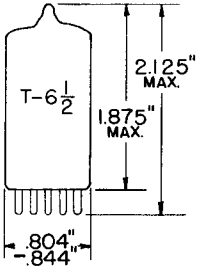
TUNG-SOL

THYRATRON

MINIATURE TYPE

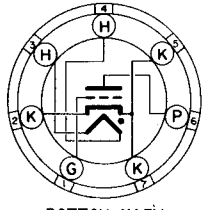


GLASS BULB
HARD

HEATER

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW.
SMALL BUTTON MINIATURE
7 PIN BASE
7FJ

THE 7190 IS A ZERO BIAS MINIATURE HYDROGEN THYRATRON DESIGNED PRIMARILY FOR THE GENERATION OF PULSE VOLTAGES UNDER EXTREME CONDITIONS OF MECHANICAL VIBRATION. THIS TUBE CAN SUPPLY PEAK PULSE POWER OF 10 KILOWATTS AND THEREFORE WILL REPLACE PHYSICALLY LARGER TYPES IN MANY RADAR APPLICATIONS. BECAUSE OF ITS CLOSE ELECTRODE SPACING AND SMALL SIZE, MADE POSSIBLE BY HARD GLASS CONSTRUCTION, THE 7190 IS CAPABLE OF RELATIVELY HIGH PULSE REPETITION RATES.

THE 7190, 7191, AND 7192 DIFFER ONLY IN THEIR ELECTRODE TERMINALS. ALL OF THESE TYPES HAVE FOUND USE IN MISSILE APPLICATIONS. THE 7190, 7191, AND 7192 HAVE BEEN DESIGNED INTO SOME EQUIPMENT UNDER THE CHATHAM DEVELOPMENTAL DESIGNATIONS CH1062, CH1092, AND CH1055 RESPECTIVELY.

ELECTRICAL DATA

	SYMBOL	MIN.	BOGEY	MAX.	
HEATER VOLTAGE					
(WHEN Ip IS LESS THAN 0.75 Aac, REFER TO RECOMMENDED HEATER VOLTAGE CURVE)	Ef	6.0	6.3	6.6	VOLTS
HEATER CURRENT					
(WITH BOGIE HEATER VOLTAGE)	If	1.6	1.8	2.0	AMP.
CATHODE HEATING TIME	tk	30			SECONDS
ANODE VOLTAGE DROP (AT RECOMMENDED Ef)	etd	45		125	VOLTS

MECHANICAL DATA

TYPE OF COOLING	CONVECTION
(HEAT DISSIPATING SHIELDS MAY BE USED. FORCED AIR COOLING IS NOT RECOMMENDED.)	
ALTITUDE	SEE APPLICATION NOTES
MOUNTING POSITION	ANY
MAXIMUM NET WEIGHT	0.5 OUNCES
DIMENSIONS: SEE OUTLINE DRAWINGS	SEE OUTLINE DRAWINGS
MAXIMUM VIBRATION CONDITIONS	50-2000 CPS @ 15 G
MAXIMUM SHOCK CONDITIONS	720 G/1MSEC.
(48° HAMMER BLOW IN NAVY FLY WEIGHT, HIGH IMPACT SHOCK MACHINE)	
MICROSCOPIC INSPECTION PER MIL-E-1775 1B (N ORD)	SEE APPLICATION NOTES

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RATINGS
ABSOLUTE VALUES

	SYMBOL	MIN.	MAX.	
PEAK ANODE VOLTAGE				
INVERSE (NOTE 1)	epx	---	1200	VOLTS
FORWARD	epy	300	1200	VOLTS
CATHODE CURRENT				
PEAK	ib		.20.0	AMP.
AVERAGE	Ib		50	MA.
RMS (FOR SQUARE PULSE APPLICATIONS $I_p = \sqrt{I_b \times ib}$)	I_p		1.0	AMP.
DC ANODE VOLTAGE	E_{bb}	300		VOLTS
HEATER–CATHODE VOLTAGE	Ehk	−100	+25	VOLTS
OPERATING FREQUENCY (THIS IS NOT NECESSARILY THE UPPER OPERATING FREQUENCY LIMIT BUT REPRESENTS THE HIGHEST REPETITION RATE EXTENSIVELY LIFE TESTED TO DATE.)	prr		5000	CPS
PEAK GRID VOLTAGE (SEE RECOMMENDED GRID PULSE CONDITIONS.)	egy	175	500	VOLTS
PEAK INVERSE GRID VOLTAGE	egx		150	VOLTS
HEATING FACTOR (epy x ib x prr.)	Pb		1×10^8	
CURRENT RATE OF RISE (NOTE 2)			400	AMP/μSEC.
ANODE DELAY TIME (NOTE 3)	tad		0.6	μSEC.
TIME JITTER (NOTE 4)	tj		0.01	μSEC.
AMBIENT TEMPERATURE	TA	−60	+125	°C

