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This Handbook of data on RCA electron tubes has been compiled to meet the requirements of electronic-equipment design engineers primarily but will prove helpful to anyone having need for technical information which can be kept up to date. Its convenient loose-leaf form permits the revision of data on existing types and the addition of data on new types as they are made available. The material is arranged in Sections divided by tabbed separators to facilitate quick reference.

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RCA Electronic Components

General

RCA TUBE HANDBOOK HB-3

GENERAL SECTION

The information in this Section, in general, applies to all classes of RCA tubes. It includes such material as the Table of Contents for all Sections; Index of Tube Types arranged in numerical-alphabetical-numerical sequence; list of preferred types; list of not-recommended types; interchangeability list; discussion of ratings; outlines; cap and base drawings; as well as other general information of interest to the equipment designer.

For further Technical Information, write to Commercial Engineering, Tube Division, Radio Corporation of America, Harrison, N. J.

Table of Contents

Sheets in the RCA Electron Tube Handbook are arranged in the Table of Contents in order of appearance in each section. The Index of Types, which follows the Table of Contents, lists type numbers in numerical-alphabetical-numerical sequence.

The Table of Contents and Index of Types may be used to determine:

(1) location of individual sheets
(2) completeness of Handbook
(3) arrangement of Handbook sheets

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▲ See sheet titled *RCA RECEIVING TUBE TYPES – Supplementary Listing* at beginning of Receiving Tube Section.

□ See sheet titled *RCA RECEIVING TUBE DATA – Types Not Recommended for New Equipment Design* at beginning of Receiving Tube Section.

* See sheet titled *RCA TRANSMITTING-TUBE TYPES – Limited Listing* at beginning of Transmitting Tube Section.

● Discontinued type. Data retained in Handbook for reference purposes only.

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	F	Curve CE-6483T3
	F	Curves CE-6865T1-6830T

Type	Section	Sheet & Date
3DB3 . . .	R	Data 1&2, 11-70
3DB3/ 3CY3 . . .	R	Suppl. Listing, 4-71▲
3DC3 . . .	R	Suppl. Listing, 4-71▲
3DF3 . . .	R	Data 1&2, 11-70
3DG3 . . .	R	Data 1&3, 5-61
3DJ3 . . .	R	Data 1&2, 11-70
3DK6 . . .	R	Data, 2-64
3DT6A . .	R	On 3DK6 sheet
3DZ4 . . .	R	On back of 3DK6 sheet Use 3AF4A/ 3DZ4
3E29 . . .	T	Data Chart, 11-69 *
3EA5• . .	R	On back of 3DK6 sheet
3EH7• . .	R	On back of 3DK6 sheet Use 3EH7/ XF183
3EJ7• . . .	R	Data, 2-64 Use 3EJ7/ XF184
3ER5, 3FH5 . . .	R	On 3EJ7 sheet
3FS5, 3GK5 . .	R	On back of 3EJ7 sheet
3GS8• . .	R	Data, 10-66 Use 3BU8/ 3GS8
3HM5/ 3HA5 . .	R	On 3GS8 sheet
3HQ5 . . .	R	Suppl. Listing, 4-71▲
3HS8 . . .	R	On 3GS8 sheet
3JC6• . . .	R	On back of 3GS8 sheet
3JC6A, 3JD6• . .	R	On back of 3GS8 sheet
3JP1	C	Data 1&2, 8-51
	C	Curve 92CM-7671

Index of Types
3JP7 to 4ES8

For key to symbols, see sheet Index of Types 1

Type	Section	Sheet & Date
3JP7	C	Data, 8-51
3KP1 ...	C	Data 1&2, 4-56
	C	Curve 92CM-7191R2
	C	Curve 92CM-6658R2
3KP4• ..	C	Data, 11-58
3KP7 ...	C	On 3KP4 sheet
3KP11 ...	C	On 3KP4 sheet
3KP16• .	C	On back of 3KP4 sheet
3KT6 ...	R	On back of 3GS8 sheet
3Q4	R	Data Chart, 2-70□
3Q5GT ..	R	Data Chart, 2-70□
3RP1 ...	C	Data, 9-55
3RP1A ..	C	Tent. Data 1&2, 7-55
	C	Curve 92CM-7143R1
3S4	R	Data Chart, 2-70□
3V4	R	Data Chart, 2-70□
3WP1 ...	C	Tent. Data 1&2, 4-57
	C	Circuit CE-9131
	C	Curve 92CM-9158
3WP2• ..	C	Data, 4-57
3WP11 ..	C	On 3WP2 sheet
3X3000F1		See 8239/3X3000F1
4-65A ...		See 8165/4-65A
4-125A/4D21 ...	T	Data Chart, 11-69*
4-250A/5D22 ...	T	Data Chart, 11-69*
4-400A ..	T	Data, 9-62 See also 8438/4-400A
4-1000A ..	T	See 8166/4-1000A
4AU6 ...	R	Data, 5-62
4AV6 ...	R	On 4AU6 sheet
4BC5• ..	R	On 4AU6 sheet
4BC8 ...	R	On back of 4AU6 sheet
4BL8• ..	R	On back of 4AU6 sheet Use 4BL8/XCF80
4BN6 ...	R	On back of 4AU6 sheet
4BQ7A .	R	Data, 5-62
4BS8 ...	R	On 4BQ7A sheet
4BU8• ..	R	On 4BQ7A sheet Use 4BU8/4GS8
4BZ6 ...	R	On back of 4BQ7A sheet
4BZ7 ...	R	On back of 4BQ7A sheet
4CB6 ...	R	On back of 4BQ7A sheet
4CS6 ...	R	Data, 3-64
4CX250F		See 7204/4CX250F
4CX1000A		See 8168/4CX1000A
4CX5000A	R	See 8170/4CX5000A
4CY5• ..	R	On 4CS6 sheet
4D21		See 4-125A/4D21
4DE6 ...	R	On 4CS6 sheet
4DK6 ...	R	On back of 4CS6 sheet
4DT6A ..	R	On back of 4CS6 sheet
4E27A/5-125B .	T	Data Chart, 11-69*
4EH7• ..	R	Data, 3-64 Use 4EH7/LF183
4EJ7• ...	R	On 4EH7 sheet Use 4EJ7/LF184
4ES8• ..	R	On 4EH7 sheet

Index of Types
4ES8 to 5HZ6

For key to symbols, see sheet Index of Types 1

Type	Section	Sheet & Date
4ES8● . . .		Use 4ES8/XCC189
4EW6 . . .	R	On back of 4EH7 sheet
4GK5 . . .	R	Suppl. Listing, 4-71▲
4GM6 . . .	R	On back of 4EH7 sheet
4HM6 . . .	R	Data, 8-63
4HQ5 . . .	R	Suppl. Listing, 4-71▲
4HS8 . . .	R	Data, 3-64
4JC6● . . .	R	Data, 10-66
4JC6A . .	R	On 4JC6 sheet
4JD6 . . .	R	On 4JC6 sheet
4JH6 . . .	R	Suppl. Listing, 4-71▲
4KE8 . . .	R	On 4JC6 sheet
4KT6 . . .	R	On 4JC6 sheet
4X150D .		See 7035/4X150D
4X500A .	T	Data Chart, 11-69*
5-125B . .		See 4E27A/5-125B
5ABP1 . .	C	Tent. Data 1&2, 6-53
	C	Outline CE-7842
	C	Curve 92CM-7910
5ABP4● .	C	Data, 11-55
5ABP7● .	C	On 5ABP4 sheet
5ABP11 .	C	On 5ABP4 sheet
5ADP1 . .	C	Tent. Data 1&2, 12-56
	C	Curve 92CM-9099
	C	Curve 92CM-6820R1
5AM8 . . .	R	On back of 4JC6 sheet
5AN8 . . .	R	On back of 4JC6 sheet
5AQ5 . . .	R	On back of 4JC6 sheet
5AS4A. . .	R	Tent. Data, 4-57
5AS8 . . .	R	Data, 7-61
5AT8 . . .	R	On 5AS8 sheet

Type	Section	Sheet & Date
5AUP24 .	C	Data 1&2, 9-58
	C	Curve 92CM-8343R1
5AV8 . . .	R	Data, 7-61
5AZ4 . . .	R	Data Chart, 2-70□
5AZP4 . .		Data 1 to 6, 2-69
5B8	R	Tent. Data 1&2, 9-58
5BC3A . .	R	Data 1 to 4, 4-65
5BE8 . .	R	Data Chart, 2-70□
5BK7A .	R	Data, 2-59
5BP1A . .	C	Data 1, 7-45
5BQ7A . .	R	On 5BK7A sheet
5BR8 . . .	R	On 5BK7A sheet Use 5BR8/5FV8
5BT8 . . .	R	Data Chart, 2-70□
5BW8 . . .	R	Data, 7-61
5C21 . . .		See C6J/5C21
5CG8 . . .	R	Data, 7-61
5CL8A . .	R	On 5CG8 sheet
5CM8● . .	R	On 5CG8 sheet
5CP1A . .	C	Data 1&2, 10-51
	C	Outline CE-6408R4
	C	Curve 92CM-6821
5CP11A .	C	Tent. Data, 4-47
5CQ8 . . .	R	On back of 5CG8 sheet
5CZ5 . . .	R	On back of 5CG8 sheet
5D22 . . .		See 4-250A/5D22
5DJ4 . . .	R	Data Chart, 2-70□
5EA8 . . .	R	Data,5-62
5EU8 . . .	R	On 5EA8 sheet
5EW6 . . .	R	On 5EA8 sheet
5FG7 . . .	R	On back of 5EA8 sheet
5FP4A . .	C	Data 1&2, 8-63
5FP7A . .	C	Data, 8-51
5FV8 . . .	R	On back of 5EA8 sheet
5GH8A . .	R	Data, 9-68
5GM6 . . .	R	On 5GH8A sheet
5GX6 . . .	R	On 5GH8A sheet
5HZ6 . . .	R	On back of 5GH8A sheet

For key to symbols, see sheet Index of Types 1

Type	Section	Sheet & Date
5J6	R	On back of 5GH8A sheet
5KE8 ...	R	On back of 5GH8A sheet
5MQ8 ...	R	On back of 5GH8A sheet
5R4GYB	D	Data 1 to 4, 7-61
5T8	R	Data, 4-56
5U4G ..	R	Data Chart, 2-70□
5U4GB ..	R	Data 1 to 3, 7-61
5U8	R	Data, 3-55
5UP1 ...	C	Tent. Data, 12-46
	C	Circuit CE-6819
	C	Curve 92CM-6808
	C	Curve 92CM-6810
5UP7 ...	C	Data, 9-65
5UP11 ..	C	On 5UP7 sheet
5UP31 ..	C	On 5UP7 sheet
5V3A ...	R	Data, 7-61 Use 5V3A/5AU4
5V4GA ..	R	Tent. Data, 7-58
	R	Outline CE-9549R1 & Curve 92CS-6110R1
5V6GT ..	R	Data, 7-58
5WP11 ..	C	Tent. Data 1&2, 2-49
5X8	R	Data, 3-55
5Y3GT ..	R	Data 1&2, 7-61
5Y4GA ..	R	Data Chart, 2-70□
5Y4GT ..	R	Data Chart, 2-70□
5Z3	R	Data Chart, 2-70□
5Z4	R	Data Chart, 2-70□
5ZP16 ..	C	Data 1&2, 7-58
	C	Outline & Notes CE-7574R2
	C	Curve 92CM-7576R1
6A7	R	Data Chart, 2-70□

Type	Section	Sheet & Date
6A8	R	Data Chart, 2-70□
6AB4 ...	R	Data, 5-52 See also 6664/6AB4
6AC7 ...	R	Data Chart, 2-70□
6AD10 ..		Suppl. Listing, 4-71▲
6AF3 ...	R	Data, 10-59
6AF4 ...	R	Data, 11-54
6AF4A ..	R	Data, 5-61
	R	Curve 92CM-7756
	R	Curve 92CM-7759R1 Use 6AF4A/6DZ4
6AF6G ..	R	Data, 12-44
6AF11 ..	R	Data, 5-65
6AG5 ...	R	Data, 1-55
	R	Curve 92CM-6399R2
6AG7 ...	R	Data 1&2, 11-52
	R	Curves CE-6035T1 & CE-6036T1
6AH4GT	R	Data Chart, 2-70□
6AH6 ...	R	Data Chart, 2-70□
6AK5 ...	R	Data, 9-55
	R	Curve 92CM-6504 Use 6AK5/EF95
6AK6 ...	D	Tent. Data 10-43
	D	Curve 92C-6449
6AL3• ..	R	Data, 3-62 Use 6AL3/EY88
6AL5 ...	R	Data, 5-54
	R	Curve 92CM-6561 See also 6663/6AL5
6AL7GT .	R	Data Chart, 2-70□
6AL11 ..	R	Data 1, 10-66
	R	Data 2&3, 8-64
6AM4 ...	R	Data Chart, 2-70□
6AM8A .	R	Data 1, 10-59
	R	Curve 92CS-8504R1
	R	Curve 92CM-10244
6AN4 ...	R	Tent. Data, 6-57

Index of Types 6AN8A to 6BE3

For key to symbols, see sheet Index of Types 1

Type	Section	Sheet & Date
6AN8A . .	R	Data 1 to 3, 1-61
6AQ5A . .	R	Data 1&2, 11-58
		See also 6669/6AQ5A
6AQ6 . . .	R	Data Chart, 2-70□
6AQ7GT	R	Data Chart, 2-70□
6AR5 . . .	R	Data Chart, 2-70□
6AR11 . .	R	Data 1&2, 1-63
6AS5 . . .	R	Data Chart, 2-70□
6AS6 . . .	D	Tent. Data, 2-50
	D	Curve 92CM-7401; -7408
	D	Curve 92CM-7404R1
6AS7G . .	D	Data, 5-55
	D	Curve 92CM-6618
6AS8 . . .	R	Tent. Data, 5-54
	R	Curve 92CM-8206
6AS11 . .	R	Data 1&2, 1-63
6AT6 . . .	R	Data, 9-55
	R	Curve 92CM-6610
6AT8A . .	R	Data, 8-60
6AU4GTA	R	Data, 8-59
6AU5GT	R	Data 1, 11-54
	R	Curve 92CM-7355
6AU6A . .	R	Data 1 to 4, 10-60
6AU8A .	R	Data 1 to 3, 1-62
6AV5GA	R	Data Chart, 2-70□
6AV6 . . .	R	Data, 8-59
6AV11 . .	R	Suppl. Listing, 4-71▲
6AW8A	R	Data 1 to 4, 1-62
6AX3 . . .	R	Data, 5-62
6AX4GTB	R	Data, 3-61
6AX5GT	R	Tent. Data 1&2, 2-50
	R	Curve 92CM-7382
6AX8 . . .	R	Data Chart, 2-70□
6AY3B . .	R	Data, 10-64
6AY11 . .	R	Data, 6-64

Type	Section	Sheet & Date
6AZ8 . . .	R	Tent. Data 1&2, 3-55
	R	Curve 92CM-8519
	R	Curve 92CM-8521
	R	Curve 92CM-8523
6B8	R	Data Chart, 2-70□
6B10 . . .	R	Data 1&2, 1-63
6BA3 . . .	R	Data, 4-65
6BA6 . . .	R	Data, 3-61
	R	Curve 92CM-6609
	R	Curve 92CM-6620
		Use 6BA6/EF93
		See also 6660/6BA6
6BA7 . . .	R	Tent. Data, 9-48
	R	Curve 92CM-6982R1
	R	Curve 92CM-6980R2
6BA8A . .	R	Tent. Data 1&2, 6-57
	R	Curve 92CM-9339; -8646
6BA11 . .	R	Data, 6-64
6BC4 . . .	R	Tent. Data, 6-54
	R	Curve 92CM-8241
6BC5 . . .	R	Data, 3-55
		Use 6BC5/6CE5
6BC7 . . .	R	Tent. Data, 3-54
6BC8 . . .	R	Data 1, 10-66
	R	Curve 92CM-8789
	R	Curve 92CM-8788R1
		Use 6BC8/6BZ8
6BD6 . . .	R	Data Chart, 2-70□
6BD11 . .	R	Data, 5-65
6BE3 . . .	R	Data, 4-64
		Use 6BE3/6BZ3

Index of Types
6BE6 to 6C5

For key to symbols, see sheet Index of Types 1

Type	Section	Sheet & Date
6BE6 ...	R	Data, 5-61
		Curve 92CM-6625; -6601
6BF5 ...	R	Data Chart, 2-70□
6BF6 ...	R	Data Chart, 2-70□
6BF11 ..	R	Data 1, 10-66
		Data 2 to 4, 4-66
6BG6G ..	R	Data Chart, 2-70□
6BG6GA•	R	Data Chart, 2-70□
6BH3A ..	R	Data, 10-64
6BH6 ...	R	Data, 9-55
	R	Curve 92CM-6892; -6893
		See also 6661/6BH6
6BH8 ...	R	Data Chart, 2-70□
6BJ3	R	Data, 6-64
6BJ6	R	Data, 9-55
		Curve 92CM-6867; -6870
		See also 6662/6BJ6
6BJ7	R	Data, 10-59
6BJ8	R	Tent. Data 1&2, 7-58
		Curve 92CM-9535
6BK4B ..	R	Data 1, 9-65
	R	Data 2, 9-67
6BK4C/ 6EL4A	R	Suppl. Listing, 4-71▲
6BK5 ...	R	Data Chart, 2-70□
6BK7B ..	R	Data, 2-59
	R	Curve 92CM-9764
6BL7GTA	R	Tent. Data, 4-58
	R	Curve 92CM-9526
6BL8• ..	R	Data, 5-62
		Use 6BL8/ECF80
6BM8/ ECL82 ..	R	Data, 5-65
6BN4A ..	R	Data, 1-62
	R	Curve 92CM-9941
6BN6 ...	R	Data 1 to 4, 8-60
		Use 6BN6/6KS6
6BN8 ...	R	Data, 8-59
	R	Curve CE-9364T
	R	Curve 92CM-9365
6BQ5 ...	R	Tent. Data, 6-59
	R	Curve 92CM-9903
		Use 6BQ5/EL84
6BQ6GTB 6CU6 ...	R	Data 1&2, 1-62
6BQ7A ..	R	Data 1&2, 1-62
		Use 6BQ7A/6BZ7/6BS8
6BR8A ..	R	Data, 2-67
		Use 6BR8A/6FV8A
6BS3A ..	R	Data, 10-64
6BS8 ...	R	Data Chart, 2-70□
6BU8 ...	R	Data, 1-62
	R	Curve 92CM-9428; -9433
6BV8 ...	R	Data Chart, 2-70□
6BV11 ..	R	Suppl. Listing, 4-71▲
6BW4 ...	R	Data Chart, 2-70□
6BW8	R	Data, 7-61
6BX7GT ..	R	Data Chart, 2-70□
6BY5GA	R	Data Chart, 2-70□
6BY6 ...	R	Tent. Data, 3-54
	R	Curve 92CM-8140
	R	Curve 92CM-8138
6BY8 ...	R	Tent. Data 1, 9-58
	R	Curve 92CS-9616
6BZ6 ...	R	Data, 8-59
	R	Curve 92CM-8508R2
	R	Curve 92CM-9485R1
6BZ7 ...	R	Data 1&2, 1-62
		Use 6BQ7A/6BZ7/6BS8
6C4	R	Data 1, 11-54
	R	Curve 92C-6378
6C5	R	Data Chart, 2-70□

Index of Types
6C6 to 6DE7

For key to symbols, see sheet Index of Types 1

Type	Section	Sheet & Date
6C6,6C9	R	Data Chart, 2-70□
6CA4	R	Data 1&2, 8-60
6CA5	R	Data, 7-61
6CB5A	R	Data, 8-59
	R	Outline CE-8988R1
	R	Curve 92CM-8436
6CB6	R	Data, 3-55
	R	Curve 92CM-7378
6CB6A	R	Tent. Data, 4-59
	R	Curve 92CM-9854
		Use 6CB6A/6CF6
		See also 6676/6CB6A
6CD6GA	R	Tent. Data, 10-56
	R	Outline CE-9012
	R	Curve 92CM-9016
6CE3	R	Data, 2-69
		Use 6CE3/6CD3
6CG3	R	Data, 2-69
		Use 6CG3/6BW3
6CG8A	R	Data, 3-61
6CH8	R	Data Chart, 2-70□
6CJ3	R	Data, 12-68
		Use 6CJ3/6CH3
6CK3	R	Data, 8-69
6CK4	R	Data Chart, 2-70□
6CL3	R	Data, 12-66
6CL6	R	Tent. Data, 9-52
	R	Circuit CE-7804
	R	Curve 92CM-7802
	R	Curve 92CM-7808
		See also 6677/6CL6
6CL8A	R	Data 1&2, 10-59
6CM3	R	Data, 4-67
6CM6	R	Tent. Data 1&2, 9-58
6CM7	R	Data 1 to 3, 5-61
6CM8	R	Data Chart, 2-70□
6CN7	R	Data, 1-63
6CQ4	R	Data, 5-62
		Use 6DE4/6CQ4

Type	Section	Sheet & Date
6CQ8	R	Data 1 to 4, 3-61
6CR6	R	Data Chart, 2-70□
6CS6	R	Data, 8-56
	R	Curve 92CM-8922
6CS7	R	Tent. Data 1&2, 11-58
6CT3	R	Data, 5-68
6CU5	R	Data, 1-62
	R	Curve 92CM-8908R1
6CU6		See 6BQ6GTB/6CU6
6CU8	R	Data, 4-60
	R	Curve 92CM-10353
	R	Curve 92CM-10646
6CW4	R	Data 1 to 3, 1-63
6CW5•	R	Data, 5-65
	R	Use 6CW5/EL86
6CX8	R	Data, 10-59
6CY5	R	Data, 10-59
	R	Curve 92CM-9518
		See also 7717/6CY5
6CY7		Data, 10-59
6CZ5	R	Data 1 to 3, 1-61
6DA4•	R	Data, 10-59
		Use 6DM4A/6DA4
6DB5	R	Data, 7-61
6DC6	R	Tent. Data, 6-54
	R	Curve 92CM-8330R1
	R	Curve 92CM-8338
6DE4	R	Data, 1-62
		Use 6DE4/6CQ4
6DE6	R	Data, 10-59
	R	Curve 92CM-8578R1
6DE7	R	Data 1, 5-62
	R	Tent. Data 2, 6-59
	R	Curve 92CM-9991
	R	Curve 92CM-9914

Index of Types 6DG6GT to 6FQ5A

For key to symbols, see sheet Index of Types 1

Type	Section	Sheet & Date
6DG6GT	R	Tent. Data, 12-56
6DK6 . . .	R	Tent. Data, 4-59
	R	Curve 92CM-9851R1
6DM4A/6DA4 . .	R	Suppl. Listing, 4-71▲
6DN3 . . .	R	Data 1&2, 5-70
6DN6 . . .	R	Data Chart, 2-70□
6DN7 . . .	R	Data, 10-59
	R	Outline CE-10241
6DQ5 . . .	R	Data 1, 7-63
	R	Outline CE-9343
	R	Curve 92CM-9309
6DR7 . . .	R	Tent. Data, 6-59
	R	Data 2, 1-62
	R	Curve 92CM-9913
6DS4 . . .	R	Data 1 to 3, 1-63
6DS5 . . .	R	Data 1&2, 8-69
	R	Curve 92CM-9292
6DT5 . . .	R	Data, 10-59
6DT6A . .	R	Data 1 to 4, 1-61
6DT8 . . .	R	Tent. Data, 8-57
	R	Curve 92CM-9397
6DV4 . . .	R	Data 1 to 3, 1-63
6DW4B .	R	Data, 4-65
6DX8• . .	R	Data, 9-62 Use 6DX8/ECL84
6DZ4 . . .	R	Data 1&2, 4-63
6E5	R	Data, 12-44
6EA5 . . .	R	See 6CY5
6EA7 . . .	R	Data, 7-61 Use 6EM7/6EA7
6EA8 . . .	R	Data, 7-61
	R	Curve 92CM-9866
	R	Curve 92CM-9867
6EB8 . . .	R	Tent. Data 1&2, 6-59
	R	Curve 92CM-9908
	R	Curve 92CM-9905
6EH5 . . .	R	Data Chart, 2-70□
6EH7• . .	R	Data, 3-62 Use 6EH7/EF183
6EJ7• . . .	R	Data, 3-62
6EL4A . .	R	Suppl. Listing, 4-71▲
6EM5 . . .	R	Data 1 to 3, 5-61
6EM7 . . .	R	Data 1 to 3, 5-61
	R	Data 4, 8-60 Use 6EM7/6EA7
6EN4 . . .	R	Data 1 to 4, 2-71
6EQ7 . . .	R	Data 1&2, 8-60
6ER5 . . .	R	Data, 8-60
6ES5 . . .	R	Data, 7-61
6ES8 . . .	R	Data, 5-61 Use 6ES8/ECC189
6EU7 . . .	R	Data 1&2, 8-60
6EU8 . . .	R	Data, 7-61
6EV5 . . .	R	Data, 7-61
6EV7 . . .	R	Data Chart, 2-70□
6EW6 . . .	R	Data, 10-59 Curve 92CM-9965
6EW7 . . .	D	Data 1 to 4, 1-62
6EZ5 . . .	D	Data Chart, 2-70□
6EZ8 . . .	R	Data, 7-61
6F4	R	Tent. Data, 8-44 Curve 92CM-6567
6F5	R	Data Chart, 2-70□
6F6	R	Data Chart, 2-70□
6F6GT . .	R	Data Chart, 2-70□
6F8G . . .	R	Data Chart, 2-70□
6FA7 . . .	R	Data 1&2, 8-60
6FD7 . . .	R	Data 1&2, 9-62
6FE5 . . .	R	Data Chart, 2-70□
6FG7 . . .	R	Data, 3-62
6FH5 . . .	R	Data 1&2, 8-60
6FH8 . . .	R	Data 1&2, 10-59
	R	Curve 92CM-10221
6FJ7	R	Data 1&2, 1-63
6FM7 . . .	R	Data, 5-65
6FM8 . . .	R	Data, 7-61
6FQ5A . .	R	Data, 3-62 Use 6GK5/6FQ5A

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6FQ7•	R	Data 1 to 3, 5-61 Use 6FQ7/6CG7
6FS5	R	Data, 3-62
6FV6	R	Tent. Data, 6-59
	R	Curve 92CM-10058
6FV8A	R	Data, 3-64
6FW5	R	Data, 5-62
6FY7	R	Data, 5-65
6G11	R	Data 1&2, 8-63
6GB5•	R	Data, 2-66 Use 6GB5/EL500
6GC5	R	Data 1, 9-62
	R	Data 2&3, 4-63
6GE5	R	Data, 4-63
6GF7A	R	Data 1 to 3, 10-64
6GH8A	R	Data 1 to 4, 4-63
6GJ5A	R	Data 1&2, 10-64
6GJ7•	R	Data, 12-65 Use 6GJ7/ECF801
6GK5	R	Data 1&2, 5-61 Use 6GK5/6FQ5A
6GK6	R	Data 1 to 3, 7-61
6GL7	R	Data 1&2, 4-63
6GM6	R	Data 1&2, 8-60
6GN8	R	Data 1 to 3, 5-61
6GT5•	R	Data 1 & 2, 6-63
6GT5A	R	Data 1&2, 10-64
6GU5	R	Data, 12-65
6GU7	R	Data 1&2, 4-63
6GV5	R	Data, 4-64
6GW6•	R	Data 1&2, 3-61 Use 6GW6/6DQ6B
6GW8/ECL86	R	Data, 5-65
6GX6	R	Data 1 to 4, 5-61
6GY6	R	Data 1 to 3, 5-61
6GY8	R	Data Chart, 2-70□
6H6, 6H6GT/G•	R	Data, 8-42
6HA5		See 6HM5/6HA5
6HB6	R	Data, 9-62 Use 6HB6/6HA6
6HB7	R	Data 1 to 3, 3-64
6HE5	R	Data, 2-69
6HF8	R	Data 1 to 4, 3-61
6HG5	R	Data 1&2, 3-64
6HJ8	R	Data, 3-62
6HL8	R	Data, 4-64
6HM5/6HA5	R	Data 1&2, 10-63
6HQ5	R	Suppl. Listing, 4-71▲
6HR5	R	Suppl. Listing, 4-71▲
6HR6	R	Data 1 & 2, 5-62
6HS6	R	Data 1 & 2, 5-62
6HS8	R	Data 1, 1-63
	R	Data 2 & 3, 1-62
6HZ6	R	Data 1 to 4, 1-63
6J4	D	Tent. Data, 4-44
	D	Curve 92CM-6543
6J4WA	R	See 8532/6J4WA
6J5, 6J5GT	R	Data Chart, 2-70□
6J6A	R	Data 1 to 3, 7-61
6J7	R	Data Chart, 2-70□
6J10	R	Data 1 to 5, 2-65 Use 6Z10/6J10
6JB6A	R	Data 1 & 2, 10-64
6JC6A	R	Data 1 & 2, 10-66
6JC8	R	Data 1 & 2, 5-62
6JD6	R	Data 1 & 2, 4-63
6JF6	R	Data 1 & 2, 2-67
6JG6A	R	Data 1 & 2, 10-64
6JH6	R	Data 1 to 3, 4-63
6JH8	R	Data 1, 5-62; 2&3, 5-65
6JM6A	R	Suppl. Listing, 4-71▲
6JQ6	R	Data 1 & 2, 9-67
6JR6	R	Data 1 & 2, 9-63
6JS6C	R	Suppl. Listing, 4-71▲
6JT6A	R	Data 1 & 2, 10-64
6JU6	R	Data 1 & 2, 4-66
6JU8A	R	Data, 3-64
6JV8	R	Data 1 to 3, 6-63
6JZ8	R	Data, 4-64

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Type	Section	Sheet & Date
6K6GT .	R	Data 1 & 2, 6-56
	R	Curve 92CM-4881R2
	R	Curve 92CM-6313
6K7,6K8	R	Data Chart, 2-70□
6K11/ 6Q11 .	R	Data, 2-65
6KA8 ..	R	Data 1 to 5, 5-62
6KD6 ..	R	Data 1 & 2, 5-69
6KE8 ..	R	Data 1 to 3, 4-63
6KL8 ..	R	Data Chart, 2-70□
6KM6 ..	R	Data 1 & 2, 9-65
6KM8 ..	R	Data 1 to 3, 1-63
6KT6 ..	R	Data 1 & 2, 10-66
6KT8 ..	R	Data, 4-64
6KV6 ..	R	Data 7-67
6KV6A .	R	Data 1 & 2, 8-69
6KV8 ..	R	Data 1 to 3, 6-66
6KY6 ..	R	Data 1 & 2, 4-67
6KY8A .	R	Data 1 to 3, 10-64
6KZ8 ..	R	Data 1 to 3, 3-64
6L6, 6L6G●	R	Data 1 to 3, 11-54
	R	Curve 92C(M)-4581R1
	R	Curve 92C-4608
6L6GC .	R	Data 1 to 5, 8-60
6L7 ..	R	Data Chart, 2-70□
6LB6 ..	R	Data 1 & 2, 5-69
6LC8 ..	R	Data 1 to 4, 9-63
6LE8 ..	R	Data 1 & 2, 12-65
6LF8 ..	R	Data 1 to 3, 4-64
6LH6A .	R	Suppl. Listing, 4-71▲
6LJ6A/ 6LH6A	R	Suppl. Listing, 4-71▲
6LM8 ..	R	Data 1 to 3, 8-64
6LQ6 ..	R	Data 1 & 2, 1-68 Use 6LQ6/ 6JE6C
6LQ8 ..	R	Data 1 to 3, 2-66
6LT8 ..	R	Suppl. Listing, 4-71▲
6MD8 ..	R	Data 1 & 2, 9-65
6ME8 ..	R	Data 1 to 3, 4-67
6MJ8 ..	R	Data 1 & 2, 5-69
6MK8 ..	R	Suppl. Listing, 4-71▲
6MN8 ..	R	Data, 5-69
6MQ8 ..	R	Data 1 to 3, 9-68
6MU8 ..	R	Data 1 & 2, 5-70

Type	Section	Sheet & Date
6N5 ..		See 6AB5/6N5
6N7, 6N7GT	R	Data Chart, 2-70□
6Q7 ..	R	Data Chart, 2-70□
6Q11 ..		See 6K11/6Q11
6S4A ..	R	Data 1 & 2, 1-62
6S8GT●	R	Data Chart, 2-70□
6SA7, 6SA7GT/G		Data, 1-43
	R	Curve 92C-4993
	R	Curve 92C-4989
6SB7Y .	R	Data Chart, 2-70□
6SC7 ..	R	Data Chart, 2-70□
6SF5 ..	R	Data Chart, 2-70□
6SF7 ..	R	Data Chart, 2-70□
6SG7 ..	R	Data Chart, 2-70□
6SH7 ..	R	Data Chart, 2-70□
6SJ7, 6SJ7GT●	R	Data, 6-48
	R	Curve 92CM-4939R1
	R	Curve 92CM-6444R1
	R	Curve 92CM-6409R1
6SK7 ..	R	Data Chart, 2-70□
6SK7GT	R	Data Chart, 2-70□
6SL7GT	R	Data, 11-54
	R	Curve 92CM-6298
6SN7GTA●		Tent. Data 1 & 2, 6-54
	R	Curve 92CM-8122
6SN7GTB	R	Data, 3-55
6SQ7, 6SQ7GT/G●	R	Data, 12-43
	R	Curve 92C-6310
6SR7 ..	R	Data Chart, 2-70□
6T4 ..	R	Data Chart, 2-70□
6T8A ..	R	Tent. Data 1 & 2, 4-59
	R	Curve 92CM-9611R1
6U5 ..	R	Data Chart, 2-70□
6U8A ..	R	Data 1 to 3, 1-61 Use 6U8A/6KD8 See also 6678/ 6U8A
6V3A ..	R	Tent. Data, 5-55
6V6 ..	R	Data Chart, 2-70□
6V6GTA	R	Data 1 to 3, 1-62
6W4GT .	R	Data, 1-62
6W6GT .	R	Tent. Data, 10-53
	R	Curve 92CM-7942
6X4 ..	R	Data 1 & 2, 10-53
	R	Rating Chart II 92CM-8024

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Type	Section	Sheet & Date
6X4 ..	R	Curve 92CM-8031
6X5,• 6X5GT/G	R	Data, 3-43
6X8 ..	R	Data 1 to 3, 8-60
6Y6GA•	R	Data, 10-59 Use 6Y6GA/6Y6G
6Z10 ..	R	Data 1 & 2, 4-66 Use 6Z10/6J10
7A7• ..	R	Data Chart, 2-70□
7AU7 ..	R	Data, 4-67
7BP7A	C	Tent. Data, 6-48
7C5 ..	R	Data Chart, 2-70□
7C7 ..	R	Data Chart, 2-70□
7C24 ..		See 5762/7C24
7EY6 ..	R	On 7AU7 sheet
7F7 ..	R	Data Chart, 2-70□
7F8 ..	R	Data Chart, 2-70□
7KY6 ..	R	On 7AU7 sheet
7KZ6 ..	R	Data 1 & 2, 7-67
7MP7 ..	C	Data, 10-51
	C	Outline CE-7438R3
7N7 ..	R	Data Chart, 2-70□
7NP4 ..	C	Data 1 & 2, 12-66
	C	Data, 3, 9-67
	C	Data 4 to 6, 12-66
7TP4 ..	C	Tent. Data, 2-52
	C	Outlines & Notes CE-7691
	C	Curve 92CM-7688
7VP1 ..	C	Tent. Data 1 & 2, 11-52
7VP31 ..	C	Data, 4-65
7WP4 ..	C	Data, 12-66
8AU8 ..	R	Data, 8-63
8AW8A.	R	Data, 8-63
8B10 ..	R	On 8AW8A sheet
8BA8A .	R	On 8AW8A sheet
8BH8 ..	R	On back of 8AW8A sheet
8BN8 ..	R	On back of 8AW8A sheet
8BQ5 ..	R	On back of 8AW8A sheet
8CG7• .	R	Data, 5-65 Use 8FQ7/8CG7
8CM7 ..	R	On 8CG7 sheet
8CN7 ..	R	On 8CG7 sheet
8CS7 ..	R	On back of 8CG7 sheet
8CW5• .	R	On back of 8CG7 sheet Use 8CW5/XL86
8CX8 ..	R	On back of 8CG7 sheet
8D21 ..	T	Data Chart, 11-69*
8DP4 ..	C	Data, 9-58
8EB8• .	R	On back of 8CG7 sheet Use 8GN8/8EB8
8EM5 ..	R	Data, 1-63
8ET7 ..	R	Data, 7-61
8FQ7 ..	R	Data, 7-67 Use 8FQ7/8CG7
8GJ7• .	R	On 8FQ7 sheet Use 8GJ7/PCF801
8GN8 ..	R	On 8FQ7 sheet Use 8GN8/8EB8
8GU7 ..	R	On 8FQ7 sheet
8HP4 ..	C	Data, 4-64
8JU8A, 8JV8 ..	R	On back of 8FQ7 sheet
8KA8, 8LC8 ..	R	On back of 8FQ7 sheet
8LT8 ..	R	Suppl. Listing, 4-71▲
8NP4 ..	C	Data, 3-64
8XP4 ..	C	Data, 4-64
8YP4 ..	C	Data, 4-65
9AU7 ..	R	Data, 7-67
9BR7 ..	R	Data Chart, 2-70□
9C25 ..	T	Data 1 to 3, 4-63
	T	Curve 92CM-7269
	T	Curve 92CM-7234
9KZ8 ..	R	Suppl. Listing, 4-71▲
9U8A ..	R	Data Chart, 2-70□
9WP4 ..	C	Data, 7-67
10AL11 .	R	On 9AU7 sheet
10BQ5 .	R	Suppl. Listing, 4-71▲
10C8 ..	R	Data Chart, 2-70□
10DE7 .	R	On 9AU7 sheet
10DR7 .	R	On back of 9AU7 sheet
10DX8•	R	On back of 9AU7 sheet Use 10DX8/LCL84
10EG7	R	Data, 3-61
10EM7 .	R	Data, 10-64
10EW7 .	R	Suppl. Listing, 4-71▲
10GF7•	R	On 10EM7 sheet
10GF7A	R	On 10EM7 sheet

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Type	Section	Sheet & Date
10GN8	R	On back of 10EM7 sheet
10HF8,	R	On back of 10EM7 sheet
10JA8 .	R	Data 1 & 2, 4-64 Use 10JA8/10LZ8
10LE8 .	R	Data, 8-69
10SP4 . .	C	Data, 8-57
	C	Outline CE-7729R1
	C	Curve 92CM-7773
11AR11	R	On 10LE8 sheet
11CP4 . .	C	Data, 6-66
11CY7, 11DS5	R	On 10LE8 sheet
11GP4 . .	C	Data, 2-67
11HM7.	R	Data 1 & 2, 6-66
11HP4A.	C	Data, 6-66
11KV8 .	R	Data, 6-66
11LQ8 . .	R	On 11KV8 sheet
11LT8 .	R	Suppl. Listing, 4-71▲
12A6 . .	D	Tent. Data, 5-42
	D	Curve 92C-6327
12AB5 . .	R	Tent. Data 1 & 2, 9-55
	R	Curve 92CM-8756
12AC6, 12AD6	R	Data Chart, 2-70□
12AE6A.	R	Data Chart, 2-70□
12AF3 .	R	Data, 10-59 Use 12AF3/12BR3/12RK19
12AF6 .	R	Data Chart, 2-70□
12AL5 . .	R	Data, 5-54
12AL8 . .	R	Data Chart, 2-70□
12AL11	R	Data, 8-64
12AQ5 .	R	Tent. Data 1, 8-53
	R	Tent. Data 2, 5-54
12AT6 .	R	On back of 12AQ5 Tent. Data 2 sheet
12AT7 . .	R	Data, 3-54
	R	Curve 92CM-7056 Use 12AT7/ECC81
12AU6 .	R	Data, 6-57
12AU7A	R	Data 1 to 3, 7-61 Use 12AU7A/ECC82
12AV5GA	R	Data, 7-58
12AV6.	R	On 12AV5GA sheet
12AV7, 12AW6 .	R	Data Chart, 2-70□
12AX3 .	R	Data, 1-63
12AX4GTA●	R	On 12AX3 sheet
12AX4GTB	R	On 12AX3 sheet
12AX7A	R	Data 1 & 2, 10-60 Use 12AX7A/ECC83
12AY3●	R	Data, 10-64
12AY3A	R	On 12AY3 sheet
12AY7	R	Tent. Data, 4-53
	R	Curve 92CM-7861
12AZ7A	R	Data, 1-62
12B4A . .	R	Tent. Data, 5-55
12BA6	R	Data, 4-66
12BA7 .	R	On 12BA6 sheet
12BD6 . .	R	On 12BA6 sheet
12BE3 . .	R	On back of 12BA6 sheet
12BE6, 12BF6.	R	On back of 12BA6 sheet
12BF11.	R	On back of 12BA6 sheet
12BH7A	R	Tent. Data 1 & 2, 3-55
12BK5 . .	R	Data Chart, 2-70□
12BL6 . .	R	Data Chart, 2-70□
12NP4A.	C	Data, 9-65
12BQ6GTB/ 12CU6.	R	Data, 10-64
12BR7 .	R	Data Chart, 2-70□
12BS3● .	R	On 12BQ6GTB/ 12CU6 sheet
12BS3A.	R	On 12BQ6GTB/ 12CU6 sheet Use 12BS3A/ 12DW4A
12BV7 . .	R	Data Chart, 2-70□ Use 12SY7A/12BV7/ 12DQ7
12BV11.	R	Suppl. Listing, 4-71▲
12BW4 .	R	Data Chart, 2-70□
12BY7A	R	Data 1 & 2, 3-61 Use 12BY7A/12BV7/ 12DQ7
12BZ6 . .	R	Data, 3-61
12BZ7 . .	R	Data Chart, 2-70□
12CA5 . .	R	Tent. Data 3-55
	R	Curve 92CM-8507
12CK3.	R	Data, 12-66

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Type	Section	Sheet & Date
12CL3	R	On 12CK3 sheet
12CN5	R	Data Chart, 2-70□
12CR6	R	Tent. Data, 6-56
	R	Curve 92CM-9006
12CT3	R	Data, 8-70
12CU5/ 12C5	R	On 12CT3 sheet
12CX6	R	Data Chart, 2-70□
12D4	R	Tent. Data, 4-59
12DB5	R	Data, 7-61
12DK6	R	Suppl. Listing, 4-71▲
12DM4	R	Data, 5-61
12DQ6A•	R	On 12DM4 sheet
12DQ6B•	R	On 12DM4 sheet
12DQ7	R	Data Chart, 2-70□ Use 12BY7A/ 12BV7/12DQ7
12DS7	R	Data Chart, 2-70□
12DT5	R	Data, 10-59
12DT8	R	On 12DT5 sheet
12DW7, 12DY8	R	Data Chart, 2-70□
12DZ6	R	Data, 4-60
	R	Curve 92CM-10399
12ED5	R	Data Chart, 2-70□
12EK6, 12EQ7	R	Data Chart, 2-70□
12F8, 12FK6	R	Data Chart, 2-70□
12FM6	R	Data Chart, 2-70□
12FQ7	R	Data, 8-70
12FQ8	R	Data 1 & 2, 10-60
12FV7	R	Data Chart, 2-70□
12FX5	R	Data, 7-63
12GC6	R	Data, 7-61
12GE5	R	Data. 10-64
12GJ5•	R	On 12GE5 sheet
12GT5	R	Data, 4-65
12GT5A•	R	On 12GT5 sheet
12GW6	R	On 12GT5 sheet Use 12GW6/12DQ6B
12H6	R	On back of 12GT5 sheet
12HG7	R	Data 1 to 3, 4-65
12HL7	R	Suppl. Listing, 4-71▲
12J5GT, 12J8	R	Data Chart, 2-70□
12JB6A	R	Data, 8-69
12JQ6	R	On 12JB6A sheet
12JT6A	R	On 12JB6A sheet
12K5	R	Data Chart, 2-70□

Type	Section	Sheet & Date
12K7GT•	R	Data Chart, 2-70□
12KL8	R	Data Chart, 2-70□
12KP4A	C	Data, 9-58
12L6GT	R	Data Chart, 2-70□
12L8GT	D	Data, 10-43
12MD8	R	Suppl. Listing, 4-71▲
12R5	R	Data Chart, 2-70□
12SA7	R	Data, 10-64
12SC7	R	Data Chart, 2-70□
12SF5	R	Data Chart, 2-70□
12SF7	R	Data Chart, 2-70□
12SG7	R	Data Chart, 2-70□
12SH7	R	Data Chart, 2-70□
12SJ7	R	On 12SA7 sheet
12SK7	R	Data Chart, 2-70□
12SK7GT	R	Data Chart, 2-70□
12SL7GT	R	On 12SA7 sheet
12SQ7	R	On back of 12SA7 sheet
12SW7	D	Tent. Data, 6-46
12SY7	D	Tent. Data, 6-46
	D	Curve 92CM-6786
12T10	R	Suppl. Listing, 4-71▲
12V6GT	R	On back of 12SA7 sheet
12W6GT	R	On back of 12SA7 sheet
12X4	R	Data, 10-64
13CW4, 13DE7	R	On 12X4 sheet
13DR7	R	On back of 12X4 sheet
13EM7	R	On back of 12X4 sheet Use 13EM7/ 15EA7
13FD7	R	On back of 12X4 sheet
13FM7	R	Data, 4-66 Use 13FM7/ 15FM7
13GB5•	R	On 13FM7 sheet Use 13GB5/ XL500
13GF7•	R	On 13FM7 sheet
13GF7A	R	On back of 13FM7 sheet
13J10•, 13Z10	R	On back of 13FM7 sheet Use 13Z10/ 13J10

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Type	Section	Sheet & Date
14GT8 . .	R	Data 1 & 2, 1-61
14WP4 . .	C	Data, 4-63
15AF11.	R	Data, 5-65
15BD11•	R	On 15AF11 sheet Use 15BD11A
15CW5•.	R	On 15AF11 sheet Use 15CW5/ PL84
15EP22 .	C	Data, 2-70
15FM7. .	R	On back of 15AF11 sheet Use 13FM7/ 15FM7
15FY7 . .	R	On back of 15AF11 sheet
15HB6 . .	R	On back of 15AF11 sheet
15KP22 .	C	Data, 7-67
15KY8A.	R	Data. 10-64
15LE8 . .	R	Suppl. Listing, 4-71▲
15LP22 .	C	Data 1 to 6, 7-67
15NP22 .	C	Data 1 to 5, 1-68
16BGP4 .	C	Data, 4-65
16CHP4A	C	Data, 7-67
16CMP4A	C	Data, 12-66
16GK6. .	R	Data, 10-64
16RP4B .	C	Data, 10-65
16TP4 . .	C	Data, 9-58
17AB10/ 17X10 .	R	Suppl. Listing, 4-71▲
17AX3. .	R	On 16GK6 sheet
17AX4GTA	R	On 16GK6 sheet
17AY3•.	R	On back of 16GK6 sheet
17AY3A.	R	On back of 16GK6 sheet
17BE3 . .	R	On back of 16GK6 sheet Use 17BE3/ 17BZ3
17BF11 .	R	On back of 16GK6 sheet Use 17BE3/ 17BZ3
17BH3. .	R	Data Chart, 2-70□
17BH3A.	R	Data, 5-68
17BJP4. .	C	Data, 4-63
17BP4D .	C	Data, 3-64
17BQ6GTB	R	Data Chart, 2-70□
17BR3/ 17RK19.	R	Suppl. Listing, 4-71▲
17BW3 .	R	Suppl. Listing, 4-71▲
17C9 . .	R	Data Chart, 2-70□
17CFP4 .	C	Data 1 & 2, 10-59
	C	Raster-Cutoff-Range Charts 92CS-10246 & 92CS-10247
	C	Outline CE-10261B
	C	Curve 92CM-9241R1
17CK3. .	R	On 17BH3A sheet
17CSP4 .	C	Data, 3-62
17CT3 . .	R	On back of 17BH3A sheet
17CU5 . .	R	On back of 17BH3A sheet Use 17CU5/17C5
17D4 . .	R	On back of 17BH3A sheet
17DAP4.	C	Data, 4-60
17DE4 . .	R	On back of 17BH3A sheet
17DM4A	R	Data, 5-65
17DQP4.	C	Data, 3-62
17DRP4 .	C	Data, 4-63
17DSP4 .	C	Data 1 to 3, 4-60
	C	Outline CE-10375B
	C	Charts 92CS-10376, -10377
	C	Curve 92CM-10382
17DWP4.	C	Data, 1-63
17DXP4.	C	Data 1 to 5, 8-60
17EFP4.	C	Data, 10-65
17EZP22	C	Data 1 to 4, 11-69
17GE5 . .	R	Data Chart, 2-70□
17GJ5A .	R	Data, 8-70
17GV5. .	R	Data Chart, 2-70□
17GW6/ 17DQ6B	R	On 17GJ5A sheet
17HP4C .	C	Data, 1-64
17JB6A .	R	On 17GJ5A sheet
17JF6 . .	R	On back of 17GJ5A sheet
17JG6A .	R	On back of 17GJ5A sheet
17JM6A .	R	Suppl. Listing, 4-71▲
17JQ6 . .	R	Data, 8-69
17JR6 . .	R	On 17JQ6 sheet
17JT6A .	R	On 17JQ6 sheet
17JZ8, 17KV6 .	R	On back of 17JQ6 sheet

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17KV6A.	R	On back of 17JQ6 sheet
17LP4B .	C	Data, 1-64
17QP4B .	C	Data, 10-63
18AJ10 .	R	Suppl. Listing, 4-71▲
18FW6A	R	Data 1 & 2, 7-61
18FX6A	R	Data 1 & 2, 7-61
18FY6A	R	Data 1 & 2, 7-61
18GD6A	R	Data 1 & 2, 1-62
19ABP4 .	C	Data, 4-63
19AFP4 .	C	Data, 5-62
19AJP4 .	C	Data, 5-62
19AU4GTA	R	Data Chart, 2-70□
19AVP4 .	C	Data 1 to 5, 10-60
19AYP4 .	C	Data, 5-62
19BDP4 .	C	Data, 5-62
19BG6GA	R	Data Chart, 2-70□
19CG3 . .	R	Data, 8-70
19CHP4 .	C	Data, 3-62
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19CMP4 .	C	Data, 7-65
19CXP4 .	C	Data, 10-65
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19DRP4 .	C	Data, 4–65
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19EGP4 .	C	Data, 2-67
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19FEP4B	C	Data, 12-66
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19GJP4A	C	Data, 12-66
19GVP22	C	Data, 4-67
19GWP22	C	Data 1 to 5, 4-67
19HCP22	C	Data 1 to 4, 5-68
19HMP22	C	Data, 2-70
19HNP22	C	Data 1 to 4, 9-68
19HR6 . .	R	On back of 19CG3 sheet
19HS6 . .	R	On back of 19CG3 sheet
19HYP22	C	Data 1 to 4, 5-69
19J6 . .	R	Data Chart, 2-70□
19JN8/ 19CL8A	R	Suppl. Listing, 4-71▲
19T8 . .	R	Data Chart, 2-70□

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19X8 . .	R	Data Chart, 2-70□
19YP4 . .	C	Data 1 to 5, 10-60
20AQ3/ LY88 . .	R	Suppl. Listing, 4-71▲
20EZ7 . .	R	Data 1, 5-61
	R	Data 2, 10-60
20SP4 . .	C	Data 1 & 2, 1-68
20TP4 . .	C	Data 1 & 2, 12-68
21AMP4B	C	Data, 1-64
21AVP4C	C	Data, 2-64
21AWP4A	C	Data, 4-65
21AXP22A	C	Tent, Data 1 to 3, 8-56
	C	Chart 92CM-8565R1
	C	Drawing CE-8399R4B
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	C	Curve 92CM-8426R3
21CBP4A	C	Data, 1-63
21CQP4 .	C	Data, 4-60
21CYP22A	C	Data 1 to 7, 10-60
21DHP4 .	C	Data, 3-62
21DLP4 .	C	Tent. Data 1 & 2, 9-58
	C	Raster-Cutoff-Range Charts 92CS-9349V & 92CS-9350V
	C	Outline CE-9660B
	C	Curve 92CS-9143R1
21DSP4 .	C	Data 1 & 2, 10-59
	C	Outline CE-10255B
	C	Raster-Cutoff-Range Chart 92CS-9911
	C	Curve 92CM-9909
21EP4C .	C	Data, 1-64
21EYP4 .	C	Data, 6-64
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21FVP4 .	C	Data, 10-65
21GUP22	C	Data, 5-68
21GVP22	C	Data 1 to 4, 5-68
21LR8 , .	R	Data 1 to 3, 10-65
21MP4• ,	C	Data, 9-58
21WP4B .	C	Data, 10-65
21XP4B .	C	Data, 10-65
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21ZP4C .	C	Data, 1-64
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22JF6 . .	R	On back of 22BH3 sheet
22JG6A .	R	Data, 8-69
22JP22 .	C	Data 1 to 5, 4-67
22JR6 . .	R	On 22JG6A sheet
22JU6 . .	R	On 22JG6A sheet
22KM6 .	R	On 22JG6A sheet
22KP22 .	C	Data, 4-67
22KV6A.	R	On back of 22JG6A sheet
22UP22 .	C	Data 1 to 4, 9-68
22WP22 .	C	Data, 8-69
23AHP4 .	C	Data 1 to 5, 3-61
23ARP4 .	C	Data, 12-65
23ASP4 .	C	Data, 3-61
23BDP4 .	C	Data, 1-63
23BGP4 .	C	Data, 5-65
23BJP4 .	C	Data, 3-62
23BKP4 .	C	Data, 5-62
23BQP4 .	C	Data, 3-62
23BTP4 .	C	Data, 2-65
23CBP4●.	C	On 23BTP4 sheet
23CGP4 .	C	On 23BTP4 sheet
23CP4 . .	C	Data 1 to 6, 8-60
23CQP4 .	C	Data, 5-65
23DAP4 .	C	Data, 8-63
23DBP4 .	C	Data, 8-64
23EKP4 .	C	Data, 8-64
23ENP4 .	C	Data, 8-64
23EP4 . .	C	Data 1 to 5, 8-60
23EQP4 .	C	Data, 12-66
23ERP4 .	C	Data, 12-66
23ETP4 .	C	Data, 8-64
23EZP4 .	C	Data, 10-66
23FDP4 .	C	Data, 8-64
23FMP4 .	C	Data, 8-64
23FP4A .	C	Data, 4-63
23FRP4 .	C	Data, 2-67
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23GSP4 .	C	Data, 10-65
23HFP4A	C	Data, 7-65
23HGP4.	C	Data, 12-66
23HUP4A	C	Data, 7-67
23HWP4A	C	Data, 12-66
23JP4 . .	C	Data, 4-63
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23NP4 . .	C	Data, 4-65
23YP4 . .	C	Data, 3-62
24AEP4 .	C	Data. 1-63
24AHP4 .	C	Tent. Data 1 & 2, 6-57
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	C	Outline CE-9345B
	C	Raster-Cutoff-Range Chart 92CS-9350
	C	Curve 92CS-9351
24AUP4 .	C	Tent. Data 1 & 2, 4-59
	C	Raster-Cutoff-Range Charts 92CS-9919 & 92CS-9918
	C	Outline CE-9917B
	C	Curve 92CM-9352
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24BF11 .	R	Suppl Listing, 4-71▲
24CP4B .	C	Data, 1-64
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24LQ6 . .	R	On back of 22JG6A sheet Use 24LQ6/24JE6C
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25AV5GA	R	Data, 10-59
25AX4GT	R	On 25AV5GA sheet
25BCP22	C	Data 1 to 4, 8-69
25BDP22	C	Data 1 & 2, 8-69
25BGP22	C	Data, 2-70
25BHP22	C	Data, 2-70
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25BQ6GTB/25CU6 .	R	On 25AV5GA sheet
25C5 . .	R	Tent. Data, 7-58
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25CA5 . .	R	Data Chart, 2-70□
25CD6GB	R	Data, 8-70
25CG3 . .	R	On 25CD6GB sheet
25CK3 . .	R	On 25CD6GB sheet
25CM3 . .	R	On back of 25CD6GB sheet
25CT3 . .	R	On back of 25CD6GB sheet
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25W4GT	R	Data Chart, 2-70□
25XP22	C	Data 1 to 6, 4-67
25YP22	C	Data, 4-67
25Z5•	R	Data Chart, 2-70□
25Z6GT	R	Data Chart, 2-70□
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	D	Curve 92CM-6784
26A7GT	D	Data 1 & 2, 1-55
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26C6	D	Tent. Data, 6-46
	D	Curve 92CM-6772
26D6	D	Tent. Data, 6-46
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31LQ6	R	On 25JQ6 sheet
32ET5A	R	Data, 1-63
33JR6	R	Data, 5-70
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34GD5A	R	Data 1 & 2, 7-61
35B5	R	Data Chart, 2-70□
35C5	R	Data 1 & 2, 1-62
35EH5	R	Data 1 & 2, 8-60
35GL6•	R	Data Chart, 2-70□
35L6GT	R	Data, 6-47
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	R	Curve 92CM-6307R1
35W4	R	Data, 9-50
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35Y4	R	Data Chart, 2-70□
35Z4GT	R	Data Chart, 2-70□
35Z5GT	R	Data Chart, 2-70□
36AM3B	R	Data, 7-61
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50A5	R	Data Chart, 2-70□
50B5	R	Tent. Data 1-46
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50C5	R	Data, 8-59
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50DC4	R	Tent. Data, 6-59
	R	Curve 92CS-9893
50EH5	R	Data, 8-60
50FE5	R	On 50EH5 sheet

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50L6GT	R	Data, 9-41
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50X6•	R	Data Chart, 2-70□
50Y6GT	R	Data Chart, 2-70□
60FX5	R	Data 1 & 2, 8-60
80	R	Data Chart, 2-70□
83	D	Data, 7-63
84/6Z4•	R	Data Chart, 2-70□
105	F	Tent. Data, 5-46
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117N7GT	R	Data Chart, 2-70□
117Z3	R	Data Chart, 2-70□
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579B	T	Data, 1-63
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615/7018	T	Data, 5-62
627	F	Tent. Data, 5-46
632B	F	Tent. Data, 8-56
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672A	F	Tent. Data, 6-48
	F	Curves CE-6734T1-6929T
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676	F	Tent. Data, 5-46
677	F	Tent. Data, 5-46
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813	T	Data Chart, 11-69*
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	T	Curve 92CM-6197
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835•...	T	Data, 12-42
836....	T	On 835 sheet
837•,845	T	Data Chart, 11-69*
857B ..	T	Data 1 & 2, 7-55
	T	Shell CE-4653R2
860•...	T	Data Chart, 11-69*
866A ..	T	Data 1 & 2, 8-57
868....	P	Data, 3-61
869B ..	T	Data 1 & 2, 11-52
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872A ..	T	Data 1 & 2, 8-57
880• ..	T	Data Chart, 11-69*
884,885	F	Data 1 & 2, 12-44
891R,892	T	Data Chart, 11-69*
892R ..	T	Data Chart, 11-69*
902A ..	C	Data 1, 7-45
917....	P	Data, 10-56
	P	Curve 92CM-4360R2
918....	P	Data 1 & 2, 3-61
919....	P	Data, 10-56
920....	P	Data 1 & 2, 3-62
921....	P	Data, 12-56
922....	P	Data, 10-56
923....	P	Data, 8-47
925....	P	Data, 1-62
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926....	P	Data, 12-56
927....	P	Data 1 & 2, 3-62
929....	P	Data 1 & 2, 1-62
930....	P	Data 1 & 2, 3-61
931A ..	P	Data 1 to 6, 11-69
934....	P	Data 1 & 2, 3-62
935....	P	Data, 5-62
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959....	D	Data, 6-44
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1621 ..	D	Data, 1-43
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1629 ..	D	Data, 6-44
1635 ..	D	Data, 4-47
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1946 ..	F	Tent. Data, 6-47
1947 ..	F	Tent. Data, 6-47
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1949 ..	F	Data, 3-54
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2050 ..	F	Data, 6-48
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2061 ..	P	Data, 6-66
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2063 ..	P	Data 1, 6-66
2064B..	P	Data 1 & 2, 6-66
2065 ..	P	Data 1 & 2, 6-66
4028A..	T	Data 1 to 5, 9-65
4037A..	T	Data 1 to 4, 7-65
4041 ..	T	Data 1 to 3, 12-68
4053 ..	T	Data 1 & 2, 5-65
4054 ..	T	Data 1 to 3, 12-68
4055...	T	Data 1 & 2, 9-67
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4441...	P	Data 1 to 4, 8-63
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4449A..	P	Data 1 to 3, 6-64
4459...	P	Data 1 to 5, 6-64
4460...	P	Data 1 to 5, 6-64
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4473	P	Data, 5-65
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4491	C	Data 1 & 2, 10-66
4492	P	Data 1 & 2, 5-70
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4499	C	Data, 12-65
4500	P	Data 1 to 7, 12-66
4503A	P	Data 1 to 6, 12-68
4510	C	Data 1, 4-71
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4542	P	Data 1 to 5, 12-68
4547	P	Data 1 to 6, 2-71
4557	C	Data 1 to 3, 2-69
4560	C	Data 1 to 4, 5-69
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4626	T	Data, 9-68
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4631	T	Data, 9-68
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4661	T	Data 1 to 4, 11-70
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5550	F	Data 1 to 4, 3-61
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5552A	F	Tent. Data 1 & 2, 4-59
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5557	F	Data, 4-58
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5558	T	Data, 4-53; Curve 92CM-7856
5559	F	Data, 3-51
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5560	F	Data, 3-51
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5561	T	Tent. Data, 5-46
5563A	F	Data 1 to 3, 4-57
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5581	P	Data 1 & 2, 3-61
5582	P	Data, 12-56
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5583	P	Data 1 & 2, 3-61
5618	T	Tent. Data 1 & 2, 10-47
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5636	D	Curve 92CM-9212
	D	Curve 92CM-9210
	D	Curve 92CM-9215
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5652	P	Data, 3-62
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5687	D	Tent. Data, 4-59
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5692	D	Tent. Data, 3-48
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5693	D	Tent. Data, 3-48
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	D	Curve 92CM-6443R1
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5696	F	Tent. Data, 2-49
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5713	T	Data Chart, 11-69*
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5719	D	Tent. Data 1 to 3, 6-53
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5725	D	Tent. Data 1 to 3, 4-57
5726	D	Tent. Data 1 & 2, 9-52
5727	F	Tent. Data 1 to 3, 8-57
5734	D	Tent. Data, 11-48
	D	Outlines & Notes CE-7036
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5750	D	Tent. Data 1 & 2, 4-59
5751	D	Tent. Data 1 & 2, 10-53
	D	Curve 92CM-7947
5762/7C24●	T	Data 1 to 5, 7-65 Use 5762
5763	T	Data 1 & 2, 5-54
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5770	T	Data 1 & 2, 1-63
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5771	T	Tent. Data 1, 2-49
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	T	Outline CE-7088
	T	Curve 92CM-7098
5786	T	Data Chart, 11-69*
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5814A	D	Tent. Data 1 to 3, 12-56
	D	Curve 92CM-7939
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5820A	P	Data 1, 5-61
	P	Data 2, 4-66
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5820A/L	P	Data, 4-65
5823	F	Tent. Data 1 & 2, 9-49
	F	Curve 92CM-7282
5825	T	Tent. Data 9-49
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5840	D	Tent. Data 1 to 3, 6-53
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5842/417A	D	Data, 3-62
5847/404A	D	Data, 3-62
5876A	T	Data 1 to 3, 5-62
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5879	R	Data 1 to 3, 3-61
5881●	R	Data Chart, 2-70□
5893	T	Data 1 to 4, 5-62
	T	Curve 92CM-7609R1
	T	Curve 92CM-7483
5915	D	Tent. Data 1 & 2, 9-50
	D	Curve 92CM-7499
5946	T	Data 1 & 2, 4-63
5963	D	Data, 9-55
	D	Curve 92CM-7493
5964	D	Tent. Data, 9-50
	D	Curve 92CM-7495
5965	D	Tent. Data 1 & 2, 6-54
	D	Curve 92CM-8262
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6012	F	Data 1 & 2, 4-56
	F	Curve 92CM-7747
6014	F	See C1K/6014
6021	D	Tent. Data 1 to 3, 4-58
	D	Curve 92CM-9439
6026	T	Data, 12-56
	T	Curve 92CM-7640
6072	D	Tent. Data 1 & 2, 6-59
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6082 ..	D	Data 1 & 2, 8-53
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6111 ..	D	Tent. Data 1 to 3, 4-58
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6130/ 3C45 ..	F	Data 1 & 2, 4-59
6136 ..	D	Tent. Data 1 to 3, 4-58
	D	Curve 92CM-6613
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6246A. .	T	Data Chart, 11-69*
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TUBE RATINGS

AND THEIR SIGNIFICANCE

A rating is a designation, as established by definite standards, of an operating limit of a tube. Tubes are rated by either of two systems, i.e., the "absolute maximum" system or the "design-center maximum" system. Of the two, the absolute maximum system is the older and dates back to the beginning of tubes. With either system, each maximum rating for a given tube type must be considered in relation to all other maximum ratings for that type, so that no one maximum rating will be exceeded in utilizing any other maximum rating. For convenience in referring to these two systems, the former will hereinafter be called the "absolute system," and the latter, the "design-center system."

In the **absolute system,*** the maximum ratings shown for each type thus rated are limiting values above which the serviceability of the tube may be impaired from the viewpoint of life and satisfactory performance. Therefore, in order not to exceed these absolute ratings, the equipment designer has the responsibility of determining an average design value for each rating below the absolute value of that rating by an amount such that the absolute values will never be exceeded under any usual condition of supply-voltage variation, load variation, or manufacturing variation in the equipment itself.

The equipment should be designed to operate the filament or heater of each tube type at rated normal value for full-load operating conditions under average voltage-supply conditions. Variations from this normal value due to voltage-supply fluctuation or other causes, should not exceed ±5 per cent unless otherwise specified by the tube manufacturer.

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* Types rated according to the **absolute system** have no identification on their data pages issued prior to April 1, 1942. Sheets issued after that date carry the statement "Maximum Ratings Are Absolute Values" preceding the ratings.

TUBE RATINGS

(continued from preceding page)

In the **design-center system**** adopted by the receiving-tube industry late in 1939, the maximum ratings shown for each type thus rated are working design-center maximums. The basic purpose underlying this system is to provide satisfactory average performance in the greatest number of equipments on the premise that they will not be adjusted to local power-supply conditions at time of installation. In the setting up of design-center ratings, consideration has been given to three important kinds of power supply commonly in use, i.e., a-c and d-c power lines, storage battery with connected charger, and dry batteries.

In the case of a-c or d-c power lines, the maximum ratings for tubes rated according to the design-center system have been chosen so that the tubes will give satisfactory performance at these maximum ratings in equipment operated from power-line supplies whose normal voltage including normal variations fall within ±10 per cent of a specified center value. In other words, it is basic to the design-center system of ratings for tubes operated from power-line supplies that filaments or heaters as well as positive- and negative-potential electrodes may have to operate at voltages differing as much as ±10 per cent from their rated values. It also recognizes that equipment may occasionally be used on power-line supplies outside the normal range, but since such extreme cases are the exception, they should be handled by adjustment made locally.

The choice of ±10 per cent takes care of voltage differences in power lines in the U.S.A. where surveys have shown that the voltages delivered fall within ±10 per cent of 117 volts. Therefore, satisfactory performance from tubes rated according to the design-center system will ordinarily be obtained

** Types rated according to the **design-center system** are identified on their data pages either by a large star in the index corner or by the statement "Maximum Ratings Are Design-Center Values" preceding the ratings. This statement is used on sheets issued since April 1, 1942.

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(continued from preceding page)

anywhere in the U.S.A. in equipment designed so that the design-center maximum ratings are not exceeded at a line-voltage-center value of 117 volts. While 117 volts represents present-day conditions, the design-center system permits the utilization of a new line-center value as new surveys may indicate the necessity for such a change.

In the case of storage-battery-with-charger supply or similar supplies, the normal battery-voltage fluctuation may be as much as 35 per cent or more. This fluctuation imposes severe operating conditions on tubes. Under these conditions, latitude for operation of tubes is provided for by the stipulation that only 90 per cent of the design-center maximum values of plate voltages, screen-supply voltages, dissipations, and rectifier output currents is never exceeded for a terminal potential at the battery source of 2.2 volts per cell. While a tube's operating voltages in this service will at times exceed the maximum values, satisfactory performance with probable sacrifice in life will be obtained.

In the cases of dry-battery supply and rectified a-c supply for 1.4-volt tubes, recommended design practice is given in RMA Standard M8-210.

RMA Standard M8-210 (Jan. 8, 1940 Rev. 11-40) is reproduced here for the convenient reference of design engineers with permission of the Engineering Department of the Radio Manufacturers Association. Although worded to cover only receiving tubes, it can be applied to any tube having design-center-system ratings.

* * *

It shall be standard to interpret the ratings on receiving types of tubes according to the following conditions:

1. CATHODE—The heater or filament voltage is given as a normal value unless otherwise stated. This means that transformers or resistances in the heater or filament circuit should be designed to op-

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erate the heater or filament at rated value for full-load operating conditions under average supply-voltage conditions. A reasonable amount of leeway is incorporated in the cathode design so that moderate fluctuations of heater or filament voltage downward will not cause marked falling off in response; also, moderate voltage fluctuations upward will not reduce the life of the cathode to an unsatisfactory degree.

A. 1.4-Volt Battery Tube Types—The filament power supply may be obtained from dry-cell batteries, from storage batteries, or from a power line. With dry-cell battery supply, the filament may be connected either directly across a battery rated at a terminal potential of 1.5 volts, or in series with the filaments of similar tubes across a power supply consisting of dry cells in series. In either case, the voltage across each 1.4-volt section of filament should not exceed 1.6 volts. With power-line or storage-battery supply, the filament may be operated in series with the filaments of similar tubes. For such operation, design adjustments should be made so that, with tubes of rated characteristics, operating with all electrode voltages applied and on a normal line voltage of 117 volts or on a normal storage-battery voltage of 2.0 volts per cell (without a charger) or 2.2 volts per cell (with a charger), the voltage drop across each 1.4-volt section of filament will be maintained within a range of 1.25 to 1.4 volts with a nominal center of 1.3 volts. In order to meet the recommended conditions for operating filaments in series from dry-battery, storage-battery, or power-line sources it may be necessary to use shunting resistors across the individual 1.4-volt sections of filament.

B. 2.0-Volt Battery Tube Types—The 2.0-volt line of tubes is designed to be operated with 2.0 volts across the filament. In all cases the operat-

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ing voltage range should be maintained within the limits of 1.8 volts to 2.2 volts.

2. POSITIVE POTENTIAL ELECTRODES — The power sources for the operation of radio equipment are subject to variations in their terminal potential. Consequently, the maximum ratings shown on the tube-type data sheets have been established for certain Design Center Voltages which experience has shown to be representative. The Design Center Voltages to be used for the various power supplies together with other rating considerations are as given below:

A. AC or DC Power Line Service in U.S.A.—The design center voltage for this type of power supply is 117 volts. The maximum ratings of plate voltages, screen-supply voltages, dissipations, and rectifier output currents are design maximums and should not be exceeded in equipment operated at a line voltage of 117 volts.

B. Storage-Battery Service—When storage-battery equipment is operated without a charger, it should be designed so that the published maximum values of plate voltages, screen-supply voltages, dissipations, and rectifier output currents are never exceeded for a terminal potential at the battery source of 2.0 volts per cell. When storage-battery equipment is operated with a charger, it should be designed so that 90% of the same maximum values is never exceeded for a terminal potential at the battery source of 2.2 volts.

C. "B"-Battery Service—The design center voltage for "B" batteries is the normal voltage rating of the battery block, such as 45 volts, 90 volts, etc. Equipment should be designed so that under no condition of battery voltage will the plate voltages, the screen-supply voltages, or dissipations ever exceed the recommended respective maximum values shown in the data for each tube type by more than 10%.

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D. Other Considerations

a. Class A_1 Amplifiers—The maximum plate dissipation occurs at the "Zero-Signal" condition. The maximum screen dissipation usually occurs at the condition where the peak-input signal voltage is equal to the bias voltage.

b. Class B Amplifiers—The maximum plate dissipation theoretically occurs at approximately 63% of the "Maximum-Signal" condition, but practically may occur at any signal voltage value.

c. Converters—The maximum plate dissipation occurs at the "Zero-Signal" condition and the frequency at which the oscillator-developed bias is a minimum. The screen dissipation for any reasonable variation in signal voltage must never exceed the rated value by more than 10%.

d. Screen Ratings—When the screen voltage is supplied through a series voltage-dropping resistor, the maximum screen voltage rating may be exceeded, provided the maximum screen dissipation rating is not exceeded at any signal condition, and the maximum screen voltage rating is not exceeded at the maximum-signal condition. Provided these conditions are fulfilled, the screen-supply voltage may be as high as, but not above, the maximum plate voltage rating.

3. TYPICAL OPERATION — For many receiving tubes, the data show typical operating conditions in particular services. These typical operating values are given to show concisely some guiding information for the use of each type. They are not to be considered as ratings, because the tube can be used under any suitable conditions within its rating limitations.

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RECEIVING TUBES

The ratings of all receiving tubes currently used in new equipment are set up according to the design-center system. Older and obsolescent types of receiving tubes still have absolute maximum ratings because these types are used only for renewal purposes and, therefore, design-center values are of no practical value. **Receiving-tube types rated on the design-center system are identified in the Receiving-Tube Section either by a large star in the index corner of each data page or by the statement "Maximum Ratings Are Design-Center Values" preceding the ratings on each data page.**

TRANSMITTING TUBES

The ratings of transmitting tubes grouped in the Transmitting-Tube Section are on the basis of the absolute system. This system enables the transmitter design engineer to choose his design values so as to obtain maximum performance within the tube ratings. Such design procedure has been considered practical for large transmitters where adequate controls are usually incorporated in the design, and ordinarily an experienced operator is present to make any necessary adjustments.

The maximum ratings given for each transmitting type on its data pages apply only when the type is operated at frequencies lower than some specified value which depends on the design of the type. As the frequency is raised above the specified value, the radio-frequency currents, dielectric losses, and heating effects increase rapidly. Most types can be operated above their specified maximum frequency provided the plate voltage and plate input are reduced in accordance with the information given in the table "Transmitting-Tube Ratings vs Operating Frequency" in the front part of the Transmitting-Tube Section.

For certain air-cooled transmitting tubes, two sets

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of absolute maximum values are shown to meet diversified design requirements. One set is designated as CCS (Continuous Commercial Service) ratings, while the other is called ICAS (Intermittent Commercial and Amateur Service) ratings.

Continuous Commercial Service is defined as that type of service in which long tube life and reliability of performance under continuous operating conditions are the prime consideration. To meet these requirements, the CCS ratings have been established.

Intermittent Commercial and Amateur Service is defined to include the many applications where the transmitter design factors of minimum size, light weight, and maximum power output are more important than long tube life. These various factors have been taken into account in establishing the ICAS ratings.

Under the ICAS classification are such applications as the use of tubes in amateur transmitters, and the use of tubes in equipment where transmissions are of an intermittent nature. The term "intermittent" is used to identify operating conditions in all applications other than amateur in which no operating or "on" period exceeds 5 minutes and every "on" period is followed by an "off" or standby period of at least the same or greater duration.

ICAS ratings are considerably higher than CCS ratings. They permit the handling of greater power, but tube life under ICAS conditions, of course, is reduced. However, the transmitter designer may very properly decide that a small tube operated with ICAS ratings better meets his requirements than a larger tube operated with CCS ratings. Although such use involves some sacrifice in tube life, the period over which tubes will continue to give satisfactory performance in intermittent service can be extremely long depending on the exact nature of the service.

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The choice of tube operating conditions best fitted for any particular application should be based on a careful consideration of all pertinent factors.

RECTIFIER TUBES

Rectifier tubes used principally in receiving equipment are rated according to the design-center system, while those used primarily in transmitting and laboratory equipment are rated according to the absolute system. The method of identifying which rating system is used for any rectifier tube in this Handbook is the same as that for other tubes in the particular section of the Handbook in which data for the rectifier tube are given.

The ratings of rectifier tubes are based on fundamental limitations in the operation of the tubes themselves, and in general include the following: maximum peak inverse plate voltage, maximum peak plate current, and maximum d-c output current.

Maximum peak inverse plate voltage is the highest instantaneous plate voltage which the tube can withstand recurrently in the direction opposite to that in which it is designed to pass current. For mercury-vapor tubes and gas-filled tubes, it is the safe top value to prevent arc-back in the tube operating within the specified temperature range.

In determining peak inverse plate voltage on a rectifier tube in a particular circuit, the equipment designer should remember that the relations between peak value of inverse plate voltage, rms value of input voltage, and average value of output voltage, depend largely on the characteristics of the particular rectifier circuit and the power supply. Furthermore, the presence of transients, such as line surges and keying surges, or waveform distortion, may raise the actual inverse plate voltage to a peak higher than that calculated for sine-wave voltages. Therefore, the **actual** inverse plate voltage on a rec-

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(continued from preceding page)

tifier tube should never exceed the maximum peak inverse plate voltage rating for that tube. The peak inverse plate voltage may be determined with an electronic peak voltmeter of the self-contained battery type.

In single-phase, full-wave rectifier circuits with sine-wave input and pure resistance load, the peak inverse plate voltage is approximately 1.4 times the rms value of the plate-to-plate voltage supply. In single-phase, half-wave circuits with sine-wave input and pure resistance load, the peak inverse plate voltage is approximately 1.4 times the rms value of the plate voltage supply, but with condenser input to filter, the peak inverse plate voltage may be as high as 2.8 times the rms value of the plate voltage supply.

Maximum peak plate current is the highest instantaneous plate current that a tube can safely carry recurrently in the direction of normal current flow. The safe value of this peak current in hot-cathode types of rectifier tubes is a function of the electron emission available and the duration of the pulsating current flow from the rectifier tube in each half-cycle.

The value of peak plate current in a given rectifier circuit is largely determined by filter constants. If a large choke is used at the filter input, the peak plate current is not much greater than the load current; but if a large condenser is used at the filter input, the peak current may be many times the load current. In order to determine accurately the peak plate current in any rectifier circuit, the designer should measure it with a peak-indicating meter or use an oscillograph.

Maximum d-c output current is the highest average plate current which can be handled continuously by a rectifier tube. Its value for any rectifier tube type is based on the permissible plate dissipation of that type. Under operating conditions involving a rapidly

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repeating duty cycle (steady load), the average plate current may be measured with a d-c meter. In the case of certain mercury-vapor tubes where the load is fluctuating, it is necessary to determine the average current over the time interval specified on the data pages for these types.

In addition to the above ratings for rectifier tubes, other ratings may be set up for a rectifier tube when the service in which the tube is to be used makes such ratings essential for satisfactory performance. Such ratings are: maximum surge plate current, and maximum heater-cathode potential.

Maximum surge plate current is the highest value of abnormal peak currents of short duration that should pass through the rectifier tube under the most adverse conditions of service. This value is intended to assist the equipment designer in a choice of circuit components such that the tube will not be subjected to disastrous currents under abnormal service conditions approximating a short circuit. This surge-current rating is not intended for use under normal operating conditions because subjecting the tube to the maximum surge current even only once may impair tube life. If the tube is subjected to repeated surge currents, its life will be seriously reduced or even terminated.

Maximum heater-cathode potential is the highest instantaneous value of voltage that a rectifier tube can safely stand between its heater and cathode. This rating is applied to certain rectifier tubes having a separate cathode terminal and used in applications where excessive potential may be introduced between heater and cathode. For convenience, this rating is usually given as a d-c value.

CATHODE-RAY TUBES

The ratings of some cathode-ray tubes are set up on the absolute system while others are set up on the design-center system. Initially, cathode-ray tubes

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were all rated according to the absolute system. With the advent of television which presented design conditions similar to those in the receiving-set field, the method of rating popular types of cathode-ray tubes was changed to the design-center system. More recently, because of procedure standardized by the RMA Cathode-Ray-Tube Committee, newer types of cathode-ray tubes are being rated on the absolute system. **Cathode-ray types rated according to the design-center system are identified in the Cathode-Ray Types Section by a statement to that effect just ahead of the maximum ratings on each data page. The data pages of types rated according to the absolute system have either (1) no identifying statement as to the rating system, or (2) an identifying statement that the ratings are according to the absolute system.**

PHOTOTUBES

The ratings of all phototubes in the Phototube Section are on the absolute maximum basis. This basis enables the designing engineer to choose design values so as to obtain optimum performance within tube ratings. In the case of gas phototubes, the value to which the plate voltage and the plate current can be raised is abruptly limited by ionization effects. If these are allowed to occur, they may ruin the photosurface almost instantly. While phototubes in general might be rated on the design-center basis, such a procedure, with provision for an adequate factor of safety to take care of all conditions of operation, would impose undue limitations on the use of gas phototubes.

MISCELLANEOUS SPECIAL TUBES

The ratings of some of the various tube types grouped in the Miscellaneous-Types Section are according to the design-center system while others are according to the absolute system. **Miscellaneous types rated on the design-center basis are identified**

TUBE RATINGS

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by a statement to that effect on the data pages or else refer back for ratings to a receiving-tube type whose rating basis is explained under TUBE RATINGS—Receiving Tubes. The data pages of types rated according to the absolute system have either (1) no identifying statement as to the rating system, or (2) an identifying statement that the ratings are according to the absolute system.

CHARACTERISTICS and TYPICAL OPERATING CONDITIONS

In addition to showing the ratings of each tube type, the data pages for many of the types in this Handbook include "characteristics," such as amplification factor, plate resistance, and transconductance, which help to distinguish between the electrical features of the respective types. Usually, the characteristics shown for any type are obtained for that type in class A service: where class A data are given for the type, the characteristics are included with that data for convenience. Based on a large number of tubes of a given type, the values shown for these characteristics are average values.

Range of Characteristics—The equipment designer should bear in mind that individual tubes of a given type may have characteristics values either side of the average values shown for the type. He should also realize that these characteristics change during the life of individual tubes. In designing equipment, therefore, he should allow for the maximum cumulative variation of any characteristic from the average value of that characteristic as shown in the tabulated data for the type. The exact percentage of the variation will be different for different types of tubes depending on the design of the tubes and their intended application, but in general the designer should consider a probable plus or minus variation of not less than 30 per cent.

Furthermore, the equipment designer should recognize the desirability of designing equipment so that the full range of the operating characteristics of tubes will be utilized. If this practice is not followed, he imposes on the equipment user special replacement problems in that the user will have to select tubes suitable for use in the equipment, and may not be able to obtain the full life capability of such tubes.

Typical Operating Values—Also included on the data pages is information on typical operating conditions for most of the various tubes when used in particular services. These typical operating values are intended to show concisely some guiding information for the use of each type. They must not be considered as ratings because each type can, in general, be used under any suitable conditions within its rating limitations. In referring to these values for transmitting tubes, it should be noted that the power output value is not a rating. It is an approximate tube output, i.e., tube input minus plate loss. Circuit losses must be subtracted from tube output in determining useful output.

Datum Point for Electrode Potentials—In the data for any type in the Handbook, the values for grid bias and positive-potential-electrode voltages are given with reference to a specified datum point as follows. For types having filaments heated with d.c., the negative filament terminal is taken as the datum point to which other electrode voltages are referred. For types having filaments heated with a.c., the mid-point (i.e., the center tap on the filament-transformer secondary, or the mid-point on a resistor shunting the filament) is taken as the datum point. For types having equipotential cathodes indirectly heated, the cathode is taken as the datum point.

Grid Bias vs Filament Excitation—If the filament of any type for which data are given on a d-c basis is to be operated with an a-c supply, the given grid

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(continued from preceding page)

bias should be increased by an amount approximately equal to one half the rated filament voltage and be referred to the filament mid-point. Conversely, if it is required to use d-c filament excitation on any filament type for which the data are given on an a-c basis, the grid-bias values as given on the data pages should be decreased by an amount approximately equal to one half the rated filament voltage and be referred to the negative filament terminal instead of the mid-point as in a-c operation.

In practice, the necessity for following this rule dep nds on circuit conditions and operating requirements. If the bias is relatively small compared with the filament voltage and hum is a consideration, adjustment of the grid bias is ordinarily essential. Conversely, if the bias is relatively large compared with the filament voltage, adjustment of the grid bias may be unnecessary.

When filament excitation of tubes used as Audio Amplifiers is changed from d.c to a.c., the grid return should, in general, be shifted to the mid-point of the filament circuit to minimize hum, and the bias adjusted accordingly. When the excitation is changed from a.c. to d.c., bias adjustment depending on the relative values of bias and filament voltage may be required to provide the full signal-handling capability of the tubes.

When filament excitation of tubes used as R-F Amplifiers is changed, bias adjustment is not required unless the change makes the circuit critical as to hum or signal-handling capability. For example, in class C amplifiers, the bias is usually so large in comparison with the filament voltage that adjustment is generally unnecessary.

Grid Current and Driving Power—The typical values of d-c grid current and driving power shown for triodes and tetrodes in class B r-f service and in class C service are subject to variations depending on the impedance of the load circuit. High-impe-

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dance load circuits require more grid current and driving power to obtain the desired output. Low-impedance circuits need less grid current and driving power, but plate-circuit efficiency is sacrificed. In comparison, the d-c grid current and driving power shown for beam tubes and pentodes in class B r-f service and in class C service are not as critical to variations in load-circuit conditions. In any event, sufficient grid current should be used so that the stage is "saturated," i.e., so that a small change in grid current results in negligible change in power output. Regardless of the type of tube used, the driving stage should have a tank circuit of good regulation and should be capable of delivering power in excess of the indicated power by a factor of several times.

TYPES OF CATHODES

AND THEIR USE

In electron tubes, a cathode is an electrode which is the primary source of electron or ion emission. There are two broad classes of cathodes, i.e., hot and cold. ' Hot cathodes" are defined as cathodes which are heated or otherwise operate at elevated temperature (frequently incandescent) in order to function as emitters. In contrast, "cold cathodes" are defined as cathodes which do not rely on heat or on elevated temperature in order to function as emitters.

HOT CATHODES

Hot cathodes commonly in use in electron tubes are classified as directly heated, indirectly heated, and ionic-heated.

A **directly heated cathode**, or filament-cathode, is a wire or ribbon which is heated by the passage of current through it. It is further classified by identifying the filament material or the electron-emitting material. Such materials in regular use are pure tungsten, thoriated tungsten, and metals coated with alkaline-earth oxides. Each of these materials has distinctive advantages which are utilized in the design of tubes for particular applications.

PURE-TUNGSTEN FILAMENTS are used in certain tubes, especially those for high-voltage transmitting service. Since these filaments must operate at a high temperature of about 2500°C (a dazzling white) to emit sufficient electrons, a relatively large amount of filament power is required. The operating life of these filaments is determined by the rate of tungsten evaporation. Their failure, therefore, occurs through decreased emission or burn-out.

Pure-tungsten filaments give best life performance when they are operated so as to conserve their emitting capability. They are designed with voltage and current ratings in accord with the service expected of the particular tube type. However, in applications where the normal emission at rated voltage is not

TYPES OF CATHODES

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required, the filament can be operated at a somewhat reduced voltage. The extent of the reduction depends on the peak emission requirements of the application as well as on the percentage regulation of the filament voltage. When these are known, the correct operating filament voltage for any tungsten-filament type can be calculated from its filament-emission characteristic. The permissible regulation in transmitters may be checked by reducing the filament voltage (with the transmitter under normal operation) to a value such that reduction in output can just be detected. The filament voltage must then be increased by an amount equivalent to the maximum percentage regulation of the filament-supply voltage and then increased further by approximately 2 per cent to allow for minor variations in emission of individual tubes. It follows that the better the regulation, the less the filament operating voltage and, therefore, the longer the filament life.

It should be noted that a reduction of 5 per cent in the filament voltage applied to tubes with pure-tungsten filaments will approximately double their life. A reduction of 15 per cent will increase the filament life almost tenfold.

During long or frequent standby periods, pure-tungsten-filament tubes may be operated at decreased filament voltage to conserve life. When the average standby time is an appreciable portion of the average duty cycle and is less than 2 hours, it is recommended that the filament voltage of all but the largest types be reduced to 80 per cent of normal; and that for longer periods, the filament power be turned off. For the largest types, such as the 898, it is recommended that the filament voltage be reduced to 80 per cent of normal during standby operation up to 12 hours; and that for longer periods, the filament power be turned off.

For turning on filament power, a filament starter should be used so as to increase the voltage gradually and to limit the high initial rush of current through

TYPES OF CATHODES

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the filament. It is important that the filament current never exceed, even momentarily, a value of more than 150 per cent of normal, unless the tube data specify otherwise. Similarly, as an added precaution, the filament power should be turned off gradually to prevent cooling strains in the filament.

THORIATED-TUNGSTEN FILAMENTS are now used mainly in certain transmitting and special tubes. Thoriated-tungsten filaments are made from tungsten impregnated with thoria. Due to the presence of thorium, these filaments liberate electrons at a more moderate temperature of about 1700°C (a bright yellow), and are, therefore, much more economical of filament power than are pure-tungsten filaments. The operating life of thoriated-tungsten filaments is ordinarily ended by a decrease in electron emission. Decreased emission, however, may be caused by the accidental application of too high filament, screen, or plate voltage. If the over-voltage has not been continued for a long time, the activity of the filament can often be restored by operating the filament at its normal voltage for 10 minutes or longer without plate, screen, or grid voltage. The reactivation process may be accelerated by raising the filament voltage to not higher than 120 per cent of normal value for a few minutes. This reactivation schedule is often effective in restoring the emission of thoriated-tungsten filaments in tubes which have failed after normal service. Sometimes a few hundred hours of additional life may be obtained after reactivation.

The operating voltage of a thoriated-tungsten filament should, in general, be held to within ±5 per cent of its rated value. However, in transmitting applications where the tube is lightly loaded, the filament may be operated on the low side—as much as 5 per cent below normal voltage. As conditions require, the voltage should be increased gradually to maintain output. Toward the end of life, additional service may be obtained by operating the fila-

TYPES OF CATHODES

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ment above its rated voltage. It should be noted that a tube having a thoriated-tungsten filament should never be operated under emission-limited conditions since this type of operation may overheat the tube and cause permanent loss of emission.

During standby periods in transmitting service, thoriated-tungsten filaments may be operated according to the following recommendations to conserve life. For short standbys of less than 15 minutes duration, the filament voltage of all but the largest types should be reduced to 80 per cent of normal; for longer periods, the filament power should be turned off. For the largest types, such as the 827-R and 861, it is recommended that the filament voltage be reduced to 80 per cent of normal during standby operation up to 2 hours; and that for longer periods, the filament power be turned off.

COATED FILAMENTS are used in receiving tubes, certain transmitting tubes, most mercury-vapor rectifiers, and some special tubes. Coated filaments employ a relatively thick coating of alkaline-earth compounds on a metallic base as a source of electronic emission. The metallic base carries the heating current. These filaments operate at a low temperature of about 800°C (a dull red) and require relatively little power to produce a copious supply of electrons.

For proper performance of these types, rated filament voltage should, in general, be applied at the filament terminals. However, when coated-filament, high-vacuum tubes are used in transmitting service with light loading, the filament voltage may be reduced as much as 5 per cent below normal to conserve life. Then, as conditions require, the voltage should be increased gradually to maintain output. Toward the end of life, the gradual increase may be carried above rated filament voltage to obtain additional service. In the case of gas or vapor tubes, it is important that these types be operated, in general, at rated filament voltage. However, if the line regu-

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lation regularly and consistently does not exceed 1 to 2 per cent, it is practical to reduce the filament voltage slightly (not over 5 per cent) with benefit to tube life.

During standby periods of less than 15 minutes, the filament voltage of quick-heating, high-vacuum types, such as the 1616 and 1624, should be reduced to 80 per cent of normal; for longer periods, the filament power should be turned off. In contrast, the voltage of coated filaments in gas or vapor tubes should not be reduced during standbys except under conditions explained in the preceding paragraph. In general, the filament voltage of small and medium types, such as the 866-A/866 and 872-A/872, should be maintained at normal rated value during standbys up to 2 hours; for longer periods, the filament power should be turned off. For large types, such as the 857-B, the filament voltage should be maintained at normal rated value during standbys up to 12 hours; for longer periods, the filament power should be turned off.

After having given normal service or after having been operated at excessive voltage, coated filaments lose their emission. When such is the case, their usefulness may be considered as terminated.

An **indirectly heated cathode**, or heater-cathode, consists of a heater wire enclosed in a thin metal sleeve coated on the outside with electron-emitting material similar to that used for coated filaments. The sleeve is heated by radiation and conduction from the heater through which current is passed. Useful emission does not take place from the heater wire. An important feature of this kind of cathode construction is that the functions of heating and emission can be independent of each other.

HEATER-CATHODES, or unipotential cathodes as they are frequently called, are used in high-vacuum tubes operating at low plate voltage, such as receiv-

TYPES OF CATHODES

(continued from preceding page)

ing tubes, low-power transmitting tubes, and small special tubes. They also find application in mercury-vapor tubes and in cathode-ray tubes. Heater-cathodes, like coated filaments, provide a copious supply of electron emission at low cathode temperature (a dull red).

For proper performance of heater-cathode tubes, rated heater voltage should, in general, be applied at the heater terminals. However, when heater-cathode high-vacuum tubes are used in transmitting service and are lightly loaded, the heater voltage may be reduced as much as 5 per cent below normal to conserve life. As conditions require, the voltage should be increased gradually to maintain output. Toward the end of life, the gradual increase may be carried above rated heater voltage to obtain additional service.

During standby periods of less than 15 minutes, the heater voltage of high-vacuum tubes should be maintained at normal rated value; for longer periods, the heater power should be turned off. In the case of vapor or gas tubes, the heater voltage should be maintained at normal during standby periods up to 12 hours; for longer periods, the heater power should be turned off.

An **ionic-heated cathode** is one which liberates electrons when it is subjected to intense positive ion bombardment. The bombardment may be so intense as to raise the temperature of the cathode, frequently causing it to become visibly hot. The ionic-heated cathode in radio tubes has found application in gas rectifiers intended primarily for automobile receiver service.

COLD CATHODES

The designation "cold cathode" is commonly used in referring to those cathodes which emit electrons when they are subjected to bombardment by other electrons, ions, or metastable atoms. Cathodes of

TYPES OF CATHODES

(continued from preceding page)

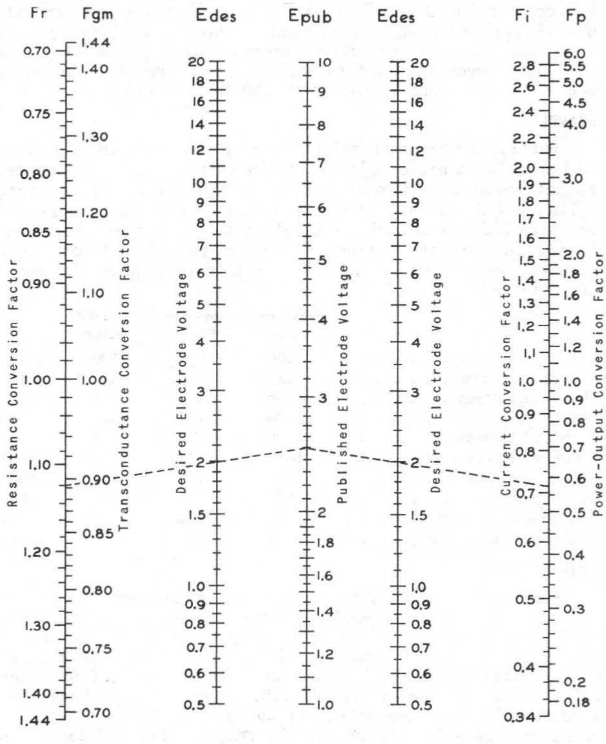
this type are sometimes designated as secondary-emission cathodes. They are used in certain glow-discharge tubes, and also in multiplier phototubes where they contribute to electron multiplication in the successive dynode stages.

Not customarily referred to as cold cathodes, although they are such, is another group of emitters known as photocathodes. By definition, a **photocathode** is one which emits electrons when it is energized with radiant flux, such as light, infra-red radiation, or ultra-violet radiation. Such cathodes are used in phototubes. When used in gas phototubes, these cathodes not only emit under the influence of radiant flux but also as a result of bombardment and thus become partial secondary-emission cathodes.

Photocathodes are classified according to the spectral response characteristics of their respective photoactive surfaces. The S1 photosurface gives high response to red and near infra-red radiation. The S2 photosurface is similar to the S1 surface but extends somewhat further into the infra-red region. The S3 photosurface has a spectral response characteristic which is closest to that of the eye. The S4 photosurface has exceptionally high response to blue and blue-green radiation with negligible response to red radiation.

Exposure of photocathodes to intense light, such as direct sunlight, may decrease the sensitivity of the tubes in which they are used, even though there is no voltage applied. The magnitude and duration of the decrease depend on the length of the exposure. Permanent damage to a phototube may result if it is exposed to radiant energy so intense as to cause excessive heating of the cathode.

CONVERSION FACTORS



CONVERSION FACTOR NOMOGRAPH

The Conversion Factor Nomograph shown above may be used to determine the approximate characteristics of an electron tube when all the electrode voltages are changed in the same proportion from the published or measured values.

The conversion factors obtained from the nomograph are applicable to triodes, tetrodes, pentodes, and beam power tubes when the plate voltage, grid-No.1 voltage, and grid-No.2 voltage are changed simultaneously by the same factor. They may be used for any class of tube operation (class A, AB_1, AB_2, B, or C).

The nomograph may be used to determine the proper value for each conversion factor for a specified relationship (F_e)

CONVERSION FACTORS

between published or measured values (E_{pub}) and desired values (E_{des}) of operating voltage. The dashed lines on the nomograph indicate the correct procedure for determining each of these conversion factors when it is desired to reduce the operating electrode voltage from 250 to 200 volts.

EXAMPLE

Published characteristics for a typical pentode are listed below for a plate voltage of 250 volts. If it is desired to determine the characteristics of this tube for a plate voltage of 200 volts, the voltage conversion factor, F_e, is equal to 200/250 or 0.8. The values for the other conversion factors are obtained from the nomograph. By use of these factors characteristics values at a plate voltage of 200 volts are obtained.

	Published Value	*Conversion Factor*	*Desired Value*	
Plate Voltage	250	0.8	200	volts
Grid-No.2 Voltage	250	0.8	200	volts
Grid-No.1 Voltage	−15	0.8	−12	volts
Plate Current	30	0.72	21.6	ma
Grid-No.2 Current	6	0.72	4.3	ma
Plate Resistance (Approx.). . .	0.13	1.12	0.15	megohm
Transconductance.	2000	0.89	1780	μmhos
Load Resistance	10000	1.12	11200	ohms
Total Harmonic Distortion . . .	10	unchanged	10	%
Max.-Signal Power Output. . . .	2.5	0.57	1.42	watts

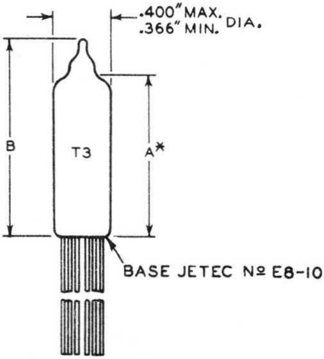
LIMITATIONS

Because this method for conversion of characteristics is necessarily an approximation, progressively greater errors will be introduced as the voltage conversion factor ($F_e = E_{des}/E_{pub}$) departs from unity. In general, it may be assumed that results obtained will be approximately correct when the value of F_e is between 0.7 and 1.5. When F_e is extended beyond these limits (down to 0.5 or up to 2.0), the accuracy becomes considerably reduced and the results obtained can serve only as a rough approximation.

It should be noted that this method does not take into account the effects of contact potential or secondary emission in electron tubes. Contact potential, however, may safely be neglected for most applications because its effects are noticeable only at very low grid-No.1 voltages. Secondary emission may occur in conventional tetrodes at low plate voltages. For such tubes, therefore, the use of conversion factors should be limited to regions of the plate characteristic in which the plate voltage is greater than the grid-No.2 voltage. For beam power tubes, the regions of both low plate currents and low plate voltages should also be avoided.

OUTLINES—Glass Tubes

SUBMINIATURE--Flexible-Lead Types

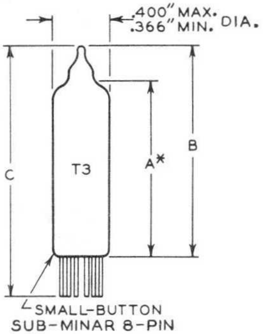


OUTLINE JETEC No.	DIMENSION A ± 0.060 INCHES	DIMENSION B Max. INCHES
3-1	1.075	1.375
3-2	1.200	1.500
3-3	1.450	1.750
3-4	1.700	2.000
3-8	1.325	1.625
3-11	0.950	1.250

* Measured from base seat to bulb-top line as determined by a ring gauge of 0.210" ± 0.001" inside diameter.

OUTLINES—Glass Tubes

SUBMINIATURE--Small-Button Sub-Minar 8-Pin Base Types



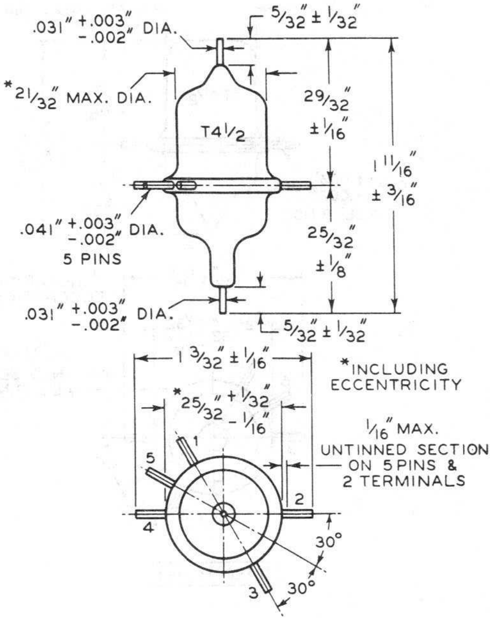
OUTLINE JETEC No.	DIMENSION		
	A ± 0.060 INCHES	B Max. INCHES	C Max. INCHES
3-5	1.200	1.500	1.750
3-9	1.075	1.375	1.625
3-10	1.450	1.750	2.000
3-12	0.950	1.125	1.500
3-13	1.325	1.625	1.875
3-14	1.575	1.875	2.125
3-15	1.700	2.000	2.250

* Measured from base seat to bulb-top line as determined by a ring gauge of 0.210" ± 0.001" inside diameter.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

OUTLINES — Glass Tubes

ACORN--Radial 5-Pin Base Type with End Terminals

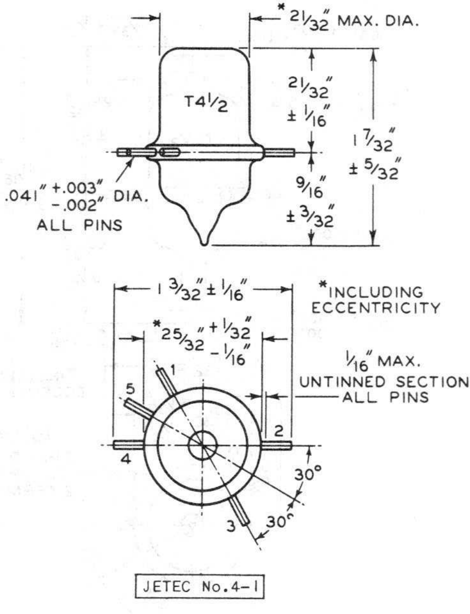


JETEC No.4-3

For additional socket design information, see back of "Outlines 3" sheet

OUTLINES—Glass Tubes

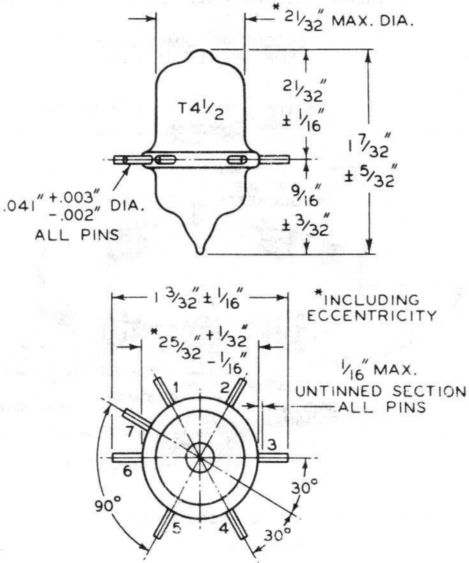
ACORN--Radial 5-Pin Base Type



For additional socket design information, see back of "Outlines 3" sheet

OUTLINES—Glass Tubes

ACORN--Radial 7-Pin Base Type



JETEC No.4-2

For additional socket design information, see back of this sheet

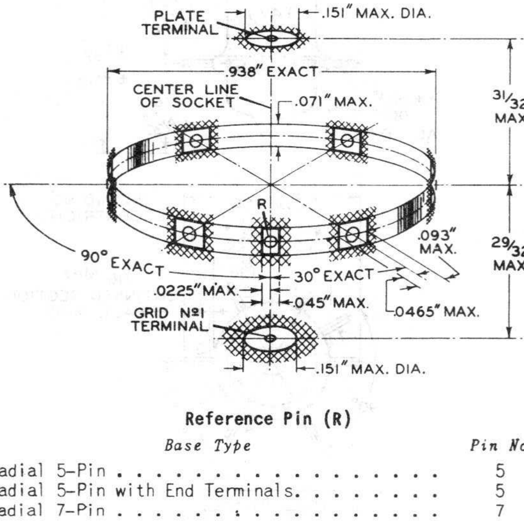
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

OUTLINES—Glass Tubes

ACORN TYPES

MAXIMUM PIN AND TERMINAL VARIATIONS AT SOCKET CLIPS AND TERMINAL CONNECTORS

ESSENTIAL DIMENSIONS
FOR SOCKET DESIGN



Reference Pin (R)

Base Type	*Pin No.* *
Radial 5-Pin	5
Radial 5-Pin with End Terminals.	5
Radial 7-Pin	7

The above composite diagram shows the ideal positions of radial-pin cross-sections at socket clips located on a circle of 0.938" diameter, as well as end-terminal cross-sections at terminal ends.

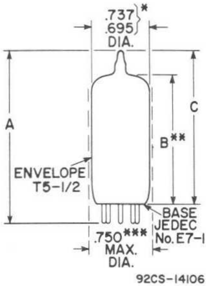
The areas within the cross-hatching show actual variations of radial-pin and end-terminal cross-sections, and indicate the maximum variations which socket clips and terminal connectors should accommodate.

The clear area for pin position R is narrower than the others because pin position R is used as a reference for the other pins.

Sockets should be designed so that the maximum diametric clearance between socket clips is never less than 0.850".

* For pin numbering of each of these bases, see respective Dimensional Outline on preceding pages.

MINIATURE — Miniature 7-Pin Base Types
with T5-1/2 Bulbs



DIMENSIONS IN INCHES

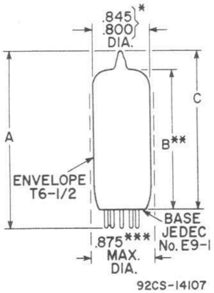
OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)			
	A	B		C
	Max	Min	Max	Max
—	1.625	.906	1.094	1.375
5-1	1.750	1.031	1.219	1.500
5-2	2.125	1.406	1.594	1.875
5-3	2.625	1.906	2.094	2.375

* Major diameter as checked by ring gauges of 0.25 inch thickness. The maximum gauge should clear the bulb above 0.38 inch from the base seat and the minimum gauge should not.

** Measured from the base seat to the bulb-top line as determined by a ring gauge of 0.437 inch I.D.

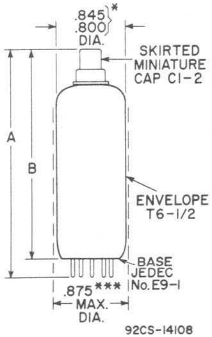
*** The diameter of the boundary cylinder as defined by the barriers of the pin alignment gauge (Gauge No. GE7-1, Sheet 24, Section 3 of EIA Standard RS-209A).

MINIATURE — Noval 9-Pin Base Types
with T6-1/2 Bulbs



DIMENSIONS IN INCHES

OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)			
	A	B		C
	Max	Min	Max	Max
6-1	1.750	1.031	1.219	1.500
6-2	2.187	1.469	1.656	1.937
6-3	2.625	1.906	2.094	2.375
6-4	3.062	2.344	2.531	2.812



DIMENSIONS IN INCHES

OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)		
	A	B	
	Max	Min	Max
6-5	1.969	1.437	1.687
6-6	2.406	1.875	2.125
6-7****	2.844	2.312	2.562
6-8	3.281	2.750	3.000

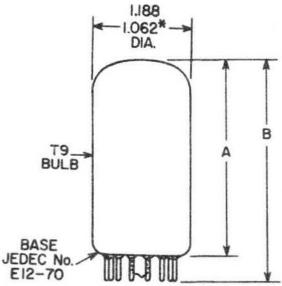
* Major diameter as checked by ring gauges of 0.25 inch thickness. The maximum gauge should clear the bulb above 0.38 inch from the base seat and the minimum gauge should not.

** Measured from the base seat to the bulb-top line as determined by a ring gauge of 0.437 inch I.D.

*** The diameter of the boundary cylinder as defined by the barriers of the pin alignment gauge (Gauge No.GE9-1, Sheet 30, Section 3 of EIA Standard RS-209A).

**** Jedec Outline No.6-7 may also use non-standard CI-33 cap.

DUODECAR—12-Pin Base Types with T9 Bulbs

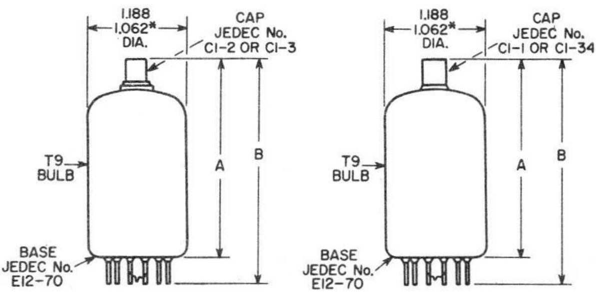


OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)		
	A		B
	Min.	Max.	Max.
9 – 55	1.000	1.250	1.625
9 – 56	1.250	1.500	1.875
9 – 57	1.500	1.750	2.125
9 – 58	1.750	2.000	2.375
9 – 59	2.000	2.250	2.625
9 – 60	2.250	2.500	2.875
9 – 61	2.500	2.750	3.125
9 – 62	2.750	3.000	3.375

DIMENSIONS IN INCHES

* Applies to minimum diameter except in area of seal.

Outlines with Top Cap



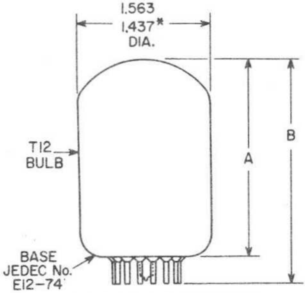
DIMENSIONS IN INCHES

* Applies to minimum diameter except in area of seal.

OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)		
	A		B
	Min.	Max.	Max.
9 – 88	2.000	2.250	2.625
9 – 89	2.250	2.500	2.875
9 – 90	2.500	2.750	3.125
9 – 91	2.750	3.000	3.375
9 – 92	3.000	3.250	3.625
9 – 93	3.250	3.500	3.875
9 – 94	3.500	3.750	4.125
9 – 95	3.750	4.000	4.375

OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)		
	A		B
	Min.	Max.	Max.
9 – 96	2.000	2.250	2.625
9 – 97	2.250	2.500	2.875
9 – 98	2.500	2.750	3.125
9 – 99	2.750	3.000	3.375
9 – 100	3.000	3.250	3.625
9 – 101	3.250	3.500	3.875
9 – 102	3.500	3.750	4.125
9 – 103	3.750	4.000	4.375

DUODECAR—12-Pin Base Types with T12 Bulbs

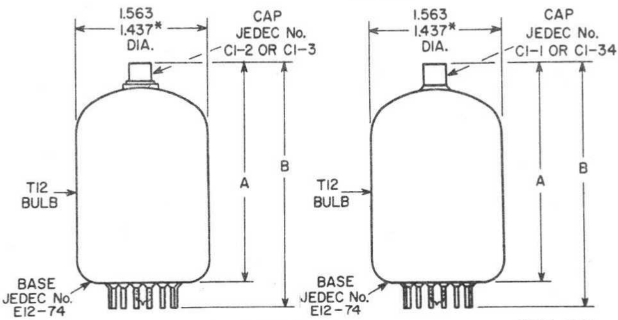


DIMENSIONS IN INCHES

* Applies to minimum diameter except in area of seal.

OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES) A Min.	A Max.	B Max.
12 - 52	1.250	1.500	1.875
12 - 53	1.500	1.750	2.125
12 - 54	1.750	2.000	2.375
12 - 55	2.000	2.250	2.625
12 - 56	2.250	2.500	2.875
12 - 57	2.500	2.750	3.125
12 - 58	2.750	3.000	3.375
12 - 59	3.000	3.250	3.625
12 - 60	3.250	3.500	3.875
12 - 61	3.500	3.750	4.125
12 - 62	3.750	4.000	4.375

Outlines with Top Cap



DIMENSIONS IN INCHES

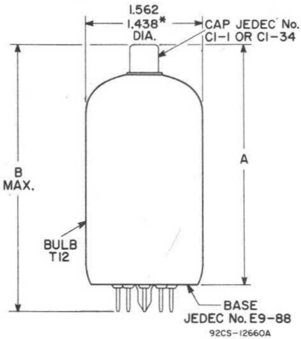
92CS-12525

* Applies to minimum diameter except in area of seal.

OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES) A Min.	A Max.	B Max.
12 - 75	2.000	2.250	2.625
12 - 76	2.250	2.500	2.875
12 - 77	2.500	2.750	3.125
12 - 78	2.750	3.000	3.375
12 - 79	3.000	3.250	3.625
12 - 80	3.250	3.500	3.875
12 - 81	3.500	3.750	4.125
12 - 82	3.750	4.000	4.375

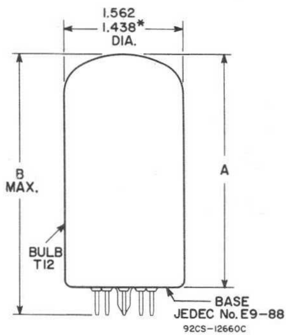
OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES) A Min.	A Max.	B Max.
12 - 83	2.000	2.250	2.625
12 - 84	2.250	2.500	2.875
12 - 85	2.500	2.750	3.125
12 - 86	2.750	3.000	3.375
12 - 87	3.000	3.250	3.625
12 - 88	3.250	3.500	3.875
12 - 89	3.500	3.750	4.125
12 - 90	3.750	4.000	4.375

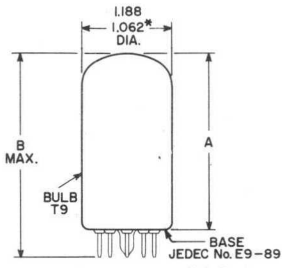
NOVAR—9-Pin Base Types



OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)		
	A		B
	Min.	Max.	Max.
12-116	3.500	3.750	4.130

OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)		
	A		B
	Min.	Max.	Max.
12-95	2.250	2.500	2.880
12-96	2.500	2.750	3.130
12-99	3.250	3.500	3.880



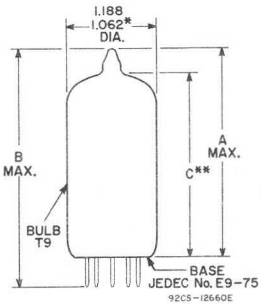


OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)		
	A		B
	Min.	Max.	Max.
9-107	1.750	2.000	2.380
–	2.375	2.625	3.005

* Applies to the minimum diameter except in the area of the seal.

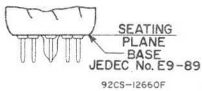
Outlines
Glass Tubes

NOVAR—9-Pin Base Types



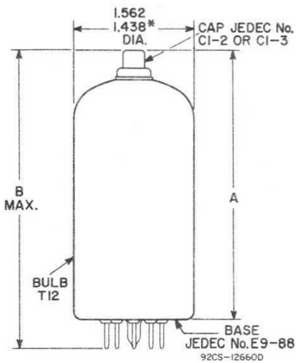
OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)			
	C		B	A
	Min.	Max.	Max.	Max.
—	2.050	2.230	3.080	2.700
—	2.405	2.585	3.110	2.730

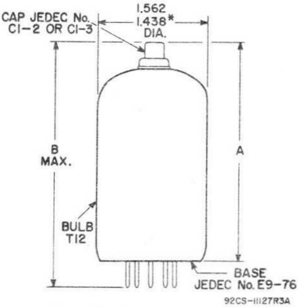
Botton-exhaust type has the same A & B dimensions as top-exhaust type shown



**Measured from the base seat to bulb top line as determined by a ring gauge of 0.600" I.D.

OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)		
	A		B
	Min.	Max.	Max.
—	2.875	3.125	3.505

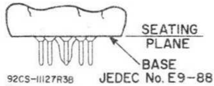




OUTLINE DRAWING NUMBER (JEDEC)	DIMENSIONS (INCHES)		
	A		B
	Min.	Max.	Max.
12-70•	2.910	3.170	3.550

Bottom-exhaust type has the same dimensions as top-exhaust type shown

• For E9-76 base



OUTLINES—Glass Tubes

GLASS OCTAL--Octal Base Types with T9 Bulbs

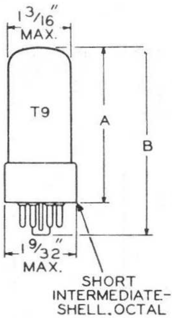


Fig. 1

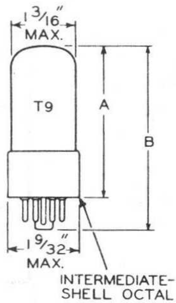


Fig. 2

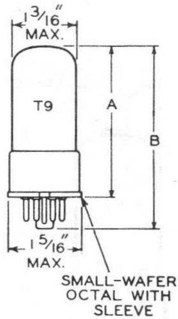
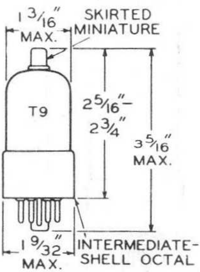
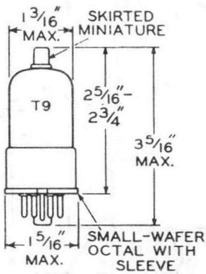


Fig. 3

OUTLINE			DIMENSION	
JETEC No.			A Max. INCHES	B Max. INCHES
Fig. 1	Fig. 2	Fig. 3		
–	9–1	–	1–3/4*	2–5/16
–	9–7	–	2–1/2	3–1/16
9–41	9–11	9–12	2–3/4	3–5/16
–	9–13	–	2–13/16	3–3/8
–	9–15	–	2–7/8	3–7/16
–	9–33	–	3–1/4	3–13/16



JETEC No. 9–17

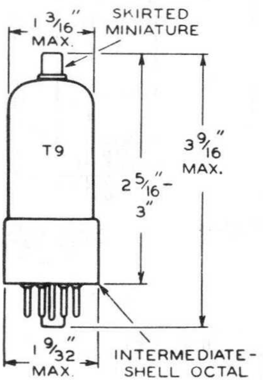


JETEC No. 9–18

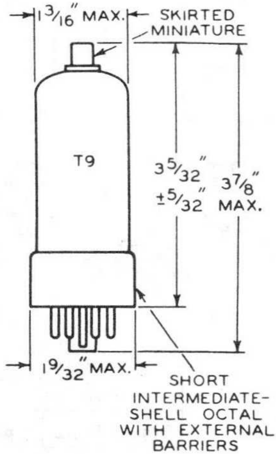
* For electron-ray tubes, the seated height is 1–11/16" + 1/16" – 1/4".

OUTLINES—Glass Tubes

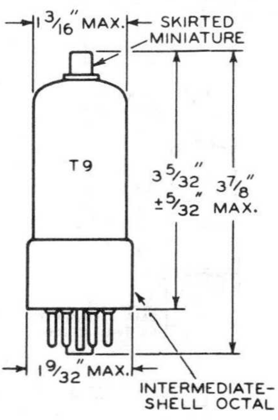
GLASS OCTAL--Octal Base Types with T9 Bulbs



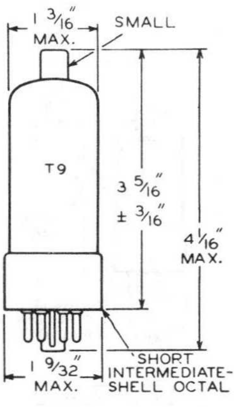
JETEC No.9-23



JETEC No. None



JETEC No. None

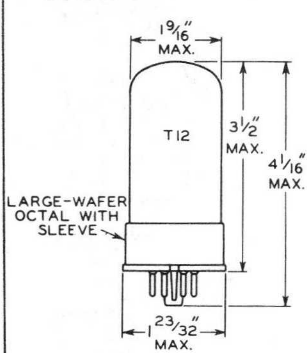


JETEC No.9-51

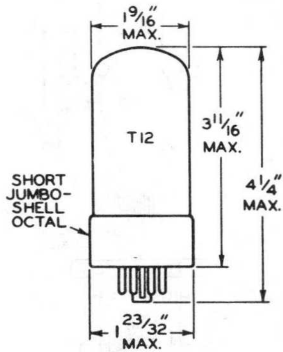
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

OUTLINES—Glass Tubes

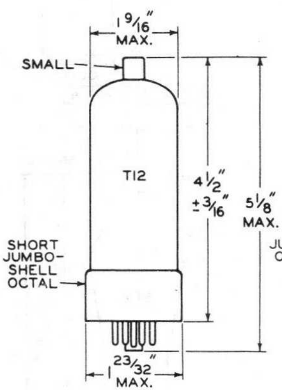
GLASS OCTAL--Octal Base Types with T12 Bulbs



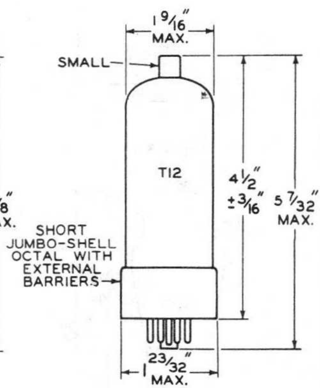
JETEC No. None



JETEC No. None



JETEC No. None

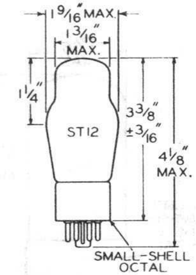


JETEC No. None

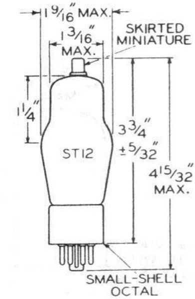
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

OUTLINES—Glass Tubes

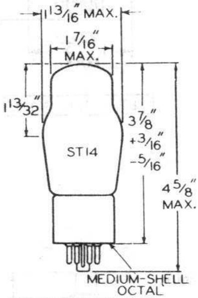
GLASS OCTAL--Octal Base Types with ST Bulbs



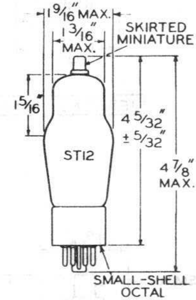
JETEC No. 12-7



JETEC No. 12-8



JETEC No. 14-3



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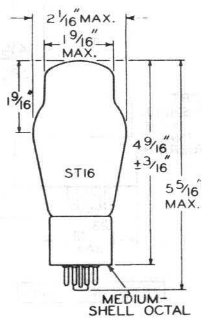
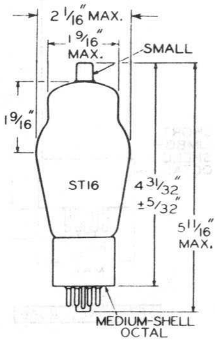


JETEC No. 16-3

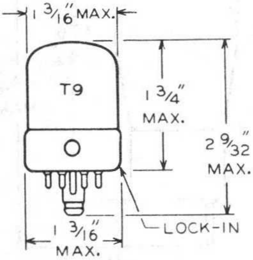


JETEC No. 16-5

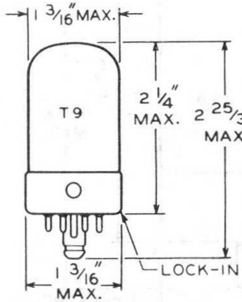
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

OUTLINES—Glass Tubes

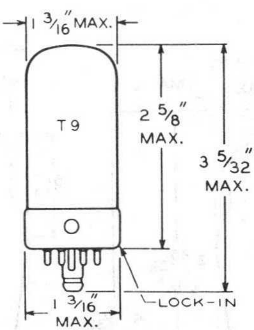
LOCK-IN--Lock-In 8-Pin Base Types



JETEC No.9-32



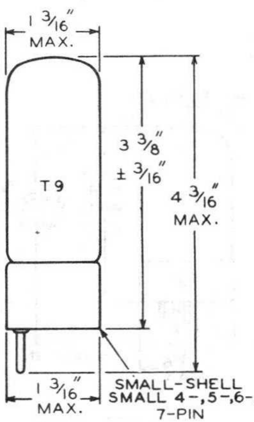
JETEC No.9-30



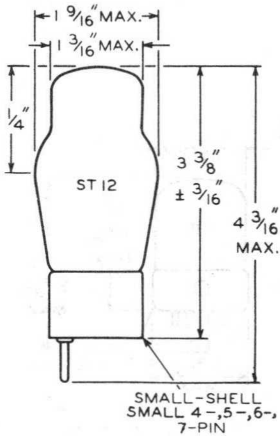
JETEC No.9-31

OUTLINES—Glass Tubes

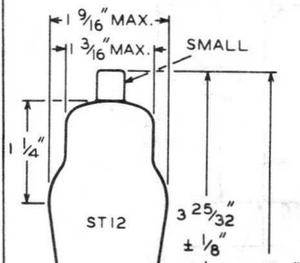
SMALL 4-PIN, SMALL 5-PIN, SMALL 6-PIN, & SMALL 7-PIN BASE TYPES



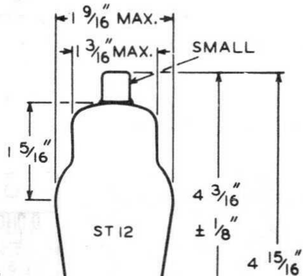
JETEC No. 9-26



JETEC No. 12-5



JETEC No. 12-6

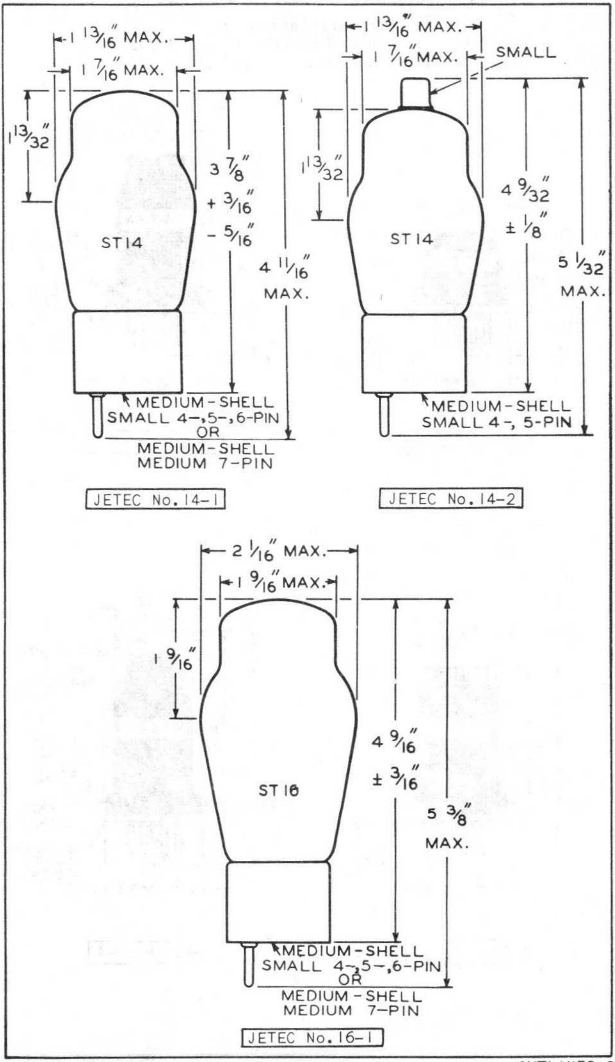


JETEC No. 12-2

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

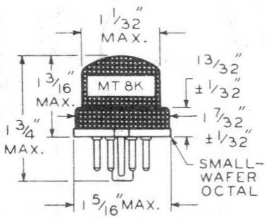
OUTLINES—Glass Tubes

SMALL 4-PIN, SMALL 5-PIN, SMALL 6-PIN, & MEDIUM 7-PIN BASE TYPES

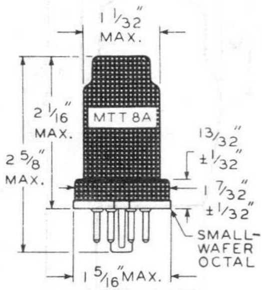


OUTLINES—Metal Tubes

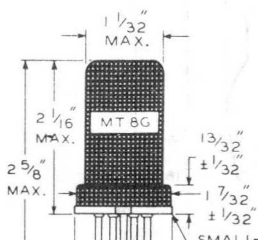
For correlation of
TUBE TYPE, ENVELOPE DESIGNATION, & OUTLINE No.,
see KEY on back of this sheet



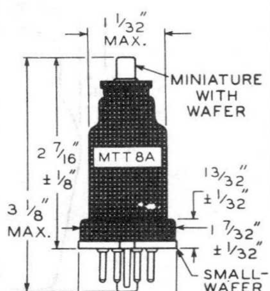
JETEC No.8-5



JETEC No.8-3



JETEC No.8-1

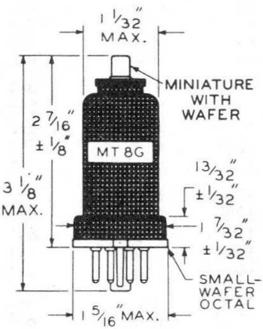


JETEC No.8-4

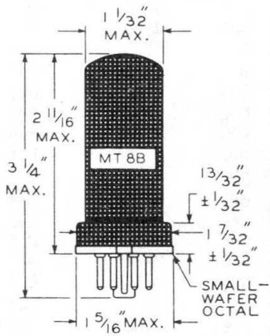
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

OUTLINES—Metal Tubes

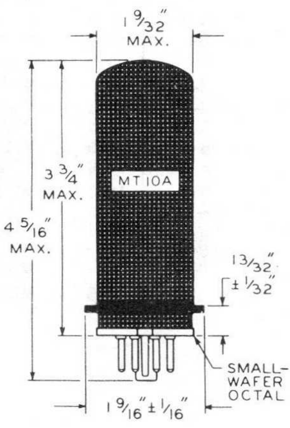
For correlation of
TUBE TYPE, ENVELOPE DESIGNATION, & OUTLINE No.,
see KEY on back of this sheet



JETEC No.8-2



JETEC No.8-6



JETEC No.10-1

OUTLINES — Metal Tubes

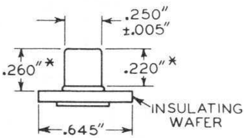
KEY

Type No.	Envelope Designation	Outline Jetec No.	Type No.	Envelope Designation	Outline Jetec No.
0Z4	MTT8A	8–3	6ST7	MT8G	8–1
5T4	MT10A	10–1	6SZ7	MT8G	8–1
5W4	MT8B	8–6	6V6	MT8B	8–6
5Z4	MT8B	8–6	6X5	MT8B	8–6
6A8	MTT8A	8–4	12A6	MT8B	8–6
6AB7	MT8G	8–1	12C8	MTT8A	8–4
6AC7	MT8G	8–1	12H6	MT8K	8–5
6AG7	MT8B	8–6	12K8	MT8G	8–2
6B8	MTT8A	8–4	12SA7	MT8G	8–1
6C5	MT8G	8–1	12SC7	MT8G	8–1
6F5	MTT8A	8–4	12SF5	MT8G	8–1
6F6	MT8B	8–6	12SF7	MT8G	8–1
6H6	MT8K	8–5	12SG7	MT8G	8–1
6J5	MT8G	8–1	12SH7	MT8G	8–1
6J7	MTT8A	8–4	12SJ7	MT8G	8–1
6K7	MTT8A	8–4	12SK7	MT8G	8–1
6K8	MT8G	8–2	12SQ7	MT8G	8–1
6L6	MT10A	10–1	12SR7	MT8G	8–1
6L7	MTT8A	8–4	12SW7	MT8G	8–1
6N7	MT8B	8–6	12SY7	MT8G	8–1
6Q7	MTT8A	8–4	25A6	MT8B	8–6
6R7	MTT8A	8–4	25L6	MT8B	8–6
6S7	MT8G	8–2	25Z6	MT8B	8–6
6SA7	MT8G	8–1	502–A	MT8G	8–1
6SB7–Y	MT8G	8–1	1611	MT8B	8–6
6SC7	MT8G	8–1	1612	MTT8A	8–4
6SF5	MT8G	8–1	1613	MT8B	8–6
6SF7	MT8G	8–1	1614	MT10A	10–1
6SG7	MT8G	8–1	1619	MT10A	10–1
6SH7	MT8G	8–1	1620	MTT8A	8–4
6SJ7	MT8G	8–1	1621	MT8B	8–6
6SK7	MT8G	8–1	1622	MT10A	10–1
6SQ7	MT8G	8–1	1631	MT10A	10–1
6SR7	MT8G	8–1	1632	MT8B	8–6
6SS7	MT8G	8–1	1634	MT8G	8–1
			5693	MT8G	8–1

BASES

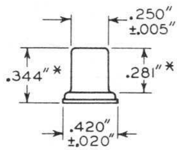
1-TERMINAL TYPES (CAPS)

MINIATURE
WITH WAFER



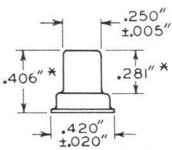
JETEC No.CI-4
RCA No.M399

SKIRTED MINIATURE



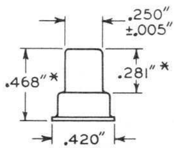
JETEC No.CI-3
RCA No.3933

SKIRTED MINIATURE



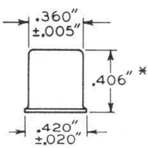
JETEC No.CI-2
RCA No.3927

SKIRTED MINIATURE



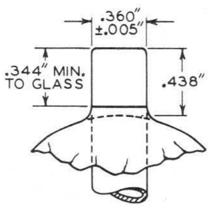
JETEC No.CI-33

SMALL



JETEC No.CI-1
RCA No.3907

SMALL
WITH TUBULAR SUPPORT



CONNECTOR SHOULD NOT EXERT MORE THAN 7 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.

JETEC No.CI-34
RCA No.3999

* Add 0.020" for solder on finished tube.

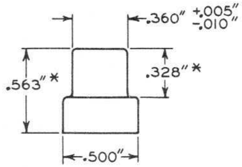
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

BASES

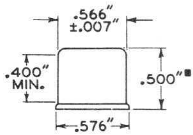
1-TERMINAL TYPES (CAPS)

SKIRTED SMALL



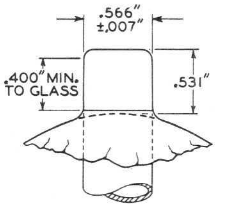
JETEC No.CI-22

MEDIUM



JETEC No.CI-5
RCA No.3903

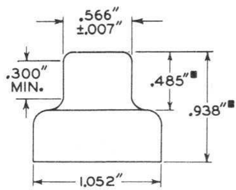
MEDIUM
WITH TUBULAR SUPPORT



CONNECTOR SHOULD NOT EXERT MORE THAN 10 POUNDS RADIAL COMPRESSION AT ANY POINT AROUND THE CIRCUMFERENCE OF THE CAP.

JETEC No.CI-39
RCA No.R7062

SKIRTED MEDIUM



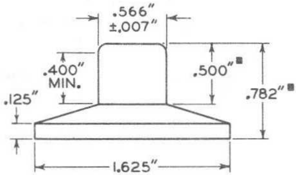
JETEC No.CI-14
RCA No.3980

* Add 0.020" for solder on finished tube.
■ Add 0.040" for solder on finished tube.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

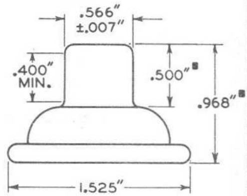
1-TERMINAL TYPES (CAPS)

SKIRTED MEDIUM



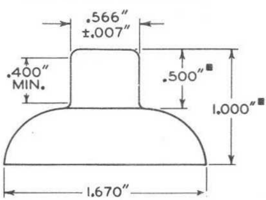
JETEC No.C1-29

SKIRTED MEDIUM WITH ROLLED EDGE



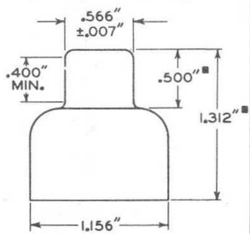
JETEC No.C1-19
RCA No.3940

SKIRTED MEDIUM



JETEC No.C1-27
RCA No.3985

SKIRTED MEDIUM



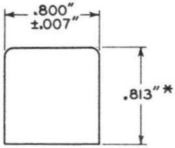
JETEC No.C1-6
RCA No.3904

■ Add 0.040" for solder on finished tube.

BASES

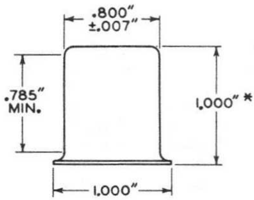
1–TERMINAL TYPES (CAPS)

LARGE



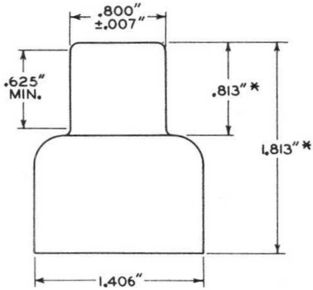
JETEC No.CI–15
RCA No.3917

LARGE



JETEC No.CI–8
RCA No.3910

SKIRTED LARGE



JETEC No.CI–9
RCA No.3905

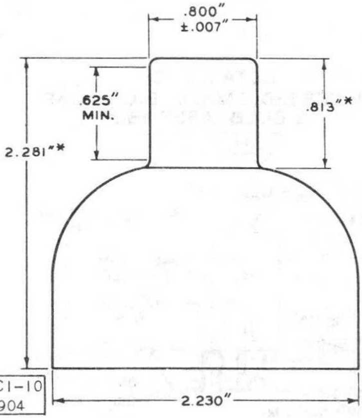
* Add 0.060" for solder on finished tube.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

BASES

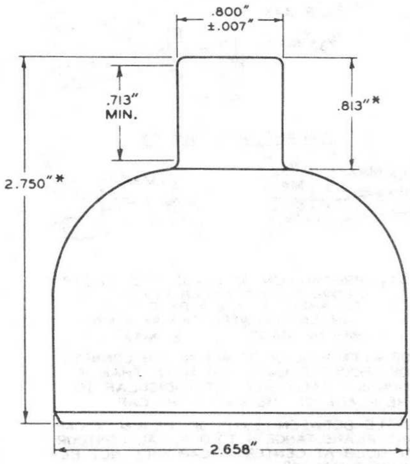
1-TERMINAL TYPES (CAPS)

SKIRTED LARGE



JETEC No.C1-10
RCA No.1904

SKIRTED LARGE



JETEC No.C1-30
RCA No.1902

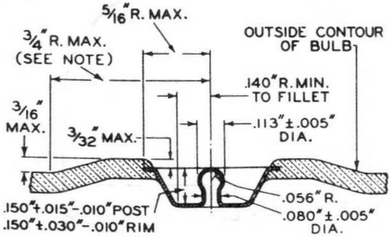
* Add 0.060" for solder on finished tube.

BASES

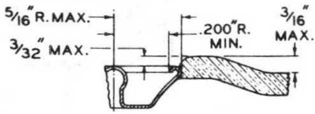
1-TERMINAL TYPES (CAPS)

DETAILS OF RECESSED SMALL BALL CAP & BULB ASSEMBLY

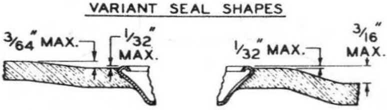
JETEC No. J1-22



ALTERNATE EDGE DESIGN



VARIANT SEAL SHAPES



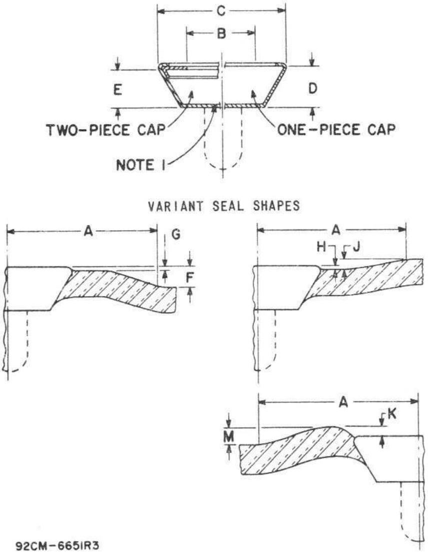
NOTE: PROTRUSION OF GLASS AROUND CAP ABOVE BULB CONTOUR IS LIMITED TO AREA BOUNDED BY CIRCLE CONCENTRIC WITH CAP AXIS AND HAVING RADIUS OF 3/4" MAX.

FOR ATTACHING OR DETACHING, THE CONNECTOR SHOULD REQUIRE NOT MORE THAN 8 POUNDS TOTAL FORCE PERPENDICULAR TO THE PLANE OF THE RIM OF THE CAP.

ANGLE BETWEEN PLANE OF THE RIM OF CAP AND PLANE TANGENT TO ORIGINAL CONTOUR OF BULB AT CENTER OF CAP WILL NOT BE MORE THAN 10°.

92CM-6535R4

Details of Recessed Small Cavity Cap & Bulb Assembly
JEDEC No.J1-21



DIMEN-SION	INCHES			MILLIMETERS			NOTES
	Min	Nom	Max	Min	Nom	Max	
A	–	–	0.750	–	–	19.05	2
B	0.307	0.312	0.317	7.798	7.925	8.051	
C	–	–	0.570	–	–	14.47	
D	0.153	–	0.173	3.89	–	4.39	
E	0.136	–	0.166	3.46	–	4.21	
F	–	–	0.188	–	–	4.78	
G	–	–	0.031	–	–	0.78	
H	–	–	0.031	–	–	0.78	
J	–	–	0.047	–	–	1.19	3
K	–	–	0.094	–	–	2.38	
M	–	–	0.188	–	–	4.78	

See Notes on reverse side.

Note 1: Connector shall not extend beyond this line. Bottom contour optional.

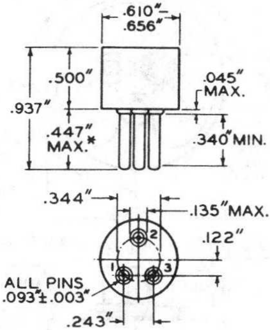
Note 2: Protrusion or depression of glass around cap above bulb contour is limited to areas bounded by circle concentric with cap axis and having radii as shown above.

Note 3: When measured in a plane perpendicular to axis of contact cone.

Note 4: When attaching or detaching the connector the total force required should not exceed eight pounds as applied perpendicular to the plane of the rim of the cap.

Note 5: The angle between plane of the rim of the cap and plane tangent to original contour of bulb at center of cap shall not exceed 10°.

SMALL-SHELL PEEWEE 3-PIN



JETEC No.A3-1
RCA No.3313

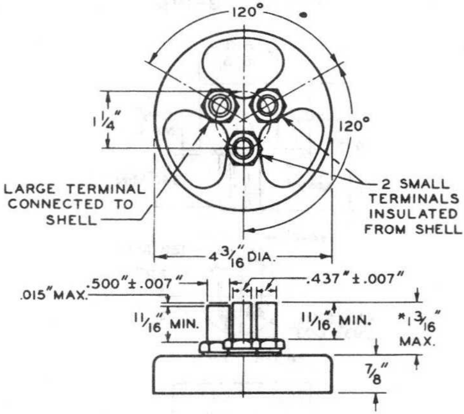
Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GA3-1) having thickness of 1/4" and three holes with diameters of 0.1030"- 0.1035" so located on a 0.3440" ± 0.0005" diameter circle that the distance along the chord between two adjacent hole centers is 0.2340" ± 0.0005" and the distance along the chord between the remaining pin and the two adjacent pins is 0.3175" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 2 pounds will not be lifted when pins are withdrawn.

* Add 0.020" for solder on finished tube.

BASES

3-TERMINAL TYPES



JETEC No.A3-80
RCA No.3232

* Add 1/8" for solder on finished tube.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

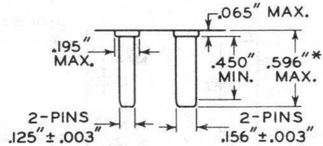
B4G

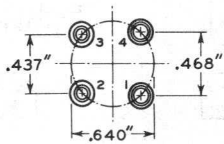
BASES

4-PIN TYPES

"SMALL 4-PIN"

PIN DIMENSIONS AND ORIENTATION

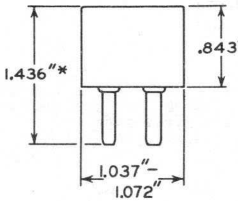




Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. GA4-1) having thickness of 1/4" and four holes, two with diameters of 0.1650" ± 0.0005" and two with diameters of 0.1340" ± 0.0005" so located on a 0.6400" ± 0.0005" diameter circle that the distance between the adjacent 0.1650" diameter pins is 0.4680" ± 0.0005" and the distance between the adjacent 0.1340" diameter pins is 0.4370" ± 0.0005".

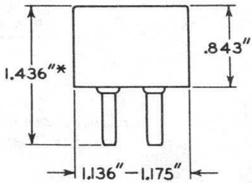
Pin fit in gauge is such that gauge together with supplementary weight totaling 4 pounds will not be lifted when pins are withdrawn.

DWARF-SHELL SMALL 4-PIN



JETEC No. A4-26
RCA No. 4107

SMALL-SHELL SMALL 4-PIN



JETEC No. A4-5
RCA No. 4108

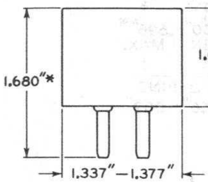
* Add 0.030" for solder on finished tube.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

BASES

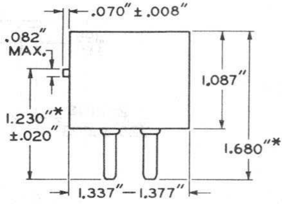
4-PIN TYPES

MEDIUM-SHELL SMALL 4-PIN



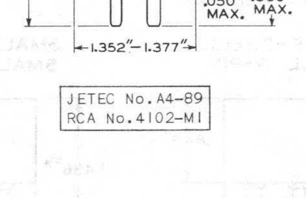
JETEC No. A4-9
RCA No. 4106

MEDIUM-SHELL SMALL 4-PIN WITH BAYONET



JETEC No. A4-10
RCA No. 4102

MEDIUM-METAL-SHELL SMALL 4-PIN WITH BAYONET



JETEC No. A4-89
RCA No. 4102-M1

For other dimensions, see first page of the "Small 4-Pin" series.

* Add 0.030" for solder on finished tube.

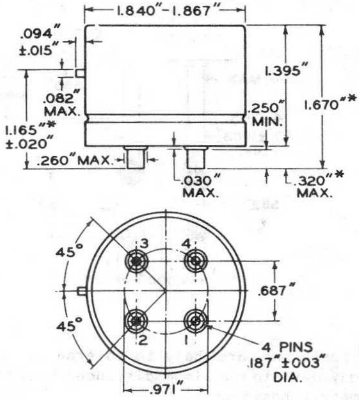
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

![RCA logo]

BASES

4-PIN TYPES

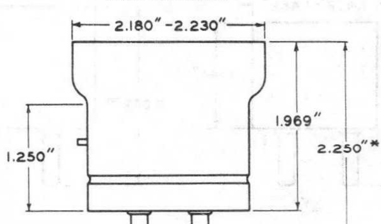
MEDIUM-METAL-SHELL JUMBO 4-PIN WITH BAYONET



JETEC No. A4-29

RCA No. 1839B

SKIRTED MEDIUM-METAL-SHELL JUMBO 4-PIN WITH BAYONET



JETEC No. A4-69

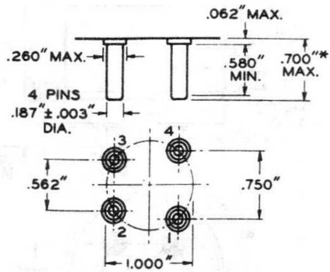
RCA No. 4260A

Other dimensions are same as Base JETEC No. A4-29 above.

* Add 0.060" for solder on finished tube.

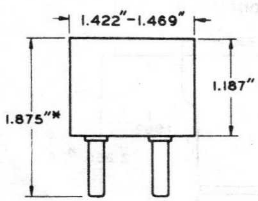
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

SUPER-JUMBO 4-PIN
PIN DIMENSIONS AND ORIENTATION



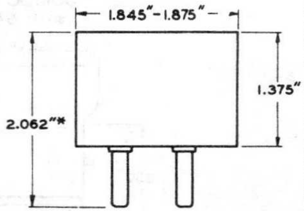
Base-pin positions are held to tolerances such that pin centers may deviate a maximum distance of 0.010" from their true geometric position.

SMALL-SHELL SUPER-JUMBO 4-PIN



JETEC No. A4-15
RCA No. 411

MEDIUM-SHELL SUPER-JUMBO 4-PIN



JETEC No. A4-16
RCA No. 412

* Add 0.060" for solder on finished tube.

TUBE DIVISION
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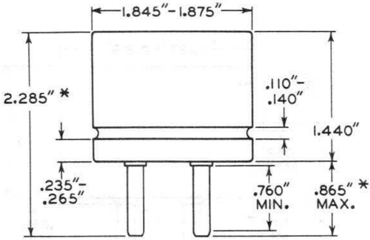
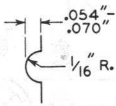
MEDIUM-METAL-SHELL SUPER-JUMBO 4-PIN



Detail of Groove



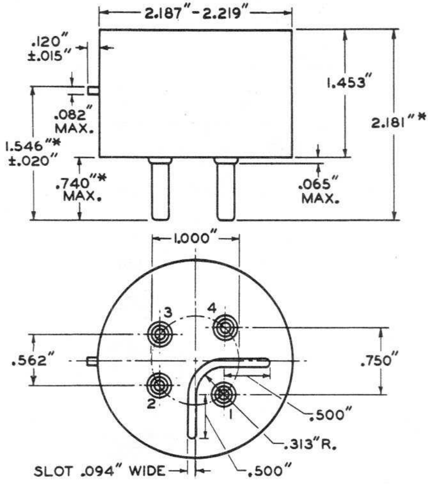
JETEC No. A4-81

For other dimensions, see first page of the "Super-Jumbo" series.

* Add 0.060" for solder on finished tube.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

LARGE - SHELL SUPER-JUMBO 4 - PIN WITH BAYONET



JETEC No. A4-88
RCA No. 3982

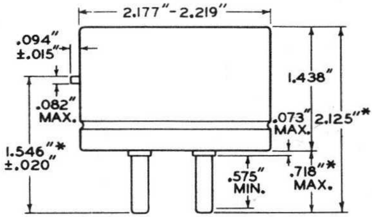
For other dimensions, see first page of the "Super-Jumbo" series.

* Add 0.060" for solder on finished tube.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

4-PIN TYPES

LARGE-METAL-SHELL
SUPER-JUMBO 4-PIN
WITH BAYONET



JETEC No. A4-18
RCA No. 4310

For other dimensions, see first page of the "Super-Jumbo" series.

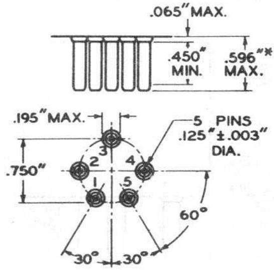
* Add 0.060" for solder on finished tube.

BASES

5-PIN TYPES

"SMALL 5-PIN"

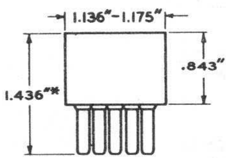
PIN DIMENSIONS AND ORIENTATION



Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. GA5-1) having thickness of 1/4" and five holes with diameters of 0.1360" ± 0.0005" so located on a 0.7500" ± 0.0005" diameter circle that the distance between centers of the four adjacent holes is 0.3750" ± 0.0005" and the distance between the center of the remaining hole and its adjacent hole centers is 0.5300" ± 0.0005".

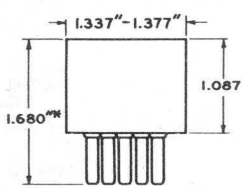
Pin fit in gauge is such that gauge together with supplementary weight totaling 4 pounds will not be lifted when pins are withdrawn.

SMALL-SHELL SMALL 5-PIN



JETEC No. A5-6
RCA No. 5108

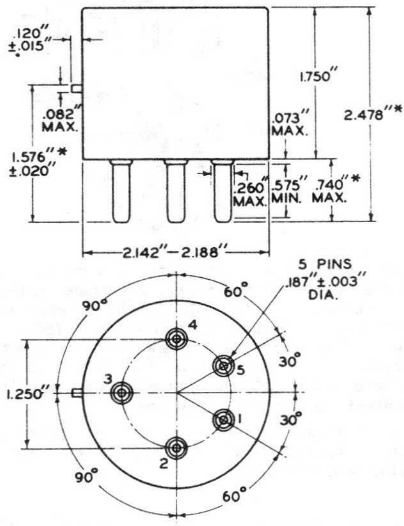
MEDIUM-SHELL SMALL 5-PIN



JETEC No. A5-11
RCA No. 5106

* Add 0.030" for solder on finished tube.

MEDIUM-SHELL GIANT 5-PIN WITH BAYONET



JETEC No. A5-19
RCA No. 5325

SPECIAL METAL-SHELL GIANT 5-PIN

See Tube Types 4-125A/4D21 and 4-250A/5D22

SPECIAL METAL-SHELL SUPER-GIANT 5-PIN

See Tube Type 4-1000A

* Add 0.030" for solder on finished tube.

5-PIN TYPES

SMALL-SHELL DUODECAL 5-PIN

For details of this base, see corresponding DUODECAL 12-PIN type

DWARF-SHELL OCTAL 5-PIN
SMALL-SHELL OCTAL 5-PIN
SMALL-WAFER OCTAL 5-PIN
SMALL-WAFER OCTAL 5-PIN WITH SLEEVE
INTERMEDIATE-SHELL OCTAL 5-PIN
SHORT INTERMEDIATE-SHELL OCTAL 5-PIN
SHORT INTERMEDIATE-SHELL OCTAL 5-PIN WITH EXTERNAL BARRIERS
MEDIUM-SHELL OCTAL 5-PIN
SHORT JUMBO-SHELL OCTAL 5-PIN

For details of above bases, see corresponding OCTAL 8-PIN type

SMALL RADIAL 5-PIN

See OUTLINES--Glass Types

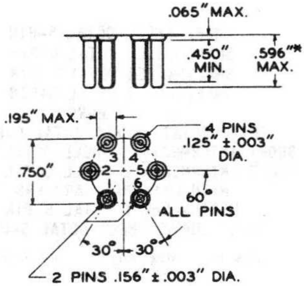
MEDIUM-MOLDED-FLARE SEPTAR 5-PIN

See Tube Type 4-65A

BASES

6-PIN TYPES

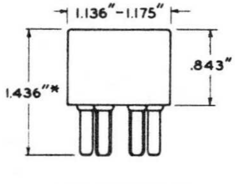
"SMALL 6-PIN"
PIN DIMENSIONS AND ORIENTATION



Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GA6-1) having thickness of 1/4" and six holes, two adjacent with diameters of 0.1650" ± 0.0005" and four with diameters of 0.1360" ± 0.0005" so located on a 0.7500" ± 0.0005" diameter circle that the distance between any two adjacent hole centers is 0.3750" ± 0.0005".

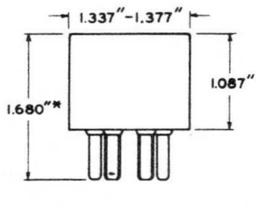
Pin fit in gauge is such that gauge together with supplementary weight totaling 4 pounds will not be lifted when pins are withdrawn.

SMALL-SHELL SMALL 6-PIN



JETEC No.A6-7
RCA No.6108

MEDIUM-SHELL SMALL 6-PIN



JETEC No.A6-12
RCA No.6106

* Add 0.030" for solder on finished tube.

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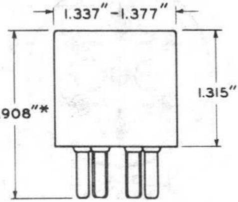
6-PIN TYPES

LONG MEDIUM-SHELL SMALL 6-PIN



RCA No.6105

For other dimensions, see first page of the "Small 6-Pin" series.

SMALL-SHELL DUODECAL 6-PIN

For details of this base, see corresponding DUODECAL 12-PIN type

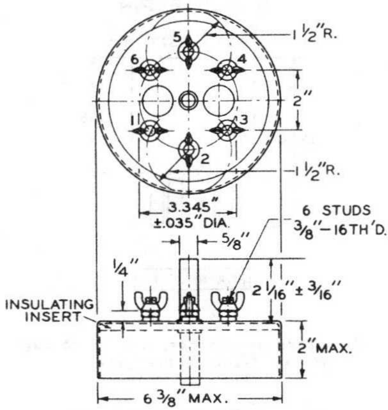
SMALL-SHELL OCTAL 6-PIN
INTERMEDIATE-SHELL OCTAL 6-PIN
SHORT INTERMEDIATE-SHELL OCTAL 6-PIN
SHORT INTERMEDIATE-SHELL OCTAL 6-PIN WITH EXTERNAL BARRIERS
MEDIUM-SHELL OCTAL 6-PIN
SHORT JUMBO-SHELL OCTAL 6-PIN
SMALL-WAFER OCTAL 6-PIN
SMALL-WAFER OCTAL 6-PIN WITH SLEEVE

For details of above bases, see corresponding OCTAL-8 PIN type

* Add 0.030" for solder on finished tube.

BASES

6-TERMINAL TYPES



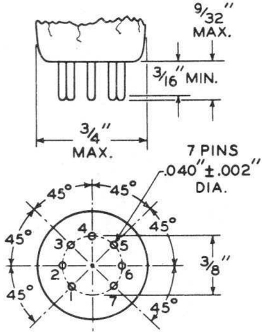
SPACE FOR CONNECTOR BETWEEN WING NUT AND LOCK NUT IS 3/16" MAX.

JETEC No. F0-6
RCA No. 6628

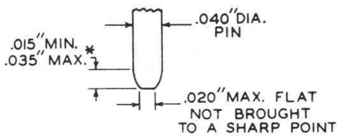
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7-PIN TYPES

SMALL-BUTTON MINIATURE 7-PIN



Miniature Base Pin Contour



JETEC No. E7-1

Base-pin positions are held to tolerances such that entire length of pins will without undue force pass into and disengage from flat-plate gauge (part of gauge JETEC No. GE7-1) having thickness of 1/4" and eight holes with diameters of 0.0520" ± 0.0005" so located on a 0.3750" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1434" ± 0.0005".

The design of the socket should be such that circuit wiring can not impress lateral strains through the socket contacts on the base pins. The point of bearing of the contacts on the base pins should not be closer than 1/8" from the bottom of the seated tube.

* This dimension around the periphery of any individual pin may vary within the limits shown.

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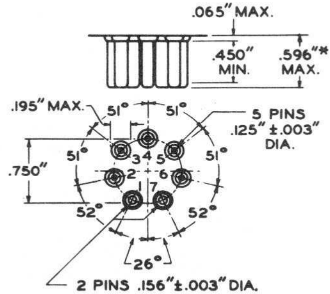
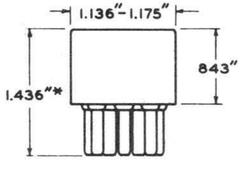
"SMALL 7-PIN"
PIN DIMENSIONS AND ORIENTATION



Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GA7-1) having thickness of 1/4" and seven holes, two adjacent with diameters of 0.1650" ± 0.0005" and five with diameters of 0.1360" ± 0.0005" so located on a 0.7500" ± 0.0005" diameter circle that the distance between centers of the adjacent 0.1650" diameter holes is 0.3288" ± 0.0005" and the distance between centers of the adjacent 0.1360" diameter holes is 0.3229" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 4 pounds will not be lifted when pins are withdrawn.

SMALL-SHELL SMALL 7-PIN



JETEC No.A7-8
RCA No.7108

* Add 0.030" for solder on finished tube.

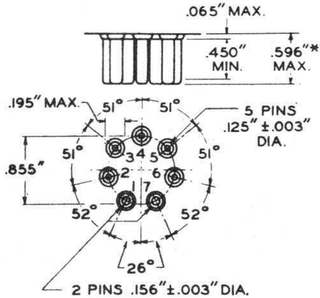
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

BASES

7-PIN TYPES

"MEDIUM 7-PIN"

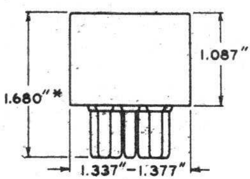
PIN DIMENSIONS AND ORIENTATION



Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. GA7-2) having thickness of 1/4" and seven holes, two adjacent with diameters of 0.1650" ± 0.0005" and five with diameters of 0.1360" ± 0.0005" so located on a 0.8550" ± 0.0005" diameter circle that the distance between centers of the adjacent 0.1650" diameter holes is 0.3748" ± 0.0005" and the distance between centers of the adjacent 0.1360" diameter holes is 0.3681" ± 0.0005".

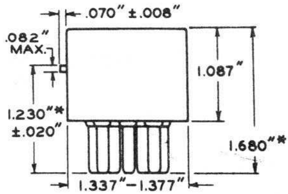
Pin fit in gauge is such that gauge together with supplementary weight totaling 4 pounds will not be lifted when pins are withdrawn.

MEDIUM-SHELL MEDIUM 7-PIN



JETEC No. A7-13
RCA No. 7306

MEDIUM-SHELL MEDIUM 7-PIN WITH BAYONET



JETEC No. A7-14
RCA No. 7302

* Add 0.030" for solder on finished tube.

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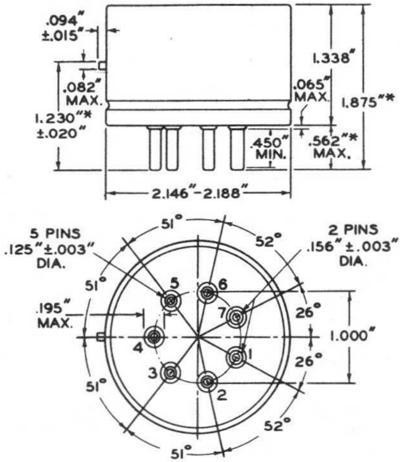
MEDIUM-METAL-SHELL GIANT 7-PIN
WITH BAYONET



JETEC No. A7-17
RCA No. 7609

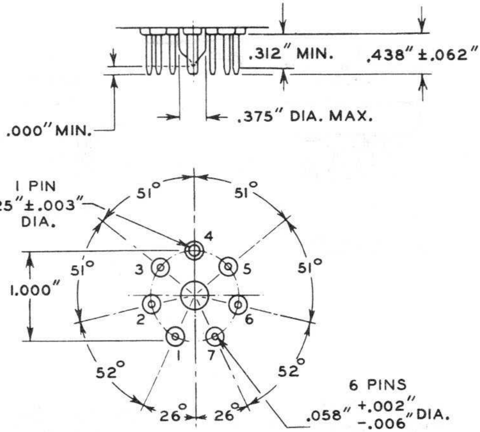
VENTILATED MEDIUM-METAL-SHELL GIANT 7-PIN

See Tube Type 4E27A/5-125B

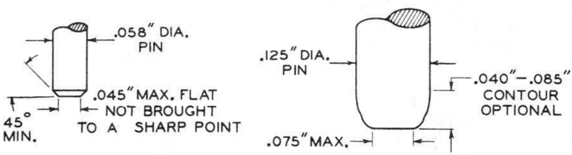
* Add 0.060" for solder on finished tube.

"SEPTAR"

PIN DIMENSIONS AND ORIENTATION



Septar Base Pin Contour



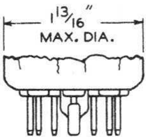
Base-pin positions are held to tolerances such that entire length of pins will without undue force pass into and disengage from flat-plate gauge having thickness of 3/8" and seven holes, one with diameter of 0.1450" ± 0.0005" and six with diameters of 0.0800" ± 0.0005" located on a 1.0000" ± 0.0005" diameter circle at specified angles with a tolerance of ±5' for each angle. Gauge is also provided with a hole 0.500" ± 0.010" concentric with pin circle.

It is essential that the socket shall be constructed with floating-contact clips.

BASES

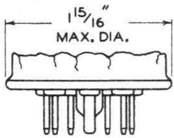
7-PIN TYPES

MEDIUM-BUTTON SEPTAR 7-PIN



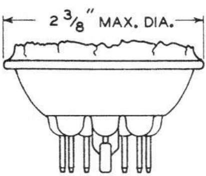
JETEC No. E7-20
RCA No. FSB6014

SMALL-WAFER SEPTAR 7-PIN



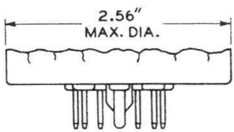
JETEC No. E7-21
RCA No. FSB712

MEDIUM MOLDED-FLARE SEPTAR 7-PIN



JETEC No. E7-2
RCA No. FSB603

JUMBO-BUTTON SEPTAR 7-PIN



JETEC No. E7-46
RCA No. FSB6038

For other dimensions of above bases, see first page of the "Septar" series

7–PIN TYPES

SMALL-SHELL DUODECAL 7-PIN

For details of this base, see corresponding SMALL-SHELL DUODECAL 12-PIN type

SMALL-BUTTON EIGHTAR 7-PIN

For details of this base, see corresponding SMALL-BUTTON EIGHTAR 8-PIN type

SMALL-SHELL OCTAL 7-PIN

SHORT INTERMEDIATE-SHELL OCTAL 7-PIN

SHORT INTERMEDIATE-SHELL OCTAL 7-PIN WITH EXTERNAL BARRIERS

INTERMEDIATE-SHELL OCTAL 7-PIN

SHORT MEDIUM-SHELL OCTAL 7-PIN WITH EXTERNAL BARRIERS, STYLES A AND B

MEDIUM-SHELL OCTAL 7-PIN

SHORT JUMBO-SHELL OCTAL 7-PIN WITH EXTERNAL BARRIERS

SMALL-WAFER OCTAL 7-PIN

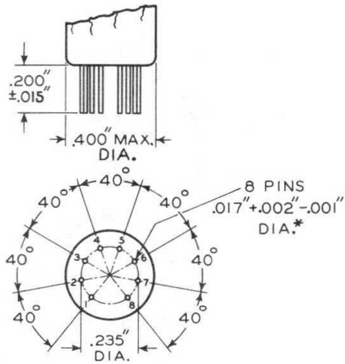
SMALL-WAFER OCTAL 7-PIN WITH SLEEVE

For details of above bases, see corresponding OCTAL 8-PIN type

SMALL RADIAL 7-PIN

See OUTLINES--Glass Tubes

SMALL-BUTTON SUB-MINAR 8-PIN



JETEC No.E8-9

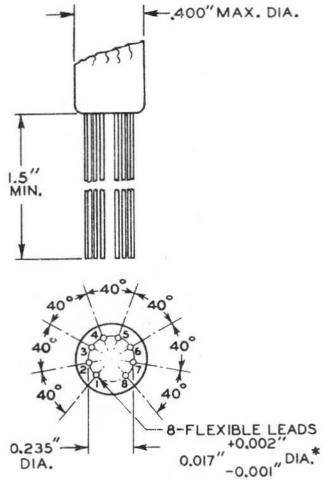
Base-pin positions are held to tolerances such that entire length of pins will without undue force pass into and disengage from flat-plate gauge JETEC No.GE8-1. This gauge contains a flat-plate section having thickness of 13/64" and nine holes with diameters of 0.0240" ± 0.0005" so located on a 0.2350" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.0804" ± 0.0005".

The design of the socket should be such that circuit wiring can not impress lateral strains through the socket contacts on the base pins. The point of bearing of the contacts on the base pins should not be closer than 0.050" from the bottom of the seated tube.

* The specified pin diameter applies only in the zone between 0.050" from the base seat and the end of the pin.

BASES

8-LEAD TYPES

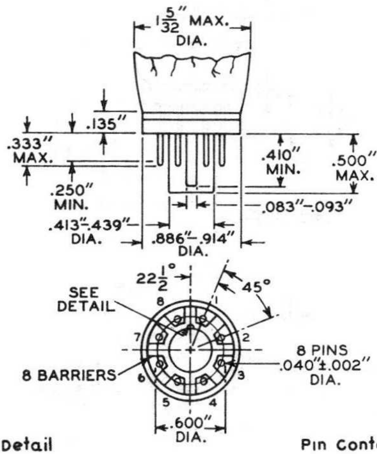


JETEC No. E8-10

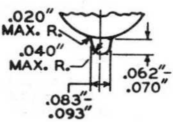
* The specified lead diameter applies only in the zone between 0.050" and 0.250" from the base seat. Between 0.250" and 1.500", a maximum diameter of 0.021" is held. Outside of these zones, the lead diameter is not controlled.

8-PIN TYPES

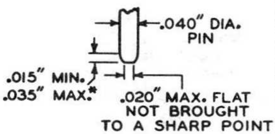
SMALL-BUTTON NEOEIGHTAR



Detail



Pin Contour



No. of Pins	*Pins*	*JEDEC No.*	*RCA No.*#
8-Pin	1,2,3,4,5,6,7,8	B8-218	80001
7-Pin■	1,2,3,4, 6,7,8	B7-208	80001
7-Pin▲	2,3,4,5,6,7,8	B7-219	80001

Base-pin positions are held to tolerances such that the base will fit a flat-plate gauge having a thickness of 3/8" and eight equally spaced holes of 0.0550" ± 0.0005" diameter located on a 0.6000" ± 0.0005" diameter circle. The gauge is also provided with a center hole to provide 0.010" diametric clearance for the lug and key. Pin fit in the gauge shall be such that the entire length of pins will, without undue force, enter into and disengage from the gauge.

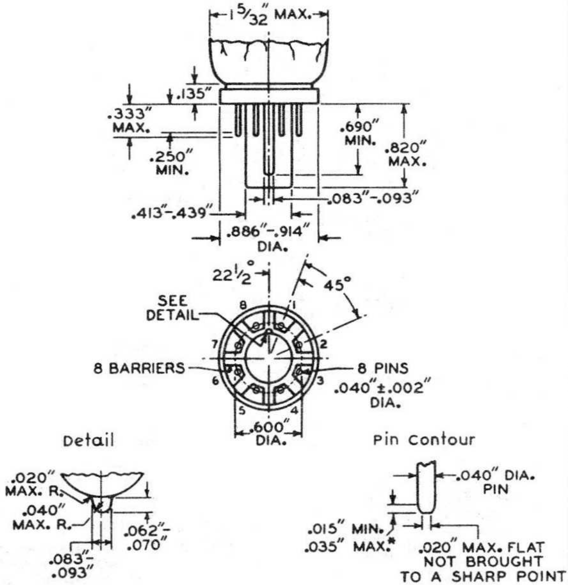
* This dimension around the periphery of any individual pin may vary within the limits shown.

\# This number applies to wafer only.

■ Arrangement 1.

▲ Arrangement 2.

SMALL-BUTTON EIGHTAR



No. of Pins	*Pins*	*JEDEC No.*	*RCA No.#*
8-Pin	1,2,3,4,5,6,7,8	B8-181	80000
7-Pin■	2,3,4,5,6,7,8	B7-182	80000
7-Pin▲	1,2,3,4, 6,7,8	B7-183	80000

Base-pin positions are held to tolerances such that the base will fit a flat-plate gauge having a thickness of 3/8" and eight equally spaced holes of 0.0550" ± 0.0005" diameter located on a 0.6000" ± 0.0005" diameter circle. The gauge is also provided with a center hole to provide 0.010" diametric clearance for the lug and key. Pin fit in the gauge shall be such that the entire length of pins will, without undue force, enter into and disengage from the gauge.

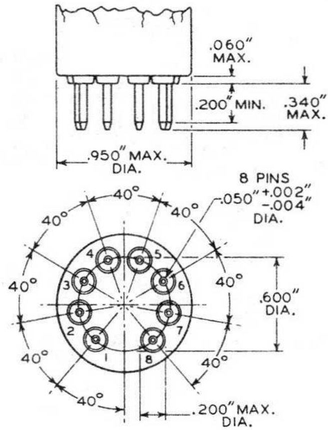
* This dimension around the periphery of any individual pin may vary within the limits shown.

\# This number applies to wafer only.

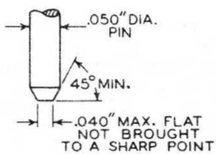
■ Arrangement 1.

▲ Arrangement 2.

SMALL-BUTTON NEODITETRAR 8-PIN



Neoditetrar-Base Pin Contour

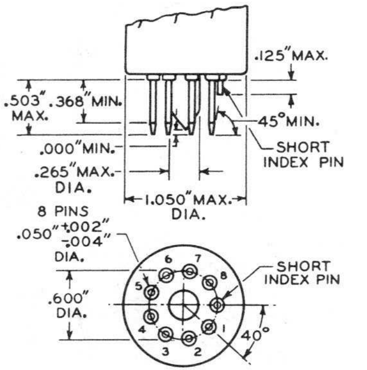


JEDEC No. E8-49
RCA No. FSB6006#

Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from flat-plate gauge having thickness of 1/4" and nine holes with diameters of 0.0700" ± 0.0005" so located on a 0.6000" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2052" ± 0.0005".

This number applies to stem only.

SMALL-BUTTON DITETRAR 8-PIN

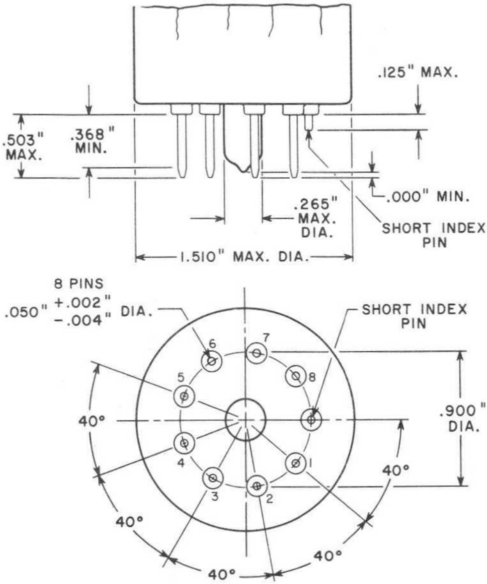


JEDEC No. E8-11	
RCA No.	FSB675#
	FSB6015#

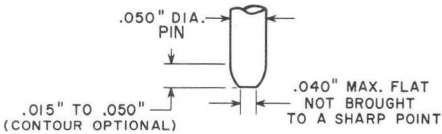
Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from flat-plate gauge having thickness of 1/4" and nine holes with diameters of 0.0700" ± 0.0005" so located on a 0.6000" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2052" ± 0.0005". Gauge is also provided with a hole having diameter of 0.300" ± 0.001" concentric with the pin circle.

This number applies to stem only.

SMALL-BUTTON SUPERDITETRAR
Pin Dimensions and Orientation



Superditetrar-Base-Pin Contour



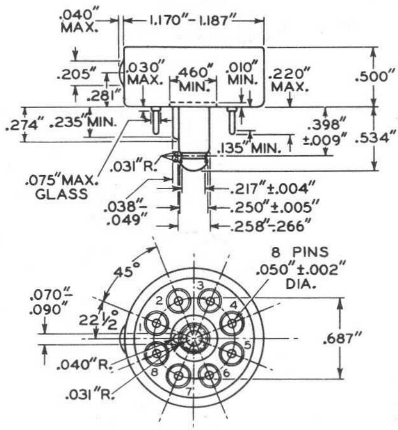
JEDEC No.E8-78
RCA No.FSB6055#

Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from a flat-plate gauge having a thickness of

This number applies to stem only.

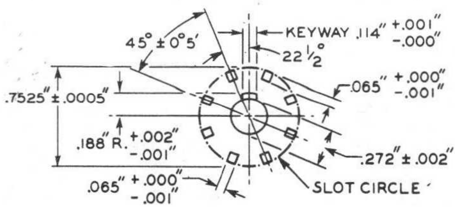
1/4" and nine holes with diameters of 0.0700" ± 0.0005" so located on a 0.9000" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.3078" ± 0.0005". Gauge is also provided with a hole having diameter of 0.300" ± 0.001" concentric with the pin circle.

LOCK-IN 8-PIN



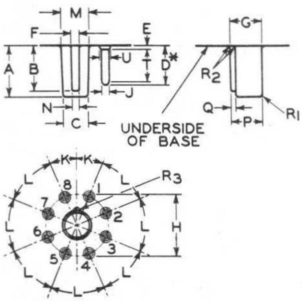
JETEC No. D8-1

Base-pin positions are held to tolerances such that entire length of pins will without undue force pass into and disengage from gauge JETEC No. GD8-1. This gauge contains a flat-plate section having thickness of 1/4" and eight slots located and dimensioned as shown on the following diagram. Flat-plate section is also provided with a hole having diameter of 0.272" ± 0.002" concentric with slot circle, and with a keyway as shown on the diagram.



8-PIN TYPES

"OCTAL"
PIN DIMENSIONS AND ORIENTATION AND INDEX GUIDE



	Min.	Center	Max.
A	.550"	.560"	.570"
B	.490"	.500"	.510"
C	.300"	.308"	.315"
D	.427"	.437"	.447"
E	–	–	.050"
F	.085"	.090"	.095"
G	.352"	.362"	.372"
H	–	.687"	–
J	.090"	.093"	.096"
K	–	22.5°	–

	Min.	Center	Max.
L	–	45°	–
M	.305"	.312"	.317"
N	.075"	.080"	.085"
P	.343"	.353"	.363"
Q	.040"	.047"	.055"
R_1	–	.031"	–
R_2	–	–	.050"
R_3	–	.040"	–
T	.340"	–	–
U	–	–	.135"

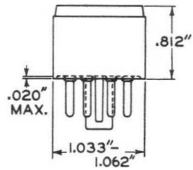
Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. GB8-1) having thickness of 1/4" and eight holes with diameters of 0.1030" ±0.0005" so located on a 0.6870" ±0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2629" ±0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 2 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.

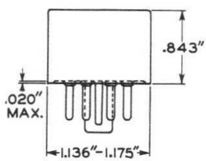
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

DWARF-SHELL OCTAL



No. of Pins	*Pins*	*JÊDEC No.*	*RCA No.*
5-Pin	1, 3, 5, 7,8	B5-45	–

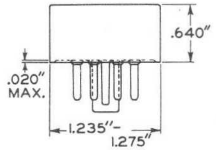
SMALL-SHELL OCTAL



No. of Pins	*Pins*	*JEDEC No.*	*RCA No.*
8-Pin	1,2,3,4,5,6,7,8	B8-1	8529
7-Pin	1,2,3,4,5, 7,8	B7-2	7529
6-Pin	1,2,3, 5, 7,8	B6-3	6529
5-Pin	1,2, 4, 6, 8	B5-5	5529

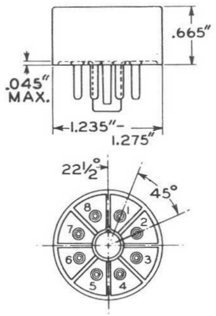
For other dimensions, see *first page of the "Octal" series*

SHORT INTERMEDIATE-SHELL OCTAL



No. of Pins	Pins	JEDEC No.	RCA No.
8-Pin	1,2,3,4,5,6,7,8	B8-46	8555
7-Pin	1,2,3,4,5, 7,8	B7-47	7555
6-Pin	1,2,3, 5, 7,8	B6-48	6555
5-Pin	1,2, 4, 6, 8	B5-49	5555

SHORT INTERMEDIATE-SHELL OCTAL
WITH EXTERNAL BARRIERS

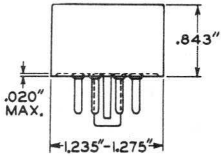


No. of Pins	Pins	JEDEC No.	RCA No.
8-Pin	1,2,3,4,5,6,7,8	B8-58	8565
7-Pin[a]	1,2,3,4,5, 7,8	B7-59	7565
7-Pin[b]	1,2,3, 5,6,7,8	B7-211	-
6-Pin[a]	1,2,3, 5, 7,8	B6-60	6565
6-Pin[b]	2,3,4,5, 7,8	B6-84	6765
5-Pin[a]	1,2, 4, 6, 8	B5-62	5565
5-Pin[b]	2,3, 5, 7,8	B5-85	5765
5-Pin[c]	2, 4,5, 7,8	B5-187	-

For other dimensions, see *first page of the "Octal" series*

[a] Arrangement 1.
[b] Arrangement 2.
[c] Arrangement 3.

INTERMEDIATE-SHELL OCTAL



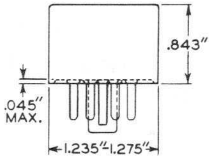
No. of Pins	*Pins*	*JEDEC No.*	*RCA No.*
8-Pin	1,2,3,4,5,6,7,8	B8-6	8537
7-Pin[a]	1,2,3,4,5, 7,8	B7-7	7537
7-Pin[b]	1,2,3, 5,6,7,8	B7-166	39100
6-Pin[a]	1,2,3, 5, 7,8	B6-8	6537
6-Pin[b]	2,3,4,5, 7,8	B6-81	6737
5-Pin[a]	1,2, 4, 6, 8	B5-10	5537
5-Pin[b]	2,3, 5, 7,8	B5-82	5737

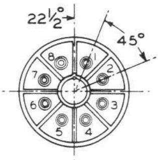
For other dimensions, see *first page of the "Octal" series*

[a] Arrangement 1.
[b] Arrangement 2.

INTERMEDIATE-SHELL OCTAL

WITH EXTERNAL BARRIERS





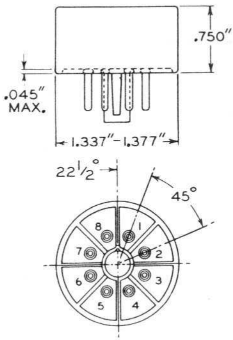
No. of Pins	*Pins*	*JEDEC No.*	*RCA No.*
8-Pin	1,2,3,4,5,6,7,8	B8-142	8566
7-Pin	1,2,3,4,5, 7,8	B7-143	7566
6-Pin[a]	1,2,3, 5, 7,8	B6-144	6566
6-Pin[b]	2,3,4,5, 7,8	B6-145	6766
6-Pin[c]	2,3, 5,6,7,8	B6-229	39111
5-Pin[a]	1,2, 4, 6, 8	B5-146	5566
5-Pin[b]	2,3, 5, 7,8	B5-147	5766

For other dimensions, see *first page of the "Octal" series*

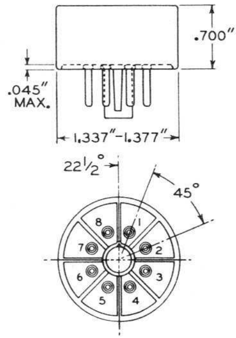
a Arrangement 1.
b Arrangement 2.
c Arrangement 3.

