

SPECIAL VALVES

Water-Cooled Industrial Triode
with Integral Water Jacket

Code: 3R/252E

The 3R/252E has been designed specifically for industrial heating applications and is capable of operation at frequencies up to 100 Mc/s. Design features give a high mutual conductance, resulting in high efficiency with the low grid dissipation and large safety factor which are desirable when the valve is operated under variable-load conditions.

This valve has identical electrical characteristics to those of the type 3Q/252E water-cooled valve which is used with a separate water jacket.

CATHODE

Thoriated tungsten filament

Filament voltage	8 ± 2%	8 ± 5%	V
*Filament current, nominal		125	A
Maximum usable emission	36	24	A

*It is recommended that some resistance or reactance be introduced into the filament supply to limit the surge peak current to about two and a half times the normal r.m.s. working value. This impedance may be short-circuited as soon as the surge has decayed.

PIRANI TEST†

Filament current	12	A
Filament voltage range	0.13 to 0.14	V
Measuring time, approx.	60	min

†See card supplied with individual valve for actual test figures.

CHARACTERISTICS

Amplification factor	$\left\{ \begin{array}{l} \text{at } V_a = 4\text{kV}, I_a = 1\text{A} \\ \text{at } V_a = 4\text{kV}, V_g = -75\text{V} \end{array} \right\}$	24	
Mutual conductance		60	mA/V

DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	30	pF
Grid to filament	80	pF
Anode to filament	1.8	pF

November 1965

3R/252E—1

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C O M P O N E N T S G R O U P

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COOLING REQUIREMENTS

It is important to observe the correct connection of water inlet and outlet.

Water flow required for full anode dissipation 3 gal/min 13 l/min

Water pressure 13 lb/in² 0,8 kg/cm²

Maximum temperature of outflowing water 70 °C

Forced-air-cooling of the grid and filament seals is required to limit their temperature to below the maximum permissible value of 180°C.

An air-flow of 50 ft³/min (1,42 m³/min) directed vertically downwards on to the seals is sufficient to meet these requirements.

MECHANICAL DATA

Dimensions As shown in outline drawing

Mounting position Vertical, anode downwards

**MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS
RADIO FREQUENCY****Class C. Industrial Heating Oscillator****Maximum Ratings**

Maximum anode voltage (peak value of direct voltage plus ripple)	13	kV
Maximum direct anode current	6	A
Maximum direct anode dissipation (continuous)	24	kW
Maximum direct grid dissipation (continuous)	500	W
Maximum frequency for above ratings	50	Mc/s
Maximum negative grid bias	1 500	V

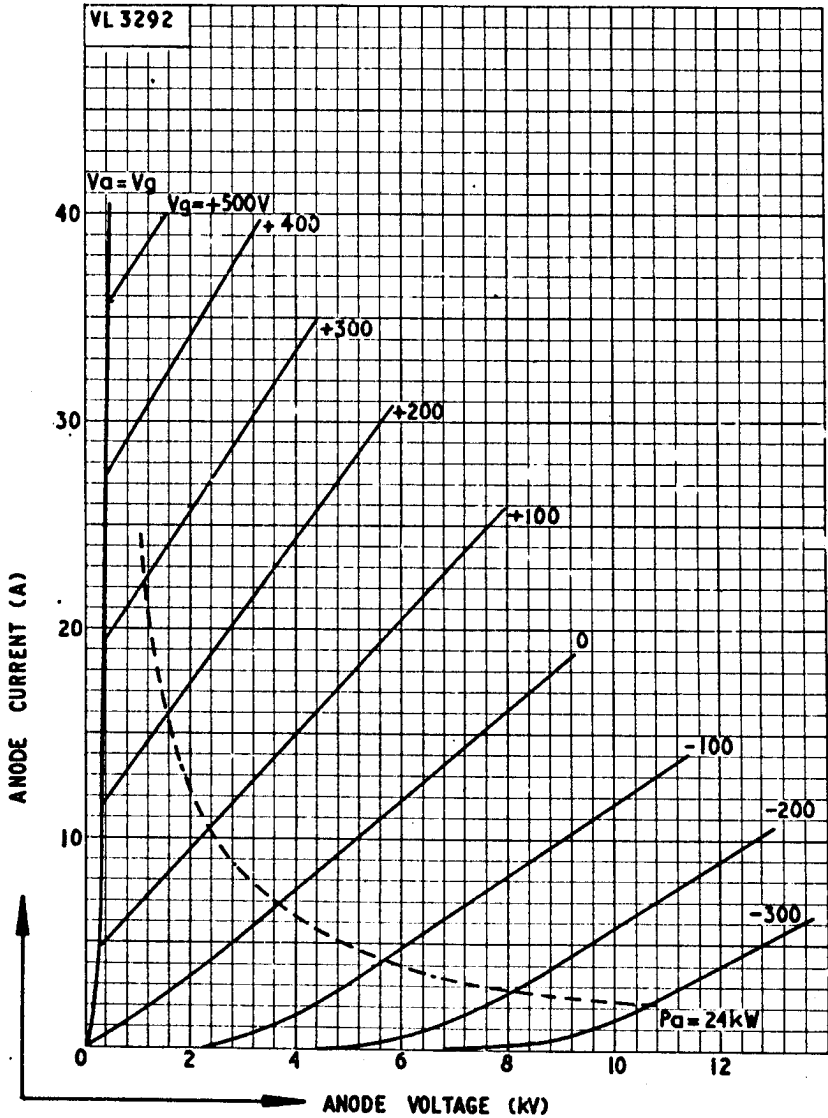
Typical Operating Conditions

Direct anode voltage	12	kV
Direct grid voltage	680	V
Direct anode current	5	A
Peak r.f. grid voltage	990	V
*Direct grid current	800	mA
*Grid dissipation	275	W
Power output	48	kW
Efficiency	80	%

*Subject to wide variation dependent upon the impedance of the load circuit.

