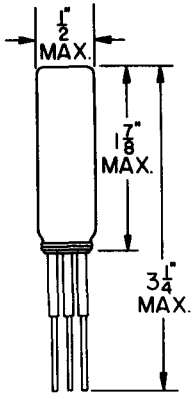
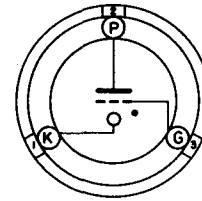
TUNG-SOL

THYRATRON

COLD CATHODE



GLASS BULB



BOTTOM VIEW

THE 395A IS A SMALL SIZE, LIGHT WEIGHT, COLD CATHODE THYRATRON USED PRIMARILY IN RELAY SERVICE. THE CHARACTERISTIC NEON GLOW DISPLAYED ON THE SURFACE OF THE CATHODE WHILE THE TUBE IS CONDUCTING, MAKES THE USE OF AUXILIARY VISUAL INDICATING DEVICES UNNECESSARY. THE MINUTE TRIGGERING CURRENT REQUIREMENTS AND THE LACK OF NECESSITY FOR FILAMENT POWER MAKE THIS TUBE EXTREMELY SUITABLE FOR USE IN TRANSISTORIZED EQUIPMENT OR IN BATTERY OPERATED EQUIPMENT. THE 395A WILL FIRE DIRECTLY FROM A SIGNAL SUPPLIED BY EITHER A VACUUM PHOTO TUBE OR A CADMIUM SULFHIDE PHOTO CELL.

THE 395A HAS ALSO FOUND USE AS A TRIGGER TUBE, AS A RELAXATION OSCILLATOR, AND AS A VOLTAGE REGULATOR.

MAXIMUM RATINGS FOR RELAY SERVICE

ABSOLUTE VALUES

POSITIVE ANODE VOLTAGE	140	VDC
NEGATIVE ANODE VOLTAGE (WITHOUT DISCHARGE TO A POSITIVE GRID)	-60	VDC
POSITIVE GRID BIAS VOLTAGE (WITHOUT GRID IONIZATION)	70	VDC
TOTAL POSITIVE GRID VOLTAGE TO INSURE BREAKDOWN (WITH Rg = 0.1 MEGOHM MAX.) (MIN.)	87	VDC
NEGATIVE GRID VOLTAGE (WITHOUT DISCHARGE TO A POSITIVE ANODE)	-10	VDC
GRID TRANSFER CURRENT	5	μADC
CATHODE CURRENT		
PEAK, RECURRING (AVERAGED OVER 1 SECOND)	35	MA.
AVERAGE (SEE LIFE EXPECTANCY CURVE)	—	
PEAK INVERSE ANODE CURRENT	1	MA.

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TUNG-SOL

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ELECTRICAL DATA
TYPICAL VALUES

CATHODE	COLD	
IONIZATION TIME (AT E_b=130V, E_c=75V, e_c = 20V. PULSE, R_g=0.1 MEGOHMS)	23	μSEC
ANODE VOLTAGE DROP (AT I_b =10. MA.)	75	VDC
GRID VOLTAGE DROP (AT I_c =10. MA.)	65	VDC
ANODE IONIZATION VOLTAGE (AT E_g = 0)	170	VDC
GRID IONIZATION VOLTAGE	75	VDC
REQUIRED TRANSFER CURRENT FOR TRANSITION OF DISCHARGE TO ANODE AT 130 VOLTS DC	2.5	μAMP.

MECHANICAL DATA

TEMPERATURE	-40 TO +60	°C
ALTITUDE FOR FULL RATINGS	10 000	FEET
NORMAL ILLUMINATION (SEE APPLICATION NOTES)	5 TO 150	lm/SQ.FT.

TYPICAL OPERATING CONDITIONS

ANODE SUPPLY VOLTAGE	130	VDC
POSITIVE GRID BIAS	70	VDC
GRID TRIGGER VOLTAGE	20	VOLTS
ANODE CIRCUIT RESISTANCE	6800	OHMS
GRID CIRCUIT RESISTANCE	1	MEGOHM