SHORT MEDIUM-SHELL OCTAL
WITH EXTERNAL BARRIERS

STYLE A



STYLE B

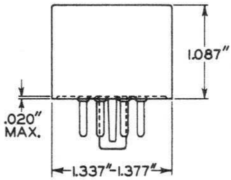


No. of Pins	*Pins*	*Style*	*JEDEC No.*	*RCA No.*
8-Pin	1,2,3,4,5,6,7,8	A	B8-110	39081
8-Pin	1,2,3,4,5,6,7,8	B	B8-118	8564
7-Pin[a]	1,2,3,4,5, 7,8	A	B7-111	–
7-Pin[a]	1,2,3,4,5, 7,8	B	B7-119	7564
7-Pin[b]	1,2,3, 5,6,7,8	B	B7-227	39113
7-Pin[c]	1,2,3,4, 6,7,8	B	B7-235	–
6-Pin[a]	1,2,3, 5, 7,8	A	B6-112	–
6-Pin[a]	1,2,3, 5, 7,8	B	B6-120	6564
6-Pin[b]	2,3,4,5, 7,8	A	B6-148	–
6-Pin[b]	2,3,4,5, 7,8	B	B6-122	6764
5-Pin[a]	1,2, 4, 6, 8	A	B5-113	–
5-Pin[a]	1,2, 4, 6, 8	B	B5-121	5564
5-Pin[b]	2,3, 5, 7,8	A	B5-149	–
5-Pin[b]	2,3, 5, 7,8	B	B5-123	5764
5-Pin[c]	1,2,3, 5, 7	A	B5-234	–
5-Pin[c]	1,2,3, 5, 7	B	B5-239	39116
5-Pin[d]	2, 4,5, 7,8	B	B5-190	39110

For other dimensions, see *first page of the "Octal" series*

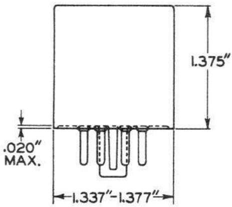
[a] Arrangement 1.
[b] Arrangement 2.
[c] Arrangement 3.
[d] Arrangement 4.

MEDIUM-SHELL OCTAL



No. of Pins	*Pins*	*JEDEC No.*	*RCA No.*
8-Pin	1,2,3,4,5,6,7,8	B8-11	8533
7-Pin	1,2,3,4,5, 7,8	B7-12	7533
6-Pin	1,2,3, 5, 7,8	B6-13	6533
5-Pin[a]	1,2, 4, 6, 8	B5-15	5533
5-Pin[b]	2,3, 5, 7,8	B5-224	5733

LONG MEDIUM-SHELL OCTAL



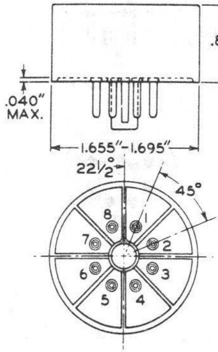
No. of Pins	*Pins*	*JEDEC No.*	*RCA No.*
8-Pin	1,2,3,4,5,6,7,8	B8-65	8545
5-Pin	2,3, 5, 7,8	B5-80	5545

For other dimensions of above bases, see *first page of the "Octal" series*

[a] Arrangement 1.
[b] Arrangement 2.

8-PIN TYPES

SHORT JUMBO-SHELL OCTAL
WITH EXTERNAL BARRIERS



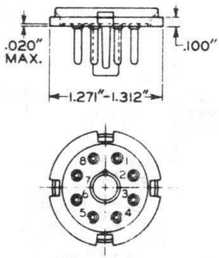
No. of Pins	Pins	JETEC No.	RCA No.
8-Pin	1,2,3,4,5,6,7,8	B8-71	8556
7-Pin	1,2,3,4,5, 7,8	B7-72	7556
6-Pin	1,2,3, 5, 7,8	B6-73	6556
5-Pin	1,2, 4, 6, 8	B5-74	5556

For other dimensions, see first page of the "Octal" series

BASES

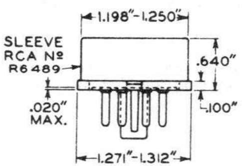
8-PIN TYPES

SMALL-WAFER OCTAL



No. of Pins	Pins	JETEC No.	RCA No.
8-Pin	1,2,3,4,5,6,7,8	B8-21	8527
7-Pin	1,2,3,4,5, 7,8	B7-22	7527
6-Pin	1,2,3, 5, 7,8	B6-23	6527
5-Pin	1,2, 4, 6, 8	B5-25	5527

SMALL-WAFER OCTAL
WITH SHORT SLEEVE



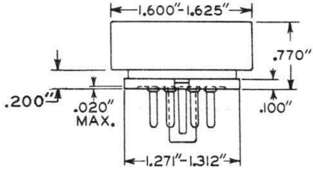
No. of Pins	Pins	JETEC No.	RCA No.
8-Pin	1,2,3,4,5,6,7,8	B8-44	-

For other dimensions of above bases, see first page of the "Octal" series

BASES

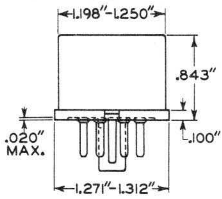
8-PIN TYPES

SMALL-WAFER OCTAL
WITH "770" SLEEVE



No. of Pins	*Pins*	*JETEC No.*	*RCA No.*	
8-Pin	1,2,3,4,5,6,7,8	B8-150	MB8540-7	MB8527-603
7-Pin	1,2,3,4,5, 7,8	B7-151	MB7540-4	-
6-Pin■	1,2,3, 5, 7,8	B6-152	MB6540-5	-
6-Pin▲	2,3,4,5, 7,8	B6-153	MB6740-1	-
5-Pin■	1,2, 4, 6, 8	B5-154	MB5540-1	-
5-Pin▲	2,3, 5, 7,8	B5-155	MB5740-1	-

SMALL-WAFER OCTAL
WITH "843" SLEEVE



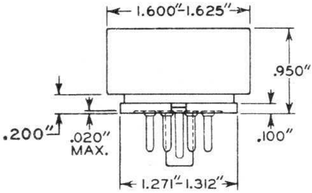
No. of Pins	*Pins*	*JETEC No.*	*RCA No.*	
8-Pin	1,2,3,4,5,6,7,8	B8-26	MB8527-1	MB8540-3
7-Pin	1,2,3,4,5, 7,8	B7-27	MB7527-1	MB7540-1
6-Pin	1,2,3, 5, 7,8	B6-28	MB6527-1	MB6540-3
5-Pin	1,2, 4, 6, 8	B5-30	MB5527-1	MB5540-2

For other dimensions of above bases, see first page of the "Octal" series

■ Arrangement 1.
▲ Arrangement 2.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

SMALL-WAFER OCTAL
WITH "950" SLEEVE



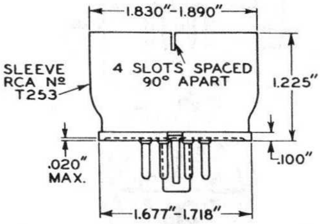
No. of Pins	*Pins*	*JETEC No.*	*RCA No.*
8-Pin	1,2,3,4,5,6,7,8	B8-191	MB8540-8
7-Pin	1,2,3,4,5, 7,8	B7-192	MB7540-5
6-Pin■	1,2,3, 5, 7,8	B6-193	MB6540-6
6-Pin▲	2,3,4,5, 7,8	B6-194	MB6740-2
5-Pin■	1,2, 4, 6, 8	B5-195	MB5540-3
5-Pin▲	2,3, 5, 7,8	B5-196	MB5740-2

For other dimensions of above base, see first page of the "Octal" series

■ Arrangement 1.
▲ Arrangement 2.

8-PIN TYPES

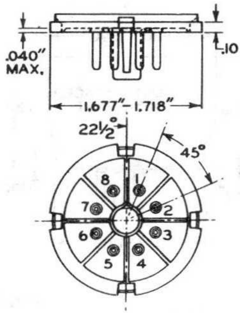
LARGE-WAFER OCTAL
WITH FLARED SLEEVE



No. of Pins	*Pins*	*JETEC No.*	*RCA No.*
8-Pin	1,2,3,4,5,6,7,8	–	–

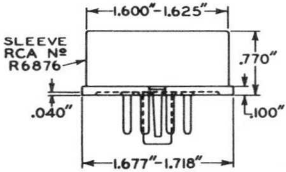
For other dimensions, see first page of the "Octal" series

LARGE-WAFER OCTAL
WITH EXTERNAL BARRIERS



No. of Pins	Pins	JETEC No.	RCA No.
8-Pin	1,2,3,4,5,6,7,8	B8-94	8554

LARGE-WAFER OCTAL
WITH EXTERNAL BARRIERS AND SLEEVE



No. of Pins	Pins	JETEC No.	RCA No.
8-Pin	1,2,3,4,5,6,7,8	B8-98	-

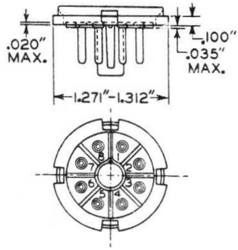
For other dimensions of above bases, see first page of the "Octal" series

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

BASES

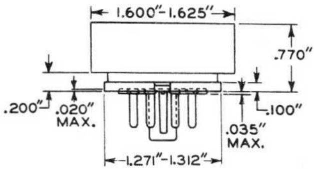
8-PIN TYPES

SMALL-WAFER OCTAL
WITH EXTERNAL BARRIERS



No. of Pins	*Pins*	*JETEC No.*	*RCA No.*
8-Pin	1,2,3,4,5,6,7,8	B8-67	8559
7-Pin	1,2,3,4,5, 7,8	B7-68	7559
6-Pin■	1,2,3, 5, 7,8	B6-69	6559
6-Pin▲	2,3,4,5, 7,8	B6-205	6759
5-Pin■	1,2, 4, 6, 8	B5-70	5559
5-Pin▲	2,3, 5, 7,8	B5-206	5759

SMALL-WAFER OCTAL
WITH EXTERNAL BARRIERS AND "770" SLEEVE

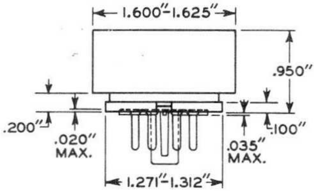


No. of Pins	*Pins*	*JETEC No.*	*RCA No.*
8-Pin	1,2,3,4,5,6,7,8	B8-159	MB8559-2
7-Pin	1,2,3,4,5, 7,8	B7-160	MB7559-1
6-Pin■	1,2,3, 5, 7,8	B6-161	MB6559-1
6-Pin▲	2,3,4,5, 7,8	B6-162	MB6759-1
5-Pin■	1,2, 4, 6, 8	B5-163	MB5559-1
5-Pin▲	2,3, 5, 7,8	B5-164	MB5759-1

For other dimensions of above bases, see first page of the "Octal" series

■ Arrangement 1.
▲ Arrangement 2.

SMALL-WAFER OCTAL
WITH EXTERNAL BARRIERS AND "950" SLEEVE

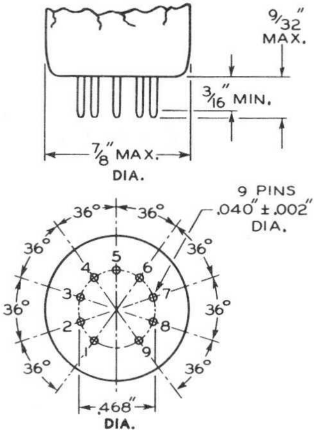


No. of Pins	*Pins*	*JETEC No.*	*RCA No.*
8-Pin	1,2,3,4,5,6,7,8	B8-197	MB8559-4
7-Pin	1,2.3,4,5, 7,8	B7-198	MB7559-2
6-Pin■	1,2,3, 5, 7,8	B6-199	MB6559-2
6-Pin▲	2,3,4,5, 7,8	B6-200	MB6759-2
5-Pin■	1,2, 4, 6, 8	B5-201	MB5559-2
5-Pin▲	2,3, 5, 7,8	B5-202	MB5759-2

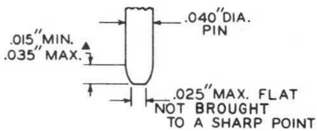
For other dimensions of above base, see first page of the "Octal" series

■ Arrangement 1.
▲ Arrangement 2.

SMALL-BUTTON NOVAL 9-PIN
Pin Dimensions and Orientation



Noval-Base-Pin Contour



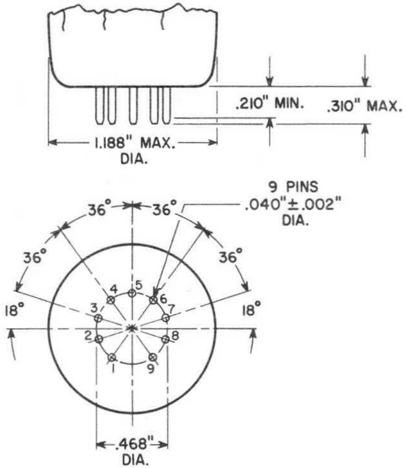
JEDEC No. E9-1
RCA No. FSD169

Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from gauge JEDEC No. GE9-1. This gauge contains a flat-plate section having thickness of 1/4" and ten holes with diameters of 0.0520" ± 0.0005" so located on a 0.4680" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1446" ± 0.0005".

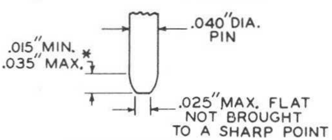
The design of the socket should be such that circuit wiring can not impress lateral strains through the socket contacts on the base pins. The point of bearing of the contacts on the base pins should not be closer than 1/8" from the bottom of the seated tube.

* This dimension around the periphery of any individual pin may vary within the limits shown. The surface of the pin is convex or conical in shape and not brought to a sharp point.

LARGE-BUTTON NEONOVAL 9-PIN
Pin Dimensions and Orientation



Neonoval-Base-Pin Contour



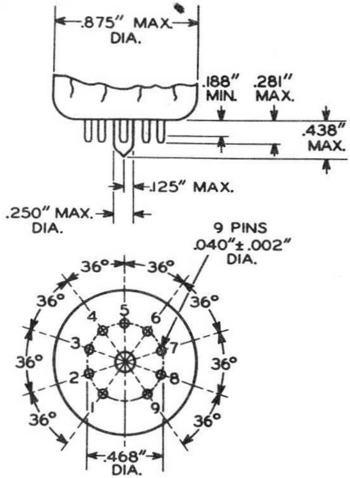
JEDEC No. E9-68
RCA No. FSD171

Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from gauge JEDEC No. GE9-4. This gauge contains a flat-plate section having thickness of 1/4" and ten holes with diameters of 0.0520" ± 0.0005" so located on a 0.4680" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1446" ± 0.0005".

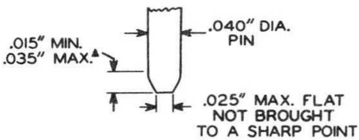
The design of the socket should be such that circuit wiring can not impress lateral strains through the socket contacts on the base pins. The point of bearing of the contacts on the base pins should not be closer than 1/8" from the bottom of the seated tube.

* This dimension around the periphery of any individual pin may vary within the limits shown. The surface of the pin is convex or conical in shape and not brought to a sharp point.

SMALL-BUTTON NINAR 9-PIN
Pin Dimensions and Orientation



Ninar-Base-Pin Contour



JEDEC No.E9-37
RCA No.FSB6047

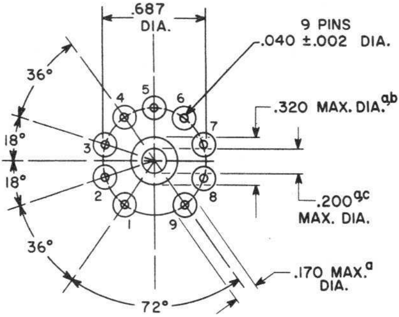
Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from gauge JEDEC No.GE9-2. This gauge contains a flat-plate section having thickness of 0.250" and ten holes with diameters of 0.0520" ± 0.0005" so located on a 0.4680" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1446" ± 0.0005". Gauge is also provided with a hole 0.281" minimum diameter concentric with the pin circle.

▲ This dimension around the periphery of any individual pin may vary within the limits shown. The surface of the pin is convex or conical in shape and not brought to a sharp point.

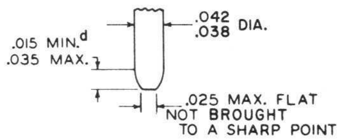
SMALL-BUTTON NINAR 9-PIN (CONT'D)

The design of the socket should be such that circuit wiring can not impress lateral strains through the socket contacts on the base pins. The point of bearing of the contacts on the base pins should not be closer than 1/8" from the bottom of the seated tube.

NOVAR
Pin Dimensions and Orientation



Novar-Base-Pin Contour



92CS-11128R1

DIMENSIONS IN INCHES

Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from flat-plate gauge having a thickness of 0.350" and ten holes with diameters of 0.0520" ± 0.0005" so located on a 0.6870" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2123" ± 0.0005". Gauge is also provided with a hole 0.330" + 0.005" - 0.000" diameter concentric with the pin circle.

[a] This dimension applies only to JEDEC Base Nos. E9-88 and E9-89.

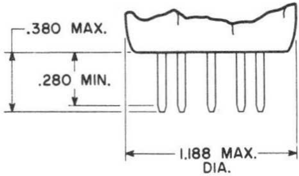
[b] Limit of exhaust tube fillet diameter.

[c] Exhaust tube maximum diameter.

[d] This dimension around the periphery of any individual pin may vary within the limits shown. The surface of the pin is convex or conical in shape and not brought to a sharp point.

TOP EXHAUST NOVAR

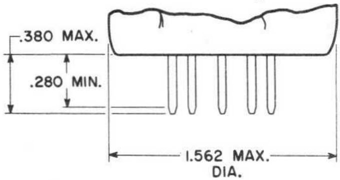
Small-Button Base



JEDEC No. E9-75
RCA No. FSE36

Fits Gauge
JEDEC No. GE9-5

Large-Button Base

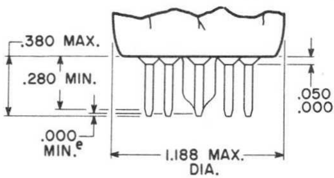


JEDEC No. E9-76
RCA No. FSE22A

Fits Gauge
JEDEC No. GE9-6

BOTTOM EXHAUST NOVAR

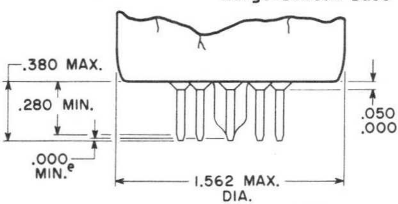
Small-Button Base



JEDEC No. E9-89
RCA No. FSE43G

Fits Gauge
JEDEC No. GE9-5

Large-Button Base



JEDEC No. E9-88
RCA No. FSE43C

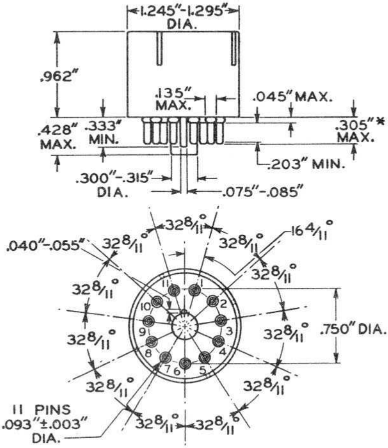
Fits Gauge
JEDEC No. GE9-6

92CM-11300R1

DIMENSIONS IN INCHES

[e] The exhaust tip shall not extend beyond the plane of the base pin ends.

SMALL-SHELL NEOSUBMAGNAL 11-PIN
Pin Dimensions and Orientation



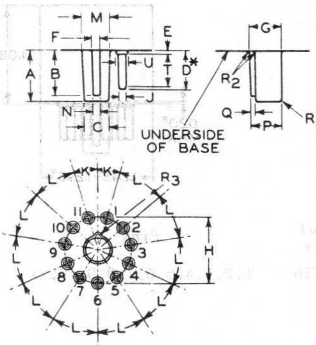
JEDEC No.B11-104
RCA No.11442

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JEDEC Group 2, No.GB11-2) having thickness of 1/4" and eleven holes with diameters of 0.1030" ± 0.0005" so located on a 0.7500" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.213" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.

"SUBMAGNAL"
PIN DIMENSIONS AND ORIENTATION AND INDEX GUIDE



	Min.	Center	Max.		Min.	Center	Max.
A	.550"	.560"	.570"	L	–	32-8/11°	–
B	.490"	.500"	.510"	M	.305"	.312"	.317"
C	.300"	.308"	.315"	N	.075"	.080"	.085"
D	.427"	.437"	.447"	P	.343"	.353"	.363"
E	--	–	.050"	Q	.040"	.047"	.055"
F	.085"	.090"	.095"	R_1	–	.031"	–
G	.352"	.362"	.372"	R_2	–	–	.050"
H	–	.750"	–	R_3	–	.040"	–
J	.090"	.093"	.096"	T	.340"	–	–
K	–	16-4/11°	–	U	–	–	.135"

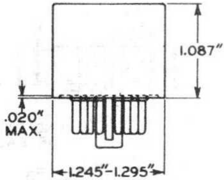
Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GB11-2) having thickness of 1/4" and eleven holes with diameters of 0.1030" ±0.0005" so located on a 0.7500" ±0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2113" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

SMALL-SHELL SUBMAGNAL

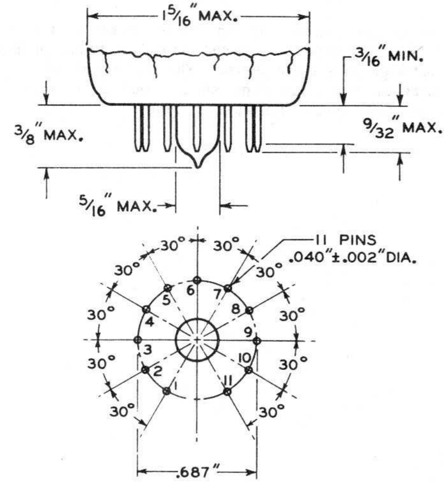


No. of Pins	*Pins*	*JETEC No.*	*RCA No.*
11-Pin	1,2,3,4,5,6,7,8,9,10,11	B11-88	11344

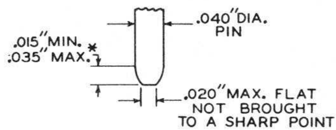
For other dimensions, see first page of the "Submagnal" series

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

SMALL-BUTTON UNIDEKAR 11-PIN



Unidekar Base Pin Contour



JETEC No. E11-22
RCA No. FSB6019

Base-pin positions are held to tolerances such that entire length of pins will without undue force pass into and disengage from flat-plate gauge having thickness of 1/4" and twelve holes with diameters of 0.0520" ± 0.0005" so located on a 0.6870" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1778" ± 0.0005". Gauge is also provided with a hole 0.3750" ± 0.0100" concentric with the pin circle.

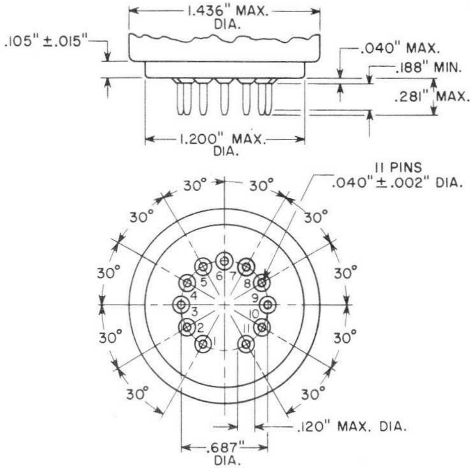
* This dimension around the periphery of any individual pin may vary within the limits shown.

SMALL-BUTTON UNIDEKAR 11-PIN (CONT'D)

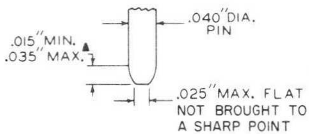
The design of the socket should be such that circuit wiring can not impress lateral strains through the socket contacts on the base pins. The point of bearing of the contacts on the base pins should not be closer than 1/8" from the bottom of the seated tube.

LARGE-WAFER ELEVENAR 11-PIN WITH RING

Pin Dimensions and Orientation



Elevenar-Base-Pin Contour



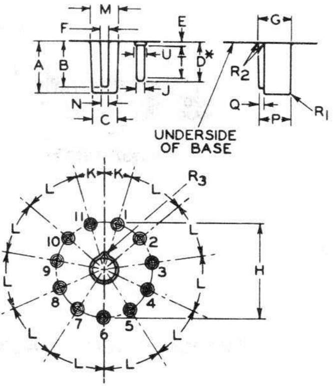
JEDEC No.E11-81

Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from flat-plate gauge (JEDEC No.GE11-1) having a thickness of 0.250" and twelve holes with diameters of 0.0520" ± 0.0005" so located on a 0.6870" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1778" ± 0.0005". Gauge is also provided with a hole 0.3750" ± 0.0005" diameter concentric with the pin circle.

▲ This dimension around the periphery of any individual pin may vary within the limits shown. The surface of the pin is convex or conical in shape and not brought to a sharp point.

11-PIN TYPES

"MAGNAL"
PIN DIMENSIONS AND ORIENTATION AND INDEX GUIDE



	Min.	Center	Max.		Min.	Center	Max.
A	.550"	.560"	.570"	L	–	32-8/11°	–
B	.490"	.500"	.510"	M	.305"	.312"	.317"
C	.300"	.308"	.315"	N	.075"	.080"	.085"
D	.427"	.437"	.447"	P	.343"	.353"	.363"
E	–	–	.050"	Q	.040"	.047"	.055"
F	.085"	.090"	.095"	R_1	–	.031"	–
G	.352"	.362"	.372"	R_2	–	–	.050"
H	–	1.063"	–	R_3	–	.040"	–
J	.090"	.093"	.096"	T	.340"	–	–
K	–	16-4/11°	–	U	–	–	.135"

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. GB11-1) having thickness of 1/4" and eleven holes with diameters of 0.1030" ±0.0005" so located on a 1.0630" ±0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2995" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

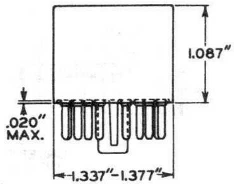
* Add 0.030" for solder on finished tube.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

BASES

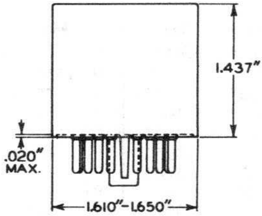
11-PIN TYPES

SMALL-SHELL MAGNAL



No. of Pins	Pins	JETEC No.	RCA No.
11-Pin	1,2,3,4,5,6,7,8,9,10,11	B11-33	11247

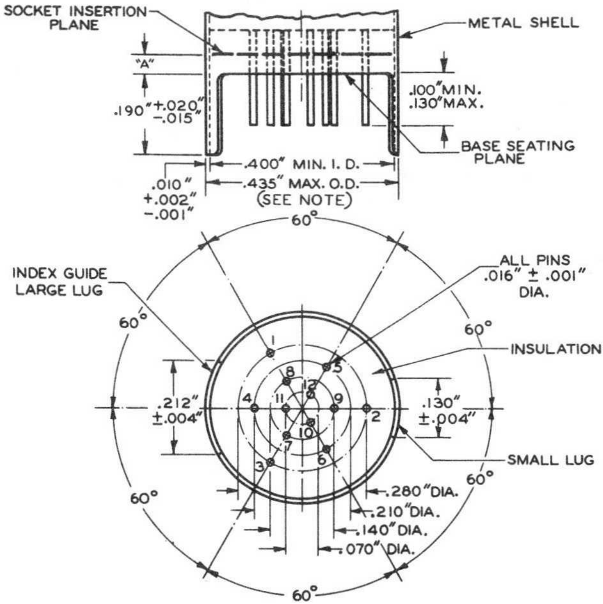
MEDIUM-SHELL MAGNAL



No. of Pins	Pins	JETEC No.	RCA No.
11-Pin	1,2,3,4,5,6,7,8,9,10,11	B11-66	11248

For other dimensions of above bases, see first page of the "Magnal" series

MEDIUM CERAMIC-WAFER TWELVAR BASE
Pin Dimensions and Orientation and Index Guide



NOTE: MAXIMUM OUTSIDE DIAMETER OF 0.440" IS PERMITTED ALONG THE 0.190" LUG LENGTH.

No. of Pins	*Pins*	*Dimension "A" Max.*	*JEDEC No.*	*RCA No.*
12-Pin	1,2,3,4,5,6,7,8,9,10,11,12	0.040"	E12-64	-
7-Pin[a]	1,2, 4, 6,7, 10, 12	0.040"	E7-83	-
7-Pin[b]	1, 3, 5,6,7, 10, 12	0.020"	E7-77	-
5-Pin[c]	2, 4, 8, 10, 12	0.040"	E5-79	-
5-Pin[d]	2, 4, 8, 10, 12	0.040"	E5-65	-

a Pins 3,5,8,9 are of a length such that their ends do not touch the socket insertion plane. Pin 11 is omitted.

b Pins 2,4,8,9 are of a length such that their ends do not touch the socket insertion plane. Pin 11 is omitted.

c Pin 7 is of a length such that its end does not touch the socket insertion plane. Pins 1,3,5,6,9,11 are omitted.

d Pins 1,3,5,6,7,9 are of a length such that their ends do not touch the socket insertion plane. Pin 11 is omitted.

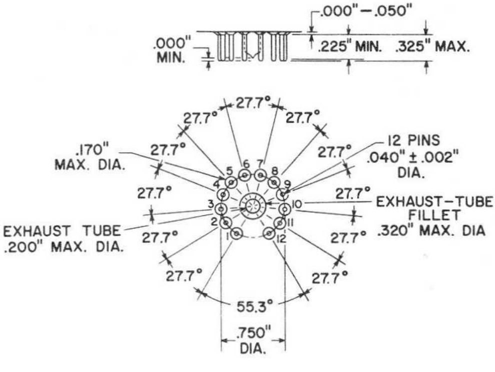
Bases

12-Pin Types

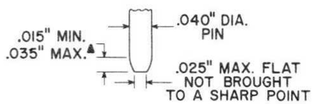
Base-pin positions and lug positions shall be held to tolerances such that entire length of pins and lugs will without undue force pass into and disengage from flat-plate gauge (JEDEC No.GE12-5) having thickness of 0.250" and twelve holes of 0.0350" ± 0.0005" diameter located on four concentric circles as follows: Three holes located on 0.2800" ± 0.0005", three holes located on 0.2100" ± 0.0005", three holes located on 0.1400" ± 0.0005", three holes located on 0.0700" ± 0.0005" diameter circles at specified angles with a tolerance of ± 0.08° for each angle. In addition, gauge provides for two curved slots with chordal lengths of 0.2270" ± 0.0005" and 0.1450" ± 0.0005" located on 0.4200" ± 0.0005" diameter circle concentric with pin circles at 180° ± 0.08° and having a width of 0.0230" ± 0.0005".

DUODECAR 12-PIN

Pin Dimensions and Orientation



Duodecar-Base-Pin Contour



Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from flat-plate gauge having a thickness of 0.250" and thirteen holes with diameters of 0.0520" ± 0.0005" so located on a 0.7500" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1795" ± 0.0005". Gauge is also provided with a hole 0.375" + 0.005" − 0.000" diameter concentric with the pin circle.

▲ This dimension around the periphery of any individual pin may vary within the limits shown. The surface of the pin is convex or conical in shape and not brought to a sharp point.

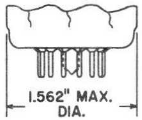
12-Pin Types

SMALL-BUTTON DUODECAR 12-PIN

JEDEC No. E12-70

Fits Gauge JEDEC No. GE12-3

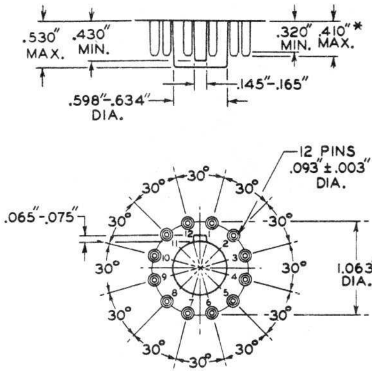
LARGE-BUTTON DUODECAR 12-PIN



JEDEC No. E12-74

Fits Gauge JEDEC No. GE12-4

"DUODECAL"
PIN DIMENSIONS AND ORIENTATION AND INDEX GUIDE



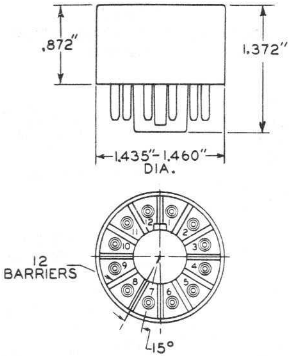
Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. GB12-1) having thickness of 1/4" and twelve holes with diameters of 0.1030" ± 0.0005" so located on a 1.0630" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2751" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.

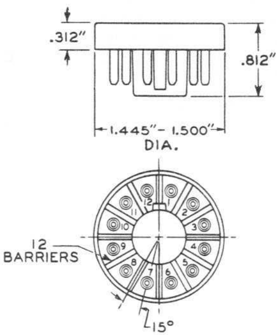
12-PIN TYPES

DWARF-SHELL DUODECAL



No. of Pins	Pins	JETEC No.	RCA No.
12-Pin	1,2,3,4,5,6,7,8,9,10,11,12	B12-157	12263
6-Pin	1,2,3, 10,11,12	B6-158	6263

ULTRASHORT SMALL-SHELL DUODECAL

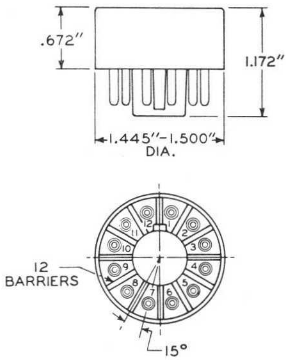


No. of Pins	Pins	JETEC No.	RCA No.
12-Pin	1,2,3,4,5,6,7,8,9,10,11,12,	B12-186	12261

For other dimensions of above bases, see first page of the "Duodecal" series

12-PIN TYPES

SHORT SMALL-SHELL DUODECAL



No. of Pins	*Pins*	*JETEC No.*	*RCA No.*
12-Pin	1,2,3,4,5,6,7,8,9,10,11,12	B12-207	12267
6-Pin	1,2, 6, 10,11,12	B6-203	6267

For other dimensions, see first page of the "Duodecal" series

ELECTRON TUBE DIVISION
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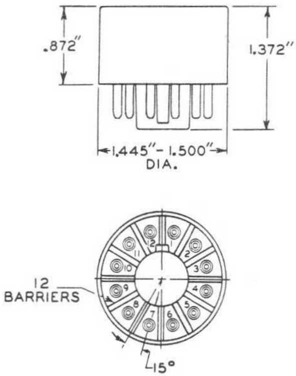
SMALL-SHELL DUODECAL

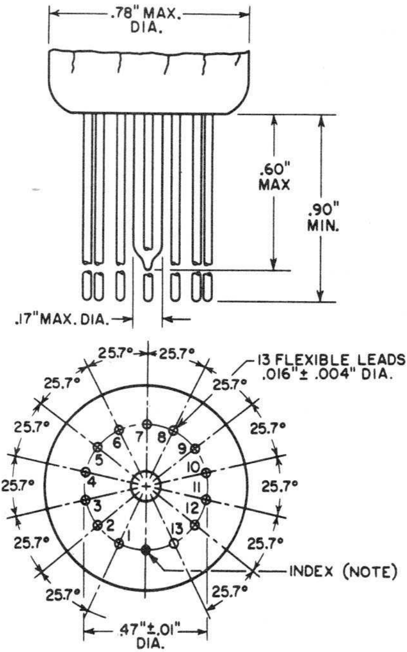


No. of Pins	*Pins*	*JETEC No.*	*RCA No.*
12-Pin	1,2,3,4,5,6,7,8,9,10,11,12	B12-43	12253
10-Pin	1,2,3,4, 6,7,8,9,10, 12	B10-75	10253
7-Pin■	1,2, 6,7, 10,11,12	B7-51	7253
7-Pin▲	1,2,3, 6, 10,11,12	B7-179	–
6-Pin■	1,2, 6, 10,11,12	B6-63	6253
6-Pin▲	4,5,6,7,8, 12	B6-180	–
5-Pin	1,2, 10,11,12	B5-57	5253

For other dimensions, see first page of the "Duodecal" series

■ Arrangement 1.
▲ Arrangement 2.

SMALL-BUTTON THIRTEENAR

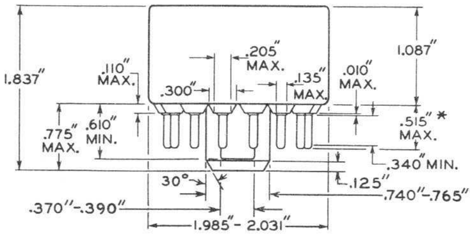


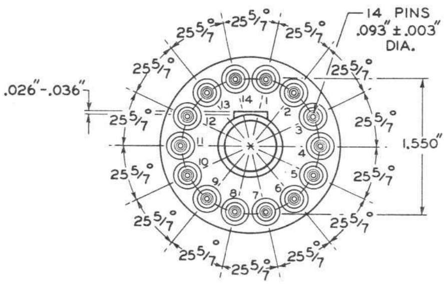
NOTE: LEAD IS CUT OFF WITHIN 0.04 INCH FROM THE GLASS BUTTON.

No. of Leads	*Leads*	*JEDEC No.*	*RCA No.*
13-Lead	1,2,3,4,5,6,7,8,9,10,11,12,13	E13-71	-
12-Lead▲	1,2,3,4,5,6,7,8,9,10,11,12,	E12-72	-

▲ Lead 13 is cut off within 0.04 inch from the glass button.

SMALL-SHELL NEODIHEPTAL





No. of Pins	Pins	JETEC No.	RCA No.
14-Pin	1,2,3,4,5,6,7,8,9,10,11,12,13,14	B14-130	14560
12-Pin	1,2,3,4,5,6,7, 9, 11,12,13,14	B12-131	12560

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No.GB14-2) having thickness of 1/4" and fourteen holes with diameters of 0.1030" ± 0.0005" so located on a 1.5500" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.3449" ± 0.0005".

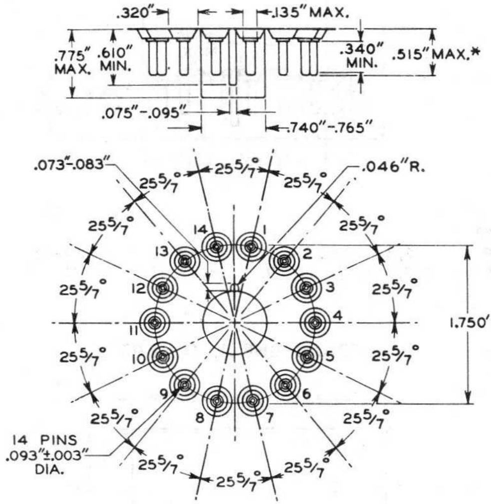
Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.

BASES

14-PIN TYPES

"DIHEPTAL"
PIN DIMENSIONS AND ORIENTATION AND INDEX GUIDE

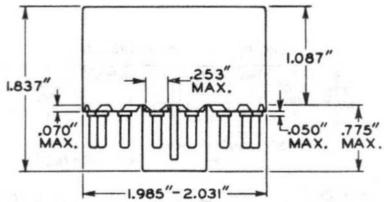


Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. GB14-1) having thickness of 1/4" and fourteen holes with diameters of 0.1030" ± 0.0005" so located on a 1.750" ± 0.0005" diameter circle that the distance along the chord between any two hole centers is 0.3895" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

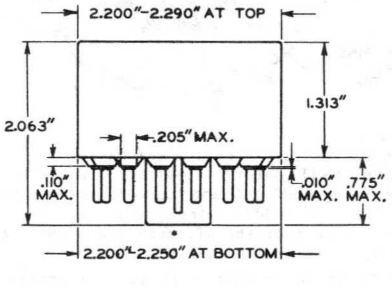
* Add 0.030" for solder on finished tube.

SMALL-SHELL DIHEPTAL



No. of Pins	Pins	JETEC No.	RCA No.
14-Pin	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	B14-45	14151
12-Pin	1, 2, 3, 4, 5, 6, 7, 9, 11, 12, 13, 14	B12-105	12151

MEDIUM-SHELL DIHEPTAL



No. of Pins	Pins	JETEC No.	RCA No.
14-Pin	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	B14-38	14146
12-Pin	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 14	B12-37	12146

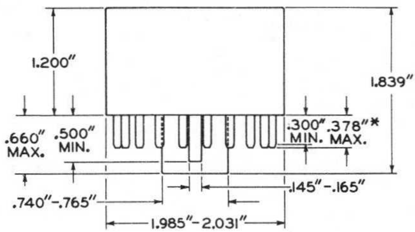
For other dimensions of above bases, see first page of the "Diheptal" series

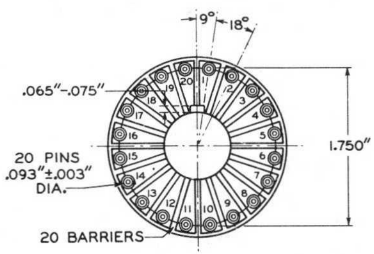
TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

BASES

20-PIN TYPES

SMALL-SHELL BIDECAL





No. of Pins	*Pins*	*JETEC No.*	*RCA No.*
20-Pin	1 through 20	B20-102	20158

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge (JETEC No. GB20-1) having thickness of 1/4" and twenty holes with diameters of 0.1030" ± 0.0005" so located on a 1.7500" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2738" ± 0.0005".

Pin fit in gauge is such that gauge together with supplementary weight totaling 3 pounds will not be lifted when pins are withdrawn.

* Add 0.030" for solder on finished tube.

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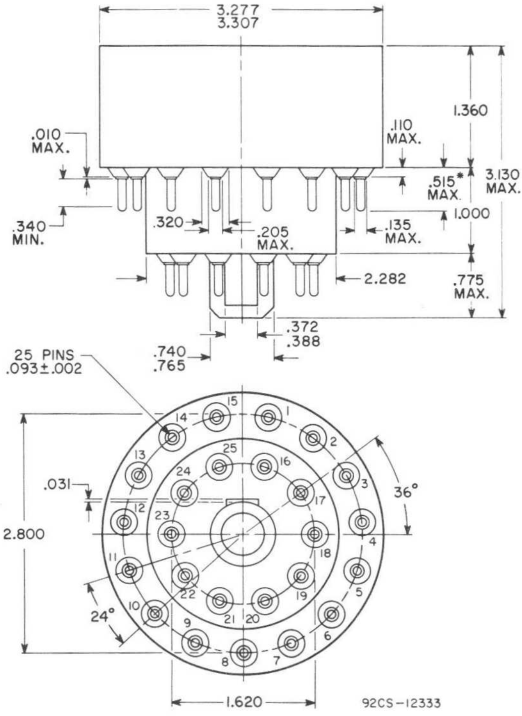
JEDEC No.B25-216



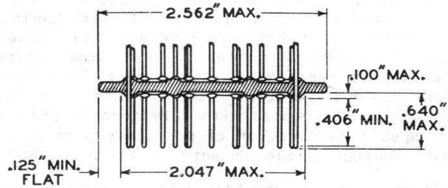
DIMENSIONS IN INCHES

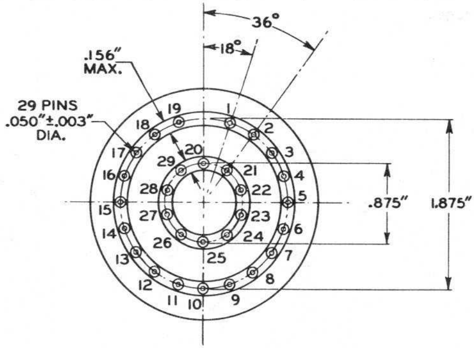
* Add 0.030 inch for solder.

BASES

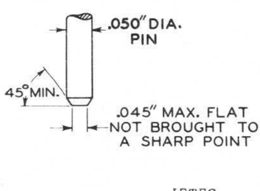
29-PIN TYPES

SMALL-BUTTON TWENTYNINAR





Twentyninar Base Pin Contour



No. of Pins	*Pins*	*JETEC No.*	*RCA No.*
29-Pin	1 through 29	E29-17	-
22-Pin	1 through 19,21,25,28	E22-16	FSB693
8-Pin	2,6,10,14,18,21,25,28	E8-19	FSB693A

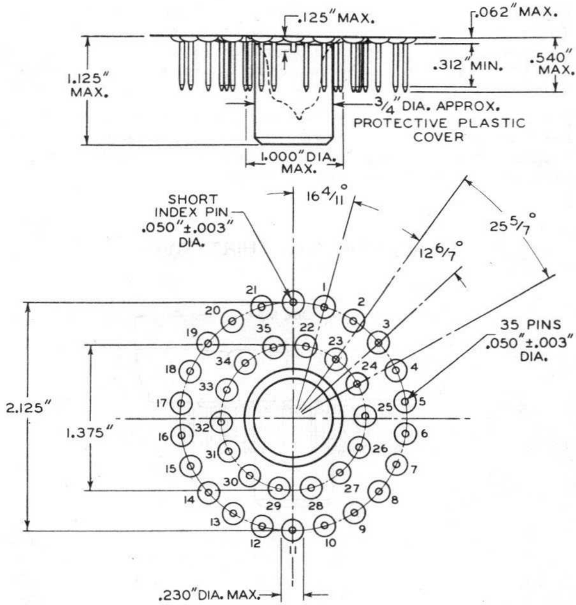
SMALL-BUTTON TWENTYNINAR (CONT'D)

Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge having thickness of 3/8" and twenty-nine holes with diameters of 0.0700" ± 0.0005", nineteen of which are located with hole centers corresponding to the specified location of pin centers on a 1.8750" ± 0.0005" diameter circle, and ten of which are located with hole centers corresponding to the specified location of pin centers on a 0.8750" ± 0.0005" diameter circle concentric with the 1.8750" circle.

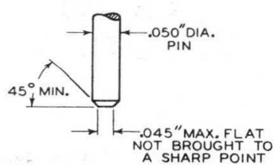
Pin fit in gauge is such that entire length of pins will, without undue force, enter into and disengage from the gauge.

35-PIN TYPES

"THIRTYFIVAR"
PIN DIMENSIONS AND ORIENTATION



Thirtyfivar-Base Pin Contour



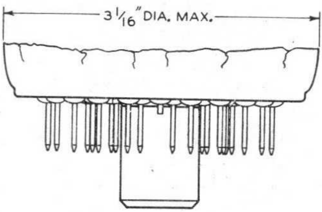
Base-pin positions are held to tolerances such that entire length of pins will enter flat-plate gauge having thickness of 3/8" and thirty-six holes with diameters of 0.0700" ± 0.0005", twenty-two of which are located with hole centers corresponding to the specified location of

THIRTYFIVAR (CONT'D)

pin centers on a 2.1250" ± 0.0005" diameter circle, and fourteen of which are located with hole centers corresponding to the specified location of pin centers on a 1.3750" ± 0.0005" diameter circle concentric with the 2.1250" circle.

Pin fit in gauge is such that entire length of pins will, without undue force, enter into and disengage from the gauge. Gauge is also provided with a hole 1.000" diameter minimum concentric with pin circles.

SMALL-BUTTON THIRTYFIVAR



No. of Pins	*Pins*	*JETEC No.*	*RCA No.*
35-Pin	1 through 35	E35-28	-
33-Pin	Omit pins 24 and 30	E33-29	-
31-Pin	Omit pins 24 and 30; pins 23 and 31 are trimmed to same dimension as index pin.	E31-36	-
21-Pin	1 through 21	E21-40	-

For other dimensions of above base, see first page of the "Thirtyfivar" series

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA TUBE
HANDBOOK
HB-3

CATHODE-RAY TUBE, STORAGE TUBE, & MONOSCOPE SECTION

This Section contains data for black-and-white and color TV picture tubes, oscillograph tubes, special-purpose kinescopes, storage tubes, and monoscopes.

For further Technical Information, write to Commercial Engineering, Tube Division, Radio Corporation of America, Harrison, N. J.

Cathode-Ray Tubes, Storage
Tubes, & Monoscopes

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
ELECTROSTATIC DEFLECTION TYPE				
Round Glass Envelope				
	6.3/600	E	6500	7JP4
MAGNETIC DEFLECTION TYPES				
Round Glass Envelope				
50	6.3/600	E	29,500	5TP4
52	6.3/600	M	15,500	16LP4A
55	6.3/600	M	13,000	10BP4A
55	6.3/600	M	13,000	10FP4A
55	6.3/600	M	13,000	12KP4A
60	6.3/600	M	16,500	16DP4A
70	6.3/600	M	17,500	16WP4A
Rectangular Metal Envelope				
70	6.3/600	M	17,500	17CP4[d]
70	6.3/600	E	17,500	17TP4[d]
Rectangular Glass Envelope				
Conventional Rectangular Glass Types				
70	6.3/600	M	17,500	16RP4B
70	6.3/600	M	15,500	16TP4
70	6.3/600	M	17,500	17BP4D
70	6.3/600	E	17,500	17HP4C
70	6.3/600	E	17,500	17LP4B[a]
70	6.3/600	M	20,000	17QP4B
70	6.3/600	M	20,000	20DP4D
70	6.3/600	E	17,500	20HP4E
70	6.3/600	M	20,000	21EP4C[a]
70	6.3/600	E	20,000	21FP4D[a]
70	6.3/600	M	20,000	21WP4B

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
Rectangular Glass Envelope Cont'd				
Conventional Rectangular Glass Types				
70	6.3/600	E	20,000	21XP4B
70	6.3/600	E	20,000	21YP4B
70	6.3/600	M	20,000	21ZP4C
72	6.3/600	E	22,000	21AVP4C
72	6.3/600	M	20,000	21AWP4A
90	6.3/600	E	9000	8DP4
90	8.4/450	E	15,500	14ATP4
90	6.3/600	E	15,500	14WP4
90	6.3/600	E	17,500	17BJP4
90	6.3/600	E	17,500	17CFP4
90	6.3/600	E	17,500	17CYP4
90	6.3/600	M	20,000	21AMP4B
90	6.3/600	E	22,000	21CBP4A
90	6.3/600	E	22,000	21DLP4
90	6.3/600	E	22,000	21DSP4[b]
90	6.3/600	E	22,000	24AEP4
90	6.3/600	E	22,000	24ATP4[b]
90	6.3/600	E	22,000	24AUP4
90	6.3/600	M	22,000	24CP4B
90	6.3/600	M	22,000	27RP4A
92	6.3/600	E	20,000	19BDP4[b]
92	6.3/600	E	22,000	23AHP4
92	6.3/600	E	22,000	23ASP4
92	6.3/600	E	25,000	23BJP4[b]
92	6.3/450	E	22,000	23CGP4
94	6.3/600	E	23,000	23DAP4[b]
110	6.3/450	E	15,000	11CP4

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
Rectangular Glass Envelope Cont'd				
Conventional Rectangular Glass Types				
110	8.4/450	E	17,500	17CDP4
110	6.3/600	E	17,500	17CSP4
110	2.68/450	E	17,500	17DAP4
110	6.3/600	E	23,000	17DKP4
110	6.3/450	E	17,500	17DQP4[b]
110	2.68/450	E	17,500	17DRP4[c]
110	6.3/600	E	20,000	17DSP4
110	6.3/450	E	17,500	17DXP4
110	6.3/450	E	20,000	17EFP4
110	6.3/600	E	20,000	21CQP4
110	6.3/600	E	22,000	21DEP4A
110	6.3/600	E	20,000	21DFP4
110	6.3/450	E	20,000	21DHP4
110	6.3/600	E	20,000	21EQP4
110	6.3/600	E	22,000	21FAP4
110	6.3/600	E	20,000	21FDP4
110	6.3/600	E	22,000	23ARP4
110	6.3/600	E	22,000	23DBP4[b]
110	6.3/600	E	22,000	24AHP4
110	6.3/600	E	22,000	24BAP4[b]
110	6.3/600	E	20,000	24BEP4
114	6.3/450	E	20,000	16AYP4
114	2.68/450	E	20,000	19ABP4
114	6.3/450	E	17,500	19AHP4
114	6.3/450	E	20,000	19AJP4[b]
114	6.3/600	E	23,000	19AVP4
114	6.3/450	E	23,000	19AYP4

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
Rectangular Glass Envelope Cont'd				
Conventional Rectangular Glass Types				
114	6.3/600	E	23,000	19BTP4
114	6.3/600	E	20,000	19CHP4[b]
114	6.3/450	E	20,000	19CMP4[b]
114	6.3/600	E	20,000	19CXP4[b]
114	6.3/600	E	20,000	19XP4
114	6.3/600	E	20,000	19YP4
114	6.3/450	E	22,000	20RP4
114	6.3/450	E	23,500	23CQP4
114	6.3/600	E	23,500	23FP4A
114	6.3/600	E	22,000	23MP4
114	6.3/600	E	22,000	23NP4[b]
Bi-Panel Rectangular Glass Types				
92	6.3/600	E	22,000	23BDP4[d]
92	6.3/600	E	25,000	23BKP4
92	6.3/600	E	25,000	23BLP4[e]
92	6.3/600	E	25,000	23BTP4
92	6.3/600	E	22,000	23YP4
110	6.3/600	E	22,000	23BGP4[b]
110	6.3/450	E	23,000	23BQP4
110	6.3/450	E	23,000	23CBP4[d]
110	6.3/600	E	22,000	23CP4
110	6.3/600	E	23,500	23CP4A
110	6.3/600	E	22,000	23EP4[b]
110	6.3/600	E	22,000	23GP4
110	6.3/450	E	22,000	23JP4[b]
114	6.3/600	E	20,000	19AFP4
114	6.3/600	E	20,000	19AUP4[d]

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
Rectangular Glass Envelope Cont'd				
Filled Rim Rectangular Glass Types				
92	6.3/600	E	25,000	23EYP4[b]
110	6.3/450	E	15,000	11GP4
110	6.3/450	E	23,000	23FRP4[b]
110	6.3/600	E	23,000	23FSP4
114	6.3/600	E	23,000	19EBP4
114	6.3/450	E	21,000	19EGP4[b]
Banded Rectangular Glass Types				
90	12.0/75	E	12,000	9WP4
92	6.3/450	E	25,000	23EKP4
92	6.3/600	E	25,000	23ENP4
92	6.3/600	E	25,000	23FBP4[e]
94	6.3/450	E	23,500	23EZP4[b,g]
110	6.3/450	E	15,000	11HP4A
110	6.3/450	E	16,000	12BNP4A
110	4.2/450	E	14,000	12CNP4
110	6.3/600	E	23,000	23ETP4
110	6.3/450	E	23,000	23FDP4[b]
110	6.3/450	E	23,000	23FMP4[b]
110	6.3/450	E	23,000	23GJP4A[b]
110	6.3/600	E	23,000	23GSP4[g]
110	6.3/450	E	22,000	23GWP4[b]
110	6.3/450	E	23,000	23HFP4A
110	6.3/450	E	23,000	23HGP4[g]
110	6.3/450	E	23,500	23HUP4A[b]
110	6.3/450	E	22,000	23HWP4A[b,g]
110	6.3/450	E	23,000	23HXP4
110	6.3/450	E	23,000	23JEP4
110	6.3/450	E	23,500	23JGP4[b]
114	6.3/450	E	20,000	16BGP4
114	6.3/450	E	20,000	16CHP4A[b]
114	6.3/450	E	18,000	16CMP4A
114	6.3/450	E	22,000	17EMP4[b]

Black-and-White Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
Rectangular Glass Envelope Cont'd				
Banded Rectangular Glass Tubes				
114	6.3/450	E	23,000	19DQP4
114	6.3/600	E	23,000	19DRP4
114	6.3/600	E	20,000	19DSP4[b]
114	6.3/450	E	20,000	19EAP4[b]
114	6.3/450	E	22,000	19DUP4[b]
114	6.3/600	E	18,000	19EHP4A
114	6.3/450	E	21,000	19ENP4A[b]
114	6.3/450	E	23,500	19FEP4B[b]
114	6.3/450	E	18,000	19FJP4A
114	6.3/450	E	23,000	19FLP4
114	6.3/600	E	23,000	19FNP4[g]
114	6.3/450	E	20,000	19FQP4[b,g]
114	6.3/450	E	23,000	19GEP4A[g]
114	6.3/450	E	23,000	19GJP4A
114	6.3/450	E	23,000	20SP4[b]
114	6.3/450	E	23,000	20TP4
114	6.3/450	E	23,000	21FVP4
114	6.3/450	E	22,000	21FYP4[b,g]
114	6.3/450	E	23,500	21GAP4A[b]
114	6.3/450	E	23,000	23EQP4
114	6.3/600	E	23,000	23ERP4

Color Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
ROUND GLASS ENVELOPE				
Conventional Types				
45	6.3/1800	E	22,000	15GP22
70	6.3/1600	E	27,500	21CYP22A
70	6.3/1800	E	27,500	21FBP22
70	6.3/1800	E	27,500	21FBP22A[f]
70	6.3/1800	E	27,500	21GUP22[f]
Integral Protective Window Types				
70	6.3/1800	E	27,500	21FJP22[d]
70	6.3/1800	E	27,500	21FJP22A[d,f]
70	6.3/1800	E	27,500	21GVP22[d,f]
ROUND METAL ENVELOPE				
70	6.3/1800	E	27,500	21AXP22A
RECTANGULAR GLASS ENVELOPE				
Conventional Types				
90	6.3/900	E	22,500	15KP22[f]
90	6.3/900	E	27,500	19EXP22[f]
90	6.3/900	E	27,500	19GVP22[f]
90	6.3/900	E	27,500	22KP22[f]
90	6.3/900	E	27,500	25BP22A[f]
90	6.3/900	E	27,500	25YP22[f]
Integral Protective Window Types				
90	6.3/900	E	22,500	15LP22[d,f]
90	6.3/900	E	27,500	19EYP22[d,f]
90	6.3/900	E	27,500	19GWP22[d,f]
90	6.3/900	E	27,500	22JP22[d,f]
90	6.3/900	E	27,500	25AP22A[d,f]
90	6.3/900	E	27,500	25XP22[d,f]
92	6.3/1350	E	27,500	23EGP22A[d]

Color Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
Banded Types				
90	6.3/900	E	22,500	15NP22[f]
90	6.3/900	E	27,500	19HCP22[f]

Test Picture Tubes

Greatest Deflection Angle (Approx.) Degrees	Heater Volts/mA	Focusing Method §	Design-Maximum Anode Volts	RCA Type
ROUND GLASS ENVELOPE				
53	6.3/600	E	20,000	5AXP4
RECTANGULAR GLASS ENVELOPE				
70	6.3/1800	E	27,500	1828P22
90	6.3/600	E	22,000	8XP4
90	6.3/900	E	27,500	1830P22
110	6.3/600	E	22,000	8YP4

§ E = Electrostatic; M = Magnetic
a Cylindrical Faceplate
b Low G_2 Type
c Internal Magnetic Shield
d Faceplate Treated
e Low G_2 Type, Faceplate Treated
f Hi-Life type, features rare-earth red-emitting phosphor
g Integral Mounting Lugs

SPECIAL-PURPOSE KINESCOPES

Approx. Bulb Dia. Inches	Focusing Method	Deflection Method	Minimum Screen Size Inches	Maximum Anode Volts[a]	Tube Type
Monitor Types					
7	M	M	6-1/2	8,000	7CP4
7	E	M	6	12,000	7TP4
8[b]	E	M	7-13/16[b]	14,000[c]	8HP4
8[b]	E	M	7-3/4[b]	22,000[c]	8NP4
10	E	M	9-1/8	20,000	10SP4
17[b]	E	M	15-9/16[b]	22,000[c]	17DWP4
21[b]	E	M	20-1/4[b]	22,000[c]	21EYP4
Display Cathode-Ray Tube					
12[b]	E	M	Has integral protective window	16,000	4557
Projection Types					
5	E	M	4-1/2[d]	40,000[c]	5AZP4
7	E	M	5 x 3-3/4[e]	80,000[c]	7NP4
7	E	M	5 x 3-3/4[e]	80,000[c]	7WP4
7	E	M	5 x 3-3/4[e]	80,000[c]	4486
View-Finder Type					
5	M	M	4-1/4	8,000	5FP4A
Transcriber Type					
5	E	M	4-1/4	27,000	5WP11

E = Electrostatic.

M = Magnetic.

a Design-Center values unless otherwise noted.

b Diagonal.

c Absolute value.

d Quality circle diameter.

e Quality rectangle.

FLYING-SPOT CATHODE-RAY TUBES

Approx. Bulb Dia. Inches	Focusing Method	Deflection Method	Phosphor[a]	Maximum Anode Volts	Tube Type
Black-and-White Television Types					
5	E	M	P15	27,000[b]	5WP15
5	E	M	P16	27,000[b]	5ZP16
Color-Television Type					
5	E	M	P24	27,000[b]	5AUP24

MONOSCOPES

Approx. Bulb Dia. Inches	Focusing Method	Deflection Method	Features	Maximum Anode Volts[c]	Tube Type
2	E	E	Customized metal stencil electrode pattern	2,500[d]	4560
5	E	M	Indian Head Pattern	1,500[b]	2F21
5	E	M	Pattern individually styled to customer requirements	1,500[b]	1699

E = Electrostatic.
M = Magnetic.

a See sheet *Features of Fluorescent Screens*.
b Design-center value.
c Pattern-electrode voltage.
d Absolute-maximum value.

OSCILLOGRAPH TUBES

Phosphor	Approx. Bulb Dia. Inches	Max. Anode Volts[a]	Tube Type
Electrostatic-Deflection & Focus Types			
P1	1	1,500	1EP1
P1	2	1,100	2AP1A
P1	2	2,500	2BP1
P1	2	600	902A
P1	3	1,500	3AP1A
P1	3	2,750	3AQP1
P1	3	2,000	3BP1A
P1	3	2,500	3KP1
P1	3	2,500	3RP1
P1	3	2,500	3RP1A
P1	3	2,500	3WP1
P1	5	2,000	5BP1A
P1	5	2,500	5UP1
P1	7	4,000	7UP1
P1	5	2,800[b]	4499
P2	1	1,500	1EP2
P7	3	2,500	3KP7
P7	3	2,500	3RP7A
P7	5	2,500	5UP7
P11	1	1,500	1EP11
P11	2	2,500	2BP11
P11	3	2,500	3KP11
P11	3	2,500	3WP11
P11	5	2,500	5UP11
P31	5	2,500	5UP31
P31	7	4,000	7UP31

a Design-center value.
b Absolute-maximum value.

OSCILLOGRAPH TUBES (Cont'd)

Phosphor	Approx. Bulb Dia. Inches	Max. Post Accelerator Volts	Tube Type
Electrostatic-Deflection & Focus Types With Post-Deflection Accelerator			
P1	3	4,000	3JP1
P1	5	6,000	5ABP1
P1	5	6,000	5ADP1
P1	5	4,000	5CP1A
P7	3	4,000	3JP7
P7	5	6,000[b]	4510
P11	5	6,000	5ABP11
P11	5	4,000	5CP11A
P31	5	6,000	5ABP31
P31	5	6,000	5ADP31
P31	5	8,000[b]	4489
P31	7	8,000[b]	4490
P31	8	8,000[b]	4491

Phosphor	Approx. Bulb Dia. Inches	Max. Anode Volts	Tube Type
Magnetic-Deflection & Focus Types			
P7	5	8,000	5FP7A
P7	7	8,000	7BP7A
P7	7	8,000	7MP7

b Absolute-maximum value.

STORAGE TUBES

Name	Description	Tube Type
Display	Ruggedized, 5"-diameter type having electrostatic-focus and deflection writing gun	2053
Display	Ruggedized, 10"-diameter type having electrostatic-focus and deflection writing gun	4412
Display	5"-diameter type having electrostatic-focus and magnetic-deflection writing gun	4454
Display	5"-diameter type having electrostatic-focus and deflection writing gun	6866
Display	5"-diameter type having electrostatic-focus and magnetic-deflection writing gun	7183A
Display	Ruggedized, 5"-diameter type having two electrostatic-focus and deflection writing guns	7268B
Display	5"-diameter type having electrostatic-focus and deflection writing gun	7315
Radechon	Single-beam barrier-grid type for digital data storage	6499
Radechon	Variant of 6499 for binary memory systems in computers	1858
Graphechon	Single-converter type with reading gun and writing gun	7539

RCA PICTURE TUBE INTERCHANGEABILITY GUIDE

Replacement Classification Keys

▲ Replacement information is based primarily on electrical and mechanical similarity of the picture-tube types covered. The technician should make certain that replacement is in accord with all safety precautions required by the TV receiver for picture-tube insulation or mechanical mounting.

A. RCA type does not require an external ion-trap magnet.

B. The ball-type anode contact must be replaced with cavity-type contact.

C. Neck length and/or overall length of RCA type is slightly greater.

D. Direct replacement.

E. The RCA replacement type is electrically interchangeable—Mechanical modifications to the receiver may be required.

F. The RCA replacement type has a 6.3-volt/600-milliampere heater. The receiver picture tube heater circuit must be modified to use this replacement type.

G. A conversion Kit (RCA Part No. 12B202) is available for RCA receivers.

H. The RCA replacement type is mechanically interchangeable—Electrical modifications to the receiver may be required.

J. The RCA replacement is directly interchangeable in most cases; however, in some cases the red cathode lead may have to be interchanged with the blue or green cathode leads to obtain satisfactory black-and-white tracking. Replacement information is packed with the tube.

K. Pin No. 6 (focusing electrode) of the RCA replacement must be connected to Pin No. 11 at the socket. The original tube did not require an external voltage for focus.

L. The RCA replacement type is electrically interchangeable – Mounting hardware may have to be modified to accept the replacement type. In some small-cabinet receivers, the replacement may not be feasible.

M. The RCA replacement type is electrically interchangeable – The receiver socket should be replaced by RCA Part No. 112579, Eby Sales Co. Part No. 49-13DD, or equivalent.

N. A conversion Kit (RCA Part No. 12B101) is available for RCA receivers.

P. External conductive coating must be gounded.

* Band around periphery of tube panel must be gounded and isolated from the ac line voltage.

RCA PICTURE TUBE INTERCHANGEABILITY GUIDE

Color Picture Tubes

Type To Be Replaced ★	Replaced By RCA Type	▲
11SP22 11WP22	C-11WP22	D
15AEP22 15AFP22 15AGP22	H-15AEP22 C-15AEP22	•D D
15LP22	H-15LP22 C-15LP22	D D
15NP22	H-15NP22 C-15NP22	•D •D
15SP22	H-15AEP22 C-15AEP22	•D •D
15TP22	H-15NP22 C-15NP22	•D •D
15WP22	H-15LP22 C-15LP22	D D
15XP22	H-15NP22 C-15NP22	•D •D
17EZP22 17FAP22	H-17EZP22 C-17EZP22	•D •D
19EXP22	H-19GVP22 C-19GVP22/ 19EXP22	D D
19EYP22 19FMP22 19FXP22 19GSP22	H-19GWP22 C-19GWP22/ 19EYP22	D D
19GVP22 19GVP22/ 19EXP22	H-19GVP22 C-19GVP22/ 19EXP22	D D
19GWP22 19GWP22/ 19EYP22	H-19GWP22 C-19GWP22/ 19EYP22	D D
19GXP22 19GYP22	H-19GVP22 C-19GVP22/ 19EZP22	C C
19GZP22	H-19GWP22 C-19GWP22/ 19EYP22	D D
19HBP22	H-19GWP22 C-19GWP22/ 19EYP22	D D
19HCP22 19HCP22/ 19HKP22	H-19HCP22/ 19HKP22 C-19HCP22/ 19HKP22	•D •D
19HFP22	H-19GWP22 C-19GWP22/ 19EYP22	D D
19HJP22 19HKP22	H-19HCP22/ 19HKP22 C-19HCP22/ 19HKP22	•D •D
19HNP22	H-19HNP22 C-19HNP22	•D •D
19HQP22	H-19GVP22 C-19GVP22/ 19EXP22	D D
19HRP22	H-19GWP22 C-19GWP22/ 19EYP22	D D
19HXP22	H-19HCP22/ 19HKP22 C-19HCP22/ 19HKP22	•D •D
19JBP22 19JDP22	H-19GVP22 C-19GVP22/ 19EXP22	D D
19JGP22	H-19JWP22 C-19JWP22	D D
19JHP22	H-19GWP22 C-19GWP22 / 19EYP22	D D
19JKP22	H-19GWP22 C-19GWP22/ 19EYP22	D D
19JWP22	H-19JWP22 C-19JWP22	D D
21AXP22 21AXP22A 21AXP22A/ 21AXP22	C-21AXP22A C-21CYP22A C-21FBP22 H-21GUP22 C-21GUP22/ 21FBP22A	D CN CJN CJN CJN
21CYP22 21CYP22A	C-21CYP22A C-21FBP22 H-21GUP22 C-21GUP22/ 21FBP22A	D J J J
21FBP22 21FBP22A	C-21FBP22 H-21GUP22 C-21GUP22/ 21FBP22A	D J J

★ *See note on back of sheet 2 of this guide.*

▲ See *Replacement information* in front of this guide.

Type To Be Replaced ★	Replaced By RCA Type	▲
21FJP22 21FJP22A 21FKP22	C-21FJP22 H-21GVP22 C-21GVP22/21FJP22A	D J J
21GFP22 21GLP22 21GRP22	H-22JP22 C-22JP22	L L
21GUP22 21GUP22/21FBP22A	H-21GUP22 C-21FBP22 C-21GUP22/21FBP22A	D D D
21GVP22 21GVP22/21FJP22A	H-21GVP22 C-21FJP22 C-21GVP22/21FJP22A	D D D
21GWP22	H-22JP22 C-22JP22	L L
21GXP22 21GYP22	H-21GVP22 C-21FJP22 C-21GVP22/21FJP22A	D D D
22ADP22 22AGP22 22AHP22	H-22UP22 C-22UP22	•D •D
22JP22	H-22JP22 C-22JP22	D D
22KP22	H-22KP22 C-22JP22	D D
22LP22 22QP22	H-22JP22 C-22JP22	D D
22RP22	H-22KP22 C-22KP22	D D
22SP22	H-22JP22 C-22JP22	D D
22UP22 22XP22	H-22UP22 C-22UP22	•D •D
22YP22	H-22JP22 C-22JP22	D D
23EGP22 23EGP22A	C-23EGP22 C-23EGP22A	D
25ABP22	H-25XP22 C-25XP22/25AP22A	D D
25ADP22	H-25AJP22 C-25AJP22	•D •D

Type To Be Replaced ★	Replaced By RCA Type	▲
25AEP22	H-25YP22 C-25YP22/25BP22A	D D
25AFP22	H-25XP22 C-25XP22/25AP22A	D D
25AGP22 25AJP22	H-25AJP22 C-25AJP22	•D •D
25ANP22 25AP22 25AP22A 25AQP22	H-25XP22 C-25XP22/25AP22A	D D
25ASP22 25AWP22 25AXP22 25AZP22	H-25AJP22 C-25AJP22	•D •D
25BMP22	H-25XP22 C-25XP22/25AP22A	D D
25BP22 25BP22A	H-25YP22 C-25YP22/25BP22A	D D
25CP22 25CP22A	H-25XP22 C-25XP22/25AP22A	D D
25FP22 25FP22A	H-25YP22 C-25YP22/25BP22A	D D
25GP22 25GP22A	H-25XP22 C-25XP22/25AP22A	D D
25RP22	H-25YP22 C-25YP22/25BP22A	D D
25SP22	H-25XP22 C-25XP22/25AP22A	D D
25VP22	H-25XP22 C-25XP22/25BP22A	D D
25WP22 25XP22 25XP22/25AP22A	H-25XP22 C-25XP22/25AP22A	D D
25YP22 25YP22/25BP22A	H-25YP22 C-25YP22/25BP22A	D D

★ *See note on back of sheet 2 of this guide.*
▲ See *Replacement information* in front of this guide.

RCA PICTURE TUBE INTERCHANGEABILITY GUIDE

Type To Be Replaced ★	Replaced By RCA Type	▲
25ZP22	H-25XP22 C-25XP22/ 25AP22A	D D
370AB22 370CB22	H-15NP22 C-15NP22	• D • D
490AB22 490ACB22 490ADB22	H-19GVP22 C-19GVP22/ 19EXP22	J J
490AEB22 490AFB22 490AGB22	H-19GWP22 C-19GWP22/ 19EYP22	J J
490AHB22	H-19GVP22 C-19GVP22/ 19EXP22	J J
490AHB22A	H-19GVP22 C-19GVP22/ 19EXP22	D D
490AJB22 490AJB22A	H-19GWP22 C-19GWP22/ 19EYP22	D D
490AKB22 490ALB22 490AMB22 490ANB22	H-19GVP22 C-19GVP22/ 19EXP22	J J
490ARB22	H-19GWP22 C-19GWP22/ 19EYP22	J J
490ASB22	H-19GWP22 C-19GWP22/ 19EYP22	D D
490BAB22	H-19GVP22 C-19GVP22/ 19EXP22	D D
490BCB22	H-19GWP22 C-19GWP22/ 19EYP22	D D
490BDB22	H-19GWP22 C-19GWP22/ 19EYP22	J J
490BGB22	H-19GVP22 C-19GVP22/ 19EXP22	D D
490BHB22	H-19GWP22 C-19GWP22/ 19EYP22	D D
490BNB22	H-19JWP22 C-19JWP22	D D
490BRB22	H-19GWP22 C-19GWP22/ 19EYP22	D D
490BVB22 490BXB22	H-19JWP22 C-19JWP22	D D
490CB22 490DB22 490EB22 490EB22A 490FB22 490GB22	H-19GVP22 C-19GVP22/ 19EXP22	J J
490HB22 490JB22 490JB22A	H-19GVP22 C-19GVP22/ 19EXP22	D D
490KB22 490KB22A 490LB22 490MB22	H-19GVP22 C-19GVP22/ 19EXP22	J J
490NB22 490RB22 490SB22 490TB22	H-19GWP22 C-19GWP22/ 19EYP22	J J
490UB22	H-19GVP22 C-19GVP22/ 19EXP22	J J
490VB22	H-19GWP22 C-19GWP22/ 19EYP22	J J
490WB22	H-19GVP22 C-19GVP22/ 19EXP22	J J
490XB22 490YB22 490ZB22	H-19GWP22 C-19GWP22/ 19EYP22	J J

★ The type to be replaced may have a manufacturer's coding prefix such as AN, C, CR, H, HR, OC, RE, REA, etc. Since these prefixes do not affect the electrical characteristics or interchangeability of the type, the prefixes have been omitted from type numbers in this column.

▲ See *Replacement information* in front of this guide.

Black & White Picture Tubes

Type To Be Replaced ★	Replaced By RCA Type	▲
7JP4	7JP4	D
8DP4	8DP4	D
9AEP4	9AEP4	•D
9WP4	9WP4	•D
10ATP4	10ATP4	D
11AP4 11BP4	11HP4A	•D
11CP4	11CP4	D
11GP4	11GP4	•D
11HP4 11HP4A	11HP4A	•D
12BNP4 12BNP4A	12BNP4A	•D
12CFP4	12CNP4	•D
12CGP4	12BNP4A	•D
12CNP4	12CNP4	•D
12DEP4	12DEP4	•D
12DFP4	12DFP4	•D
12DSP4	12DSP4	D
14NP4 14NP4A 14RP4 14RP4A 14SP4	14WP4	A
14WP4 14WP4/ 14ZP4 14ZP4 14ZP4/ 14WP4	14WP4	D
16ASP4 16AXP4	16CMP4A	•E
16AYP4	16BGP4	•E
16BFP4	16CMP4A	•C
16BGP4	16BGP4	•D
16BKP4	16CHP4A	•C
16BMP4	16BGP4	•CE
16BQP4	16CMP4	•C
16CHP4	16ATP4	•E
16BVP4	16CMP4A	•E
16BWP4 16CAP4	16BGP4	•D
16CEP4	16CMP4A	•D
16CHP4 16CHP4A	16CHP4A	•D
16CJP4 16CMP4 16CMP4A	16CMP4A	•D
16CTP4	16BGP4	•C
16CUP4	16CMP4A	•C
16CVP4	16CHP4A	•CE
16KP4 16KP4A	16RP4B	A
16QP4	16RP4B	AP
16RP4 16RP4/ 16KP4 16RP4A 16RP4A/ 16KP4A	16RP4B	A
16RP4B	16RP4B	D
16TP4	16TP4	D
16UP4	16RP4B	ACP
16XP4	16RP4B	AP
17AP4	17BP4D	ACP
17ATP4 17ATP4/ 17AVP4 17ATP4A 17ATP4A/ 17AVP4A 17AVP4 17AVP4/ 17ATP4 17AVP4A 17AVP4A/ 17ATP4A	17BJP4	A

▲ See *Replacement information* in front of this guide.

RCA PICTURE TUBE INTERCHANGEABILITY GUIDE

Type To Be Replaced ★	Replaced By RCA Type	▲
17BJP4	17BJP4	D
17BP4	17BP4D	AP
17BP4A 17BP4B 17BP4C	17BP4D	A
17BP4D	17BP4D	D
17BRP4	17DSP4	A
17BUP4	17BJP4	A
17BZP4 17BZP4/ 17CAP4/ 17CKP4 17BZP4/ 17CAP4/ 17CKP4/ 17BRP4 17CAP4	17DSP4	D
17CBP4	17BJP4	A
17CFP4	17CFP4	D
17CKP4	17DSP4	D
17CLP4	17BJP4	AP
17CTP4	17EFP4	D
17CWP4	17DSP4	D
17CYP4	17CFP4	D
17DAP4	17DAP4	D
17DHP4	17EFP4	P
17DKP4	17DSP4	C
17DLP4	17DSP4	D
17DQP4	17DQP4	D
17DRP4	17DRP4	D
17DSP4	17DSP4	D
17DTP4	17DSP4	C
17DXP4 17DZP4	17DXP4	D
17EAP4	17HP4C	AK
17EBP4	17EFP4	D
17EFP4	17EFP4	D
17EMP4	17EMP4	• D
17EWP4	17EWP4	• D
17FCP4	17FCP4	• D
17FP4 17FP4A 17HP4 17HP4/ 17RP4 17HP4A 17HP4B 17HP4B/ 17RP4C	17HP4C	A
17HP4C	17HP4C	D
17JP4	17BP4D	A
17KP4 17KP4A	17HP4C	AK
17LP4 17LP4/ 17VP4 17LP4A 17LP4A/ 17VP4B	17LP4B	A
17LP4B	17LP4B	D
17QP4 17QP4A	17QP4B	A
17QP4B	17QP4B	D
17RP4 17RP4C	17HP4C	A
17SP4	17LP4B	AK
17UP4	17QP4B	A
17VP4 17VP4/ 17LP4 17VP4B	17LP4B	A
17YP4	17QP4B	A
19ABP4	19ABP4	D
19ACP4	19CHP4	D
19ADP4	19AVP4	D
19AFP4	19AFP4	D
19AGP4	19AVP4	C
19AHP4	19AYP4	D
19AJP4	19AJP4	D
19AKP4	19AVP4	D
19ANP4	19AYP4	C
19ARP4	19AFP4	D

▲ See *Replacement information* in front of this guide.

Type To Be Replaced ★	Replaced By RCA Type	▲
19ATP4	19AFP4	C
19AUP4	19AFP4	D
19AVP4	19AVP4	D
19AWP4	19AYP4	C
19AXP4 19AYP4	19AYP4	D
19AZP4	19AVP4	D
19BDP4	19BDP4	D
19BHP4	19AVP4	D
19BLP4	19AVP4	C
19BMP4	19AFP4	C
19BRP4	19DRP4	•E
19BSP4 19BTP4	19AVP4	C
19BVP4	19AVP4	D
19BWP4	19AYP4	D
19BXP4	19AYP4	E
19CAP4	19AVP4	C
19CDP4	19CXP4	D
19CFP4	19CHP4	CE
19CHP4	19CHP4	D
19CJP4	19AVP4	D
19CKP4	19CHP4	E
19CLP4	19BDP4	D
19CMP4 19CMP4A	19CMP4	D
19CQP4	19CXP4	D
19CRP4	19BDP4	D
19CSP4	19CHP4	D
19CUP4	19CMP4	D
19CXP4	19CXP4	D
19CYP4	19AVP4	C
19CZP4 19DAP4	19DQP4	•E
19DCP4	19DRP4	•D
19DEP4	19AVP4	E
19DFP4	19CHP4	D
19DHP4	19DSP4	•D
19DKP4	19DRP4	•E
19DLP4	19CHP4	D
19DNP4	19DRP4	•E
19DQP4	19DQP4	•D
19DRP4	19DRP4	•D
19DSP4	19DSP4	•D
19DTP4	19DQP4	•C
19DUP4	19DUP4	•D
19DWP4	19DQP4	•D
19EAP4	19FEP4B	•D
19EBP4	19EBP4	•D
19EDP4	19DRP4	•D
19EFP4	19DSP4	•D
19EGP4	19EGP4	•D
19EHP4 19EHP4A	19DRP4	•D
19EJP4	19FEP4B	•D
19ELP4	19AVP4	D
19EMP4	19EBP4	•C
19ENP4 19ENP4A	19FEP4B	•D
19ERP4	19DRP4	•D
19ESP4	19DSP4	•D
19EUP4	19DRP4	•D
19EVP4 19EWP4	19DQP4	•D
19EZP4	19EZP4	•D
19FBP4	19EGP4	•D
19FCP4 19FCP4A 19FDP4	19DQP4	•D
19FEP4 19FEP4A	19FEP4B	•D
19FEP4B	19FEP4B	•D
19FJP4 19FJP4A	19DQP4	•D
19FLP4	19FLP4	•D
19FSP4	19FEP4B	•D
19FTP4	19FLP4	•D

▲ See *Replacement information* in front of this guide.

RCA PICTURE TUBE INTERCHANGEABILITY GUIDE

Type To Be Replaced ★	Replaced By RCA Type	▲
19FWP4	19AYP4	D
19GAP4	19GAP4	•D
19GBP4	19DQP4	•E
19GEP4	19GEP4A	•D
19GEP4A		
19GFP4		
19GHP4	19DUP4	•C
19GJP4	19DQP4	•D
19GJP4A		
19GNP4	19DRP4	•D
19GRP4	19DQP4	•D
19GTP4	19FEP4B	•C
19XP4	19AVP4	D
19YP4	19AVP4	C
19ZP4	19AVP4	D
20CP4	20DP4D	ACP
20CP4A	20DP4D	AC
20CP4B	20DP4D	ACP
20CP4C		
20CP4D	20DP4D	AP
20DP4A		
20DP4A/ 20CP4A	20DP4D	A
20DP4B	20DP4D	AP
20DP4C		
20DP4C/ 20CP4D	20DP4D	A
20DP4D	20DP4D	D
20RP4	20RP4	•D
20SP4	20SP4	•D
20TP4	20TP4	•D
20XP4		
20YP4	20SP4	•D
20ZP4	20SP4	•D
21ACP4	21AMP4B	A
21ACP4/ 21AMP4		
21ACP4A		
21ACP4A/ 21AMP4A		
21ACP4A/		
21ACP4A/ 21BSP4/ 21AMP4A		

Type To Be Replaced ★	Replaced By RCA Type	▲
21AFP4	21YP4B	AP
21ALP4	21CBP4A	AP
21ALP4A		
21ALP4B		
21ALP4B/ 21ALP4A		
21AMP4	21AMP4B	A
21AMP4A		
21AMP4B	21AMP4B	D
21ANP4	21CBP4A	AP
21ANP4A		
21AP4	21ZP4C	G
21AQP4	21AMP4B	AP
21AQP4A		
21ASP4	21XP4B	AP
21ATP4	21CBP4A	AP
21ATP4A		
21ATP4A/ 21ATP4		
21ATP4B		
21AUP4	21AVP4C	A
21AUP4A		
21AUP4B		
21AUP4B/ 21AUP4A		
21AUP4C	21AVP4C	D
21AVP4	21AVP4C	A
21AVP4/ 21AUP4		
21AVP4A		
21AVP4B		
21AVP4B/ 21AVP4A		
21AVP4B/ 21AUP4B 21AVP4A 21AUP4A		
21AVP4C	21AVP4C	D
21AWP4	21AWP4A	A
21AWP4A	21AWP4A	D
21AYP4	21XP4B	A
21BAP4	21CBP4A	D
21BCP4	21YP4B	C
21BDP4	21AVP4C	D
21BNP4	21CBP4A	D

▲ See *Replacement information* in front of this guide.

Type To Be Replaced ★	Replaced By RCA Type	▲
21BSP4	21AMP4B	A
21BTP4	21CBP4A	A
21CBP4 21CBP4A 21CBP4A/ 21CBP4/ 21CMP4 21CBP4B	21CBP4A	D
21CEP4 21CEP4A	21EMP4/ 21EQPA	D
21CMP4	21CBP4A	A
21CQP4	21CQP4	D
21CUP4	21AMP4B	A
21CVP4	21CBP4A	D
21CWP4	21CBP4A	A
21CXP4	21DSP4	D
21CZP4	21EMP4/ 21EQP4	A
21DAP4 21DEP4 21DEP4A 21DEP4A/ 21DEP4/ 21CZP4	21DEP4A	D
21DFP4	21EMP4/ 21EQP4	D
21DHP4	21DHP4	D
21DLP4	21DLP4	D
21DMP4	21EMP4/ 21EQP4	D
21DNP4	21CBP4A	AP
21DQP4	21DLP4	D
21DRP4	21CBP4A	D
21DSP4	21DSP4	D
21EAP4	21FDP4	F
21EDP4 21EMP4 21EMP4/ 21EQP4	21EMP4/ 21EQP4	D
21EP4	21EP4C	AP
21EP4A 21EP4B	21EP4C	A
21EP4C	21EP4C	D
21EQP4 21ESP4 21ETP4	21EMP4/ 21EQP4	D
21EVP4	21FDP4	CF
21FAP4	21EMP4/ 21EQP4	D
21FDP4	21FDP4	D
21FLP4	21CBP4A	D
21FP4	21FP4D	AP
21FP4A 21FP4C	21FP4D	A
21FP4D	21FP4D	D
21FVP4 21FWP4 21FZP4	21FVP4	• D
21GAP4 21GAP4A	21GAP4A	• D
21KP4 21KP4A	21FP4D	AK
21MP4	21YP4B	E
21WP4 21WP4A	21WP4B	A
21WP4B	21WP4B	D
21XP4 21XP4A	21XP4B	A
21XP4B	21XP4B	D
21YP4 21YP4A	21YP4B	A
21YP4B	21YP4B	D
21ZP4	21ZP4C	AP
21ZP4A 21AP4B	21ZP4C	A
21ZP4C	21ZP4C	D
23ACP4 23AFP4	23YP4	D
23AGP4	23CP4	C
23AHP4	23AHP4/	D
23AKP4	23FP4A	C

▲ See *Replacement information* in front of this guide.

RCA PICTURE TUBE INTERCHANGEABILITY GUIDE

Type To Be Replaced ★	Replaced By RCA Type	▲
23ALP4	23CQP4	D
23ANP4	23BKP4	D
23ARP4	23ARP4	D
23ASP4	23ASP4	D
23ATP4	23BKP4	D
23AUP4	23AHP4/	D
23AVP4	23CP4	C
23AWP4	23BJP4	C
23BAP4	23CP4	C
23BDP4	23YP4	D
23BFP4	23FP4A	C
23BGP4 23BHP4	23BGP4	D
23BJP4	23BJP4	D
23BKP4 23BLP4	23BKP4	D
23BMP4	23YP4	D
23BNP4	23CP4	D
23BP4	23CP4	C
23BQP4	23BQP4	D
23BTP4 23BVP4 23BWP4	23YP4	D
23BXP4	23EKP4	•E
23BZP4	23CGP4	D
23CBP4	23BQP4	D
23CEP4	23ARP4	D
23CGP4	23CGP4	D
23CP4 23CP4A	23CP4	D
23CQP4	23CQP4	D
23CUP4	23CP4	C
23CZP4	23AHP4	D
23DAP4	23DAP4	D
23DBP4	23DBP4	D
23DKP4	23EKP4	•D
23DLP4 23DLP4A	23ENP4	•C
23DNP4	23BKP4	D
23DP4	23CP4	C
23DQP4	23BKP4	M
23DSP4 23DSP4A	23ENP4	•M
23DTP4	23EKP4	•D
23DXP4	23CP4	D
23DYP4	23ETP4	•P
23DZP4	23EQP4	•D
23ECP4	23ENP4	•E
23EDP4	23EKP4	•E
23EHP4 23EKP4 23ELP4 23EMP4	23EKP4	•D
23ENP4	23ENP4	•D
23EP4	23EP4	D
23EQP4	23EQP4	•D
23ESP4	23HFP4A	•D
23ETP4	23ETP4	•D
23EWP4 23EWP4A	23EQP4	•D
23EYP4	23EYP4	D
23EZP4	23EZP4	•D
23FBP4	23ENP4	•D
23FCP4 23FDP4	23GJP4A	•D
23FEP4	23ENP4	•D
23FHP4	23GJP4A	•D
23FJP4	23ETP4	•D
23FLP4	23EKP4	•D
23FMP4	23HFP4A	•D
23FP4 23FP4A	23FP4A	D
23FRP4	23FRP4	•D
23FSP4	23FSP4	•D
23FVP4 23FVP4A	23HFP4A	•D

▲ See *Replacement information* in front of this guide.

Type To Be Replaced ★	Replaced By RCA Type	▲
23FZP4	23GSP4	*D
23GBP4	23HFP4A	*D
23GEP4	23ENP4	*D
23GFP4	23HGP4	*D
23GJP4 23GJP4A	23GJP4A	*D
23GP4	23CP4	D
23GSP4	23GSP4	*D
23GTP4	23ETP4	*D
23GUP4	23FRP4	*D
23GVP4	23HUP4A	*D
23GWP4	23GWP4	*D
23GXP4	23GSP4	*D
23GZP4	23EKP4	*E
23HFP4 23HFP4A	23HFP4A	*D
23HGP4	23HGP4	*D
23HLP4	23GSP4	*D
23HP4	23CP4	D
23HQP4	23HGP4	*D
23HRP4 23HSP4	23HWP4A	*C
23HUP4 23HUP4A	23HUP4A	*D
23HWP4	23HWP4A	*D
23HWP4A	23HWP4A	*D
23HXP4	23HFP4A	*D
23HYP4	23JEP4	*D
23JAP4	23GJP4A	*D
23JBP4	23FSP4	*C
23JEP4	23JEP4	*D
23JGP4	23FRP4	*D
23JHP4	23HFP4A	*D
23JLP4	23HUP4A	*D
23JP4	23JP4	D
23KP4 23KP4A	23FP4A	C
23LP4	23ETP4	*D
23MP4 23MP4/ 23MP4A/ 23WP4 23MP4A	23FP4A	D
23NP4	23NP4	D
23QP4	23CP4	D
23TP4	23YP4	D
23UP4	23BQP4	D
23WP4	23FP4A	D
23XP4 23YP4	23YP4	D
24ADP4 24ADP4/ 24VP4A/ 24CP4A/ 24TP4	24CP4B	A
24AEP4	24AEP4	D
24AHP4	24AHP4	D
24ALP4	24AHP4	D
24ANP4	24AEP4	A
24AUP4	24AUP4	D
24AVP4	24BEP4	F
24BEP4	24BEP4	D
24CP4	24CP4B	D
24CP4A	24CP4B	A
24CP4B	24CP4B	D
24DP4 24DP4A 24DP4A/ 24YP4	24AEP4	A
24QP4	24CP4B	AP
24TP4 24VP4 24VP4A	24CP4B	A
24XP4	24CP4B	AP
24YP4	24AEP4	A
24ZP4	24EAP4	D
230RB4	9WP4	*D
310AVB4	12CNP4	*D
470ACB4	19AYP4	D
500KB4	20TP4	*D
SG10FP4A	10FP4A	D
SG14WP4	14WP4	D
SG16KP4A	16RP4B	D
SG17BJP4	17BJP4	D
SG17BP4B	17BP4D	D
SG17CKP4	17DSP4	D
SG17HP4B	17HP4C	D
SG17LP4A	17LP4B	D
SG17QP4A	17QP4B	D
SG20CP4D	20DP4D	C
SG21ACP4A	21AMP4B	D
SG21AUP4B	21AVP4C	D
SG21AWP4	21AWP4A	D
SG21DEP4A	21EMP4/ 21EQP4	D
SG21EP4B	21EP4C	D
SG21FLP4	21CBP4A	D
SG21FP4C	21FP4D	D
SG21WP4A	21WP4B	D

▲ See *Replacement information* in front of this guide.

Type To Be Replaced ★	Replaced By RCA Type	▲
SG21XP4A	21XP4B	D
SG21YP4A	21YP4B	D
SG21ZP4B	21ZP4C	D
SG24AEP4	24AEP4	D
SG24CP4A	24CP4B	D

▲ See *Replacement information* in front of this guide.

Safety Precautions For Color Picture Tubes

WARNING

X-Radiation:

Operation of the referenced color picture tube at abnormal conditions which exceed the 0.5 mR/h isodose-rate curve shown for this tube may produce soft X-rays which may constitute a health hazard on prolonged exposure at close range unless adequate external shielding is provided. Therefore, precautions must be exercised during servicing of TV receivers employing this tube to assure that the anode voltage and other tube voltages are adjusted to the recommended values so that the Design-Maximum Ratings will not be exceeded.

This color picture tube incorporates integral X-radiation shielding and must be replaced with a tube of the same type number or an RCA recommended replacement to assure continued safety.

Implosion Protection:

This picture tube employs integral implosion protection and must be replaced with a tube of the same type number or an RCA recommended replacement to assure continued safety.

Shock Hazard:

The high voltage at which the tube is operated may be very dangerous. Design of the TV receiver should include safeguards to prevent the user from coming in contact with the high voltage. Extreme care should be taken in the servicing or adjustment of any high-voltage circuit.

Caution must be exercised during the replacement or servicing of the picture tube since a residual electrical charge may be contained on the high-voltage capacitor formed by the external and internal conductive coatings of the picture tube funnel. To remove any undesirable residual high-voltage charges from the picture tube, "bleed off" the charge by shorting the anode contact button, located in the funnel of the picture tube, to the external conductive coating before handling the tube. Discharging the high voltage to isolated metal parts such as cabinets and control brackets may produce a shock hazard.

Tube Handling:
Picture tubes should be kept in the shipping box or similar protective container until just prior to installation. Wear heavy protective clothing, including gloves and safety goggles with side shields, in areas containing unpacked and unprotected tubes to prevent possible injury from flying glass in the event a tube breaks. Handle the picture tube with extreme care. Do not strike, scratch or subject the tube to more than moderate pressure. Particular care should be taken to prevent damage to the seal area.

The equipment manufacturer should provide a warning label in an appropriate position on the equipment to advise the serviceman of all safety precautions.

FEATURES OF FLUORESCENT SCREENS

The fluorescent screens of the cathode-ray tubes covered in this Section are identified according to phosphor number, e.g., P1, P2, P4, P5, P7, etc.

Phosphor P1 produces a brilliant spot having yellowish-green fluorescence and medium persistence. Types having this phosphor are particularly useful for general oscillographic applications in which recurrent-wave phenomena are to be observed visually.

Phosphor P2 is a medium-persistence screen which exhibits yellowish-green fluorescence and phosphorescence. The phosphorescence may persist for over a minute under conditions of adequate excitation and low-ambient light. Types utilizing this phosphor are particularly useful for observing either low- or medium-speed non-recurring phenomena.

Phosphor P4 is a highly efficient screen having white fluorescence and medium-short persistence. Types having this phosphor are of particular interest for television picture tubes.

Phosphor P5 produces a highly actinic spot having blue fluorescence and medium-short persistence. Types having this phosphor are especially useful in photographic applications involving film moving at very high speeds.

Phosphor P7 is a very long-persistence, cascade (two-layer) screen. During excitation by the electron beam, this phosphor produces a purplish-blue fluorescence. After excitation, the screen exhibits a yellowish-green phosphorescence which persists for several minutes. Types having this phosphor are particularly useful where either extremely low-speed recurrent phenomena or medium-speed non-recurrent phenomena are to be observed.

Phosphor P11 produces a brilliant actinic spot of blue fluorescence and medium-short persistence to permit its use in all photographic applications except those in which film moves at high speed. P11 screens, because of their unusually high brightness characteristic, may also be used for visual observation of phenomena.

Phosphor P12 is a long-persistence phosphor which exhibits both yellowish-orange fluorescence and phosphorescence. Types utilizing this phosphor are particularly useful for observing low- and medium-speed recurring phenomena.

Phosphor P14 is a long-persistence cascade (two-layer) screen. During excitation by the electron beam, this phosphor exhibits purplish-blue fluorescence. After excitation, it exhibits a yellowish-orange phosphorescence which persists for a little over a minute. Types utilizing this phosphor are particularly useful for observing either low- and medium-speed non-recurring phenomena or high-speed recurring phenomena.

FEATURES OF FLUORESCENT SCREENS

Phosphor P15 has radiation in the visible green region and in the invisible near-ultraviolet region. The ultraviolet radiation has short persistence which is appreciably shorter than that of the visible radiation. This phosphor finds application in flying-spot cathode-ray tubes.

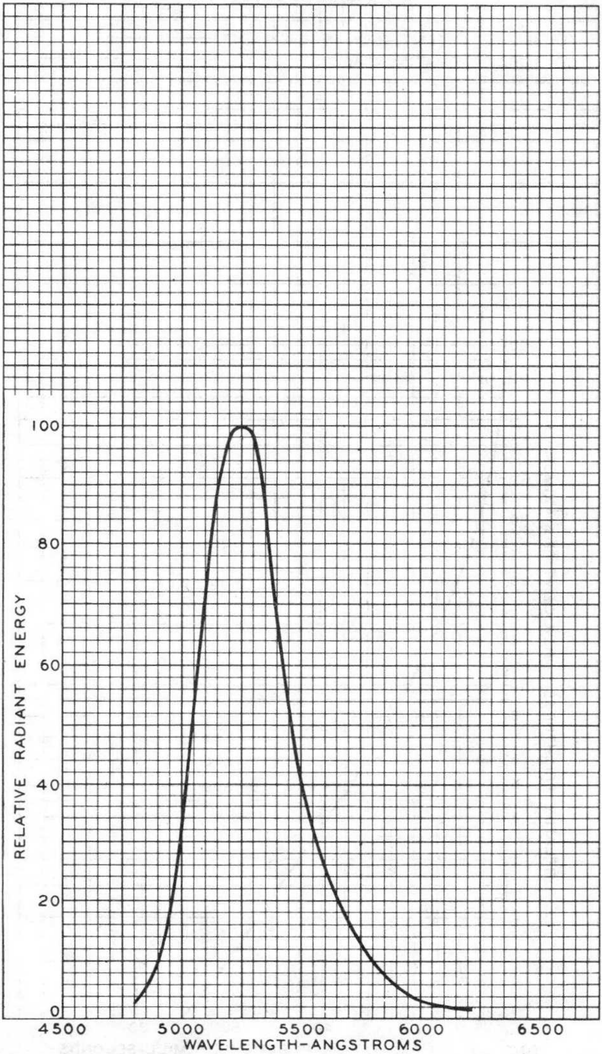
Phosphor P16 has violet as well as near-ultroviolet fluorescence and phosphorescence with very short persistence. This phosphor has a stable, exponential decay characteristic and is particularly useful for the high-speed scanning requirements of a flying-spot video-signal generator.

Phosphor P20 has high luminous efficiency, yellow-green fluorescence and medium-short persistence. The screen may be used in applications requiring relatively short persistence and good visual efficiency.

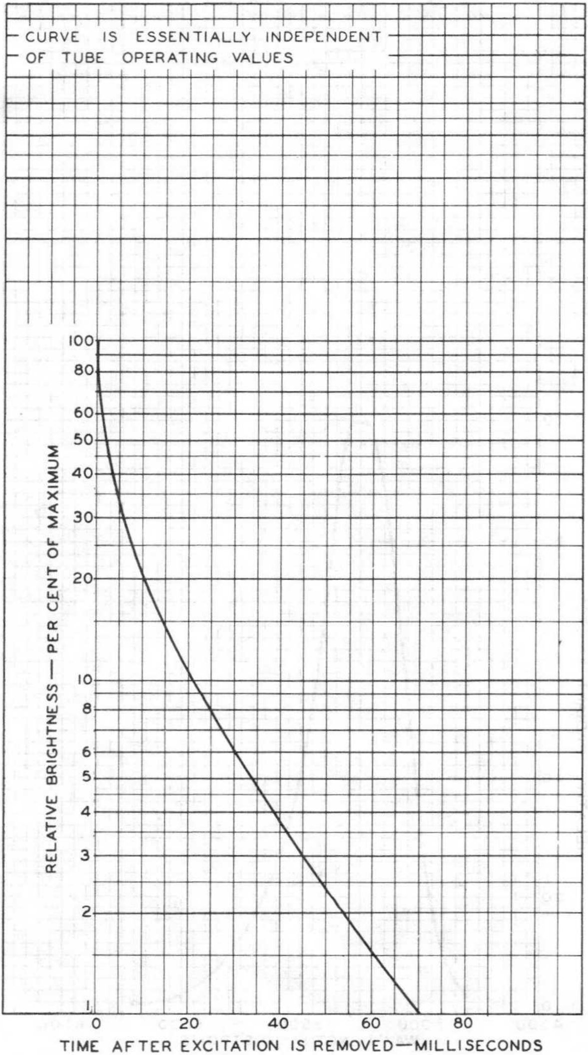
Phosphor P22 is the designation for three separate phosphors used in combination in a color picture tube. The separate phosphors are blue, green, and red, respectively. The persistence of the group phosphorescence is classified as medium.

Phosphor P24 is a short-persistence phosphor with green fluorescence and phosphorescence. Its spectral-energy emission characteristic has sufficient range to provide useable energy over the visible spectrum required for generating color signals from color transparencies.

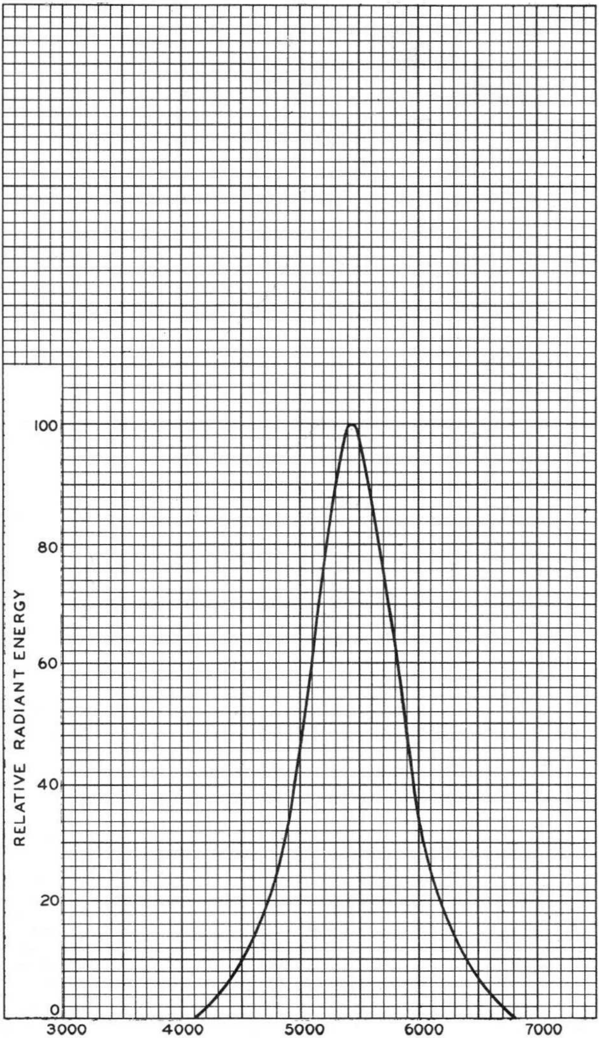
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P1



PERSISTENCE CHARACTERISTIC OF PHOSPHOR P1



SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P2



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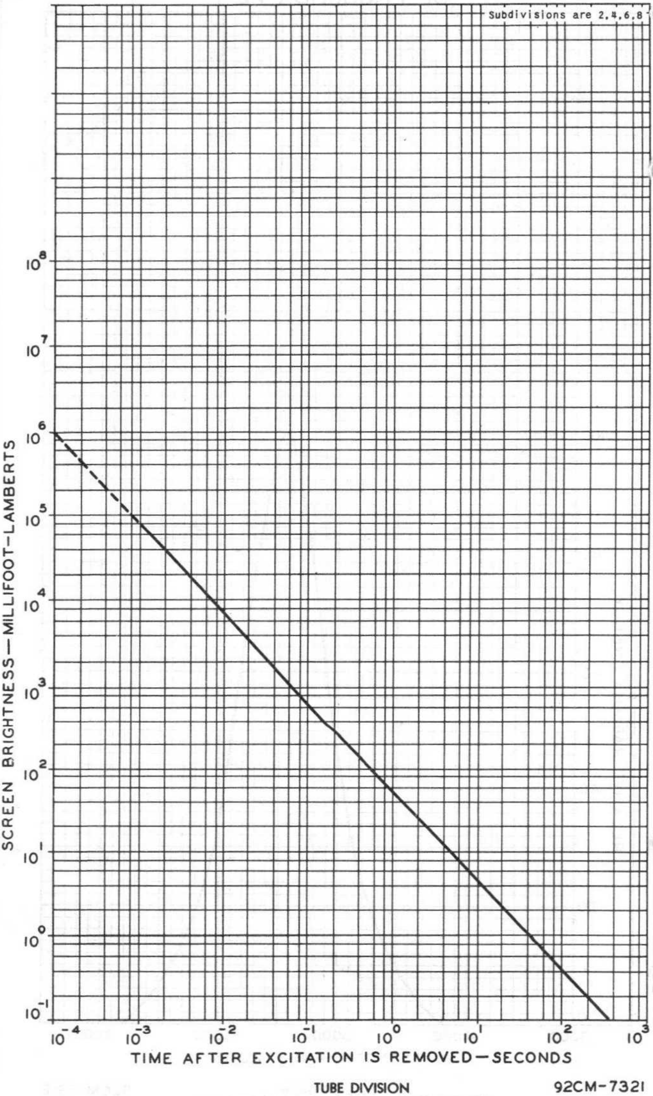
PERSISTENCE CHARACTERISTIC OF PHOSPHOR P2



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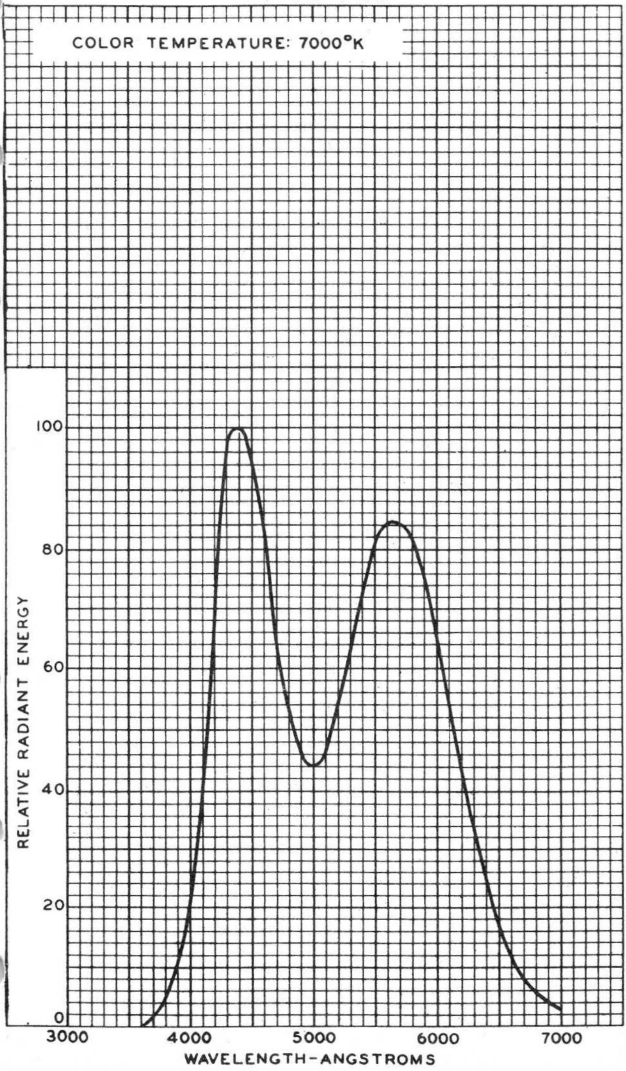
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P4

SULFIDE TYPE



PERSISTENCE CHARACTERISTIC OF PHOSPHOR P4
SULFIDE TYPE

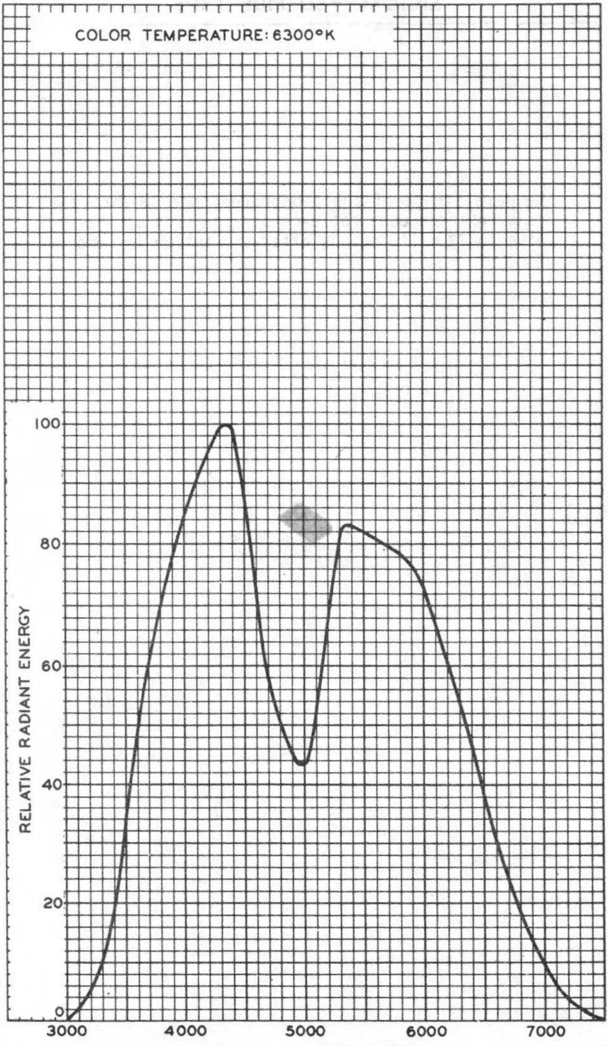
FOR KINESCOPES

The persistence of the phosphorescence is such that its brightness does not exceed 7 per cent of the peak value in 33 milliseconds after excitation is removed.

FOR OSCILLOGRAPH TUBES

The persistence characteristics of the phosphorescence are the same as those shown for the P11 phosphor.

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR No. 4
SILICATE-SULFIDE TYPE

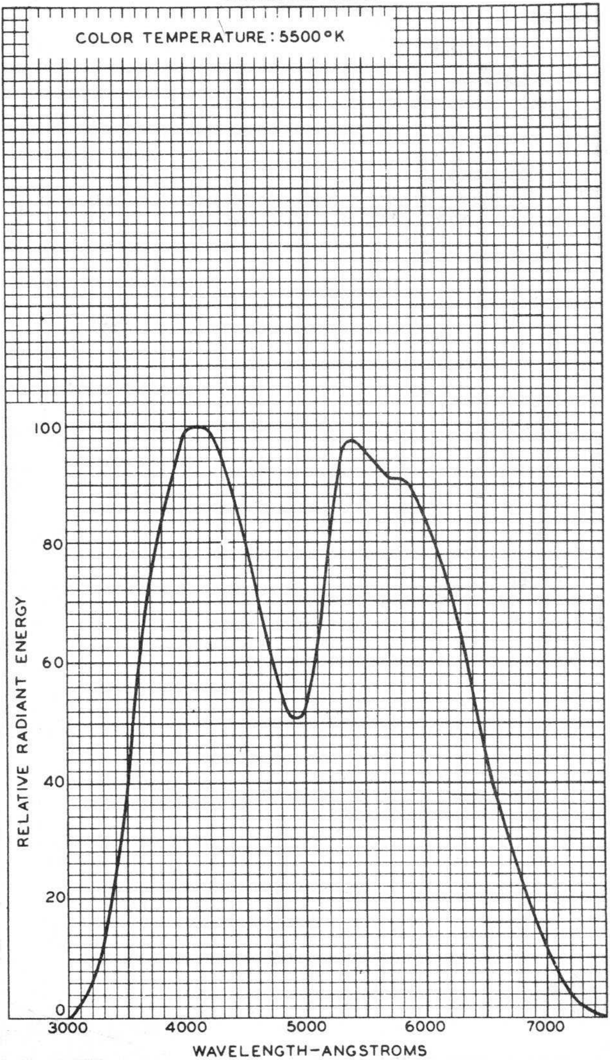


PERSISTENCE CHARACTERISTIC
OF PHOSPOR № 4
SILICATE-SULFIDE TYPE

The persistence of the phosphorescence is such that its brightness does not exceed 7 per cent of the peak value in 33 milliseconds after excitation is removed.

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P4

SILICATE TYPE



AUG. 2, 1949

TUBE DIVISION

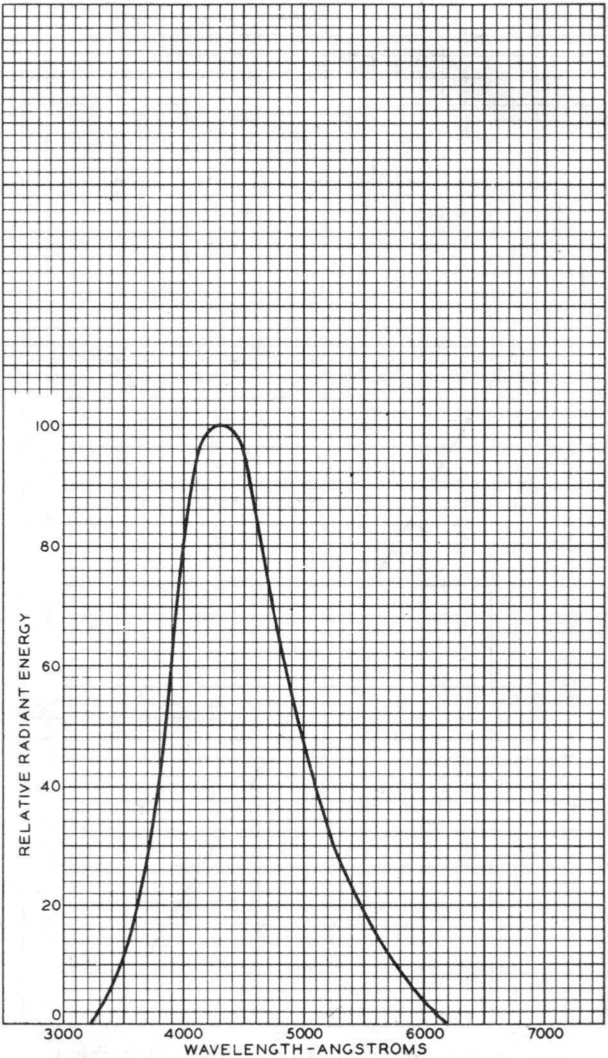
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7335

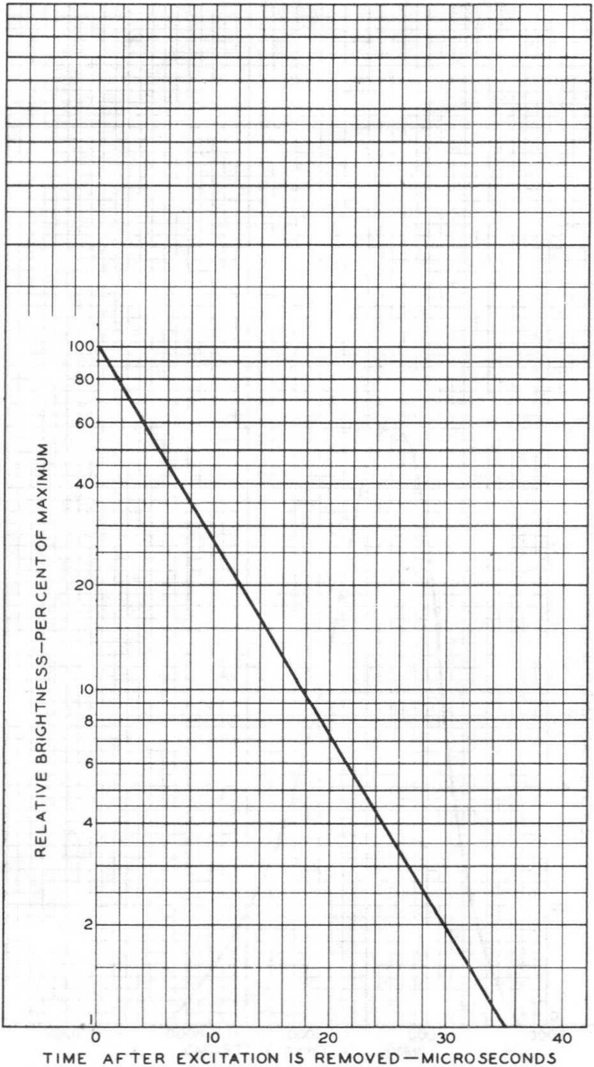
PERSISTENCE CHARACTERISTIC OF PHOSPOR P4
SILICATE TYPE

The persistence of the phosphorescence is such that its brightness does not exceed 7 per cent of the peak value in 33 milliseconds after excitation is removed.

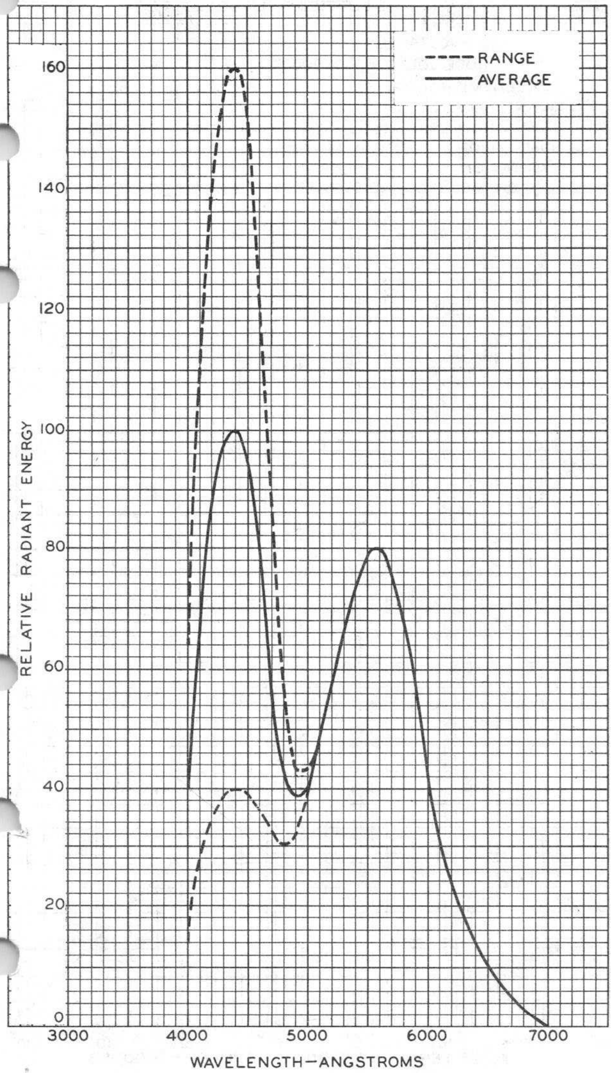
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR № 5



PERSISTENCE CHARACTERISTIC OF PHOSPHOR Nº 5

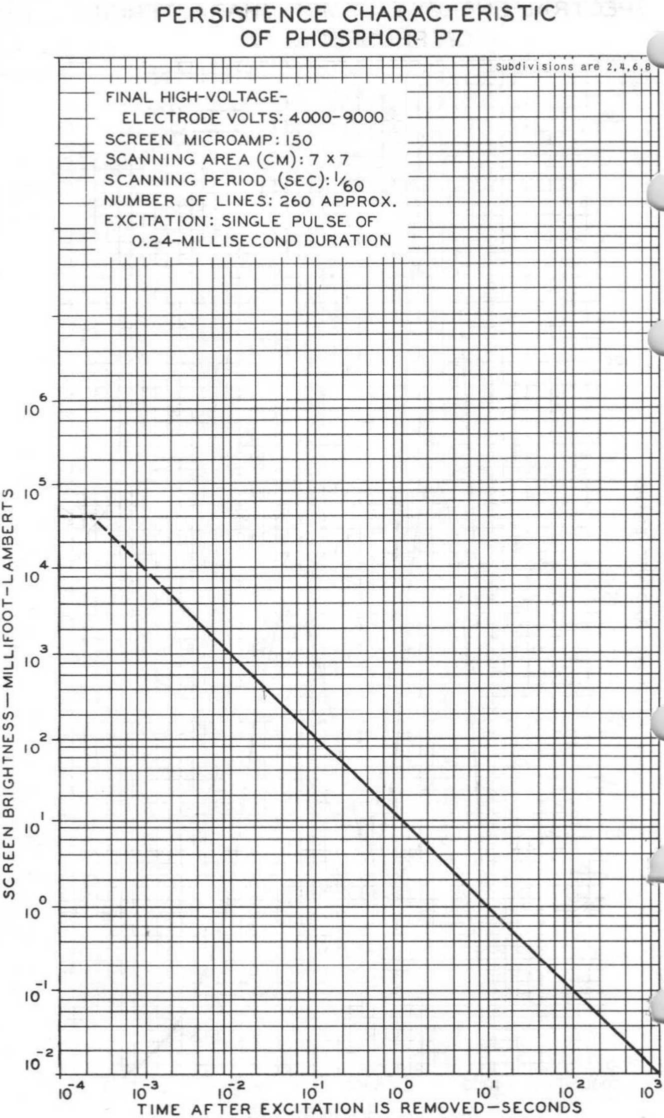


SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P7



TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7336

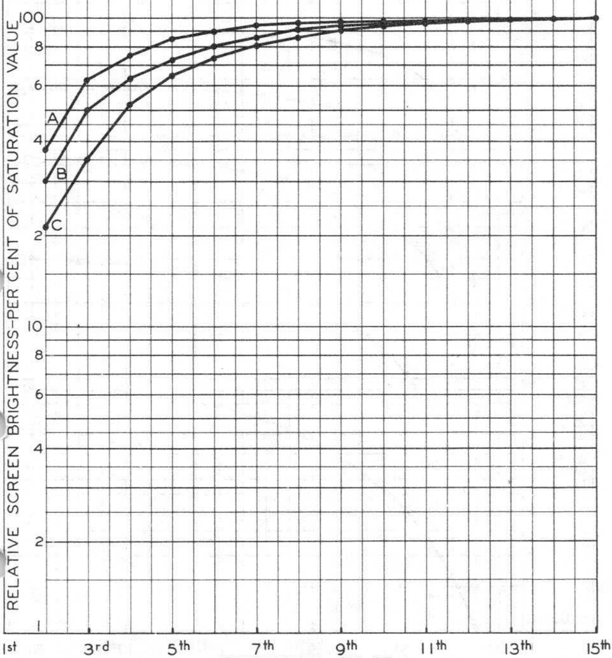


TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

BUILDUP CHARACTERISTICS OF PHOSPHOR P7

FINAL HIGH-VOLTAGE-ELECTRODE VOLTS: 4000—9000
SCANNING AREA (CM): 7 X 7
NUMBER OF LINES: 260 APPROX.
EXCITATION: PULSE OF 1/60-SECOND DURATION SUPPLIED TO GRID No1 OF CATHODE-RAY TUBE AT 1-SECOND INTERVALS FOR EACH OF THE LOCI UNDER THE INDICATED CONDITIONS.
BRIGHTNESS: MEASURED JUST BEFORE EACH EXCITATION PULSE.

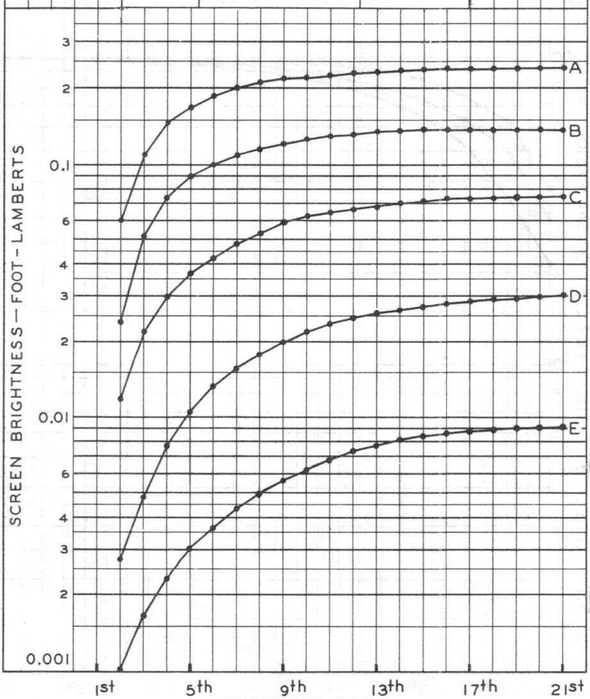
LOCUS	SCREEN MICROAMP
A	150
B	75
C	37



BUILDUP CHARACTERISTICS OF PHOSPHOR P7

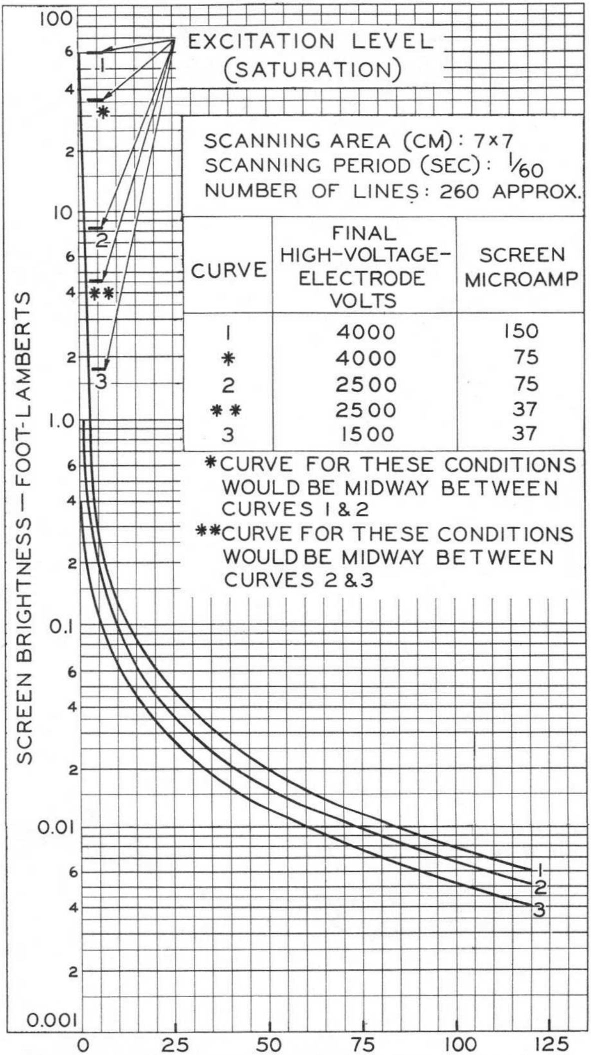
SCANNING AREA (CM): 7×7
NUMBER OF LINES: 260 APPROX.
EXCITATION: PULSE OF 1/60-SECOND DURATION SUPPLIED TO GRID Nº1 OF CATHODE-RAY TUBE AT 1-SECOND INTERVALS FOR EACH OF THE LOCI UNDER THE INDICATED CONDITIONS.
BRIGHTNESS: MEASURED JUST BEFORE EACH EXCITATION PULSE.

LOCUS	FINAL HIGH-VOLTAGE-ELECTRODE VOLTS	SCREEN MICROAMP
A	4000	150
B	4000	75
C	2500	75
D	2500	37
E	1500	37



![RCA]

PERSISTENCE CHARACTERISTICS OF PHOSPHOR P7

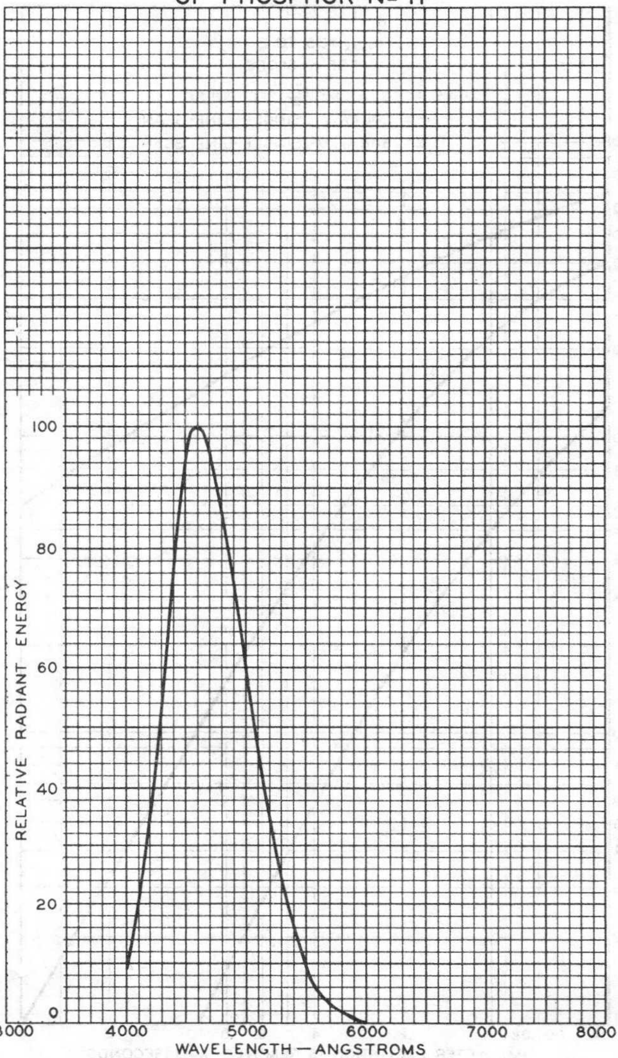


TUBE DIVISION 92CL-6804R5

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

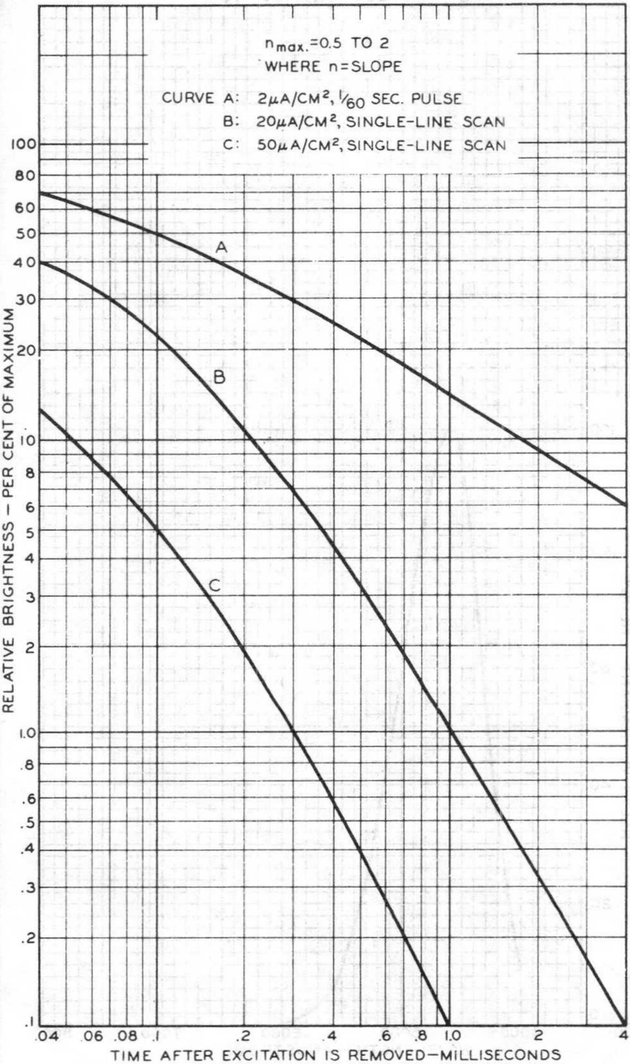
![RCA]

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR Nº 11



RCA

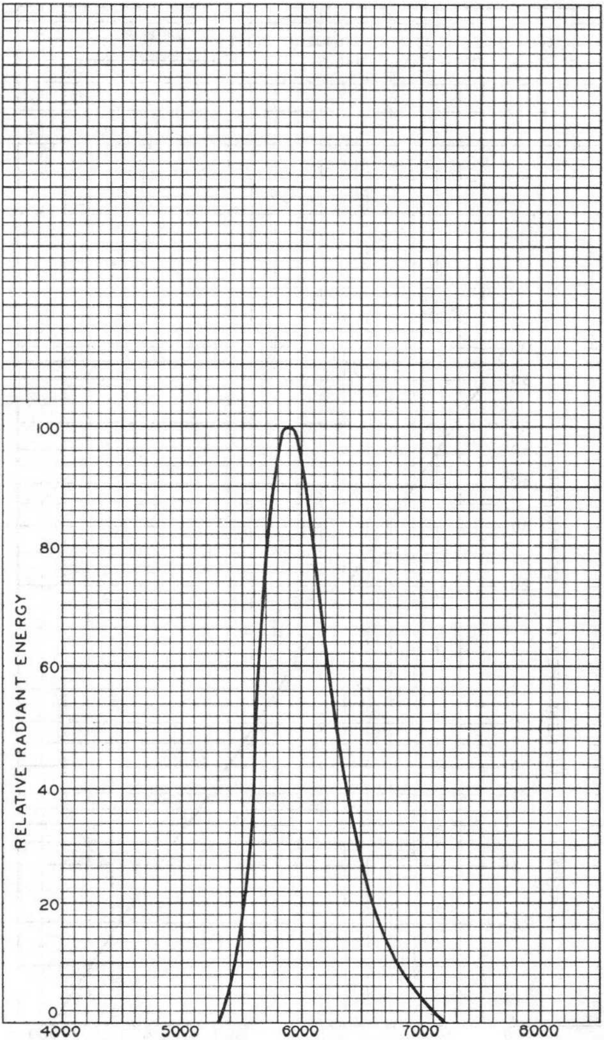
PERSISTENCE CHARACTERISTICS OF PHOSPHOR №11



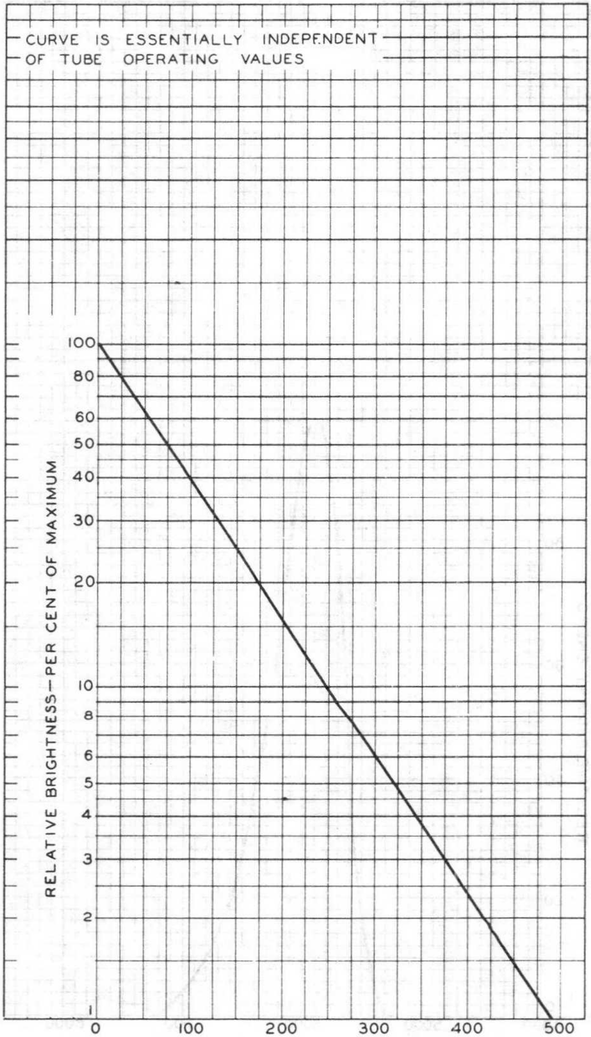
JULY 7, 1950 | TUBE DEPARTMENT | 92CM-6806R2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

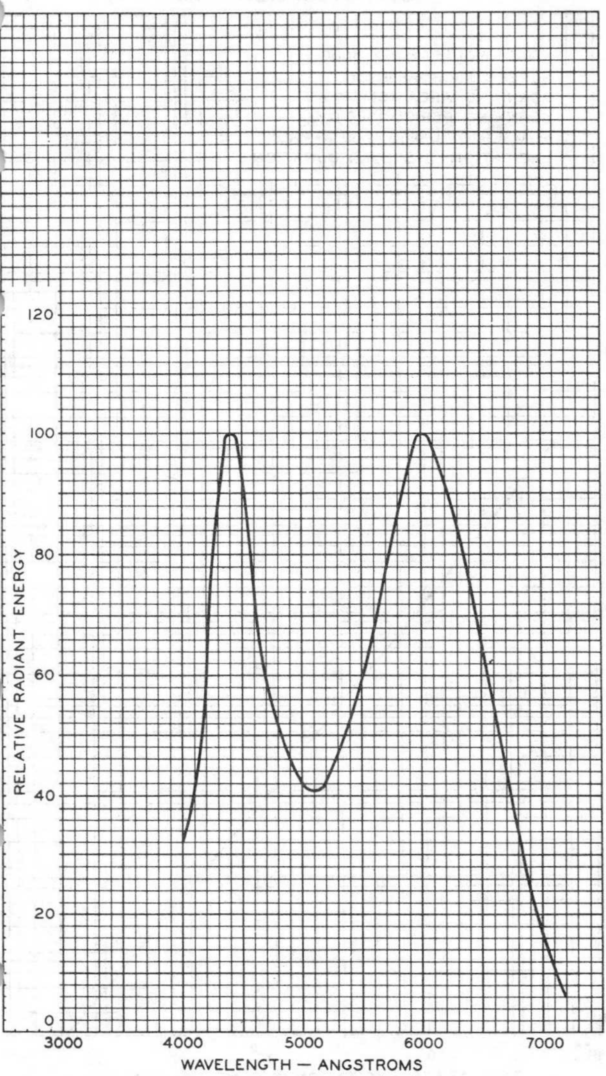
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P12



PERSISTENCE CHARACTERISTIC OF PHOSPHOR P12



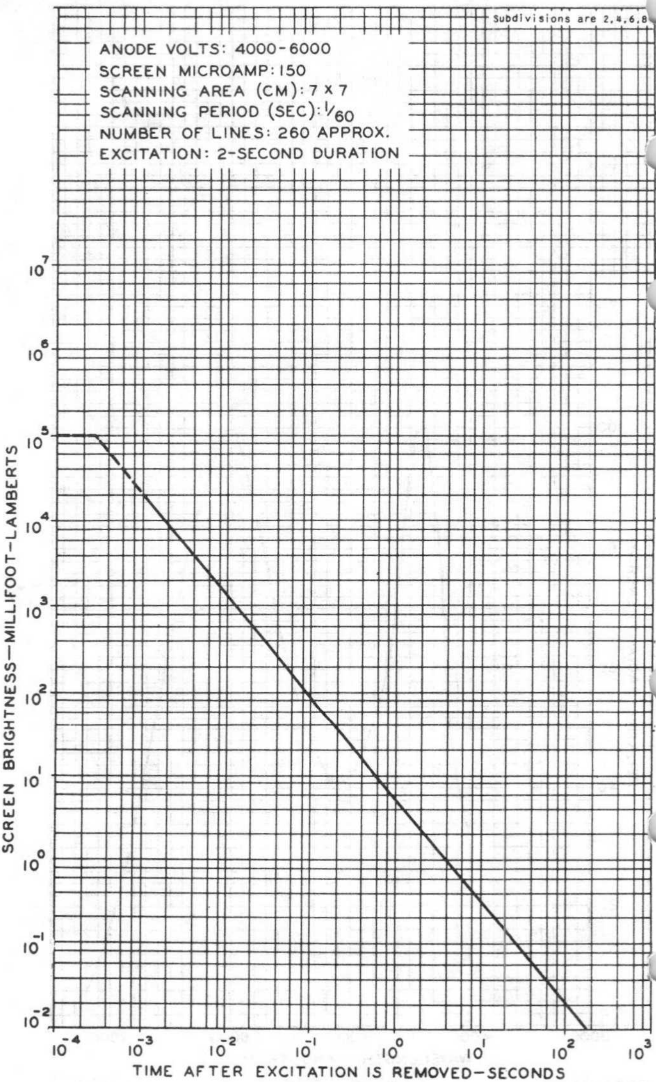
SPECTRAL-ENERGY EMISSION CHARACTERISTIC
OF PHOSPHOR P14



AUG. 1, 1951 | TUBE DEPARTMENT | 92CM-7675

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

PERSISTENCE CHARACTERISTIC OF PHOSPHOR P14



JAN. 26, 1951

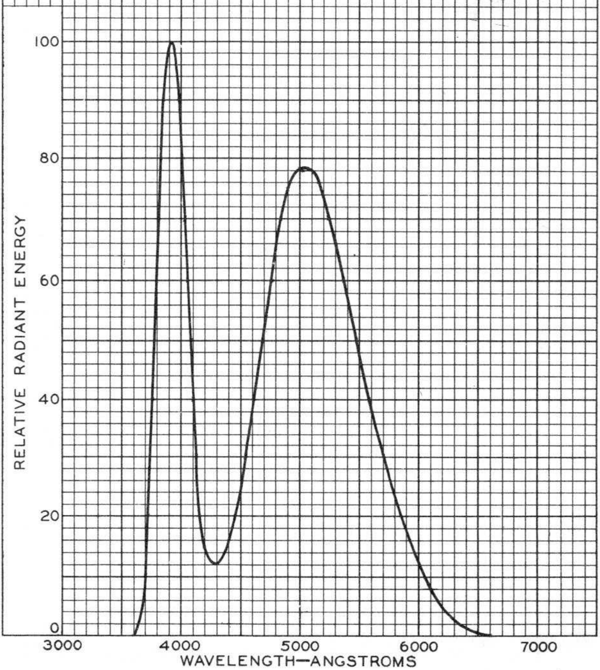
TUBE DEPARTMENT

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7326R1

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P15

COMPONENT	COLOR	I.C.I. COORDINATES	
		X	Y
VISIBLE	GREEN	0.246	0.439
ULTRAVIOLET	——	——	——



ELECTRON TUBE DIVISION

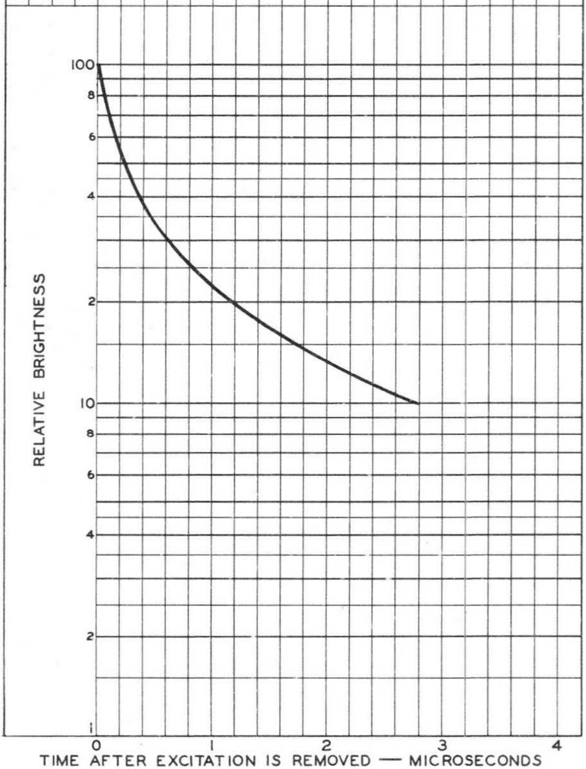
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-6915R1

PERSISTENCE CHARACTERISTIC OF PHOSPHOR P15

COMPONENTS	EACH ESSENTIALLY INDEPENDENT OF TUBE OPERATING VALUES.
VISIBLE	SHOWN BY CURVE.
ULTRAVIOLET	DECAYS TO APPROXIMATELY 10 % OF MAXIMUM IN NOT MORE THAN 0.05 MICROSECOND.

SPOT: SHARPLY FOCUSED.



ELECTRON TUBE DIVISION

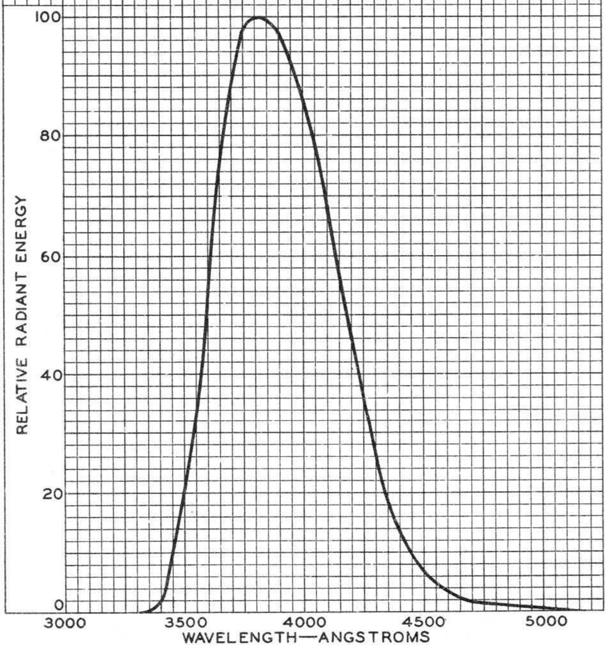
92CM-8540R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P16

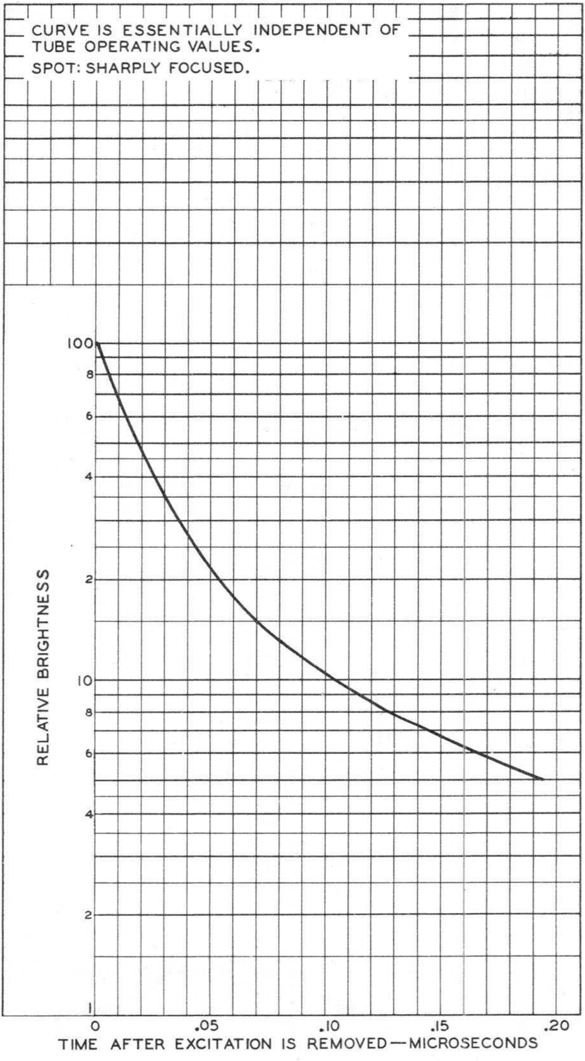
COMPONENT	COLOR	I.C.I. COORDINATES X	I.C.I. COORDINATES Y
VISIBLE	VIOLET	0.175	0.003
NEAR ULTRAVIOLET	——	——	——



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7563R1

PERSISTENCE CHARACTERISTIC OF PHOSPHOR P16

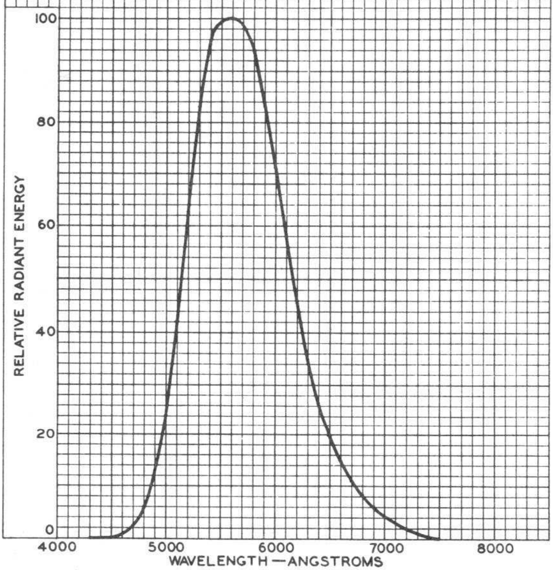


ELECTRON TUBE DIVISION 92CM—7564R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

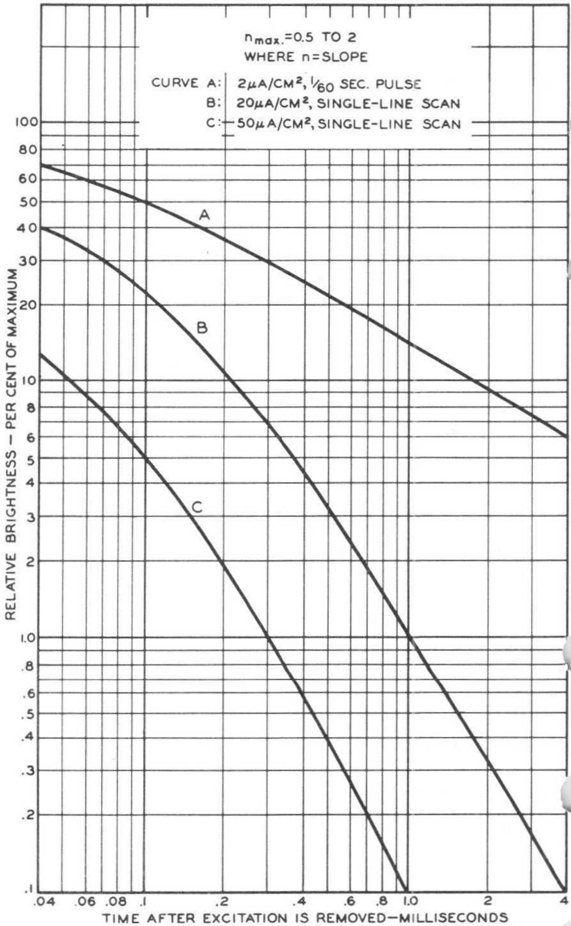
Spectral-Energy Emission Characteristic

COLOR	C.I.E. COORDINATES	
	X	Y
YELLOW-GREEN	0.426	0.546



92CM-7647R2

Persistence Characteristic

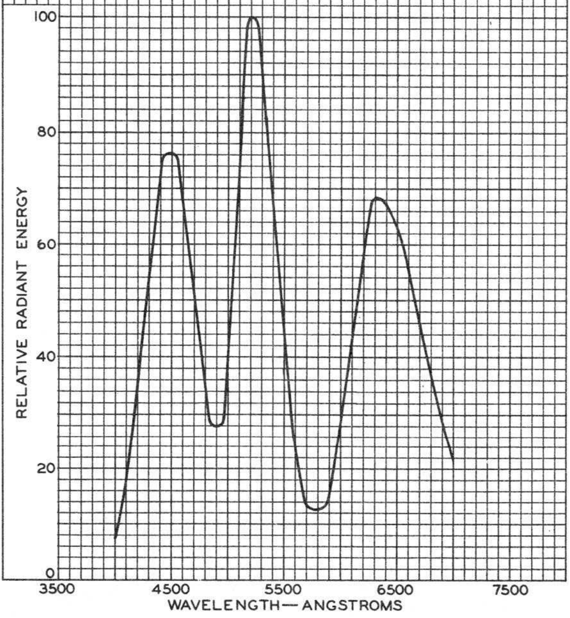


SPECTRAL-ENERGY EMISSION CHARACTERISTIC

SIMULTANEOUS EXCITATION OF BLUE PHOSPHOR, GREEN PHOSPHOR, AND RED PHOSPHOR TO PRODUCE 8500° K + 27 M.P.C.D. WHITF (X=0.287,Y=0.316).

COMPONENT COLOR		CIE COORDINATES	
GENERAL DESCRIPTION	JEDEC DESIGNATION*	X	Y
BLUE	PURPLISH-BLUE	0.146	0.052
GREEN	YELLOWISH-GREEN	0.218	0.712
RED	REDDISH-ORANGE	0.674	0.326

*JEDEC COLOR CLASSIFICATION CORRESPONDING TO CIE COORDINATE VALUES.



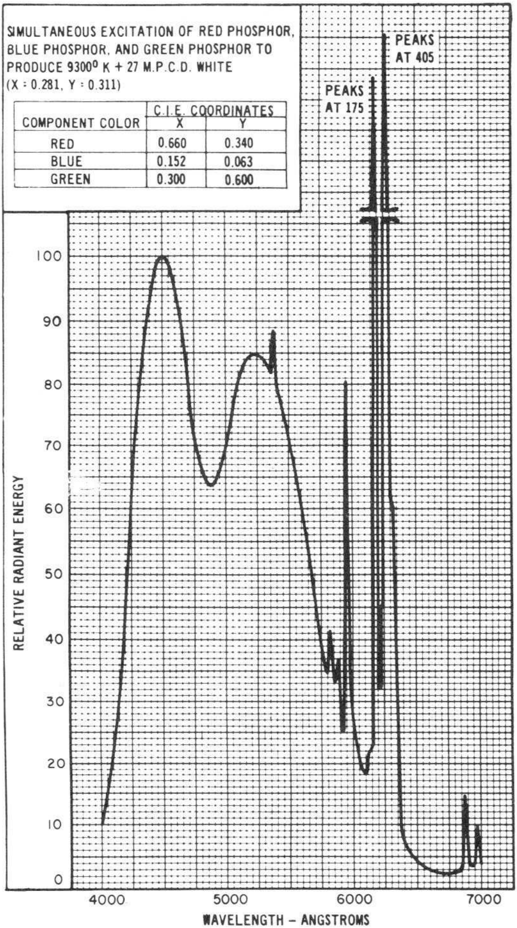
92CM-7969R4

PERSISTENCE CHARACTERISTIC

The persistence of the group phosphorescence is such that its brightness does not exceed 7 per cent of the peak value in 33 milliseconds after excitation is removed.

Spectral-Energy Emission Characteristic

[a] The relative intensities of the narrow-emission bands of the red phosphor are dependent on the resolution of the measuring device.



COMPONENT COLOR	C.I.E. COORDINATES X	Y
RED	0.660	0.340
BLUE	0.152	0.063
GREEN	0.300	0.600

92LM-1952

Group Phosphor P22

New Rare-Earth (Red), Sulfide (Blue & Green) Type

PERSISTENCE CHARACTERISTIC

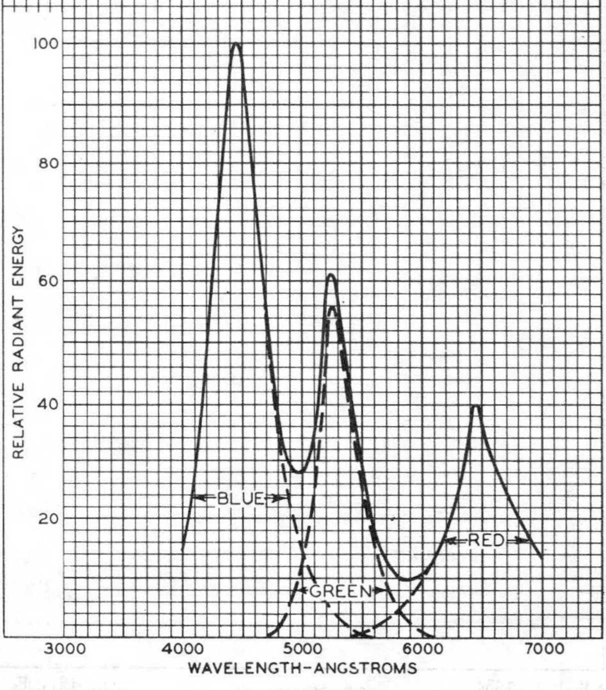
The persistence of the group phosphorescence is *medium short*. Persistence of the component phosphors is such that after excitation is removed, brightness decays to a level not exceeding 10 per cent of the initial value in:

22 microseconds (Approx.). . . . . .Blue phosphor
60 microseconds (Approx.). . . . . Green phosphor
1 millisecond (Approx.). . . . . Red phosphor

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF GROUP PHOSPHOR P22

EQUAL EXCITATION OF EACH PHOSPHOR

PHOSPHOR	RANGE OF MAX. VALUE ANGSTROMS
BLUE EMITTING	4420 TO 4520
GREEN EMITTING	5230 TO 5270
RED EMITTING	6360 TO 6580



PERSISTENCE CHARACTERISTIC OF GROUP PHOSPHOR P22

The persistence of the group phosphorescence is such that its brightness does not exceed 7 per cent of the peak value in 33 milliseconds after excitation is removed.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Group Phosphor P22

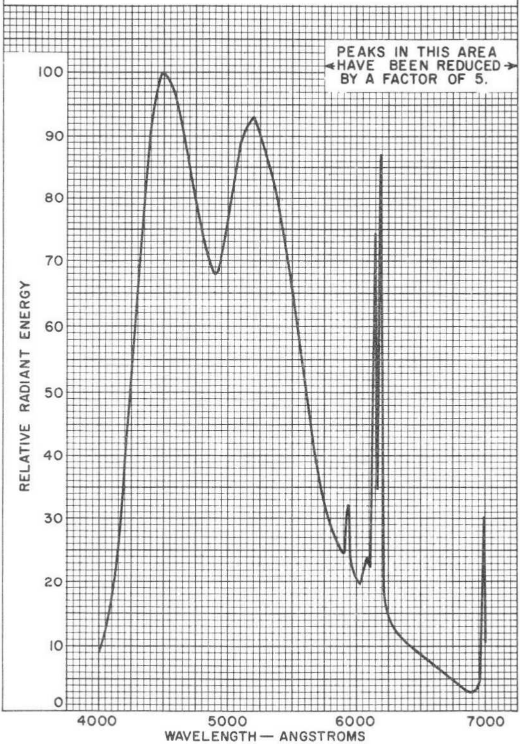
Rare-Earth (Red), Sulfide (Blue & Green) Type[a]

Spectral-Energy Emission Characteristic

[a] The relative intensities of the narrow-emission bands of the red phosphor are dependent on the resolution of the measuring device.

SIMULTANEOUS EXCITATION OF RED PHOSPHOR, BLUE PHOSPHOR, AND GREEN PHOSPHOR TO PRODUCE 9300° K + 27 M.P.C.D. WHITE (X = 0.281, Y = 0.311).

COMPONENT COLOR	C.I.E. COORDINATES	
	X	Y
RED	0.676	0.324
BLUE	0.155	0.061
GREEN	0.290	0.590



92CM-13088R1

Group Phosphor P22

Rare-Earth (Red), Sulfide (Blue & Green) Type

PERSISTENCE CHARACTERISTIC

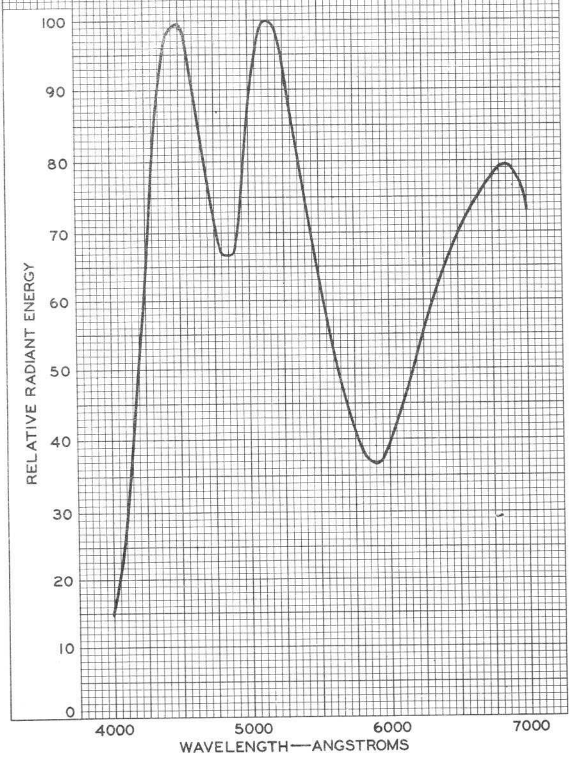
The persistence of the group phosphorescence is *medium short*. Persistence of the component phosphors is such that after excitation is removed, brightness decays to a level not exceeding 10 per cent of the initial value in:

22 microseconds (Approx.) . . . . Blue phosphor
60 microseconds (Approx.) . . . . .Green phosphor
1 millisecond (Approx.) . . . . .Red phosphor

SPECTRAL-ENERGY EMISSION CHARACTERISTIC

SIMULTANEOUS EXCITATION OF BLUE PHOSPHOR, GREEN PHOSPHOR, AND RED PHOSPHOR TO PRODUCE 9300° K + 27 M.P.C.D. WHITE (X=0.281, Y=0.311).

COMPONENT COLOR	C.I.E. COORDINATES	
	X	Y
BLUE	0.155	0.061
GREEN	0.265	0.585
RED	0.639	0.342



92CM-10857

Group Phosphor P22

All-Sulfide Type

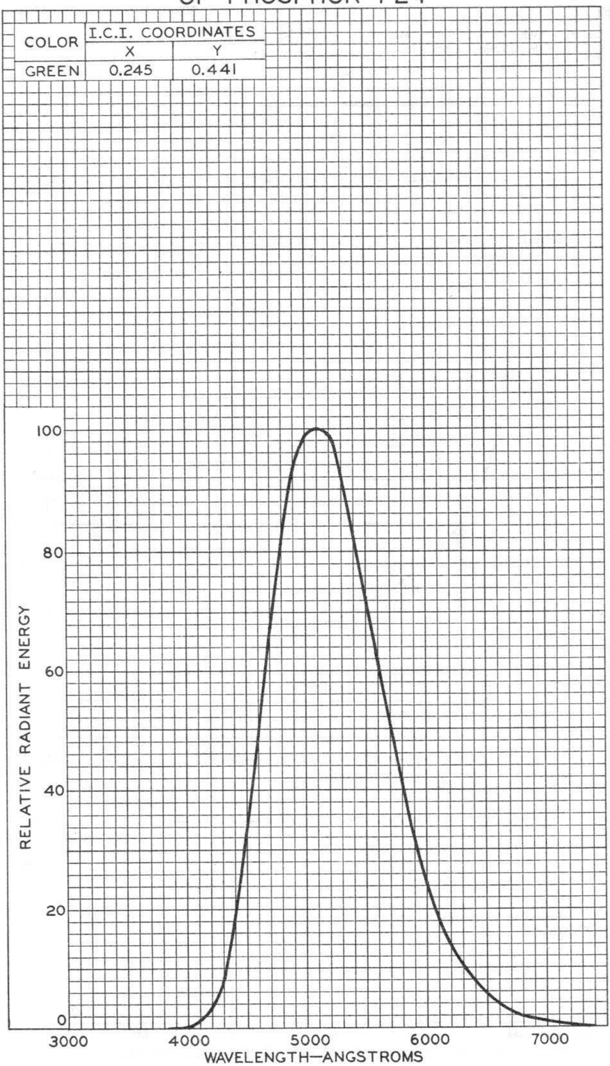
PERSISTENCE CHARACTERISTIC

The persistence of the group phosphorescence is ***medium short***. Persistence of the component phosphors is such that after excitation is removed, brightness decays to a level not exceeding 10 per cent of the initial value in:

22 microseconds (Approx.). . . . . .Blue phosphor
60 microseconds (Approx.). . . . . Green phosphor
60 microseconds (Approx.). . . . . Red phosphor

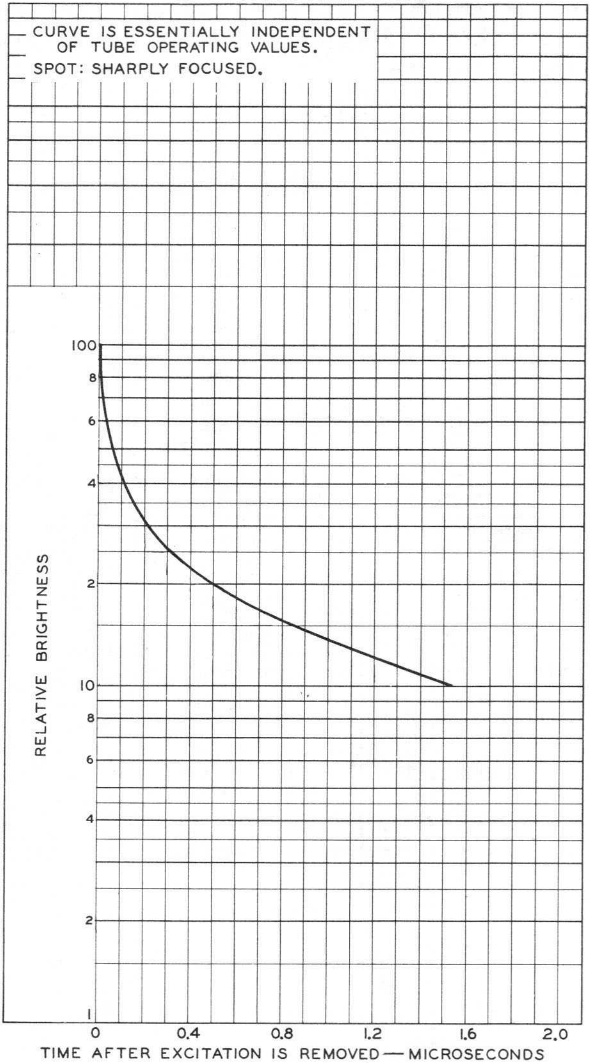
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P24

COLOR	I.C.I. COORDINATES	
	X	Y
GREEN	0.245	0.441



92CM-8204

PERSISTENCE CHARACTERISTIC OF PHOSPHOR P24

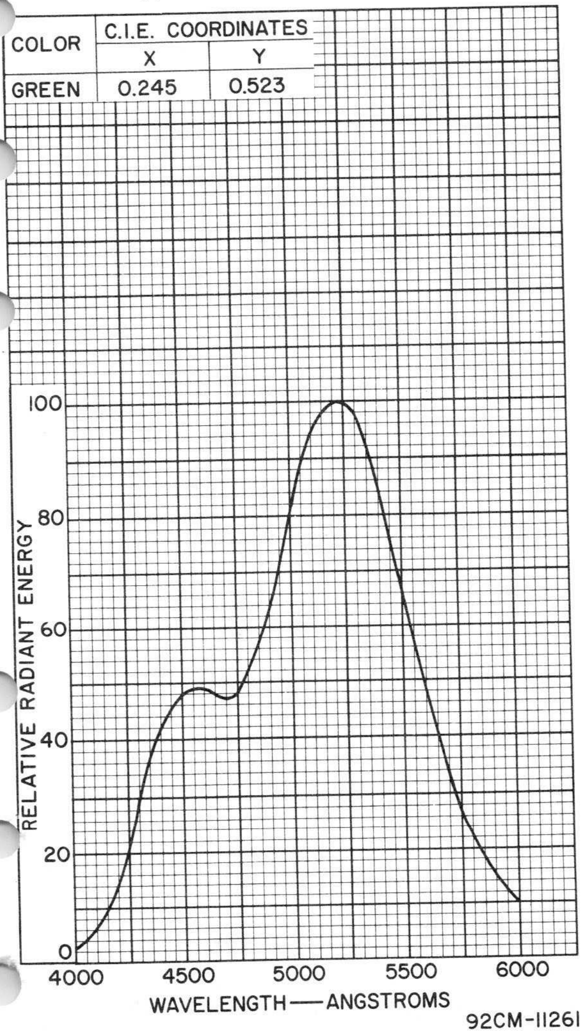


ELECTRON TUBE DIVISION 92CM-8205R2
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

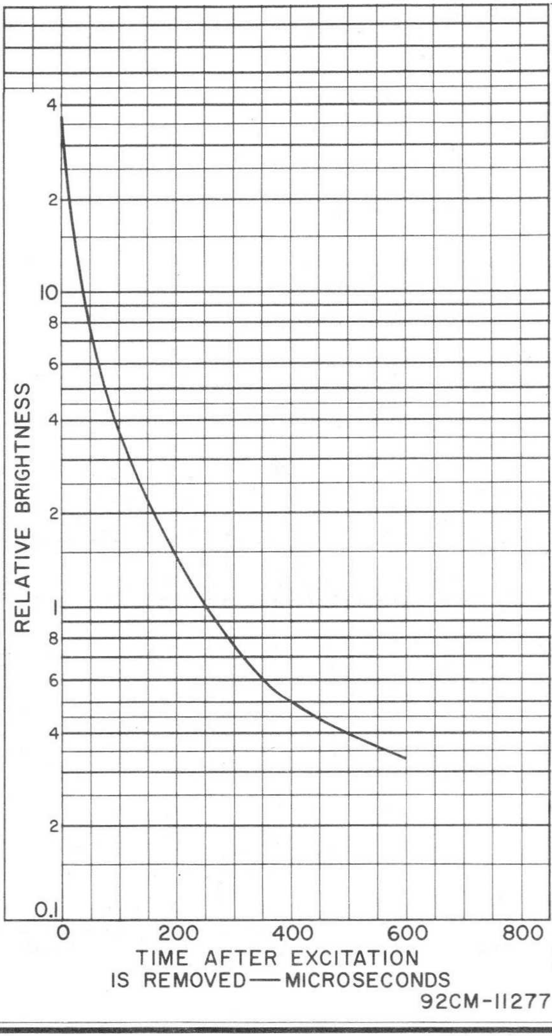
JEDEC PHOSPHOR P31

Spectral-Energy Emission Characteristic

COLOR	C.I.E. COORDINATES	
	X	Y
GREEN	0.245	0.523



Persistence Characteristic



Picture-Tube Dimensional Outlines

The *Dimensional Outlines* on the following pages provide the basic dimensions of RCA Picture Tubes. These Dimensional Outlines are classified by Bulb Designations in accordance with the designation system established by the American Standards Association. Tube neck length, tube overall length, base designation, and the configuration of the external conductive coating (when used) are not shown on these Dimensional Outlines. These items are covered on the data sheets for specific picture-tube types.

The terms used in the picture-tube data sheets to describe the *Type of External Conductive Coating* and the *Contact Area for Grounding* are defined below:

Type of External Conductive Coating

Regular Band. A band of external conductive coating of uniform height covering part of the bulb funnel. The band may entirely encompass the funnel except for an insulated area in the region of the anode (ultor) contact.

Modified Band. A coating configuration similar to a Regular Band except for special contouring of the upper and/or lower edges.

Special. A coating configuration not defined in the industry specification for the tube type.

Contact Area for Grounding

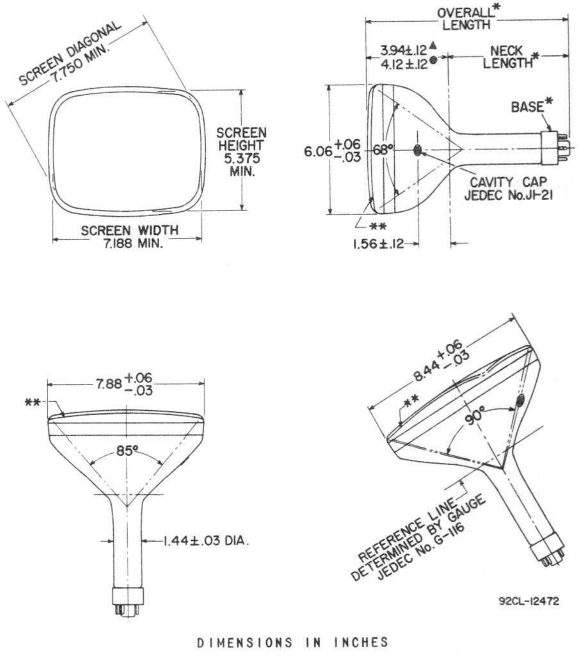
Near Reference Line. Refers to the position of the contact area usually employed for grounding a Regular or Modified Band of external conductive coating. A spring-finger contact mounted on the deflecting yoke or on the tube mounting assembly is normally employed for grounding the external conductive coating.

Special. Indicates that one or more contact areas for grounding the external conductive coating other than the area near the reference line are provided in the industry specification for the tube type.

Dimensional Outline Bulb J67-1/2 A

FOR PICTURE TUBES UTILIZING BULB J67-1/2 A

(For bulbs with and without integral protective window)

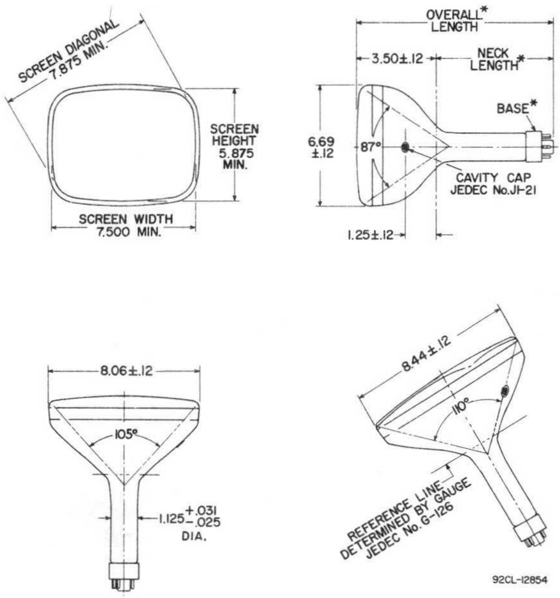


DIMENSIONS IN INCHES

* See data for specific tube type.
** Integral protective window is indicated.
▲ For bulb without protective window.
● For bulb with protective window.

Dimensional Outline Bulb J67-1/2 B

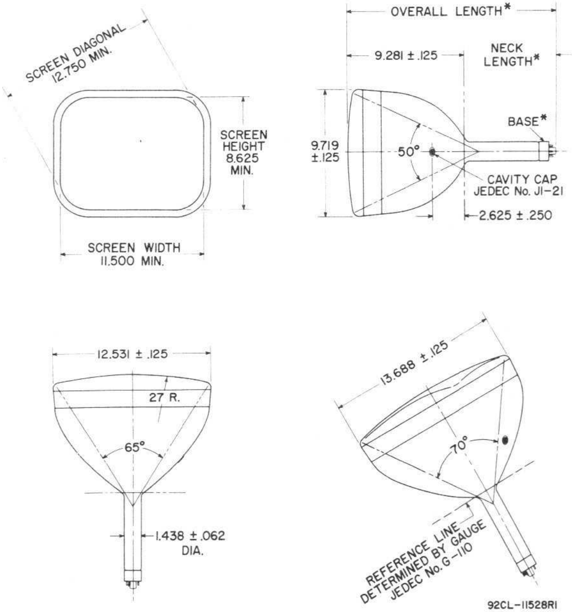
FOR PICTURE TUBES UTILIZING BULB J67-1/2 B



DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J109-1/2 A/C

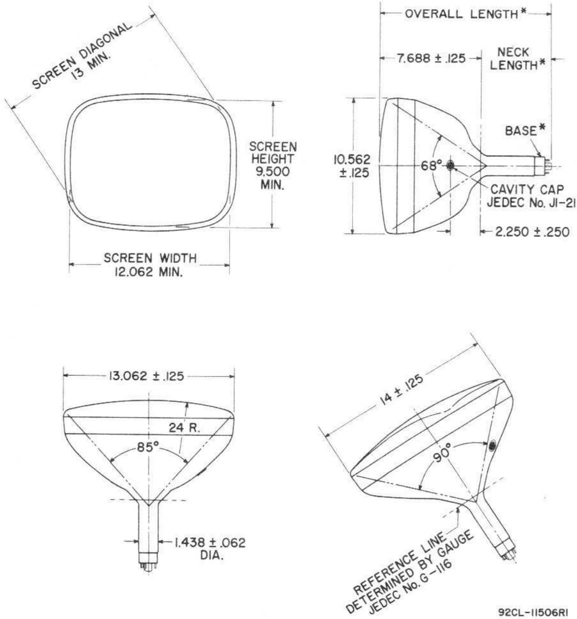


DIMENSIONS IN INCHES

* See data for specific tube type.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

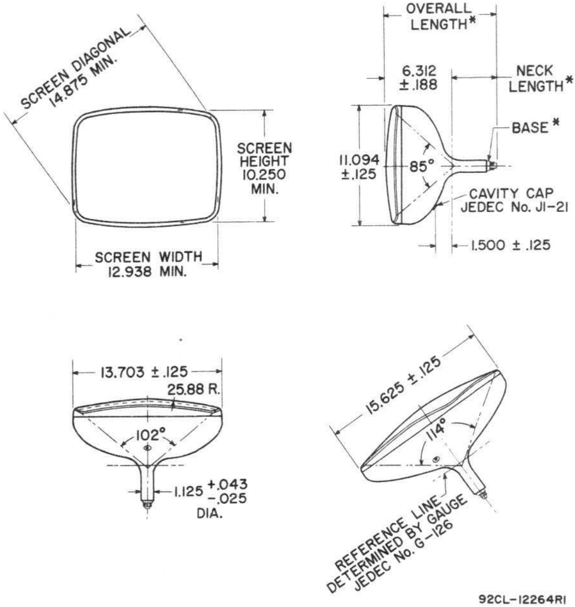
FOR PICTURE TUBES UTILIZING BULB J112 A/B



DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J125 A
AND PROTECTIVE WINDOW (FP125 A)



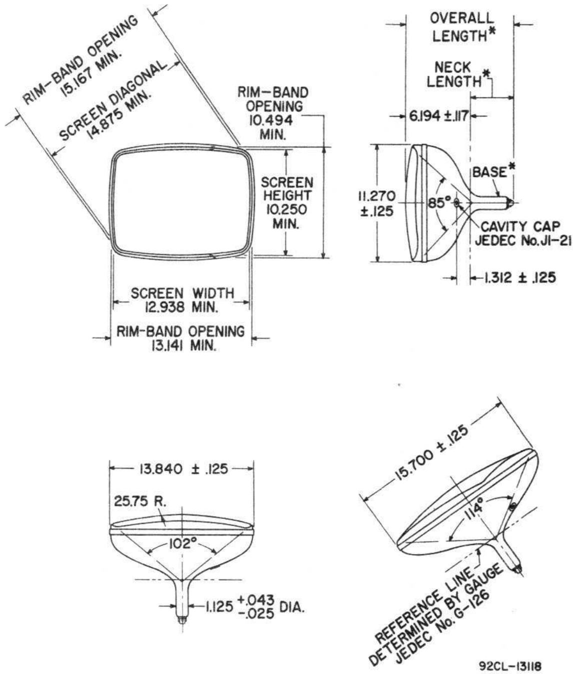
DIMENSIONS IN INCHES

* See data for specific tube type.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

Dimensional Outline Bulb J125 B

FOR PICTURE TUBE UTILIZING BULB J125 B

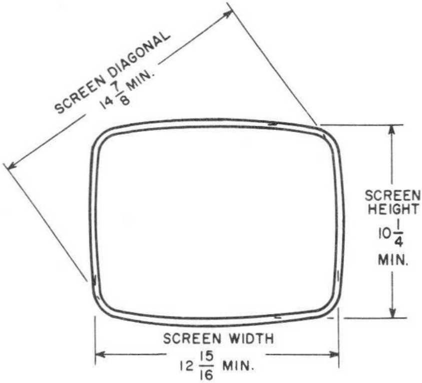


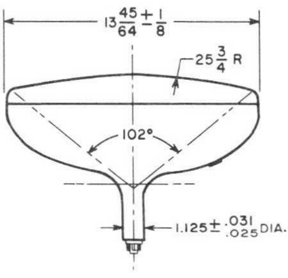
DIMENSIONS IN INCHES

* See data for specific tube type.

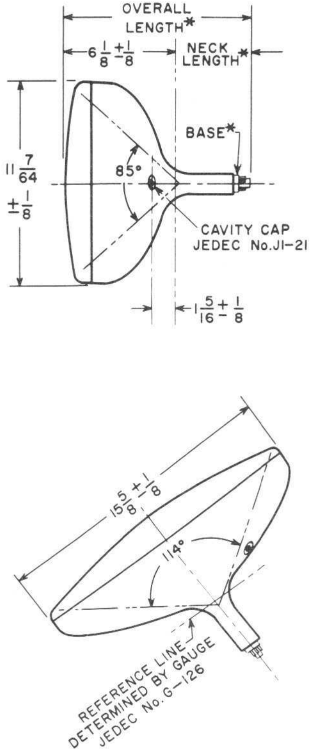
Dimensional Outline

FOR PICTURE TUBES UTILIZING BULB J125 C2





BULB J125 C2



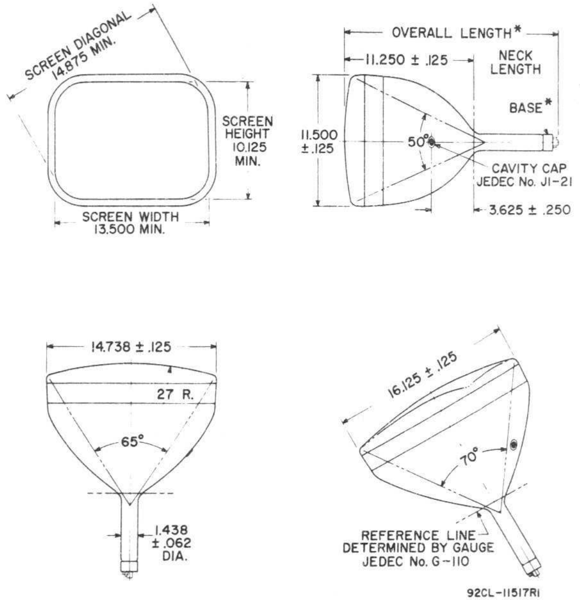
92CL-12037

DIMENSIONS IN INCHES

* See data for specific tube type.

