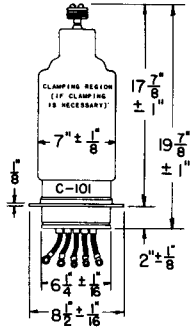
TUNG-SOL

THYRATRON

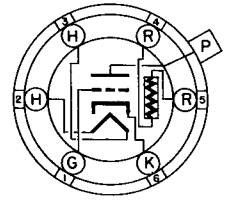


GLASS BULB

HEATER

AC OR DC

VERTICAL MOUNTING POSITION
(BASE DOWN)



BOTTOM VIEW

THE VC-1257 IS A THREE ELECTRODE, HYDROGEN FILLED, ZERO BIAS THYRATRON DESIGNED FOR THE GENERATION OF HIGH POWER PULSES. THE PRIMARY APPLICATION OF THE TUBE IS IN HIGH POWER, HIGH VOLTAGE RADAR MUDULATORS. THE VC-1257 IS CAPABLE OF SUPPLYING 33 MEGAWATT PULSES IN THIS SERVICE. AN INTERNAL HYDROGEN RESERVOIR PROMOTES LONG LIFE AND PERMITS OPTIMUM PRESSURE ADJUSTMENT FOR VARIOUS CONDITIONS OF OPERATION. THE CATHODE IS UNIPOTENTIAL AND IS CONNECTED TO THE ELECTRICAL CENTER OF THE CATHODE HEATER CIRCUIT IN ORDER TO MINIMIZE TIME JITTER.

FIRM ELECTRICAL CONNECTIONS ARE MADE TO THE CATHODE HEATERS, GRID AND RESERVOIR BY MEANS OF FLEXIBLE CABLES FITTED WITH LUGS. THE TUBE IS RIGIDLY SUPPORTED BY A BASE WITH A FLANGE CONTAINING BOLT HOLES. THE CATHODE CONNECTION IS MADE THROUGH THE BASE FLANGE.

ELECTRICAL DATA

	SYMBOL	MIN.	BOGEY	MAX.	
HEATER VOLTAGE	Ef	6.0	6.3	6.6	VOLTS
HEATER CURRENT (WITH BOGIE HEATER AND RESERVOIR VOLTAGE)	If	20	23	40	AMPS.
CATHODE HEATING TIME	tk	15			MINUTES
RESERVOIR VOLTAGE (SEE APPLICATION NOTES)	Eres	3.5	MARKED ON BASE	6.0	VOLTS
RESERVOIR CURRENT	Ires			12	AMPS.
RESERVOIR HEATING TIME	tres	15			MINUTES
ANODE VOLTAGE DROP	etd	100	200	400	VOLTS

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TUNG-SOL

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MECHANICAL DATA

TYPE OF COOLING	CONVECTION	
(FORCED AIR COOLING ACROSS THE RADIATOR IS RECOMMENDED FOR MAXIMUM TUBE LIFE)		
MOUNTING POSITION	VERTICAL, BASE DOWN	
MAXIMUM NET WEIGHT	10	POUNDS
DIMENSIONS:	SEE OUTLINE DRAWING	

RATINGS

ABSOLUTE VALUES

	SYMBOL	MIN.	MAX.	
PEAK ANODE VOLTAGE				
INVERSE (NOTE 1)	epx	0.5	33	KVOLTS
FORWARD (SEE APPLICATION NOTES FOR STARTING PROCEDURE)	epy	7.	33	KVOLTS
CATHODE CURRENT				
PEAK	ib		2000	AMPS.
AVERAGE	ib		2.6	AMPS.
RMS (FOR SQUARE PULSE APPLICATIONS $I_p = \sqrt{I_b \times ib}$)	I_p		60	AMPS.
DC ANODE VOLTAGE	Ebb		3.5	KVOLTS
OPERATING FREQUENCY (THIS IS NOT NECESSARILY THE UPPER OPERATING FREQUENCY LIMIT OF THE VC-1257 BUT REPRESENTS THE HIGHEST REPETITION RATE EXTENSIVELY LIFE TESTED TO DATE.)	prr		1500	CPS
PEAK GRID VOLTAGE (NOTE 2)	egy	1100	2500	VOLTS
PEAK INVERSE GRID VOLTAGE	egx		650	VOLTS
GRID TIME OF RISE OF GRID PULSE (NOTE 5)	tr		0.35	μSEC.
GRID PULSE WIDTH AT 70.7% POINT		2.0		μSEC.
HEATING FACTOR (epy X ib X prr. SEE FIG. 3)	Pb		20×10^9	
CURRENT RATE OF RISE (NOTE 5)			10 000	AMP/μSEC.
ANODE DELAY TIME (NOTE 3)	tad		0.5	μSEC.
TIME JITTER (NOTE 4)	tj		0.01	μSEC.
AMBIENT TEMPERATURE	TA	−55	+75	°C