NOTES

[1] IN PULSED OPERATION, THE PEAK INVERSE VOLTAGE, EXCLUSIVE OF A SPIKE OF 0.05 μSEC. MAXIMUM DURATION, SHALL NOT EXCERD 500 VOLTS DURING THE FIRST 25 μSEC, FOLLOWING THE ANODE PULSE.

[2] MEASUREMENT MADE BETWEEN 26% AND 70.7% POINTS.

[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 600 VOLTS AND ABOVE, JITTER NOT EXCEEDING 0.005 μSEC. CAN BE EASILY ACHIEVED.

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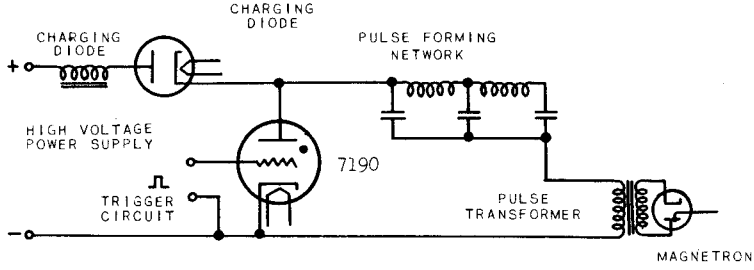
APPLICATION NOTES

THIS FAMILY OF MINIATURE HYDROGEN THYRATRONS IS DESIGNED FOR USE IN LINE TYPE RADAR MODULATORS. A BASIC CIRCUIT FOR SUCH SERVICE IS ILLUSTRATED BELOW. IN SUCH A CIRCUIT, THE HYDROGEN THYRATRON SERVES AS A SWITCH TO, RELEASE INTO THE MAGNETRON OR OTHER RADIO FREQUENCY GENERATOR, THE ENERGY STORED IN THE PULSE FORMING NETWORK. THESE TUBES ARE ADMIRABLY SUITED FOR SUCH SERVICE BY THEIR ABILITY TO HOLD OFF RELATIVELY HIGH VOLTAGE, AND TO PASS HIGH PEAK CURRENT WITH RELATIVELY LOW TUBE VOLTAGE DROP. THE TUBES WILL OPERATE OVER A WIDE RANGE OF PULSE REPETITION RATES, PULSE WIDTHS AND PEAK CURRENTS, THUS PROVIDING VERY FLEXIBLE CIRCUIT ELEMENTS. TRIGGERING REQUIREMENTS ARE SIMPLIFIED SINCE THE TUBES OPERATE WITH ZERO BIAS.



THE SMALL SIZE, LIGHT WEIGHT, EXTREME RUGGEDNESS, AND ABILITY TO OPERATE AT HIGH AMBIENT TEMPERATURES, MAKE THESE TUBES PARTICULARLY SUITABLE FOR AIRBORNE USE. THE TUBES CAN BE OPERATED IN ANY POSITION. ALL TUBES ARE TESTED IN ACCORDANCE WITH MIL-E-1775 1B (N ORD), THE MILITARY SPECIFICATION FOR ELECTRON TUBES FOR GUIDED MISSILES. THIS ENTAILS 100% MICROSCOPIC INSPECTION WITH A 10 POWER BINOCULAR MICROSCOPE FOR SUCH ITEMS AS SEALS, LEADS AND SPOT WELDS. SAMPLE TUBES ARE VIBRATED WITH VOLTAGES APPLIED OVER A RANGE OF 50 TO 2000 TO 50CPS AT 15G IN 4 MINUTES.