Dimensional Outline Bulb J129 A/B

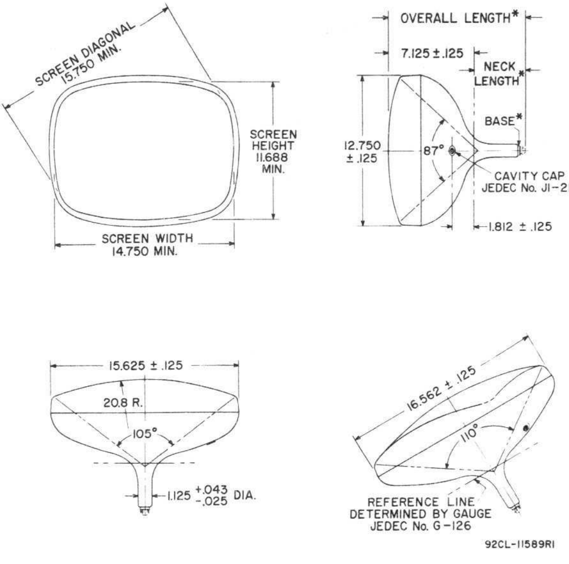
FOR PICTURE TUBES UTILIZING BULB J129 A/B



DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J132-1/2 A/B

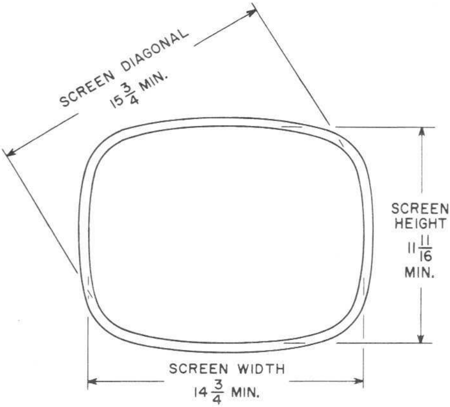


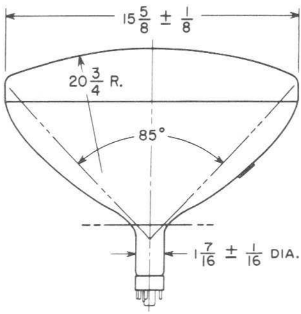
DIMENSIONS IN INCHES

* See data for specific tube type.

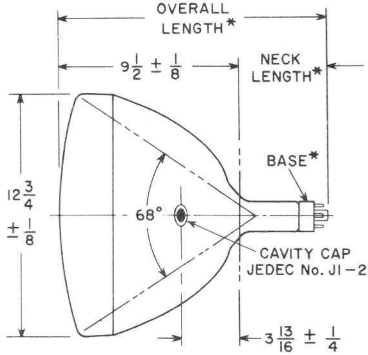
Dimensional Outline

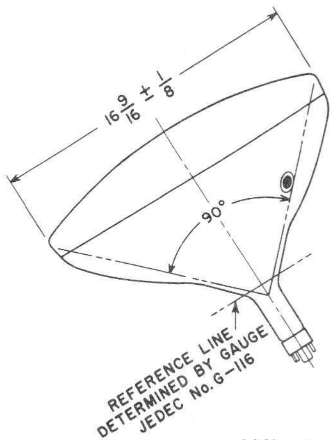
FOR PICTURE TUBES UTILIZING BULB J132-1/2 C/D





BULB J132-1/2 C/D





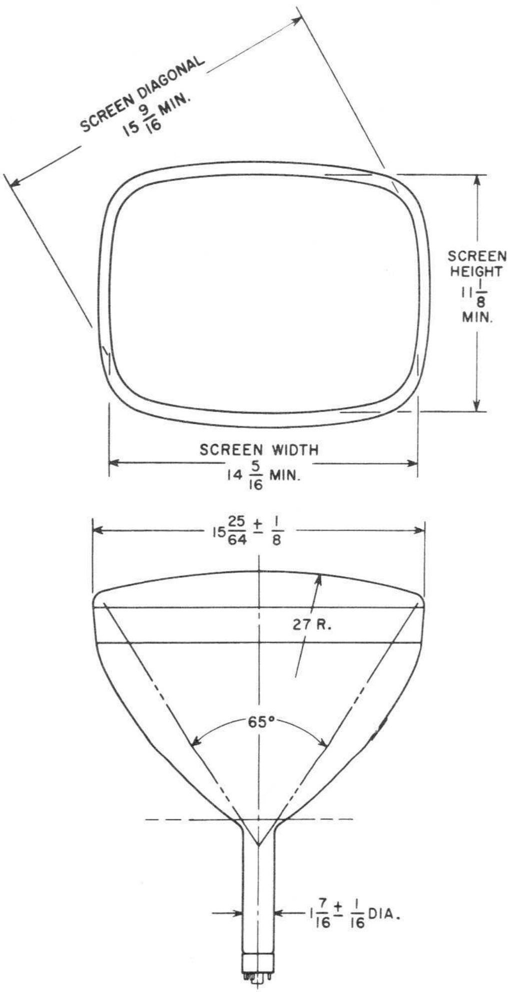
92CL-11514

ALL DIMENSIONS IN INCHES

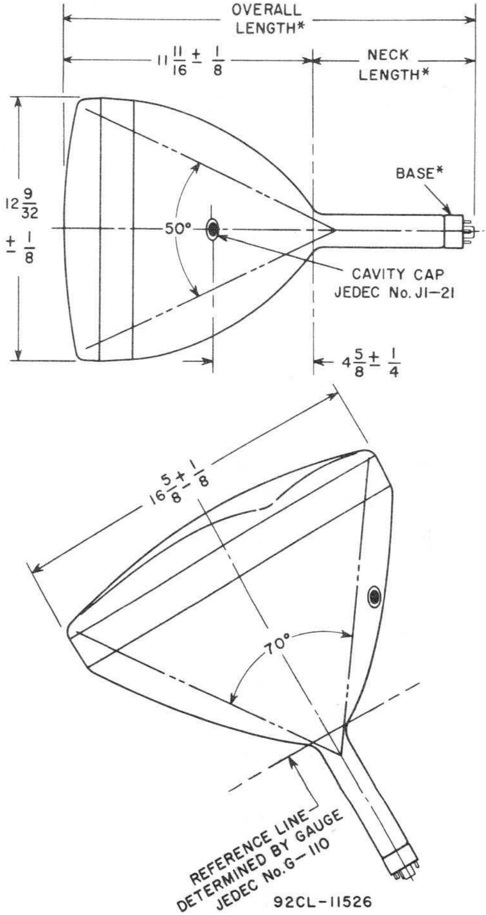
* See data for specific tube type.

Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB J133 B/D

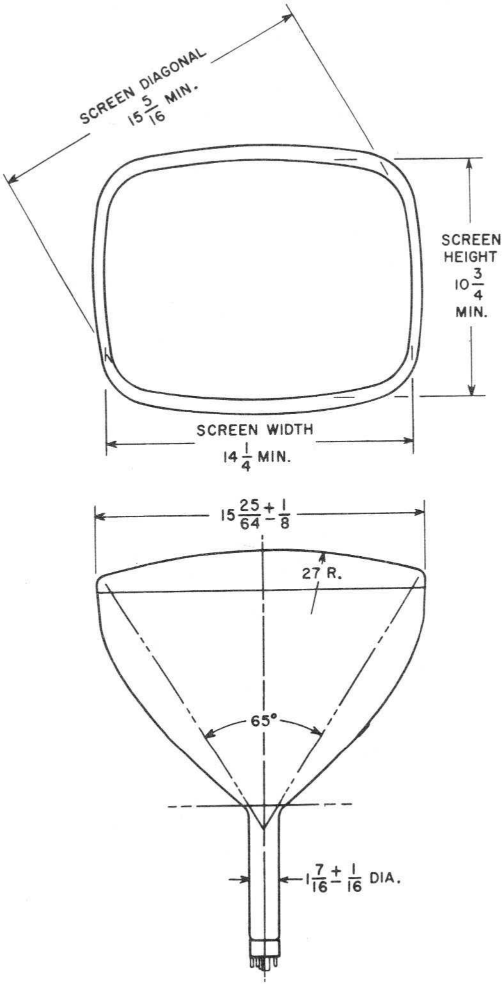


ALL DIMENSIONS IN INCHES

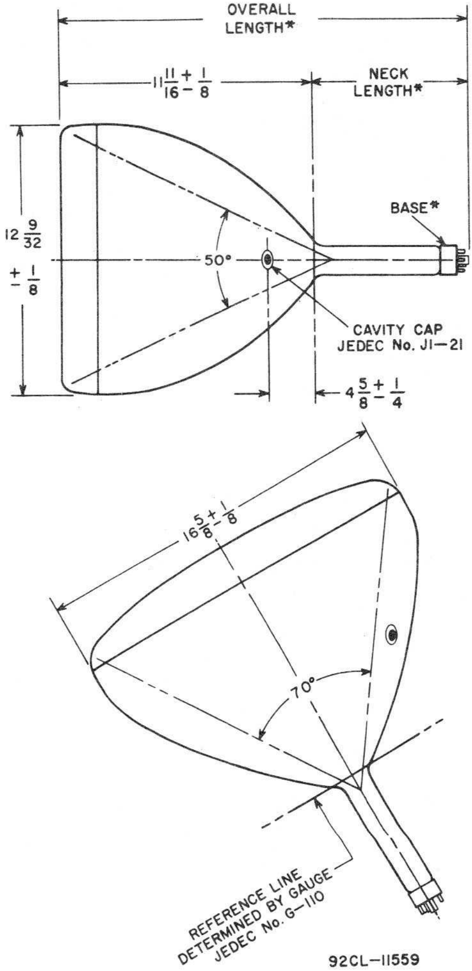
* See data for specific tube type.

Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB J133 C/E

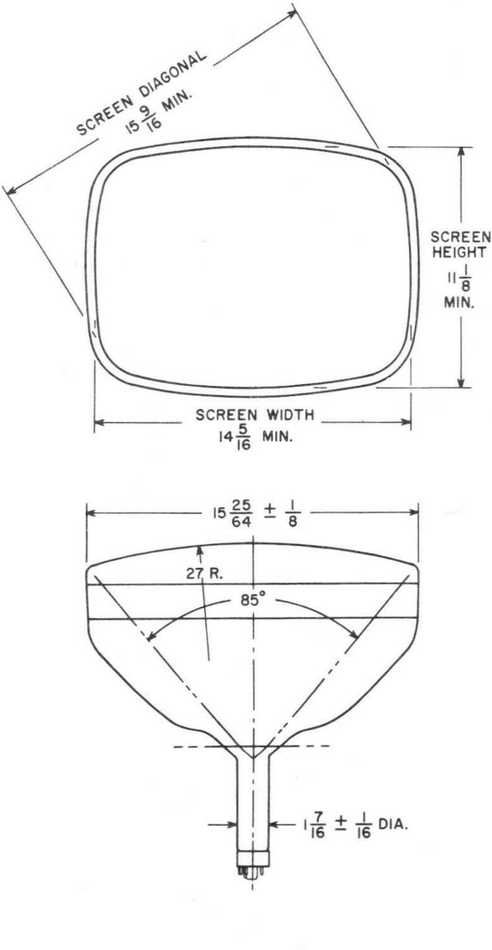


ALL DIMENSIONS IN INCHES

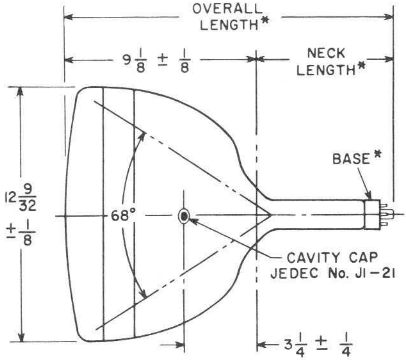
* See data for specific tube type.

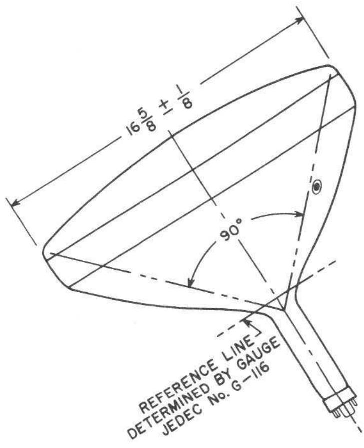
Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB J133 F/G



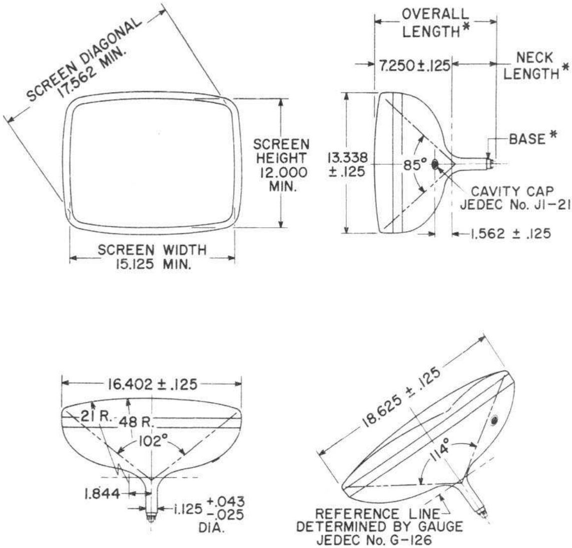


92CL-11557

DIMENSIONS IN INCHES

* See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J149 A



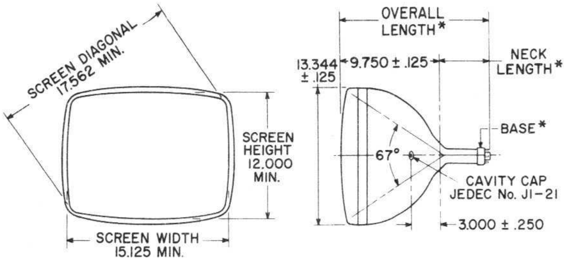
92CL-11510R1

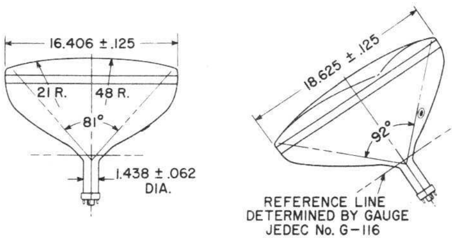
DIMENSIONS IN INCHES

* See data for specific tube type.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

FOR PICTURE TUBES UTILIZING BULB J149 B

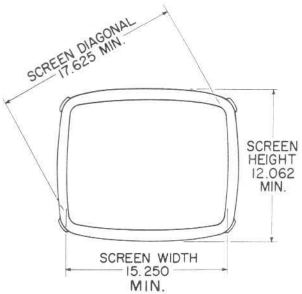


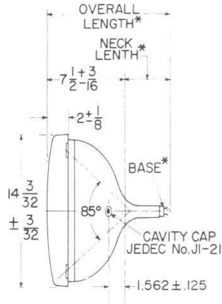


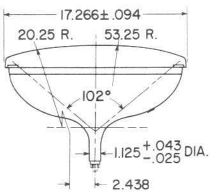
DIMENSIONS IN INCHES

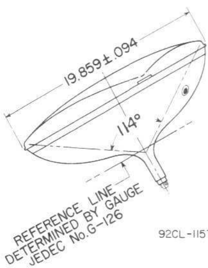
* See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J149 C AND PROTECTIVE PANEL









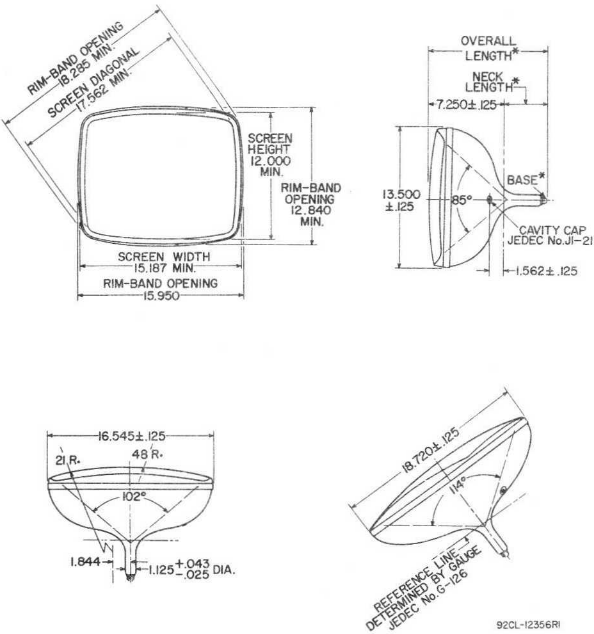
92CL-11570R1

DIMENSIONS IN INCHES

* See data for specific tube type.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

FOR PICTURE TUBES UTILIZING BULB J149 F



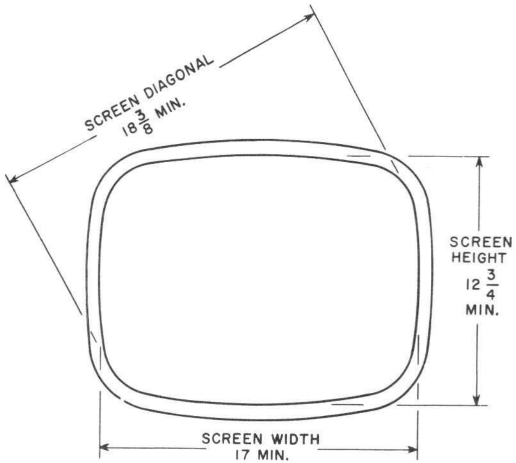
92CL-12356R1

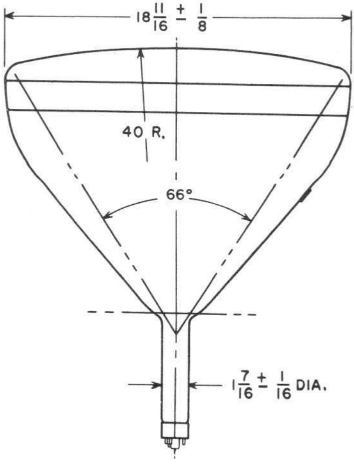
DIMENSIONS IN INCHES

*See data for specific tube type.

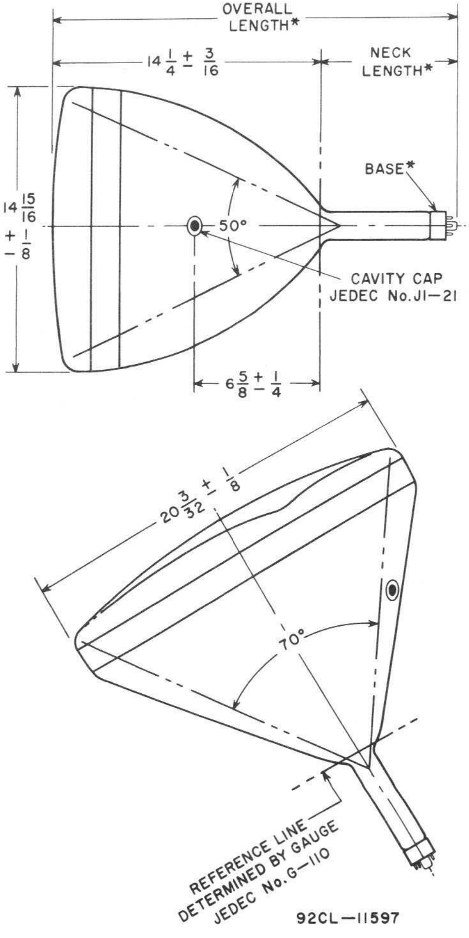
Dimensional Outline

FOR PICTURE TUBES UTILIZING BULB J161 C/D





BULB J161 C/D

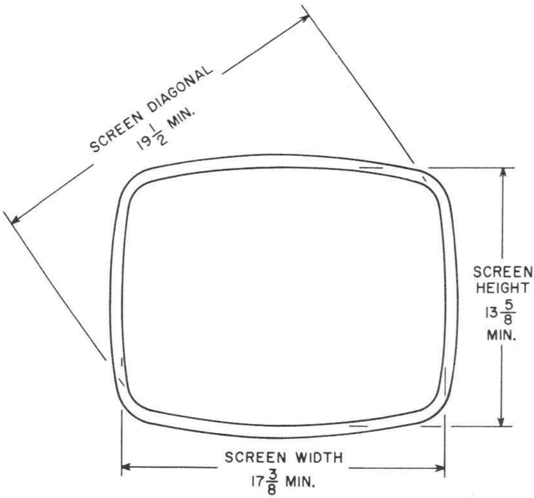


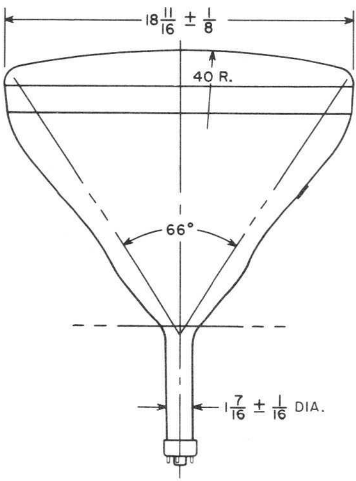
ALL DIMENSIONS IN INCHES

* See data for specific tube type.

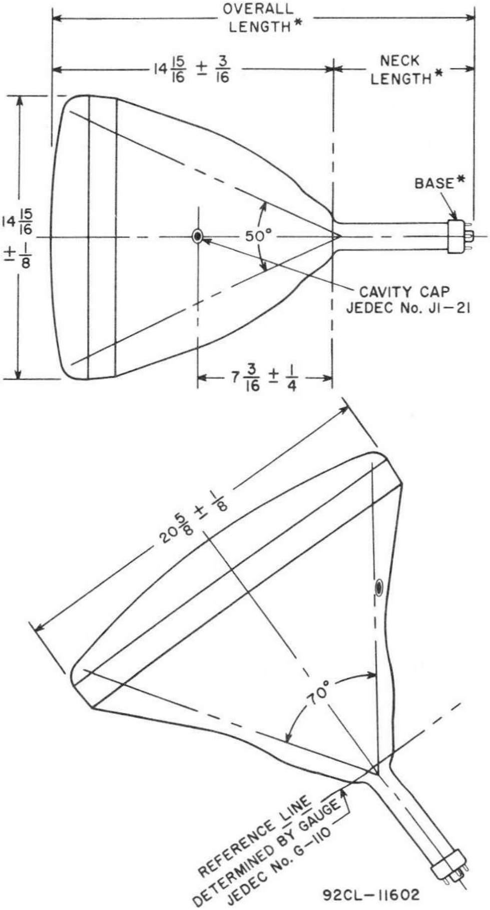
Dimensional Outline

FOR PICTURE TUBES UTILIZING





BULB J165 Z

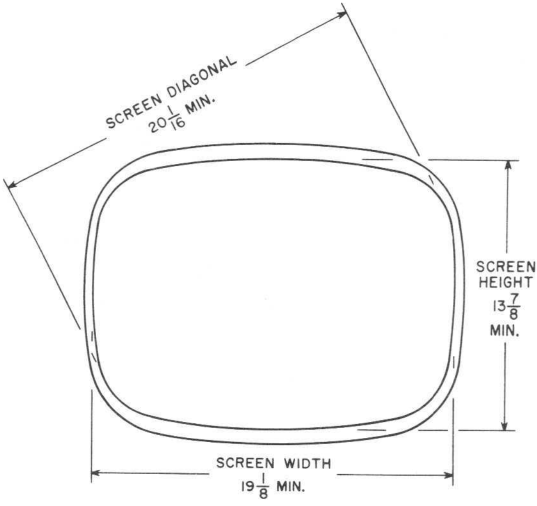


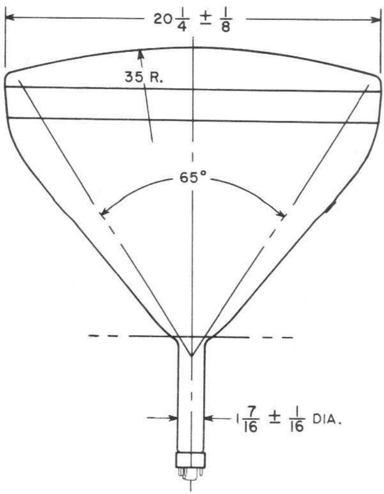
ALL DIMENSIONS IN INCHES

*See data for specific tube type.

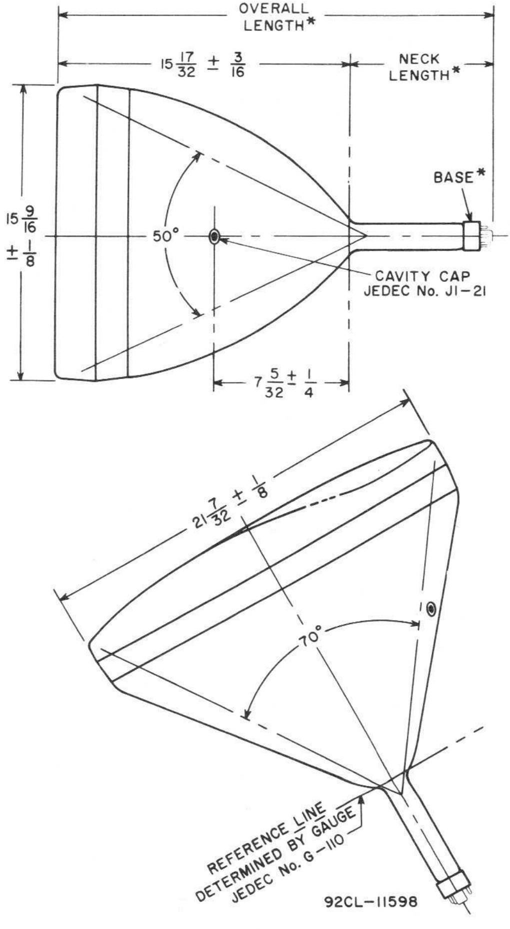
Dimensional Outline

FOR PICTURE TUBES UTILIZING





BULB J170 A/C

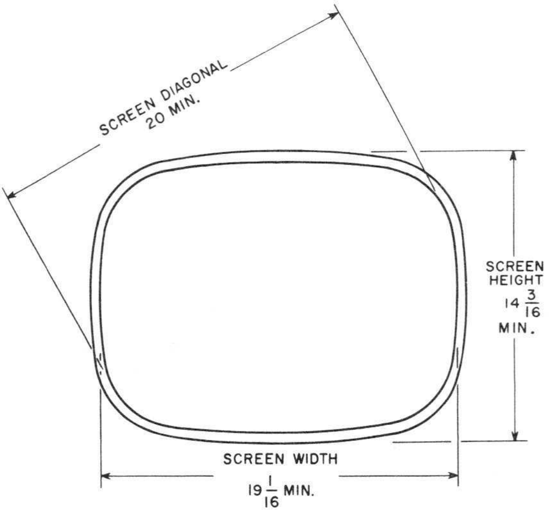


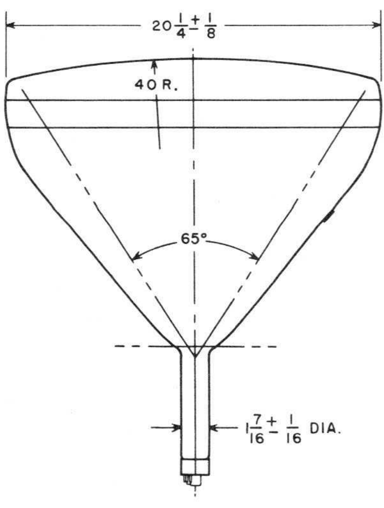
ALL DIMENSIONS IN INCHES

* See data for specific tube type.

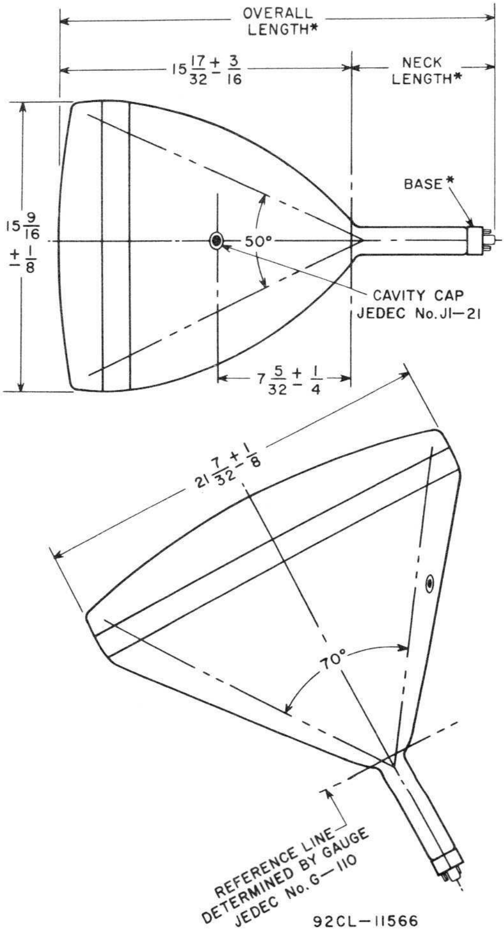
Dimensional Outline

FOR PICTURE TUBES UTILIZING





BULB J170 B/D

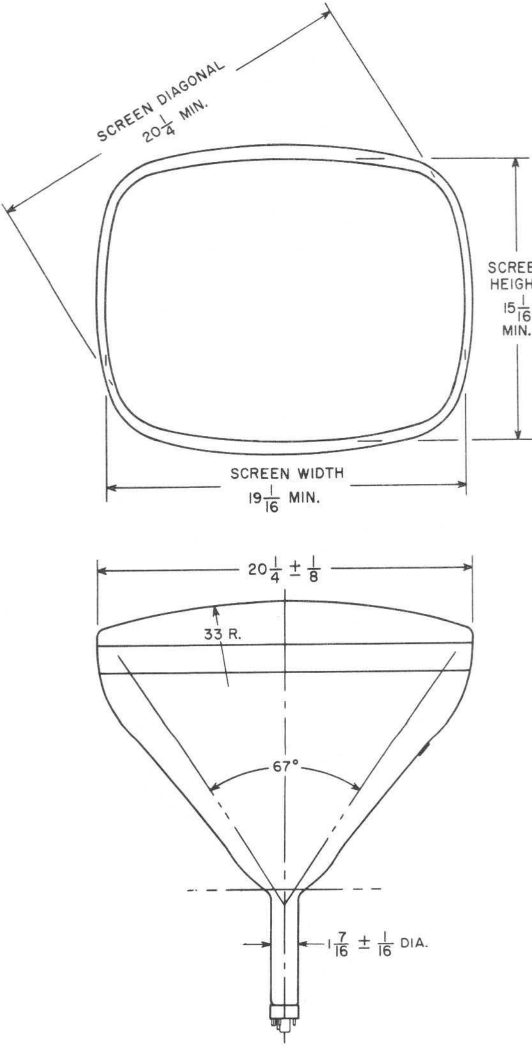


ALL DIMENSIONS IN INCHES

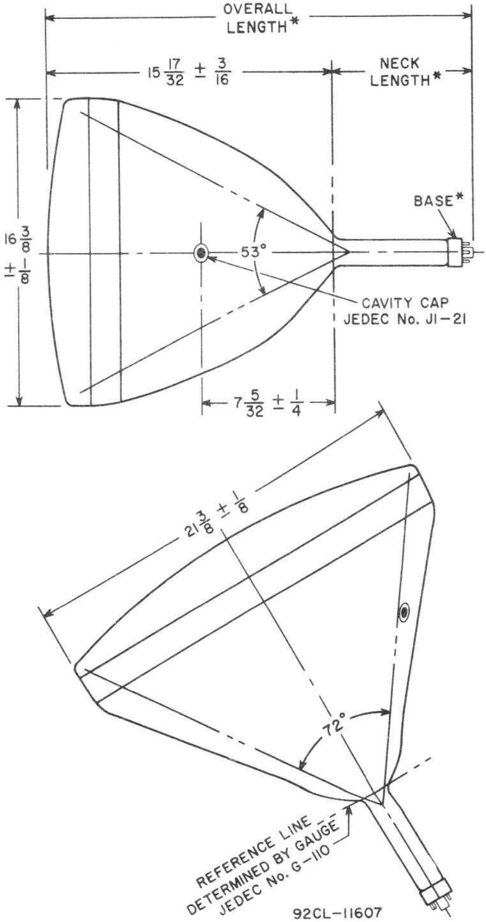
* See data for specific tube type.

Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB J171 B/F

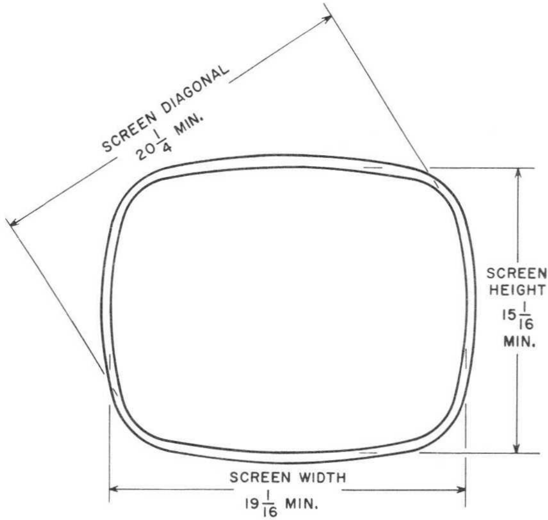


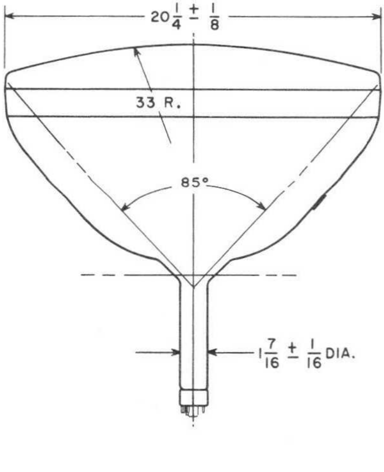
ALL DIMENSIONS IN INCHES

*See data for specific tube type.

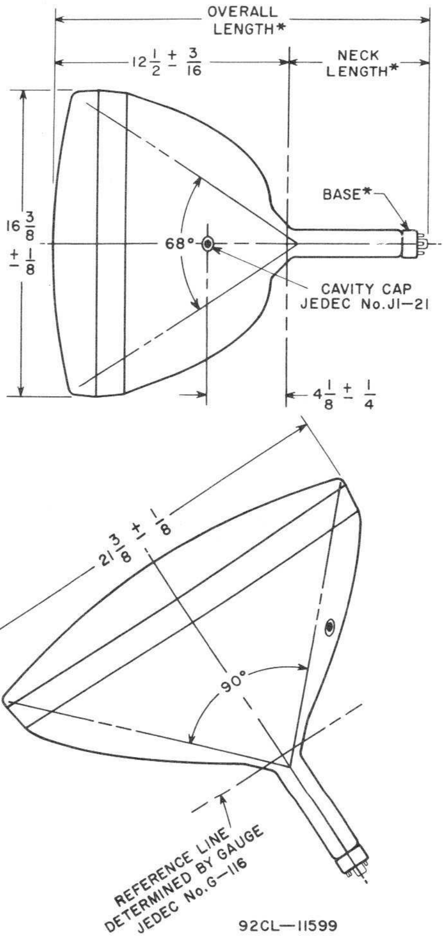
Dimensional Outline

FOR PICTURE TUBES UTILIZING





BULB J171 D/E

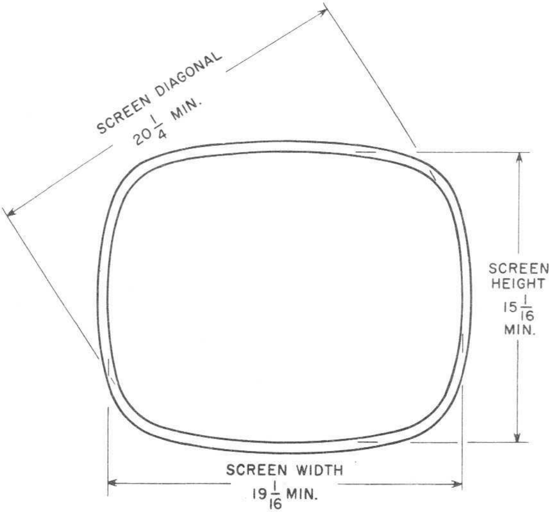


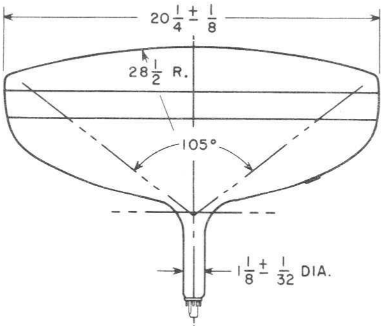
ALL DIMENSIONS IN INCHES

* See data for specific tube type.

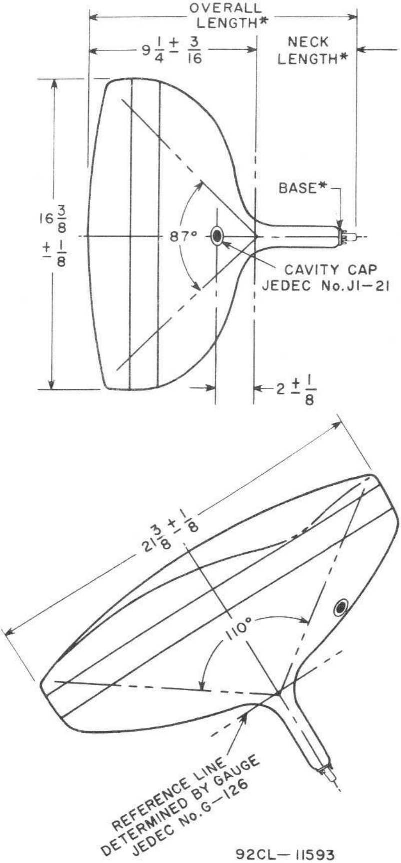
Dimensional Outline

FOR PICTURE TUBES UTILIZING





BULB J171 G/K

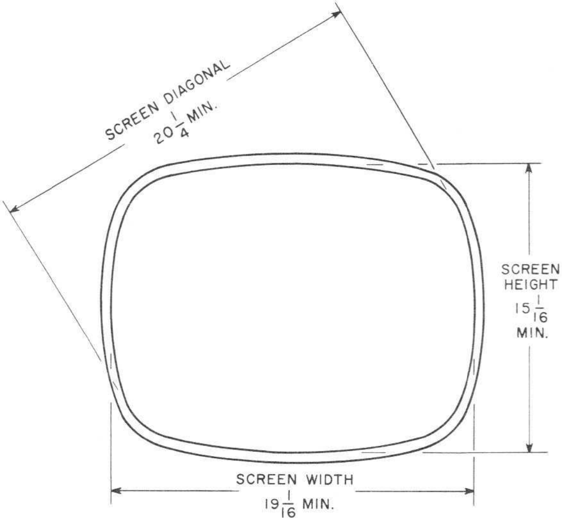


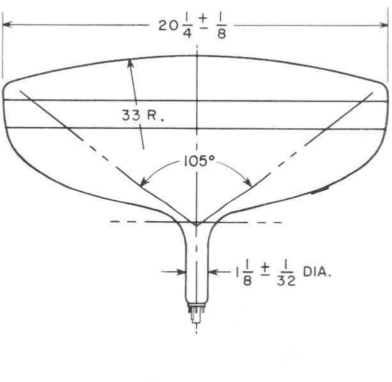
ALL DIMENSIONS IN INCHES

* See data for specific tube type.

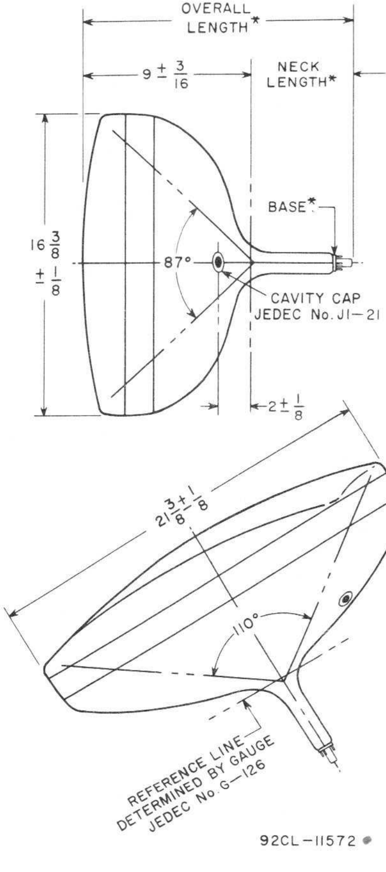
Dimensional Outline

FOR PICTURE TUBES UTILIZING





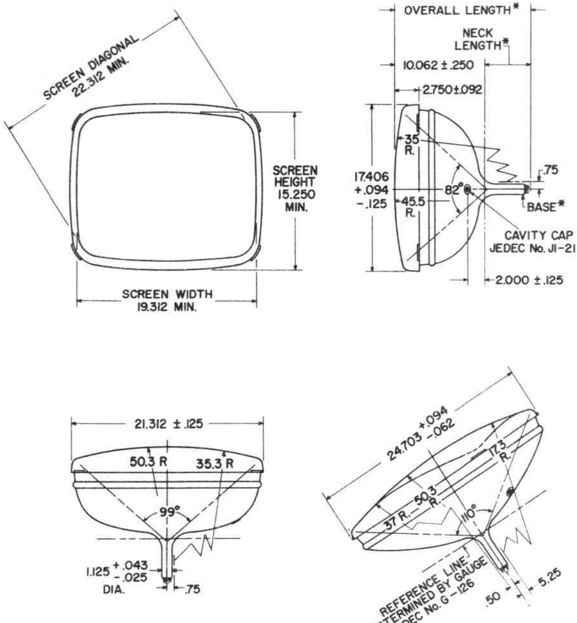
BULB J171 H/J



DIMENSIONS IN INCHES

*See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J187A
AND PROTECTIVE PANEL FP198



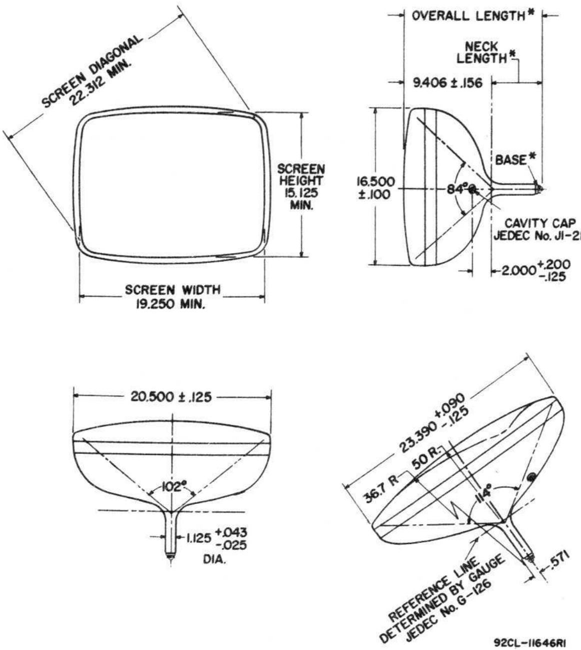
92CL-11576R1

DIMENSIONS IN INCHES

* See data for specific tube type.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

FOR PICTURE TUBES UTILIZING BULB J187 B

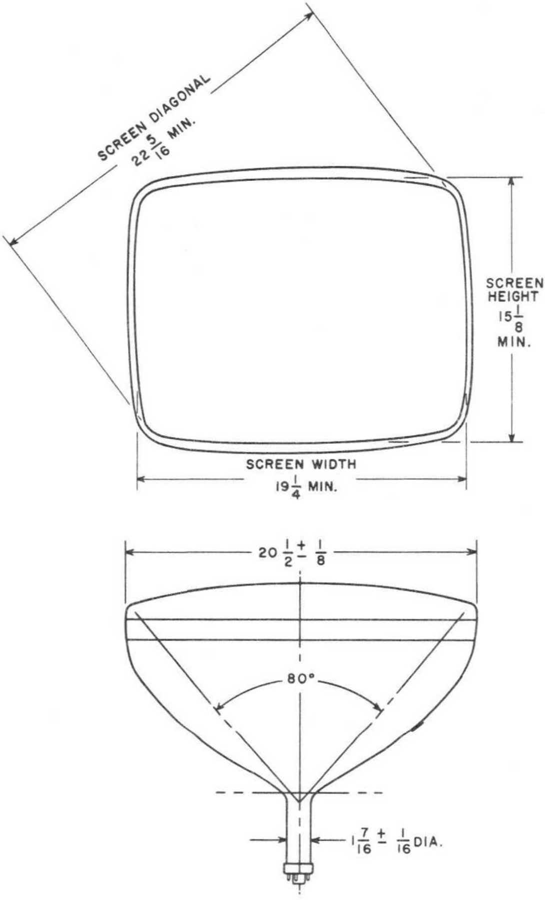


DIMENSIONS IN INCHES

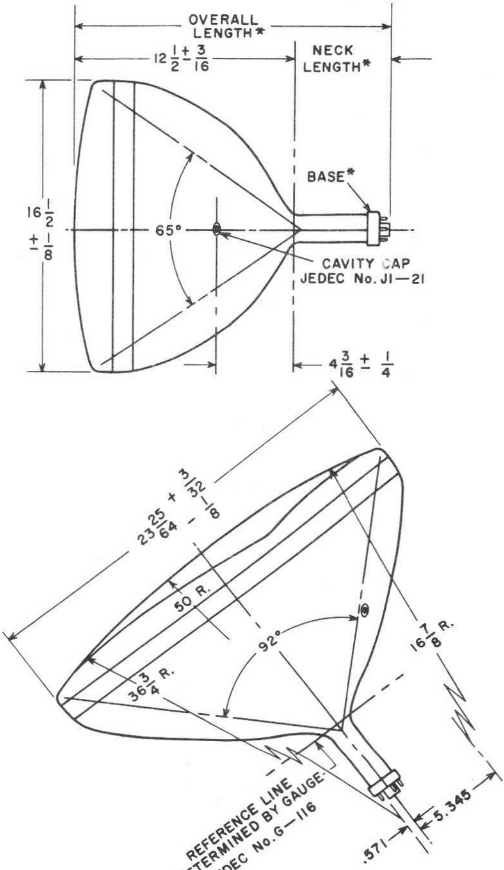
* See data for specific tube type.

Dimensional Outline

FOR PICTURE TUBES UTILIZING BULB J187 C/F



BULB J187 C/F



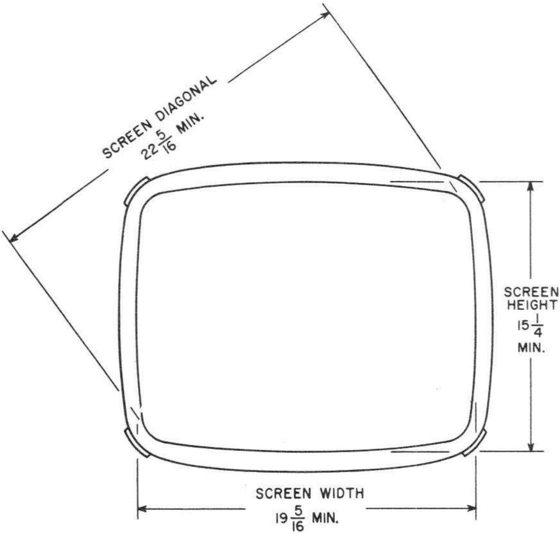
92CL—11584

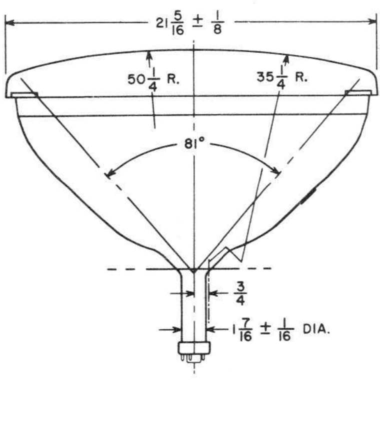
ALL DIMENSIONS IN INCHES

* See data for specific tube type.

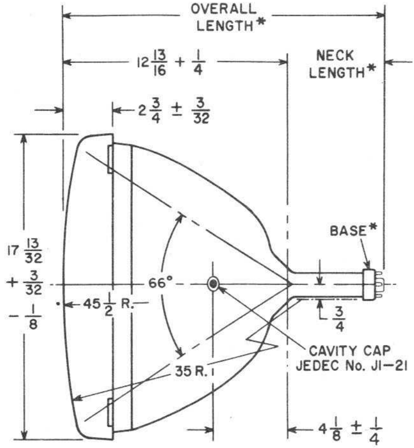
Dimensional Outline

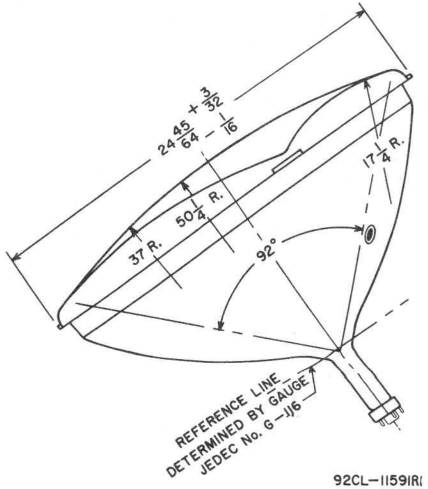
FOR PICTURE TUBES UTILIZING





BULB J187 D/G AND PROTECTIVE PANEL

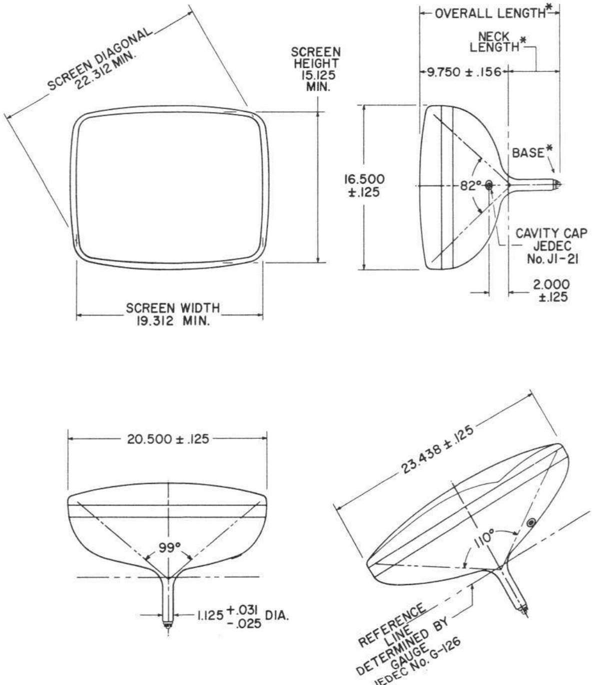




DIMENSIONS IN INCHES

*See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J187 E

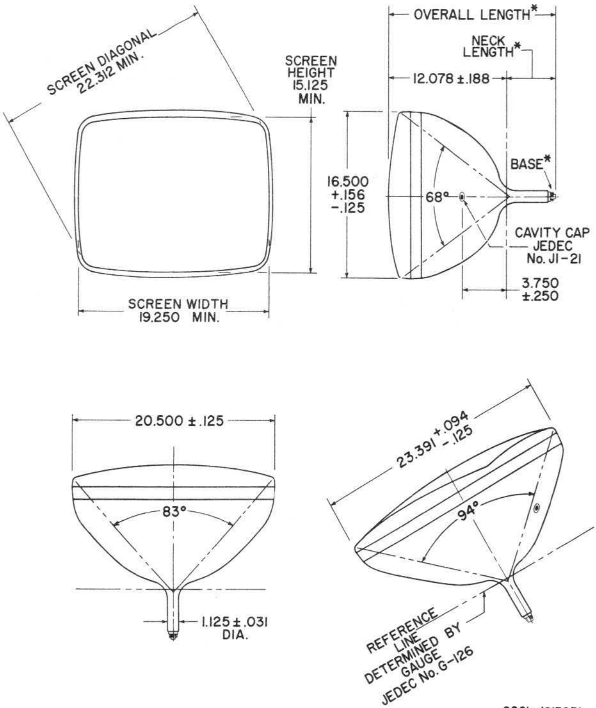


92CL-12724

DIMENSIONS IN INCHES

*See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J187 H1

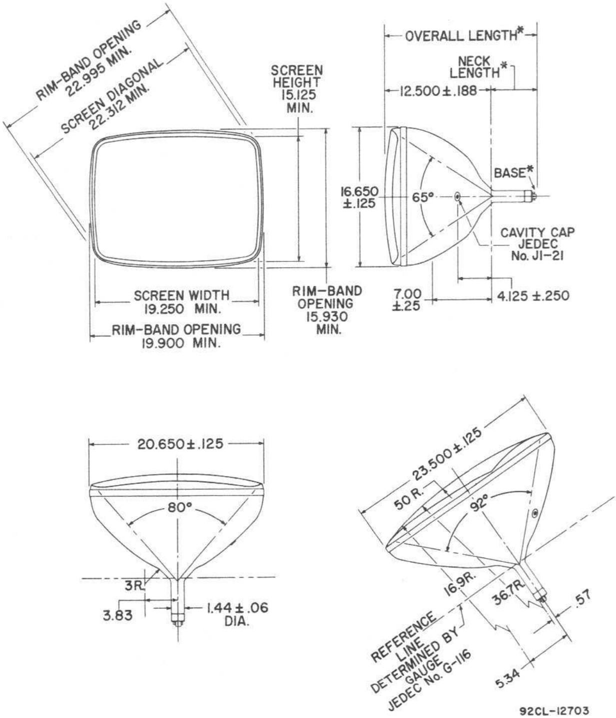


92CL-12139R1

DIMENSIONS IN INCHES

*See data for specific tube type.

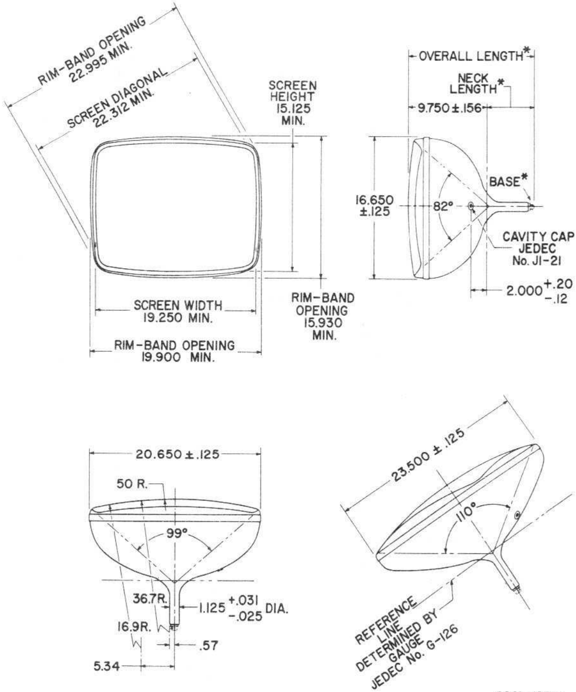
FOR PICTURE TUBES UTILIZING BULB J187 J



DIMENSIONS IN INCHES

*See data for specific tube type.

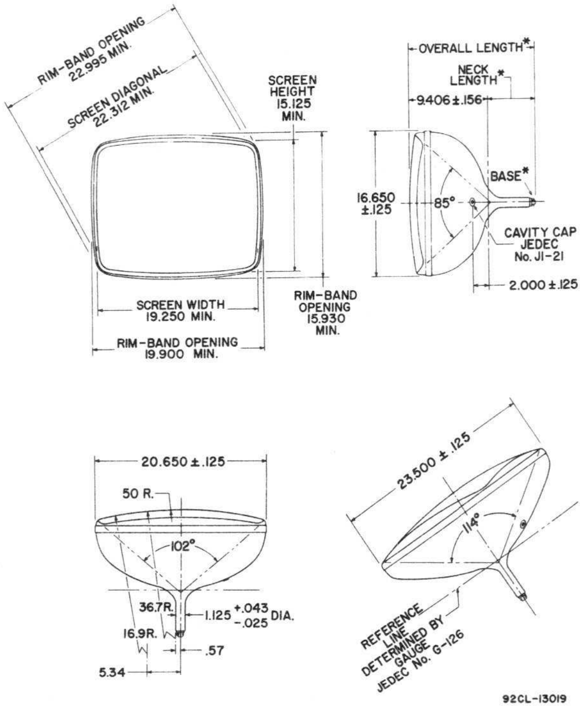
FOR PICTURE TUBES UTILIZING BULB J187 K



DIMENSIONS IN INCHES

*See data for specific tube type.

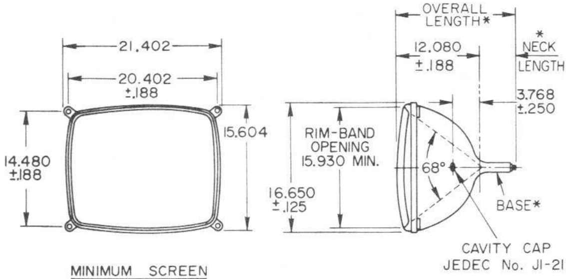
FOR PICTURE TUBES UTILIZING BULB J187 L



DIMENSIONS IN INCHES

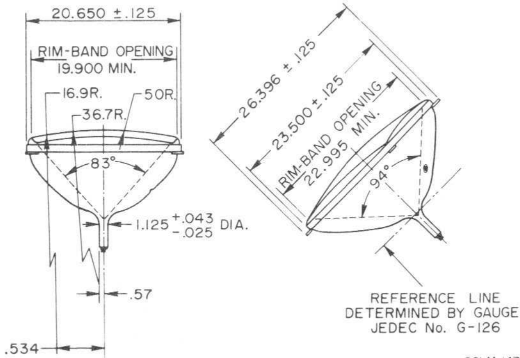
*See data for specific tube type.

FOR PICTURE TUBES UTILIZING BULB J187 M



MINIMUM SCREEN

DIAGONAL	22.312
GREATEST WIDTH	19.250
GREATEST HEIGHT	15.125



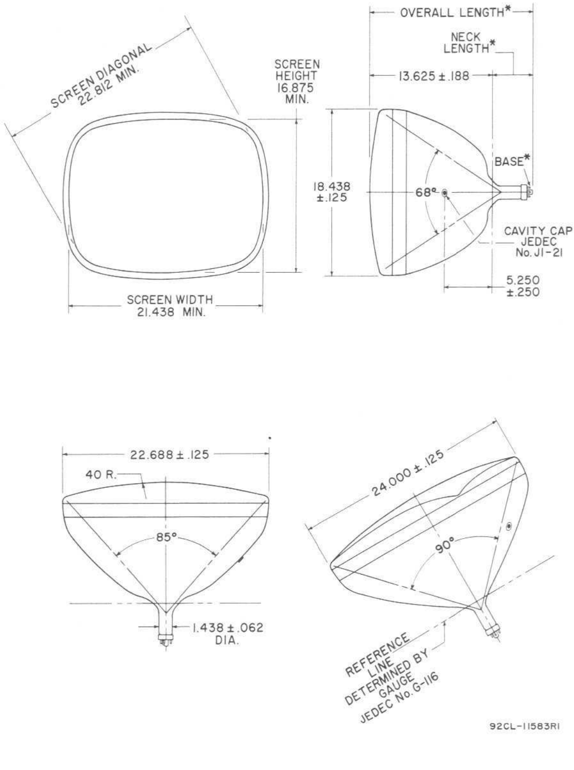
92LM-1477

DIMENSIONS IN INCHES

* See data for specific tube type.

Dimensional Outline Bulb J192 A/B

FOR PICTURE TUBES UTILIZING BULB J192 A/B

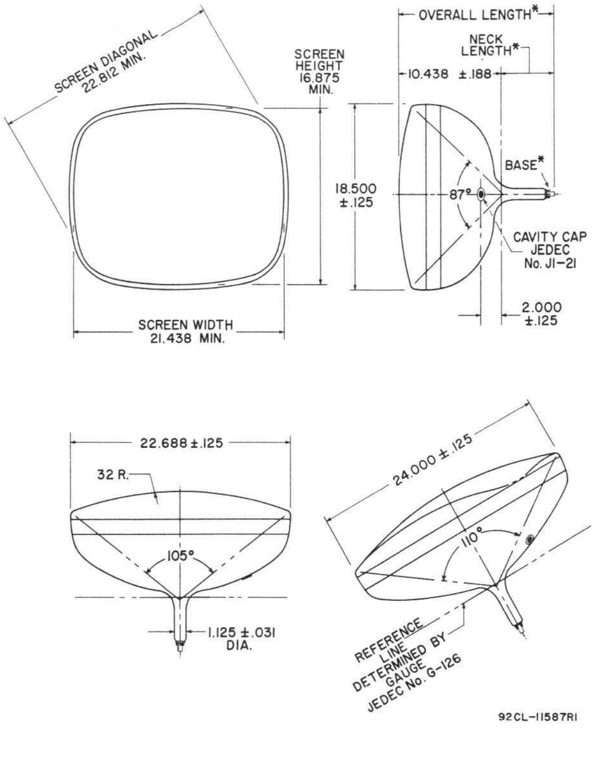


DIMENSIONS IN INCHES

* See data for specific tube type.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

FOR PICTURE TUBES UTILIZING BULB J192 C/D

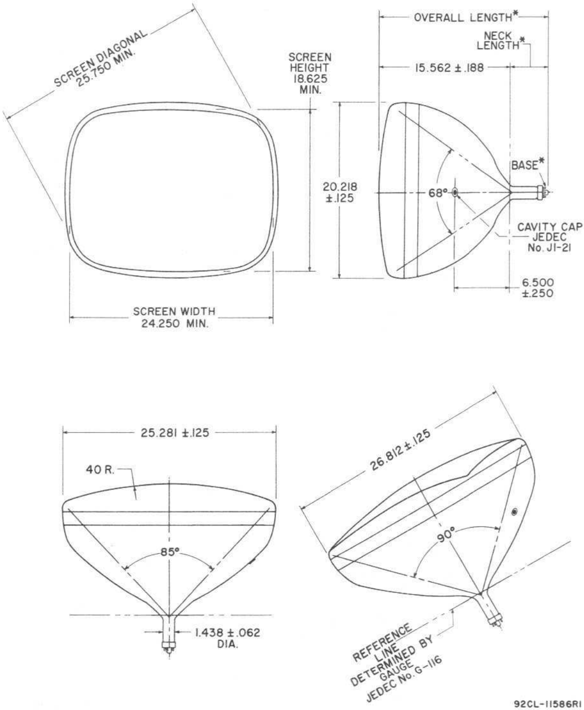


DIMENSIONS IN INCHES

*See data for specific tube type.

Dimensional Outline Bulb J214-1/2 A

FOR PICTURE TUBES UTILIZING BULB J214-1/2 A

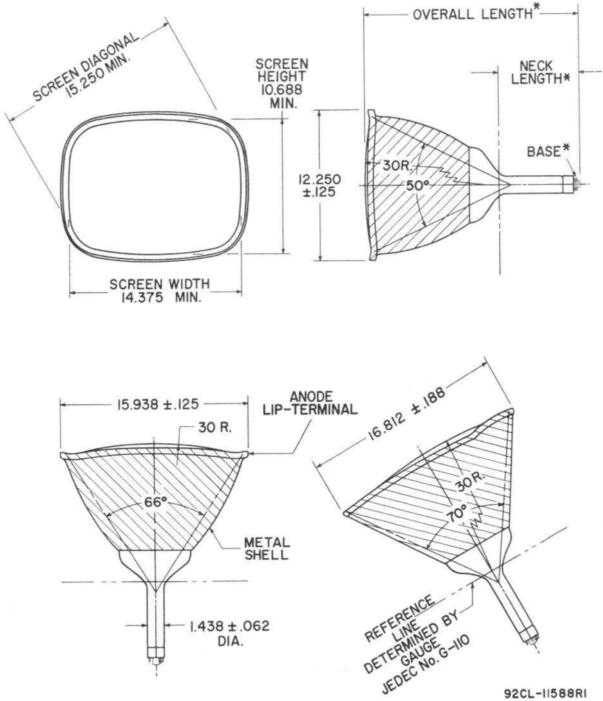


DIMENSIONS IN INCHES

*See data for specific tube type.

Dimensional Outline Bulb MJ135 A

FOR PICTURE TUBES UTILIZING BULB MJ135 A

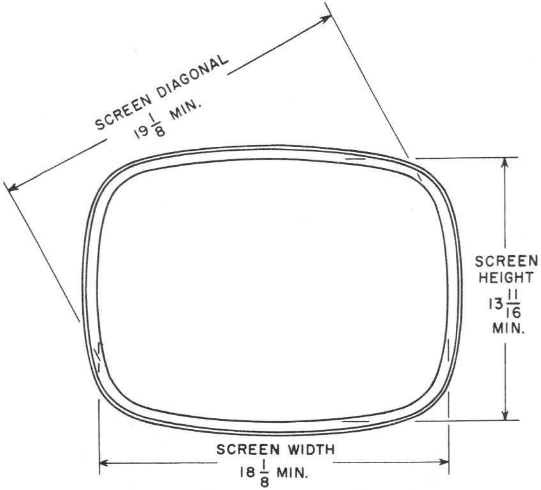


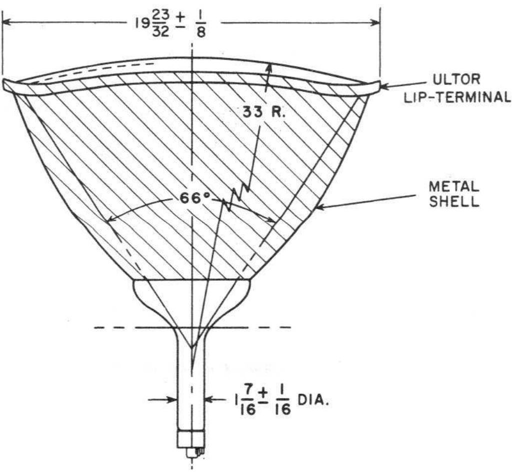
DIMENSIONS IN INCHES

*See data for specific tube type.

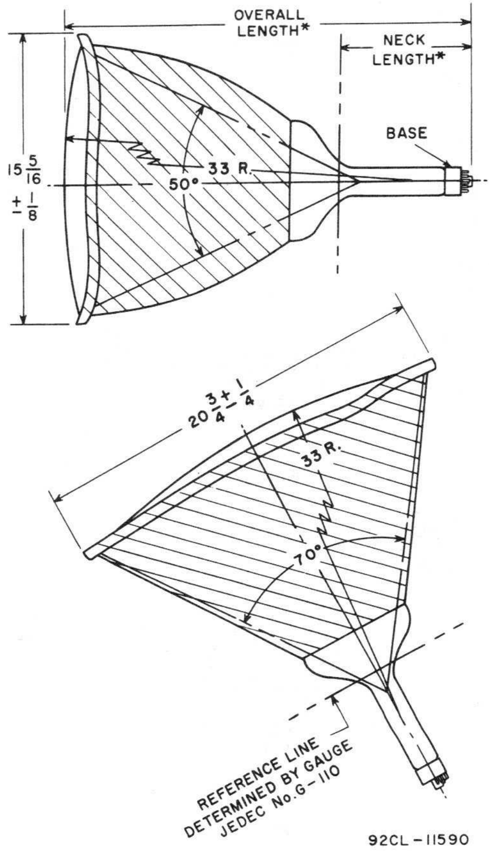
Dimensional Outline

FOR PICTURE TUBES UTILIZING BULB MJ166 A





BULB MJ166 A

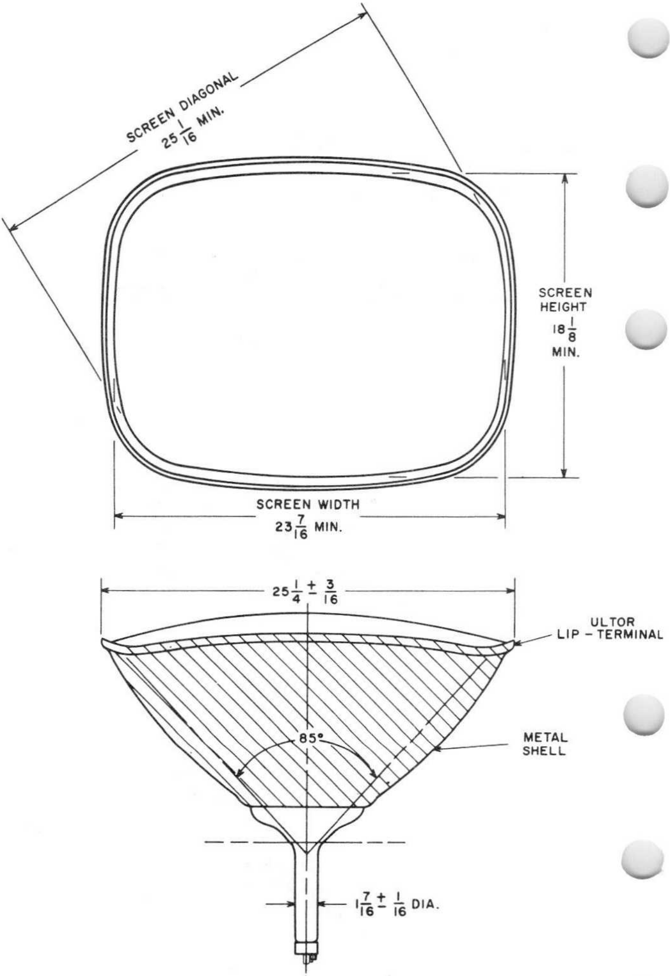


ALL DIMENSIONS IN INCHES

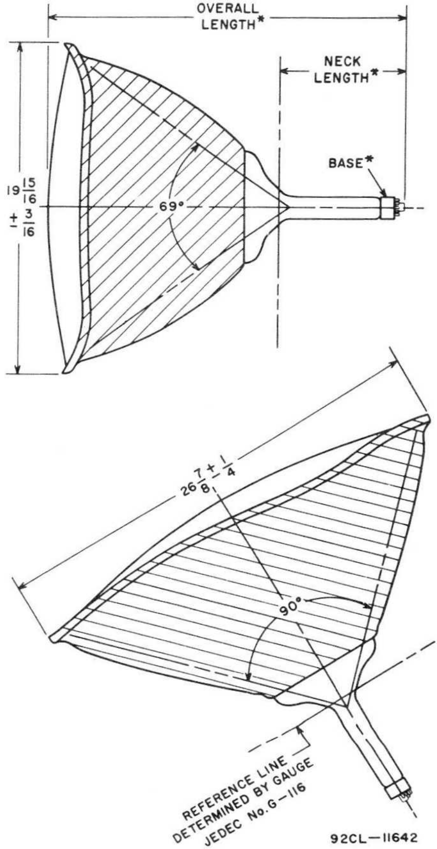
* See data for specific tube type.

Dimensional Outline

FOR PICTURE TUBES UTILIZING



BULB MJ214 A

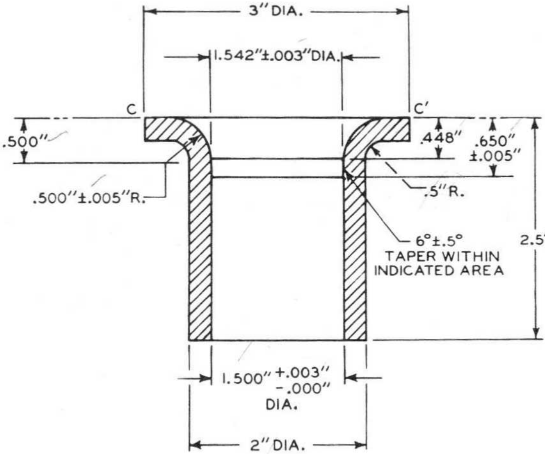


ALL DIMENSIONS IN INCHES

* See data for specific tube type.

![RCA]

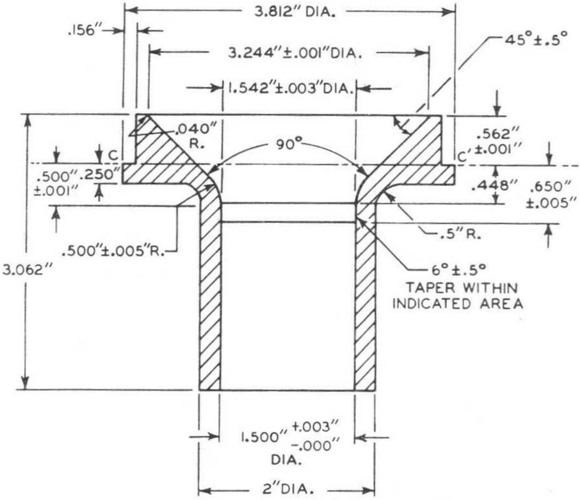
REFERENCE-LINE GAUGE
JETEC № G-110



WHEN TUBE NECK IS INSERTED THROUGH GAUGE, REFERENCE LINE WILL BE DETERMINED BY PLANE C-C' WHEN GAUGE IS RESTING ON FUNNEL.

92CS-7391R1

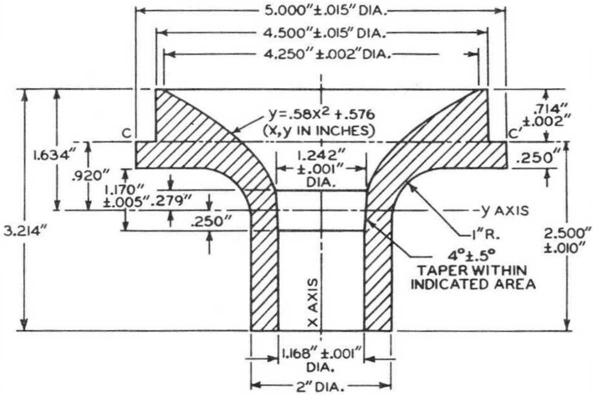
REFERENCE-LINE GAUGE
JETEC No G-116



WHEN TUBE NECK IS INSERTED THROUGH GAUGE, REFERENCE LINE WILL BE DETERMINED BY PLANE C-C' WHEN GAUGE IS RESTING ON FUNNEL.

92CS-7896R1

REFERENCE-LINE GAUGE
JETEC No G-126



WHEN TUBE NECK IS INSERTED THROUGH GAUGE, REFERENCE LINE WILL BE DETERMINED BY PLANE C-C' WHEN GAUGE IS RESTING ON FUNNEL.

"y" VALUES MUST BE HELD TO ±.002."

92CS-9145RI

WARNING

All types of cathode-ray tubes may be operated at voltages (where ratings permit) up to 16 kilovolts without personal injury on prolonged exposure at close range.

Above 16 kilovolts, special shielding precautions for X radiation may be necessary.

Definitions

Of Cathode-Ray-Tube Terms

Ultor. The "ultor" in a cathode-ray tube is the element to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

Post-Ultor. The "post-ultor" in a cathode-ray tube is the element to which is applied a dc voltage higher than the ultor voltage for accelerating the electrons in the beam after its deflection.

IEPI

IEPI

OSCILLOGRAPH TUBE

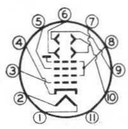
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to all other electrodes	6.5	$\mu\mu f$
Deflecting electrode DJ_1 to deflecting electrode DJ_2	1.7	$\mu\mu f$
Deflecting electrode DJ_3 to deflecting electrode DJ_4	0.6	$\mu\mu f$
DJ_1 to all other electrodes	5	$\mu\mu f$
DJ_2 to all other electrodes	5	$\mu\mu f$
DJ_3 to all other electrodes	3.8	$\mu\mu f$
DJ_4 to all other electrodes	3.8	$\mu\mu f$
Faceplate, Flat		Clear Glass
Phosphor (For Curves, see front of this Section)		P1
Fluorescence		Green
Phosphorescence		Green
Persistence		Medium
Focusing Method		Electrostatic
Deflection Method		Electrostatic
Maximum Overall Length		4-1/16"
Maximum Diameter		1-1/4" ± 1/16"
Minimum Useful Screen Diameter		1-1/16"
Mounting Position		Any
Weight (Approx.)		2 oz
Bulb		T-10
Base		Small-Button Unidekar 11-Pin (JETEC No.E11-22)
Basing Designation for BOTTOM VIEW		11V

Pin 1 - Heater
Pin 2 - Heater
Pin 3 - Grid No.1
Pin 4 - Cathode
Pin 5 - Grid No.3
Pin 6 - Deflecting Electrode DJ_4
Pin 7 - Deflecting Electrode DJ_3



Pin 8 - Ultor (Grid No.2, Grid No.4, Collector)
Pin 9 - Deflecting Electrode DJ_2
Pin 10 - Deflecting Electrode DJ_1
Pin 11 - Internal Connection—Do Not Use

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

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RCA

1EP1

OSCILLOGRAPH TUBE

With DJ_2 positive with respect to DJ_1, the spot is deflected toward the midpoint between pins 6 and 7. With DJ_3 positive with respect to DJ_4, the spot is deflected toward the midpoint between pins 9 and 10.

The angle between the trace produced by DJ_3 and DJ_4 and its intersection with the plane through the tube axis and the midpoint between pins 9 and 10 does not exceed $\pm 10^o$.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is $90^o \pm 3^o$.

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	1500 max.	volts
GRID-No.3 VOLTAGE	1200 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	200 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE.	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	125 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_{c4}) between recommended minimum and 1500 volts*

Grid-No.3 Voltage for Focus	10% to 30% of E_{c4}	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot.	-1.4% to -4.2% of E_{c4}	volts
Grid-No.3 Current for Any Operating Condition.	-15 to +10	μamp
Deflection Factors:		
DJ_1 & DJ_2	210 to 310 v dc/in./kv of E_{c4}	
DJ_3 & DJ_4	240 to 350 v dc/in./kv of E_{c4}	
Spot Position	##	

Examples of Use of Design Ranges:

For ultor voltage of	*500*	*1000*	*volts*
Grid-No.3 Voltage for Focus	50 to 150	100 to 300	volts

* Brilliance and definition decrease with decreasing ultor voltage. Recommended minimum for the 1EP1 in general service is 500 volts, but a value as low as 300 volts may be used under conditions of low-velocity deflection and low ambient light levels. For operation between 300 and 500 volts, it is essential that the ultor voltage be applied before beam-current flow. Otherwise, a screen charge may develop to block off or distort the scanning pattern.

##: See next page.

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IEPI

OSCILLOGRAPH TUBE

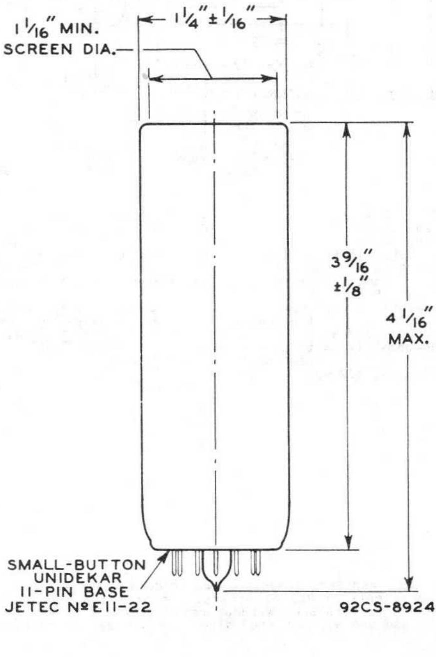
For ultor voltage of	*500*	*1000*	*volts*
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-7 to -21	-14 to -42	volts
Deflection Factors:			
DJ_1 & DJ_2.	105 to 155	210 to 310	volts dc/in.
DJ_3 & DJ_4.	120 to 175	240 to 350	volts dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit■	2.0 max.	megohms

The center of the undeflected focused spot will fall within a circle having 2.5-mm radius concentric with the center of the tube face.

■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.



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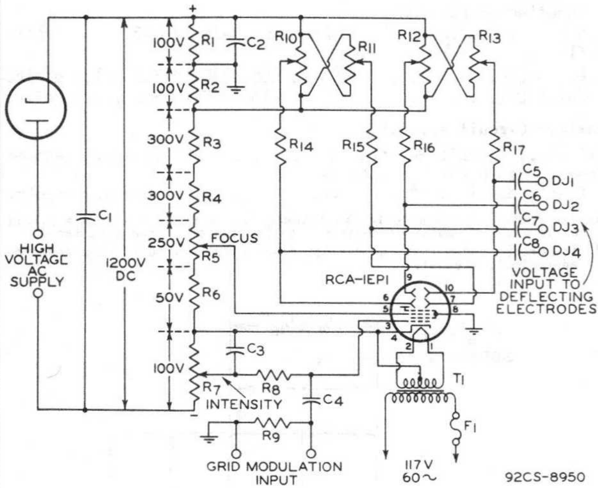
OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



C1: 0.5 µf, 2000 volts
C2: 1 µf, 200 volts
C3: 1 µf, 200 volts
C4: 0.05 µf, 1600 volts
C5 C6 C7 C8: 0.05 µf, 600 volts
R1 R2: 510,000 ohms, 1/2 watt
R3 R4: 300,000 ohms, 1 watt
R5: 250,000-ohms, 2-watt potentiometer
R6: 51,000 ohms, 1/2 watt
R7: 100,000-ohms, 1/2-watt potentiometer
R8: 510,000 ohms, 1/2 watt
R9: 5 megohms, 1/2 watt
R10 R11: Dual 1-megohm potentiometer
R12 R13: Dual 1-megohm potentiometer
R14 R15 R16 R17: 1.5 megohms, 1/2 watt
T1: Transformer, 6.3 volts at 1 ampere, insulated for 2000 volts, such as Thordarson T21F08
F1: 1-ampere fuse

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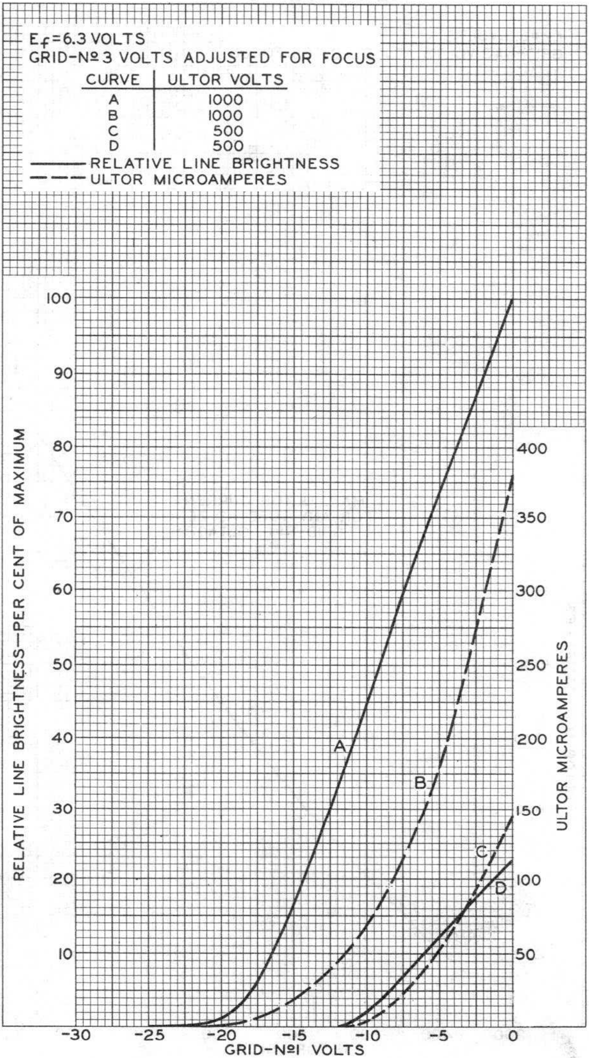
1EP1

AVERAGE CHARACTERISTICS



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92CM-8938

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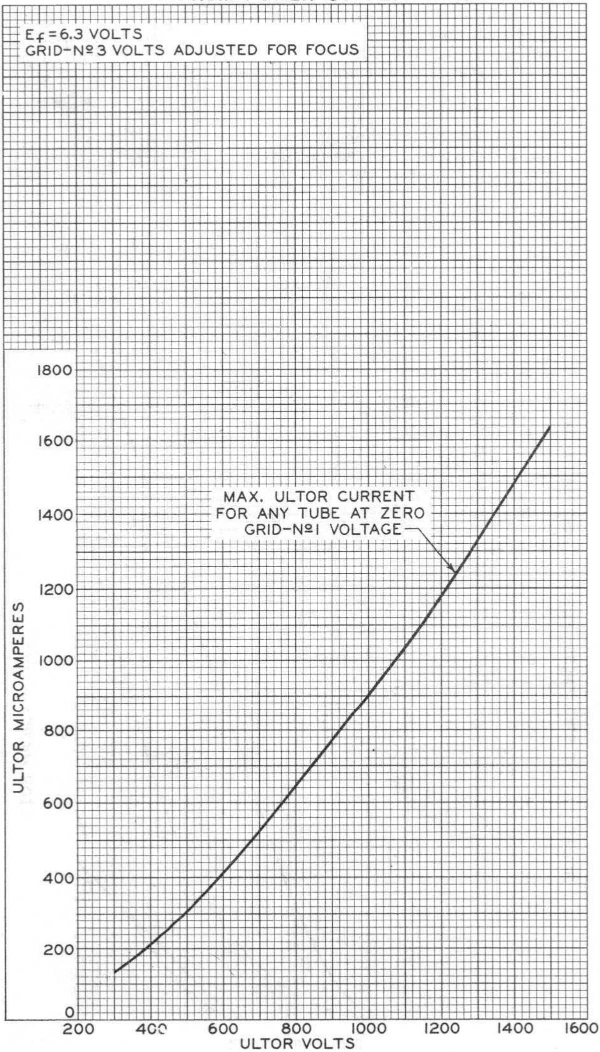
1EP1

MAXIMUM ULTOR-CURRENT REQUIREMENTS
FROM POWER SUPPLY



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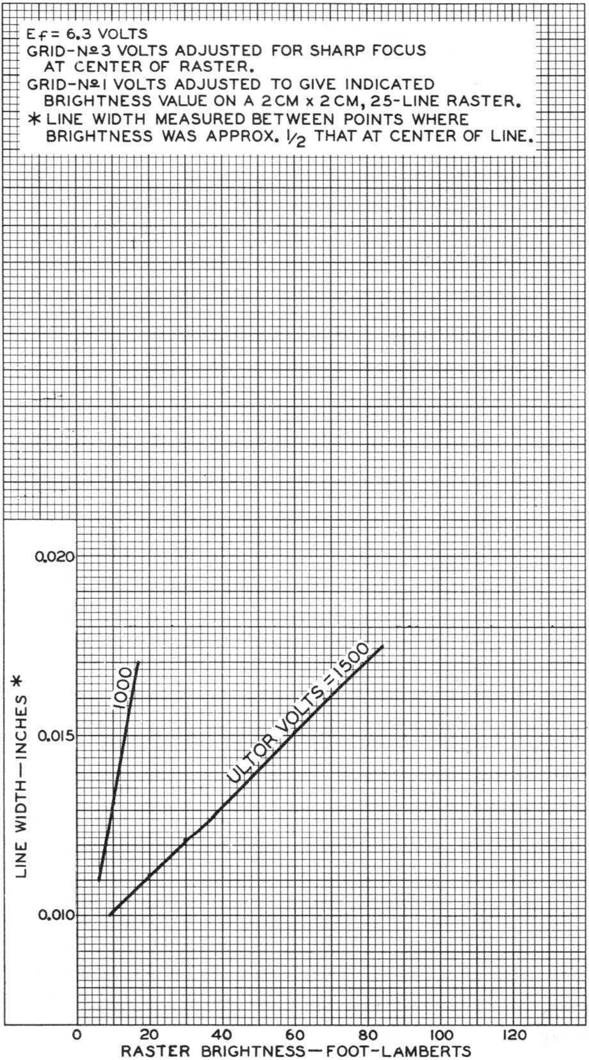
AVERAGE CHARACTERISTICS



RCA

1EP2

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

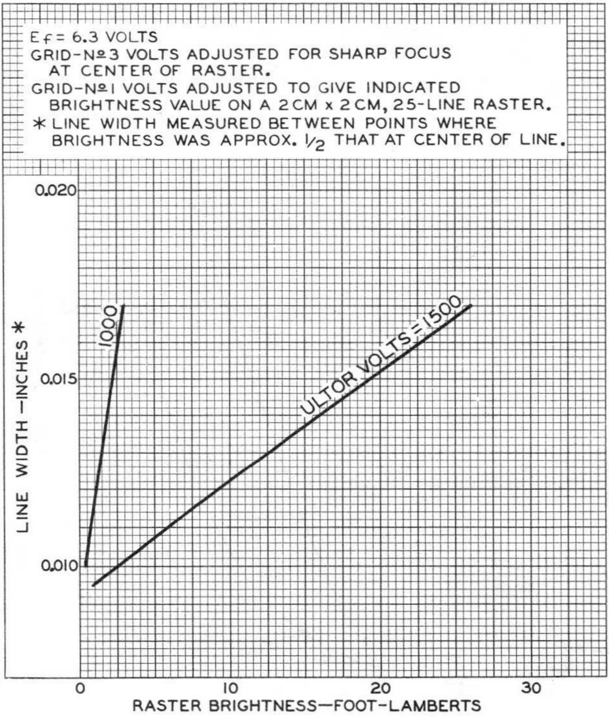
The 1EP2 is the same as the 1EP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section). P2
Fluorescence. . . . . Greenish-Yellow
Phosphorescence . . . . Greenish-Yellow
Persistence . . . . .Long

In general, operation of the 1EP2 at an ultor voltage less than 750 volts is not recommended.

AVERAGE CHARACTERISTICS



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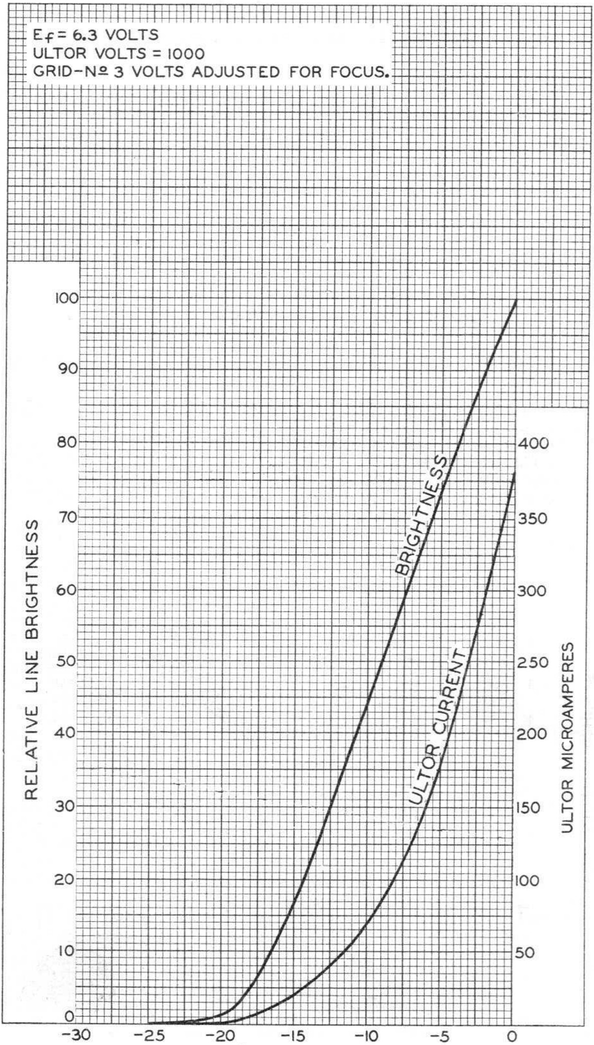
92CM-9189

IEP2

RCA

IEP2

AVERAGE CHARACTERISTICS



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92CM-9298

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1EP11

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS | ELECTROSTATIC DEFLECTION

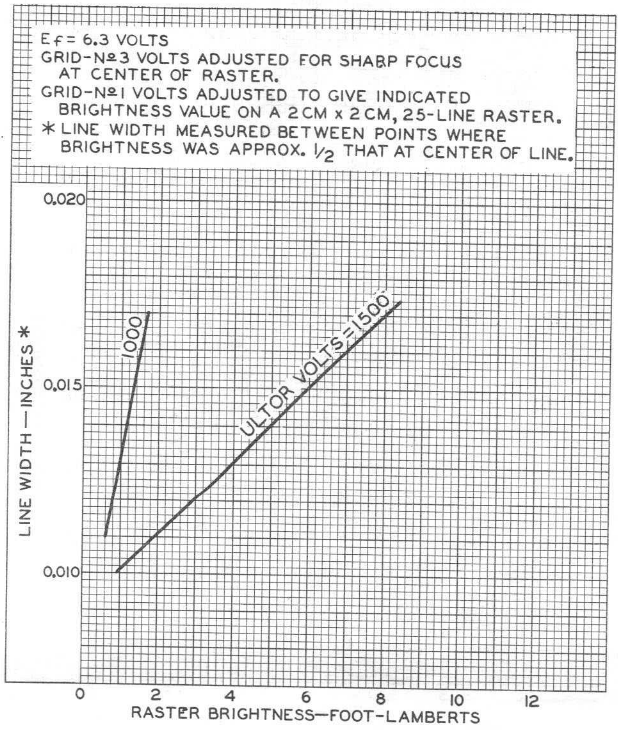
The 1EP11 is the same as the 1EP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section). P11
Fluorescence. . . . . .Blue
Phosphorescence . . . . .Blue
Persistence . . . . Short

In general, operation of the 1EP11 at an ultor voltage less than 750 volts is not recommended.

AVERAGE CHARACTERISTICS



92CM-9188

IEP11

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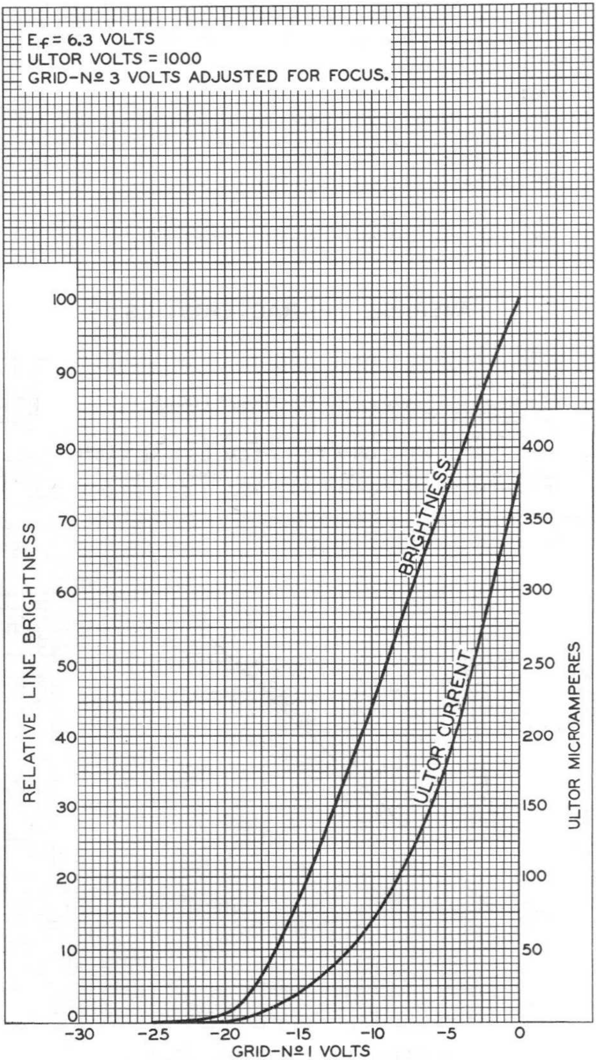
IEP11

AVERAGE CHARACTERISTICS



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2AP1-A

HIGH-VACUUM CATHODE-RAY TUBE

Supersedes Type 2AP1

General:

Heater, for Unipotential Cathode:

Voltage	6.3 ± 10%	ac or dc volts
Current	0.6	amp.

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	8.0	μμf
Cathode to All Other Electrodes	5.5	μμf
DJ_1 to DJ_2	0.6	μμf
DJ_3 to DJ_4	1.1	μμf
DJ_1 to All Other Electrodes	8.5	μμf
DJ_3 to All Other Electrodes	9.0	μμf
DJ_1 to All Other Electrodes except DJ_2	8.0	μμf
DJ_2 to All Other Electrodes except DJ_1	4.6	μμf
DJ_3 to All Other Electrodes except DJ_4	7.5	μμf
DJ_4 to All Other Electrodes except DJ_3	6.0	μμf

Phosphor (For Curves, see front of this Section)	No.1
Fluorescence	Green
Persistence	Medium
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Overall Length	7-7/16" ± 3/16"
Greatest Diameter of Bulb	2" ± 1/16"
Minimum Useful Screen Diameter	1-3/4"
Mounting Position	Any
Base	Small Shell Magnal 11-Pin
Basing Designation for BOTTOM VIEW	11L

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Deflecting Electrode DJ_1
Pin 4 - Anode No.1
Pin 5 - No Connection
Pin 6 - Deflecting Electrode DJ_4
Pin 7 - Anode No.2, Grid No.2

Pin 8 - Deflecting Electrode DJ_2
Pin 9 - Deflecting Electrode DJ_3
Pin 10 - Grid No.1
Pin 11 - Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 4. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 1.

The angle between the trace produced by DJ_3 and DJ_4 and its intersection with the plane through the tube axis and pin 1 does not exceed 10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 4°.

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2AP1-A

HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

Maximum Ratings, ***Absolute Values:***

ANODE-No.2 & GRID-No.2 VOLTAGE.	1100	*max.*	volts
ANODE-No.1 VOLTAGE	550	*max.*	volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:			
Negative Value	125	*max.*	volts
Positive Value	0	*max.*	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE	660	*max.*	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	125	*max.*	volts
Heater positive with respect to cathode	10	*max.*	volts

Typical Operation:

Anode-No.2 & Grid-No.2 Voltage★ . .	500	1000	volts
Anode-No.1 Voltage for Focus at 75% of Grid-No.1 Voltage for Cutoff● . .	125	250	volts
Grid-No.1 Volt. for Visual Cutoff#	−30	−60	volts
Max. Anode-No.1 Current Range▲ .	Between −50 and +10 . .		µamp.
Deflection Sensitivity:			
DJ_1 and DJ_2.	0.220	0.110 . . .	mm/v dc
DJ_3 and DJ_4.	0.260	0.130 . . .	mm/v dc
Deflection Factor:**			
DJ_1 and DJ_2.	115	230 . .	v dc/in.
DJ_3 and DJ_4.	98	196 . .	v dc/in.

★ Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 500 volts.

● Individual tubes may require between +20% and −45% of the values shown with grid-No.1 voltages between zero and cutoff.

\# Visual extinction of stationary focused spot. Supply should be adjustable to ± 50% of these values.

▲ See curve for average values.

** Individual tubes may vary from these values by ± 20%.

Spot Position:

The undeflected focused spot will fall within a 10-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ_1 and DJ_2. Suitable test conditions are: anode-No.2 voltage, 1000 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each, connected to anode No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No.1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5	*max.*	megohms
Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency	1.0	*max.*	megohm

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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2AP1-A

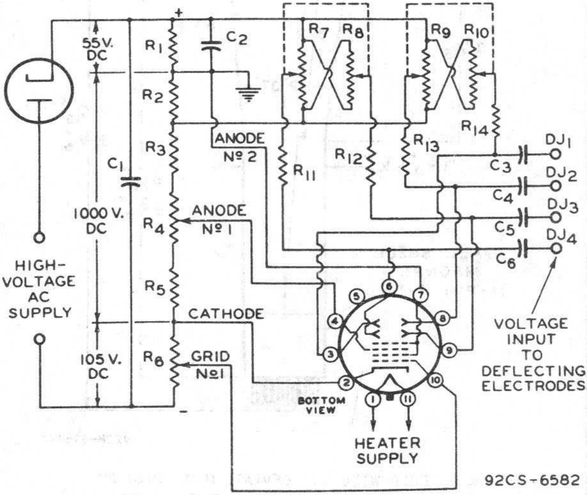
HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

Resistance in Any Deflecting-Electrode Circuit▲▲ 5.0 *max.* megohms

▲▲ It is recommended that all deflecting-electrode-circuit resistances be approximately equal.

TYPICAL OSCILLOGRAPH CIRCUIT



C1: 0.1 µf
C2: 1.0 µf
C3 C4 C5 C6: 0.05-µf Blocking Capacitor*
R1 R2: 0.5 Megohm
R3: 3.0 Megohms
R4: 1.0-Megohm Potentiometer
R5: 0.5 Megohm
R6: 0.5-Megohm Potentiometer
R7 R8: Dual 5-Megohm Potentiometer
R9 R10: Dual 5-Megohm Potentiometer
R11 R12 R13 R14: 2 Megohms

*When cathode is grounded, capacitors should have high voltage rating; when anode No.2 is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that anode No.2 be returned to a point in the amplifier system which will give the lowest possible potential difference between anode No.2 and the deflecting electrodes.

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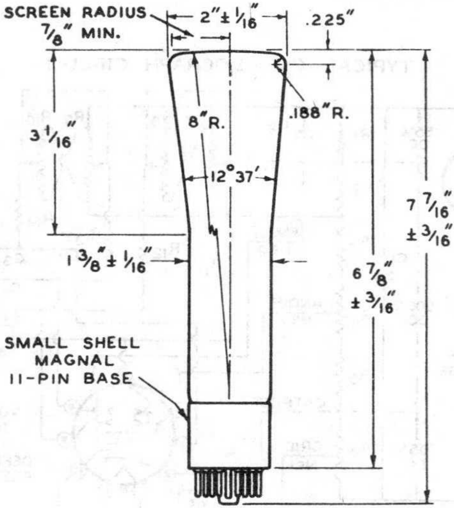
2AP1-A

HIGH-VACUUM CATHODE-RAY TUBE



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE

2BP1

OSCILLOGRAPH TUBE

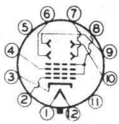
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to All Other Electrodes	8	$\mu\mu f$
DJ_1 to DJ_2	2	$\mu\mu f$
DJ_3 to DJ_4	2	$\mu\mu f$
DJ_1 to All Other Electrodes	11	$\mu\mu f$
DJ_2 to All Other Electrodes	8	$\mu\mu f$
DJ_3 to All Other Electrodes	7	$\mu\mu f$
DJ_4 to All Other Electrodes	8	$\mu\mu f$ ←
Phosphor (For Curves, see front of this Section)		No. 1
Fluorescence		Green
Persistence		Medium
Focusing Method		Electrostatic
Deflection Method		Electrostatic
Overall Length		7-5/8" ± 3/16"
Greatest Diameter of Bulb		2" ± 1/16"
Minimum Useful Screen Diameter		1-3/4"
Mounting Position		Any
Base		Small-Shell Duodecal 12-Pin
Basing Designation for BOTTOM VIEW		12E

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Cathode
Pin 4 - Anode No.1
Pin 5 - Internal Connection-- Do Not Use
Pin 6 - Deflecting Electrode DJ_3
Pin 7 - Deflecting Electrode DJ_4



Pin 8 - Anode No.2, Grid No.2
Pin 9 - Deflecting Electrode DJ_2
Pin 10 - Deflecting Electrode DJ_1
Pin 11 - Internal Connection-- Do Not Use
Pin 12 - Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ1 positive with respect to DJ2, the spot is deflected toward pin 4. With DJ3 positive with respect to DJ4, the spot is deflected toward pin 1.

The plane through the tube axis and pin No.4 may vary from the trace produced by DJ1 and DJ2 by an angular tolerance (measured about the tube axis) of 10°.

The angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is 90° ± 3°.

← Indicates a change.

2BP1

2BP1
OSCILLOGRAPH TUBE

Maximum Ratings, *Design-Center Values:*

ANODE-No.2● VOLTAGE	2500 max.	volts
ANODE-No.1 VOLTAGE	1000 max.	volts
→ GRID-No.1 VOLTAGE:		
Negative bias value	200 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

Equipment Design Ranges:

For any anode-No.2 voltage (E_{b_2}) between 500 and 2500 volts*

Anode-No.1 Voltage	15% to 28% of E_{b_2}	volts
→ Max. Grid-No.1 Voltage for Visual Cutoff	6.75% of E_{b_2}	volts
Max. Anode-No.1 Current Range	-15 to +10	microamperes
Deflection Factors:		
DJ_1 & DJ_2	115 to 155	v dc/in./kv of E_{b_2}
DJ_3 & DJ_4	74 to 100	v dc/in./kv of E_{b_2}
→ Spot Position	□	

Examples of Use of Design Ranges:

For anode-No.2 voltage of	*1000*	*2000*	*volts*
Anode-No.1 Voltage	150 - 280	300 - 560	volts
Max. Grid-No.1 Voltage for Visual Cutoff	-67.5	-135	volts
Deflection Factors:			
DJ_1 & DJ_2	115 - 155	230 - 310	volts dc/in.
DJ_3 & DJ_4	74 - 100	148 - 200	volts dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit°	5.0 max.	megohms

* Brilliance and definition decrease with decreasing anode-No.2 voltage. A value as low as 500 volts is recommended only for low-velocity deflection and low room-light levels.

° It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

● Anode No.2 and grid No.2 which are connected together within tube, are referred to herein as anode No.2. The product of anode-No.2 voltage and average anode-No.2 current should be limited to 6 watts.

□ The center of the undeflected, focused spot will fall within a circle having a 5.0-mm radius concentric with the center of the tube face.

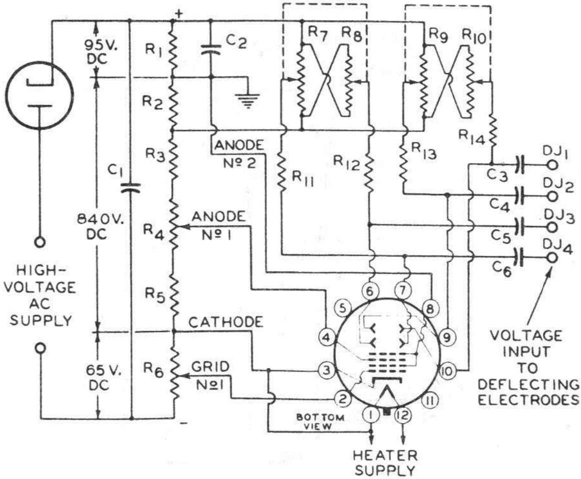
→ Indicates a change.

RCA

2BP1

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



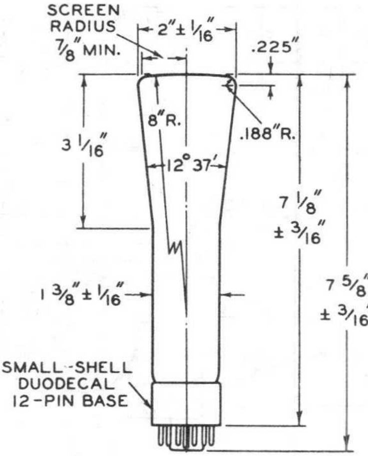
92CM-6777R1

C1: 0.2 μf
C2: 1.0 μf
C3 C4 C5 C6: 0.05-μf Blocking Capacitors*
R1 R2: 2.5 Megohms, 0.5 Watt
R3: 2.5 Megohms, 1 Watt
R4: 1.0-Megohm Potentiometer
R5: 0.5 Megohm, 0.5 Watt
R6: 0.35 Megohm, 0.5 Watt
R7 R8: Dual 5-Megohm Potentiometer
R9 R10: Dual 5-Megohm Potentiometer
R11 R12 R13 R14: 2 Megohms, 0.5 Watt

* When cathode is grounded, capacitors should have high voltage rating; when anode No.2 is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that anode No.2 be returned to a point in the amplifier system which will give the lowest possible potential difference between anode No.2 and the deflecting electrodes.

2BP1

OSCILLOGRAPH TUBE



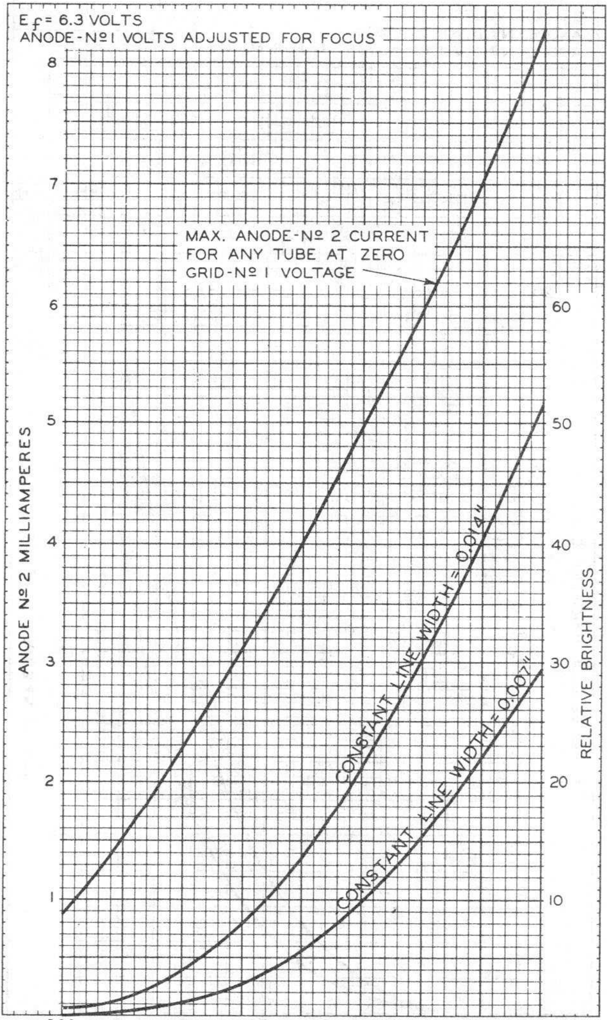
℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

92CS-6689

RCA

2BP1

CHARACTERISTICS



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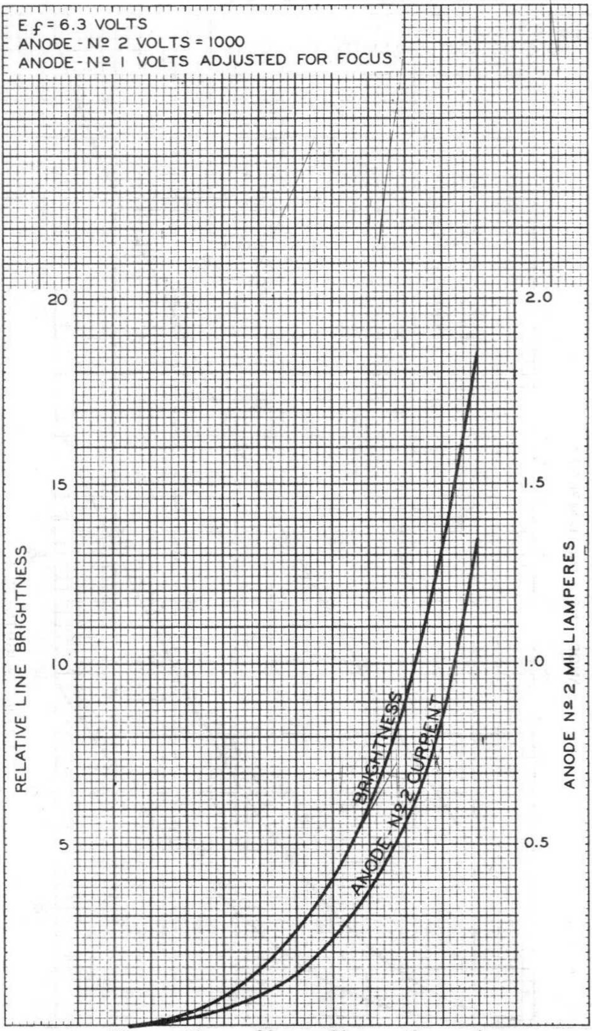
2BP1

AVERAGE CHARACTERISTICS



RCA

2BP11

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 2BP11 is the same as the 2BP1 except that it has a phosphor of the short-persistence, blue-fluorescence type designated P11. The blue radiation of the P11 screen is highly actinic and has sufficiently short persistence to permit use of the 2BP11 in all moving film photographic applications without blurring except in those where film moves at a high speed. The 2BP11 is also quite satisfactory for visual observation of phenomena because its phosphor has unusually high brightness for a blue screen.

In general, operation of the 2BP11 at an anode-No.2 voltage less than 1000 volts is not recommended.

THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC
and the PERSISTENCE CHARACTERISTIC of
the P11 Phosphor are shown at the
front of this Section

2F21

2F21
MONOSCOPE

5-INCH MAGNETIC-DEFLECTION TYPE

Supersedes Type 1899

General:

Heater, for Unipotential Cathode:

Voltage	6.3 ± 10%	ac or dc volts
Current	0.6	amp

Direct Interelectrode Capacitances:

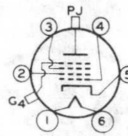
Grid No.1 to All Other Electrodes	7	μμf
Pattern Electrode to Grid No.4	5	μμf

Pattern:

Type	See illustration on next page
Dimensions (Approx.)	2-5/16" x 3-1/16"
Calibration	Up to 500 lines

Focusing Method	Electrostatic
Deflection Method	Magnetic
Maximum Solid Deflection Angle	40°
Overall Length	12-7/16" + 1/4" − 7/16"
Greatest Diameter of Bulb	5-1/16" max.
Caps (Two)	Recessed Small Ball
Mounting Position	Any
Base	Long-Shell Medium 6-Pin
Basing Designation for BOTTOM VIEW	6BV

Pin 1 - Heater
Pin 2 - Grid No.2
Pin 3 - Grid No.3
Pin 4 - Grid No.1
Pin 5 - Cathode



Pin 6 - Heater
End Cap - Pattern Electrode
Side Cap - Grid No.4

Maximum Ratings, ***Design-Center Values:***

PATTERN-ELECTRODE VOLTAGE	1500 max.	volts
GRID-No.4 (COLLECTOR) VOLTAGE	1500 max.	volts
GRID-No.3 (FOCUSING ELECTRODE) VOLTAGE	600 max.	volts
GRID-No.2 (ACCELERATING ELECTRODE) VOLT.	1600 max.	volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:		
Negative Bias Value	125 max.	volts
Positive Bias Value	0 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

Typical Operation: ❡

Pattern-Electrode Voltage	1000	volts
Grid-No.4 Voltage	1050	volts
Grid-No.3 Voltage for Focus at 0.5 μamp Grid-No.4 Current▲	300 approx.	volts
Grid-No.2 Voltage	1000	volts
Grid-No.1 Voltage for Visual Cutoff on Monitor#	−50 approx.	volts
Internal Resistance between Grid No.4 and Pattern Electrode	Greater than 1 meg.	
Grid-No.4 Current	0.5	μamp

❡, ▲, #: See next page.

2F21
MONOSCOPE

Pattern-Electrode Signal Current (Peak-to-Peak)	0.5 approx. µamp
Resolution Capability▲▲	500 . . . lines
Maximum Circuit Value:	
Grid-No.1-Circuit Resistance	1.5 max. megohms

•

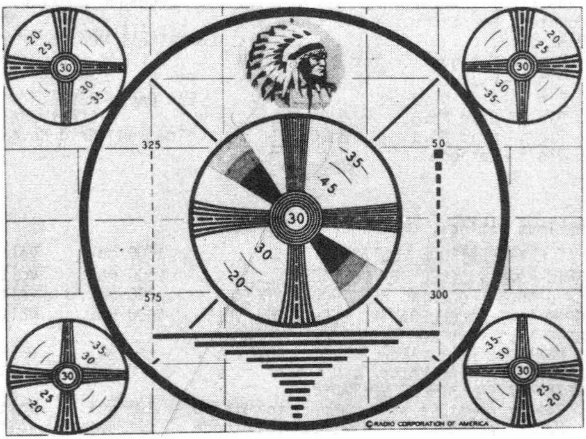
▲ Individual tubes may requi. ; between + 20% and − 20% of these values.

† Deflection must be maintained at all times. When scanned area does not cover entire pattern, th beam current should be reduced accordingly and time of operation limi.ed to prevent damaging the pattern.

Supply should be adjustable between + 40% and − 80% of this value.

▲▲ With full scanning.

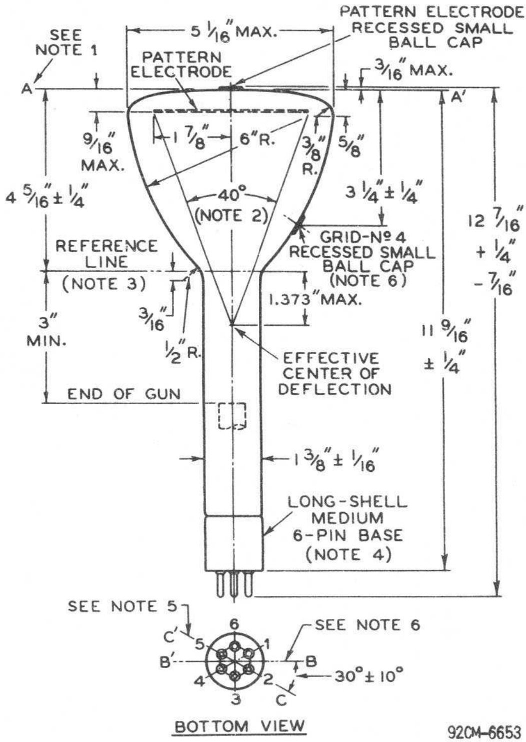
PATTERN



92CS-6665

2F21

2F21
MONOSCOPE



92CM-6653

NOTE 1: LINE AA' IS PERPENDICULAR TO THE AXIS OF THE TUBE AND INTERSECTS THE FACE CONTOUR 1/2" FROM THE AXIS OF THE TUBE.

NOTE 2: DEFLECTION ANGLE BETWEEN DIAGONALLY OPPOSITE CORNERS OF PATTERN.

NOTE 3: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE 1.438" ± .003 I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 4: ℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

NOTE 5: MINOR AXIS OF PATTERN ELECTRODE MAY VARY FROM PLANE CC' THROUGH PIN 2 AND TUBE AXIS BY 10°. TOP EDGE OF PATTERN IS ON SAME SIDE OF TUBE AS PIN 5.

NOTE 6: BB' INDICATES PLANE THROUGH TUBE AXIS AND GRID-No.4 TERMINAL.

RCA

3API-A
OSCILLOGRAPH TUBE

GENERAL DATA
except for those on the phosphor as indicated below,
MAXIMUM RATINGS, TYPICAL OPERATION, OUTLINE,
and
AVERAGE CHARACTERISTICS CURVES
(Anode-No.2 & Grid-No.2 Microamperes vs Grid-No.1 Volts)
for the 3API-A
are the same as those for Type 908-A.

Phosphor (For Curves, see front of this Section). . . No.1
Fluorescence. Green
Persistence . . . . Medium

Oscillograph Tube

ELECTROSTATIC FOCUS **ELECTROSTATIC DEFLECTION**

DATA

General:

Heater, for Unipotential Cathode:

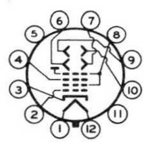
Voltage (AC or DC)	6.3	volts
Current	0.6 ± 10%	amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to all other electrodes	7.5	$\mu\mu$f
Cathode to all other electrodes	4.3	$\mu\mu$f
Deflecting electrode DJ_1 to deflecting electrode DJ_2	5.2	$\mu\mu$f
Deflecting electrode DJ_3 to deflecting electrode DJ_4	7	$\mu\mu$f
DJ_1 to all other electrodes	10.1	$\mu\mu$f
DJ_2 to all other electrodes	7.5	$\mu\mu$f
DJ_3 to all other electrodes	8.1	$\mu\mu$f
DJ_4 to all other electrodes	9.2	$\mu\mu$f

Faceplate, Spherical	Clear Glass
Phosphor (For Curves, see front of this Section)	P1
Fluorescence	Yellowish-Green
Phosphorescence	Yellowish-Green
Persistence	Medium
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Overall Length	9-1/8" ± 1/4"
Greatest Diameter of Bulb	3" ± 1/16"
Minimum Useful Screen Diameter	2-3/4"
Useful Scan (Centered with respect to tube face):	
By deflecting electrodes DJ_1 & DJ_2	2-3/4"
By deflecting electrodes DJ_3 & DJ_4	2-1/4"
Operating Position	Any
Bulb	J24P1
Base. .Small-Shell Duodecal 12-Pin (JEDEC Group 4, No.B12-43)	
Basing Designation for BOTTOM VIEW	12E

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Cathode
Pin 4 - Grid No.3
Pin 5 - Internal Connection— Do Not Use
Pin 6 - Deflecting Electrode DJ_3
Pin 7 - Deflecting Electrode DJ_4



Pin 8 - Ultor (Grid No.2, Grid No.4, Collector)
Pin 9 - Deflecting Electrode DJ_2
Pin 10 - Deflecting Electrode DJ_1
Pin 11 - Internal Connection— Do Not Use
Pin 12 - Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

3AQP1

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	2750 max. / 500 min.	volts / volts
ULTOR INPUT (AVERAGE)	6 max.	watts
GRID-No.3 VOLTAGE	1100 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	200 max.	volts
Positive-bias value	0 max.	volts
Positive-peak value	2 max.	volts
PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE	550 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_{c4}) between 500 and 2750 volts

Grid-No.3 Voltage for focus	16.5% to 31% of E_{c4}	volts
Negative Grid-No.1 Voltage for visual extinction of undeflected spot	2.8% to 6.7% of E_{c4}	volts
Grid-No.3 Current for any operating condition	−15 to +10	μa
Deflection Factors:		
DJ_1 & DJ_2	73 to 99	v dc/in./kv of E_{c4}
DJ_3 & DJ_4	26 to 35	v dc/in./kv of E_{c4}

3BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

Supersedes Type 3BP1

General:

Heater, for Unipotential Cathode:

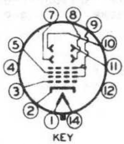
Voltage	6.3 ± 10%	ac or dc volts
Current	0.6	amp.

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	8.5	μμf
Cathode to All Other Electrodes	8.0	μμf
DJ_1 to DJ_2	2.0	μμf
DJ_3 to DJ_4	2.0	μμf
DJ_1 to All Other Electrodes	8.0	μμf
DJ_3 to All Other Electrodes	6.0	μμf
DJ_1 to All Other Electrodes except DJ_2	6.0	μμf
DJ_2 to All Other Electrodes except DJ_1	5.0	μμf
DJ_3 to All Other Electrodes except DJ_4	4.0	μμf
DJ_4 to All Other Electrodes except DJ_3	6.0	μμf

Phosphor (For Curves, see front of this Section)	No.1
Fluorescence	Green
Persistence	Medium
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Overall Length	10" ± 1/4"
Greatest Diameter of Bulb	3" ± 1/16"
Minimum Useful Screen Diameter	2-3/4"
Mounting Position	Any
Base	Medium Shell Diheptal 12-Pin
Basing Designation for BOTTOM VIEW	14G

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - Internal Con. Do Not Use
Pin 5 - Anode No.1
Pin 7 - Deflecting Electrode DJ_3
Pin 8 - Deflecting Electrode DJ_4



Pin 9 - Anode No.2, Grid No.2
Pin 10 - Deflecting Electrode DJ_2
Pin 11 - Deflecting Electrode DJ_1
Pin 12 - No Conn.
Pin 14 - Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 5. With DJ_3 positive with respect to DJ_4 the spot is deflected toward pin 2.

The angle between the trace produced by DJ_1 and DJ_2 and its intersection with the plane through the tube axis and pin 5 does not exceed 10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 3°.

Maximum Ratings, *Abolute Values*:

ANODE-No.2 & GRID-No.2 VOLTAGE	2200 *max.*	volts
ANODE-No.1 VOLTAGE	1100 *max.*	volts

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3BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:		
Negative Value.	200 *max.*	volts
Positive Value.	0 *max.*	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE	550 *max.*	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 *max.*	volts
Heater positive with respect to cathode	10 *max.*	volts

Typical Operation:

Anode-No.2 & Grid-No.2 Voltage■	1500	2000	volts
Anode No.1 Voltage for Focus at 75% of Grid-No.1 Voltage for Cutoff●	430	575	volts
Grid-No.1 Volt. for Visual Cutoff#	−45	−60	volts
Max. Anode-No.1 Current Range▲	Between −50 and +10		µamp.
Deflection Sensitivity:			
DJ_1 and DJ_2	0.169	0.127	mm/v dc
DJ_3 and DJ_4	0.229	0.172	mm/v dc
Deflection Factor:**			
DJ_1 and DJ_2	150	200	v dc/in.
DJ_3 and DJ_4	111	148	v dc/in.

■ Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 1500 volts.

● Individual tubes may require between +20% and −30% of the values shown with grid-No.1 voltages between zero and cutoff.

Visual extinction of stationary focused spot. Supply should be adjustable to ± 50% of these values.

▲ See curve for average values.

** Individual tubes may vary from these values by ± 20%.

Spot Position:

The undeflected focused spot will fall within a 15-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ_1 and DJ_2. Suitable test conditions are: anode-No.2 voltage, 1500 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each, connected to anode No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No.1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values.

Grid-No.1-Circuit Resistance	1.5 *max.*	megohms
Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency	1.0 *max.*	megohm
Resistance in Any Deflecting-Electrode Circuit▲▲	5.0 *max.*	megohms

▲▲ It is recommended that all deflecting-electrode-circuit resistances be approximately equal.

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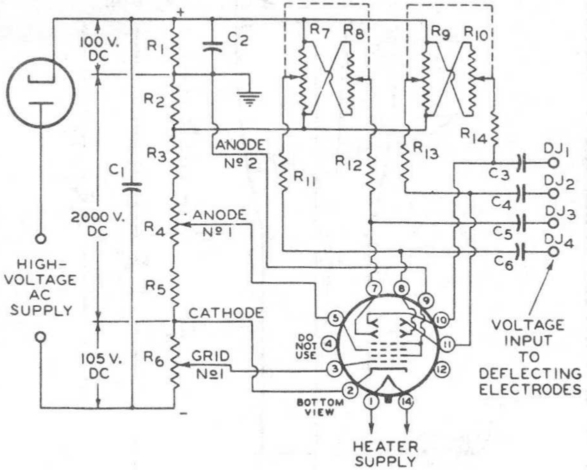
3BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CS-6514

C1: 0.1 µf
C2: 1.0 µf
C3 C4 C5 C6: 0.05-µf Blocking Capacitors*
R1 R2: 2 Megohms
R3: 5.5 Megohms

R4: 2-Megohm Potentiometer
R5: 1.5 Megohms
R6: 0.5-Megohm Potentiometer
R7 R8: Dual 5-Megohm Potentiometer
R9 R10: Dual 5-Megohm Potentiometer
R11 R12 R13 R14: 2 Megohms

*When cathode is grounded, capacitors should have high voltage rating; when anode No.2 is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that anode No.2 be returned to a point in the amplifier system which will give the lowest possible potential difference between anode No.2 and the deflecting electrodes.

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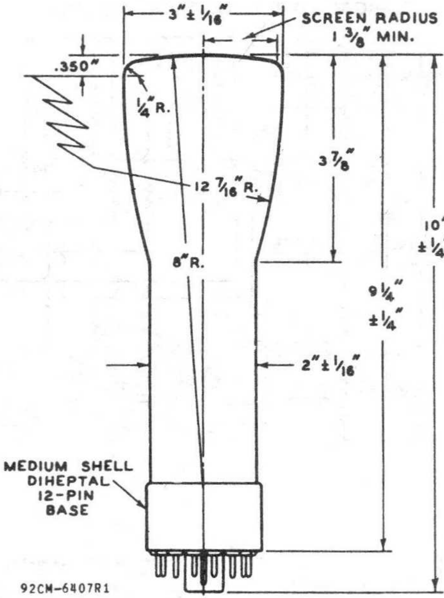
3BP1-A

HIGH-VACUUM CATHODE-RAY TUBE



℄ OF BULB WILL NOT DEVIATE MORE THAN 2°
IN ANY DIRECTION FROM PERPENDICULAR
ERECTED AT CENTER OF BOTTOM OF BASE

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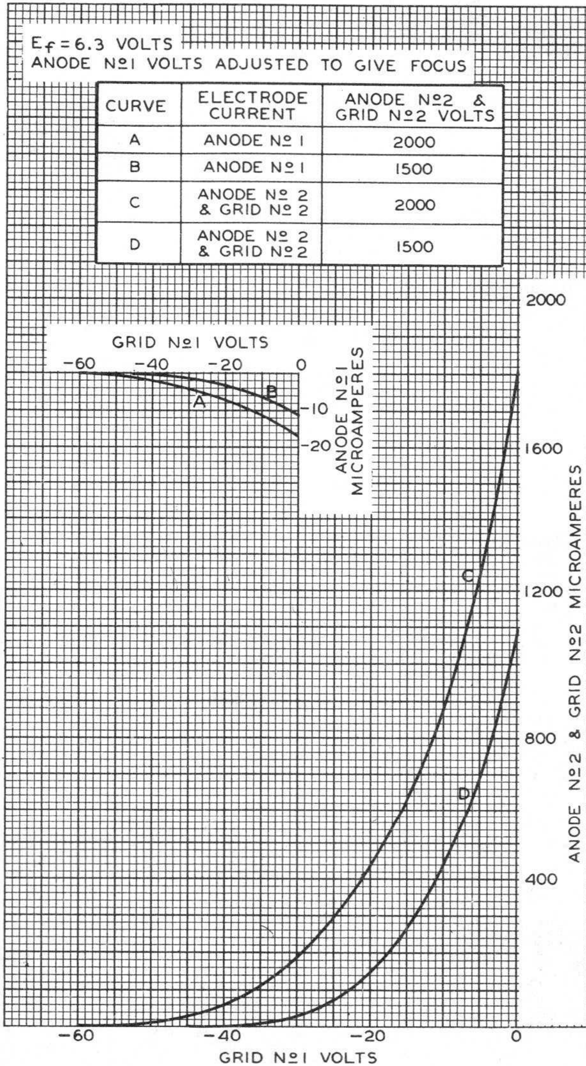
RCA

3BP1-A

AVERAGE CHARACTERISTICS

E_f = 6.3 VOLTS
ANODE No. 1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE No. 2 & GRID No. 2 VOLTS
A	ANODE No. 1	2000
B	ANODE No. 1	1500
C	ANODE No. 2 & GRID No. 2	2000
D	ANODE No. 2 & GRID No. 2	1500



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3JPI

3JPI

OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

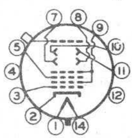
Voltage	6.3	ac or dc volts
Current	0.6	amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	8	μμf
Cathode to All Other Electrodes	8	μμf
DJ_1 to DJ_2	2.5	μμf
DJ_3 to DJ_4	2	μμf
DJ_1 to All Other Electrodes	8	μμf
DJ_2 to All Other Electrodes	7	μμf
DJ_3 to All Other Electrodes	7	μμf
DJ_4 to All Other Electrodes	8	μμf

Phosphor (For Curves, see front of this Section) P1
  Fluorescence and Phosphorescence . . . . Green
  Persistence of Phosphorescence . . . . Medium
Focusing Method. . . . . Electrostatic
Deflection Method. . . . . Electrostatic
Overall Length . . . . 10" ± 1/4"
Greatest Diameter of Bulb. . . . . 3" ± 1/16"
Minimum Useful Screen Diameter . . . . 2-3/4"
Mounting Position. Any
Cap. . . . . Recessed Small Ball (JETEC No.J1-22)
Base . . . . Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)
  Basing Designation for BOTTOM VIEW . . . . $14J_1$

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - Internal Connection- Do Not Use
Pin 5 - Anode No.1
Pin 7 - Deflecting Electrode DJ_3
Pin 8 - Deflecting Electrode DJ_4



Pin 9 - Anode No.2, Grid No.2
Pin 10 - Deflecting Electrode DJ_2
Pin 11 - Deflecting Electrode DJ_1
Pin 12 - No Connection
Pin 14 - Heater
Cap - Anode No.3

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 5. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 2.

The plane through the tube axis and each of the following items may vary from the trace produced by DJ_1 and DJ_2 by the following angular tolerances measured about the tube axis: Pin 5, 10°; Cap (on same side of tube as pin 5), 10°.

The angle between $DJ_1 - DJ_2$ trace and $DJ_3 - DJ_4$ trace is 90° ± 3°.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

3JP1

RCA

3JP1

OSCILLOGRAPH TUBE

Maximum Ratings, *Design-Center Values:*

ANODE-No.3 VOLTAGE	4000 max.	volts
ANODE-No.2□ VOLTAGE.	2000 max.	volts
RATIO OF ANODE-No.3 VOLTAGE TO ANODE-No.2 VOLTAGE	2.3 : 1 max.	
ANODE-No.1 VOLTAGE	1000 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value.	200 max.	volts
Positive bias value●	0 max.	volts
Positive peak value.	2 max.	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	125 max.	volts

Equipment Design Ranges:

For any anode-No.3 voltage (Eb_3) between 2000 and 4000 volts and any anode-No.2 voltage (Eb_2) between 1500** and 2000 volts*

Anode-No.1 Voltage	20% to 34.5% of Eb_2 . . .	volts
Grid-No.1 Voltage†	1.5% to 4.5% of Eb_2 . . .	volts
Anode-No.1 Current for any Operating Condition . .	-50 to +10 . . .	μamp
Deflection Factors:		
	When $Eb_3 = 2 \times Eb_2$	
DJ_1 & DJ_2	85 to 115	v dc/in./kv of Eb_2
DJ_3 & DJ_4	62.5 to 85	v dc/in./kv of Eb_2
	When $Eb_3 = Eb_2$	
DJ_1 & DJ_2	68 to 92	v dc/in./kv of Eb_2
DJ_3 & DJ_4	50 to 68	v dc/in./kv of Eb_2
Spot Position.	#	

□ Anode No.2 and grid No.2, which are connected together within tube, and referred to herein as anode No.2.

● At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode-No.2 input power to 6 watts.

* It is recommended that anode-No.3 voltage be not less than 3000 volts for high-speed transients.

** Recommended minimum value of anode-No.2 voltage.

With heater voltage of 6.3 volts, anode-No.3 voltage of 3000 volts, anode-No.2 voltage of 1500 volts, anode-No.1 voltage adjusted for focus, grid-No.1 voltage adjusted to give spot that is just visible, each deflecting electrode connected through 1-megohm resistor to anode No.2, and tube shielded from all extraneous fields, the undeflected focused spot will fall within a 15-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ_1 and DJ_2.

†: See next page.

3JP1

OSCILLOGRAPH TUBE

Examples of Use of Design Ranges:

For anode-No.3 voltage of	*2000*	*3000*	*4000*	*volts*
and anode-No.2 voltage of	*2000*	*1500*	*2000*	*volts*
Anode-No.1 Volt.	400 to 690	300 to 515	400 to 690	volts
Grid-No.1 Volt.†	-30 to -90	22.5 to -67.5	-30 to -90	volts
Deflection Factors:				
DJ_1 & DJ_2. . . .	136 to 184	127 to 173	170 to 230	■
DJ_3 & DJ_4. . . .	100 to 136	94 to 128	125 to 170	■

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max. megohms
Resistance in Any Deflecting-Electrode Circuit▲. . . .	5.0 max. megohms

† For visual extinction of undeflected focused spot.

■ Volts dc/in.

▲ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

OPERATING NOTES

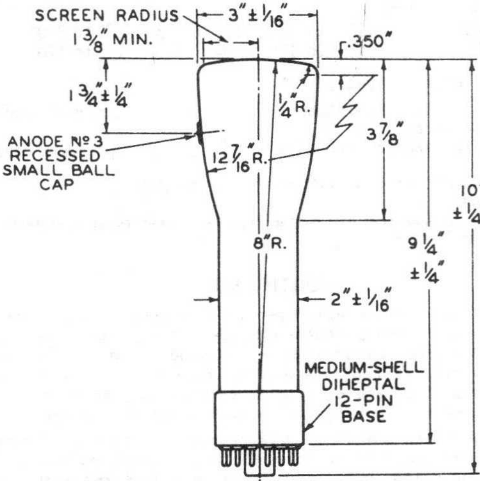
The 3JP1 utilizes a medium-persistence screen having green fluorescence and phosphorescence. The screen has high visual efficiency and exceptionally good brightness contrast between the scanned line and the background. Under conditions of high ambient light, contrast may be maintained by the use of a green filter, such as Wratten No.58.

For high-speed scanning, it is recommended that the anode-No.3 (post-deflection accelerator) voltage be not less than 3000 volts, but for low- and medium-speed scanning, anode No.3 may be operated at a voltage as low as 2000 volts.

Because of its medium persistence, the 3JP1 is particularly useful where either medium-speed non-recurring phenomena or medium- and high-speed recurring phenomena are to be observed. The persistence is such that the 3JP1 can be operated with scanning frequencies as low as 20 cycles per second without excessive flicker.

3JPI

3JPI
OSCILLOGRAPH TUBE



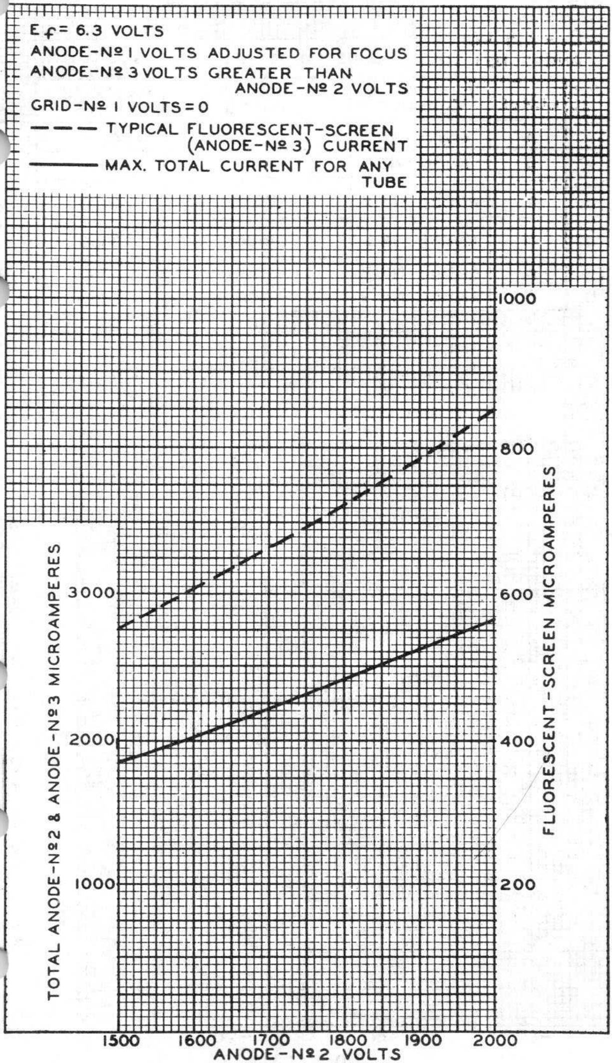
℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF BASE.

92CM-6583

RCA

3JP1

CHARACTERISTICS



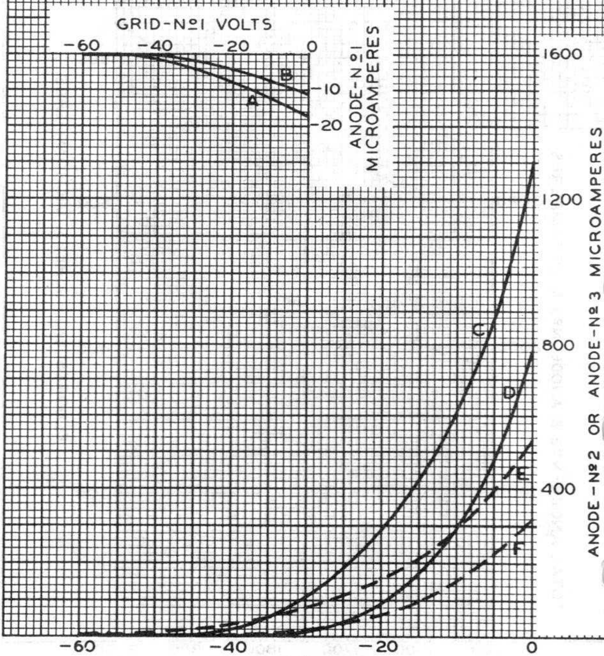
RCA

3JP1

AVERAGE CHARACTERISTICS

E_f = 6.3 VOLTS
ANODE-No.1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE-No.2 VOLTS	ANODE-No.3 VOLTS
A	ANODE No. 1	2000	4000
B	ANODE No. 1	1500	3000
C	ANODE No. 2	2000	4000
D	ANODE No. 2	1500	3000
E	ANODE No. 3	2000	4000
F	ANODE No. 3	1500	3000



3JP7

OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 3JP7 is electrically and mechanically like the 3JP1 but utilizes a long-persistence, cascade (two-layer) screen which exhibits bluish fluorescence of short persistence and greenish-yellow phosphorescence which persists for several minutes under conditions of adequate excitation and low ambient light.

Because of its long persistence, the 3JP7 is particularly useful where either low-speed non-recurring phenomena or high-speed recurring phenomena are to be observed.

The persistence is such that the 3JP7 without filter can be operated with scanning frequencies as low as 30 cycles per second without excessive flicker. When used with a yellow filter, such as Wratten No. 15 (G), the 3JP7 can be operated with much lower scanning frequencies.

GENERAL DATA, MAXIMUM RATINGS, AND EQUIPMENT DESIGN RANGES

for the 3JP7 are identical with those for the 3JP1 except that Spot Position is defined as follows:

With heater voltage of 6.3 volts, anode-No.3 voltage of 4000 volts, anode-No.2 voltage of 2000 volts, anode-No.1 voltage adjusted for focus, grid-No.1 voltage adjusted to give spot that is just visible, each deflecting electrode connected through 1-megohm resistor to anode No.2, and tube shielded from all extraneous fields, the undeflected focused spot will fall within a 12-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ_1 and DJ_2.

THE SPECTRAL-ENERGY EMISSION CHARACTERISTIC, BUILDUP CHARACTERISTICS, and PERSISTENCE CHARACTERISTICS of the P7 Phosphor are shown at the front of this Section.

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RCA

3KP1

OSCILLOGRAPH TUBE

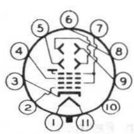
ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp ←
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to all other electrodes	8	μμf
Deflecting electrode DJ_1 to deflecting electrode DJ_2	2.5	μμf
Deflecting electrode DJ_3 to deflecting electrode DJ_4	2.5	μμf
DJ_1 to all other electrodes	11	μμf
DJ_2 to all other electrodes	8	μμf
DJ_3 to all other electrodes	7	μμf
DJ_4 to all other electrodes	8	μμf
Faceplate	Clear Glass ←	
Phosphor (For Curves, see front of this Section)	P1	
Fluorescence	Green	
Phosphorescence	Green ←	
Persistence	Medium	
Focusing Method	Electrostatic	
Deflection Method	Electrostatic	
Overall Length	11-1/2" ± 1/4"	
Greatest Diameter of Bulb	3" ± 1/16"	
Mimimum Useful Screen Diameter	2-3/4"	
Weight (Approx.)	9 oz ←	
Mounting Position	Any ←	
Bulb	J-24 ←	
Base	Medium-Shell Magnal 11-Pin (JETEC No.B11-66) ←	
Basing Designation for BOTTOM VIEW	11M	

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Cathode
Pin 4 - Grid No.3
Pin 5 - Deflecting Electrode DJ_3
Pin 6 - Deflecting Electrode DJ_4
Pin 7 - Ultor (Grid No.2, Grid No.4, Collector)



Pin 8 - Deflecting Electrode DJ_2
Pin 9 - Deflecting Electrode DJ_1
Pin 10 - Internal Connection-Do Not Use
Pin 11 - Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

← Indicates a change.

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3KP1

OSCILLOGRAPH TUBE

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 4. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 1.

The plane through the tube axis and pin 1 may vary from the trace produced by DJ_3 and DJ_4 by $\pm10^o$ (measured about the tube axis).

The angle between DJ_1 – DJ_2 trace and DJ_3 – DJ_4 trace is 90^o $\pm3^o$.

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	2500 max.	volts
→ ULTOR INPUT (AVERAGE)	6 max.	watts
GRID-No.3 VOLTAGE	1000 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	200 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE.	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode .	125 max.	volts
Heater positive with respect to cathode .	125 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_{c_4}) between recommended minimum and 2500 volts*

Grid-No.3 Voltage for Focus	16% to 30% of E_{c_4}	volts
→ Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot.	1.9% to 4.5% of E_{c_4}	volts
Grid-No.3 Current for Any Operating Condition.	-15 to +10	μamp
Deflection Factors:		
DJ_1 & DJ_2	50 to 68	v dc/in./kv of E_{c_4}
DJ_3 & DJ_4	38 to 52	v dc/in./kv of E_{c_4}
Spot Position	##	

Examples of Use of Design Ranges:

For ultor voltage of	*1000*	*2000*	*volts*
Grid-No.3 Voltage for Focus	160 to 300	320 to 600	volts

* Brilliance and definition decrease with decreasing ultor voltage. Recommended minimum for the 3KP1 in general service is 1000 volts but a value as low as 500 volts may be used under conditions of low-velocity deflection and low ambient-light levels.

The center of the undeflected focused spot will fall within a circle having 7.5-mm radius concentric with the center of the tube face.

→ Indicates a change.

RCA

3KP1

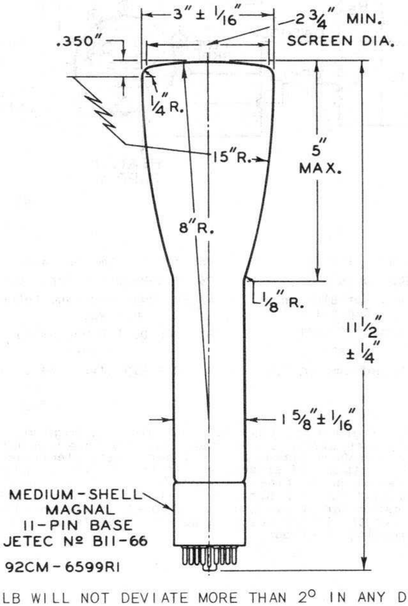
OSCILLOGRAPH TUBE

For ultor voltage of	*1000*	*2000*	*volts*
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	−19 to −45	−38 to −90	volts ←
Deflection Factors:			
DJ_1 & DJ_2.	50 to 68	100 to 136	volts dc/in.
DJ_3 & DJ_4.	38 to 52	76 to 104	volts dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting Electrode Circuit■	5 max.	megohms

■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

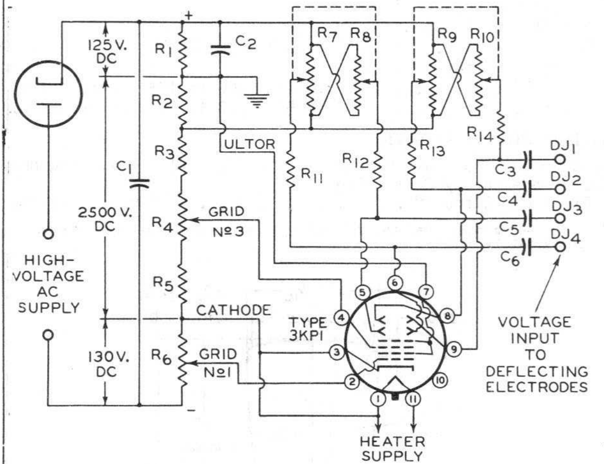
← Indicates a change.

3KP1

3KP1

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CS-6690R2

C1: 0.1 μf, 3000 Volts	R5: 1.0 Megohm, 0.5 Watt
C2: 1.0 μf, 200 Volts	R6: 0.5-Megohm Potentiometer, 0.5 Watt
C3 C4 C5 C6: 0.05-μf Blocking Capacitors*	R7 R8: Dual 5-Megohm Potentiometer, 0.5 Watt
R1 R2: 2 Megohms, 0.5 Watt	R9 R10: Dual 5-Megohm Potentiometer, 0.5 Watt
R3: 6 Megohms, 0.5 Watt	
R4: 2-Megohm Potentiometer, 0.5 Watt	R11 R12 R13 R14: 2 Megohms, 0.5 Watt

* When cathode is grounded, capacitors should have high voltage rating (3000 volts); when ultor is grounded, they may have low voltage rating (200 volts). For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that ultor be returned to a point in the amplifier system which will give the lowest possible potential difference between ultor and the deflecting electrodes.

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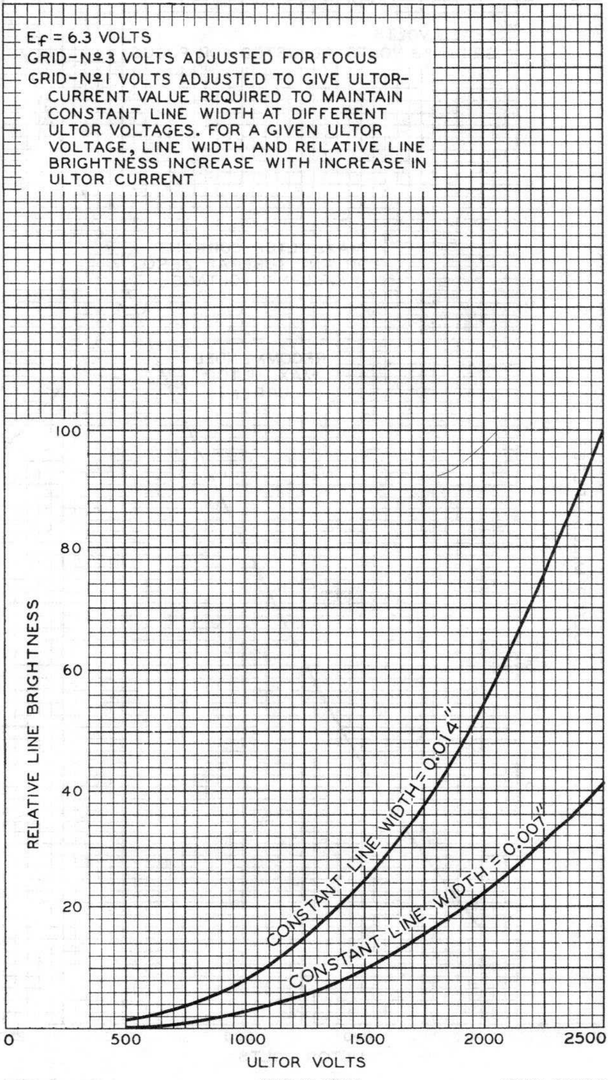
3KP1

CHARACTERISTICS



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92CM-7191R2

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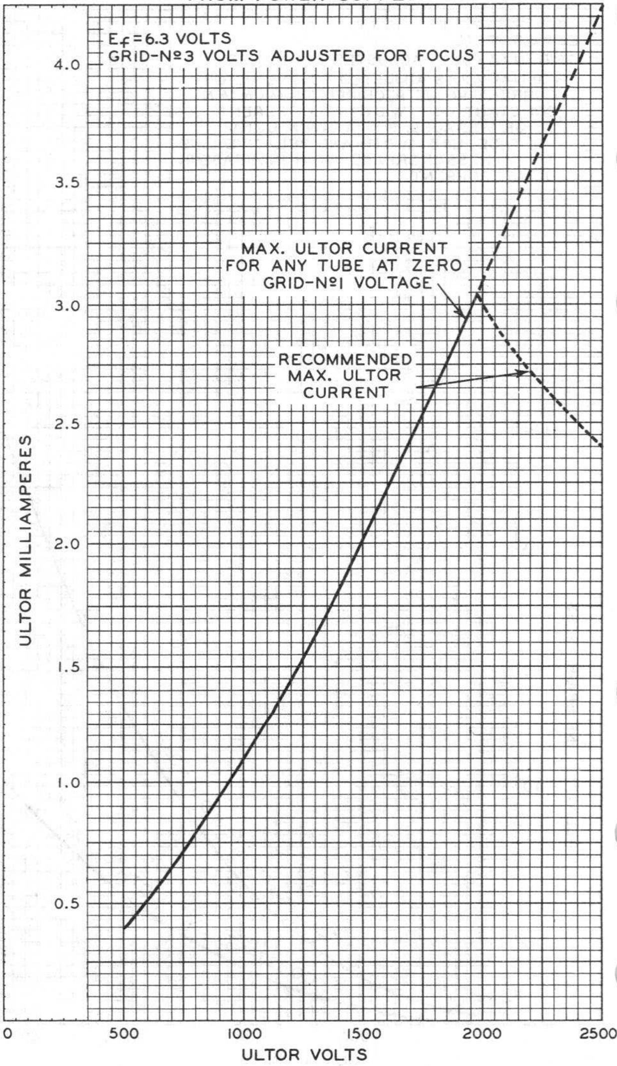
3KP1

MAXIMUM ULTOR-CURRENT REQUIREMENTS FROM POWER SUPPLY

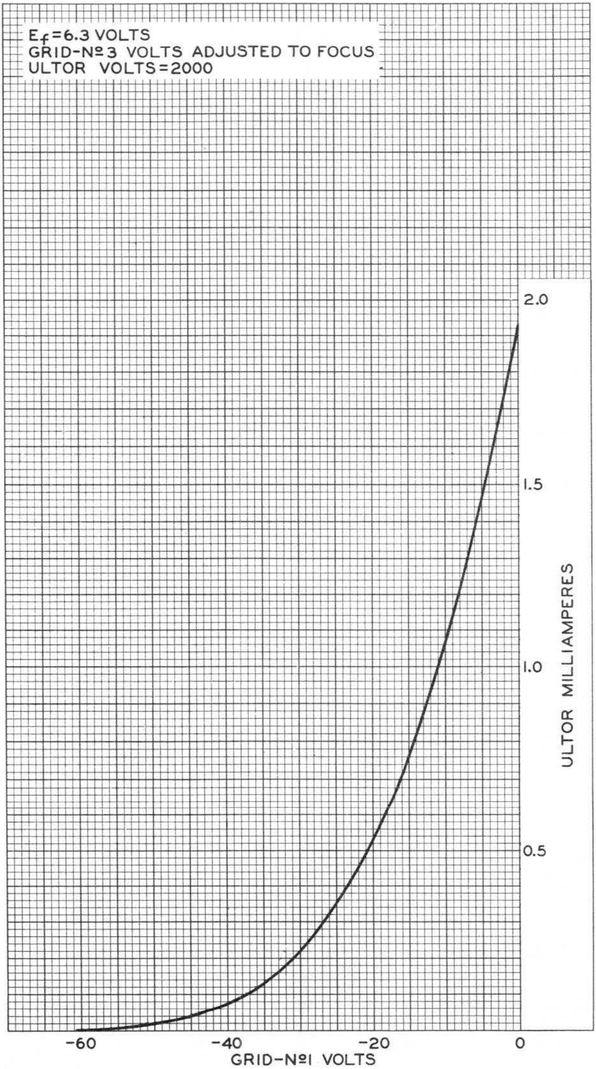


92CM-7192R1

RCA
3KP1

3KP1

AVERAGE CHARACTERISTIC



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92CM-6658R2

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3KP4

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 3KP4 is the same as the 3KP1 except for the following items:

General:

Phosphor (For curves, see front of this section). . P4—Sulfide Type
Fluorescence. . . . . White
Phosphorescence . . . . White
Persistence . . . . Medium-Short ←

In general, operation of the 3KP4 at an ultor voltage less than 1500 volts is not recommended.

The PERSISTENCE CHARACTERISTICS of the P4-sulfide phosphor are the same as those shown for the P11 phosphor at the front of this Section

3KP7

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 3KP7 is the same as the 3KP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section). P7
Fluorescence. . . . . Purplish-Blue ←
Persistence . . . . Medium-Short ←
Phosphorescence . . . . Yellowish-Green ←
Persistence . . . . Very Long ←

In general, operation of the 3KP7 at an ultor voltage less than 1500 volts is not recommended.

3KP11

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 3KP11 is the same as the 3KP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section). P11
Fluorescence. . . . . Blue
Phosphorescence . . . . Blue
Persistence . . . . Medium-Short ←

In general, operation of the 3KP11 at an ultor voltage less than 1500 volts is not recommended.

← Indicates a change.

3KP16

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 3KP16 is the same as the 3KP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section) P16
Fluorescence—
Visible radiation. . . . . Violet
Invisible radiation. . . . . Near-Ultraviolet
Phosphorescence—
Persistence of visible radiation . . . . Very Short
Persistence of invisible radiation . . . . Very Short

In general, operation of the 3KP16 at an ultor voltage less than 1500 volts is not recommended.

3RPI

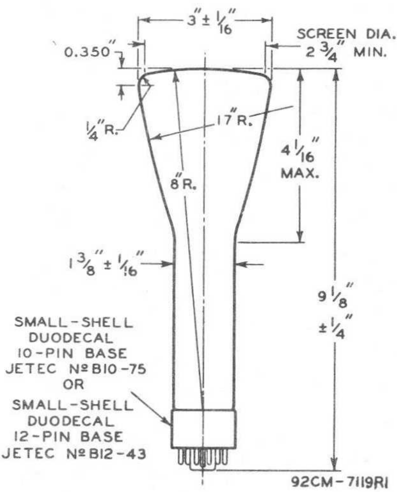
OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 3RP1 is the same as the 3RP1-A except for the following items:

General:

Faceplate. . . . . Spherical Clear Glass
Bulb J-24P1
Weight (Approx.) . . . . 7 oz



CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

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3RP1-A

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . 6.3 . . . . ac or dc volts
- Current . . . . 0.6 ± 10% . . . . amp

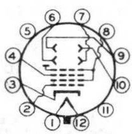
Direct Interelectrode Capacitances (Approx.):

Grid No.1 to all other electrodes	8	$\mu\mu f$
Deflecting electrode DJ_1 to deflecting electrode DJ_2	2	$\mu\mu f$
Deflecting electrode DJ_3 to deflecting electrode DJ_4	2	$\mu\mu f$
DJ_1 to all other electrodes	11	$\mu\mu f$
DJ_2 to all other electrodes	8	$\mu\mu f$
DJ_3 to all other electrodes	7	$\mu\mu f$
DJ_4 to all other electrodes	8	$\mu\mu f$

Faceplate . . . . Flat Clear Glass
Phosphor (For Curves, see front of this Section). P1
- Fluorescence. .Green
- Phosphorescence . . . . .Green
  - Persistence . . . . Medium

Focusing Method . . . . .Electrostatic
Deflection Method . . . . .Electrostatic
Overall Length. . . . . 9-1/8" ± 1/4"
Greatest Diameter of Bulb . . . . 3" ± 1/16"
Minimum Useful Screen Diameter. . . . . 2-3/4"
Mounting Position . . . . .Any
Weight (Approx.). . . . . 12 oz
Bulb. J-24S1
Base. . . . . .Small-Shell Duodecal 10-Pin (JETEC No.B10-75), or Small-Shell Duodecal 12-Pin (JETEC No.B12-43)
- Basing Designation for BOTTOM VIEW. 12E

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Cathode
Pin 4 - Grid No.3
Pin 5▲- Internal Connection- Do Not Use
Pin 6 - Deflecting Electrode DJ_3
Pin 7 - Deflecting Electrode DJ_4



Pin 8 - Ultor (Grid No.2, Grid No.4, Collector)
Pin 9 - Deflecting Electrode DJ_2
Pin 10 - Deflecting Electrode DJ_1
Pin 11▲- Internal Connection- Do Not Use
Pin 12 - Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

▲ Pins 5 and 11 are omitted from the 10-pin base.

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

3RP1-A

3RP1-A

OSCILLOGRAPH TUBE

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 4. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 1.

The plane through the tube axis and pin 1 may vary from the trace produced by DJ_3 and DJ_4 by 10° (measured about the tube axis).

The angle between DJ_1 - DJ_2 trace and DJ_3 - DJ_4 trace is $90^{\circ} \pm 3^{\circ}$.

Maximum Ratings, *Design-Center Values*:

ULTOR° VOLTAGE	2500 max.	volts
ULTOR INPUT (AVERAGE)	6 max.	watts
GRID-No.3 VOLTAGE	1000 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	200 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_{c_4}) between 500 and 2500 volts*

Grid-No.3 Voltage for Focus	16.5% to 31% of E_{c4}	volts
Maximum Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	−6.75% of E_{c4}	volts
Grid-No.3 Current for Any Operating Condition	-15 to +10	μamp
Deflection Factor:		
DJ_1 & DJ_2	73 to 99	v dc/in./kv of E_{c4}
DJ_3 & DJ_4	52 to 70	v dc/in./kv of E_{c4}
Spot Position	##	

° The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 3RP1-A, the ultor function is performed by grid No.4. Since grid No.4, grid No.2, and collector are connected together within the 3RP1-A, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

* Brilliance and definition decrease with decreasing ultor voltage. A value as low as 500 volts is recommended only for low-velocity deflection and low ambient-light levels.

The center of the undeflected focused spot will fall within a circle having 7.5-mm radius concentric with the center of the tube face.

TUBE DIVISION
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RCA

3RP1-A

OSCILLOGRAPH TUBE

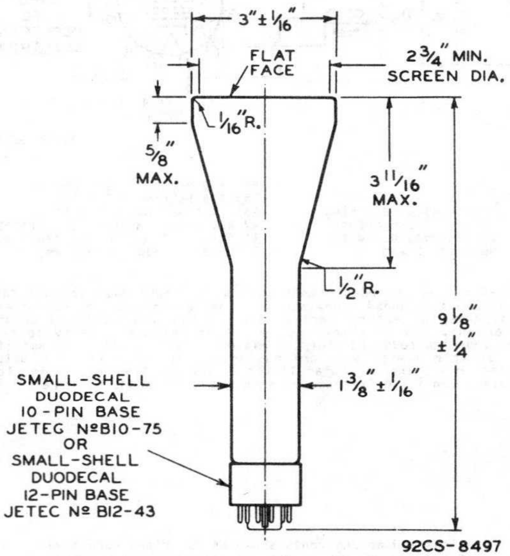
Examples of Use of Design Ranges:

For ultor voltages of	*1000*	*2000*	*volts*
Grid-No.3 Voltage for Focus.	165 to 310	330 to 620	volts
Maximum Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-67.5	-135	volts
Deflection Factors:			
DJ_1 & DJ_2.	73 to 99	146 to 198	volts dc/in.
DJ_3 & DJ_4.	52 to 70	104 to 140	volts dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit■	5 max.	megohms

■ It is recommended that the deflecting-electrode circuit resistances be approximately equal.



CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

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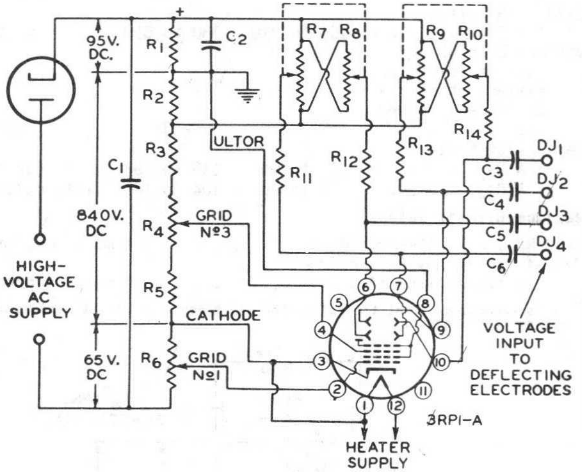
RCA

3RP1-A

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



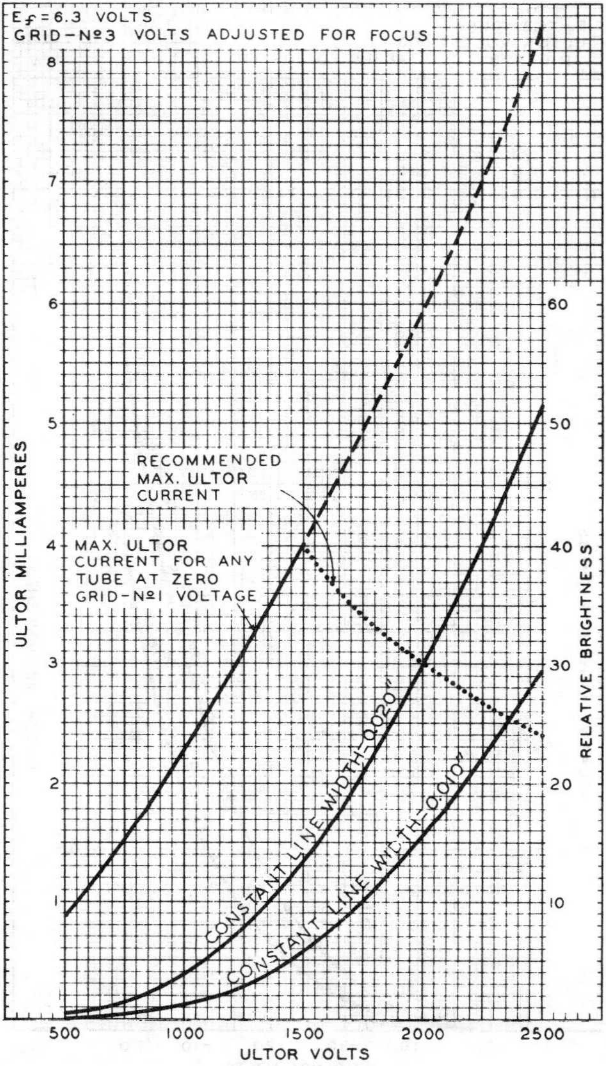
92CS-6777R1

C1: 0.2 μf
C2: 1.0 μf
C3 C4 C5 C6: 0.05-μf Blocking Capacitors*
R1 R2: 2.5 Megohms, 0.5 Watt
R3: 2.5 Megohms, 1 Watt
R4: 1.0-Megohm Potentiometer
R5: 0.5 Megohm, 0.5 Watt
R6: 0.35 Megohm, 0.5 Watt
R7 R8: Dual 5-Megohm Potentiometer
R9 R10: Dual 5-Megohm Potentiometer
R11 R12 R13 R14: 2 Megohms, 0.5 Watt

* When cathode is grounded, capacitors should have high voltage rating; when ultor is grounded, they may have low voltage rating. For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that ultor be returned to a point in the amplifier system which will give the lowest possible potential difference between ultor and the deflecting electrodes.

RCA

3RPI-A
CHARACTERISTICS



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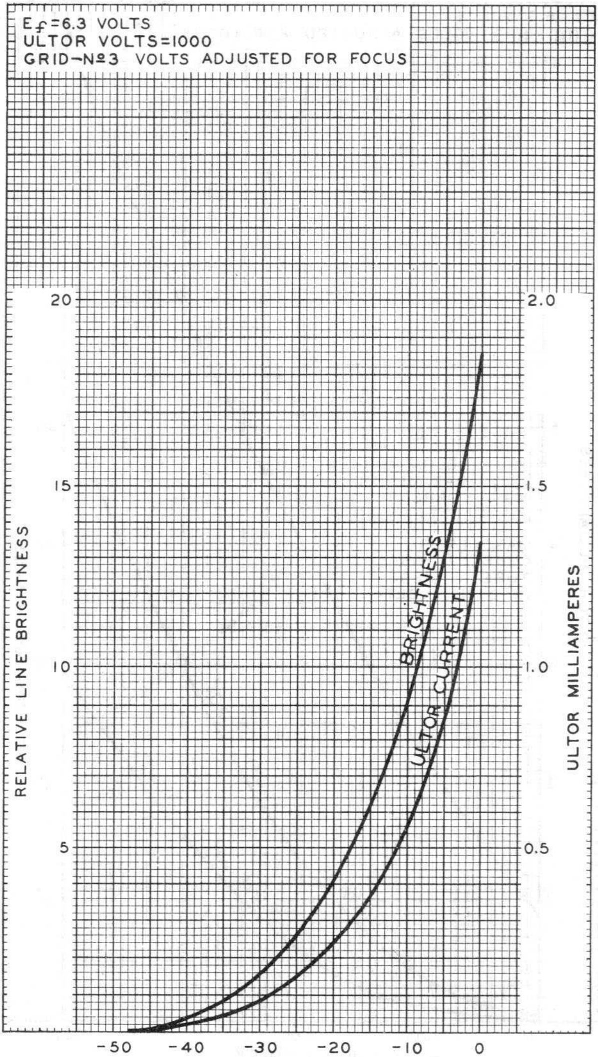
3RP1-A

AVERAGE CHARACTERISTICS



3WP1

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage . . . . 6.3 . . . . ac or dc volts

Current . . . . 0.6 ± 10% . . . . amp

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes . . . 4.6 to 8.7 $\mu\mu f$

Cathode to all other electrodes . . . . 3 to 5.7 $\mu\mu f$

Deflecting electrode DJ_1 to deflecting electrode DJ_2 . . . . . . 1.7 to 3.3 $\mu\mu f$

Deflecting electrode DJ_3 to deflecting electrode DJ_4 . . . . . . 1 to 2 $\mu\mu f$

DJ_1 to all other electrodes . . . . . . 5.5 to 10.5 $\mu\mu f$

DJ_2 to all other electrodes . . . . . . 5.5 to 10.5 $\mu\mu f$

DJ_3 to all other electrodes . . . . . . 3.5 to 6.8 $\mu\mu f$

DJ_4 to all other electrodes . . . . . . 3.5 to 6.8 $\mu\mu f$

Faceplate, Flat . . . . Clear Glass

Phosphor (For Curves, see front of this Section) P1

Fluorescence . . . . Green

Phosphorescence . . . . Green

Persistence . . . . Medium

Focusing Method . . . . Electrostatic

Deflection Method . . . . Electrostatic

Deflecting-electrode arrangement . . . . *See Dimensional Outline*

Overall Length . . . . 11-1/2" ± 1/8"

Greatest Diameter of Bulb . . . . 3" ± 1/16"

Minimum Useful Screen Diameter . . . . 2-3/4"

Minimum Useful Scan (Centered with respect to tube face):

By deflecting electrodes DJ_1 & DJ_2 . . . . 2-1/2"

By deflecting electrodes DJ_3 & DJ_4 . . . . 2-1/4"

Weight (Approx.) . . . . 1 lb

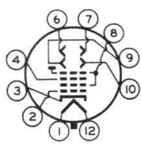
Mounting Position . . . . Any

Bulb J24R

Base . . . . . . Small-Shell Duodecal 10-Pin (JETEC No.B10-75), or Small-Shell Duodecal 12-Pin (JETEC No.B12-43)

Basing Designation for BOTTOM VIEW 12T

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Cathode
Pin 4 – Grid No.3
Pin 6 – Deflecting Electrode DJ_1
Pin 7 – Deflecting Electrode DJ_2



Pin 8 – Ultor (Grid No.2, Grid No.4, Collector)
Pin 9 – Deflecting Electrode DJ_4
Pin 10 – Deflecting Electrode DJ_3
Pin 12 – Heater

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3WP1

RCA

3WP1

OSCILLOGRAPH TUBE

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE.	2500 max.	volts
ULTOR INPUT (AVERAGE).	6 max.	watts
GRID-No.3 VOLTAGE.	1000 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value.	200 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	0 max.	volts
PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_{c4}) between recommended minimum and 2500 volts*

Grid-No.3 Voltage for Focus.	16.5% to 31% of E_{c4}	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-3% to -5% of E_{c4}	volts
Grid-No.3 Current for Any Operating Condition. . . .	-15 to +10	μa
Deflection Factors:		
DJ_1 & DJ_2.	41.5 to 50.5	v dc/in./kv of E_{c4}
DJ_3 & DJ_4.	28.5 to 35	v dc/in./kv of E_{c4}
Spot Position.	##	

Examples of Use of Design Ranges:

For ultor voltage of	*1000*	*1500*	*2000*	*volts*
Grid-No.3 Voltage for Focus.	165 to 310	247 to 465	330 to 620	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot .	-30 to -50	-45 to -75	-60 to -100	volts
Deflection Factors:				
DJ_1 & DJ_2. . .	41.5 to 50.5	62.3 to 75.8	83 to 101	v dc/in.
DJ_3 & DJ_4. . .	28.5 to 35	42.8 to 52.5	57 to 70	v dc/in.

* Brilliance and definition decrease with decreasing ultor voltage. Recommended minimum for the 3WP1 in general service is 1000 volts but a value as low as 500 volts may be used under conditions of low-velocity deflection and low ambient-light levels.

##: See next page.

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3WPI

OSCILLOGRAPH TUBE

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit■	5 max.	megohms

SPECIAL PERFORMANCE DATA

For ultor voltage of 1500 volts

Line Width▲.	0.026 max.	inch
Peak Grid-No.1 Drive from Spot Cutoff▲.	50 max.	volts
Raster Shape	§	
Deflection Factor Uniformity	●	

With grid-No.1 voltage adjusted to give a spot that is just visible, and the tube shielded from all extraneous fields, the center of the undeflected focused spot will fall within a circle of 3/16-inch radius concentric with the center of the tube face.

■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

▲ Under the following conditions: heater voltage of 6.3 volts, brightness of 7 foot-lamberts measured on a 2" x 2", 49-line raster with high-frequency scanning applied to deflecting electrodes DJ_1 and DJ_2. For *line-width measurement*, the high-frequency scanning is adjusted to give a raster width of 6.9 cm with the grid-No.3 voltage adjusted to give sharpest focus at center of tube face. Raster height is contracted until the individual scanning lines are just barely distinguishable. *Line width* is expressed as the quotient of the contracted raster height measured at the center line of the tube face divided by the number of scanning lines (49).

§ Under the following conditions: heater voltage of 6.3 volts, grid-No.3 voltage adjusted for focus, and grid-No.1 voltage adjusted to give visible raster. With 49-line raster centered with respect to the tube face and size adjusted to give mean dimensions of 1.875" in 1DJ2 direction and 1.688" in 3DJ4 direction, all points on the raster will lie within the area between the two rectangles also centered with respect to the tube face; the one, 1.920" in 1DJ2 direction by 1.730" in 3DJ4 direction; the other, 1.830" in 1DJ2 direction and 1.646" in 3DJ4 direction.

● The deflection factor for either DJ_1 and DJ_2 electrodes or DJ_3 and DJ_4 electrodes for a deflection of less than 75 per cent of the respective useful scan will not differ from the deflection factor for the corresponding deflecting electrodes at 25 per cent of the useful scan by more than 2 per cent.

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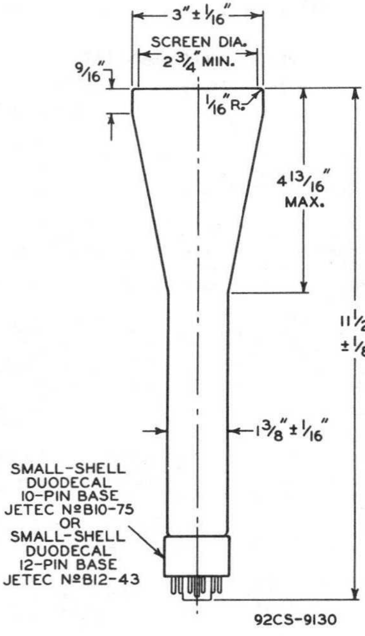
3WP1

OSCILLOGRAPH TUBE



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

THE PLANE THROUGH THE TUBE AXIS AND PIN 3 MAY VARY FROM THE TRACE PRODUCED BY DJ_1 AND DJ_2 BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ANGLE BETWEEN DJ_1 − DJ_2 TRACE AND DJ_3 − DJ_4 TRACE IS 90° ± 1°.

DJ_1 AND DJ_2 ARE NEARER THE SCREEN: DJ_3 AND DJ_4 ARE NEARER THE BASE. WITH DJ_1 POSITIVE WITH RESPECT TO DJ_2, THE SPOT WILL BE DEFLECTED TOWARD PIN 3: LIKEWISE, WITH DJ_3 POSITIVE WITH RESPECT TO DJ_4, THE SPOT WILL BE DEFLECTED TOWARD PIN 12.

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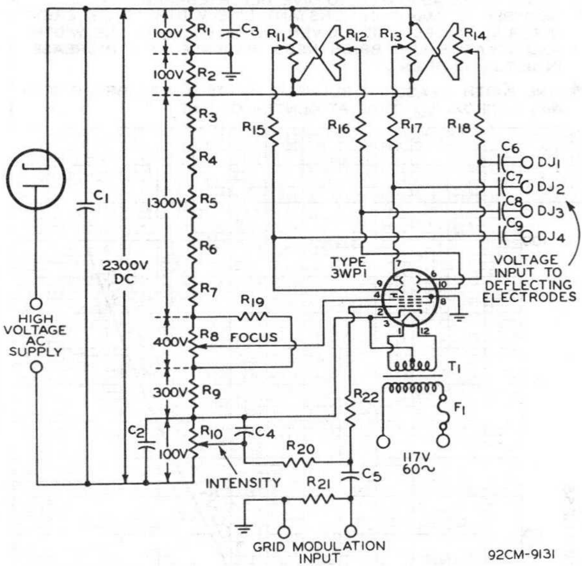
OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



C1: 0.5 μf, 3000 volts
C2: 8 μf, 250 volts
C3: 1 μf, 200 volts
C4: 1 μf, 200 volts
C5: 0.05 μf, 3000 volts
C6 C7 C8 C9: 0.05 μf, 600 volts
R1 R2: 510000 ohms, 1/2 watt
R3 R4 R5 R6: 270000 ohms, 1/2 watt
R7: 220000 ohms, 1/2 watt
R8: 500000-ohm potentiometer, 1/2 watt
R9: 300000 ohms, 1/2 watt
R10: 100000-ohm potentiometer, 1/2 watt
R11 R12: Dual 1-megohm potentiometer, 1/2 watt
R13 R14: Dual 1-megohm potentiometer, 1/2 watt
R15 R16 R17 R18: 1.5 megohms, 1/2 watt
R19: 2 megohms, 1 watt
R20: 510000 ohms, 1/2 watt
R21: 5 megohms, 1/2 watt
R22: 5100 ohms, 1/2 watt
T1: Transformer, with 6.3-volt/1-ampere secondary, insulated for at least 3000 volts, such as Thordarson T26F65.
F1: 1-ampere fuse

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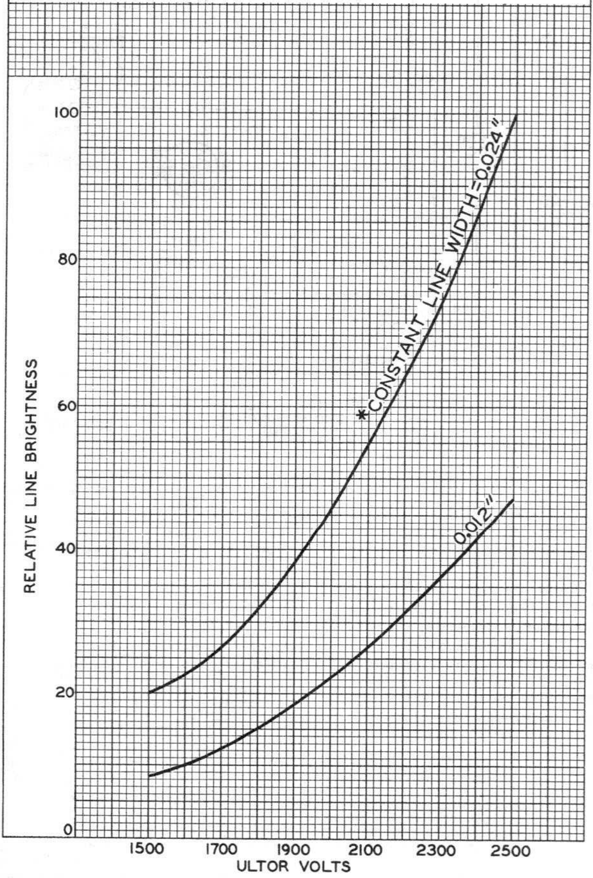
3WP1

AVERAGE CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-No.3 VOLTS ADJUSTED FOR FOCUS.
GRID-No.1 VOLTS ADJUSTED TO GIVE ULTOR-CURRENT VALUE REQUIRED TO MAINTAIN CONSTANT LINE WIDTH AT DIFFERENT ULTOR VOLTAGES. FOR A GIVEN ULTOR VOLTAGE, LINE WIDTH AND RELATIVE LINE BRIGHTNESS INCREASE WITH INCREASE IN ULTOR CURRENT.

* LINE WIDTH MEASURED BETWEEN POINTS WHERE BRIGHTNESS WAS APPROX. 1/2 THAT AT CENTER OF LINE.



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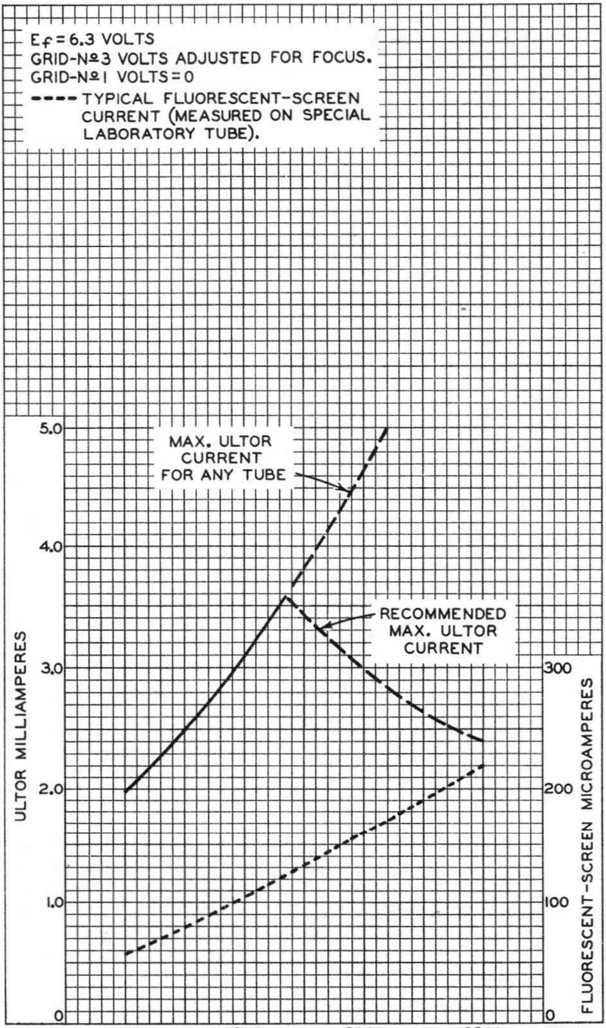
3WP1

CHARACTERISTICS



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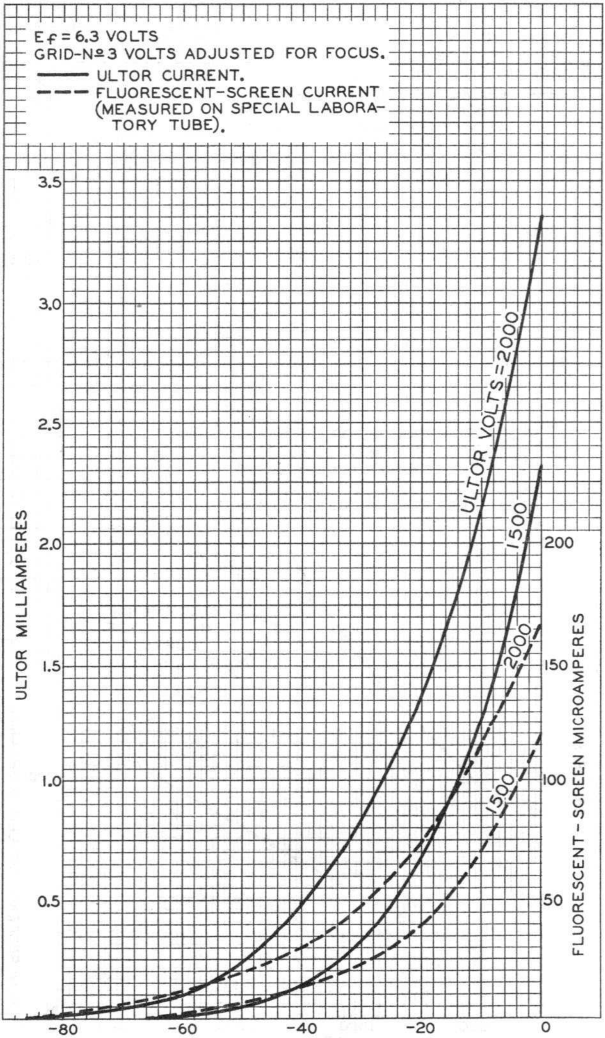
3WP1

AVERAGE CHARACTERISTICS



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3WP2

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 3WP2 is the same as the 3WP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section). P2
Fluorescence. . . . . Greenish-Yellow
Phosphorescence . . . . Greenish-Yellow
Persistence . . . . .Long

Line width and drive values for the 3WP2 are the same as those shown for type 3WP1 under the heading SPECIAL PERFORMANCE DATA and are based upon operation at brightness values calculated from 3WP1 performance.

