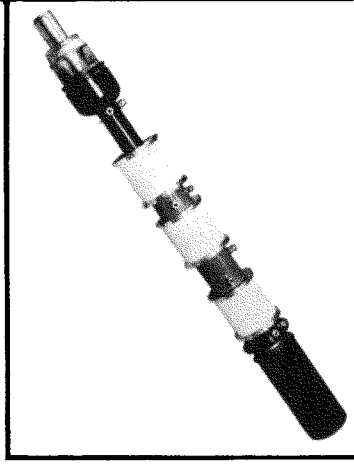
TENTATIVE DATA

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

3K50,000LA
3K50,000LF
3K50,000LK
KLYSTRONS
●
L-BAND AMPLIFIERS



The Eimac 3K50,000LA, 3K50,000LF and 3K50,000LK klystrons are three cavity, magnetically focused power amplifiers intended primarily for UHF television broadcast service. Each klystron type, operating as a television visual r-f amplifier, will deliver 12 kW of peak synchronizing power output with a power gain of approximately 20 db. The cavities of the Eimac UHF television klystrons have ceramic windows and are completed by tuning boxes external to the tubes.

NOMINAL TUNING RANGE

The UHF television band (470-890 Mc) is covered by the three tube types as follows:

TUBE TYPE NUMBER	MC.	CHANNEL
3K50,000LA	470-580	14-32
3K50,000LF	580-720	33-55
3K50,000LK	720-890	56-83

GENERAL CHARACTERISTICS

MECHANICAL

Mounting (See Outline Drawing)	Support from Mounting Flange			
Mounting Position	Axis Vertical			
Cooling	Water & Forced Air			
Connections:				
Filament	Flexible Leads			
Cathode	Cylindrical Strap			
Focus Electrode	Cylindrical Strap			
Cavities	Multiple Contact Fingers			
Collector	Cylindrical Strap			
Klystron Type	"A"	"F"	"K"	
Maximum Overall Dimensions:				
Length	54	49	45	inches
Diameter	5⅛	5⅛	5⅛	inches
Net Weight	53	48	46	pounds
Shipping Weight	185	175	170	pounds

ELECTRICAL

Filament: Pure Tungsten		
Voltage	9.0	volts
Current (with cathode cold)	42	amperes
Current (with cathode at operating temperature)	39	amperes
Maximum Allowable Short Circuit Current of Filament Current Source	84	amperes
Cathode: Unipotential; heated by electron bombardment		
MAXIMUM CATHODE RATINGS		
DC VOLTAGE	2300	MAX. VOLTS
DC CURRENT	.75	MAX. AMPERES
DC POWER	1600	MAX. WATTS
Focus Electrode		
*Voltage (with respect to cathode)	0 to —500	volts
Magnetic Field: Axial (See Magnetic Circuit Schematic)		
Field Strength (approximately)	120	gauss

*May be varied over a range of 0 to —500 volts if beam current control is desired.

ULTRA HIGH FREQUENCY POWER AMPLIFIER

MAXIMUM RATINGS

DC BEAM VOLTAGE	19.5 MAX. KILOVOLTS
DC BEAM CURRENT	2.56 MAX. AMPERES
COLLECTOR DISSIPATION	50.0 MAX. KILOWATTS

Note: Maximum beam voltage and beam current should not be applied without r-f excitation.

TYPICAL OPERATION

RF Linear Amplifier—Television Visual Service (In accordance with United States Federal Communications Commission Standards)

DC Cathode Bombarding Power	1400	watts
DC Cathode Bombarding Voltage (approximately)	2100	volts
DC Cathode Bombarding Current (approximately)	.66	amperes
DC Focus Electrode Voltage	0	volts
DC Beam Voltage	17.2	kilovolts
DC Beam Current	2.15	amperes
DC Collector Current (approximately)[1]	1.72	amperes
Peak Synchronizing Level (80% of saturation power)		
Driving Power (approximately)[2]	55	watts
Power Output	12.0	kilowatts
Efficiency	41	percent
Black Level		
Collector Dissipation (approximately)[1]	30	kilowatts
Driving Power (approximately)[2]	33	watts
Power Output	7.2	kilowatts
Efficiency	19	percent

RF Amplifier—Television Aural Service

DC Cathode Bombarding Power	1400	watts
DC Cathode Bombarding Voltage	2100	volts
DC Cathode Bombarding Current	.66	amperes
DC Focus Electrode Voltage	0	volts
DC Beam Voltage	12.3	kilovolts
DC Beam Current	1.33	amperes
DC Collector Current[1]	1.06	amperes
Driving Power[3]	20	watts
Collector Dissipation (approximately)[1]	10	kilowatts
Power Output	6	kilowatts
Efficiency	36	percent

[1]Minor tube-to-tube variations may be expected.