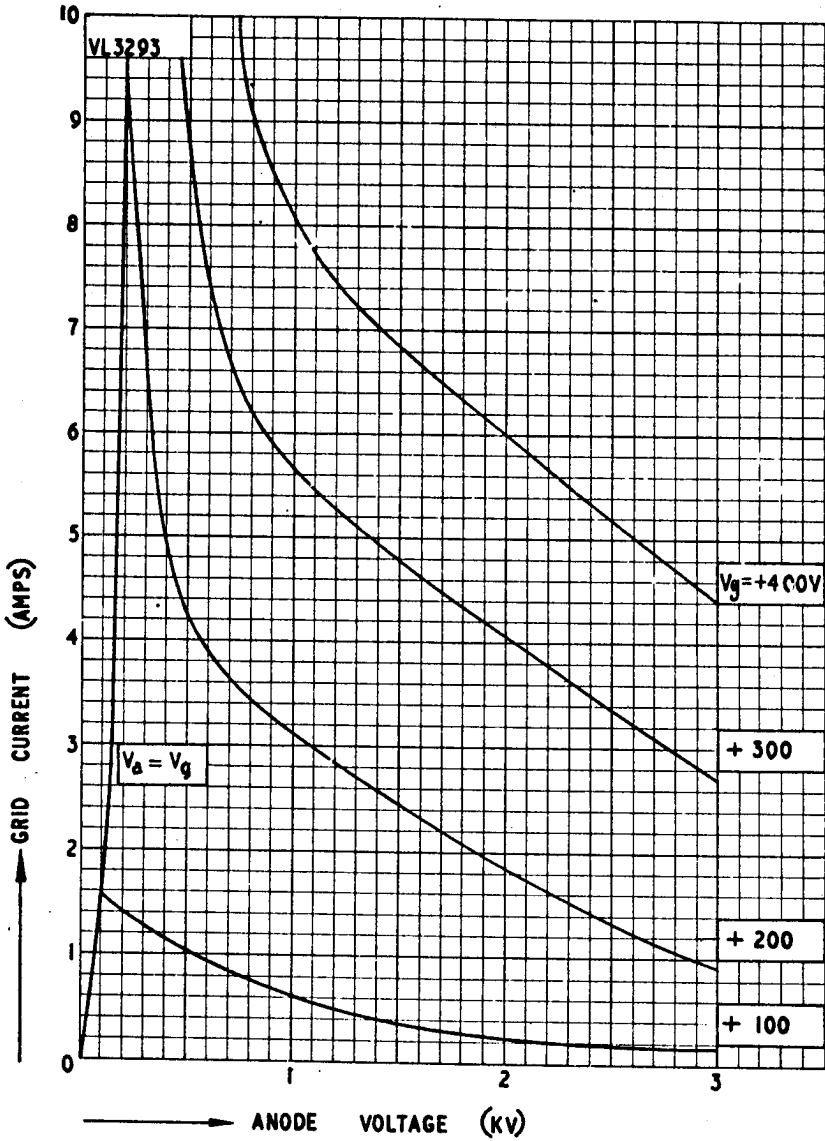
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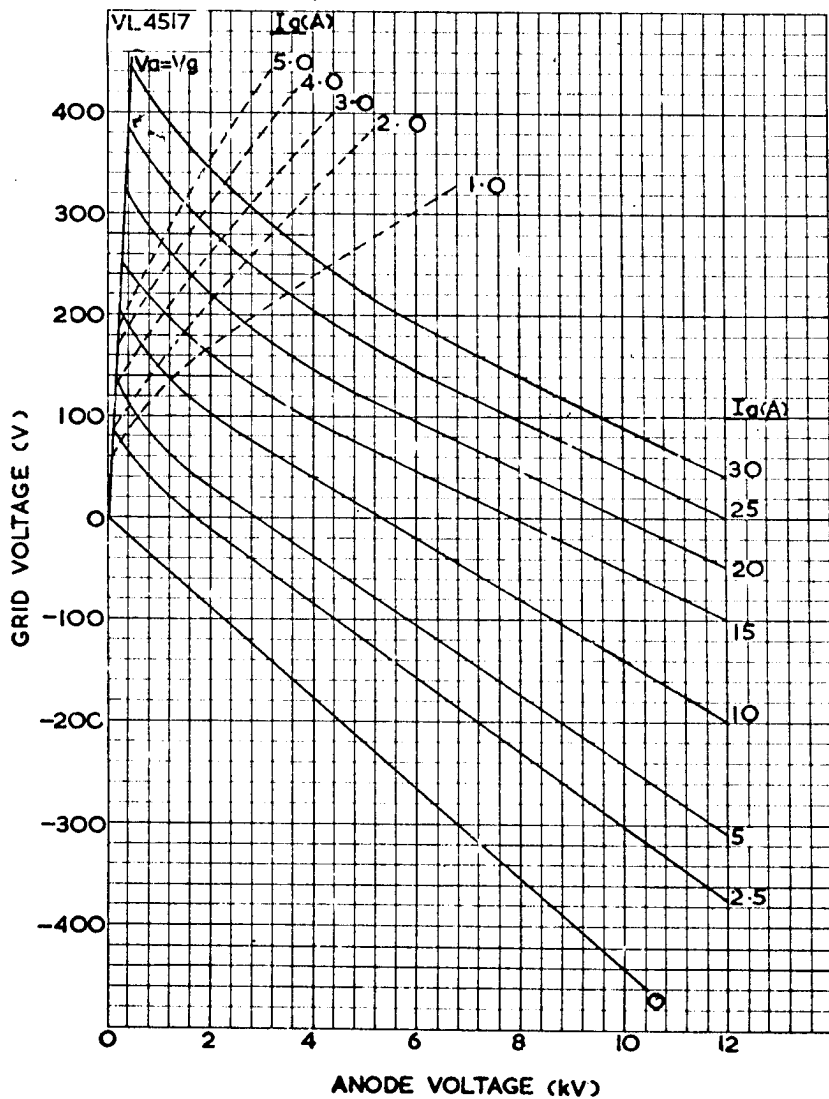
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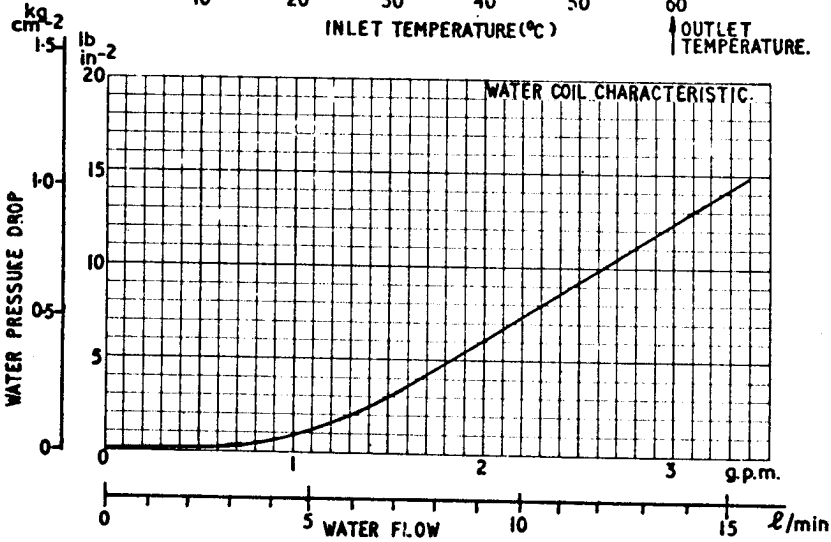