3WP11

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 3WP11 is the same as the 3WP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section). P11
Fluorescence. . . . . .Blue
Phosphorescence . . . . .Blue
Persistence . . . . Short

Line width and drive values for the 3WP11 are the same as those shown for type 3WP1 under the heading SPECIAL PERFORMANCE DATA and are based upon operation at brightness values calculated from 3WP1 performance.

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OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS   ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

Voltage	6.3	ac or dc volts
Current	0.6	amp

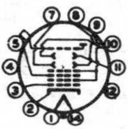
Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	8	$\mu\mu$f
Cathode to All Other Electrodes	5	$\mu\mu$f
DJ_1 to DJ_2	2.5	$\mu\mu$f
DJ_3 to DJ_4	1.3	$\mu\mu$f
DJ_1 to All Other Electrodes	9	$\mu\mu$f
DJ_2 to All Other Electrodes	9	$\mu\mu$f
DJ_3 to All Other Electrodes	5	$\mu\mu$f
DJ_4 to All Other Electrodes	6	$\mu\mu$f

Faceplate, Flat	Clear Glass
Phosphor (For Curves, see front of this Section)	P1
Fluorescence and Phosphorescence	Green
Persistence of Phosphorescence	Medium
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Overall Length	16-3/4" ± 3/8"
Greatest Diameter of Bulb	5-1/4" ± 3/32"
Minimum Useful Screen Diameter	4-9/16"
Bulb	J42
Weight (Approx.)	2-1/2 lbs
Mounting Position	Any
Cap	Recessed Small Ball (JETEC No.J1-22)
Base	Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - No Connection— Do Not Use
Pin 5 - Grid No.3
Pin 7 - Deflecting Electrode DJ_3
Pin 8 - Deflecting Electrode DJ_4



Pin 9 - Ultor (Grid No.2, Grid No.4)
Pin 10 - Deflecting Electrode DJ_2
Pin 11 - Deflecting Electrode DJ_1
Pin 12 - No. Conn.
Pin 14 - Heater
Cap - Post-Ultor (Grid No.5, Collector)

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 5. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 2.

The plane through the tube axis and each of the following items may vary from the trace produced by DJ_1 and DJ_2 by

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OSCILLOGRAPH TUBE

the following angular tolerances (measured about the tube axis): Pin 5, 10°; side terminal (on same side of tube as pin 5), 10°. Angle between $DJ_1 - DJ_2$ trace and $DJ_3 - DJ_4$ trace is $90^{\circ} \pm 1.5^{\circ}$.

Maximum Ratings, *Design-Center Values:*

POST-ULTOR● VOLTAGE	6000 max.	volts
ULTOR▲ VOLTAGE	2600 max.	volts
RATIO OF POST-ULTOR VOLTAGE TO ULTOR VOLTAGE	2.3:1 max.	
GRID-No.3 VOLTAGE	1000 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	200 max.	volts
Positive bias value○.	0 max.	volts
Positive peak value	2 max.	volts
PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	125 max.	volts

Equipment Design Ranges:

For any post-ultor voltage (E_{c_5}) between 2000 and 6000 volts and any ultor voltage (E_{c_4}) between 1500** and 2600 volts*

Grid-No.3 Voltage for Focus . .	20% to 34.5% of E_{c_4}	. . .	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	2.6% to 4.3% of E_{c_4}	. . .	volts
Grid-No.3 Current for Any Operating Condition	−15 to +10	. . .	μamp
Deflection Factors:#			
When E_{c_5} = 2 x E_{c_4}			
DJ_1 & DJ_2	26.5 to 36		v dc/in./kv of E_{c_4}
DJ_3 & DJ_4	18 to 24		v dc/in./kv of E_{c_4}
When E_{c_5} = E_{c_4}			
DJ_1 & DJ_2	21.5 to 29		v dc/in./kv of E_{c_4}
DJ_3 & DJ_4	14.5 to 19.5		v dc/in./kv of E_{c_4}
Spot Position	##		

Examples of Use of Design Ranges:

For post-ultor voltage of	*2000*	*3000*	*4000*	*volts*
and ultor voltage of	*2000*	*1500*	*2000*	*volts*
Grid-No.3 Volt. for Focus	400 to 690	300 to 515	400 to 690	volts
Grid-No.1 Volt.□	−52 to −87	−39 to −65	−52 to −87	volts

●,▲,○,*,**,#,##,□: See next page.

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Deflection Factors:#

DJ_1 & DJ_2	43 to 58	40 to 54	53 to 72	v dc/in.
DJ_3 & DJ_4	29 to 39	27 to 36	36 to 48	v dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance . . . . 1.5 max. megohms

Resistance in Any Deflecting-Electrode Circuit■ . . . . 5.0 max. megohms

● The "post-ultor" in a cathode-ray tube is the electrode to which is applied a dc voltage higher than the ultor voltage for accelerating the electrons in the beam after its deflection. In the 5AB-types, the post-deflection acceleration function and the collector function are both performed by grid No.5 which is conveniently referred to as "post-ultor".

▲ The "ultor" in a cathode-ray tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 5AB-types, the ultor function is performed by grid No.4. Since grid No.4 and grid No.2 are connected together within the 5AB-types, they are collectively referred to simply as "ultor" for convenience in presenting data and curves.

○ At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.

* It is recommended that the post-ultor voltage be not less than 3000 volts for high-speed scanning.

** Recommended minimum value of ultor voltage.

The deflecting electrodes DJ_3 and DJ_4 are designed to have extra-high deflection sensitivity and consequently produce less than full-screen deflection. With post-deflection acceleration, the length of deflection may be limited to 4 inches; without post-deflection acceleration, deflection to full screen diameter will ordinarily be obtained. These electrodes are, therefore, more suitable for the signal voltage than for the time-base voltage.

With heater voltage of 6.3 volts, post-ultor voltage of 4000 volts, ultor voltage of 2000 volts, grid-No.3 voltage adjusted to give focus, grid-No.1 voltage adjusted to give spot that is just visible, each deflecting electrode connected through a 1-megohm resistor to ultor, and tube shielded from all extraneous fields, the center of the undeflected, focused spot will fall within a circle having a 12.5-mm radius concentric with the center of the tube face.

□ For visual cutoff of undeflected focused spot.

■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

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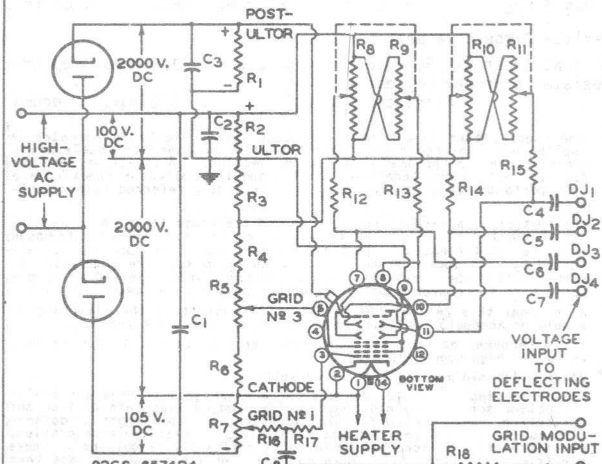
OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



92CS-6574R4

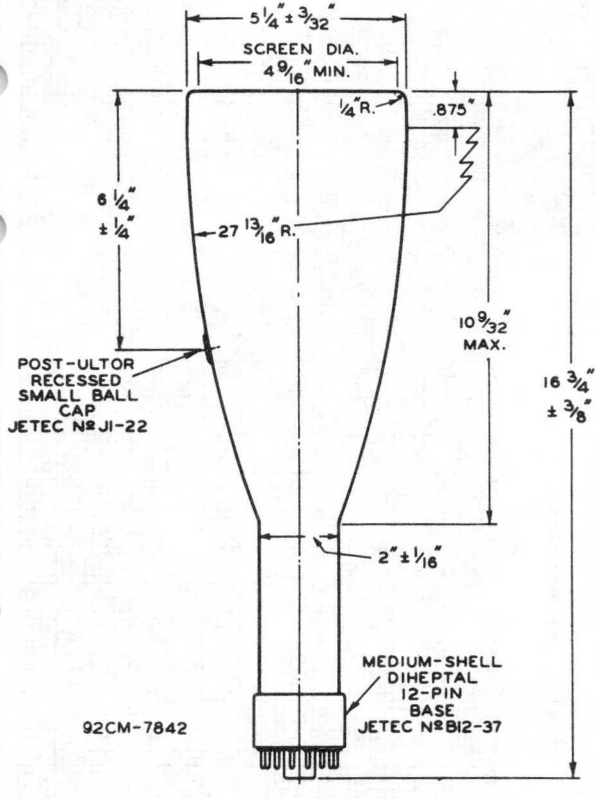
C1: 0.1 μf, 2500 Volts
C2: 1.0 μf, 200 Volts
C3: 0.1 μf, 2500 Volts
C4 C5 C6 C7: 0.05-μf, Blocking Capacitors*
C8: 0.0001 μf, 2500 Volts
R1: 50 Megohms (Five 10-Meg-ohm, 1-Watt Resistors in Series)
R2 R3: 2 Megohms, 0.5 Watt
R4: 5.5 Megohms, 2 Watts
R5: 2-Megohm Potentiometer
R6: 1.5 Megohms, 0.5 Watt
R7: 0.5-Megohm Potentiometer
R8 R9: 5-Megohm Potentiometer
R10 R11: Dual 5-Megohm Potentiometer
R12 R13 R14 R15: 2 Megohms, 0.5 Watt
R16: 0.5 Megohm, 0.5 Watt
R17: Not less than 2000 ohms per 1 volt of positive signal
R18: 5 Megohms, 0.5 Watt

* When cathode is grounded, capacitors should have high voltage rating (2500 volts); when ultor is grounded, they may have low voltage rating (200 volts). For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that ultor be returned to a point in the amplifier system which will give the lowest possible potential difference between ultor and the deflecting electrodes.

5ABP1

5ABP1

OSCILLOGRAPH TUBE



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE

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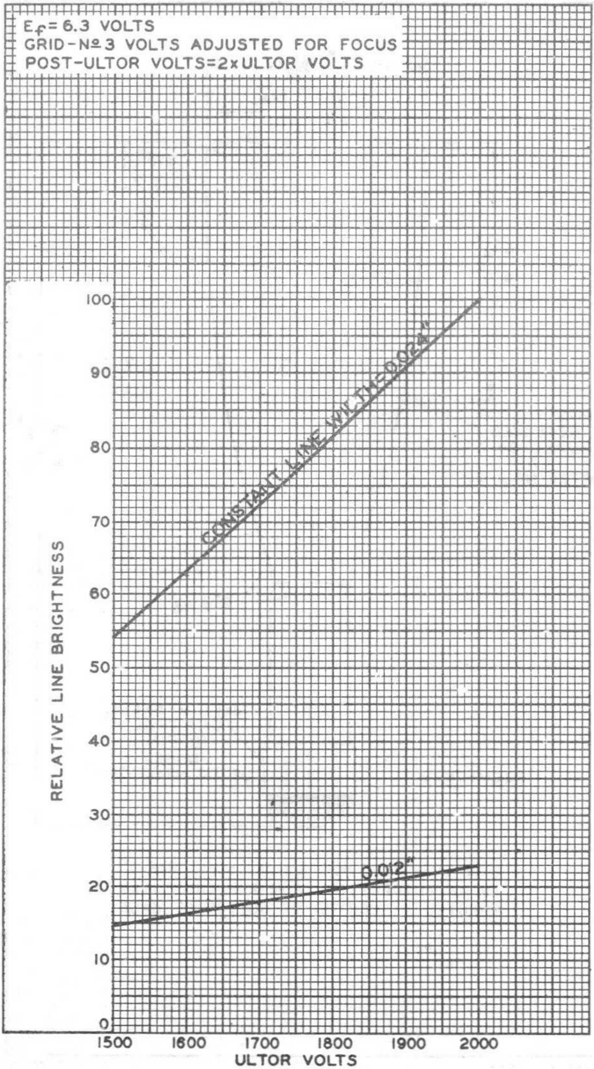
5ABP1

TYPICAL CHARACTERISTICS



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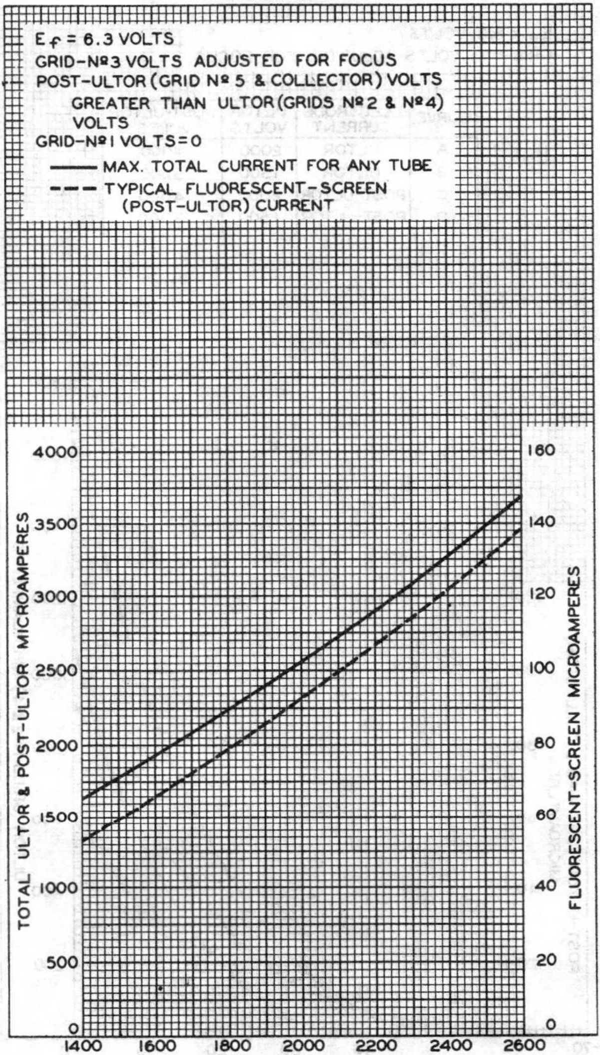
5ABP1

CHARACTERISTICS



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5ABP1

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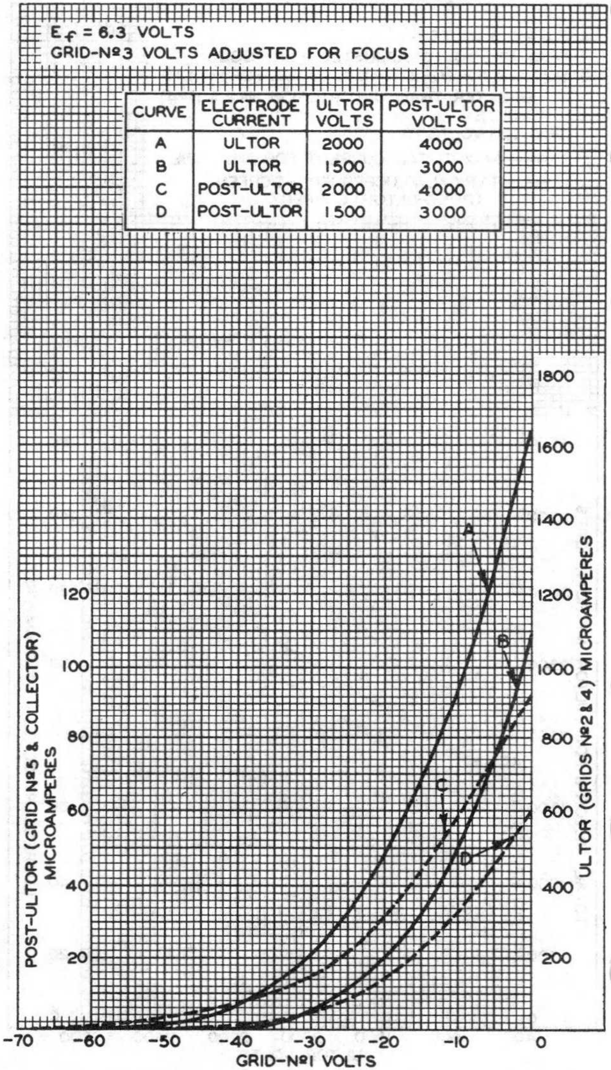
AVERAGE CHARACTERISTICS



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5ABP4
OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 5ABP4 is the same as the 5ABP1 except for the following items:

General:

Phosphor (For curves, see front of this section). . P4—Sulfide Type
Fluorescence. . . . . White
Phosphorescence . . . . White
Persistence . . . . Short

THE PERSISTENCE CHARACTERISTICS

of the P4-sulfide phosphor are the same as those shown for the P11 phosphor at the front of this Section

5ABP7
OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 5ABP7 is the same as the 5ABP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section). P7
Fluorescence. . . . . .Blue
Persistence . . . . Short
Phosphorescence . . . . Greenish-Yellow
Persistence . . . . .Long

5ABP11
OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR
ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 5ABP11 is the same as the 5ABP1 except for the following items:

General:

Phosphor (For Curves, see front of this Section). P11
Fluorescence. . . . . .Blue
Phosphorescence . . . . .Blue
Persistence . . . . Short

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5ADPI
OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . 6.3 . . . . ac or dc volts
- Current . . . . 0.6 ± 10% . . . . amp

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes	4.2 to 7.9	$\mu\mu$f
Cathode to all other electrodes	3.1 to 5.8	$\mu\mu$f
Deflecting electrode DJ_1 to deflecting electrode DJ_2	1.7 to 3.1	$\mu\mu$f
Deflecting electrode DJ_3 to deflecting electrode DJ_4	0.7 to 1.3	$\mu\mu$f
DJ_1 to all other electrodes	4.4 to 9.2	$\mu\mu$f
DJ_2 to all other electrodes	4.4 to 9.2	$\mu\mu$f
DJ_3 to all other electrodes	2.8 to 5.3	$\mu\mu$f
DJ_4 to all other electrodes	2.8 to 6.3	$\mu\mu$f

Faceplate, Flat . . . . Clear Glass

Phosphor (For Curves, see front of this Section) P1
- Fluorescence . . . . Green
- Phosphorescence . . . . Green
  - Persistence . . . . Medium

Focusing Method . . . . Electrostatic

Deflection Method . . . . Electrostatic
- Deflecting-electrode arrangement . . . . *See Dimensional Outline*

Overall Length . . . . 16-3/4" ± 3/16"

Greatest Diameter of Bulb . . . . 5-1/4" ± 3/32"

Minimum Useful Screen Diameter . . . . 4-1/2"

Weight (Approx.) . . . . 2-1/2 lbs

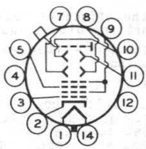
Mounting Position . . . . Any

Cap . . . . Recessed Small Ball (JETEC No.J1-22)

Bulb J42

Base . . . . . Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)
- Basing Designation for BOTTOM VIEW 14J

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - No Connection-Do Not Use
Pin 5 - Grid No.3
Pin 7 - Deflecting Electrode DJ_3
Pin 8 - Deflecting Electrode DJ_4



Pin 9 - Ultor (Grid No.2, Grid No.4)
Pin 10 - Deflecting Electrode DJ_2
Pin 11 - Deflecting Electrode DJ_1
Pin 12 - No Connection
Pin 14 - Heater
Cap - Post-Ultor (Grid No.5, Collector)

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

5ADP1

OSCILLOGRAPH TUBE

Maximum Ratings, *Design-Center Values:*

POST-ULTOR VOLTAGE	6000 max.	volts
ULTOR VOLTAGE.	2600 max.	volts
RATIO OF POST-ULTOR VOLTAGE TO ULTOR VOLTAGE.	2.3:1 max.	
GRID-No.3 VOLTAGE.	1000 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value.	200 max.	volts
Positive bias value●	0 max.	volts
Positive peak value.	2 max.	volts
PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	180 max.	volts
Heater positive with respect to cathode	180 max.	volts

Equipment Design Ranges:

With any post-ultor voltage (E_{c_5}) between 2000 and 6000 volts and any ultor voltage (E_{c_4}) between 1500** and 2600 volts*

Grid-No.3 Voltage for Focus.	20% to 34.5% of E_{c_4}	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-2.25% to -3.75% of E_{c_4}	volts
Grid-No.3 Current for Any Operating Condition.	-15 to +10	μamp
Deflection Factors:#		
When $E_{c_5} = 2 \times E_{c_4}$:		
DJ_1 & DJ_2. . . .	26.7 to 33.3	v dc/in./kv of E_{c_4}
DJ_3 & DJ_4. . . .	20.3 to 25	v dc/in./kv of E_{c_4}
When $E_{c_5} = E_{c_4}$:		
DJ_1 & DJ_2. . . .	21.5 to 26.5	v dc/in./kv of E_{c_4}
DJ_3 & DJ_4. . . .	16 to 20	v dc/in./kv of E_{c_4}
Spot Position. . . .	##	

● At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.

* It is recommended that the post-ultor voltage be not lessthan 3000 volts for high-speed scanning.

** Recommended minimum value of ultor voltage.

With heater voltage of 6.3 volts, post-ultor voltage of 4000 volts, ultor voltage of 2000 volts, grid-No.3 voltage adjusted to give focus, grid-No.1 voltage adjusted to give spot that is just visible, each deflecting electrode connected through a 1-megohm resistor to ultor, and the tube shielded from all extraneous fields, the center of the undeflected, focused spot will fall within a circle having an 8-mm radius concentric with the center of the tube face.

#: See next page.

TUBE DIVISION
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5ADPI

OSCILLOGRAPH TUBE

Examples of Use of Design Ranges:

With post-ultor voltage of	*2000*	*3000*	*4000*	*volts*
and ultor voltage of	*2000*	*1500*	*2000*	*volts*
Grid-No.3 Voltage for Focus	400 to 690	300 to 515	400 to 690	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot. .	-45 to -75	-34 to -56	-45 to -75	volts
Deflection Factors:#				
DJ_1 & DJ_2 . . .	43 to 53	40 to 50	53.4 to 66.6	v dc/in.
DJ_3 & DJ_4 . . .	32 to 40	30.5 to 37.5	40.6 to 50	v dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit■.	5.0 max.	megohms

SPECIAL PERFORMANCE DATA

With post-ultor voltage of	*3000*	*volts*
and ultor voltage of	*1500*	*volts*
Line Width♦	0.030 max.	inch
Peak Grid-No.1 Drive from Spot Cutoff♦.	45 max.	volts
Raster Shape.	§	

The deflecting electrodes in the 5ADP1 are designed to have extra-high deflection sensitivity and consequently produce less than full-screen deflection. With post-deflection acceleration, the length of deflection in either horizontal or vertical direction may be limited to 4-1/4 inches; without post-deflection acceleration, deflection to full screen diameter will ordinarily be obtained.

■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

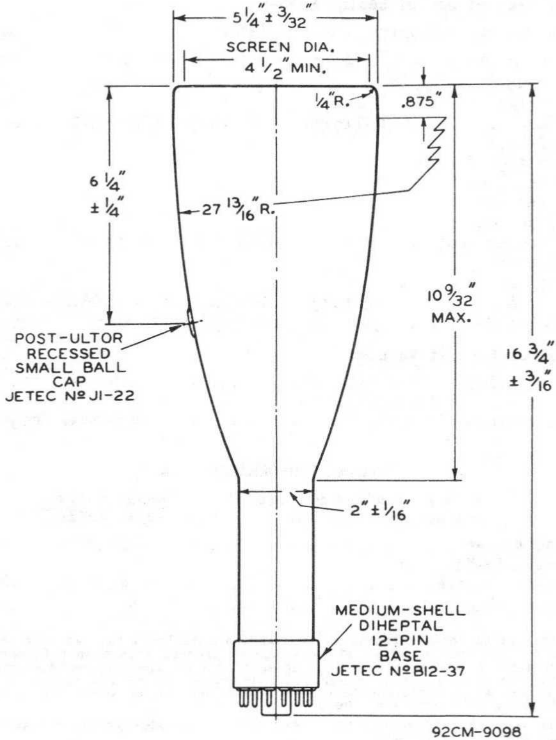
♦ Under the following conditions: heater voltage of 6.3 volts, brightness of 15 foot-lamberts measured on a 2" x 2", 49-line raster with high-frequency scanning applied to deflecting electrodes DJ_1 and DJ_2. For *line-width* measurement, the high-frequency scanning is adjusted to give a raster width of 12 cm with the grid-No.3 voltage adjusted to give sharpest focus at center of tube face. Raster height is contracted until individual scanning lines are just barely distinguishable. *Line width* is expressed as the quotient of the contracted raster height measured at the center line of the tube face divided by the number of scanning lines (49).

§ Under the following conditions: heater voltage of 6.3 volts, grid-No.3 voltage adjusted for focus, and grid-No.1 voltage adjusted to give visible raster. With 49-line raster, the size of which is adjusted so that the widest points on the raster just touch the sides of a square 3.075" on a side, no point on the raster sides will lie within an inscribed square 2.925" on a side having its sides parallel to the sides of the 3.075" square and its center at the center of the 3.075" square.

RCA

5ADP1

OSCILLOGRAPH TUBE



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

THE PLANE THROUGH TUBE AXIS AND EACH OF THE FOLLOWING ITEMS MAY VARY FROM THE TRACE PRODUCED BY DJ_1 AND DJ_2 BY THE FOLLOWING ANGULAR TOLERANCES (MEASURED ABOUT THE TUBE AXIS): PIN 5, ±10°; SIDE TERMINAL (ON SAME SIDE OF TUBE AS PIN 5), ±10°. ANGLE BETWEEN DJ_1 – DJ_2 TRACE AND DJ_3—DJ_4 TRACE IS 90° ±1°.

DJ_1 AND DJ_2 ARE NEARER THE SCREEN. DJ_3 AND DJ_4 ARE NEARER THE BASE. WITH DJ_1 POSITIVE WITH RESPECT TO DJ_2, THE SPOT WILL BE DEFLECTED TOWARD PIN 5; LIKEWISE, WITH DJ_3 POSITIVE WITH RESPECT TO DJ_4, THE SPOT WILL BE DEFLECTED TOWARD PIN 2.

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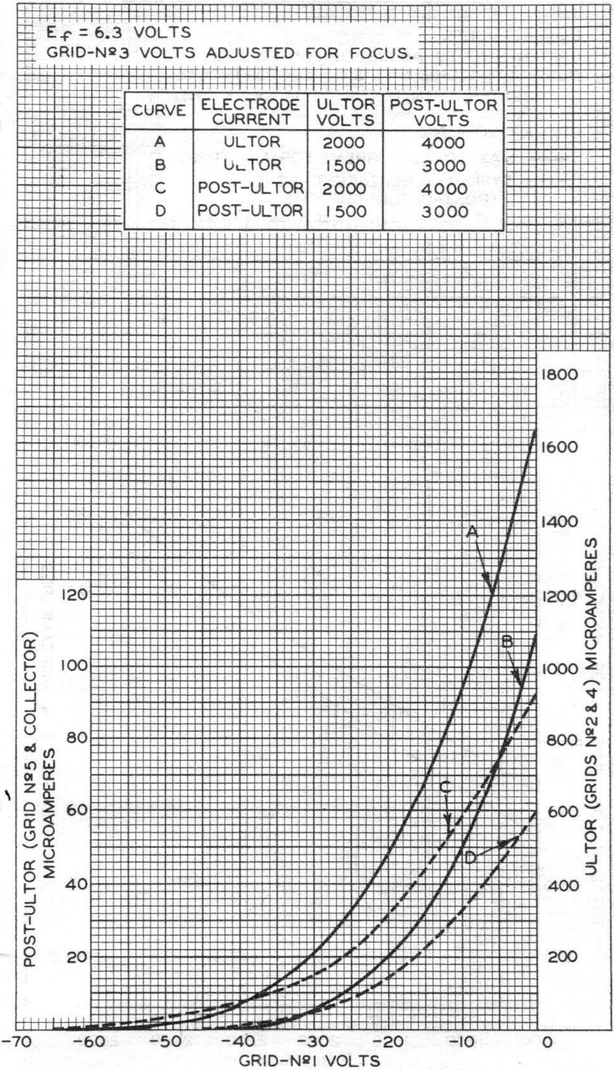
5ADP1

AVERAGE CHARACTERISTICS



CURVE	ELECTRODE CURRENT	ULTOR VOLTS	POST-ULTOR VOLTS
A	ULTOR	2000	4000
B	ULTOR	1500	3000
C	POST-ULTOR	2000	4000
D	POST-ULTOR	1500	3000

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5ADP1

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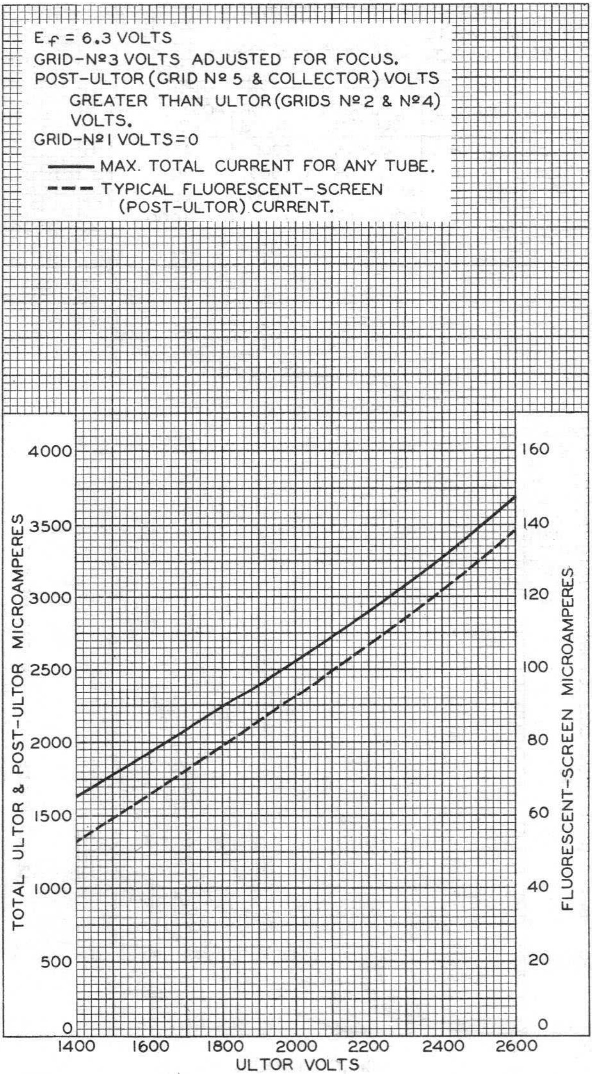
5ADP1

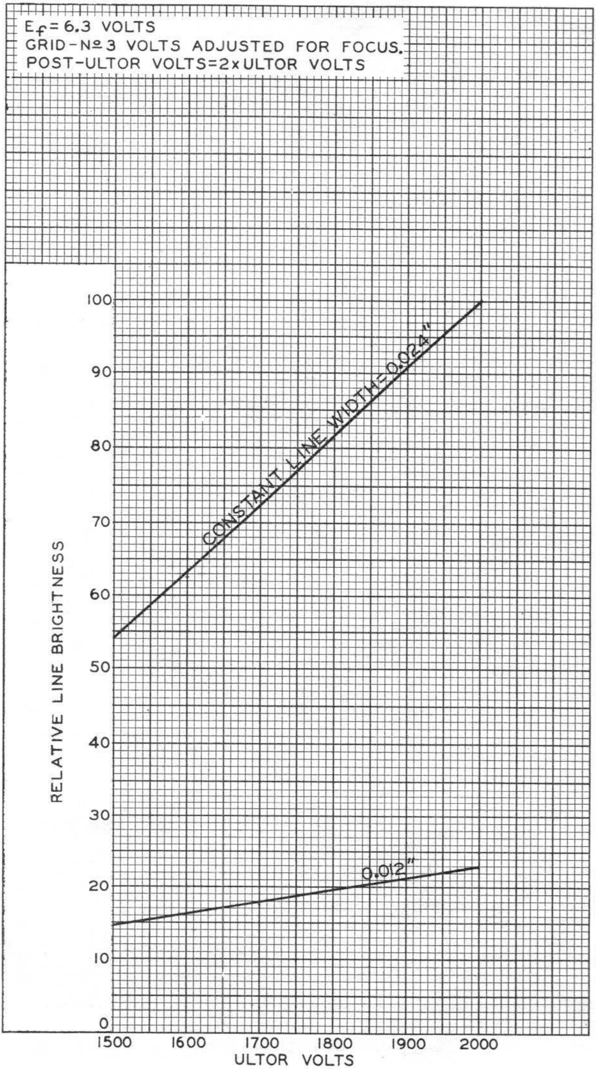
CHARACTERISTICS



5ADPI

5ADPI

TYPICAL CHARACTERISTICS



TUBE DIVISION

92CM-6820R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

5AUP24

COLOR FLYING-SPOT CATHODE-RAY TUBE

HIGH-RESOLUTION CAPABILITY — ALUMINIZED SCREEN
ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

For use as flying-spot scanner in color video-signal generators

DATA

General:

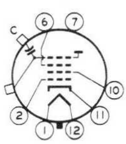
Heater, for Unipotential Cathode:
- Voltage . . . 6.3 . . . ac or dc volts
- Current . . . 0.6 ± 10% . . . amp

Direct Interelectrode Capacitances:
- Grid No.1 to all other electrodes . . . 8 μμf
- Cathode to all other electrodes . . . 5 μμf
- External conductive neck coating to ultor . . . {500 max. μμf; 100 min. μμf}

Faceplate, Flat . . . Clear Glass
Phosphor . . . P24, Aluminized
- Fluorescence . . . Green
- Phosphorescence . . . Green
  - Persistence . . . Short

Focusing Method . . . Electrostatic
Deflection Method . . . Magnetic
Deflection Angle (Approx.) . . . 40°
Overall Length . . . 12-1/2" ± 3/8"
Greatest Diameter . . . 5" ± 1/8"
Minimum Useful Screen Diameter . . . 4-1/4"
Operating Position . . . Any
Weight (Approx.) . . . 1.4 lbs
Cap . . . Recessed Small Cavity (JETEC No.J1-21)
Socket . . . *See Operating Considerations*
Base . . Small-Shell Duodecal 7-Pin (JETEC Group 4, No.B7-51)
- Basing Designation for BOTTOM VIEW . . . 12C

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.3
Pin 7 - Internal Connection—Do Not Use
Pin 10 - Grid No.2



Pin 11 - Cathode
Pin 12 - Heater
Cap - Ultor (Grid No.4, Collector)
C - External Conductive Neck Coating

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	27000 max.	volts
GRID-No.3 VOLTAGE	6000 max.	volts
GRID-No.2 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value	150 max.	volts
Positive-bias value	0 max.	volts
Positive-peak value	2 max.	volts

← Indicates a change.

5AUP24

5AUP24

COLOR FLYING-SPOT CATHODE-RAY TUBE

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
→ After equipment warm-up period	150 max.	volts
→ Heater positive with respect to cathode.	150 max.	volts

Characteristics Range Values for Equipment Design:

For any ultor voltage (E_{c_4}) between 20000• and 27000 volts

Grid-No.3 Voltage for focus with ultor current of 200 μa	17% to 21.5% of E_{c_4}	volts
Grid-No.2 Voltage when circuit design utilizes fixed grid-No.1 voltage (E_{c_1}) for visual extinction of undeflected focused spot	2 to 5 times E_{c_1}	volts
Grid-No.1 Voltage for visual extinction of undeflected focused spot when circuit design utilizes grid-No.2 voltage (E_{c_2}) at fixed value	20% to 50% of E_{c_2}	volts
Maximum Grid-No.3 Current for ultor current of 200 μa	170	μa
Grid-No.2 Current	-15 to +15	μa

Examples of Use of Design Ranges:

For ultor voltage of	*27000*	*volts*
Grid-No.3 Voltage for focus with ultor current of 200 μa	4600 to 5800	volts
Grid-No.2 Voltage when circuit design utilizes fixed grid-No.1 voltage of -70 volts for visual extinction of undeflected focused spot	140 to 350	volts
Grid-No.1 Voltage for visual extinction of undeflected focused spot when circuit design utilizes grid-No.2 voltage of 200 volts	-40 to -100	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

• Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20,000 volts.

→

OPERATING CONSIDERATIONS

X-Ray Warning. X-ray radiation is produced at the face of the 5AUP24 when it is operated at its normal ultor voltage. These rays can constitute a health hazard unless the tube is

→ Indicates a change.

5AUP24

COLOR FLYING-SPOT CATHODE-RAY TUBE

adequately shielded for X-ray radiation. Although relatively simple shielding should prove adequate, make sure that it provides the required protection against personal injury.

The *base pins* of the 5AUP24 fit the Duodecal 12-contact socket. The socket contacts corresponding to the vacant pin positions should be omitted in order to provide the maximum insulation for the high-voltage pins 6 and 7. The socket should be made of high-grade, arc-resistant, insulating material and should preferably be designed with baffles.

Heater Protection. Although maximum values of peak heater-cathode voltage are specified in the tabulated data, it is recommended that the mid-tap or one side of the heater transformer winding be connected directly to the cathode to minimize the possibility of heater burnout. This connection will also minimize the possibility of damage due to heater-cathode shorts produced by arcing between heater and cathode when a possible momentary arc causes the voltage between heater and cathode to exceed the maximum heater-cathode ratings.

When in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum values shown in the tabulated data. It is also recommended that a series limiting resistance of 50,000 ohms be placed in both the ultor and grid-No.3 leads between the tube and any filter capacitors.

Resolution of better than 800 lines at the center of the reproduced picture can be produced by the 5AUP24 when it is operated with 27,000 volts on the ultor. At lower ultor voltages, the resolution capability decreases. To obtain high resolution in the horizontal direction, it is necessary to use a video amplifier having a bandwidth of about 20 megacycles.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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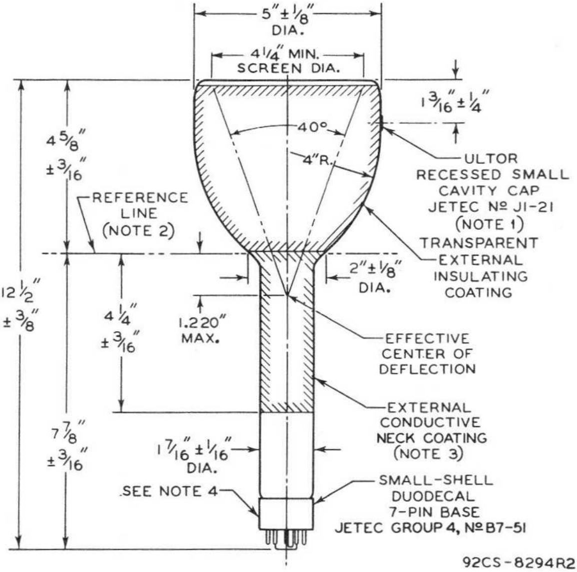
5AUP24

COLOR FLYING-SPOT CATHODE-RAY TUBE



92CS-8294R2

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ULTOR TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION 3.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. G-110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY INTERSECTION OF PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

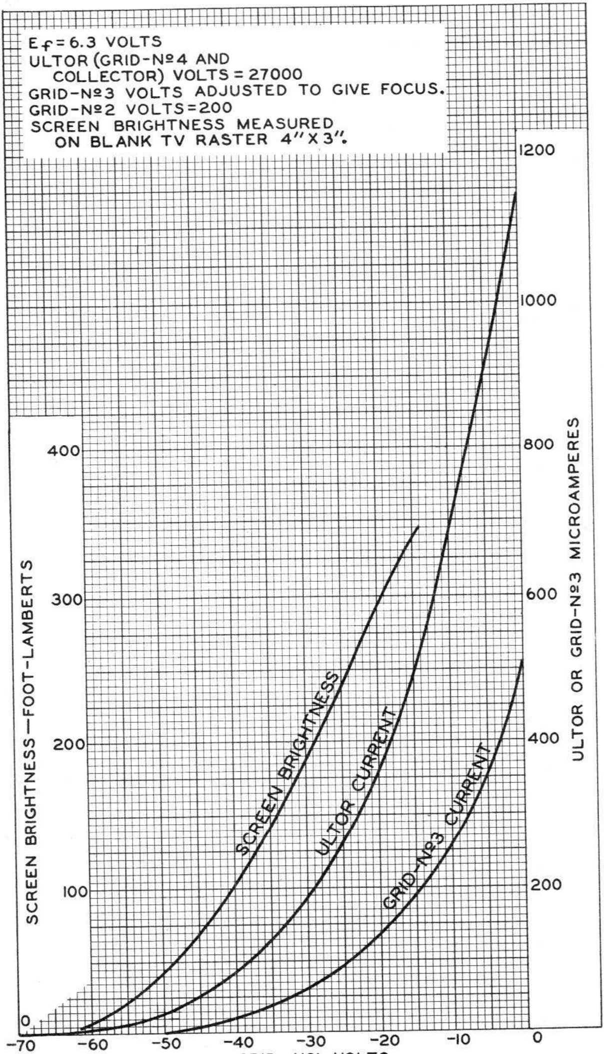
NOTE 3: EXTERNAL CONDUCTIVE NECK COATING MUST BE GROUNDED.

NOTE 4: ℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

5AUP24

5AUP24

AVERAGE CHARACTERISTICS



ELECTRON TUBE DIVISION 92CM-8343R1

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Projection Kinescope

P4 – Aluminized Silicate Phosphor Screen

Electrostatic Focus **Magnetic Deflection**

Forced-Air Cooled

For Use with Reflective Optical Systems

ELECTRICAL

Heater Current at 6.3 volts . . . . 0.6 A

Focusing Method . . . . Electrostatic

Deflection Method . . . . Magnetic

Deflection Angle (Approx.) . . . . 50^{o}

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to all other electrodes . . . . 8 pF

Cathode to all other electrodes . . . . 5 pF

OPTICAL

Faceplate, Spherical . . . . . Clear, Browning-Resistant Glass

Minimum Useful Screen Diameter . . . . 4.50"

Minimum Optical-Quality-
Circle Diameter . . . . 4.25"

Refractive Index of Faceplate 1.519

Phosphor, Aluminized . . . . P4 Silicate Type

C.I.E. Coordinates:

x-coordinate 0.333

y-coordinate 0.347

Luminance . . . . White

Persistence . . . . Medium

MECHANICAL

Tube Dimensions:

Overall Length . . . . 12.19" + 0.37" -0.38"

Greatest Diameter of Bulb . . . . 5.00" ± 0.12"

Base . . . . Small-shell duodecal 7-pin, (JEDEC No.B7-51)

Anode Lead . . . . Molded-on, Insulated Cable, 48" Long

Bulb J4OH1

Operating Position . . . . Any

Weight (Approx.) . . . . 1-1/2 lb

MAXIMUM AND MINIMUM RATINGS, Absolute-Maximum Values

Face Temperature . . . . 100 max. °C

Anode Voltage . . . . 42,000 max. V

Average Anode Power:
- Without forced-air cooling of faceplate . . . . 9 max. W
- With forced-air cooling of faceplate . . . . 12 max. W

Air Flow to Face, when Average Anode Power Exceeds 9 Watts:

An air-cooling system is required to cool the face of these tubes when they are operated with an average anode input in excess of 9 watts. The system consists of a suitable blower and an air duct, having an outlet diameter of about 2 inches, directed perpendicularly onto the face of the tube. The air flow must be adequate to limit the faceplate temperature to 100° C. The cooling air must not contain water, dust, or other foreign matter. The air-cooling system should be electrically interconnected with the anode power supply to prevent operation of the tube without cooling.

Cooling of the face by a tangential flow of air across the face is not recommended because the temperature gradient produced across the face may result in immediate or delayed cracking of the face.

Grid-No.3 (Focusing Electrode) Voltage	9000 max.	V
Grid-No.2 Voltage	400 max.	V
Grid-No.1 Voltage:		
Negative bias value	150 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	175 max.	V
Heater positive with respect to cathode	10 max.	V
Heater Voltage (ac or dc):		
Under operating conditions[b]	6.9 max.	V
	5.7 min.	V

RECOMMENDED OPERATING VALUES

Unless otherwise specified, values are positive with respect to cathode.

Anode Voltage	40,000 V[c]
Average Anode Current	300 μA
Grid-No.3 (Focusing Electrode) Voltage for an Anode Current of 300 microamperes	7400 to 9000 V

Grid-No.2 and Grid-No.1 Voltages for Visual Extinction of Focused Spot	See accompanying *Cutoff Design Chart*

TYPICAL PERFORMANCE DATA

At recommended operating values

Grid-No.3 Current (Total)	See accompanying *Typical Grid-No.3 Current Characteristic*
Grid-No.2 Current	±15 μA
Equivalent Passband (N_e)	270

(For sine-wave response, see accompanying *Typical Sine-Wave Response)*

Center Resolution[d]	900 TV Lines
Drive Characteristics	See accompanying *Typical Drive Characteristics*
Luminance at 300 μA	1650 fL
Luminance Characteristics	See accompanying *Typical Luminance Characteristic*

LIMITING CIRCUIT VALUES

(See accompanying *Schematic Diagram of Circuit Showing Protective Elements Employed to Prevent Tube Damage)*

HIGH-VOLTAGE CIRCUITS

In order to minimize the possibility of damage to the tubes caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type.

Anode-Circuit Resistance (unbypassed)	0.5 min.	MΩ
Grid-No.3 Circuit Resistance (unbypassed)	0.1	MΩ

LOW-VOLTAGE CIRCUITS

Grid-No.2 Circuit Resistance (bypassed)	10	kΩ
Grid-No.1 Circuit Resistance (unbypassed)	1	kΩ
Effective Grid-No.1-to-Cathode Circuit Resistance	1.5 max.	MΩ
Cathode Circuit Resistance (unbypassed)	1	kΩ
Heater Circuit Resistance (bypassed) to one side of heater	10	kΩ

[b] For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.

[c] Brilliance and definition may change with decreasing anode voltage. In general, the anode voltage should not be less than 30,000 volts.

[d] Determined for a 3-inch high TV resolution test pattern with tube operating at an average screen current of 300 microamperes.

HIGH-VOLTAGE PRECAUTIONS

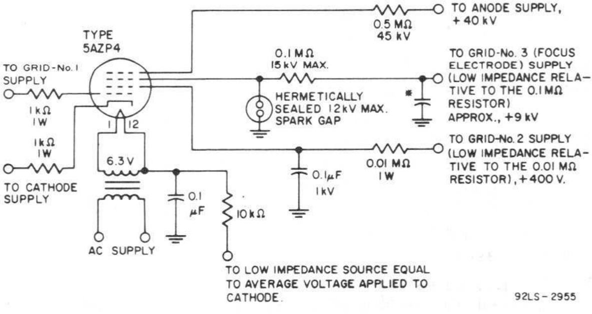
The high voltages at which this type is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

X-RADIATION WARNING

X-radiation is produced at the face of this tube when it is operated at normal anode voltage.

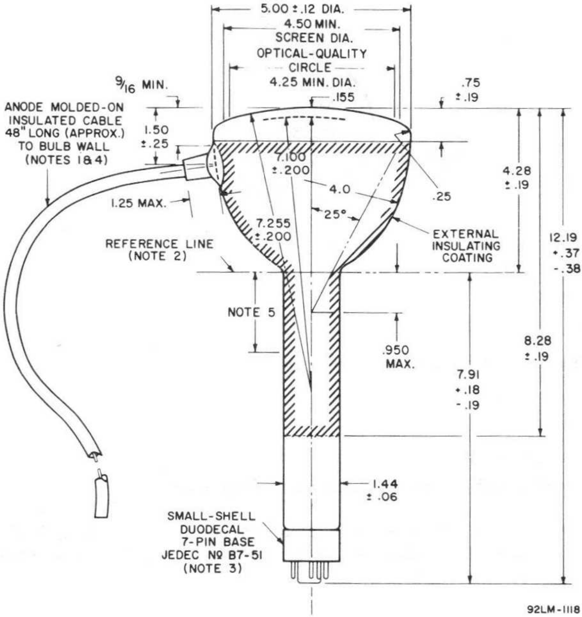
These rays can constitute a health hazard unless the tube is adequately shielded. Make sure that the shielding provides the required protection against personal injury.

SCHEMATIC DIAGRAM OF CIRCUIT SHOWING PROTECTIVE ELEMENTS EMPLOYED TO PREVENT TUBE DAMAGE



* The value of this capacitor should be such that its charging time constant is at least five times greater than the firing time of the spark gap.

DIMENSIONAL OUTLINE – Dimensions In Inches



Note 1: The plane through the tube axis and vacant pin position No.3 may vary from the plane through the tube axis and anode-cable connection at bulb wall by angular tolerance (measured about the tube axis) of ±20°. Anode-cable connection is on same side as vacant pin position No.3

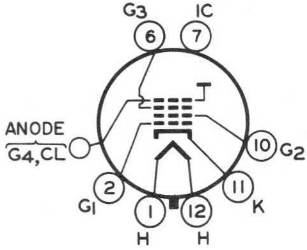
Note 2: Reference line is determined by position where gauge 1.500" + 0.003" – 0.000" I.D. and 2" long will rest on bulb cone.

Note 3: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Socket contacts corresponding to vacant pin positions No.3, 4, 5, 8 and 9 should be removed in order to provide maximum insulation for pins No.6 and 7.

Note 4: Anode cable should not be sharply bent within 3" of bulb wall.

Note 5: The windings of the deflecting yoke should not extend more than 2" from the reference line toward the base. They should be insulated to withstand 20 kV and be spaced at least 1/10" from the tube neck.

TERMINAL DIAGRAM (Bottom View)



Pin 1: Heater

Pin 2: Grid No.1

Pin 6: Grid No.3

Pin 7: Internal Connection – Do not use

Pin 10: Grid No.2

Pin 11: Cathode

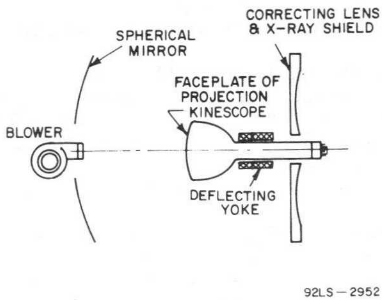
Pin 12: Heater

Flexible Cable: Anode (Grid No.4, Collector)

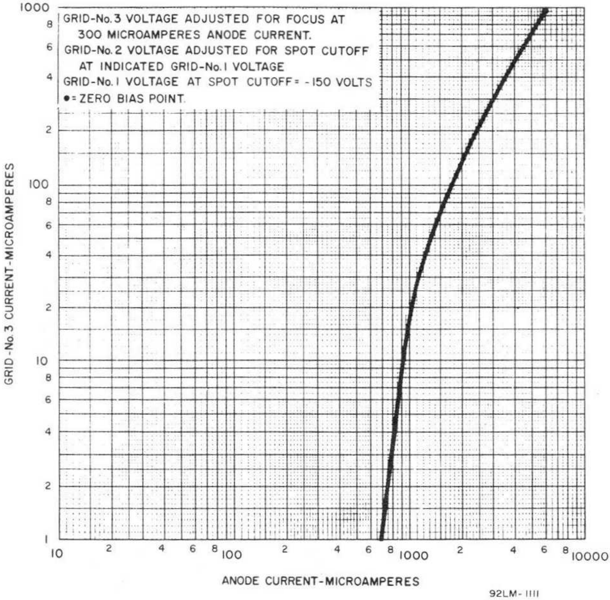
Note: Socket contacts for vacant pin positions No.3, 4, 5, 8, and 9 should be removed so that maximum insulation is provided for pins No.6 and 7.

REFLECTIVE OPTICAL SYSTEM

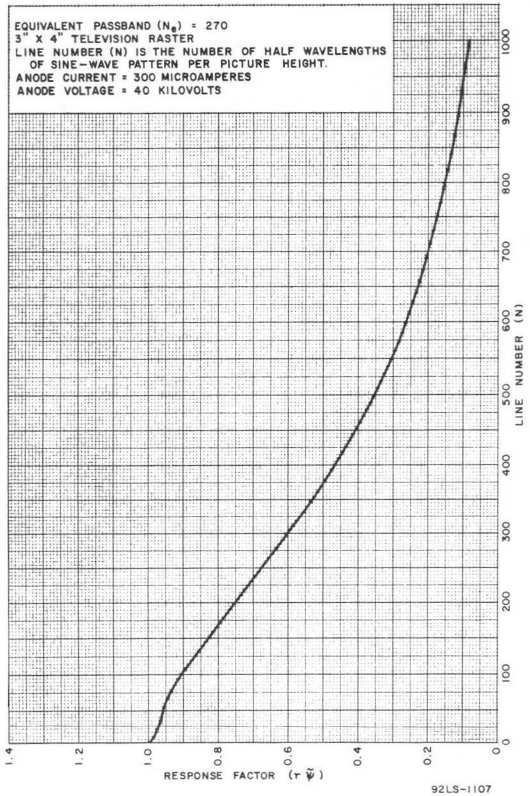
Arrangement of Typical Optical System and Air-Cooling System for Television Projector Using Reflective Optical Principles.



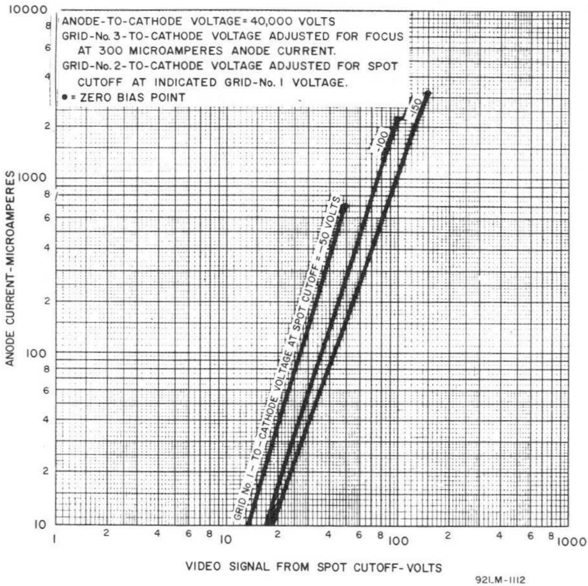
TYPICAL GRID-No.3 CURRENT CHARACTERISTIC



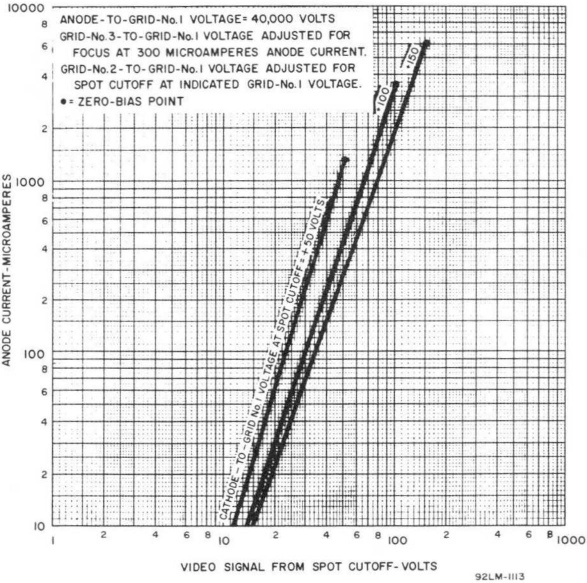
TYPICAL SINE-WAVE RESPONSE



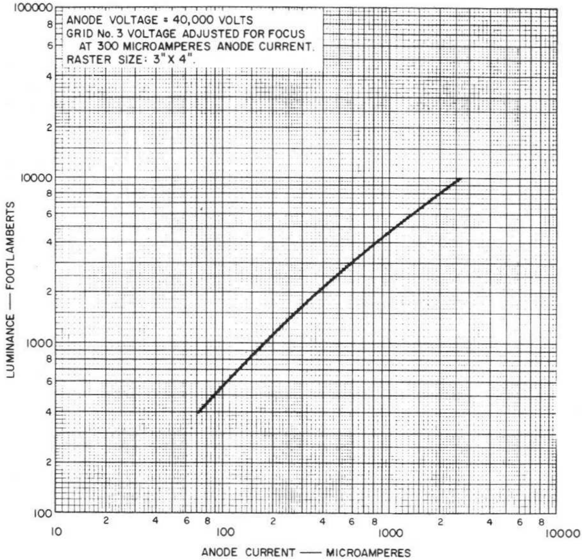
TYPICAL DRIVE CHARACTERISTICS
GRID-DRIVE SERVICE



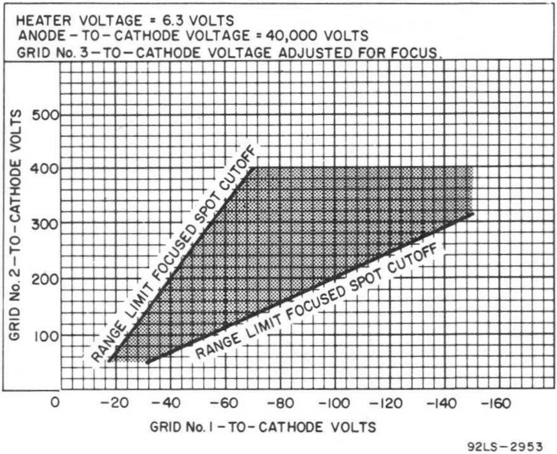
TYPICAL DRIVE CHARACTERISTICS
CATHODE-DRIVE SERVICE



TYPICAL LUMINANCE CHARACTERISTIC



CUTOFF DESIGN CHART



5BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

Supersedes Type 5BP1

General:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± *10%*	ac or dc volts
Current	0.6	amp.
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to All Other Electrodes	8.0	μμf
DJ_1 to DJ_2	1.3	μμf
DJ_3 to DJ_4	1.2	μμf
DJ_1 to All Other Electrodes	9.5	μμf
DJ_3 to All Other Electrodes	12.0	μμf
DJ_1 to All Other Electrodes except DJ_2	8.0	μμf
DJ_2 to All Other Electrodes except DJ_1	7.5	μμf
DJ_3 to All Other Electrodes except DJ_4	10.0	μμf
DJ_4 to All Other Electrodes except DJ_3	7.5	μμf
Phosphor (For Curves, see front of this Section)		No.1
Fluorescence		Green
Persistence		Medium
Focusing Method		Electrostatic
Deflection Method		Electrostatic
Overall Length		16-3/4" ± 3/8"
Greatest Diameter of Bulb		5-1/4" + 1/16" − 3/32"
Minimum Useful Screen Diameter		4-1/2"
Mounting Position		Any
Base		Medium Shell Magnal 11-Pin
Basing Designation for BOTTOM VIEW		11N

Pin 1 - Heater
Pin 2 - No Connection
Pin 3 - Deflecting Electrode DJ_1
Pin 4 - Anode No.1
Pin 5 - Internal Con. Do not use
Pin 6 - Deflecting Electrode DJ_4

Pin 7 - Anode No.2, Grid No.2
Pin 8 - Deflecting Electr. DJ_2
Pin 9 - Deflecting Electr. DJ_3
Pin 10 - Grid No.1
Pin 11 - Heater, Cathode

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 4. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 1.

The angle between the trace produced by DJ_3 and DJ_4 and its intersection with the plane through the tube axis and pin 1 does not exceed 10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 3°.

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5BP1-A

HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

Maximum Ratings, *Absolute Values*:

ANODE-No.2 & GRID-No.2 VOLTAGE	2200 *max.*	volts
ANODE-No.1 VOLTAGE	1100 *max.*	volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:		
Negative Value	125 *max.*	volts
Positive Value	0 *max.*	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE	550 *max.*	volts

Typical Operation:

Anode-No.2 & Grid-No.2 Voltage*	1500	2000	volts
Anode-No.1 Volt. for Focus at 75% of Grid-No.1 Volt. for Cutoff●	337	450	volts
Grid-No.1 Volt. for Visual Cutoff#	-30	-40	volts
Max. Anode-No.1 Current Range▲	Between -50 and +10		μamp.
Deflection Sensitivity:			
DJ_1 and DJ_2	0.404	0.303	mm/v dc
DJ_3 and DJ_4	0.446	0.334	mm/v dc
Deflection Factor:**			
DJ_1 and DJ_2	63	84	v dc/in.
DJ_3 and DJ_4	57	76	v dc/in.

* Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 1500 volts.

● Individual tubes may require between +25% and -30% of the values shown with grid-No.1 voltages between zero and cutoff.

\# Visual extinction of stationary focused spot. Supply should be adjustable to ± 50% of these values.

▲ See curve for average values.

** Individual tubes may vary from these values by ± 17%.

Spot Position:

The undeflected focused spot will fall within a 15-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ_1 and DJ_2. Suitable test conditions are: anode-No.2 voltage, 1500 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each, connected to anode-No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No.1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 *max.*	megohms
Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency	1.0 *max.*	megohm
Resistance in Any Deflecting-Electrode Circuit▲▲	5.0 *max.*	megohms

▲▲ It is recommended that all deflecting-electrode-circuit resistances be approximately equal.

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5CP1-A
OSCILLOGRAPH TUBE
POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:

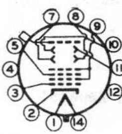
Voltage	6.3	ac or dc volts
Current	0.6	amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	8	$\mu\mu f$
Cathode to All Other Electrodes	9	$\mu\mu f$
DJ_1 to DJ_2	2	$\mu\mu f$
DJ_3 to DJ_4	2	$\mu\mu f$
DJ_1 to All Other Electrodes	9	$\mu\mu f$
DJ_2 to All Other Electrodes	9	$\mu\mu f$
DJ_3 to All Other Electrodes	7	$\mu\mu f$
DJ_4 to All Other Electrodes	8	$\mu\mu f$

Phosphor (For Curves, see front of this Section)	P1
Fluorescence and Phosphorescence	Green
Persistence of Phosphorescence	Medium
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Overall Length	16-3/4" ± 3/8"
Greatest Diameter of Bulb	5-1/4" ± 3/32"
Minimum Useful Screen Diameter	4-1/2"
Mounting Position	Any
Cap	Recessed Small Ball (JETEC No.J1-22)
Base	Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)
Basing Designation for BOTTOM VIEW	$14J_1$

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - Internal Con. Do not use
Pin 5 - Anode No.1
Pin 7 - Deflecting Electrode DJ_3
Pin 8 - Deflecting Electrode DJ_4



Pin 9 - Anode No.2, Grid No.2
Pin 10 - Deflecting Electr. DJ_2
Pin 11 - Deflecting Electr. DJ_1
Pin 12 - No Connection
Pin 14 - Heater
Cap - Anode No.3

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 5. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 2.

The plane through the tube axis and each of the following items may vary from the trace produced by DJ_1 and DJ_2 by the following angular tolerances measured about the tube axis: Pin 5, 10^o; Cap (on same side of tube as pin 5), 10^o.

The angle between the trace produced by DJ_1 and DJ_2 and the trace produced by DJ_3 and DJ_4 is $90^o \pm 3^o$.

5CPI-A

5CPI-A
OSCILLOGRAPH TUBE

Maximum Ratings, ***Design-Center Values:***

ANODE-No.3 VOLTAGE	4000 max.	volts
ANODE-No.2* VOLTAGE.	2000 max.	volts
RATIO OF ANODE-No.3 VOLTAGE TO ANODE-No.2 VOLTAGE . . .	2.3 : 1	
ANODE-No.1 VOLTAGE	1000 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value.	200 max.	volts
Positive bias value●	0 max.	volts
Positive peak value.	2 max.	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	125 max.	volts

Equipment Design Ranges:

*For any anode-No.3 voltage (Eb_3) between 2000** and 4000 volts and any anode-No.2 voltage (Eb_2) between 1500▲ and 2000 volts*

→ Anode-No.1 Voltage	18.7 to 34.5% of Eb_2 . . .	volts
→ Grid-No.1 Voltage♠	1.5% to 4.5% of Eb_2 . . .	volts
Anode-No.1 Current of any Operating Condition . .	-15 to +10	µamp
Deflection Factors:		
	When $Eb_3 = 2 \times Eb_2$	
DJ_1 & DJ_2	39 to 53 v dc/in./kv of Eb_2	
DJ_3 & DJ_4	33 to 45 v dc/in./kv of Eb_2	
	When $Eb_3 = Eb_2$	
DJ_1 & DJ_2	31 to 42 v dc/in./kv of Eb_2	
DJ_3 & DJ_4	27 to 37 v dc/in./kv of Eb_2	
Spot Position.	##	

Examples of Use of Design Ranges:

For anode-No.3 voltage of. .	*2000*	*3000*	*4000*	*volts*
and anode-No.2 voltage of. .	*2000*	*1500*	*2000*	*volts*
→ Anode-No.1 Volt.	375 to 690	280 to 515	375 to 690	volts
→ Grid-No.1 Volt.♠	-30 to -90	-22.5 to -67.5	-30 to -90	volts
Deflection Factors:				
DJ_1 & DJ_2 . . .	62 to 84	59 to 80	78 to 106	□
DJ_3 & DJ_4 . . .	54 to 74	50 to 68	66 to 90	□

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit■	5.0 max.	megohms

*, ●, **, ▲, ♠, ##, ■, □: See next page. → Indicates a change.

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5CP1-A
OSCILLOGRAPH TUBE

* Anode No. 2 and grid No. 2, which are connected together within tube, are referred to herein as anode No. 2.

● At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode-No. 2 input power to 6 watts.

** It is recommended that anode-No. 3 voltage be not less than 3000 volts for high-speed scanning.

▲ Recommended minimum value of anode-No. 2 voltage.

♁ For visual cutoff of undeflected focused spot.

□ Volts dc/in.

With heater voltage of 6.3 volts, anode-No. 3 voltage of 4000 volts, anode-No. 2 voltage of 2000 volts, anode-No. 1 voltage adjusted to focus, grid-No. 1 voltage adjusted to give spot that is just visible, each deflecting electrode connected through 1-megohm resistor to anode No. 2, and tube shielded from all extraneous fields, the center of the undeflected, focused spot will fall within a circle having a 12.5-mm radius concentric with the center of the tube face.

■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

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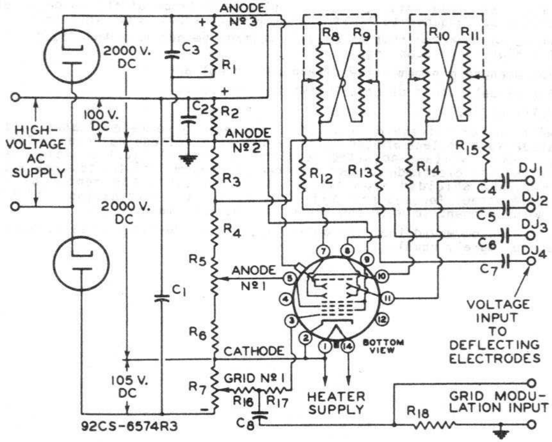
5CP1-A

OSCILLOGRAPH TUBE

TYPICAL OSCILLOGRAPH CIRCUIT



C1: 0.1 µf, 2500 Volts
C2: 1.0 µf, 200 Volts
C3: 0.1 µf, 2500 Volts
C4 C5 C6 C7: 0.05-µf, Blocking Capacitors*
C8: 0.0001 µf, 2500 Volts
R1: 50 Megohms (Five 10-Megohm, 1-Watt Resistors in Series)
R2 R3: 2 Megohms, 0.5 Watt
R4: 5.5 Megohms, 2 Watts
R5: 2-Megohm Potentiometer
R6: 1.5 Megohms, 0.5 Watt
R7: 0.5-Megohm Potentiometer
R8 R9: Dual 5-Megohm Potentiometer
R10 R11: Dual 5-Megohm Potentiometer
R12 R13 R14 R15: 2 Megohms, 0.5 Watt
R16: 0.5 Megohm, 0.5 Watt
R17: Not less than 2000 ohms per volt of positive signal
R18: 5 Megohms, 0.5 Watt

* When cathode is grounded, capacitors should have high voltage rating (2500 volts); when anode No. 2 is grounded, they may have low voltage rating (200 volts). For dc amplifier service, deflecting electrodes should be connected direct to amplifier output. In this service, it is preferable usually to remove deflecting-electrode resistors to minimize loading effect on amplifier. In order to minimize spot defocusing, it is essential that anode No. 2 be returned to a point in the amplifier system which will give the lowest possible potential difference between anode No. 2 and the deflecting electrodes.

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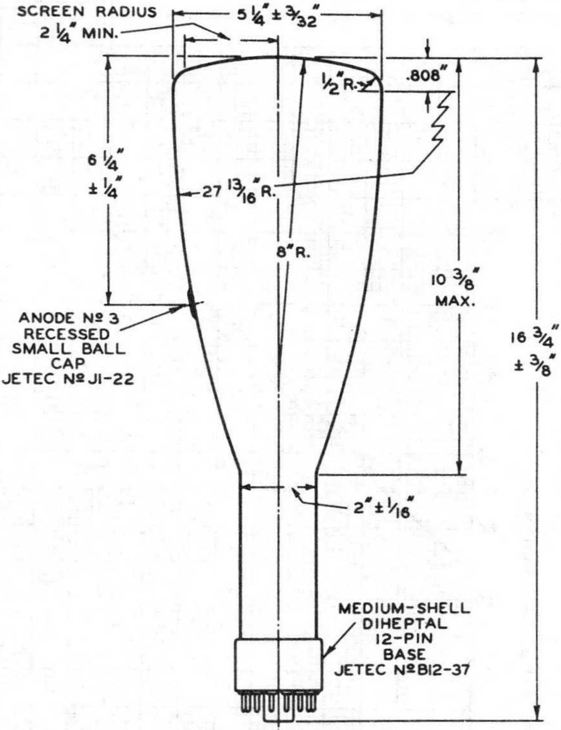
OSCILLOGRAPH TUBE



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE

92CM-6408R4

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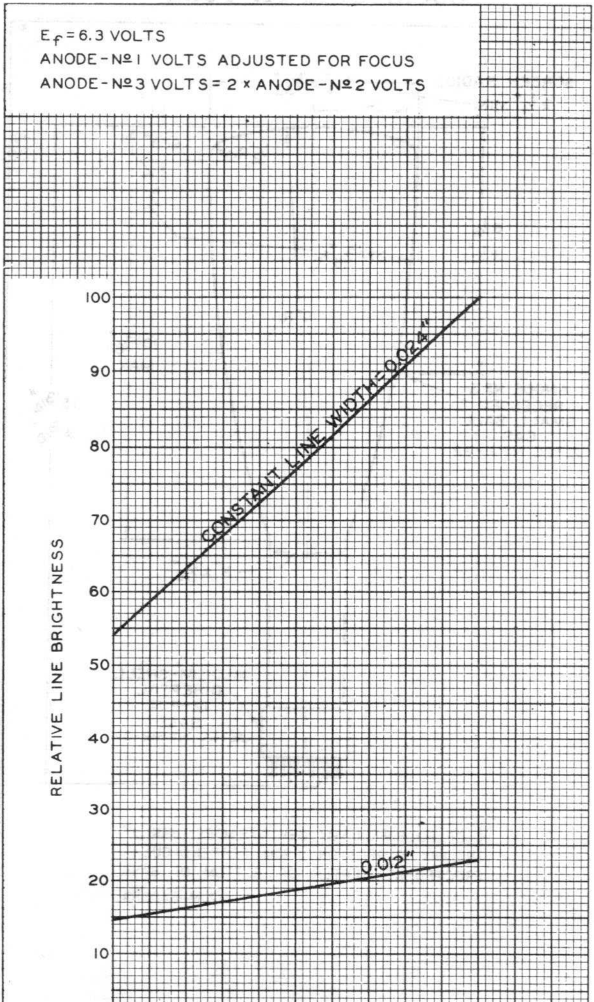
5CP1-A
CHARACTERISTICS



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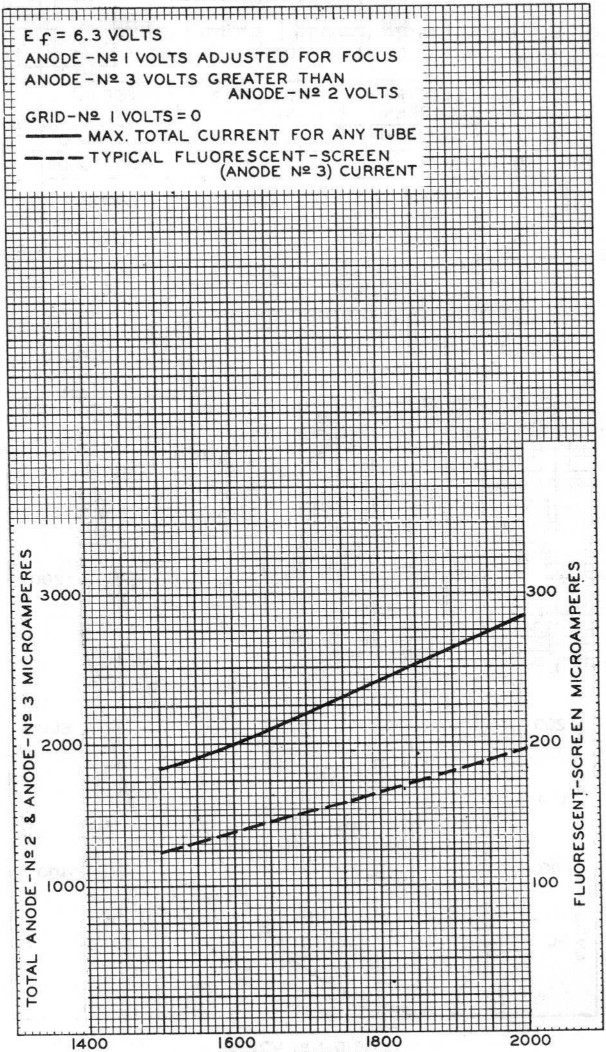
5CPI-A

CHARACTERISTICS



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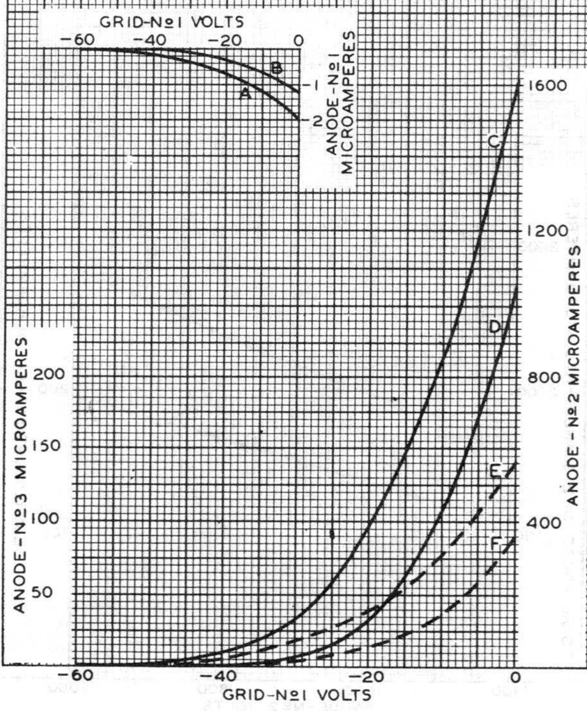
5CP1-A

AVERAGE CHARACTERISTICS

E_f = 6.3 VOLTS
ANODE-No. 1 VOLTS ADJUSTED TO GIVE FOCUS

CURVE	ELECTRODE CURRENT	ANODE-No. 2 VOLTS	ANODE-No. 3 VOLTS
A	ANODE No. 1	2000	2000-4000
B	ANODE No. 1	1500	1500-3000
C	ANODE No. 2	2000	4000
D	ANODE No. 2	1500	3000
E	ANODE No. 3	2000	4000
F	ANODE No. 3	1500	3000



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92CM-6414R2

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5CP11-A
OSCILLOGRAPH TUBE

POST-DEFLECTION ACCELERATOR

ELECTROSTATIC FOCUS ELECTROSTATIC DEFLECTION

The 5CP11-A is the same as the 5CP1-A, except that it has a screen of the short-persistence, blue-fluorescence type designated P11. Its highly actinic fluorescent spot of unusually high brightness makes the 5CP11-A particularly useful for photographic recording. Because its improved phosphor has exceptional brightness for a blue screen, the 5CP11-A is also quite useful for visual observation of phenomena.

The SPECTRAL-ENERGY EMISSION CHARACTERISTIC, as well as the PERSISTENCE CHARACTERISTIC for the P11 PHOSPHOR are shown at the beginning of this Section.

View-Finder Kinescope

MAGNETIC FOCUS — MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:		
Cathode to all other electrodes	8	pf
Grid No.1 to all other electrodes	5	pf
Heater Current at 6.3 volts	600	ma

Optical:

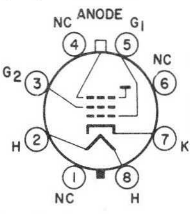
Phosphor (For curves, see front of this section)	P4—Sulfide Type
Fluorescence	White
Phosphorescence	White
Persistence	Short
Focusing Method	Magnetic
Deflection Method	Magnetic
Deflection Angle (Approx.)	53°

Mechanical:

Overall Length	11-1/8" ± 3/8"
Greatest Diameter	4-15/16" ± 3/32"
Minimum Useful Screen Diameter	4-1/4"
Cap	Recessed Small Ball (JEDEC No.J1-22)

Bases (Alternates):
- Long Medium-Shell Octal:
  - 8-Pin (JEDEC Group 1, No.B8-65)
  - 5-Pin (JEDEC Group 1, No.B5-80)
- Medium-Shell Octal 8-Pin:
  - 8-Pin (JEDEC Group 1, No.B8-11)

Pin 1 - No Internal Connection
Pin 2 - Heater
Pin 3 - Grid No.2
Pin 4 - Same as Pin 1
Pin 5 - Grid No.1



Pin 6 - Same as Pin 1
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Collector)

Maximum Ratings, *Design-Center Values:*

ANODE VOLTAGE[a]	8000 max.	volts
GRID-No.2 VOLTAGE	410 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	150 max.	volts
Heater positive with respect to cathode	150 max.	volts

5FP4A

Typical Operation:

Anode Voltage[b]	6000	volts
Grid-No.2 Voltage	250	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-25 to -70	volts
Focused-Coil Current (DC, approx.)[c]	120 ± 15%	ma

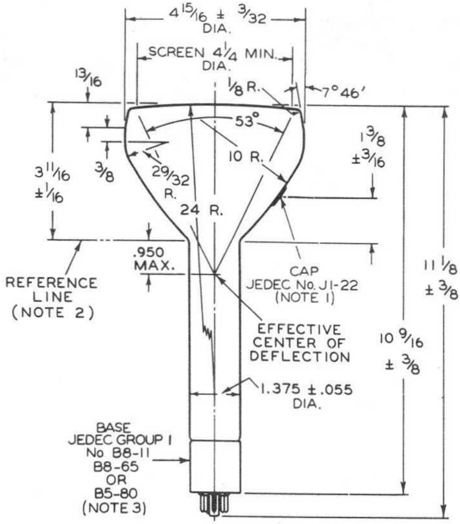
Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

[a] The product of anode voltage and average anode current should be limited to 6 watts.

[b] Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.

[c] For specimen focusing coil similar to JEDEC Focusing Coil No.106 positioned with air gap toward kinescope screen, and center line of air gap 3-1/4" from Reference Line (see Outline Drawing). The indicated current is for condition with combined grid-No.1 bias voltage and video-signal voltage adjusted to produce a highlight brightness of 10 foot-lamberts on a 3-7/8" x 2-7/8" picture area sharply focused at center of screen.



92CM-6362R5

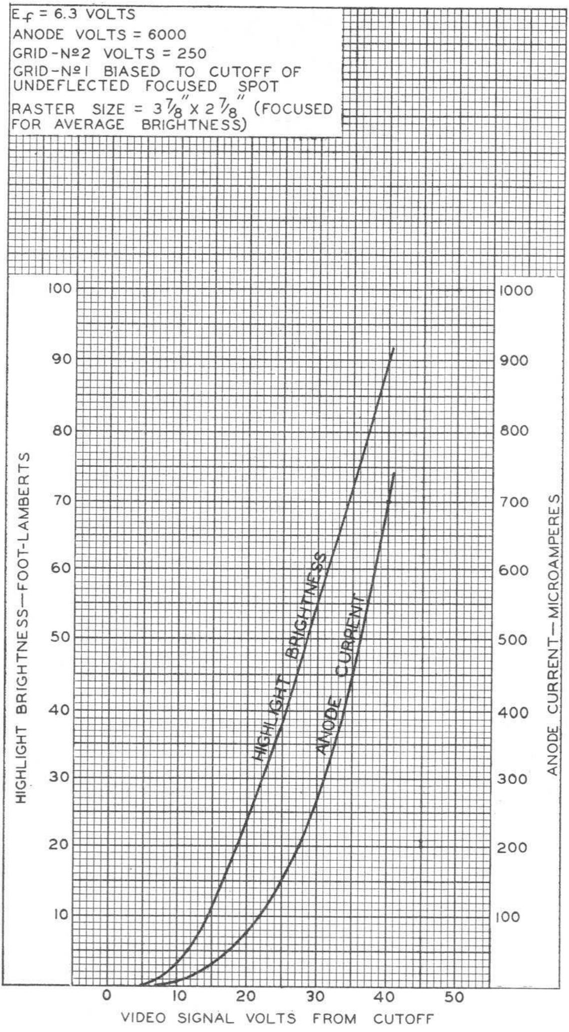
DIMENSIONS IN INCHES

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 5 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ANODE TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF 10°. ANODE TERMINAL IS ON SAME SIDE OF TUBE AS PIN 5.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE GAUGE 1.430" +.003" -000" INSIDE DIAMETER AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

AVERAGE GRID-DRIVE CHARACTERISTICS



92CM-6683R1

5FP7-A

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5FP7-A

OSCILLOGRAPH TUBE

MAGNETIC FOCUS — MAGNETIC DEFLECTION

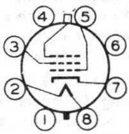
DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances:		
Grid No.1 to All Other Electrodes	8	μμf ←
Cathode to All Other Electrodes	5	μμf
Phosphor (For Curves, see front of this Section)		P7
Fluorescence		Blue
Phosphorescence		Greenish-Yellow
Persistence of Phosphorescence		Long
Focusing Method		Magnetic
Deflection Method		Magnetic
Deflection Angle (Approx.)		53°
Overall Length		11-1/8" ± 3/8"
Greatest Diameter of Bulb		4-15/16" ± 3/32"
Minimum Useful Screen Diameter		4-1/4"
Mounting Position		Any
Cap		Recessed Small Ball (JETEC No.J1-22)
Base		Long Medium-Shell Octal 8-Pin (JETEC No.B8-65)

BOTTOM VIEW

Pin 1 - No Connection
Pin 2 - Heater
Pin 3 - Grid No.2
Pin 4 - No Connection



Pin 5 - Grid No.1
Pin 6 - No Connection
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode

Maximum Ratings, ***Design-Center Values:***

ANODE VOLTAGE	8000 max.	volts
GRID-No.2 VOLTAGE	700 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	180 max.	volts ←
Positive bias value*	0 max.	volts
Positive peak value	2 max.	volts
PEAK GRID-No.1 DRIVE FROM CUTOFF	65 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

Typical Operation:

Anode Voltage**	4000	7000	volts
Grid-No.2 Voltage	250	250	volts

* At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode input power to 6 watts.

** Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.

← Indicates a change.

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5FP7-A

5FP7-A

OSCILLOGRAPH TUBE

Grid-No.1 Voltage°	-25 to -70	-25 to -70	volts
→ Grid-No.2 Current.	-15 to +15	-15 to +15	μamp
Focusing-Coil Current			
→ (DC, approx.)#	96 ± 15%	128 ± 15%	ma
Spot Position.	##	—	

Maximum Circuit Values:

Grid-No.1-Circuit Resistance . . . . 1.5 max. megohms

° For visual extinction of undeflected focused spot.

\# For specimen focusing coil similar to JETEC Focusing Coil No.106 positioned with air gap toward face plate, and center line of airgap 2-3/4 inches from Reference Line (see Outline Drawing), and total anode current of 200 microamperes.

\#\# The center of the undeflected, unfocused spot will fall within a circle having 9-mm radius concentric with center of tube face.

OPERATING NOTES

The 5FP7-A utilizes a long-persistence, cascade (two-layer) screen which exhibits bluish fluorescence of short persistence and greenish-yellow phosphorescence.

Because of its long persistence, the 5FP7-A is particularly useful where either low-speed non-recurring phenomena or high-speed recurring phenomena are to be observed. Furthermore, two or more phenomena can be observed simultaneously on the screen by means of a suitable switching arrangement.

The persistence is such that the 5FP7-A without filter can be operated with scanning frequencies as low as 30 cycles per second without excessive flicker. When used with yellow filter, such as Wratten No.15 (G), the 5FP7-A can be operated with much lower scanning frequencies.

In general, operation of the 5FP7-A at an anode voltage below 4000 volts will not give persistence of useable brigntness.

OUTLINE DIMENSIONS for Type 5FP7-A
are the same as those for Type 5FP4-A

AVERAGE CHARACTERISTIC CURVE
for Type 5FP7-A is the same as that shown for
Type 7BP7-A

→Indicates a change.

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5UP1

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

General:

Heater, for Unipotential Cathode:

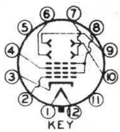
Voltage	6.3 ± 10%	ac or dc volts
Current	0.6	amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 to All Other Electrodes	8.0	$\mu\mu$f
DJ_1 to DJ_2	2.5	$\mu\mu$f
DJ_3 to DJ_4	2.5	$\mu\mu$f
DJ_1 to All Other Electrodes	11.0	$\mu\mu$f
DJ_2 to All Other Electrodes	8.0	$\mu\mu$f
DJ_3 to All Other Electrodes	7.0	$\mu\mu$f
DJ_4 to All Other Electrodes	8.0	$\mu\mu$f

Phosphor (For Curves, see front of this Section)	No.1
Fluorescence	Green
Persistence	Medium
Focusing Method	Electrostatic
Deflection Method	Electrostatic
Overall Length	14-3/4" ± 3/8"
Greatest Diameter of Bulb	5-1/4" ± 3/32"
Minimum Useful Screen Diameter	4-1/2"
Mounting Position	Any
Base	Small-Shell Duodecal 12-Pin
Basing Designation for BOTTOM VIEW	12E

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Cathode
Pin 4 - Anode No.1
Pin 5 - Internal Con. Do Not Use
Pin 6 - Deflecting Electrode DJ_3
Pin 7 - Deflecting Electrode DJ_4



Pin 8 - Anode No.2, Grid No.2
Pin 9 - Deflecting Electrode DJ_2
Pin 10 - Deflecting Electrode DJ_1
Pin 11 - Internal Con. Do Not Use
Pin 12 - Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 4. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 1.

The angle between the trace produced by DJ_1 and DJ_2 and its intersection with the plane through the tube axis and pin 1 does not exceed 10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 3°.

5UPI

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5UPI
OSCILLOGRAPH TUBE

Maximum Ratings, *Design-Center Values*:

ANODE-No.2 ■ VOLTAGE	2500 max.	volts
ANODE-No.1 VOLTAGE	1000 max.	volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:		
Negative bias value	200 max.	volts
Positive bias value	0 max.	volts
Peak positive value	2 max.	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND ANY DEFLECTING ELECTRODE	500 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

Equipment Design Ranges:

For any anode-No.2 voltage (E_{b_2}) between 1000 and 2500 volts*

Anode-No.1 Voltage	17% to 32% of E_{b2}	volts
Max. Grid-No.1 Voltage for Visual Cutoff	4.5% of E_{b2}	volts
Anode-No.1 Current for Any Operating Condition	-15 to +10	microamp
Deflection Factors:		
DJ_1 & DJ_2	28 to 38.5	v dc/in./kv of E_{b2}
DJ_3 & DJ_4	23 to 31	v dc/in./kv of E_{b2}

Examples of Use of Design Ranges:

For anode-No.2 voltages of	*1000*	*2000*	*volts*
Anode-No.1 Voltage	170 - 320	340 - 640	volts
Max. Grid-No.1 Voltage for Visual Cutoff	-45	-90	volts
Deflection Factors:			
DJ_1 & DJ_2	28 - 38.5	56 - 77	volts dc/in.
DJ_3 & DJ_4	23 - 31	46 - 62	volts dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting Electrode Circuit□	5.0 max.	megohms

* Recommended minimum value.

□ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

■ Anode No.2 and grid No.2, which are connected together within tube, are referred to herein as anode No.2.

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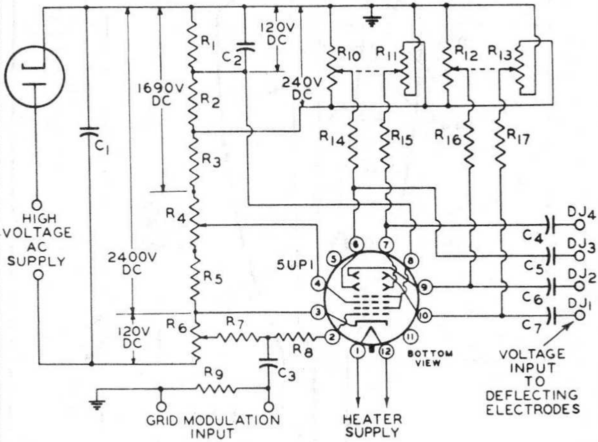
OSCILLOGRAPH TUBE

TYPICAL CIRCUIT



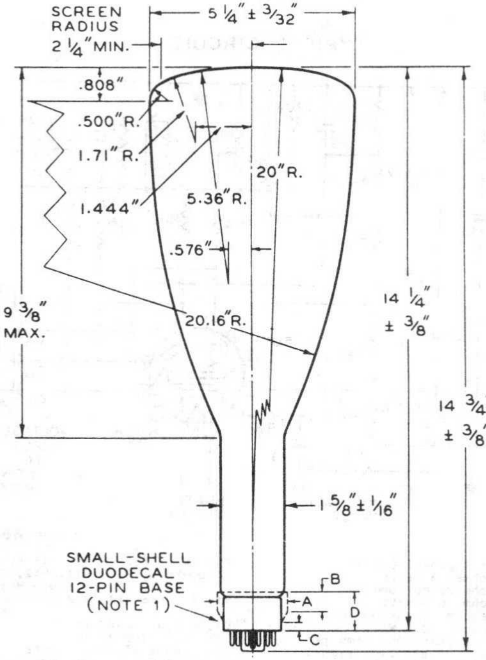
92CM-6819

R1 R2: 2.5 Megohms, 0.5 Watt
R3: 6 Megohms, 3 Watts
R4: 2-Megohm Potentiometer
R5: 1 Megohm, 0.5 Watt
R6: 0.5-Megohm Potentiometer
R7: 0.5-Megohm, 0.5 Watt
R8: Not less than 2000 Ohms per volt of positive signal
R9: 5-Megohms, 0.5 Watt

R10 - R11, R12 - R13: Dual Potentiometers, R10, R11, R12, R13: 0.5 Megohm
R14 R15 R16 R17: 2.2 Megohms, 0.5 Watt
C1: 0.1 μf, 2500 Volts
C2: 1 μf, 200 Volts
C3: 0.0001 μf, 2500 Volts
C4 C5 C6 C7: 0.1 μf, 600 Volts

5UP1

5UP1
OSCILLOGRAPH TUBE



℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE 1: THIS BASE MAY BE SUPERSEDED BY AN ALTERNATE BASE WHICH WILL FIT THE SAME SOCKET BUT WHICH WILL HAVE A FLARED SHELL INDICATED BY THE DASHED LINES AND DIMENSIONED APPROXIMATELY AS FOLLOWS:

A = 1.85" MAX., B = 0.500", C = 0.200" MIN., D = 0.925".

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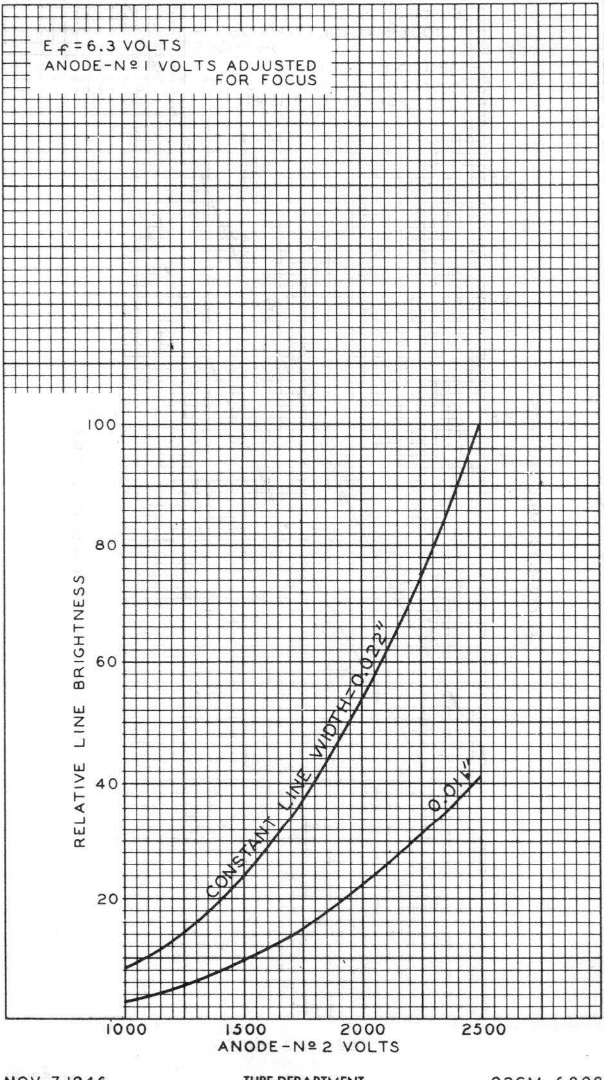
5UP1

AVERAGE CHARACTERISTICS



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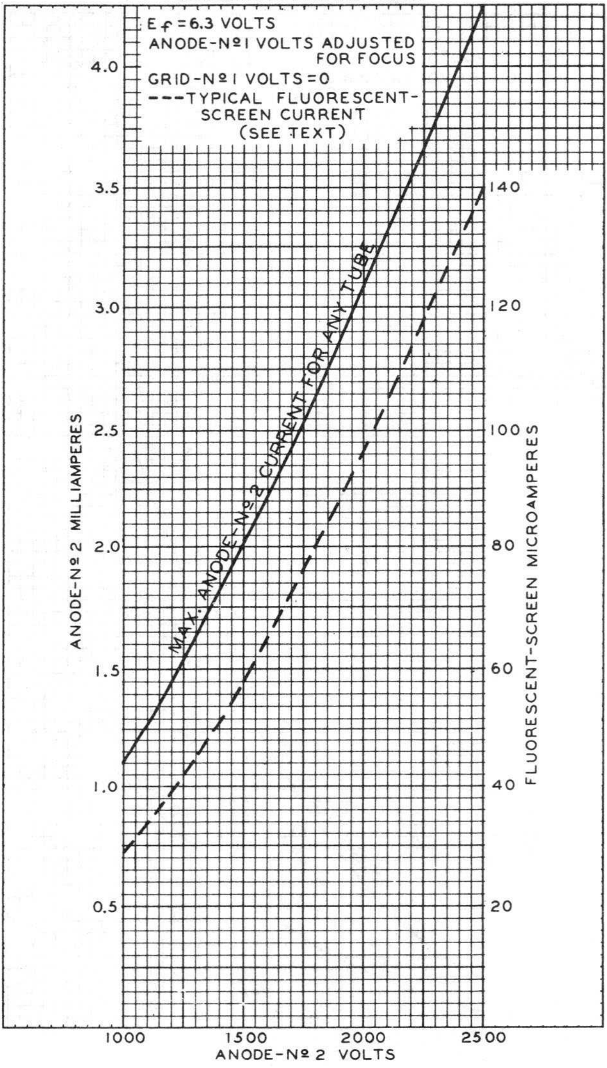
5UP1

CHARACTERISTICS



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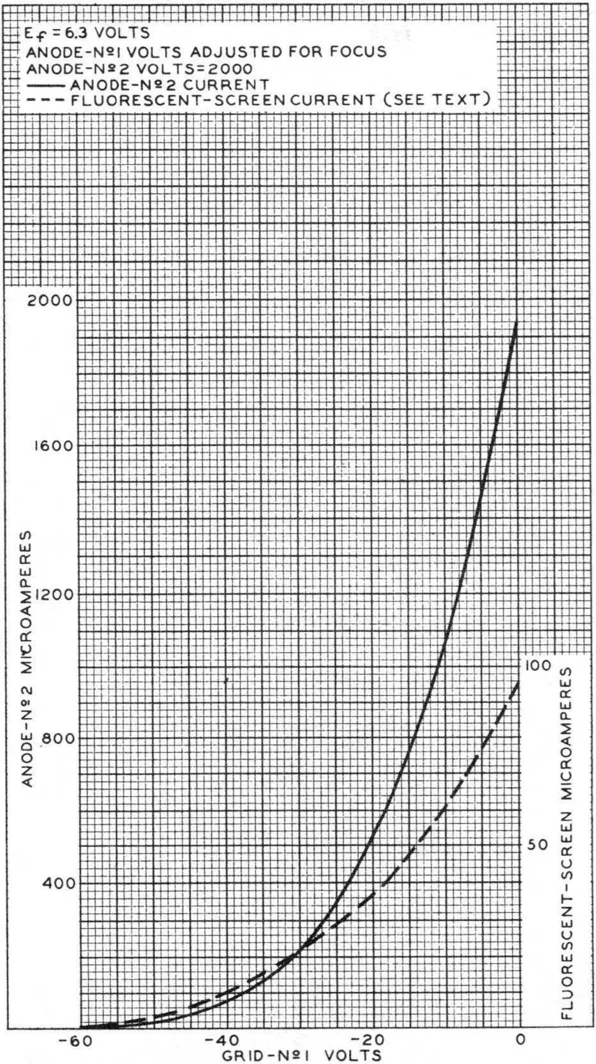
5UP1

AVERAGE CHARACTERISTICS



5UP7

Oscillograph Tube

ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

For Extremely Low-Speed Recurrent, or Medium-Speed Non-Recurrent Image Displays

The 5UP7 is the same as the 5UP1 except for the following items:

GENERAL

Phosphor (For curves, see front of this section). P7
Fluorescence . . . . White
Phosphorescence. . . . . Yellowish-Green
Persistence[a,b] . . . . Very-Long

5UP11

Oscillograph Tube

ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

For Photographic Recording and Visual Observations

The 5UP11 is the same as the 5UP1 except for the following items:

GENERAL

Phosphor (For curves, see front of this section) P11
Fluorescence . . . . Actinic-Blue
Phosphorescence. . . . . Actinic-Blue
Persistence[a,b] . . . . Medium-Short

5UP31

Oscillograph Tube

ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

For Low- or Medium-Speed Non-Recurring Image Displays

The 5UP31 is the same as the 5UP1 except for the following items:

GENERAL

Phosphor (For curves see type 7VP31) P31
Fluorescence . . . . Green
Phosphorescence. . . . . Green
Persistence[b] . . . . Medium-Short[c] (Approx. 38 μsec)

[a] Persistence of useable brightness can be obtained with an anode-No. 2 voltage of as low as 1500 volts.
[b] Time for initial brightness to decay to 10% point.
[c] Phosphorescence may have a useful brightness for over a minute under conditions of adequate excitation and low-ambient illumination.

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5WP11

TRANSCRIBER KINESCOPE

ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

DATA

General:

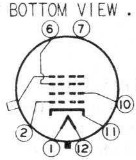
Heater, for Unipotential Cathode:
- Voltage . . . . 6.3 . . . . ac or dc volts
- Current . . . . 0.6 . . . . amp

Direct Interelectrode Capacitances:
- Grid No.1 to All Other Electrodes . . . . . 7.5 . . . $\mu\mu f$
- Cathode to All Other Electrodes . . . . . . 5 . . . $\mu\mu f$
- External Conductive Coating to Anode No.2 . $\begin{cases} 500 \text{ max.} \\ 100 \text{ min.} \end{cases}$ $\mu\mu f$

Phosphor (For Curves, see front of this Section) P11
- Fluorescence . . . . Blue
- Persistence . . . . Short

Focusing Method . . . . Electrostatic
Deflection Method . . . . Magnetic
Deflection Angle (Approx.) . . . . 50^{o}
Overall Length . . . . 11-7/16" ± 3/8"
Greatest Diameter of Bulb . . . . 5" ± 1/8"
Minimum Useful Screen Diameter . . . . 4-1/4"
Raster Size (Approx.) . . . . 2-1/2" x 3-3/8"
Mounting Position . . . . Any
Cap . . . . Recessed Small Cavity
Base . . . . Small-Shell Duodecal 7-Pin
- Basing Designation for BOTTOM VIEW 12C

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Anode No.1
Pin 7 - Internal Con.- Do Not Use



Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater
Cap - Anode No.2

Maximum Ratings, *Design-Center Values*:

ANODE-No.2 VOLTAGE	27000 max.	volts
ANODE-No.1 VOLTAGE	6000 max.	volts
GRID-No.2 VOLTAGE	350 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	150 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

Typical Operation:

Anode-No.2 Voltage* . . . . 27000 volts

*: See next page.

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5WP11

5WP11

TRANSCRIBER KINESCOPE

Anode-No.1 Voltage Range for Anode-No.2 Current of 20 µamp.	4200 to 5400	volts
Grid-No.2 Voltage**.	200	volts
Grid-No.1 Voltage for Visual Cutoff . . .	-42 to -98	volts
Anode-No.2 Current	20	µamp
Max. Anode-No.1 Current.	25	µamp
Grid-No.2 Current Range.	-15 to +15	µamp

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

Minimum Circuit Values:

When the output capacitor of the power supply is capable of storing more than 250 microcoulombs, and when the inherent regulation of the power supply permits the instantaneous short-circuit current to exceed 1 ampere, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:

Grid-No.1-Circuit Resistance	180 min.	ohms
Grid-No.2-Circuit Resistance	390 min.	ohms
Anode-No.1-Circuit Resistance.	6800 min.	ohms
Anode-No.2-Circuit Resistance.	30000 min.	ohms

The resistors used should be capable of withstanding the voltages involved.

Components:

Deflecting Yoke.	RCA Type No. 201D11
Hor. Deflection Output Transformer:	
For use with 6AS7-G booster scanning tube and separate high-voltage supply . . .	RCA Type No. 204T1
For use with single high-voltage tripler supply employing 3 1B3-GT/8016's. . .	RCA Type No. 211T2
Ver. Deflection Output Transformer . . .	RCA Type No. 204T2

* Brilliance and definition decrease with decreasing anode voltages. In general, anode-No.2 voltage should not be less than 15000 volts.

** Subject variation of ± 40% when grid-No.1 voltage cutoff is desired at -70 volts.

OPERATING NOTES

Soft x-rays are produced when the 5WP11 is operated with an anode-No.2 voltage above approximately 20000 volts. These rays can constitute a health hazard unless the tube is adequately shielded. Relatively simple shielding should prove adequate, but the need for this precaution should be considered in equipment design.

Resolution of better then 700 lines at the center of the reproduced picture can be produced by the 5WP11. To utilize such resolution capability in the horizontal direction with the standard scanning rate of 525 lines, it is necessary to use a video amplifier having a band-width of at least 10 megacycles.

5WP11

5WP11

TRANSCRIBER KINESCOPE

The screen of the 5WP11 has highly actinic blue radiation, and is particularly effective for photography. The presistence of the radiation is sufficiently short to prevent "carry over" from one frame to the next. The persistence is dependent to some extent on the current density in the focused spot, and decreases with current density.

Operation of the 5WP11 results in gradual browning of the face. The rate of browning increases markedly with increase in anode-No.2 voltage, is proportional to beam current, and is inversely proportional to the scanned area. The browning is most noticeable during initial operation; thereafter, a gradual increase in the amount of browning will be observed during the life of the tube.

OUTLINE DIMENSIONS for the 5WP11 are the same as those for the 5WP15

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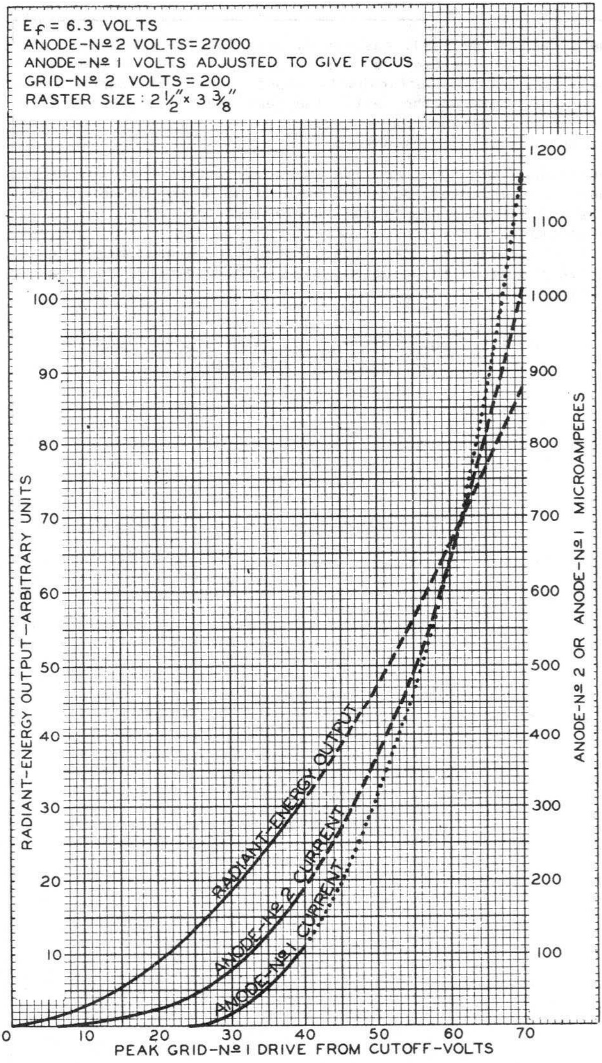
5WP11

AVERAGE CHARACTERISTICS



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5ZP16

5ZP16

FLYING-SPOT CATHODE-RAY TUBE

HIGH RESOLUTION CAPABILITY — ALUMINIZED SCREEN
ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

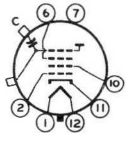
For use as scanner in high-quality flying-spot video-signal generators

DATA

General:

Heater, for Unipotential Cathode:
Voltage . . . . . . 6.3 . . . . . . ac or dc volts
Current . . . . . . 0.6 ± 10% . . . . . . amp
Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes . . . . . 8 μμf
Cathode to all other electrodes . . . . . 5 μμf
External conductive neck coating to ultor . . . . . 500 max. μμf / 100 min. μμf
Faceplate, Flat . . . . Clear Glass
Phosphor (For curves, see front of this Section) . . . . . P16 Aluminized
Fluorescence—
Visible radiation . . . . Violet
Invisible radiation . . . . Near Ultraviolet
Phosphorescence—
Persistence of visible radiation . . . . . . Very Short
Persistence of invisible radiation . . . . . . Very Short
Focusing Method . . . . Electrostatic
Deflection Method . . . . Magnetic
Deflection Angle (Approx.) . . . . 40°
Tube Dimensions:
Overall length . . . . 14-3/8" ± 3/8"
Greatest diameter of bulb . . . . 5" ± 1/8"
Minimum Useful Screen Diameter . . . . 4-1/4"
Weight (Approx.) . . . . 1-1/2 lbs
Operating Position . . . . Any
Cap . . . . . . Recessed Small Cavity (JETEC No.J1-21)
Socket . . . . . . *See Operating Considerations*
Base . . . . . . Small-Shell Duodecal 7-Pin (JETEC No.B7-51)
Basing Designation for BOTTOM VIEW 12C

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 6 – Grid No.3
Pin 7 – Internal Connection— Do Not Use
Pin 10 – Grid No.2
Pin 11 – Cathode



Pin 12 – Heater
Cap – Ultor (Grid No.4, Collector)
C – External Conductive Neck Coating

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	27000 max.	volts
GRID-No.3 VOLTAGE	7000 max.	volts
GRID-No.2 VOLTAGE	350 max.	volts

← Indicates a change.

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5ZP16

FLYING-SPOT CATHODE-RAY TUBE

GRID-No.1 VOLTAGE:		
Negative bias value	150 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	150 max.	volts
Heater positive with respect to cathode	150 max.	volts

→ **Equipment Design Ranges:**

For any ultor voltage (E_{c_4}) between 20000 and 27000 volts*

Grid-No.3 Voltage for focus with ultor current of 25 μa or less	20.5% to 26.5% of E_{c4}	volts
Grid-No.2 Voltage for visual extinction of undeflected focused spot when circuit design utilizes fixed grid-No.1 voltage	2 to 5 times E_{c_1}	volts
Grid-No.1 Voltage for visual extinction of undeflected focused spot when circuit design utilizes fixed grid-No.2 voltage	−20% to −50% of E_{c_2}	volts
Grid-No.2 Current	−15 to +15	μa

→ **Examples of Use of Design Ranges:**

For ultor voltage of	*20000*	*27000*	*volts*
Grid-No.3 Voltage for focus with ultor current as indicated	4100 to 5300	5500 to 7100	volts
Grid-No.2 Voltage for visual extinction of undeflected focused spot when circuit design utilizes fixed grid-No.1 voltage of −70 volts	140 to 350	140 to 350	volts
Grid-No.1 Voltage for visual extinction of undeflected focused spot when circuit design utilizes fixed grid-No.2 voltage of 200 volts	−40 to −100	−40 to −100	volts
Ultor Current	25	15	μa

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20,000 volts.

→ Indicates a change.

RCA

5ZP16

FLYING-SPOT CATHODE-RAY TUBE

OPERATING CONSIDERATIONS

X-Ray Warning. X-ray radiation is produced at the face of the 5ZP16 when it is operated at its normal ultor voltage. These rays can constitute a health hazard unless the tube is adequately shielded for X-ray radiation. Although relatively simple shielding should prove adequate, make sure that it provides the required protection against personal injury.

The *base pins* of the 5ZP16 fit the Duodecal 12-contact socket. The socket contacts corresponding to the vacant pin positions (pin positions 3,4,5,8, and 9) should be removed in order to provide the maximum insulation for the high-voltage pins 6 and 7. The socket should be made of high-grade, arc-resistant, insulating material and should preferably be designed with baffles.

Resolution of better than 1000 lines at the center of the reproduced picture can be produced by the 5ZP16 when it is operated with 27,000 volts on the ultor. At lower ultor voltages, the resolution capability decreases. To obtain high resolution in the horizontal direction, it is necessary to use a video amplifier having a bandwidth of about 20 megacycles.

The *ultraviolet output* of the 5ZP16 is a linear function of the ultor current. For any particular value of ultor current, the ultraviolet output is approximately 50 per cent higher when the 5ZP16 is operated with 27,000 volts on the ultor than when operated with 20,000 volts.

Underscanning over a protracted period should be avoided because an underscanned area of the screen will be burned and thus give diminished radiation when the raster is again scanned to full size and be slightly noticeable in the reproduced picture. Furthermore, it is inadvisable to permit a modulated stationary pattern to remain more than a few minutes on the face of the tube. If it remains for a longer time, the phosphor will be burned unevenly over the pattern area.

Never allow the beam to remain stationary, even momentarily, because the high peak energy in the beam will seriously damage the screen. Provision should be made to prevent such a possibility. Provision should also be made in equipment design to insure that the ultor voltage will drop as fast as the scanning current when the equipment is turned off; or to bias grid No. 1 to beam-current cutoff when the equipment is turned off.

← Indicates a change.

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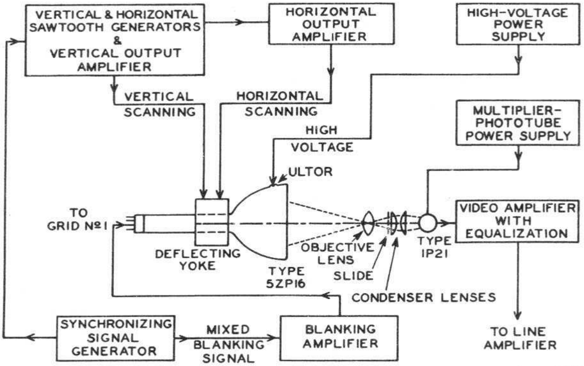
5ZP16

FLYING-SPOT CATHODE-RAY TUBE

BLOCK DIAGRAM OF FLYING-SPOT VIDEO-SIGNAL GENERATOR SYSTEM FOR SLIDE TRANSPARENCIES



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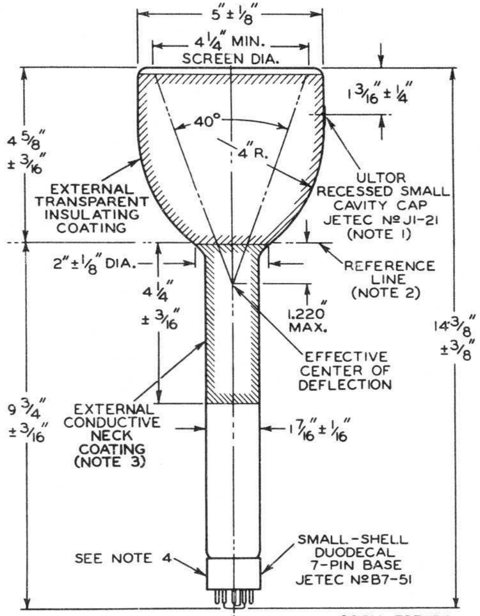
5ZP16

FLYING-SPOT CATHODE-RAY TUBE



92CM-7574R2

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION 3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. THE ULTOR TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION 3.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. 110 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY INTERSECTION ON PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

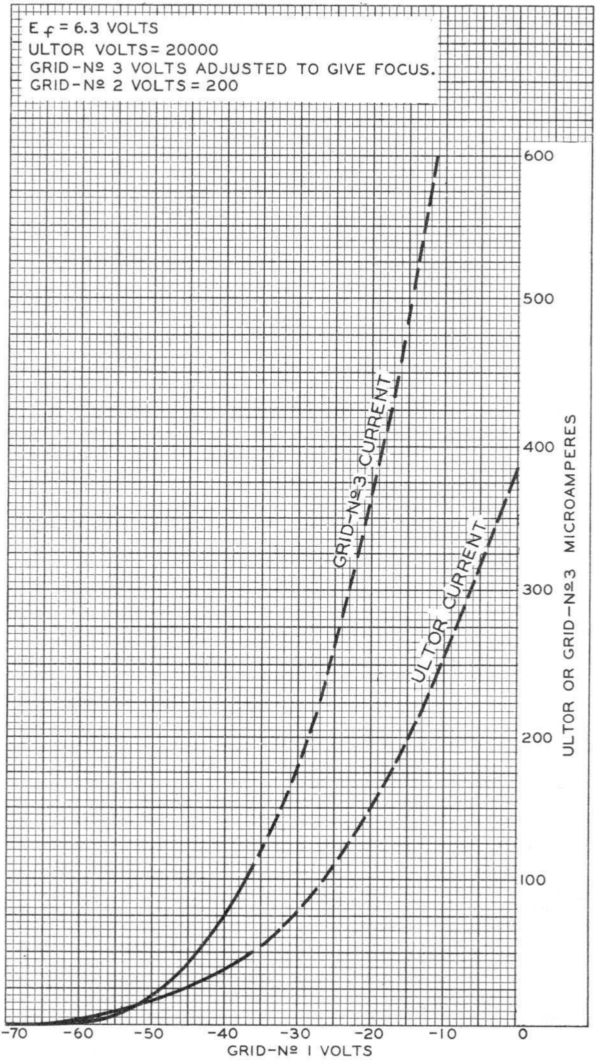
NOTE 3: EXTERNAL CONDUCTIVE NECK COATING MUST BE GROUNDED.

NOTE 4: ℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF THE BOTTOM OF THE BASE.

5ZP16

5ZP16

AVERAGE CHARACTERISTICS



5ZP16

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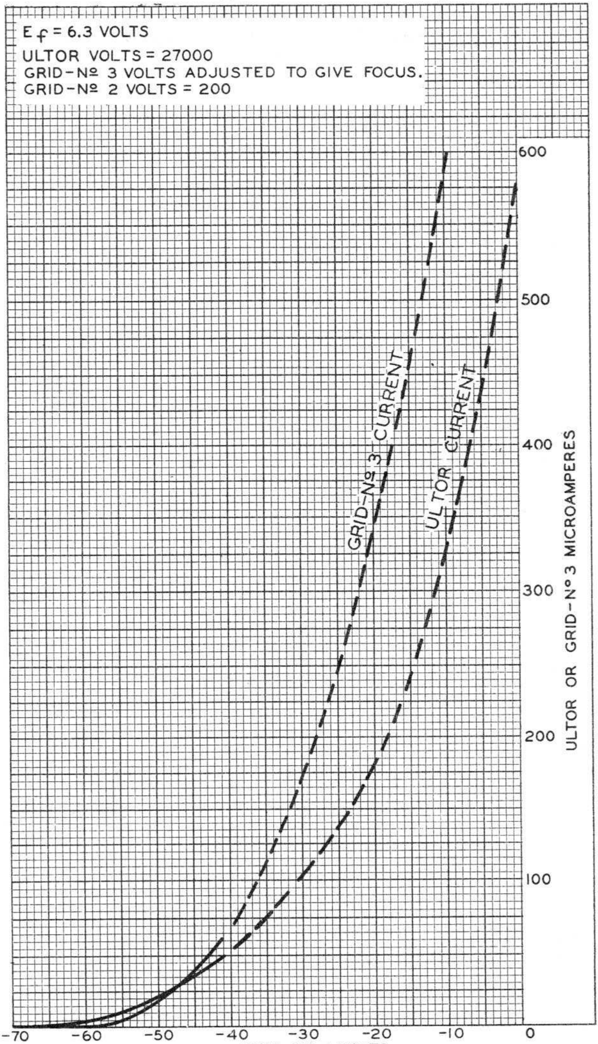
5ZP16

AVERAGE CHARACTERISTICS



ELECTRON TUBE DIVISION

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7576R1

7BP7-A
OSCILLOGRAPH TUBE

MAGNETIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
- Voltage. . . . . 6.3 . . . . ac or dc volts
- Current. . . . . 0.6 . . . . amp

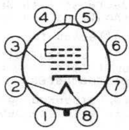
Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to All Other Electrodes. . . . . 8.5 $\mu\mu f$
- Grid No.2 to All Other Electrodes. . . . . 7 $\mu\mu f$
- Cathode to All Other Electrodes. . . . . 5 $\mu\mu f$

Phosphor (For Curves, see front of this Section) . . . No.7
- Fluorescence . . . . Blue
- Phosphorescence. . . . . Greenish-Yellow
- Persistence of Phosphorescence . . . . Long

Focusing Method. . . . . Magnetic
Deflection Method. . . . . Magnetic
Deflection Angle (Approx.) . . . . 53°
Overall Length . . . . 13-1/4" ± 3/8"
Greatest Diameter of Bulb. . . . . 7" ± 1/8"
Maximum Useful Screen Diameter . . . . 6"
Mounting Position. . . . . Any
Cap. . . . . Recessed Small Ball
Base . . . . Long Medium-Shell Octal 8-Pin

BOTTOM VIEW

Pin 1 – No Connection
Pin 2 – Heater
Pin 3 – Grid No.2
Pin 4 – No Connection
Pin 5 – Grid No.1



Pin 6 – No Connection
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode, Grid No.3

Maximum Ratings, ***Design-Center Values*:**

ANODE● VOLTAGE	8000 max.	volts
GRID-No.2 VOLTAGE.	700 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value.	125 max.	volts
Positive bias value□	0 max.	volts
Positive peak value.	2 max.	volts
PEAK GRID-No.1 DRIVE FROM CUTOFF	65 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	125 max.	volts

Typical Operation:

Anode Voltage*	4000	7000	volts
Grid-No.2 Voltage.	250	250	volts
Grid-No.1 Voltage Range° . .	-25 to -70	-25 to -70	volts
Focusing-Coil Current▲ . . .	75 to 102	99 to 135	ma
Spot Position.	#	-	

●, □, *, °, ▲, #: See next page

RCA

7BP7-A
OSCILLOGRAPH TUBE

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

Minimum Circuit Values:

When the output capacitor of the power supply is capable of storing more than 250 microcoulombs, and when the inherent regulation of the power supply permits the instantaneous short-circuit current to exceed 1 ampere, the effective resistance in circuit between indicated electrode and the output capacitor should be as follows:

Grid-No.1-Circuit Resistance	150 min.	ohms
Grid-No.2-Circuit Resistance	820 min.	ohms
Anode-Circuit Resistance	9100 min.	ohms

The resistors used should be capable of withstanding the voltages involved.

Components:

RCA Focusing Coil.	RCA Type No. 202D1

● Anode and grid No.3, which are connected together within tube, are referred to herein as anode.

□ At or near this rating, the effective resistance of the anode supply should be adequate to limit the anode input power to 6 watts.

* Brilliance and definition decrease with decreasing anode voltage. In general, the anode voltage should not be less than 4000 volts.

○ For visual extinction of undeflected focused spot.

▲ For JETEC Focusing Coil No.106, or equivalent, with center line of air gap approximately 2-3/4" from reference line (see Outline Drawing), and total anode current of 200 microamperes.

The center of the undeflected, unfocused spot will fall within a circle having 12 mm radius concentric with the center of the tube face.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

7MP7

OSCILLOGRAPH TUBE

MAGNETIC FOCUS MAGNETIC DEFLECTION

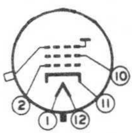
DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to All Other Electrodes	6	$\mu\mu$f
Cathode to All Other Electrodes	5	$\mu\mu$f
Phosphor (For Curves, see front of this Section)		P7
Fluorescence		Blue
Phosphorescence		Greenish-Yellow
Persistence		Long
Focusing Method		Magnetic
Deflection Method		Magnetic
Deflection Angle (Approx.)		50°
Overall Length		12-3/4" ± 3/8"
Greatest Diameter of Bulb		7-3/16" ± 1/8"
Minimum Useful Screen Diameter		6"
Mounting Position		Any
Cap	Recessed Small Cavity	(JETEC No.J1-21)
Base	Small-Shell Duodecal 5-Pin	(JETEC No.B5-57)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 10 - Grid No.2



Pin 11 - Cathode
Pin 12 - Heater
Cap - Grid No.3, Collector

Maximum Ratings, ***Design-Center Values:***

Ultor• VOLTAGE	8000 max.	volts
GRID-No.2 VOLTAGE:		
Positive Value (DC or Peak AC)	700 max.	volts
Negative Value (DC or Peak AC)	180 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	180 max.	volts
Positive bias value#	0 max.	volts
Positive peak value	2 max.	volts
PEAK GRID-No.1 DRIVE FROM CUTOFF	65 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	125 max.	volts
Heater positive with respect to cathode.	125 max.	volts

• In the 7M-types, grid No.3 which has the ultor function, and collector are connected together within the tube and are conveniently referred to collectively as "ultor". The "ultor" in a cathode-ray tube is the electrode, or the electrode in combination with one or more additional electrodes connected within the tube to it, to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.

RCA

7MP7
OSCILLOGRAPH TUBE

Typical Operation:

Ultor Voltage*	4000	7000	volts
Grid-No. 2 Voltage	250	250	volts
Grid-No. 1 Voltage °	-27 to -63	-27 to -63	volts
→ Grid-No. 2 Current	-15 to +15	-15 to +15	μamp
→ Focusing-Coil Current (DC Approx.)** . . .	64 ± 15%	85 ± 15%	ma
→ Spot Position	–	##	

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance. . . . . . 1.5 max. megohms

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 4000 volts.

° For visual extinction of undeflected, focused spot.

** For specimen focusing coil similar to JETEC Focusing Coil No. 109 positioned with air gap toward faceplate and center line of air gap 2-3/4" from Reference Line (see Outline Drawing) and ultor current of 200 microamperes.

The center of the undeflected, unfocused spot will fall within a circle having 12-mm radius concentric with the center of the tube face.

→ Indicates a change

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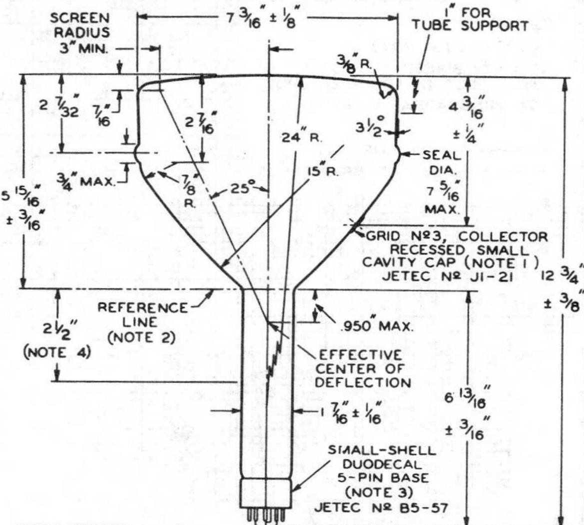
7MP7
OSCILLOGRAPH TUBE



92CM-7438R3

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND VACANT PIN POSITION No.3 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND BULB TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. BULB TERMINAL IS ON SAME SIDE AS VACANT PIN POSITION No.3.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE REFERENCE-LINE GAUGE (JETEC No. 112) 1.500 + .003" - .000" I. D. AND 2" LONG WILL REST ON BULB CONE.

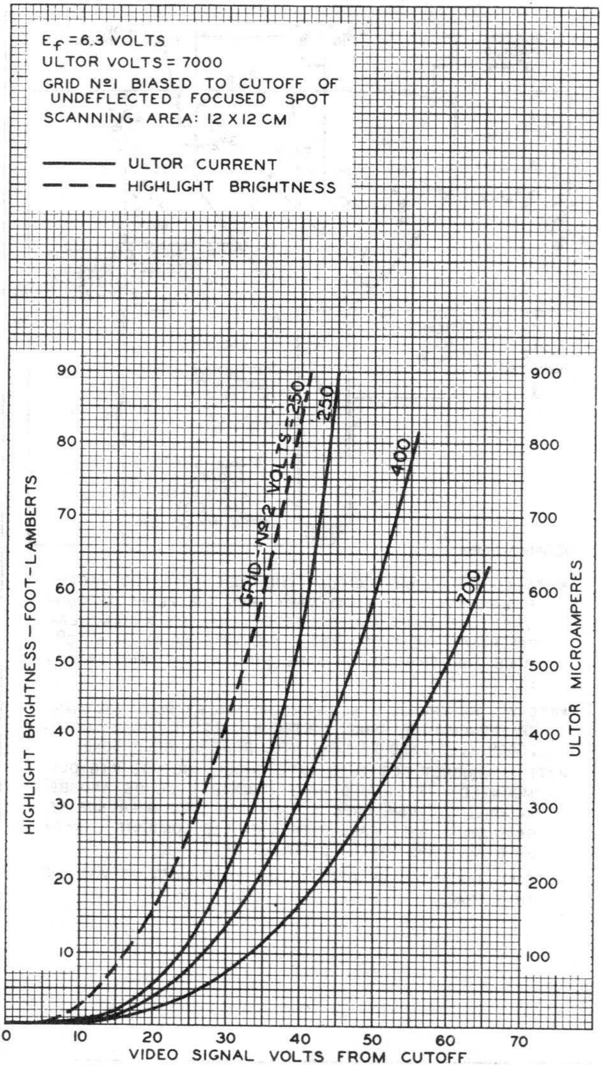
NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED: IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF 1-7/8".

NOTE 4: LOCATION OF DEFLECTING YOKE MUST BE WITHIN THIS SPACE.

RCA

7MP7

AVERAGE GRID-DRIVE CHARACTERISTICS



JULY 18, 1951

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7450R1

Projection Kinescopes

FORCED-AIR COOLED
ELECTROSTATIC FOCUS

MAGNETIC DEFLECTION
20 FT. x 15 FT. PROJECTED PICTURES

For Black-and-White Projection Systems in Theater and Closed-Circuit Television Applications

ELECTRICAL

Heater, for Unipotential Cathode		
Voltage (AC or DC)	6.6 ± 5%	V
Current	0.62	A
Focusing Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Angle (Approx.)	35°	
Direct Interelectrode Capacitances (Approx.)		
Grid No.1 to all other electrodes	12	pF
Cathode to all other electrodes	6	pF

OPTICAL

Faceplate	Spherical, Non-Browning Glass	
Quality Rectangle of Faceplate (See Dimensional Outline)	5 x 3-3/4	in
Refractive Index of Faceplate	1.469	
Projection-Throw Distance for 20 ft x 15 ft Picture	60	feet
Phosphor	Aluminized P4-Silicate-Sulfide Type	
Luminescence	White	
Persistence	Medium	

MECHANICAL

Air Flow to Face . . . . . 40 cfm

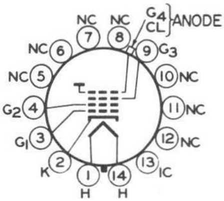
The specified air flow should be delivered perpendicularly from a nozzle having a diameter of about 2 inches onto the face of the tube while it is in operation. See REFLECTIVE OPTICAL SYSTEM. In a typical system with air filter, the total system static pressure is approximately 0.25 inch of water. The cooling air must not contain water, dust, or other foreign matter. The air-cooling system should be electrically interconnected with the anode power supply to prevent operation of the tube without cooling.

Cooling of the tube by a tangential flow of air across its face is not recommended because the temperature gradient produced across the face may result in immediate or delayed cracking of the face.

Operating Position	Any	
Tube Dimensions		
Overall Length	19-1/2 ± 5/8	in
Greatest Diameter of Bulb (Excluding side cap or cable)	7 ± 3/16	in
Cap	Medium (JEDEC No.C1-5)	
Base	Plastic Filled, Small-Shell Diheptal 14-Pin, (JEDEC No.B14-15)	

TERMINAL DIAGRAM (Bottom View)

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - Grid No.2
Pin 5 - No Connection
Pin 6 - No Connection
Pin 7 - No Connection
Pin 8 - No Connection
Pin 9 - Grid No.3
Pin 10 - No Connection
Pin 11 - No Connection
Pin 12 - No Connection
Pin 13 - Internal Connection—Do Not Use
Pin 14 - Heater
Cap - Anode (Grid No.4, Collector)



14N

Note: Socket contacts for Pins No.5, 6, 7, 8, 10, 11, 12, and 13 should be removed so that maximum insulation is provided for Pin No.9.

CATHODE-DRIVE[a] SERVICE

Absolute-Maximum Ratings

Anode-to-Grid-No.1 Voltage[b]	80000	V
Grid-No.3-to-Grid-No.1 Voltage	20000	V
Grid-No.2-to-Grid-No.1 Voltage	1300	V
Cathode-to-Grid-No.1 Voltage		
Positive bias value	250	V
Negative bias value	0	V
Peak negative value	2	V
Average Anode Current[b]	2	mA
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410	V
After equipment warm-up period	150	V
Heater positive with respect to cathode	150	V

→ ### Equipment Design Ranges

With any anode-to-grid-No.1 voltage (E_{c4g1}) between 70000[c] and 80000 volts and grid-No.2-to-grid-No.1 voltage (E_{c2g1}) between 400 and 850 volts

Grid-No.3-to-Grid-No.1 Voltage for Focus	20% to 22.6% of E_{c4g1}	V
Grid-No.2-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster when Circuit Design Utilizes Fixed Cathode-to-Grid-No.1 Voltage (E_{kg1})	2.58 to 3.87 times E_{kg1} plus E_{kg1} voltage	V
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level) to White-Level Value	Same values as fixed cathode-to-grid-No.1 voltage except video drive is a negative voltage	

→ Indicates a change.

Grid-No.3 Current	See footnote[d]	
Grid-No.2 Current	-15 to +15	µA

Examples of Use of Design Ranges

For anode-to-grid-No.1 voltage of	*75000*	*V*
Grid-No.3-to-Grid-No.1 Voltage for Focus	15000 to 17000	V
Grid-No.2-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster when Circuit Design Utilizes Fixed Cathode-to-Grid-No.1 Voltage (E_{kg1}) of 125 V	447 to 609	V
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level) to White Level Value	-125	V

Maximum Circuit Value

Grid No.1 Circuit Resistance	1.5	megohms

GRID-DRIVE[e] SERVICE

Absolute-Maximum Ratings

Anode-to-Cathode Voltage[b]	80000	V
Grid-No.3-to-Cathode Voltage	20000	V
Grid-No.2-to-Cathode Voltage	1050	V ←
Grid-No.1-to-Cathode Voltage		
Negative bias value	250	V
Positive bias value	0	V
Peak positive value	2	V
Average Anode Current[b]	2	mA
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410	V
After equipment warm-up period	150	V
Heater positive with respect to cathode	150	V

Equipment Design Ranges

With any anode voltage (E_{c4k}) between 70000[c] and 80000 volts and grid-No.2 voltage (E_{c2k}) between 400 and 600 volts

Grid-No.3 Voltage for Focus	20% to 22.6% of E_{c4k}	V
Grid-No.2 Voltage for Visual Extinction of Focused Raster when Circuit Design Utilizes Fixed Grid-No.1 Voltage (E_{c1k})	2.58 to 3.87 times E_{c1k}	V
Grid-No.1 Video Drive from Raster Cutoff (Black Level) to White-Level Value	Same value as fixed grid-No.1 voltage except video drive is a positive voltage	
Grid-No.3 Current	See footnote[d] ←	
Grid-No.2 Current	-15 to +15	µA

← Indicates a change.

Examples of Use of Design Ranges

For anode voltage	*75000*	*V*
Grid-No.3 Voltage for Focus.	15000 to 17000	V
Grid-No.2 Voltage for Visual Extinction of Focused Raster when Circuit Design Utilizes Fixed Grid-No.1 Voltage (E_{c1k}) of -155 V.	400 to 600	V
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level) to White-Level Value	155	V

Maximum Circuit Value

Grid-No.1 Circuit Resistance	1.5	megohms

[a] Cathode drive is the operating condition in which the video signal varies the cathode potential.

[b] The product of anode-to-grid-No.1 voltage, or anode-to-cathode voltage, and average anode current should be limited to 160 watts.

[c] Brilliance and definition decrease with decreasing anode-to-grid-No.1 voltage or anode-to-cathode voltage. In general, the anode-to-grid-No.1 voltage or the anode-to-cathode voltage should not be less than 70000 volts.

[d] Grid-No.3 current will be approximately 10% to 5%, or less, of anode current. However, a grid-No.3 leakage current of up to 15 μA may be present.

[e] Grid drive is the operating condition in which the video signal varies the grid-No.1 potential.

GENERAL CONSIDERATIONS

The high voltages at which this type is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

In the use of this tube, it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. Therefore, before any part of the circuit or the tube is touched, the power-supply switch should be turned off, both terminals of high-voltage capacitors should be grounded, and the terminals of the high-voltage power supply should be grounded. After these steps have been taken and before touching the tube, discharge the anode terminal, the surface of the faceplate, and the coated surface of the cone by use of a suitable wand which is connected to ground. It is to be noted that the entire surface of the cone and of the faceplate will not be discharged by touching the wand to a single point on either surface, because the surfaces have high resistance. Therefore, to discharge each surface, it will be necessary to sweep over the entire surface with the wand.

The *fluorescent screen,* utilizing phosphor No.4 of the silicate-sulfide type, is aluminized. The white fluorescence of the screen has a color temperature of approximately 6300° K.

The spectral energy emission characteristic is shown in *Spectral-Energy Emission Characteristic of Phosphor No. 4.* The persistence of the phosphorescence is such that its brightness does not exceed 7 per cent of the peak value in 33 milliseconds after excitation is removed.

Darkening of face occurs during normal operation of the tubes with resulting decrease in the light transmitted by the face. The rate of darkening increases rapidly with increase in anode voltage, is proportional to the beam current, and is inversely proportional to the scanned area. The darkening develops rapidly during initial operation; thereafter, a gradual increase in the amount of darkening will be observed during the life of the tube.

The *anode connection* is made to the medium cap on the side of the bulb. The anode connector should have a ball-type corona shield with a diameter of about 1-1/2 inches in order to prevent corona.

OPERATING HINTS

1. Never apply power input to the screen suddenly because immediate or delayed cracking of the face may result. Always increase or decrease the anode current gradually.

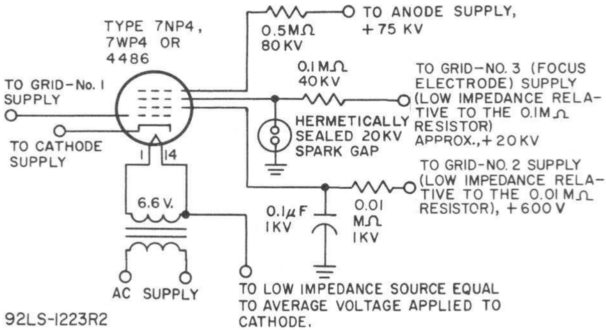
2. Never exceed the rated maximum anode current of 2 milliamperes.

3. Never overscan the screen because the beam will strike the neck and liberate occluded gas which may cause internal arcing.

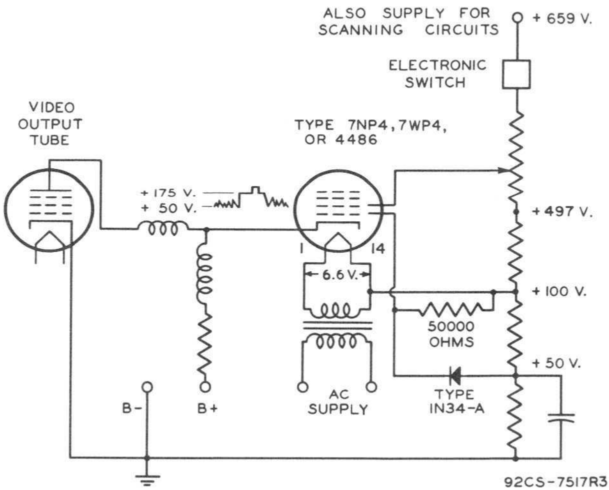
4. Never fail to operate this tube in its equipment at intervals of about 2 months to keep the tube in condition.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

SCHEMATIC DIAGRAM OF CIRCUIT SHOWING PROTECTIVE ELEMENTS EMPLOYED TO PREVENT TUBE DAMAGE



SCHEMATIC DIAGRAM SHOWING PRINCIPLES OF CATHODE DRIVE AS WELL AS METHOD FOR AUTOMATICALLY PROTECTING THE TUBE AGAINST OVERDRIVE AND SCANNING FAILURE



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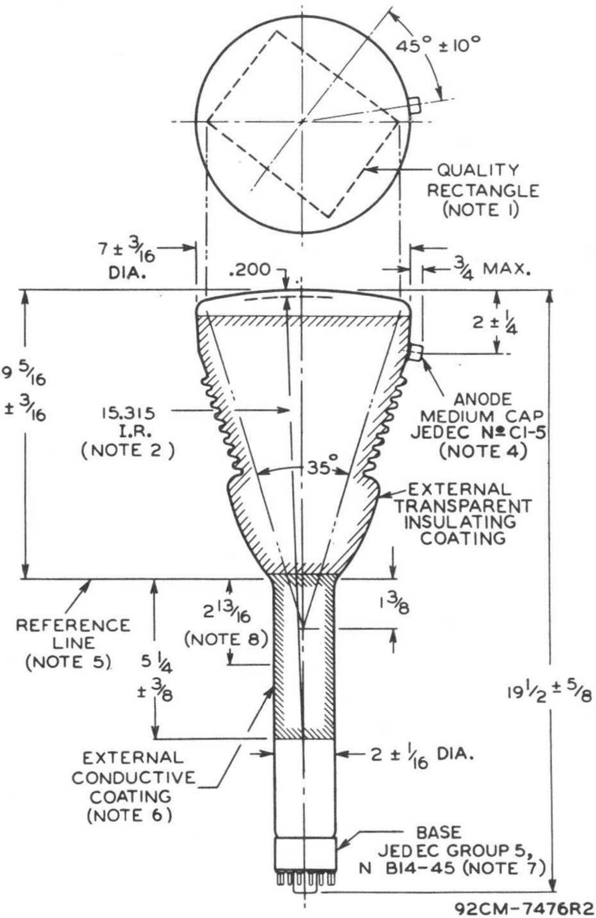
DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

See Notes on next page.

Note 1: When viewed from the face of the tube, the minor axis of the 5 x 3-3/4 inch quality rectangle is located 45° ± 10° in a counter-clockwise direction from a plane through the anode terminal and the tube axis.

Note 2: Inside surface of faceplate within the quality rectangle may vary ± 0.006" from the spherical surface having a 15.315 inch radius.

Note 3: Inside surface of faceplate within the quality rectangle may vary ± 0.006 inch from the spherical surface having a 20.3 inch radius (Type 7WP4 only).

Note 4: The plane through Base Pin No.9 and the tube axis may vary from the plane through the anode terminal and the tube axis by an angular tolerance (measured about the tube axis) of ± 10°. The anode terminal is on same side as Pin No.9.

Note 5: Reference line is determined by position where gauge 2.100 ± 0.001 inch I.D. and 3 inches long will rest on bulb cone.

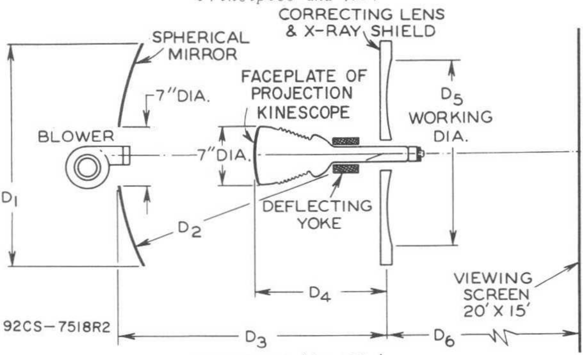
Note 6: External conductive coating must be grounded.

Note 7: Socket for this base should not be rigidly mounted, it should have flexible leads and be allowed to move freely. Socket contacts for Pins 5, 6, 7, 8, 10, 11, 12, and 13 should be removed in order to provide maximum insulation for Pin No.9.

Note 8: Effective deflecting field must be within this space.

REFLECTIVE OPTICAL SYSTEM

Arrangement of Typical Optical System and Air-Cooling System for Theater-Television Projector Using Reflective Optical Principles and 7NP7



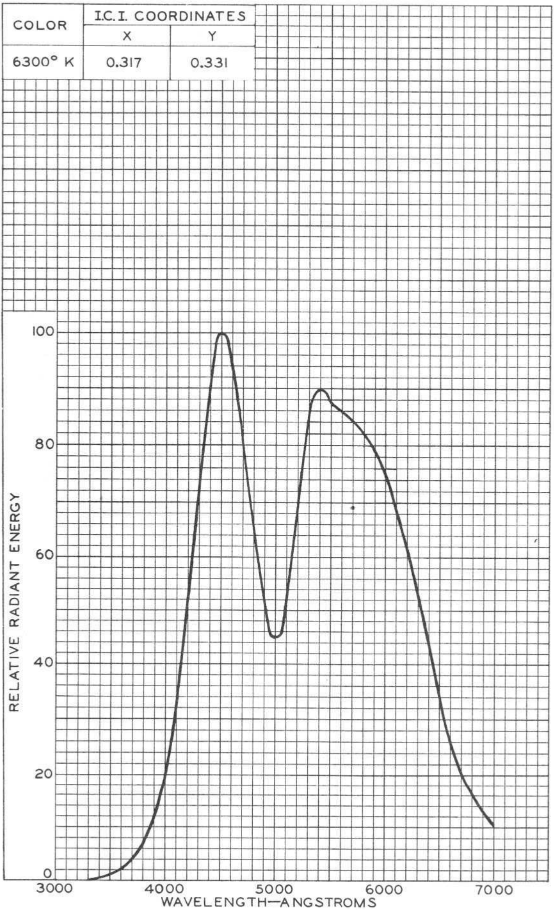
DIMENSIONS (APPROX.)

D_1	26 inch Diameter	D_4	15 inches
D_2	30 inch Radius	D_5	21.5 inches
D_3	30 inches	D_6	60 feet

Spectral-Energy Emission Characteristic of Phosphor No.6

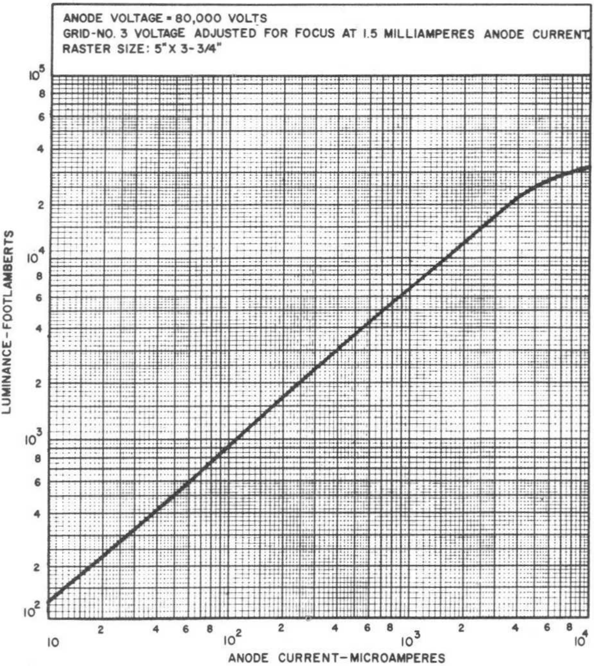
SILICATE-SULFIDE TYPE

COLOR	I.C.I. COORDINATES	
	X	Y
6300° K	0.317	0.331



92CM-7458R1

Typical Luminance Characteristic



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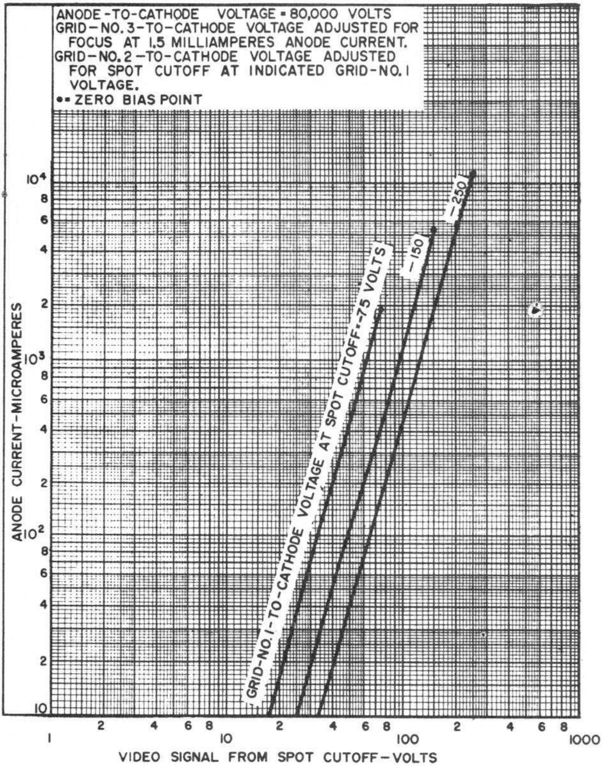
Typical Drive Characteristics

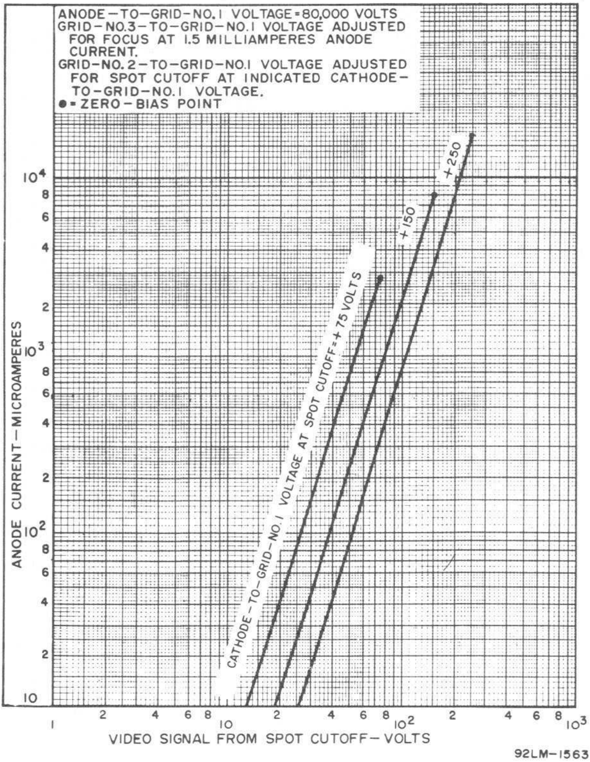
GRID-DRIVE SERVICE



92LM-1564

Typical Drive Characteristics

CATHODE-DRIVE SERVICE



7TP4

7TP4
MONITOR KINESCOPE

METAL-BACKED SCREEN

ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

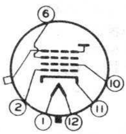
DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to All Other Electrodes	6	$\mu\mu$f
Cathode to All Other Electrodes	5	$\mu\mu$f
Faceplate		Clear Glass
Phosphor, Metal-Backed°		P4—Sulfide Type
Fluorescence and Phosphorescence		White
Persistence of Phosphorescence		Short
Focusing Method		Electrostatic
Deflection Method		Magnetic
Deflection Angle (Approx.)		50°
Overall Length		13-1/8" ± 3/8"
Greatest Diameter of Bulb		7-3/16" ± 1/8"
Minumum Useful Screen Diameter		6"
Picture Size (Within minimum-useful-screen area)		5-3/8" x 4"
Cap		Recessed Small Cavity (JETEC No. J1-21)
Base		Small-Shell Duodecal 6-Pin (JETEC No. B6-63)

BOTTOM VIEW

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.3
Pin 10 - Grid No.2
Pin 11 - Cathode



Pin 12 - Heater
Cap - Grid No.4, Collector (Ultor)

Maximum Ratings, ***Design-Center Values:***

ULTOR• VOLTAGE	12000 max.	volts
GRID-No.3 VOLTAGE	2000 max.	volts
GRID-No.2 VOLTAGE	410 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	125 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts

° For curves, see front of this Section.

• In the 7TP4, grid No.4 which has the ultor function, and collector are connected together within the tube and are conveniently referred to collectively as "ultor". The "ultor" in a cathode-ray tube is the electrode, or the electrode in combination with one or more additional electrodes connected within the tube to it, to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

7TP4

7TP4
MONITOR KINESCOPE

PEAK HEATER-CATHODE VOLTAGE:

Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period. . .	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_u) between 10000 and 12000 volts and grid-No.2 voltage (E_{c2}) between 150 and 410 volts*

Grid-No.3 Voltage for Focus with Ultor Current of 100 μamp. . .	11.6% to 15.8% of E_u	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot.	11% to 25.7% of E_{c2}	volts
Grid-No.3 Current**.	See Curves	
Grid-No.2 Current.	-15 to +15	μamp
Field Strength of Adjustable Centering Magnet.	0 to 8	gausses

Examples of Use of Design Ranges:

For ultor voltage of	*10000*	*volts*
and grid-No.2 voltage of	*200*	*volts*
Grid-No.3 Voltage for Focus with Ultor Current of 100 μamp . .	1160 to 1580	volts
Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-22 to -52	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms

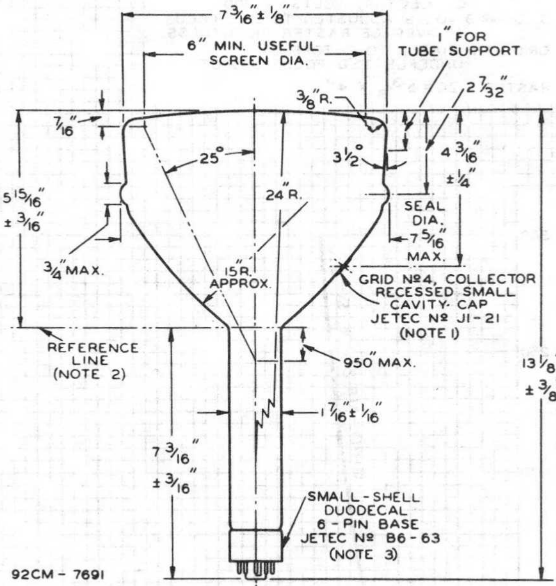
* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 10000 volts.

** Grid-No.3 current increases as the ultor voltage is decreased.

7TP4

7TP4

MONITOR KINESCOPE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN No.6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND BULB TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS OF ± 10°. BULB TERMINAL IS ON SAME SIDE AS PIN No.6.

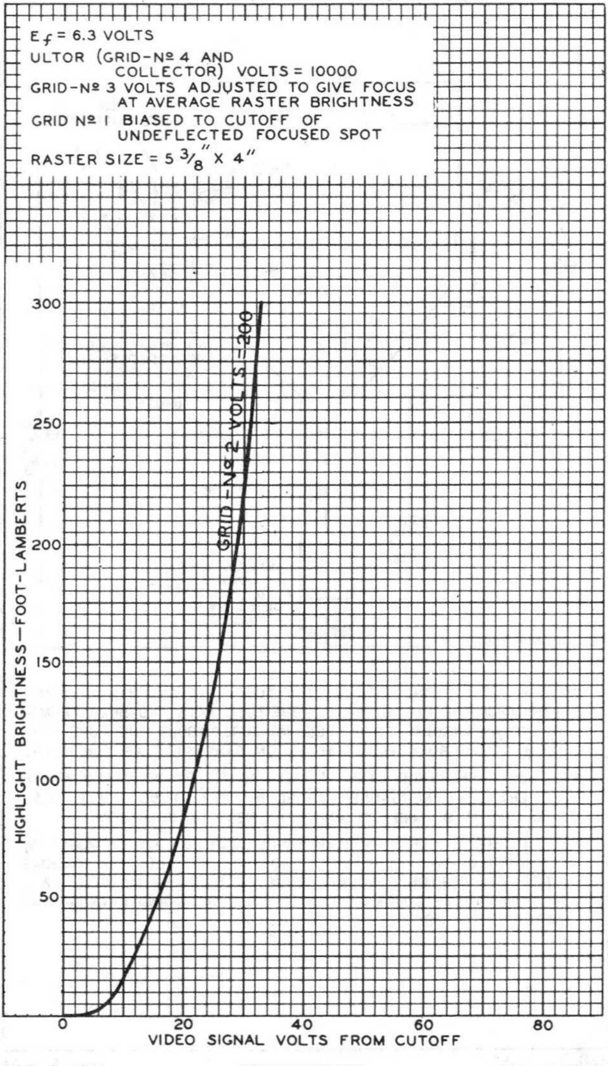
NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE REFERENCE-LINE GAUGE (JETEC No. 112) 1.500" + 0.003" - 0.000" I.D. AND 2" LONG WILL REST ON BULB CONE.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF 1-7/8".

7TP4

7TP4

AVERAGE GRID-DRIVE CHARACTERISTICS

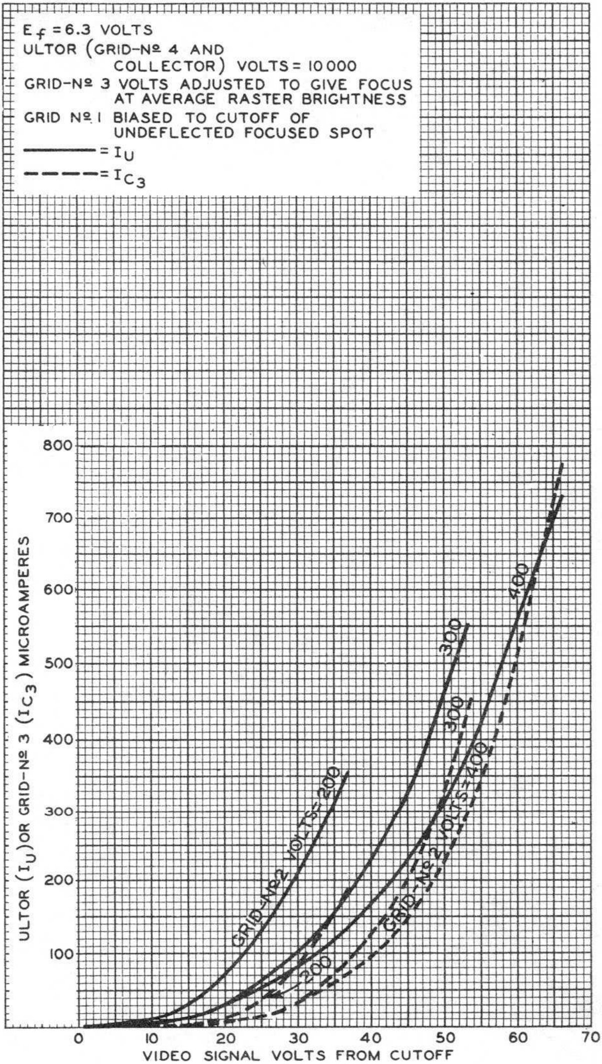


TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

7TP4

AVERAGE GRID-DRIVE CHARACTERISTICS



7VPI

OSCILLOGRAPH TUBE

ELECTROSTATIC FOCUS — ELECTROSTATIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . 6.3 . . . . . . ac or dc volts
- Current . . . . 0.6 . . . . amp

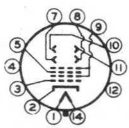
Direct Interelectrode Capacitances (Approx.):
- Grid No.1 to All Other Electrodes . . . . . 6 . . $\mu\mu$f
- DJ_1 to DJ_2 . . . . 3 . . $\mu\mu$f
- DJ_3 to DJ_4 . . . . 2 . . $\mu\mu$f
- DJ_1 to All Other Electrodes . . . . 9 . . $\mu\mu$f
- DJ_2 to All Other Electrodes . . . . 9 . . $\mu\mu$f
- DJ_3 to All Other Electrodes . . . . 7 . . $\mu\mu$f
- DJ_4 to All Other Electrodes . . . . 7 . . $\mu\mu$f

Faceplate . . . . Clear Glass
Phosphor (For Curves, see front of this Section) . . . P1
- Fluorescence and Phosphorescence . . . . Green
- Persistence of Phosphorescence . . . . Medium

Focusing Method . . . . Electrostatic
Deflection Method . . . . Electrostatic
Overall Length . . . . 14-1/2" ± 3/8"
Greatest Diameter of Bulb . . . . 7" ± 1/8"
Minimum Useful Screen Diameter . . . . 6"
Mounting Position . . . . Any
Bulb J56H
Base . . . . Medium-Shell Diheptal 12-Pin (JETEC No.B12-37)

BOTTOM VIEW

- Pin 1 – Heater
- Pin 2 – Cathode
- Pin 3 – Grid No.1
- Pin 4 – No Connection
- Pin 5 – Grid No.3
- Pin 7 – Deflecting Electrode DJ_3
- Pin 8 – Deflecting Electrode DJ_4



- Pin 9 – Ultor● (Grid No.2, Grid No.4, Collector)
- Pin 10 – Deflecting Elect. DJ_2
- Pin 11 – Deflecting Elect. DJ_1
- Pin 12 – Internal Connection– Do Not Use
- Pin 14 – Heater

DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 5. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 2.

The plane through the tube axis and pin 5 may vary from the trace produced by DJ_1 and DJ_2 by an angular tolerance (measured about the tube axis) of ±10°. Angle between $DJ_1 - DJ_2$ trace and $DJ_3 - DJ_4$ trace is 90° ± 3°.

●: See next page.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7VP1

RCA

7VP1

OSCILLOGRAPH TUBE

Maximum Ratings, ***Design-Center Values:***

ULTOR• VOLTAGE	4000 max.	volts
GRID-No.3 VOLTAGE	2000 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	200 max.	volts
Positive bias value*	0 max.	volts
Positive peak value	2 max.	volts
PEAK VOLTAGE BETWEEN ULTOR AND ANY DEFLECTING ELECTRODE	750 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	125 max.	volts

Equipment Design Ranges:

For any ultor voltage (E_u) between 1000# and 4000 volts

Grid-No.3 Voltage for Focus	27% to 40% of E_u	volts
Maximum Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	2.8% of E_u	volts
Grid-No.3 Current	-15 to +10	μamp
Deflection Factors:		
DJ_1 & DJ_2	31 to 41	v dc/in./kv of E_u
DJ_3 & DJ_4	25 to 34	v dc/in./kv of E_u
Spot Position	##	

Examples of Use of Design Ranges:

For ultor voltage of	*1500*	*3000*	*volts*
Grid-No.3 Voltage for Focus	400 to 600	800 to 1200	volts
Maximum Grid-No.1 Voltage for Visual Extinction of Undeflected Focused Spot	-42	-84	volts
Deflection Factors:			
DJ_1 & DJ_2	47 to 62	93 to 123	volts dc/in.
DJ_3 & DJ_4	38 to 51	75 to 102	volts dc/in.

Maximum Circuit Values:

Grid No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit°	5.0 max.	megohms

• In the 7VP1, grid No.4 which has the ultor function, grid No.2, and collector are connected together within the tube and are conveniently referred to collectively as "ultor." The "ultor" in a cathode-ray tube is the electrode, or the electrode in combination with one or more additional electrodes connected within the tube to it, to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection.

* At or near this rating, the effective resistance of the ultor supply should be adequate to limit the ultor input power to 6 watts.

#,##,°: See next page.

RCA

7VP1

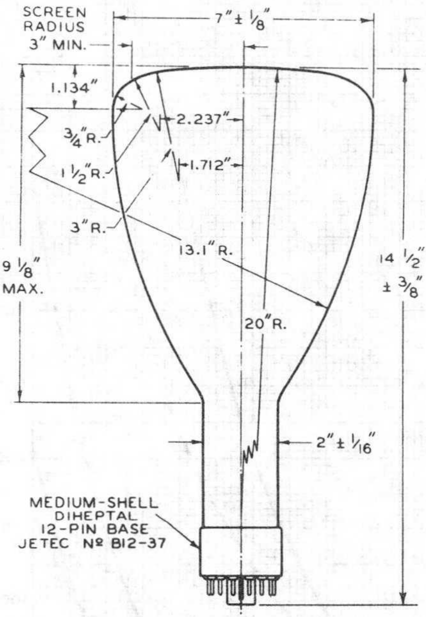
OSCILLOGRAPH TUBE

\# Brilliance and definition decrease with decreasing ultor voltage. A value as low as 1000 volts is recommended only for low-velocity deflection and low ambient-light levels.

\#\# With ultor voltage of 1500 volts, the center of the undeflected focused spot will fall within a circle having a 10-mm radius concentric with the center of the tube face.

o It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

The 7VP1 can be used as a direct replacement for the 7JP1 in all equipment where the high-voltage supply does not provide more than 4000 volts.



92CM-6667R1

℄ OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

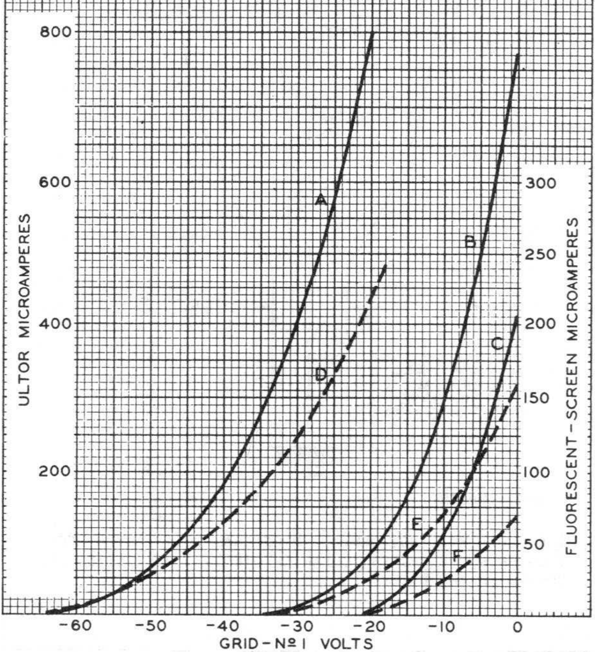
RCA

7VP1

AVERAGE CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-No. 3 VOLTS ADJUSTED FOR FOCUS

CURVE	CURRENT	ULTOR VOLTS
A	ULTOR	3000
B	ULTOR	1500
C	ULTOR	1000
D	FLUORESCENT SCREEN	3000
E	FLUORESCENT SCREEN	1500
F	FLUORESCENT SCREEN	1000



Oscillograph Tube

ELECTROSTATIC FOCUS
ELECTROSTATIC DEFLECTION

MEDIUM-SHORT-PERSISTENCE SCREEN
HIGH DEFLECTION SENSITIVITY

The 7VP31 is the same as the 7VP1 except for the following items:

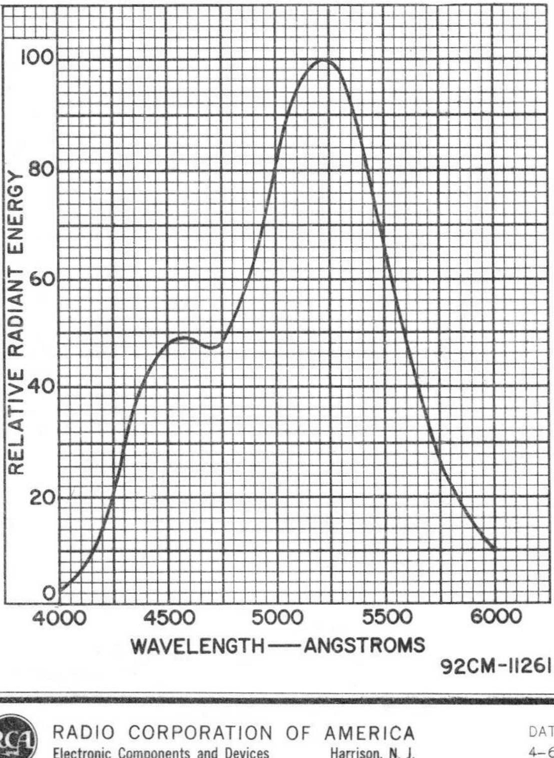
General:

Phosphor (See accompanying curves)	P31
Fluorescence	Green
Phosphorescence.	Green
Persistence[a] . . . . Medium Short[b] (Approx. 38 μsec)	

[a] Time for initial brightness to decay to 10% point.

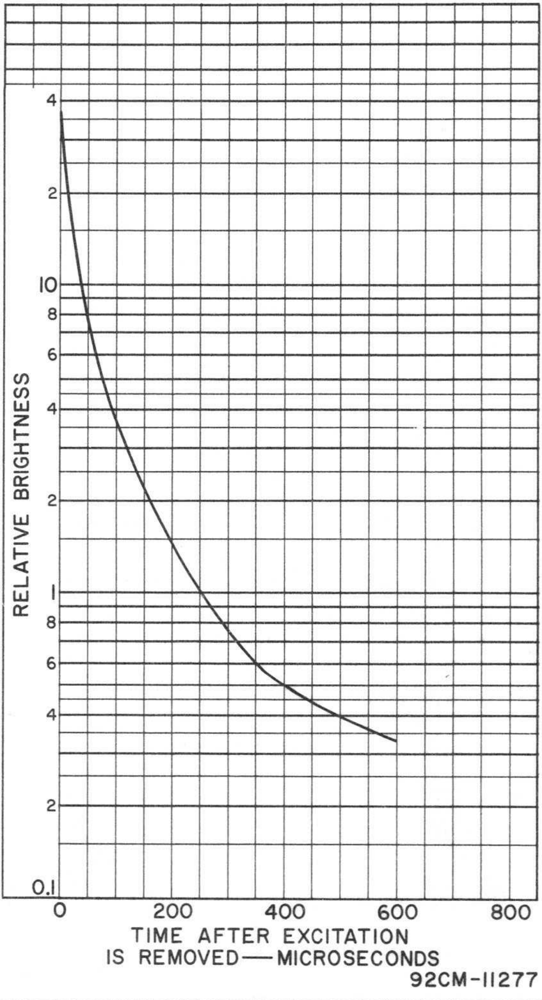
[b] Phosphorescence may have a useful brightness for over a minute under conditions of adequate excitation and low-ambient illumination.

SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR P31



92CM-11261

PERSISTENCE CHARACTERISTIC
OF PHOSPHOR P31



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

Projection Kinescope

FORCED-AIR COOLED
ELECTROSTATIC FOCUS

MAGNETIC DEFLECTION
20 FT. x 15 FT. PROJECTED PICTURES

For Black-and-White Projection Systems in Theater and Closed-Circuit Television Applications

The 7WP4 *is the same as the* 7NP4 *except for the following items:*

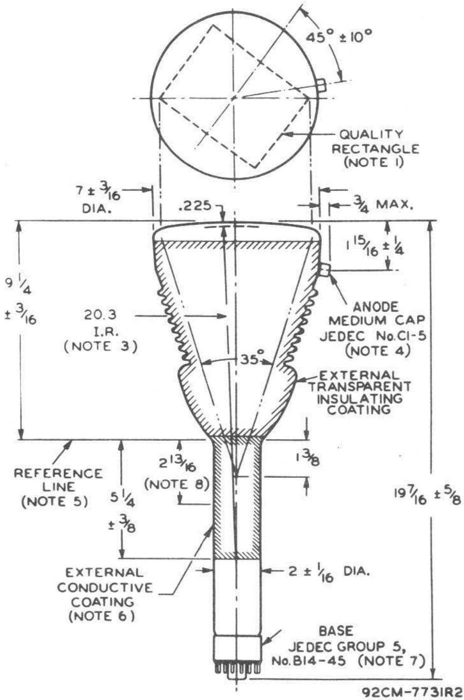
OPTICAL

Projection-Throw Distance for 20 ft x 15 ft Picture. . .80 ft

MECHANICAL

Overall Length . . . . 19-7/16 ± 5/8 in

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

See notes on other side.

Note 1: When viewed from the face of the tube, the minor axis of the 5 inch x 3-3/4 inch quality rectangle is located $45^{o} \pm 10^{o}$ in a counter-clockwise direction from a plane through the anode terminal and the tube axis.

Note 2: Inside surface of faceplate within the quality rectangle may vary ±0.006 inch from the spherical surface having a 15.315 inch radius (Type 7NP4 only).

Note 3: Inside surface of faceplate within the quality rectangle may vary ± 0.006 inch from the spherical surface having a 20.3 inch radius.

Note 4: The plane through base Pin No.9 and the tube axis may vary from the plane through the anode terminal and the tube axis by an angular tolerance (measured about the tube axis) of $\pm 70^{o}$. The anode terminal is on same side as Pin No.9.

Note 5: Reference line is determined by position where gauge 2.100 inch ± 0.001 inch I.D. and 3 inch long will rest on bulb cone.

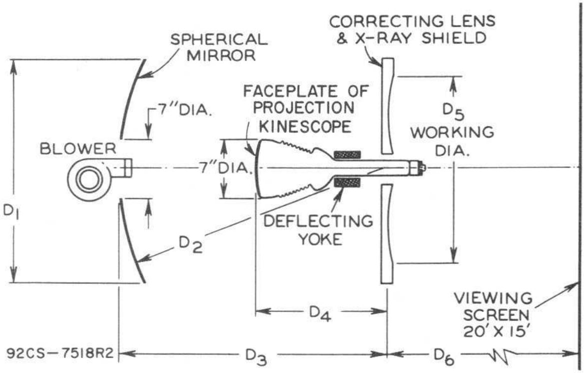
Note 6: External conductive coating must be grounded.

Note 7: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Socket contacts for Pins 5, 6, 7, 8, 10, 11, 12, and 13 should be removed in order to provide maximum insulation for Pin No.9.

Note 8: Effective deflecting field must be within this space.

REFLECTIVE OPTICAL SYSTEM

Arrangement of Typical Optical System and Air-Cooling System for Theater-Television Projector Using Reflective Optical Principles and 7WP4



DIMENSIONS (APPROX.)

D_1 27 inch Diameter	D_4 20 inches
D_2 40 inch Radius	D_5 24.5 inches
D_3 40 inches	D_6 80 feet

8DP4
PICTURE TUBE

SMALL, COMPACT, RECTANGULAR GLASS TYPE

LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . 6.3 . . . . ac or dc volts
- Current . . . . 0.6 ± 10% . . . . amp

Capacitance between External Conductive Coating and Ultor . . . . {350 max. $\mu\mu$f; 250 min. $\mu\mu$f}

Faceplate, Spherical . . . . Filterglass

Phosphor (For Curves, see front of this Section) . P4—Sulfide Type

Deflection Angles (Approx.):
- Diagonal . . . . 90°
- Horizontal . . . . 85°
- Vertical . . . . 68°

Electron Gun . . . . Ion-Trap Type Requiring External Single-Field Magnet

Tube Dimensions:
- Overall length . . . . 10-7/16" ± 5/16"
- Greatest width . . . . 7-7/8" + 1/16" − 1/32"
- Greatest height . . . . 6-1/16" + 1/16" − 1/32"
- Diagonal . . . . 8-7/16" + 1/16" − 1/32"
- Neck length . . . . 6-1/2" ± 3/16"
- Radius of curvature of faceplate (External surface) . . . . 27"

Screen Dimensions (Minimum):
- Greatest width . . . . 7-3/16"
- Greatest height . . . . 5-3/8"
- Diagonal . . . . 7-13/16"
- Projected area . . . . 35.5 sq. in.

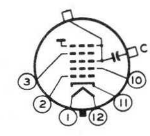
Operating Position . . . . Any

Cap . . . . Recessed Small Cavity (JETEC No.J1-21)

Base . . Dwarf-Shell Duodecal 6-Pin (JETEC Group 4, No.B6-158) ←

Basing Designation for BOTTOM VIEW 12AB

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.4
Pin 10 – Grid No.2
Pin 11 – Cathode
Pin 12 – Heater



Cap – Ultor (Grid No.3, Grid No.5, Collector)
C – External Conductive Coating

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE . . . . 8000 max. volts

GRID-No.4 (FOCUSING) VOLTAGE:
- Positive value . . . . 500 max. volts
- Negative value . . . . 500 max. volts

GRID-No.2 VOLTAGE . . . . 300 max. volts

← Indicates a change.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

8DP4

PICTURE TUBE

GRID-No.1 VOLTAGE:		
Negative-peak value.	130 max.	volts
Negative-bias value.	100 max.	volts
Positive-bias value.	0 max.	volts
Positive-peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode.	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

Monitor Kinescope

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 90° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:
- Cathode to all other electrodes. . . . . . 5 pf
- Grid No.1 to all other electrodes. . . . . 9 pf
- External conductive coating to anode . . . 350 max. pf / 250 min. pf

Heater Current at 6.3 volts. . . . . 600 ± 60 ma
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (For Curves, see front of this Section) . . P4—Sulfide Type, Aluminized
Faceplate. . . . . .Filterglass
Light transmission (Approx.) 80%

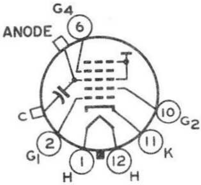
Mechanical:

Weight (Approx.) . . . . 2.5 lbs
Overall Length . . . . 9.94" ± .31"
Neck Length. . . . . 6.00" ± .19"
Projected Area of Screen . . . . 36 sq. in.
External Conductive Coating:
- Type . . . . Regular-Band
- Contact area for grounding . . . . .Near Reference Line

For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J67-1/2A* sheets at front of this section

Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Shell Duodecal 6-Pin (JEDEC Group 4, B6-63)
Basing Designation for BOTTOM VIEW. 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



Maximum and Minimum Ratings, *Absolute-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000 max.	volts
Grid-No.4 (Focusing) Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	550 max.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	180 max.	volts
Heater positive with respect to cathode	180 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	11000	volts
Grid-No.4 Voltage	0 to 300	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	−28 to −72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section.

Monitor Kinescope

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE	ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS	90° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:
  Cathode to all other electrodes. . . . . . . 5 pf
  Grid No.1 to all other electrodes. . . . . . 6 pf
Heater Current at 6.3 volts. . . . . 600 ± 30 ma
Heater Warm-up Time (Average). . . . . 11 seconds
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

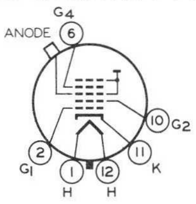
Optical:

Phosphor (For curves, see front of this Section). .P4—Sulfide Type, Aluminized
Faceplate. . . . . .Filterglass
  Light transmission at center (Approx.). 80%

Mechanical:

Weight (Approx.) . . . . 2-1/2 lbs
Overall Length . . . . 9.75" ± .19"
Neck Length. . . . . 5.81" ± .12"
Projected Area of Screen . . . . 36 sq.in.
External Conductive Coating. . . . . None
For Additional Information on Dimensions:
  See *Bulb J67-1/2A* sheets at front of this Section.
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . .Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63)
  Basing Designation for BOTTOM VIEW 12M

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)

Maximum and Minimum Ratings, *Design-Maximum Values:*
Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	22000 max.	volts
Grid-No.4 Voltage:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
Grid-No.2 Voltage	550 max.	volts
	200 min.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts

Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
Heater Voltage	{6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC Voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	16000	volts
Grid-No.4 Voltage[a]	200	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

[a] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 to +400 volts.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Test Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
ELECTROSTATIC SELF FOCUS — **90° MAGNETIC DEFLECTION**

Electrical:

Direct Interelectrode Capacitances:
- Cathode to all other electrodes. . . . . 5 pf
- Grid No.1 to all other electrodes. . . . . . . 6 pf

Heater Current at 6.3 volts. . . . . 600 ma
Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

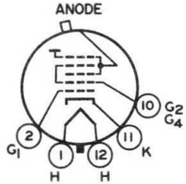
Optical:

Phosphor (For Curves, see front of this Section) . . P4—Sulfide Type, Aluminized
Faceplate. Filterglass
  Light transmission (Approx.) 80%

Mechanical:

Weight (Approx.) . . . . 3 lbs
Overall Length . . . . 11.44" ± .31"
Neck Length. . . . . 7.50" ± .19"
Projected Area of Screen . . . . 36 sq. in.
External Conductive Coating. . . . . None
For Additional Information on Dimensions:
  See *Picture-Tube Dimensional-Outlines and Bulb J67-1/2A* sheets at front of this section
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)
  Basing Designation for BOTTOM VIEW. 12S

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 10 - Grid No.2, Grid No.4
Pin 11 - Cathode
Pin 12 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)



Maximum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	22000 max.	volts
Grid-No.2 and Grid-No.4 Voltage.	550 max.	volts
Grid-No.1 Voltage:		
Negative peak value.	220 max.	volts
Negative bias value.	155 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts

Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment-warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to Grid No. 1

Anode Voltage	16000	volts
Grid-No.2 and Grid-No.4 Voltage	400	volts
Cathode Voltage for visual extinction of focused raster	36 to 78	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Test Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN

ELECTROSTATIC SELF FOCUS — 110° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	4	pf
Grid No.1 to all other electrodes.	6	pf
Heater Current at 6.3 volts.	600	ma

Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (For curves, see front of this section) . . .P4—Sulfide Type, Aluminized

Faceplate. . . . . .Filterglass

Light transmission (Approx.) 80%

Mechanical:

Weight (Approx.)	2 lbs
Overall Length	8.69" ± .31"
Neck Length.	5.19" ± .19"
Projected Area of Screen	39 sq. in.
External Conductive Coating.	None

For Additional Information on Dimensions:

See *Picture-Tube Dimensional-Outlines and Bulb J67-1/2 B* sheets at front of this section

Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)

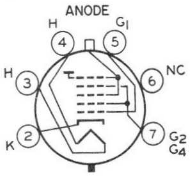
Bases (Alternates):

Special 6-Pin (JEDEC No.B6-185)

Special 6-Pin (JEDEC No.B6-214)

Basing Designation for BOTTOM VIEW 7FG

Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Grid No.1
Pin 6 - No Internal Connection
Pin 7 - Grid No.2, Grid No.4
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)



Maximum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	22000	volts
Grid-No.2 and Grid-No.4 Voltage.	550	volts
Grid-No.1 Voltage:		
Negative peak value.	220	volts
Negative bias value.	155	volts
Positive bias value.	0	volts
Positive peak value.	2	volts

Peak Heater-Cathode Voltage:
Heater negative with respect to cathode:

During equipment warm-up period not exceeding 15 seconds	450	volts
After equipment-warm-up period	200	volts
Heater positive with respect to cathode	200	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to Grid No.1

Anode Voltage	16000	volts
Grid-No.2 and Grid-No.4 Voltage	400	volts
Cathode Voltage for visual extinction of focused raster	42 to 78	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

PAN-O-PLY TYPE

90° MAGNETIC DEFLECTION LOW-GRID-No.2 VOLTAGE

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes. . . .	5	pF
Grid No.1 to all other electrodes . . .	6	pF
External conductive coating to anode. .	300 min—750 max	pF
Heater Current at 12V.	75 ± 7	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

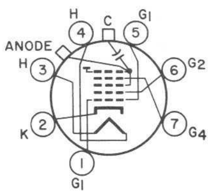
Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . .Filterglass
Light transmission at center (Approx.) 49.5%

MECHANICAL

Weight (Approx.) . . . . 3.1 lb
Overall Length . . . . 8.28 max in
Neck Length. 3.55 max in
Projected Area of Screen . . . . 38 sq in
External Conductive Coating[a]
Type (see CRT OUTLINES 1 at front of this section). . . Regular-Band
Contact area for grounding . . . . .Near Reference Line
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Special Miniature 7-Pin (JEDEC No.E7-91)

TERMINAL DIAGRAM (Bottom View)

Pin 1-Grid No.1
Pin 2-Cathode
Pin 3-Heater
Pin 4-Heater
Pin 5-Grid No.1
Pin 6-Grid No.2
Pin 7-Grid No.4
Cap-Grid No.3, Grid No.5, Screen, Collector
C-External Conductive Coating



7GR

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	8000 min—12000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	75 min—250 max	V

Grid-No. 1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	10.8 min—13.2 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s	450 max	V
After equipment warm-up period	200 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

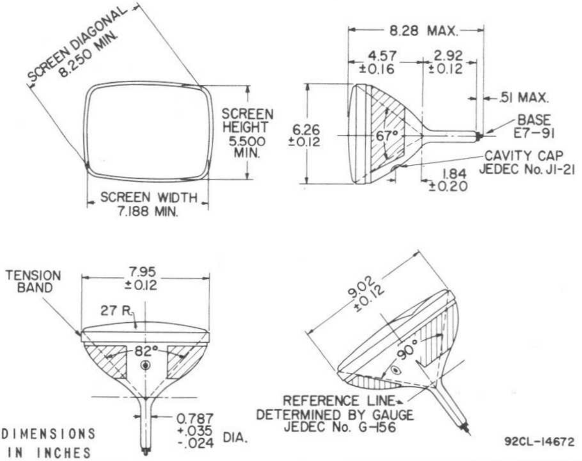
Anode Voltage	9000	V
Grid-No. 4 Voltage	0 to 300	V
Grid-No. 2 Voltage	100	V
Cathode Voltage	32 to 50	V
For visual extinction of focused raster		
Field Strength	0 to 8	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

Grid-No. 1 Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

DIMENSIONAL OUTLINE (BULB J71-1/2 B1)



10SP4

10SP4

MONITOR KINESCOPE

ALUMINIZED SCREEN

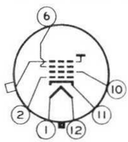
ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:			
Voltage	6.3	ac or dc volts	
Current	0.6	amp	
Direct Interelectrode Capacitances:			
Grid No.1 to all other electrodes	6	$\mu\mu f$	
Cathode to all other electrodes	5	$\mu\mu f$	
Faceplate, Spherical		Filterglass	
Light transmission (Approx.)		76%	←
Phosphor (For curves, see front of this Section)		P4—Sulfide Type Aluminized	
Fluorescence		White	
Phosphorescence		White	
Persistence		Short	
Focusing Method		Electrostatic	
Deflection Method		Magnetic	
Deflection Angle (Approx.)		50°	
Overall Length		16-5/8" ± 3/8"	
Greatest Diameter of Bulb		10-1/2" ± 1/16"	←
Minimum Useful Screen Diameter		9-1/8"	
Picture Size (Within minimum useful screen area)		8" x 6"	
Weight (Approx.)		10 lbs	←
Operating Position		Any	
Cap		Recessed Small Cavity (JETEC No.J1-21)	
Bulb		J84	←
Base		Small-Shell Duodecal 6-Pin (JETEC No.B6-63)	
Basing Designation for BOTTOM VIEW		12Q	←

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.3
Pin 10 - Grid No.2
Pin 11 - Cathode



Pin 12 - Heater
Cap - Ultor (Grid No.4, Collector)

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	20000 max.	volts	←
GRID-No.3 VOLTAGE	3000 max.	volts	←
GRID-No.2 VOLTAGE	410 max.	volts	
GRID-No.1 VOLTAGE:			
Negative bias value	125 max.	volts	
Positive bias value	0 max.	volts	
Positive peak value	2 max.	volts	
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	410 max.	volts	
After equipment warm-up period	180 max.	volts	
Heater positive with respect to cathode	180 max.	volts	

← Indicates a change.