NOTES

1: IN PULSED OPERATION, THE PEAK INVERSE VOLTAGE, EXCLUSIVE OF A SPIKE OF 0.05μSEC. MAXIMUM DURATION, SHALL NOT EXCEED 5.0 KILOVOLTS DURING THE FIRST 25μSEC. FOLLOWING THE ANODE PULSE.

2: THE GRID DRIVE REQUIREMENTS OF A VC-1257 CHANGE CONSIDERABLY DURING THE FIRST FEW MINUTES OF TUBE OPERATION. IN ORDER TO RELIABLY TRIGGER A COLD TUBE, THE GRID PULSE VOLTAGE AND DURATION AND THE GRID CIRCUIT IMPEDANCE SHOULD BE CHOSEN ACCORDING TO THE LIMITING CURVES.

3: ANODE DELAY TIME IS DEFINED AS THE TIME INTERVAL BETWEEN THE POINT ON THE RISING PORTION OF THE GRID VOLTAGE PULSE WHICH IS 26 PERCENT OF THE MAXIMUM UNLOADED PULSE AMPLITUDE AND THE POINT WHERE ANODE CONDUCTION TAKES PLACE.

4: TIME JITTER IS MEASURED AT 50 PERCENT OF THE PULSE AMPLITUDE AFTER THE TUBE HAS BEEN OPERATING FOR AT LEAST 60 SECONDS. THE LIMIT OF 0.01 μSEC. SHOWN IS THE MAXIMUM ALLOWABLE UNDER SPECIFIED UNFAVORABLE OPERATING CONDITIONS. WITH SUFFICIENT GRID DRIVE AND WITH ANODE VOLTAGES OF 20 KV AND ABOVE, JITTER NOT EXCEEDING 0.005 μSEC. CAN BE EASILY ACHIEVED.

5: MEASUREMENT MADE BETWEEN 26% AND 70.7% POINTS.

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TUNG-SOL

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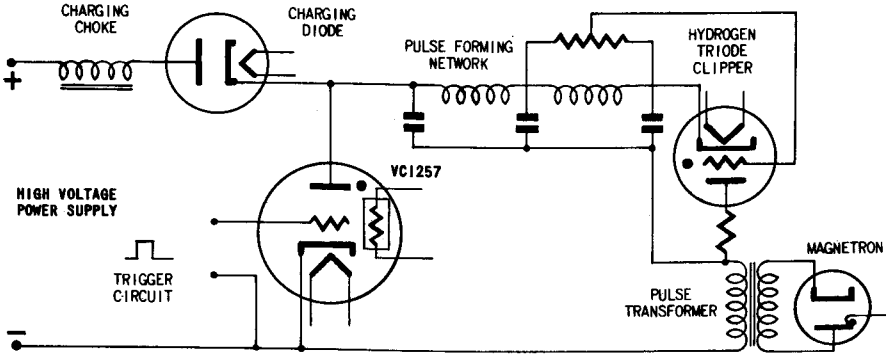
APPLICATION NOTES

THE VC-1257 HYDROGEN THYRATRON IS DESIGNED PRIMARILY FOR USE IN HIGH POWER RADAR MODULATOR SERVICE. A BASIC CIRCUIT FOR SUCH SERVICE IS ILLUSTRATED BELOW. IN SUCH A CIRCUIT, THE HYDROGEN THYRATRON SERVES AS A SWITCH TO RELEASE INTO THE MAGNATRON OR OTHER RADIO FREQUENCY GENERATOR, THE ENERGY STORED IN THE PULSE FORMING NETWORK. THE VC-1257 IS ADMIRABLY SUITED FOR SUCH SERVICE BY ITS ABILITY TO HOLD OFF HIGH VOLTAGE, AND TO PASS HIGH PEAK CURRENTS WITH RELATIVELY LOW TUBE VOLTAGE DROP. THE TUBE WILL OPERATE OVER A WIDE RANGE OF PULSE REPETITION RATES, PULSE WIDTHS AND PEAK CURRENTS, THUS PROVIDING A VERY FLEXIBLE CIRCUIT ELEMENT. TRIGGERING REQUIREMENTS ARE SIMPLIFIED SINCE THE TUBE OPERATES WITH ZERO BIAS.



