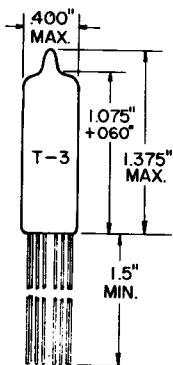


TUNG-SOL

TWIN TRIODE
SUBMINIATURE TYPE

GLASS BULB
SUBMINIATURE BUTTON
8 LEAD EB-10
OUTLINE DRAWING
J EDEC 3-1

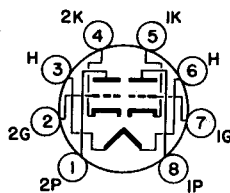
COATED UNIPOTENTIAL CATHODE

HEATER

 6.3 ± 0.3 VOLTS 0.3 AMP.

AC OR DC

ANY MOUNTING POSITION



BOTTOM VIEW
BASING DIAGRAM
J EDEC 8DG

8DG

THE 6111 IS A SUBMINIATURE MEDIUM-MU TWIN TRIODE DESIGNED FOR USE IN GENERAL-PURPOSE AMPLIFIER APPLICATIONS. EACH SECTION HAS AN INDIVIDUAL CATHODE AND IS ELECTRICALLY INDEPENDENT. THE TUBE MAY ALSO BE USED AS A COMBINED OSCILLATOR AND MIXER IN HIGH-FREQUENCY CIRCUITS.

DIRECT INTERELECTRODE CAPACITANCES

	WITH SHIELD ^A	WITHOUT SHIELD	
GRID TO PLATE, EACH SECTION	1.4	1.5	pf
INPUT, EACH SECTION	2.1	1.9	pf
OUTPUT, SECTION 1	1.3	0.28	pf
OUTPUT, SECTION 2	1.4	0.32	pf
GRID TO GRID, MAX.	0.010	0.011	pf
PLATE TO PLATE, MAX.	0.3	0.5	pf

^A WITH EXTERNAL SHIELD OF 0.405" INSIDE DIAMETER CONNECTED TO CATHODE OF SECTION UNDER TEST.

RATINGS

ABSOLUTE MAXIMUM VALUES

EACH SECTION

MAXIMUM PLATE VOLTAGE	165	VOLTS
MAXIMUM NEGATIVE DC GRID VOLTAGE	55	VOLTS
MAXIMUM PLATE DISSIPATION	0.95	WATTS
MAXIMUM DC PLATE CURRENT	22	MA.
MAXIMUM DC GRID CURRENT	5.5	MA.
MAXIMUM HEATER-CATHODE VOLTAGE:		
HEATER POSITIVE WITH RESPECT TO CATHODE	200	VOLTS
HEATER NEGATIVE WITH RESPECT TO CATHODE	200	VOLTS
MAXIMUM GRID CIRCUIT RESISTANCE	1.1	MEGOHMS
MAXIMUM BULB TEMPERATURE AT HOTTEST POINT	220	C

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TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

CLASS A₁ AMPLIFIER - EACH SECTION

PLATE VOLTAGE	100	VOLTS
CATHODE-BIAS RESISTOR	220	OHMS
AMPLIFICATION FACTOR	20	
PLATE RESISTANCE, APPROX.	4000	OHMS
TRANSCONDUCTANCE	5000	μMHOS
PLATE CURRENT	8.5	MA.
GRID VOLTAGE, APPROX. $I_b = 10$ μAMPERES	-9.0	VOLTS