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APPLICATION NOTES

THE 395A THYRATRON CONTAINS A CATHODE, A TRIGGER GRID AND AN ANODE WITHIN A GASEOUS ATMOSPHERE. IF AN INCREASING POSITIVE VOLTAGE IS APPLIED TO THE GRID, A MINUTE PRE-IONIZATION CURRENT WILL FLOW UNTIL THE CRITICAL GRID CURRENT OF ABOUT TWO MICROAMPERES IS REACHED. AT THIS POINT THE REGION BETWEEN THE GRID AND CATHODE "BREAKS DOWN" OR IONIZES. IF THE APPLIED ANODE VOLTAGE IS EQUAL TO OR GREATER THAN THE GRID VOLTAGE, THE GLOW WILL THEN TRANSFER TO THE CATHODE-ANODE REGION. THUS, A VERY LOW ENERGY SIGNAL IN THE GRID CIRCUIT CAN CONTROL MUCH HIGHER ENERGY IN THE ANODE CIRCUIT. IF, IN THIS ILLUSTRATION AN ANODE CURRENT OF 10 MILLIAMPERES WERE TO FLOW, THE TUBE HAS PROVIDED CURRENT AMPLIFICATION OF 5,000.

AS WITH ANY GAS TUBE, ONCE THE TUBE CONDUCTS, THE TUBE VOLTAGE DROP REMAINS VIRTUALLY CONSTANT AND THE CURRENT THROUGH THE TUBE IS LIMITED BY THE CIRCUIT RESISTANCE. IN THE ANODE CIRCUIT THIS MAY BE THE RESISTANCE OF THE LOAD ITSELF, OR, THE LOAD PLUS ADDITIONAL LIMITING RESISTANCE. THE GRID CIRCUIT SHOULD CONTAIN A 5,000 OHM SERIES RESISTANCE IF THE SOURCE RESISTANCE IS LOWER THAN THIS FIGURE. IF THE GRID CIRCUIT RESISTANCE IS ABOVE 10 MEGOHMS, HOWEVER, IT MAY BE NECESSARY TO CONNECT A SMALL CAPACITANCES BETWEEN THE GRID AND CATHODE. THIS IS TO STORE ENOUGH ENERGY TO INSURE GRID IONIZATION.

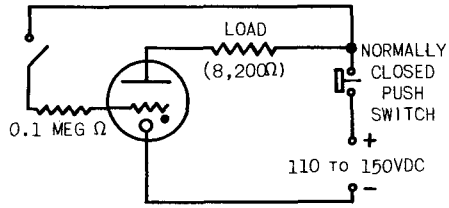
IF THE 395A IS USED IN TOTALLY ENCLOSED EQUIPMENT THERE MAY BE A DELAY OF SEVERAL MILLISECONDS BEFORE FIRING. THIS CAN BE ALLEVIATED BY PROVIDING OVER-VOLTAGE ON THE GRID SIGNAL OR LOCATING THE TUBE WHERE IT WILL RECEIVE SOME ILLUMINATION FROM PILOT LIGHTS OR THE HEATERS OF VACUUM TUBES. THE 395A IS RADIOACTIVELY DOSED TO MINIMIZE THIS DELAY. THE MAGNITUDE OF ACTIVITY IS NOT GREAT ENOUGH TO INSTITUTE A PERSONAL HAZARD. HOWEVER, PERSONS ARE CAUTIONED NOT TO HANDLE BROKEN TUBES TO AVOID GETTING THE ACTIVE MATERIAL DIRECTLY INTO THE BLOODSTREAM THROUGH CUTS. IF A PERSON CUTS HIMSELF ON A BROKEN TUBE, THE CUT SHOULD BE CLEANSED IMMEDIATELY. AN OPEN CUT CAN BE CLEANSED BY HOLDING IT IN RUNNING WATER.

FOR "END ON" VISUAL INDICATION THE 395A CAN BE MOUNTED IN A RECESS IN A PANEL. FOR CURRENT LEVELS BELOW TWO MILLIAMPERES, THE ILLUMINATION CAN BE INCREASED BY USING FOR THE RECESS, TUBING WITH SHINY INNER WALLS. IF THE TUBE IS NOT USED IN A RECESS, THE BULB SIDES SHOULD BE SHIELDED (eg; NICKEL MESH) TO PREVENT HAND CAPACITY OR STRONG ELECTRIC FIELDS FROM ALTERING FIRING POTENTIALS.