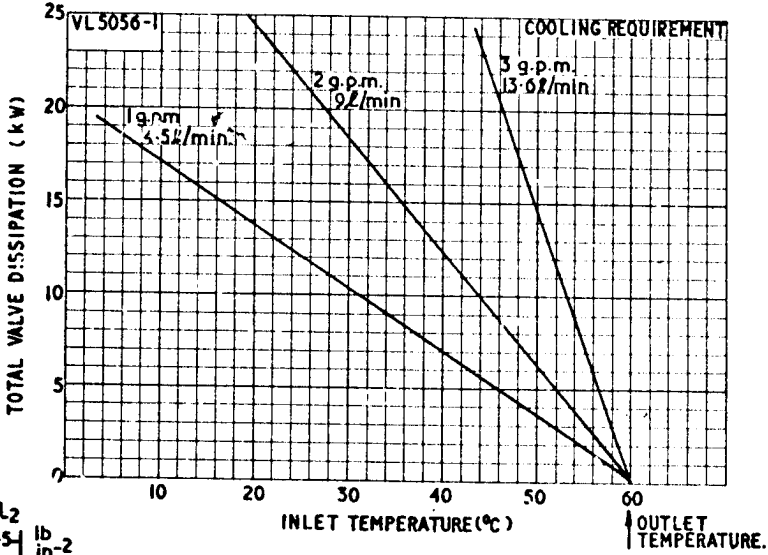
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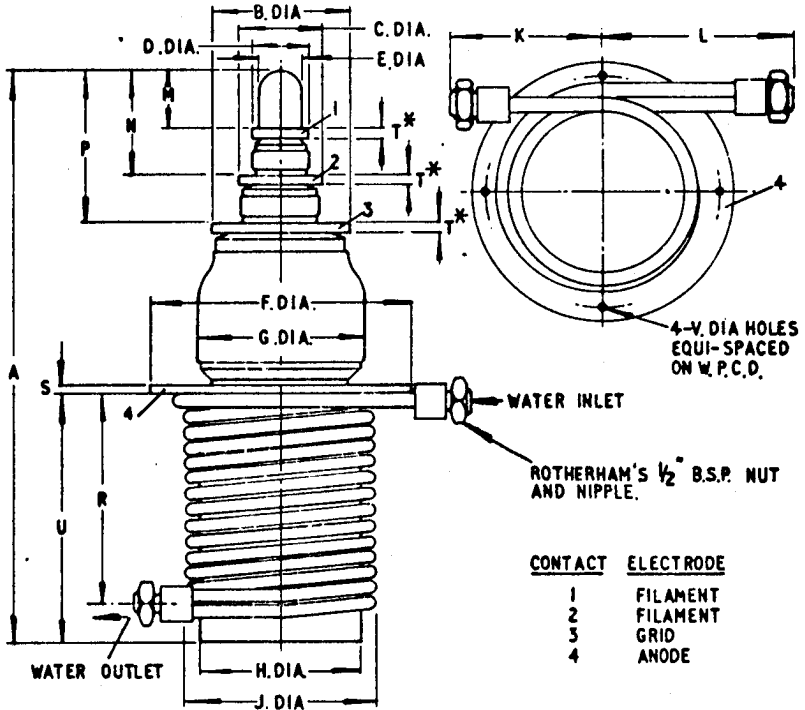
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3R/252E Outline