[2]Total driving power includes losses inserted for broadband operation. The output power is useful power measured in a load circuit.

[3]The driving power is the total power required by the tube and a resonant circuit.

APPLICATION

Mounting—The klystrons are provided with a mounting flange (See Outline Drawing) which may be used to support the tubes with either end up.

Filament Operation—For maximum tube life, the pure tungsten filament should be operated just above the emission limiting temperature. This temperature will be obtained with a filament voltage, as measured directly at the terminals, of approximately 9 volts.

Cathode Heating Power—The cathode is unipotential and heated by electron bombardment. A dc potential of approximately 2100 volts is applied between the filament and the cathode; and the recommended cathode heating power of 1400 watts is obtained with approximately .66 amperes. The filament is designed to operate under space-charge limited conditions. Cathode temperature is varied by changing the bombarding potential between the filament and the cathode.

Cooling—Forced air is used to cool the Electron Gun Structure and the Middle and Output Cavities. Only clean, well filtered air should be blown on the tube to avoid voltage breakdown due to dust accumulation. The temperature of the metal in the region of the metal-to-glass seals should not exceed 150°C. Tube temperatures may be measured with a temperature-sensitive paint, such as "Tempilaq", manufactured by the Tempil Corporation, 132 West 22nd Street, New York 11, N. Y.

Water is used to cool the Drift Tubes and the Collector Assembly. The cooling water should be of sufficient purity to prevent liming of the water system, and the use of a heat exchanger is recommended. The inlet water pressure of the Drift Tubes and the Collector Assembly should not exceed 50 pounds per square inch. The outlet water temperature must not exceed a maximum of 70°C. under any condition.

Air and water flow should be started before the filament and cathode power are applied and maintained for at least two minutes after the filament and cathode power have been removed.

Klystron Cooling Requirements for Typical Operating Conditions and Correct Magnetic Field Adjustment:

	Cooling Medium	Volume	Pressure Drop	Remarks
Input Drift Tube	*Water	1 gpm	1 psi	Total pressure drop if series connected with 5/16" tubing= 4 psi.
Short Drift Tube Jacket	*Water	1 gpm	1 psi	
Long Drift Tube Jacket	*Water	1 gpm	1 psi	
Output Drift Tube	*Water	1 gpm	1 psi	
Collector Assembly	*Water	15 gpm	3 psi	
Electron Gun Structure — Filament Stem	Air	1-2 cfm		See Cooling Diagram
Electron Gun Structure — Cathode Terminal	Air	90 cfm		
Electron Gun Structure — Focus Electrode and Anode Seals	Air	90 cfm		
Input Cavity	None			
Center Cavity	Air	15 cfm		
Output Cavity	Air	50 cfm		

*Cooling water connections should be made as noted on Cooling Diagram.

RF Contact Surfaces—The means by which contact is made between the cavities and the tuning boxes is of great importance. Two requirements which must be met to ensure proper electrical connections are as follows:

(1) Contact to the tube cavities must be made only on the peripheral surface of the 1/4" cavity flanges as shown on the outline drawing.

(2) Each individual finger of the collet or spring stock material must make positive contact to the cavity flange to prevent arcing.

Magnetic Field—An adjustable magnetic field is necessary to control and direct the beam throughout the length of the drift tube. The magnetic field should be capable of variation around the recommended field strength of 120 gauss. Typical magnetic circuit requirements for a 3K50,000LK are shown in the Magnetic Circuit Schematic. The current and adjustment of the pre-focusing coil are optimized under low beam voltage conditions and will require minor readjustment with changes in beam voltage. The current and location of the focusing coils should be capable of independent adjustment. Readjustment of the current of the focusing coils is necessary with changes in beam voltage. Beam transmission (collector current divided by the beam current as measured in the cathode return to beam power supply) will vary from 75% to 95%. Improper adjustment or misalignment of the magnetic field, as indicated by too low a value of beam transmission, may cause the beam to strike and overheat the drift tube walls.

MAGNETIC FIELD COIL REQUIREMENTS

Number of Coils Required for Field Strength of Approximately 120 Gauss.