TYPICAL CIRCUIT CONFIGURATIONS ARE ILLUSTRATED ABOVE. AS WITH ANY THYRATRON CIRCUIT, ONCE THE TUBE CONDUCTS, THE GRID WILL NOT REGAIN CONTROL UNTIL THE ANODE VOLTAGE FALLS LOW ENOUGH TO EXTINGUISH THE CATHODE-ANODE GLOW. THIS IS USUALLY ACCOMPLISHED BY BREAKING THE ANODE CIRCUIT. HOWEVER, IT CAN ALSO BE DONE UNDER D.C. OPERATION, BY CAUSING THE ANODE CURRENT TO FLOW IN SAW TOOTH STEPS. THE SAW TOOTH IS GENERATED BY RUNNING THE TUBE AS A RELAXATION OSCILLATOR BY INSERTING SUFFICIENT CAPACITY BETWEEN THE CATHODE AND ANODE. FIGURE 3 ILLUSTRATES AN APPLICATION OF THIS IDEA. THE 395A WILL ALSO REGAIN GRID CONTROL ON EACH CYCLE IF IT IS RUN FROM HALF WAVE RECTIFIER A.C. FIGURE 4 ILLUSTRATES AN APPLICATION OF THE TUBE ON A.C. OPERATION OF THE TUBE ON A.C. WITHOUT THE SERIES DIODE IS NOT RECOMMENDED.

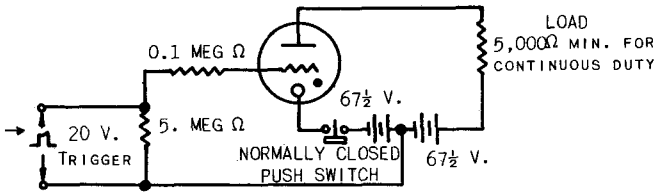
THE FLAT ANODE VOLTAGE-CURRENT CHARACTERISTIC OF THE 395A HAS LED TO THE USE OF THE TUBE AS A VOLTAGE REGULATOR OR AS AN OVER VOLTAGE PROTECTIVE DEVICE. THE TUBE HAS ALSO FOUND USE AS A TRIGGER DEVICE CARRYING AMPERES OF CURRENT FOR SEVERAL SECONDS IN "ONE SHOT" APPLICATIONS.

TUNG-SOL



7400 USED AS A MECHANICALLY OPERATED RELAY

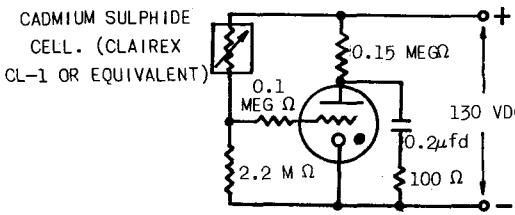
FIG. 1



395A OPERATED FROM DRY BATTERIES

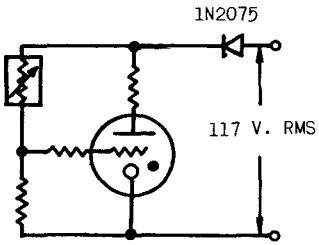
FIG. 2

→ INDICATES A CHANGE.