CONTACT	ELECTRODE
1	FILAMENT
2	FILAMENT
3	GRID
4	ANODE

DIM	MILLIMETRES	INCHES	DIM	MILLIMETRES	INCHES
A	544,5 MAX	13 ⁹ / ₁₆ MAX.	M	38,1 ± 1,6	1 ¹ / ₂ ± ¹ / ₁₆
B	89,9 ± 0,4	3 ¹ / ₂ ± ¹ / ₆₄	N	60,3 ± 4,8	2 ³ / ₈ ± ³ / ₁₆
C	50,8 ± 0,4	2 ± ¹ / ₆₄	P	95,3 ± 4,8	3 ³ / ₄ ± ³ / ₁₆
D	31,8 ± 0,4	1 ¹ / ₄ ± ¹ / ₆₄	R	123,8 ± 1,6	4 ⁷ / ₈ ± ¹ / ₁₆
E	25,4 MAX	1 MAX.	S	4,8 ± 0,4	³ / ₁₆ ± ¹ / ₆₄
F	155,6 ± 0,8	6 ¹ / ₈ ± ¹ / ₃₂	T	4,7 MIN. 6,4 MAX.	³ / ₁₆ MIN. ¹ / ₄ MAX.
G	101,6 MAX	4 MAX.	U	153,2 MAX.	6 ¹ / ₃₂ MAX
H	96,8 ± 0,8	3 ¹³ / ₁₆ ± ¹ / ₃₂	V	7,94 ± 0,18	0-312 ± 0-037
J	114,3 MAX	4 ¹ / ₂ MAX.	W	139,70 ± 0,25	5-500 ± 0-010
K	79,4 MAX.	3 ¹ / ₈ MAX.	* DENOTES - CONTACT LENGTH.		
L	104,8 MAX.	4 ¹ / ₈ MAX.	NOTE - BASIC FIGURES ARE INCHES.		

The 3R/262E has an integral water jacket and is intended primarily for r.f. heating applications.

MAXIMUM RATINGS

Anode voltage (peak value of direct voltage plus ripple)	7,0	kV
Direct anode current	10	A
Anode dissipation, continuous	24	kW
Grid dissipation, continuous	1,0	kW
Direct negative grid voltage	-1 500	V
Maximum frequency for above ratings	30	MHz

TYPICAL OPERATING CONDITIONS

Class C. Industrial Heating R.F. Oscillator

Filament voltage	8,0V \pm 5%	8,0V \pm 5%	
Filament current, nominal	300	300	A
Direct anode voltage	6,0	6,5	kV
Direct grid voltage	-850	-925	V
Direct anode current	9,0	9,9	A
Peak r.f. grid voltage	1 270	1 375	V
Direct grid current (Note 1)	1,37 (2,0)	1,37 (2,0)	A
Anode dissipation	13	16,5	kW
Grid dissipation (Note 1)	590	630	W
Grid resistor	620	680	Ω
Power output	41	48	kW
Power output, less drive	39	46	kW
Power into load at 85% transfer efficiency	33	39	kW

Note 1. Subject to wide variation dependent upon impedance of load circuit. Value of current shown in brackets is typical of off-load conditions and is given for guidance only: a practical figure is dependent upon compensatory devices in the grid circuit.

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ITT

COMPONENTS

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TYPICAL OPERATING CONDITIONS (continued)

Class AB₁, AB₂. A.F. Amplifier - (2 tubes)

	Class AB ₁	Class AB ₂	
Filament voltage	8,0V ± 5%	8,0V ± 5%	
Filament current, nominal	300	300	A
Direct anode voltage	6,5	7,0	kV
Direct anode current	2 x 3,2	2 x 5,8	A
Grid bias	-540	-550	V
Grid voltage swing, peak-to-peak	1 040	1 420	V
Anode-to-anode load	1,8	1,3	kΩ
Anode dissipation	2 x 10	2 x 13	kW
Power input	42	80	kW
Power output	22	54	kW
Grid current		190	mA
Drive power (Note 2)		2 x 135	W
Bias power loss		2 x 104	W
Grid dissipation		2 x 31	W

Note 2. Figures given do not include all circuit losses.

CATHODE

Thoriated tungsten filament		
Maximum usable emission	60	A
Cold filament resistance	0,0034	Ω

It is recommended that some resistance or reactance be introduced into the filament supply to limit the surge current to about two and a half times the normal r.m.s. working value. This impedance may be short-circuited if desired as soon as the surge has decayed.

For tube operation at frequencies above 30MHz, it is recommended that the r.f. return path to the cathode be capacitively coupled to both filament terminals.