RCA

10SP4

MONITOR KINESCOPE

Equipment Design Ranges:

→ *For any ultor voltage (E_{c_4}) between 10000* and 20000 volts and grid-No.2 voltage (E_{c_2}) between 150 and 410 volts*

Grid-No.3 Voltage for focus with ultor current of 100 μa.	11.7% to 15.9% of E_{c_4}	volts
Grid-No.1 Voltage for visual extinction of 8" x 6" raster	9% to 24% of E_{c_2}	volts
Maximum Grid-No.3 Current**.	*See Curves*	
Grid-No.2 Current.	−15 to +15	μa
Field Strength of Adjustable Centering Magnet	0 to 8	gausses

Examples of Use of Design Ranges:

For ultor voltage of	*12000*	*14000*	*volts*
and grid-No.2 voltage of	*200*	*200*	*volts*
Grid-No.3 Voltage for focus with ultor current of 100 μa.	1400 to 1900	1640 to 2225	volts
Grid-No.1 Voltage for visual extinction of 8" x 6" raster	−18 to −48	−18 to −48	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance . . . . 1.5 max. megohms

* Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 10,000 volts.

** Grid-No.3 current increases as the ultor voltage is decreased.

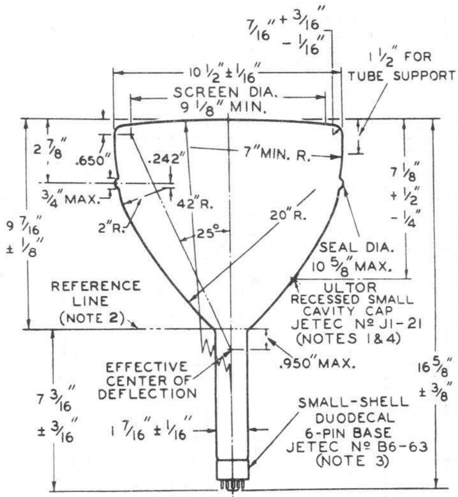
For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

→ Indicates a change.

RCA

10SP4

MONITOR KINESCOPE



92CM-7729R1

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY AN ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: REFERENCE LINE IS DETERMINED BY POSITION WHERE REFERENCE-LINE GAUGE (JETEC No. 112) 1.500" + 0.003" - 0.000" I.D. AND 2" LONG WILL REST ON BULB CONE.

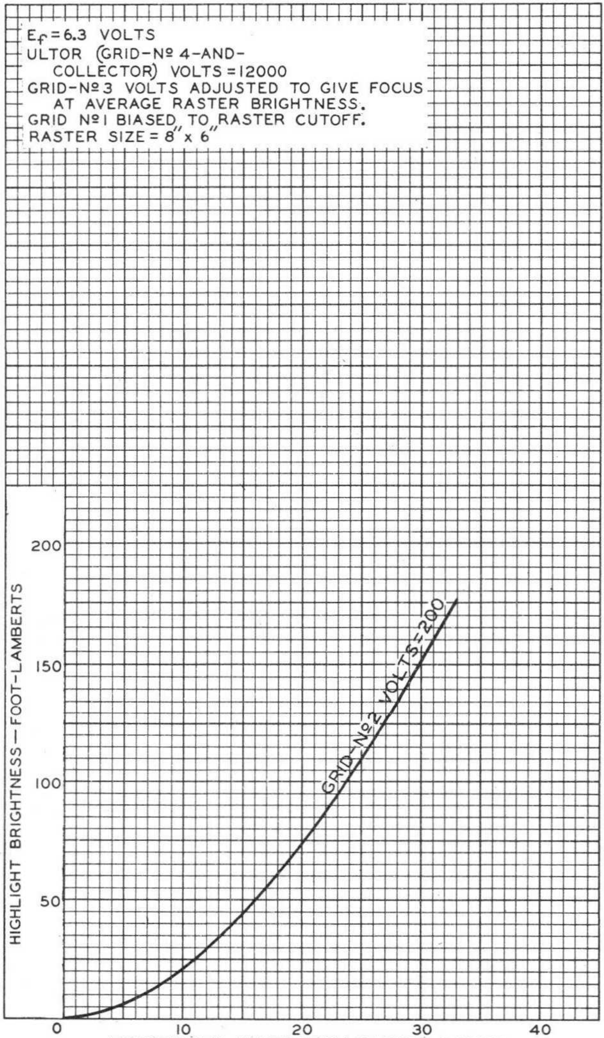
NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING DIAMETER OF 1-7/8".

NOTE 4: TUBE SUPPORT MUST BE KEPT AT LEAST 2" AWAY FROM BULB TERMINAL.

RCA

10SP4

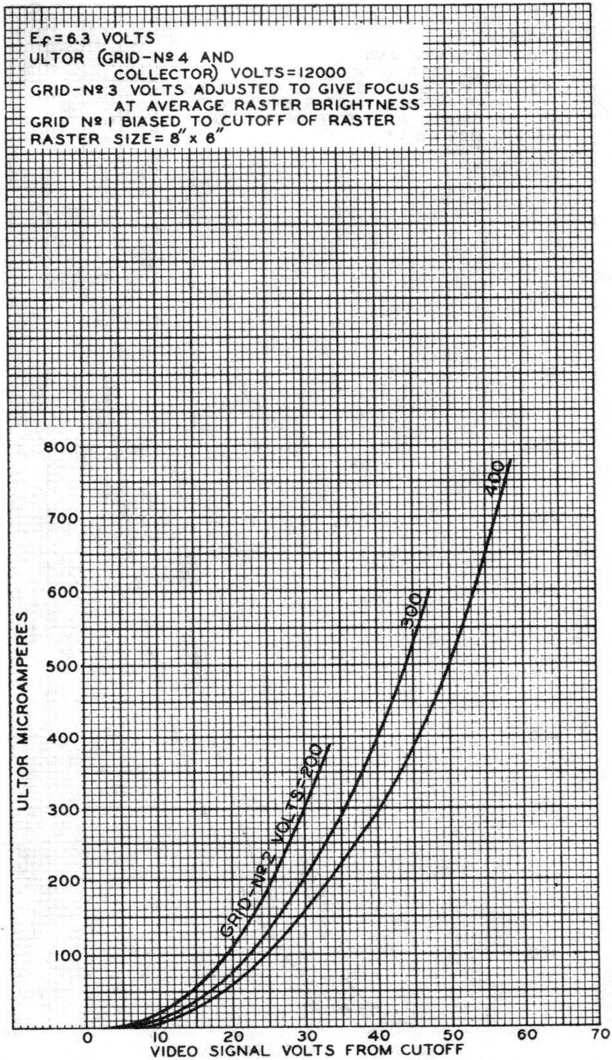
AVERAGE GRID-DRIVE CHARACTERISTIC



RCA

10SP4

AVERAGE GRID-DRIVE CHARACTERISTICS



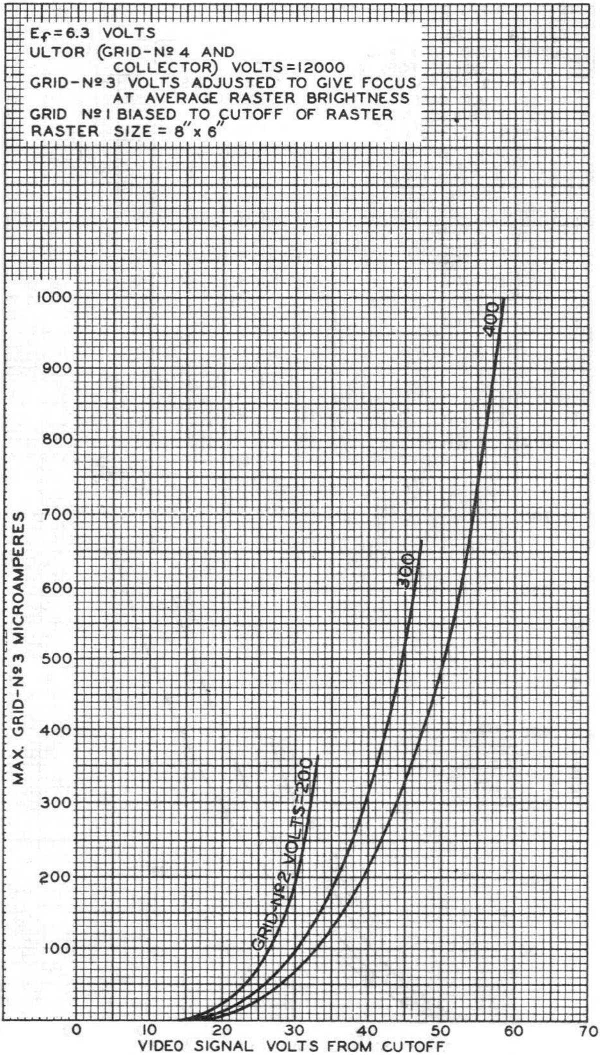
MAR. 21, 1952

TUBE DEPARTMENT
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7773

10SP4

GRID-DRIVE CHARACTERISTICS



MAR. 21, 1952

Picture Tube

PAN-O-PLY TYPE

110° MAGNETIC DEFLECTION LOW-VOLTAGE ELECTROSTATIC FOCUS

Direct Interelectrode Capacitances		
Cathode to all other electrodes. . . .	5	pF
Grid No.1 to all other electrodes. . . .	6	pF
External conductive coating to anode . .	500 min—750 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

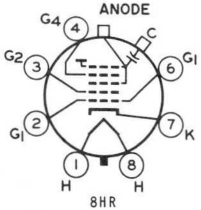
Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate.	Filterglass
Light transmission at center (approx.)	79%

MECHANICAL

Weight (Approx.)	4 lb
Overall Length	8.785 ± .250 in
Neck Length.	4.125 ± .125 in
Projected Area of Screen	60 sq in
External Conductive Coating[a]	
Type (See CRT OUTLINES I at front of this section) . . .	Regular-Band
Contact area for grounding	Near Reference Line
Cap.	Recessed Small Cavity (JEDEC No.J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	8000 min—15000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V
Heater Voltage	5.7 min—6.9 max	V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:	
During equipment warm-up period ≤ 15 s.	450 max V
After equipment warm-up period	300 max V
Heater positive with respect to cathode:	
Combined AC & DC voltage	200 max V
DC component	100 max V

TYPICAL OPERATING CONDITIONS FOR GRID-DRIVE SERVICE

Voltages are positive with respect to cathode

Anode Voltage	12000 V
Grid-No.4 Voltage	0 to 400 V
Grid-No.2 Voltage	400 V
Grid-No.1 Voltage	-39 to -94 V
For visual extinction of focused raster	

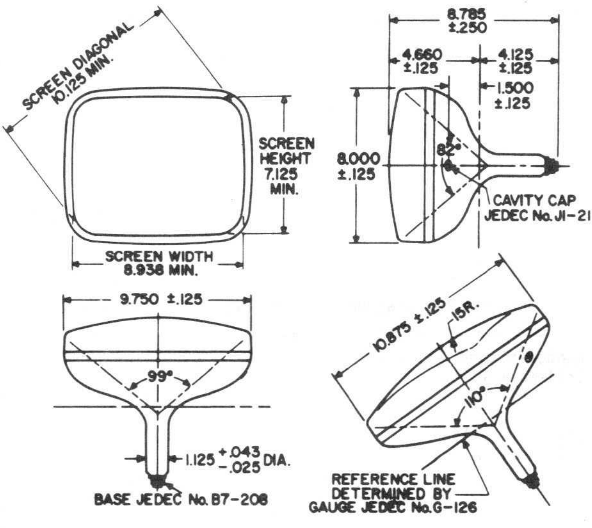
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max MΩ

[a] Includes implosion protection hardware.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

DIMENSIONAL OUTLINE (BULB J87A)



DIMENSIONS IN INCHES

Picture Tube

FILLED-RIM TYPE

110° MAGNETIC DEFLECTION — INTERMEDIATE-GRID-No.2 VOLTAGE

Direct Interelectrode Capacitances		
Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode[a]	500 min—750 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

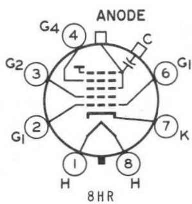
Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate	Filterglass
Light transmission at center (Approx.)	52 %

MECHANICAL

Weight (Approx.)	5 lb
Overall Length	8.785 ± .250 in
Neck Length	4.125 ± .125 in
Projected Area of Screen	60 sq in
External Conductive Coating	
Type (See CRT OUTLINES 1 at front of this section)	Regular-Band
Contact area for grounding	Near Reference Line
Cap	Recessed Small Cavity (JEDEC No.J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	8000 min—15000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage	100 min—250 max	V
Cathode Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	5.7 min—6.9 max	V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:

During equipment warm-up period ≤ 15 s.	450 max V
After equipment warm-up period	300 max V

Heater positive with respect to cathode:

Combined AC & DC voltage.	200 max V
DC component.	100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	11000	V
Grid-No.4 Voltage	0	V
Grid-No.2 Voltage	150	V
Cathode Voltage	31 to 49	V
For visual extinction of focused raster		

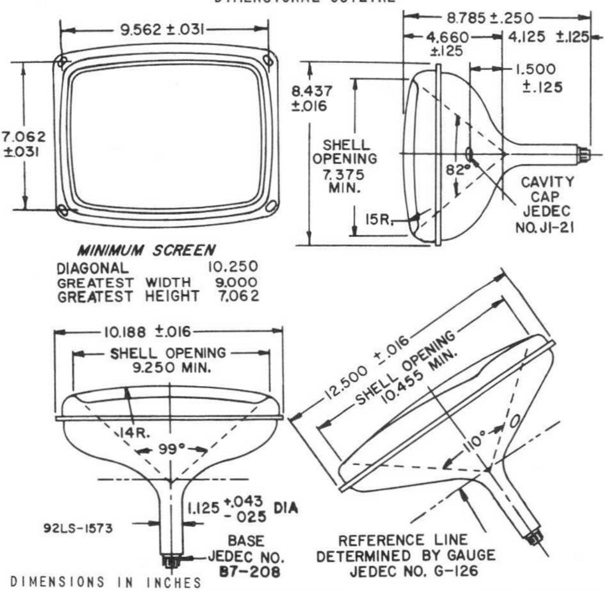
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance.	1.5 max	MΩ

[a] Includes implosion protection hardware.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Picture Tube

PAN-O-PLY TYPE

110° MAGNETIC DEFLECTION   LOW-VOLTAGE ELECTROSTATIC FOCUS

Direct Interelectrode Capacitances		
Cathode to all other electrodes. . . .	5	pF
Grid No.1 to all other electrodes. . . .	6	pF
External conductive coating to anode . .	500 min—750 max	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

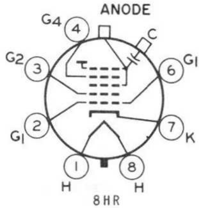
Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate.	Filterglass
Light transmission at center (approx.).	52%

MECHANICAL

Weight (Approx.)	4 lb
Overall Length	8.785 ± .250 in
Neck Length.	4.125 ± .125 in
Projected Area of Screen	60 sq in
External Conductive Coating[a]	
Type (See CRT OUTLINES I at front of this section) . . .	Regular-Band
Contact area for grounding	Near Reference Line
Cap.	Recessed Small Cavity (JEDEC No.J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	9000 min—15000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	100 min—250 max	V
Grid-No.1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V
Heater Voltage	5.7 min—6.9 max	V

Peak Heater-Cathode Voltage
Heater negative with respect to cathode:
During equipment warm-up period ≤ 15 s . . . . . 450 max V
After equipment warm-up period . . . . 300 max V
Heater positive with respect to cathode:
Combined AC & DC voltage . . . . 200 max V
DC component . . . . 100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	11000 V
Grid-No.4 Voltage	0 V
Grid-No.2 Voltage	150 V
Cathode Voltage	31 to 49 V
For visual extinction of focused raster	

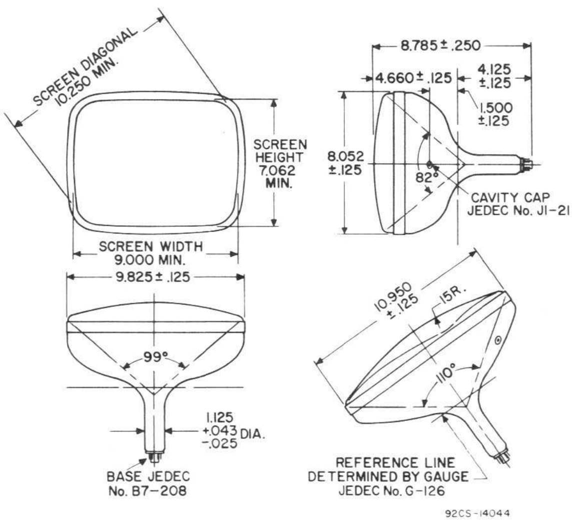
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance . . . . 1.5 max MΩ

[a] Includes implosion protection hardware.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

DIMENSIONAL OUTLINE (BULB J87B)



DIMENSIONS IN INCHES

12BNP4A

Picture Tube

PAN-O-PLY TYPE	LOW-VOLTAGE ELECTROSTATIC FOCUS
NO ION-TRAP MAGNET REQUIRED	110° MAGNETIC DEFLECTION

Direct Interelectrode Capacitances		
Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes . . .	6	pF
External conductive coating to anode[a]	550 min - 850 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-up Time (Average)	11	s

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

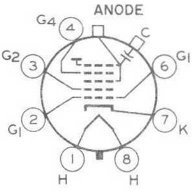
OPTICAL

Phosphor. . . . . .P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 49%

MECHANICAL

Weight (Approx.). . . . . 5 lb
Overall Length. . . . . 9.348 ± .250 in
Neck Length . . . . 4.375 ± .125 in
Projected Area of Screen. . . . . .74 sq in
External Conductive Coating
Type (see CRT OUTLINES 1 at front of this section) . . . .Regular-Band
Contact area for grounding. . . . . Near Reference Line
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW. 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	9000 min - 15000 max	V
Grid-No.4 Voltage		
Positive value.	1100 max	V
Negative value.	550 max	V
Grid-No.2 Voltage	125 min - 550 max	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V

Heater Voltage	5.7 min - 6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 sec.	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	13000	V
Grid-No.4 Voltage[b]	100	V
Grid-No.2 Voltage	140	V
Cathode Voltage	22 to 42	V
For visual extinction of focused raster		
Field Strength	0 to 12	G
Of required adjustable centering magnet		

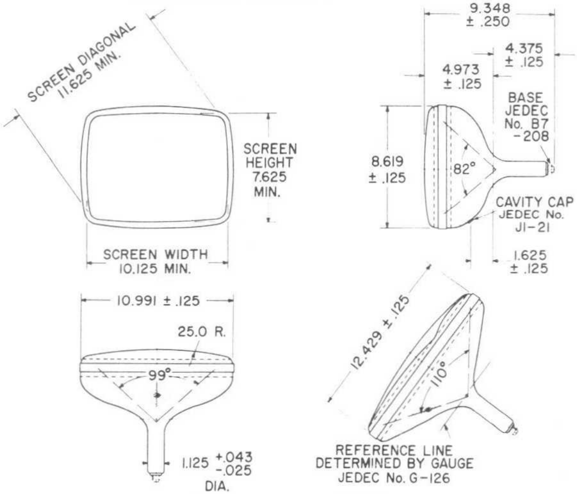
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts with the combined cathode voltage and video-signal voltage adjusted to give an anode current of 75 microamperes on a 6-3/4-inch by 9-inch pattern from an RCA-2F21 monoscope, or equivalent.

DIMENSIONAL OUTLINE (BULB J99C/E)



92CL-13275

DIMENSIONS IN INCHES

RCA

14RP4
PICTURE TUBE

SHORT RECTANGULAR GLASS TYPE

LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

The 14RP4 is the same as the 14RP4-A except that it utilizes a *non-aluminized phosphor.*

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 90° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:		
Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode	1200 max.	pf
	800 min.	pf
Heater Current at 6.3 volts	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds
Electron Gun	Type Requiring No Ion-Trap Magnet	

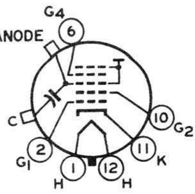
Optical:

Phosphor (For curves, see front of this section). P4—Sulfide Type, Aluminized
Faceplate, Spherical. . . . . Filterglass
Light transmission (Approx.). 78%

Mechanical:

Weight (Approx.). 8.5 lbs
Overall Length. . . . . 13-3/16" ± 5/16"
Neck Length . . . . 5-1/2" ± 3/16"
Projected Area of Screen. . . . . 104 sq. in.
External Conductive Coating:
Type. . . . . .Regular-Band
Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J112 A/B* sheets at front of this section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Bases (Alternates):
Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63)
Short Small-Shell Duodecal 6-Pin (JEDEC No.B6-203)
Basing Designation for BOTTOM VIEW. 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

14WP4

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	15500 max.	volts
	9000 min.	volts
GRID-No. 4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No. 2 VOLTAGE	550 max.	volts
GRID-No. 1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	200 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	12000	volts
Grid-No.4 Voltage	-50 to + 350	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Color Picture Tube

This data sheet is to be used in conjunction with data for RCA-15NP22

For general data, maximum and minimum ratings, equipment design ranges, limiting circuit values, and terminal diagram of the 15AEP22, refer to 15NP22 except as noted below.

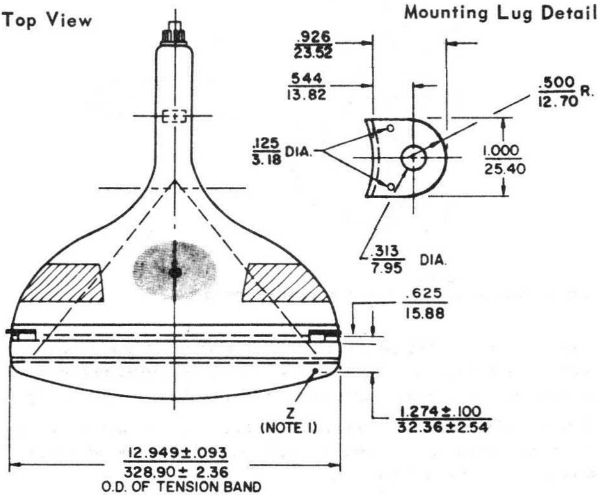
MECHANICAL

Tube Dimensions (excluding mounting lugs):

Diagonal	14.910 ± .093 in (378.21 ± 2.36 mm)
Greatest width	12.949 ± .093 in (328.90 ± 2.36 mm)
Greatest height (including tension-band clip)	10.613 ± .100 in (269.57 ± 2.54 mm)
Weight (Approx.)	11.3 lb (5.1 kg)

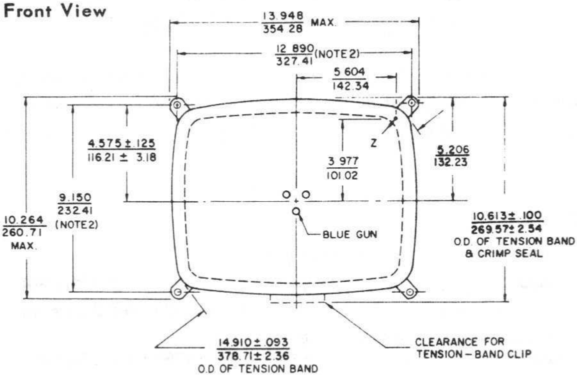
DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 15NP22.

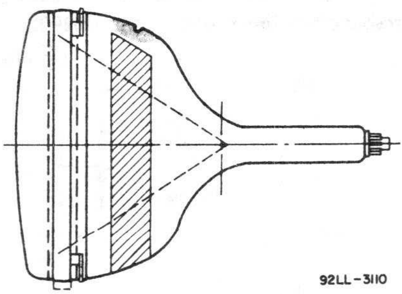


DIMENSIONAL OUTLINE (Cont'd)

Front View



Front Side View



Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise noted.

Note 1: "Z" is located on the outside surface of the faceplate, on the screen diagonal at a point .094 in (2.39 mm) beyond the minimum screen. This point is used as a reference for the mounting lugs.

Note 2: The tolerance of the mounting lug holes will accommodate mounting screws up to 0.250 in (6.35 mm) in diameter when positioned on the true hole centers.

Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands around Periphery of Tube Panel--- No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 114° MAGNETIC DEFLECTION
NO ION-TRAP MAGNET REQUIRED

Electrical:

Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes . . .	6	pf
Cathode to all other electrodes	5	pf
External conductive coating to anode[a] .	1300 max.	pf
	800 min.	pf
Heater Current at 6.3 volts	450 ± 20	ma
Heater Warm-Up Time (Average)	11	seconds
Electron Gun.	Type Requiring No Ion-Trap Magnet	

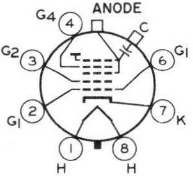
Optical:

Phosphor (For curves, see front of this Section) . . P4—Sulfide Type Aluminized
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 54%

Mechanical:

Weight (Approx.). 9.5 lbs
Overall Length. . . . . 10.569" ± .242"
Neck Length . . . . 4.375" ± .125"
Projected Area of Screen. . . . . 125 sq. in.
External Conductive Coating:
Type. . . . . .Regular Band
Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings, Dimensions, and Deflection Angles, See *Picture-Tube Dimensional-Outlines* and *Bulb J125 B* sheets at front of this Section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . .Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW. 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	20000 max. 12000 min.	volts volts
Grid-No.4 Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	550 max. 200 min.	volts volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	6.9 max. 5.7 min.	volts volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Peak value	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16000	volts
Grid-No.4 Voltage[b]	100	volts
Grid-No.2 Voltage	300	volts
Cathode Voltage for visual extinction of focused raster	28 to 60	volts
Field Strength of required adjustable centering magnet	0 to 8	gauss

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between −100 and +300 volts with the combined cathode voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 9-inch by 12-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

PAN-O-PLY TYPE — LOW-VOLTAGE ELECTROSTATIC FOCUS
114° MAGNETIC DEFLECTION — LOW GRID-No.2 VOLTAGE

Direct Interelectrode Capacitances		
Cathode to all other electrodes . . .	5	pF
Grid No.1 to all other electrodes . . .	6	pF
External conductive coating to anode[a] .	1000 min—1500 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet
Focus Lens. . . . . Unipotential

OPTICAL

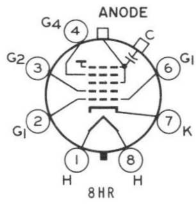
Phosphor. . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 54%

MECHANICAL

Weight (Approx.). . . . . 9.5 lb
Overall Length. . . . . 10.569 ± .242 in
Neck Length . . . . 4.375 ± .125 in
Projected Area of Screen. . . . . 125 sq in
External Conductive Coating
Type (See CRT OUTLINES 1 at front of this section) . . . Regular-Band
Contact area for grounding. . . . . Near Reference Line
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . Small-Button Neoeightar 7-Pin,
Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to grid No.1

Anode Voltage	12000 min—20000 max	V
Grid-No.4 Voltage		
Positive value.	1250 max	V
Negative value.	400 max	V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V

Grid-No.2 Voltage.	20 min—60 max	V
Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s . . .	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage.	16000	V
Grid-No.4 Voltage[b]	100	V
Grid-No.2 Voltage.	30	V
Cathode Voltage.	22 to 45	V
For visual extinction of focused raster		
Field Strength	0 to 8	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

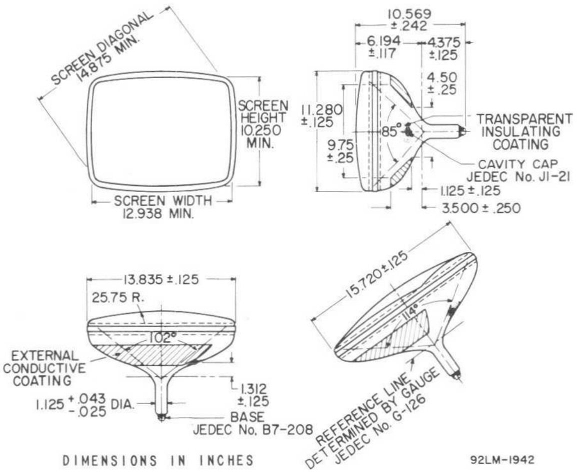
Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts with the combined cathode voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 9-inch by 12-inch pattern from an RCA-2F21 monoscope, or equivalent.

See *X-RADIATION PRECAUTIONS* at front of this section

DIMENSIONAL OUTLINE (BULB J125 B2A)



DIMENSIONS IN INCHES

92LM-1942

Picture Tube

PAN-O-PLY TYPE — 114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes . . .	5	pF
Grid No.1 to all other electrodes . .	6	pF
External conductive coating to anode.	1000 min—1500 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

OPTICAL

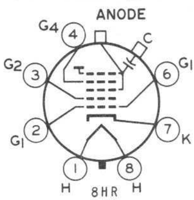
Phosphor. . . . . .P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 54%

MECHANICAL

Weight (Approx.). . . . . 9.5 lb
Overall Length. . . . . 10.569 ± 0.242 in
Neck Length . . . . 4.375 ± 0.125 in
Projected Area of Screen. . . . . 125 sq in
External Conductive Coating[a]
Type (See CRT OUTLINES 1 at front of this section) .Regular-Band
Contact area for grounding. . . . . Near Reference Line
Cap . . . . .Recessed Small Cavity (JEDEC No. J1-21)
Base. . . . . .Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	10000 min—18000 max	V
Grid-No.4 Voltage		
Positive value.	1100 max	V
Negative value.	550 max	V
Grid-No.2 Voltage	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V

Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	16000	V
Grid-No.4 Voltage	-100 to 300	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 60	V
For visual extinction of focused raster		
Field Strength	0 to 8	G
Of required adjustable centering magnet		

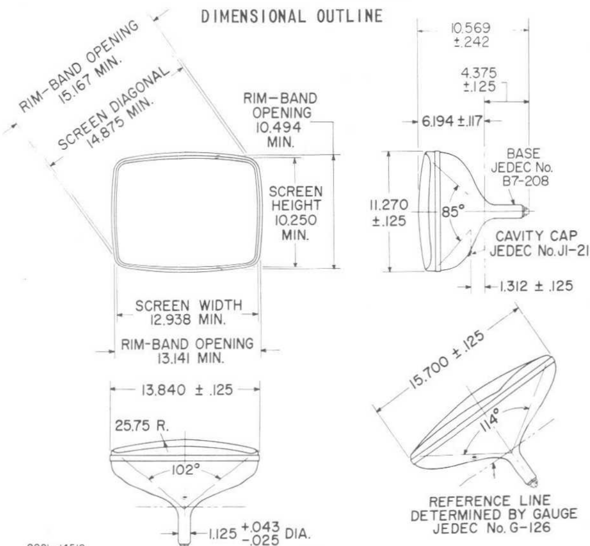
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

16RP4B

Picture Tube

NO ION-TRAP MAGNET REQUIRED

MAGNETIC FOCUS — 70° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	2000 max 750 min	pF pF
Heater Current at 6.3 V	600 ± 30	mA
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate	Filterglass
Light Transmission (Approx.)	66%

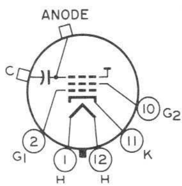
MECHANICAL

Weight (Approx.)	16 lb
Overall Length	18.750 ± 0.375 in
Neck Length	7.500 ± 0.188 in
Projected Area of Screen	139 sq in
External Conductive Coating	
Type	Regular-Band
Contact area for grounding	Near Reference-Line

For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J129A/B* sheets at front of this section

Cap	Recessed Small Cavity (JEDEC No.J1-21)
Base	Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)
Basing Designation for BOTTOM VIEW	12N

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 10 – Grid No.2
Pin 11 – Cathode
Pin 12 – Heater
Cap – Anode (Grid No.3, Screen, Collector)
C – External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	17500 max	V
Grid-No.2 Voltage	450 max	V
Grid-No.1 Voltage		
Negative bias value	140 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V

Heater Voltage	6.9 max 5.7 min	V V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max	V
After equipment warm-up period	165 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	165 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR GRID-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	12000	V
Grid-No.2 Voltage	300	V
Grid-No.1 Voltage	-28 to -72	V
For visual extinction of focused raster		

MAXIMUM CIRCUIT VALUE

Grid-No.1-Circuit Resistance	1.5 max	MΩ

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 90° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes. . . .	6	pf
External conductive coating to anode . .	1500 max.	pf
	1000 min.	pf
Heater Current at 6.3 volts.	600 ± 30	ma

Electron Gun . . . . Type Requiring No Ion-Trap Magnet

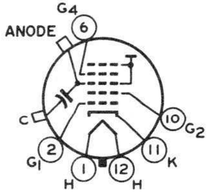
Optical:

Phosphor (For curves, see front of this Section). . P4—Sulfide Type, Aluminized
Faceplate, Spherical . . . . Filterglass
Light transmission (Approx.) 74%

Mechanical:

Weight (Approx.) . . . . 15 lbs
Overall Length . . . . 14-5/8" ± 3/8"
Neck Length. 5-1/2" ± 3/16"
Projected Area of Screen . . . . 149 sq. in.
External Conductive Coating:
Type . . . . Regular-Band
Contact area for grounding . . . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J133 F/G* sheets at front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Bases (Alternates):
Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63)
Short Small-Shell Duodecal 6-Pin (JEDEC No.B6-203)
Basing Designation for BOTTOM VIEW 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

← Indicates a change.

→ **Maximum and Minimum Ratings,** *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	{17500 max. / 11000 min.	volts / volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	{6.9 max. / 5.7 min.	volts / volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.4 Voltage	-55 to +300	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

→ Indicates a change.

Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
MAGNETIC FOCUS — 70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode	1500 max.	pf
	750 min.	pf
Heater Current at 6.3 volts	600 ± 60	ma

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

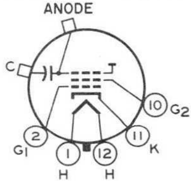
Optical:

Phosphor (For curves, see front of this Section) . P4—Sulfide Type, Aluminized
Faceplate, Spherical. . . . . Filterglass
Light transmission (Approx.). 74%

Mechanical:

Weight (Approx.). . . . . 18 lbs
Overall Length. . . . . 19-3/16" ± 3/8"
Neck Length . . . . . 7-1/2" ± 3/16"
Projected Area of Screen. . . . . 149 sq. in.
External Conductive Coating:
Type. . . . . Regular-Band
Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J133B/D* sheets at front of this section
Cap . . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)
Basing Designation for BOTTOM VIEW. 12N

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Screen, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	17500 max.	volts
Grid-No.2 Voltage	550 max.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	165 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	165 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	12000	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

17CFP4
PICTURE TUBE

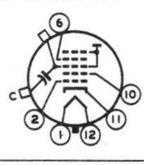
RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3	volts
Current	0.6 ± 10%	amp
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	1500 max.	μμf
	1200 min.	μμf
Faceplate, Spherical	Filterglass	
Light transmission (Approx.)	79%	
Phosphor (For curves, see front of this Section)	P4—Sulfide Type Aluminized	
Fluorescence	White	
Phosphorescence	White	
Persistence	Medium-Short	
Focusing Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	90°	
Horizontal	85°	
Vertical	68°	
Electron Gun	Type Requiring No Ion-Trap Magnet	
Tube Dimensions:		
Overall length	15" ± 3/8"	
Greatest width	15-5/8" ± 1/8"	
Greatest height	12-3/4" ± 1/8"	
Diagonal	16-9/16" ± 1/8"	
Neck length	5-1/2" ± 3/16"	
Radius of curvature of faceplate (External surface)	20-3/4"	
Screen Dimensions (Minimum):		
Greatest width	14-3/4"	
Greatest height	11-11/16"	
Diagonal	15-3/4"	
Projected area	155 sq. in.	
Weight (Approx.)	10 lbs	
Operating Position	Any	
Cap	Recessed Small Cavity (JEDEC No. J1-21)	
Bulb	J132-1/2 C1/D1	
Base	Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)	
Basing Designation for BOTTOM VIEW	12L	

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

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PICTURE TUBE

GRID-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	16000	max.	volts
	12000⊕	min.	volts
GRID-No.4 (FOCUSING) VOLTAGE:			
Positive value	1000	max.	volts
Negative value	500	max.	volts
GRID-No.2 VOLTAGE	500	max.	volts
GRID-NO.1 VOLTAGE:			
Negative-peak value	200	max.	volts
Negative-bias value	140	max.	volts
Positive-bias value	0	max.	volts
Positive-peak value	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	410	max.	volts
After equipment warm-up period	180	max.	volts
Heater positive with respect to cathode	180	max.	volts

Equipment Design Ranges:

With any ultor voltage (Ec_5k) between 12000⊕ and 16000 volts and grid-No.2 voltage (Ec_2k) between 200 and 500 volts

Grid-No.4 Voltage for focus§	-50 to +350	volts
Grid-No.1 Voltage for visual extinction of focused raster	*See Raster-Cutoff-Range Chart for Grid-Drive Service*	
Grid-No.1 Video Drive From Raster Cutoff (Black level): White-level value (Peak positive)	Same value as determined for Ec_1k except video drive is a positive voltage	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	*16000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus	-50 to +350	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

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PICTURE TUBE

Grid-No.1 Video Drive from Raster
Cutoff (Black level):
White-level value. . . . . 28 to 72 volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance . . . . 1.5 max. megohms

CATHODE-DRIVE■ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	16000	max.	volts
	12000⊕	min.	volts
GRID-No.4-TO-GRID-No.1 VOLTAGE:			
Positive value	1000	max.	volts
Negative value	500	max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	640	max.	volts
GRID-No.2-TO-CATHODE VOLTAGE	500	max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:			
Positive-peak value.	200	max.	volts
Positive-bias value.	140	max.	volts
Negative-bias value.	0	max.	volts
Negative-peak value.	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	410	max.	volts
After equipment warm-up period	180	max.	volts
Heater positive with respect to cathode.	180	max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage (Ec_5g_1) between 12000⊕ and 16000 volts and grid-No.2-to-grid-No.1 voltage (Ec_2g_1) between 220 and 640 volts

Grid-No.4-to-Grid-No.1
Voltage for focus§ . . . . 0 to 400 volts

Cathode-to-Grid-No.1
Voltage (Ek_{g_1}) for visual extinction of focused raster. . . . .*See Raster-Cutoff-Range Chart for Cathode-Drive Service*

Cathode-to-Grid-No.1
Video Drive from Raster
Cutoff (Black level):
White-level value
(Peak negative). . . . . Same value as determined for Ek_{g_1} except video drive is a negative voltage

Grid-No.4 Current. . . . . -25 to +25 μa

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PICTURE TUBE

Grid-No.2 Current.	−15 to +15	μa
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of.	*16000*	*volts*
and grid-No.2-to-grid-No.1 voltage of.	*300*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus.	0 to 400	volts
Cathode-to-Grid No.1 Voltage for visual extinction of focused raster	28 to 60	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value.	−28 to −60	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance . . . . 1.5 max. megohms

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

✥ This value is a working design-center minimum. The equivalent *absolute minimum* ultor- or ultor-to-grid-No.1 voltage is 10,800 volts, below which the serviceability of the 17CFP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor- or ultor-to-grid-No.1 voltage is never less than 10,800 volts.

§ The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

* Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/2". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 5/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

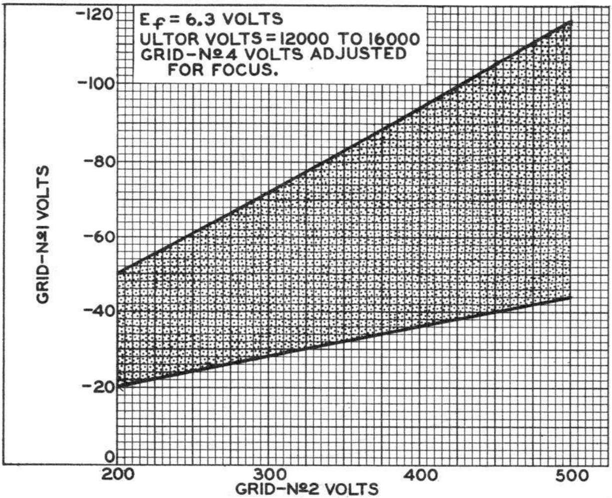
For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

17CFP4

RCA 17CFP4

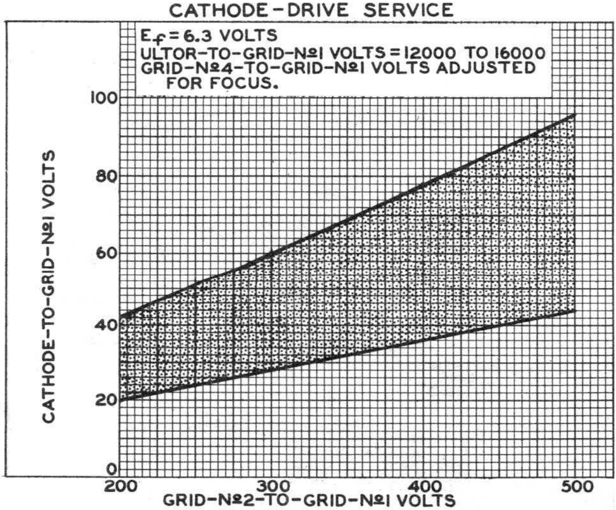
RASTER-CUTOFF-RANGE CHARTS

GRID-DRIVE SERVICE



92CS-10246

CATHODE-DRIVE SERVICE



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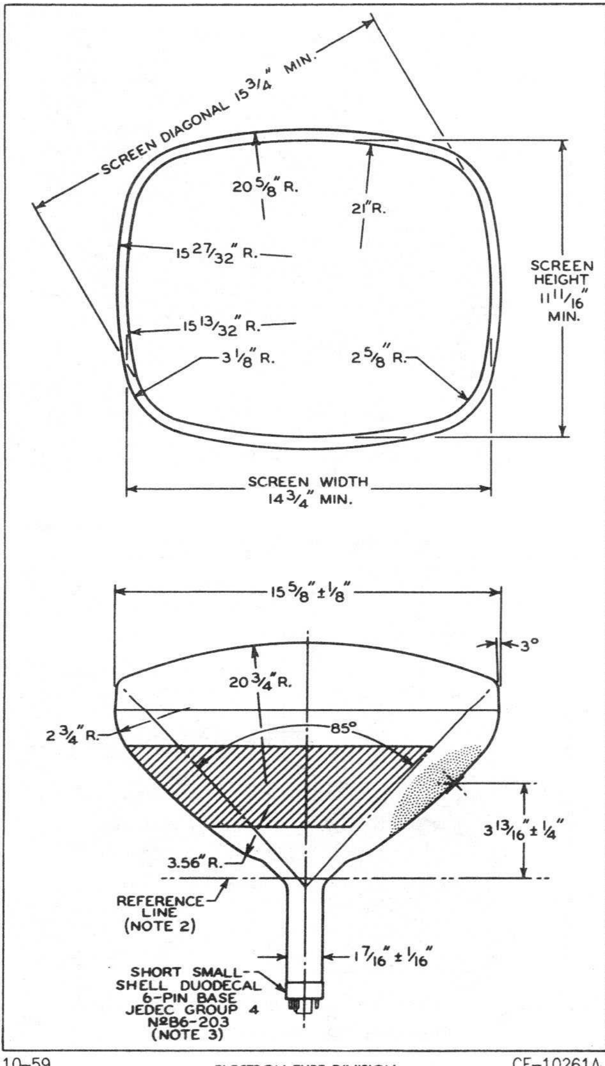
17CFP4
PICTURE TUBE



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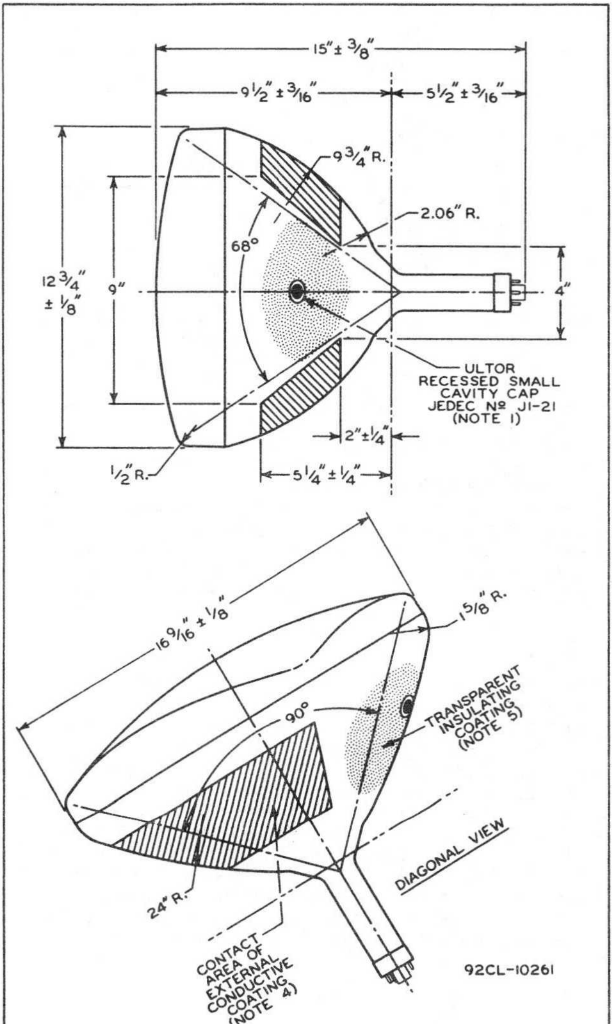
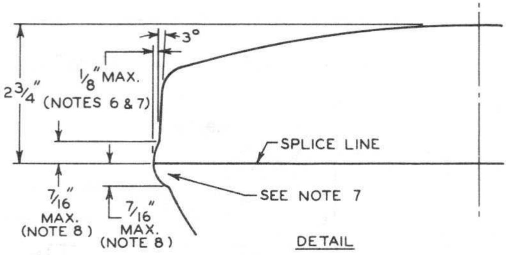
PICTURE TUBE



17CFP4
PICTURE TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No.G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUITRY CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED 2-9/32" ± 1/32" FROM THE PLANE TANGENT TO THE SURFACE OF THE FACEPLATE AT THE TUBE AXIS.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/4", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/8" BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: THE TUBE SHOULD BE SUPPORTED ON BOTH SIDES OF THE BULGE. THE MECHANISM USED SHOULD PROVIDE CLEARANCE FOR THE MAXIMUM DIMENSIONS OF THE BULGE.

RCA

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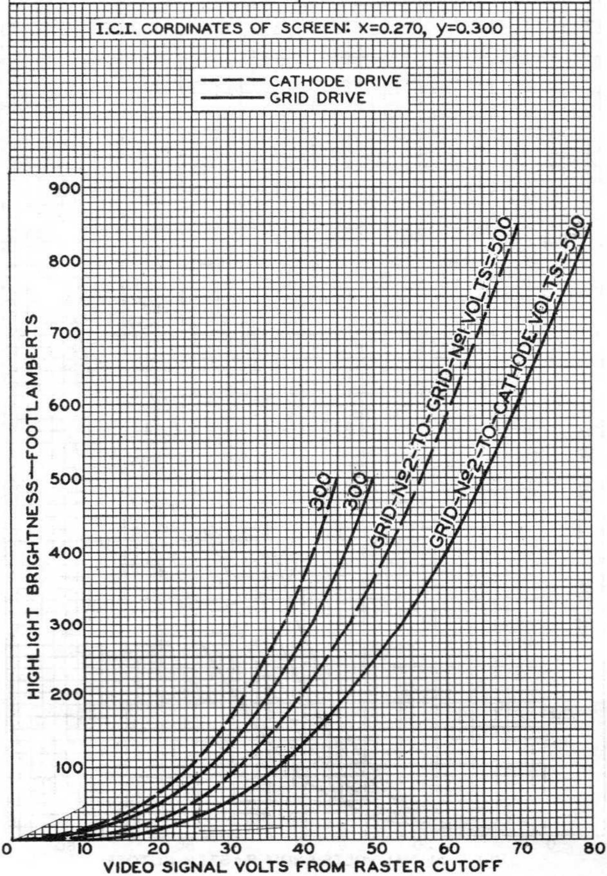
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-Nº1 VOLTS = 16000	ULTOR VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID Nº1 TO GIVE FOCUSED RASTER CUTOFF.	GRID Nº1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.	RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 14" x 10½"	RASTER SIZE = 14" x 10½"

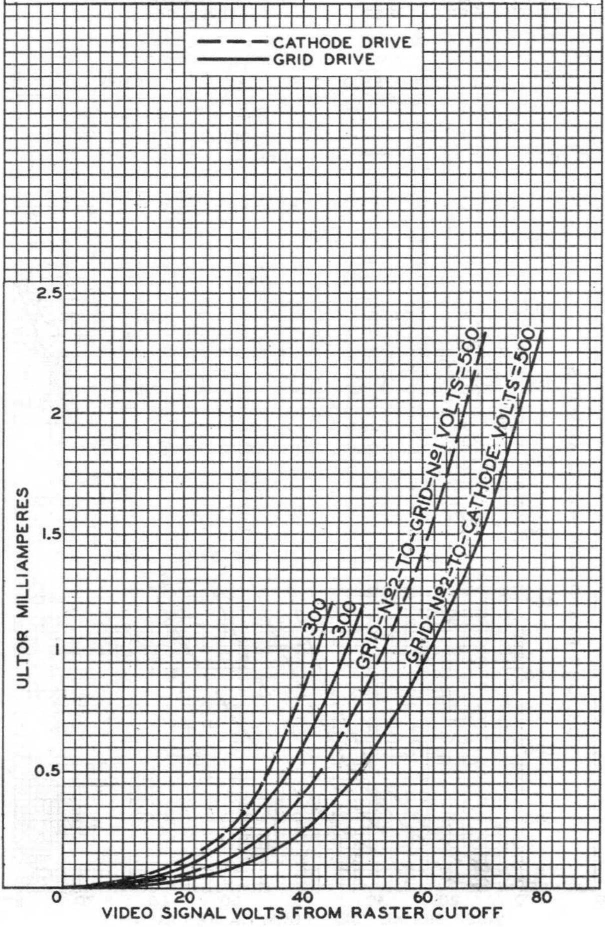


17CFP4

17CFP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS ULTOR-TO-GRID-Nº1 VOLTS=12000 TO 16000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID Nº1 TO GIVE FOCUSED RASTER CUTOFF.	E_f = 6.3 VOLTS ULTOR VOLTS=12000 TO 16000 GRID Nº1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



ELECTRON TUBE DIVISION
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92CM-9243

Picture Tube

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
110° MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	450 ± 5%	ma
Heater Warm-Up Time (Average).	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes. . .	6	μμf
Cathode to all other electrodes. . . .	5	μμf
External conductive coating to ultor .	{ 1700 max.	μμf
	1200 min.	μμf
Electron Gun	Type Requiring No Ion-Trap Magnet	

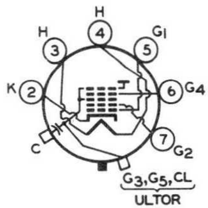
Optical:

Faceplate. . . . . .Filterglass
Light transmission (Approx.) 77%
Phosphor (For Curves, see front of this Section) . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position . . . . .Any
Weight (Approx.) . . . . 10 lbs
Overall Length . . . . 12-1/8" ± 1/4"
Neck Length. . . . . 5" ± 1/8"
Projected Area of Screen . . . . 155 sq. in.
External Conductive Coating:
Type . . . . Regular Band
Contact area for grounding . . . . .Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J132-1/2 A/B* sheets at the front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . .Special 6-Pin (JEDEC No.B6-214)
Basing Designation for BOTTOM VIEW 7FA

Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Grid No.1
Pin 6 - Grid No.4
Pin 7 - Grid No.2



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

Maximum Ratings, *Design-Maximum Values:*

ULTOR-TO-GRID-No.1 VOLTAGE.	17600 max.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	70 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive bias value	150 max.	volts
Negative peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period. . .	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of	*14500*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*50*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	-200 to +350	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster .	31 to 49	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

SHORT RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 110° MAGNETIC DEFLECTION
INTERNAL MAGNETIC SHIELD

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	3.65	pf
Grid No.1 to all other electrodes	4.15	pf
External conductive coating to anode	1400 max.	pf
	900 min.	pf
Heater Current at 2.68 volts	450 ± 45	ma
Heater Warm-Up Time (Average)	11	seconds

Electron Gun . . . . Type Requiring No Ion-Trap Magnet

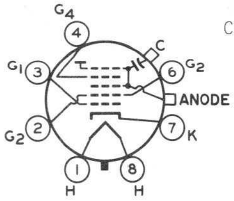
Optical:

Phosphor (For curves, see front of this Section). . P4—Sulfide Type, Aluminized
Faceplate, Spherical . . . . Filterglass
Light transmission (Approx.) 77%

Mechanical:

Weight (Approx.) . . . . 10 lbs
Overall Length . . . . 10-13/16" ± 3/16"
Neck Length. . . . . 3-11/16" ± 1/16"
Projected Area of Screen . . . . 155 sq. in.
External Conductive Coating:
Type . . . . Modified-Band
Contact area for grounding . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J132-1/2 A/B* sheets at front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW 8JK

Pin 1 - Heater
Pin 2 - Grid No.2
Pin 3 - Grid No.1
Pin 4 - Grid No.4
Pin 6 - Grid No.2
Pin 7 - Cathode
Pin 8 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

17DRP4

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	17600 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	950 max.	volts
Negative value	700 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	400 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	2.9 max.	volts
	2.4 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.4 Voltage	100 to 500	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-35 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

17DSP4

17DSP4
PICTURE TUBE

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

With heater having controlled warm-up time

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3	volts
Current	0.6	amp
Warm-up time (Average)	11	sec
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	$\mu\mu f$
Cathode to all other electrodes	5	$\mu\mu f$
External conductive coating to ultor	1500 max.	$\mu\mu f$
	1000 min.	$\mu\mu f$
Faceplate, Spherical	Filterglass	
Light transmission (Approx.)	78%	
Phosphor (For curves, see front of this section)	P4—Sulfide Type Aluminized	
Fluorescence	White	
Phosphorescence	White	
Persistence	Medium-Short	
Focusing Method	Electrostatic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	110°	
Horizontal	105°	
Vertical	87°	
Electron Gun	Type Requiring No Ion-Trap Magnet	
Tube Dimensions:		
Overall length	11-1/4" ± 3/16"	
Greatest width	15-5/8" ± 1/8"	
Greatest height	12-3/4" ± 1/8"	
Diagonal	16-9/16" ± 1/8"	
Neck length	4-1/8" ± 1/8"	
Radius of curvature of faceplate (External surface)	20-3/4"	
Screen Dimensions (Minimum):		
Greatest width	14-3/4"	
Greatest height	11-11/16"	
Diagonal	15-3/4"	
Projected area	155 sq. in.	
Weight (Approx.)	10 lbs	
Operating Position	Any	
Cap	Recessed Small Cavity (JEDEC No.J1-21)	
Bulb	J132-1/2 A1/B1	
Socket	Ucinite Part No.115446, or equivalent	

RCA

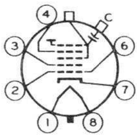
17DSP4

PICTURE TUBE

Base. . . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW. 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

GRID-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	18000	max.	volts
	12000#	min.	volts
GRID-No.4 (FOCUSING) VOLTAGE:			
Positive value.	1000	max.	volts
Negative value.	500	max.	volts
GRID-No.2 VOLTAGE	500	max.	volts
GRID-No.1 VOLTAGE:			
Negative-peak value	200	max.	volts
Negative-bias value	140	max.	volts
Positive-bias value	0	max.	volts
Positive-peak value	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds.	410	max.	volts
After equipment warm-up period. . . .	180	max.	volts
Heater positive with respect to cathode.	180	max.	volts

Equipment Design Ranges:

With any ultor voltage (Ec_5k) between 12000# and 18000 volts and grid-No.2 voltage (Ec_2k) between 200 and 500 volts

Grid-No.4 Voltage for focus§.	0 to 400	volts
Grid-No.1 Voltage (Ec_1k) for visual extinction of focused raster	*See Raster-Cutoff-Range Chart for Grid-Drive Service*	
Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak positive)	Same value as determined for Ec_1k except video drive is a positive voltage	

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PICTURE TUBE

Grid-No.4 Current.	−25 to +25		μa
Grid-No.2 Current.	−15 to +15		μa
Field Strength of Adjustable Centering Magnet*	0 to 8		gausses

Examples of Use of Design Ranges:

With ultor voltage of	*16000*	*16000*	*volts*
and grid-No.2 voltage of	*300*	*400*	*volts*
Grid-No.4 Voltage for focus.	0 to 400	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	−38 to −72	−45 to −90	volts
Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value.	38 to 72	45 to 90	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

CATHODE-DRIVE■ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	18000	max.	volts
	12000#	min.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:			
Positive value	1000	max.	volts
Negative value	500	max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	640	max.	volts
GRID-No.2-TO-CATHODE VOLTAGE	500	max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:			
Positive-peak value.	200	max.	volts
Positive-bias value.	140	max.	volts
Negative-bias value.	0	max.	volts
Negative-peak value.	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	410	max.	volts
After equipment warm-up period . . .	180	max.	volts
Heater positive with respect to cathode.	180	max.	volts

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PICTURE TUBE

Equipment Design Ranges:

With any ultor-to-grid-No. 1 voltage ($E_{c_5 g_1}$) between 12000⊕ and 18000 volts and grid-No. 2-to-grid-No. 1 voltage ($E_{c_2 g_1}$) between 225 and 640 volts

Grid-No.4-to-Grid-No.1 Voltage for focus§.	0 to 400	volts
Cathode-to-Grid-No.1 Voltage (Ek_{g_1}) for visual extinction of focused raster	*See Raster-Cutoff-Range Chart for Cathode-Drive Service*	
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak negative)	Same value as determined for Ek_{g_1} except video drive is a negative value	
Grid-No.4 Current	−25 to +25	μa
Grid-No.2 Current	−15 to +15	μa
Field Strength of Adjustable Centering Magnet*. . . .	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No. 1 voltage of	*16000*	*16000*	*volts*
and grid-No. 2-to-grid-No. 1 voltage of	*300*	*400*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	0 to 400	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster. . .	35 to 63	43 to 78	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value	−35 to −63	−43 to −78	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance. . . . . 1.5 max. megohms

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

⊕ This value is a working design-center minimum. The equivalent *absolute minimum* ultor (or ultor-to-grid-No.1) voltage is 11,000 volts, below which the serviceability of the 17DSP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor (or ultor-to-grid-No.1) voltage is never less than 11,000 volts.

§ The grid-No.4 (or grid-No.4-to-grid-No.1) voltage required for optimum focus of any individual tube will have a value between 0 and 400 volts independent of ultor current and will remain essentially constant for values of ultor (or ultor-to-grid-No.1) voltage or grid-No.2 (or grid-No.2-to-grid-No.1) voltage within design ranges shown for these items.

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PICTURE TUBE

* Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/8". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 5/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

OPERATING CONSIDERATIONS

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 17DSP4 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

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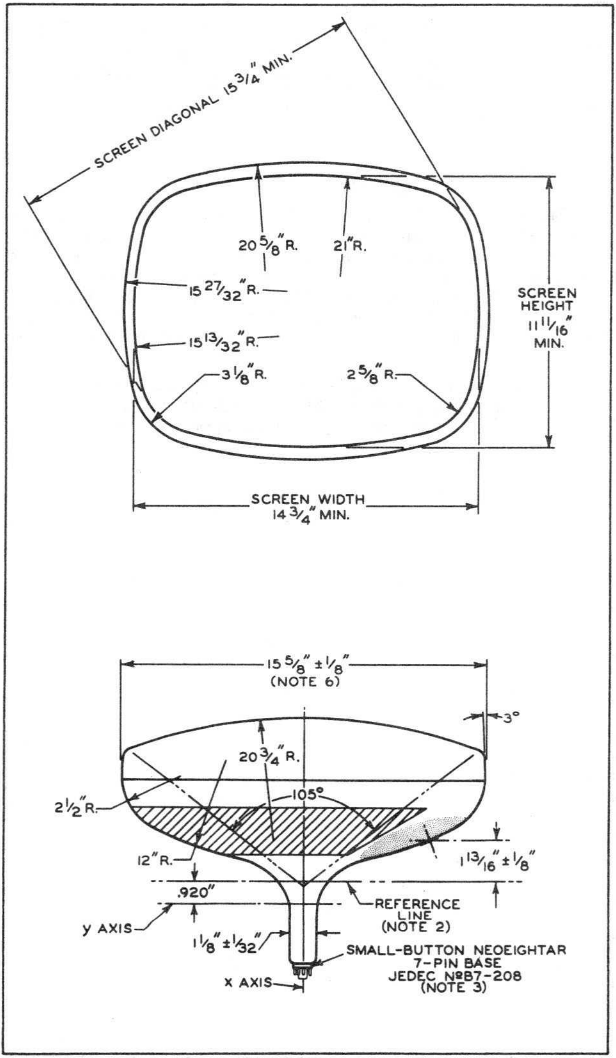
17DSP4

PICTURE TUBE



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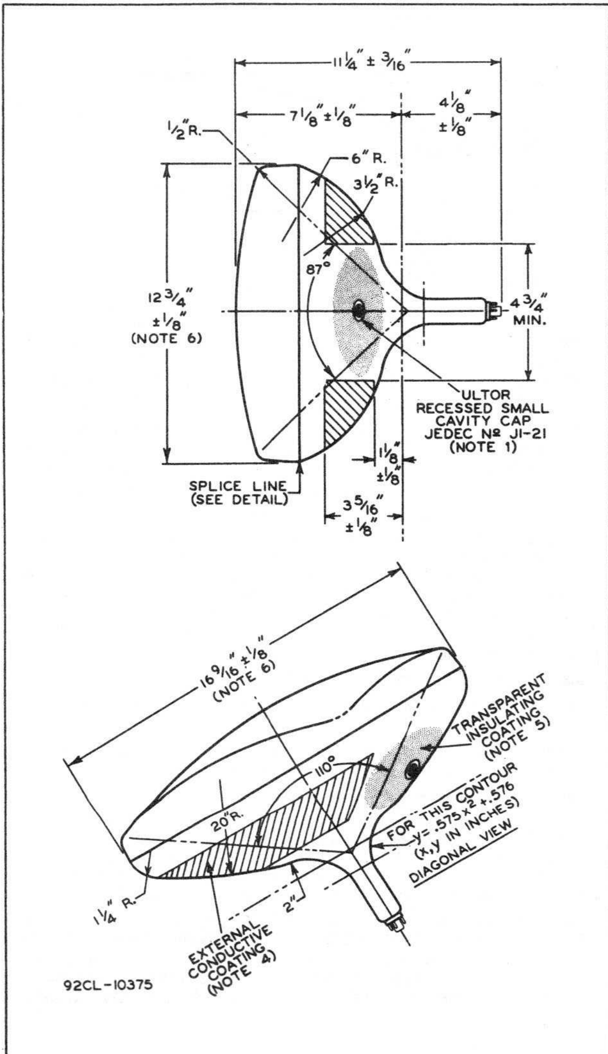
17DSP4

PICTURE TUBE



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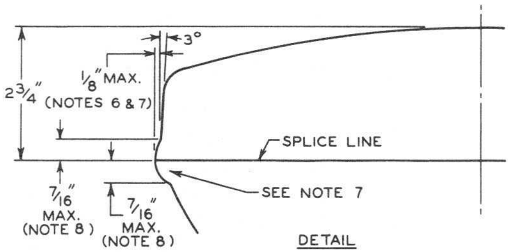
17DSP4

PICTURE TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED 2-9/32" ± 1/32" FROM THE PLANE TANGENT TO THE SURFACE OF THE FACEPLATE AT THE TUBE AXIS.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/4", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/8" BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: THE TUBE SHOULD BE SUPPORTED ON BOTH SIDES OF THE BULGE. THE MECHANISM USED SHOULD PROVIDE CLEARANCE FOR THE MAXIMUM DIMENSIONS OF THE BULGE. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

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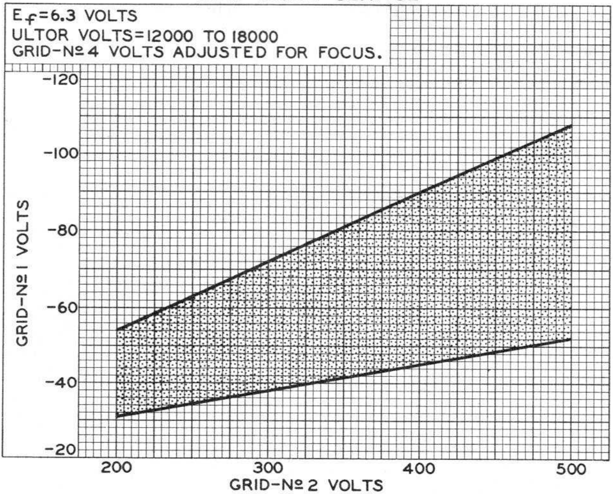
RASTER-CUTOFF-RANGE CHARTS

GRID-DRIVE SERVICE



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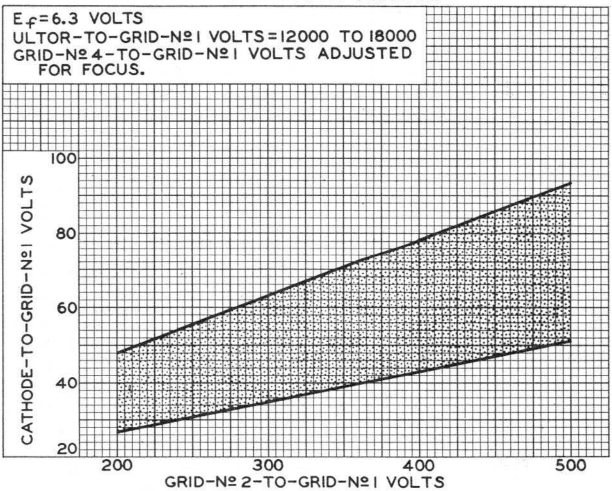
CATHODE-DRIVE SERVICE



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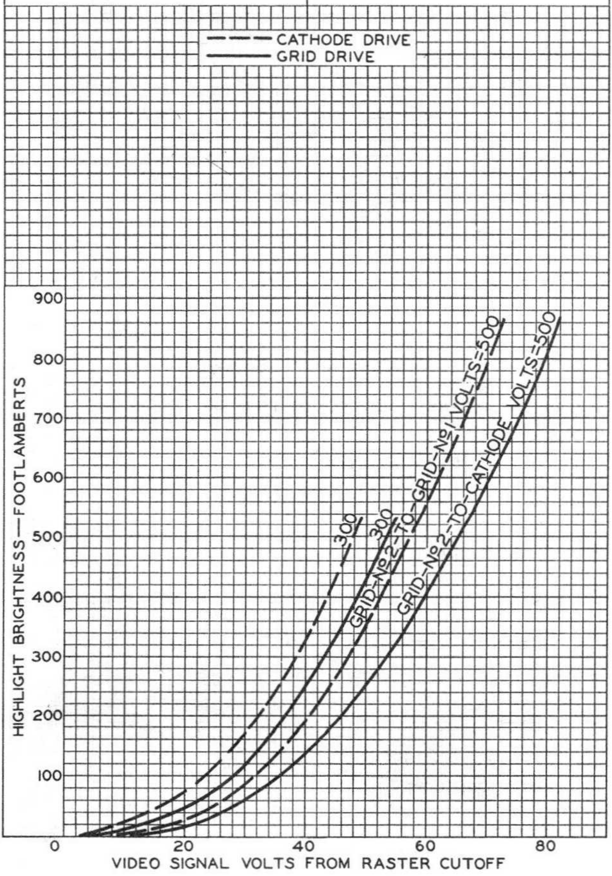
17DSP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-No.1 VOLTS = 16000	ULTOR VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID No.1 TO GIVE FOCUSED RASTER CUTOFF.	GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.	RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 14" x 10 1/2"	RASTER SIZE = 14" x 10 1/2"



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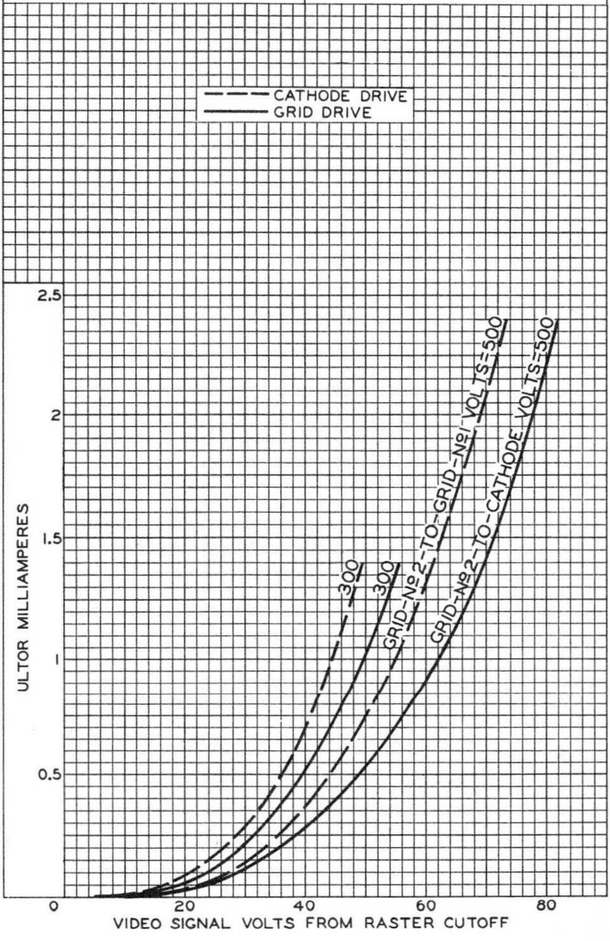
17DSP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f=6.3 VOLTS ULTOR-TO-GRID-№1 VOLTS=12000 TO 18000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID №1 TO GIVE FOCUSED RASTER CUTOFF.	E_f=6.3 VOLTS ULTOR VOLTS=12000 TO 18000 GRID №1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 70° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Heater Current at 6.3 volts . . . . 600 ± 10% ma
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes . . . . . . 6.5 μμf
  Cathode to all other electrodes . . . . 5 μμf
  External conductive coating to ultor. . . . {1500 max. μμf; 750 min. μμf}
Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

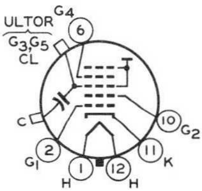
Optical:

Faceplate . . . . Filterglass
  Light transmission (Approx.). 74%
Phosphor (For curves, see front of this section). . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position. Any
Weight (Approx.). . . . . 18 lbs
Overall Length. . . . . 19-3/16" ± 3/8"
Neck Length . . . . 7-1/2" ± 3/16"
Projected Area of Screen. . . . . 149 sq. in.
External Conductive Coating:
  Type. . . . . .Regular-Band
  Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
  See *Picture-Tube Dimensional-Outlines* and *Bulb J133 B/D* sheets at the front of this section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . Small-Shell Duodecal 6-Pin, Arrangement 1, (JEDEC Group 4, No.B6-63)
  Basing Designation for BOTTOM VIEW. 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

Maximum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	22000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	800 max.	volts
GRID-No.2 VOLTAGE	700 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	180 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts

Typical Operating Conditions:

With ultor voltage of	*18000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

Picture Tube

SHORT RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

DATA

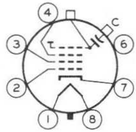
General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3	volts
Current at 6.3 volts	0.45	amp
Warm-up time (Average)	11	sec
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	1500 max. 1000 min.	μμf μμf
Faceplate, Spherical		Filterglass
Light transmission (Approx.)		77%
Phosphor (For curves, see front of this section)		P4—Sulfide Type Aluminized
Fluorescence		White
Phosphorescence		White
Persistence		Medium Short
Focusing Method		Electrostatic
Deflection Method		Magnetic
Deflection Angles (Approx.):		
Diagonal		110°
Horizontal		105°
Vertical		87°
Electron Gun		Type Requiring No Ion-Trap Magnet
Tube Dimensions:		
Overall length		10-11/16" ± 1/4"
Greatest width		15-5/8" ± 1/8"
Greatest height		12-3/4" ± 1/8"
Diagonal		16-9/16" ± 1/8"
Neck length		3-9/16" ± 1/8"
Radius of curvature of faceplate (External surface)		20-3/4"
Screen Dimensions (Minimum):		
Greatest width		14-3/4"
Greatest height		11-11/16"
Diagonal		15-3/4"
Projected area		155 sq. in.
Weight (Approx.)		10 lbs
Operating Position		Any
Cap		Recessed Small Cavity (JEDEC No.J1-21)
Bulb		J132-1/2 A/B
Socket		Ucinite Part No.115446, or equivalent
Base		Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

17DXP4

Basing Designation for BOTTOM VIEW. 8JR

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.3
Pin 6 – Internal Connection— Do Not Use
Pin 7 – Cathode



Pin 8 – Heater
Cap – Ultor (Grid No.4, Collector)
C – External Conductive Coating

GRID-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR VOLTAGE.	16000	max.	volts
	12000‡	min.	volts
GRID-No.3 (FOCUSING) VOLTAGE	650	max.	volts
GRID-No.2 VOLTAGE.	550	max.	volts
	300	min.	volts
GRID-No.1 VOLTAGE:			
Negative-peak value.	200	max.	volts
Negative-bias value.	140	max.	volts
Positive-bias value.	0	max.	volts
Positive-peak value.	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	410	max.	volts
After equipment warm-up period . . .	180	max.	volts
Heater positive with respect to cathode.	180	max.	volts

Equipment Design Ranges:

With any ultor voltage (E_{c_4k}) between 12000 and 16000 volts and grid-No.2 voltage (E_{c_2k}) between 400 and 550 volts

Grid-No.3 Voltage for focus§	0 to 400	volts
Grid-No.1 Voltage (E_{c_1k}) for visual extinction of focused raster.	See *Raster-Cutoff-Range Chart for Grid-Drive Service*	
Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak positive).	Same value as determined for E_{c_1k} except video drive is a positive voltage	
Grid-No.3 Current.	−25 to +25	μa
Grid-No.2 Current.	−15 to +15	μa

Field Strength of Adjustable Centering Magnet• . .		0 to 12	gausses

Examples of Use of Design Ranges:

With ultor voltage of	*16000*	*16000*	*volts*
and grid-No.2 voltage of	*400*	*500*	*volts*
Grid-No.3 Voltage for focus.	0 to 400	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-34 to -63	-43 to -78	volts
Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value.	34 to 63	43 to 78	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms

CATHODE-DRIVE■ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR-TO-GRID-No.1 VOLTAGE.	16000	max.	volts
	12000#	min.	volts
GRID-No.3-TO-GRID-No.1 (FOCUSING) VOLTAGE	650	max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	690	max.	volts
GRID-No.2-TO-CATHODE VOLTAGE.	550	max.	volts
	300	min.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:			
Positive-peak value	200	max.	volts
Positive-bias value	140	max.	volts
Negative-bias value	0	max.	volts
Negative-peak value	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds.	410	max.	volts
After equipment warm-up period. . . .	180	max.	volts
Heater positive with respect to cathode.	180	max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage ($E_{c_4g_1}$) between 12000 and 16000 volts and grid-No.2-to-grid-No.1 voltage ($E_{c_2g_1}$) between 400 and 690 volts

Grid-No.3-to-Grid-No.1 Voltage for focus§.	0 to 400	volts

Cathode-to-Grid-No.1 Voltage (Ek_{g_1}) for visual extinction of focused raster.	See *Raster-Cutoff-Range Chart for Cathode-Drive Service*		
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak negative)	Same value as determined for Ek_{g_1} except video drive is a negative voltage		
Grid-No.3 Current	−25 to +25		μa
Grid-No.2 Current	−15 to +15		μa
Field Strength of Adjustable Centering Magnet♦. .	0 to 12		gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of	*16000*	*16000*	*volts*
and grid-No.2 to-grid-No.1 voltage of	*400*	*500*	*volts*
Grid-No.3 to-Grid-No.1 Voltage for focus	0 to 400	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster.	34 to 56	41 to 69	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value	−34 to −56	−41 to −69	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance. . . . . . . 1.5 max. megohms

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

⊕ This value is a working design-center minimum. The equivalent *absolute minimum* ultor- or ultor-to-grid-No.1 voltage is 11,000 volts, below which the serviceability of the 17DXP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor- or ultor-to-grid-No.1 voltage is never less than 11,000 volts.

§ The grid-No.3 voltage required for optimum focus of any individual tube may have a value anywhere between 0 and 400 volts and is a function of the value of the ultor voltage, ultor current, and grid-No.2 voltage. It changes directly with the ultor voltage at the rate of approximately 46 volts for each 1000-volt change in ultor voltage; inversely with grid-No.2 voltage at the rate of about 60 volts for each 100-volt change in grid-No.2 voltage; and inversely with ultor current at the rate of about 60 volts for each 100-microampere change in ultor current. Because the 17DXP4 has a narrow depth of focus, it is necessary to provide means such as a potentiometer or a 4-tap switch for adjusting the focusing voltage. In general, commercially acceptable focus is obtained if the focusing voltage is within 75 volts of the value required for optimum focus and if the focusing voltage is maintained to within 75 volts of the optimum value during line-voltage fluctuations.

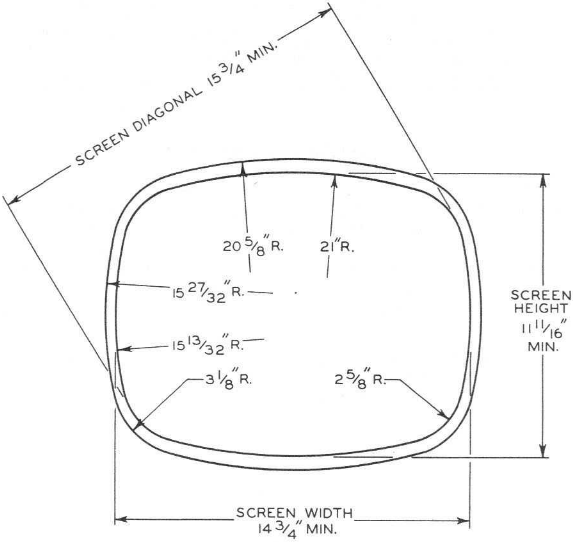
● Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 5/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

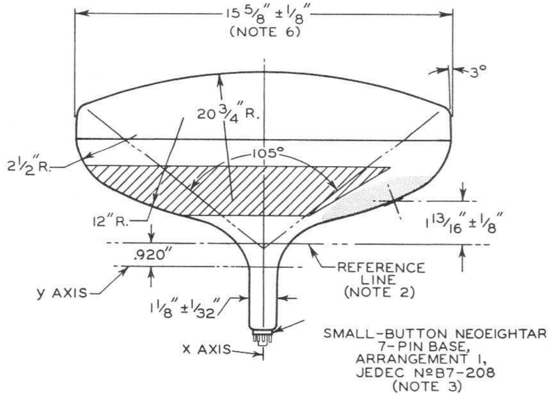
■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

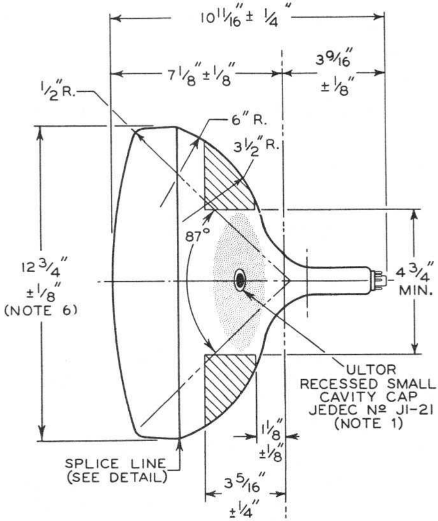
OPERATING CONSIDERATIONS

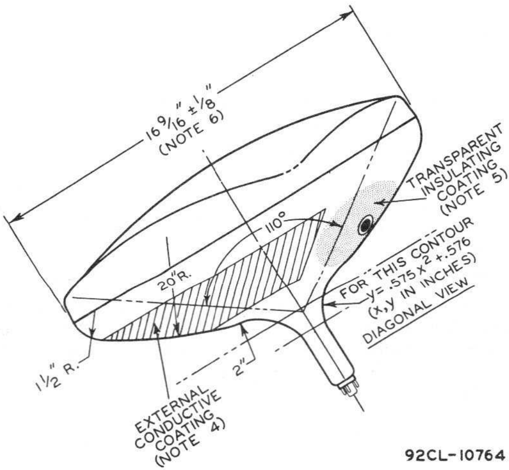
Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 17DXP4 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

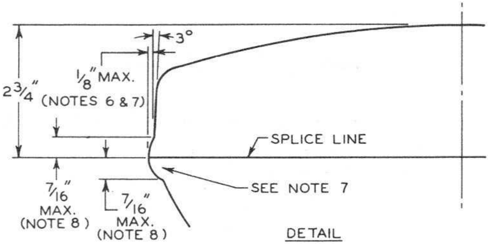

SCREEN DIAGONAL 15 3/4" MIN.
20 5/8" R.
21" R.
15 27/32" R.
15 13/32" R.
3 1/8" R.
2 5/8" R.
SCREEN HEIGHT 11 11/16" MIN.
SCREEN WIDTH 14 3/4" MIN.


15 5/8" ± 1/8" (NOTE 6)
3°
20 3/4" R.
105°
2 1/2" R.
12" R.
1 13/16" ± 1/8"
.920"
REFERENCE LINE (NOTE 2)
Y AXIS
1 1/8" ± 1/32"
X AXIS
SMALL-BUTTON NEOEIGHTAR 7-PIN BASE, ARRANGEMENT 1, JEDEC № B7-208 (NOTE 3)


10 11/16" ± 1/4"
7 1/8" ± 1/8"
3 9/16" ± 1/8"
1/2" R.
6" R.
3 1/2" R.
87°
12 3/4" ± 1/8" (NOTE 6)
4 3/4" MIN.
ULTOR
RECESSED SMALL CAVITY CAP
JEDEC № J1-21
(NOTE 1)
1 1/8" ± 1/8"
SPLICE LINE (SEE DETAIL)
3 5/16" ± 1/4"


16 9/16" ± 1/8" (NOTE 6)
TRANSPARENT INSULATING COATING (NOTE 5)
110°
20" R.
FOR THIS CONTOUR
y = .575 x² + .576
(x, y IN INCHES)
DIAGONAL VIEW
1 1/2" R.
2"
EXTERNAL CONDUCTIVE COATING (NOTE 4)

92CL-10764



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 6: MEASURED 2-9/32" ± 1/32" FROM THE PLANE TANGENT TO THE SURFACE OF THE FACEPLATE AT THE TUBE AXIS.

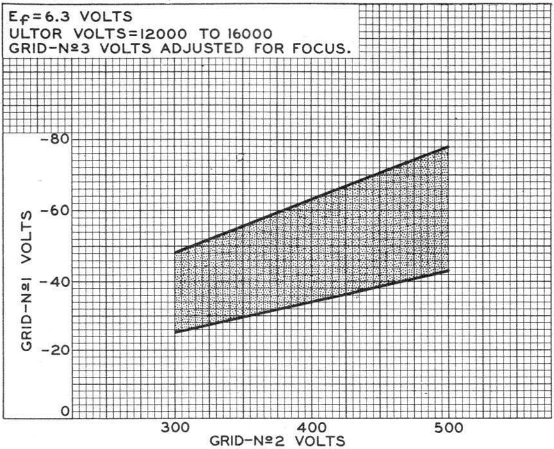
NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/4", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/8" BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: THE TUBE SHOULD BE SUPPORTED ON BOTH SIDES OF THE BULGE. THE MECHANISM USED SHOULD PROVIDE CLEARANCE FOR THE MAXIMUM DIMENSIONS OF THE BULGE. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

NOTE 9: NECK DIAMETER IS MAINTAINED TO AT LEAST 2-7/16" FROM REFERENCE LINE.

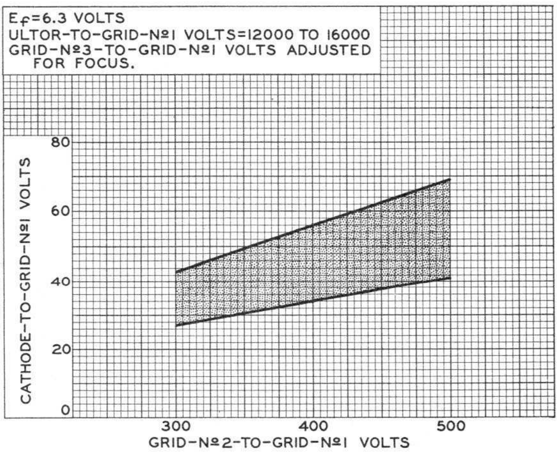
RASTER-CUTOFF-RANGE CHARTS

Grid-Drive Service



92CS-9930

Cathode-Drive Service



92CS-9931

17EZP22

Color Picture Tube

Perma-Chrome	Banded-Type Implosion Protection
90° Rectangular	Hi-Lite Screen
Blue-Gun-Down Operation	Unity Current Ratios

ELECTRICAL

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green
Heater, of Each Gun Series Connected within Tube with Each of the Other Two Heaters:	
Current at 6.3 V	900 mA
Focusing Method	Electrostatic
Focus Lens	Unipotential
Convergence Method	Magnetic
Deflection Method	Magnetic
Deflection Angles (Approx.):	
Diagonal	90 deg.
Horizontal	79 deg.
Vertical	63 deg.
Direct Interelectrode Capacitances (Approx.):	
Grid No.1 of any gun to all other electrodes	7.5 pF
Grid No.4 to all other electrodes	6 pF
All cathodes to all other electrodes	15 pF
External conductive coating to anode	1500 max. pF 1000 min. pF

OPTICAL

Faceplate	Filterglass
Light transmission at center (Approx.)	48 %
Surface	Polished
Screen	Aluminized
Matrix	Black opaque material
Phosphor, rare-earth (red), sulfide (blue & green)	P22
Persistence	Medium-Short
Array	Dot trios
Spacing between centers of adjacent dot trios (approx.)	0.029 in (0.74 mm)

17EZP22

MECHANICAL

Minimum Screen Area (Projected)	145 sq. in (935 sq. cm)
Bulb Funnel Designation	JEDEC No.J 139 A1
Bulb Panel Designation	JEDEC No.FP 139B1
Base Designation[a]	Small-Button Diheptar 12-pin
Basing Designation	JEDEC No.14BH
Pin Position Alignment	Pin No. 5 Aligns Approx. with Anode Bulb Contact
Operating Position:	
For blue gun down	Anode Bulb Contact on Top
For blue gun up	Anode Bulb Contact on Bottom
Weight (Approx.)	17.5 lb (8.0 kg)

MAXIMUM AND MINIMUM RATINGS, Design-Maximum Values

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	22,500 max. / 17,000 min.	V / V
Total Anode Current, Long-Term Average	750 max.	µA
Grid-No.4 (Focusing Electrode) Voltage:		
Positive value	1100 max.	V
Negative value	550 max.	V
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max.	V
Grid-No.1 Voltage:		
Negative bias value	400 max.	V
Negative operating cutoff value	140 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Heater Voltage (ac or dc):[c]		
Under operating conditions	6.9 max. / 5.7 min.	V / V
Under standby conditions[d]	5.5 max.	V
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
Combined AC and DC value	200 max.	V
DC component value	200 max.	V
Heater positive with respect to cathode:		
AC component value	200 max.	V
DC component value	0 max.	V

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 17,000 and 22,500 V

Grid-No.4 (Focusing Electrode) Voltage	−75 to 400	V

Grid-No.2 and Grid-No.1 Voltages for Visual Extinction of Focused Spot . . . . *SEE CUTOFF DESIGN CHART*

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At grid-No.1 spot cutoff voltage of –100 V) 1.86

Heater Voltage:[c]

Under operating conditions:

When standby operation is not utilized. . . . . 6.3 V

When 5.0-V standby operation is utilized[d]. . . . . 6.0 V

Under standby conditions[d]. . . . . 5.0 V

Grid-No.4 Current (Total) . . . . –60 to +60 µA

Grid-No.2 Current . . . . –5 to +5 µA

To Product White of 9300° K + 27 M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311):

	Red	*Blue*	*Green*	
Percentage of total anode current supplied by each gun (average)	34	32	34	%

Ratio of cathode currents:	*Min.*	*Typ.*	*Max.*
Red/blue	0.75	1.10	1.50
Red/green	0.65	1.00	1.50
Blue/green	0.60	0.91	1.30

Displacements, Measured at Center of Screen:

Raster centering displacement:

Horizontal . . . . ± 0.45 in (± 11.4 mm)

Vertical . . . . ± 0.45 in (± 11.4 mm)

Lateral distance between the blue beam and the converged red and green beams . . . . ± 0.25 in (± 6.4 mm)

Radial convergence displacement excluding effects of dynamic convergence (each beam) . . . . . ± 0.37 in (± 9.4 mm)

Maximum Required Correction for Register[e] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the center of the Screen in any Direction . . . . . . 0.005 in (0.13 mm) max.

LIMITING CIRCUIT VALUES

Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . 0.75 max. MΩ

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 mA total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

[a] The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound.

[c] For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.

[d] For "instant on" applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

[e] Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

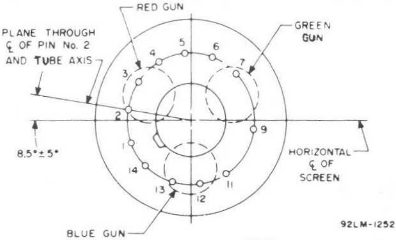
X-RADIATION WARNING

Because the 17EZP22 is designed to be operated at anode voltages as high as 22.5 kilovolts (design-maximum value), shielding of the 17EZP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

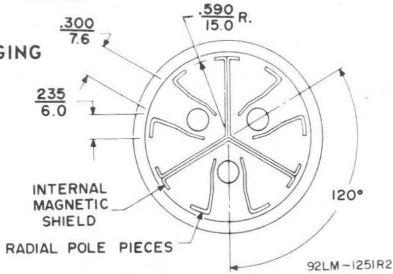
BASE SPECIFICATION – JEDEC No. 14BH

Pin 1: Heater
Pin 2: Cathode of Red Gun
Pin 3: Grid No.1 of Red Gun
Pin 4: Grid No.2 of Red Gun
Pin 5: Grid No.2 of Green Gun
Pin 6: Cathode of Green Gun
Pin 7: Grid No.1 of Green Gun
Pin 9: Grid No.4
Pin 11: Cathode of Blue Gun
Pin 12: Grid No.1 of Blue Gun
Pin 13: Grid No.2 of Blue Gun
Pin 14: Heater
Cap: Anode (Grid No.3, Grid No.5, Screen, Collector)
C: External Conductive Coating

BOTTOM VIEW OF BASE



LOCATION OF RADICAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



NOTES FOR DIMENSIONAL OUTLINE

Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C′ of the gauge with the glass funnel.

Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

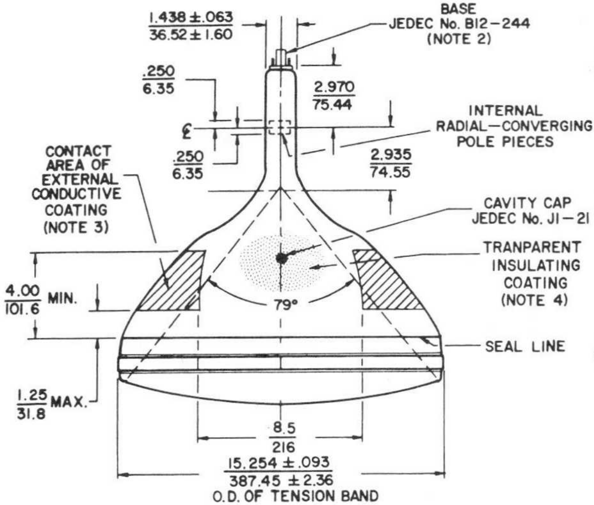
Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

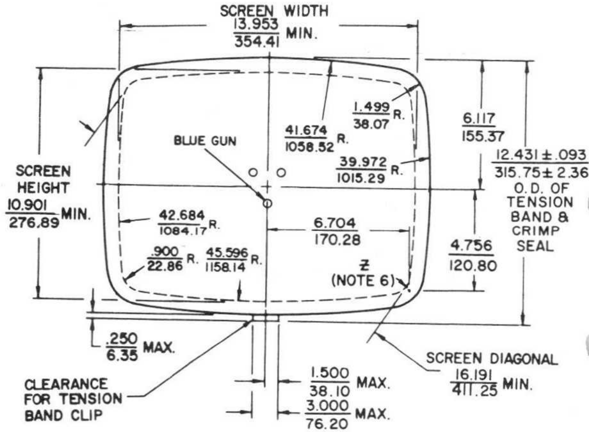
Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

Note 5: All peripheral points of the faceplate lie on a spherical surface having a radius of 25.141 inches (638.58 mm). The center of the faceplate is located .016 inch (.41 mm) above this spherical surface.

Note 6: "Z" is located on the outside surface of the faceplate, on the screen diagonal at a point .125 in (3.18 mm) beyond the minimum screen. This point is used as a reference for the tension band.

DIMENSIONAL



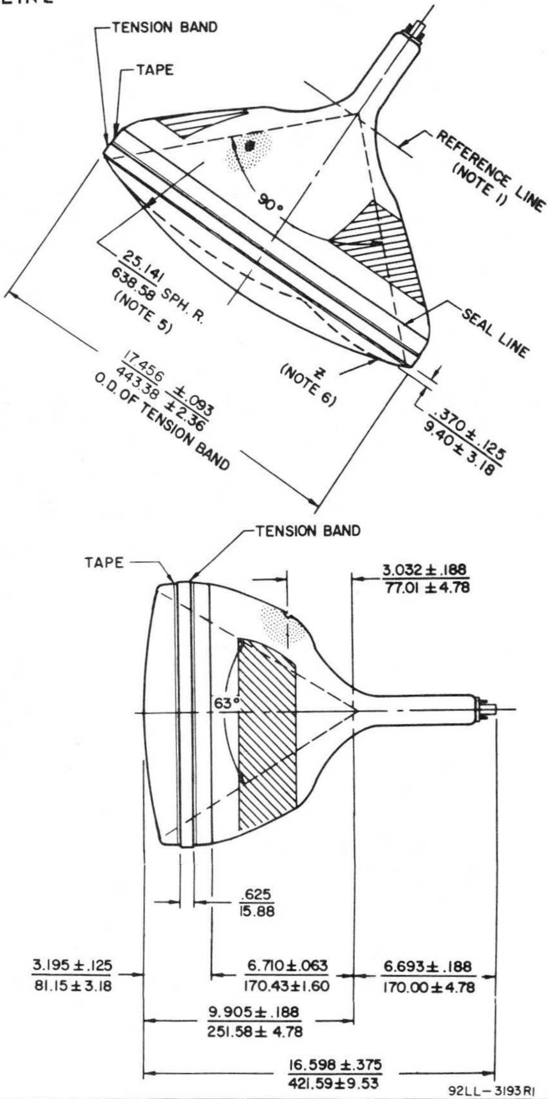


SAGITTAL HEIGHTS AT POINTS $\frac{.125}{3.18}$ BEYOND EDGE OF MIN. SCREEN

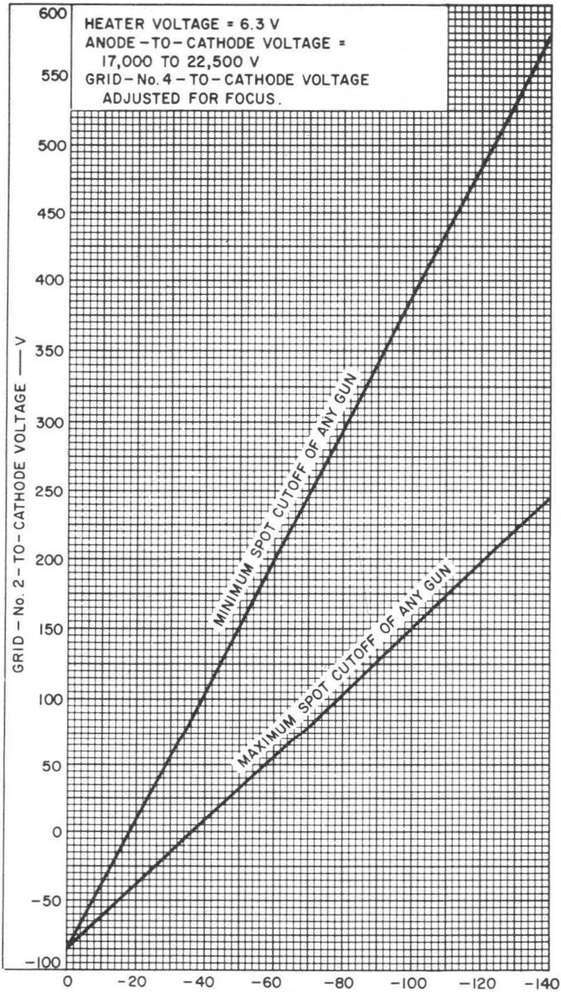
DIAGONAL $\frac{1.398}{35.51}$ WIDTH $\frac{1.040}{26.42}$ HEIGHT $\frac{.642}{16.31}$

Dimensions in Inches / mm unless otherwise noted

OUTLINE


TENSION BAND
TAPE
90°
REFERENCE LINE (NOTE 1)
25.141 / 638.58 SPH. R. (NOTE 5)
SEAL LINE
Z (NOTE 6)
17.456 ±.093 / 443.38 ±2.36 O.D. OF TENSION BAND
.370±.125 / 9.40±3.18
TENSION BAND
TAPE
3.032±.188 / 77.01 ±4.78
63°
.625 / 15.88
3.195±.125 / 81.15±3.18
6.710±.063 / 170.43±1.60
6.693±.188 / 170.00±4.78
9.905±.188 / 251.58± 4.78
16.598±.375 / 421.59±9.53
92LL-3193R1

CUTOFF DESIGN CHART



Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:		
Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes. . . .	6	pf
External conductive coating to anode . .	1500 max.	pf
	750 min.	pf
Heater Current at 6.3 volts.	600 ± 30	ma
Electron Gun	Type Requiring No Ion-Trap Magnet	

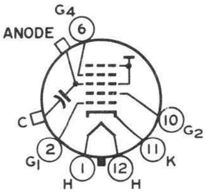
Optical:

Phosphor (For curves, see front of this Section). . P4—Sulfide Type, Aluminized
Faceplate, Spherical . . . . Filterglass
Light transmission (Approx.) 74%

Mechanical:

Weight (Approx.) . . . . 18 lbs
Overall Length . . . . 19-3/16" ± 3/8"
Neck Length. . . . . 7-1/2" ± 3/16"
Projected Area of Screen . . . . 149 sq. in.
External Conductive Coating:
Type . . . . Regular-Band
Contact area for grounding . . . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J133 B/D* sheets at front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE.	17500 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts

GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.4 Voltage	-56 to +310	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

RECTANGULAR GLASS TYPE	ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS	70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:		
Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode	1500 max.	pf
	750 min.	pf
Heater Current at 6.3 volts	600 ± 30	ma
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (For curves, see front of this Section)	P4—Sulfide Type, Aluminized
Faceplate, Cylindrical	Filterglass
Light transmission (Approx.)	66%

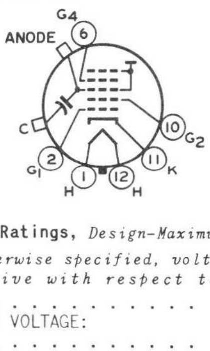
Mechanical:

Weight (Approx.)	19 lbs
Overall Length	19-3/16" ± 3/8"
Neck Length	7-1/2" ± 3/16"
Projected Area of Screen	149 sq. in.
External Conductive Coating:	
Type	Regular-Band
Contact area for grounding	Near Reference Line

For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J133 C/E* sheets at front of this section

Cap	Recessed Small Cavity (JEDEC No.J1-21)
Base	Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW	12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	17500 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts

GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.4 Voltage	-56 to +310	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

17QP4B

Picture Tube

RECTANGULAR GLASS TYPE	ALUMINIZED SCREEN
MAGNETIC FOCUS	70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes. . . .	5	pf
Grid No.1 to all other electrodes. . .	6	pf
External conductive coating to anode .	1500 max.	pf
	750 min.	pf
Heater Current at 6.3 volts.	600 ± 60	ma
Heater Warm-Up Time (Average).	11	seconds

Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (For curves, see front of this section). P4—Sulfide Type, Aluminized

Faceplate. . . . . Filterglass

Light transmission (Approx.) 74%

Mechanical:

Weight (Approx.). 19 lbs

Overall Length . . . . 19-3/16" ± 3/8"

Neck Length. . . . . 7-1/2" ± 3/16"

Projected Area of Screen . . . . 149 sq. in.

External Conductive Coating:

Type . . . . Regular-Band

Contact area for grounding . . . . Near Reference Line

For Additional Information on Coatings, Dimensions, and Deflection Angles:

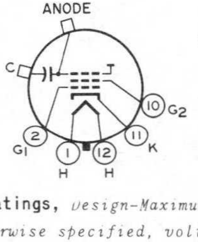
See *Picture-Tube Dimensional-Outlines and Bulb J133 C/E* sheets at front of this section

Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)

Base . . . . Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)

Basing Designation for BOTTOM VIEW 12N

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Screen, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	20000 max.	volts
Grid-No.2 Voltage.	550 max.	volts

Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	{6.9 max. / 5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	−28 to −72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

SHORT RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 114° MAGNETIC DEFLECTION
INTERNAL MAGNETIC SHIELD

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	3.4	pf
Grid No.1 to all other electrodes . . .	3.4	pf
External conductive coating to anode. .	1400 max.	pf
	850 min.	pf
Heater Current at 2.68 volts.	450 ± 45	ma
Heater Warm-Up Time (Average)	11	seconds

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

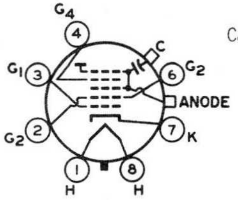
Optical:

Phosphor (For curves, see front of this Section). P4—Sulfide Type, Aluminized
Faceplate . . . . Filterglass
Light transmission (Approx.). 77%

Mechanical:

Weight (Approx.). . . . . 14 lbs
Overall Length. . . . . 10-15/16" ± 3/16"
Neck Length . . . . 3-11/16" ± 1/16"
Projected Area of Screen. . . . . 172 sq.in.
External Conductive Coating:
Type. . . . . .Regular-Band
Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J149 A* sheets at front of this section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW. 8JK

Pin 1 - Heater
Pin 2 - Grid No.2
Pin 3 - Grid No.1
Pin 4 - Grid No.4
Pin 6 - Grid No.2
Pin 7 - Cathode
Pin 8 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	20000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	950 max.	volts
Negative value	700 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	400 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	2.9 max.	volts
	2.4 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	16000	volts
Grid-No.4 Voltage	100 to 500	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	−35 to −72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS **114° MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	600 ± 5%	ma
Heater Warm-Up Time (Average).	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes. . .	6	μμf
Cathode to all other electrodes. . . .	5	μμf
External conductive coating to ultor .	1500 max.	μμf
	1000 min.	μμf

Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

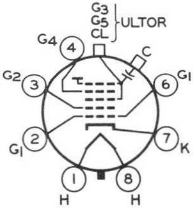
Optical:

Faceplate and Protective Panel . . . . .Filterglass
Light transmission (Approx.) 44%
Phosphor (For Curves, see front of this Section) .P4—Sulfide Type, Aluminized

Mechanical:

Operating Position .Any
Weight (Approx.) . . . . 18-1/2 lbs
Overall Length . . . . 11-5/8" ± 5/16"
Neck Length. . . . . 4-1/8" ± 1/8"
Projected Area of Screen . . . . 172 sq. in.
External Conductive Coating:
Type . . . . Regular Band
Contact area for grounding . . . . .Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J149 C* sheets at the front of this section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . .Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

Maximum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	20000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE.	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value.	220 max.	volts
Negative bias value.	155 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period . . .	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	*16000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus.	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-35 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
114° MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	450 ± 10%	ma
Heater Warm-Up Time (Average)	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	1900 max.	μμf
	1400 min.	μμf
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate	Filterglass
Light transmission (Approx.)	78%
Phosphor (For curves, see front of this Section)	P4—Sulfide Type, Aluminized

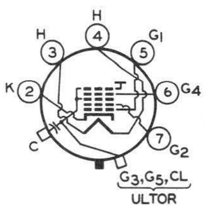
Mechanical:

Operating Position	Any
Weight (Approx.)	14 lbs
Overall Length	11-3/8" ± 1/4"
Neck Length	4-1/8" ± 1/8"
Projected Area of Screen	172 sq. in.
External Conductive Coating:	
Type	Regular Band
Contact area for grounding	Near Reference Line

For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J149 A* sheets at the front of this section

Cap	Recessed Small Cavity (JEDEC No.J1-21)
Base	Special 6-Pin (JEDEC No.B6-214)
Basing Designation for BOTTOM VIEW	7FA

Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Grid No.1
Pin 6 - Grid No.4
Pin 7 - Grid No.2



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	19800 max.	volts
	12000 min.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	500 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	70 max.	volts
	40 min.	volts
CATHODE-TO-GRID-No.1 VOLTAGE	100 max.	volts
HEATER VOLTAGE	7 max.	volts
	5.8 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	180 max.	volts
Heater positive with respect to cathode	180 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of	*14500*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*50*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	0 to 500	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster	31 to 49	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds
Focusing Method		Electrostatic
Deflection Method		Magnetic
Deflection Angles (Approx.):		
Diagonal		114°
Horizontal		102°
Vertical		85°
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	1500 max.	μμf
	1000 min.	μμf
Electron Gun		Type Requiring No Ion-Trap Magnet

Optical:

Faceplate	Filterglass
Light transmission at center (Approx.)	78%
Phosphor (For curves, see front of this Section)	P4—Sulfide Type Aluminized
Fluorescence	White
Phosphorescence	White
Persistence	Medium Short

Mechanical:

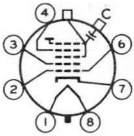
Tube Dimensions:	
Overall length	11-3/8" ± 1/4"
Greatest width	16-13/32" ± 1/8"
Greatest height	13-11/32" ± 1/8"
Diagonal	18-5/8" ± 1/8"
Neck length	4-1/8" ± 1/8"
Curvature of faceplate (External Radii):	
Center	48"
Edge	21"
Screen Dimensions (Minimum):	
Greatest width	15-1/8"
Greatest height	12"
Diagonal	17-9/16"
Projected area	172 sq. in.
Weight (Approx.)	14 lbs
Operating Position	Any
Cap	Recessed Small Cavity (JEDEC No.J1-21)
Bulb	J149A1

19AVP4

Base. . . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No. B7-208)

Basing Designation for BOTTOM VIEW. 8HR

Pin 1 - Heater
Pin 2 - Grid No. 1
Pin 3 - Grid No. 2
Pin 4 - Grid No. 4
Pin 6 - Grid No. 1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Ultor (Grid No. 3, Grid No. 5, Collector)
C - External Conductive Coating

GRID-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	23000 max.	volts
	15000 min.	volts
GRID-No. 4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No. 2 VOLTAGE	550 max.	volts
	200 min.	volts
GRID-No. 1 VOLTAGE:		
Negative-peak value	220 max.	volts
Negative-bias value	154 max.	volts
Positive-bias value	0 max.	volts
Positive-peak value	2 max.	volts
HEATER VOLTAGE.	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period. . .	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor voltage (E_{c_5k}) *of*	*20000*	*volts*
and grid-No. 2 voltage (E_{c_2k}) *of*	*400*	*volts*
Grid-No. 4 Voltage for focus●.	0 to 400	volts
Grid-No. 1 Voltage for visual extinction of focused raster★	-36 to -94	volts
Field Strength of Adjustable Centering Magnet♦	0 to 9	gausses

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance.	1.5 max.	megohms

CATHODE-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	23000 max. / 15000 min.	volts / volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	700 max. / 350 min.	volts / volts
GRID-No.2-TO-CATHODE VOLTAGE	550 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value	220 max.	volts
Positive-bias value	154 max.	volts
Negative-bias value	0 max.	volts
Negative-peak value	2 max.	volts
HEATER VOLTAGE	6.9 max. / 5.7 min.	volts / volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage ($E_{c_5 g_1}$) of	*20000*	*volts*
and grid-No.2-to-grid-No.1 voltage ($E_{c_2 g_1}$) of	*400*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus●	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster★	36 to 78	volts
Field Strength of Adjustable Centering Magnet♦	0 to 9	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

● The grid-No.4 (or grid-No.4-to-grid-No.1) voltage required for optimum focus of any individual tube will have a value anywhere between 0 and 400 volts, is independent of ultor current and will remain essentially constant for values of ultor (or ultor-to-grid-No.1) voltage or grid-No.2 (or grid-No.2-to-grid-No.1) voltage within design-maximum ratings shown for these items.

★ See *Raster-Cutoff-Range Chart for Grid-Drive Service*.

♦ Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equals:

$$\sqrt{\frac{Ec_5k \text{ or } Ec_5g_1 \text{ (volts)}}{16000 \text{ (volts)}}} \times 8 \text{ gausses}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

♣ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

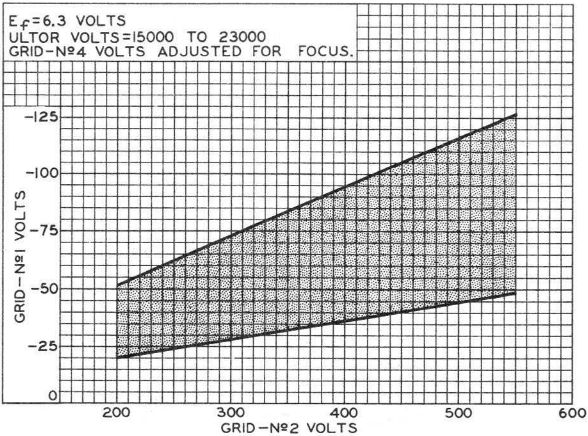
♠ See *Raster-Cutoff-Range Chart for Cathode-Drive Service.*

OPERATING CONSIDERATIONS

X-Ray Warning. When operated at ultor voltages up to 16 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 23 kilovolts (Design-maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture tube practice, it is recommended that the cabinet be provided with\a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

RASTER-CUTOFF-RANGE CHARTS
Grid-Drive Service



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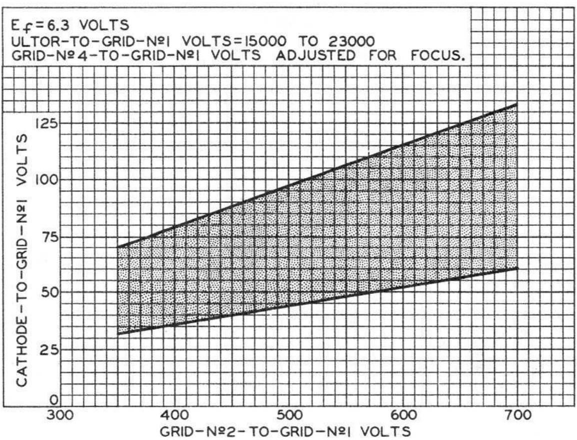
Cathode-Drive Service



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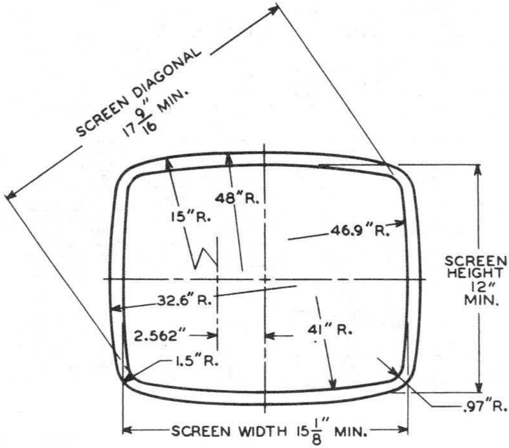
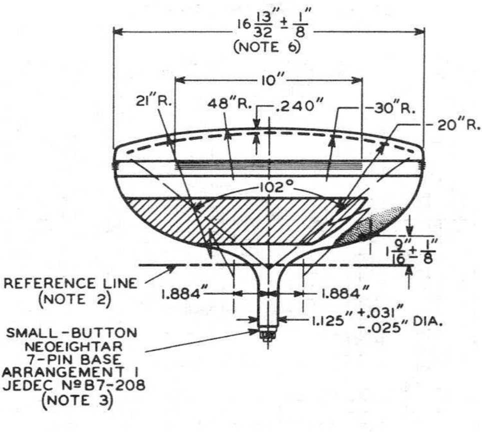
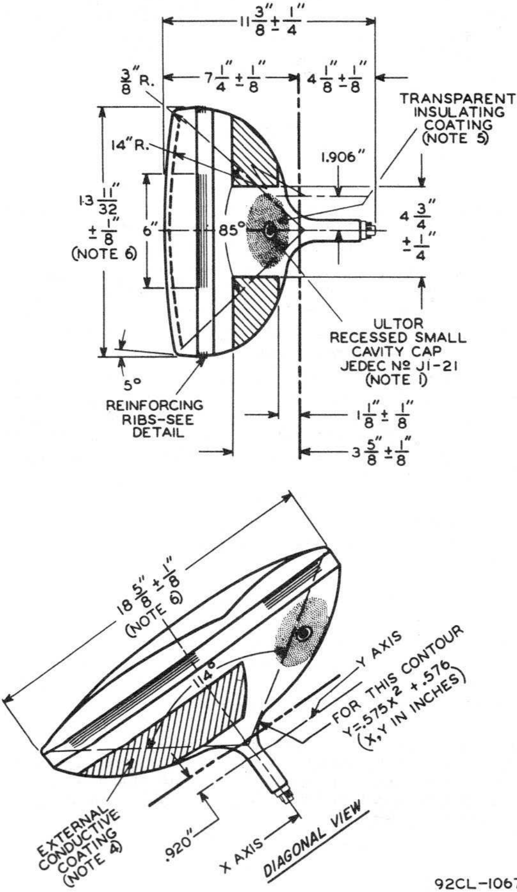

SCREEN DIAGONAL
17 9/16" MIN.
48"R.
15"R.
46.9"R.
SCREEN HEIGHT 12" MIN.
32.6"R.
2.562"
41"R.
1.5"R.
.97"R.
SCREEN WIDTH 15 1/8" MIN.


16 13/32" ± 1/8"
(NOTE 6)
10"
21"R.
48"R.
.240"
30"R.
20"R.
102°
1 9/16" ± 1/8"
REFERENCE LINE
(NOTE 2)
1.884"
1.884"
1.125" +.031" -.025" DIA.
SMALL-BUTTON
NEOEIGHTAR
7-PIN BASE
ARRANGEMENT 1
JEDEC Nº B7-208
(NOTE 3)



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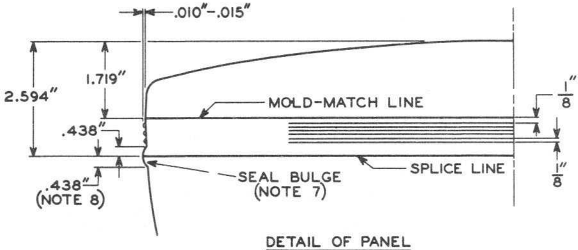


DETAIL OF PANEL

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No.G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

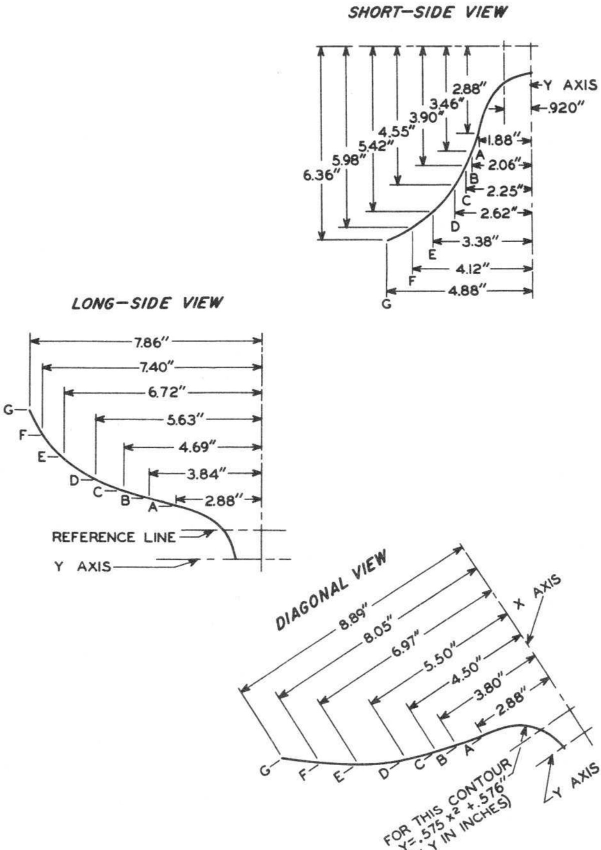
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

NOTE 8: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPLICE LINE IS 3/8" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF THE TUBE SUPPORT BAND. TUBE MOUNTING AND YOKE SUPPORT CLAMPS MUST BE SPECED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

BULB-CONTOUR DIMENSIONS



92CL-10669R1

NOTE: PLANES A THROUGH G ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE-BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.

Picture Tube

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
114° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

The 19AYP4 is the same as the 19AVP4 except for the following item:

Electrical:

Heater Current at 6.3 volts. . . . . 450 ± 20 ma

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW-GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 10%	ma
Heater Warm-Up Time (Average)	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	$\mu\mu f$
Cathode to all other electrodes	5	$\mu\mu f$
External conductive coating to ultor	2000 max.	$\mu\mu f$
	1500 min.	$\mu\mu f$
Electron Gun	Type Requiring No Ion-Trap Magnet	

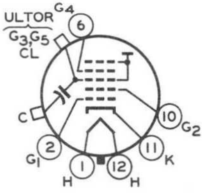
Optical:

Faceplate . . . . Filterglass
Light transmission (Approx.) 78%
Phosphor (For curves, see front of this Section) . . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position . . . . Any
Weight (Approx.) . . . . 15 lbs
Overall Length . . . . 15-1/4" ± 3/8"
Neck Length . . . . 5-1/2" ± 3/16"
Projected Area of Screen . . . . 172 sq. in.
External Conductive Coating:
Type . . . . Regular Band
Contact area for grounding . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J149 B* sheets at the front of this section
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Bases (Alternates):
Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)
Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	19800 max.	volts
	12000 min.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	500 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	70 max.	volts
	40 min.	volts
CATHODE-TO-GRID-No.1 VOLTAGE	100 max.	volts
HEATER VOLTAGE	7 max.	volts
	5.8 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	180 max.	volts
Heater positive with respect to cathode	180 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of	*14500*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*50*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	0 to 500	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster	31 to 49	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

Picture Tube

SHORT RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
114° MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes . . .	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor. . .	1500 max.	μμf
	1000 min.	μμf
Electron Gun. . . . . Type Requiring No Ion-Trap Magnet		

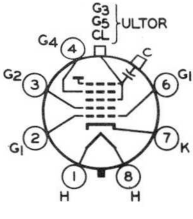
Optical:

Faceplate . . . . Filterglass
Light transmission (Approx.). 78%
Phosphor (For curves, see front of this Section) . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position. . . . . Any
Weight (Approx.). 14 lbs
Overall Length. . . . . 11-5/8" ± 1/4"
Neck Length . . . . 4-3/8" ± 1/8"
Projected Area of Screen. . . . . 172 sq. in.
External Conductive Coating:
Type. . . . . .Regular Band
Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J149 A* sheets at the front of this section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . .Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW. 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	20000 max.	volts
	10000 min.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	70 max.	volts
	40 min.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive peak value	150 max.	volts
Positive bias value	100 max.	volts
Negative bias value	0 max.	volts
Negative peak value	2 max.	volts
HEATER VOLTAGE	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of	*16000*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*50*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	-50 to +250	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster	32 to 50	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS — 114° MAGNETIC DEFLECTION

Low-Grid-No.2 Voltage — for Cathode-Drive Operation

The 19CMP4 is the same as the 19CHP4 except for the following items:

ELECTRICAL

Heater Current at 6.3 volts	450 ± 20	mA

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Anode Voltage	12000 min	V

Picture Tube

NO ION-TRAP MAGNET REQUIRED

LOW-VOLTAGE ELECTROSTATIC FOCUS 114° MAGNETIC DEFLECTION

Low-Grid-No.2 Voltage — for Cathode-Drive Operation

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	1900 max	pF
	1400 min	pF
Heater Current at 6.3 V	600 ±60	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

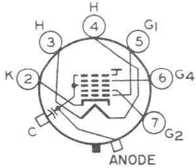
OPTICAL

Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission (Approx.) 78%

MECHANICAL

Weight (Approx.) . . . . 14 lb
Overall Length . . . . 11.625 ± 0.250 in
Neck Length . . . . 4.375 ± 0.125 in
Projected Area of Screen . . . . 172 sq in
External Conductive Coating
Type . . . . Regular-Band
Contact area for grounding . . . . Near Reference Line
For Addition Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J149A* sheets at front of this section
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Special 6-Pin (JEDEC No.B6-214)
Basing Designation for BOTTOM VIEW 7FA

Pin 2 - Cathode
Pin 3 - Heater
Pin 4 - Heater
Pin 5 - Grid No.1
Pin 6 - Grid No.4
Pin 7 - Grid No.2
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	20000 max	V
	12000 min	V
Grid-No.4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	500 max	V
Grid-No.2 Voltage	55 max	V
	30 min	V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V
Heater Voltage	6.9 max	V
	5.7 min	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period	200 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16000	V
Grid-No.4 Voltage	0 to 500	V
Grid-No.2 Voltage	45	V
Cathode Voltage	35 to 50	V
For visual extinction of focused raster		

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands Around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

LOW-VOLTAGE ELECTROSTATIC FOCUS   114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances
- Cathode to all other electrodes . . . . 5 pF
- Grid No.1 to all other electrodes . . . 6 pF
- External conductive coating to anode . 1250 min—1750 max pF ←

Heater Current at 6.3 volts . . . . . . 450 ± 20 mA
Heater Warm-Up Time (Average) . . . . . 11 s
Electron Gun . . . . Type Requiring No Ion-Trap Magnet

OPTICAL

Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light Transmission (Approx.) 48%

MECHANICAL

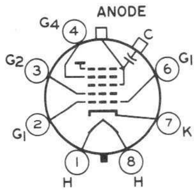
Weight (Approx.) . . . . 15 lb
Overall Length . . . . 11.375 ± .250 in
Neck Length . . . . 4.125 ± .125 in
Projected Area of Screen . . . . 172 sq in
External Conductive Coating[a]
- Type . . . . Regular-Band
- Contact area for grounding . . . . Near Reference Line

For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J149F* sheets at front of this section

Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



8HR

← Indicates a change.

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	11000 min—23000 max	V
Grid-No.4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16000	V
Grid-No.4 Voltage[b]	200	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 62	V
For visual extinction of focused raster		
Field Strength of required adjustable centering magnet[c]	0 to 8	G

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] External conductive coating and implosion protection hardware must be grounded.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10-1/2-inch by 14-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

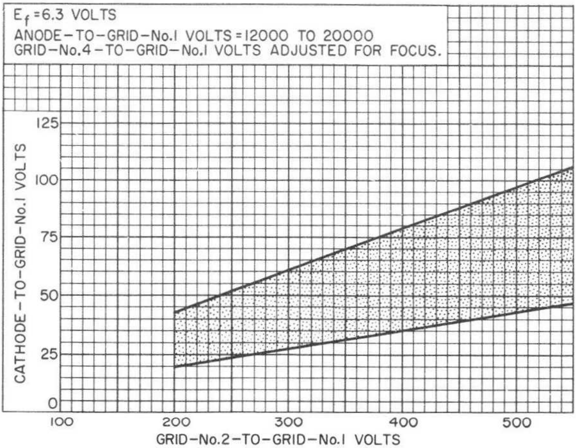
c Distance from Reference Line for suitable PM centering magnet should not exceed 2-1/4 inches. The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected, focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equals

$$\sqrt{\frac{\text{Anode volts}}{16000 \text{ volts}}} \times 8 \text{ gauss}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

RASTER-CUTOFF-RANGE CHART
Cathode-Drive Service



92CS-12008

Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands Around Periphery of Tube Panel — No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
HEATER CONTROLLED WARM-UP TIME
NO ION-TRAP MAGNET REQUIRED
114° MAGNETIC DEFLECTION
ALUMINIZED SCREEN

The 19DRP4 is the same as the 19DQP4 except for the following item:

Electrical:

Heater current at 6.3 volts . . . . 600 ± 30 ma

Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands Around Periphery of Tube Panel — No Separate Safety-Glass or Integral Protective Window Required)

LOW-VOLTAGE ELECTROSTATIC FOCUS **114° MAGNETIC DEFLECTION**

NO ION-TRAP MAGNET REQUIRED

Low-Grid-No.2-Voltage — for Cathode-Drive Operation

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode[a]	1750 max	pF ←
	1250 min	pF ←
Heater Current at 6.3 volts	600 ± 30	mA
Heater Warm-Up Time (Average)	11	s

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

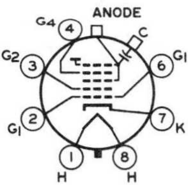
OPTICAL

Phosphor. . . . . P4—Sulfide Type, Aluminized
(For Curves, see front of this section)
Faceplate . . . . Filterglass
Light Transmission (Approx.). . . . . 48% ←

MECHANICAL

Weight (Approx.). . . . . 15.5 lbs ←
Overall Length. . . . . 11.625 ± 0.250 in
Neck Length . . . . 4.375 ± 0.125 in
Projected Area of Screen. . . . . 172 sq in
External Conductive Coating[a]
Type. . . . . Regular-Band
Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J149 F* sheets at front of this section
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW. 8HR

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



← Indicates a change.

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	20000 max / 10000 min	V
Grid-No.4 (Focusing) Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage	70 max / 40 min	V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V
Heater Voltage	6.9 max / 5.7 min	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16000	V
Grid-No.4 Voltage[b]	100	V
Grid-No.2 Voltage	50	V
Cathode Voltage for visual extinction of focused raster	32 to 50	V
Field Strength of required adjustable centering magnet	0 to 8	G

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] External conductive coating and implosion protection hardware must be grounded.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10-1/2-inch by 14-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

FILLED-RIM TYPE — 114° MAGNETIC DEFLECTION

Direct Interelectrode Capacitances		
Cathode to all other electrodes. . .	5	pF
Grid No.1 to all other electrodes. .	6	pF
External conductive coating to anode[a].	1250 min—1750 max	pF
Heater Current at 6.3 V.	600 ± 30	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet		

OPTICAL

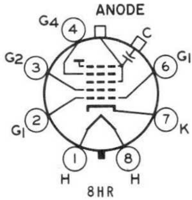
Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . Filterglass
Light transmission at center (Approx.) . . . . 48 %

MECHANICAL

Weight (Approx.) . . . . 16 lb
Overall Length . . . . 11.625 ± .250 in
Neck Length. . . . . 4.375 ± .125 in
Projected Area of Screen . . . . 172 sq in
External Conductive Coating
Type (See CRT OUTLINES 1 at front of this section). . Regular-Band
Contact area for grounding . . . . .Near Reference Line
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	11000 min—23000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V
Heater Voltage	5.7 min—6.9 max	V

Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

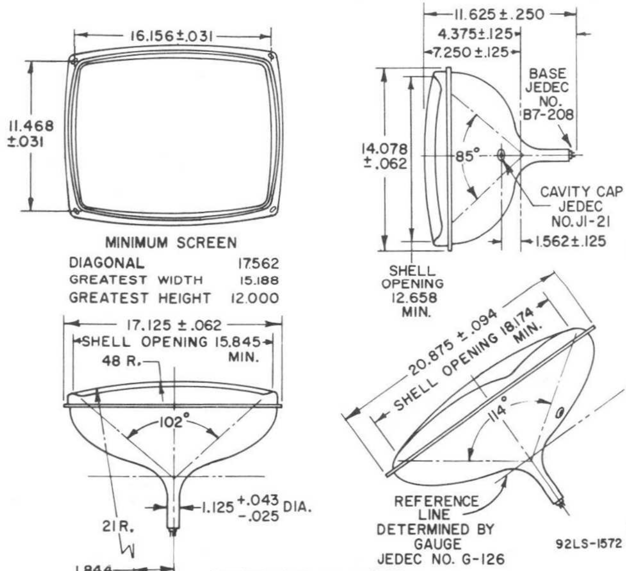
Anode Voltage	16000	V
Grid-No.4 Voltage	0 to 400	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 62	V
For visual extinction of focused raster		
Field Strength	0 to 8	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

DIMENSIONAL OUTLINE
(Bulb J149 F)



DIMENSIONS IN INCHES

Picture Tube

FILLED-RIM TYPE

114° MAGNETIC DEFLECTION — LOW GRID-No.2 VOLTAGE

Direct Interelectrode Capacitances		
Cathode to all other electrodes . . .	5	pF
Grid No.1 to all other electrodes . .	6	pF
External conductive coating to anode[a]	1000 min—1500 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

OPTICAL

Phosphor. . . . . .P4—Sulfide Type, Aluminized
For curves, see front of this section

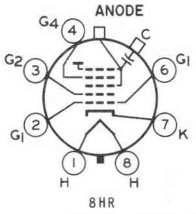
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 48%

MECHANICAL

Weight (Approx.). . . . . 16 lb
Overall Length. . . . . 11.625 ± .250 in
Neck Length . . . . 4.375 ± .125 in
Projected Area of Screen. . . . . 172 sq in
External Conductive Coating
Type (See CRT OUTLINES 1 at front of this section). . Modified-Band
Contact area for grounding. . . . . Near Reference Line
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . .Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to grid No.1

Anode Voltage	12000 min—21000 max	V
Grid-No.4 Voltage		
Positive value.	1250 max	V
Negative value.	400 max	V
Grid-No.2 Voltage	25 min—60 max	V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V

Heater Voltage	5.7 min—6.9 max V
Peak Heater-Cathode Voltage	
Heater negative with respect to cathode:	
During equipment warm-up period ≤ 15 s. .	450 max V
After equipment warm-up period.	300 max V
Heater positive with respect to cathode:	
Combined AC & DC voltage.	200 max V
DC component.	100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	16000 V
Grid-No.4 Voltage	0 to 400 V
Grid-No.2 Voltage	50 V
Cathode Voltage	32 to 50 V
For visual extinction of focused raster	
Field Strength.	0 to 8 G
Of required adjustable centering magnet	

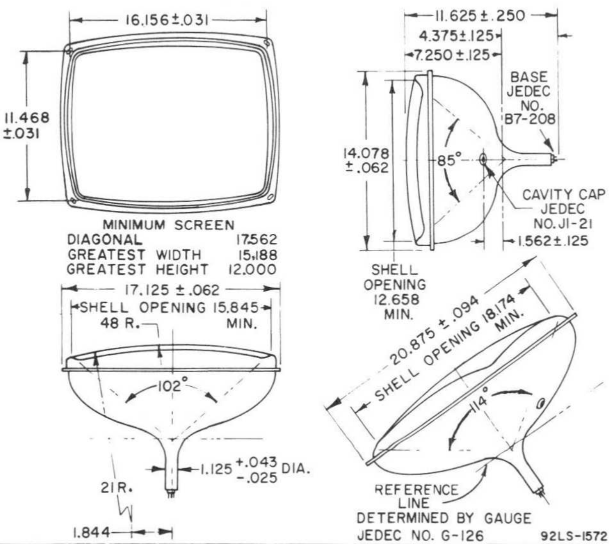
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance.	1.5 max MΩ

[a] Includes implosion protection hardware.

DIMENSIONAL OUTLINE
(Bulb J149 F)

DIMENSIONS IN INCHES



Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION
LOW-VOLTAGE ELECTROSTATIC FOCUS 114° MAGNETIC DEFLECTION
LOW-GRID-No.2 VOLTAGE CATHODE-DRIVE TYPE

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes.	5	pF
Grid No.1 to all other electrodes.	6	pF
External conductive coating to anode[a].	1500 max	pF
	1000 min	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . .Filterglass
Light transmission at center (approx.) 48%

MECHANICAL

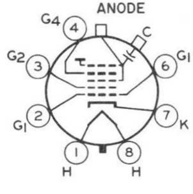
Weight (Approx.)	15 lb
Overall Length	11.625 ± 0.250 in
Neck Length.	4.375 ± 0.125 in
Projected Area of Screen	172 sq in
External Conductive Coating	
Type	Modified-Band
Contact area for grounding	Near Reference Line

For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J149 F* sheets at front of this section

Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



8HR

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to Grid No.1

Anode Voltage	21000 max 12000 min	V V
Grid-No.4 (Focusing) Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage	60 max 25 min	V V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V
Heater Voltage	6.9 max 5.7 min	V V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16000	V
Grid-No.4 Voltage	250	V
Grid-No.2 Voltage	50	V
Cathode Voltage For visual extinction of focused raster	32 to 50	V

MAXIMUM CIRCUIT VALUE

Grid-No.1-Circuit Resistance	1.5 max	MΩ

[a] External conductive coating and implosion protection hardware must be grounded.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 to + 400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10-1/2 inch by 14-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

PAN-O-PLY TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

LOW-GRID-No.2 VOLTAGE
114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes. . . .	5	pF
Grid No.1 to all other electrodes . . .	6	pF
External conductive coating to anode. .	1250 min–1750 max	pF
Heater Current at 6.3 volts.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	
Focus Lens	Unipotential	

OPTICAL

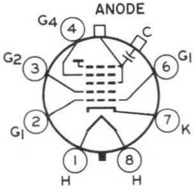
Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . Filterglass
Light transmission at center (approx.) 48%

MECHANICAL

Weight (Approx.) . . . . 15 lb
Overall Length . . . . 11.625 ± .250 in
Neck Length. . . . . 4.375 ± .125 in
Projected Area of Screen . . . . 172 sq in
External Conductive Coating[a]
Type . . . . Regular-Band
Contact area for grounding . . . . Near Reference Line
For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J149F* sheets at front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



8HR

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	12000 min–23500 max	V
Grid-No.4 Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage	20 min—60 max	V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V
Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16000	V
Grid-No.4 Voltage[b]	100	V
Grid-No.2 Voltage	30	V
Cathode Voltage	22 to 45	V
For visual extinction of focused raster		
Field Strength of required adjustable centering magnet	0 to 8	G

MAXIMUM CIRCUIT VALUE

Grid-No.1-Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10.5-inch by 14-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION
LOW-VOLTAGE ELECTROSTATIC FOCUS 114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes. . .	5	pF
Grid No.1 to all other electrodes. .	6	pF
External conductive coating to anode[a].	1250 min—1750 max	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . .Filterglass
Light transmission at center (approx.) 48%

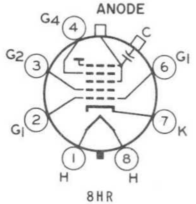
MECHANICAL

Weight (Approx.)	15	lb
Overall Length	11.625 ± 0.250	in
Neck Length.	4.375 ± 0.125	in
Projected Area of Screen	172 sq	in

External Conductive Coating
Type (See CRT OUTLINES 1 at front of this section) . . . Regular-Band
Contact area for grounding . . . . . . .Near Reference Line
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	11000 min—23000 max	V
Grid-No.4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V

Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 seconds	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	16000	V
Grid-No.4 Voltage[b]	200	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 62	V

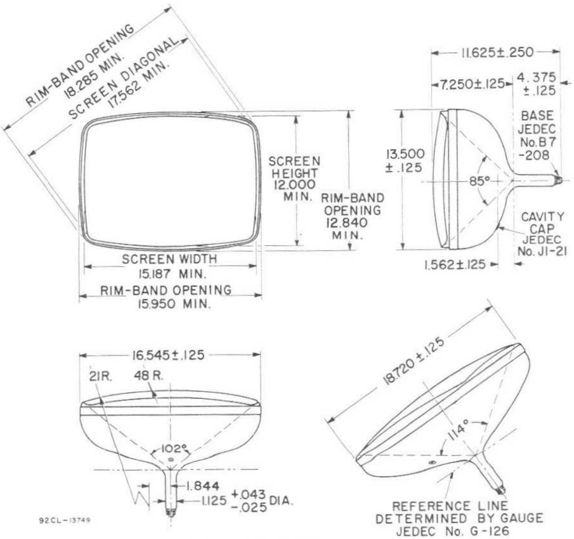
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] External conductive coating and implosion protection hardware must be grounded.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 10.5-inch by 14-inch pattern from an RCA-2F21 monoscope, or equivalent.

DIMENSIONAL OUTLINE (BULB J149 FA)



DIMENSIONS IN INCHES

19GEP4A

Picture Tube

PAN-O-PLY TYPE WITH MOUNTING LUGS — 114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances
- Cathode to all other electrodes . . . . 5 pF
- Grid No.1 to all other electrodes . . 6 pF
- External conductive coating to anode. . 1250 min—1750 max pF

Heater Current at 6.3 V . . . . 450 mA
Heater Warm-Up Time (Average) . . . . . 11 s
Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

OPTICAL

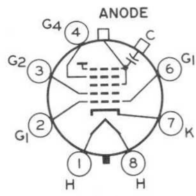
Phosphor. . . . . P4—Sulfide Type, Aluminized
  For curves, see front of this section
Faceplate . . . . Filterglass
  Light transmission at center (Approx.). 48%

MECHANICAL

Weight (Approx.). . . . . 15 lb
Overall Length. . . . . 11.625 ± .250 in
Neck Length . . . . 4.375 ± .125 in
Projected Area of Screen. . . . . 172 sq in
External Conductive Coating[a]
  Type (See CRT OUTLINES 1 at front of this section). . . . Regular-Band
  Contact area for grounding. . . . . Near Reference Line
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . Small-Button Neoeightar 7-Pin,
Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



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MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage. . . . . 11000 min—23000 max V
Grid-No.4 Voltage
- Positive value . . . . 1100 max V
- Negative value . . . . 550 max V

Grid-No.2 Voltage. . . . . 200 min—550 max V

Grid-No.1 Voltage			
Negative peak value	220	max	V
Negative bias value	155	max	V
Positive bias value	0	max	V
Positive peak value	2	max	V
Heater Voltage	5.7 min—6.9	max	V
Peak Heater-Cathode Voltage			
Heater negative with respect to cathode:			
During equipment warm-up period ≤ 15 s	450	max	V
After equipment warm-up period	300	max	V
Heater positive with respect to cathode:			
Combined AC & DC voltage	200	max	V
DC component	100	max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	16000	V
Grid-No.4 Voltage	0 to 400	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 62	V
For visual extinction of focused raster		
Field Strength	0 to 8	G
Of required adjustable centering magnet		

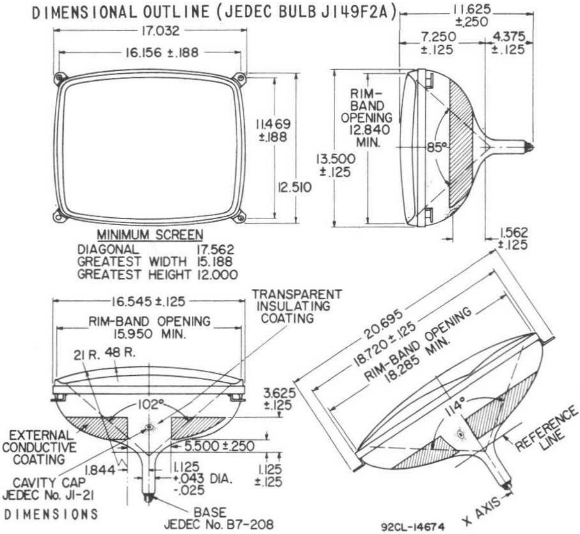
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

See *X-RADIATION PRECAUTIONS* at front of this section

DIMENSIONAL OUTLINE (JEDEC BULB J149F2A)



DIMENSIONS

19GJP4A

Picture Tube

PAN-O-PLY TYPE — 114° MAGNETIC DEFLECTION

The 19GJP4A is the same as the 19DQP4 except for the following item:

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Anode Voltage. . . . . 10000 min—23000 max V

Color Picture Tube

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD PURITY AND UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE — 90° MAGNETIC DEFLECTION
MAGNETIC CONVERGENCE — 3 ELECTROSTATIC-FOCUS GUNS

ALUMINIZED TRICOLOR PHOSPHOR-DOT "*Hi-Lite*" SCREEN
(Utilizing a New, Improved Rare-Earth Red-Emitting Phosphor)

For Use in Color-TV Receivers

The 19GVP22 is the same as the 19GWP22 except for the following items:

OPTICAL

Faceplate. . . . . .Filterglass
  Light transmission (Approx.) 69%
  Faceplate does not have an integral protective window[a]

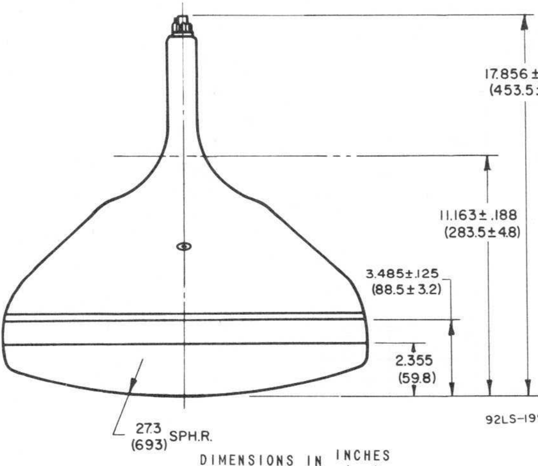
MECHANICAL

Tube Dimensions
  Overall length . . . . . 17.856 ± .375 in (453.5 ± 9.5 mm)
  Weight (Approx.) . . . . 21 lb (9.5 kg)

[a] It is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 19GVP22 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide x-radiation protection when required.

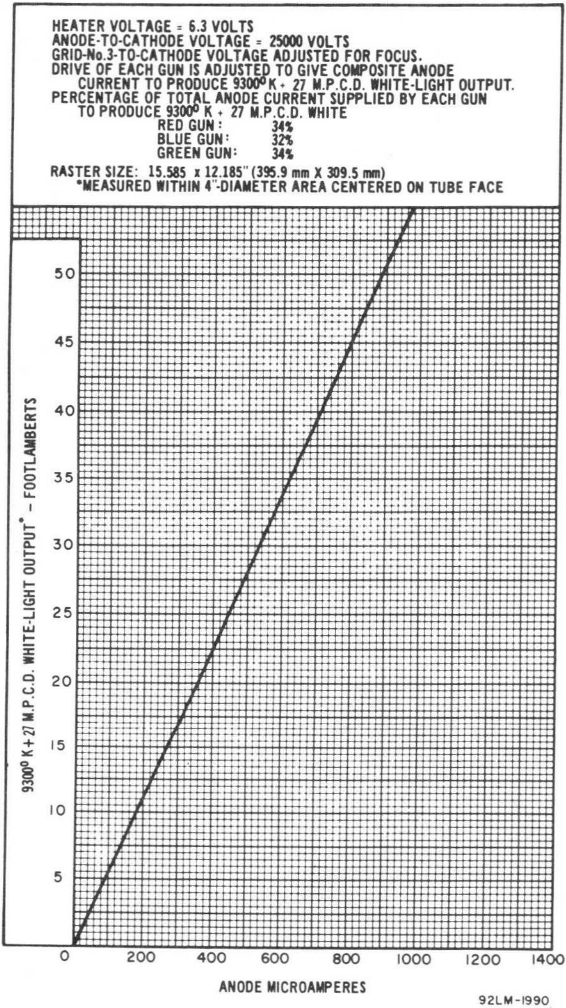
DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 19GWP22



DIMENSIONS IN INCHES (mm)

Typical Light-Output Characteristic



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

Color Picture Tube

ULTRA-RECTANGULAR — **HI-LITE SCREEN**

4 X 3 Aspect Ratio — **Blue-Gun-Down Operation**

Electrical

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green
Heater, of Each Gun Series Connected within Tube with Each of the Other Two Heaters:	
Current at 6.3 V	900 mA
Focusing Method	Electrostatic
Focus Lens	Unipotential
Convergence Method	Magnetic
Deflection Method	Magnetic
Deflection Angles (Approx.):	
Diagonal	90 deg
Horizontal	78 deg
Vertical	60 deg
Direct Interelectrode Capacitance (Approx.):	
Grid No.1 of any gun to all other electrodes	7.5 pF
Grid No.4 to all other electrodes	6 pF
All cathodes to all other electrodes	15 pF
Capacitance Between Anode and External Conductive Coating	2300 max. pF 1800 min. pF
Resistance Between Metal Hardware and External Conductive Coating	50 MΩ

Optical

Faceplate	Filterglass
Light transmission at center (Approx.)	53%
Surface	Polished
Screen	Aluminized
Phosphor, rare-earth (red) sulfide (blue & green)	P22
Persistence	Medium-Short
Array	382,000 Dot trios
Spacing between centers of adjacent dot trios (Approx.)	0.024 in (0.61 mm)

Mechanical

Minimum Screen Area (Projected)	185 sq in (1194 sq cm)
Bulb Funnel Designation	JEDEC No.J160-3/4 B1/C1
Bulb Panel Designation	JEDEC No.FP161-3/4 V1
Base Designation[a]	Small-Button Diheptar 12-Pin (JEDEC No.B12-244)
Basing Designation	JEDEC No.14BH
Pin Position Alignment	Pin No.5 Aligns Approx. with Anode Bulb Contact

Operating Position, preferred	Anode Bulb Contact on Top
Gun Configuration	Delta
Weight (Approx.)	25 lb (11.4 kg)

Implosion Protection

Type	Banded

Maximum and Minimum Ratings, Design-Maximum Values

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode.

Anode Voltage	22.5 max.	kV
	17 min.	kV
Anode Current, Long-Term Average[b]	1000 max.	μA
Grid-No.4 (Focusing Electrode) Voltage:		
Positive value	1100 max.	V
Negative value	550 max.	V
Peak-Grid-No.2 Voltage, Including Video Signal Voltage	1000 max.	V
Grid-No.1 Voltage:		
Negative bias value	400 max.	V
Negative operating cutoff value	140 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Heater Voltage (ac or dc):[c]		
Under operating conditions	6.9 max.	V
	5.7 min.	V
Under standby conditions[d]	5.5 max.	V
Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
DC component value	200 max.	V
Peak value	200 max.	V
Heater positive with respect to cathode:		
DC component value	0 max.	V
Peak value	200 max.	V

Equipment Design Ranges

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode.

For anode voltages between 17 and 22.5 kV

Grid-No.4 (Focusing Electrode) Voltage	–75 to 400	V
Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot	See CUTOFF DESIGN CHART in Figure 3	
At Grid No.1 voltage of –75 V	90 to 270	V

At Grid No.1 voltage of −125 V . . . . 210 to 505 V
At Grid No.1 voltage of −140 V . . . . 245 to 580 V

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At grid-No.1 spot cutoff voltage of −100 V) 1.86

Heater Voltage:[c]
Under operating conditions:
When standby operation is not utilized . . . . 6.3 V
When 5.0-V standby operation is utilized[d] . . . . 6.0 V
Under standby conditions[d] . . . . 5.0 V

Grid-No.4 Current (Total) . . . . ±60 μA

Grid-No.2 Current . . . . ±5 μA

Grid-No.1 Current . . . . ±5 μA

	Illum. D	Color	
To Produce White Light of	6550° K + 7 M.P.C.D.	9300° K + 27 M.P.C.D.	
CIE Coordinates:			
X	0.313	0.281	
Y	0.329	0.311	
Percentage of total anode current supplied by each gun (average):			
Red	41	30	%
Blue	24	31	%
Green	35	39	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.35	0.75	
Typical	1.70	0.95	
Maximum	2.20	1.25	
Red/green:			
Minimum	0.95	0.60	
Typical	1.15	0.75	
Maximum	1.70	1.10	
Blue/green:			
Minimum	0.50	0.60	
Typical	0.70	0.80	
Maximum	0.95	1.10	

Displacements, Measured at Center of Screen:
Raster centering displacement:
Horizontal . . . . ± 0.45 in (± 11.4 mm)
Vertical . . . . ± 0.45 in (± 11.4 mm)
Lateral distance between the blue beam and the converged red and green beams . . . ± 0.25 in (± 6.4 mm)
Radial convergence displacement excluding effects of dynamic convergence (each beam) . . . . ± 0.37 in (± 9.4 mm)

Maximum Required Correction for Register[e] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the Center of the Screen in any Direction . . . . 0.005 in (0.13 mm) max.

Typical Operation

Heater Voltage	6.3 V
Anode Voltage	20 kV
Grid-No.4 Voltage	Adjusted for focus
Color Temperature	9300° K + 27 M.P.C.D.
Raster Size	15.922 x 11.941 in (404.42 x 303.30 mm)

Typical White-Light Output Measured within 4 in (102 mm) diameter area centered on tube face:

At anode current of 1000 μA . . . . 44 fL / 151 Nit

Limiting Circuit Values

Low-Voltage Circuits:
Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . 0.75 max. MΩ

X-Radiation Characteristic:

Maximum Anode Voltage at which the X-radiation emitted will not exceed 0.5 mR/h at an anode current of 300 μA . . . . 33 kV

The X-radiation emitted from this picture tube, as measured in accordance with the procedure of JEDEC Publication No.64A will not exceed 0.5 mR/h throughout the useful life of the tube when operated within the Design-Maximum ratings: 27.5 kV anode voltage and 1000 μA anode current. The tube should not be operated beyond its Design-Maximum ratings stated above (such operation may shorten tube life or have other permanent adverse affects on its performance), but its X-radiation will not exceed 0.5 mR/h for anode voltage and current combinations given by the isodose-rate limit characteristics as shown in **Figure 1.** Operation above the values shown by the curve may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers, Sub-Part C of Part 78 of Title 42, Code of Federal Regulations (PL90-602) as published in the Federal Register Vol.34, No. 247, Thursday, December 25, 1969. Maximum X-radiation as a function of anode voltage at 300 μA anode current is shown by the curve in **Figure 2.** X-radiation at a constant anode voltage varies linearly with anode current.

a The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound (one-half kilogram).

b The short-term average anode current should be limited by circuitry to 1500 microamperes.

c For maximum cathode life, it is recommended that the heater supply be regulated. The series impedance to any chassis connection in the dc biasing circuit for the heater should be between 100 kilohms and 1 megohm. The surge voltage across the heater must be limited to 9.5 volts rms.

d The use of a 5-volt standby condition in conjunction with 6-volt operating conditions is recommended to improve the reliability of the color picture tube by extending the emission wear-out life and reducing other gun-related defects. A maximum heater voltage of 5.5 volts (Design-Maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

e Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

IMPORTANT: Refer to sheet **Safety Precautions For Color Picture Tubes** at front of this section.

Notes For Dimensional Outline

Note 1 – With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C′ of the gauge with the glass funnel.

Note 2 – Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

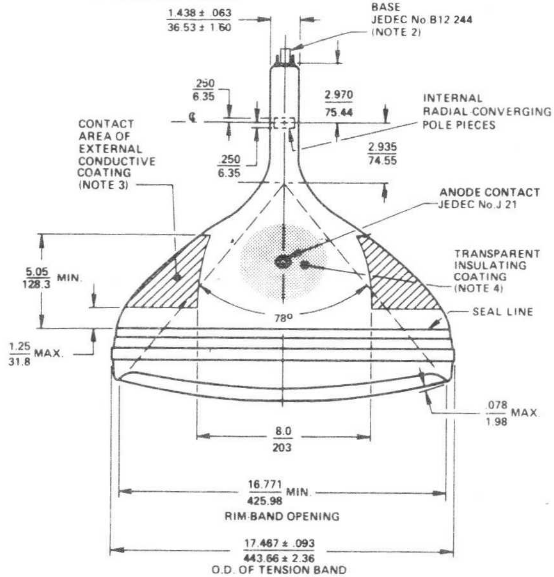
Note 3 – The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

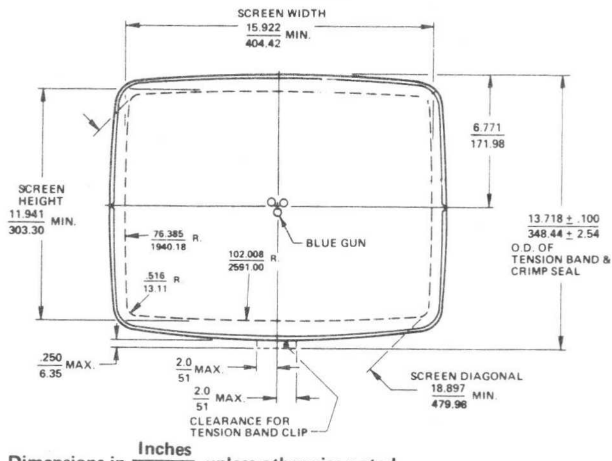
Note 4 – To clean this area, wipe only with soft, dry, lintless cloth.

SAGITTAL HEIGHTS AT POINTS $\frac{.125}{3.18}$ BEYOND EDGE OF MIN. SCREEN

DIAGONAL	$\frac{1.485}{37.72}$	WIDTH	$\frac{1.044}{26.52}$	HEIGHT	$\frac{.582}{14.78}$

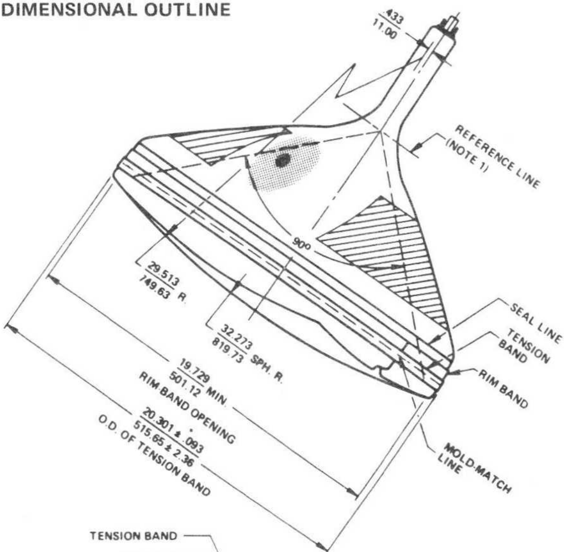
DIMENSIONAL OUTLINE

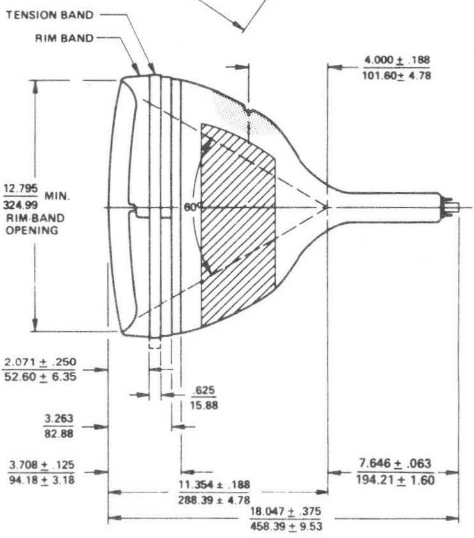




Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise noted

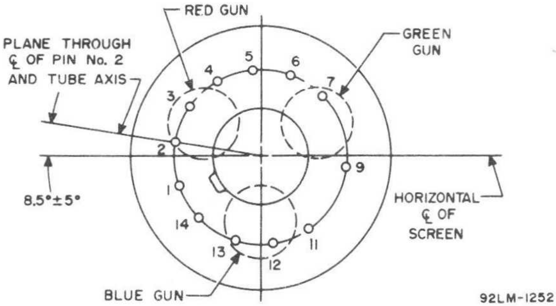
DIMENSIONAL OUTLINE





92LL-3949R1

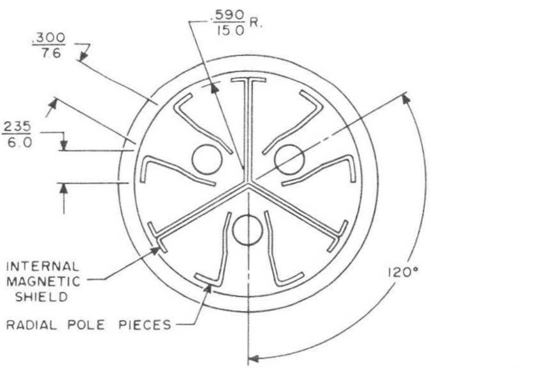
BOTTOM VIEW OF BASE



Base Specification – JEDEC No.14BH

Pin 1:	Heater	Cap:	Anode (Grid No.3, Grid No.5, Screen, Collector)
Pin 2:	Cathode of Red Gun	C:	External Conductive Coating
Pin 3:	Grid No.1 of Red Gun		
Pin 4:	Grid No.2 of Red Gun		
Pin 5:	Grid No.2 of Green Gun		
Pin 6:	Cathode of Green Gun		
Pin 7:	Grid No.1 of Green Gun		
Pin 9:	Grid No.4		
Pin 11:	Cathode of Blue Gun		
Pin 12:	Grid No.1 of Blue Gun		
Pin 13:	Grid No.2 of Blue Gun		
Pin 14:	Heater		

LOCATION OF RADIAL-COVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



0.5 mR/h ISODOSE – RATE LIMIT CURVE

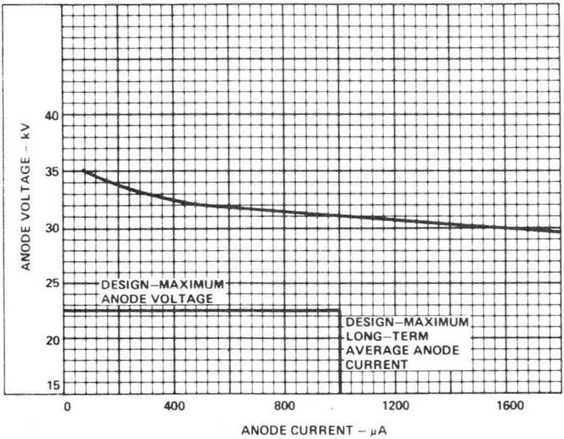


Figure 1 92LS-3657

X-RADIATION LIMIT CURVE AT A CONSTANT ANODE CURRENT OF 300 μA (X-RADIATION AT A CONSTANT ANODE VOLTAGE VARIES LINEARLY WITH ANODE CURRENT)

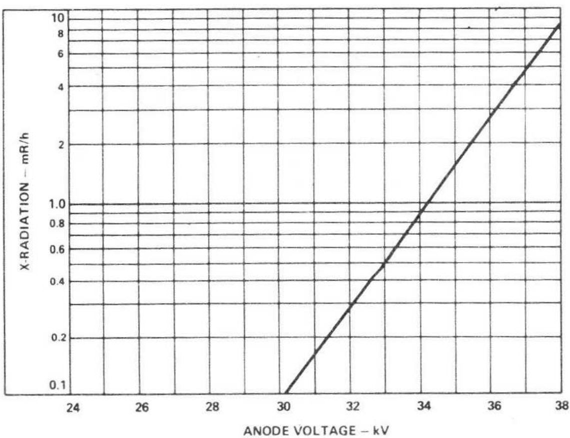
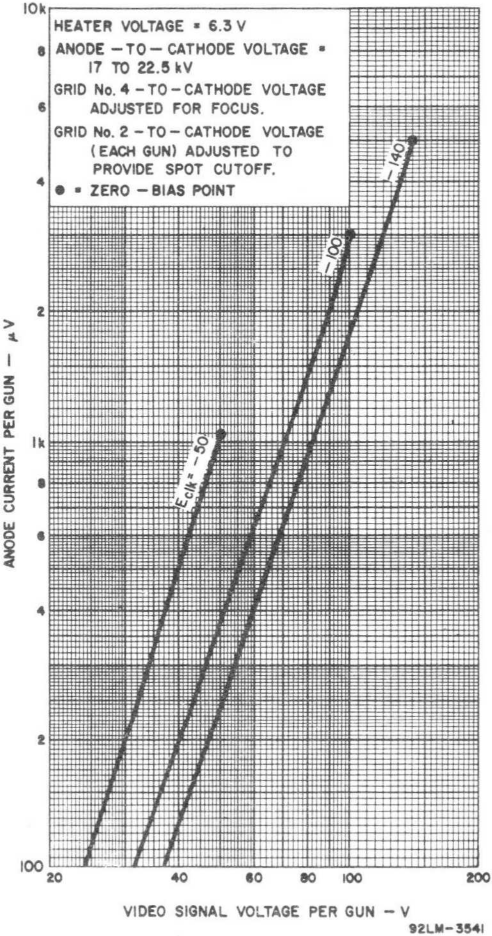
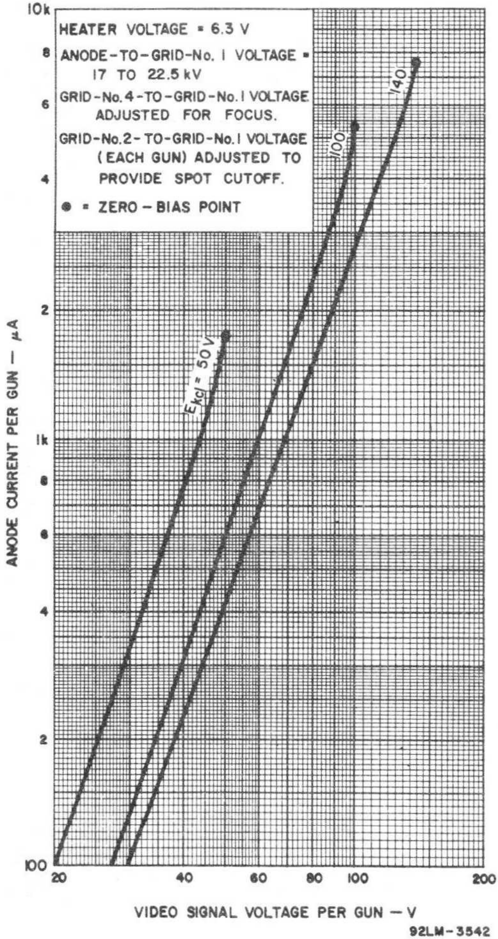


Figure 2 92LS-3296R1

TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE



TYPICAL DRIVE CHARACTERISTICS, CATHODE-DRIVE SERVICE



CUTOFF DESIGN CHART

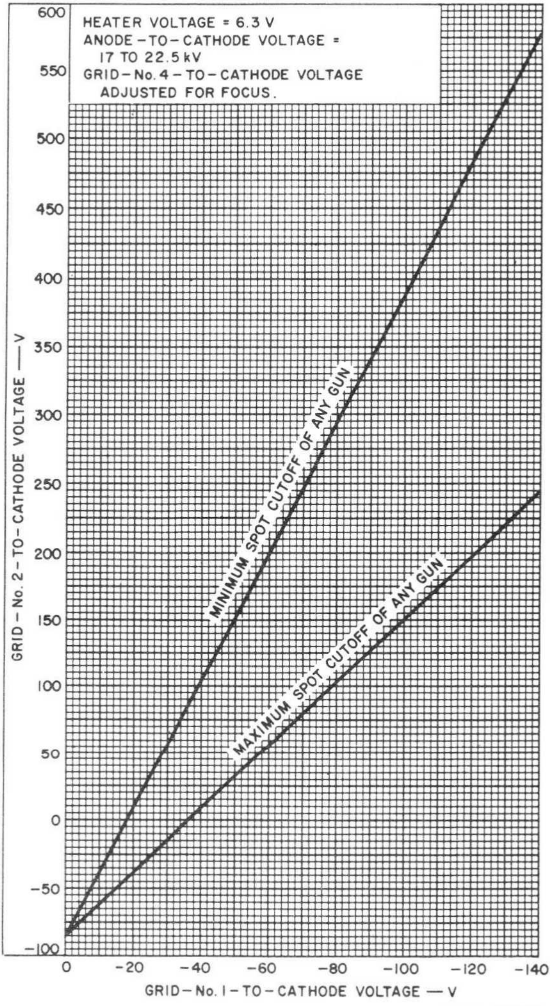


Figure 3

19VBRP22

Color Picture Tube

Ultra-Rectangular | Hi-Lite Matrix Screen

4 x 3 Aspect Ratio | **Light Neutral Screen Appearance**

Electrical:

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green
Heater:	
Voltage	6.3 V
Current	900 mA
Focusing Method	Electrostatic
Focus Lens	Bipotential
Convergence Method	Magnetic
Deflection Method	Magnetic
Deflection Angles (Approx.):	
Diagonal	90 deg
Horizontal	78 deg
Vertical	60 deg
Direct Interelectrode Capacitance (Approx.):	
Grid No.1 of any gun to all other electrodes	6 pF
Grid No.3 to all other electrodes	6.5 pF
All cathodes to all other electrodes	15 pF
Capacitance Between Anode and External Conductive Coating	2300 max. pF 1800 min. pF
Resistance Between Metal Hardware and External Conductive Coating	50 MΩ

Optical:

Faceplate	Filterglass
Light transmission at center (Approx.)	70%
Surface	Polished
Screen	Aluminized
Matrix	Black opaque material
Phosphor, rare-earth (red) sulfide (blue & green)	P22
Persistence	Medium-Short
Array	382,000 Dot trios
Spacing between centers of adjacent dot trios (Approx.)	0.024 in (0.61 mm)

Mechanical:

Minimum Screen Area (Projected)	185 sq in (1194 sq cm)
Bulb Funnel Designation	JEDEC No.J510A06
Bulb Panel Designation	JEDEC No.FP161-3/4 W1
Base Designation[a]	Small-Button Diheptar 12-Pin (JEDEC No.B12-244)
Basing Designation	JEDEC No.14BE
Pin Position Alignment	Pin No.12 Aligns Approx. with Anode Bulb Contact

Operating Position, preferred ..... Anode Bulb Contact on Top

Gun Configuration .... Delta

Weight (Approx.) .... 25 lb (11.4 kg)

Implosion Protection:

Type .... Rim Bands and Tension Band

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode.

Anode Voltage	27.5 max.	kV
	20 min.	kV
Anode Current, Long-Term Average[b]	1000 max.	μA
Grid-No.3 (Focusing Electrode) Voltage	6000 max.	V
Peak-Grid-No.2 Voltage, Including Video Signal Voltage	1000 max.	V
Grid-No.1 Voltage:		
Negative bias value	400 max.	V
Negative operating cutoff value	200 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Heater Voltage (ac or dc):[c]		
Under operating conditions	6.9 max.	V
	5.7 min.	V
Under standby conditions[d]	5.5 max.	V
Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
DC component value	200 max.	V
Peak value	200 max.	V
Heater positive with respect to cathode:		
DC component value	0 max.	V
Peak value	200 max.	V

Equipment Design Ranges:

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20 and 27.5 kV

Grid-No.3 (Focusing Electrode) Voltage .... 16.8% to 20% of Anode voltage

Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot. . . . See CUTOFF DESIGN CHART in **Figure** 3

At Grid No.1 voltage of −75 V	**80 to 280 V**
At Grid No.1 voltage of −125 V	**215 to 550 V**
At Grid No.1 voltage of −175 V	**355 to 820 V**

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At **grid-No.1** spot cutoff voltage of −100 V) . . . 1.86

Heater Voltage:[c]

Under operating conditions:	
When standby operation in not utilized	6.3 V
When 5.0-V standby operation is utilized[d]	6.0 V
Under standby conditions[d]	5.0 V

Grid-No.3 Current (Total)	±15 μA
Grid-No.2 Current	±5 μA
Grid-No.1 Current	±5 μA

	Illum. D	**Color**	
To Produce White Light of	6550° K + 7 M.P.C.D.	9300° K + 27 M.P.C.D.	
CIE Coordinates:			
X	0.313	0.281	
Y	0.329	0.311	
Percentage of total anode current supplied by each gun (average):			
Red	41	30	%
Blue	24	31	%
Green	35	39	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.35	0.75	
Typical	1.70	0.95	
Maximum	2.20	1.25	
Red/green:			
Minimum	0.95	0.60	
Typical	1.15	0.75	
Maximum	1.70	1.10	
Blue/green:			
Minimum	0.50	0.60	
Typical	0.70	0.80	
Maximum	0.95	1.10	

Displacements, Measured at Center of Screen:

Raster centering displacement:	
Horizontal	± 0.45 in (± 11.4 mm)
Vertical	± 0.45 in (± 11.4 mm)
Lateral distance between the blue beam and the converged red and green beams	± 0.25 in (± 6.4 mm)

Radial convergence displacement excluding effects of dynamic convergence (each beam) . . . . ± 0.37 in (± 9.4 mm)

Maximum Required Correction for Register[e] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the Center of the Screen in any Direction . . . . 0.005 in (0.13 mm) max.

Light-Output Characteristic:

Typical White-Light Output . . . . 80 fL / 274 Nit

Measured within a 4 in (102 mm) diameter area centered on the tube face with the following operating conditions:

Anode Voltage	25 kV
Anode Current	1000 μA
Grid No.3 Voltage	Adjusted for focus
Color Temperature	9300° K + 27 M.P.C.D.

Limiting Circuit Values:

High-Voltage Circuits:

Grid-No.3 circuit resistance . . . . 7.5 max. MΩ

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . 0.75 max. MΩ

X-Radiation Characteristic:

Maximum Anode Voltage at which the X-radiation emitted will not exceed 0.5 mR/h at an anode current of 300 μA . . . . 33 kV

The X-radiation emitted from this picture tube, as measured in accordance with the procedure of JEDEC Publication No.64A will not exceed 0.5 mR/h throughout the useful life of the tube when operated within the Design-Maximum ratings: 27.5 kV anode voltage and 1000 μA anode current. The tube should not be operated beyond its Design-Maximum ratings stated above (such operation may shorten tube life or have other permanent adverse affects on its performance), but its X-radiation will not exceed 0.5 mR/h for anode voltage and current combinations given by the isodose-rate limit characteristics as shown in Figure 1 . Operation above the values shown by the curve may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers, Sub-Part C of Part 78 of Title 42, Code of Federal Regulations (PL90-602) as published in the Federal Register Vol.34, No. 247, Thursday, December 25, 1969. Maximum X-radiation as a function of anode voltage at 300 μA anode current is shown by the curve in Figure 2 . X-radiation at a constant anode voltage varies linearly with anode current.

a The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound (one-half kilogram).

b The short-term average anode current should be limited by circuitry to 1500 microamperes.

c For maximum cathode life, it is recommended that the heater supply be regulated. The series impedance to any chassis connection in the dc biasing circuit for the heater should be between 100 kilohms and 1 megohm. The surge voltage across the heater must be limited to 9.5 volts rms.

d The use of a 5-volt standby condition in conjunction with 6-volt operating conditions is recommended to improve the reliability of the color picture tube by extending the emission wear-out life and reducing other gun-related defects. A maximum heater voltage of 5.5 volts (Design-Maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

e Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

Notes for Dimensional Outline

Note 1 – With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C′ of the gauge with the glass funnel.

Note 2 – Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

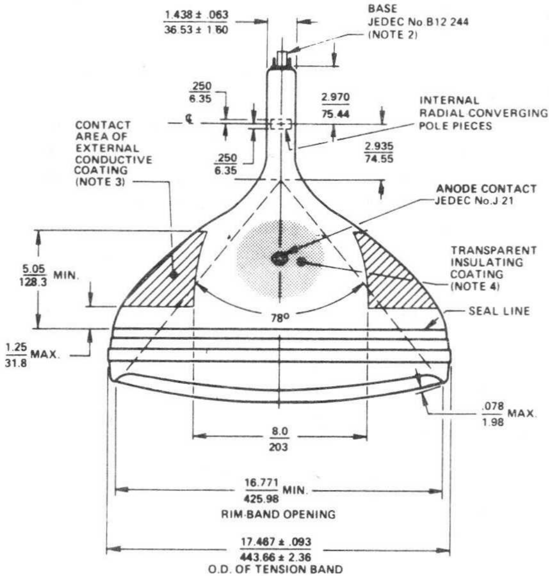
Note 3 – The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

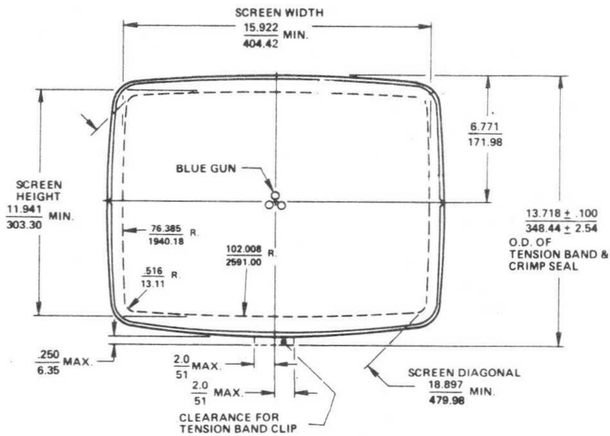
Note 4 – To clean this area, wipe only with soft, dry, lintless cloth.

SAGITTAL HEIGHTS AT POINTS $\frac{.125}{3.18}$ BEYOND EDGE OF MIN. SCREEN

DIAGONAL	$\frac{1.485}{37.72}$	WIDTH	$\frac{1.044}{26.52}$	HEIGHT	$\frac{.582}{14.78}$

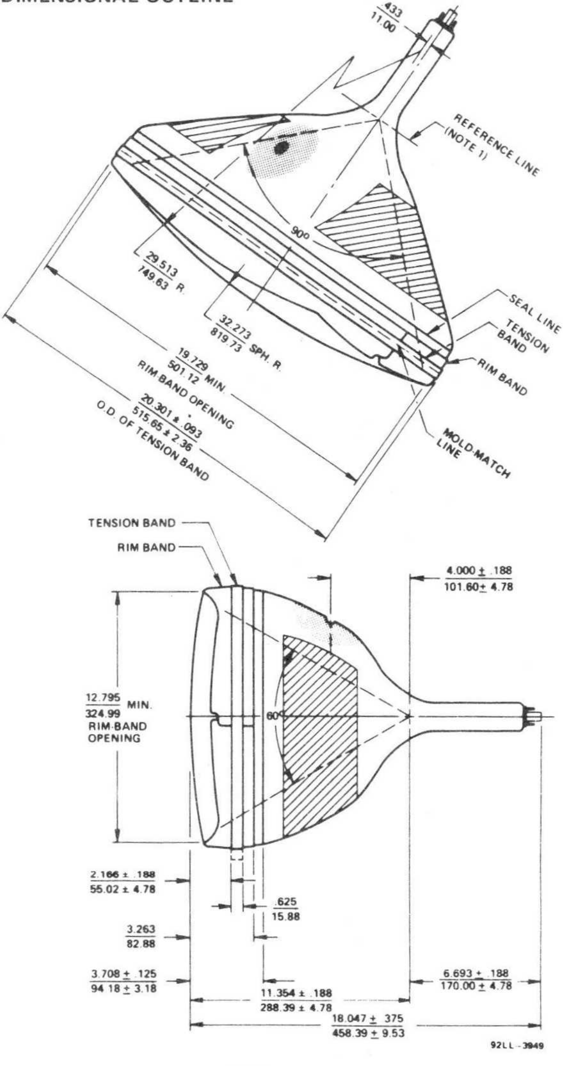
DIMENSIONAL OUTLINE



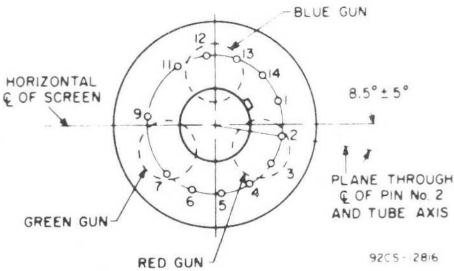


Dimensions in Inches/mm unless otherwise noted

DIMENSIONAL OUTLINE



BOTTOM VIEW OF BASE

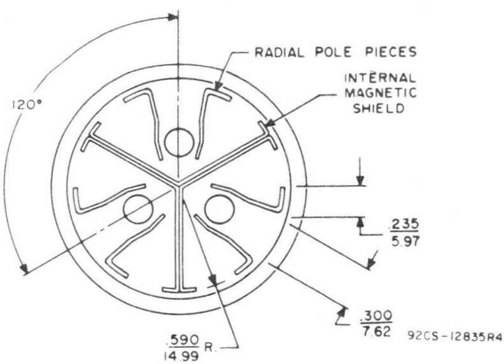


Base Specification – JEDEC No.14BE

Pin 1– Heater
Pin 2– Cathode of Red Gun
Pin 3– Grid No.1 of Red Gun
Pin 4– Grid No.2 of Red Gun
Pin 5– Grid No.2 of Green Gun
Pin 6– Cathode of Green Gun
Pin 7– Grid No.1 of Green Gun
Pin 9– Grid No.3
Pin 11– Cathode of Blue Gun
Pin 12– Grid No.1 of Blue Gun
Pin 13– Grid No.2 of Blue Gun
Pin 14– Heater

Bulb Contact – Anode (Grid No.4, Screen, Collector)
C– External Conductive Coating

LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



0.5 mR/h ISODOSE – RATE LIMIT CURVE
(JEDEC CURVE No.XC-2)

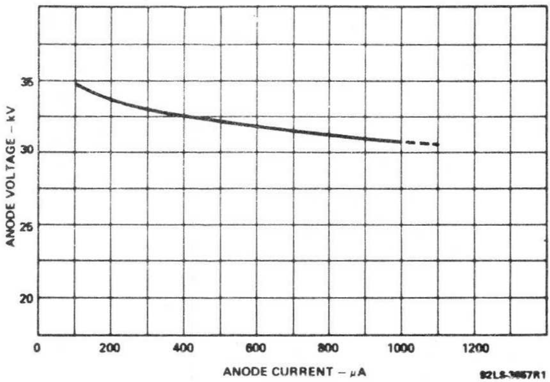


Figure 1

X-RADIATION LIMIT CURVE AT A CONSTANT ANODE CURRENT OF 300 μA (X-RADIATION AT A CONSTANT ANODE VOLTAGE VARIES LINEARLY WITH ANODE CURRENT)
(JEDEC CURVE No.XC-1)

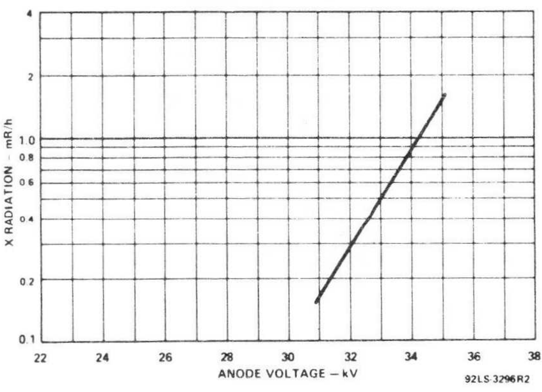
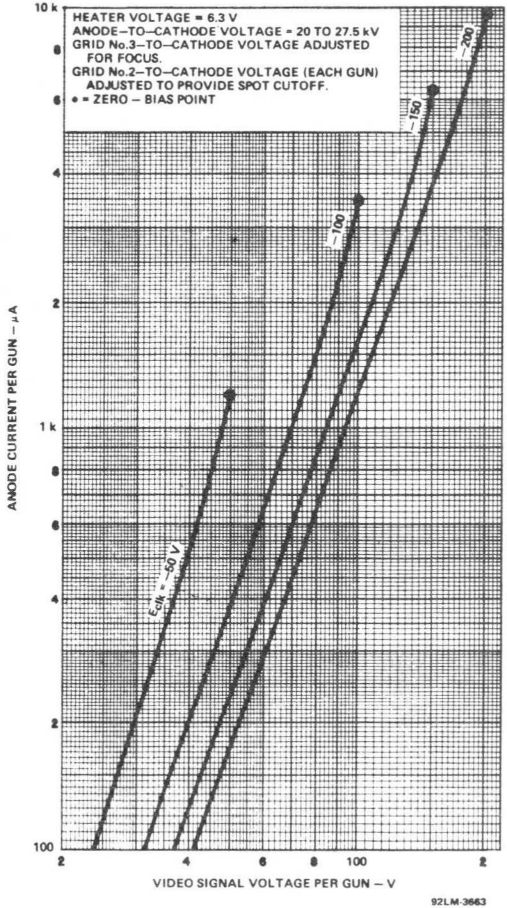
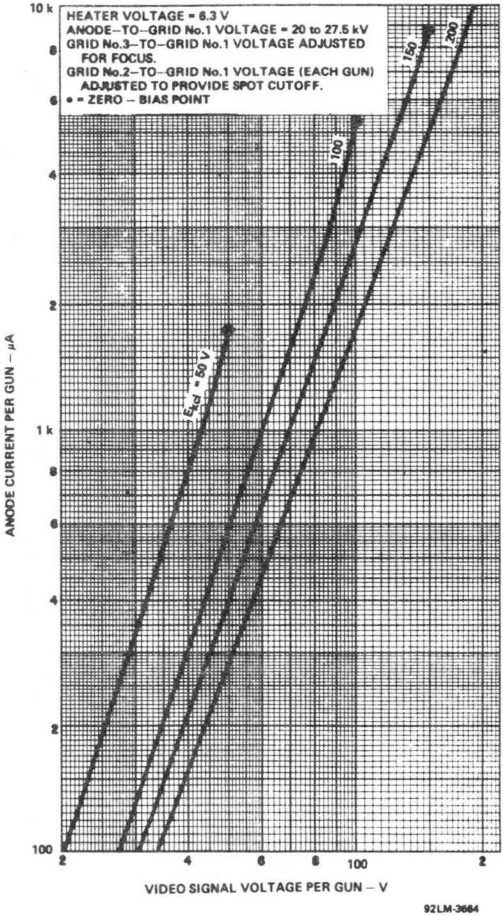


Figure 2

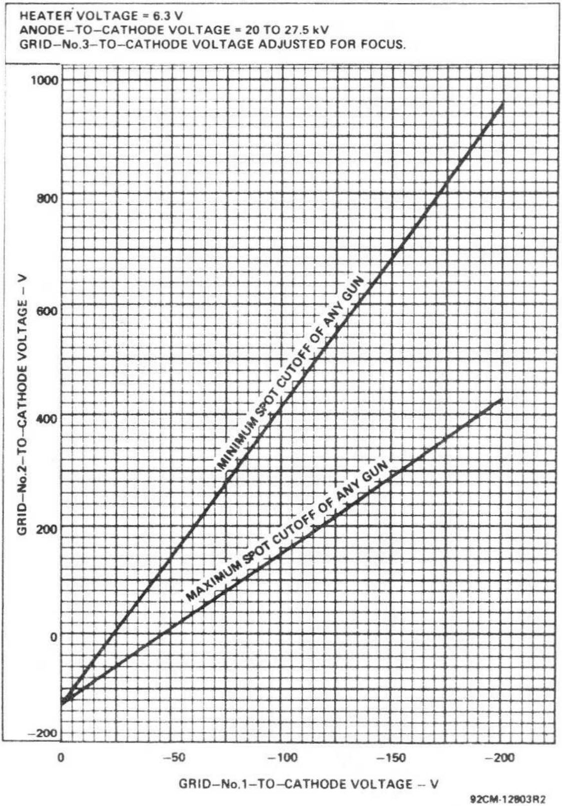
TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE



TYPICAL DRIVE CHARACTERISTICS,
CATHODE-DRIVE SERVICE



CUTOFF DESIGN CHART



IMPORTANT: Refer to sheet **Safety Precautions For Color Picture Tubes** at front of this section.