THE VC-1257 CONTAINS A HYDROGEN RESERVOIR THAT MAINTAINS THE GAS PRESSURE WITHIN THE TUBE IN ACCORDANCE WITH THE VOLTAGE IMPRESSED ACROSS IT. SINCE THE RESERVOIR CAN HOLD MANY TUBE VOLUMES OF GAS, LONG TUBE LIFE IS INSURED. IN ADDITION IT IS POSSIBLE TO SET THE GAS PRESSURE AT THE OPTIMUM VALUE FOR ANY PARTICULAR SET OF OPERATING CONDITIONS. THE RESERVOIR HEATER VOLTAGE STAMPED ON THE TUBE BASE HAS BEEN DETERMINED FOR A PARTICULAR SET OF CONDITIONS SOMEWHAT BEYOND THE MAXIMUM TUBE RATINGS AND WILL BE SATISFACTORY FOR MOST APPLICATIONS. IN GENERAL, IT IS DESIRABLE TO OPERATE AT AS HIGH A RESERVOIR VOLTAGE AS POSSIBLE WITHOUT OBTAINING SPURIOUS DISCHARGES IN THE GRID-ANODE REGION. WHEN THE VC-1257 IS OPERATED AT OR NEAR MAXIMUM RATINGS, THE RESERVOIR VOLTAGE REGULATION SHOULD NOT EXCEED ±2.5%. IF THE VC-1257 IS OPERATED AT REDUCED DUTY A WIDER RESERVOIR OPERATING RANGE CAN BE EXPECTED. HOWEVER, CARE SHOULD BE TAKEN WHEN DETERMINING THE RESERVOIR VOLTAGE TO INSURE SATISFACTORY OPERATION WITH THE ANTICIPATED RESERVOIR VOLTAGE REGULATION. UNDER NO CIRCUMSTANCES SHOULD THE RESERVOIR VOLTAGE BE REDUCED TO SUCH AN EXTENT THAT THE ANODE SHOWS COLOR.

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APPLICATION NOTES —CONT'D.

THE INSTANTANEOUS APPLICATION OF ANODE VOLTAGE (INSTANTANEOUS STARTING OR "SLAT ON") IS NOT RECOMMENDED. WHEN IT IS ABSOLUTELY NECESSARY, THE MAXIMUM PERMISSIBLE EPY IS 22 KV AND THIS VALUE SHALL NOT BE ATTAINED IN LESS THAN 0.04 SEC. FOR INITIAL APPLICATION OF MAXIMUM RATED ANODE VOLTAGE, IT IS RECOMMENDED THAT ONE OF THE FOLLOWING STARTING METHODS BE USED:

A) *Step Starting.* APPLY NO MORE THAN 22 KV EPY INITIALLY. DO NOT INCREASE IN STEPS GREATER THAN 5 KV PER MINUTE.

B) *Reduced Reservoir Voltage.* THIS METHOD IS SUITABLE FOR AUTOMATIC CONTROL. DURING WARM-UP AND STANDBY PERIODS, THE RESERVOIR VOLTAGE IS HELD AT 92.5 PERCENT OF THE NOMINAL VALUE. AFTER INITIAL ANODE VOLTAGE APPLICATION OF NOT GREATER THAN 22KV, THE ANODE VOLTAGE MAY BE INCREASED AT A MAXIMUM RATE OF 1 KV PER SECOND, AFTER 7.5 MINUTES OF ANODE OPERATION AT MAXIMUM VOLTAGE, THE RESERVOIR VOLTAGE IS INCREASED TO ITS NOMINAL VALUE. OTHER STARTING METHODS CAN BE SUPPLIED TO MEET VARIOUS PARTICULAR APPLICATIONS.

TYPICAL OPERATION

VARIATIONS IN THE OPERATING PARAMETERS AFFECT THE LIFE EXPECTANCY OF HYDROGEN THYRATRONS; THEREFORE, A SIMPLE METHOD OF RATING FOR ALL CONDITIONS IS DIFFICULT. UNTIL SUCH TIME AS SUFFICIENT INFORMATION IS AVAILABLE TO PREPARE COMPLETE OPERATION RATING CHARTS, WE LIST THE FOLLOWING TYPICAL CONDITIONS OF OPERATION UNDER WHICH CONSIDERABLE TUBE LIFE HAS BEEN OBTAINED. IF THE VC-1257 IS TO BE EMPLOYED IN AN OPERATION DIFFERING WIDELY FROM THESE CONDITIONS (UNLESS THE REQUIREMENTS ARE OBVIOUSLY LESS SEVERE) IT IS SUGGESTED THAT THE CUSTOMER REQUEST A RECOMMENDATION FOR THE SPECIFIC APPLICATION.