CHARACTERISTICS

Amplification factor (at $V_a = 4,5kV$: $I_a = 4A$)	12	
Mutual conductance (at $V_a = 2,0kV$: $V_g = -87V$)	60	mA/V

DIRECT INTERELECTRODE CAPACITANCES

Grid to anode	86	pF
Grid to filament	106	pF
Anode to filament	6,0	pF

COOLING

The anode must be cooled by an adequate water flow. (See Figures 3 and 4). It is essential that the water enters the water jacket at its lowest point in relation to the attitude of the tube when mounted.

Forced air cooling of the grid and filament seals is required to limit their temperature to below the maximum permissible value of 180°C. An air flow of 50 ft³/min (1,42 m³/min) directed vertically downwards on to the seals from a 4 inch (10 cm) diameter orifice is sufficient for operation at frequencies up to 30 MHz. At higher frequencies, additional cooling of the grid seal may be required.

MECHANICAL DATA

Dimensions	As shown in outline drawings included
Mounting position	Vertical, anode upwards or downwards
Weight of tube	12,6 lb (5,7 kg)
Accessories	Filament and grid connectors, which are supplied as separate items, are available under following codes: CN-2A Filament connector ring, smaller CN-2B Filament connector ring, larger CN-2C Grid connector ring

Fig. 1. Constant Voltage Characteristics

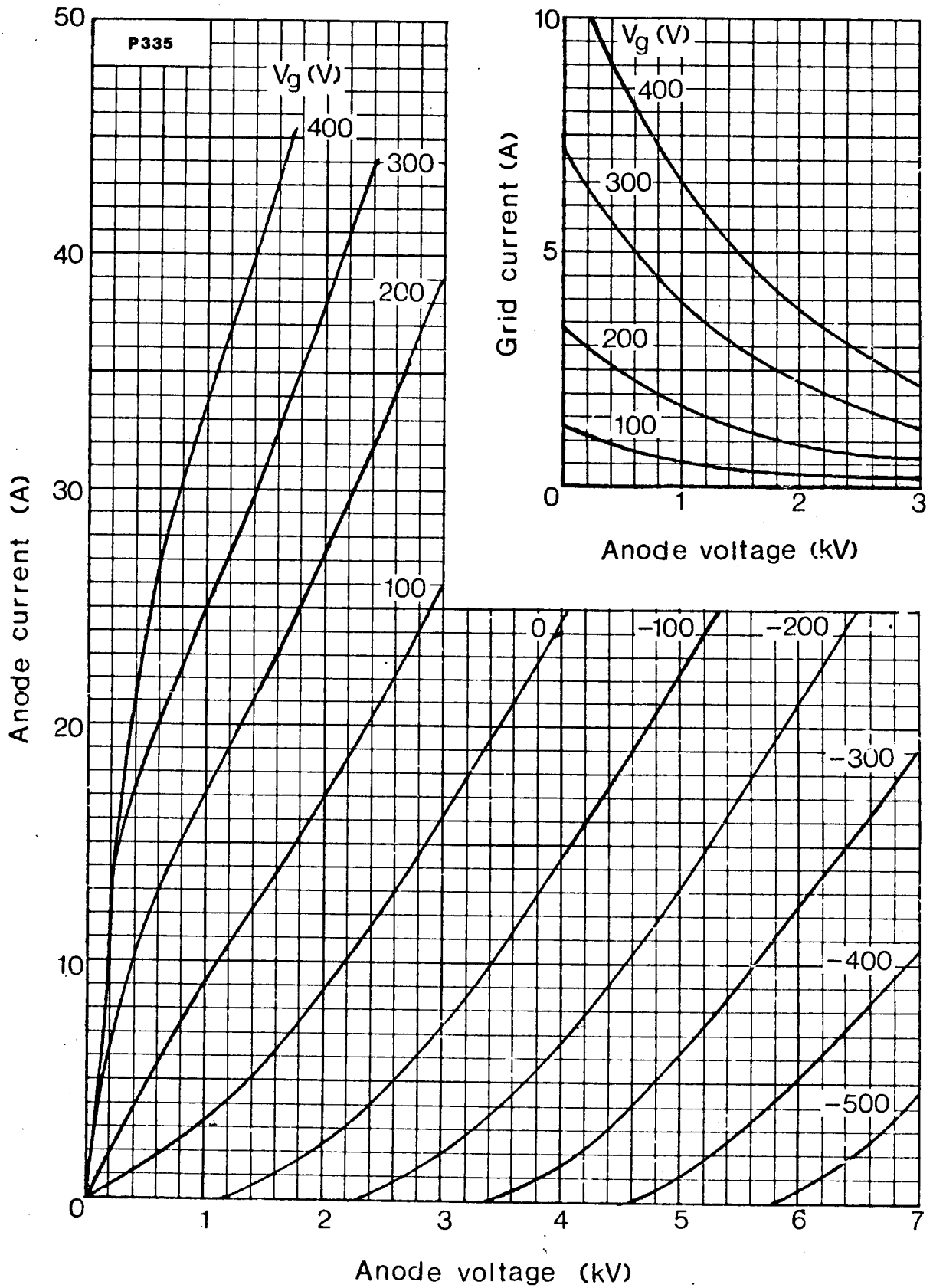


Fig. 2. Constant Current Characteristics

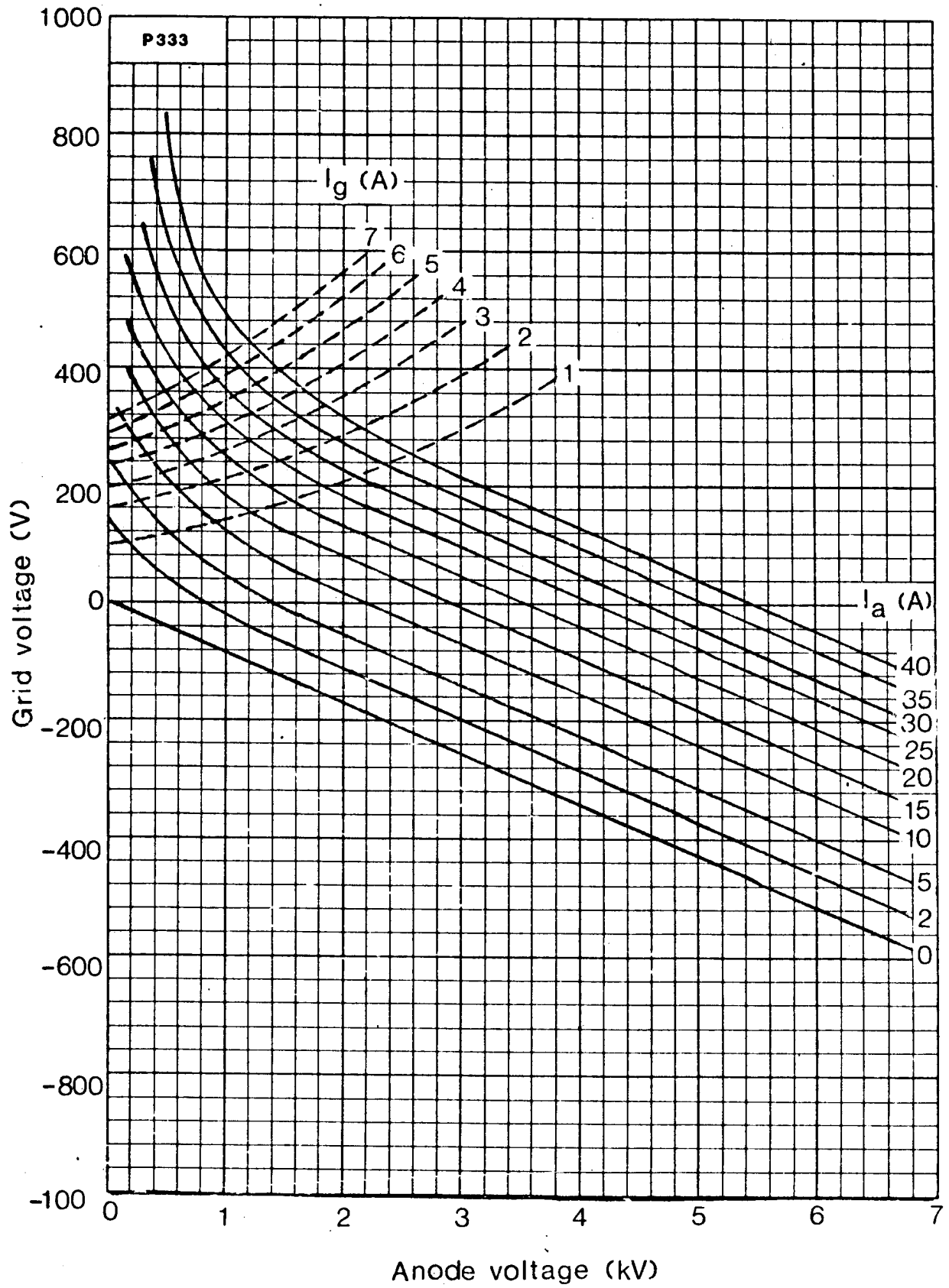


Fig. 3. Cooling Water Requirement for Outlet Water Temperature of 60°C

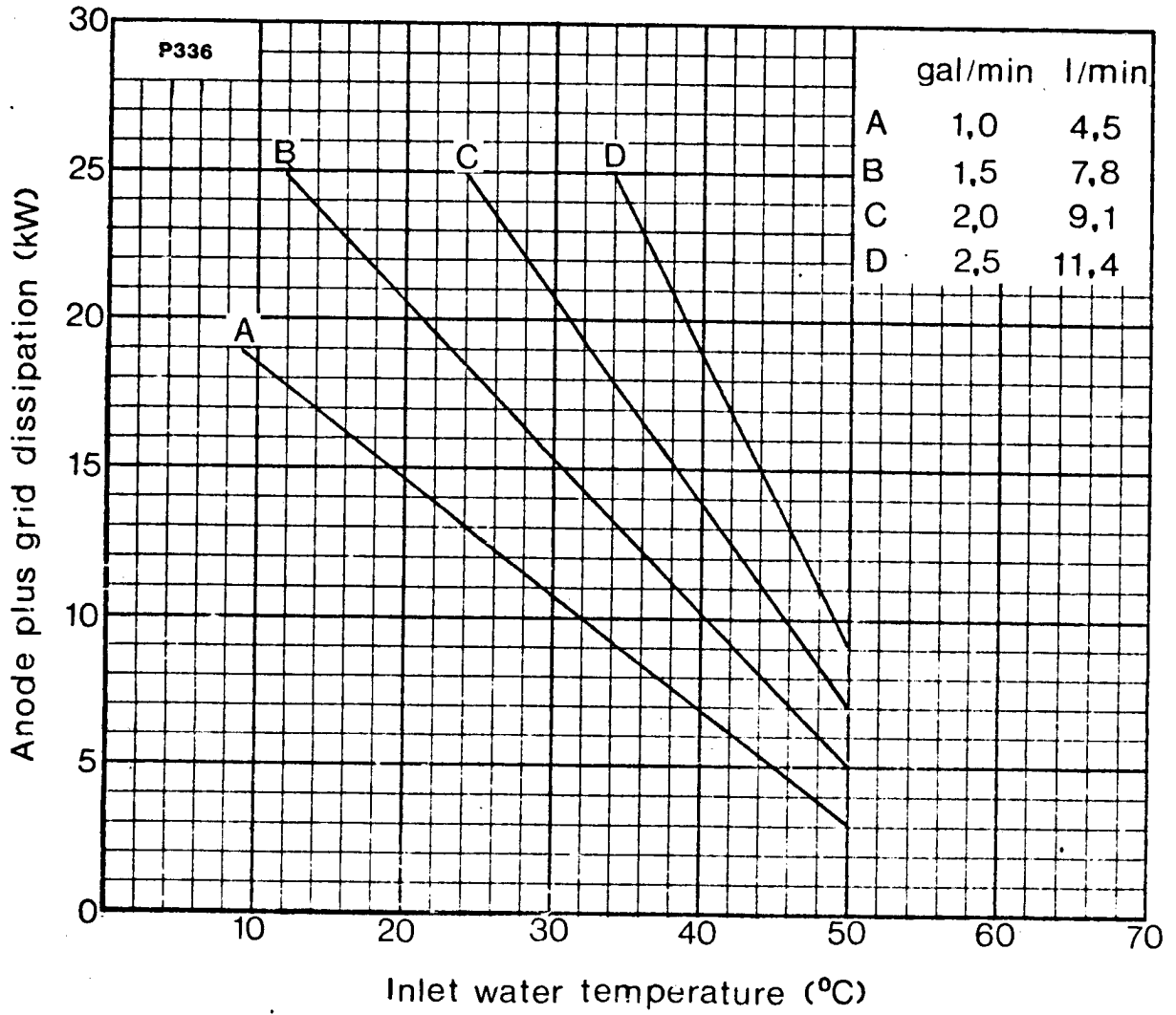
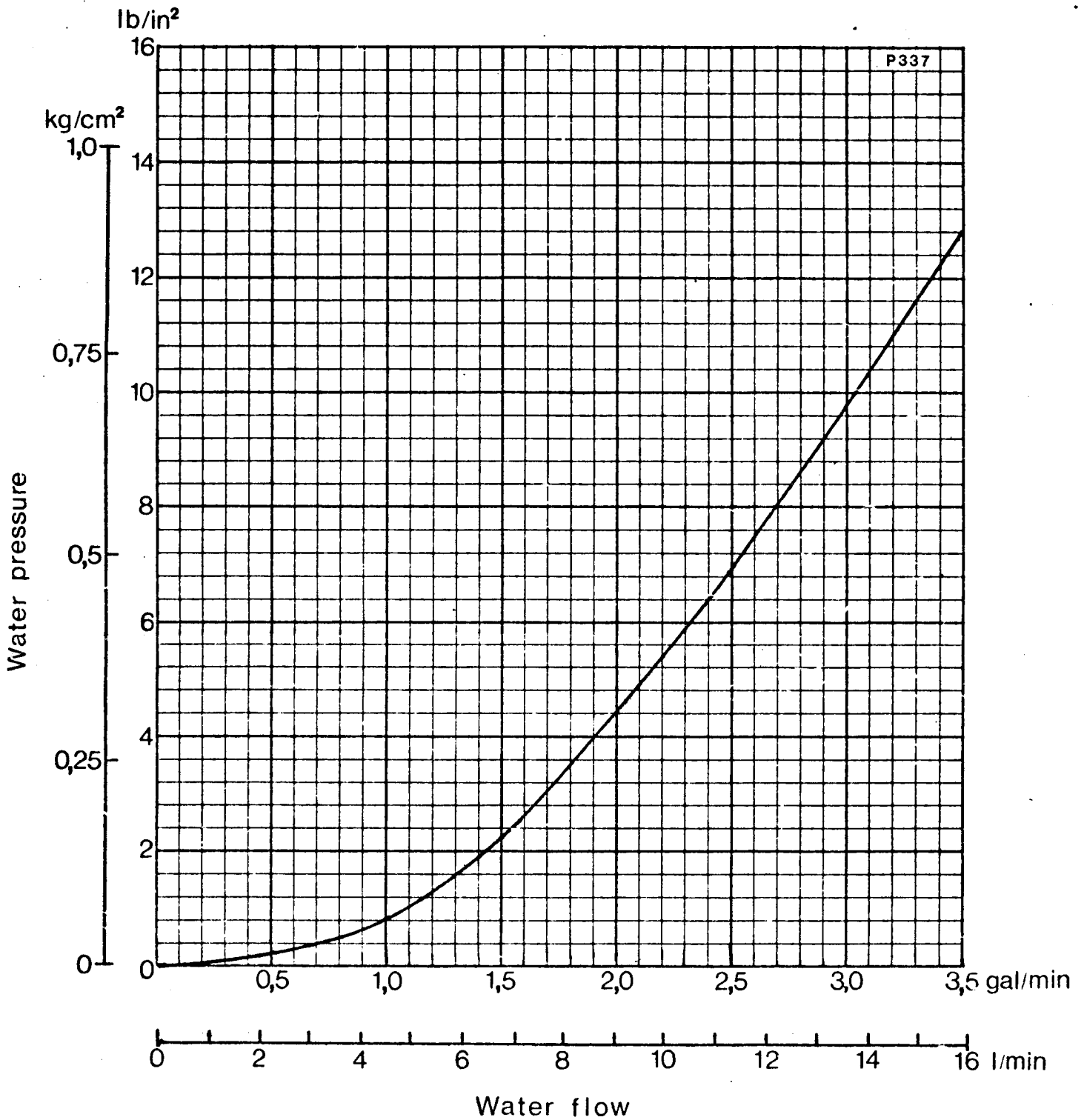
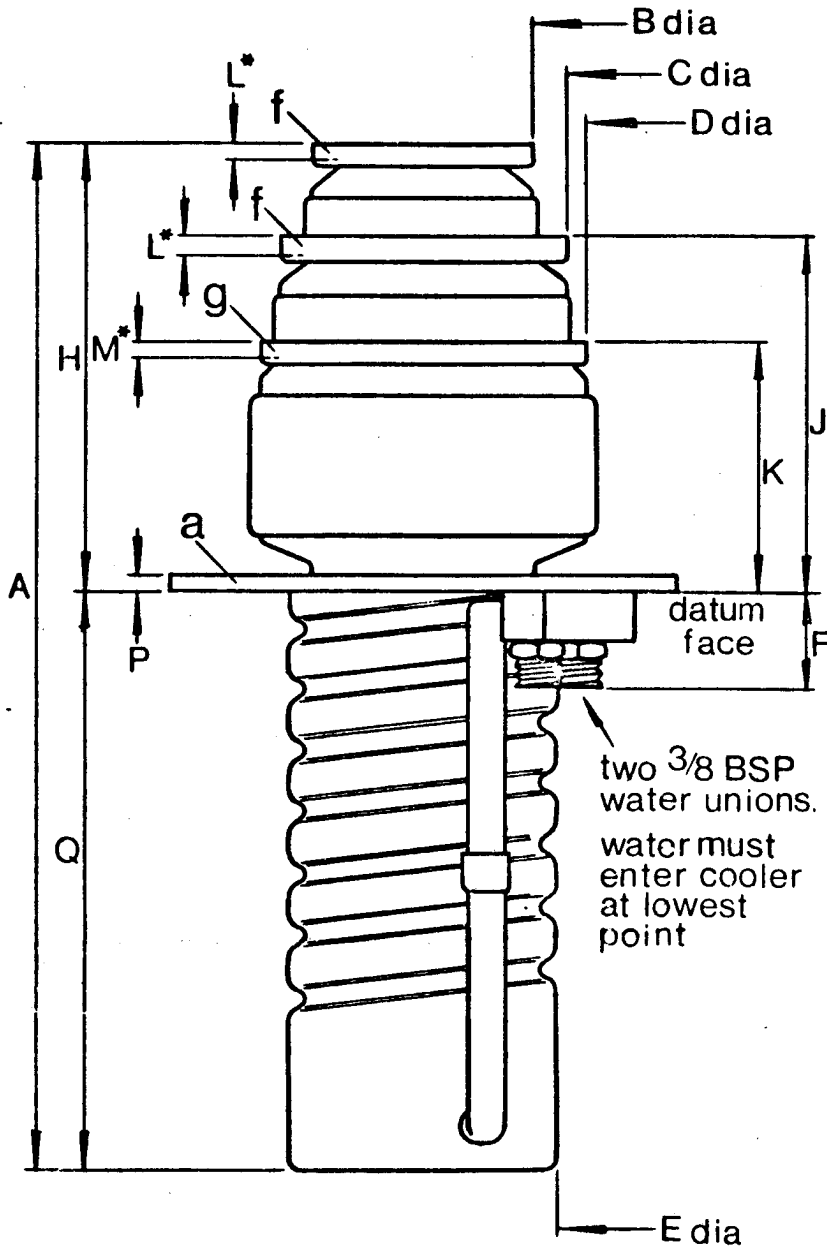