FIGURE 3

Picture Tube

SHORT RECTANGULAR GLASS TYPE **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS **MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds
Focusing Method		Electrostatic
Deflection Method		Magnetic
Deflection Angles (Approx.):		
Diagonal		114°
Horizontal		102°
Vertical		85°
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	$\mu\mu f$
Cathode to all other electrodes	5	$\mu\mu f$
External conductive coating to ultor	1500 max.	$\mu\mu f$
	1000 min.	$\mu\mu f$
Electron Gun		Type Requiring No Ion-Trap Magnet

Optical:

Faceplate	Filterglass
Light transmission at center (Approx.)	78%
Phosphor (For Curves, see front of this Section)	P4—Sulfide Type Aluminized
Fluorescence	White
Phosphorescence	White
Persistence	Medium Short

Mechanical:

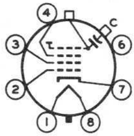
Tube Dimensions:	
Overall length	10-13/16" ± 1/4"
Greatest width	16-13/32" ± 1/8"
Greatest height	13-11/32" ± 1/8"
Diagonal	18-5/8" ± 1/8"
Neck length	3-9/16" ± 1/8"
Curvature of faceplate (External Radii):	
Center	48"
Edge	21"
Screen Dimensions (Minimum):	
Greatest width	15-1/8"
Greatest height	12"
Diagonal	17-9/16"
Projected area	172 sq. in.
Weight (Approx.)	14 lbs
Operating Position	Any
Cap	Recessed Small Cavity (JEDEC No.J1-21)
Bulb	J149A1

19YP4

Base. . . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW. 8JR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.3
Pin 6 - Internal Connection— Do Not Use
Pin 7 - Cathode



Pin 8 - Heater
Cap - Ultor (Grid No.4, Collector)
C - External Conductive Coating

GRID-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	20000 max.	volts
	11000 min.	volts
GRID-No.3 (FOCUSING) VOLTAGE:		
Positive value.	700 max.	volts
Negative value.	350 max.	volts
GRID-No.2 VOLTAGE	600 max.	volts
	300 min.	volts
GRID-No.1 VOLTAGE:		
Negative-peak value	220 max.	volts
Negative-bias value	154 max.	volts
Positive-bias value	0 max.	volts
Positive-peak value	2 max.	volts
HEATER VOLTAGE.	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period. . .	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor voltage (E_{c_4k}) of	*16000*	*volts*
and grid-No.2 voltage (E_{c_2k}) of	*500*	*volts*
Grid-No.3 Voltage for focus•.	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster★	-43 to -78	volts
Field Strength of Adjustable Centering Magnet♦	0 to 10	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms

CATHODE-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	20000 max. / 11000 min.	volts / volts
GRID-No.3-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	850 max.	volts
Negative value	200 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	750 max. / 450 min.	volts / volts
GRID-No.2-TO-CATHODE VOLTAGE	600 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value	220 max.	volts
Positive-bias value	154 max.	volts
Negative-bias value	0 max.	volts
Negative-peak value	2 max.	volts
HEATER VOLTAGE	6.9 max. / 5.7 min.	volts / volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage (Ec_4g_1) of	*16000*	*volts*
and grid-No.2-to-grid-No.1 voltage (Ec_2g_1) of	*500*	*volts*
Grid-No.3-to-Grid-No.1 Voltage for focus●	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster♠	41 to 69	volts
Field Strength of Adjustable Centering Magnet♦	0 to 10	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

● The grid-No.3 voltage required for optimum focus of any individual tube may have a value anywhere between 0 and 400 volts and is a function of the value of the ultor voltage, ultor current, and grid-No.2 voltage. It changes directly with the ultor voltage at the rate of approximately 46 volts for each 1000-volt change in ultor voltage; inversely with grid-No.2 voltage at the rate of about 60 volts for each 100-volt change in grid No.2 voltage; and inversely with ultor current at the rate of about 60 volts for each 100-microampere change in ultor current. Because this tube has a narrow depth of focus, it is necessary to provide means such as a potentiometer or a 4-tap switch for adjusting the focusing voltage. In general, commercially acceptable focus is obtained if the focusing voltage is within 75 volts of the value required for optimum focus and if the focusing voltage is maintained to within 75 volts of the optimum value during line-voltage fluctuations.

★ See *Raster-Cutoff-Range Chart for Grid-Drive Service*.

♦ Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equals:

$$\sqrt{\frac{E_{c_4k} \text{ or } E_{c_4g_1} \text{ (volts)}}{16000 \text{ (volts)}}} \times 10 \text{ gausses}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

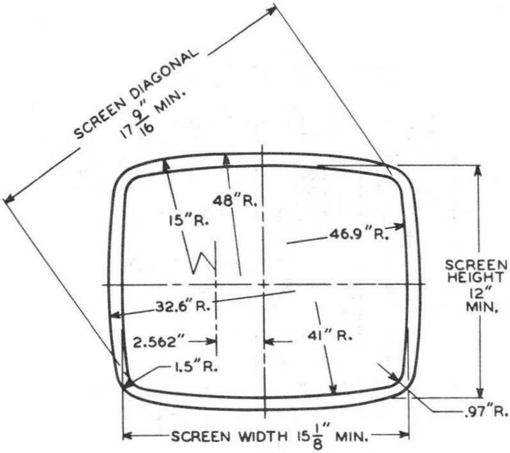
♣ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

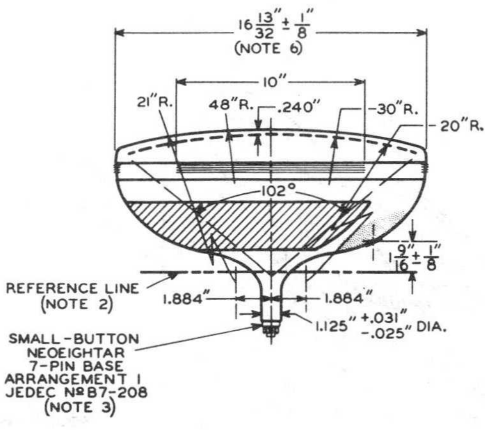
♠ See *Raster-Cutoff-Range Chart for Cathode-Drive Service*.

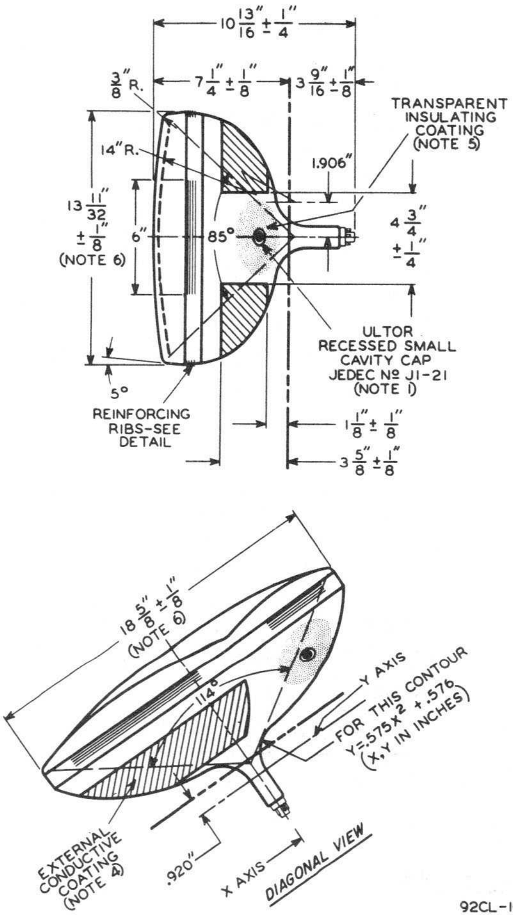
OPERATING CONSIDERATIONS

X-Ray Warning. When operated at ultor voltages up to 16 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 20 kilovolts (Design-maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

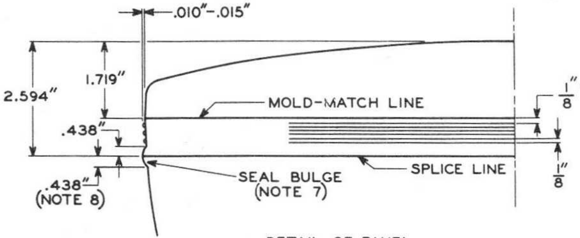

SCREEN DIAGONAL
$17\frac{9}{16}$" MIN.
48"R.
15"R.
46.9"R.
SCREEN HEIGHT
12"
MIN.
32.6" R.
2.562"
41" R.
1.5"R.
.97"R.
SCREEN WIDTH $15\frac{1}{8}$" MIN.


$16\frac{13}{32}" \pm \frac{1}{8}"$
(NOTE 6)
10"
21"R.
48"R.
.240"
-30"R.
-20"R.
102°
$1\frac{9}{16}" \pm \frac{1}{8}"$
REFERENCE LINE
(NOTE 2)
1.884"
1.884"
1.125" +.031" -.025" DIA.
SMALL-BUTTON
NEOEIGHTAR
7-PIN BASE
ARRANGEMENT 1
JEDEC № B7-208
(NOTE 3)



$10\frac{13}{16}'' \pm \frac{1}{4}''$
$\frac{3}{8}''$ R.
$7\frac{1}{4}'' \pm \frac{1}{8}''$
$3\frac{9}{16}'' \pm \frac{1}{8}''$
TRANSPARENT INSULATING COATING (NOTE 5)
14" R.
1.906"
$13\frac{11}{32}''$ $\pm\frac{1}{8}''$ (NOTE 6)
6"
85°
$4\frac{3}{4}''$ $\pm\frac{1}{4}''$
ULTOR RECESSED SMALL CAVITY CAP JEDEC Nº J1-21 (NOTE 1)
5°
REINFORCING RIBS-SEE DETAIL
$1\frac{1}{8}'' \pm \frac{1}{8}''$
$3\frac{5}{8}'' \pm \frac{1}{8}''$
$18\frac{5}{8}'' \pm \frac{1}{8}''$ (NOTE 6)
114°
Y AXIS
FOR THIS CONTOUR $Y=.575X^2+.576$ (X, Y IN INCHES)
EXTERNAL CONDUCTIVE COATING (NOTE 4)
.920"
X AXIS
DIAGONAL VIEW

92CL-10699



DETAIL OF PANEL

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm$ 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No.G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

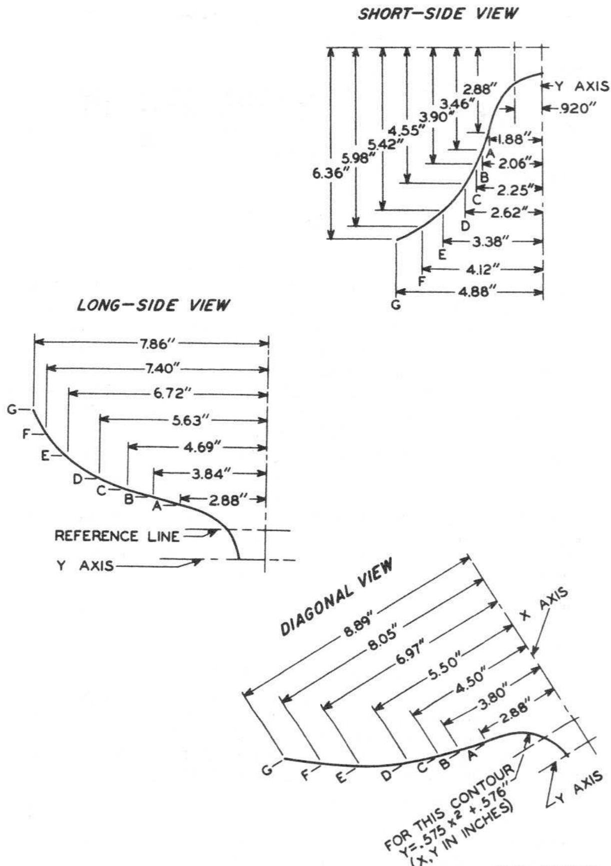
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

NOTE 8: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPLICE LINE IS 3/8" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF THE TUBE SUPPORT BAND. TUBE MOUNTING AND YOKE SUPPORT CLAMPS MUST BE SPACED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

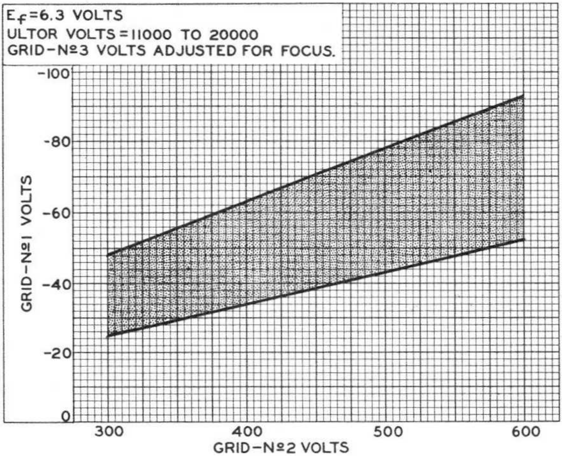
BULB-CONTOUR DIMENSIONS



92CL-10669R1

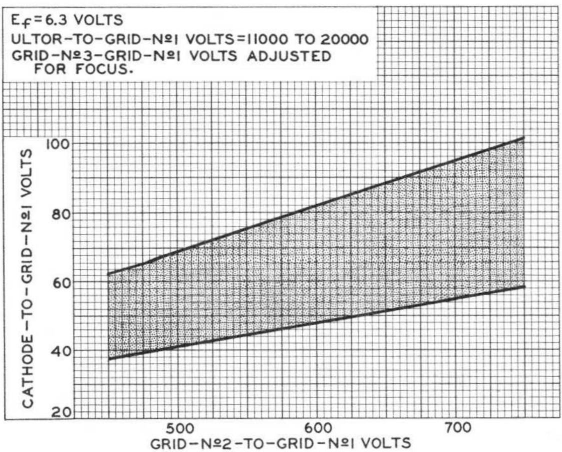
NOTE: PLANES A THROUGH G ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE-BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.

RASTER-CUTOFF-RANGE CHARTS
Grid-Drive Service



92CS-10789

Cathode-Drive Service



92CS-10818

Picture Tube

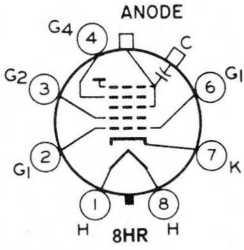
Pan-o-Ply Type — **Low-Voltage Electrostatic Focus**
114° Magnetic Deflection — **Low Grid-No.2 Voltage**

Direct Interelectrode Capacitances:		
Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode[a]	2000 max.	pF
	1400 min.	pF
Heater Current at 6.3 volts	450 ± 20	mA
Heater Warm-Up Time (Average)	11	seconds

Electron Gun . . . . Type Requiring No Ion-Trap Magnet
Focus Lens . . . . Unipotential
Phosphor . . . . P4–Sulfide Type, Aluminized
Faceplate . . . . .Filterglass
Light Transmission at Center (Approx.) 44%
Weight (Approx.) . . . . 16.5 lb
Overall length . . . . 12.269" ± .250"
Neck length . . . . 4.375" ± .125"
Projected Area of Screen . . . . 184 sq. in.
Cap Designation . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base Designation . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1: Heater
Pin 2: Grid No.1
Pin 3: Grid No.2
Pin 4: Grid No.4
Pin 6: Grid No.1
Pin 7: Cathode
Pin 8: Heater
Cap: Anode (Grid No.3, Grid No.5, Screen, Collector)
C: External Conductive Coating



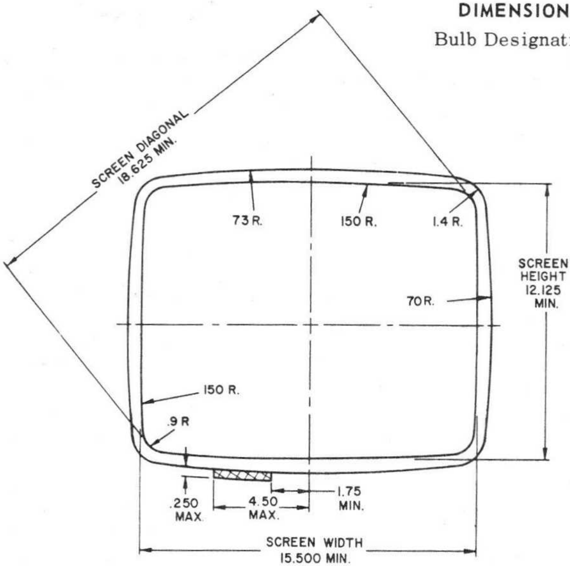
MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to grid No.1

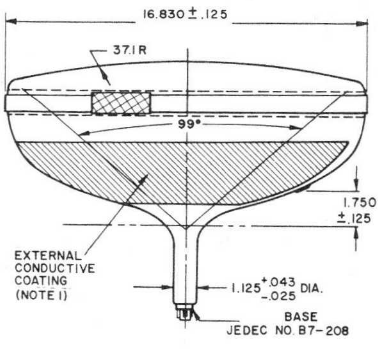
Anode Voltage	23,000 max.	V
	11,000 min.	V
Grid-No.4 Voltage:		
Positive value	1250 max.	V
Negative value	400 max.	V

DIMENSIONAL

Bulb Designation

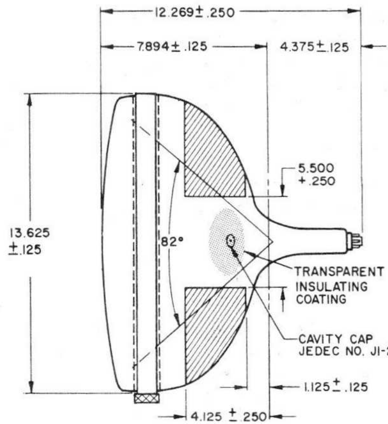


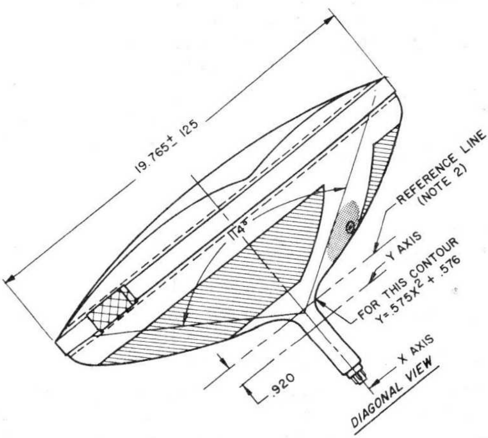
⊠ KEEP THIS SPACE CLEAR OF ANY MEHANICAL OBSTRUCTION



OUTLINE

JEDEC NO.J157-1/2 A1





DIMENSIONS IN INCHES 92LL-1914R1

Note 1: External conductive coating and implosion protection hardware must be grounded.

Note 2: Determined by Gauge JEDEC No.G-126.

MAXIMUM AND MINIMUM RATINGS (CONT'D)

Grid-No.2 Voltage	60 max. / 20 min.	V / V
Cathode Voltage:		
Negative peak value	2 max.	V
Negative bias value	0 max.	V
Positive bias value	100 max.	V
Positive peak value	150 max.	V
Heater Voltage	6.9 max. / 5.7 min.	V / V
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period	300 max.	V
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max.	V
DC Component	100 max.	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16,000	V
Grid-No.4 Voltage[b]	100	V
Grid-No.2 Voltage	30	V
Cathode Voltage for visual extinction of focused raster	22 to 40	V
Field Strength of required adjustable Centering Magnet	0 to 8	G

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max.	MΩ

[a]Includes implosion protection hardware.

[b]The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between −100 and +300 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 11.25-inch by 15-inch pattern from an RCA-2F21 monoscope, or equivalent.

See *X-RADIATION PRECAUTIONS* at front of this section

Picture Tube

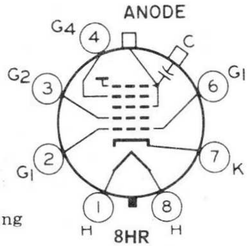
Pan-o-Ply Type
Low-Voltage Electrostatic Focus
114° Magnetic Deflection

Direct Interelectrode Capacitances:		
Cathode to all other electrodes . .	5	pF
Grid No.1 to all other electrodes .	6	pF
External conductive coating to anode[a]	2000 max. / 1400 min.	pF / pF
Heater Current at 6.3 volts	450 ± 20	mA
Heater Warm-Up Time (Average). . . .	11	seconds

Electron Gun . . . . Type Requiring No Ion-Trap Magnet
Focus Lens . . . . Unipotential
Phosphor . . . . P4-Sulfide Type, Aluminized
Faceplate . . . . Filterglass
Light Transmission at Center (Approx.). 44%
Weight (Approx.) . . . . 16.5 lb
Overall length . . . . 12.269 in ± .250 in
Neck length . . . . 4.375 in ± .125 in
Projected Area of Screen . . . . 184 sq. in
Cap Designation . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base Designation . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



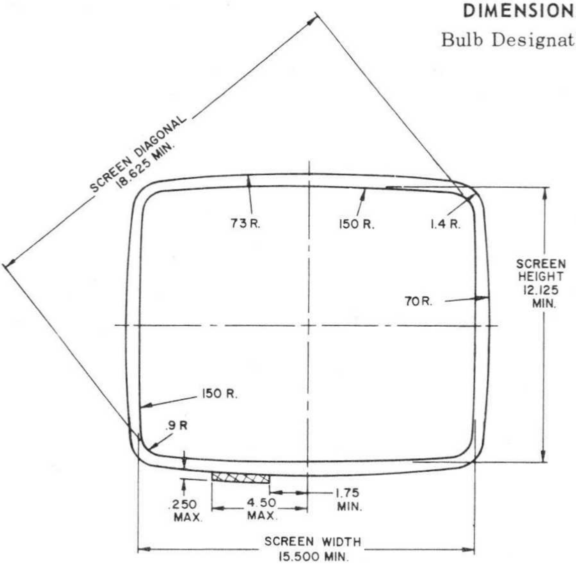
MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

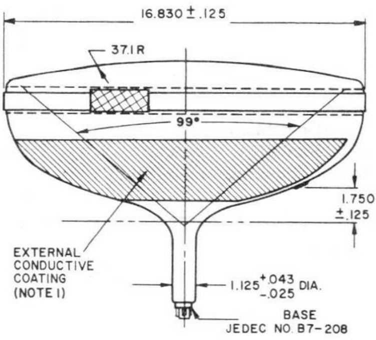
Anode Voltage	23,000 max. / 11,000 min.	V / V
Grid-No.4 Voltage:		
Positive value	1100 max.	V
Negative value	550 max.	V

DIMENSIONAL

Bulb Designation

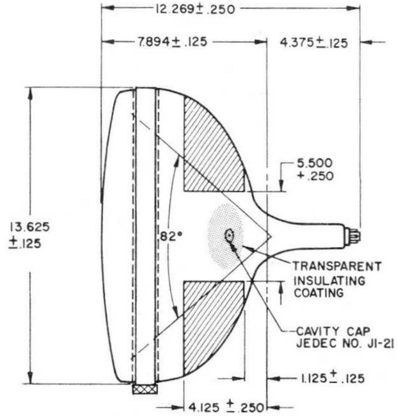


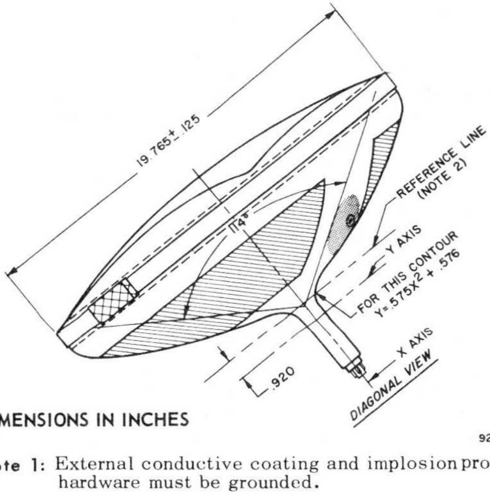
KEEP THIS SPACE CLEAR OF ANY MEHANICAL OBSTRUCTION



OUTLINE

JEDEC No.J157-1/2 A1





DIMENSIONS IN INCHES

92LL-1914R1

Note 1: External conductive coating and implosion protection hardware must be grounded.

Note 2: Reference line is determined by gauge JEDEC No.G-126.

MAXIMUM AND MINIMUM RATINGS (CONT'D)

Grid-No.2 Voltage	550 max. / 200 min.	V / V
Grid-No.1 Voltage:		
Negative peak value	220 max.	V
Negative bias value	155 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Heater Voltage	6.9 max. / 5.7 min.	V / V
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period	300 max.	V
Heater positive with respect to cathode:		
Combined AC & DC Voltage	200 max.	V
DC Component	100 max.	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16,000	V
Grid-No.4 Voltage[b]	200	V
Grid-No.2 Voltage	300	V
Cathode Voltage for visual extinction of focused raster	28 to 62	V
Field Strength of required adjustable Centering Magnet	0 to 8	G

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max.	MΩ

[a] Include implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 11.25-inch by 15-inch pattern from an RCA-2F21 monoscope, or equivalent.

See *X-RADIATION PRECAUTIONS* at front of this section.

21AMP4B

Picture Tube

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS

ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION

Electrical:

Heater Current at 6.3 volts	600	ma
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	pf
Cathode to all other electrodes	5	pf
External conductive coating to anode	2500 max.	pf
	2000 min.	pf
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate, Spherical	Filterglass
Light transmission (Approx.)	74%
Phosphor (For curves, see front of this Section)	P4-Sulfide Type, Aluminized

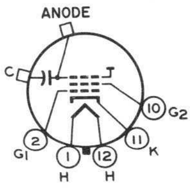
Mechanical:

Operating Position	Any
Weight (Approx.)	24 lbs
Overall Length	20" ± 3/8"
Neck Length	7-1/2" ± 3/16"
Projected Area of Screen	262 sq. in.
External Conductive Coating:	
Type	Regular-Band
Contact area for grounding	Near Reference Line

For Additional Information on Coatings, Dimensions, and Deflection Angles:
See *Picture-Tube Dimensional-Outlines* and *Bulb J171 D/E* sheets at the front of this section

Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)
Basing Designation for BOTTOM VIEW 12N

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap-Anode (Grid No.3, Collector)
C-External Conductive Coating

Maximum Ratings, *Design-Maximum Values:*

Anode Voltage	20000 max.	volts
Grid-No.2 Voltage	550 max.	volts

Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With anode voltage of	*16000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

21AVP4C

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
72° MAGNETIC DEFLECTION

Electrical:

Heater Current at 6.3 volts. . . . . 600 ma
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes. . . . . . 6 pf
  Cathode to all other electrodes. . . . . . . 5 pf
  External conductive coating to anode . . . . 2500 max. pf / 2000 min. pf
Electron Gun . . . . Type Requiring No Ion-Trap Magnet

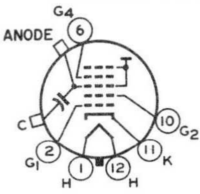
Optical:

Faceplate, Spherical . . . . .Filterglass
  Light transmission (Approx.) 74%
Phosphor (For curves, see front of this section) . . P4-Sulfide Type, Aluminized

Mechanical:

Operating Position. Any
Weight (Approx.). . . . . 24 lbs
Overall Length. . . . . 23-1/32" ± 3/8"
Neck Length . . . . 7-1/2" ± 3/16"
Projected Area of Screen. . . . . 262 sq. in.
External Conductive Coating:
  Type. . . . . Special
  Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
  See *Picture-Tube Dimensional-Outlines* and *Bulb J171 B/F* sheets at the front of this section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Shell Duodecal 6-Pin, Arrangement 1,(JEDEC Group 4, No.B6-63)
  Basing Designation for BOTTOM VIEW. 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

Maximum Ratings, *Design-Maximum Values:*

Anode Voltage	22000 max.	volts
Grid-No.4 (Focusing) Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	550 max.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With anode voltage of	*18000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus	-72 to +396	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
MAGNETIC FOCUS — **72° MAGNETIC DEFLECTION**

Electrical:

Direct Interelectrode Capacitances:
- Cathode to all other electrodes. . . . . . . 5 pf
- Grid No.1 to all other electrodes. . . . . . 6 pf
- External conductive coating to anode. . . . . {2500 max. pf / 2000 min. pf}

Heater Current at 6.3 volts. . . . . 600 ± 30 ma
Heater Warm-up time (Average). . . . . 11 seconds
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

Optical:

Phosphor (For curves, see front of this Section). . . P4—Sulfide Type, Aluminized
Faceplate, Spherical . . . . .Filterglass
- Light transmission (Approx.) 74%

Surface of Protective Window . . . . .Treated to reduce specular reflection

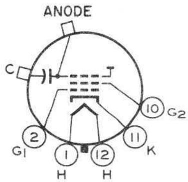
Mechanical:

Weight (Approx.) . . . . 24 lbs
Overall Length . . . . 23.031" ± .375"
Neck Length. . . . . 7.500" ± .188"
Projected Area of Screen . . . . 262 sq. in.
External Conductive Coating:
- Type . . . . Regular-Band
- Contact area for grounding. . . . . .Near Reference Line

For Additional Information on Coatings and Dimensions:
- See *Picture-Tube Dimensional-Outlines and Bulb J171 B/F* sheets at front of this section

Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)
- Basing Designation for BOTTOM VIEW. 12N

Pin 1 - Heater
Pin 2 - Grid-No.1
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater
Cap - Anode (Grid No.3, Screen, Collector)
C - External Conductive Coating



Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage. . . . . 20000 max. volts
Grid-No.2 Voltage. . . . . 550 max. volts

Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	18000	volts
Grid-No.2 Voltage	400	volts
Cathode Voltage for visual extinction of focused raster	36 to 78	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

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21AXP22-A

COLOR KINESCOPE

THREE-GUN SHADOW-MASK TYPE — ELECTROSTATIC FOCUS
MAGNETIC CONVERGENCE — MAGNETIC DEFLECTION
ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN

Supersedes Type 21AXP22

DATA

General:

Electron Guns, Three with Axes Tilted
Toward Tube Axis . . . . Blue, Green, Red
Heater, for Unipotential Cathode of Each Gun, Paralleled with Each of the Other Two Heaters within Tube:
Voltage. . . . . 6.3 . . . . ac or dc volts
Current. . . . . 1.8 ± 10% . . . . .amp
Direct Interelectrode Capacitances (Approx.):
Grid No.1 of any gun to all other electrodes except the No.1 grids of the other two guns. . . . . 7 $\mu\mu$f
Cathode of blue gun + cathode of green gun + cathode of red gun to all other electrodes . . . . 16 $\mu\mu$f
Grid No.3 (Of each gun tied within tube to No.3 grids of other two guns) to all other electrodes. . . . . . 9 $\mu\mu$f
Faceplate, Spherical . . . . .Filterglass
Light transmission (Approx.) 77%
Screen, on Inner Surface of Faceplate:
Type . . . . Aluminized, Tricolor, Phosphor-Dot
Phosphor (Three separate phosphors, collectively). P22
Fluorescence and phosphorescence of separate phosphors, respectively. . . Blue, Green, Red
Persistence of group phosphorescence . . . . Medium
Dot arrangement. . . . . Triangular group consisting of blue dot, green dot, and red dot
Spacing between centers of adjacent dot trios (Approx.) 0.029"
Size (Minimum):
Greatest width . . . . 19-1/16"
Height . . . . 15-1/4"
Projected area . . . . 255 sq. in.
Focusing Method. . . . . .Electrostatic
Convergence Method . . . . Magnetic
Deflection Method. . . . . Magnetic
Deflection Angles (Approx.):
Horizontal . . . . 70°
Vertical . . . . 55°
Tube Dimensions:
Maximum overall length . . . . 25-5/16"
Diameter:
At lip . . . . 20-9/16" ± 1/8"
At flange. . . . . 20-15/16" ± 5/16"
Weight (Approx.) . . . . 28 lbs
Mounting Position. . . . . Tube axis horizontal (base pin 12 on top)

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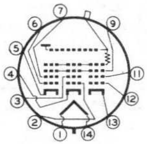
Ultor Terminal. . . . . Metal Shell
Base. . . . Small-Shell Neodiheptal 12-Pin (JETEC No.B12-131)
Socket. . . . . Alden Nos.214NMINSC (Radial leads), 214NMINC (Axial leads), or equivalent
Basing Designation for BOTTOM VIEW. 14AH

Pin 1 - Heater
Pin 2 - Grid No.1 of Red Gun
Pin 3 - Grid No.2 of Red Gun
Pin 4 - Cathode of Red Gun
Pin 5 - Cathode of Green Gun
Pin 6 - Grid No.1 of Green Gun
Pin 7 - Grid No.2 of Green Gun



Pin 9 - Grids No.3
Pin 11 - Grid No.2 of Blue Gun
Pin 12 - Grid No.1 of Blue Gun
Pin 13 - Cathode of Blue Gun
Pin 14 - Heater
METAL SHELL: Ultor (Grid No.4, Grid No.5, Collector)

Maximum Ratings, *Design-Center Values:*

ULTOR-TO-CATHODE (Of each gun) VOLTAGE. . .	25000 max.	volts
ULTOR CURRENT, (Average, each gun).	500* max.	μamp
GRID-No.3-TO-CATHODE (Of each gun) VOLTAGE .	6000 max.	volts
GRID-No.2-TO-CATHODE VOLTAGE (Each gun) . .	800 max.	volts
GRID-No.1-TO-CATHODE VOLTAGE (Each gun):		
Negative bias value	400 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE (Each gun):		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	410 max.	volts
After equipment warm-up period.	180 max.	volts
Heater positive with respect to cathode .	180 max.	volts

Equipment Design Ranges:

With any ultor voltage ($E_{c_4}k_{each\ gun}$) between 20000# and 25000 volts

Grid-No.3 (Focusing electrode)-to-Cathode (Of each gun) Voltage .	15.2% to 21.2% of $E_{c_4}k_{each\ gun}$	volts
Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage ($E_{c_1}k$) at fixed value for raster cutoff.	*See Cutoff Design Chart*	

*,#: See next page.

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COLOR KINESCOPE

Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage (E_{c_2k}) at fixed value.	*See Cutoff Design Chart*	
Variation in Raster Cutoff Between Guns in Any Tube.	± 21% of average of highest and lowest cutoff values	
Grid-No.3 Current for ultor current of 800 µamp.	-45 to +75	µamp
Grid-No.2 Current (Each gun) . . .	-5 to +5	µamp
Percentage of Total Ultor Current Supplied by Each Gun:		
To produce Illuminant-C White (I.C.I. Coordinates x = 0.310, y = 0.316):		
Red gun.	47 to 67	per cent
Blue gun	11 to 24	per cent
Green gun.	20 to 33	per cent
To produce White of 8500°K + 27 M.P.C.D. (I.C.I. Coordinates x = 0.287, y = 0.316):		
Red gun.	42 to 60	per cent
Blue gun	12 to 27	per cent
Green gun.	23 to 38	per cent
Maximum Raster Shift in Any Direction from Screen Center□. .	1	inch
Adjustment to be Provided by the Following Components:		
Purifying magnet	Raster shift of 1" max. in any direction from screen center	
Magnetic-field equalizer	Beam displacement with respect to phosphor dot at position of max. displacement (i.e., edge of screen)	
Tangential	±0.0005" to ±0.007"	
Radial	±0.0005" to ±0.005"	

* A value of average ultor current per gun higher than 500 microamperes will increase picture brightness but may impair resolution and shorten cathode life.

□ Centering of the raster on the screen is accomplished by passing direct current of the required value through each pair of deflecting coils to compensate for raster shift resulting from adjustments for optimum convergence and color purity.

Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20000 volts.

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Lateral-Converging Magnet:⊕♁	
After adjustment has been made for color purity and dynamic convergence--	
Max. shift of blue beam.	±1/4"
Max. shift of red and green beams.	±1/8" to ±3/8"
Average of max. shift of red and green beams	±7/32" to ±9/32"
Radial-Converging Magnet Assembly:⊕	
For static convergence--	
After adjustment has been made for optimum color purity and dynamic convergence (Each beam).	Shift of ±5/8"
For dynamic convergence†--	
Effected by magnetomotive force of parabolic and/or sawtooth waveshape synchronized with scanning.	
Horizontal:	
Blue pattern--	
Parabola amplitude to provide▲.	Shift of 1/4" to 9/16"
Sawtooth amplitude to provide○○	Shift of ±50% of the shift caused by parabola amplitude
Red pattern & green pattern--	
Parabola:	
Amplitude to provide▲. . . .	Shift of 1/8" to 3/8"
Ratio of red-pattern shift to green-pattern shift.	1/2 to 2
Sawtooth:	
Amplitude for red pattern to provide○○	Shift of -35% to +85% of the shift caused by parabola amplitude
Amplitude for green pattern to provide○○	Shift of -85% to +35% of the shift caused by parabola amplitude
Difference between red-pattern shift and green-pattern shift ($Shift_R - Shift_G$).	0 to +100%
Vertical:	
Blue pattern--	
Parabola amplitude to provide▲.	Shift of 0 to 1/8"

⊕,♁,†,▲,○○: See next page.

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COLOR KINESCOPE

For dynamic convergence† (Cont'd):

Vertical:

Sawtooth amplitude to provide°° . . . . Shift of 0 to 1/4"

Red pattern & green pattern—

Parabola:

Amplitude to provide▲. . . . Shift of 1/8" to 3/8"

Ratio of red-pattern shift to green-pattern shift . . . . 1/2 to 2

Sawtooth:

Amplitude to provide°° . . Shift of -1/8" to +3/16"

Difference between red-pattern shift and green-pattern shift ($Shift_R$ - $Shift_G$) . . . . 0 to +100%

Examples of Use of Design Ranges:

For ultor voltage of	*20000*	*25000*	*volts*
Grid-No.3 (Focusing Electrode)-to-Cathode (Of Each Gun) Voltage.	3040 to 4240	3800 to 5300	volts
Grid-No.2-to-Cathode Voltage (Each Gun) when circuit design utilizes grid-No.1-to-cathode voltage of -70 volts for raster cutoff.	130 to 370	130 to 370	volts
Grid-No.1-to-Cathode Voltage (Each Gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage of 200 volts	-45 to -100	-45 to -100	volts

Limiting Circuit Values:

High-Voltage Circuits:

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *ultor power supply* and the *grid-No.3 power supply* be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 50 milliamperes. In addition, to prevent cathode damage with resultant decrease in tube life, the effective resistance between grid-No.3 power supply output capacitor and the grid-No.3 electrode should be not less than 50000 ohms. This resistance should be capable of withstanding the maximum instantaneous current and voltage in the grid-No.3 circuit.

In equipment utilizing a well-regulated ultor power supply, the *grid-No.3-circuit resistance* should be limited to 7.5 megohms.

⊕,↓,†,▲,°°: See next page.

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21AXP22-A
COLOR KINESCOPE

Low-Voltage Circuits:
Grid-No.1-Circuit Resistance (Each Gun) . . . . 1.5 max. megohms

When the cathode of each gun is not connected directly to the heater, the grid-No.2-to-heater circuit, the grid-No.1-to-heater circuit, and the cathode-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

When the cathode is connected directly to the heater, the grid-No.2-to-heater circuit, and the grid-No.1-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

⊕ Shift is the movement of the regions of bar-or-dot-generator pattern indicated in notes (▲) and (oo).

● The direction of movement of the red and green beam is opposite to that of the blue beam.

† Indicated values apply when RCA test yoke is used with the 21AXP22-A.

▲ The parabola amplitude is determined by the average value of the shifts at the extremities of the respective horizontal and vertical axes of the screen with convergence of the three beams maintained at the center of the screen. An increase in amplitude should move the blue beam toward the top of the screen; the red beam toward the lower left of the screen; and the green beam toward the lower right of the screen.

oo The sawtooth amplitude is determined by the difference between the shifts at the extremities of the respective horizontal and vertical axes of the screen. Positive amplitude indicates that the shift at the right or bottom of the screen is greater than the shift at the left or top of the screen.

X-RAY WARNING

X-ray radiation is produced by the 21AXP22-A when it is operated at its normal ultor voltage. The radiation is through the faceplate, and is sufficient to require the adoption of safety measures in TV receivers. Shielding such as that provided by a 1/4-inch thickness of safety glass (lime) in front of the faceplate, should prove adequate to provide protection against personal injury from prolonged exposure at close range when the tube is operated at its maximum ultor voltage rating.

When this tube is being serviced outside of the TV receiver cabinet, it should never be operated without providing adequate X-ray shielding in front of faceplate. Because the ultor voltage may rise above its maximum rated value for short periods during adjustment with increase in the amount of X-ray radiation, provision should be made for placing a 3/8-inch thickness of safety glass in front of the faceplate to avoid the hazard of X-ray radiation.

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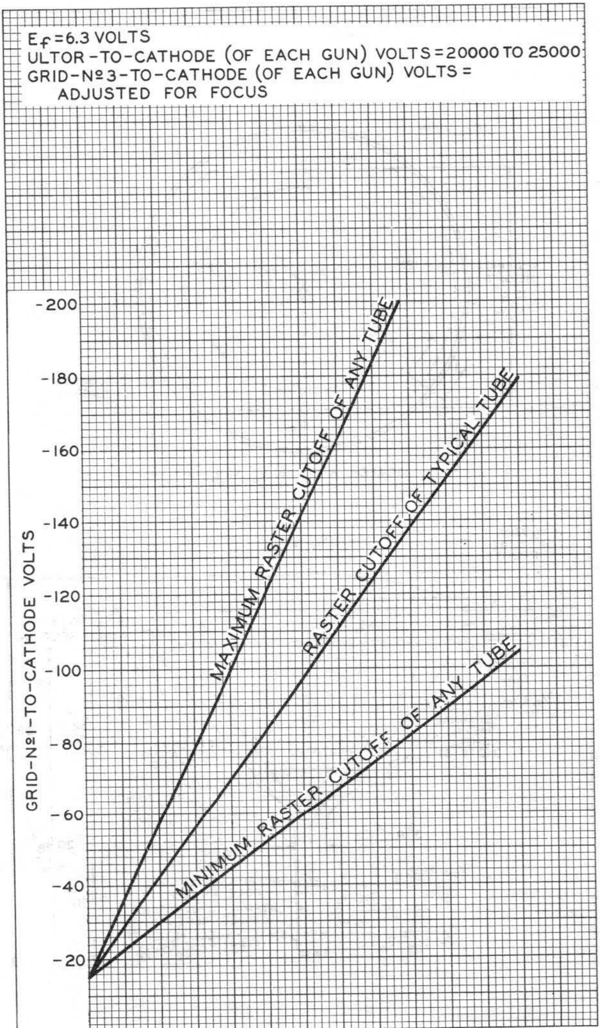
21AXP22-A

CUTOFF DESIGN CHART



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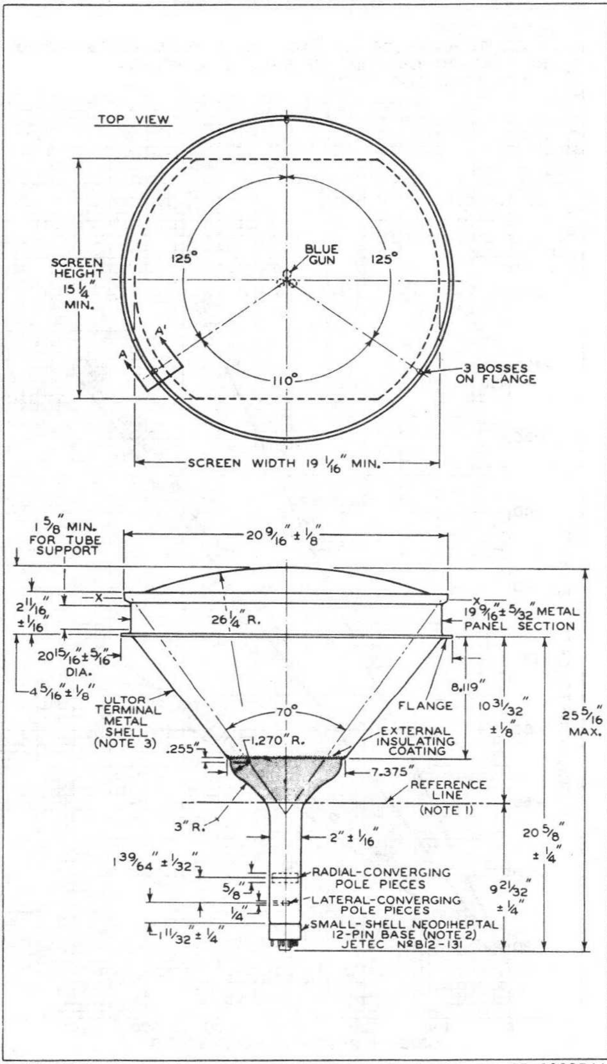
RCA

21AXP22-A

COLOR KINESCOPE



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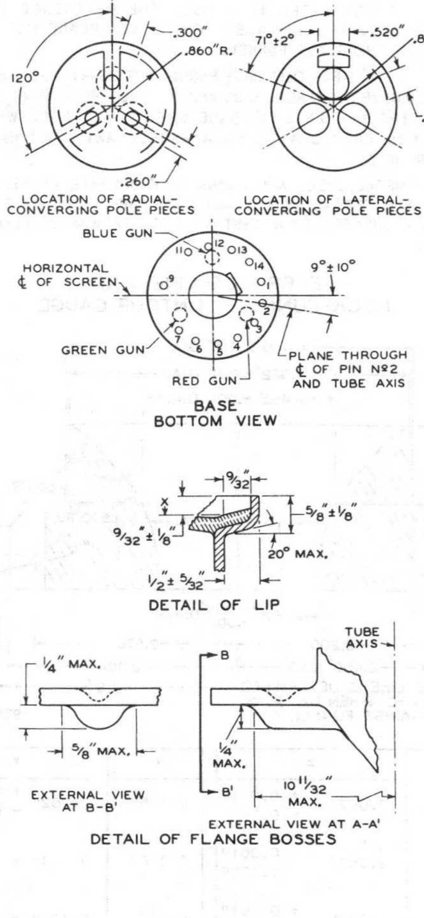
21AXP22-A

COLOR KINESCOPE



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RCA

21AXP22-A

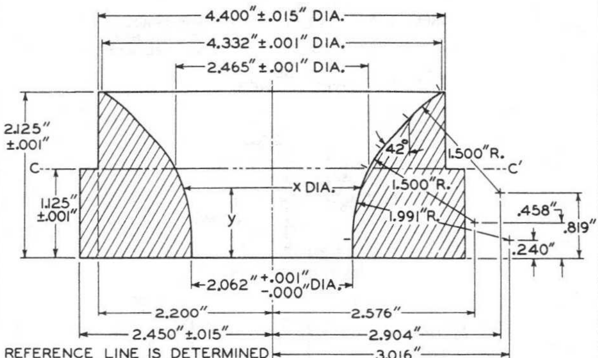
COLOR KINESCOPE

NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE (SHOWN BELOW) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 2: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH METAL-SHELL AXIS AND HAVING A DIAMETER OF 3".

NOTE 3: METAL SHELL AND GLASS FACE OPERATE AT HIGH VOLTAGE. ANY MATERIAL IN CONTACT WITH THE SHELL OR THE FACE MUST BE INSULATED TO WITHSTAND THE MAXIMUM APPLIED ULTOR VOLTAGE.

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE



REFERENCE LINE IS DETERMINED BY PLANE C-C' WHEN GAUGE IS SEATED AGAINST FUNNEL

92CM-8844

y	x		y	x
0.000"	2.062" + 0.001" − 0.000"		0.385"	2.062" + 0.001" − 0.000"
0.125"	2.062" + 0.001" − 0.000"		0.500"	2.084" ± 0.001"
0.250"	2.062" + 0.001" − 0.000"		0.625"	2.122" ± 0.001"
0.375"	2.062" + 0.001" − 0.000"		0.750"	2.182" ± 0.001"

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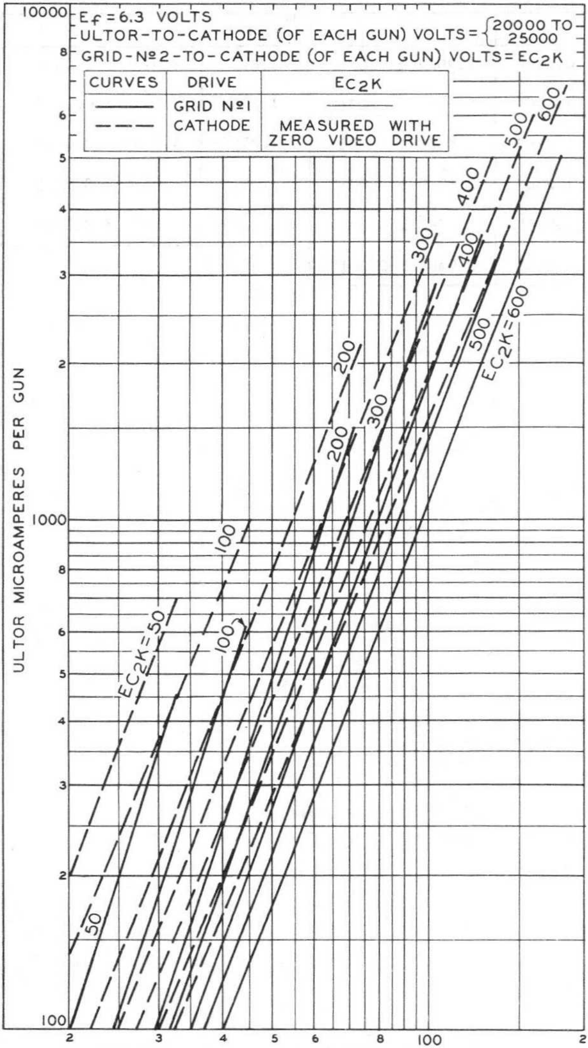
y	x
0.875"	2.258" ± 0.001"
1.000"	2.352" ± 0.001"
1.125"	2.465" ± 0.001"
1.250"	2.604" ± 0.001"
1.375"	2.778" ± 0.001"
1.500"	2.990" ± 0.001"

y	x
1.625"	3.216" ± 0.001"
1.750"	3.440" ± 0.001"
1.875"	3.678" ± 0.001"
2.000"	3.958" ± 0.001"
2.125"	4.332" ± 0.001"

RCA

21AXP22-A

TYPICAL DRIVE CHARACTERISTICS



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92CM-8566RI

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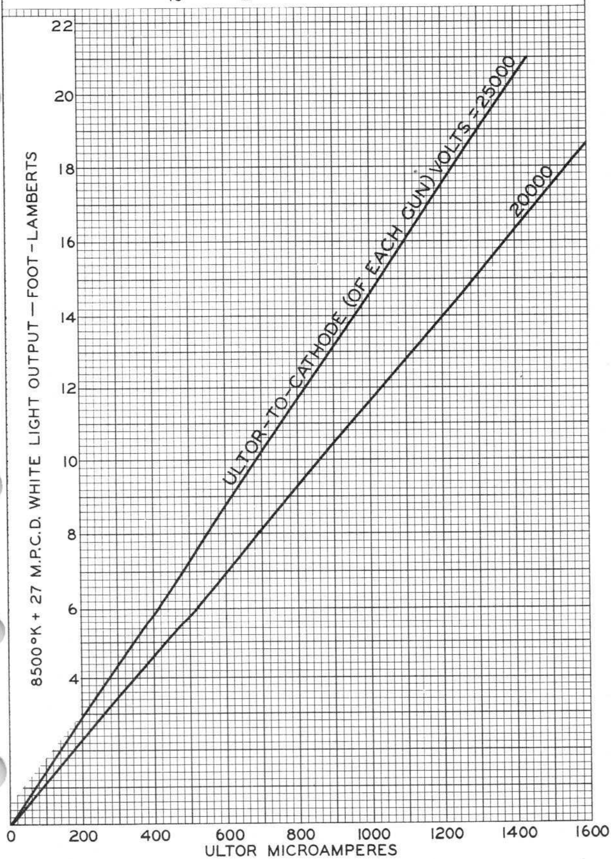
21AXP22-A

TYPICAL LIGHT-OUTPUT CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-№ 3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CURRENT TO PRODUCE 8500°K + 27 M.P.C.D. WHITE LIGHT OUTPUT
PERCENTAGE OF TOTAL ULTOR CURRENT SUPPLIED BY EACH GUN TO PRODUCE 8500°K + 27 M.P.C.D. WHITE:

RED GUN: 51%
BLUE GUN: 19%
GREEN GUN: 30%

RASTER SIZE: 19 1/16" x 14 1/2"



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21AXP22-A/21AXP22
COLOR PICTURE TUBE

THREE-GUN SHADOW-MASK TYPE ELECTROSTATIC FOCUS
MAGNETIC CONVERGENCE MAGNETIC DEFLECTION
ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN
Replacement for Types 21AXP22 & 21AXP22-A

DATA

General:

Electron Guns, Three with Axes Tilted Toward Tube Axis		Red, Blue, Green
Heater, for Unipotential Cathode of Each Gun, Paralleled with Each of the Other Two Heaters within Tube:		
Voltage	6.3	ac or dc volts
Current	1.8 ± 10%	amp
Faceplate, Spherical		Filterglass
Light transmission (Approx.)		77%
Screen, On Inner Surface of Faceplate:		
Type		Aluminized, Tricolor, Phosphor-Dot
Phosphor (Three separate phosphors, collectively)♦		P22
Fluorescence and phosphorescence of separate phosphors, respectively		Red, Blue, Green
Persistence of group phosphorescence		Medium
Dot arrangement		Triangular group consisting of red dot, blue dot, and green dot
Spacing between centers of adjacent dot trios (Approx.)		0.029"
Size (Minimum):		
Greatest width		19-1/16"
Height		15-1/4"
Projected area		255 sq. in.
Focusing Method		Electrostatic
Convergence Method		Magnetic
Deflection Method		Magnetic
Deflection Angles (Approx.):		
Horizontal		70°
Vertical		55°
Tube Dimensions:		
Maximum overall length		25-5/16"
Diameter:		
At lip		20-9/16" ± 1/8"
At flange		20-15/16" ± 5/16"
Weight (Approx.)		28 lbs
Operating Position		Tube axis horizontal (Base pin 12 on top)
Ultor Terminal		Metal Shell
Socket		Alden Nos. 214NMINSC (Radial leads), 214NMINC (Axial leads), or equivalent

♦ For Curves, see front of this Section.

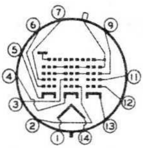
RCA

21AXP22-A/21AXP22

COLOR PICTURE TUBE

Base. . . . Small-Shell Neodiheptal 12-Pin (JEDEC No.B12-131)
Basing Designation for BOTTOM VIEW. 14W

Pin 1 - Heater
Pin 2 - Grid No.1 of Red Gun
Pin 3 - Grid No.2 of Red Gun
Pin 4 - Cathode of Red Gun
Pin 5 - Cathode of Green Gun
Pin 6 - Grid No.1 of Green Gun
Pin 7 - Grid No.2 of Green Gun



Pin 9 - Grids No.3
Pin 11 - Grid No.2 of Blue Gun
Pin 12 - Grid No.1 of Blue Gun
Pin 13 - Cathode of Blue Gun
Pin 14 - Heater
METAL SHELL - Ultor (Grid No.4, Grid No.5, Collector)

Maximum Ratings, *Design-Center Values:*

ULTOR-TO-CATHODE (Of each gun) VOLTAGE. . .	25000 max.	volts
GRID-No.3-TO-CATHODE (Of each gun) VOLTAGE.	6000 max.	volts
GRID-No.2-TO-CATHODE VOLTAGE (Each gun) . .	800 max.	volts
GRID-No.1-TO-CATHODE VOLTAGE (Each gun):		
Negative-bias value	400 max.	volts
Positive-bias value	0 max.	volts
Positive-peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE (Each gun):		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	410 max.	volts
After equipment warm-up period.	180 max.	volts
Heater positive with respect to cathode .	180 max.	volts

Limiting Circuit Values:

High-Voltage Circuits:

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *ultor power supply* and the *grid-No.3 power supply* be of the limited-energy type with inherent regulation to limit the continuous short-circuit current to 50 milliamperes. In addition, to prevent cathode damage with resultant decrease in tube life, the effective resistance between grid-No.3 power-supply output capacitor and the grid-No.3 electrode should be not less than 50,000 ohms. This resistance should be capable of withstanding the maximum instantaneous current and voltage in the grid-No.3 circuit.

In equipment utilizing a well-regulated ultor power supply, the *grid-No.3-circuit resistance* should be limited to 7.5 megohms.

Low-Voltage Circuits:

Grid-No.1-Circuit Resistance (Each gun) . .	1.5 max.	megohms

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RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

21AXP22-A/21AXP22

COLOR PICTURE TUBE

When the cathode of each gun is not connected directly to the heater, the grid-No.2-to-heater circuit, the grid-No.1-to-heater circuit, and the cathode-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

When the cathode is connected directly to the heater, the grid-No.2-to-heater circuit, and the grid-No.1-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

X-RAY WARNING

X-ray radiation is produced by the 21AXP22-A/21AXP22 when it is operated at its normal ultor voltage. The radiation is through the faceplate, and is sufficient to require the adoption of safety measures in television receivers. Shielding such as that provided by a 1/4-inch thickness of safety glass (lime) in front of the faceplate, should prove adequate to provide protection against personal injury from prolonged exposure at close range when the tube is operated at its maximum ultor-voltage rating.

When this tube is being serviced outside of the television-receiver cabinet, it should never be operated without providing adequate X-ray shielding in front of faceplate. Because the ultor voltage may rise above its maximum rated value for short periods during adjustment with increase in the amount of X-ray radiation, provision should be made for placing a 3/8-inch thickness of safety glass in front of the faceplate to avoid the hazard of X-ray radiation.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 90° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Heater Current at 6.3 volts . . . . 600 ± 10% ma
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes . . . . . 6 μμf
  Cathode to all other electrodes . . . . . . 5 μμf
  External conductive coating to ultor. . . . {2500 max. μμf; 2000 min. μμf}
Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

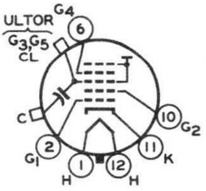
Optical:

Faceplate, Spherical. . . . . Filterglass
  Light transmission (Approx.). 74%
Phosphor (For curves, see front of this Section). . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position. Any
Weight (Approx.). . . . . 24 lbs
Overall Length. . . . . 18" ± 3/8"
Neck Length . . . . 5-1/2" ± 3/16"
Projected Area of Screen. . . . . 262 sq. in.
External Conductive Coating:
  Type. . . . . Special
  Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
  See *Picture-Tube Dimensional-Outlines* and *Bulb J171 D/E* sheets at the front of this section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Bases (Alternates):
  Short Small-Shell Duodecal 6-Pin
    (JEDEC Group 4, No.B6-203)
  Small-Shell Duodecal 6-Pin, Arrangement 1
    (JEDEC Group 4, No.B6-63)
  Basing Designation for BOTTOM VIEW. 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	22000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1000 max.	volts
Negative value	500 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	*16000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus	0 to 450	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

21CQP4
PICTURE TUBE

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

With heater having controlled warm-up time

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3	volts
Current	0.6 ± 5%	amp
Warm-up time (Average)	11	sec
Capacitance between External Conductive Coating and Ultor	2500 max. / 2000 min.	μμf / μμf

Faceplate, Spherical . . . . Filterglass
Phosphor (For curves, see front of this Section) . . P4—Sulfide Type Aluminized

Deflection Angles (Approx.):

Diagonal	110°
Horizontal	105°
Vertical	87°

Electron Gun . . . . Type Requiring No Ion-Trap Magnet

Tube Dimensions:

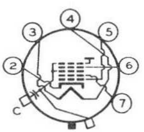
Overall length	14-7/16" ± 3/8"
Greatest width	20-1/4" ± 1/8"
Greatest height	16-3/8" ± 1/8"
Diagonal	21-3/8" ± 1/8"
Neck length	5-3/16" ± 3/16"
Radius of curvature of faceplate (External surface)	28-1/2"

Screen Dimensions (Minimum):

Greatest width	19-1/16"
Greatest height	15-1/16"
Diagonal	20-1/4"
Projected area	262 sq. in.

Operating Position . . . . Any
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Special (JEDEC No.B6-185)
Basing Designation for BOTTOM VIEW 7FA

Pin 2 – Cathode
Pin 3 – Heater
Pin 4 – Heater
Pin 5 – Grid No.1
Pin 6 – Grid No.4
Pin 7 – Grid No.2



Cap – Ultor (Grid No.3, Grid No.5, Collector)
C – External Conductive Coating

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	18000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1000 max.	volts
Negative value	500 max.	volts
GRID-No.2 VOLTAGE	500 max.	volts

21CQP4
PICTURE TUBE

GRID-No.1 VOLTAGE:		
Negative-peak value.	200 max.	volts
Negative-bias value.	140 max.	volts
Positive-bias value.	0 max.	volts
Positive-peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	180 max.	volts
Heater positive with respect to cathode	180 max.	volts
Maximum Circuit Values:		
Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

Color Picture Tube

THREE-GUN, GRADED-HOLE, SHADOW-MASK TYPE
ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN

ALL-GLASS ENVELOPE — **ELECTROSTATIC FOCUS**
MAGNETIC CONVERGENCE — **MAGNETIC DEFLECTION**

Supersedes Type 21CYP22

DATA

General:

Electron Guns, Three with Axes Tilted Toward Tube Axis . . . . Blue, Green, Red

Heater, for Unipotential Cathode of Each Gun, Paralleled with Each of the Other Two Heaters within Tube:

Voltage (AC or DC)▲	6.3	volts
Current at 6.3 volts	1.6	amp

Direct Interelectrode Capacitances (Approx.):

Grid No.1 of any gun to all other electrodes except the No.1 grids of the other two guns	7	μμf
Cathode of blue gun + cathode of green gun + cathode of red gun to all other electrodes	16	μμf
Grid No.3 (Of each gun tied within tube to No.3 grids of other two guns) to all other electrodes	9	μμf
External conductive coating to grid No.6	2500 max.	μμf
	2000 min.	μμf

Faceplate, Spherical . . . . .Filterglass
  Light transmission (Approx.) 72%

Screen, on Inner Surface of Faceplate:
  Type . . . . Aluminized, Tricolor, Phosphor-Dot
  Phosphor (Three separate phosphors, collectively)● . . .P22
    Fluorescence and phosphorescence of separate phosphors, respectively . . . Blue, Green, Red
    Persistence of group phosphorescence . . . . Medium
  Dot arrangement. . . . . Triangular group consisting of blue dot, green dot, and red dot
  Spacing between centers of adjacent dot trios (Approx.) 0.029"
  Size (Minimum):
    Greatest width . . . . 19-1/4"
    Height . . . . 15-1/2"
    Projected area . . . . 261 sq. in.

Focusing Method. . . . . .Electrostatic
Convergence Method . . . . Magnetic
Deflection Method. . . . . Magnetic

Deflection Angles (Approx.):
  Horizontal . . . . 70°
  Vertical . . . . 55°

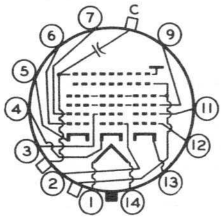
Tube Dimensions:
  Overall length . . . . 25-1/32" ± 3/8"
  Diameter . . . . 20-13/16" ± 1/8"

Weight (Approx.) . . . . 36-1/2 lbs

21CYP22-A

Operating Position . . . . Tube Axis Horizontal
(Base pin 12 and V-grooved panel pad on top)
Caps (Two) . . . . Recessed Small Cavity (JEDEC No.J1-21)
Socket . . . . .Alden Nos.214NMINSC (Radial leads),
214NMINC (Axial leads), or equivalent
Base . . . .Small-Shell Neodiheptal 12-Pin (JEDEC No.B12-131)
Basing Designation for BOTTOM VIEW 14AL

Pin 1 - Heater
Pin 2 - Grid No.1 of Red Gun
Pin 3 - Grid No.2 of Red Gun
Pin 4 - Cathode of Red Gun
Pin 5 - Cathode of Green Gun
Pin 6 - Grid No.1 of Green Gun
Pin 7 - Grid No.2 of Green Gun
Pin 9 - Grid No.3
Pin 11 - Grid No.2 of Blue Gun
Pin 12 - Grid No.1 of Blue Gun
Pin 13 - Cathode of Blue Gun
Pin 14 - Heater
Cap Over Pin 1 - Ultor (Grid No.4, Grid No.5)



Cap★ Over Pin 2 - Grid No.6, Collector, High-Voltage-Supply Terminal
C - External Conductive Coating

Maximum Ratings, *Design-Center Values:*

ULTOR-TO-CATHODE (Of each gun) VOLTAGE . . 25000 max. volts

Between the Ultor Terminal and the High-Voltage-Supply Terminal (See *Dimensional Outline*), it is necessary to connect a resistor of 50,000 ohms as described under *Limiting Circuit Values*. The high voltage must be connected to the High-Voltage-Supply Terminal—never directly to the Ultor Terminal.

GRID-No.3-TO-CATHODE (Of each gun) VOLTAGE.	6000 max.	volts
GRID-No.2-TO-CATHODE VOLTAGE (Each gun). .	600 max.	volts
GRID-No.1-TO-CATHODE VOLTAGE (Each gun):		
Negative-bias value.	400 max.	volts
Positive-bias value.	0 max.	volts
Positive-peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE (Each gun):		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	410 max.	volts
After equipment warm-up period	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Equipment Design Ranges:

With ultor voltage ($Ec_4k_{each\ gun}$) between 20000♦ and 25000 volts

Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage. .	16.8% to 20% of $Ec_4k_{each\ gun}$	volts
Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage (E_{c_1k}) at fixed value for raster cutoff.	See *Cutoff Design Chart*	
Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage (E_{c_2k}) at fixed value.	See *Cutoff Design Chart*	
Variation in Raster Cutoff Between Guns in Any Tube.	± 21% of average of highest and lowest cutoff values	
Grid-No.3 Current.	−45 to +45	μa
Grid-No.2 Current (Each gun)	−5 to +5	μa
Percentage of Total Ultor Current Supplied by Each Gun:		
To Produce White of 8500° K + 27 M.P.C.D. (CIE Coordinates x = 0.287, y = 0.316):		
Red gun.	49	%
Blue gun	18	%
Green gun.	33	%

Ratios of Cathode Currents:

To Produce White of 8500° K + 27 M.P.C.D. (CIE Coordinates x = 0.287, y = 0.316):•	*Min.*	*Typical*	*Max.*
Red cathode to green cathode. . . .	1.2	1.5	1.8
Red cathode to blue cathode	2.1	2.7	3.3

Maximum Raster Shift in Any Direction from Screen Center♣	7/8	inch

Maximum Required Displacements
of Beam Trios with Respect to
Associated Phosphor-Dot Trios:
Uniform in any direction over
entire screen area . . . . .0.005"♠

Adjustment to be Provided by
the Following Components:

Lateral-Converging Magnet:♣,⊕

Maximum lateral shift of blue beam . . . . ±1/4"

Maximum lateral shift of red beam and green beam . . . . ±1/8" to ±3/8"

Average of maximum lateral shift of red beam and green beam . . . . ±7/32" to ±9/32"

Radial-Converging Magnet Assembly:♣

For static convergence including compensation for dc component of dynamic convergence (Each beam). . . . . Shift of ±5/8"

For dynamic convergence#—
Effected by magnetomotive force of parabolic and/or sawtooth waveshape synchronized with scanning.

Horizontal:

Blue pattern—

Parabola amplitude to provide* . . . . Shift of 3/16" to 1/2"

Sawtooth amplitude to provide⊕ . . . . Shift of ±50% of the shift caused by parabola amplitude

Red pattern & green pattern—

Parabola:

Amplitude to provide*. . . . Shift of 1/16" to 5/16"

Ratio of red-pattern shift to green-pattern shift . . . . 2/3 to 3/2

Sawtooth:

Amplitude to provide⊕. . . . . Shift of −60% to +60% of the shift caused by parabola amplitude

Difference between red-pattern shift and green-pattern shift ($Shift_R$ − $Shift_G$). −75% to +75%

Vertical:

Blue pattern—

Parabola amplitude to provide* . . . . Shift of −1/8" to +1/16"

Sawtooth amplitude to provide⊕ . . . . Shift of −1/16" to +3/16"

Red pattern & green pattern—
Parabola:
Amplitude to provide*. . . . Shift of 1/8" to 5/16"
Ratio of red-pattern shift to green-pattern shift . . . . 2/3 to 3/2
Sawtooth:
Amplitude to provide#. . . Shift of -1/8" to +3/16"
Difference between red-pattern shift and green-pattern shift ($Shift_R$ − $Shift_G$). . . . . -100% to +100%

Examples of Use of Design Ranges:

For ultor voltage of	*20000*	*25000*	*volts*
Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage. .	3360 to 4000	4200 to 5000	volts
Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage of -70 volts for raster cutoff. . . .	130 to 370	130 to 370	volts
Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage of 200 volts . .	-45 to -100	-45 to -100	volts

Limiting Circuit Values:

High-Voltage Circuits:

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type with inherent regulation to limit the continous short-circuit current to 50 milliamperes. In addition, to prevent cathode damage with resultant decrease in tube life, an external resistor having a value of 50,000 ohms must be connected between the two bulb terminals and the effective resistance between the grid-No.3 power-supply output capacitor and the grid-No.3 electrode should not be less than 50,000 ohms. These resistances should be capable of withstanding the maximum instantaneous currents and voltages in their respective circuits. It is to be noted that the high voltage must be connected only to the High-Voltage-Supply Terminal—*never directly to the Ultor Terminal*. A resistor of 50,000 ohms must be connected between the Ultor Terminal and the High-Voltage-Supply Terminal.

In equipment utilizing a well-regulated high-voltage power supply, the *grid-No.3-circuit resistance* should be limited to 7.5 megohms.

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The maximum dc current capability of the high-voltage power supply should be limited to a value of 1100 μa as measured by a dc ammeter in the lead from the high-voltage power supply to the high-voltage terminal of the tube. The product of the maximum current capability and the maximum dc voltage between the high-voltage terminal and any cathode of the tube, as measured by an electrostatic voltmeter, should not exceed 25 watts.

Low-Voltage Circuits:

Effective Grid-No.1-to-Cathode-Circuit Resistance (Each gun).	0.75 max. megohm

When the cathode of each gun is not connected directly to the heater, the grid-No.2-to-heater circuit, the grid-No.1-to-heater circuit, and the cathode-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

When the cathode is connected directly to the heater, the grid-No.2-to-heater circuit, and the grid-No.1-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

▲ For maximum cathode life, it is recommended that the heater supply be regulated. When current regulation is employed, the regulator should be designed to provide a heater current of 1.5 amperes with variations not exceeding ± 3% under normal line-voltage variations. When voltage regulation is employed, the regulator should be designed to provide a heater voltage of 5.5 volts with variations not exceeding ± 6% under normal line-voltage variations.

● For Curves, see front of this Section.

★ Connect high-voltage supply to this cap and also connect 50,000-ohm resistor between this cap and cap over pin 1 (Ultor cap).

⧫ Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20,000 volts.

♣ Centering of the raster on the screen may be accomplished by passing direct current of the required value through each pair of deflecting coils to compensate for raster shift resulting from adjustments for optimum convergence and color purity.

♠ If this displacement is accomplished by means of a purifying magnet located on the neck of the tube, the equivalent raster movement is about 3/4".

♣ Shift is the movement of the regions of dot/crosshatch-generator pattern indicated in notes (*) and (⧺).

⊕ The direction of movement of the red and green beam is opposite to that of the blue beam.

Indicated values apply when RCA test yoke is used with this color picture tube.

* The parabola amplitude is determined by the average value of the shifts at the extremities of the respective horizontal and vertical axes of the screen with convergence of the three beams maintained at the center of the screen. An increase in amplitude should move the blue beam toward the top of the screen; the red beam toward the lower left of the screen; and the green beam toward the lower right of the screen.

⧺ The sawtooth amplitude is determined by the difference between the shifts at the extremities of the respective horizontal and vertical axes of the screen. Positive amplitude indicates that the shift at the right or bottom of the screen is greater than the shift at the left or top of the screen.

DEFINITIONS

Beam Trio. The red beam, green beam, and blue beam passing through a common hole in the shadow mask.

Register. Exact correspondence in position of the centers of beam trios with respect to the centers of the associated phosphor-dot trios.

Misregister. Lack of correspondence in position of the centers of the beam trios with respect to the centers of the center of the associated phosphor-dot trios.

Displacement. Shift of the position of the beams with respect to the phosphor dots.

GENERAL CONSIDERATIONS

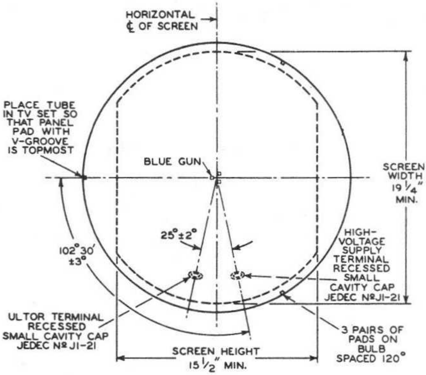
X-Ray-Warning. Because this color picture tube is designed to be operated at ultor voltages as high as 25 kilovolts (Design-center maximum value), shielding of this color picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range.

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of this color picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

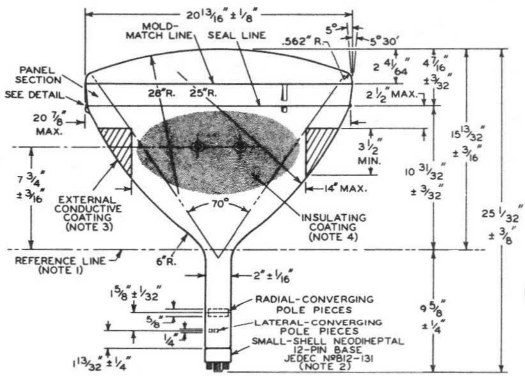
High Voltages. The high voltages at which cathode-ray tubes are operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the inclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE
for Type 21CYP22-A is the same as that shown for
Type 21AXP22-A

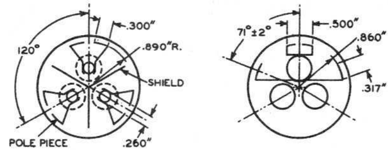
21CYP22-A



HORIZONTAL ℄ OF SCREEN
PLACE TUBE IN TV SET SO THAT PANEL PAD WITH V-GROOVE IS TOPMOST
BLUE GUN
SCREEN WIDTH 19 1/4" MIN.
25°±2°
102°30' ±3°
HIGH-VOLTAGE SUPPLY TERMINAL RECESSED SMALL CAVITY CAP JEDEC No J1-21
ULTOR TERMINAL RECESSED SMALL CAVITY CAP JEDEC No J1-21
3 PAIRS OF PADS ON BULB SPACED 120°
SCREEN HEIGHT 15 1/2" MIN.

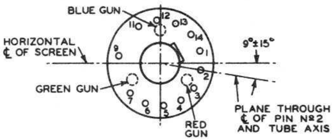


20 13/16" ± 1/8"
MOLD-MATCH LINE
SEAL LINE
5°
.562" R.
5°30'
PANEL SECTION
SEE DETAIL
28"R.
25"R.
2 41/64"
4 7/16" ±3/32"
2 1/2" MAX.
20 7/8" MAX.
3 1/2" MIN.
15 13/32" ± 3/16"
10 31/32" ± 3/32"
7 3/4" ± 3/16"
14" MAX.
EXTERNAL CONDUCTIVE COATING (NOTE 3)
70°
INSULATING COATING (NOTE 4)
25 1/32" ± 3/8"
REFERENCE LINE (NOTE 1)
6"R.
2" ± 1/16"
1 5/8" ± 1/32"
RADIAL-CONVERGING POLE PIECES
9 5/8" ± 1/4"
5/8"
LATERAL-CONVERGING POLE PIECES
1/4"
SMALL-SHELL NEODIHEPTAL 12-PIN BASE JEDEC No B12-131 (NOTE 2)
1 13/32" ± 1/4"

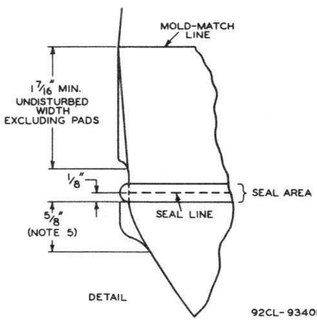


LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS

LOCATION OF LATERAL-CONVERGING POLE PIECES WITH RESPECT TO GUNS



BASE BOTTOM VIEW



DETAIL

92CL-9340R2

NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

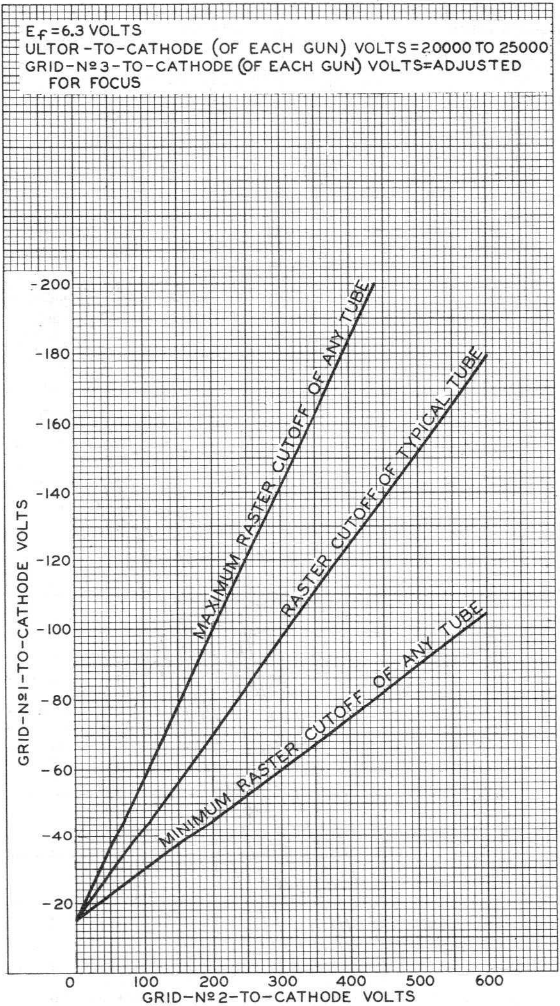
NOTE 2: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 3".

NOTE 3: THE DRAWING SHOWS THE MINIMUM SIZE AND LOCATION OF THE CONTACT BAND OF THE EXTERNAL CONDUCTIVE COATING. THE ACTUAL AREA OF THIS COATING WILL BE GREATER THAN THAT OF THE CONTACT BAND SO AS TO PROVIDE THE REQUIRED CAPACITANCE. EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 4: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 5: THE MAXIMUM EFFECTIVE WIDTH OF A FUNNEL PAD IS 5/8".

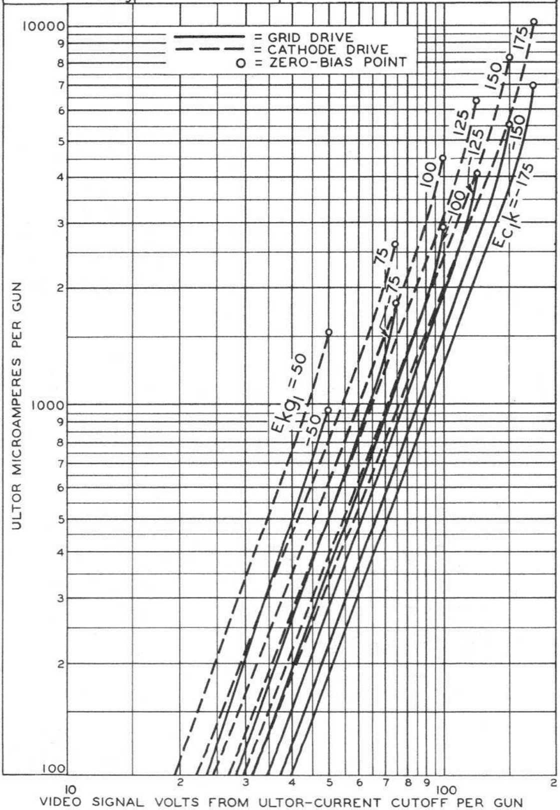
CUTOFF DESIGN CHART



92CM-8565R1

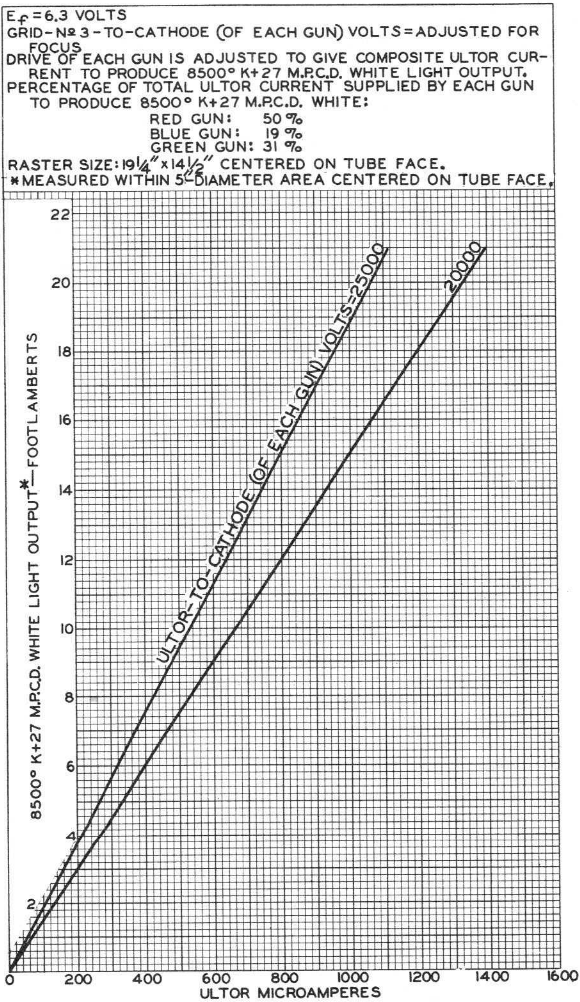
TYPICAL DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-№1 (OF EACH GUN) VOLTS = 20000 TO 25000	ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
GRID-№3-TO-GRID-№1 (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS	GRID-№3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
GRID-№2-TO-GRID-№1 VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUT-OFF FOR DESIRED FIXED CATHODE-TO-GRID-№1 (EACH GUN) VOLTAGE (E_{kg_1})	GRID-№2-TO-CATHODE VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUTOFF FOR DESIRED FIXED GRID-№1-TO-CATHODE (EACH GUN) VOLTAGE (E_{c_1k})



92CL-9421

TYPICAL LIGHT-OUTPUT CHARACTERISTICS



92CM-9417

21DHP4

Picture Tube

RECTANGULAR GLASS TYPE | **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS | **110° MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	450 ± 5%	ma
Heater Warm-Up Time (Average).	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes. . .	6	μμf
Cathode to all other electrodes. . . .	5	μμf
External conductive coating to ultor .	2500 max.	μμf
	1700 min.	μμf

Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

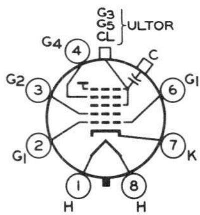
Optical:

Faceplate. . . . . .Filterglass
Light transmission (Approx.) 76%
Phosphor (For curves, see front of this Section) . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position . . . . .Any
Weight (Approx.) . . . . 20 lbs
Overall Length . . . . 14-11/16" + 5/16" − 5/8"
Neck Length. . . . . 5-7/16" + 1/8" − 7/16"
Projected Area of Screen . . . . 262 sq. in.
External Conductive Coating:
Type . . . . Regular Band
Contact area for grounding . . . . .Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J171 Ǧ/K* sheets at the front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Bases (Alternates):
Small-Button Eightar 7-Pin, Arrangement 2, (JEDEC No.B7-183)
Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

21DHP4

Maximum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	19800 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	154 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	*16000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	−35 to −72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

21DLP4
PICTURE TUBE

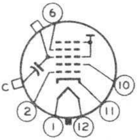
RECTANGULAR GLASS TYPE | ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS | MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6 ± 10%	amp
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	$\mu\mu$f
Cathode to all other electrodes	5	$\mu\mu$f
External conductive coating to ultor	2500 max.	$\mu\mu$f
	2000 min.	$\mu\mu$f
Faceplate, Spherical		Filterglass
Light transmission (Approx.)		74%
Phosphor (For curves, see front of this Section)		P4—Sulfide Type Aluminized
Fluorescence		White
Phosphorescence		White
Persistence		Short
Focusing Method		Electrostatic
Deflection Method		Magnetic
Deflection Angles (Approx.):		
Diagonal		90°
Horizontal		85°
Vertical		68°
Electron Gun		Type Requiring No Ion-Trap Magnet
Tube Dimensions:		
Overall length		17" ± 3/8"
Greatest width		20-1/4" ± 1/8"
Greatest height		16-3/8" ± 1/8"
Diagonal		21-3/8" ± 1/8"
Neck length		4-1/2" ± 3/16"
Screen Dimensions (Minimum):		
Greatest width		19-1/16"
Greatest height		15-1/16"
Diagonal		20-1/4"
Projected area		262 sq. in.
Weight (Approx.)		24 lbs
Operating Position		Any
Cap		Recessed Small Cavity (JETEC No.J1-21)
Bulb		J171D2/E1
Base		Short Small-Shell Duodecal 6-Pin (JETEC Group 4, No.B6-203), or Small-Shell Duodecal 6-Pin (JETEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW		12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

21DLP4
PICTURE TUBE

GRID-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	20000	max.	volts
	12000✠	min.	volts
GRID-No.4 (FOCUSING) VOLTAGE:			
Positive value	1000	max.	volts
Negative value	500	max.	volts
GRID-No.2 VOLTAGE	500	max.	volts
GRID-No.1 VOLTAGE:			
Negative-peak value	200	max.	volts
Negative-bias value	140	max.	volts
Positive-bias value	0	max.	volts
Positive-peak value	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	410	max.	volts
After equipment warm-up period	180	max.	volts
Heater positive with respect to cathode	180	max.	volts

Equipment Design Ranges:

With any ultor voltage (E_{c_5k}) between 12000 and 20000 volts and grid-No.2 voltage (E_{c_2k}) between 200 and 500 volts

Grid-No.4 Voltage for focus§	-50 to +400	volts
Grid-No.1 Voltage (E_{c_1k}) for visual extinction of focused raster	*See Raster-Cutoff-Range Chart for Grid-Drive Service*	
Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value (Peak positive)	Same value as determined for E_{c_1k} except video drive is a positive voltage	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	*16000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus	0 to 400	volts

▲,✠,§,*: See next page.

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PICTURE TUBE

Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts
Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value.	28 to 72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

CATHODE-DRIVE■ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	20000	max.	volts
	12000✠	min.	volts
GRID-No.4-TO-GRID-No.1 VOLTAGE:			
Positive value	1000	max.	volts
Negative value	500	max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	640	max.	volts
GRID-No.2-TO-CATHODE VOLTAGE	500	max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:			
Positive-peak value.	200	max.	volts
Positive-bias value.	140	max.	volts
Negative-bias value.	0	max.	volts
Negative-peak value.	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	410	max.	volts
After equipment warm-up period . . .	180	max.	volts
Heater positive with respect to cathode.	180	max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage (Ec_5g_1) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage (Ec_2g_1) between 225 and 640 volts

Grid-No.4-to-Grid-No.1 Voltage for focus§	0 to 450	volts
Cathode-to-Grid-No.1 Voltage (Ekg_1) for visual extinction of focused raster.	*See Raster-Cutoff-Range Chart for Cathode-Drive Service*	

▲,✠,§,*,■: See next page.

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PICTURE TUBE

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value (Peak negative).	Same value as determined for Ekg_1 except video drive is a negative voltage	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet*. . .	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of	*16000*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*300*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster.	28 to 60	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value	-28 to -60	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance. . . . . 1.5 max. megohms

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

⊕ This value is a working design-center minimum. The equivalent *absolute minimum* ultor- or ultor-to-grid-No.1 voltage is 11,000 volts, below which the serviceability of the 21DLP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor- or ultor-to-grid-No.1 voltage is never less than 11,000 volts.

§ The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

* Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 7/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

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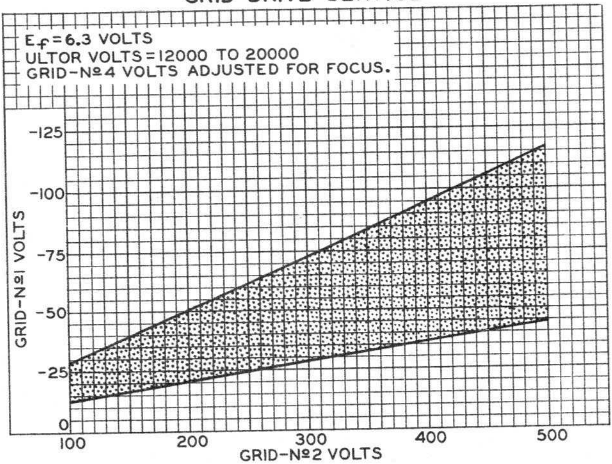
21DLP4

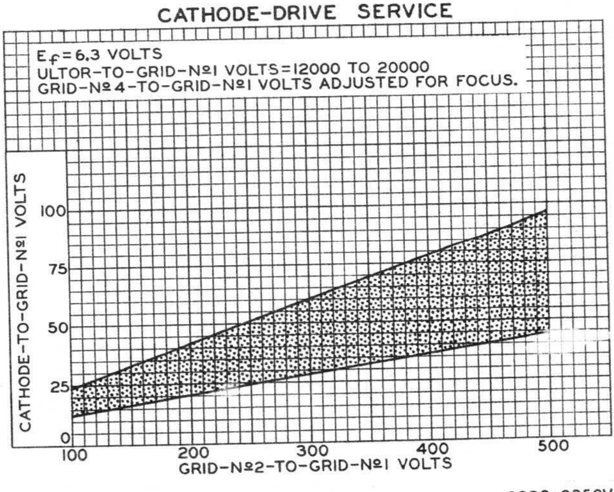
RASTER-CUTOFF-RANGE CHARTS

GRID-DRIVE SERVICE



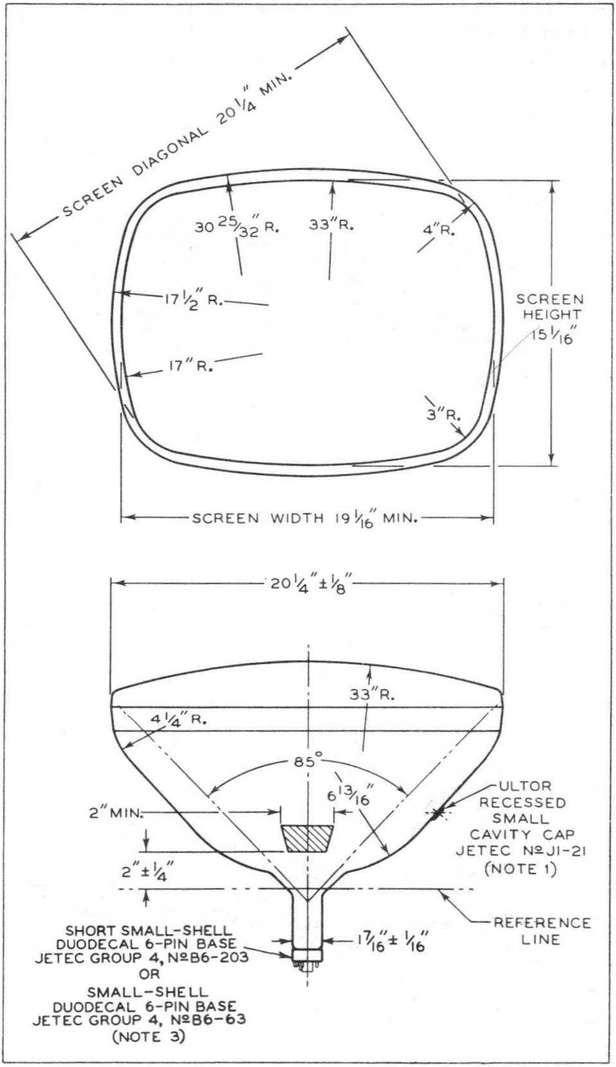
92CS-9349V

CATHODE-DRIVE SERVICE



92CS-9350V

21DLP4
PICTURE TUBE



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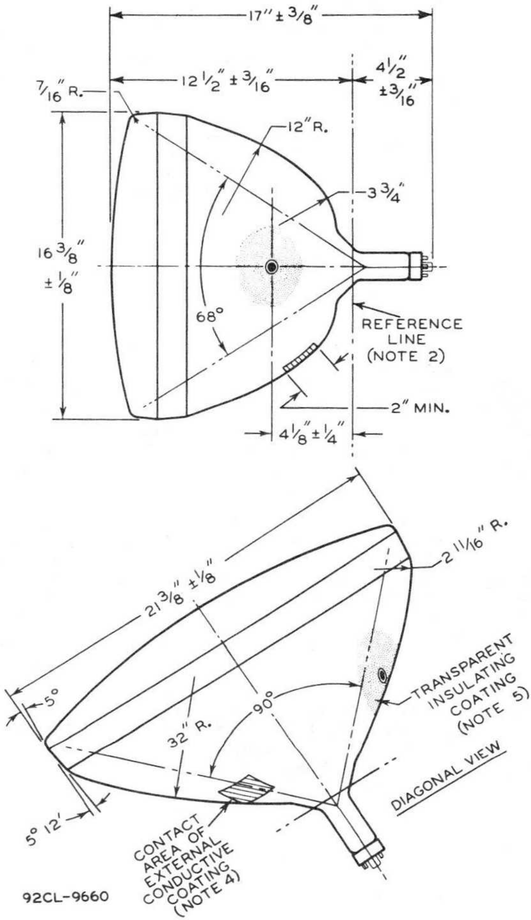
21DLP4

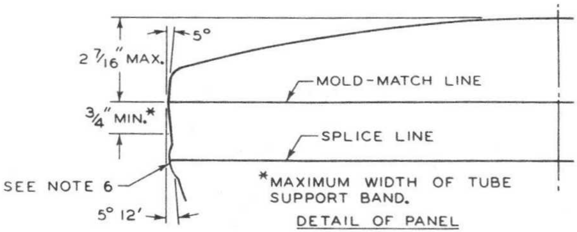
PICTURE TUBE



92CL-9660

21DLP4

PICTURE TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: THE DRAWING SHOWS THE MINIMUM SIZE AND LOCATION OF THE CONTACT AREA OF THE EXTERNAL CONDUCTIVE COATING. THE ACTUAL AREA OF THIS COATING WILL BE GREATER THAN THE CONTACT AREA SO AS TO PROVIDE THE REQUIRED CAPACITANCE. EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

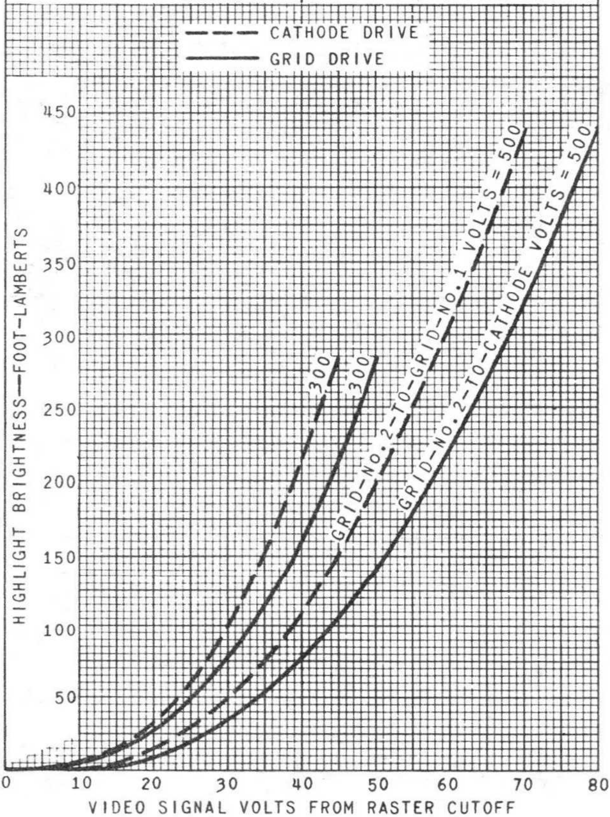
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

21DLP4

21DLP4
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-No.1 VOLTS = 16000	ULTOR VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID No.1 TO GIVE FOCUSED RASTER CUTOFF.	GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.	RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 18"×13-1/2"	RASTER SIZE = 18"×13-1/2"



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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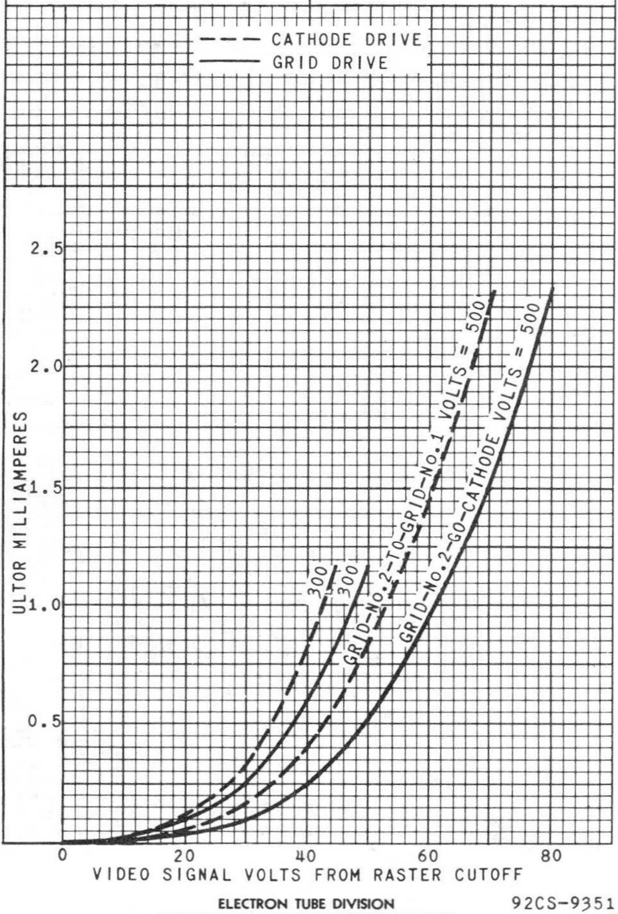
AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS ULTOR-TO-GRID-No.1 VOLTS = 12000 TO 20000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID No.1 TO GIVE FOCUSED RASTER CUTOFF.	E_f = 6.3 VOLTS ULTOR VOLTS = 12000 TO 20000 GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



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21DSP4

PICTURE TUBE

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

DATA

General:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3	volts
Current	0.6	amp
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	2500 max.	μμf
	2000 min.	μμf

Faceplate, Spherical . . . . Filterglass
Light transmission (Approx.) 74%
Phosphor (For curves, see front of this Section) . . P4—Sulfide Type Aluminized
Fluorescence . . . . White
Phosphorescence . . . . White
Persistence . . . . Medium-Short
Focusing Method . . . . Electrostatic
Deflection Method . . . . Magnetic
Deflection Angles (Approx.):
Diagonal . . . . 90^o
Horizontal . . . . 85^o
Vertical . . . . 68^o
Electron Gun . . . . Type Requiring No Ion-Trap Magnet
Tube Dimensions:
Overall length . . . . 18" ± 3/8"
Greatest width . . . . 20-1/4" ± 1/8"
Greatest height . . . . 16-3/8" ± 1/8"
Diagonal . . . . 21-3/8" ± 1/8"
Neck length . . . . 5-1/2" ± 3/16"
Radius of curvature of faceplate (External surface) . . 33"
Screen Dimensions (Minimum):
Greatest width . . . . 19-1/16"
Greatest height . . . . 15-1/16"
Diagonal . . . . 20-1/4"
Projected area . . . . 262 sq. in.
Weight (Approx.) . . . . 24 lbs
Operating Position . . . . Any
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Bulb J171 D2/E1
Base . . . . Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No.B6-63), or Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)

ELECTRON TUBE DIVISION
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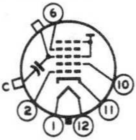
21DSP4
PICTURE TUBE

Basing Designation for BOTTOM VIEW. 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

CATHODE-DRIVE■ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR-TO-GRID-No.1 VOLTAGE.	20000	max.	volts
	12000#	min.	volts
GRID-No.4-TO-GRID-No.1 VOLTAGE:			
Positive value.	1000	max.	volts
Negative value.	500	max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	64	max.	volts
GRID-No.2-TO-CATHODE VOLTAGE.	64	max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:			
Positive-peak value	200	max.	volts
Positive-bias value	140	max.	volts
Negative-bias value	0	max.	volts
Negative-peak value	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds.	410	max.	volts
After equipment warm-up period. . .	180	max.	volts
Heater positive with respect to cathode.	180	max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage ($E_{c_5g_1}$) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage ($E_{c_2g_1}$) between 40 and 64 volts

Grid-No.4-to-Grid-No. Voltage for focus§.	0 to 400	volts
Cathode-to-Grid-No.1 Voltage (E_{kg_1}) for visual extinction of focused raster	*See Raster-Cutoff-Range Chart*	
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak negative)	Same value as determined for E_{kg_1} except video drive is a negative voltage	

21DSP4

PICTURE TUBE

Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet*	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of	*18000*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*50*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	0 to 350	volts
Cathode-to-Grid-No.1 Voltage♦ for visual extinction of focused raster	32 to 47	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value	-32 to -47	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms

■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

\# Operation below this value is not recommended.

§ The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor-to-grid-No.1 voltage or grid-No.2-to-grid-No.1 voltage within design ranges shown for these items.

* Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 7/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

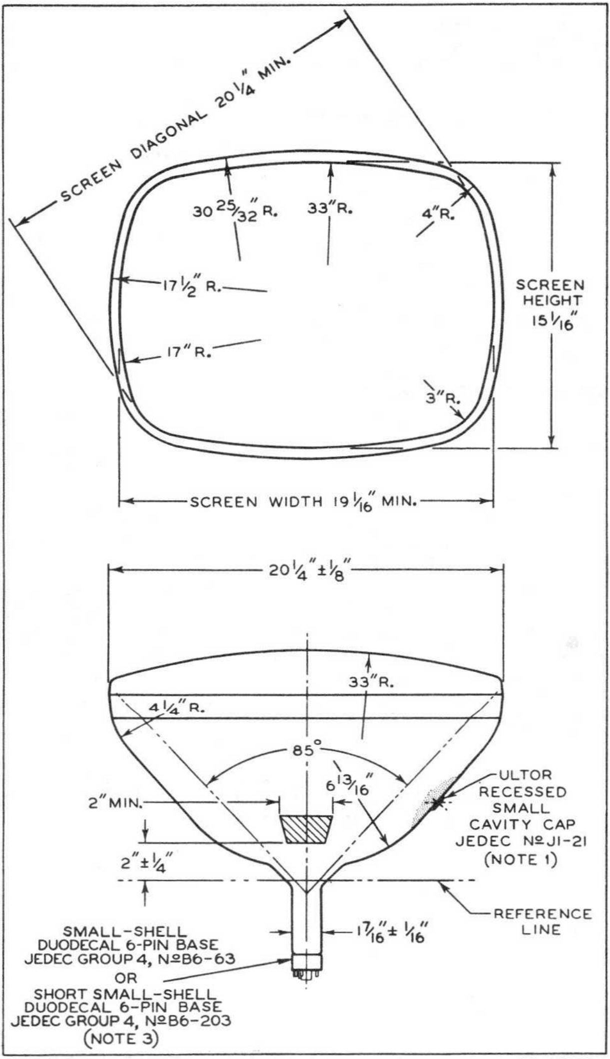
♦ The cathode-to-grid-No.1 voltage (E_{kg_1}) for visual extinction of focused raster will increase by approximately 2 per cent for every 1000-volt increase in ultor-to-grid-No.1 voltage and will decrease by approximately 2 per cent for every 1000-volt decrease in ultor-to-grid-No.1 voltage.

For x-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

RCA

21DSP4

PICTURE TUBE

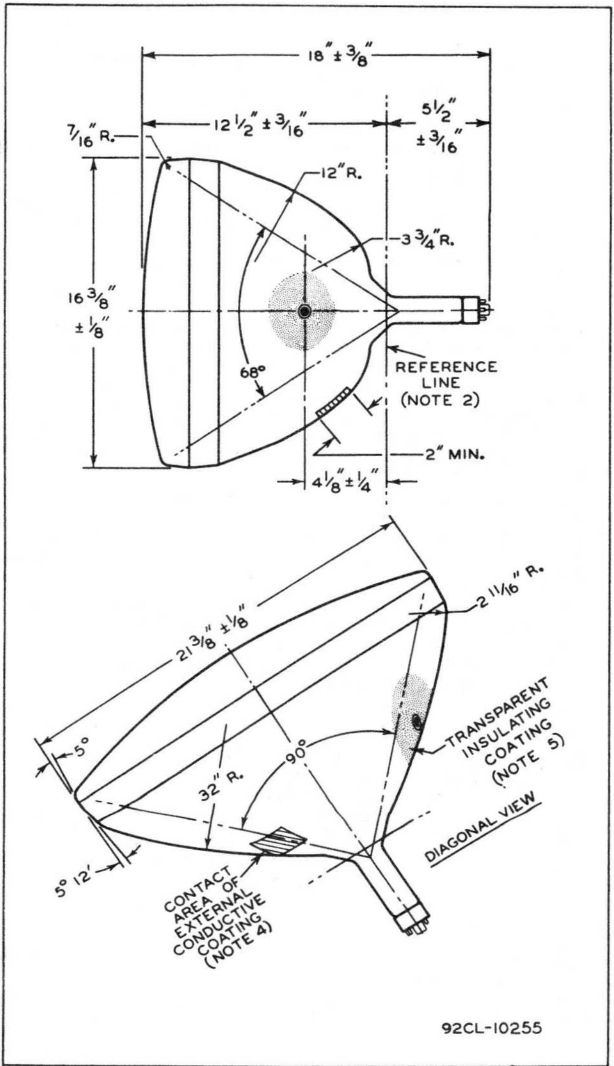


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

21DSP4

PICTURE TUBE

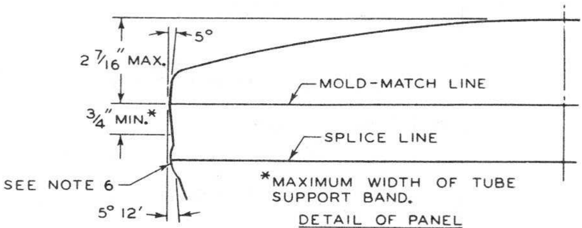


ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

21DSP4

PICTURE TUBE



DETAIL OF PANEL

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No.G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

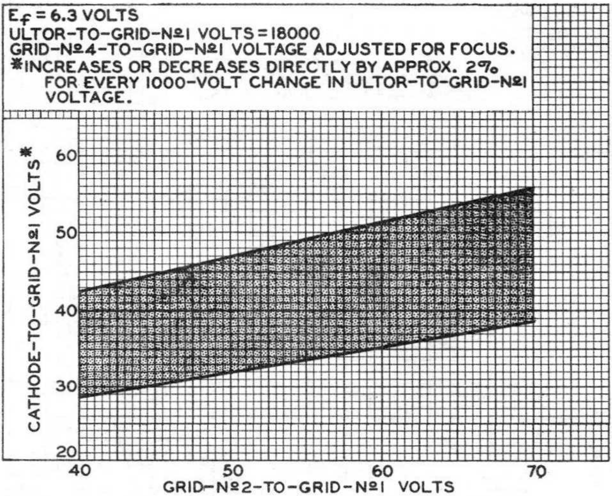
NOTE 4: THE DRAWING SHOWS THE MINIMUM SIZE AND LOCATION OF THE CONTACT AREA OF THE EXTERNAL CONDUCTIVE COATING. THE ACTUAL AREA OF THIS COATING WILL BE GREATER THAN THE CONTACT AREA SO AS TO PROVIDE THE REQUIRED CAPACITANCE. EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

21DSP4

RASTER-CUTOFF-RANGE CHART

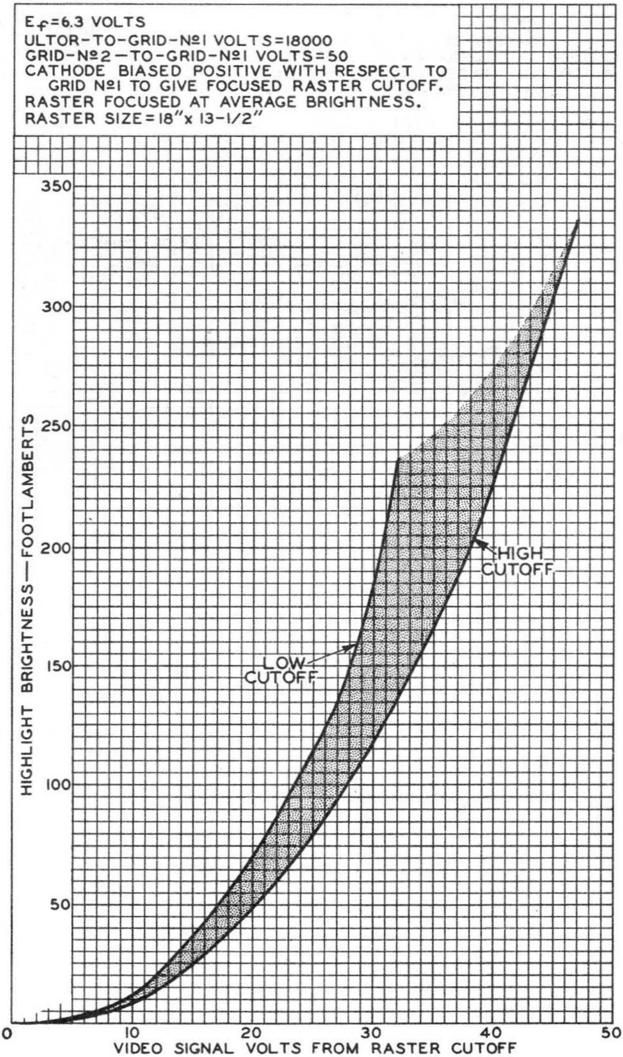


92CS-9911

2IDSP4

2IDSP4

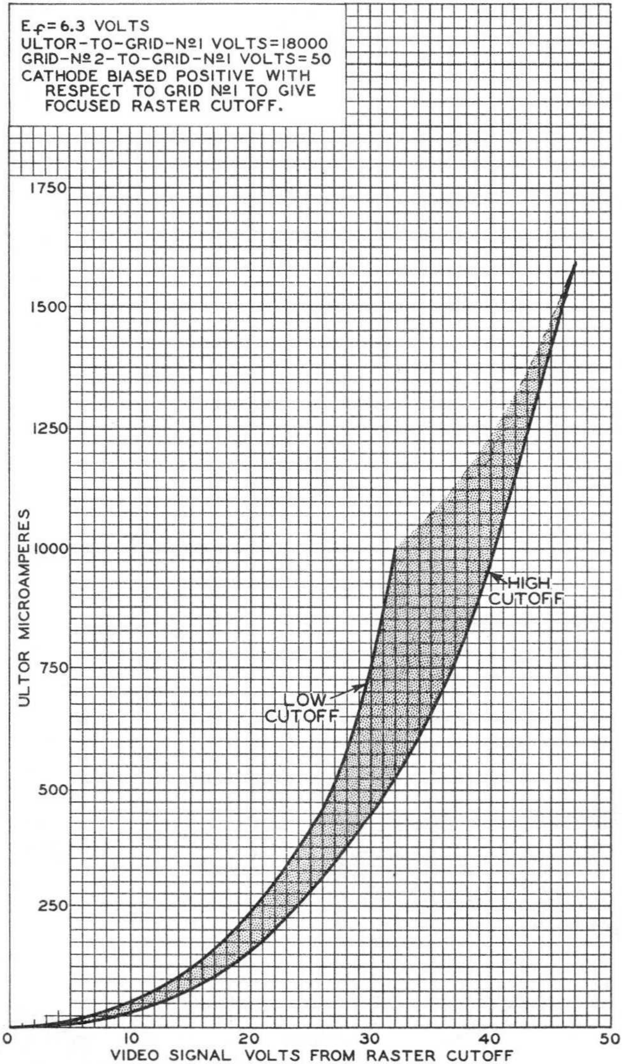
CATHODE-DRIVE CHARACTERISTICS



RCA

2IDSP4

CATHODE-DRIVE CHARACTERISTICS



Picture Tube

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid-No.1 to all other electrodes	6	pf
External conductive coating to anode. . .	750 max.	pf
	500 min.	pf
Heater Current at 6.3 volts	600 ± 60	ma
Electron Gun.	Type Requiring No Ion Trap Magnet	

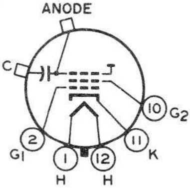
Optical:

Phosphor (For curves, see front of this Section) . P4—Sulfide Type, Aluminized
Faceplate, Cylindrical. . . . . Filterglass
Light transmission (Approx.). 74%

Mechanical:

Weight (Approx.). . . . . 29 lbs
Overall Length. . . . . 23-1/32" ± 3/8"
Neck Length . . . . 7-1/2" ± 3/16"
Projected Area of Screen. . . . . 248 sq. in.
External Conductive Coating:
Type. . . . . Regular-Band
Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J170 A/C* sheets at front of this section
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)
Basing Designation for BOTTOM VIEW. 12N

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Screen, Collector)
C - External Conductive Coating

21EP4C

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	20000 max.	volts
GRID-No. 2 VOLTAGE	550 max.	volts
GRID-No. 1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	12000	volts
Grid-No. 2 Voltage	300	volts
Grid-No. 1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No. 1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Monitor Kinescope

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 72° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6.5	pf
External conductive coating to anode	1500 max.	pf
	1200 min.	pf
Heater Current at 6.3 volts	600 ± 60	ma
Electron Gun	Type Requiring No Ion-Trap Magnet	

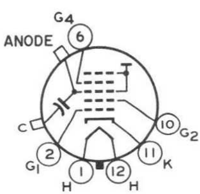
Optical:

Phosphor (For curves, see front of this Section) . P4—Sulfide Type, Aluminized
Faceplate, Spherical . . . . . Filterglass
Light transmission (Approx.) 75.5%

Mechanical:

Weight (Approx.) . . . . . 24 lbs
Overall Length . . . . . 23.031" ± .375"
Neck Length . . . . . 7.500" ± .188"
Projected Area of Screen . . . . . 262 sq.in.
External Conductive Coating:
Type . . . . . Regular-Band
Contact area for grounding . . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J171 B/F* sheets at front of this Section
Cap. . . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . . Small-Shell Duodecal 6-Pin, Arrangement 1, (JEDEC No.B6-63)
Basing Designation for BOTTOM VIEW 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	22000 max.	volts
	12000 min.	volts

Grid-No.4 (Focusing) Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	700 max.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	180 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	6.9 max. 5.7 min.	volts volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	18000	volts
Grid-No.4 Voltage	0 to +400	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

SHORT RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **110° MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	600 ± 5%	ma
Heater Warm-Up Time (Average).	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes. . .	6	μμf
Cathode to all other electrodes. . . .	5	μμf
External conductive coating to ultor .	2000 max.	μμf
	1500 min.	μμf

Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

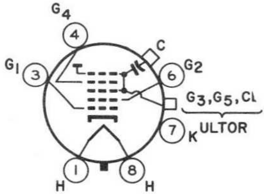
Optical:

Faceplate. . . . . .Filterglass
Light transmission (Approx.) 76%
Phosphor (For curves, see front of this Section) . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position . . . . .Any
Weight (Approx.) . . . . 20 lbs
Overall Length . . . . 13-1/8" ± 1/4"
Neck Length. 3-7/8" ± 1/16"
Projected Area of Screen . . . . 262 sq. in.
External Conductive Coating:
Type . . . . Regular Band
Contact area for grounding . . . . .Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J171 G/K* sheets at the front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW 8KW

Pin 1 – Heater
Pin 3 – Grid No.1
Pin 4 – Grid No.4
Pin 6 – Grid No.2
Pin 7 – Cathode
Pin 8 – Heater
Cap – Ultor (Grid No.3, Grid No.5, Collector)
C – External Conductive Coating



21FDP4

Maximum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE.	20000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE.	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value.	400 max.	volts
Negative bias value.	155 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period . .	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	*16000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus.	+100 to +500	volts
Grid-No.1 Voltage for visual extinction of focused raster	-35 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:		
Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode. . . .	750 max.	pf
	500 min.	pf
Heater Current at 6.3 volts	600 ± 60	ma
Electron Gun.	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (For curves, see front of this Section) .	P4—Sulfide Type, Aluminized
Faceplate, Cylindrical.	Filterglass
Light transmission (Approx.).	74%

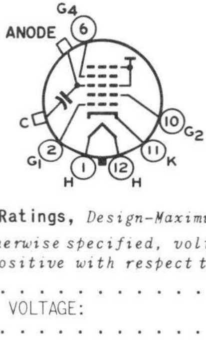
Mechanical:

Weight (Approx.).	29 lbs
Overall Length.	23-1/32" ± 3/8"
Neck Length	7-1/2" ± 3/16"
Projected Area of Screen.	248 sq. in.
External Conductive Coating:	
Type.	Regular-Band
Contact area for grounding.	Near Reference Line

For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J170 A/C* sheets at front of this section

Cap	Recessed Small Cavity (JEDEC No.J1-21)
Base.	Small-Shell Duodecal (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW.	12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	20000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts

GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	{6.9 max.	volts
	{5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No.4 Voltage	−56 to +310	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	−28 to −72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

PAN-O-PLY-INTEGRAL IMPLOSION PROTECTION — 114° MAGNETIC DEFLECTION
NO ION-TRAP MAGNET REQUIRED — LOW-VOLTAGE ELECTROSTATIC FOCUS

Direct Interelectrode Capacitances		
Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	1500 min—2300 max	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

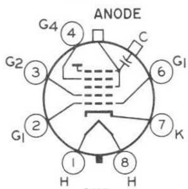
Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section.	
Faceplate.	Filterglass
Light transmission at center (approx.)	46%

MECHANICAL

Weight (Approx.)	19 lb
Overall Length	12.656 ± .281 in
Neck Length.	4.375 ± .125 in
Projected Area of Screen	212 sq in
External Conductive Coating[a]	
Type (see CRT OUTLINES 1 at front of this section).	Regular-Band
Contact area for grounding.	Near Reference Line
Cap.	Recessed Small Cavity (JEDEC No.J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



8HR

Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage.	11000 min—23000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage.	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V
Heater Voltage	5.7 min—6.9 max	V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 seconds . .	450 max	V
After equipment warm-up period.	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage.	200 max	V
DC component.	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

Anode Voltage.	20000	V
Grid-No. 4 Voltage[b]	100	V
Grid-No. 2 Voltage.	400	V
Cathode Voltage.	36 to 78	V
For visual extinction of focused raster		
Field Strength	0 to 10	G
Of required adjustable centering magnet		

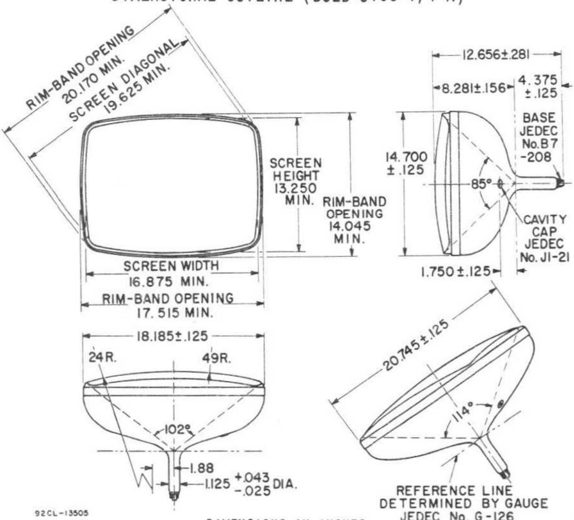
MAXIMUM CIRCUIT VALUE

Grid-No. 1 Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

[b] The grid-No. 4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts with the combined grid-No. 1 voltage and video-signal voltage adjusted to give an anode current of 100 microamperes on a 11.750-inch by 15.500-inch pattern from an RCA-2F21 monoscope, or equivalent.

DIMENSIONAL OUTLINE (BULB J165-1/4 A)



Color Picture Tube

New Rare-Earth (Red) Phosphor

70° Round **HI-LITE Screen**
Unity Current Ratios **70° Magnetic Deflection**

The 21GUP22 is the same as the 21GVP22 except for the following:

Faceplate . . . . Filterglass
Light transmission (Approx.) 72%
Faceplate does not have an integral protective window [a]

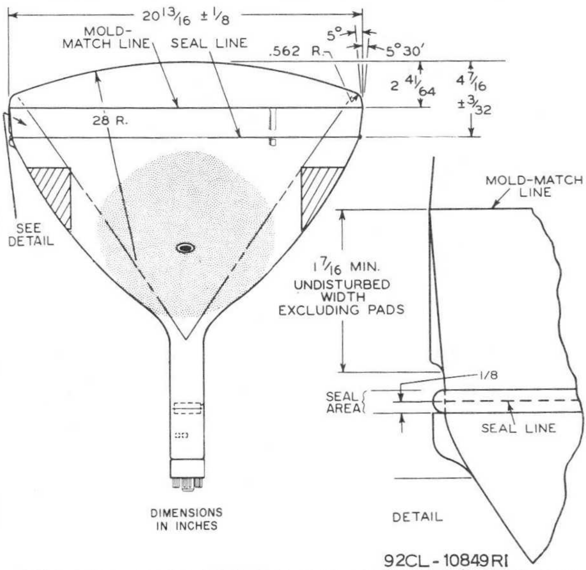
TUBE DIMENSIONS

Overall length . . . . 25-1/32 ± 3/8 in
Diameter. . . . . 20-13/16 ± 1/8 in
Weight (Approx.) . . . . 36.5 lb

[a] It is recommended that the cabinet be provided with a shatter-proof glass cover over the face of the 21GUP22 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide x-radiation protection when required.

DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 21GVP22

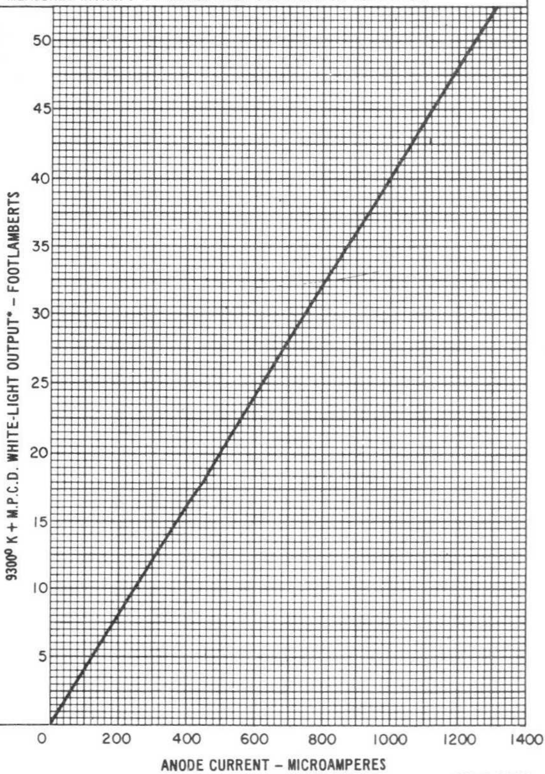


TYPICAL LIGHT-OUTPUT CHARACTERISTIC

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25000 VOLTS
GRID-No.3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE
CURRENT TO PRODUCE 93000° K + 27 M.P.C.D. WHITE-LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO
PRODUCE 9300° K + M.P.C.D. WHITE:

RED GUN: 34%
BLUE GUN: 32%
GREEN GUN: 34%

RASTER SIZE: 19 1/4" X 16"
*MEASURED WITHIN 5"-DIAMETER AREA CENTERED ON TUBE FACE.



92LM-2286

Color Picture Tube

70° Round — **New Rare-Earth (Red) Phosphor**
Antiglare Integral Protective Window — **HI-LITE Screen**
Unity Current Ratios — **70° Magnetic Deflection**

ELECTRICAL

Electron Guns, Three with Axes Tilted
Toward Tube Axis . . . . Red, Blue, Green
Heater, of Each Gun Parallel
Connected within Tube with
Each of the Other Two Heaters:

Current at 6.3 volts[a]	1.9	A
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Horizontal	70	deg.
Vertical	55	deg.
Direct Interelectrode Capacitance (Approx.):		
Grid No.1 of any gun to all other electrodes	10	pF
Grid No.3 to all other electrodes	12	pF
All cathodes to all other electrodes	16	pF
External conductive coating to anode (Approx.)	2500 max.	pF
	2000 min.	pF

OPTICAL

Faceplate and Protective Window . . . . Filterglass
Light transmission at center (Approx.) 39%
Surface of Protective Window . . . . Treated to minimize specular reflection

Screen, on Inner Surface of Faceplate:
Type . . . . Aluminized, Tricolor, Phosphor-Dot
Phosphor (three separate phosphors, collectively) . . . . P22-New Rare-Earth (Red), Sulfide (Blue & Green) Type
Fluorescence and phosphorescence of separate phosphors, respectively . . Red, Blue, Green
Persistence of group phosphorescence . . . . Medium Short
Dot Arrangement . . . . Triangular group consisting of red dot, blue dot, and green dot
Spacing between centers of adjacent dot trios (Approx.) . . . . 0.029 in

MECHANICAL

Minimum Screen Area (Projected)	267 sq. in
Bulb Funnel Designation	JEDEC No.J164-1/4A1
Bulb Panel Designation	JEDEC No.FP166-1/2D1
Protective Window Designation	JEDEC No.FP166-1/2B1
Base	Small-Shell Neodiheptal 12-pin
Operating Position	Tube Axis Horizontal, V-grooved panel pad on top (Base pin 12 near top)
Socket	Alden Nos.214NMINSC (Radial leads), 214NMINC (Axial leads), or equivalent
Weight (Approx.)	41 lb

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	27,500 max. / 20,000 min.	volts
Total Anode Current, Long-Term Average	1000 max.	μA
Grid-No.3 (Focusing Electrode) Voltage	6000 max.	volts
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max.	volts
Grid-No.1 Voltage:		
Negative bias value	400 max.	volts
Negative operating cutoff value	200 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage (ac or dc):		
Under operating conditions[a]	6.9 max. / 5.7 min.	volts
Under standby conditions[c]	5.5 max.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period:		
Combined AC and DC value	200 max.	volts
DC component value	200 max.	volts
Heater positive with respect to cathode:		
AC component value	200 max.	volts
DC component value	0 max.	volts

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 volts

Grid-No.3 (Focusing Electrode) Voltage	16.8% to 20% of Anode volts

Grid-No.2 and Grid-No.1 Voltages for Visual Extinction of Focused Spot . . . . See *CUTOFF DESIGN CHART*

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At grid-No.1 spot cutoff voltage of −100 volts) 1.86

Grid-No.3 Current (Total) . . . . −45 to +15 µA

Grid-No.2 Current . . . . −5 to +5 µA

To Produce White of 9300°K + 27 M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311):

	Red	*Blue*	*Green*	
Percentage of total anode current supply by each gun (average) . . .	34	32	34	%

Ratio of cathode currents:

	Min.	*Typ.*	*Max.*
Red/blue	0.75	1.10	1.50
Red/green	0.65	1.00	1.50
Blue/green	0.60	0.91	1.30

Displacements, Measured at Center of Screen:

Raster centering displacement:

Horizontal	±0.60	in
Vertical	±0.45	in
Lateral distance between the blue beam and the converged red and green beams	±0.40	in
Radial convergence displacement excluding effects of dynamic convergence (each beam).	±0.50	in

Maximum Required Correction for Register[d] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the Center of the Screen in any Direction . . . . 0.005 in max.

LIMITING CIRCUIT VALUES

High-Voltage Circuits:

Grid-No.3 circuit resistance . . . . . . 7.5 max. megohms

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type, in which the short-circuit current does not exceed 20 mA.

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . . 0.75 max. megohm

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short-circuit current of more than 750 mA total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

[a] For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.

[b] For curve, see *Group Phosphor P22 - New Rare-Earth (Red), Sulfide (Blue & Green)* at front of this section.

[c] For "instant on" applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

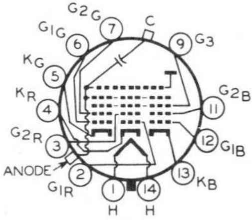
[d] Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

X-RADIATION WARNING

Because the 21GVP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 21GVP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

TERMINAL DIAGRAM (Bottom View)

Pin 1 - Heater
Pin 2 - Grid No.1 of Red Gun
Pin 3 - Grid No.2 of Red Gun
Pin 4 - Cathode of Red Gun
Pin 5 - Cathode of Green Gun
Pin 6 - Grid No.1 of Green Gun
Pin 7 - Grid No.2 of Green Gun
Pin 9 - Grid No.3
Pin 11 - Grid No.2 of Blue Gun
Pin 12 - Grid No.1 of Blue Gun
Pin 13 - Cathode of Blue Gun
Pin 14 - Heater
Cap - Anode
C - External Conductive Coating



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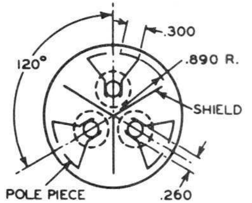
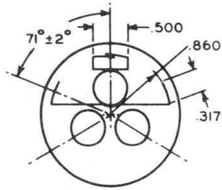
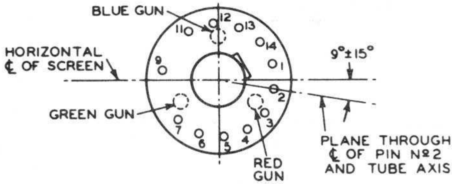


LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS

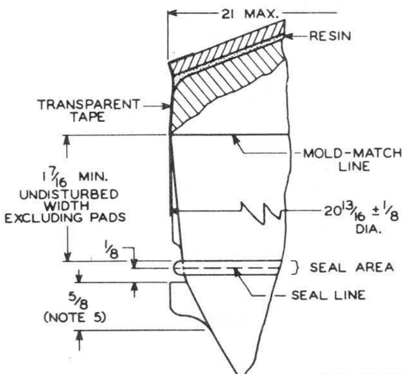


LOCATION OF LATERAL-CONVERGING POLE PIECES WITH RESPECT TO GUNS



BASE
BOTTOM VIEW

DIMENSIONAL OUTLINE DETAIL



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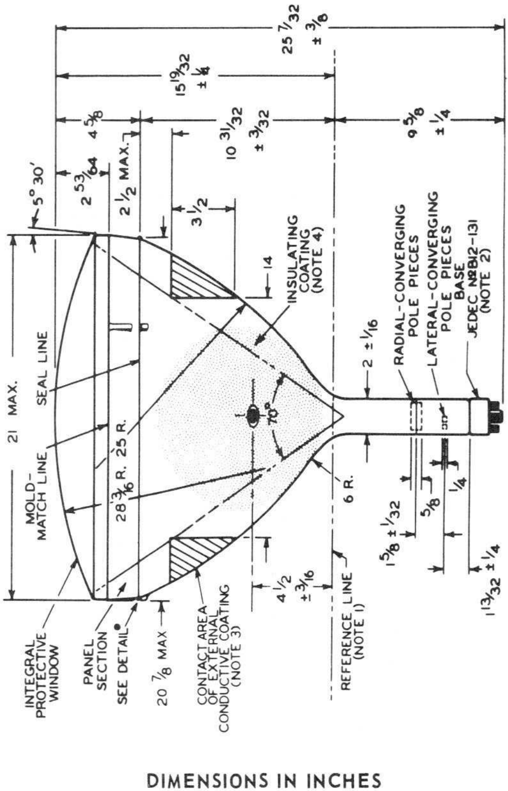
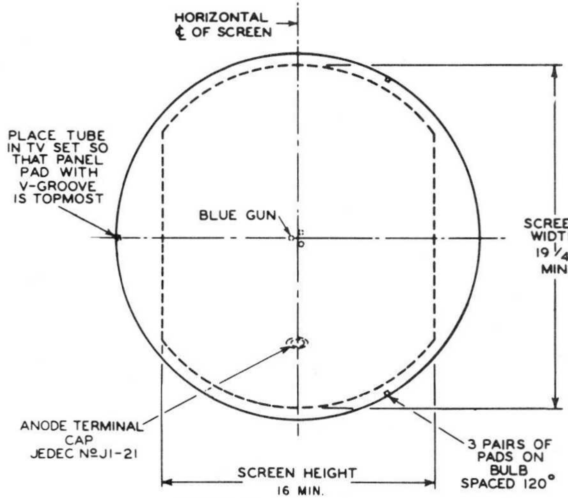
DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

DIMENSIONAL OUTLINE (Top View)



DIMENSIONS IN INCHES

NOTES FOR DIMENSIONAL OUTLINE

Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge JEDEC No. G-150 and with tube seated in gauge, the reference line is determined by the intersection of the plane CC' of the gauge with the glass funnel.

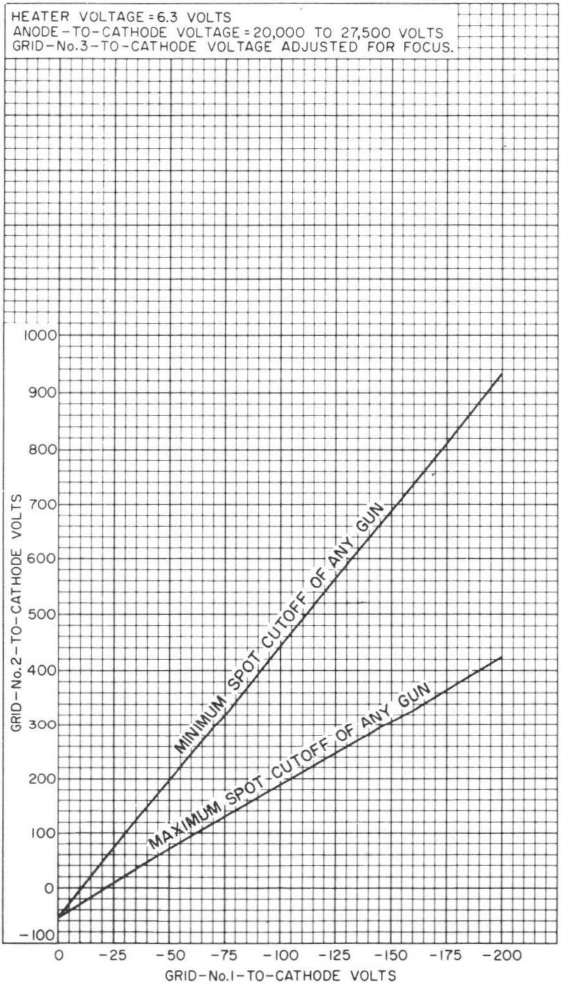
Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base shell will fall within a circle concentric with bulb axis and having a diameter of 3".

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4: To clean this area, wipe only with soft dry lintless cloth.

Note 5: The maximum effective width of a funnel pad is 5/8".

CUTOFF DESIGN CHART



92CM-12330

RCA

21MP4
PICTURE TUBE

RECTANGULAR METAL-SHELL TYPE

LOW-VOLTAGE ELECTROSTATIC FOCUS MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:
- Voltage . . . . 6.3 . . . . ac or dc volts
- Current . . . . 0.6 ± 10% . . . . amp ←

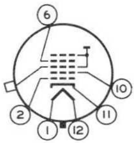
Faceplate, Spherical . . . . Frosted Filterglass
Phosphor (For Curves, see front of this Section) . P4—Sulfide Type
Deflection Angles (Approx.):
- Diagonal . . . . 70°
- Horizontal . . . . 66°
- Vertical . . . . 50°

Electron Gun . . . . Ion-Trap Type Requiring External Single-Field Magnet
Tube Dimensions:
- Maximum overall length . . . . 22-5/8"
- Greatest width at lip. . . . . 19-23/32" ± 1/8"
- Greatest height at lip . . . . 15-5/16" ± 1/8"
- Diagonal at lip. . . . . 20-3/4" ± 1/4"
- Neck length. . . . . 7-1/2" ± 3/16"
- Radius of curvature of faceplate (External surface). . 33" ←

Screen Dimensions (Minimum):
- Greatest width . . . . 18-1/8"
- Greatest height. . . . . 13-11/16"
- Diagonal . . . . 19-1/8"

Operating Position . . . . Any
Ultor Terminal . . . . Metal-Shell Lip
Base . . Small-Shell Duodecal 6-Pin (JETEC Group 4, No. B6-63) ←
- Basing Designation for BOTTOM VIEW . . . . 12M ←

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Metal-Shell Lip - Ultor (Grid No.3, Grid No.5, Collector)

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	16000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1000 max.	volts
Negative value	500 max.	volts
GRID-No.2 VOLTAGE.	500 max.	volts
GRID-No.1 VOLTAGE:		
Negative-bias value.	125 max.	volts
Positive-bias value.	0 max.	volts
Positive-peak value.	2 max.	volts

← Indicates a change.

21MP4

PICTURE TUBE

PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period		
not exceeding 15 seconds	410 max.	volts
After equipment warm-up period . . .	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts
Maximum Circuit Values:		
Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

Color Picture Tube

Ultra-Rectangular **Hi=Lite Matrix Screen**
4 X 3 Aspect Ratio **Light Neutral Screen Appearance**

Electrical

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green
Heater, of Each Gun Series Connected within Tube with Each of the Other Two Heaters:	
Current at 6.3 V	900 mA
Focusing Method	Electrostatic
Focus Lens	Bipotential
Convergence Method	Magnetic
Deflection Method	Magnetic
Deflection Angles (Approx.):	
Diagonal	92 deg
Horizontal	79 deg
Vertical	61 deg
Direct Interelectrode Capacitance (Approx.):	
Grid No.1 of any gun to all other electrodes	7.5 pF
Grid No.3 to all other electrodes	6.5 pF
All cathodes to all other electrodes	15 pF
Capacitance Between Anode and External Conductive Coating	2250 max. pF 1750 min. pF

Optical

Faceplate and Safety Panel	Filterglass
Light transmission at center (Approx.)	66%
Surface of Safety Panel	Treated to minimize specular reflection
Screen	Aluminized
Matrix	Black opaque material
Phosphor, rare-earth (red) sulfide (blue & green)	P22
Persistence	Medium-Short
Array	377,000 Dot trios
Spacing between centers of adjacent dot trios (Approx.)	0.026 in (0.66 mm)

Mechanical

Minimum Screen Area (Projected)	226 sq in (1458 sq cm)
Bulb Funnel Designation	JEDEC No.J561A06
Bulb Panel Designation	JEDEC No.FP177-3/4 W2
Base Designation[a]	Small-Button Diheptar 12-Pin (JEDEC No.B12-244)
Basing Designation	JEDEC No.14BE
Pin Position Alignment	Pin No.12 Aligns Approx. with Anode Bulb Contact

Operating Position, preferred	Anode Bulb Contact on Top
Gun Configuration	Delta
Weight (Approx.)	35.5 lb (16.0 kg)

Implosion Protection

Integral Safety Panel	JEDEC No.SP177-1/4A1

Maximum and Minimum Ratings, Design-Maximum Values

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode.

Anode Voltage	27.5 max.	kV
	20 min.	kV
Anode Current, Long-Term Average[b]	1000 max.	μA
Grid-No.3 (Focusing Electrode) Voltage	6000 max.	V
Peak-Grid-No.2 Voltage, Including Video Signal Voltage	1000 max.	V
Grid-No.1 Voltage:		
Negative bias value	400 max.	V
Negative operating cutoff value	200 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Heater Voltage (ac or dc):[c]		
Under operating conditions	6.9 max.	V
	5.7 min.	V
Under standby conditions[d]	5.5 max.	V
Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
DC component value	200 max.	V
Peak value	200 max.	V
Heater positive with respect to cathode:		
DC component value	0 max.	V
Peak value	200 max.	V

Equipment Design Ranges

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20 and 27.5 kV

Grid-No.3 (Focusing Electrode) Voltage . . . . 16.8% to 20% of Anode voltage

Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot. . . . See CUTOFF DESIGN CHART in Figure 3

At Grid No.1 voltage of −75 V	**80 to 280 V**
At Grid No.1 voltage of −125 V	**215 to 550 V**
At Grid No.1 voltage of −175 V	**355 to 820 V**

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At **grid-No.1** spot cutoff voltage of −100 V) 1.86

Heater Voltage:[c]

Under operating conditions:	
When standby operation in not utilized	6.3 V
When 5.0-V standby operation is utilized[d]	6.0 V
Under standby conditions[d]	5.0 V

Grid-No.3 Current (Total) . . . . ±15 μA

Grid-No.2 Current . . . . ±5 μA

Grid-No.1 Current . . . . ±5 μA

	Illum. D	Color	
To Produce White Light of	6550° K + 7 M.P.C.D.	9300° K + 27 M.P.C.D.	
CIE Coordinates:			
X	0.313	0.281	
Y	0.329	0.311	
Percentage of total anode current supplied by each gun (average):			
Red	41	30	%
Blue	24	31	%
Green	35	39	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.35	0.75	
Typical	1.70	0.95	
Maximum	2.20	1.25	
Red/green:			
Minimum	0.95	0.60	
Typical	1.15	0.75	
Maximum	1.70	1.10	
Blue/green:			
Minimum	0.50	0.60	
Typical	0.70	0.80	
Maximum	0.95	1.10	

Displacements, Measured at Center of Screen:

Raster centering displacement:	
Horizontal	± 0.45 in (± 11.4 mm)
Vertical	± 0.45 in (± 11.4 mm)
Lateral distance between the blue beam and the converged red and green beams . . .	± 0.25 in (± 6.4 mm)

Radial convergence displacement excluding effects of dynamic convergence (each beam) . . . . ± 0.37 in (± 9.4 mm)

Maximum Required Correction for Register[e] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the Center of the Screen in any Direction . . . . 0.005 in (0.13 mm) max.

Typical Operation

Heater Voltage	6.3 V
Anode Voltage	25 kV
Grid No.3 Voltage	Adjusted for focus
Color Temperature	9300° K + 27 M.P.C.D.
Raster Size	17.538 x 13.256 in (445.47 x 336.70 mm)

Typical White-Light Output Measured within 5 in (127 mm) diameter area centered on tube face:

At anode current of 1000 μA . . . . $\left\{ \begin{array}{l} 58 \text{ fL} \\ 200 \text{ Nit} \end{array} \right.$

Limiting Circuit Values

High-Voltage Circuits:

Grid-No.3 circuit resistance . . . . 7.5 max. MΩ

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . 0.75 max. MΩ

X-Radiation Characteristic

Maximum Anode Voltage at which the X-radiation emitted will not exceed 0.5 mR/h at an anode current of

300 μA . . . . 35 kV

The X-radiation emitted from this picture tube, as measured in accordance with the procedure of JEDEC Publication No.64A will not exceed 0.5 mR/h throughout the useful life of the tube when operated within the Design-Maximum ratings: 27.5 kV anode voltage and 1000 μA anode current. The tube should not be operated beyond its Design-Maximum ratings stated above (such operation may shorten tube life or have other permanent adverse affects on its performance), but its X-radiation will not exceed 0.5 mR/h for anode voltage and current combinations given by the isodose-rate limit characteristics as shown in **Figure 1.** Operation above the values shown by the curve may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers, Sub-Part C of Part 78 of Title 42, Code of Federal Regulations (PL90-602) as published in the Federal Register Vol.34, No. 247, Thursday, December 25, 1969. Maximum X-radiation as a function of anode voltage at 300 μA anode current is shown by the curve in **Figure 2.** X-radiation at a constant anode voltage varies linearly with anode current.

a The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound (one-half kilogram).

b The short-term average anode current should be limited by circuitry to 1500 microamperes.

c For maximum cathode life, it is recommended that the heater supply be regulated. The series impedance to any chassis connection in the dc biasing circuit for the heater should be between 100 kilohms and 1 megohm. The surge voltage across the heater must be limited to 9.5 volts rms.

d The use of a 5-volt standby condition in conjunction with 6-volt operating conditions is recommended to improve the reliability of the color picture tube by extending the emission wear-out life and reducing other gun-related defects. A maximum heater voltage of 5.5 volts (Design-Maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

e Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

Notes For Dimensional Outline

Note 1— With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C′ of the gauge with the glass funnel.

Note 2— Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with blub axis.

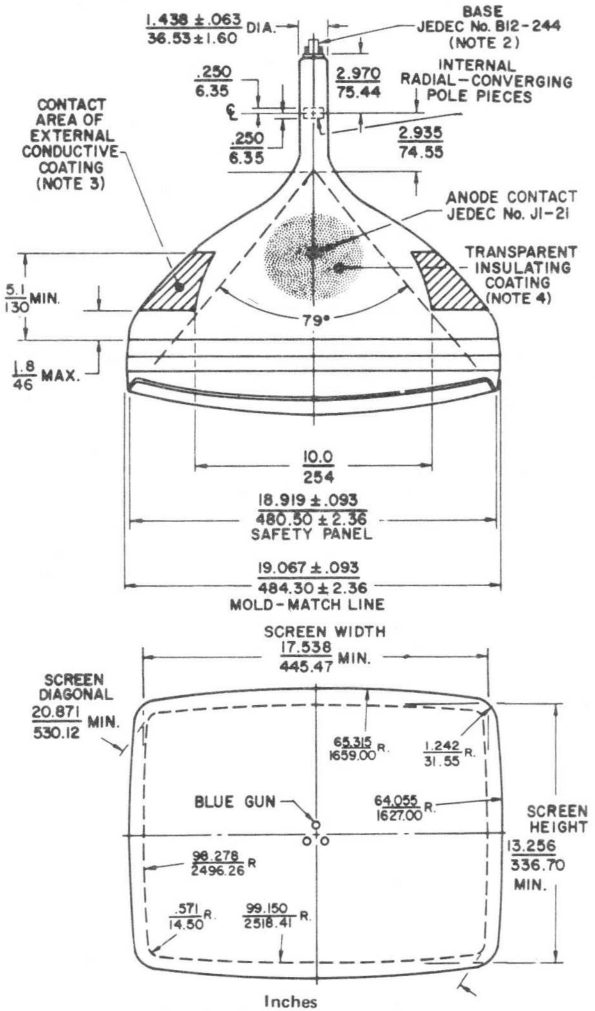
Note 3— The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4— To clean this area, wipe only with soft, dry, lintless cloth.

SAGITTAL HEIGHTS AT POINTS $\frac{.125}{3.18}$ BEYOND EDGE OF MIN. SCREEN

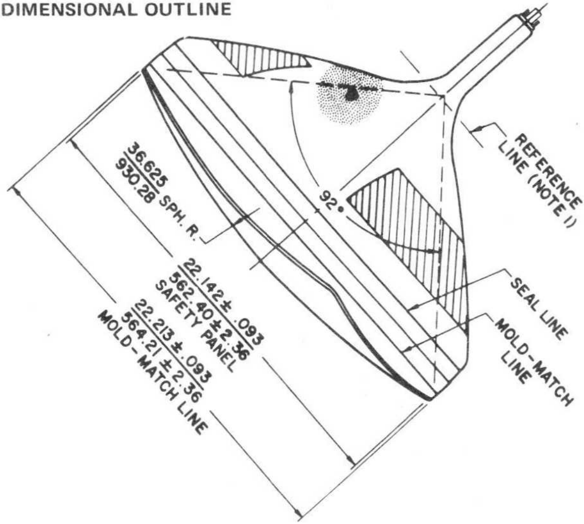
DIAGONAL $\frac{1.561}{39.65}$; HORIZONTAL $\frac{1.100}{27.94}$; VERTICAL $\frac{0.630}{16.00}$

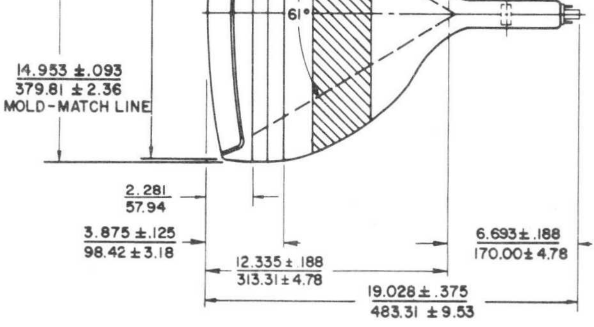
DIMENSIONAL OUTLINE



Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise noted

DIMENSIONAL OUTLINE





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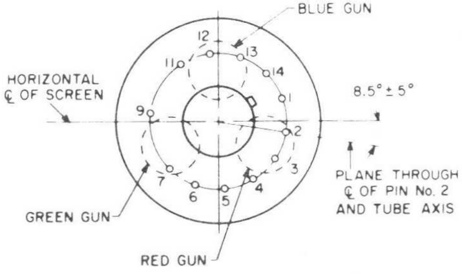
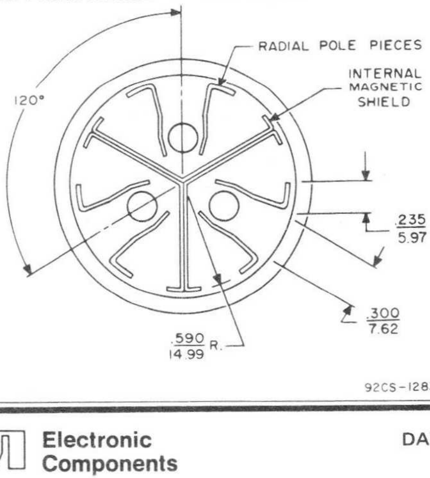
BOTTOM VIEW OF BASE



Base Specification – JEDEC No.14BE

Pin 1–	Heater
Pin 2–	Cathode of Red Gun
Pin 3–	Grid No.1 of Red Gun
Pin 4–	Grid No.2 of Red Gun
Pin 5–	Grid No.2 of Green Gun
Pin 6–	Cathode of Green Gun
Pin 7–	Grid No.1 of Green Gun
Pin 9–	Grid No.3
Pin 11–	Cathode of Blue Gun
Pin 12–	Grid No.1 of Blue Gun
Pin 13–	Grid No.2 of Blue Gun
Pin 14–	Heater
Cap–	Anode (Grid No.4, Screen, Collector)
C–	External Conductive Coating

LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



0.5 mR/h ISODOSE-RATE LIMIT CURVE (JEDEC CURVE No.XC-4)

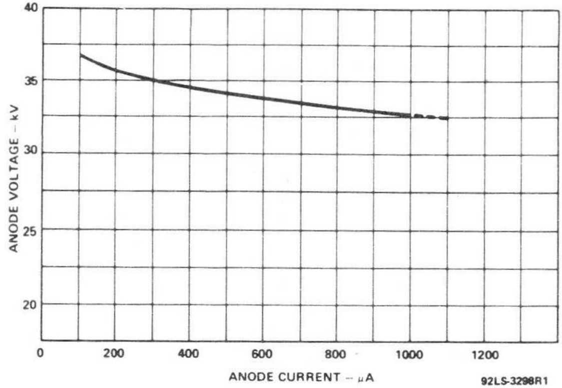


Figure I

X-RADIATION LIMIT CURVE AT A CONSTANT ANODE CURRENT OF 300 μA (X-RADIATION AT A CONSTANT ANODE VOLTAGE VARIES LINEARLY WITH ANODE CURRENT) (JEDEC CURVE No.XC-3)

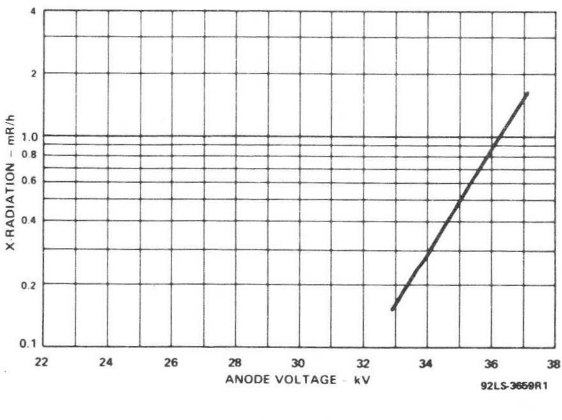
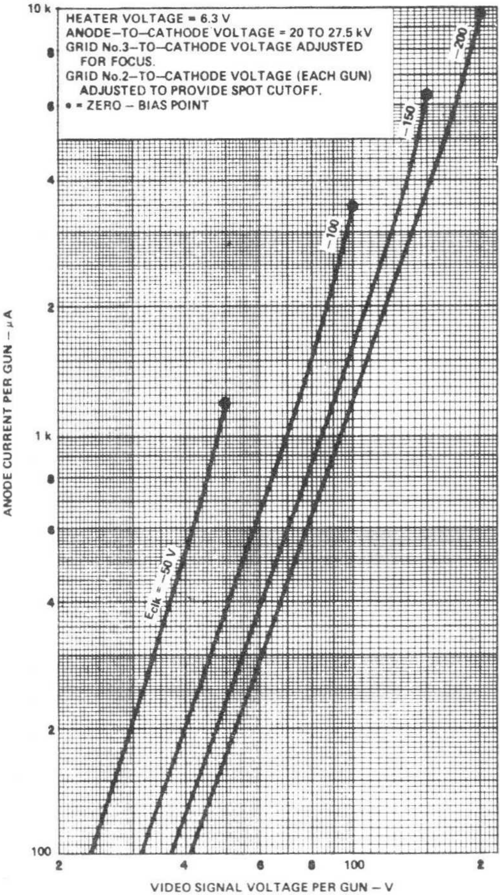
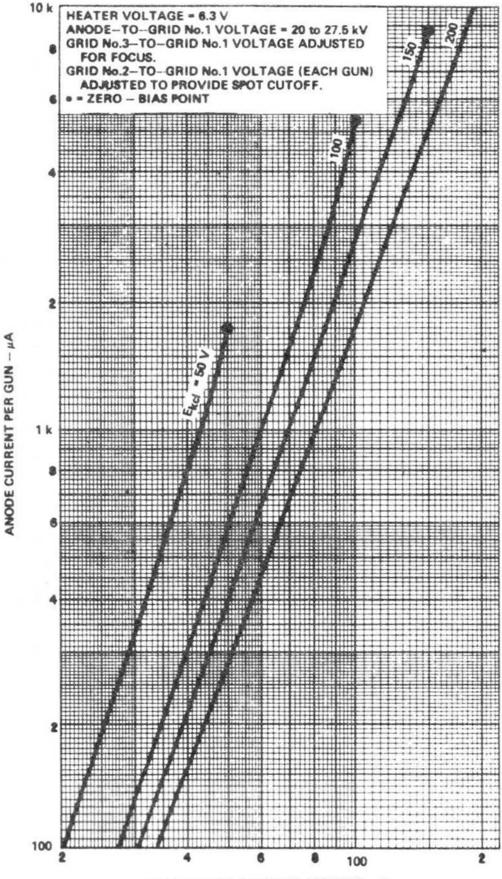


Figure 2

TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE



TYPICAL DRIVE CHARACTERISTICS, CATHODE-DRIVE SERVICE



CUTOFF DESIGN CHART

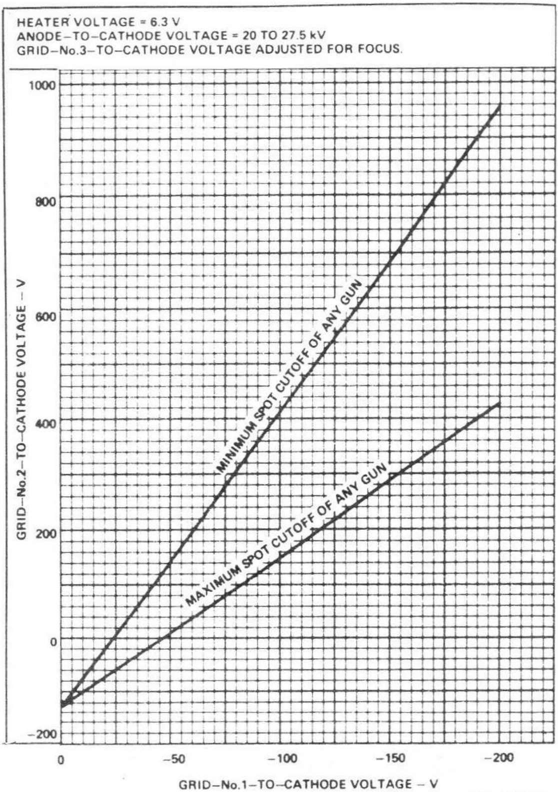


Figure 3

IMPORTANT: Refer to sheet **Safety Precautions For Color Picture Tubes** at front of this section.

21WP4B

Picture Tube

NO ION-TRAP MAGNET REQUIRED

MAGNETIC FOCUS — 70° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes.	5	pF
Grid No.1 to all other electrodes.	6	pF
External conductive coating to anode	750 max	pF
	500 min	pF
Heater Current at 6.3 V.	600 ± 30	mA
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet		

OPTICAL

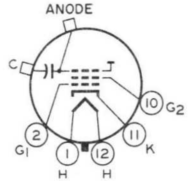
Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . .Filterglass
Light Transmission (Approx.) 73%

MECHANICAL

Weight (Approx.)	24	lb
Overall Length	22.438 ± 0.375	in
Neck Length.	7.500 ± 0.188	in
Projected Area of Screen	224	sq in

External Conductive Coating
Type . . . . Regular-Band
Contact area for grounding . . . . Near Reference Line
For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J165 Z* sheets at front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)
Basing Designation for BOTTOM VIEW 12N

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 10 – Grid No.2
Pin 11 – Cathode
Pin 12 – Heater
Cap – Anode (Grid No.3, Screen Collector)
C – External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	20000 max	V
Grid-No.2 Voltage.	550 max	V
Grid-No.1 Voltage		
Negative peak value.	220 max	V
Negative bias value.	155 max	V
Positive bias value.	0 max	V
Positive peak value.	2 max	V

Heater Voltage	6.9 max 5.7 min	V V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period	200 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC Component	100 max	V

TYPICAL OPERATING CONDITIONS FOR GRID-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	16000	V
Grid-No. 2 Voltage	300	V
Grid-No. 1 Voltage	-28 to -72	V
For visual extinction of focused raster		

MAXIMUM CIRCUIT VALUE

Grid-No. 1-Circuit Resistance	1.5 max	MΩ

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

21XP4B

Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS　　70° MAGNETIC DEFLECTION
NO ION-TRAP MAGNET REQUIRED

ELECTRICAL

Direct Interelectrode Capacitances

Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	2500 max	pF
	2000 min	pF
Heater Current at 6.3 V	600 ± 30	mA

Electron Gun . . . . Type Requiring No Ion-Trap Magnet

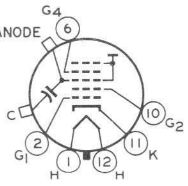
OPTICAL

Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light Transmission (Approx.) 73%

MECHANICAL

Weight (Approx.) . . . . 24 lb
Overall Length . . . . 22.438 ± 0.375 in
Neck Length . . . . 7.500 ± 0.188 in
Projected Area of Screen . . . . 224 sq in
External Conductive Coating
Type . . . . Regular-Band
Contact area for grounding . . . . Near Reference Line
For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J165 Z* sheets at front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-63)
Basing Designation for BOTTOM VIEW 12L

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 6 – Grid No.4
Pin 10 – Grid No.2
Pin 11 – Cathode
Pin 12 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	20000 max	V
Grid-No.4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	550 max	V

Grid-No.2 Voltage	550 max	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	6.9 max	V
	5.7 min	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period	200 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC Component	100 max	V

TYPICAL OPERATING CONDITIONS FOR GRID-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	16000	V
Grid-No.4 Voltage	-64 to 352	V
Grid-No.2 Voltage	300	V
Grid-No.1 Voltage	-28 to -72	V
For visual extinction of focused raster		

MAXIMUM CIRCUIT VALUE

Grid-No.1-Circuit Resistance	1.5 max	MΩ

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

21YP4B

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes . . .	6	pf
External conductive coating to anode. .	750 max.	pf
	500 min.	pf
Heater Current at 6.3 volts	600 ± 60	ma
Electron Gun.	Type Requiring No Ion-Trap Magnet	

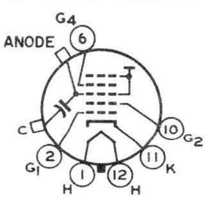
Optical:

Phosphor (For curves, see front of this section) . P4—Sulfide Type, Aluminized
Faceplate, Spherical. . . . . Filterglass
Light transmission (Approx.). 75%

Mechanical:

Weight (Approx.). . . . . 24 lbs
Overall Length. . . . . 23-1/32" ± 3/8"
Neck Length . . . . 7-1/2" ± 3/16"
Projected Area of Screen. . . . . 248 sq. in.
External Conductive Coating:
Type. Regular-Band
Contact area for grounding. . . . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J170 B/D* sheets at front of this section
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . Small-Shell Duodecal 6-Pin (JEDEC Group 4, No. B6-63)
Basing Designation for BOTTOM VIEW. 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE . . . . 20000 max. volts

GRID-No.4 (FOCUSING) VOLTAGE:			
Positive value	1100	max.	volts
Negative value	550	max.	volts
GRID-No.2 VOLTAGE	550	max.	volts
GRID-No.1 VOLTAGE:			
Negative peak value	220	max.	volts
Negative bias value	155	max.	volts
Positive bias value	0	max.	volts
Positive peak value	2	max.	volts
HEATER VOLTAGE	6.9	max.	volts
	5.7	min.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	450	max.	volts
After equipment warm-up period	200	max.	volts
Heater positive with respect to cathode:			
Combined AC and DC voltage	200	max.	volts
DC component	100	max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	16000	volts
Grid-No.4 Voltage	-64 to +350	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance . . . . . . 1.5 max. megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

21ZP4C

Picture Tube

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS

ALUMINIZED SCREEN
70° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes . . .	6	pf
External conductive coating to anode. .	750 max.	pf
	500 min.	pf
Heater Current at 6.3 volts	600 ± 60	ma
Electron Gun.	Type Requiring No Ion-Trap Magnet	

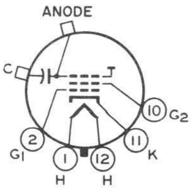
Optical:

Phosphor (For curves, see front of this section) . P4—Sulfide Type, Aluminized
Faceplate, Spherical. . . . . Filterglass
Light transmission (Approx.). 75%

Mechanical:

Weight (Approx.). . . . . 24 lbs
Overall Length. . . . . 23-1/32" ± 3/8"
Neck Length . . . . 7-1/2" ± 3/16"
Projected Area of Screen. . . . . 248 sq. in.
External Conductive Coating:
Type. . . . . Regular-Band
Contact area for grounding. . . . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J170 B/D* sheets at front of this section
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . Small-Shell Duodecal 5-Pin (JEDEC Group 4, No. B5-57)
Basing Designation for BOTTOM VIEW. 12N

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode (Grid No.3, Screen, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	20000 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts

GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	16000	volts
Grid-No.2 Voltage	300	volts
Grid-No.1 Voltage for visual extinction of focused raster	-28 to -72	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Color Picture Tube

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD PURITY AND UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE | 90° MAGNETIC DEFLECTION

ALUMINIZED TRICOLOR PHOSPHOR-DOT *Hi-Lite* SCREEN
(Utilizing a New Improved Rare-Earth Red-Emitting Phosphor)

INTEGRAL FILTERGLASS PROTECTIVE WINDOW

MAGNETIC CONVERGENCE | 3 ELECTROSTATIC-FOCUS GUNS

For Use in Color-TV Receivers

ELECTRICAL

Electron Guns, Three	Red, Blue, Green
Axes tilted toward tube axis	
Heater, of Each Gun	
Series connected within tube with each of the other two heaters	
Current at 6.3 volts[a]	900 mA
Focusing Method	Electrostatic
Focus Lens	Bipotential
Convergence Method	Magnetic
Deflection Method	Magnetic
Deflection Angles (Approx.)	
Diagonal	90°
Horizontal	79°
Vertical	63°
Direct Interelectrode Capacitances (Approx.)	
Grid No.1 of any gun to all other electrodes	6 pF
Grid No.3 to all other electrodes	6.5 pF
All cathodes to all other electrodes	15 pF
External conductive coating to anode	2500 max pF 2000 min pF

OPTICAL

Faceplate and Protective Window	Filterglass
Light transmission at center (Approx.)	41%
Surface of Protective Window	Treated to minimize specular reflection
Screen, on Inner Surface of Faceplate	
Type	Aluminized, Tricolor, Phosphor-Dot
Phosphor (Three separate phosphors, collectively)[b]	P22—New Rare-Earth (Red), Sulfide (Blue & Green) Type
Fluorescence and phosphorescence of separate phosphors, respectively	Red, Blue, Green
Persistence of group phosphorescence	Medium Short
Dot arrangement	Each triangular group consists of a red, green, and blue dot
Spacing between centers of adjacent dot trios (Approx.)	0.025 in (0.64 mm)

MECHANICAL

Tube Dimensions

Overall length	19.204 ± .375 in	(487.8 ± 9.5 mm)
Neck length	6.693 ± .188 in	(170.0 ± 4.8 mm)
Diagonal	21.721 ± .093 in	(551.7 ± 2.4 mm)
Greatest width	18.976 ± .093 in	(482.0 ± 2.4 mm)
Greatest height	15.236 ± .093 in	(387.0 ± 2.4 mm)

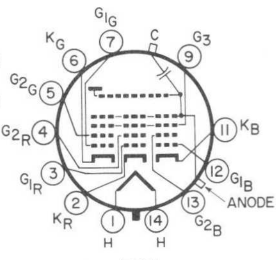
Minimum Screen Dimensions (Projected)

Diagonal	20.233 in	(513.9 mm)
Greatest width	17.446 in	(443.1 mm)
Greatest height	13.640 in	(346.5 mm)
Area	227 sq. in	(1465 sq. cm)

Bulb Funnel Designation . . . . JEDEC No.J173-1/2 A1A
Bulb Panel Designation. . . . . JEDEC No.FP173-3/4 B2
Protective Window Designation . . . . .JEDEC No.FP172-1/2
Bulb Contact Designation. . . . . . Recessed Small Cavity Cap (JEDEC No.J1-21)
Pin Position Alignment. . . . . .Pin No.12 Aligns Approx. with Anode Bulb Contact
Operating Position. . . . . Anode Bulb Contact on Top
Weight (Approx.). . . . . 32.5 lb (14.8 kg)
Base. . . . . Small-Button Diheptar 12-pin (JEDEC No.B12-244)

TERMINAL DIAGRAM (Bottom View)

Pin 1 - Heater
Pin 2 - Cathode of Red Gun
Pin 3 - Grid No.1 of Red Gun
Pin 4 - Grid No.2 of Red Gun
Pin 5 - Grid No.2 of Green Gun
Pin 6 - Cathode of Green Gun
Pin 7 - Grid No.1 of Green Gun
Pin 9 - Grid No.3
Pin 11 - Cathode of Blue Gun
Pin 12 - Grid No.1 of Blue Gun
Pin 13 - Grid No.2 of Blue Gun
Pin 14 - Heater
Cap - Anode (Grid No.4, Grid No.5, Screen, Collector)
C - External Conductive Coating



14BE

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	27,500 max / 20,000 min	V
Typical Anode Current, Long-Term Average	1000 max	μA
Grid-No.3 (Focusing Electrode) Voltage	6000 max	V
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max	V

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Grid-No.1 Voltage

Negative bias value	400 max V
Negative operating cutoff value	200 max V
Positive bias value	0 max V
Positive peak value	2 max V

Heater Voltage (AC or DC)

Under operating conditions[a]	6.9 max V 5.7 min V
Under standby conditions[b]	5.5 max V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:	
During equipment warm-up period not exceeding 15 seconds	450 max V
After equipment warm-up period:	
Combined AC and DC value	200 max V
DC component value	200 max V
Heater positive with respect to cathode:	
AC component value	200 max V
DC component value	0 max V

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 V

Grid-No.3 (Focusing Electrode) Voltage . . . . . . 16.8% to 20% of anode volts

Grid-No.2 and Grid-No.1 Voltages . . . . See accompanying *Cutoff Design Chart*
For visual extinction of focused spot

Maximum Ratio of Grid-No.2 Voltages 1.86
Highest gun to lowest gun in any tube (At grid-No.1 spot cutoff voltage of −100 volts)

Grid-No.3 Current (Total) . . . . −45 to +15 μA

Grid-No.2 Current . . . . −5 to +5 μA

To Produce White 9300°K + 27 M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311)

	Red	*Blue*	*Green*	
Percentage of total anode current supplied by each gun (Average)	34	32	34	%

Ratio of cathode currents:	*Min*	*Typ*	*Max*
Red/blue	0.75	1.10	1.50
Red/green	0.65	1.00	1.50
Blue/green	0.60	0.91	1.30

Displacements, Measured at Center of Screen

Raster centering displacement:	
Horizontal	±0.47 in (±11.9 mm)
Vertical	±0.45 in (±11.4 mm)
Lateral distance between the blue beam and the converged red and green beams	±0.25 in (±6.4 mm)
Radial convergence displacement excluding effects of dynamic convergence (Each beam)	±0.37 in (±9.4 mm)

Maximum Required Correction for Register[c] (Including Effect of Earth's Magnet Field when Using Recommended Components) Measured at the center of the screen in any direction.	0.005 in (0.13 mm) max

EXAMPLES OF USE OF DESIGN RANGES

Unless otherwise specified, voltage values are for each gun and are positive with respect to cathode

Anode Voltage	25,000	V
Grid-No.3 (Focusing Electrode) Voltage. . . .	4200 to 5000	V
Grid-No.2 Voltage when circuit design utilizes grid-No.1 voltage of -150 volts for visual extinction of focused spot.	285 to 685	V
Grid-No.1 Voltage for visual extinction of focused spot when circuit design utilizes grid-No.2 voltage of 400 volts	-95 to -190	V
Heater Voltage		
Under operating conditions[a]	6.3	V
Under standby conditions.	5.0	V

LIMITING CIRCUIT VALUES

High-Voltage Circuits

Grid-No.3 circuit resistance. . . . . 7.5 max MΩ

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type, in which the short-circuit current does not exceed 20 mA.

Low-Voltage Circuits

Effective grid-No.1-to-cathode-circuit resistance (Each gun). . . . . 0.75 max MΩ

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 mA total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

a For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.

b For curve, see *Group Phosphor P22—New Rare-Earth (Red), Sulfide (Blue & Green)* at front of this section.

c For "instant on" applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

d Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

GENERAL CONSIDERATIONS

X-Radiation Warning. Because the 22JP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 22JP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

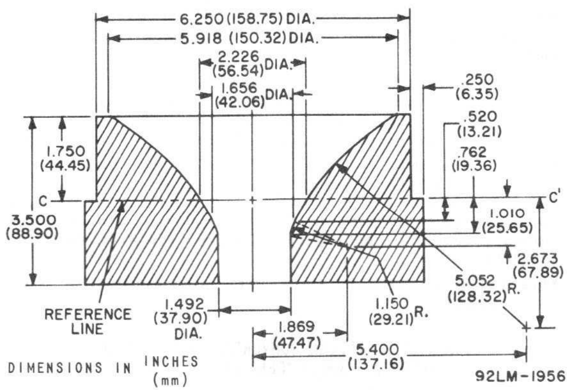
Orientation. The 22JP22 must be operated with tube axis in a horizontal position and with the blue gun uppermost (i.e., the anode contact button on top).

The **Deflecting Yoke** and tube axes must coincide and the yoke must be free to move along the neck for a distance of approximately 0.5 inch (13 mm) from its most forward position for adjustment purposes. The yoke mount should also provide for a small amount of rotational adjustment.

Contact to the **external conductive coating** should be made by multiple fingers to prevent possible damage to the tube from localized overheating due to poor contact.

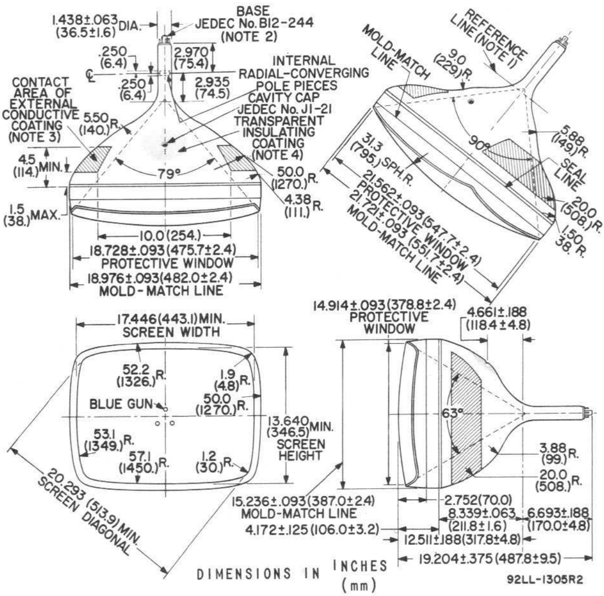
Misregister Compensation. Proper operation of the 22JP22 requires compensation for the effects of extraneous magnetic fields, the earth's magnetic field, and other causes which may produce misregister. Compensation for these effects may be accomplished by the use of a purifying magnet.

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE JEDEC No.G162



Reference Line is determined by plane C-C' when gauge is seated.

DIMENSIONAL OUTLINE



Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge and with tube seated in gauge, the reference line is determined by the intersection on the plane C-C' of the gauge with the glass funnel.

Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS

for type 22JP22 is the same as that shown for type 25XP22

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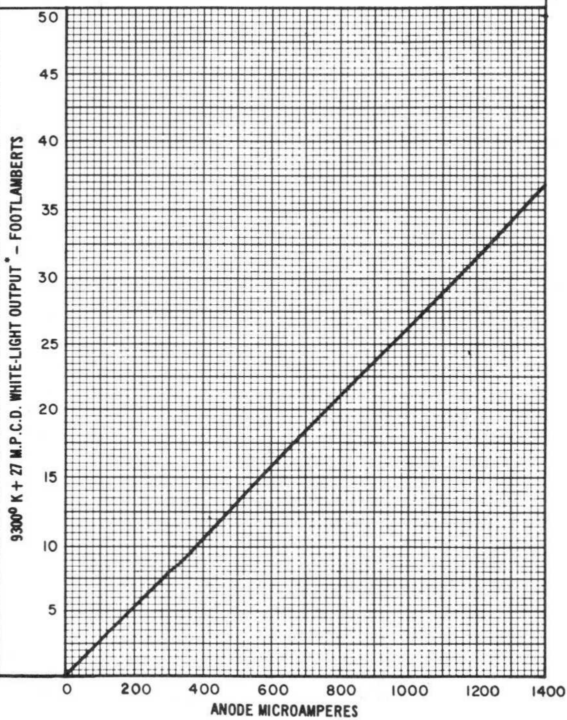
Typical Light-Output Characteristic

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25000 VOLTS
GRID-No.3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE CURRENT TO PRODUCE 9300° K+27 M.C.P.D. WHITE-LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO PRODUCE 9300° K+27 M.P.C.D. WHITE:

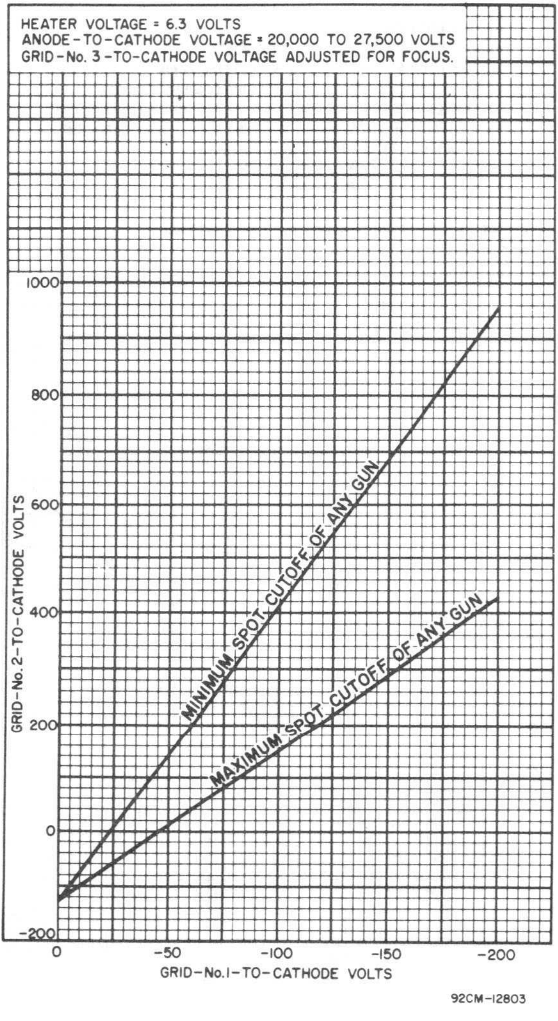
RED GUN : 34%
BLUE GUN : 32%
GREEN GUN : 34%

RASTER SIZE: 17.446" X 13.640" (443.1 mm X 346.5 mm)
* MEASURED WITHIN 4" – DIAMETER AREA CENTERED ON TUBE FACE.



92LM-1989

Cutoff Design Chart



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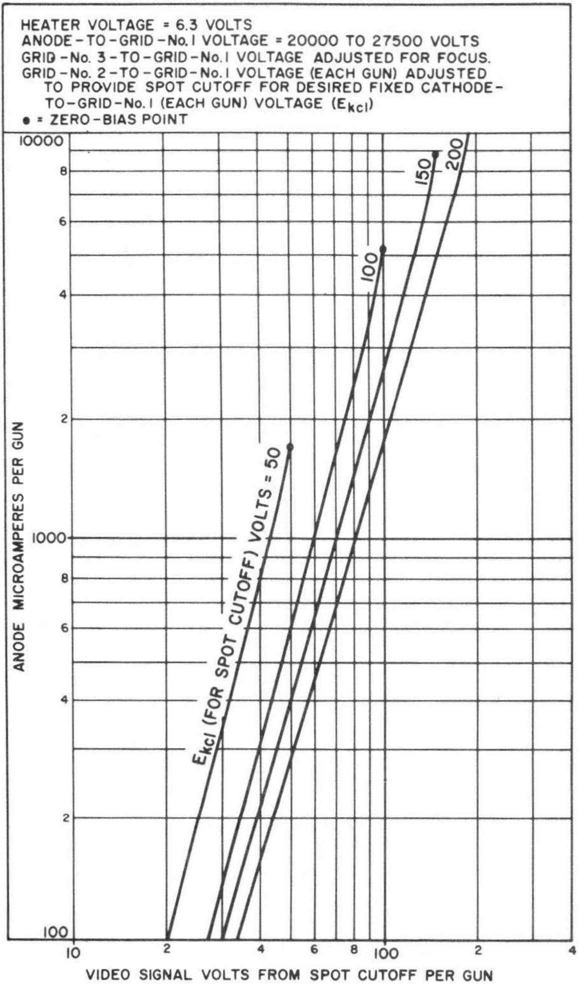
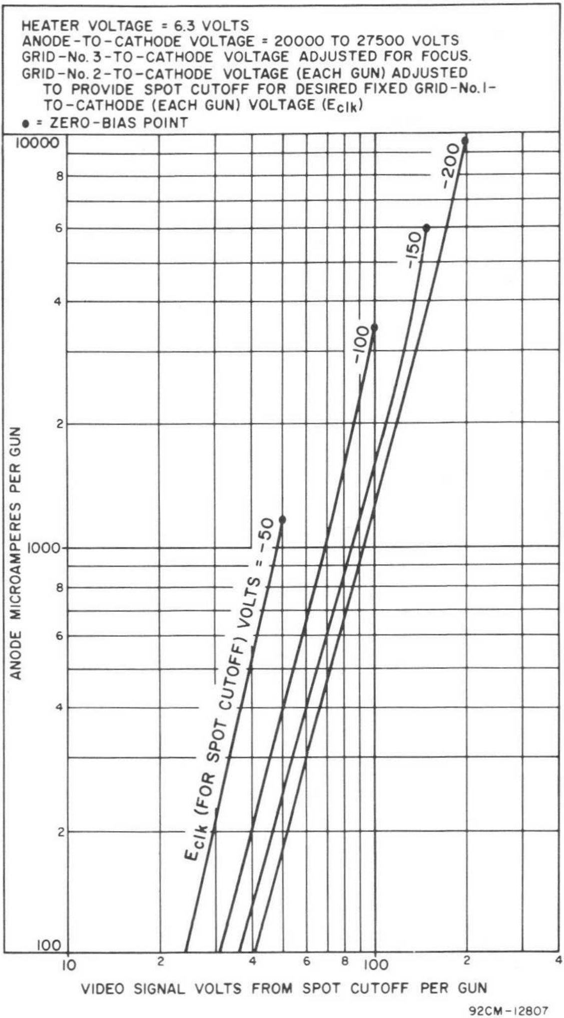
Typical Drive Characteristics

Cathode-Drive Service



Typical Drive Characteristics

Grid-Drive Service



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

Color Picture Tube

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD PURITY AND UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE — 90° MAGNETIC DEFLECTION

ALUMINIZED TRICOLOR PHOSPHOR-DOT "Hi-Lite" SCREEN
(Utilizing an Improved Rare-Earth Red-Emitting Phosphor)

MAGNETIC CONVERGENCE — 3 ELECTROSTATIC-FOCUS GUNS

For Use in Color-TV Receivers

The 22KP22 is the same as the 22JP22 except for the following items:

OPTICAL

Faceplate . . . . Filterglass
Light transmission (Approx.). 69%
Faceplate does not have an integral protective window[a]

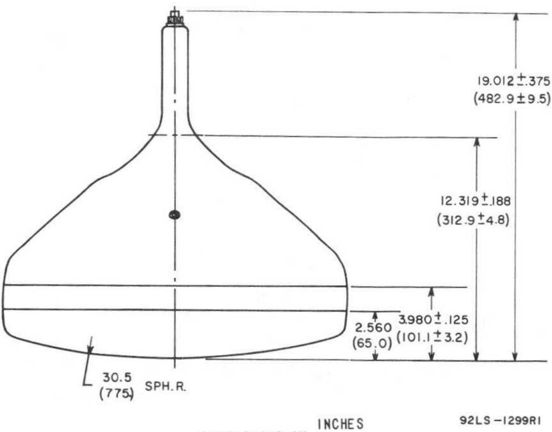
MECHANICAL

Tube Dimensions
Overall length. . . . . 19.012 ± .375 in (482.9 ± 9.5 mm)
Weight (Approx.). . . . . 28 lb (12.7 kg)

[a] It is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 22KP22 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide x-radiation protection when required.

DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 22JP22



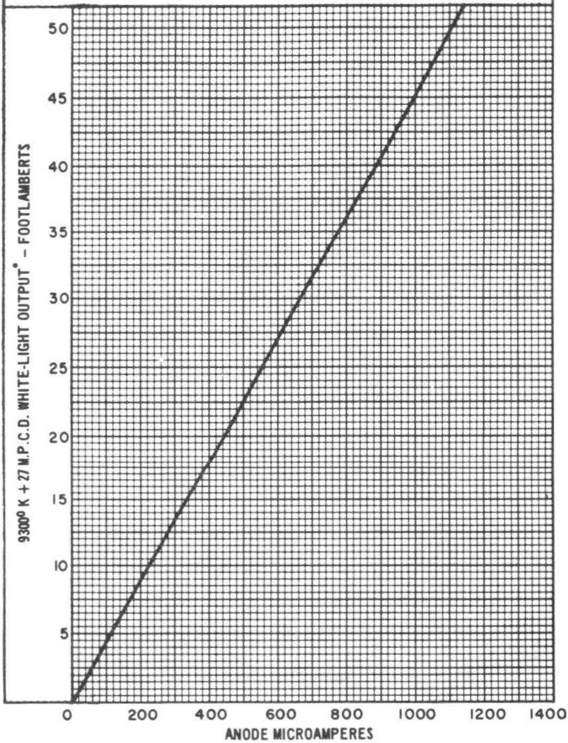
DIMENSIONS IN INCHES (mm)

Typical Light-Output Characteristic

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25000 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE CURRENT TO PRODUCE 9300° K + 27 M.P.C.D. WHITE-LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO PRODUCE 9300° K + 27 M.P.C.D. WHITE:

RED GUN : 34%
BLUE GUN : 32%
GREEN GUN : 34%

RASTER SIZE: 17.446" X 13.640" (443.1 mm X 346.5 mm)
*MEASURED WITHIN 4" – DIAMETER AREA CENTERED ON TUBE FACE.



92LM-1961

Color Picture Tube

Perma-Chrome Banded-Type Implosion Protection
90° Rectangular HI-LITE Screen
New Rare-Earth (Red) Phosphor Unity Current Ratios

ELECTRICAL

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green	
Heater, of Each Gun Series Connected within Tube with Each of the Other Two Heaters:		
Current at 6.3 V[a]	900	mA
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	90	deg.
Horizontal	79	deg.
Vertical	63	deg.
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 of any gun to all other electrodes	6	pF
Grid No.3 to all other electrodes	6.5	pF
All cathodes to all other electrodes	15	pF
External conductive coating to anode (Approx.)	2500 max.	pF
	2000 min.	pF

OPTICAL

Faceplate	Filterglass
Light transmission at center (Approx.)	42%
Surface	Polished
Screen, on Inner Surface of Faceplate:	
Type	Aluminized, Tricolor, Phosphor-Dot
Phosphor (three separate phosphors, collectively)[b]	P22–New Rare-Earth (Red), Sulfide (Blue & Green) Type
Fluorescence and phosphorescence of separate phosphors, respectively	Red, Blue, Green
Persistence of group phosphorescence	Medium Short
Dot Arrangement	Triangular group consisting of red dot, blue dot, and green dot
Spacing between centers of adjacent dot trios (Approx.)	0.025 in (0.64 mm)

22UP22

MECHANICAL

Minimum Screen Area (Projected):	227 sq. in (1465 sq. cm)
Bulb Funnel Designation	JEDEC No.J173-1/2 A1A
Bulb Panel Designation	JEDEC No.FP173-3/4
Base	Small-Button Diheptar 12-pin
Pin Position Alignment	Pin No.12 Aligns Approx. with Anode Bulb Contact
Operating Position	Anode Bulb Contact on Top
Weight (Approx.)	29 lb (13.3 kg)

MAXIMUM AND MINIMUM RATINGS, Design-Maximum Values

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	27,500 max.	V
	20,000 min.	V
Total Anode Current, Long-Term Average	1000 max.	μA
Grid-No.3 (Focusing Electrode) Voltage	6000 max.	V
Peak Grid-No.2 Voltage, Including Video Signal Voltage . . .	1000 max.	V
Grid-No.1 Voltage:		
Negative bias value	400 max.	V
Negative operating cutoff value . . .	200 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Heater Voltage (ac or dc):		
Under operating conditions[a]	6.9 max.	V
	5.7 min.	V
Under standby conditions[c]	5.5 max.	V
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
Combined AC and DC value . . .	200 max.	V
DC component value	200 max.	V
Heater positive with respect to cathode:		
AC component value	200 max.	V
DC component value	0 max.	V

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 V

Grid-No.3 (Focusing Electrode) Voltage . . . . . 16.8% to 20% of Anode Voltage

Grid-No.2 and Grid-No.1 Voltages for Visual Extinction of Focused Spot . . . . See *CUTOFF DESIGN CHART*

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At grid-No.1 spot cutoff voltage of −100 V) 1.86

Heater Voltage:

Under operating conditions[a]	6.3	V
Under standby conditions[c]	5.0	V
Grid-No.3 Current (Total)	−45 to +15	μA
Grid-No.2 Current	−5 to +5	μA

To Produce White 9300° K + 27 M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311):

	Red	*Blue*	*Green*	
Percentage of total anode current supplied by each gun (average)	34	32	34	%

Ratio of cathode currents:	*Min.*	*Typ.*	*Max.*
Red/blue	0.75	1.10	1.50
Red/green	0.65	1.00	1.50
Blue/green	0.60	0.91	1.30

Displacements, Measured at Center of Screen:

Raster centering displacement:

Horizontal . . . . ± 0.47 in (± 11.9 mm)

Vertical . . . . ± 0.45 in (± 11.4 mm)

Lateral distance between the blue beam and the converged red and green beams . . . . ± 0.25 in (± 6.4 mm)

Radial convergence displacement excluding effects of dynamic convergence (each beam) . . . . . . ± 0.37 in (± 9.4 mm)

Maximum Required Correction for Register[d] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the center of the Screen in any Direction . . . . . . 0.005 in (0.13 mm) max.

LIMITING CIRCUIT VALUES:

High-Voltage Circuits:

Grid-No.3 circuit resistance . . . . 7.5 max. MΩ

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type, in which the short-circuit current does not exceed 20 mA.

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . 0.75 max. MΩ

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 mA total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

[a] For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.

[b] For curve, see *Group Phosphor-P22-New Rare Earth (Red), Sulfide (Blue & Green)* at front of this section.

[c] For "instant on" applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

[d] Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

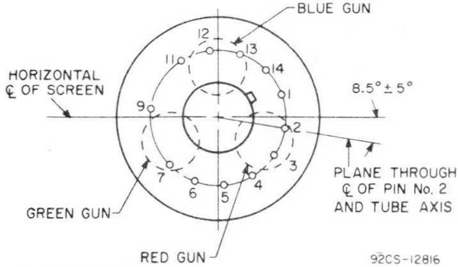
X-RADIATION WARNING

Because the 22UP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 22UP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

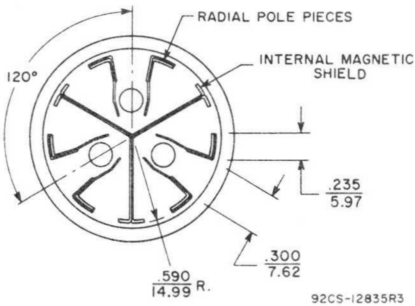
BASE SPECIFICATION – JEDEC No. 14BE

Pin 1: Heater
Pin 2: Cathode of Red Gun
Pin 3: Grid No.1 of Red Gun
Pin 4: Grid No.2 of Red Gun
Pin 5: Grid No.2 of Green Gun
Pin 6: Cathode of Green Gun
Pin 7: Grid No.1 of Green Gun
Pin 9: Grid No.3
Pin 11: Cathode of Blue Gun
Pin 12: Grid No.1 of Blue Gun
Pin 13: Grid No.2 of Blue Gun
Pin 14: Heater
Cap: Anode (Grid No.4, Screen, Collector)
C: External Conductive Coating

BOTTOM VIEW OF BASE



LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



NOTES FOR DIMENSIONAL OUTLINE

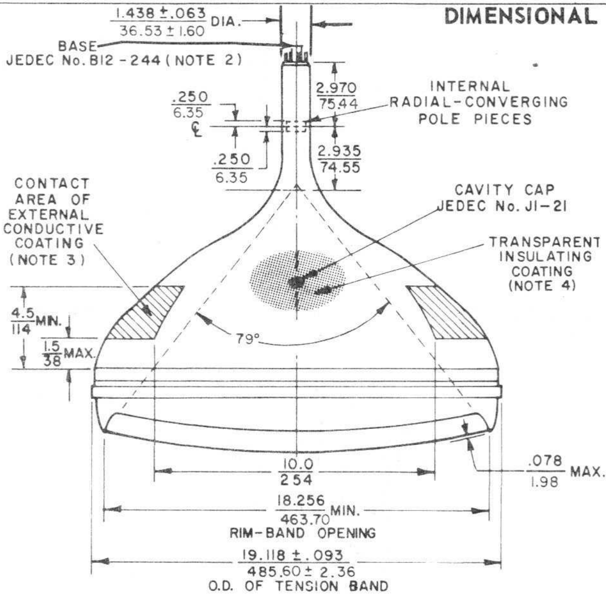
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge JEDEC No.G162 and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C' of the gauge with the glass funnel.

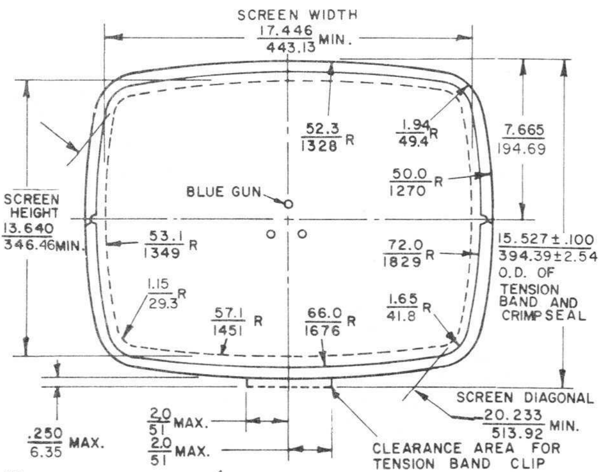
Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

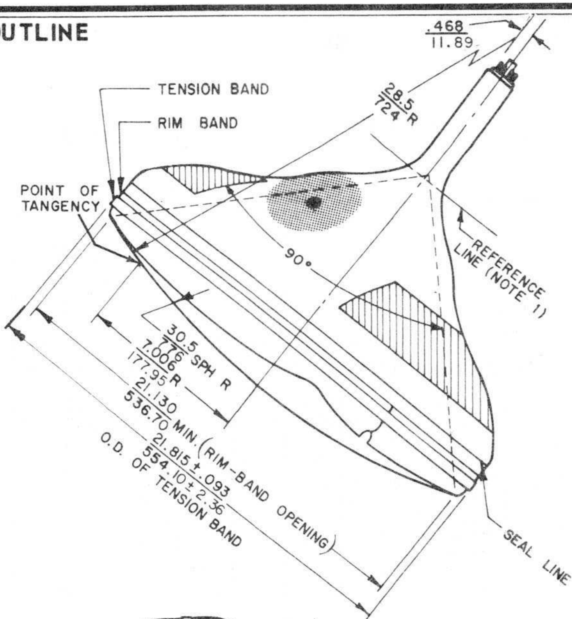
DIMENSIONAL

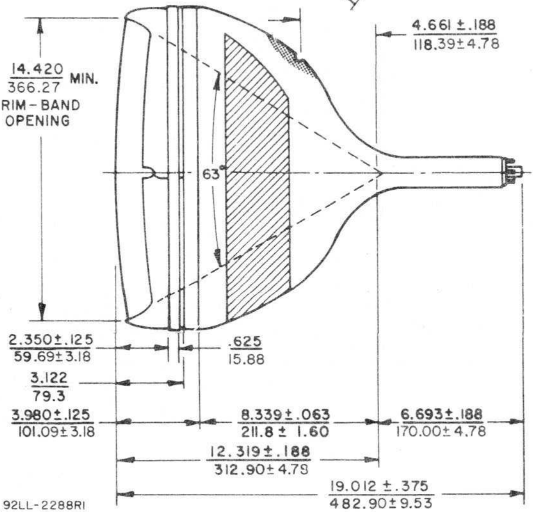




Dimensions in Inches/mm

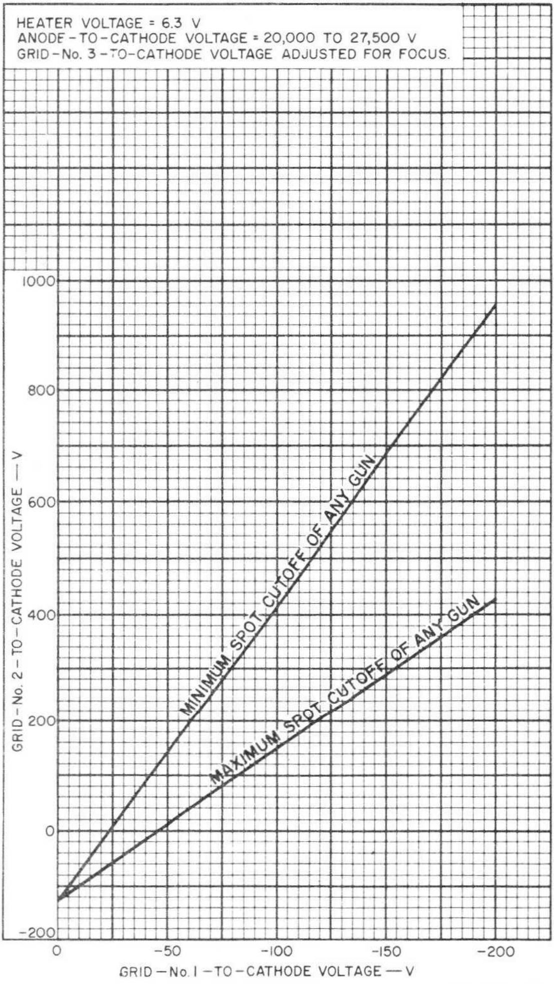
OUTLINE





92LL-2288R1

CUTOFF DESIGN CHART



Color Picture Tube

Perma-Chrome — **Banded-Type Implosion Protection**
90° Rectangular — **HI-LITE Screen**
New Rare-Earth (Red) Phosphor — **Unity Current Ratios**

This data sheet is to be used in conjunction with data for RCA-22UP22.

For general data, maximum and minimum ratings, equipment design ranges, limiting circuit values, x-radiation warning, and base specification of the 22WP22, refer to the 22UP22 except as noted below.

MECHANICAL

Tube Dimensions (excluding mounting lugs):

Diagonal . . . . 21.971 ± .093 in (558.06 ± 2.36 mm)

Greatest Width . . . . 19.118 ± .093 in (485.60 ± 2.36 mm)

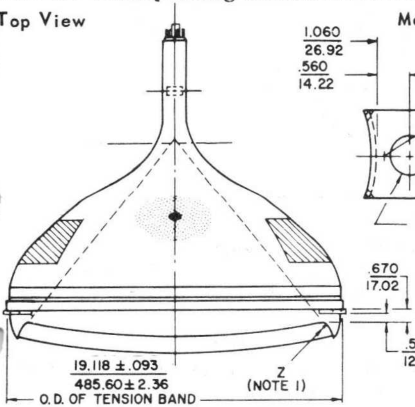
Greatest Height (including tension-band clip) . . . . . . 15.527 ± .100 in (394.39 ± 2.54 mm)

Weight (Approx.) . . . . 29 lb (13.3 kg)

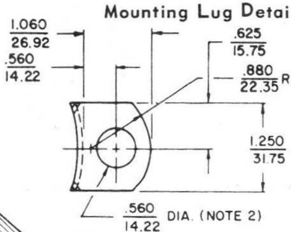
DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 22UP22.

Top View

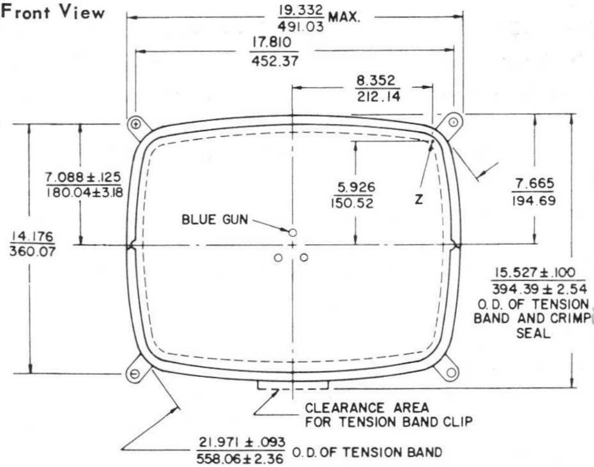


Mounting Lug Detail

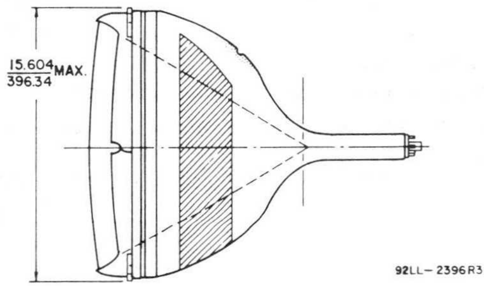


DIMENSIONAL OUTLINE (Cont'd)

Front View



Front Side View



Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise noted

Note 1: "Z" is located on the outside surface of the faceplate, on the screen diagonal at a point .125" beyond the minimum screen. This point is used as a reference for the mounting lugs.

Note 2: The tolerance of the mounting lug holes will accommodate mounting screws up to 0.375 in (9.5 mm) in diameter when positioned on the true hole centers.

Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts . . . . 600 ± 30 ma
Heater Warm-Up Time (Average) . . . . . . 11 seconds
Focusing Method . . . . Electrostatic
Deflection Method . . . . .Magnetic
Deflection Angles (Approx.):
  Diagonal. . . . . 92^{o}
  Horizontal. . . . . 80^{o}
  Vertical. . . . . 65^{o}
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes . . . 6 μμf
  Cathode to all other electrodes . . . . 5 μμf
  External conductive coating to ultor. . {2500 max. μμf; 1700 min. μμf}
Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

Optical:

Faceplate . . . . Filterglass
  Light transmission at center (Approx.). 78%
Phosphor (For Curves, see front of this Section). .P4—Sulfide Type Aluminized
  Fluorescence. . . . . White
  Phosphorescence . . . . White
    Persistence . . . . .Medium Short

Mechanical:

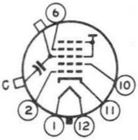
Tube Dimensions:
  Overall length. . . . . 18" ± 3/8"
  Greatest width. . . . . 20-1/2" + 1/16" - 1/8"
  Greatest height . . . . 16-1/2" ± 1/8"
  Diagonal. . . . . 23-25/64" + 3/32" - 1/8"
  Neck length . . . . 5-1/2" ± 3/16"
  Curvature of faceplate (Radii):
    Center. . . . . 50"
    Edge. . . . . 36-3/4"
Screen Dimensions (Minimum):
  Greatest width. 19-1/4"
  Greatest height . . . . 15-1/8"
  Diagonal. . . . . 22-5/16"
  Projected area. . . . . 282 sq. in.
Weight (Approx.). . . . . 25 lbs
Operating Position. . . . . Any
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Bulb. J187C1

23AHP4

Base. . . . . .Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, B6-203)

Basing Designation for BOTTOM VIEW. 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

GRID-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	22000 max. / 11000 min.	volts / volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2 VOLTAGE	550 max. / 200 min.	volts / volts
GRID-No.1 VOLTAGE:		
Negative-peak value	220 max.	volts
Negative-bias value	154 max.	volts
Positive-bias value	0 max.	volts
Positive-peak value	2 max.	volts
HEATER VOLTAGE.	6.9 max. / 5.7 min.	volts / volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period. . . .	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor voltage (E_{c_5k}) of	*18000*	*volts*
and grid-No.2 voltage (E_{c_2k}) of	*400*	*volts*
Grid-No.4 Voltage for focus●.	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster★	-36 to -94	volts
Field Strength of Adjustable Centering Magnet♦	0 to 11	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms

CATHODE-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	22000 max. / 11000 min.	volts / volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	700 max. / 350 min.	volts / volts
GRID-No.2-TO-CATHODE VOLTAGE	550 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value	220 max.	volts
Positive-bias value	154 max.	volts
Negative-bias value	0 max.	volts
Negative-peak value	2 max.	volts
HEATER VOLTAGE	6.9 max. / 5.7 min.	volts / volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage (Ec_5g_1) of	*18000*	*volts*
and grid-No.2-to-grid-No.1 voltage (Ec_2g_1) of	*400*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus●	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster★	36 to 78	volts
Field Strength of Adjustable Centering Magnet♦	0 to 11	gausses

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

● The grid-No.4 (or grid-No.4-to-grid-No.1) voltage required for optimum focus of any individual tube will have a value anywhere between 0 and 400 volts, is independent of ultor current and will remain essentially constant for values of ultor (or ultor-to-grid-No.1) voltage or grid-No.2 (or grid-No.2-to-grid-No.1) voltage within design-maximum ratings shown for these items.

★ See *Raster-Cutoff-Range Chart for Grid-Drive Service.*

♦ Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". The specified centering magnet compensates only for the effect which mechanical tube tolerances may have on the location of the undeflected focused spot with respect to the center of the tube face. Maximum field strength of adjustable centering magnet equals:

$$\sqrt{\frac{E_{c_5k} \text{ or } E_{c_5g_1} \text{ (volts)}}{16000 \text{ (volts)}}} \times 10 \text{ gausses}$$

The equipment manufacturer must determine and supply additional compensation for the effects of the earth's magnetic field and extraneous fields due to choice of circuitry and components. The additional compensation should preferably be applied as part of the magnetic field of the deflecting yoke.

♣ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

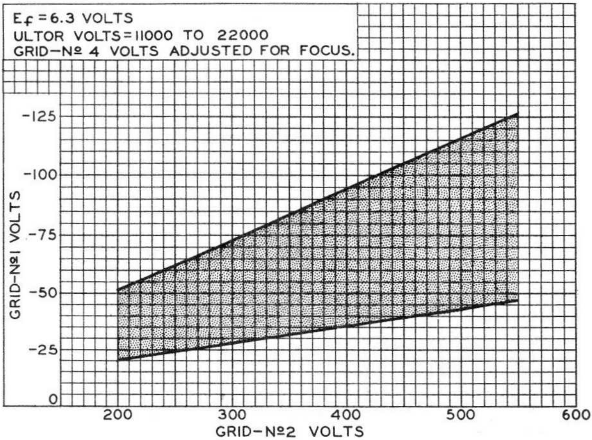
♠ See *Raster-Cutoff-Range Chart for Cathode-Drive Service*.

OPERATING CONSIDERATIONS

X-Ray Warning. When operated at ultor voltages up to 16 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 22 kilovolts (Design-maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture tube practice, it is recommended that the cabinet be provided with a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

RASTER-CUTOFF-RANGE CHARTS
Grid-Drive Service



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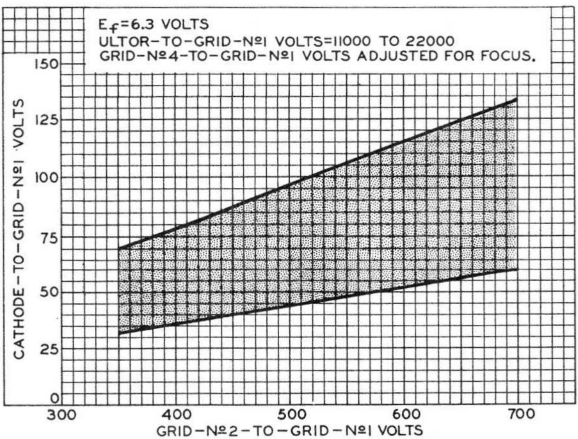
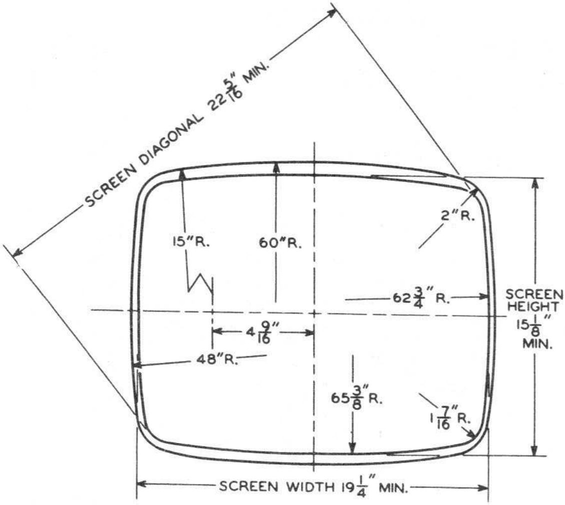
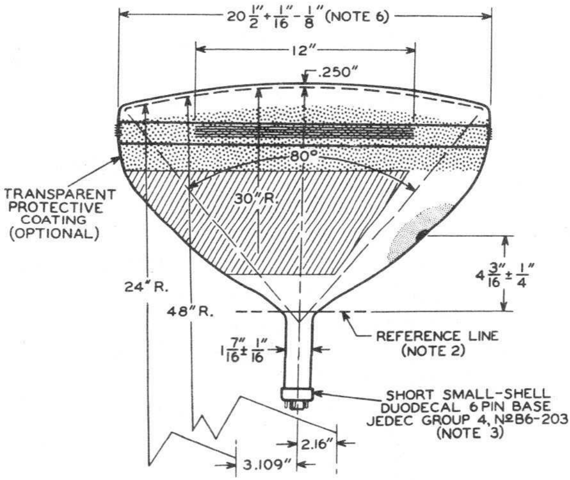
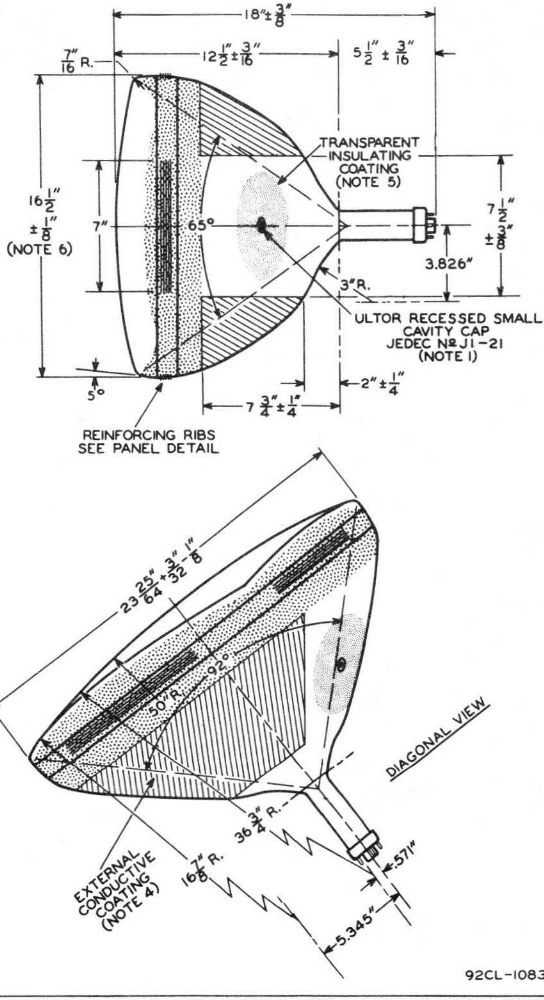
Cathode-Drive Service



92CS-10825


SCREEN DIAGONAL 22 5/16" MIN.
15"R.
60"R.
2"R.
62 3/4" R.
SCREEN HEIGHT 15 1/8" MIN.
4 9/16"
48"R.
65 3/8" R.
1 7/16" R.
SCREEN WIDTH 19 1/4" MIN.


20 1/2" + 1/16" - 1/8" (NOTE 6)
12"
.250"
80°
30"R.
TRANSPARENT PROTECTIVE COATING (OPTIONAL)
4 3/16" ± 1/4"
24"R.
48"R.
REFERENCE LINE (NOTE 2)
1 7/16" ± 1/16"
SHORT SMALL-SHELL DUODECAL 6 PIN BASE JEDEC GROUP 4, № B6-203 (NOTE 3)
2.16"
3.109"



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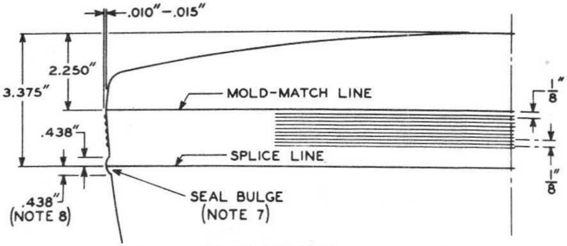


DETAIL OF PANEL

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm 30^{\circ}$. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No.G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 2-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

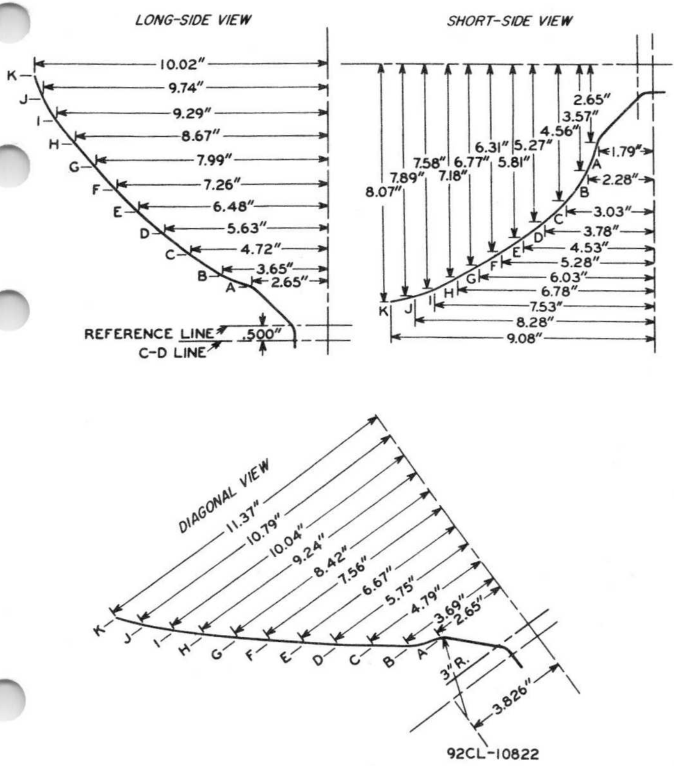
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: AREA BETWEEN MOLD-MATCH LINE AND SEAL BULGE IS 1/2" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

BULB-CONTOUR DIMENSIONS



NOTE: PLANES A THRU K ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE C-D LINE. THESE COORDINATES DESCRIBE THE BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.

Picture Tube

NO ION-TRAP MAGNET REQUIRED

LOW-VOLTAGE ELECTROSTATIC FOCUS 110° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances
- Cathode to all other electrodes . . . . 5 pF
- Grid No.1 to all other electrodes . . . . 6 pF
- External conductive coating to anode . . . . {2500 max pF / 1700 min pF}

Heater Current at 6.3 V . . . . 600 ± 30 mA

Heater Warm-up Time (Average) . . . . 11 s

Electron Gun . . . . Type Requiring No Ion-Trap Magnet

OPTICAL

Phosphor . . . . P4—Sulfide Type, Aluminized
- For curves, see front of this section

Faceplate . . . . Filterglass
- Light transmission (Approx.) 76%

MECHANICAL

Weight (Approx.) . . . . 25 lb

Overall Length . . . . 14.875 ± 0.281 in

Neck Length . . . . 5.125 ± 0.125 in

Projected Area of Screen . . . . 282 sq in

External Conductive Coating
- Type . . . . Regular-Band
- Contact area for grounding . . . . Near Reference Line

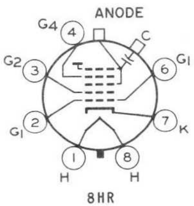
For Additional Information on Coatings and Dimensions
- See *Picture-Tube Dimensional-Outlines* and *Bulb J187 E* sheets at front of this section

Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)

Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	22000 max	V
	12000 min	V
Grid-No.4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage	550 max	V
	200 min	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	6.9 max	V
	5.7 min	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period	200 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16000	V
Grid-No.4 Voltage	0 to 400	V
Grid-No.2 Voltage	400	V
Cathode Voltage	43 to 78	V
For visual extinction of focused raster		

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

The 23ASP4 is the same as the 23AHP4 except for the following items:

Mechanical:

Tube Dimensions:

Overall length	17" ± 3/8"
Neck length.	4-1/2" ± 3/16"

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

The 23BDP4 is the same as the 23YP4 except for the following item:

Optical:

Surface of Protective Panel . . . . Treated to reduce specular reflection

23BGP4

Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS
BI-PANEL TYPE
NO ION-TRAP MAGNET REQUIRED

LOW-GRID-No.2 VOLTAGE
CATHODE-DRIVE TYPE
110° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:
- Cathode to all other electrodes . . . . 5 pf
- Grid No.1 to all other electrodes. . . . 6 pf
- External conductive coating to anode . . . 2500 max. pf / 1700 min. pf

Heater Current at 6.3 volts. . . . . 600 ± 30 ma
Heater Warm-up Time (Average). . . . . . 11 seconds
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

Optical:

Phosphor . . . . P4—Sulfide Type, Aluminized
(For Curves, see front of this Section)
Faceplate and Protective Panel . . . . .Filterglass
Light transmission (Approx.) 40%

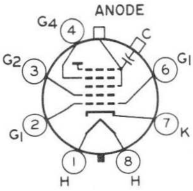
Mechanical:

Weight (Approx.) . . . . 33 lbs
Overall Length . . . . 15.188" ± .375"
Neck Length. . . . . 5.125" ± .125"
Projected Area of Screen . . . . 282 sq. in.
External Conductive Coating:
- Type . . . . Regular-Band
- Contact area for grounding . . . . .Near Reference Line

For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J187 A* sheets at front of this section

Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . .Small-Button Neoeightar 7-Pin Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	22000 max. / 12000 min.	volts / volts
Grid-No.4 (Focusing) Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	70 max. / 40 min.	volts / volts
Cathode Voltage:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	155 max.	volts
Positive peak value	220 max.	volts
Heater Voltage	6.9 max. / 5.7 min.	volts / volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	16000 max.	volts
Grid-No.4 Voltage	0 to 400	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster	32 to 50	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts . . . . 600 ± 30 ma
Heater Warm-Up Time (Average) . . . . . . 11 seconds
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes . . . 6 μμf
  Cathode to all other electrodes . . . . 5 μμf
  External conductive coating to ultor . {2500 max. μμf; 1700 min. μμf}
Electron Gun . . . . Type Requiring No Ion-Trap Magnet

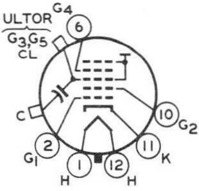
Optical:

Faceplate . . . . Filterglass
  Light transmission (Approx.) 78%
Phosphor (For curves, see front of this Section) . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position . . . . Any
Weight (Approx.) . . . . 25 lbs
Overall Length . . . . 18-1/8" ± 3/8"
Neck Length . . . . 5-5/8" ± 3/16"
Projected Area of Screen . . . . 282 sq. in.
External Conductive Coating:
  Type . . . . Regular Band
  Contact area for grounding . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
  See *Picture-Tube Dimensional-Outlines* and *Bulb J187 C/F* sheets at the front of this section
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)
  Basing Designation for BOTTOM VIEW 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	25000 max.	volts
	11000 min.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	1250 max.	volts
Negative value	450 max.	volts
GRID-No.2 TO-GRID-No.1 VOLTAGE	225 max.	volts
	40 min.	volts
GRID-No.2-TO-CATHODE VOLTAGE	70 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive peak value	220 max.	volts
Positive bias value	154 max.	volts
Negative bias value	0 max.	volts
Negative peak value	2 max.	volts
HEATER VOLTAGE	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid No.1 voltage of	*20000*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*50*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster	36 to 54	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

23BKP4

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
92° MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes . . .	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor. .	2500 max.	μμf
	1700 min.	μμf

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

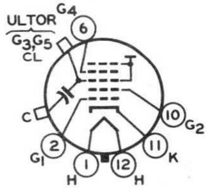
Optical:

Faceplate and Protective Panel. . . . . Filterglass
Light transmission (Approx.). 40%
Phosphor (For Curves, see front of this Section) . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position. . . . . Any
Weight (Approx.). 35 lbs
Overall Length. . . . . 18-7/16" ± 7/16"
Neck Length . . . . 5-5/8" ± 3/16"
Projected Area of Screen. . . . . 282 sq. in.
External Conductive Coating:
Type. . . . . .Regular Band
Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J187 D/G* sheets at the front of this section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . .Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)
Basing Designation for BOTTOM VIEW. 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3 Grid No.5, Collector)
C - External Conductive Coating

23BKP4

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	25000 max.	volts
	15000 min.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	225 max.	volts
	40 min.	volts
GRID-No.2-TO-CATHODE VOLTAGE	70 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive peak value	220 max.	volts
Positive bias value	154 max.	volts
Negative bias value	0 max.	volts
Negative peak value	2 max.	volts
HEATER VOLTAGE	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor-to-grid-No.1 voltage of	*20000*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*50*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster	36 to 54	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS **110° MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts.	450 ± 5%	ma
Heater Warm-Up Time (Average).	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes. . .	6	μμf
Cathode to all other electrodes. . . .	5	μμf
External conductive coating to ultor .	2500 max.	μμf
	2000 min.	μμf

Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

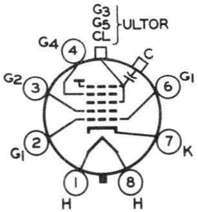
Optical:

Faceplate and Protective Panel . . . . .Filterglass
Light transmission (Approx.) 40%
Phosphor (For curves, see front of this Section) .P4—Sulfide Type, Aluminized

Mechanical:

Operating Position . . . . .Any
Weight (Approx.) . . . . 32-1/2 lbs
Overall Length . . . . 15-3/16" ± 3/8"
Neck Length. . . . . 5-1/8" ± 1/8"
Projected Area of Screen . . . . 282 sq. in.
External Conductive Coating:
Type . . . . Regular Band
Contact area for grounding . . . . .Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J187 A* sheets at the front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW 8HR

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



Cap – Ultor (Grid No.3, Grid No.5, Collector)
C – External Conductive Coating

23BQP4

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	23000 max.	volts
	12000 min.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	154 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	*16000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	-35 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

23BTP4

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **92° MAGNETIC DEFLECTION**

The 23BTP4 is the same as the 23YP4 except for the following item:

Maximum and Minimum Ratings, *Design-Maximum Values:*

Anode (Ultor) Voltage.	25000 max.	volts
	15000 min.	volts

23CBP4

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **110° MAGNETIC DEFLECTION**

The 23CBP4 is the same as the 23BQP4 except for the following item:

Optical:

Surface of Protective Panel. . . . . .Treated to reduce specular reflection

23CGP4

Picture Tube

CONTROLLED HEATER WARM-UP TIME

RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **92° MAGNETIC DEFLECTION**

The 23CGP4 is the same as the 23AHP4 except for the following item:

Electrical:

Heater Current at 6.3 volts. . . . . 450 ± 20 ma

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

DATA

General:

Heater, for Unipotential Cathode:

Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.6 ± 5%	amp
Warm-up time (Average)	11	sec

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	2500 max.	μμf
	2000 min.	μμf

Faceplate and Protective Panel . . . . Filterglass
Total light transmission (Approx.) 40%
Phosphor (For curves, see front of this section) . . . P4—Sulfide Type Aluminized
Fluorescence . . . . White
Phosphorescence . . . . White
Persistence . . . . Medium Short
Focusing Method . . . . Electrostatic
Deflection Method . . . . Magnetic
Deflection Angles (Approx.):
Diagonal . . . . 110°
Horizontal . . . . 99°
Vertical . . . . 82°
Electron Gun . . . . Type Requiring No Ion-Trap Magnet
Tube Dimensions:
Overall length . . . . 15-3/16" ± 3/8"
Greatest width . . . . 21-5/16" + 1/8" − 1/16"
Greatest height . . . . 17-5/16" + 1/8" − 1/16"
Diagonal . . . . 24-45/64" + 3/32" − 1/16"
Neck length . . . . 5-1/8" ± 1/8"

Radius of curvature of protective panel (External surface):

	Radius at center	*Radius at edge*
In plane of diagonal deflection	50-1/4"	See *Dimensional Outline*
In plane of horizontal deflection	50-1/4"	35-1/4"
In plane of vertical deflection	45-1/2"	35"

Radius of curvature of faceplate (Internal surface):

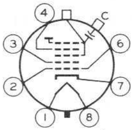
	Radius at center	*Radius at edge*
In plane of diagonal deflection	39-1/2"	31-1/2"
In plane of horizontal deflection	39-3/4"	26-1/2"

23CP4

	Radius at center	*Radius at edge*
In plane of vertical deflection.	36-3/4"	18-1/2"

Screen Dimensions (Minimum):
  Greatest width. .19-5/16"
  Greatest height . . . . 15-1/4"
  Diagonal. . . . . 22-5/16"
  Projected area. . . . . 282 sq. in.
Weight (Approx.). . . . . 33 lbs
Operating Position. . . . . Any
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Bulb. . . . . J187 Fitted with Protective Panel FP198
Base. . . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
  Basing Designation for BOTTOM VIEW. 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

GRID-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	20000	max.	volts
	12000•	min.	volts
GRID-No.4 (FOCUSING) VOLTAGE:			
Positive value.	1000	max.	volts
Negative value.	500	max.	volts
GRID-No.2 VOLTAGE	500	max.	volts
GRID-No.1 VOLTAGE:			
Negative-peak value	200	max.	volts
Negative-bias value	140	max.	volts
Positive-bias value	0	max.	volts
Positive-peak value	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds.	410	max.	volts
After equipment warm-up period. . . .	180	max.	volts
Heater positive with respect to cathode .	180	max.	volts

Equipment Design Ranges:

With any ultor voltage (E_{c_5k}) between 12000• and 20000 volts and grid-No.2 voltage (E_{c_2k}) between 200 and 500 volts

Grid-No.4 Voltage for focus★.	0 to 400	volts

Grid-No.1 Voltage (E_{c_1k}) for visual extinction of focused raster	*See Raster-Cutoff-Range Chart for Grid-Drive Service*	
Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak positive).	Same value as determined for E_{c_1k} except video drive is a positive voltage	
Grid-No.4 Current.	−25 to +25	μa
Grid-No.2 Current.	−15 to +15	μa
Field Strength of Adjustable Centering Magnet♦	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	*18000*	*volts*
and grid-No. 2 voltage of	*400*	*volts*
Grid-No.4 Voltage for focus★	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	−44 to −94	volts
Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value.	44 to 94	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance . . . . 1.5 max. megohms

CATHODE-DRIVE♣ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	20000	max.	volts
	12000•	min.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:			
Positive value	1000	max.	volts
Negative value	500	max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	640	max.	volts
GRID-No.2-TO-CATHODE VOLTAGE	500	max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:			
Positive-peak value.	200	max.	volts
Positive-bias value.	140	max.	volts
Negative-bias value.	0	max.	volts
Negative-peak value.	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	410	max.	volts

After equipment warm-up period.	180	max.	volts
Heater positive with respect to cathode. .	180	max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No. 1 voltage ($E_{c_5g_1}$) between 12000● and 20000 volts and grid-No. 2-to-grid-No. 1 voltage ($E_{c_2g_1}$) between 225 and 640 volts

Grid-No.4-to-Grid-No.1 Voltage for focus★.	0 to 400	volts
Cathode-to-Grid-No.1 Voltage (E_{kg_1}) for visual extinction of focused raster.	*See Raster-Cutoff-Range Chart for Cathode-Drive Service*	
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak negative)	Same value as determined for E_{kg_1} except video drive is a negative voltage	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet♦	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No. 1 voltage of	*18000*	*volts*
and grid-No. 2-to-grid-No. 1 voltage of	*400*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus★.	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster.	42 to 78	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value	-42 to -78	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms

▲ Grid drive is the operating condition in which the video signal varies the grid-No. 1 potential with respect to cathode.

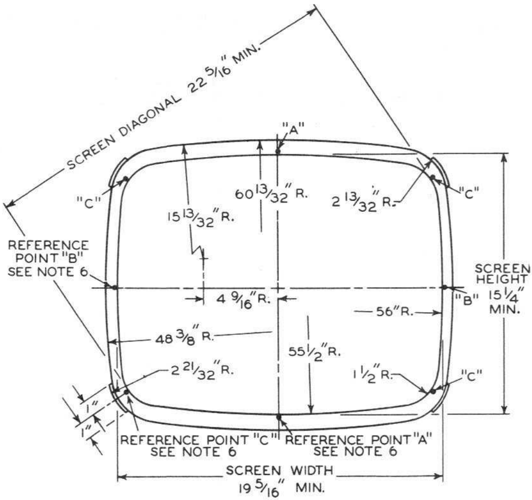
● This value is a working design-center minimum. The equivalent ***absolute minimum*** ultor (or ultor-to-grid-No. 1) voltage is 11,000 volts below which the serviceability of the 23CP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor (or ultor-to-grid-No. 1) voltage is never less than 11,000 volts.

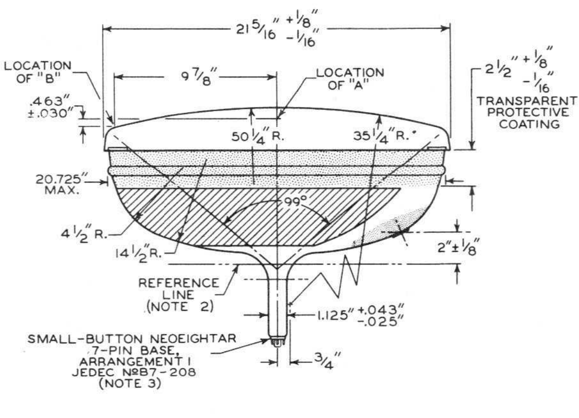
★ The grid-No. 4 (or grid-No. 4-to-grid-No. 1) voltage required for optimum focus of any individual tube may have a value anywhere between 0 and 400 volts; is independent of ultor current; and will remain essentially constant for values of ultor (or ultor-to-grid-No. 1) voltage, or grid-No. 2 (or grid-No. 2-to-grid-No. 1) voltage, within design ranges shown for these items.

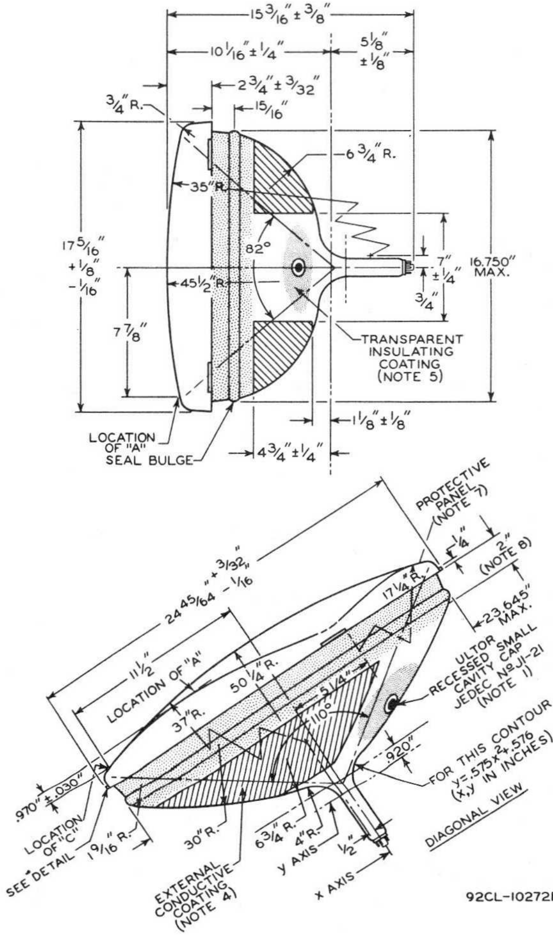
♦ Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 3/8-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

♣ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section


SCREEN DIAGONAL 22 5/16" MIN.
"A"
"C"
60 13/32" R.
2 13/32" R.
15 13/32" R.
REFERENCE POINT "B" SEE NOTE 6
4 9/16" R.
56" R.
"B"
SCREEN HEIGHT 15 1/4" MIN.
48 3/8" R.
55 1/2" R.
2 21/32" R.
1 1/2" R.
1"
1"
REFERENCE POINT "C" SEE NOTE 6
REFERENCE POINT "A" SEE NOTE 6
SCREEN WIDTH 19 5/16" MIN.


21 5/16" +1/8" -1/16"
LOCATION OF "B"
9 7/8"
LOCATION OF "A"
2 1/2" +1/8" -1/16"
.463" ±.030"
TRANSPARENT PROTECTIVE COATING
50 1/4" R.
35 1/4" R.
20.725" MAX.
99°
4 1/2" R.
14 1/2" R.
2" ± 1/8"
REFERENCE LINE (NOTE 2)
1.125" +.043" -.025"
SMALL-BUTTON NEOEIGHTAR 7-PIN BASE, ARRANGEMENT 1 JEDEC No B7-208 (NOTE 3)
3/4"



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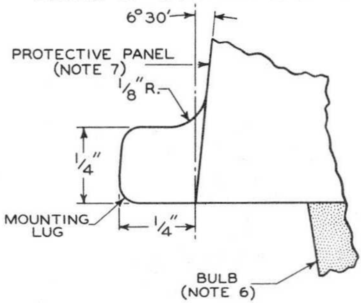
DETAIL OF MOUNTING LUG



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS OF THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

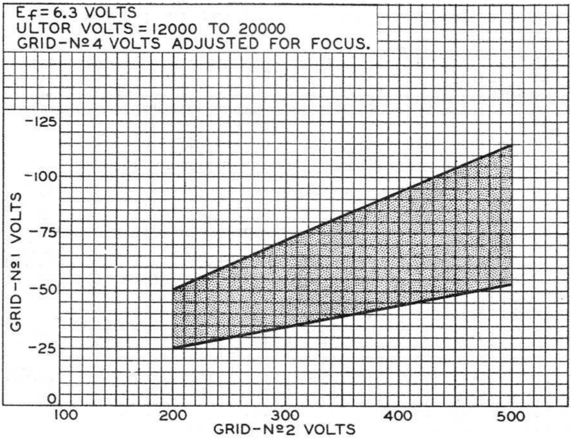
NOTE 6: REFERENCE POINTS A, B, AND C ARE PROVIDED FOR USE IN DESIGN OF A MASK CONTOURED FOR CLOSE FIT TO THE PROTECTIVE PANEL.

NOTE 7: THE CENTER OF THE PROTECTIVE PANEL MAY BE ECCENTRIC WITH RESPECT TO THE AXIS OF THE TUBE ENVELOPE. ASSOCIATED SHIFT OF THE PROTECTIVE PANEL ALONG ITS MINOR AND/OR MAJOR AXIS WILL NOT EXCEED 1/16".

NOTE 8: KEEP THIS CIRCUMFERENTIAL AREA FREE OF MOUNTING HARDWARE.

NOTE 9: ADEQUATE TUBE SUPPORT IS OBTAINED BY CLAMPING TO THE MOUNTING LUGS PROVIDED AT EACH CORNER OF THE PROTECTIVE PANEL. TUBE MOUNTING AND YOKE SUPPORT CLAMPS MUST BE SPACED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

RASTER-CUTOFF-RANGE CHARTS
Grid-Drive Service



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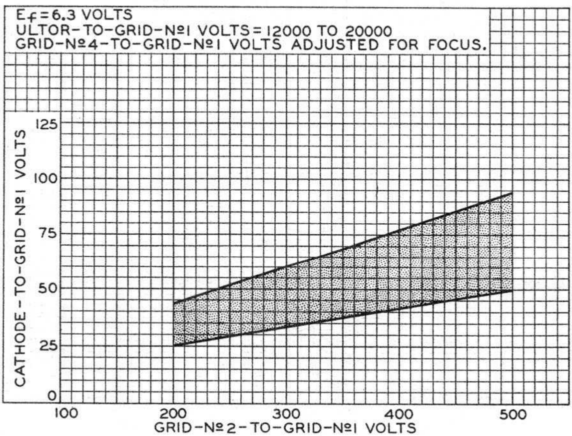
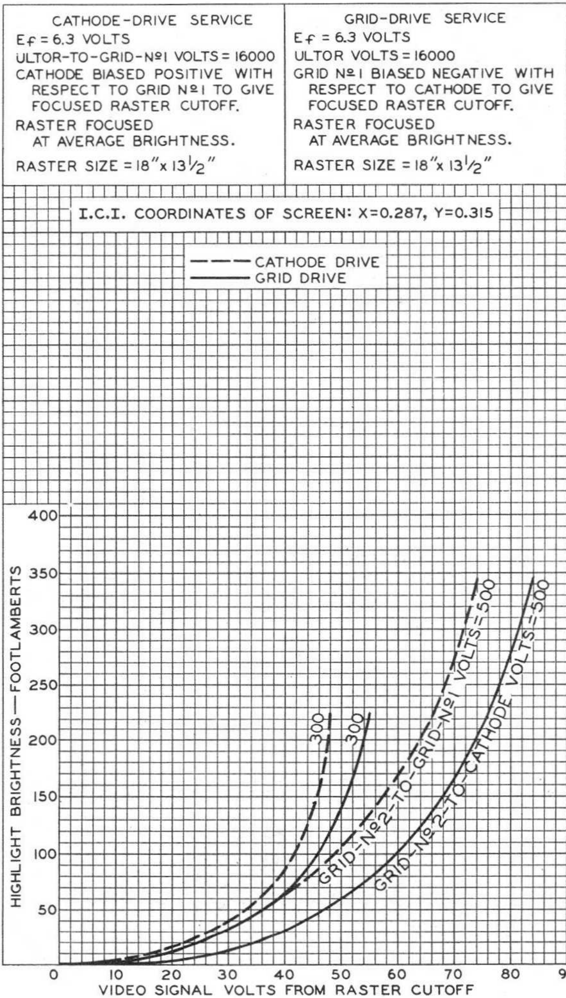
Cathode-Drive Service

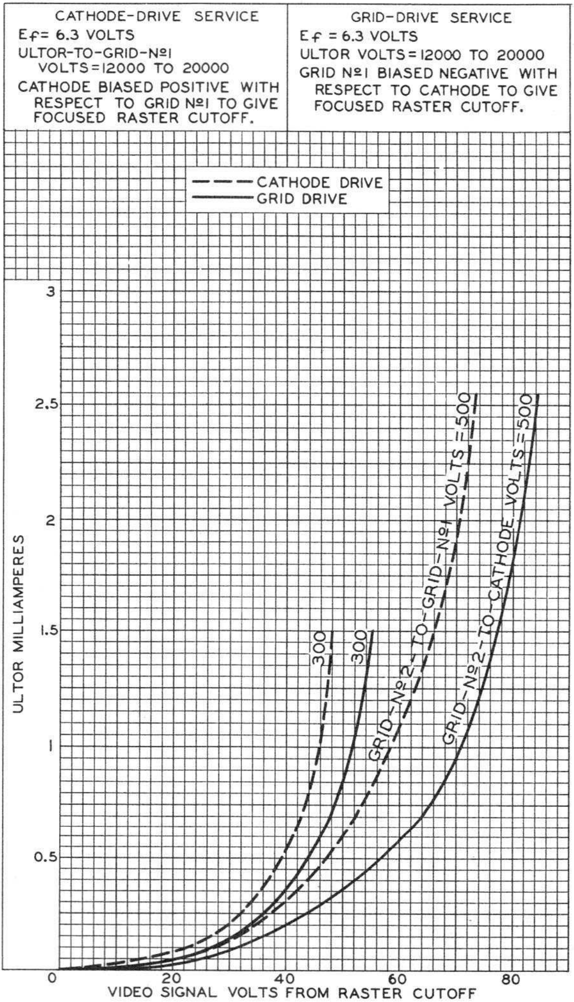


92CS-10313

AVERAGE DRIVE CHARACTERISTICS



AVERAGE DRIVE CHARACTERISTICS



92CM-10317

Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS

NO ION-TRAP MAGNET REQUIRED — 114° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode. . .	2500 max.	pf
	1700 min.	pf
Heater Current at 6.3 volts	450 ± 20	ma
Heater Warm-Up Time (Average)	11	seconds

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

Optical:

Phosphor. . . . . .P4—Sulfide Type, Aluminized
(For Curves, see front of this Section)

Faceplate and Protective Window . . . . Filterglass
Light transmission (Approx.). 78%

Mechanical:

Weight (Approx.). 24 lbs
Overall Length. . . . . 13.781" ± .281"
Neck Length . . . . 4.375" ± .125"
Projected Area of Screen. . . . . 282 sq. in.
External Conductive Coating:
Type. . . . . .Regular-Band
Contact area for grounding. . . . . Near Reference Line

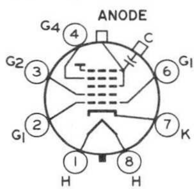
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J187B* sheets at front of this section.

Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)

Base. . . . . Small-Button Neoeightar 7-Pin Arrangement 1,(JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW. 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	23500 max. / 11000 min.	volts / volts
Grid-No.4 (Focusing) Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	550 max. / 200 min.	volts / volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	6.9 max. / 5.7 min.	volts / volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	14000	volts
Grid-No.4 Voltage	0 to 400	volts
Grid-No.2 Voltage	400	volts
Cathode Voltage for visual extinction of focused raster	36 to 78	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

23DAP4

Picture Tube

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 94° MAGNETIC DEFLECTION

Low-Grid-No.2-Voltage Type
for Cathode-Drive Operation

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode	2500 max.	pf
	1700 min.	pf
Heater Current at 6.3 volts	600 ± 30	ma
Heater Warm-Up Time (Average)	11	seconds

Electron Gun . . . . Type Requiring No Ion-Trap Magnet

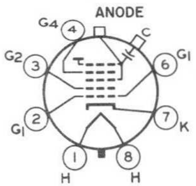
Optical:

Phosphor (For curves, see front of this section) . . . P4--Sulfide Type, Aluminized
Faceplate . . . . Filterglass
Light transmission (Approx.) 78%

Mechanical:

Weight (Approx.) . . . . 27 lbs
Overall Length . . . . 17-5/64" ± 5/16"
Neck Length . . . . 5" ± 1/8"
Projected Area of Screen . . . . 282 sq. in.
External Conductive Coating:
Type . . . . Regular-Band
Contact area for grounding . . . . Near Reference Line
For Additional Information on Coatings, Dimensions, and Deflection Angles:
See *Picture-Tube Dimensional-Outlines and Bulb J187 H1* sheets at the front of this section.
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to grid No.1

ANODE VOLTAGE	23000 max.	volts
	10000 min.	volts
GRID-No.4 VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	70 max.	volts
	40 min.	volts
CATHODE VOLTAGE:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	100 max.	volts
Positive peak value	150 max.	volts
HEATER VOLTAGE	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	18000	volts
Grid-No.4 Voltage[a]	100	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster	35 to 55	volts
Field Strength of required adjustable Centering Magnet	0 to 12	gausses

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

[a] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between -100 and +300 volts.

Picture Tube

LOW-VOLTAGE ELECTROSTATIC FOCUS
NO ION-TRAP MAGNET REQUIRED — ALUMINIZED SCREEN
RECTANGULAR GLASS TYPE — 110° MAGNETIC DEFLECTION
Low-Grid-No.2-Voltage—for Cathode-Drive Operation

Electrical:

Direct Interelectrode Capacitances:		
Cathode to all other electrodes. . . .	5	pf
Grid No.1 to all other electrodes. . .	6	pf
External conductive coating to anode. .	2500 max.	pf
	2000 min.	pf
Heater Current at 6.3 volts.	600 ± 30	ma
Heater Warm-Up Time (Average).	11	seconds
Electron Gun	Type Requiring No Ion-Trap Magnet	

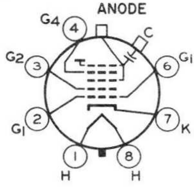
Optical:

Phosphor (For curves, see front of this Section) . P4—Sulfide Type, Aluminized
Faceplate. . . . . Filterglass
Light transmission (Approx.) 75%

Mechanical:

Weight (Approx.) . . . . 25 lbs
Overall length . . . . 14.875" ± .281"
Neck length. . . . . 5.125" ± .125"
Projected Area of Screen . . . . 282 sq.in.
External Conductive Coating:
Type . . . . Regular-Band
Contact area for grounding . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See Picture-Tube *Dimensional-Outlines* and *Bulb J187 E* at front on this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208) or (JEDEC No. B7-237)
Basing Designation for BOTTOM VIEW 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



23DBP4

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to Grid No.1

Anode Voltage	22000 max. / 15000 min.	volts / volts
Grid-No.4 (Focusing) Voltage:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
Grid-No.2 Voltage	250 max.	volts
Grid-No.2 to Cathode Voltage	100 max. / 40 min.	volts / volts
Cathode Voltage:		
Positive peak value	220 max.	volts
Positive bias value	155 max.	volts
Negative bias value	0 max.	volts
Negative peak value	2 max.	volts
Heater Voltage	6.9 max. / 5.7 min.	volts / volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	18000	volts
Grid-No.4 Voltage	250	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster	34 to 52	volts

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front on this Section

23EKP4

Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 92° MAGNETIC DEFLECTION
NO ION-TRAP MAGNET REQUIRED

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes. . . .	5	pf
Grid No.1 to all other electrodes. . .	6	pf
External conductive coating to anode[a] .	2500 max.	pf
	1700 min.	pf
Heater Current at 6.3 volts.	450 ± 20	ma
Heater Warm-Up Time (Average).	11	seconds

Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

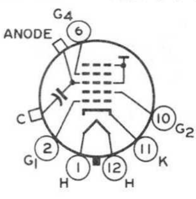
Optical:

Phosphor (For curves, see front of this Section) .P4--Sulfide Type, Aluminized
Faceplate. . . . . .Filterglass
Light transmission at center (Approx.) 42%

Mechanical:

Weight (Approx.) . . . . 29 lbs
Overall Length . . . . 18.000" ± .375"
Neck Length. . . . . 5.500" ± .188"
Projected Area of Screen . . . . 282 sq. in.
External Conductive Coating:
Type . . . . Regular-Band
Contact area for grounding . . . . .Near Reference Line
For Additional Information on Coatings, Dimensions, and Deflection Angles:
See *Picture-Tube Dimensional-Outlines and Bulb J187 J* sheets at the front of this section.
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . .Short Small-Shell Duodecal 6-Pin, (JEDEC Group 4, No. B6-203)
Basing Designation for BOTTOM VIEW 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Anode, (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

23EKP4

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	25000 max.	volts
	11000 min.	volts
Grid-No.4 Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	550 max.	volts
	200 min.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	20000	volts
Grid-No.4 Voltage[b]	200	volts
Grid-No.2 Voltage	400	volts
Cathode Voltage for visual extinction of focused raster	36 to 78	volts
Field Strength of required adjustable Centering Magnet	0 to 12	gauss

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front on this Section

23ENP4

Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 92° MAGNETIC DEFLECTION
NO ION-TRAP MAGNET REQUIRED

Low-Grid-No.2-Voltage—for Cathode-Drive Operation

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes. . . .	5	pf
Grid No.1 to all other electrodes. . .	6	pf
External conductive coating to anode[a] .	2500 max.	pf
	1700 min.	pf
Heater Current at 6.3 volts.	600 ± 30	ma
Heater Warm-up Time (Average).	11	seconds

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

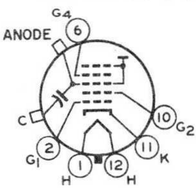
Optical:

Phosphor (For curves, see front of this section) . . P4-Sulfide Type, Aluminized
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 42%

Mechanical:

Weight (Approx.). . . . . 29 lbs
Overall Length. . . . . 18.125" ± .375"
Neck Length . . . . 5.625" ± .125"
Projected Area of Screen. . . . . 282 sq. in.
External Conductive Coating:
Type. . . . . Regular-Band
Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings, Dimensions, and Deflection Angles:
See *Picture-Tube Dimensional-Outlines and Bulb J187 J* sheets at the front of this section.
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . Short Small-Shell Duodecal 6-Pin, (JEDEC Group 4, No. B6-203)
Basing Designation for BOTTOM VIEW. 12L

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 6 – Grid No.4
Pin 10 – Grid No.2
Pin 11 – Cathode
Pin 12 – Heater



Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	25000 max.	volts
	11000 min.	volts
Grid-No.4 Voltage:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
Grid-No.2 Voltage	70 max.	volts
	40 min.	volts
Cathode Voltage:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	100 max.	volts
Positive peak value	150 max.	volts
Heater Voltage	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	20000	volts
Grid-No.4 Voltage[b]	200	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster	36 to 54	volts
Field Strength of required adjustable Centering Magnet	0 to 12	gauss

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW GRID-No.2 VOLTAGE

ALUMINIZED SCREEN
MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

DATA

General:

Heater, for Unipotential Cathode:
  Voltage (AC or DC) . . . . 6.3 ± 10% volts
  Current at 6.3 volts . . . . 0.6 amp
  Warm-up time (Average) . . . . 11 sec
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes. . . . 6 μμf
  Cathode to all other electrodes. . . . . 5 μμf
  External conductive coating to ultor . . {2500 max. μμf / 1700 min. μμf}
Faceplate and Protective Panel . . . . .Filterglass
  Total light transmission (Approx.) 40%
Phosphor (For curves, see front of this Section) . . .P4—Sulfide Type Aluminized
  Fluorescence . . . . .White
  Phosphorescence. . . . . .White
    Persistence. Medium Short
Focusing Method. .Electrostatic
Deflection Method. . . . . Magnetic
Deflection Angles (Approx.):
  Diagonal . . . . 110°
  Horizontal . . . . 99°
  Vertical . . . . 82°
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet
Tube Dimensions:
  Overall length . . . . 15-3/16" ± 3/8"
  Greatest width . . . . 21-5/16" + 1/8" - 1/16"
  Greatest height. . . . . 17-5/16" + 1/8" - 1/16"
  Diagonal . . . . 24-45/64" + 3/32" - 1/16"
  Neck length. . . . . 5-1/8" ± 1/8"
  Radius of curvature of protective panel (External surface):

	Radius at center	*Radius at edge*
In plane of diagonal deflection	50-1/4"	See *Dimensional Outline*
In plane of horizontal deflection. . . .	50-1/4"	35-1/4"
In plane of vertical deflection	45-1/2"	35"

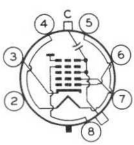
  Radius of curvature of faceplate (Internal surface):

	Radius at center	*Radius at edge*
In plane of diagonal deflection	39-1/2"	31-1/2"

	Radius at center	*Radius at edge*
In plane of horizontal deflection . . .	39-3/4"	26-1/2"
In plane of vertical deflection.	36-3/4"	18-1/2"

Screen Dimensions (Minimum):
Greatest width. . . . . 19-5/16"
Greatest height . . . . 15-1/4"
Diagonal. 22-5/16"
Projected area. . . . . 282 sq. in.
Weight (Approx.). . . . . 33 lbs
Operating Position. Any
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Bulb. . . . . J187 Fitted with Protective Panel FP198
Base. . . . . . Small-Button Neoeightar 7-Pin Arrangement 2, (JEDEC No.B7-219)
Basing Designation for BOTTOM VIEW. 8KP

Pin 2 - Internal Connection— Do Not Use
Pin 3 - Cathode
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Grid No.1
Pin 7 - Grid No.2



Pin 8 - Grid No.4
Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

CATHODE-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, *Design-Center Values:*

ULTOR-TO-GRID-No.1 VOLTAGE.	20000	max.	volts
	12000•	min.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:			
Positive value.	1000	max.	volts
Negative value.	500	max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	64	max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:			
Positive-peak value	200	max.	volts
Positive-bias value	140	max.	volts
Negative-bias value	0	max.	volts
Negative-peak value	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds.	410	max.	volts
After equipment warm-up period. . . .	180	max.	volts
Heater positive with respect to cathode.	180	max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No. 1 voltage (Ec_5g_1) between 12000● and 20000 volts and grid-No. 2-to-grid No. 1 voltage (Ec_2g_1) between 40 and 64 volts

Grid-No. 4-to-Grid-No. 1 Voltage for focus★	0 to 400	volts
Cathode-to-Grid-No. 1 Voltage (Ek_{g_1}) for visual extinction of focused raster	See Raster-Cutoff-Range Chart	
Cathode-to-Grid-No. 1 Video Drive from Raster Cutoff (Black level): White-level value (Peak negative).	Same value as determined for Ek_{g1} except video drive is a negative voltage	
Grid-No. 4 Current.	−25 to +25	μa
Grid-No. 2 Current.	−15 to +15	μa
Field Strength of Adjustable Centering Magnet♦.	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No. 1 voltage of	*16000*	*18000*	*volts*
and grid-No. 2-to-grid-No. 1 voltage of	*50*	*50*	*volts*
Grid-No. 4-to-Grid-No. 1 Voltage for focus★	0 to 400	0 to 400	volts
Cathode-to-Grid-No. 1 Voltage for visual extinction of focused raster	32 to 47	34 to 49	volts
Cathode-to-Grid-No. 1 Video Drive from Raster Cutoff (Black level): White-level value.	−32 to −47	−34 to −49	volts

Maximum Circuit Values:

Grid-No. 1-Circuit Resistance . . . . 1.5 max. megohms

▲ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No. 1 and the other electrodes.

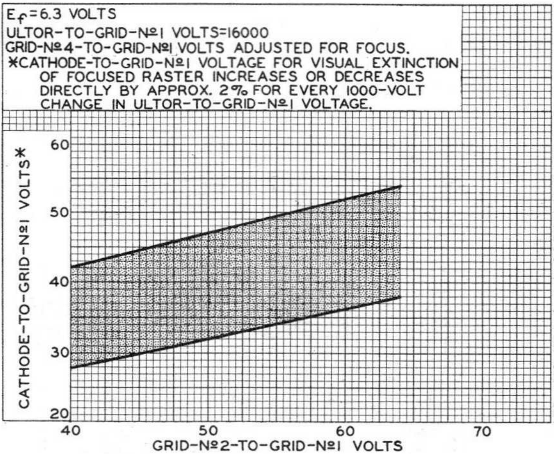
● This value is a working design-center minimum. The equivalent *absolute minimum* ultor-to-grid-No. 1 voltage is 11,000 volts below which the serviceability of the 23EP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor-to-grid-No. 1 voltage is never less than 11,000 volts.

★ The grid-No. 4-to-grid-No. 1 voltage required for focus of any individual tube may have a value anywhere between 0 and 400 volts.

♦ Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 3/8-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

For X-ray shielding considerations, see sheet
X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this Section

RASTER-CUTOFF-RANGE CHART
Cathode-Drive Service



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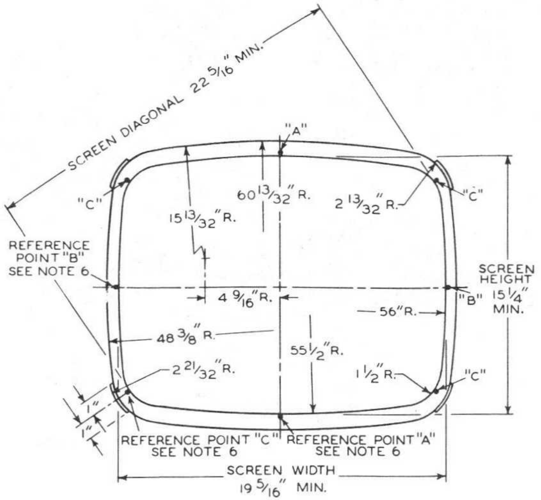
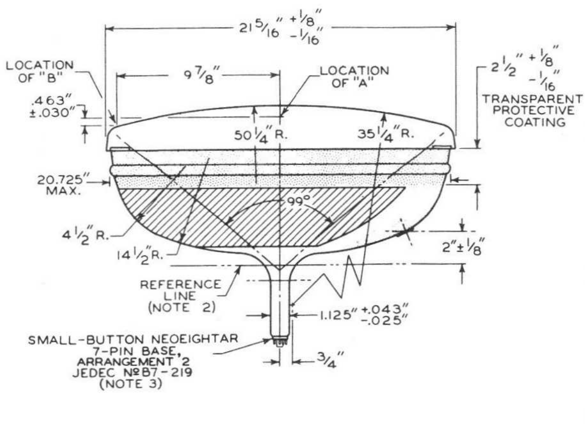
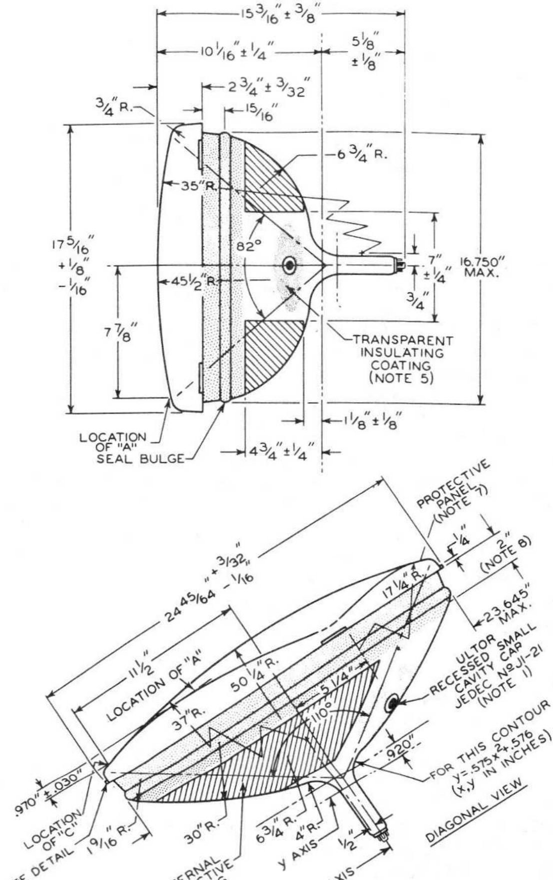

SCREEN DIAGONAL 22 5/16" MIN.
"A"
"C"
60 13/32" R.
2 13/32" R.
15 13/32" R.
REFERENCE POINT "B" SEE NOTE 6
SCREEN HEIGHT 15 1/4" MIN.
4 9/16" R.
"B"
56" R.
48 3/8" R.
55 1/2" R.
2 21/32" R.
1 1/2" R.
1"
1"
REFERENCE POINT "C" SEE NOTE 6
REFERENCE POINT "A" SEE NOTE 6
SCREEN WIDTH 19 5/16" MIN.


21 5/16" +1/8" -1/16"
LOCATION OF "B"
9 7/8"
LOCATION OF "A"
2 1/2" +1/8" -1/16"
TRANSPARENT PROTECTIVE COATING
.463" ±.030"
50 1/4" R.
35 1/4" R.
20.725" MAX.
99°
4 1/2" R.
14 1/2" R.
2" ± 1/8"
REFERENCE LINE (NOTE 2)
1.125" +.043" -.025"
SMALL-BUTTON NEOEIGHTAR 7-PIN BASE, ARRANGEMENT 2 JEDEC № B7-219 (NOTE 3)
3/4"



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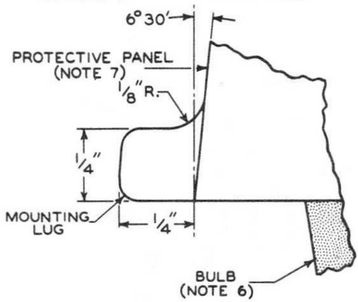
DETAIL OF MOUNTING LUG



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 8 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 8.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS OF THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

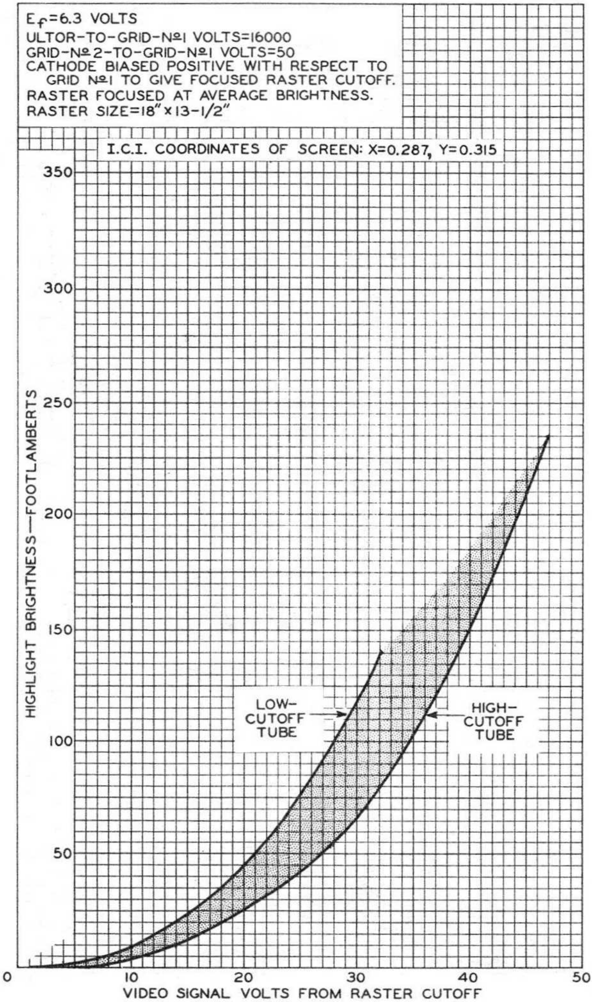
NOTE 6: REFERENCE POINTS A, B, AND C ARE PROVIDED FOR USE IN DESIGN OF A MASK CONTOURED FOR CLOSE FIT TO THE PROTECTIVE PANEL.

NOTE 7: THE CENTER OF THE PROTECTIVE PANEL MAY BE ECCENTRIC WITH RESPECT TO THE AXIS OF THE TUBE ENVELOPE. ASSOCIATED SHIFT OF THE PROTECTIVE PANEL ALONG ITS MINOR AND/OR MAJOR AXIS WILL NOT EXCEED 1/16".

NOTE 8: KEEP THIS CIRCUMFERENTIAL AREA FREE OF MOUNTING HARDWARE.

NOTE 9: ADEQUATE TUBE SUPPORT IS OBTAINED BY CLAMPING TO THE MOUNTING LUGS PROVIDED AT EACH CORNER OF THE PROTECTIVE PANEL. TUBE MOUNTING AND YOKE SUPPORT CLAMPS MUST BE SPACED FROM THE TUBE BY USE OF CUSHIONING PADS MADE OF MATERIAL SUCH AS ASPHALT-IMPREGNATED FELT, OR EQUIVALENT.

CATHODE-DRIVE CHARACTERISTICS



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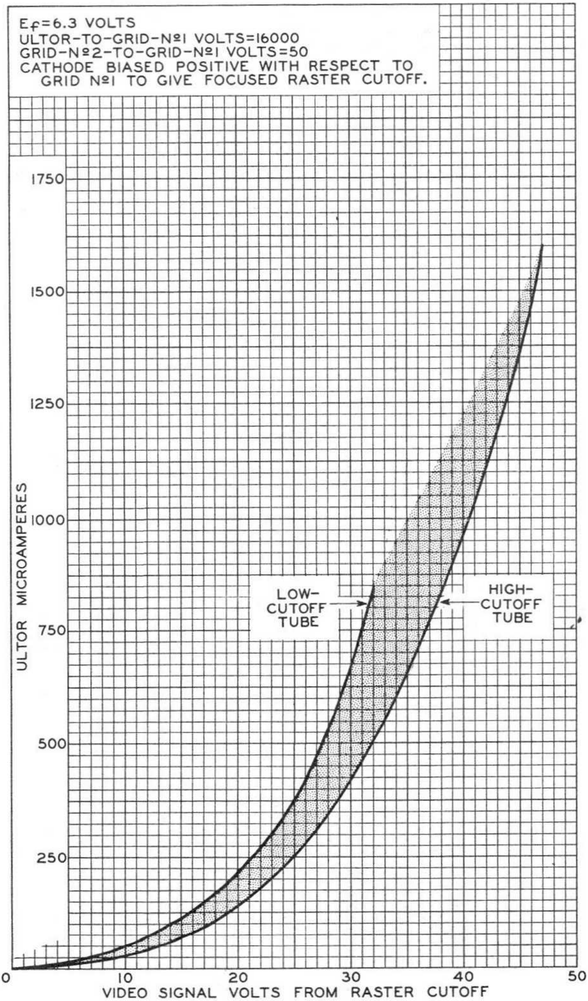
CATHODE-DRIVE CHARACTERISTICS



Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands Around Periphery of Tube Panel— No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS **114° MAGNETIC DEFLECTION**
NO ION-TRAP MAGNET REQUIRED

Electrical:

Direct Interelectrode Capacitances:		
Cathode to all other electrodes.	5	pf
Grid No.1 to all other electrodes	6	pf
External conductive coating to anode[a] . .	2500 max.	pf
	1700 min.	pf
Heater Current at 6.3 volts	450 ± 20	ma
Heater Warm-Up Time (Average).	11	seconds
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Phosphor (For curves, see front of this section) . .	P4—Sulfide Type, Aluminized
Faceplate.	Filterglass
Light Transmission (Approx.)	42%

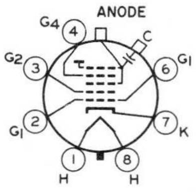
Mechanical:

Weight (Approx.)	28 lbs
Overall Length	14.531" ± 0.281"
Neck Length.	5.125" ± .125"
Projected Area of Screen	282 sq. in.
External Conductive Coating:	
Type	Regular-Band
Contact area for grounding.	Near Reference Line

For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J187L sheets* at front of this section

Cap.	Recessed Small Cavity (JEDEC No.J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW	8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	23000 max. / 11000 min.	volts / volts
Grid-No.4 (Focusing) Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	550 max. / 200 min.	volts / volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	6.9 max. / 5.7 min.	volts / volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	18000	volts
Grid-No.4 Voltage[b]	200	volts
Grid-No.2 Voltage	300	volts
Cathode Voltage for visual extinction of focused raster	28 to 62	volts
Field Strength of required adjustable centering magnet	0 to 12	gauss

Maximum Circuit Values:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

[a] External conductive coating and implosion protection hardware must be grounded.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 and video-signal-voltage adjusted to give a 200-microampere anode current.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands Around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

LOW-VOLTAGE ELECTROSTATIC FOCUS 114° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes . . .	5	pF
Grid No.1 to all other electrodes. . .	6	pF
External conductive coating to anode. .	1700 min—2500 max	pF
Heater Current at 6.3 volts	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

OPTICAL

Phosphor. . . . . .P4—Sulfide Type, Aluminized

For curves, see front of this section

Faceplate . . . . Filterglass

Light Transmission (Approx.). 42%

MECHANICAL

Weight (Approx.). . . . . 28 lb

Overall Length. . . . . 14.531 ± 0.281 in

Neck Length . . . . 5.125 ± .125 in

Projected Area of Screen. . . . . 282 sq in

External Conductive Coating[a]

Type. . . . . Modified-Band

Contact area for grounding. . . . . Near Reference Line

For Additional Information on Coatings and Dimensions

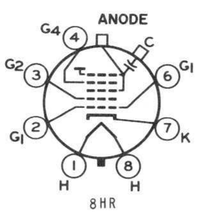
See *Picture-Tube Dimensional-Outlines* and *Bulb J187L* sheets at front of this section

Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)

Base. . . . . .Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



←Indicates a change.

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	11000 min—23000 max	V
Grid-No.4 (Focusing) Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	18000	V
Grid-No.4 Voltage[b]	200	V
Grid-No.2 Voltage	300	V
Cathode Voltage for visual extinction of focused raster	28 to 62	V
Field Strength of required adjustable centering magnet	0 to 12	G

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] External conductive coating and implosion protection hardware must be grounded.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 and video-signal-voltage adjusted to give a 200-microampere anode current.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

PAN-O-PLY TYPE

114° MAGNETIC DEFLECTION — LOW GRID-No.2 VOLTAGE

The 23ERP4 is the same as the 23EQP4 except for the following items:

ELECTRICAL

Heater Current at 6.3 V. . . . . 600 ± 30 mA

MECHANICAL

External Conductive Coating
  Type (See CRT OUTLINES 1 at front of this section) . . Regular-Band
  Contact area for grounding . . . . . . Near Reference Line

Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 110° MAGNETIC DEFLECTION
NO ION-TRAP MAGNET REQUIRED

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes. . . .	5	pf
Grid No.1 to all other electrodes. . .	6	pf
External conductive coating to anode[a] .	2500 max.	pf
	1700 min.	pf
Heater Current at 6.3 volts.	600 ± 30	ma
Heater Warm-Up Time (Average).	11	seconds

Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

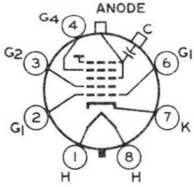
Optical:

Phosphor (For curves, see front of this section). .P4--Sulfide Type, Aluminized
Faceplate. . . . . .Filterglass
Light Transmission at center (Approx.) 42%

Mechanical:

Weight (Approx.) . . . . 28 lbs
Overall length . . . . 14.875" ± .281"
Neck length. . . . . 5.125" ± .125"
Projected Area of Screen . . . . 282 sq. in.
External Conductive Coating:
Type . . . . Regular-Band
Contact area for grounding . . . . .Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J187 K* sheets at front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External conductive Coating



Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	23000 max. / 11000 min.	volts / volts
Grid-No.4 Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
Grid-No.2 Voltage	550 max. / 200 min.	volts / volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	6.9 max. / 5.7 min.	volts / volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC Voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	18000	volts
Grid-No.4 Voltage[b]	200	volts
Grid-No.2 Voltage	300	volts
Cathode Voltage for visual extinction of focused raster	28 to 62	volts
Field Strength of required adjustable Centering Magnet	0 to 12	gauss

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and + 400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

PAN-O-PLY TYPE WITH MOUNTING LUGS

94° MAGNETIC DEFLECTION — LOW-GRID-No.2 VOLTAGE

LOW-VOLTAGE ELECTROSTATIC FOCUS — CATHODE-DRIVE TYPE

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode	1700 min—2500 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section

Faceplate . . . . Filterglass
Light transmission at center (approx.) 42%

MECHANICAL

Weight (Approx.)	30	lb
Overall Length	17.080 ± .312	in
Neck Length	5.000 ± .125	in
Projected Area of Screen	282	sq in

External Conductive Coating[a]
Type . . . . Regular-Band
Contact area for grounding . . . . Near Reference Line

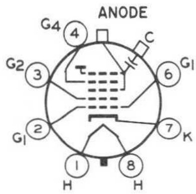
For Additional Information on Coatings and Dimensions
See *Picture-Tube Dimensional-Outlines* and *Bulb J187M* sheets at front of this section

Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)

Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



8HR

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to Grid No.1

Anode Voltage	11000 min—23500 max	V
Grid-No.4 Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage	20 min—70 max	V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V
Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	18000	V
Grid-No.4 Voltage[b]	200	V
Grid-No.2 Voltage	50	V
Cathode Voltage	34 to 52	V
For visual extinction of focused raster		

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2 inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

Picture Tube

PAN-O-PLY — INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 110° MAGNETIC DEFLECTION

NO ION-TRAP MAGNET REQUIRED

Low-Grid-No.2-Voltage—for Cathode-Drive Operation

Electrical:

Direct Interelectrode Capacitances:		
Cathode to all other electrodes. . . .	5	pf
Grid No.1 to all other electrodes. . .	6	pf
External conductive coating to anode[a] .	2500 max.	pf
	1700 min.	pf
Heater Current at 6.3 volts.	450 ± 20	ma
Heater Warm-Up Time (Average).	11	seconds

Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

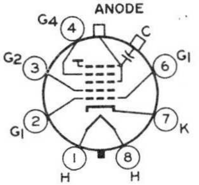
Optical:

Phosphor (For curves, see front of this section) .P4—Sulfide Type, Aluminized
Faceplate. . . . . .Filterglass
Light transmission at center (Approx.) 42%

Mechanical:

Weight (Approx.) . . . . 28 lbs
Overall Length . . . . 14.875" ± .281"
Neck Length. . . . . 5.125" ± .125"
Projected Area of Screen . . . . 282 sq. in.
External Conductive Coating:
Type . . . . .Regular-Band
Contact area for grounding . . . . .Near Reference Line
For Additional Information on Coatings, Dimensions, and Deflection Angles:
See *Picture-Tube Dimensional-Outlines and Bulb J187 K* sheets at the front of this section.
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . .Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW. 8HR

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	23000 max.	volts
	11000 min.	volts
Grid-No.4 Voltage:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
Grid-No.2 Voltage	70 max.	volts
	40 min.	volts
Cathode Voltage:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	100 max.	volts
Positive peak value	150 max.	volts
Heater Voltage	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC & DC voltage	200 max.	volts
DC Component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	18000	volts
Grid-No.4 Voltage[b]	200	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster	34 to 52	volts
Field Strength of required adjustable Centering Magnet	0 to 12	gauss

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN

LOW-VOLTAGE ELECTROSTATIC FOCUS — 110° MAGNETIC DEFLECTION

NO ION-TRAP MAGNET REQUIRED

The 23FMP4 is the same as the 23ETP4 except for the following item:

Electrical:

Heater Current at 6.3 volts. . . . . 450 ± 20 ma

23FP4A

Picture Tube

SHORT RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 114° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes . . .	6	pf
External conductive coating to anode. .	{2500 max.	pf
	1700 min.	pf
Heater Current at 6.3 volts	600 ± 60	ma
Heater Warm-Up Time (Average)	11	seconds

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

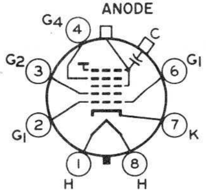
Optical:

Phosphor (For curves, see front of this section). P4—Sulfide Type, Aluminized
• Faceplate . . . . Filterglass
  Light transmission (Approx.). 78%

Mechanical:

Weight (Approx.). 24 lbs
Overall Length. . . . . 13-11/16" + 5/16" − 1/4"
Neck Length . . . . 4-3/8" ± 1/8"
Projected Area of Screen. . . . . 282 sq. in.
External Conductive Coating:
  Type. . . . . .Regular-Band
  Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
  See *Picture-Tube Dimensional-Outlines and Bulb J187 B* sheets at front of this section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
  Basing Designation for BOTTOM VIEW. 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode.
Pin 8 - Heater



Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating

23FP4A

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

ANODE VOLTAGE	23500 max. / 11000 min.	volts / volts
GRID-No. 4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No. 2 VOLTAGE	550 max. / 200 min.	volts / volts
GRID-No. 1 VOLTAGE:		
Negative peak value	200 max.	volts
Negative bias value	154 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
HEATER VOLTAGE	6.9 max. / 5.7 min.	volts / volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Grid-Drive Service:

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage	14000	volts
Grid-No. 4 Voltage	0 to 400	volts
Grid-No. 2 Voltage	450	volts
Grid-No. 1 Voltage for visual extinction of focused raster	-45 to -105	volts

Maximum Circuit Value:

Grid-No. 1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

23FRP4

Picture Tube

FILLED-RIM TYPE

110° MAGNETIC DEFLECTION — LOW GRID-No.2 VOLTAGE

Direct Interelectrode Capacitances		
Cathode to all other electrodes. . .	5	pF
Grid No.1 to all other electrodes. .	6	pF
External conductive coating to anode[a]	1700 min—2500 max	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun . . . . Type Requiring No Ion-Trap Magnet		

OPTICAL

Phosphor . . . . P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate. . . . . Filterglass
Light transmission at center (Approx.) . . . . 42 %

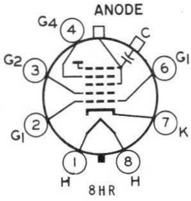
MECHANICAL

Weight (Approx.)	29 lb
Overall Length	14.250 ± .281 in
Neck Length	4.500 ± .125 in
Projected Area of Screen	282 sq in

External Conductive Coating
Type (See CRT OUTLINES 1 at front of this section) . . Regular-Band
Contact area for grounding . . . . Near Reference Line
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin,
Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to grid No.1

Anode Voltage	11000 min—23000 max	V
Grid-No.4 Voltage		
Positive value.	1250 max	V
Negative value.	400 max	V
Grid-No.2 Voltage	25 min—60 max	V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V
Heater Voltage.	5.7 min—6.9 max	V

Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s . . .	450 max	V
After equipment warm-up period.	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage.	200 max	V
DC component.	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No. 1

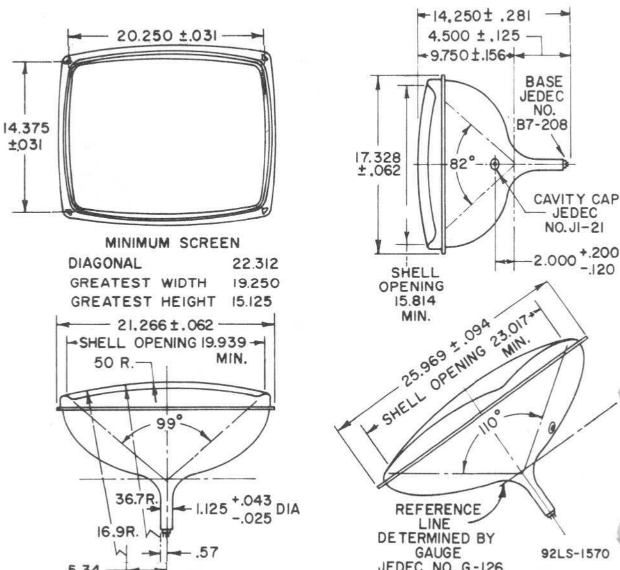
Anode Voltage	16000	V
Grid-No.4 Voltage	0 to 400	V
Grid-No.2 Voltage	50	V
Cathode Voltage	32 to 50	V
For visual extinction of focused raster		
Field Strength.	0 to 10	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance.	1.5 max	MΩ

[a] Includes implosion protection hardware.

DIMENSIONAL OUTLINE
(Bulb J187 K)



DIMENSIONS IN INCHES

Picture Tube

FILLED-RIM TYPE — 110° MAGNETIC DEFLECTION

Direct Interelectrode Capacitances		
Cathode to all other electrodes	5	pF
Grid No.1 to all other electrodes	6	pF
External conductive coating to anode[a]	1700 min—2500 max	pF
Heater Current at 6.3 V	600 ± 30	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

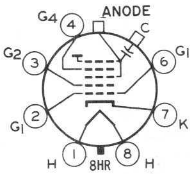
Phosphor. . . . . .P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 42%

MECHANICAL

Weight (Approx.). . . . . 29 lb
Overall Length. . . . . 14.875 ± .281 in
Neck Length . . . . 5.125 ± .125 in
Projected Area of Screen. . . . . 282 sq in
External Conductive Coating
Type (see CRT OUTLINES 1 at front of this section) . . .Regular-Band
Contact area for grounding. . . . . Near Reference Line
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . .Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	11000 min—23000 max	V
Grid-No.4 Voltage		
Positive value	1100 max	V
Negative value	550 max	V
Grid-No.2 Voltage	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	5.7 min—6.9 max	V

Peak Heater-Cathode Voltage	
Heater negative with respect to cathode:	
During equipment warm-up period ≤ 15 s. . . .	450 max V
After equipment warm-up period.	300 max V
Heater positive with respect to cathode:	
Combined AC & DC voltage.	200 max V
DC component.	100 max V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	18000 V
Grid-No.4 Voltage	0 to 400 V
Grid-No.2 Voltage	300 V
Cathode Voltage	28 to 62 V
For visual extinction of focused raster	
Field Strength.	0 to 12 G
Of required adjustable centering magnet	

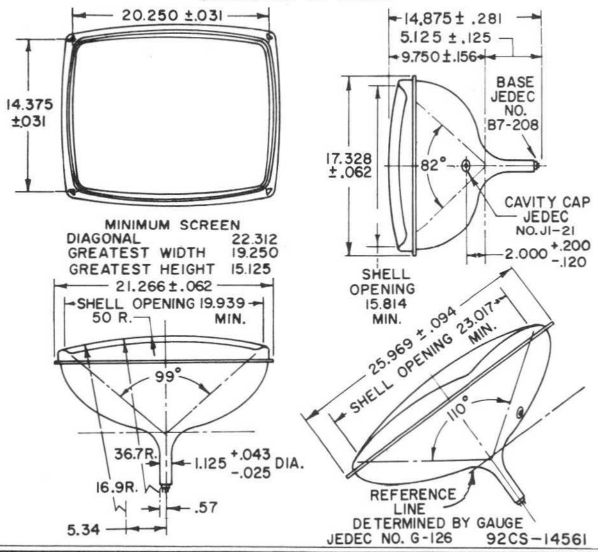
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance.	1.5 max MΩ

[a] Includes implosion protection hardware.

DIMENSIONAL OUTLINE
(Bulb J187 K)

DIMENSIONS IN INCHES



Picture Tube

PAN-O-PLY TYPE — LOW-VOLTAGE ELECTROSTATIC FOCUS
NO ION-TRAP MAGNET REQUIRED — 110° MAGNETIC DEFLECTION

Direct Interelectrode Capacitances

Cathode to all other electrodes . . .	5	pF
Grid No.1 to all other electrodes . .	6	pF
External conductive coating to anode.	1700 min — 2500 max	pF
Heater Current at 6.3 V	600 ± 30	mA
Heater Warm-Up Time (Average)	11	s

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

OPTICAL

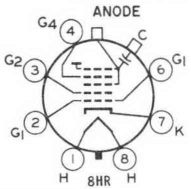
Phosphor. . . . . .P4—Sulfide Type, Aluminized
For curves, see front of this section
Faceplate . . . . Filterglass
Light transmission at center (Approx.). 42%

MECHANICAL

Weight (Approx.). . . . . 28 lb
Overall Length. . . . . .14.875 ± .281 in
Neck Length . . . . 5.125 ± .125 in
Projected Area of Screen. . . . . 282 sq in
External Conductive Coating[a]
Type (see CRT OUTLINES 1 at front of this section) . .Regular-Band
Contact area for grounding. . . . . Near Reference Line
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . .Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (BOTTOM VIEW)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	11000 min — 23000 max	V
Grid-No.4 Voltage		
Positive value.	1100 max	V
Negative value.	550 max	V
Grid-No.2 Voltage	200 min — 550 max	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage.	5.7 min — 6.9 max	V

Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s. . .	450 max	V
After equipment warm-up period.	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage.	200 max	V
DC component.	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	18000	V
Grid-No.4-Voltage[b].	200	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 62	V
For visual extinction of focused raster		
Field Strength.	0 to 12	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

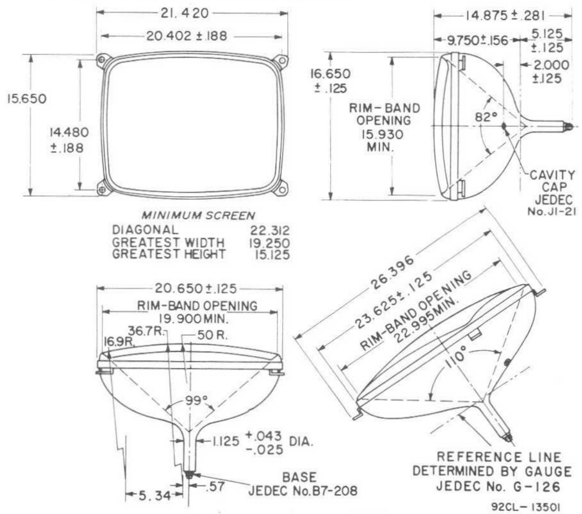
Grid-No.1 Circuit Resistance.	1.5 max	MΩ

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

DIMENSIONAL OUTLINE

FOR PICTURE TUBE UTILIZING BULB J187K WITH MOUNTING LUGS



DIMENSIONS IN INCHES

23HFP4A

Picture Tube

PAN-O-PLY—INTEGRAL IMPLOSION PROTECTION

(Provided by Formed Rim and Welded Tension Bands Around Periphery of Tube Panel—No Separate Safety-Glass or Integral Protective Window Required)

LOW-VOLTAGE ELECTROSTATIC FOCUS 110° MAGNETIC DEFLECTION
NO ION-TRAP MAGNET REQUIRED

The 23HFP4A is the same as the 23ETP4 except for the following items:

ELECTRICAL

Heater current at 6.3 volts. . . . . 450 ± 20 mA

MECHANICAL

External Conductive Coating
Type . . . . .Special
Contact area for grounding . . . . . . Near Reference Line

Picture Tube

PAN-O-PLY TYPE WITH MOUNTING LUGS

110° MAGNETIC DEFLECTION LOW-VOLTAGE ELECTROSTATIC FOCUS

Direct Interelectrode Capacitances		
Cathode to all other electrodes . . .	5	pF
Grid No.1 to all other electrodes . .	6	pF
External conductive coating to anode. .	1700 min—2500 max	pF
Heater Current at 6.3 V	450 ± 20	mA
Heater Warm-Up Time (Average)	11	s
Electron Gun.	Type Requiring No Ion-Trap Magnet	

OPTICAL

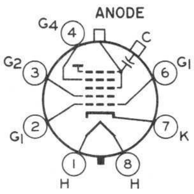
Phosphor.	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate	Filterglass
Light transmission at center (Approx.).	42%

MECHANICAL

Weight (Approx.).	28.5 lb
Overall Length.	14.875 ± .281 in
Neck Length	5.125 ± .125 in
Projected Area of Screen.	282 sq in
External Conductive Coating[a]	
Type (See CRT OUTLINES 1 at front of this section) . .	Regular-Band
Contact area for grounding.	Near Reference Line
Cap	Recessed Small Cavity (JEDEC No.J1-21)
Base.	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



8HR

Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to cathode

Anode Voltage	11000 min—23000 max	V
Grid-No.4 Voltage		
Positive value.	1100 max	V
Negative value.	550 max	V
Grid-No.2 Voltage	200 min—550 max	V
Grid-No.1 Voltage		
Negative peak value	220 max	V
Negative bias value	155 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage.	5.7 min—6.9 max	V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:		
During equipment warm-up period ≤ 15 s . .	450 max	V
After equipment warm-up period.	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage.	200 max	V
DC component.	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	18000	V
Grid-No.4 Voltage[b].	200	V
Grid-No.2 Voltage	300	V
Cathode Voltage	28 to 62	V
For visual extinction of focused raster		
Field Strength.	0 to 12	G
Of required adjustable centering magnet		

MAXIMUM CIRCUIT VALUE

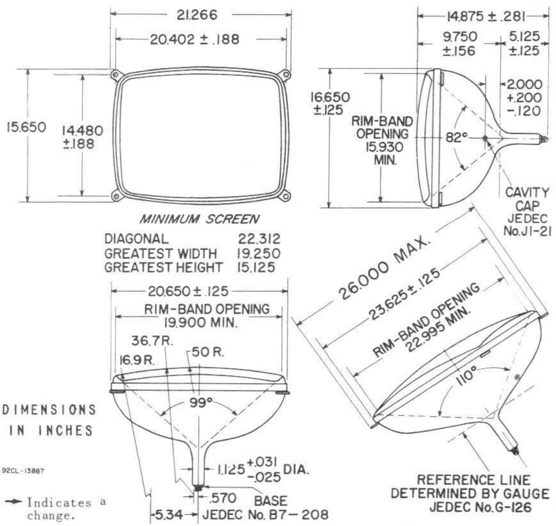
Grid-No.1 Circuit Resistance.	1.5 max	MΩ

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13-1/2-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

DIMENSIONAL OUTLINE (Bulb J187 K With Mounting Lugs)



→ Indicates a change.

Picture Tube

PAN-O-PLY TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

LOW-GRID-No.2 VOLTAGE
110° MAGNETIC DEFLECTION

ELECTRICAL

Direct Interelectrode Capacitances
- Cathode to all other electrodes . . . 5 pF
- Grid No.1 to all other electrodes . . . 6 pF
- External conductive coating to anode. . 1700 min—2500 max pF

Heater Current at 6.3 volts . . . . . . 450 ± 20 mA
Heater Warm-Up Time (Average) . . . . . 11 s
Electron Gun. . . . . Type Requiring No Ion-Trap Magnet
Focus Lens. .Unipotential

OPTICAL

Phosphor. . . . . .P4—Sulfide Type, Aluminized
- For curves, see front of this section

Faceplate . . . . Filterglass
- Light transmission at center (approx.). 42%

MECHANICAL

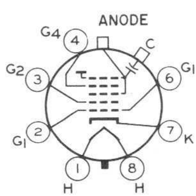
Weight (Approx.). . . . . 28 lb
Overall Length. . . . . 14.125 ± .281 in ←
Neck Length . . . . 4.375 ± .125 in ←
Projected Area of Screen. . . . . 282 sq in
External Conductive Coating[a]
- Type. . . . . .Regular-Band
- Contact area for grounding. . . . . Near Reference Line

For Additional Information on Coatings and Dimensions
- See *Picture-Tube Dimensional-Outlines* and *Bulb J187K* sheets at front of this section

Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . .Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater
Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating



8HR

← Indicates a change.

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	12000 min—23500 max	V
Grid-No.4 (Focusing) Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage	20 min—60 max	V
Cathode Voltage		
Negative peak value	2 max	V
Negative bias value	0 max	V
Positive bias value	100 max	V
Positive peak value	150 max	V
Heater Voltage	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period	300 max	V
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max	V
DC component	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	18000	V
Grid-No.4 Voltage[b]	200	V
Grid-No.2 Voltage	30	V
Cathode Voltage	22 to 45	V
For visual extinction of focused raster		
Field Strength of required adjustable centering magnet	0 to 12	G

MAXIMUM CIRCUIT VALUE

Grid-No.1-Circuit Resistance	1.5 max	MΩ

[a] Includes implosion protection hardware.

[b] The grid-No.4 voltage required for optimum focus of any individual tube will have a value anywhere between 0 and +400 volts with the combined grid-No.1 voltage and video-signal voltage adjusted to give an anode current of 200 microamperes on a 13.5-inch by 18-inch pattern from an RCA-2F21 monoscope, or equivalent.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

23HWP4A

Picture Tube

PAN-O-PLY TYPE WITH MOUNTING LUGS

110° MAGNETIC DEFLECTION — LOW GRID-No.2 VOLTAGE

ELECTRICAL

Direct Interelectrode Capacitances		
Cathode to all other electrodes. . .	5	pF
Grid No.1 to all other electrodes. .	6	pF
External conductive coating to anode[a].	1700 min—2500 max	pF
Heater Current at 6.3 V.	450 ± 20	mA
Heater Warm-Up Time (Average).	11	s
Electron Gun	Type Requiring No Ion-Trap Magnet	

OPTICAL

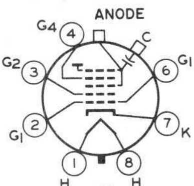
Phosphor	P4—Sulfide Type, Aluminized
For curves, see front of this section	
Faceplate.	Filterglass
Light transmission at center (Approx.)	42%

MECHANICAL

Weight (Approx.)	28 lb
Overall Length	14.875 ± .281 in
Neck Length	5.125 ± .125 in
Projected Area of Screen	282 sq in
External Conductive Coating	
Type (See CRT OUTLINES 1 at front of this section) . .	Regular-Band
Contact area for grounding.	Near Reference Line
Cap.	Recessed Small Cavity (JEDEC no.J1-21)
Base	Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Grid No.2
Pin 4 – Grid No.4
Pin 6 – Grid No.1
Pin 7 – Cathode
Pin 8 – Heater



8HR

Cap – Anode (Grid No.3, Grid No.5, Screen Collector)
C – External Conductive Coating

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Voltages are positive with respect to grid No.1

Anode Voltage.	12000 min—22000 max	V
Grid-No.4 Voltage		
Positive value	1250 max	V
Negative value	400 max	V
Grid-No.2 Voltage.	30 min—70 max	V
Cathode Voltage		
Negative peak value.	2 max	V
Negative bias value.	0 max	V
Positive bias value.	100 max	V
Positive peak value.	150 max	V

Heater Voltage.	5.7 min—6.9 max	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode:		
During equipment warm-up period≤ 15 s . . .	450 max	V
After equipment warm-up period.	300 max	V
Heater positive with respect to cathode:		
Combined AC & DC voltage.	200 max	V
DC component.	100 max	V

TYPICAL OPERATING CONDITIONS FOR CATHODE-DRIVE SERVICE

Voltages are positive with respect to grid No.1

Anode Voltage	16000	V
Grid-No.4 Voltage	0 to 400	V
Grid-No.2 Voltage	50	V
Cathode Voltage	32 to 50	V
For visual extinction of focused raster		
Field Strength.	0 to 10	G
Of required adjustable centering magnet		

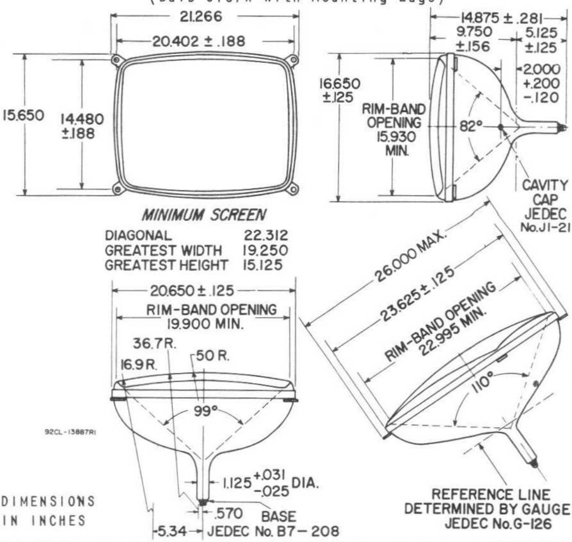
MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance.	1.5 max	MΩ

a Includes implosion protection hardware.

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

DIMENSIONAL OUTLINE
(Bulb J187K with Mounting Lugs)



DIMENSIONS IN INCHES

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS
LOW-GRID-NO.2 VOLTAGE

ALUMINIZED SCREEN
110° MAGNETIC DEFLECTION
CATHODE-DRIVE TYPE

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Direct Interelectrode Capacitances:

Cathode to all other electrodes	5	pf
Grid No.1 to all other electrodes . . .	6	pf
External conductive coating to anode. .	2500 max.	pf
	2000 min.	pf
Heater Current at 6.3 volts	450 ± 25	ma
Heater Warm-Up Time (Average)	11	seconds

Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

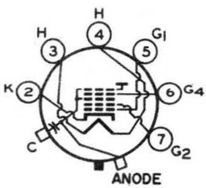
Optical:

Phosphor (For curves, see front of this section). P4—Sulfide Type, Aluminized
Faceplate and Protective Panel. . . . . Filterglass
Light transmission (Approx.). 40%

Mechanical:

Weight (Approx.). . . . . 32-1/2 lbs
Overall Length. . . . . 15-7/16" ± 7/16"
Neck Length . . . . 5-3/8" ± 3/16"
Projected Area of Screen. . . . . 282 sq. in.
External Conductive Coating:
Type. . . . . .Regular-Band
Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J187 A* sheets at front of this section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base. . . . . JEDEC No.B6-214
Basing Designation for BOTTOM VIEW. 7FA

Pin 2 – Cathode
Pin 3 – Heater
Pin 4 – Heater
Pin 5 – Grid No.1
Pin 6 – Grid No.4
Pin 7 – Grid No.2



Cap – Anode (Grid No.3, Grid No.5, Screen, Collector)
C – External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to grid No. 1

ANODE VOLTAGE	22000 max. / 15000 min.	volts / volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	70 max. / 44 min.	volts / volts
CATHODE VOLTAGE:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	100 max.	volts
Positive peak value	150 max.	volts
HEATER VOLTAGE	6.9 max. / 5.7 min.	volts / volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	16000	volts
Grid-No.4 Voltage	0 to 500	volts
Grid-No.2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster	35 to 50	volts

Maximum Circuit Value:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

RECTANGULAR GLASS TYPE — **ALUMINIZED SCREEN**
LOW-VOLTAGE ELECTROSTATIC FOCUS — **MAGNETIC DEFLECTION**

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts. . . . . 600 ± 30 ma
Heater Warm-Up Time (Average). . . . . 11 seconds
Direct Interelectrode Capacitances:
Grid No.1 to all other electrodes. . . . 6 $\mu\mu$f
Cathode to all other electrodes. . . . . 5 $\mu\mu$f
External conductive coating to ultor . . {2500 max. $\mu\mu$f; 1700 min. $\mu\mu$f}
Focusing Method. . . . . .Electrostatic
Deflection Method. . . . . Magnetic
Deflection Angles (Approx.):
Diagonal . . . . 114°
Horizontal . . . . 102°
Vertical . . . . 84°
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

Optical:

Faceplate. . . . . .Filterglass
Light transmission at center (Approx.) 78%
Phosphor (For curves, see front of this section) . P4—Sulfide Type Aluminized
Fluorescence . . . . .White
Phosphorescence. . . . . .White
Persistence. . . . . Medium Short

Mechanical:

Tube Dimensions:
Overall length . . . . 14-3/8" ± 5/16"
Greatest width . . . . 20-1/2" + 1/16" − 1/8"
Greatest height. . . . . 16-1/2" ± 1/8"
Diagonal . . . . 23-25/64" + 3/32" − 1/8"
Neck length. . . . . 5-1/8" ± 1/8"
Curvature of faceplate (Radii):

	Center	*Intermediate*	*Edge*
External surface	50"	–	36-3/4"
Internal surface	30"	48"	24"

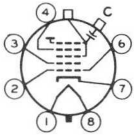
Screen Dimensions (Minimum):
Greatest width . . . . 19-1/4"
Greatest height. . . . . 15-1/8"
Diagonal . . . . 22-5/16"
Projected area . . . . .282 sq. in.
Weight (Approx.) . . . . 24 lbs
Operating Position . . . . Any
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Bulb . . . . J187 (114°)

23MP4

Base. . . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)

Basing Designation for BOTTOM VIEW. 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

GRID-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	22000 max.	volts
	11000 min.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
	200 min.	volts
GRID-No.1 VOLTAGE:		
Negative-peak value	220 max.	volts
Negative-bias value	154 max.	volts
Positive-bias value	0 max.	volts
Positive-peak value	2 max.	volts
HEATER VOLTAGE.	6.9 max.	volts
	5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period. . .	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Equipment Design Ranges:

With any ultor voltage (Ec_5k) between 11000 and 22000 volts and grid-No.2 voltage (Ec_2k) between 220 and 550 volts

Grid-No.4 Voltage for focus•.	0 to 400	volts
Grid-No.1 Voltage (Ec_1k) for visual extinction of focused raster	See *Raster-Cutoff-Range Chart for Grid-Drive Service*	
Grid-No:1 Video Drive from Raster Cutoff (Black level): White level value (Peak positive)	Same value as determined for Ec_1k except video drive is a positive voltage	

Grid-No.4 Current.	-25 to +25	μa
Grid-No.2 Current.	-15 to +15	μa
Field Strength of Adjustable Centering Magnet★.	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	*18000*	*volts*
and grid-No.2 voltage of	*400*	*volts*
Grid-No.4 Voltage for focus●	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	-36 to -94	volts
Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value.	36 to 94	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

CATHODE-DRIVE♦ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	{22000 max.	volts
	{11000 max.	volts
GRID-No.4-TO-GRID-No.1 (FOCUSING) VOLTAGE:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	{700 max.	volts
	{350 min.	volts
GRID-No.2-TO-CATHODE VOLTAGE	550 max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:		
Positive-peak value.	220 max.	volts
Positive-bias value.	154 max.	volts
Negative-bias value.	0 max.	volts
Negative-peak value.	2 max.	volts
HEATER VOLTAGE	{6.9 max.	volts
	{5.7 min.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period . .	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage ($E_{c_5g_1}$) between 11000 and 22000 volts and grid-No.2-to-grid-No.1 voltage ($E_{c_2g_1}$) between 225 and 700 volts

Grid-No.4-to-Grid-No.1 Voltage for focus●	0 to 400	volts

Cathode-to-Grid-No.1 Voltage (E_{kg_1}) for visual extinction of focused raster.	See *Raster-Cutoff-Range Chart for Cathode-Drive Service*	
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value (Peak negative).	Same value as determined for E_{kg_1} except video drive is a negative voltage	
Grid-No.4 Current.	-25 to +25	μa
Grid-No.2 Current.	-15 to +15	μa
Field Strength of Adjustable Centering Magnet★.	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of	*18000*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*400*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus●	0 to 400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster.	36 to 78	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black level): White-level value.	-36 to -78	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

● Individual tubes will have satisfactory focus at some value of grid-No.4 (or grid-No.4-to-grid-No.1) voltage between 0 and 400 volts under conditions with the combined bias voltage and video-signal voltage adjusted to produce an ultor current of 200 microamperes.

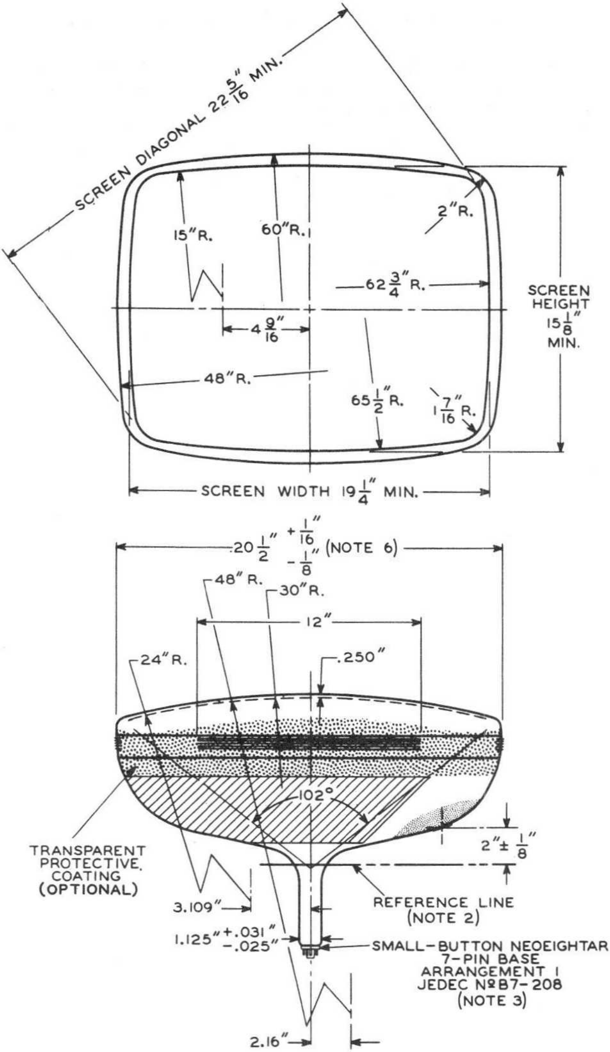
★ Distance from *Reference-Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 3/8-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the the center of the tube face.

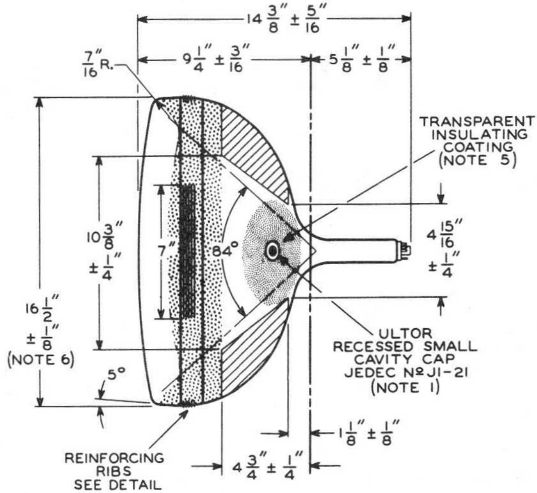
♦ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

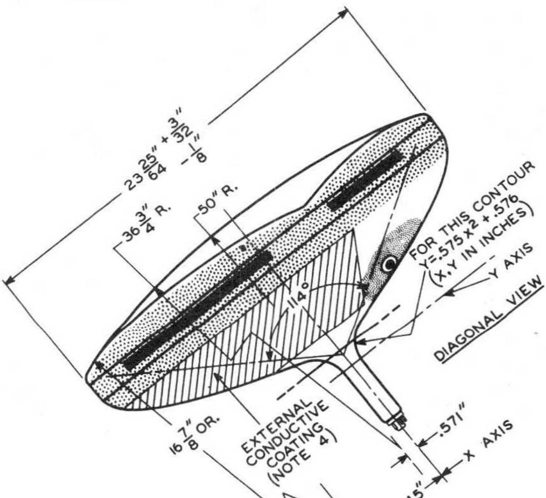
OPERATING CONSIDERATIONS

X-Ray Warning. When operated at ultor voltages up to 16 kilovolts, this picture tube does not produce any harmful X-ray radiation. However, because the rating of this type permits operation at voltages as high as 22 kilovolts (Design-maximum value), shielding of this picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range whenever the operating conditions involve voltages in excess of 16 kilovolts.

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatterproof, glass cover over the face of this picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.


SCREEN DIAGONAL 22 5/16" MIN.
15" R.
60" R.
2" R.
62 3/4" R.
SCREEN HEIGHT 15 1/8" MIN.
4 9/16"
48" R.
65 1/2" R.
1 7/16" R.
SCREEN WIDTH 19 1/4" MIN.
20 1/2" +1/16" -1/8" (NOTE 6)
48" R.
30" R.
12"
24" R.
.250"
102°
2" ± 1/8"
TRANSPARENT PROTECTIVE COATING (OPTIONAL)
3.109"
REFERENCE LINE (NOTE 2)
1.125" +.031" -.025"
SMALL-BUTTON NEOEIGHTAR 7-PIN BASE ARRANGEMENT 1 JEDEC Nº B7-208 (NOTE 3)
2.16"





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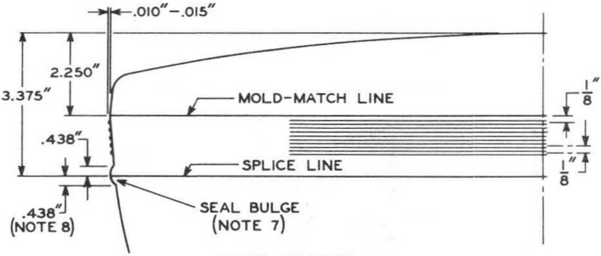


DETAIL OF PANEL

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF $\pm$ 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No.G-126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUITRY CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

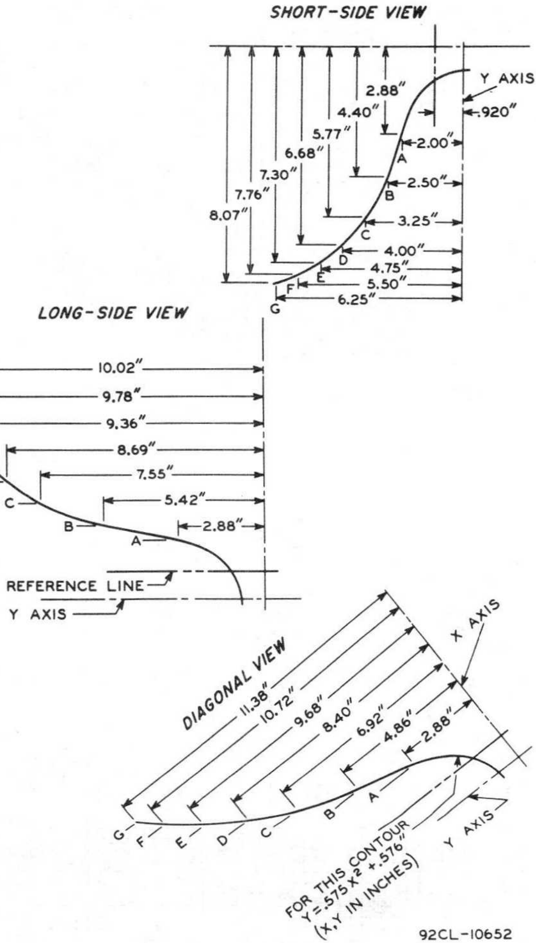
NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 6: MEASURED AT THE MOLD-MATCH LINE.

NOTE 7: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE LOCATION SPECIFIED FOR DIMENSIONING THE ENVELOPE WIDTH, DIAGONAL, AND HEIGHT.

NOTE 8: AREA BETWEEN MOLD-MATCH LINE AND SEAL BULGE IS 1/2" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND. SUPPORTS MUST BE SPACED FROM THE TUBE BY THE USE OF CUSHIONING PADS MADE OF ASPHALT, IMPREGNATED FELT OR EQUIVALENT.

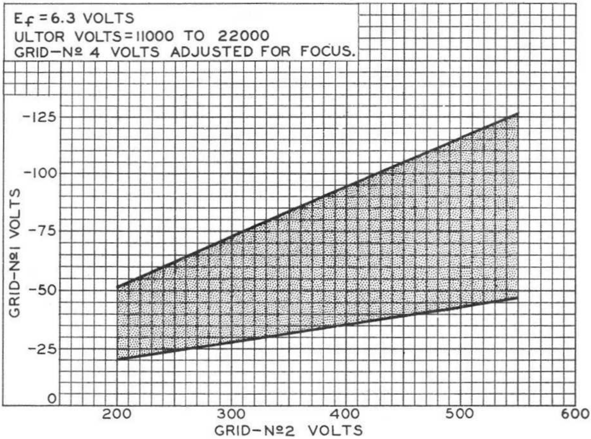
BULB-CONTOUR DIMENSIONS



92CL-10652

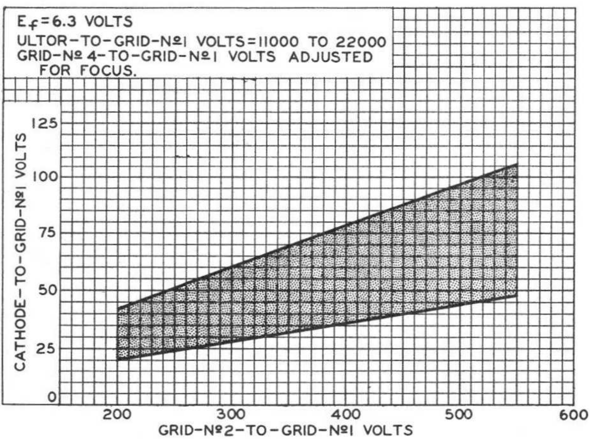
NOTE: PLANES A THRU G ARE NORMAL TO THE TUBE AXIS AND AT FIXED LOCATIONS FROM THE Y AXIS. THESE COORDINATES DESCRIBE THE BOGIE-BULB EXTERNAL CONTOUR IN PLANES THROUGH THE TUBE AXIS AND THE RESPECTIVE FACEPLATE AXES.

RASTER-CUTOFF-RANGE CHARTS
Grid-Drive Service



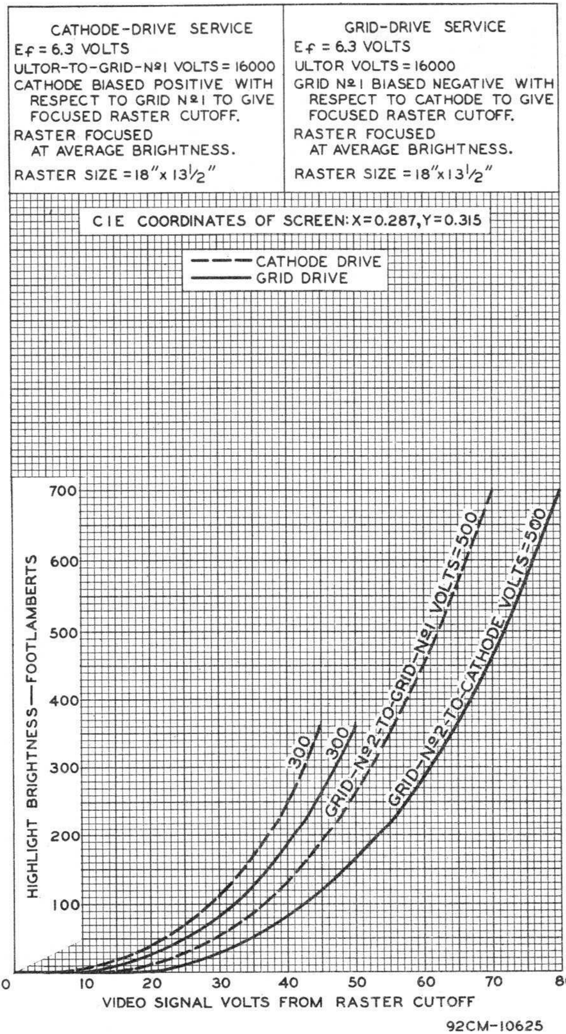
92CS-10620R1

Cathode-Drive Service



92CS-10621R1

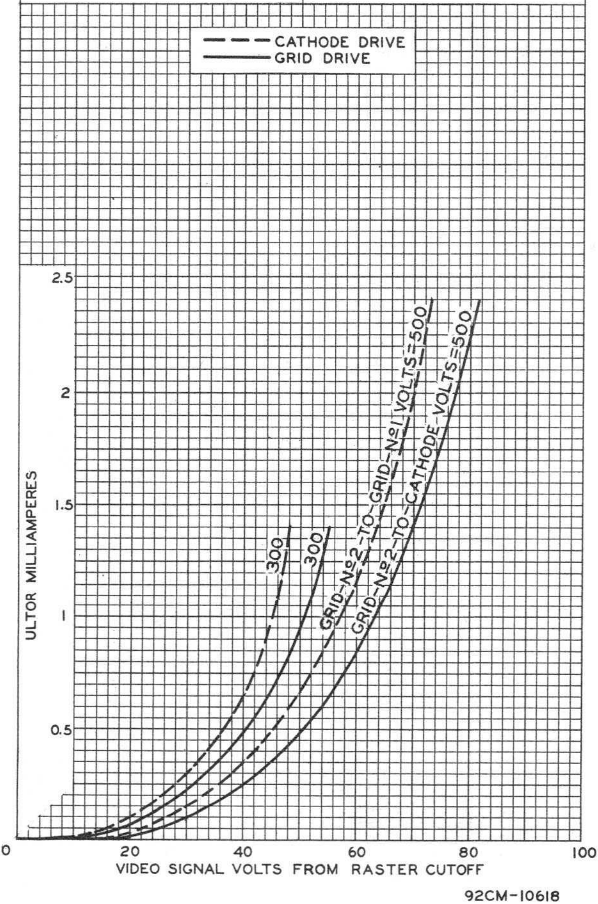
AVERAGE DRIVE CHARACTERISTICS



92CM-10625

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f=6.3 VOLTS ULTOR-TO-GRID-Nº1 VOLTS=11000 TO 22000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID Nº1 TO GIVE FOCUSED RASTER CUTOFF.	E_f= 6.3 VOLTS ULTOR VOLTS=11000 TO 22000 GRID Nº1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



92CM-10618

Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE
ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS
114° MAGNETIC DEFLECTION
LOW GRID-No.2 VOLTAGE
CATHODE-DRIVE TYPE

Electrical:

Direct Interelectrode Capacitances:
 Grid No.1 to all other electrodes. . . . . 6 pf
 Cathode to all other electrodes. . . . . . 5 pf
 External conductive coating to anode . . {2500 max. pf; 1700 min. pf}
Heater Current at 6.3 volts. . . . . 600 ± 30 ma
Heater Warm-Up Time (Average). . . . . . . 11 seconds
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet

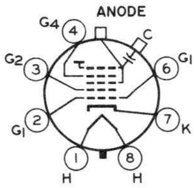
Optical:

Phosphor (For curves, see front of this Section). . . P4—Sulfide Type Aluminized
Faceplate. . . . . .Filterglass
 Light transmission at center (Approx.) 78%

Mechanical:

Weight (Approx.) . . . . 24 lbs
Overall Length . . . . 14.531" ± .281"
Neck Length. . . . . 5.125" ± .125"
Projected Area of Screen . . . . 282 sq. in.
External Conductive Coating:
 Type . . . . Regular-Band
 Contact area for grounding . . . . .Near Reference Line
For Additional Information on Coatings and Dimensions:
 See *Picture-Tube Dimensional-Outlines and Bulb J187 B* sheets at front of this section
Cap. . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1 (JEDEC No.B7-208)
 Basing Designation for BOTTOM VIEW. 8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	22000 max. / 11000 min.	volts / volts
Grid-No. 4 (Focusing) Voltage:		
Positive value	1250 max.	volts
Negative value	400 max.	volts
Grid-No. 2 Voltage	70 max. / 40 min.	volts / volts
Cathode Voltage:		
Negative peak value	2 max.	volts
Negative bias value	0 max.	volts
Positive bias value	155 max.	volts
Positive peak value	220 max.	volts
Heater Voltage	6.9 max. / 5.7 min.	volts / volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	300 max.	volts
Heater positive with respect to cathode:		
Combined AC and DC voltage	200 max.	volts
DC component	100 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No. 1

Anode Voltage	18000	volts
Grid-No. 4 Voltage	200	volts
Grid-No. 2 Voltage	50	volts
Cathode Voltage for visual extinction of focused raster	34 to 52	volts

Maximum Circuit Value:

Grid-No. 1 Circuit Resistance	1.5 max.	megohms

For X-radiation shielding consideration, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this Section

Picture Tube

BI-PANEL RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 92° MAGNETIC DEFLECTION

With Heater Having Controlled Warm-Up Time

GENERAL DATA

Electrical:

Heater Current at 6.3 volts	600 ± 5%	ma
Heater Warm-Up Time (Average)	11	seconds
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	μμf
Cathode to all other electrodes	5	μμf
External conductive coating to ultor	2500 max.	μμf
	2000 min.	μμf
Electron Gun	Type Requiring No Ion-Trap Magnet	

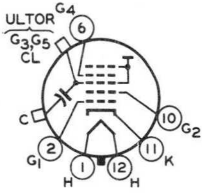
Optical:

Faceplate and Protective Panel . . . . Filterglass
Light transmission (Approx.) 40%
Phosphor (For curves, see front of this section) . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position . . . . Any
Weight (Approx.) . . . . 34-1/2 lbs
Overall Length . . . . 18-5/16" ± 7/16"
Neck Length . . . . 5-1/2" ± 3/16"
Projected Area of Screen . . . . 282 sq. in.
External Conductive Coating:
Type . . . . Regular Band
Contact area for grounding . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines* and *Bulb J187 D/G* sheets at the front of this section
Cap . . . . Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203)
Basing Designation for BOTTOM VIEW 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

Maximum and Minimum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	22000 max.	volts
	12000 min.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value	1100 max.	volts
Negative value	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	220 max.	volts
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	*16000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus	0 to 400	volts
Grid-No.1 Voltage for visual extinction of focused raster	-35 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* at front of this section

Picture Tube

RECTANGULAR GLASS TYPE
LOW-VOLTAGE ELECTROSTATIC FOCUS

ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION

GENERAL DATA

Electrical:

Heater Current at 6.3 volts . . . . 600 ± 10% ma
Direct Interelectrode Capacitances:
  Grid No.1 to all other electrodes . . . . . 6 μμf
  Cathode to all other electrodes . . . . . . 5 μμf
  External conductive coating to ultor. . . . {2500 max. μμf; 2000 min. μμf}
Electron Gun. . . . . Type Requiring No Ion-Trap Magnet

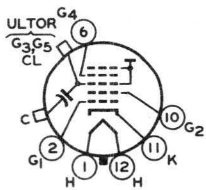
Optical:

Faceplate, Spherical. . . . . Filterglass
  Light transmission (Approx.). 75%
Phosphor (For curves, see front of this section). . P4—Sulfide Type, Aluminized

Mechanical:

Operating Position. . . . . Any
Weight (Approx.). 35 lbs
Overall Length. . . . . 19-1/8" ± 3/8"
Neck Length . . . . 5-1/2" ± 3/16"
Projected Area of Screen. . . . . 332 sq. in.
External Conductive Coating:
  Type. . . . . Special
  Contact area for grounding. . . . . Near Reference Line
For Additional Information on Coatings and Dimensions:
  See *Picture-Tube Dimensional-Outlines* and *Bulb J192 A/B* sheets at the front of this section
Cap . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Bases (Alternates):
  Short Small-Shell Duodecal 6-Pin
    (JEDEC Group 4, No.B6-203)
  Small-Shell Duodecal 6-Pin, Arrangement 1
    (JEDEC Group 4, No.B6-63)
  Basing Designation for BOTTOM VIEW. 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

24AEP4

Maximum Ratings, *Design-Maximum Values:*

ULTOR VOLTAGE	22000 max.	volts
GRID-No.4 (FOCUSING) VOLTAGE:		
Positive value.	1100 max.	volts
Negative value.	550 max.	volts
GRID-No.2 VOLTAGE	550 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value	155 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	450 max.	volts
After equipment warm-up period. . . .	200 max.	volts
Heater positive with respect to cathode.	200 max.	volts

Typical Operating Conditions:

With ultor voltage of	*18000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus	-50 to +350	volts
Grid-No.1 Voltage for visual extinction of focused raster.	-28 to -72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

24AHP4

PICTURE TUBE

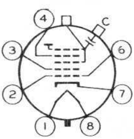
RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE FOCUS — MAGNETIC DEFLECTION

DATA

General:

Heater, for Unipotential Cathode:	
Voltage	6.3 ac or dc volts
Current	0.6 ± 10% amp
Direct Interelectrode Capacitances:	
Grid No.1 to all other electrodes	6 μμf
Cathode to all other electrodes	5 μμf
External conductive coating to ultor	2500 max. μμf 2000 min. μμf
Faceplate, Spherical	Filterglass
Light transmission (Approx.)	76%
Phosphor (For curves, see front of this Section)	P4—Sulfide Type Aluminized
Fluorescence	White
Phosphorescence	White
Persistence	Short
Focusing Method	Electrostatic
Deflection Method	Magnetic
Deflection Angles (Approx.):	
Diagonal	110°
Horizontal	105°
Vertical	87°
Electron Gun	Type Requiring No Ion-Trap Magnet
Tube Dimensions:	
Overall length	15-7/8" ± 5/16"
Greatest width	22-11/16" ± 1/8"
Greatest height	18-1/2" ± 1/8"
Diagonal	24" ± 1/8"
Neck length	5-7/16" ± 1/8"
Screen Dimensions (Minimum):	
Greatest width	21-7/16"
Greatest height	16-7/8"
Diagonal	22-13/16"
Projected area	332 sq. in.
Weight (Approx.)	28 lbs
Mounting Position	Any
Cap	Recessed Small Cavity (JETEC No.J1-21)
Bulb	J192 (110°)
Base	Small-Button Eightar 7-Pin, Arrangement 2, (JETEC No.B7-183)
Basing Designation for BOTTOM VIEW	8HR

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 3 - Grid No.2
Pin 4 - Grid No.4
Pin 6 - Grid No.1
Pin 7 - Cathode
Pin 8 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

24AHP4

PICTURE TUBE

GRID-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE	{20000 max. / 12000#min.	volts / volts
GRID-No.4 VOLTAGE:		
Positive value.	1000 max.	volts
Negative value.	500 max.	volts
GRID-No.2 VOLTAGE	500 max.	volts
GRID-No.1 VOLTAGE:		
Negative peak value	200 max.	volts
Negative bias value	140 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds.	410 max.	volts
After equipment warm-up period. . . .	180 max.	volts
Heater positive with respect to cathode.	180 max.	volts

Equipment Design Ranges:

With any ultor voltage (E_{c_5k}) between 12000 and 20000 volts and grid-No.2 voltage (E_{c_2k}) between 200 and 500 volts

Grid-No.4 Voltage for Focus§.	-50 to +350	volts
Grid-No.1 Voltage ($E_{c_1}k$) for Visual Extinction of Focused Raster. .	*See Raster-Cutoff-Range Chart for Grid-Drive Service*	
Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value (Peak positive)	Same value as determined for $E_{c_1}k$ except video drive is a positive voltage	
Grid-No.4 Current	-25 to +25	μa
Grid-No.2 Current	-15 to +15	μa
Field Strength of Adjustable Centering Magnet*. .	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	*14000*	*16000*	*volts*
and grid-No.2 voltage of	*300*	*400*	*volts*
Grid-No.4 Voltage for Focus	-50 to +350	-50 to +350	volts

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

#,§,*: See next page.

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PICTURE TUBE

Grid-No.1 Voltage for Visual Extinction of Focused Raster	-28 to -72	-36 to -94	volts
Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value. . . .	28 to 72	36 to 94	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance . . . . 1.5 max. megohms

CATHODE-DRIVE■ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum Ratings, *Design-Center Values:*

ULTOR-TO-GRID-No.1 VOLTAGE	20000	max.	volts
	12000#	min.	volts
GRID-No.4-TO-GRID-No.1 VOLTAGE:			
Positive value	1000	max.	volts
Negative value	500	max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE	640	max.	volts
GRID-No.2-TO-CATHODE VOLTAGE	500	max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:			
Positive peak value.	200	max.	volts
Positive bias value.	140	max.	volts
Negative bias value.	0	max.	volts
Negative peak value.	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	410	max.	volts
After equipment warm-up period . . .	180	max.	volts
Heater positive with respect to cathode.	180	max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage ($E_{c_5g_1}$) *between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage* ($E_{c_2g_1}$) *between 225 and 640 volts*

Grid-No.4-to-Grid-No.1 Voltage for Focus§ . . . . -50 to +350 volts

■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and the other electrodes.

This value is a working design-center minimum. The equivalent *absolute minimum* ultor-or ultor-to-grid-No.1 voltage is 11000 volts, below which the serviceability of the 24AHP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor-or ultor-to-grid-No.1 voltage is never less than 11000 volts.

*,§: See next page.

24AHP4

PICTURE TUBE

Cathode-to-Grid-No.1 Voltage (E_{kg_1}) for Visual Extinction of Focused Raster. . . .	*See Raster-Cutoff-Range Chart for Cathode-Drive Service*		
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value (Peak negative). . . .	Same value as determined for E_{kg_1} except video drive is a negative voltage		
Grid-No.4 Current.	-25 to +25		μa
Grid-No.2 Current.	-15 to +15		μa
Field Strength of Adjustable Centering Magnet* .	0 to 8		gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of	*14000*	*16000*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*300*	*400*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for Focus . .	-50 to +350	-50 to +350	volts
Cathode-to-Grid-No.1 Voltage for Visual Extinction of Focused Raster	28 to 60	36 to 78	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value.	-28 to -60	-36 to -78	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance. . . . . . . 1.5 max. megohms

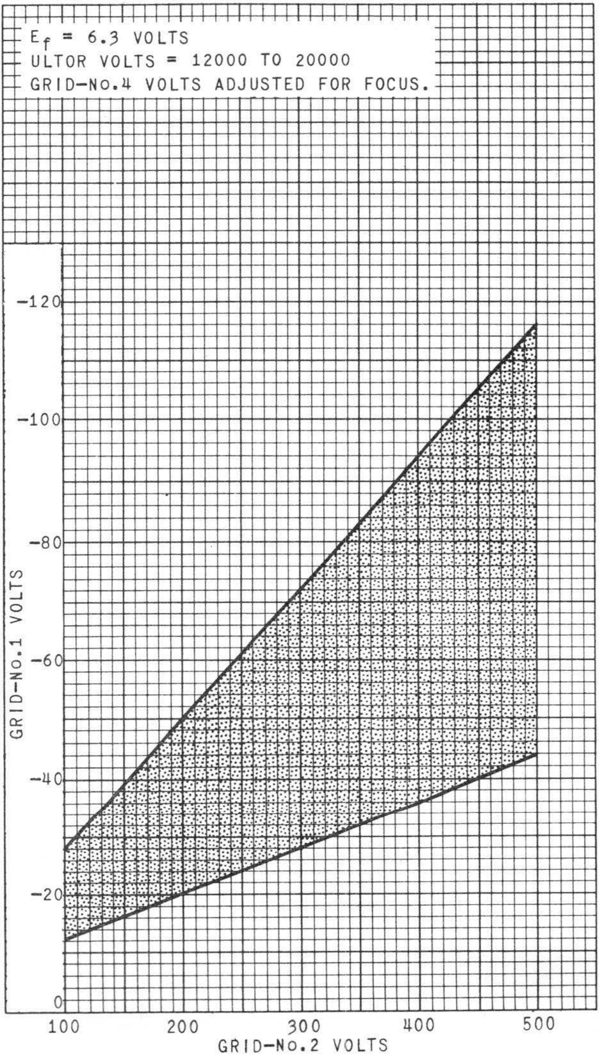
* Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 7/16-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

§ The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

RCA

24AHP4
RASTER-CUTOFF-RANGE CHART
For Grid-Drive Service



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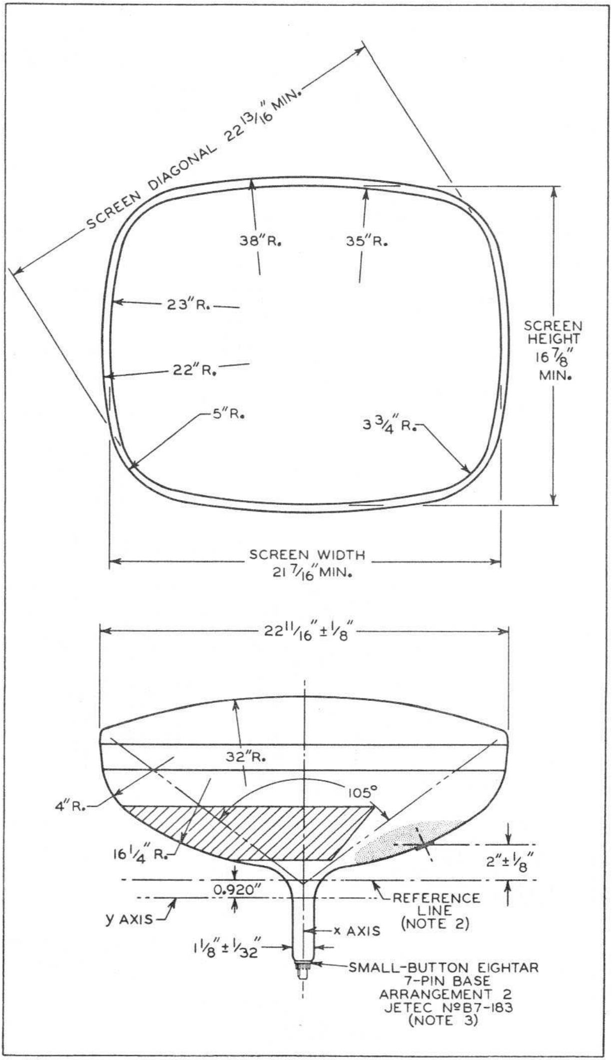
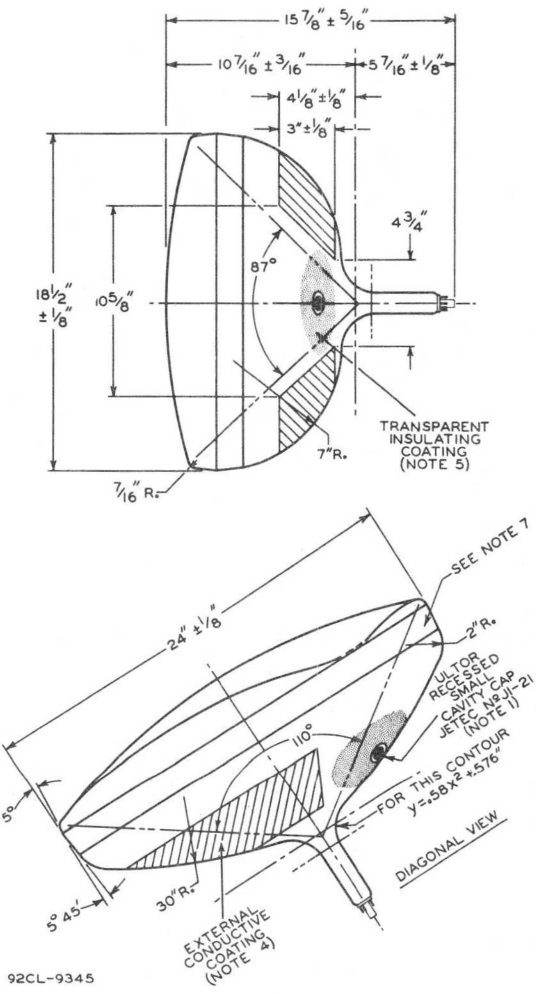
24AHP4

PICTURE TUBE



24AHP4
PICTURE TUBE



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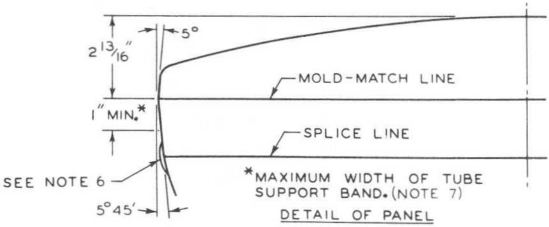
PICTURE TUBE



NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 4 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 4.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JETEC No. 126 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. THE DESIGN OF THE SOCKET SHOULD BE SUCH THAT THE CIRCUIT WIRING CANNOT IMPRESS LATERAL STRAINS THROUGH THE SOCKET CONTACTS ON THE BASE PINS. BOTTOM CIRCUMFERENCE OF BASE WAFER WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 1-3/4".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINTLESS CLOTH.

NOTE 6: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

NOTE 7: UNDISTURBED AREA BETWEEN MOLD-MATCH LINE AND SPLICE LINE IS 1" MINIMUM. THIS SHOULD BE THE MAXIMUM WIDTH OF TUBE SUPPORT BAND.

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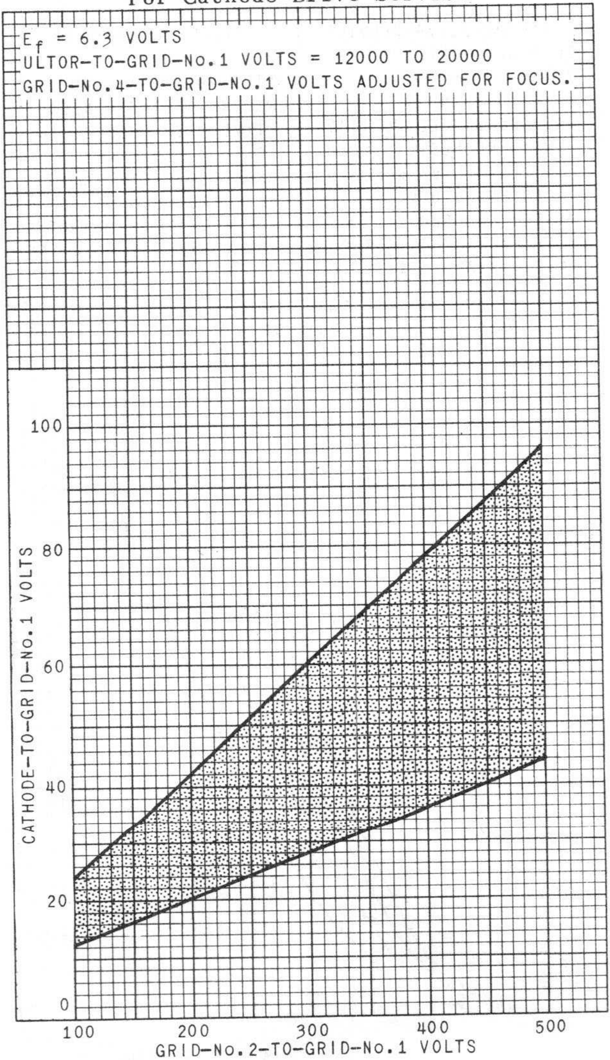
24AHP4

RASTER-CUTOFF-RANGE CHART
For Cathode-Drive Service



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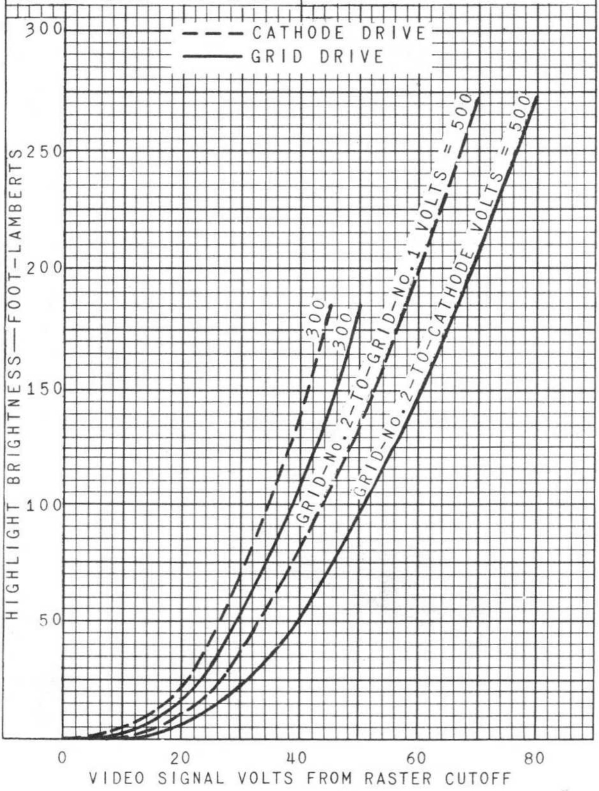
24AHP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
Ef = 6.3 VOLTS ULTOR-TO-GRID-No.1 VOLTS = 16000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID No.1 TO GIVE FOCUSED RASTER CUTOFF. RASTER FOCUSED AT AVERAGE BRIGHTNESS. RASTER SIZE = 21" x 16"	E_f = 6.3 VOLTS ULTOR VOLTS = 16000 GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF. RASTER FOCUSED AT AVERAGE BRIGHTNESS. RASTER SIZE = 21" x 16"



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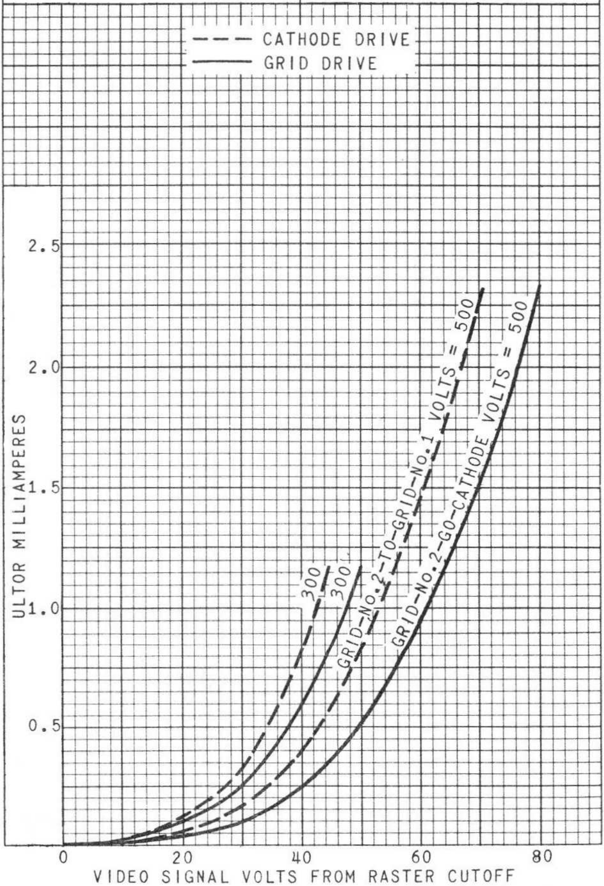
24AHP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-No.1 VOLTS = 12000 TO 20000	ULTOR VOLTS = 12000 TO 20000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID No.1 TO GIVE FOCUSED RASTER CUTOFF.	GRID No.1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



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24AUP4

PICTURE TUBE

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — MAGNETIC DEFLECTION

With heater having controlled warm-up time

DATA

General:

Heater, for Unipotential Cathode:

Voltage	6.3	ac or dc volts
Current	0.6 ± 5%	amp
Warm-up time (Average)	11	sec

For definition of heater warm-up time and method of determining it, see sheet HEATER WARM-UP TIME MEASUREMENT at front of Receiving Tube Section.

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes	6	$\mu\mu f$
Cathode to all other electrodes	5	$\mu\mu f$
External conductive coating to ultor	2500 max.	$\mu\mu f$
	1700 min.	$\mu\mu f$

Faceplate, Spherical . . . Filterglass
  Light transmission (Approx.) . . . 74%
Phosphor (For curves, see front of this Section) . . . P4—Sulfide Type Aluminized
  Fluorescence . . . White
  Phosphorescence . . . White
    Persistence . . . Short
Focusing Method . . . Electrostatic
Deflection Method . . . Magnetic
Deflection Angles (Approx.):
  Diagonal . . . 90°
  Horizontal . . . 85°
  Vertical . . . 68°
Electron Gun . . . Type Requiring No Ion-Trap Magnet
Tube Dimensions:
  Overall length . . . 18-1/8" ± 3/8"
  Greatest width . . . 22-11/16" ± 1/8"
  Greatest height . . . 18-7/16" ± 1/8"
  Diagonal . . . 24" ± 1/8"
  Neck length . . . 4-1/2" ± 3/16"
  Radius of curvature of faceplate (External surface) . . 40"
Screen Dimensions (Minimum):
  Greatest width . . . 21-7/16"
  Greatest height . . . 16-7/8"
  Diagonal . . . 22-13/16"
  Projected area . . . 332 sq. in.
Weight (Approx.) . . . 32-1/2 lbs
Operating Position . . . Any
Cap . . . Recessed Small Cavity (JEDEC No.J1-21)
Bulb . . . J192A/B
Base . . . Short Small-Shell Duodecal 6-Pin (JEDEC Group 4, No.B6-203), or Small-Shell Duodecal 6-Pin, Arrangement 1 (JEDEC Group 4, No.B6-63)

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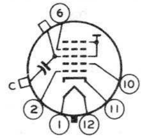
PICTURE TUBE

Basing Designation for BOTTOM VIEW 12L

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 6 - Grid No.4
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap - Ultor (Grid No.3, Grid No.5, Collector)
C - External Conductive Coating

GRID-DRIVE▲ SERVICE

Unless otherwise specified, voltage values are positive with respect to cathode

Maximum Ratings, *Design-Center Values:*

ULTOR VOLTAGE.	20000	max.	volts
	12000⊕	min.	volts
GRID-No.4 (FOCUSING) VOLTAGE:			
Positive value	1000	max.	volts
Negative value	500	max.	volts
GRID-No.2 VOLTAGE.	500	max.	volts
GRID-No.1 VOLTAGE:			
Negative-peak value.	200	max.	volts
Negative-bias value.	140	max.	volts
Positive-bias value.	0	max.	volts
Positive-peak value.	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	410	max.	volts
After equipment warm-up period . . .	180	max.	volts
Heater positive with respect to cathode.	180	max.	volts

Equipment Design Ranges:

With any ultor voltage (E_{c_5k}) between 12000 and 20000 volts and grid-No.2 voltage (E_{c_2k}) between 200 and 500 volts

Grid-No.4 Voltage for focus§	-75 to +400 volts
Grid-No.1 Voltage (E_{c_1k}) for visual extinction of focused raster	*See Raster-Cutoff-Range Chart for Grid-Drive Service*
Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value (Peak positive).	Same value as determined for E_{c_1k} except video drive is a positive voltage
Grid-No.4 Current.	-25 to +25 μa

▲,⊕,§: See next page.

24AUP4

PICTURE TUBE

Grid-No.2 Current.	-15 to +15	μa
Field Strength of Adjustable Centering Magnet†.	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor voltage of	*18000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.4 Voltage for focus . . .	-75 to +400	volts
Grid-No.1 Voltage for visual extinction of focused raster. .	-35 to -72	volts
Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value	35 to 72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms

CATHODE-DRIVE■ SERVICE

Unless otherwise specified, voltage values are positive with respect to grid No.1

Maximum Ratings, *Design-Center Values:*

ULTOR-TO-GRID-No.1 VOLTAGE.	20000	max.	volts
	12000#	min.	volts
GRID-No.4-TO-GRID-No.1 VOLTAGE:			
Positive value.	1000	max.	volts
Negative value.	500	max.	volts
GRID-No.2-TO-GRID-No.1 VOLTAGE.	640	max.	volts
GRID-No.2-TO-CATHODE VOLTAGE.	500	max.	volts
CATHODE-TO-GRID-No.1 VOLTAGE:			
Positive-peak value	200	max.	volts
Positive-bias value	140	max.	volts
Negative-bias value	0	max.	volts
Negative-peak value	2	max.	volts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds.	410	max.	volts
After equipment warm-up period. . . .	180	max.	volts
Heater positive with respect to cathode.	180	max.	volts

Equipment Design Ranges:

With any ultor-to-grid-No.1 voltage ($E_{c_5g_1}$) between 12000 and 20000 volts and grid-No.2-to-grid-No.1 voltage ($E_{c_2g_1}$) between 225 and 640 volts

Grid-No.4-to-Grid-No.1 Voltage for focus§.	-75 to +400	volts
Cathode-to-Grid-No.1 Voltage (E_{kg_1}) for visual extinction of focused raster	*See Raster-Cutoff-Range Chart for Cathode-Drive Service*	

▲,#,§,†,■: See next page.

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PICTURE TUBE

Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level):		
White-level value (Peak negative)	Same value as determined for E_{kg1} except video drive is a negative voltage	
Grid-No.4 Current	−25 to +25	μa
Grid-No.2 Current	−15 to +15	μa
Field Strength of Adjustable Centering Magnet†	0 to 8	gausses

Examples of Use of Design Ranges:

With ultor-to-grid-No.1 voltage of	*18000*	*volts*
and grid-No.2-to-grid-No.1 voltage of	*300*	*volts*
Grid-No.4-to-Grid-No.1 Voltage for focus	−75 to +400	volts
Cathode-to-Grid-No.1 Voltage for visual extinction of focused raster	33 to 60	volts
Cathode-to-Grid-No.1 Video Drive from Raster Cutoff (Black Level): White-level value	−33 to −60	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance.	1.5 max.	megohms

▲ Grid drive is the operating condition in which the video signal varies the grid-No.1 potential with respect to cathode.

⊕ This value is a working design-center minimum. The equivalent *absolute minimum* ultor-or ultor-to-grid-No.1 voltage is 11,000 volts, below which the serviceability of the 24AUP4 will be impaired. The equipment designer has the responsibility of determining a minimum design value such that under the worst probable operating conditions involving supply-voltage variation and equipment variation the absolute minimum ultor-or ultor-to-grid-No.1 voltage is never less than 11,000 volts.

§ The grid-No.4 voltage or grid-No.4-to-grid-No.1 voltage required for focus of any individual tube is independent of ultor current and will remain essentially constant for values of ultor voltage (or ultor-to-grid-No.1 voltage) or grid-No.2 voltage (or grid-No.2-to-grid-No.1 voltage) within design ranges shown for these items.

† Distance from *Reference Line* for suitable PM centering magnet should not exceed 2-1/4". Excluding extraneous fields, the center of the undeflected focused spot will fall within a circle having a 1/2-inch radius concentric with the center of the tube face. It is to be noted that the earth's magnetic field can cause as much as 1/2-inch deflection of the spot from the center of the tube face.

■ Cathode drive is the operating condition in which the video signal varies the cathode potential with respect to grid No.1 and other electrodes.

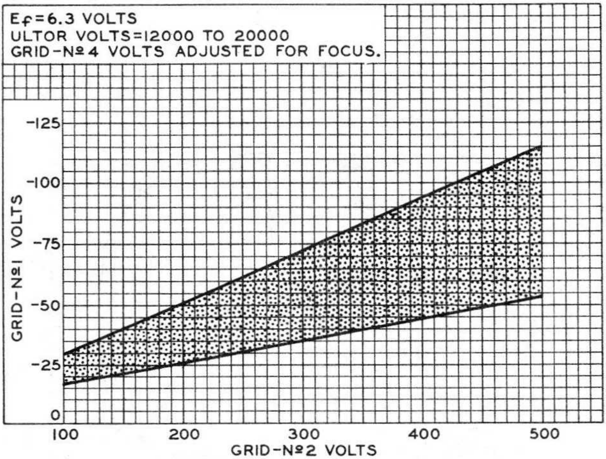
For X-ray shielding considerations, see sheet X-RAY PRECAUTIONS FOR CATHODE-RAY TUBES at front of this Section

RCA

24AUP4

RASTER-CUTOFF-RANGE CHARTS

GRID-DRIVE SERVICE



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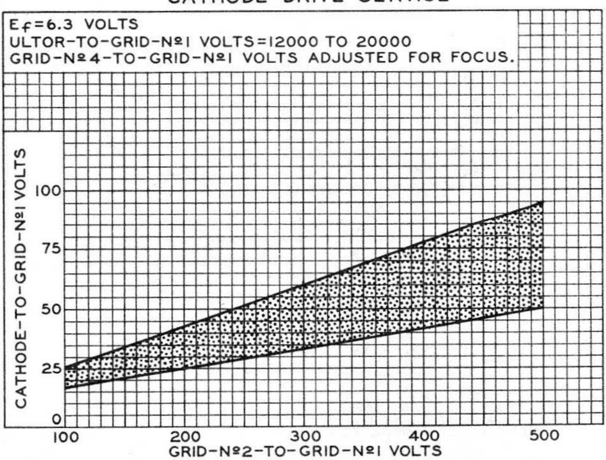
CATHODE-DRIVE SERVICE



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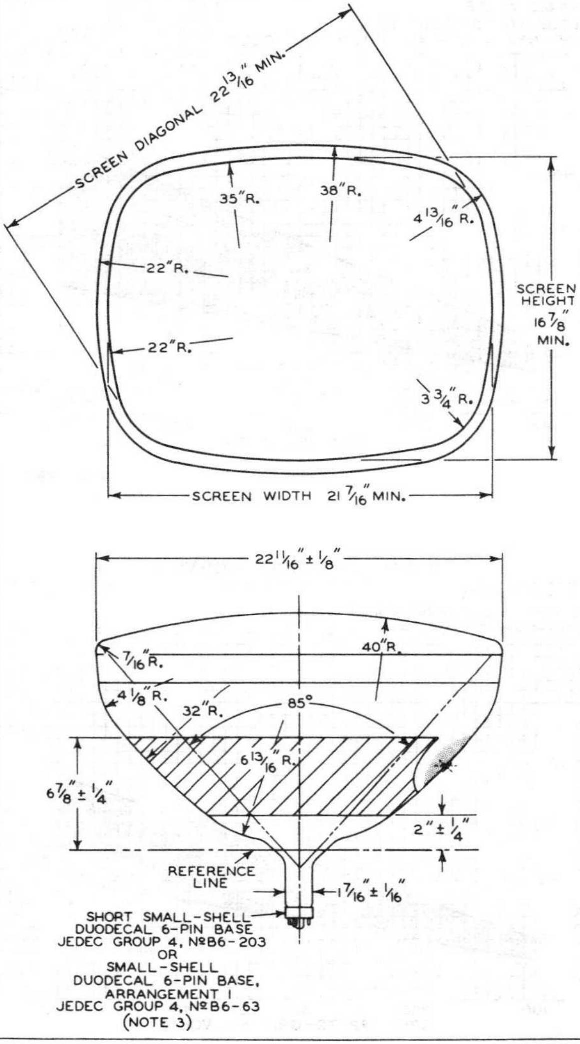
24AUP4

PICTURE TUBE



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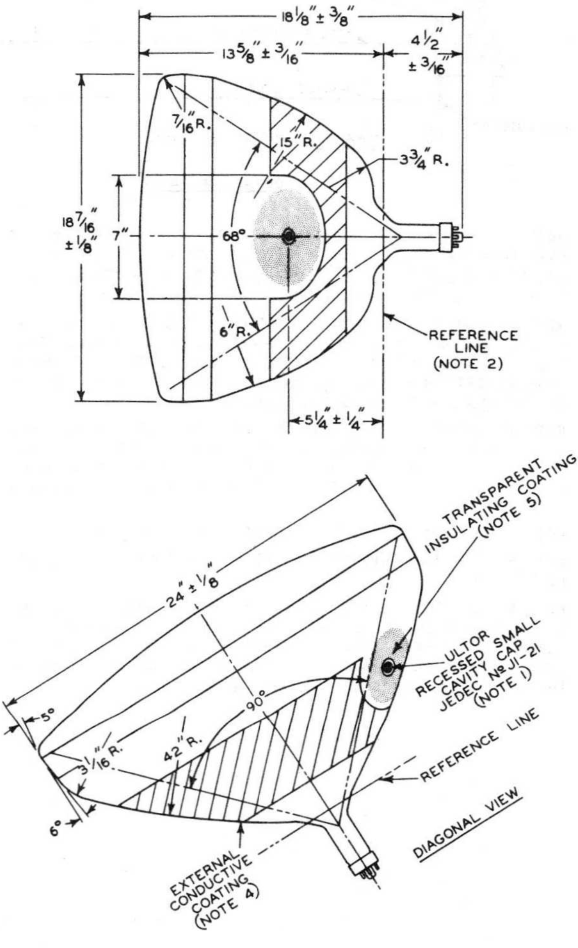
24AUP4

PICTURE TUBE



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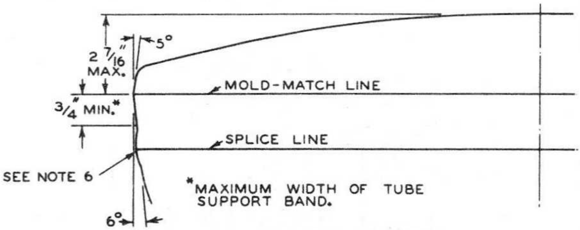
24AUP4
PICTURE TUBE



DETAIL OF PANEL

NOTE 1: THE PLANE THROUGH THE TUBE AXIS AND PIN 6 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND ULTOR TERMINAL BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 30°. ULTOR TERMINAL IS ON SAME SIDE AS PIN 6.

NOTE 2: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE GAUGE JEDEC No. G-116 (SHOWN AT FRONT OF THIS SECTION) AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

NOTE 3: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 3".

NOTE 4: EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 5: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

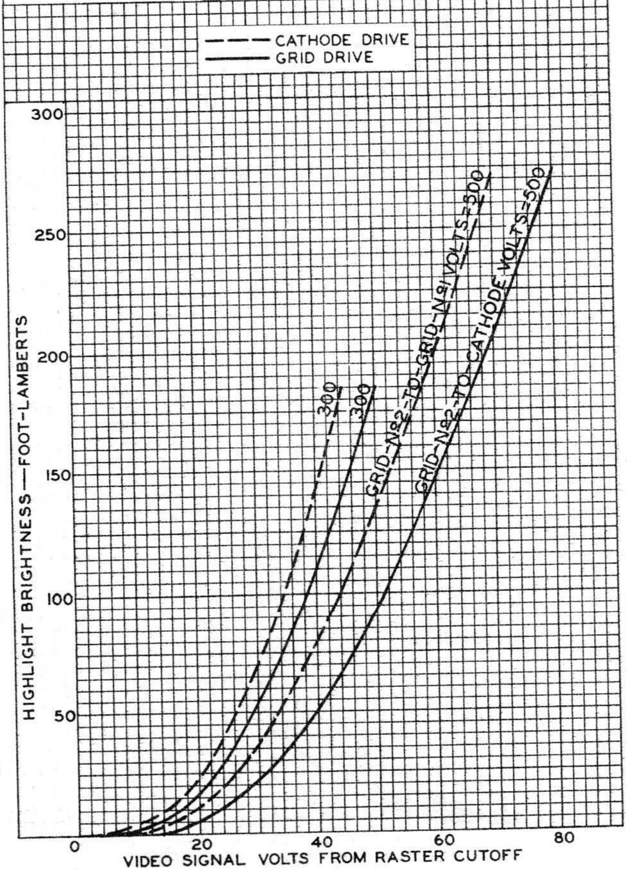
NOTE 6: BULGE AT SPLICE-LINE SEAL MAY INCREASE THE INDICATED MAXIMUM VALUE FOR ENVELOPE WIDTH, DIAGONAL, AND HEIGHT BY NOT MORE THAN 1/8", BUT AT ANY POINT AROUND THE SEAL, THE BULGE WILL NOT PROTRUDE MORE THAN 1/16" BEYOND THE ENVELOPE SURFACE AT THE MOLD-MATCH LINE.

RCA

24AUP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-Nº1 VOLTS = 16000	ULTOR VOLTS = 16000
CATHODE BIASED POSITIVE WITH RESPECT TO GRID Nº1 TO GIVE FOCUSED RASTER CUTOFF.	GRID Nº1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.
RASTER FOCUSED AT AVERAGE BRIGHTNESS.	RASTER FOCUSED AT AVERAGE BRIGHTNESS.
RASTER SIZE = 21" x 16"	RASTER SIZE = 21" x 16"



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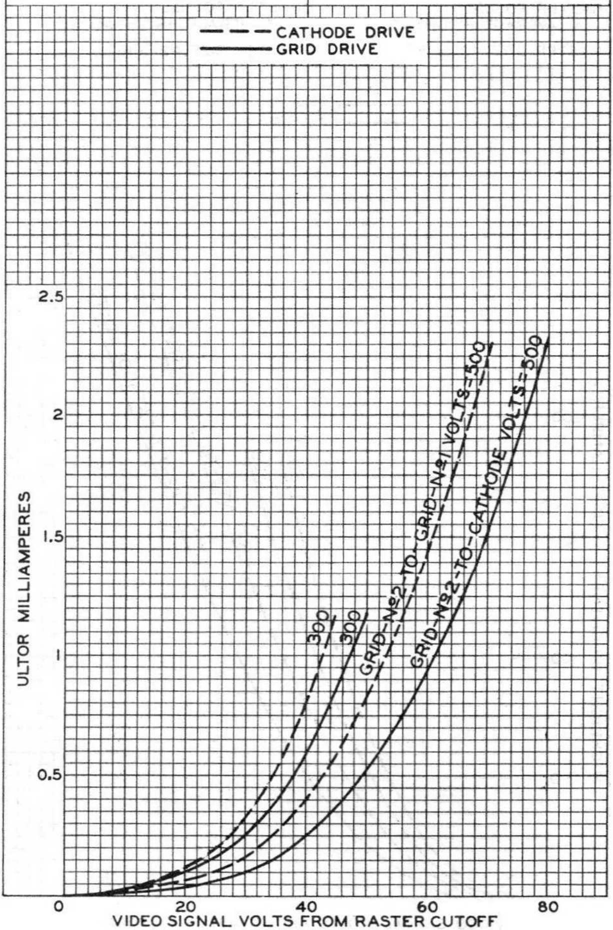
24AUP4

AVERAGE DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f=6.3 VOLTS ULTOR-TO-GRID-Nº1 VOLTS = 12000 TO 20000 CATHODE BIASED POSITIVE WITH RESPECT TO GRID Nº1 TO GIVE FOCUSED RASTER CUTOFF.	E_f=6.3 VOLTS ULTOR VOLTS=12000 TO 20000 GRID Nº1 BIASED NEGATIVE WITH RESPECT TO CATHODE TO GIVE FOCUSED RASTER CUTOFF.



24BEP4

Picture Tube

NO ION-TRAP MAGNET REQUIRED

RECTANGULAR GLASS TYPE — ALUMINIZED SCREEN
LOW-VOLTAGE ELECTROSTATIC FOCUS — 110° MAGNETIC DEFLECTION

Electrical:

Direct Interelectrode Capacitances:		
Cathode to all other electrodes. . . .	5	pf
Grid No.1 to all other electrodes. . .	6	pf
External conductive coating to anode .	2500 max.	pf
	1700 min.	pf
Heater Current at 6.3 volts.	600 ± 30	ma
Heater Warm-up Time (Average).	11	seconds
Electron Gun . . . . .Type Requiring No Ion-Trap Magnet		

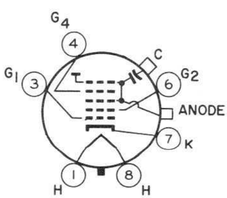
Optical:

Phosphor (For curves, see front of this Section) . . . P4—Sulfide Type, Aluminized
Faceplate. . . . . .Filterglass
Light transmission (Approx.) 74%

Mechanical:

Weight (Approx.) . . . . 26-1/2 lbs
Overall Length . . . . .14.812" ± .312"
Neck Length. . . . . 4.375" ± .125"
Projected Area of Screen . . . . 332 sq. in.
External Conductive Coating:
Type . . . . .Modified-Band
Contact area for grounding . . . . .Near Reference Line
For Additional Information on Coatings and Dimensions:
See *Picture-Tube Dimensional-Outlines and Bulb J192 C/D* sheets at front of this section.
Cap. . . . . .Recessed Small Cavity (JEDEC No.J1-21)
Base . . . . Small-Button Neoeightar 7-Pin, Arrangement 1, (JEDEC No.B7-208)
Basing Designation for BOTTOM VIEW 8KW

Pin 1 - Heater
Pin 3 - Grid No.1
Pin 4 - Grid No.4
Pin 6 - Grid No.2
Pin 7 - Cathode
Pin 8 - Heater
Cap - Anode (Grid No.3, Grid No.5, Screen, Collector)
C - External Conductive Coating



Maximum and Minimum Ratings, *Design-Maximum Values:*

Unless otherwise specified, voltage values are positive with respect to cathode

Anode Voltage.	20000 max.	volts
Grid-No.4 (Focusing) Voltage:		
Positive value	1100 max.	volts
Negative value	550 max.	volts

Grid-No.2 Voltage	550 max.	volts
Grid-No.1 Voltage:		
Negative peak value	220 max.	volts
Negative bias value	154 max.	volts
Positive bias value	0 max.	volts
Positive peak value	2 max.	volts
Heater Voltage	6.9 max.	volts
	5.7 min.	volts
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	volts
After equipment warm-up period	200 max.	volts
Heater positive with respect to cathode	200 max.	volts

Typical Operating Conditions for Cathode-Drive Service:

Unless otherwise specified, voltage values are positive with respect to grid No.1

Anode Voltage	16000	volts
Grid-No.4 Voltage	200	volts
Grid-No.2 Voltage	400	volts
Cathode Voltage for visual extinction of focused raster	42 to 78	volts

Maximum Circuit Value:

Grid-No.1 Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet *X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES* At front of this section

24CP4B

Picture Tube

RECTANGULAR GLASS TYPE
MAGNETIC FOCUS

ALUMINIZED SCREEN
90° MAGNETIC DEFLECTION

Electrical:

Heater Current at 6.3 volts	600 ± 10%	ma
Direct Interelectrode Capacitances:		
Grid No.1 to all other electrodes	6	pf
Cathode to all other electrodes	5	pf
External conductive coating to anode	2500 max.	pf
	2000 min.	pf
Electron Gun	Type Requiring No Ion-Trap Magnet	

Optical:

Faceplate, Spherical	Filterglass
Light transmission (Approx.)	75%
Phosphor (For curves, see front of this section)	P4—Sulfide Type, Aluminized

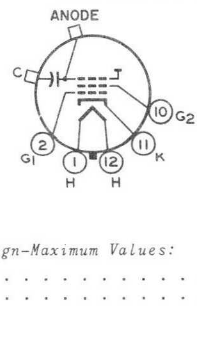
Mechanical:

Operating Position	Any
Weight (Approx.)	35 lbs
Overall Length	21-1/8" ± 3/8"
Neck Length	7-1/2" ± 3/16"
Projected Area of Screen	332 sq. in.
External Conductive Coating:	
Type	Regular-Band
Contact area for grounding	Near Reference Line

For Additional Information on Coatings, Dimensions, and Deflection Angles:
See *Picture-Tube Dimensional-Outlines* and *Bulb J192 A/B* sheets at the front of this section

Cap	Recessed Small Cavity (JEDEC No.J1-21)
Base	Small-Shell Duodecal 5-Pin (JEDEC Group 4, No.B5-57)
Basing Designation for BOTTOM VIEW	12N

Pin 1 - Heater
Pin 2 - Grid No.1
Pin 10 - Grid No.2
Pin 11 - Cathode
Pin 12 - Heater



Cap-Anode (Grid No.3, Collector)
C-External Conductive Coating

Maximum Ratings, *Design-Maximum Values:*

Anode Voltage	22000 max.	volts
Grid-No.2 Voltage	550 max.	volts

Grid-No.1 Voltage:			
Negative peak value	220	max.	volts
Negative bias value	155	max.	volts
Positive bias value	0	max.	volts
Positive peak value	2	max.	volts
Peak Heater-Cathode Voltage:			
Heater negative with respect to cathode:			
During equipment warm-up period not exceeding 15 seconds	450	max.	volts
After equipment warm-up period	200	max.	volts
Heater positive with respect to cathode	200	max.	volts

Typical Operating Conditions:

With anode voltage of	*16000*	*volts*
and grid-No.2 voltage of	*300*	*volts*
Grid-No.1 Voltage for visual extinction of focused raster	−28 to −72	volts

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms

For X-radiation shielding considerations, see sheet
X-RADIATION PRECAUTIONS FOR CATHODE-RAY TUBES
at front of this section

25AJP22

Color Picture Tube

Perma-Chrome | **Banded-Type Implosion Protection**
90° Rectangular | **HI-LITE Screen**
New Rare-Earth (Red) Phosphor | **Unity Current Ratios**

ELECTRICAL

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green	
Heater, of Each Gun Series Connected within Tube with Each of the Other Two Heaters:		
Current at 6.3 V[a]	900	mA
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Method	Magnetic	
Deflection Angles (Approx.):		
Diagonal	89	deg.
Horizontal	78	deg.
Vertical	63	deg.
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 of any gun to all other electrodes	6	pF
Grid No.3 to all other electrodes	6.5	pF
All cathodes to all other electrodes	15	pF
External conductive coating to anode (Approx.)	2500 max.	pF
	2000 min.	pF

OPTICAL

Faceplate	Filterglass
Light transmission at center (Approx.)	42%
Surface	Polished
Screen, on Inner Surface of Faceplate:	
Type	Aluminized, Tricolor, Phosphor-Dot
Phosphor (three separate phosphors, collectively)[b]	P22-New Rare-Earth (Red), Sulfide (Blue & Green) Type
Fluorescence and phosphorescence of separate phosphors, respectively	Red, Blue, Green
Persistence of group phosphorescence	Medium Short
Dot Arrangement	Triangular group consisting of red dot, blue dot, and green dot
Spacing between centers of adjacent dot trios (Approx.)	0.029 in (0.74 mm)

MECHANICAL

Minimum Screen Area (Projected):	295 sq. in (1905 sq. cm)
Bulb Funnel Designation	JEDEC No.J195–1/2 A1
Bulb Panel Designation	JEDEC No.FP196–1/2
Base	Small-Button Diheptar 12-pin
Basing Designation[c]	JEDEC No.14BE
Pin Position Alignment	Pin No.12 Aligns Approx. with Anode Bulb Contact
Operating Position	Anode Bulb Contact on Top
Weight (Approx.)	38 lb (17.4 kg)

MAXIMUM AND MINIMUM RATINGS, Design - Maximum Values

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	27,500 max. / 20,000 min.	V
Total Anode Current, Long-Term Average	1000 max.	μA
Grid-No.3 (Focusing Electrode) Voltage	6000 max.	V
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max.	V
Grid-No.1 Voltage:		
Negative bias value	400 max.	V
Negative operating cutoff value	200 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Heater Voltage (ac or dc):		
Under operating conditions[a]	6.9 max. / 5.7 min.	V
Under standby conditions[d]	5.5 max.	V
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
Combined AC and DC value	200 max.	V
DC component value	200 max.	V
Heater positive with respect to cathode:		
AC component value	200 max.	V
DC component value	0 max.	V

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 V

Grid-No.3 (Focusing Electrode) Voltage . . . . 16.8% to 20% of Anode voltage

Grid-No.2 and Grid-No.1 Voltages for Visual Extinction of Focused Spot	See *CUTOFF DESIGN CHART*			
Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At grid-No.1 spot cutoff voltage of −100 V)	1.86			
Heater Voltage:				
Under operating conditions[a]	6.3			V
Under standby conditions[c]	5.0			V
Grid-No.3 Current (Total)	−45 to +15			μA
Grid-No.2 Current	−5 to +5			μA

To Produce White of 9300° K + 27 M.P.C.D. (CIE Coordinates x=0.281, y=0.311):

	Red	Blue	Green	
Percentage of total anode current supplied by each gun (average)	34	32	34	%

Ratio of cathode currents:	*Min.*	*Typ.*	*Max.*
Red/blue	0.75	1.10	1.50
Red/green	0.65	1.00	1.50
Blue/green	0.60	0.91	1.30

Displacements, Measured at Center of Screen:

Raster centering displacement:	
Horizontal	±0.47 in (±11.9 mm)
Vertical	±0.45 in (±11.4 mm)
Lateral distance between the blue beam and the converged red and green beams	±0.25 in (±6.4 mm)
Radial convergence displacement excluding effects of dynamic convergence (each beam)	±0.37 in (±9.4 mm)
Maximum Required Correction for Register[e] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the Center of the Screen in any Direction	0.005 in (0.13 mm) max.