CLASS A RESISTANCE-COUPLED AMPLIFIER

EACH SECTION

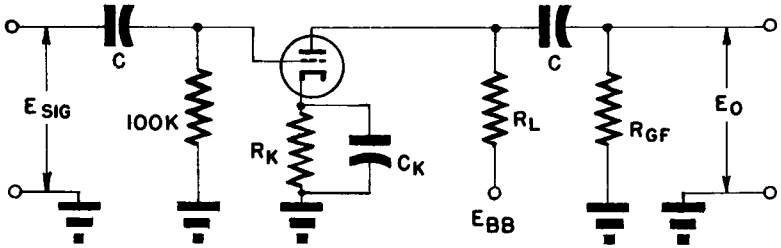
LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)										
R _L	R _{gf}	E _{bb} = 90 Volts			E _{bb} = 150 Volts			E _{bb} = 225 Volts		
		R _k	E _o	Gain	R _k	E _o	Gain	R _k	E _o	Gain
0.10	0.10	2400	8.4	13	2100	16	14	1900	25	15
0.10	0.24	3100	12	14	2800	22	15	2600	34	16
0.24	0.24	6200	10	14	5600	19	15	5200	30	16
0.24	0.51	7800	13	14	7200	25	15	7000	38	15
0.51	0.51	14000	11	13	13000	21	14	12000	32	15
0.51	1.0	19000	14	13	17000	26	14	16000	40	15
HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)										
R _L	R _{gf}	E _{bb} = 90 Volts			E _{bb} = 150 Volts			E _{bb} = 225 Volts		
		R _k	E _o	Gain	R _k	E _o	Gain	R _k	E _o	Gain
0.10	0.10	3200	11	13	2500	21	14	2100	32	15
0.10	0.24	4200	15	14	3400	28	15	3000	43	15
0.24	0.24	8400	13	13	6800	24	14	6000	36	15
0.24	0.51	10000	16	13	8700	29	15	7800	45	15
0.51	0.51	17000	13	13	15000	25	14	13000	38	15
0.51	1.0	21000	17	13	19000	30	14	17000	47	15

NOTES:

1. E_o IS MAXIMUM RMS VOLTAGE OUTPUT FOR APPROXIMATELY FIVE PERCENT TOTAL HARMONIC DISTORTION.
2. GAIN IS MEASURED FOR AN OUTPUT VOLTAGE OF TWO VOLTS RMS.
3. R_k IS IN OHMS; R_L AND R_{gf} ARE IN MEGOHMS.
4. COUPLING CAPACITORS (C) SHOULD BE SELECTED TO GIVE DESIRED FREQUENCY RESPONSE. R_k SHOULD BE ADEQUATELY BY-PASSED.

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CHARACTERISTICS LIMITS

		MIN	MAX	
HEATER CURRENT: $E_f = 6.3$ V	INITIAL	280	320	MA.
	500 HR.	276	328	MA.
PLATE CURRENT, EACH SECTION $E_f = 6.3$ V., $E_b = 100$ V., $R_k = 220$ OHMS (BY PASSED)	INITIAL	6.0	11	MA.
PLATE CURRENT DIFFERENCE BETWEEN SECTIONS: DIFFERENCE BETWEEN PLATE CURRENTS FOR EACH SECTION AT $E_f = 6.3$ V., $E_b = 100$ V., $R_k = 220$ OHMS (BY-PASSED)	INITIAL	---	2.0	MA.
TRANSCONDUCTANCE (1), EACH SECTION $E_f = 6.3$ V., $E_b = 100$ V., $R_k = 220$ OHMS (BY-PASSED)	INITIAL	4100	5900	μ MHOS
TRANSCONDUCTANCE CHANGE WITH HEATER VOLTAGE, EACH SECTION: DIFFERENCE BETWEEN TRANSDUCTANCE (1) AND TRANSDUCTANCE AT $E_f = 5.7$ VOLTS (OTHER CONDITIONS THE SAME) EXPRESSED AS A PERCENTAGE OF TRANSDUCTANCE (1)	INITIAL	---	15	PERCENT
	500 HR.	---	15	PERCENT
TRANSCONDUCTANCE CHANGE WITH OPERATION, EACH SECTION: DIFFERENCE BETWEEN TRANSDUCTANCE (1) INITIALLY AND AFTER OPERATION EXPRESSED AS A PERCENTAGE OF INITIAL VALUE	500 HR.	---	20	PERCENT
AVERAGE TRANSDUCTANCE CHANGE WITH OPERATION, EACH SECTION: AVERAGE OF VALUES FOR "TRANSDUCTANCE CHANGE WITH OPERATION"	500 HR	---	15	PERCENT
AMPLIFICATION FACTOR, EACH SECTION: $E_f = 6.3$ V., $E_b = 100$ V., $R_k = 220$ OHMS (BY-PASSED)	INITIAL	17	23	
PLATE CURRENT CUTOFF, EACH SECTION: $E_f = 6.3$ V., $E_b = 100$ V., $E_c = -9.0$ V.	INITIAL	---	100	μ AMPS.
INTERELECTRODE CAPACITANCES: GRID TO PLATE (G TO P), EACH SECTION	INITIAL	1.2	1.8	μ F
INPUT (G TO K+H), EACH SECTION	INITIAL	1.4	2.4	μ F
OUTPUT (P TO K+H), SECTION 1	INITIAL	0.20	0.36	μ F
OUTPUT (P TO K+H), SECTION 2	INITIAL	0.22	0.42	μ F
GRID TO GRID (G TO G)	INITIAL	---	0.011	μ F
PLATE TO PLATE (P TO P)	INITIAL	---	0.50	μ F