Fig. 4. Water Coil Characteristic



3R/262E Outline



dim.	millimetres	inches
A	370,08 max.	14,57 max.
B	77,85 ± 0,25	3,065 ± ,010
C	100,08 ± 0,25	3,940 ± ,010
D	114,83 ± 0,25	4,521 ± ,010
E	94,0 max.	3,70 max.
F	33,27 ± 1,52	1,31 ± ,06
H	157,23 ± 9,65	6,19 ± ,38
J	126,24 ± 4,83	4,97 ± ,19
K	88,14 ± 2,29	3,47 ± ,09
L	4,57 min. 7,87 max.	,18 min. ,31 max.
M	6,35 min. 9,65 max.	,25 min. ,38 max.
P	6,35 ± 0,38	,25 ± ,015
Q	203,2 max.	8,00 max.
R	65,02 max.	2,56 max.
T	146,05 t.p.	5,750 t.p.
U	9,53 ± 0,18	,375 ± ,007
V	177,8 ± 0,76	7,00 ± ,030
W	46,48 t.p.	1,83 t.p.
X	24,13 t.p.	,95 t.p.
Y	69,09 t.p.	2,72 t.p.
Z	46,48 t.p.	1,83 t.p.

*denotes contact length
metric dimensions are derived from original inch dimensions

5 holes of U dia. spaced as shown on T p.c.d. t.p.
posn. tol. 0,010 in. dia. datum dia. V

unions posn. tol. 0,10 in. dia. datum T p.c.d.