THE 7190 AND THE 7191 FIT A STANDARD 7 PIN MINIATURE SOCKET. THE TUBE PINS, HOWEVER, ARE STIFF, AND CARE SHOULD BE TAKEN TO HAVE THE SOCKET CLIPS IN PERFECT ALIGNMENT BEFORE ATTEMPTING TO INSERT A TUBE. AS THE TUBE OPERATES AT HIGH TEMPERATURES, A CERAMIC TYPE SOCKET SHOULD BE EMPLOYED. CONNECTIONS TO THE SOCKET SHOULD BE MADE WITH FLEXIBLE LEADS TO PROVIDE FLOATING ACTION FOR THE SOCKET CLIPS. PIN STRAIGHTENERS SHOULD NEVER BE USED ON THESE TUBE TYPES, AS ANY ATTEMPT TO BEND THE PINS WILL RESULT IN CRACKED BUTTON BASES!

THE ANODE CONNECTION ON TYPE 7191 IS A SOLDERING TERMINAL BROUGHT OUT THE TOP OF THE ENVOLOPE. THIS DESIGN PROVIDES A MAXIMUM SPACING BETWEEN THE ANODE LEAD AND THE GRID AND CATHODE PINS TO PREVENT ARC-OVER AT REDUCED AIR PRESSURES. THE 7191 WILL OPERATE FOR SHORT PERIODS AT 80,000 FEET WITHOUT FORCED AIR COOLING. THE NOMINAL ALTITUDE RATING FOR THE 7190 AND 7192 IS 10,000 FEET. HOWEVER, IF PROVISION IS MADE TO PREVENT ARC-OVER BETWEEN PINS, THESE TYPES ALSO WILL OPERATE AT 80,000 FEET. ONE METHOD OF PREVENTING ARC-OVER BETWEEN PINS IS TO POT THE BASE END OF THE TUBE. IF THE ENTIRE ENVELOPE IS TO BE POTTED, HOWEVER, PRECAUTION MUST BE TAKEN TO KEEP BULB TEMPERATURE BELOW 225°C.

TYPE 7192 IS SUPPLIED WITH LONG, FLEXIBLE STRANDED LEAD CONNECTORS THAT MAY BE CRIMPED OR SOLDERED DIRECTLY IN THE CIRCUIT. THE TUBE ITSELF CAN BE SECURED BY ANY SUITABLE MECHANICAL MEANS. ONE SUCH METHOD IS TO HOLD IT IN POSITION WITH A HEAT DISSIPATING CLAMP SUCH AS THE BIRTCHER 6A3.

CATHODE TEMPERATURE IS DETERMINED BY RMS CATHODE CURRENT AS WELL AS BY HEATER POWER. THE BOGEY HEATER VOLTAGE OF 6.3 VOLTS HEREFORE IS APPLICABLE ONLY NEAR FULL OPERATING CONDITIONS. AT LIGHT LOADING IT IS RECOMMENDED TO OPERATE THE HEATER VOLTAGE HIGHER. RECOMMENDED FIGURES FOR VARIOUS OPERATING CONDITIONS ARE SHOWN ON THE CURVES.

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TYPICAL OPERATION

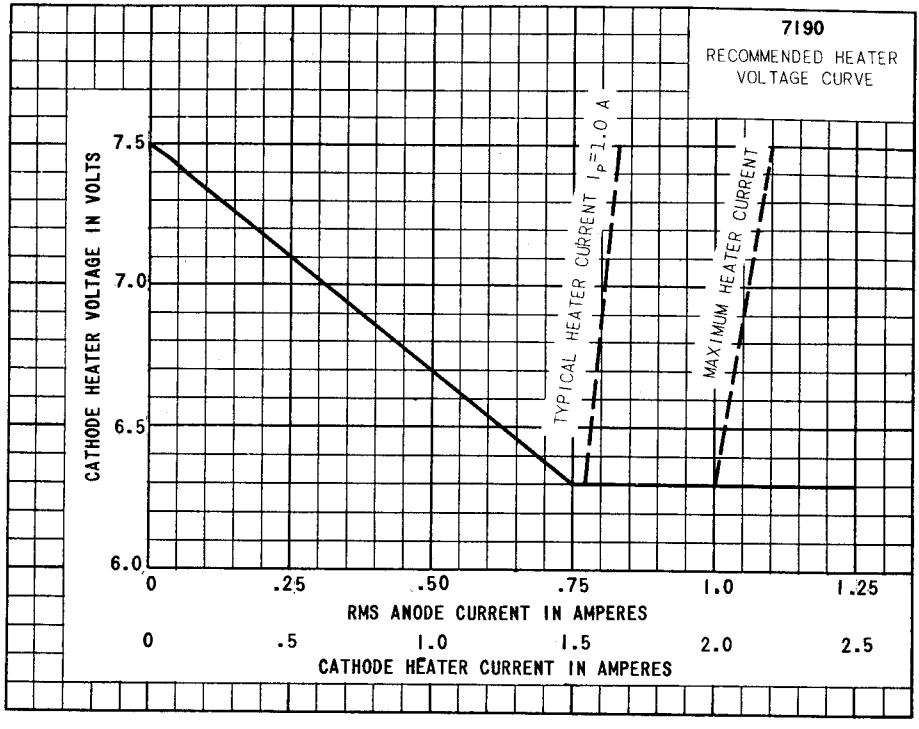
PRR (pps)	ANODE CURRENT PEAK (Amps)	RMS Amps AC	AVG. mAd.c.	Peak Anode Voltage VOLTS	PULSE WIDTH μ sec	GRID μ sec	DRIVE VOLTS
5000	20.0	1.0	50.	1000	0.5	1.0	250
10000	6.6	0.5	37.	316	0.56	2.0	250
33000*	3.5	0.46	60.	350	0.5	BLOCKING OSCILLATOR	200