Tube Type	Pre-focusing Coil: 375-750 ampere-turns per coil	Focusing Coils: 1600-4800 ampere-turns per coil	Focusing Coils: 0-1600 ampere-turns per coil
3K50,000LA	1	3	1
3K50,000LF	1	3	1
3K50,000LK	1	2	1

CAUTION—It is convenient to operate the r-f and collector portions of the tube at ground potential. Since the cathode and filament are operated at high negative potentials with respect to ground, filament and cathode power supplies and voltmeters must be adequately insulated for these high voltages. Protection must also be afforded to operating personnel.

Protection—It is recommended that the following protective devices be used:

(1) Interlocks in air and water supplies.

(2) Interlocks in magnetic field supply circuits.

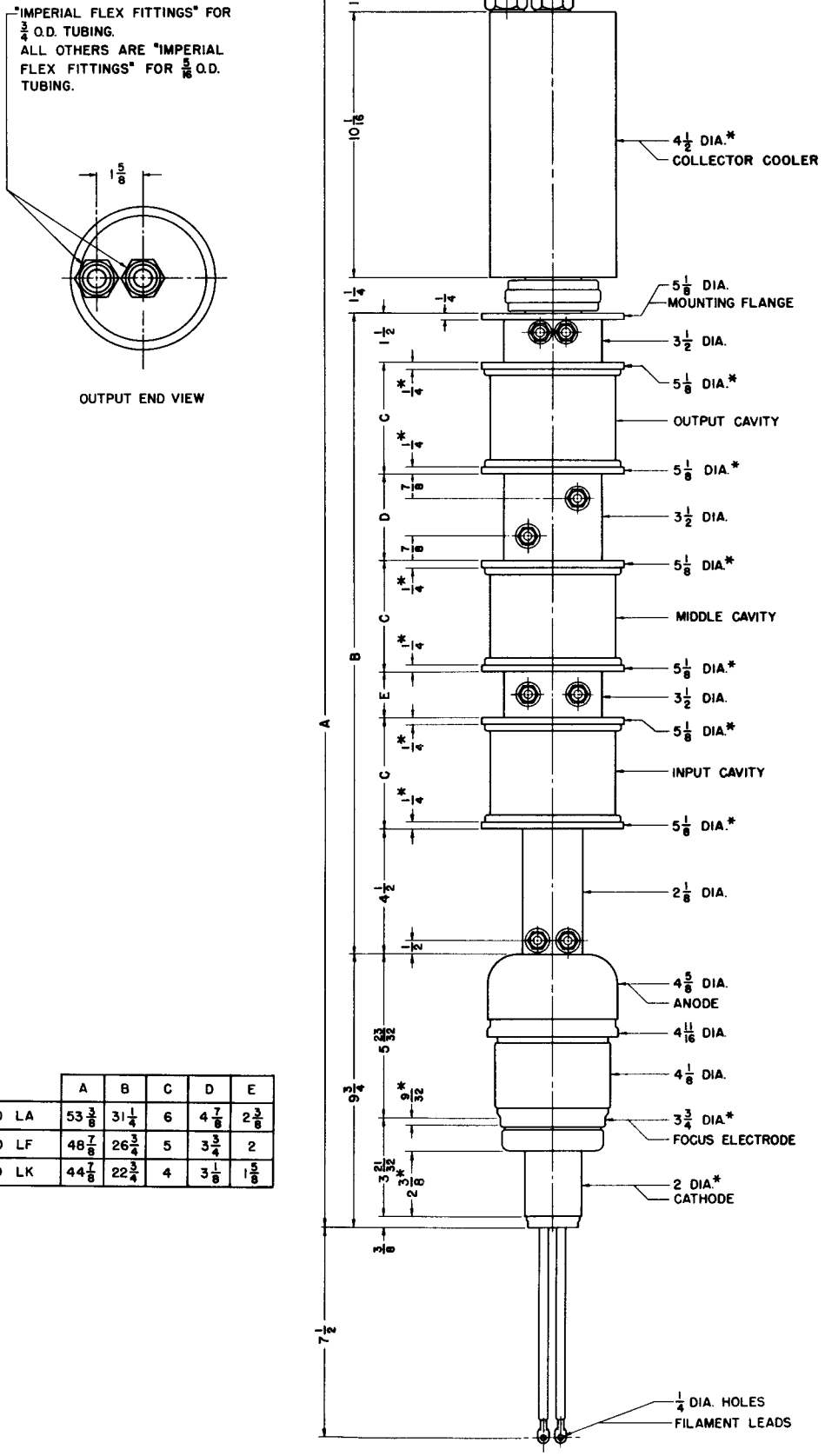
(3) Current overload in cathode bombardment supply circuit.