MEASURED WITHOUT EXTERNAL SHIELD.

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CHARACTERISTICS LIMITS - cont'd.

NEGATIVE GRID CURRENT, EACH SECTION

E_f = 6.3 V., E_b = 100 V., R_k = 220 OHMS(BY-PASSED) R_g = 1.0 MEG.

INITIAL	---	0.3	μAMPS.
500 HR.	---	0.9	μAMPS.

HEATER-CATHODE LEAKAGE CURRENT:

E_f = 6.3 V., E_{hk} = 100 V.,HEATER POSITIVE WITH RESPECT
TO CATHODE

INITIAL	---	5.0	μAMPS.
500 HR.	---	10	μAMPS.

HEATER NEGATIVE WITH RESPECT
TO CATHODE

INITIAL	---	5.0	μAMPS.
500 HR.	---	10	μAMPS.

INTERELECTRODE LEAKAGE RESISTANCE:

E_f = 6.3 V., POLARITY OF APPLIED DC

INTERELECTRODE VOLTAGE IS SUCH

THAT NO CATHODE EMISSION RESULTS.

GRID (EACH SECTION) TO ALL AT 100V.DC

INITIAL	100	---	MEGOHMS
500 HR.	50	---	MEGOHMS

PLATE (EACH SECTION) TO ALL AT 300V.DC

INITIAL	100	---	MEGOHMS
500 HR.	50	---	MEGOHMS

VIBRATIONAL NOISE OUTPUT VOLTAGE, RMS:

E_f = 6.3 V., E_{bb} = 100 V., R_k = 220 OHMS(BY-PASSED) R_L = 10,000 OHMS, VIBRATIONAL

ACCELERATION = 15 G AT 40 cps.

INITIAL	---	50	MV.
---------	-----	----	-----

GRID EMISSION CURRENT, EACH SECTION:

E_f = 7.5 V., E_b = 100 V., E_{cc} = -9.0 V.,R_g = 1.0 MEG.

INITIAL	---	0.5	μAMPS.
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PULSE CATHODE CURRENT:

E_f = 6.0 V., PULSE OF 25 μSECONDS DURATION,

200-CYCLE REPETITION RATE, AND 50 VOLT

AMPLITUDE IS APPLIED TO PLATE AND GRID

TIED TOGETHER. PULSE CATHODE CURRENT

IS MEASURED FOR EACH SECTION WITH OP-

POSITE SECTION FLOATING

INITIAL	300	---	MA.
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SPECIAL TESTS AND RATINGS

STABILITY LIFE TEST

STATISTICAL SAMPLE OPERATED FOR ONE HOUR TO EVALUATE AND CONTROL INITIAL VARIATIONS IN
TRANSCONDUCTANCE.

SURVIVAL RATE LIFE TEST

STATISTICAL SAMPLE OPERATED FOR ONE HUNDRED HOURS TO EVALUATE AND CONTROL EARLY-LIFE
ELECTRICAL AND MECHANICAL IN-OPERATIVES.

HEATER-CYCLING LIFE TEST

STATISTICAL SAMPLE OPERATED FOR 2000 CYCLES TO EVALUATE AND CONTROL HEATER-CATHODE
DEFECTS. CONDITIONS OF TEST INCLUDE E_f = 7.0 VOLTS CYCLED FOR ONE MINUTE ON AND FOUR MIN-
UTES OFF, E_b = E_c = 0 VOLTS, AND E_{hk} = 140 VOLTS RMS.