	PEAK ANODE VOLTAGE		PEAK	PULSE WIDTH	di/dt
Prr	FORWARD	INVERSE	CURRENT	70% POINT	AMPS/μS
pps	kv	kv	Amps	μS	
310	33	5.	2000	2.5	10000
500	30	1.7	1250	3.6	3400
900*	30	1.6	1250	1.0	4200
1500	20	5.	667	1.3	6670

* OPERATION MADE POSSIBLE BY USE OF HYDROGEN TRIODE CLIPPER.

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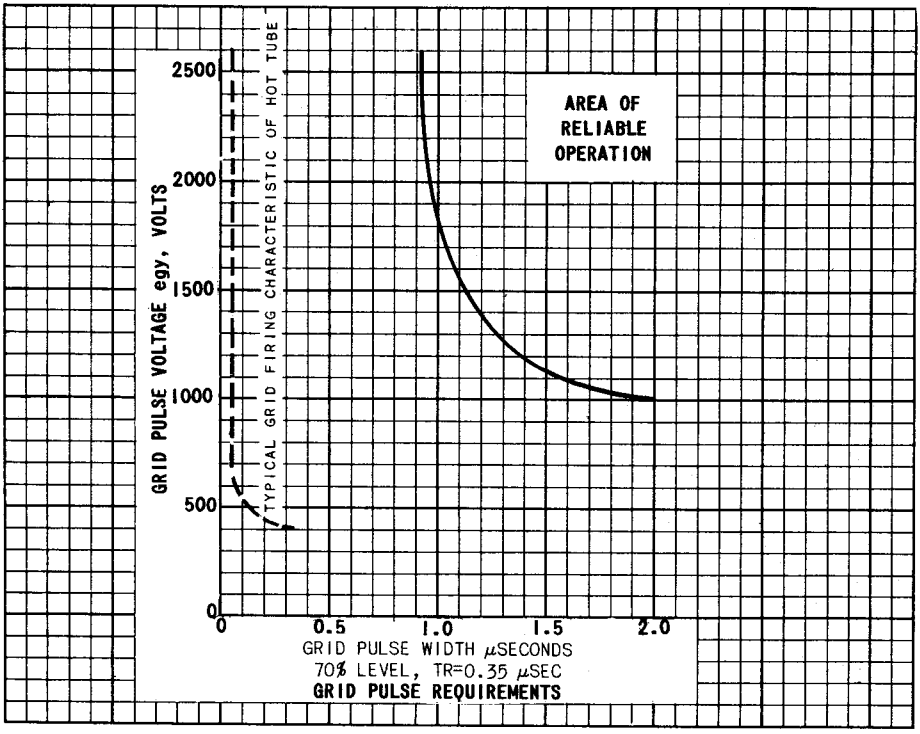
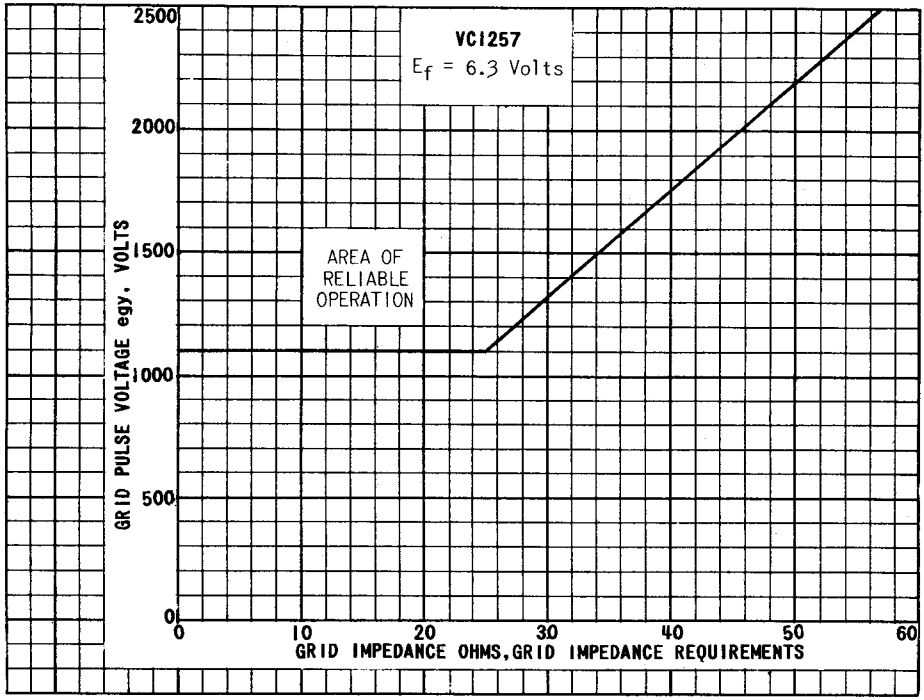
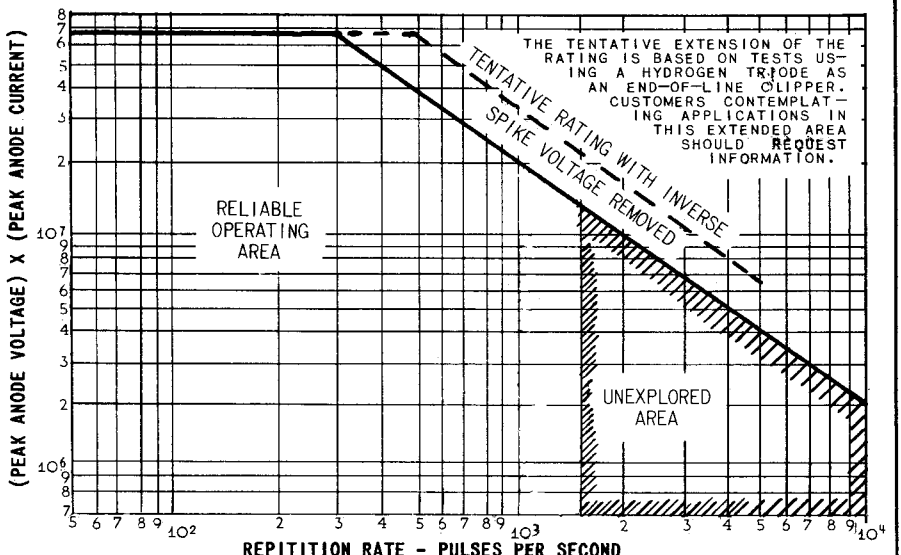

