficient "flytrap" collector.

The use of a modulating anode instead of a grid eliminates grid-dissipation problems and results in superior mechanical stability.

Although only 11 inches long, this oil-cooled tube may be operated at a DC plate voltage of 120 kilovolts and a pulse plate current of 5 amperes.

The versatile X629 may be used in a wide range of switching applications.



X629

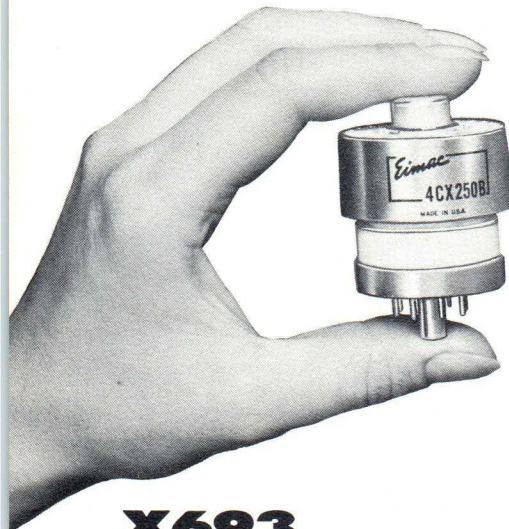




4CX250B



4CX250K



## **X693**

This 300 watt radial-beam power tetrode is a water-cooled version of the ceramic-metal Eimac 4CX250B, and has the same electrical characteristics.

## **New Eimac Ceramic Radial-Beam Power Tetrodes**

### **4CX250B**

This new premium quality radial-beam power tetrode is an all ceramic-metal version of the famous 4X250B. The 4CX250B is similar to the 4X250B in mechanical and electrical characteristics and is interchangeable in most cases with the 4X150A. It has a plate dissipation rating of 250 watts and operates at maximum ratings to 500 megacycles.

Among the advantages gained by using ceramics in place of glass in the production of the 4CX250B are: greater resistance to damage by mechanical shock and high temperature, lower RF dielectric losses, greater dimensional stability, and suitability to rigorous high temperature processing that leads to higher performance and exceptional reliability.

### **4CX250K**

This forced air-cooled high-transconductance tetrode has concentric terminals ideal for VHF and UHF circuits. For example, at 1200 megacycles the 4CX250K will deliver 20 kilowatts output power in plate pulse operation and 100 watts output power at 750 megacycles in Class C CW pulse. This tube has a 6 volt heater.

### **4CX250M**

This tube has the same general characteristics as the 4CX250K except that it has a 26.5 volt heater.





**First covering the spectrum with ceramic tubes**

# 1958

## **4CX1000A**

Eimac fills another important transmitting need with this air-cooled ceramic-metal radial-beam tetrode having a plate dissipation rating of 1 kilowatt. Specifically designed for single sideband operation, the 4CX1000A is a low-voltage high-current Class AB<sub>1</sub> RF linear amplifier tube, exhibiting high power gain and low distortion characteristics. It achieves its maximum output power capability with zero grid current.

Eimac stacked-ceramic design gives the 4CX1000A excellent resistance to damage by mechanical and thermal shock. Electrical stability is assured by internal ceramic support of the tube elements, clean internal design and high temperature processing.

Less than 5 inches high and 3½ inches in diameter, this thousand watt tetrode is ideal for applications where space is at a premium.

## **X703**

This ceramic-metal tetrode is a water-cooled version of the 4CX1000A. It has a plate dissipation capability of 2500 watts.

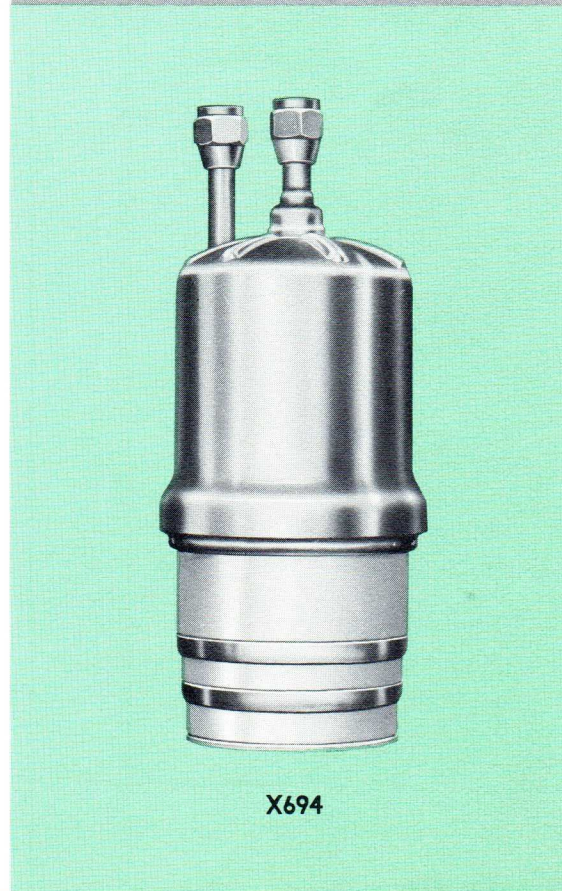
Other electrical characteristics are the same as those of the 4CX1000A.