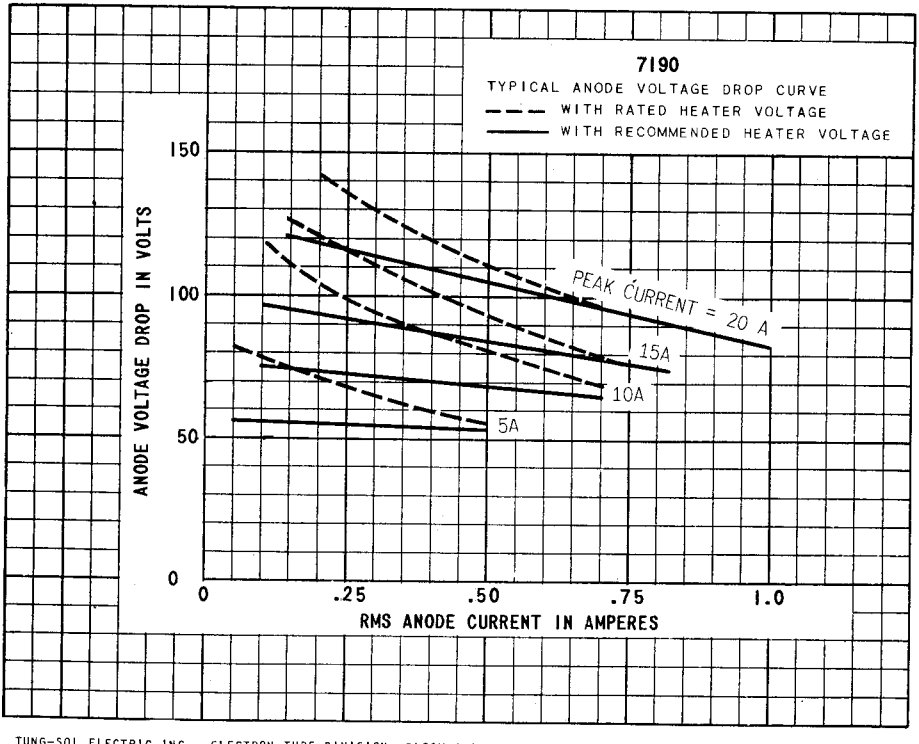
*LIMITED TEST INFORMATION.

RECOMMENDED GRID PULSE VALUES

	MIN.	MAX.	
PEAK VOLTAGE	200	500	VOLTS
DRIVER CIRCUIT IMPEDANCE	200	1000	OHMS
VOLTAGE RATE OF RISE μ SEC.	350		VOLTS

THESE VALUES ARE AS MEASURED AT THE TUBE SOCKET WITH THE THYRATRON REMOVED. THE GRID PULSE WIDTH SHOULD NOT BE LONGER THAN THE ANODE PULSE EXCEPT IN CASES WHERE THE DRIVER CIRCUIT IMPEDANCE IS HIGH. THE MINIMUM PEAK TRIGGER VOLTAGE RECOMMENDED WILL INCREASE WITH DECREASING TRIGGER PULSE WIDTH. HOWEVER, THIS EFFECT IS IMPORTANT ONLY AT PULSE WIDTHS LESS THAN 0.5 MICROSECONDS.





7190

GRAPHICAL REPRESENTATION OF HEAT FACTOR