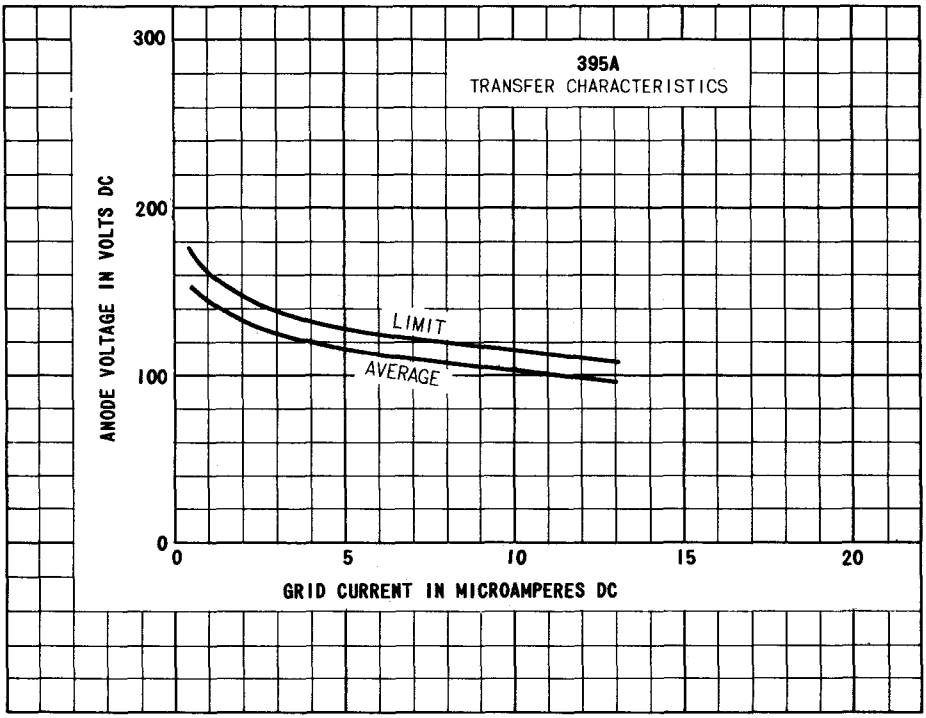
7400 ACTING AS A RELAY FOR A CADMIUM SULPHIDE PHOTO CELL

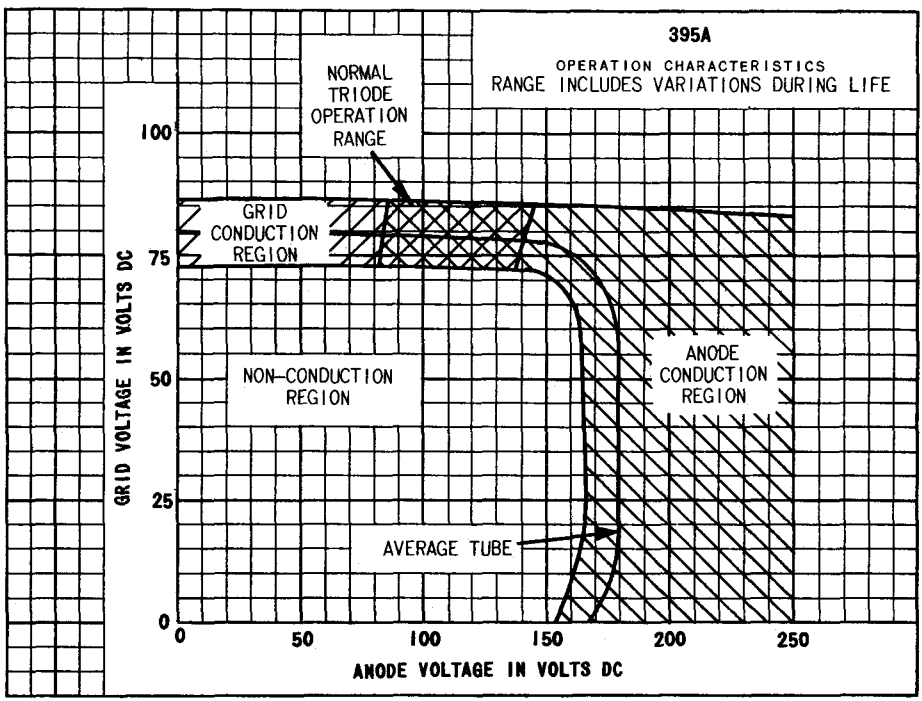