SHOCK RATING—450 G

STATISTICAL SAMPLE SUBJECTED TO FIVE IMPACT ACCELERATIONS OF 450 G IN EACH OF FOUR DIF-
FERENT POSITIONS. THE ACCELERATING FORCES ARE APPLIED BY THE NAVY-TYPE, HIGH IMPACT
(FLYWEIGHT) SHOCK MACHINE FOR ELECTRONIC DEVICES OR ITS EQUIVALENT.

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SPECIAL TESTS AND RATINGS - cont'd.

FATIGUE RATING—2.5 G

STATISTICAL SAMPLE SUBJECTED TO VIBRATIONAL ACCELERATION OF 2.5 G FOR 32 HOURS IN EACH OF THREE DIFFERENT POSITIONS. THE SINUSOIDAL VIBRATION IS APPLIED AT A FIXED FREQUENCY BETWEEN 25 AND 60 CYCLES PER SECOND.

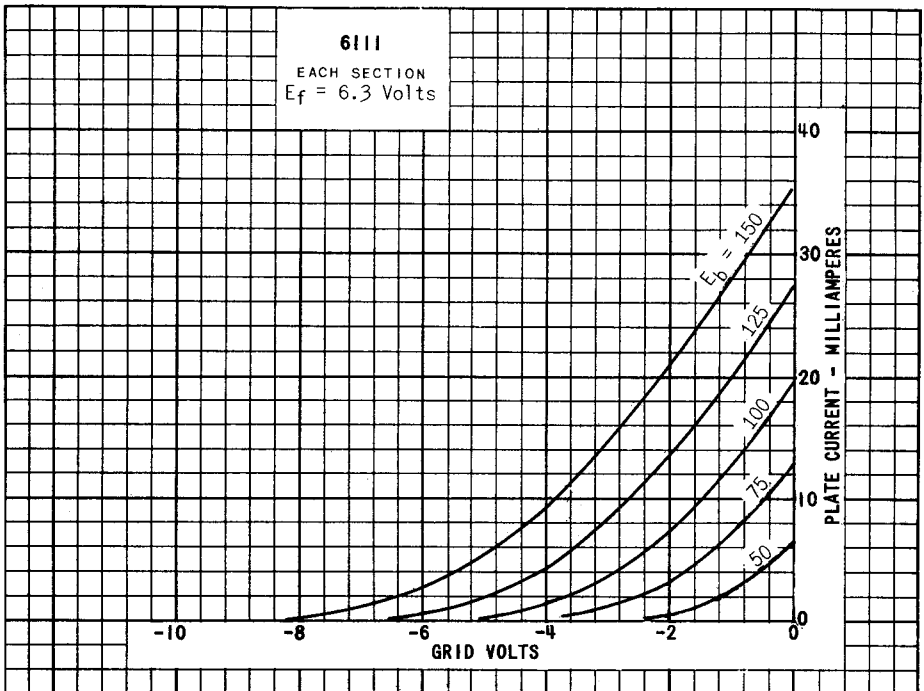
ALTITUDE RATING—40,000 FEET

STATISTICAL SAMPLE SUBJECTED TO PRESSURE OF 55 MILLIMETERS OF MERCURY TO EVALUATE AND CONTROL ARCING AND CORONA.