GRID PULSE VOLTAGE egy, VOLTS
2500
2000
1500
1000
500
0
TYPICAL GRID FIRING CHARACTERISTIC OF HOT TUBE
AREA OF RELIABLE OPERATION
0
0.5
1.0
1.5
2.0
GRID PULSE WIDTH μSECONDS
70% LEVEL, TR=0.35 μSEC
GRID PULSE REQUIREMENTS


VC1257
E_f = 6.3 Volts
GRID PULSE VOLTAGE egy, VOLTS
2500
2000
1500
1000
500
0
AREA OF RELIABLE OPERATION
0
10
20
30
40
50
60
GRID IMPEDANCE OHMS, GRID IMPEDANCE REQUIREMENTS

TUNG-SOL



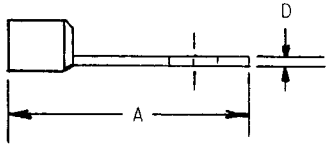
GRAPHICAL REPRESENTATION OF HEAT FACTOR

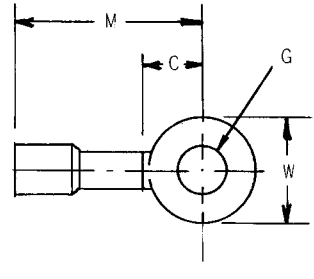
TUNG-SOL

LEAD CONNECTIONS

LEAD	FUNCTION	LEAD COLOR	LUG COLOR	LUG
1	GRID	GREEN	GREEN	S
2	HEATER	YELLOW	YELLOW	L
3	HEATER	YELLOW	YELLOW	L
4	RESERVOIR	RED	RED	S
5	RESERVOIR	RED	RED	S
6	CATHODE	TUBE BASE FLANGE		

LEADS ARE FLEXIBLE 8"±3/4" LONG FROM BOTTOM OF BASE TO CENTER OF LUG HOLE. COLOR CODING AS WELL AS BASE MARKING IDENTIFIES THE LEADS.





LUG DIMENSIONS

LUG	G STUD	A MAX.	W MAX.	C MIN.	D	M MAX.
L	1/4"	1.21"	.53"	.41"	.04"	.94"
S	#10	.90"	.31"	.30"	.03"	.74"