FIG. 3

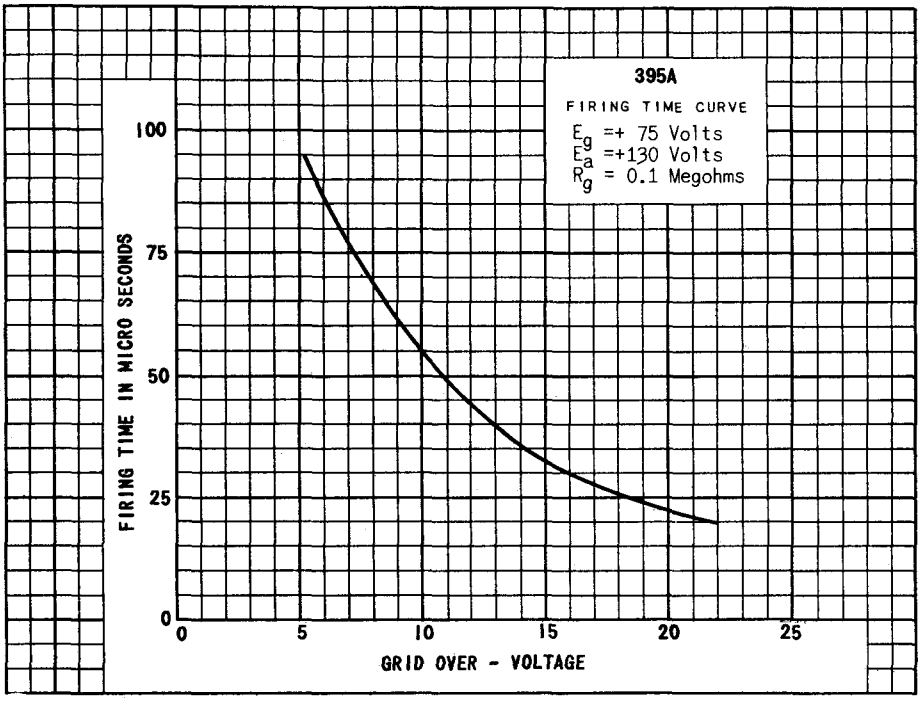


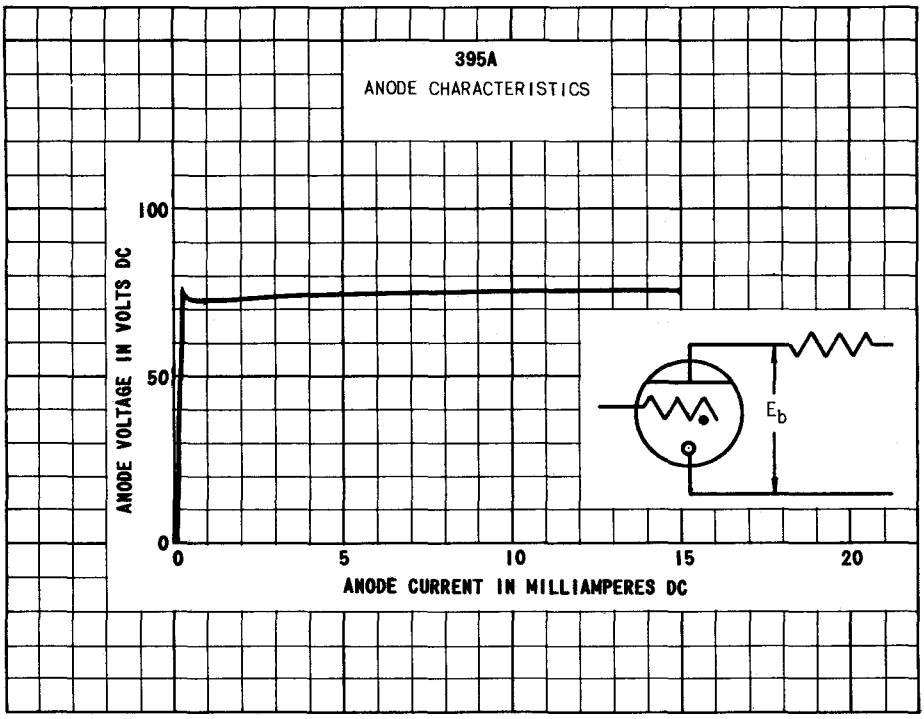
SAME AS FIGURE 3 BUT OPERATED FROM A.C. LINE