## **X694**

This ceramic tetrode is a water-cooled version of the Eimac 4CX5000A. Suitable for use as an oscillator, amplifier, or modulator, the X694 is especially useful as an RF linear amplifier in single sideband applications. It is designed for use where water cooling is preferred, or when additional over-load and plate dissipation capability are needed.



4CX1000A



X694



## New Eimac Air System Sockets

### PIN-BASE TUBE SOCKETS

SK-900 Socket for 4X500A

SK-906 Air chimney for SK-900 socket

SK-626 Ceramic air chimney for SK-620 and SK-630 sockets

SK-636 Air chimney with anode clamping device for SK-620 and SK-630 sockets

### BRECHLOCK-BASE TUBE SOCKETS

SK-800 Socket for 4CX1000A

SK-806 Air chimney for SK-800 socket

SK-700 Socket for 4CX300A (Ungrounded cathode)

SK-710 Socket for 4CX300A (Grounded cathode)

SK-740 Lightweight socket for 4CX300A, without integral air chimney

SK-760 Lightweight socket for 4CX300A, integral air chimney (Ungrounded Screen)

SK-770 Lightweight socket for 4CX300A, air chimney (Grounded Screen)



SK-900



SK-800

### KLYSTRON SOCKETS

SK-1000 Socket for 4KM170,000LA klystron





**First with ceramic tubes that can take it**

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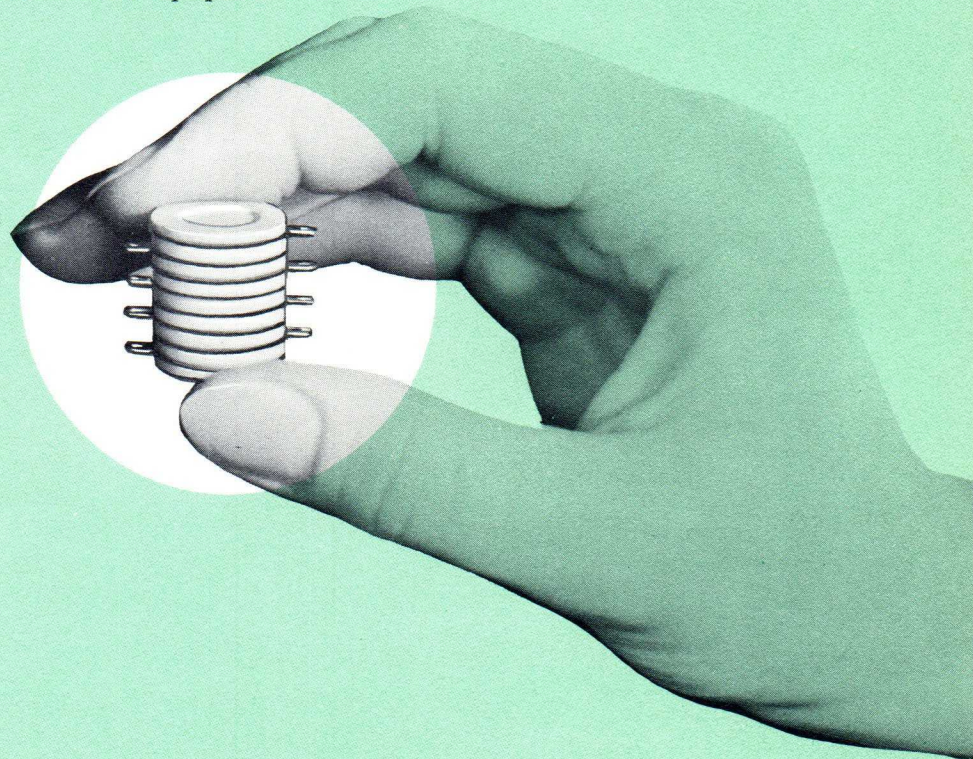
## Ceramic Receiving Tubes

Eimac-pioneered stacked-ceramic design is actively being applied to a new line of compact, rugged highly reliable receiving tubes. In Eimac's simple, straightforward design, precision ceramic rings form part of the tube envelope and also act as precise electrode spacers.

These ceramic rings are stacked alternately with metal electrodes in an operation ideally suited to automated production. The entire assembly is then brazed into a rugged, compact unit. Terminal lugs project from the side of the tube allowing it to be permanently soldered into circuitry.