(4) Current overload in beam current supply circuit.

(5) Current overload in cavity current circuit.

(6) Current limiting resistor of approximately 100 ohms in series with beam power supply to isolate tube from final capacitor of supply.

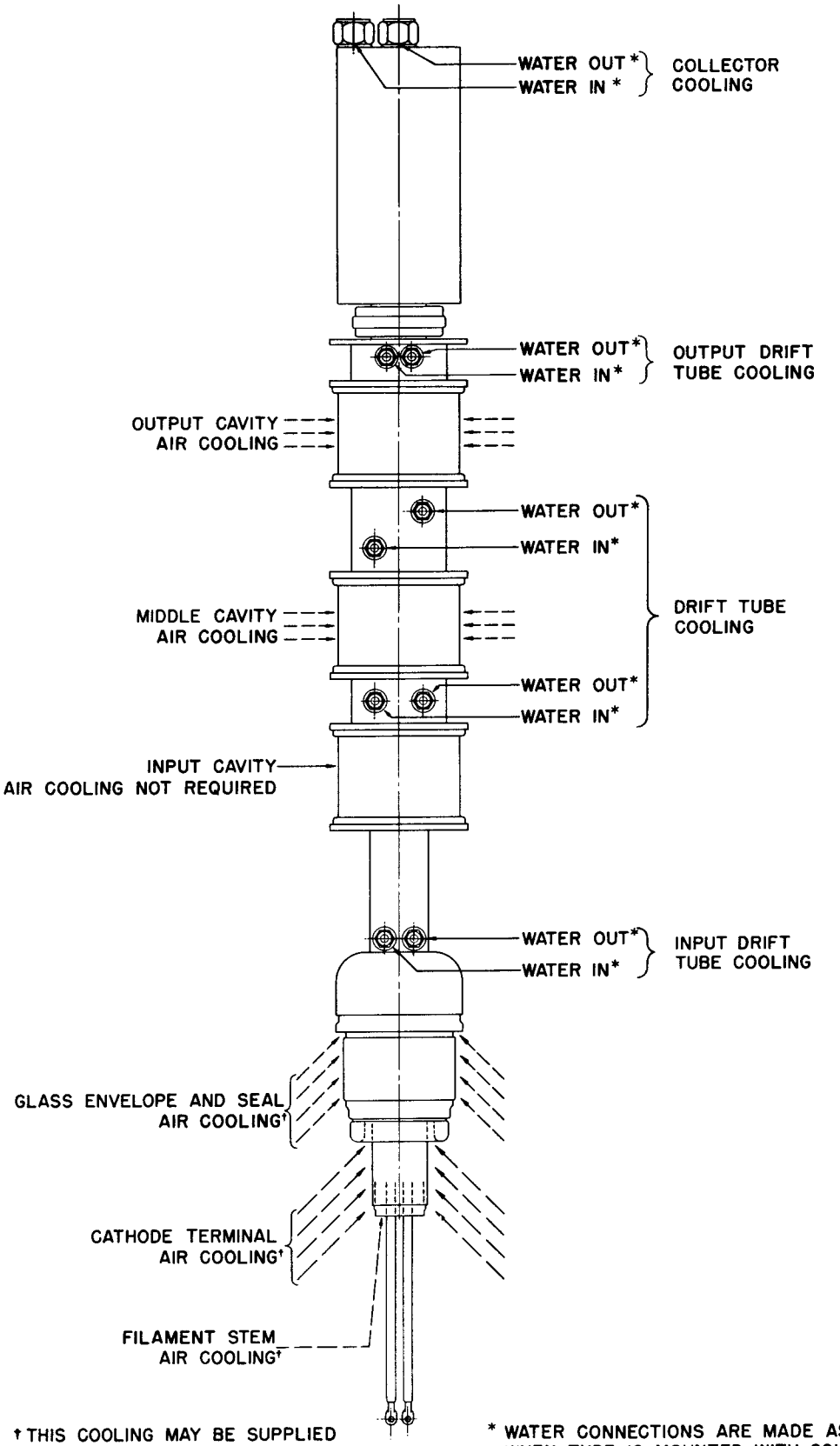
The filament and cathode bombardment voltages will normally be applied before the beam voltage. Cavity tuning or magnetic field adjustment should be made with reduced beam voltage (1/2 to 2/3 normal). Slight retuning and readjustment will be necessary when beam voltage is raised to full value.