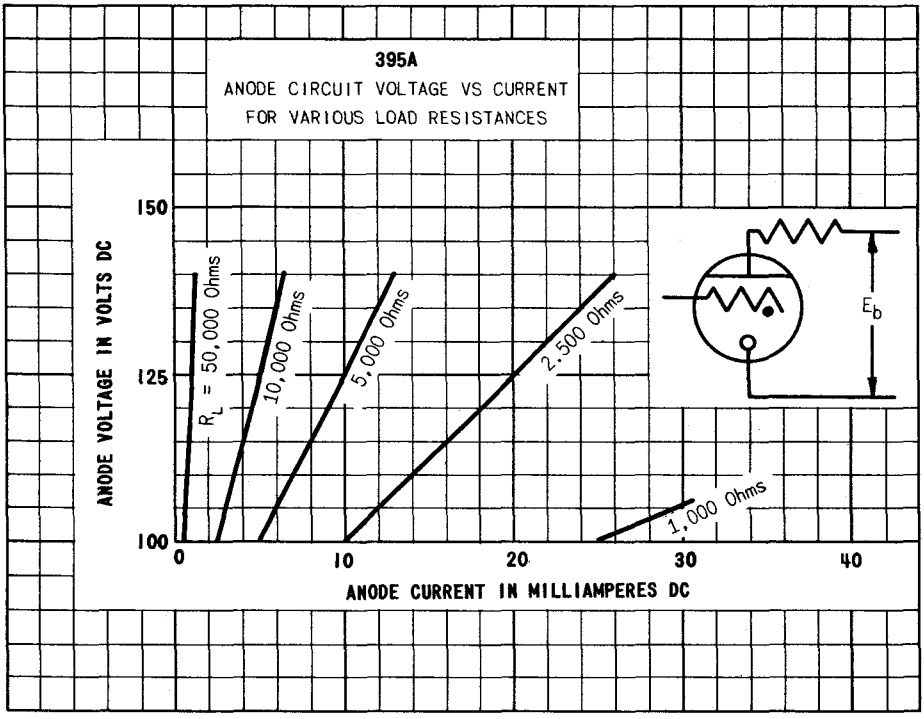
FIG. 4

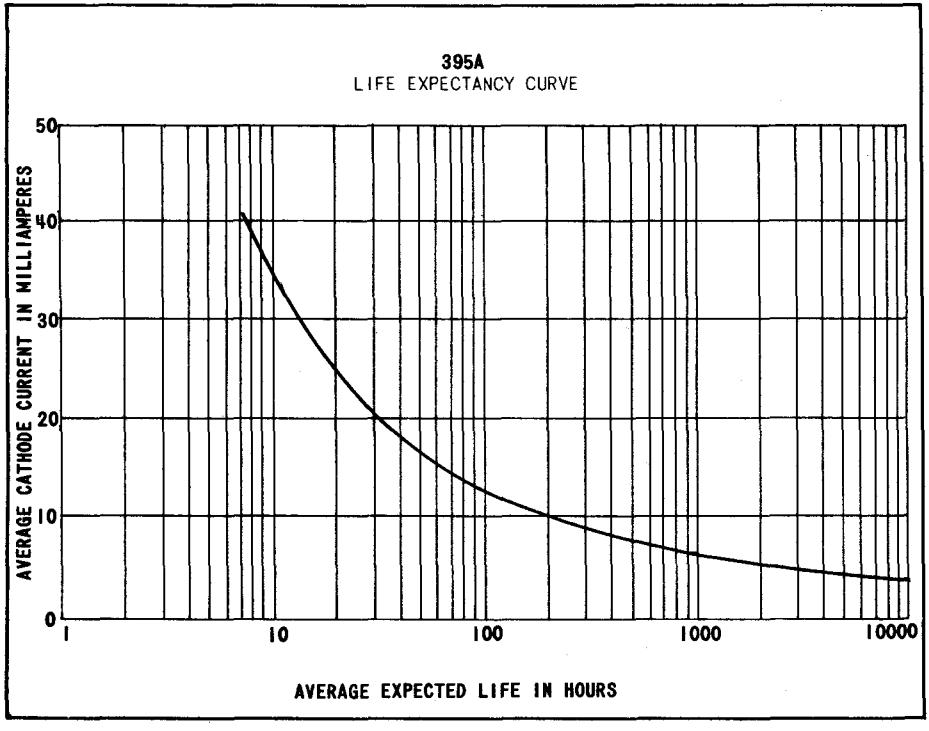

395A
TRANSFER CHARACTERISTICS
ANODE VOLTAGE IN VOLTS DC
300
200
100
0
LIMIT
AVERAGE
0
5
10
15
20
GRID CURRENT IN MICROAMPERES DC


395A
OPERATION CHARACTERISTICS
RANGE INCLUDES VARIATIONS DURING LIFE
NORMAL TRIODE OPERATION RANGE
GRID CONDUCTION REGION
NON-CONDUCTION REGION
ANODE CONDUCTION REGION
AVERAGE TUBE
GRID VOLTAGE IN VOLTS DC
100
75
50
25
0
0
50
100
150
200
250
ANODE VOLTAGE IN VOLTS DC


395A
FIRING TIME CURVE
E_g =+ 75 Volts
E_a =+130 Volts
R_g = 0.1 Megohms
FIRING TIME IN MICRO SECONDS
100
75
50
25
0
0
5
10
15
20
25
GRID OVER - VOLTAGE


395A
ANODE CHARACTERISTICS
ANODE VOLTAGE IN VOLTS DC
100
50
0
0
5
10
15
20
ANODE CURRENT IN MILLIAMPERES DC
E_b


395A
ANODE CIRCUIT VOLTAGE VS CURRENT
FOR VARIOUS LOAD RESISTANCES
ANODE VOLTAGE IN VOLTS DC
150
125
100
0
10
20
30
40
ANODE CURRENT IN MILLIAMPERES DC
R_L = 50,000 Ohms
10,000 Ohms
5,000 Ohms
2,500 Ohms
1,000 Ohms
E_b


395A
LIFE EXPECTANCY CURVE
AVERAGE CATHODE CURRENT IN MILLIAMPERES
50
40
30
20
10
0
1
10
100
1000
10000
AVERAGE EXPECTED LIFE IN HOURS