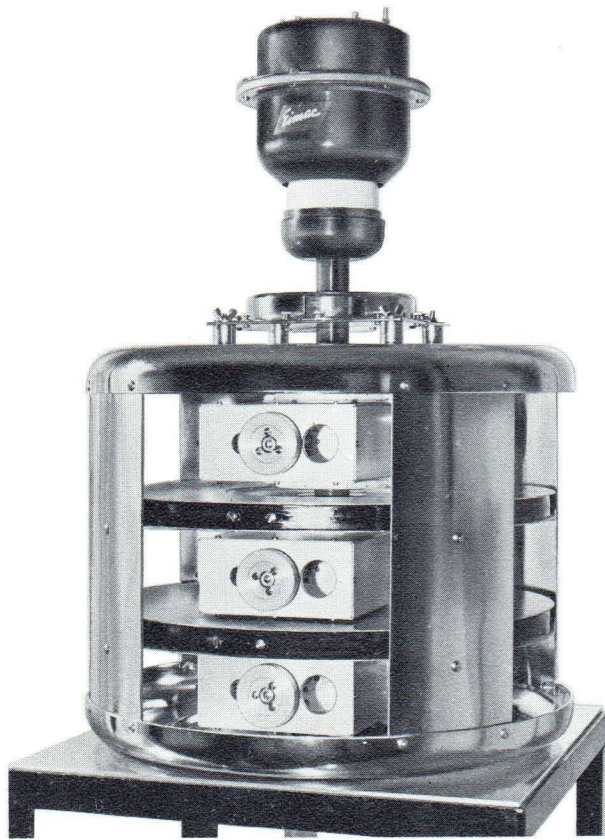
This advanced design eliminates internal insulators and spacers and enables these tubes to withstand heavy accelerative forces from shock and vibration without introducing appreciable noise. Ceramic-metal construction also allows these tubes to operate continuously at high envelope temperature without deterioration of electrical characteristics.

Compact, rugged, reliable . . . these Eimac stacked-ceramic receiving tubes are tubes of the future that will successfully meet the increasingly strenuous demands placed on electronic equipment.





## Eimac Circuit Components + Eimac Klystron → Complete Amplifier Package



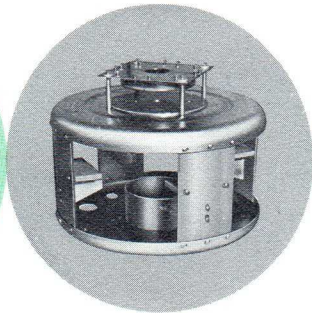
With Eimac's simplified external-cavity system the tunable portions of the RF circuitry are completed outside the vacuum system. This makes possible a wider tuning range with a single tube and allows the RF circuitry to become a permanent part of the transmitter—a considerable economy when it becomes necessary to replace a tube.

External circuit components necessary for a complete amplifier package can be supplied for all Eimac klystrons. These components include RF resonant cavities, magnetic beam control coils, magnetic frameworks, air system sockets and RF output load couplers.

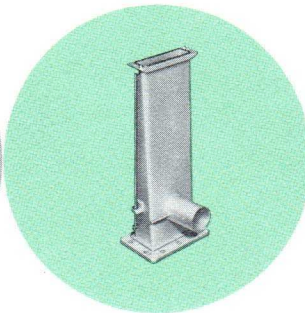
The Complete Amplifier Package



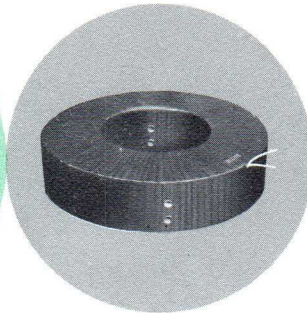
Air System Socket



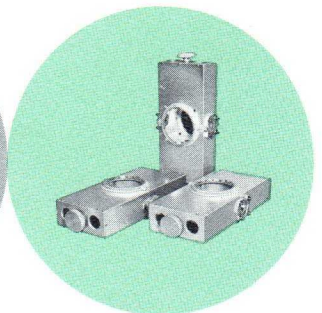
Magnetic Framework



RF Output Load Coupler



Magnetic Beam Control Coils



RF Resonant Cavities

## Eimac Water Loads

Eimac water loads can now be obtained in most waveguide sizes for use in adjusting and testing Eimac klystrons. The power handling capability of these dummy loads is limited only by the size of the waveguide used. RF power is efficiently converted directly to heat in the water circulating through the load. Water flow rate and pressure requirements are moderate. Power reading response is very fast—in most cases 15 to 30 seconds. The VSWR of these loads is typically less than 1.1 to 1.

The following water load types are representative of the frequency coverage now available:

X726	350 to	530 Mc.	X729	3,950 to	5,850 Mc.
X727	1,700 to	2,600 Mc.	X730	5,300 to	8,200 Mc.
X728	2,600 to	3,950 Mc.	X731	7,500 to	10,000 Mc.



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