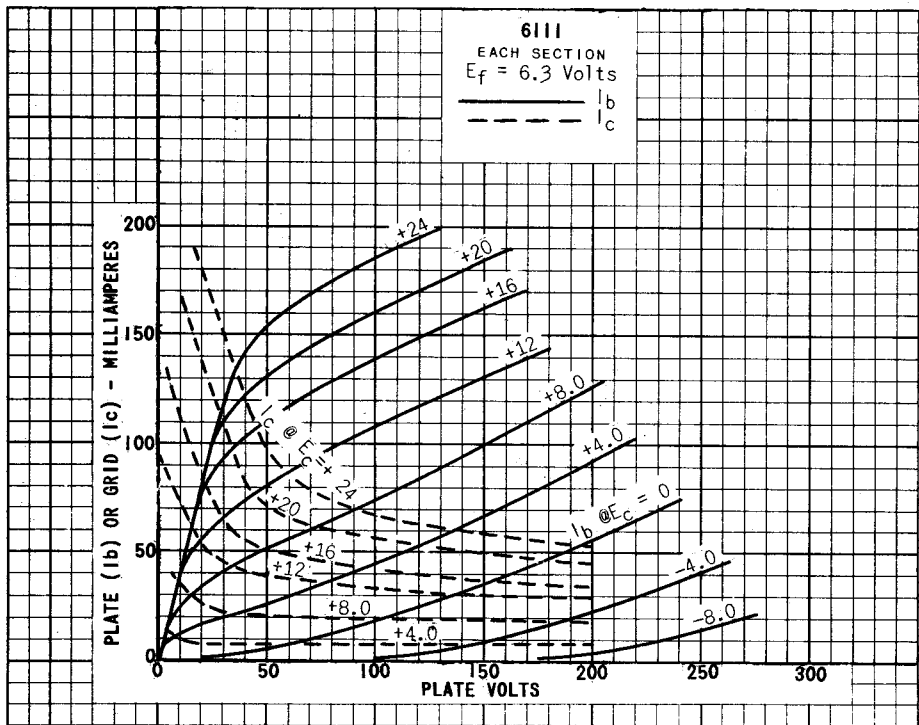
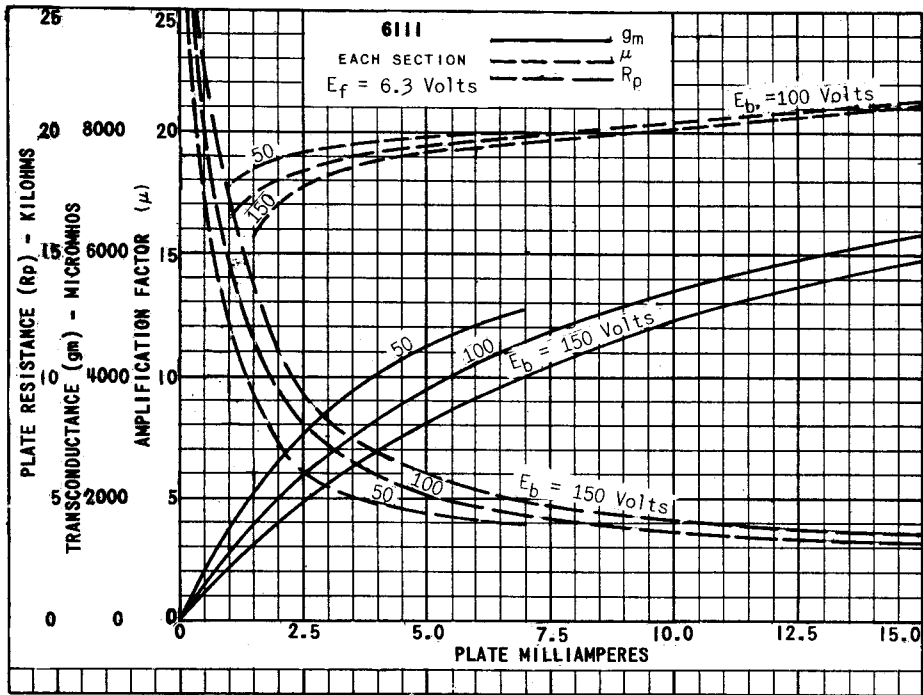
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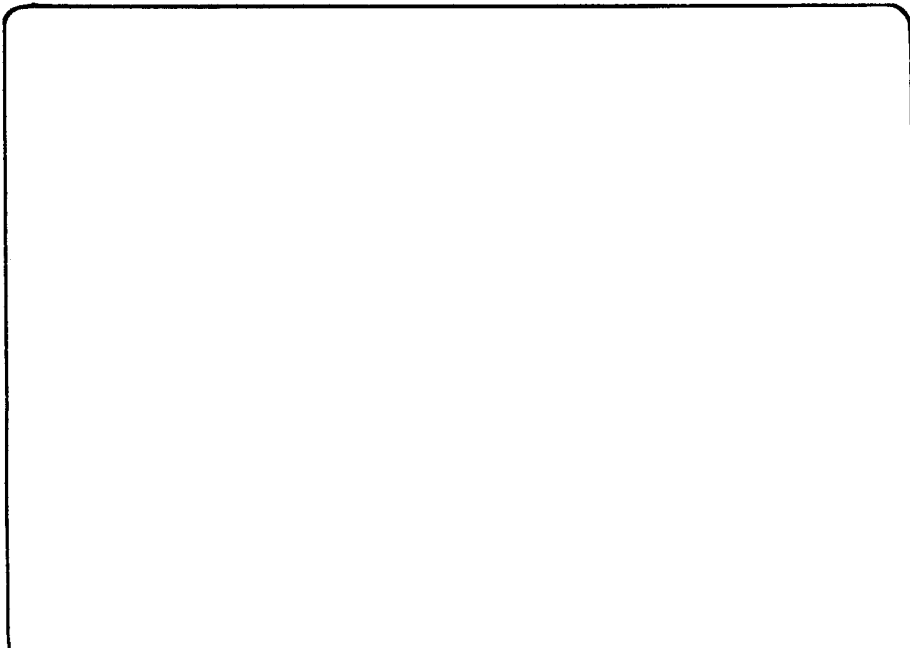
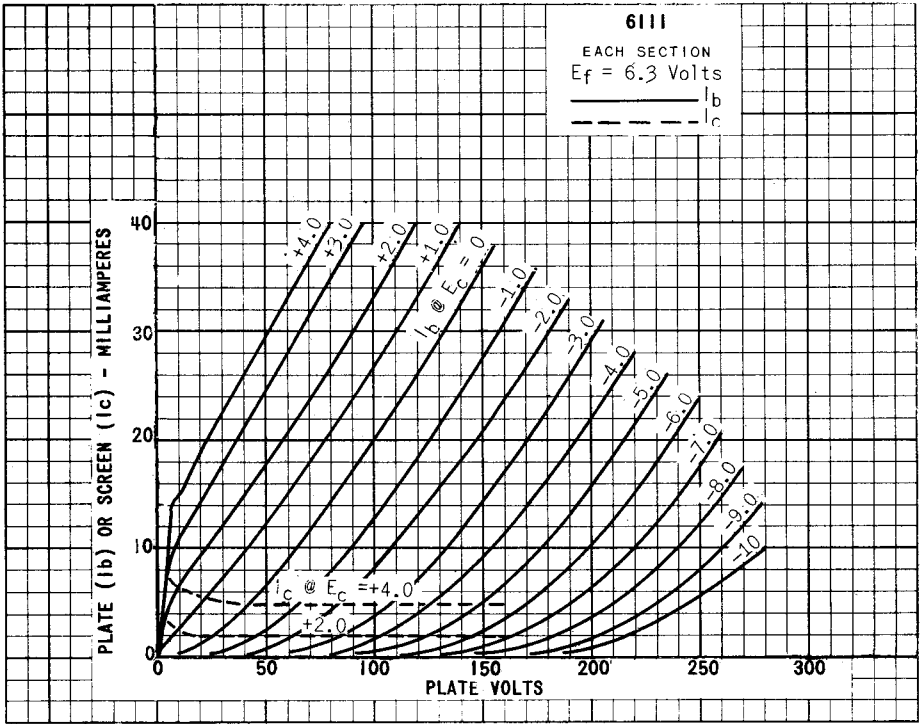
THE CONDITIONS FOR SOME OF THE INDICATED TESTS HAVE DELIBERATELY BEEN SELECTED TO AGGRAVATE TUBE FAILURES FOR TEST AND EVALUATION PURPOSES. IN NO SENSE SHOULD THESE CONDITIONS BE INTERPRETED AS SUITABLE CIRCUIT OPERATING CONDITIONS.

IN THE DESIGN OF MILITARY EQUIPMENT EMPLOYING THIS TUBE, REFERENCE SHOULD BE MADE TO THE APPROPRIATE MIL-E-1 SPECIFICATION.



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