	A	B	C	D	E
3K50,000 LA	53 3/8	31 1/4	6	4 7/8	2 3/8
3K50,000 LF	48 7/8	26 3/4	5	3 3/4	2
3K50,000 LK	44 7/8	22 3/4	4	3 1/8	1 15/16

DIMENSIONS IN INCHES

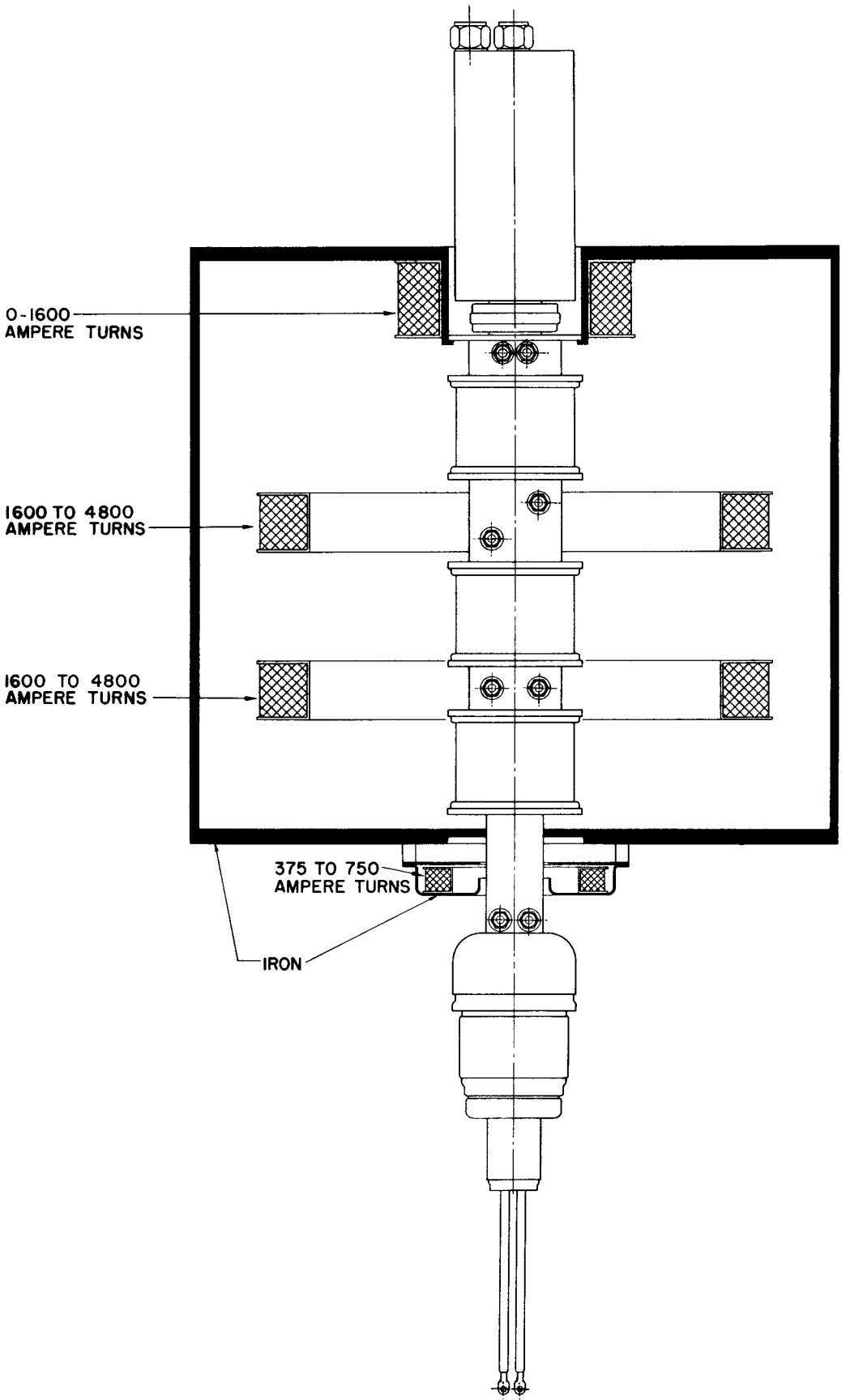
*CONTACT SURFACE



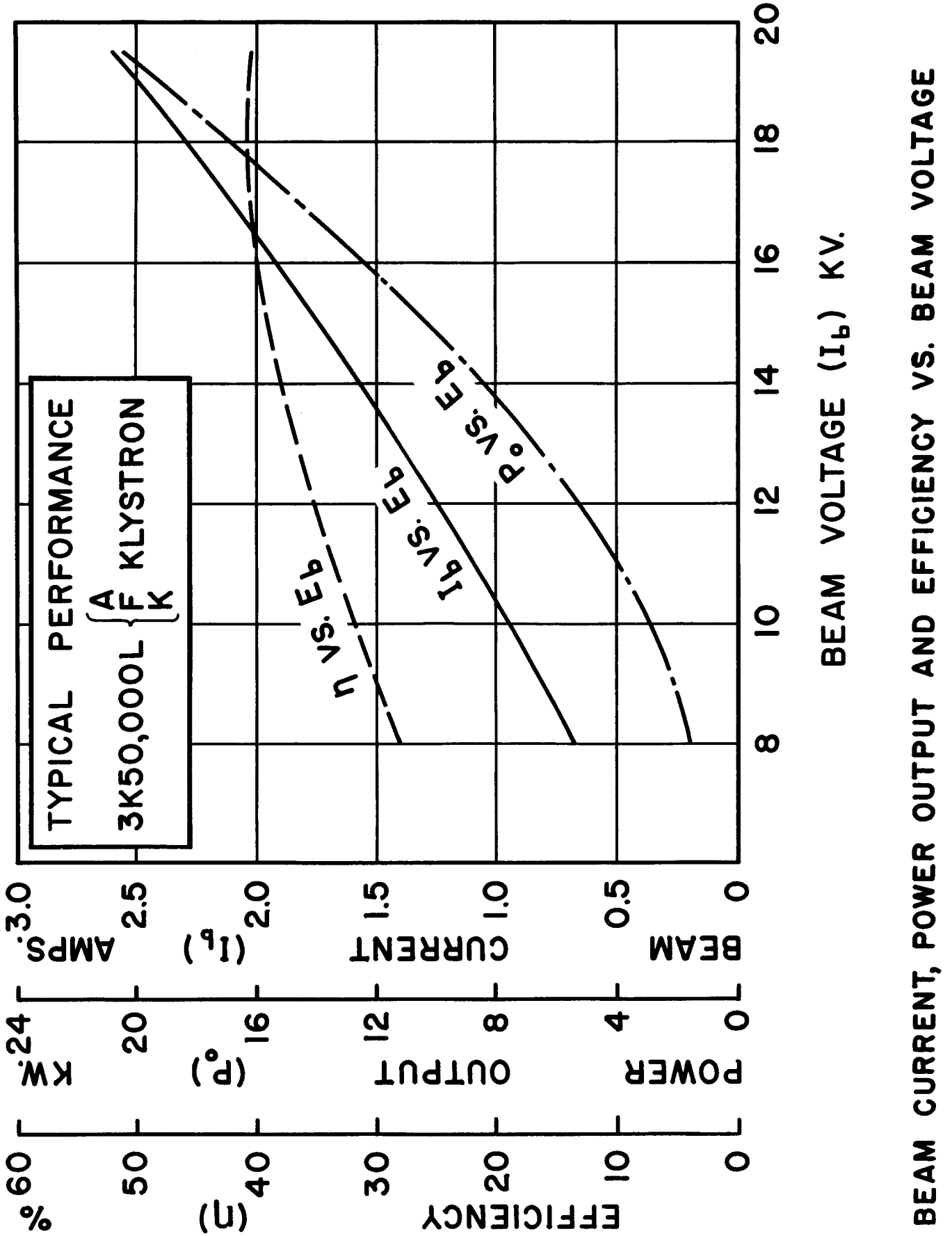
† THIS COOLING MAY BE SUPPLIED BY A SINGLE BLOWER THROUGH SUITABLE MANIFOLD & BAFFLES

* WATER CONNECTIONS ARE MADE AS SHOWN WHEN TUBE IS MOUNTED WITH COLLECTOR UP. WHEN TUBE IS MOUNTED WITH ANODE UP THE WATER CONNECTIONS MUST BE REVERSED.

COOLING DIAGRAM



MAGNETIC CIRCUIT SCHEMATIC FOR 3K50,000LK



BEAM CURRENT, POWER OUTPUT AND EFFICIENCY VS. BEAM VOLTAGE