LIMITING CIRCUIT VALUES

High-Voltage Circuits:

Grid-No.3 circuit resistance . . . . 7.5 max. MΩ

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type, in which the short-circuit current does not exceed 20 milliamperes.

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . 0.75 max. MΩ

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 milliamperes total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

[a] For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.

[b] For curve, see *Group Phosphor-P22-New Rare-Earth (Red), Sulfide (Blue & Green)* at front of this section.

[c] The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound.

[d] For "instant on" applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

[e] Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

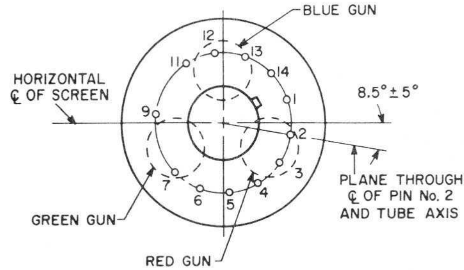
X-RADIATION WARNING

Because the 25AJP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 25AJP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

BASE SPECIFICATION – JEDEC No.14BE

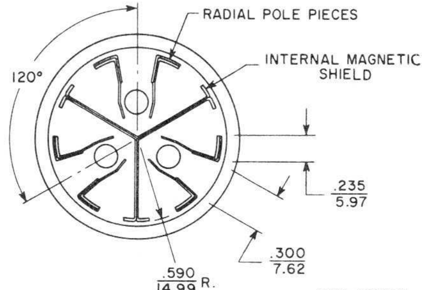
Pin 1: Heater
Pin 2: Cathode of Red Gun
Pin 3: Grid No.1 of Red Gun
Pin 4: Grid No.2 of Red Gun
Pin 5: Grid No.2 of Green Gun
Pin 6: Cathode of Green Gun
Pin 7: Grid No.1 of Green Gun
Pin 9: Grid No.3
Pin 11: Cathode of Blue Gun
Pin 12: Grid No.1 of Blue Gun
Pin 13: Grid No.2 of Blue Gun
Pin 14: Heater
Cap: Anode (Grid No.4, Screen, Collector)
C: External Conductive Coating

BOTTOM VIEW OF BASE



92CS-12816

LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



92CS-12835R3

NOTES FOR DIMENSIONAL OUTLINE

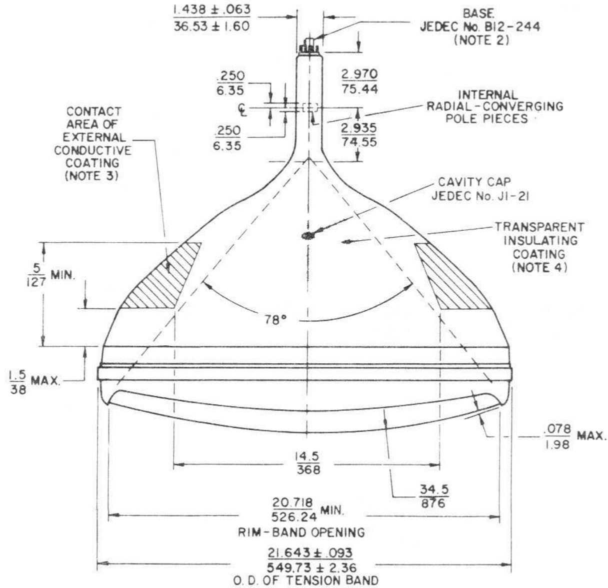
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge JEDEC No. G162 and with tube seated in guage, the reference line is determined by the intersection on the plane C-C' of the gauge with the glass funnel.

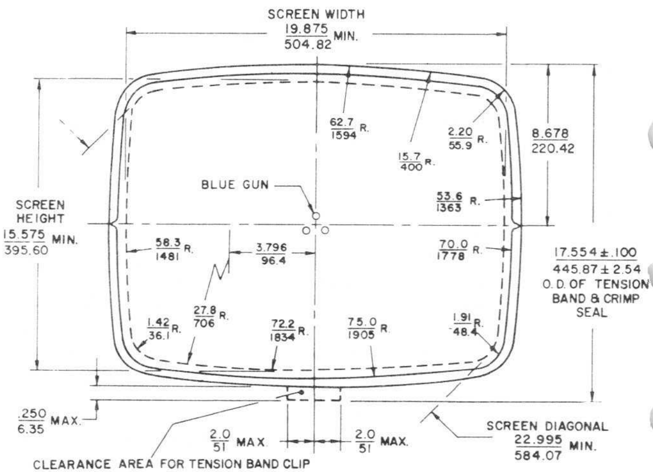
Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

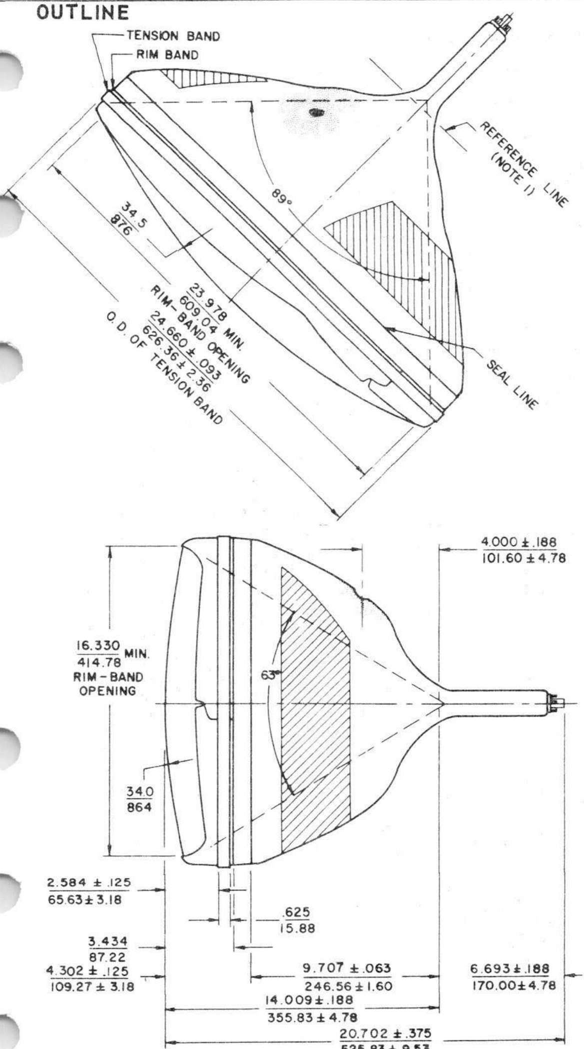
Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

DIMENSIONAL



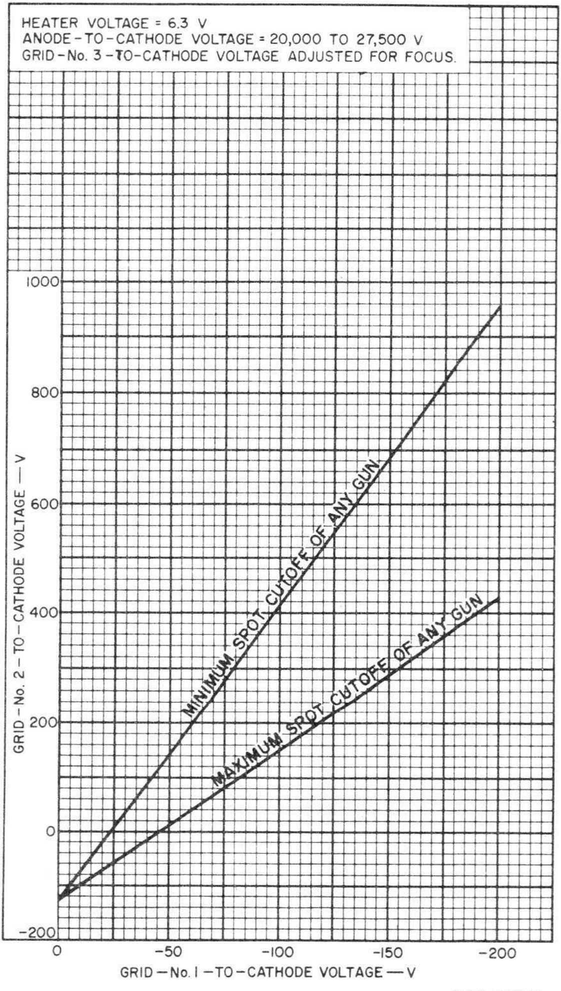


OUTLINE



Dimensions in Inches/mm

CUTOFF DESIGN CHART



92CM-12803R1

25BCP22

Color Picture Tube

Hi-Lite Matrix Screen — **Perma-Chrome**
90° Rectangular — **High-Resolution Gun**
New Green Phosphor — **Unity Current Ratios**

Antiglare Integral Protective Window

ELECTRICAL

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green	
Heater, of Each Gun Series Connected within Tube with Each of the Other two Heaters:		
Current at 6.3 V[a]	900 mA	
Focusing Method	Electrostatic	
Focus Lens	Bipotential	
Convergence Method	Magnetic	
Deflection Method	Magnetic	
Deflection Angles:		
Diagonal	89 deg.	
Horizontal	78 deg.	
Vertical	63 deg.	
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 of any gun to all other electrodes	7.5	pF
Grid No.3 to all other electrodes	6.5	pF
All cathodes to all other electrodes	15	pF
External conductive coating to anode	2500 max.	pF
	2000 min.	pF

OPTICAL

Faceplate and Protective Window	Filterglass
Light transmission at center (Approx.)	67.5%
Surface of Protective Window	Treated to minimize specular reflection
Screen	Aluminized
Matrix	Black opaque material
Phosphor, rare-earth (red), sulfide (blue & green)	P22
Persistence	Medium-Short
Array	422,550 Dot trios
Spacing between centers of adjacent dot trios (approx.)	0.029 in (0.74 mm)

MECHANICAL

Minimum Screen Area (Projected)	295 sq. in (1905 sq. cm)
Bulb Funnel Designation	JEDEC No.J195–1/2
Bulb Panel Designation	JEDEC No.FP196–1/2
Protective Window Designation	JEDEC No.SP196–1/2
Base[b]	Small-Button Diheptar 12-pin
Pin Position Alignment	Pin No.12 Aligns Approx. with Anode Bulb Contact
Operating Position	Anode Bulb Contact on Top
Weight (Approx.)	42 lb (19.1 kg)

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	27,500 max.	V
	20,000 min.	V
Total Anode Current, Long-Term Average	1000 max.	μA
Grid-No.3 (Focusing Electrode) Voltage	6000 max.	V
Peak-Grid-No.2 Voltage, Including Video Signal Voltage	1000 max.	V
Grid-No.1 Voltage:		
Negative bias value	400 max.	V
Negative operating cutoff value	200 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Heater Voltage (ac or dc):		
Under operating conditions[a]	5.7 min.—6.9 max.	V
Under standby conditions[d]	5.5 max.	V
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
Combined AC and DC value	200 max.	V
DC component value	200 max.	V
Heater positive with respect to cathode:		
AC component value	200 max.	V
DC component value	0 max.	V

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 V

Grid-No.3 (Focusing Electrode) Voltage .... 16.8% to 20% of Anode voltage

Grid-No.2 and Grid-No.1 Voltages for Visual Extinction of Focused Spot . . . . See CUTOFF DESIGN CHART

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At grid-No.1 spot cutoff voltage of -100 V) 1.86

Heater Voltage:

Under operating conditions:[a]

When standby operation is not utilized . . . . 6.3 V

When 5.0-V standby operation is utilized . . . . 6.0 V

Under standby conditions[d] . . . . 5.0 V

Grid-No.3 Current (Total) . . . . -45 to +15 µA

Grid-No.2 Current . . . . -5 to +5 µA

To Produce White of 9300° K + 27 M.P.C.D. (CIE Coordinates x = 0.281, y =0.311):

	Red	Blue	Green	
Percentage of total anode current supplied by each gun (average)	34	32	34	%

Ratio of cathode currents:	Min.	Typ.	Max.
Red/blue	0.75	1.10	1.50
Red/green	0.65	1.00	1.50
Blue/green	0.60	0.91	1.30

Displacements, Measured at Center of Screen:

Raster centering displacement:

Horizontal . . . . ± 0.45 in (± 11.4 mm)

Vertical . . . . ± 0.45 in (± 11.4 mm)

Lateral distance between the blue beam and the converged red and green beams . . . . ± 0.25 in (± 6.4 mm)

Radial convergence displacement excluding effects of dynamic convergence (each beam) . . . . . . ± 0.37 in (± 9.4 mm)

Maximum Required Correction for Register[e] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the Center of the Screen in any Direction . . . . 0.005 in (0.13 mm) max.

LIMITING CIRCUIT VALUES

High-Voltage Circuits:

Grid-No.3 circuit resistance . . . . 7.5 max. MΩ

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type, in which the short-circuit current does not exceed 20 milliamperes.

Low-Voltage Circuits:

Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . 0.75 max. MΩ

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 milliamperes total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

[a] For maximum cathode life, it is recommended that the heater supply be regulated. The series impedance to any chassis connection in the dc biasing circuit for the heater should be between 100,000 ohms and 1 megohm.

[b] The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound.

[d] The use of a 5-volt standby condition in conjunction with 6-volt operating condition is recommended to improve the reliability of the color picture tube by extending the emission wear-out life and reducing other gun-related defects. A maximum heater voltage of 5.5 volts (Design-Maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

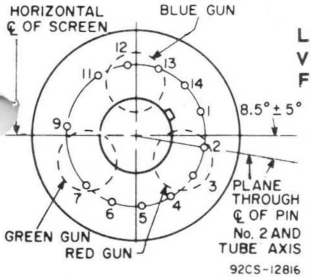
[e] Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

X-RADIATION WARNING: Because the 25BCP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (Design-Maximum value), shielding of the 25BCP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

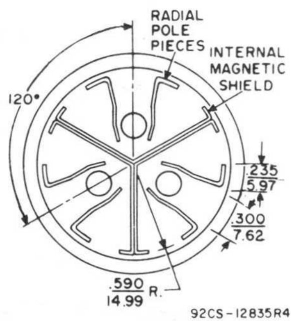
BASE SPECIFICATION – JEDEC No. 14BE

Pin 1: Heater
Pin 2: Cathode of Red Gun
Pin 3: Grid No.1 of Red Gun
Pin 4: Grid No.2 of Red Gun
Pin 5: Grid No.2 of Green Gun
Pin 6: Cathode of Green Gun
Pin 7: Grid No.1 of Green Gun
Pin 9: Grid No.3
Pin 11: Cathode of Blue Gun
Pin 12: Grid No.1 of Blue Gun
Pin 13: Grid No.2 of Blue Gun
Pin 14: Heater
Cap: Anode (Grid No.4, Screen, Collector)
C: External Conductive Coating

BOTTOM VIEW OF BASE



LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



NOTES FOR DIMENSIONAL OUTLINE

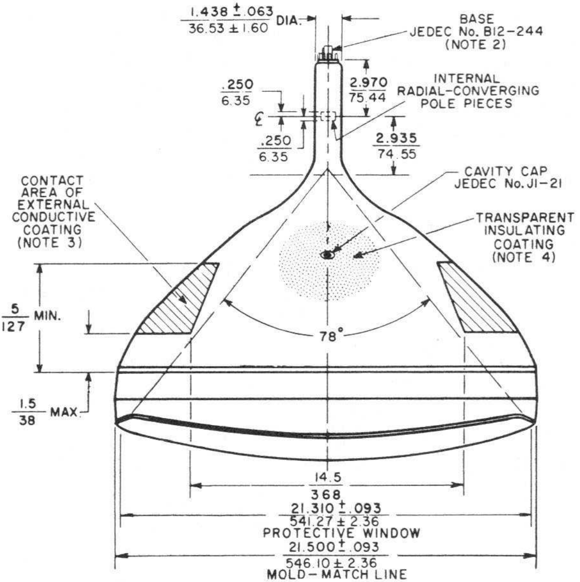
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C′ of the gauge with the glass funnel.

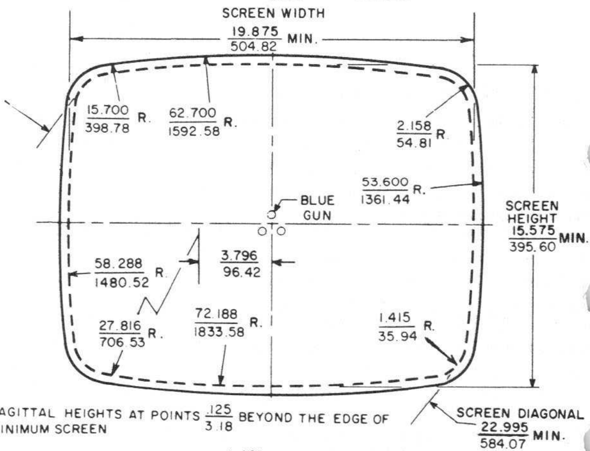
Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

DIMENSIONAL

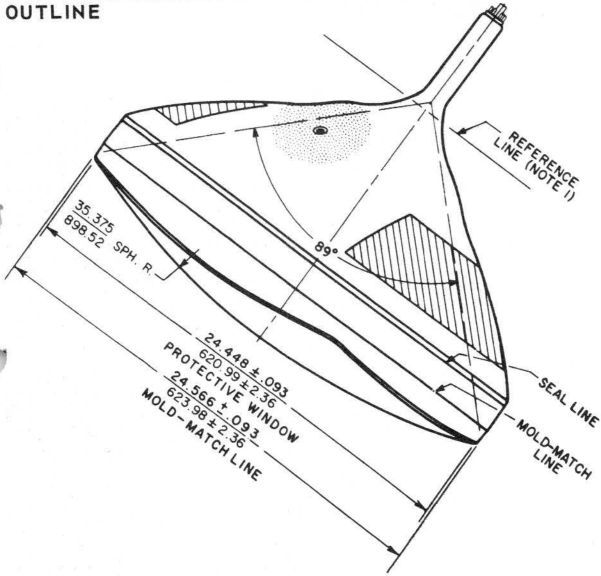


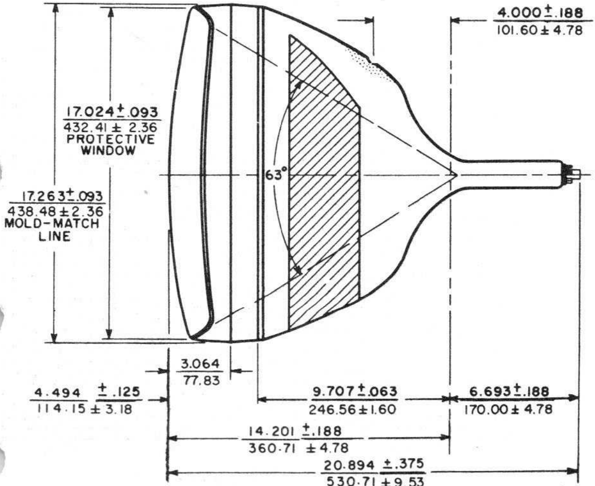


SAGITTAL HEIGHTS AT POINTS .125/3.18 BEYOND THE EDGE OF MINIMUM SCREEN

DIAGONAL	1.964 / 49.89	WIDTH	1.461 / 37.11	HEIGHT	0.896 / 22.76

OUTLINE

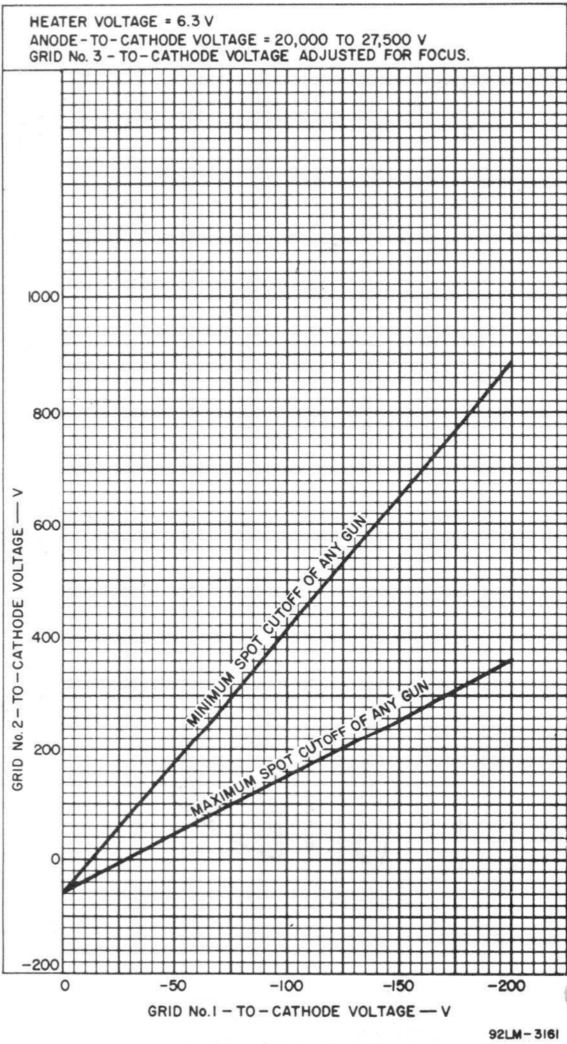




92CL-12838R3

Dimensions in Inches / mm unless otherwise shown

CUTOFF DESIGN CHART



Color Picture Tube

Hi-Lite Matrix Screen
90° Rectangular
New Green Phosphor

Perma-Chrome
High-Resolution Gun
Unity Current Ratios

Integral Implosion Protection – Banded Type

The 25BDP22 is the same as the 25BCP22 except for:

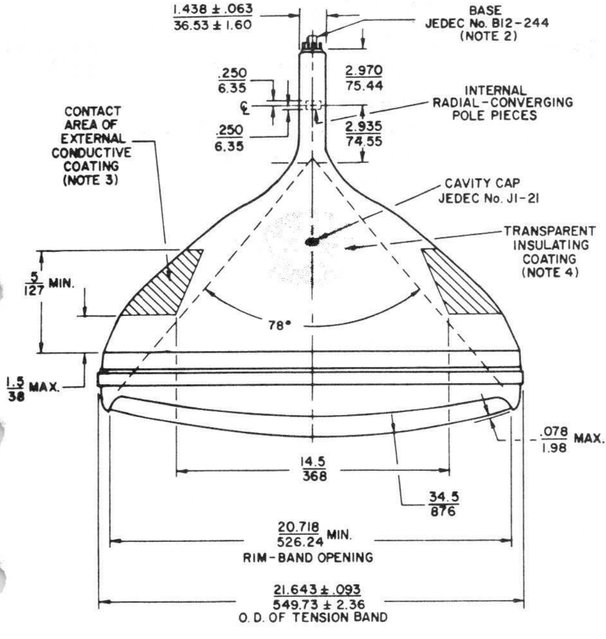
OPTICAL

Faceplate . . . . Filterglass
- Light transmission at center (Approx.) 69%
- Surface . . . . Polished

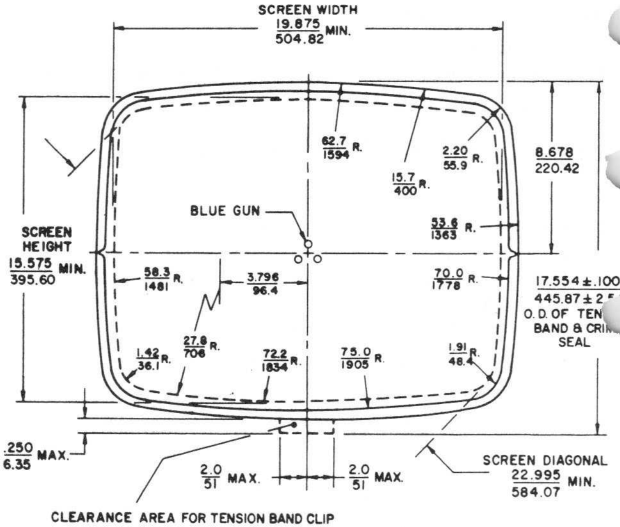
MECHANICAL

Weight (Approx.). 38 lb (17.4 kg)

DIMENSIONAL OUTLINE (Top View)



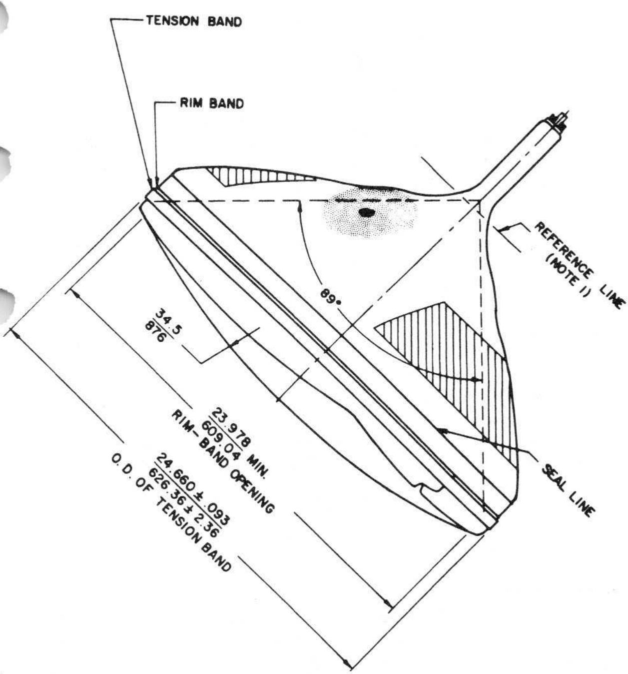
DIMENSIONAL OUTLINE (Front View)



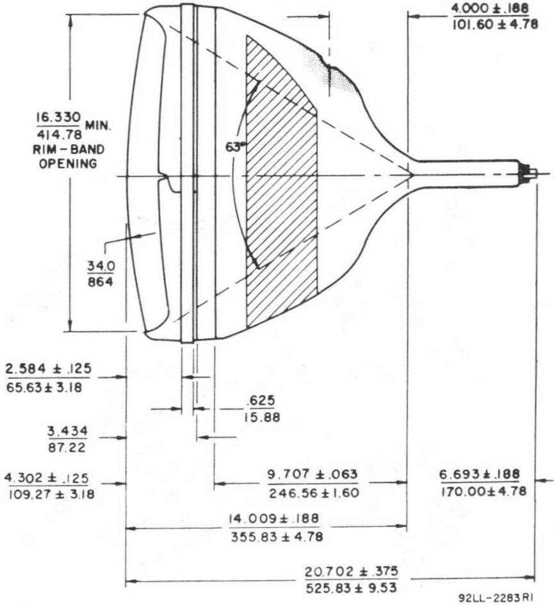
SAGITTAL HEIGHTS AT POINTS $\frac{.125}{3.18}$ BEYOND THE EDGE OF MINIMUM SCREEN

DIAGONAL	$\frac{2.063}{52.40}$
WIDTH	$\frac{1.524}{38.71}$
HEIGHT	$\frac{0.950}{24.13}$

DIMENSIONAL OUTLINE (Right Oblique View)



DIMENSIONAL OUTLINE (Right Side View)



Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C′ of the gauge with the glass funnel.

Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

Dimensions in $\frac{\text{Inches}}{\text{mm}}$ unless otherwise shown

Color Picture Tube

PERMA-CHROME **HI-LITE Screen**

Rare-Earth (Red) Phosphor

Antiglare Integral Protective Window

This data sheet is to be used in conjunction with data for RCA-25XP22.

For general data, terminal diagram, maximum and minimum ratings, equipment design ranges, limiting circuit values, x-radiation warning, and general considerations of the 25BGP22, refer to the 25XP22 except as noted below.

MECHANICAL

Bulb Panel Designation . . . . JEDEC No.FP196-1/2A3

OPTICAL

Faceplate and Protective Window
Light Transmission at center (Approx.) 52.5%

EQUIPMENT DESIGN RANGES

To Product White of 9300° K + 27 M.P.C.D.
(CIE Coordinates x = 0.281, y = 0.311):

	Red	Blue	Green	
Percentage of total anode current supplied by each gun (average)	30	31	39	%

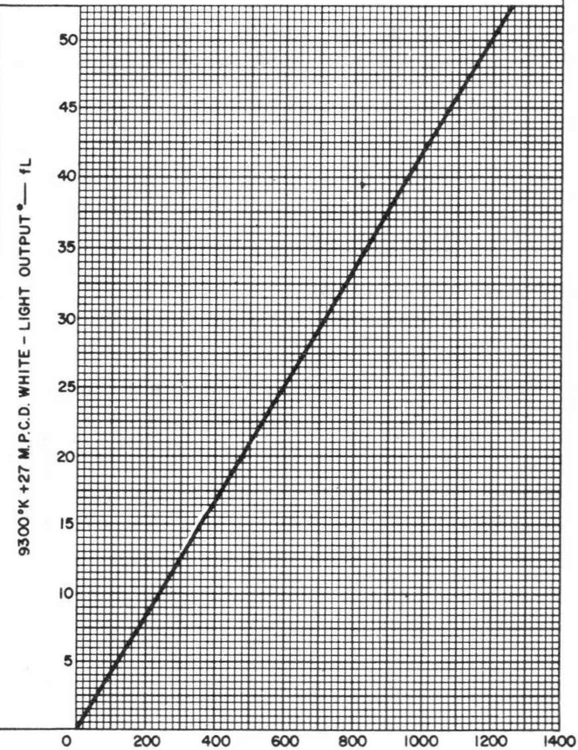
Ratio of cathode currents:	Min	Typ	Max
Red/blue	0.75	0.95	1.25
Red/green	0.60	0.75	1.10
Blue/green	0.60	0.80	1.10

TYPICAL LIGHT-OUTPUT CHARACTERISTIC

HEATER VOLTAGE = 6.3 V
ANODE - TO - CATHODE VOLTAGE = 25,000 V
GRID No. 3 - TO - CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE CURRENT TO PRODUCE 9300°K 27 M.P.C.D. WHITE - LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO PRODUCE 9300°K + 27 M.P.C.D. WHITE:

RED GUN:	30%
BLUE GUN:	31%
GREEN GUN:	39%

RASTER SIZE: 19.875" × 15.575" (504.82 mm × 395.60 mm)
* MEASURED WITHIN 5" (127 mm) DIAMETER AREA CENTERED ON TUBE FACE.



Color Picture Tube

PERMA-CHROME **HI-LITE Screen**

Rare-Earth (Red) Phosphor

Integral Implosion Protection – Banded Type

This data sheet is to be used in conjunction with data for RCA-25AJP22.

For general data, maximum and minimum ratings, equipment design ranges, limiting circuit values, x-radiation warning and base specification of the 25BHP22, refer to the 25AJP22 except as noted below.

MECHANICAL

Bulb Panel Designation . . . . JEDEC No.FP196-1/2HI

OPTICAL

Faceplate:

Light transmission at center (Approx.) 52%

EQUIPMENT DESIGN RANGES

To Product White of 9300° K + 27 M.P.C.D. (CIE Coordinates x = 0.281, y = 0.311):

	Red	Blue	Green	
Percentage of total anode current supplied by each gun (average)	30	31	39	%

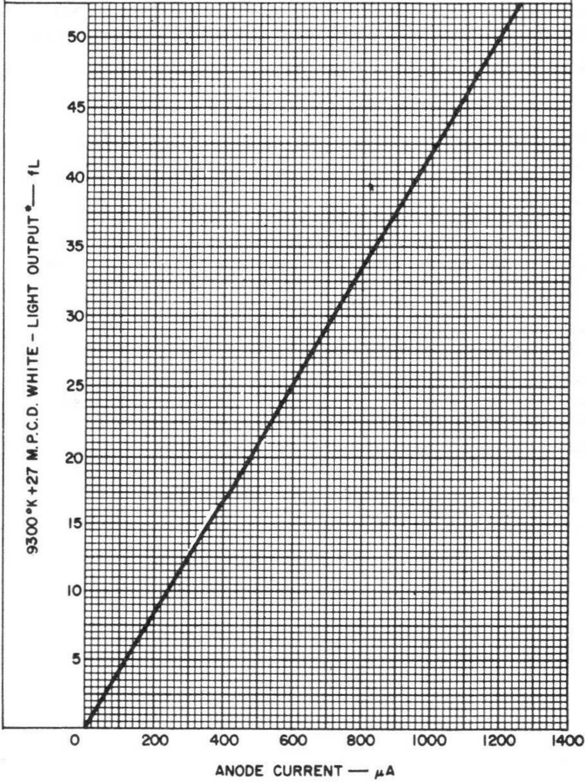
Ratio of cathode currents:	Min	Typ	Max
Red/blue	0.75	0.95	1.25
Red/green	0.60	0.75	1.10
Blue/green	0.60	0.80	1.10

TYPICAL LIGHT-OUTPUT CHARACTERISTIC

HEATER VOLTAGE = 6.3 V
ANODE - TO - CATHODE VOLTAGE = 25,000 V
GRID No. 3 - TO - CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE CURRENT TO PRODUCE 9300°K 27 M.P.C.D. WHITE - LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN TO PRODUCE 9300°K + 27 M.P.C.D. WHITE:

RED GUN:	30 %
BLUE GUN:	31 %
GREEN GUN:	39 %

RASTER SIZE: 19.875" × 15.575" (504.82 mm × 395.60 mm)
* MEASURED WITHIN 5" (127 mm) DIAMETER AREA CENTERED ON TUBE FACE.



92LM – 3430

Color Picture Tube

Ultra-Rectangular | Hi-Lite Matrix Screen
4 x 3 Aspect Ratio | Light-Neutral Screen Appearance

Electrical:

Electron Guns, Three with Axes Tilted Toward Tube Axis	Red, Blue, Green
Heater, of Each Gun Series Connected within Tube with Each of the Other Two Heaters:	
Current at 6.3 V	900 mA
Focusing Method	Electrostatic
Focus Lens	Bipotential
Convergence Method	Magnetic
Deflection Method	Magnetic
Deflection Angles (Approx.):	
Diagonal	90 deg
Horizontal	78 deg
Vertical	60 deg
Direct Interelectrode Capacitance (Approx.):	
Grid No.1 of any gun to all other electrodes	7.5 pF
Grid No.3 to all other electrodes	6.5 pF
All cathodes to all other electrodes	15 pF
Capacitance Between Anode and External Conductive Coating	2500 max. pF 2000 min. pF

Optical:

Faceplate and Safety Panel	Filterglass
Light transmission at center (Approx.)	66%
Surface of Safety Panel	Treated to minimize specular reflection
Screen	Aluminized
Matrix	Black opaque material
Phosphor, rare-earth (red) sulfide (blue & green)	P22
Persistence	Medium-Short
Array	566,000 Dot trios
Spacing between centers of adjacent dot trios (approx.)	0.026 in (0.66 mm)

Mechanical:

Minimum Screen Area (Projected)	315 sq. in (2032 sq. cm)
Bulb Funnel Designation	JEDEC No.J208-3/4 B1/D1
Bulb Panel Designation	JEDEC No.FP209-3/4 W2
Base Designation[a]	Small-Button Diheptar 12-Pin (JEDEC No.B12-244)
Basing Designation	JEDEC No.14BE
Pin Position Alignment	Pin No.12 Aligns Approx. with Anode Bulb Contact

Operating Position, preferred	Anode Bulb Contact on Top
Gun Configuration	Delta
Weight (Approx.)	49 lb (22.3 kg)

Implosion Protection:

Integral Safety Panel	JEDEC No.SP209-1/4A1

Maximum and Minimum Ratings, Design-Maximum Values:

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode.

Anode Voltage	27.5 max. / 20 min.	kV / kV
Anode Current, Long-Term Average[b]	1000 max.	μA
Grid-No.3 (Focusing Electrode) Voltage	6000 max.	V
Peak-Grid-No.2 Voltage, Including Video Signal Voltage	1000 max.	V
Grid-No.1 Voltage:		
Negative bias value	400 max.	V
Negative operating cutoff value	200 max.	V
Positive bias value	0 max.	V
Positive peak value	2 max.	V
Heater Voltage (ac or dc):[c]		
Under operating conditions	6.9 max. / 5.7 min.	V / V
Under standby conditions[d]	5.5 max.	V
Heater-Cathode Voltage:		
Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max.	V
After equipment warm-up period:		
DC component value	200 max.	V
Peak value	200 max.	V
Heater positive with respect to cathode:		
DC component value	0 max.	V
Peak value	200 max.	V

Equipment Design Ranges:

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20 and 27.5 kV

Grid-No.3 (Focusing Electrode) Voltage	16.8% to 20% of Anode voltage

Grid-No.2 Voltage for Visual Extinction of Undeflected Focused Spot . . . See CUTOFF DESIGN CHART in Figure 3

At Grid No.1 voltage of −75 V	95 to 295 V
At Grid No.1 voltage of −125 V	205 to 535 V
At Grid No.1 voltage of −175 V	315 to 780 V

Maximum Ratio of Grid-No.2 Voltages, Highest Gun to Lowest Gun in Any Tube (At grid-No.1 spot cutoff voltage of −100 V) . . . 1.86

Heater Voltage:[c]

Under operating conditions:	
When standby operation is not utilized	6.3 V
When 5.0-V standby operation is utilized[d]	6.0 V
Under standby conditions[d]	5.0 V

Grid-No.3 Current (Total)	±15 μA
Grid-No.2 Current	±5 μA
Grid-No.1 Current	±5 μA

To Produce White Light of	Illum.D 6550°K + 7 M.P.C.D.	Color 9300°K + 27 M.P.C.D.	
CIE Coordinates:			
X	0.313	0.281	
Y	0.329	0.311	
Percentage of total anode current supplied by each gun (average):			
Red	41	30	%
Blue	24	31	%
Green	35	39	%
Ratio of cathode currents:			
Red/blue:			
Minimum	1.35	0.75	
Typical	1.70	0.95	
Maximum	2.20	1.25	
Red/green:			
Minimum	0.95	0.60	
Typical	1.15	0.75	
Maximum	1.70	1.10	
Blue/green:			
Minimum	0.50	0.60	
Typical	0.70	0.80	
Maximum	0.95	1.10	

Displacements, Measured at Center of Screen:

Raster centering displacement:	
Horizontal	± 0.45 in (± 11.4 mm)
Vertical	± 0.45 in (± 11.4 mm)
Lateral distance between the blue beam and the converged red and green beams	± 0.25 in (± 6.4 mm)

Radial convergence displacement excluding effects of dynamic convergence (each beam) . . . . ± 0.37 in (± 9.4 mm)

Maximum Required Correction for Register[e] (Including Effect of Earth's Magnetic Field when Using Recommended Components) as Measured at the Center of the Screen in any Direction . . . . 0.005 in (0.13 mm) max.

Typical Operation:

Heater Voltage	6.3 V
Anode Voltage	25 kV
Grid No.3 Voltage	Adjusted for focus
Color Temperature	9300° K + 27 M.P.C.D.
Raster Size	20.776 x 15.582 in (527.71 x 395.78 mm)

Typical White-Light Output Measured within 5 in (127 mm) diameter area centered on tube face:

At anode current of 1000 μA . . . . 54 fL / 185 Nit

Limiting Circuit Values:

High-Voltage Circuits:
Grid-No.3 circuit resistance . . . . 7.5 max. MΩ

Low-Voltage Circuits:
Effective grid-No.1-to-cathode-circuit resistance (each gun) . . . . 0.75 max. MΩ

X-Radiation Characteristic:

Maximum Anode Voltage at which the X-radiation emitted will not exceed 0.5 mR/h at an anode current of 300 μA . . . . 35 kV

The X-radiation emitted from this picture tube, as measured in accordance with the procedure of JEDEC Publication No.64A will not exceed 0.5 mR/h throughout the useful life of the tube when operated within the Design-Maximum ratings: 27.5 kV anode voltage and 1000 μA anode current. The tube should not be operated beyond its Design-Maximum ratings stated above (such operation may shorten tube life or have other permanent adverse affects on its performance), but its X-radiation will not exceed 0.5 mR/h for anode voltage and current combinations given by the isodose-rate limit characteristics as shown in **Figure 1**. Operation above the values shown by the curve may result in failure of the television receiver to comply with the Federal Performance Standard for Television Receivers, Sub-Part C of Part 78 of Title 42, Code of Federal Regulations (PL90-602) as published in the Federal Register Vol.34, No. 247, Thursday, December 25, 1969. Maximum X-radiation as a function of anode voltage at 300 μA anode current is shown by the curve in **Figure 2**. X-radiation at a constant anode voltage varies linearly with anode current.

a The mating socket, including its associated, physically-attached hardware and circuitry, must not weigh more than one pound (one-half kilogram).

b The short-term average anode current should be limited by circuitry to 1500 microamperes.

c For maximum cathode life, it is recommended that the heater supply be regulated. The series impedance to any chassis connection in the dc biasing cirucit for the heater should be between 100 kilohms and 1 megohm. The surge voltage across the heater must be limited to 9.5 volts rms.

d The use of a 5-volt standby condition in conjunction with 6-volt operating conditions is recommended to improve the reliability of the color picture tube by extending the emission wear-out life and reducing other gun-related defects. A maximum heater voltage of 5.5 volts (Design-Maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

e Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

Notes for Dimensional Outline

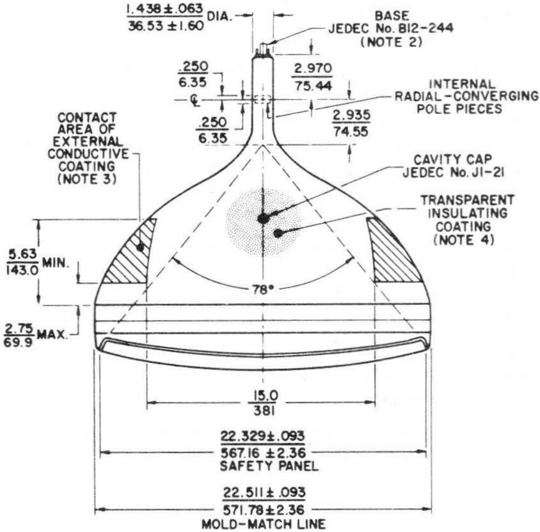
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge (JEDEC No.G162) and with tube seated in gauge, the reference line is determined by the intersection of the plane C-C′ of the gauge with the glass funnel.

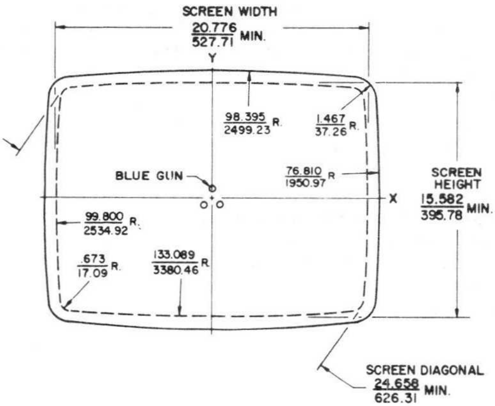
Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

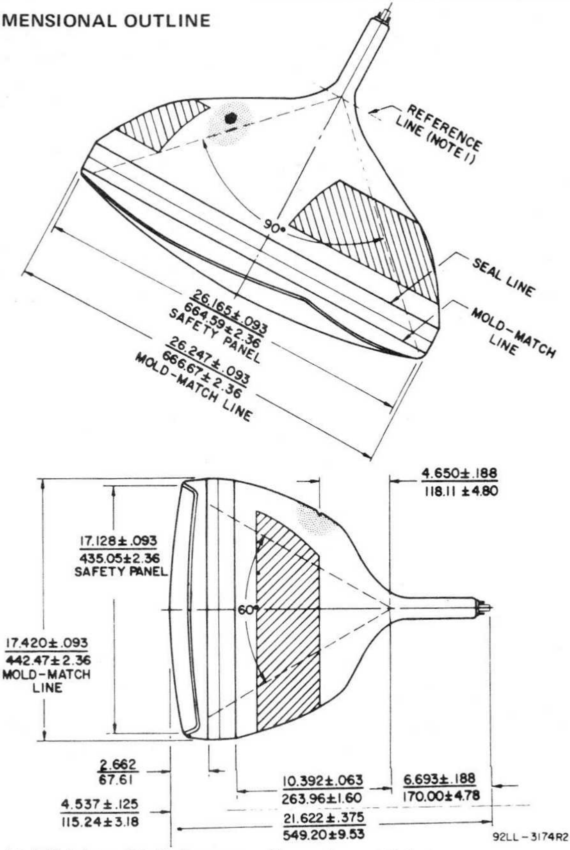
DIMENSIONAL OUTLINE





Dimensions in inches/mm unless otherwise noted

DIMENSIONAL OUTLINE



Sagittal Heights with Reference to Centerface at Points (3.18 mm) Beyond Edge of Minimum Screen.

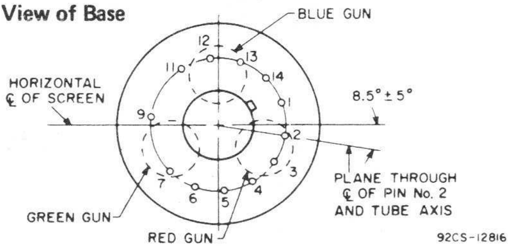
Station No.	Coordinates X in (mm)	Coordinates Y in (mm)	Sagittal Height in (mm)
1 (Minor)	0 (0)	7.916 (201.07)	.680 (17.27)
2	1.000 (25.40)	7.912 (200.96)	.692 (17.58)
3	2.000 (50.80)	7.901 (200.69)	.730 (18.54)
4	3.000 (76.20)	7.882 (220.20)	.791 (20.09)
5	4.000 (101.60)	7.856 (199.54)	.877 (22.28)
6	5.000 (127.00)	7.822 (198.68)	.987 (25.07)

(continued on next page.)

Sagittal Heights (Cont'd)

7	6.000 (152.40)	7.781 (197.64)	1.121 (28.47)
8	7.000 (177.80)	7.732 (196.39)	1.279 (32.49)
9	8.000 (203.20)	7.676 (194.97)	1.461 (37.11)
10	9.000 (228.60)	7.612 (193.34)	1.668 (42.37)
11	9.540 (242.32)	7.574 (192.38)	1.790 (45.47)
12 (Diagonal)	10.132 (257.35)	7.242 (183.95)	1.878 (47.70)
13	10.279 (261.09)	6.832 (173.53)	1.841 (46.76)
14	10.333 (262.46)	6.000 (152.40)	1.720 (43.69)
15	10.388 (263.86)	5.000 (127.00)	1.595 (40.51)
16	10.433 (265.00)	4.000 (101.60)	1.492 (37.90)
17	10.468 (265.89)	3.000 (76.20)	1.412 (35.86)
18	10.493 (266.52)	2.000 (50.80)	1.355 (34.42)
19	10.508 (266.90)	1.000 (25.40)	1.320 (33.53)
20 (Major)	10.513 (267.03)	0 (0)	1.308 (33.22)

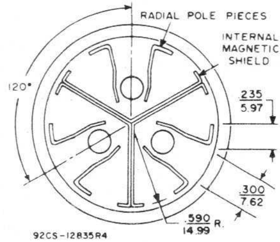
Bottom View of Base



Base Specification — JEDEC No.14BE

Pin 1:	Heater	Pin 11:	Cathode of Blue Gun
Pin 2:	Cathode of Red Gun	Pin 12:	Grid No.1 of Blue Gun
Pin 3:	Grid No.1 of Red Gun	Pin 13:	Grid No.2 of Blue Gun
Pin 4:	Grid No.2 of Red Gun	Pin 14:	Heater
Pin 5:	Grid No.2 of Green Gun	Cap:	Anode (Grid No.4, Screen, Collector)
Pin 6:	Cathode of Green Gun		
Pin 7:	Grid No.1 of Green Gun	C:	External Conductive Coating
Pin 9:	Grid No.3		

Location of Radial-Converging Pole Pieces Viewed from Screen End of Guns



0.5 mR/h ISODOSE - RATE LIMIT CURVE

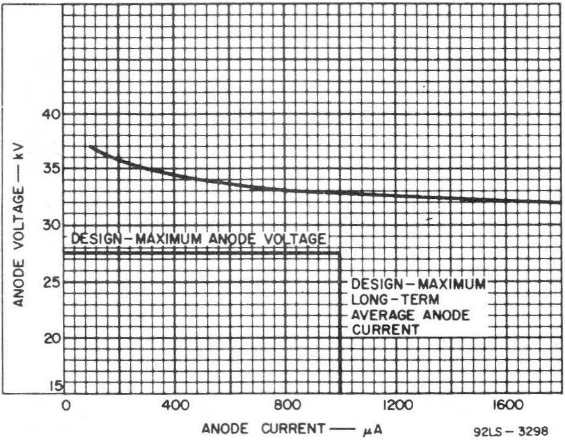


Figure 1

X-RADIATION LIMIT CURVE AT A CONSTANT ANODE CURRENT OF 300 µA (X-RADIATION AT A CONSTANT ANODE VOLTAGE VARIES LINEARLY WITH ANODE CURRENT)

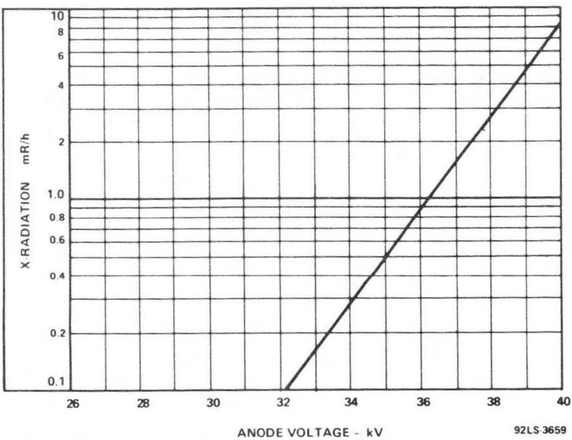
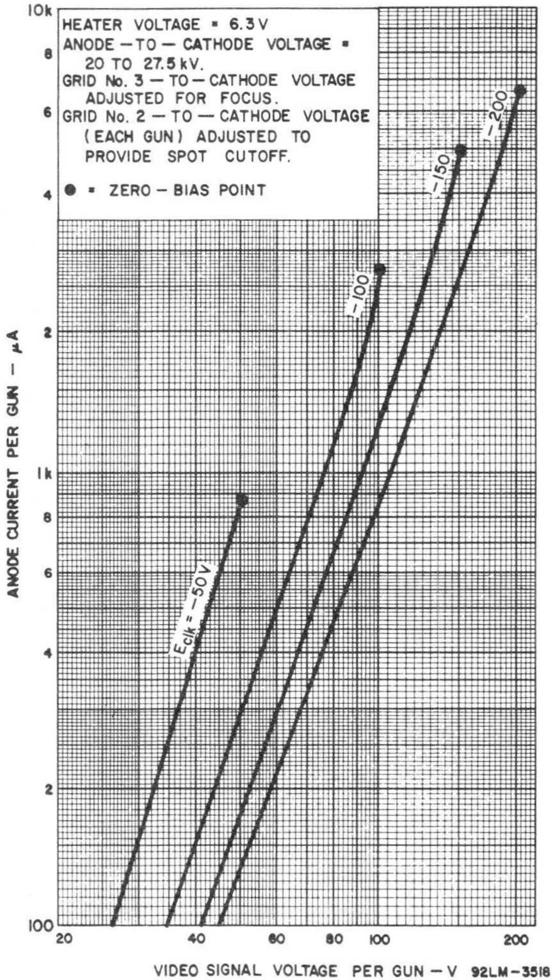
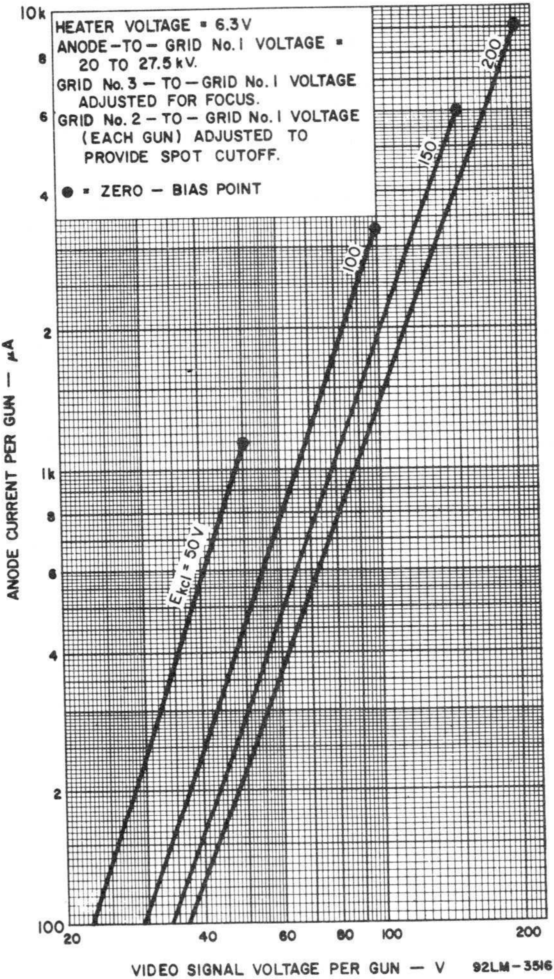


Figure 2

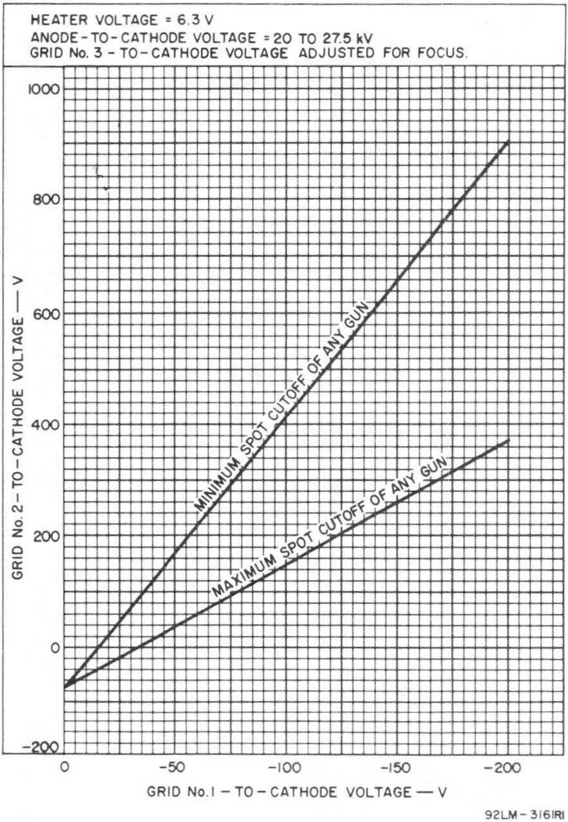
TYPICAL DRIVE CHARACTERISTICS, GRID-DRIVE SERVICE



TYPICAL DRIVE CHARACTERISTICS,
CATHODE-DRIVE SERVICE



CUTOFF DESIGN CHART



IMPORTANT: Refer to sheet **Safety Precautions for Color Picture Tubes** at front of this section.

Figure 3

Color Picture Tube

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD PURITY AND UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE — 90° MAGNETIC DEFLECTION

ALUMINIZED TRICOLOR PHOSPHOR-DOT *Hi-Lite* Screen
(Utilizing a New Improved Rare-Earth Red-Emitting Phosphor)

INTEGRAL FILTERGLASS PROTECTIVE WINDOW

MAGNETIC CONVERGENCE — 3 ELECTROSTATIC-FOCUS GUNS

For Use in Color-TV Receivers

ELECTRICAL

Electron Guns, Three . . . . Red, Blue, Green
  Axes tilted toward tube axis
Heater, of Each Gun
  Series connected within tube with each of the other two heaters
    Current at 6.3 volts[a] . . . . 900 mA
Focusing Method . . . . Electrostatic
Focus Lens . . . . Bipotential
Convergence Method . . . . Magnetic
Deflection Method . . . . Magnetic
Deflection Angles (Approx.)
  Diagonal . . . . 89°
  Horizontal . . . . 78°
  Vertical . . . . 63°

Direct Interelectrode Capacitances (Approx.)

Grid No.1 of any gun to all other electrodes	6	pF
All cathodes to all other electrodes	15	pF
Grid No.3 to all other electrodes	6.5	pF
External conductive coating to anode	2500 max	pF
	2000 min	pF

OPTICAL

Faceplate and Protective Window . . . . Filterglass
  Light transmission at center (Approx.) 41%
Surface of Protective Window . . . . Treated to minimize specular reflection
Screen, on Inner Surface of Faceplate
  Type . . . . Aluminized, Tricolor, Phosphor-Dot
  Phosphor (Three separate phosphors, collectively)[b] . . . P22—New Rare-Earth (Red), Sulfide (Blue & Green) Type
  Fluorescence and phosphorescence of separate phosphors, respectively . . . . . Red, Blue, Green
  Persistence of group phosphorescence . . . . . . Medium Short
  Dot arrangement . . . . Each triangular group consists of a red, green, and blue dot
  Spacing between centers of adjacent dot trios (Approx.) . . . . . . 0.029 in (0.74 mm)

MECHANICAL

Tube Dimensions

Overall length	20.924 ± .375 in (531.5 ± 9.5 mm)
Neck length	6.693 ± .188 in (170.0 ± 4.8 mm)
Diagonal	24.566 ± .093 in (624.0 ± 2.4 mm)
Greatest width	21.500 ± .093 in (546.1 ± 2.4 mm)
Greatest height	17.263 ± .093 in (438.5 ± 2.4 mm)

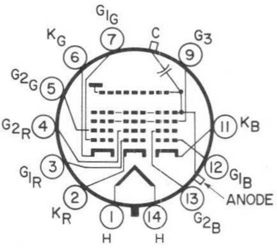
Minimum Screen Dimensions (Projected)

Diagonal	22.995 in (584.1 mm)
Greatest width	19.875 in (504.8 mm)
Greatest height	15.575 in (395.6 mm)
Area	295 sq. in (1905 sq. cm)

Bulb Funnel Designation	JEDEC No.J195-1/2 A1
Bulb Panel Designation	JEDEC No.FP196-1/2 A3
Protective Window Designation	JEDEC No.FP196-1/2 C1
Bulb Contact Designation	Recessed Small Cavity Cap (JEDEC No.J1-21)
Pin Position Alignment	Pin No.12 Aligns Approx. with Anode Bulb Contact
Operating Position	Anode Bulb Contact on Top
Weight (Approx.)	42 lb (19.1 kg)
Base	Small-Button Diheptar 12-pin (JEDEC No.B12-244)

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Cathode of Red Gun
Pin 3 – Grid No.1 of Red Gun
Pin 4 – Grid No.2 of Red Gun
Pin 5 – Grid No.2 of Green Gun
Pin 6 – Cathode of Green Gun
Pin 7 – Grid No.1 of Green Gun
Pin 9 – Grid No.3
Pin 11 – Cathode of Blue Gun
Pin 12 – Grid No.1 of Blue Gun
Pin 13 – Grid No.2 of Blue Gun
Pin 14 – Heater
Cap – Anode (Grid No.4, Grid No.5, Screen, Collector)
C – External Conductive Coating



14BE

MAXIMUM AND MINIMUM RATINGS, DESIGN-MAXIMUM VALUES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

Anode Voltage	27,500 max 20,000 min	V V
Total Anode Current, Long-Term Average	1000 max	µA
Grid-No.3 (Focusing Electrode) Voltage	6000 max	V
Peak Grid-No.2 Voltage, Including Video Signal Voltage	1000 max	V

Grid-No.1 Voltage

Negative bias value	400 max	V
Negative operating cutoff value	200 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V

Heater Voltage (AC or DC)

Under operating conditions[a]	6.9 max	V
	5.7 min	V
Under standby conditions[b]	5.5 max	V

Peak Heater-Cathode Voltage

Heater negative with respect to cathode:		
During equipment warm-up period not exceeding 15 seconds	450 max	V
After equipment warm-up period:		
Combined AC and DC value	200 max	V
DC component value	200 max	V
Heater positive with respect to cathode:		
AC component value	200 max	V
DC component value	0 max	V

EQUIPMENT DESIGN RANGES

Unless otherwise specified, values are for each gun and voltage values are positive with respect to cathode

For anode voltages between 20,000 and 27,500 V

Grid-No.3 (Focusing Electrode Voltage . . . . . 16.8% to 20% of anode volts

Grid-No.2 and Grid-No.1 Voltages . . . . . . See accompanying *Cutoff Design Chart*
For visual extinction of focused spot

Maximum Ratio of Grid-No.2 Voltages 1.86
Highest gun to lowest gun in any tube (At grid-No.1 spot cutoff voltage of −100 volts)

Grid-No.3 Current (Total) . . . . . . -45 to +15 μA

Grid-No.2 Current . . . . . . -5 to +5 μA

To Produce White of 9300°K +27 M.P.C.D.
(CIE Coordinates x = 0.281, y = 0.311)

	Red	*Blue*	*Green*	
Percentage of total anode current supplied by each gun (Average)	34	32	34	%

Ratio of cathode currents:	*Min*	*Typ*	*Max*
Red/blue	0.75	1.10	1.50
Red/green	0.65	1.00	2.50
Blue/green	0.60	0.91	1.30

Displacement, Measured at Center of Screen

Raster centering displacement:	
Horizontal	±0.47 in (±11.9 mm)
Vertical	±0.45 in (±11.4 mm)
Lateral distance between the blue beam and the converged red and green beams	±0.25 in (±6.4 mm)
Radial convergence displacement excluding effects of dynamic convergence (Each beam)	±0.37 in (±9.4 mm)

Maximum Required Correction for Register[c] (Including Effect of Earth's Magnetic Field when Using Recommended Components)		
Measured at the center of the screen in any direction.	0.005 in (0.13 mm) max	

EXAMPLES OF USE OF DESIGN RANGES

Unless otherwise specified, voltage values are for each gun and are positive with respect to cathode

Anode Voltage	25,000	V
Grid-No.3 (Focusing Electrode) Voltage	4200 to 5000	V
Grid-No.2 Voltage when circuit design utilizes grid-No.1 voltage of -150 volts for visual extinction of focused spot.	285 to 685	V
Grid-No.1 Voltage for visual extinction of focused spot when circuit design utilizes grid-No.2 voltage of 400 volts. . .	-95 to -190	V
Heater Voltage		
Under operating conditions[a]	6.3	V
Under standby conditions.	5.0	V

LIMITING CIRCUIT VALUES

High-Voltage Circuits

Grid-No.3 Circuit Resistance. . . . . 7.5 max MΩ

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type, in which the short-circuit current does not exceed 20 mA.

Low-Voltage Circuits

Effective grid-No.1-to-cathode-circuit resistance (Each gun). . . . . 0.75 max MΩ

The low-voltage circuits, including all heater circuits, should be analyzed by assuming the color picture tube heater is connected directly to the receiver chassis ground. Under these conditions the circuits to the elements of all tubes, including the color picture tube, operating from the same heater winding and all connections of any other circuits to the heater winding should each have an impedance such that their respective power sources in combination will not supply a continuous short circuit current of more than 750 mA total in the assumed picture tube heater ground connection. The leads from all other circuits must be separated from the picture tube leads by a minimum distance of 0.25 inch (6.4 mm) to prevent energy transfer to the picture tube circuits. Such current limitation will help prevent picture tube damage in case of momentary cascade arcing.

[a] For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts. The series impedance to any chassis connection in the DC biasing circuit for the heater should be between 100,000 ohms and 1 megohm.

[b] For curve, see Group Phosphor P22—*New Rare-Earth (Red), Sulfide (Blue & Green)* at front of this section.

[c] For "instant on" applications, a maximum heater voltage of 5.5 volts (design-maximum value) may be maintained on the color picture tube when the receiver is in the "off" (standby) position. All other voltages normally applied to the tube must be removed during standby operation.

[d] Register is defined as the relative position of the beam trios with respect to the associated phosphor-dot trios.

GENERAL CONSIDERATIONS

X-Radiation Warning. Because the 25XP22 is designed to be operated at anode voltages as high as 27.5 kilovolts (design-maximum value), shielding of the 25XP22 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

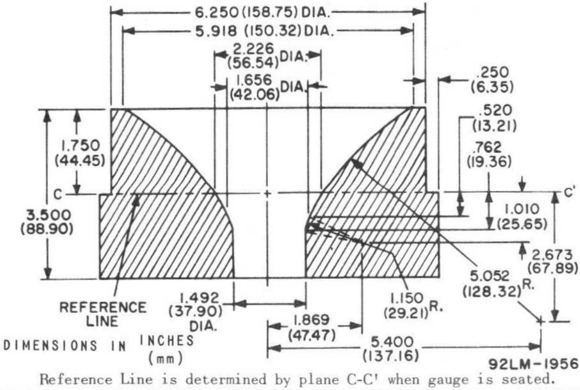
Orientation. The 25XP22 must be operated with tube axis in a horizontal position and with the blue gun uppermost (i.e., the anode contact button on top).

The **Deflecting Yoke** and tube axes must coincide and the yoke must be free to move along the neck for a distance of approximately 0.5 inch (13 mm) from its most forward position for adjustment purposes. The yoke mount should also provide for a small amount of rotational adjustment.

Contact to the **external conductive coating** should be made by multiple fingers to prevent possible damage to the tube from localized overheating due to poor contact.

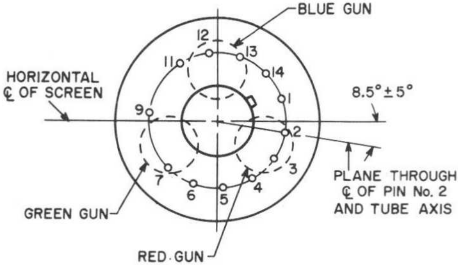
Misregister Compensation. Proper operation of the 25XP22 requires compensation for the effects of extraneous magnetic fields, the earth's magnetic field, and other causes which may produce misregister. Compensation for these effects may be accomplished by the use of a purifying magnet.

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE JEDEC No.G162



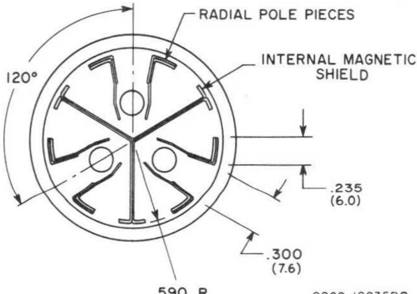
Reference Line is determined by plane C-C' when gauge is seated.

BOTTOM VIEW OF BASE



92CS-12816

LOCATION OF RADIAL-CONVERGING POLE PIECES
VIEWED FROM SCREEN END OF GUNS

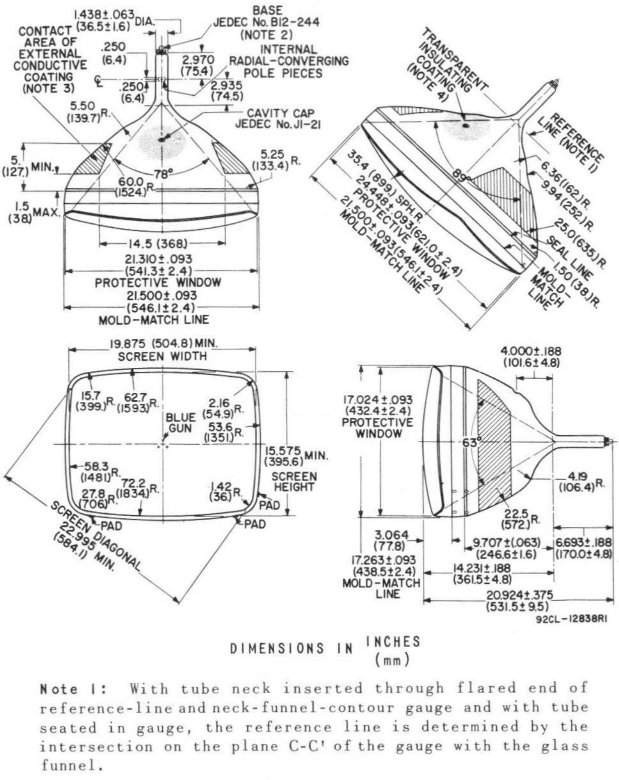


92CS-12835R2

DIMENSIONS IN INCHES (mm)

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES (mm)

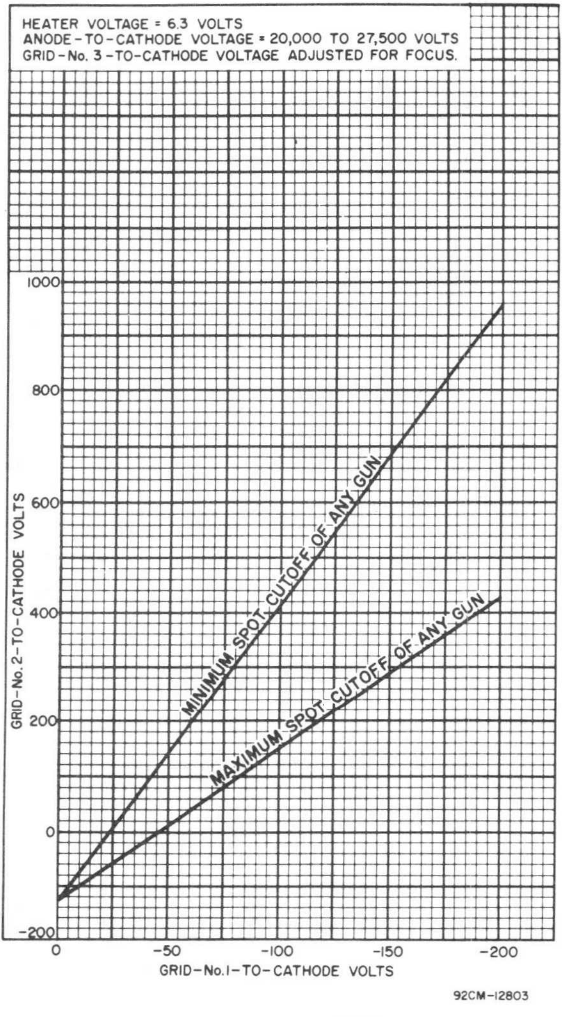
Note 1: With tube neck inserted through flared end of reference-line and neck-funnel-contour gauge and with tube seated in gauge, the reference line is determined by the intersection on the plane C-C' of the gauge with the glass funnel.

Note 2: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Bottom circumference of base will fall within a 2-inch (51-mm) circle concentric with bulb axis.

Note 3: The drawing shows the size and location of the contact area of the external conductive coating. The actual area of this coating will be greater than that of the contact area so as to provide the required capacitance. External conductive coating must be grounded with multiple contacts.

Note 4: To clean this area, wipe only with soft, dry, lintless cloth.

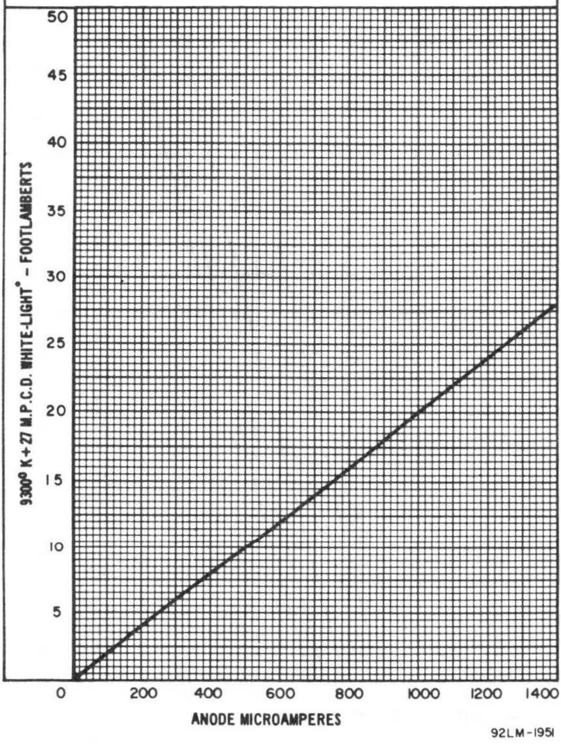
Cutoff Design Chart



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

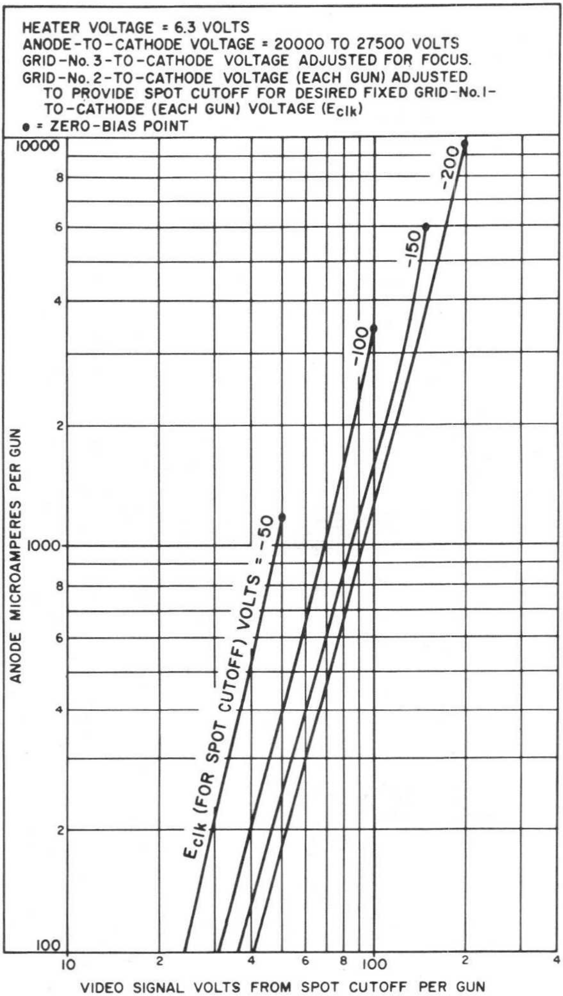
Typical Light-Output Characteristic

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25000 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE
CURRENT TO PRODUCE 9300° K 27 M.P.C.D. WHITE-LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN
TO PRODUCE 9300° K+27 M.P.C.D. WHITE:
RED GUN: 34%
BLUE GUN: 32%
GREEN GUN: 34%
RASTER SIZE: 19.875" X 15.575" (504.8 mm X 395.6 mm)
*MEASURED WITHIN 5" – DIAMETER AREA CENTERED ON TUBE FACE.



Typical Drive Characteristics

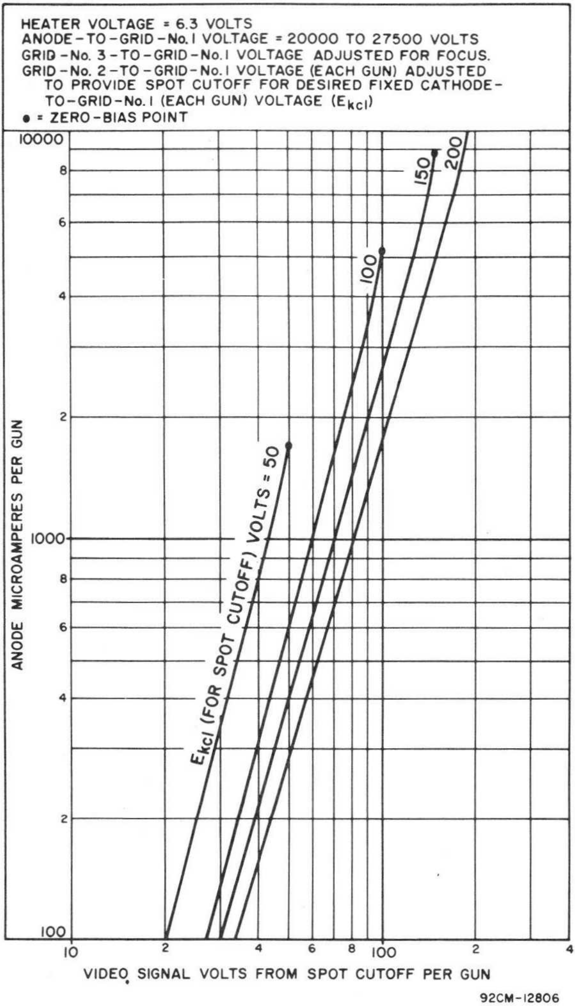
Grid-Drive Service



RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

Typical Drive Characteristics

Cathode-Drive Service



Color Picture Tube

"PERMA-CHROME" ASSEMBLY FOR OPTIMUM FIELD PURITY AND UNIFORMITY DURING WARM-UP

RECTANGULAR TUBE — 90° MAGNETIC DEFLECTION

MAGNETIC CONVERGENCE — 3 ELECTROSTATIC-FOCUS GUNS

ALUMINIZED TRICOLOR PHOSPHOR-DOT *Hi-Lite* SCREEN
(Utilizing a New, Improved Rare-Earth Red-Emitting Phosphor)

For Use in Color-TV Receivers

The 25YP22 is the same as the 25XP22 except for the following items:

OPTICAL

Faceplate. . . . . .Filterglass
Light transmission (Approx.) 69%
Faceplate does not have an integral protective window[a]

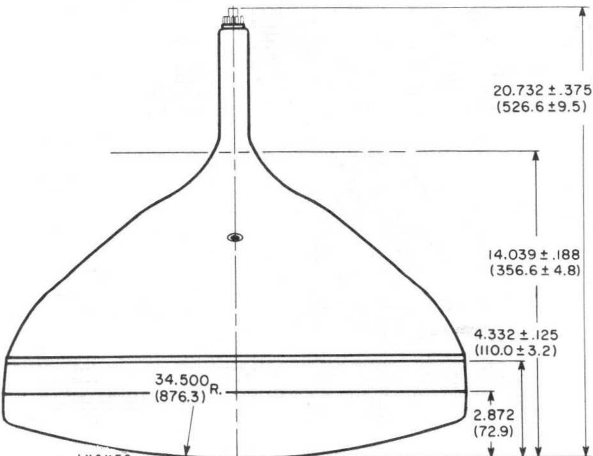
MECHANICAL

Tube Dimensions
Overall length . . . . . 20.732 ± .375 in (526.6 ± 9.5 mm)
Weight (Approx.) . . . . 37 lb (16.8 kg.)

[a] It is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of the 25YP22 to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide x-radiation protection when required.

DIMENSIONAL OUTLINE

Dimensions shown are only those which are different from the corresponding dimensions for the 25XP22



DIMENSIONS IN INCHES (mm)

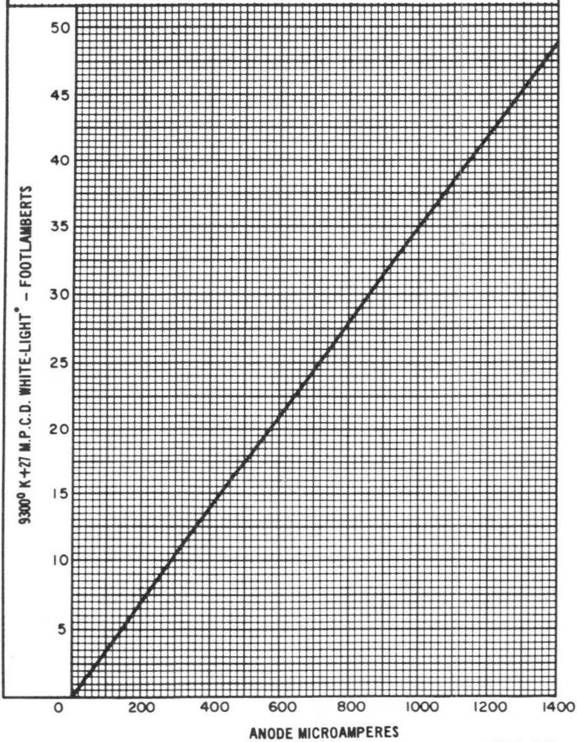
Note: In side view, spherical radius = 34.000 in (863.6 mm).

Typical Light-Output Characteristic

HEATER VOLTAGE = 6.3 VOLTS
ANODE-TO-CATHODE VOLTAGE = 25000 VOLTS
GRID-No. 3-TO-CATHODE VOLTAGE ADJUSTED FOR FOCUS.
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ANODE
CURRENT TO PRODUCE 9300° K+27 M.P.C.D. WHITE-LIGHT OUTPUT.
PERCENTAGE OF TOTAL ANODE CURRENT SUPPLIED BY EACH GUN
TO PRODUCE 9300° K+27 M.P.C.D. WHITE:

RED GUN: 34%
BLUE GUN: 32%
GREEN GUN: 34%

RASTER SIZE: 19.875" X 15.575" (504.8 mm X 395.6 mm)
*MEASURED WITHIN 5"– DIAMETER AREA CENTERED ON TUBE FACE.



92LM-1955

902-A

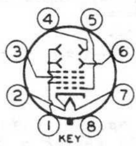
HIGH-VACUUM CATHODE-RAY TUBE

Supersedes Type 902

General:

Heater, for Unipotential Cathode:		
Voltage	6.3 ± *10%*	ac or dc volts
Current	0.6	amp.
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to All Other Electrodes .	7.5	μμf
DJ_1 to All Other Electrodes	8.5	μμf
DJ_4 to All Other Electrodes	6.0	μμf
Phosphor (For Curves, see front of this Section) . . .		No.1
Fluorescence		Green
Persistence		Medium
Focusing Method		Electrostatic
Deflection Method		Electrostatic
Overall Length		7-7/16" ± 3/16"
Greatest Diameter of Bulb		2" ± 1/16"
Minimum Useful Screen Diameter		1-3/4"
Mounting Position		Any
Base		Medium Shell Octal 8-Pin
Basing Designation for BOTTOM VIEW		8CD

Pin 1 - Grid No.2, Anode No.2, Deflecting Electrode DJ_2, Deflecting Electrode DJ_3,
Pin 2 - Heater, Cathode
Pin 3 - Anode No.1
Pin 4 - Deflecting Electr. DJ_1
Pin 5 - Grid No.1
Pin 6 - Deflecting Electr. DJ_4
Pin 7 - Heater
Pin 8 - No Connection



DJ_1 and DJ_2 are nearer the screen
DJ_3 and DJ_4 are nearer the base

With DJ_1 positive with respect to DJ_2, the spot is deflected toward pin 3. With DJ_3 positive with respect to DJ_4, the spot is deflected toward pin 1.

The angle between the trace produced by DJ_3 and DJ_4 and its intersection with the plane through the tube axis and pin 1 does not exceed 10°.

The angle between the trace produced by DJ_3 and DJ_4 and the trace produced by DJ_1 and DJ_2 is 90° ± 4°.

Maximum Ratings, ***Absolute Values*:**

ANODE-No.2 & GRID No.2 VOLTAGE	660 *max.*	volts
ANODE-No.1 VOLTAGE	330 *max.*	volts
GRID-No.1 (CONTROL ELECTRODE) VOLTAGE:		
Negative Value	125 *max.*	volts
Positive Value	0 *max.*	volts
PEAK VOLTAGE BETWEEN ANODE No.2 AND DEFLECTING ELECTRODE DJ_1 OR DJ_4	385 *max.*	volts

RCA VICTOR DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

902-A

HIGH-VACUUM CATHODE-RAY TUBE

(continued from preceding page)

Typical Operation:

Anode No.2 & Grid No.2 Voltage★	400	600	volts
Anode No.1 Voltage for Focus at 75% of Grid-No.1 Voltage for Cutoff ●	100	150	volts
Grid-No.1 Volt. for Visual Cutoff#	−40	−60	volts
Max. Anode-No.1 Current Range▲	Between −50 and +10		µamp.
Deflection Sensitivity:			
DJ_1 and DJ_2	0.273	0.183	mm/v dc
DJ_3 and DJ_4	0.326	0.217	mm/v dc
Deflection Factor:**			
DJ_1 and DJ_2	93	139	v dc/in.
DJ_3 and DJ_4	78	117	v dc/in.

★ Brilliance and definition decrease with decreasing anode-No.2 voltage. In general, anode-No.2 voltage should not be less than 400 volts.

● Individual tubes may require between +20% and −35% of the values shown with grid-No.1 voltages between zero and cutoff.

\# Visual extinction of stationary focused spot. Supply should be adjustable to ± 50% of these values.

▲ See curve for average values.

** Individual tubes may vary from these values by ± 20%.

Spot Position:

The undeflected focused spot will fall within a 10-mm square centered at the geometric center of the tube face and having one side parallel to the trace produced by DJ_1 and DJ_2. Suitable test conditions are: anode-No.2 voltage, 600 volts; anode-No.1 voltage, adjusted for focus; deflecting-electrode resistors, 1 megohm each for DJ_1 and DJ_4, connected to anode No.2; the tube shielded from all extraneous fields. To avoid damage to the tube, grid-No.1 voltage should be near cutoff before application of anode voltages.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 *max.*	megohms
Impedance of Any Deflecting-Electrode Circuit at Heater-Supply Frequency	1.0 *max.*	megohm
Resistance in Any Deflecting-Electrode Circuit▲▲	5.0 *max.*	megohms

▲▲ It is recommended that both deflecting-electrode-circuit resistances be approximately equal.

Projection Kinescope

FORCED-AIR COOLED
ELECTROSTATIC FOCUS

MAGNETIC DEFLECTION
20 FT. x 15 FT. PROJECTED PICTURES

For Black-and-White Projection Systems in Theater and Closed-Circuit Television Applications

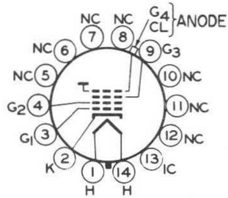
The **4486** *is the same as the* **7NP4** *except that it is supplied with a fitted high-voltage anode cable. (See Accompanying Dimension Outline).*

MECHANICAL

Cap shown for type 7NP4 does not apply for type 4486.

TERMINAL DIAGRAM (Bottom View)

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - Grid No.2
Pin 5 - No Connection
Pin 6 - No Connection
Pin 7 - No Connection
Pin 8 - No Connection
Pin 9 - Grid No.3
Pin 10 - No Connection
Pin 11 - No Connection
Pin 12 - No Connection
Pin 13 - Internal Connection— Do Not Use
Pin 14 - Heater
Cable - Anode (Grid No.4, Collector)

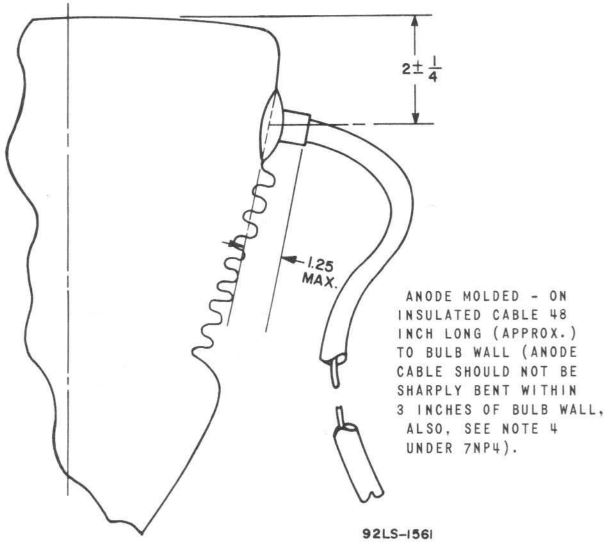


14N

Note: Socket contacts for Pins No.5, 6, 7, 8, 10, 11, 12, and 13 should be removed so that maximum insulation is provided for Pin No.9.

DIMENSIONAL OUTLINE

(Other dimensions are the same as those shown for Type 7NP4)



DIMENSIONS IN INCHES

Oscillograph-Type Cathode-Ray Tube

7-IN DIAMETER
ELECTROSTATIC DEFLECTION

POST-DEFLECTION ACCELERATOR
ELECTROSTATIC FOCUS

For General Oscillographic Applications in which Low-Speed or Medium Speed Recurrent-Wave Phenomena are to be Observed

ELECTRICAL

Heater Current at 6.3 V	0.6 A
Direct Interelectrode Capacitances (Approx.)	
Grid-No.1 to all other electrodes	6 pF
Cathode to all other electrodes	7.5 pF
DJ1 to DJ2	3 pF
DJ3 to DJ4	2 pF
DJ1 to all other electrodes	9 pF
DJ2 to all other electrodes	9 pF
DJ3 to all other electrodes	7 pF
DJ4 to all other electrodes	7 pF
Focusing Method	Electrostatic
Deflection Method	Electrostatic

OPTICAL

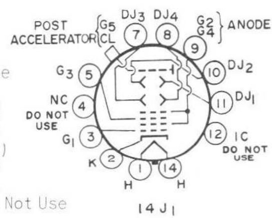
Phosphor	P31
Flourescence and phosphorescence	Green
Persistence	Medium-Short
Faceplate	Clear Glass
Shape	Curved, Circular
Minimum Useful Screen Diameter	6 in

MECHANICAL

Operating Position	Any
Weight (Approx.)	3 lb
Overall Length	14.62 + 0.25-0.50 in
Greatest Diameter	7.12 in
Bulb	J56H1A
Base	Medium-Shell

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Cathode
Pin 3 – Grid No.1
Pin 4 – No Connection – Do Not Use
Pin 5 – Grid No.3
Pin 7 – Deflecting Electrode DJ3
Pin 8 – Deflecting Electrode DJ4
Pin 9 – Anode (Grids No.2 & No.4)
Pin 10 – Deflecting Electrode DJ2
Pin 11 – Deflecting Electrode DJ1
Pin 12 – Internal Connection – Do Not Use
Pin 14 – Heater
Cap – Post-Accelerator (Grid No.5 & Collector)



ABSOLUTE-MAXIMUM AND MINIMUM RATINGS

Post-Deflection Accelerator Voltage	8000 max	V
Anode Voltage	4000 max	V
Grid-No.3 (Focusing-Electrode) Voltage	2000 max	V

Grid-No. 1 Voltage			
Negative bias value	200	max	V
Positive bias value	0	max	V
Positive peak value	2	max	V
Heater Voltage	{6.9	max	V
	5.7	min	V
Peak Heater-Cathode Voltage			
Heater negative with respect to cathode	125	max	V
Heater positive with respect to cathode	125	max	V

TYPICAL OPERATING VALUES

Unless otherwise specified all values are positive with respect to cathode

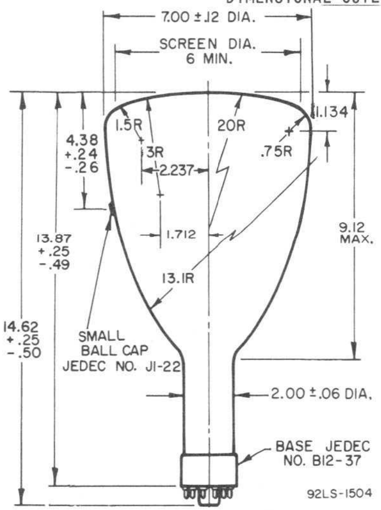
Post-Deflection Accelerator Voltage	6000	V
Anode Voltage	3000	V
Grid-No. 3 (Focusing-Electrode) Voltage	750 to 1200	V
Grid-No. 1 Voltage	-58 to -93	V
For visual cutoff of focused spot		
Deflection Factors		
DJ1 and DJ2	133 to 153	V (dc)/in
DJ3 and DJ4	99 to 115	V (dc)/in

MAXIMUM CIRCUIT VALUES

Grid-No. 1-Circuit Resistance	1.5	max	MΩ
Resistance in any Deflection Electrode Circuit[a]	5	max	MΩ

[a] It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

DIMENSIONAL OUTLINE



Center line of bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base.

The plane through the tube axis and pin 5 may vary from the trace produced by DJ1 and DJ2 by an angular tolerance (measured about the tube axis) of ± 10°. Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is 90° ± 3°.

DJ1 and DJ2 are nearer the screen; DJ3 and DJ4 are nearer the base. With DJ1 positive with respect to DJ2, the spot will be deflected toward pin 5; likewise, with DJ3 positive with respect to DJ4, the spot will be deflected toward pin 2.

DIMENSIONS IN INCHES

Oscillograph-Type Cathode-Ray Tube

8-INCH DIAMETER
ELECTROSTATIC DEFLECTION

POST-DEFLECTION ACCELERATOR
ELECTROSTATIC FOCUS

For General Oscillographic Applications in which Low-Speed or Medium-Speed Recurrent-Wave Phenomena are to be Observed

ELECTRICAL

Heater Current at 6.3 V	0.6 A
Direct Interelectrode Capacitances (Approx.)	
Grid-No.1 to all other electrodes	6 pF
Cathode to all other electrodes	7.5 pF
DJ1 to DJ2	3 pF
DJ3 to DJ4	2 pF
DJ1 to all other electrodes	9 pF
DJ2 to all other electrodes	9 pF
DJ3 to all other electrodes	7 pF
DJ4 to all other electrodes	7 pF
Focusing Method	Electrostatic
Deflection Method	Electrostatic

OPTICAL

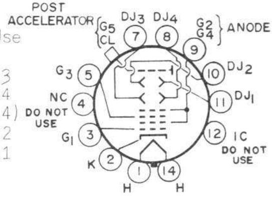
Phosphor	P31
Fluorescence and phosphorescence	Green
Persistence	Medium-Short
Faceplate	Clear Glass
Shape	Curved, Circular
Minimum Useful Screen Diameter	7 in

MECHANICAL

Operating Position	Any
Weight (Approx.)	3 lb
Overall Length	16.50 ± 0.38 in
Greatest Diameter	8.50 in
Bulb	J67A1A
Base	Medium-Shell Diheptal 12-Pin (JEDEC No.B12-37)

TERMINAL DIAGRAM (Bottom View)

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - No Connection - Do Not Use
Pin 5 - Grid No.3
Pin 7 - Deflecting Electrode DJ3
Pin 8 - Deflecting Electrode DJ4
Pin 9 - Anode (Grids No.2 & No.4)
Pin 10 - Deflecting Electrode DJ2
Pin 11 - Deflecting Electrode DJ1
Pin 12 - Internal Connection - Do Not Use
Pin 14 - Heater
Cap - Post-Accelerator (Grid No.5 & Collector)



14J1

ABSOLUTE-MAXIMUM AND MINIMUM RATINGS

Post-Deflection Accelerator Voltage	8000 max	V
Anode Voltage	4000 max	V
Grid-No.3 (Focusing-Electrode) Voltage	2000 max	V
Grid-No.1 Voltage		
Negative bias value	200 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	6.9 max	V
	5.7 min	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	125 max	V
Heater positive with respect to cathode	125 max	V

TYPICAL OPERATING VALUES

Unless otherwise specified all values are positive with respect to cathode

Post-Deflection Accelerator Voltage	6000	V
Anode Voltage	3000	V
Grid-No.3 (Focusing-Electrode) Voltage	750 to 1200	V
Grid-No.1 Voltage	-58 to -93	V
For visual cutoff of focused spot		
Deflection Factors		
DJ1 and DJ2	107 to 129	V (dc)/in
DJ3 and DJ4	85 to 101	V (dc)/in

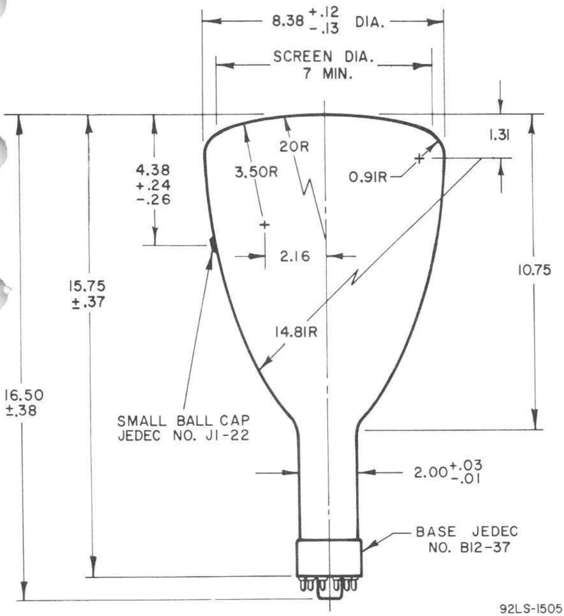
MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance	1.5 max	MΩ
Resistance in any Deflection Electrode Circuit[a]	5 max	MΩ

[a] It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

Center line of bulb will not deviate more than 2° in any direction from the perpendicular erected at the center of bottom of the base.

The plane through the tube axis and pin 5 may vary from the trace produced by DJ1 and DJ2 by an angular tolerance (measured about the tube axis) of ±10°. Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is 90° ± 3°.

DJ1 and DJ2 are nearer the screen; DJ3 and DJ4 are nearer the base. With DJ1 positive with respect to DJ2; the spot will be deflected toward pin 5; likewise, with DJ3 positive with respect to DJ4, the spot will be deflected toward pin 2.

Oscillograph-Type Cathode-Ray Tube

ELECTROSTATIC DEFLECTION 5-in DIAMETER ELECTROSTATIC FOCUS

For General Oscillographic Applications in which Recurrent-Wave Phenomena are to be Observed

ELECTRICAL

Heater Current at 6.3 V	0.6 A
Direct Interelectrode Capacitances (Approx.)	
Grid-No.1 to all other electrodes	10 pF
Cathode to all other electrodes	5.5 pF
DJ1 to DJ2	2.5 pF
DJ3 to DJ4	3.0 pF
DJ1 to all other electrodes	10.5 pF
DJ2 to all other electrodes	8.5 pF
DJ3 to all other electrodes	8.5 pF
DJ4 to all other electrodes	9.5 pF
Focusing Method	Electrostatic
Deflection Method	Electrostatic

OPTICAL

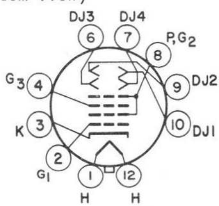
Phosphor	P1
Fluorescence and phosphorescence	Yellowish-Green
Persistence	Medium
Faceplate	Clear Glass
Shape	Flat, Circular
Minimum Useful Screen Diameter	4.56 in

MECHANICAL

Operating Position	Any
Weight	2 lb
Overall Length	12.000 ± 0.125 in
Greatest Diameter	5.25 ± 0.06 in
Bulb	J42 Dev.66
Base	Special, Small-Shell Duodecal, 10-pin

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Cathode
Pin 4 – Grid No.3
Pin 6 – Deflecting Electrode DJ3
Pin 7 – Deflecting Electrode DJ4
Pin 8 – Anode, Grid No.2
Pin 9 – Deflecting Electrode DJ2
Pin 10 – Deflecting Electrode DJ1
Pin 12 – Heater



ABSOLUTE-MAXIMUM AND MINIMUM RATINGS

Anode Voltage	2800 max	V
Grid-No.3 (Focusing-Electrode) Voltage	1100 max	V
Grid-No.1 Voltage		
Negative bias value	200 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V

Heater Voltage	6.9 max 5.7 min	V V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	125 max	V
Heater positive with respect to cathode	125 max	V

TYPICAL OPERATING VALUES

Unless otherwise specified all values are positive with respect to cathode

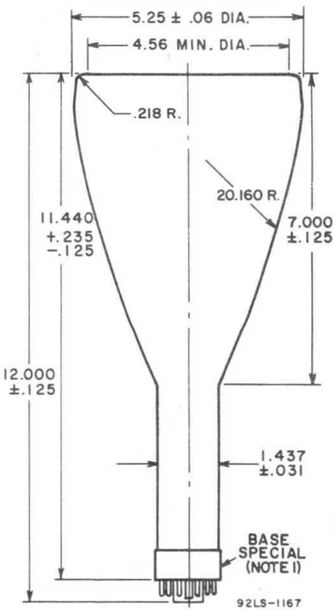
Anode Voltage	2200	V
Grid-No.3 (Focusing-Electrode) Voltage	750 to 1000	V
Grid-No.1 Voltage	-60 to -140	V
For visual cutoff of focused spot		
Deflection Factors		
DJ1 and DJ2	84 to 106	V (dc)/in
DJ3 and DJ4	67 to 83	V (dc)/in

MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance	1.5 max	MΩ
Resistance in any Deflection Electrode Circuit[a]	5 max	MΩ

[a] It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

The plane through the tube axis and pin 4 may vary from the trace produced by DJ1 and DJ2 by an angular tolerance (measured about the tube axis) of 10°. Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is 90° ± 3°.

DJ1 and DJ2 are nearer the screen; DJ3 and DJ4 are nearer the base. With DJ1 positive with respect to DJ2, the spot will be deflected toward pin 4; likewise, with DJ3 positive with respect to DJ4, the spot will be deflected toward Pin 1.

Note 1: Base is identical to short small-shell duodecal JEDEC No. B12-207 except pin No.5 and pin No.11 are omitted.

Oscillograph-Type Cathode-Ray Tube

5-Inch Diameter
Electrostatic Deflection

Post-Deflection Accelerator
Electrostatic Focus

For General Oscillographic Applications in which Extremely Low-Speed or Medium-Speed Recurrent- or Non-Recurrent-Wave Phenomena are to be Observed

ELECTRICAL

Heater Current at 6.3 V	0.6	A
Direct Interelectrode Capacitances (Approx.)		
Grid No.1 to all other electrodes	10	pF
Cathode to all other electrodes	5.5	pF
DJ1 to DJ2	2.5	pF
DJ3 to DJ4	3.0	pF
DJ1 to all other electrodes	10.5	pF
DJ2 to all other electrodes	8.5	pF
DJ3 to all other electrodes	8.5	pF
DJ4 to all other electrodes	9.0	pF
Focusing Method	Electrostatic	
Deflection Method	Electrostatic	

OPTICAL

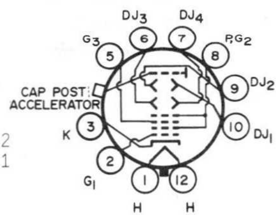
Phosphor	P7
Fluorescence	Purplish-Blue
Phosphorescence	Yellowish-Green
Persistence	Long
Faceplate	Clear Glass
Shape	Flat, Circular
Minimum Useful Screen Diameter	4.56 in

MECHANICAL

Operating Position	Any
Weight (Approx.)	2 lb
Overall Length	12.00 ± 0.13 in
Greatest Diameter	5.31 in
Bulb	J42 Dev.67
Base	Special, Small-Shell Duodecal, 10-Pin

TERMINAL DIAGRAM (Bottom View)

Pin 1 – Heater
Pin 2 – Grid No.1
Pin 3 – Cathode
Pin 5 – Grid No.3
Pin 6 – Deflecting Electrode DJ3
Pin 7 – Deflecting Electrode DJ4
Pin 8 – Anode, Grid No.2
Pin 9 – Deflecting Electrode DJ2
Pin 10 – Deflecting Electrode DJ1
Pin 12 – Heater
Cap – Post-Accelerator
(Grid No.5 & collector)



ABSOLUTE-MAXIMUM AND MINIMUM RATINGS

Post-Deflection Accelerator Voltage	6000 max	V
Anode Voltage	3000 max	V
Grid-No.3 (Focusing-Electrode) Voltage	1200 max	V
Grid-No.1 Voltage		
Negative bias value	200 max	V
Positive bias value	0 max	V
Positive peak value	2 max	V
Heater Voltage	6.9 max	V
	5.7 min	V
Peak Heater-Cathode Voltage		
Heater negative with respect to cathode	125 max	V
Heater positive with respect to cathode	125 max	V

TYPICAL OPERATING VALUES

Unless otherwise specified all values are positive with respect to cathode

Post-Deflection Accelerator Voltage	3000	V
Anode Voltage	1500	V
Grid-No.3 (Focusing-Electrode) Voltage	475 to 725	V
Grid-No.1 Voltage	-40 to -94	V
For visual cutoff of focused spot		
Deflection Factors		
DJ1 and DJ2	69 to 91	V (dc)/in
DJ3 and DJ4	57 to 73	V (dc)/in

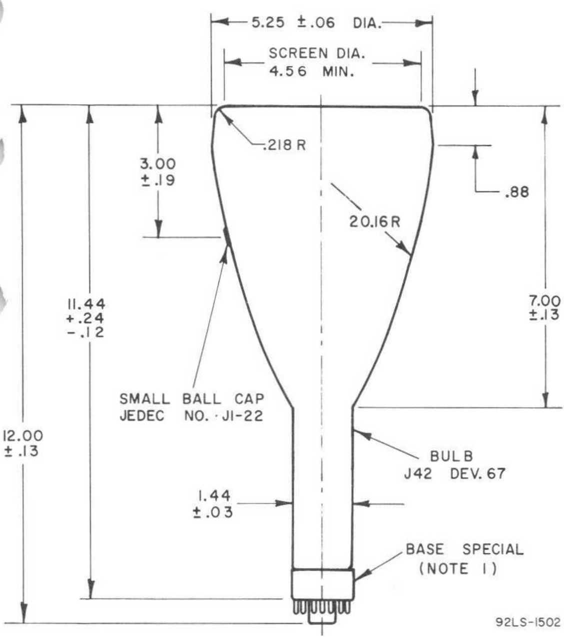
MAXIMUM CIRCUIT VALUES

Grid-No.1-Circuit Resistance	1.5 max	MΩ
Resistance in any Deflection Electrode Circuit[a]	5 max	MΩ

[a] It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

X-RADIATION WARNING: Shielding of these cathode-ray tubes for x-radiation may be needed to protect against possible danger of personal injury from prolonged exposure at close range.

DIMENSIONAL OUTLINE



DIMENSIONS IN INCHES

The plane through the tube axis and pin 1 may vary from the trace produced by DJ3 and DJ4 by an angular tolerance (measured about the tube axis) of 10°. Angle between DJ1 - DJ2 trace and DJ3 - DJ4 trace is 90° ± 3°.

DJ1 and DJ2 are nearer the screen; DJ3 and DJ4 are nearer the base. With DJ1 positive with respect to DJ2, the spot will be deflected toward pin 5; likewise, with DJ3 positive with respect to DJ4, the spot will be deflected toward pin 1.

Note 1: Base is identical to short small-shell duodecal JEDEC No.B12-207 except pin No.4 and pin No.11 are omitted.

5" Radar Display CRT

- Electrostatic focus
- Magnetic deflection
- Less than ten inches overall length
- Offset neck facilitates positioning of display origin at screen edge
- For display of airborne weather radar data in airplane cockpits

Data

Electrical:

Heater for Unipotential Cathode:

Voltage[a] (AC or DC)	6.3		V
Current at 6.3 V	0.3		A
Focusing Method			Electrostatic
Deflection Method			Magnetic

Direct Interelectrode Capacitances:

Grid No.1 to all other electrodes	10	max.	pF
Cathode to all other electrodes	6	max.	pF

Optical:

Faceplate:

Material	Clear Glass
Shape	Spherical
Minimum useful diameter	4.5 in

Phosphor:

Type	Aluminized, P7
Fluorescence	White
Phosphorescence	Yellowish Green
Persistence	Long (100 ms to 1 sec.)

Mechanical:

Tube Dimensions:

Maximum overall length	9-13/16	in
Maximum bulb diameter	5	in
Neck diameter	7/8	in
Base (9 Pin)	JEDEC No.E9-37	
Anode Connector	Button J1-22	
Operating Attitude	Any	
Weight	2	lb

Maximum Ratings, Absolute Maximum Values[b]

Anode Voltage	12000	max.	V
Grid No.4 Voltage	450	max.	V
Grid No.2 Voltage	450	max.	V
Grid No.1 Voltage:			
Negative bias value	100	max.	V
Positive bias value	0	max.	V
Positive peak value	2	max.	V
Peak Heater Cathode Voltage	125	max.	V

Typical Operating Values

All values are specified with respect to cathode.

Anode Voltage	8500	V
Grid No.4 Voltage[c]	40 to 250	V
Grid No.2 Voltage	250	V
Grid No.1 Voltage[d]	−25 to −50	V
Anode Current	100	μA
Grid No.3 Current	10	μA
Grid No.2 Current	1.0	μA
Grid No.1 Drive Voltage	25	V
Resolution[e]	0.014	in

a For optimum life the heater voltage should be regulated at 6.3 volts.

b A description of the Absolute-Maximum Rating is given in the General Section, titled Rating Systems for Electron Tubes.

c Adjust for best focus.

d Adjust for visual cutoff of undeflected spot.

e At center of tube face. Shrinking raster measurement.

X-Ray Warning
Shielding of this cathode-ray tube for X-ray radiation may be needed to protect against possible danger of personal injury from prolonged exposure at close range.

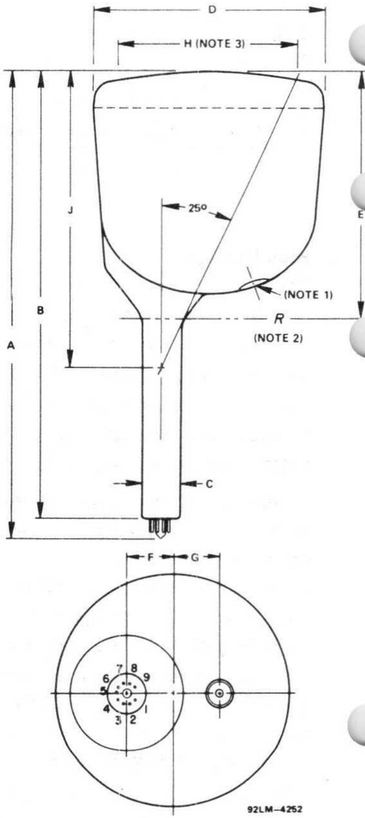
High Voltage

The high voltages at which tube type is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

In the use of the - tube it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. Therefore, before any part of the circuit or the tube is touched, the power-supply switch should be turned off, both terminals of high-voltage capacitors should be grounded, and the terminals of the high-voltage power supply should be grounded.

After these steps have been taken and before touching the tube, discharge the anode terminals, the surface of the faceplate, and the coated surface of the cone by use of a suitable wand which is connected to ground. It is to be noted that the entire surface of the cone and of the faceplate will not be discharged by touching the wand to a single point on either surface, because the surfaces have high resistance. Therefore, to discharge each surface, it will be necessary to sweep over the entire surface with the wand.

Dimensional Outline



Note 1: Anode button J1-22.

Note 2: Reference line; ring gauge (1.000" +.003" −.000" diameter x 1.500" long) will stop at this reference line.

Note 3: Quality circle.

Pin No.1	G1
Pin No.2	H
Pin No.3	H
Pin No.4	G1
Pin No.5	NC
Pin No.6	G4
Pin No.7	G2
Pin No.8	G1
Pin No.9	K
Button	Anode, G3

Tabulated Dimensions

A	9.812 Max.
B	9.060 ± .060
C	0.870 ± .030
D	4.950 ± .062
E	5.218 ± .125
F	1.000 Ref.
G	1.000 Ref.
H	4.500 Min.
J	6.250 Ref.

Display-Storage Tube

Single Writing Gun
Single Viewing Gun
High Display Uniformity
High Luminance
High Resolution
TV Capability

ELECTRICAL

	Writing Section	Viewing Section	Units
Heater: For Unipotential Cathode			
Voltage (AC or DC)	6.3 ± 10%	6.3 ± 10%	V
Current at 6.3 V	0.6	0.6	A
Warmup Time[a]		60	s
Direct Interelectrode Capacitances:			
Grid No.1 to all other electrodes	7.0		pF
Cathode to all other electrodes	5.0		pF
Backplate to all other electrodes		150	pF
Focusing Method	Electrostatic		
Deflection Method	Magnetic		
Phosphor		P20 (Aluminized)	

MECHANICAL

Minimum Useful Viewing Diameter	4.0	in
Maximum Overall Length (Excluding Ring)[b]	11.59	in
Maximum Seated Length (Excluding Ring)[b]	11.25	in
Maximum Diameter (Silastic Padding Ring)[b]	5.396 ± 0.015	in
Bases:		
Writing gun	JEDEC No.E8-49	
Viewing gun	JEDEC No.E7-1	
Bulb terminals (two)	JEDEC No.J1-21	
Screen connector	AMP Type LGH[c] No.832692 or equiv.	
Operating Position	Any	
Weight (Approx.)	20	lb

MAXIMUM RATINGS

Absolute-Maximum Ratings – All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified.

	Min.	Max.	Units
Screen Voltage			
Peak	0	10,000	V
DC	0	9,000	V
Backplate Voltage			
Peak	0	15	V
DC	-30	10	V
Viewing Section Voltages			
Collector (Grid No.5)	180	300	V
Collimator (Grid No.4)	40	150	V
Grid No.3[e]	10	150	V
Grid No.2		150	V
Grid No.1	-100	0	V
Heater	-125	125	V
Writing Section			
Grid No.4[e]	10	150	V
Grid No.3[f]	0	1200	V
Grid No.2[e]	10	150	V
Grid No.1[f]	-200	Note g	V
Cathode	-2750	145	V
Heater[f]	-125	125	V
Screen Resistor[h]	1.0		MΩ
Collector Resistor[h]	5,000		Ω

RECOMMENDED OPERATING VALUES

All voltages are shown with respect to the cathode of the viewing gun.

Screen Voltage	8500	V
Backplate Voltage	0	V
Viewing Section Voltages		
Collector (Grid No.5)	200	V
Collimator[j] (Grid No.4)	60 to 110	V
Grid No.3[j]	10 to 60	V
Grid No.2[j]	110	V
Grid No.1[j]	-40 to 0	V

RECOMMENDED OPERATING VALUES (Cont'd)

Writing Section Voltages		
Grid No.3[k]	-2075 to 1575	V
Grid No.1	Notes g,m	
Cathode	-2500	V
Screen Resistor	1.0	MΩ
Collector Resistor	10,000	Ω

PERFORMANCE DATA AND CHARACTERISTICS

	Min.	Typical	Max.	Units
Useful Viewing Diameter	4.0			in
Luminance (Brightness)[p]	700	1300		fL
Viewing Duration[r]	10			s
Undeflected Spot Position			Note s	
Screen Current[p]		300	750	μA
Viewing Gun Collector Current[t]		1.0	2.4	mA
Viewing Gun Cathode Current[u]		2.5	4.0	mA
Writing Gun Cathode Current[v]		2.5	5.0	mA
Resolution[w]	400			lines
Erase Time[x]	1.5	2.5	3.5	ms

a Viewing-gun Heater Warm-up Time must be completed before any other voltages are applied.

b The silastic-padding ring is permanently attached to the bulb and is used to facilitate shock mounting.

c Mates with AMP No.833589 or equiv. from AMP Inc., 155 Park Street, Elizabethtown, PA 17022.

e Grids No.4 and No.2 of Writing Gun and grid No.3 of Viewing Gun are connected within the tube.

f Voltages are shown with respect to cathode of Writing Gun.

g The writing-gun grid No.1 should never be more positive than necessary to write the display to saturated brightness for a given scanning and drive condition. In no case should the writing-gun No.1 voltage have a value greater than zero with respect to the writing-gun cathode.

h Unbypassed, current-limiting resistor.

j Adjust for brightest, most uniform, full-size pattern.

k Adjust for the smallest, most circular spot.

m The maximum bias-voltage value for writing-beam cutoff is -130 volts with respect to writing-gun cathode.

p Luminance (Brightness) and screen current are measured after the entire display is written to saturated brightness, the writing gun has been turned off, and with no erasing pulse applied.

r The time required for any 1.5-inch diameter area of the useful 4-inch diameter viewing area to spontaneously rise (with no writing or erasing) from zero brightness (viewing-beam cutoff) to 10% of saturated brightness.

s The undeflected spot position must fall within a circle having a 5/16-inch radius (maximum), 1-3/4-inches from the geometric center of the tube face, on the radius passing through the center of the neck of the writing gun.

t With writing gun turned off, with no erasing pulse applied, and display erased to cutoff.

u Measured with viewing-gun grid No.1 at zero volts and with all other electrodes at voltages shown under Recommended Operating Values.

v Measured with writing-gun grid No.1 at zero volts while writing an overscanned TV-type raster.

w Adjust erase pulser to 60 pps, 0.5 milliseconds width, and sufficient amplitude to just erase any written information. Using a standard television raster, without blanking or video, adjust raster to 3.0 inch horizontal by 2-1/4 inch vertical. Adjust writing-gun grid No.1 bias to reduce the raster to just under write threshold. Adjust the video amplitude so that all half-tones, of a television pattern such as that provided by an RCA 2F21 Monoscope, are clearly discernable. Move the raster and adjust the erase-pulse amplitude to eliminate undersirable picture retention. Minor re-adjustment of the write-gun grid No.1 bias, the erase pulse amplitude and the video drive may be necessary to obtain the best subjective picture.

x Measured from saturated brightness to cutoff with an erase pulse 0.5 volt more positive than that necessary for complete erasure.

ENVIRONMENTAL TESTS

The 4547 is designed to withstand the following environmental tests:

Test 1. Vibration in each of the three orthogonal axes as shown in **Figure 1**, to a double amplitude of 0.03 inch, varied at a uniform rate from 10 to 55 Hz and back to 10 Hz over a five minute interval for each axis.

Test 2. Temperature storage for 24 hours each at 100° C and at -65° C.

Test 3. Temperature and altitude in three phases as follows:

Phase 1. Storage for one hour at a temperature of -40° C followed by tube operation for five minutes under the conditions shown under Recommended Operating Values.

Phase 2. Temperature is increased from -40° C at a rate of 2° C per minute until a temperature of +86° C is reached. Following one hour storage at +86° C, the tube is operated for five minutes under the conditions shown under Recommended Operating Values.

Phase 3. Barometric pressure is next reduced until a pressure equivalent to an altitude of 20,000 feet is attained. The tube is then operated for five minutes under the conditions shown under Recommended Operating Values. Upon completion of the third phase of this test, pressure is increased and temperature decreased, at a rate of 2° C per minute, until ambient pressure-temperature conditions are reached.

ORTHOGONAL AXES OF 4547 USED FOR ENVIRONMENTAL TESTING

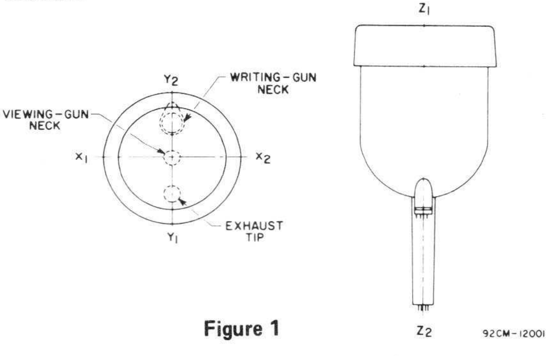


Figure 1

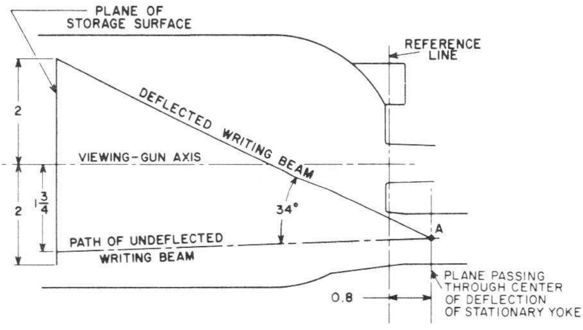
OPERATING CONSIDERATIONS

Deflection. The undeflected, focused writing beam lands nearly normal (perpendicular) to the storage-grid surface at a distance of 1-3/4 inches from its center and in the direction of the wirting gun neck.

The writing beam may be deflected by two stationary pairs of coils. One pair is used for horizontal deflection, and the other pair for vertical deflection. When these coils are used, centering the undeflected writing beam can be accomplished by passing direct current of the required value through each pair of deflecting coils.

To avoid neck shadow, when the stationary coils are used, it is essential that the center of deflection should be located not more than 0.8 inch from the reference line as shown below. The writing beam must be deflected from its undeflected position, through a typical angle of 34° to sweep fully the storage surface.

LOCATION OF CENTER OF DEFLECTION



92LS-3654

CAUTION

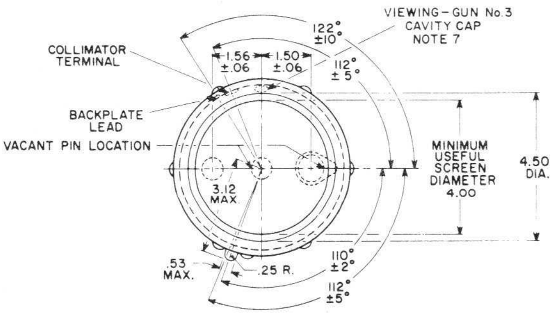
To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing beam on till the writing beam is turned off.

PRECAUTIONS

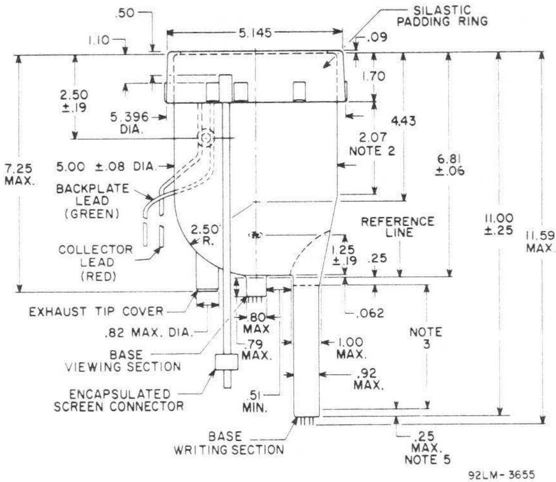
The following operating precautions must be followed to protect the 4547 from inadvertent damage –

1. Do not exceed maximum ratings.
2. Be sure to include the screen resistor.
3. Be sure to include the collector resistor.
4. Do not apply excessive writing-beam current density.
5. Protect against scanning failure.
6. Protect against loss of bias.
7. Apply voltages to tube in correct order.
8. Never write unless viewing beam is on.
9. Stay within recommended viewing-grid voltage ranges.

DIMENSIONAL OUTLINE (TOP VIEW)



DIMENSIONAL OUTLINE (FRONT VIEW)



DIMENSIONAL OUTLINE NOTES

Note 1: The silastic-padding ring is permanently attached to the bulb and fits with a light push into a gauge having an inside diameter of 5.396" ±0.015".

Note 2: Within this length, bulb diameter is 5.00" ±0.08".

Note 3: Within this length, neck diameter is 0.920" maximum.

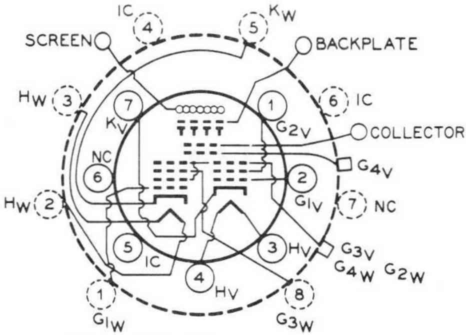
Note 4: Aircraft-Marine Products, Inc., type LGH Part No.832692, or equivalent. This part mates with Aircraft-Marine Products, Inc., Part No. AMP 833589, Ceramic Terminal, or Equivalent.

Note 5: Within this length, neck diameter is 0.950" maximum.

Note 6: Do not use these cavity caps for connection. The caps are connected internally and may be at a potential which could constitute a shock hazard. It is recommended that these caps be covered with electrical insulation.

Note 7: Grids No.4 and No.2 of Writing Gun and grid No.3 of the Viewing Gun are connected within the tube.

BASING DIAGRAM – BOTTOM VIEW



SOLID-LINE CIRCLES DEPICT MINIATURE 7-PIN BASE
BROKEN-LINE CIRCLES DEPICT NEODITETRAR 8-PIN BASE   461

Small-Button Miniature 7-Pin Base

VIEWING SECTION

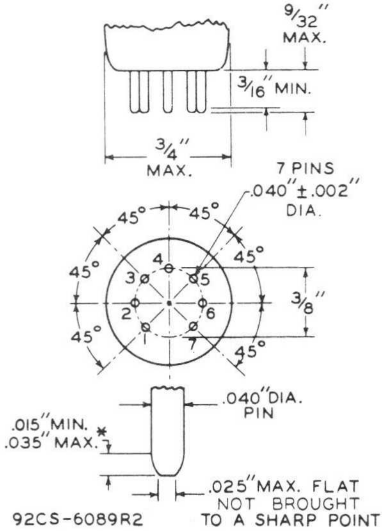
Pin 1: Grid No.2
Pin 2: Grid No.1
Pin 3: Heater
Pin 4: Heater
Pin 5: Internal Connection —Do Not Use
Pin 6: No Connection
Pin 7: Cathode
Flexible Lead (Large): Screen 8.38" ± 0.20" long
Flexible Lead (Green): Backplate 10.00" ± 0.50" long
Flexible Lead (Red): Collector 10.0 ± 0.5" long
Recessed Cavity Caps: JEDEC No.J1-21
Collimator (Grid No.4)

Small-Button Neoditetrar 8-Pin Base

WRITING SECTION

Pin 1: Grid No.1
Pin 2: Heater
Pin 3: Heater
Pin 4: Internal Connection — Do Not Use
Pin 5: Cathode
Pin 6: Internal Connection — Do Not Use
Pin 7: No Connection
Pin 8: Grid No.3
Note: Grids No.4 & No.2 are connected internally to Grid No.3 of viewing gun.

SMALL BUTTON MINIATURE 7-PIN BASE



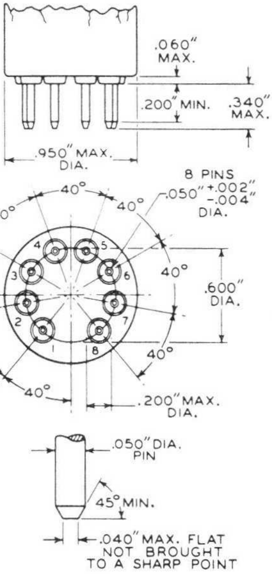
*This dimension around the periphery of any individual pin may vary within the limits shown.

Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from flat-plate gauge (part of gauge JEDEC No.GE7-1) having thickness of 1/4" and eight holes with diameters of 0.0520" ± 0.0005" so located on a 0.3750" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.1434" ± 0.0005".

The design of the socket should be such that circuit wiring can not impress lateral strains through the socket contacts on the base pins. The point of bearing of the contacts on the base pins should not be closer than 1/8" from the bottom of the seated tube.

SMALL BUTTON NEODITETRAR 8-PIN BASE

Base-pin positions are held to tolerances such that entire length of pins will, without undue force, pass into and disengage from flat-plate gauge having thickness of 1/4" and nine holes with diameter of 0.0700" ± 0.0005" so located on a 0.6000" ± 0.0005" diameter circle that the distance along the chord between any two adjacent hole centers is 0.2052" ± 0.0005'.



92CS-9603

X-RADIATION WARNING: Shielding of this cathode-ray tube for x-radiation may be needed to protect against possible danger of personal injury from prolonged exposure at close range.

For further information or application assistance on this device, contact your RCA Field Representative or write, Display Tube Marketing, RCA, Lancaster, PA. 17604

Display Cathode–Ray Tube

12"-Rectangular 70°-Magnetic Deflection Display Cathode-Ray Tube Having Integral Protective Window and P4 Phosphor Screen

ELECTRICAL

Heater Current at 6.3 volts . . . . 0.6 A

Focus Method . . . . Electrostatic

Deflection Method . . . . Magnetic

Direct Interelectrode Capacitances (Typical):

- Grid No.1 to all other electrodes . . . . 6 pF
- Cathode to all other electrodes . . . . 5 pF
- External conductive coating to anode . . . . 1300 max. pF; 700 min. pF

OPTICAL

Faceplate, Spherical . . . . Filterglass

- Light transmission at center (Approx.) 37%

Phosphor . . . . P4-Sulfide Type, Aluminized

Tube Dimensions:

- Overall length . . . . 16.60 max. in
- Neck length . . . . 7.56 ± 0.25 in
- Greatest width . . . . 10.94 ± 0.12 in
- Greatest height . . . . 8.56 ± 0.12 in

Bulb . . . . See Dimensional Outline

Anode Cap . . . . Recessed Small Cavity Cap (JEDEC No.J1-21)

Base . . . . Small-Shell Duodecal, Arrangement 1, 6-Pin (JEDEC No.B6-63)

Operating Position . . . . Any

Weight (Approx.) . . . . 9-1/2 lb

MAXIMUM AND MINIMUM RATINGS, *Absolute-Maximum Values*

Unless otherwise specified, values are positive with respect to cathode.

Anode Voltage . . . . 16,000 max. V

Grid-No.3 (Focusing-Electrode) Voltage . . . 2700 max. V

Grid-No.2 Voltage . . . . 400 max. V

Grid-No.1 Voltage:

- Negative bias value . . . . 80 max. V
- Positive bias value . . . . 0 max. V

Positive peak value	2 max. V
Peak Heater-Cathode Voltage:	
Heater negative with respect to cathode	180 max. V
Heater positive with respect to cathode	180 max. V
Heater Voltage (ac or dc):	
Under operating conditions[b]	6.9 max. V 5.7 min. V

RECOMMENDED OPERATING VALUES

Unless otherwise specified, values are positive with respect to cathode. Raster size 6 inches by 8 inches. Standard TV Scan.

Anode Voltage	12000 V
Anode Current	100 μA
Grid-No.3 (Focusing-Electrode) Voltage for an Anode Current of 100 microamperes	1400 to 1800 V
Grid-No.2 Voltage	340 V
Grid-No.1 Voltage for Visual Extinction of Focused Raster	-68 to -38 V

See accompanying *Cutoff Design Chart*

TYPICAL PERFORMANCE DATA

At recommended operating values, unless otherwise specified.

Anode Current	70 to 30% of cathode current
Grid-No.3 Current	30 to 70% of cathode current
Typical Trace Luminance[c]	See accompanying *Typical Trace Luminance Characteristic*
Typical Center Line Width[d]	0.010 in
Spot Position	See footnote e

MAXIMUM CIRCUIT VALUE

Grid-No.1 Circuit Resistance	1.5 max. MΩ

[b] For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.

[c] Average luminance (brightness) at the center of a single trace scanned at a given sweep speed and refreshed at a given rate.

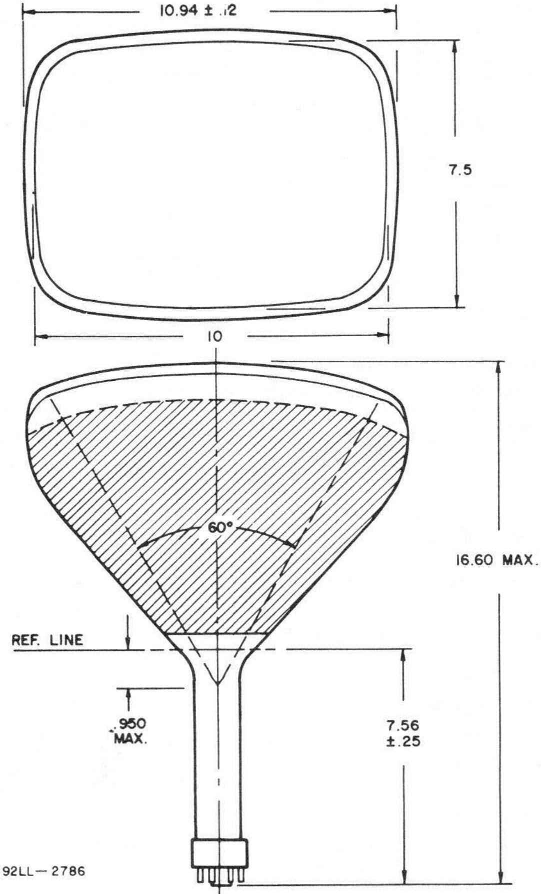
[d] Measured by shrinking raster technique at an anode current of 100 microamperes.

[e] The center of the undeflected, unfocused spot will fall within a circle having a 0.8 inch diameter concentric with the center of the tube face.

X-RADIATION WARNING

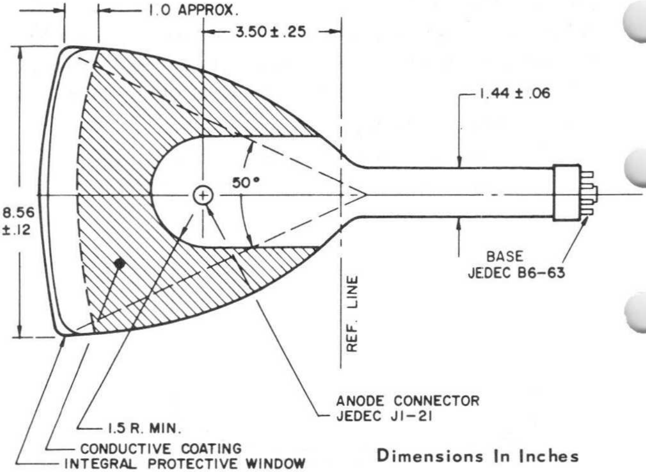
Because the 4557 is designed to be operated at anode voltages as high as 16,000 volts, shielding of the 4557 for X-radiation may be needed to protect against possible injury from prolonged exposure at close range.

DIMENSIONAL OUTLINE Dimensions In Inches



See accompanying *Inch Dimension Equivalents in Millimeters.*

DIMENSIONAL OUTLINE(Top Right Side View)

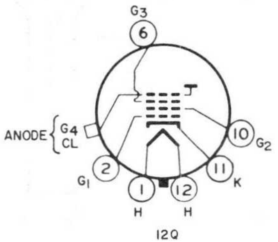


Dimensions In Inches

Inch Dimension Equivalents in Millimeters					
Inch	**mm**	**Inch**	**mm**	**Inch**	**mm**
.06	1.5	1.44	36.5	8.56	217.4
.12	3	1.5	38.1	10	254
.25	6.3	3.50	88.9	10.94	277.8
.950	24.1	7.5	190.5	16.60	421.6
1.0	25.4	7.56	192		

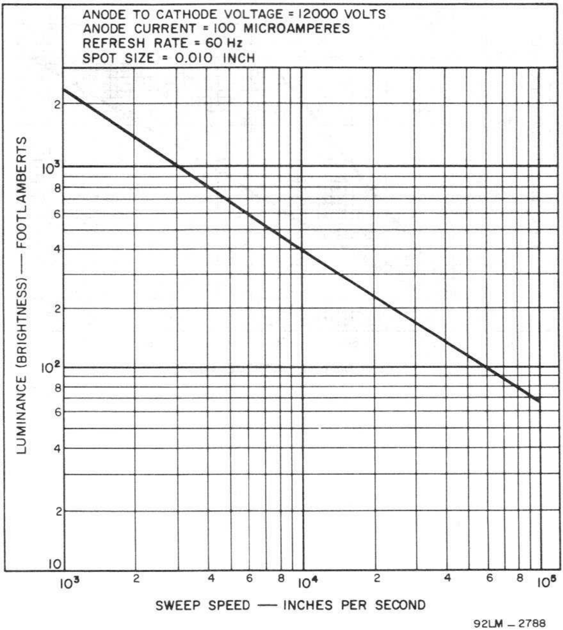
TERMINAL DIAGRAM (Bottom View)

Pin 1: Heater
Pin 2: Grid No.1
Pin 6: Grid No.3
Pin 10: Grid No.2
Pin 11: Cathode
Pin 12: Heater
Cap: Anode (Grid No.4 and Collector)

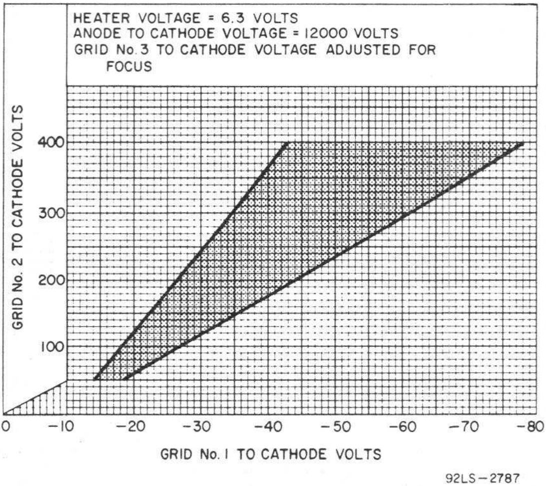


TYPICAL TRACE LUMINANCE CHARACTERISTIC

(Average brightness at center of single trace scanned at the refreshed at the indicated rate)



CUTOFF DESIGN CHART



Monoscopes[a]

Custom-Built 2"-Diameter, Electrostatic-Focus, Electrostatic-Deflection Monoscope Tubes For Use As Alpha-Numeric Character Generators

ELECTRICAL

Heater Current at 6.3 volts . . . . 0.6 A
Focusing Method . . . . Electrostatic
Deflection Method . . . . Electrostatic
Direct Interelectrode Capacitances (Approx.):

- Grid No.1 to all other electrodes . . . . 7 pF
- Cathode to all other electrodes . . . . 5 pF
- Output Signal Electrode to all other electrodes . . . . 8 pF
- DJ1 to all other electrodes . . . . 10 pF
- DJ2 to all other electrodes . . . . 10 pF
- DJ3 to all other electrodes . . . . 7 pF
- DJ4 to all other electrodes . . . . 7 pF
- DJ1 to DJ2 . . . . 3 pF
- DJ3 to DJ4 . . . . 3 pF

Deflection Direction:

A positive voltage on DJ1 deflects the beam toward top of stencil.

A positive voltage on DJ3 deflects the beam toward the left side of the stencil.

MECHANICAL

Tube Dimensions:

- Maximum Overall Length . . . . 11.5 in
- Maximum Diameter Including Bulb Terminals . . . . 2.285 in

Bulb (Glass) T16
Base . . . . Medium-Shell, Diheptal 12-Pin JEDEC No.B12-37
Socket . . . . Cinch[b] Part No.3M14, or equivalent
Bulb Terminals (Two) . . . . Small Ball JEDEC J1-25
Bulb Terminal Contacts . . Cinch[b] Part No.3A1, or equivalent

Stencil Electrode:

Useful area	1.1 x 1.1 in
Typical Pattern	See accompanying pattern.
Operating Position	Any
Weight (Approx.)	13 oz

MAXIMUM AND MINIMUM RATINGS,
Absolute-Maximum Values

Unless otherwise stated, values are positive with respect to cathode.

Output Signal Electrode Voltage	2500 max. V
Stencil-Electrode Voltage	2500 max. V
Deflecting Electrode Voltage:	
DJ1 and DJ2	2500 max. V
DJ3 and DJ4	2500 max. V
Grid-No.4 & Grid-No.2 Voltage	2500 max. V
Grid-No.3 Voltage	1000 max. V
Grid-No.1 Voltage:	
Negative Bias Value	200 max. V
Positive Bias Value	0 max. V
Positive Peak Value	2 max. V
Peak Heater-Cathode Voltage:	
Heater Negative with respect to Cathode	200 max. V
Heater Positive with respect to Cathode	200 max. V
Heater Voltage (ac or dc):	
Under Operating Conditions[c]	6.9 max. V 5.7 min. V

RECOMMENDED OPERATING VALUES[d]

Unless otherwise specified, values are positive with respect to output signal electrode.

Output Signal Electrode Voltage	Ground[e]
Stencil-Electrode Voltage	-15 V
Average Deflecting Electrode Voltage:	
Vertical (DJ1 and DJ2)	+35 V
Horizontal (DJ3 and DJ4)	+35 V
Grid-No.4 & Grid-No.2 Voltage[f] (Astigmatism)	0 to +70 V

Grid-No.3 (Focusing Electrode) Voltage	-1600 to -1500 V
Grid-No.1 Voltage[g]	-1865 to -1800 V
Cathode Voltage	-1800 V
Heater Voltage[h]	6.3 V

TYPICAL PERFORMANCE CHARACTERISTICS AT RECOMMENDED OPERATING VALUES

	Min.	Typical	Max.	
Output Signal Current[i]	–	5	–	μA
Trace Angle:				
Vertical	–	2	5	degrees
Horizontal	–	2	5	degrees
Between Vertical and Horizontal Traces	89	90	91	degrees
Deflection Factors:[k]				
Vertical (DJ1 and DJ2)	46	–	60	V/in
Horizontal (DJ3 and DJ4)	46	–	60	V/in
Undeflected Spot Position[m]	–	–	0.15	in

[a] A specific tube designation in the 4560 series will be assigned to each type employing a different stencil pattern.

[b] Made by Cinch Manufacturing Company, 1501 Morse Avenue, Elk Grove Village, IL 60007.

[c] For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.

[d] The tube must be shielded to prevent stray magnetic fields from affecting performance. At no time should the undeflected beam be allowed to rest on the usable 1.1" x 1.1" area of the stencil electrode pattern.

[e] The output signal electrode is grounded through a 1000-ohm load resistor.

[f] Adjust for minimum astigmatism.

[g] Adjust as required.

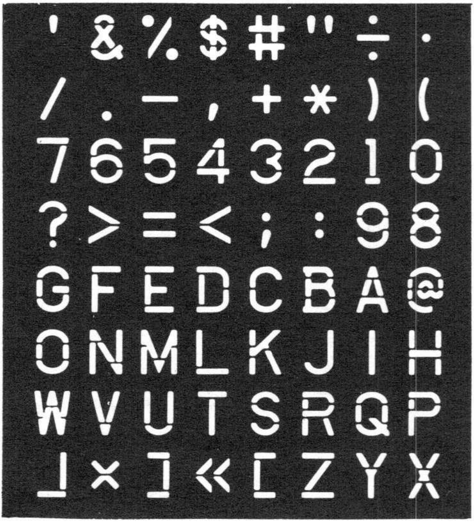
[h] One side of heater terminal (Pin No.1) is connected to -1800 V dc.

i For cathode current not exceeding 110 microamperes.

k Useful area of stencil electrode is 1.1"x 1.1".

m The undeflected spot position must fall within a circle having a 0.15 inch diameter (maximum) centered on the stencil electrode pattern.

TYPICAL STENCIL ELECTRODE PATTERN



OPERATING CONSIDERATIONS

Tubes in the 4560 series are intended for use as character generators in conjunction with display cathode-ray tubes in computer data terminal display equipment. In such equipment, the electron beam in the monoscope is first deflected to a desired character location on the stencil and at the same time the display cathode-ray tube electron beam is deflected to a desired position in the display. The monoscope electron beam is then rapidly scanned over the selected character in the stencil and the display cathode-ray tube electron beam is synchronously deflected on the phosphor screen.

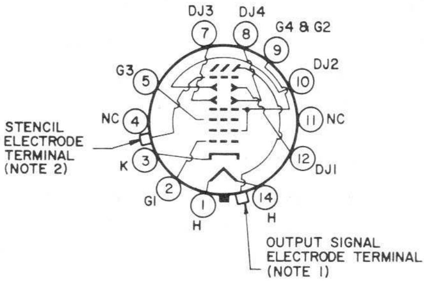
In the monoscope, electrons which pass through the stencil are collected on the output signal electrode and generate a video signal across the output load resistor. This signal is amplified and then applied to the grid of the display cathode-ray tube.

The effect of this operation is that the character stenciled into the monoscope is displayed on the phosphor screen of the display cathode-ray tube. Other characters may be chosen by positioning the monoscope electron beam at different locations on the stencil. A character may be located anywhere in the cathode-ray tube display by appropriate positioning of its electron beam.

NOTE

Stencil patterns supplied to RCA for incorporation in the 4560 family of monoscopes should be at least 10 times larger than the useful 1.1" x 1.1" area of the stencil electrode. The alpha-numeric characters of the pattern should be white on a dark background. Such patterns or requests for information on RCA fabricated stencil patterns should be directed to Storage Tube Marketing, RCA, Lancaster, PA 17604, or to the nearest Sales Office.

TERMINAL DIAGRAM (Bottom View)

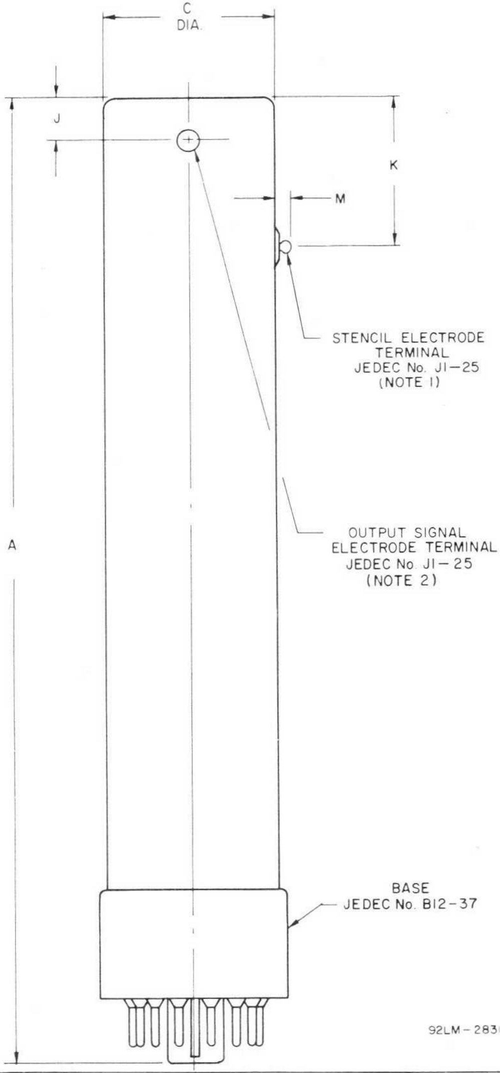


Pin No.1: Heater
Pin No.2: Grid No.1
Pin No.3: Cathode
Pin No.4: No connection
Pin No.5: Grid No.3
Pin No.7: Deflecting Electrode DJ3
Pin No.8: Deflecting Electrode DJ4
Pin No.9: Grid No.4 and Grid No.2
Pin No.10: Deflecting Electrode DJ2
Pin No.11: No connection
Pin No.12: Deflection Electrode DJ1
Pin No.14: Heater
Terminals –
 Nearest Base: Stencil Electrode
 Furthest from Base: Output Signal Electrode

Note 1: The plane passing through the tube axis and the key of the base does not deviate more than ± 10° from the plane passing through the tube axis and the output signal electrode terminal cap.

Note 2: The plane passing through the tube axis and Pin No.4 of the base does not deviate more than ± 10° from the plane passing through the tube axis and the stencil electrode cap.

DIMENSIONAL OUTLINE



NOTES FOR DIMENSIONAL OUTLINE

Note 1: Angular orientation of the stencil electrode terminal with respect to pin No.4 of base is ± 10°.

Note 2: Angular orientation of the output signal electrode terminal with respect to key of base is ± 10°.

OUTLINE DIMENSIONS

Dimensions	Inches	mm
A	11.312 ± .188	287.32 ± 4.77
C	2.050 ± .050 Dia.	52.07 ± 1.27 Dia.
J	.500 ± .062	12.70 ± 1.57
K	1.750 ± .125	44.45 ± 3.17
M	.185 max.	4.69 max.

4583, 4584, 4585

Projection Kinescopes

7"-Diameter Electrostatic-Focus, Magnetic-Deflection Types

- Matched Trio of Tubes for Color Projection Systems
- Designed for Use with Schmidt Reflective Optical Systems
- Matched Phosphors
- High Picture Brightness
- Wide Range of Synthesized Colors
- Balanced Drive Characteristics

General Data

Electrical:

Heater Current at 6.6 Volts . . . . 0.62 A
Focusing Method . . . . Electrostatic
Deflection Method[a] . . . . Magnetic
Deflection Angle (Approx.) . . . . 35^{o}
Direct Interelectrode Capacitances (Approx.):
Grid No.1 to all other electrodes . . . . 12 pF
Cathode to all other electrodes . . . . 6 pF

Optical:

Faceplate, Spherical . . . . Clear, Browning-Resistant Glass
Radius of curvature (inner radius) . . . . 15.315 in
Minimum Optical-Quality-Rectangle . . . . 5x3-3/4 in
Refractive Index of Faceplate 1.469
Phosphors, Aluminized:
4583 . . . . Sulfide (Blue) Type
C.I.E. coordinates (x,y) 0.155, 0.048
Luminescence . . . . Blue
Persistence . . . . Medium
4584 . . . . Silicate (Green) Type
C.I.E. coordinates (x,y) 0.218, 0.728
Luminescence . . . . Green
Persistence . . . . Medium
4585 . . . . Rare-Earth (Red) Type
C.I.E. coordinates (x,y) 0.660, 0.340
Luminescence . . . . Red
Persistence . . . . Medium

4583, 4584, 4585

Mechanical:

Tube Dimensions:

Overall length	19-1/2 ± 5/8 in
Greatest diameter of bulb (excluding side cap or cable)	7 ± 3/16 in
Base	Small-Shell Diheptal 14-Pin, JEDEC No.B14-45
Anode Lead	Molded-on, Insulated Cable, 48 in. long
Operating Position	Any
Weight (Approx.)	5 lbs

Maximum and Minimum Ratings, Absolute-Maximum Values[b]

Average Anode Power:[c]			
With forced-air cooling of faceplate	160	max.	W
Air Flow to Face[d]	40		cfm
Anode-to-Cathode Voltage	80	max.	kV
Grid-No.3-to-Cathode Voltage	20	max.	kV
Grid-No.2-to-Cathode Voltage	1.05	max.	kV
Grid-No.1-to-Cathode Voltage:			
Negative bias value	250	max.	V
Positive bias value	0	max.	V
Peak positive value	2	max.	V
Anode Current, Long-Term Average (for 5″ x 3-3/4″ TV raster)	2	max.	mA
Peak Heater-Cathode Voltage:			
Heater negative with respect to cathode	150	max.	V
Heater positive with respect to cathode	150	max.	V
Heater Voltage (AC or DC)[e]	6.93	max.	V
	6.27	min.	V

Recommended Operating Values[f]

Raster Size	5″ x 3-3/4″
Anode Voltage	75 kV
Anode Current, Long-Term Average	1000 µA
Grid-No.3 Voltage for Focus at an Anode Current of 1000 µA	15 to 17 kV
Grid-No.2 and Grid-No.1 Voltages for Visual Extinction of Focused Raster	See **Figure 1**
Heater Voltage	6.6 V

Typical Performance Data

	Blue	Green	Red	
Luminous Output of each Tube at an Anode Current of 1000 μA for each tube	88	1400	520	lumens
Luminance of Each Tube at an Anode Current of 1000 μA for Each Tube	680	10800	4000	fL
Luminance of Three Tubes Combined at an Anode Current of 1000 μA on Limiting Tube and with Anode Current of Other Two Tubes Adjusted to Produce White of 9300° K + 27 M.P.C.D.			8500	total fL
Percentage of Total Luminance Supplied by Each Tube	8	70	22	%
Percentage of Total Anode Current Supplied by Each Tube (Approx.)	50	27	23	%
Center Resolution[g]			600	TV Lines
Grid-No.3 Current (Total)[h]			±15	μA
Grid-No.2 Current			±15	μA

Circuit Requirements

High-Voltage Circuits

In order to minimize the possibility of damage to the tubes and adjacent circuits caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type. An external spark gap must be provided at the grid-No.3 terminal. The following resistor and voltage values are mandatory.

Anode-Circuit Resistance (unbypassed)	0.5	min.	MΩ
Grid-No.3 Circuit Resistance (unbypassed)	0.1		MΩ
Grid-No.3 Spark-Gap Firing Voltage	20		kV

Low-Voltage Circuits

Grid-No.2 Circuit Resistance (bypassed)	10		kΩ
Grid-No.1 Circuit Resistance (unbypassed)	1		kΩ
Effective Grid-No.1-to-Cathode Circuit Resistance	1.5	max.	MΩ

a Sharp corners on the yoke assembly in the vicinity of the tube neck should be avoided. Insulation between the yoke winding and/or the core and the tube neck should be capable of withstanding at least 10 kV and preferably 15 kV.

b A description of the Absolute Maximum Rating is given in the General Section, titled Rating Systems for Electron Tubes.

c The product of anode-to-cathode voltage and anode current (long term average) should never exceed 160 watts.

d The specified air flow should be delivered perpendicularly from a nozzle having a diameter of about 2 inches onto the face of the tube while it is in operation. In a typical system with air filter, the total system static pressure is approximately 0.25 inch of water. The cooling air must not contain water, dust, or other foreign matter. The air-cooling system should be electrically interconnected with the anode power supply to prevent operation of the tube without cooling.

Cooling of the tube by a tangential flow of air across its face is not recommended because the temperature gradient produced across the face may result in immediate or delayed cracking of the face.

e For maximum cathode life, it is recommended that the heater suppiy be regulated at 6.6 volts.

f These tubes may be operated at reduced anode voltage and/or anode current. At reduced anode voltage, center resolution will decrease. At reduced anode voltage and/or anode current, luminance will decrease. The grid-No.3 voltage for focus will be reduced in proportion to the reduction in anode voltage. Other performance characteristics may also be affected.

g Determined for a 3-3/4 inch high TV resolution test pattern with tube operating at a screen current of 1000 microamperes.

h Grid-No.3 current is normally low, as indicated in the data, when the tube is operated under recommended conditions. Lower grid-No.3 voltages (as required for focus if anode voltage is reduced) and/or higher grid-No.2 voltages can lead to a grid-No.3 current level approaching that measured in the anode circuit. Note that the fraction of available current intercepted by the grid-No.3 electrode is not constant, but increases with increasing anode current.

The Conductive Coating

The conductive coating on the exterior of the tube neck must be grounded. Connection to the coating may be made by using a flexible metal band fastened firmly around the neck at the base end of the coating. The metal band should be fastened only tight enough to insure good contact. If the band is clamped very tight, resultant glass strains may eventually cause the neck to break. This coating must not be scratched and must never be washed with liquids likely to soften or dissolve lacquers.

The external coating on the neck serves to prevent corona between the neck and the yoke. Corona would damage the yoke insulation and cause breakdown in the glass of the neck. It is important that the yoke insulation be adequate for operation of the yoke against the external grounded coating. The resistance of the external conductive coating is sufficiently high so that damping of the yoke deflecting energy is negligible. Because of this high resistance, a contact area of at least 1/4 square inch should be used in making connection to the external coating.

Safety Precautions

X-Radiation Warning

Although X-radiation is generated primarily at the face of the tube when it is operated, the X-rays are emitted in all directions.

These rays can constitute a health hazard unless the tube is adequately shielded. Make sure that the shielding provides the required protection against personal injury.

On the neck of the tube itself the following warning appears and should be strictly adhered to:

> **X-Ray Warning**
>
> **This tube in operation produces X-rays which can constitute a health hazard unless the tube is adequately shielded for radiation.**

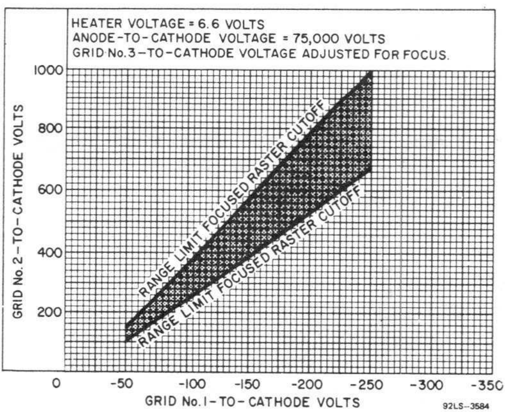
High Voltage

The high voltages at which these tubes are operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

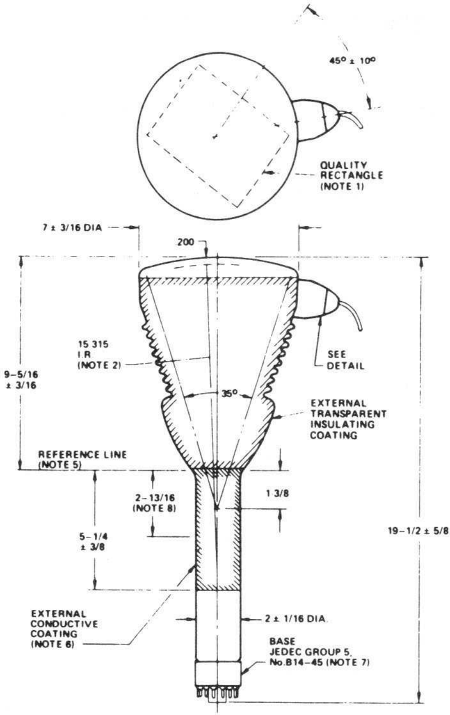
In the use of these tubes it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. Therefore, before any part of the circuit or the tube is touched, the power-supply switch should be turned off, both terminals of high-voltage capacitors should be grounded, and the terminals of the high-voltage power supply should be grounded.

After these steps have been taken and before touching the tube, discharge the anode terminal, the surface of the faceplate, and the coated surface of the cone by use of a suitable wand which is connected to ground. It is to be noted that the entire surface of the cone and of the faceplate will not be discharged by touching the wand to a single point on either surface, because the surfaces have high resistance. Therefore, to discharge each surface, it will be necessary to sweep over the entire surface with the wand.

Cutoff Design Chart



Dimensional Outline



Note 1: When viewed from the face of the tube, the minor axis of the 5" x 3-3/4" quality rectangle is located 45° ± 10° in a counter-clockwise direction from a plane through the anode terminal and the tube axis.

Note 2: Inside surface of faceplate within the quality rectangle may vary ± 0.006" from the spherical surface having a 15.315" radius.

Note 4: The plane through Base Pin No.9 and the tube axis may vary from the plane through the anode terminal and the tube axis by an angular tolerance (measured about the tube axis) of ± 10°. The anode terminal is on same side as Pin No.9.

Note 5: Reference line is determined by position where gauge 2.100" ± 0.001" I.D. and 3" long will rest on bulb cone.

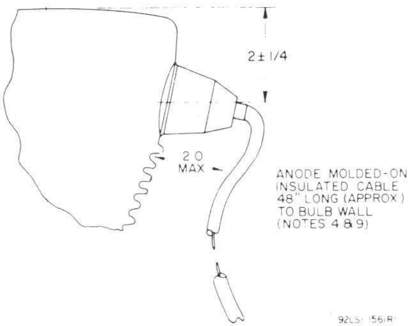
Note 6: External conductive coating must be grounded.

Note 7: Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Socket contacts for Pins 5, 6, 7, 8, 10, 11, 12, and 13 should be removed in order to provide maximum insulation for Pin No.9.

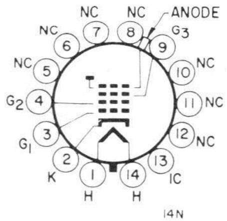
Note 8: Effective deflecting field must be within this space.

Note 9: Anode cable should not be sharply bent within 5" of bulb wall.

Dimensional Outline Detail



Socket Connections (Bottom View)



Pin 1: Heater
Pin 2: Cathode
Pin 3: Grid No.1
Pin 4: Grid No.2
Pin 5: No Connection
Pin 6: No Connection
Pin 7: No Connection
Pin 8: No Connection
Pin 99: Grid No.3
Pin 10: No Connection
Pin 11: No Connection
Pin 12: No Connection
Pin 13: Internal Connection – Do Not use
Pin 14: Heater
Cable: Anode

Note: Socket contacts for Pins No. 5, 6, 7, 8, 10, 11, 12, and 13 should be removed so that maximum insulation is provided for Pin No. 9.

Graphechon Tube

Scan-Conversion Storage-Tube Assembly

Very High Resolution Capability

Ruggedized Structure Designed to Meet MIL-E-5400 Specification

Integral Shielding and Deflection Coils

Small Size – 15" Max. Length 3.65" Diameter

0.6-Watt Heaters for Writing and Reading Guns

ELECTRICAL

Heater Current at 6.3 Volts, Each Gun	0.1 A
Focusing Method, Each Gun	Electrostatic
Deflection Method, Each Gun	Magnetic
Deflection Coils	See footnote a
Total Deflection Angle, Each Gun (Approx.)	50 degrees
Deflection Coil Alignment[b]	0.5 degrees
Undeflected Spot Position, Each Gun[c]	5% of target diameter

Direct Interelectrode Capacitances:

	Typ.	Max.	
Output-signal-electrode to all other electrodes[d]	17	20	pF
Reading-gun grid No.1 to all other electrodes	–	15	pF
Reading-gun cathode to all other electrodes	–	9	pF
Writing-gun grid No.1 to all other electrodes	–	15	pF
Writing-gun cathode to all other electrodes	–	9	pF

MECHANICAL

Tube Dimensions	See Dimensional Outline
Connections	See footnote e
Operating Position	Any
Maximum Weight	5.25 lbs

MAXIMUM AND MINIMUM RATINGS, *Absolute-Maximum Values*

Voltages are referred to ground unless otherwise specified.

	Min.	Max.	
Writing Gun:			
Heater voltage[g] (AC or DC)	5.7	6.9	V
Cathode voltage	-9000	–	V
Heater-cathode voltage	-125	10	V
Grid-No.1 (control grid) voltage[h]	-300	0	V
Grid-No.2 voltage[h]	–	750	V
Grid-No.3 (beam focus) voltage[h,j]	–	1500	V
Grid-No.4 (anode) voltage	Ground		
Reading Gun:			
Heater voltage[k] (AC or DC)	5.7	6.9	V
Cathode voltage	-1500	–	V
Heater-cathode voltage	-125	10	V
Grid-No.1 (control grid) voltage[m]	-300	0	V
Grid-No.2 voltage[m]	–	750	V
Grid-No.4 (beam focus) voltage[j,m]	–	750	V
Grids No.3 & No.5 (anode) voltage	-30	30	V
External conductive coating	Ground		
Target Section:			
Output signal electrode voltage	-10	10	V
Shading electrode voltage	-30	30	V
Backplate voltage	-20	50	V

TYPICAL OPERATING CONDITIONS

Voltages are referred to ground unless otherwise specified.

Writing Gun:		
Heater voltage[g] (AC or DC)	6.3	V
Cathode voltage	-8000	V
Grid-No.1 (control grid) voltage for beam cutoff[h]	-120 to -70	V
Grid-No.2 voltage[h]	300	V
Grid-No.3 (beam focus) voltage[h,j]	600 to 1400	V
Grid-No.4 (anode) voltage	Ground	
Reading Gun:		
Heater voltage[k] (AC or DC)	6.3	V
Cathode voltage	-1200	V

TYPICAL OUTPUT CONDITIONS

Reading Gun:

Grid-No.1 (control grid) voltage for beam cutoff[m]	-120 to -70	V
Grid-No.2 voltage[m]	300	V
Grid-No.4 (beam focus) voltage[j,m]	200 to 440	V
Grids No.3 & No.5 (anode) voltage[n]	-20 to 0	V
External conductive coating	Ground	

Target Section:

Output-signal-electrode voltage	0	V
Shading electrode voltage[n]	0 to 20	V
Backplate voltage[n]	-15 to 0	V

PERFORMANCE CHARACTERISTICS

The Performance Characteristics shown below are obtained in one mode of tube operation which is representative of many applications. Trade-offs in these characteristics may be made to achieve optimum tube performance in other operating modes.

	Min.	Max.	
Output Signal Current[p]	0.5	–	μA
Storage Time[q]		See footnote r	
Signal-to-Shading Ratio[s]	5:1	–	
Signal-to-Background-Shading Ratio[t]	8:1	–	
Center Resolution, At 50% amplitude response	1600	–	TV lines/ target diameter
Edge Resolution, At 50% amplitude response		See footnote v	
Writing Speed	200	–	μs/ target diameter
Shades of Gray[w]	7	–	
Blemishes[x]		See footnote y	

ENVIRONMENTAL CONDITIONS

The 4598 will provide the performance specified under **Performance Characteristics** when the tube is exposed to the following environmental conditions:

	Requirement
Temperature-Altitude[z]	MIL-E-5400L, Par. 3.2.24.3, Table I Class 1A
Humidity	MIL-E-5400L, Par. 3.2.24.4
Shock	MIL-E-5400L, Par. 3.2.24.6
Vibration	See accompanying *Vibration Levels*

a The deflection coils are electrically similar to type Y65 manufactured by Syntronic Instruments Inc., Addison, Illinois. A variety of inductances are available, which are suitable for either push-pull or single-ended circuit configurations.

b The orthogonality of the horizontal and vertical axes of each deflection coil is within 1/2 degree of 90 degrees. The horizontal axis of the writing deflection coil is parallel within 1/2 degree to the horizontal axis of the reading deflection coil.

c The undeflected spots of both guns fall within a circle having a diameter that is 5 per cent of the target diameter, and is centered on the target.

d The value shown is the capacitance of the assembly supplied with a solderable terminal as the output signal electrode connection; if a coaxial connector or cable is supplied, their capacitance must be added to this value.

e Connection to the output signal electrode can be provided by means of a solderable terminal, coaxial connector, or coaxial cable. Connections to the deflection coils and low voltage electrodes are by flexible leads. Connections to the high voltage electrodes are made by silicone rubber leads; connectors such as type 840706 lead assemblies manufactured by AMP Inc., Capitron Division, Elizabethtown, PA, can also be supplied.

g One side to be externally connected to writing-gun cathode.

h With respect to writing-gun cathode.

j Adjust for best focus.

k One side to be externally connected to reading-gun cathode.

m With respect to reading-gun cathode.

n Adjust for optimum signal and storage performance.

p This value is the saturated output signal current.

q Storage time is proportional to the area scanned by the reading-gun raster. The limits are given for a raster of aspect ratio 1:1, and inscribed within the target area.

r The specified performance characteristics are obtained over a range of storage times from 1.0 second maximum to 3.0 seconds minimum. The specified performance characteristics except shades of gray are obtained over a range of storage times from 0.5 second maximum to 4.0 seconds minimum. Storage time is measured to 10 per cent of signal amplitude.

s This limit applies to the central 75 per cent of the target. The measurement is taken along that single line of the output video signal which has the lowest signal-to-shading ratio.

t This limit applies to the central 75 per cent of the target. The measurement is taken along that single line of the output video signal which has the lowest signal-to-background-shading ratio.

u Resolution is measured using a raster written perpendicular to the horizontal scanning lines of the reading-gun raster, and with the writing-gun drive voltage adjusted to give a peak output signal 85 per cent of saturated signal amplitude.

v A minimum resolution of 1200 TV lines per target diameter is obtained over 75 per cent of the target diameter. A minimum resolution of 1400 TV lines per target diameter is obtained over 75 per cent of the target diameter using dynamic focusing of the reading gun.

w A step voltage waveform with seven equally spaced levels is used as input.

x Blemishes are measured within a circular area centered on the target and with a diameter of 90 per cent of the target diameter. Blemish size is specified as a percentage of the target diameter;

blemish amplitude, as a percentage of saturated signal amplitube. Blemishes with an amplitude of less than 10 per cent are not counted. Dark blemishes with a size of less than 1/8 per cent are not counted.

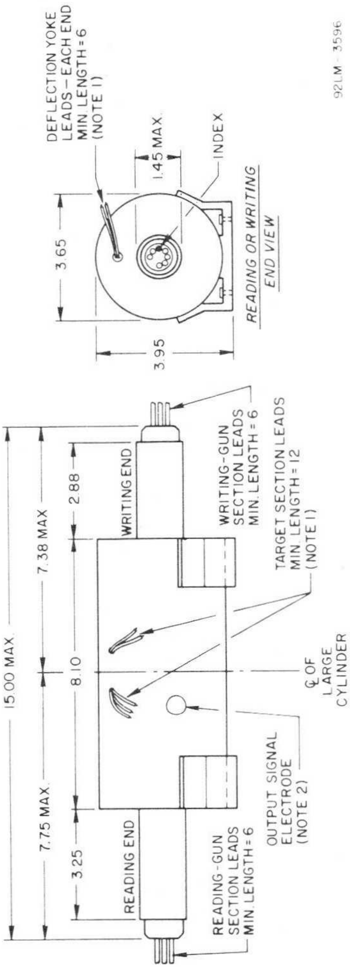
y The maximum size of any light blemish is 1/2 per cent. The amplitude and number of light blemishes are limited as shown in the following table:

Amplitude	Maximum Number
10% to 50%	10
20% to 50%	3
Greater than 50%	0

The maximum size of any dark blemish is 1/2 per cent. The maximum number of dark blemishes is five.

z The backplate voltage of the tube may be changed in a predetermined manner to compensate for the variation in storage time as a function of temperature.

DIMENSIONAL OUTLINE



Dimensions in Inches

DIMENSIONAL OUTLINE (cont'd)

Note 1 – All leads are labeled.

Note 2 – Connection to the output signal electrode can be provided by means of a solderable terminal, coaxial connector, or coaxial cable.

TARGET-SECTION LEADS

Lead 1: Writing-Gun Grid No.4
Lead 2: Backplate
Lead 3: Shading Electrode
Lead 4: Reading Gun Grids No. 3 & 5
Lead 5: Reading-Gun External Conductive Coating

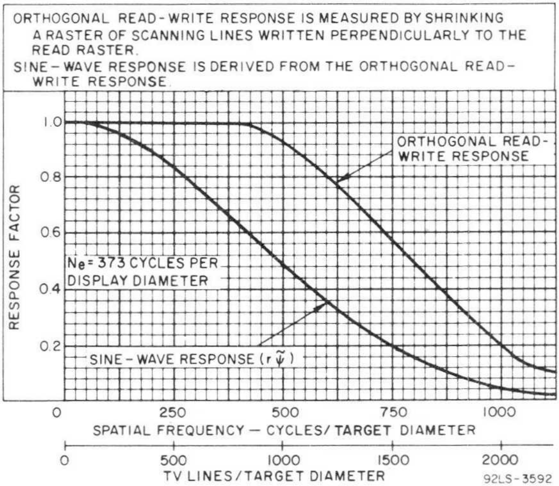
WRITING-GUN SECTION LEADS

Lead 1: Heater
Lead 2: Grid No.1
Lead 3: Grid No.3
Lead 4: Grid No.2
Lead 5: Cathode
Lead 6: Heater

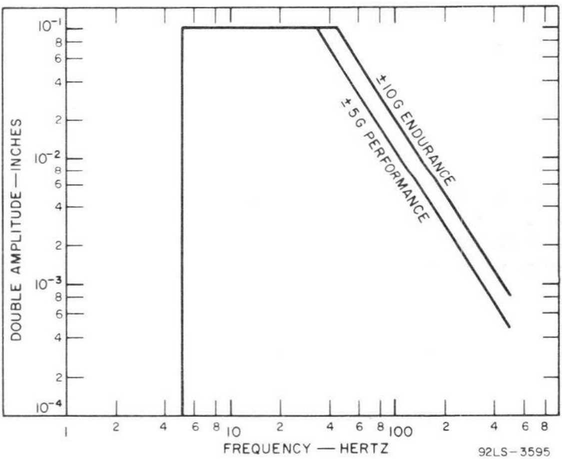
READING-GUN SECTION LEADS

Lead 1: Heater
Lead 2: Grid No.1
Lead 3: Grid No.4
Lead 4: Grid No.2
Lead 5: Cathode
Lead 6: Heater

FREQUENCY RESPONSE CHARACTERISTICS



VIBRATION LEVELS



Projection Kinescope

5"-Diameter Electrostatic-Focus, Magnetic-Deflection Type

- For Monochrome Television Projectors
- Designed for Use with Schmidt Reflective Optics
- High Picture Luminance – 3000 fL at 300 μA
- High Resolution – 600 TV Lines at 300 μA
- Forced-Air Cooled
- Rare Earth (White) Phosphor
- Fine Screen Texture
- Color Temperature – 7800° K + 70 MPCD

General Data

Electrical:

Heater Current at 6.3 Volts	0.6 A
Focusing Method	Electrostatic
Deflection Method[a]	Magnetic
Deflection Angle (Approx.)	50°
Direct Interelectrode Capacitances (Approx.):	
Grid No.1 to all other electrodes	8 pF
Cathode to all other electrodes	5 pF

Optical:

Faceplate, Spherical	Clear, Browning-Resistant Glass
Radius of curvature (inner radius)	7.10 ± 0.20 in
Minimum Useful Screen Diameter	4.50 in
Minimum Optical-Quality-Circle Diameter	4.25 in
Refractive Index of Faceplate	1.519
Phosphor, Aluminized	P45 Rare Earth
C.I.E. coordinates (x,y)	0.290, 0.361
Luminescence	White
Color temperature	7800° K + 70 M.P.C.D.
Persistence	Medium

Mechanical:

Tube Dimensions:	
Overall length	12.19 + 0.37 −0.38 in
Greatest diameter of bulb (Excluding cable)	5.00 ± 0.12 in
Base	Small-Shell Duodecal 7-Pin, JEDEC No.B7-51

Anode Lead	Molded-on, Insulated Cable, 48 in long		
Bulb	J40H1		
Operating Position	Any		
Weight (Approx.)	1-1/2 lbs		

Maximum and Minimum Ratings, Absolute-Maximum Values[b]

Average Anode Power:			
Without forced-air cooling of faceplate	9	max.	W
With forced-air cooling of faceplate	12	max.	W
Air Flow to Face[c] when Average Anode Power Exceeds 9 Watts	40		cfm
Anode-to-Cathode Voltage	42	max.	kV
Grid-No.3-to-Cathode Voltage	9	max.	kV
Grid-No.2-to-Cathode Voltage	400	max.	V
Grid-No.1-to-Cathode Voltage:			
Negative bias value	150	max.	V
Positive bias value	0	max.	V
Peak positive value	2	max.	V
Anode Current, Long-Term Average (for 4" x 3" TV raster)	300	max.	μA
Peak Heater-Cathode Voltage:			
Heater negative with respect to cathode	175	max.	V
Heater positive with respect to cathode	10	max.	V
Heater Voltage (ac or dc)[d]	6.9	max.	V
	5.7	min.	V

Recommended Operating Values[e]

Raster Size	4" x 3"	
Anode Voltage	40	kV
Anode Current, Long-Term Average	300	μA
Grid-No.3 Voltage for Focus at an Anode Current of 300 μA	7.4 to 9	kV
Grid-No.2 and Grid-No.1 Voltages for Visual Extinction of Focused Spot	See **Figure 1**	
Heater Voltage	6.3	V

Typical Performance Data

At Recommended Operating Values:

Center Resolution[f]	600	TV Lines
Luminance at 300 μA	3000	fL
	10300	nits

Luminous Flux	250	lumens
Grid-No.3 Current (Total)[g]	±10	μA
Grid-No.2 Current	±15	μA

Circuit Requirements

High-Voltage Circuits:

In order to minimize the possibility of damage to the tubes and adjacent circuits caused by a momentary internal arc, it is recommended that the high-voltage power supply and the grid-No.3 power supply be of the limited-energy type. An external spark gap must be provided at the grid-No.3 terminal. The following resistor and voltage values are mandatory.

Anode-Circuit Resistance (unbypassed)	0.5 min.	MΩ
Grid-No.3 Circuit Resistance (unbypassed)	0.1	MΩ
Grid-No.3 Spark-Gap Firing Voltage	12	kV

Low-Voltage Circuits:

Grid-No.2 Circuit Resistance (bypassed)	10	kΩ
Grid-No.1 Circuit Resistance (unbypassed)	1	kΩ
Effective Grid-No.1-to-Cathode Circuit Resistance	1.5 max.	MΩ

---

a Sharp corners on the yoke assembly in the vicinity of the tube neck should be avoided. Insulation between the yoke winding and/or the core and the tube neck should be capable of withstanding at least 10 kV and preferably 15 kV.

b A description of the Absolute Maximum Ratings is given in the General Section, titled Rating System for Electron Tubes.

c The specified air flow should be delivered perpendicularly from a nozzle having a diameter of about 2 inches onto the face of the tube while it is in operation. In a typical system with air filter, the total system static pressure is approximately 0.25 inch of water. The cooling air must not contain water, dust, or other foreign matter. The air-cooling system should be electrically interconnected with the anode power supply to prevent operation of the tube without cooling.
Cooling of the tube by a tangential flow of air across its face is not recommended because the temperature gradient produced across the face may result in immediate or delayed cracking of the face.

d For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.

e This tube may be operated at reduced anode voltage and/or anode current. At reduced anode voltage, center resolution will decrease. At reduced anode voltage and/or anode current, luminance will decrease. The grid-No.3 voltage for focus will be reduced in proportion to the reduction in anode voltage. Other performance characteristics may also be affected.

f Determined for a 3-inch high TV resolution test pattern with tube operating at a screen current of 300 microamperes.

g Grid-No.3 current is normally low, as indicated in the data, when the tube is operated under recommended conditions. Lower grid-No.3 voltage (as required for focus if anode voltage is reduced) and/or higher grid-No.2 voltages can lead to a grid-No.3 current level approaching that measured in the anode circuit. Note that the fraction of available current intercepted by the grid-No.3 electrode is not constant, but increases with increasing anode current.

Safety Precautions

X-Radiation Warning

Although X-radiation is generated primarily at the face of the tube when it is operated, the X-rays are emitted in all directions.

These rays can constitute a health hazard unless the tube is adequately shielded. Make sure that the shielding provides the required protection against personal injury.

On the neck of the tube itself the following warning appears and should be strictly adhered to:

> X-RAY WARNING
> **This tube in operation produces X-Rays which can constitute a health hazard unless the tube is adequately shielded for radiation.**
>
> **In normal operation, this tube produces more x-radiation than the Tube Type 5AZP4 which it may replace. Make sure that shielding is adequate.**

High Voltage

The high voltages at which this type is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.

In the use of this tube it should always be remembered that high voltages may appear at normally low-potential points in the circuit because of capacitor breakdown or incorrect circuit connections, and that the tube surface maintains a static charge for some time after the power has been turned off. Therefore, before any part of the circuit or the tube is touched, the power-supply switch should be turned off, both terminals of high-voltage capacitors should be grounded, and the terminals of the high-voltage power supply should be grounded.

After these steps have been taken and before touching the tube, discharge the anode terminal, the surface of the faceplate, and the coated surface of the cone by use of a suitable wand which is connected to ground. It is to be noted that the entire surface of the cone and of the faceplate will not be discharged by touching the wand to a single point on either surface, because the surfaces have high resistance. Therefore, to discharge each surface, it will be necessary to sweep over the entire surface with the wand.

Tube Handling

Wear "Safety" Goggles with side shields, when handling tube to prevent possible injury from flying glass in case of tube breakage. Do not strike or scratch tube. Never subject it to more than moderate pressure when installing in or removing from equipment. Always Handle Tube with Extreme Care. Ground anode contact before touching after power is off.

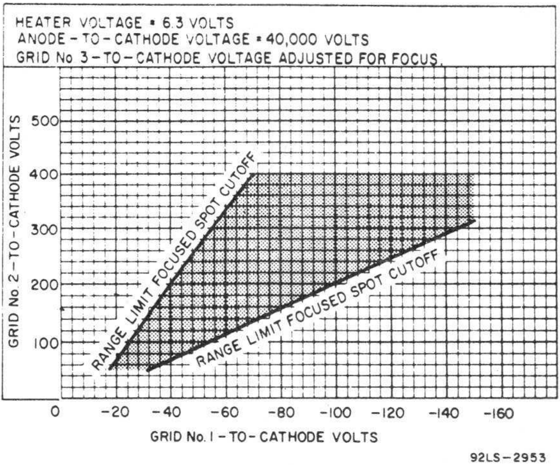
Operating Considerations

Humidity Considerations. When humidity is high, a continuous film of moisture may form on untreated glass. If a high-voltage gradient is present, this film may permit sparking to take place over the glass surface. In order to minimize the formation of a continuous moisture film, the glass cone is treated with a **transparent moisture-repellent insulating coating.** This coating must not be scratched, and must be kept clean and free from contamination such as fingerprints. The coating may be washed with a solution of a mild soapless detergent and water. After the surface is washed, it should be rinsed with clean water and be dried immediately. Any damage to the coating or any contamination on the surface may result in sparking over the cone of the bulb.

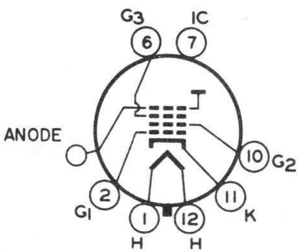
Dust Considerations. The high voltage applied to the tube increases the rate at which dust is precipitated on the surface of the tube. The rate of precipitation is further accelerated in the presence of corona. Such dust not only decreases the insulation of the bulb coating but also reduces the amount of radiation transmitted through the bulb face. The dust usually consists of fibrous materials and may contain soluble salts. The fibers absorb and retain moisture; the soluble salts provide electrical leakage paths that increase in conductivity as the humidity increases. Because a film of dust can nullify the protection provided by the insulating coating on the bulb, the tube should be protected as much as possible from dust and should be cleaned, when necessary, as described under **Humidity Considerations**.

Corona Considerations. A high-voltage system may be subject to corona, especially when the humidity is high, unless suitable precautions are taken. Corona, which is an electrical discharge appearing on the surface of a conductor when the voltage gradient exceeds the breakdown value of air, causes deterioration of organic insulating materials, induces arc-over at points and sharp edges, and forms ozone, a gas which is deleterious to many insulating materials. Sharp points or other irregularities on any part of the high-voltage system may increase the possibility of corona and should be avoided. Instead, rounded contours and surfaces should be used.

Cutoff Design Chart



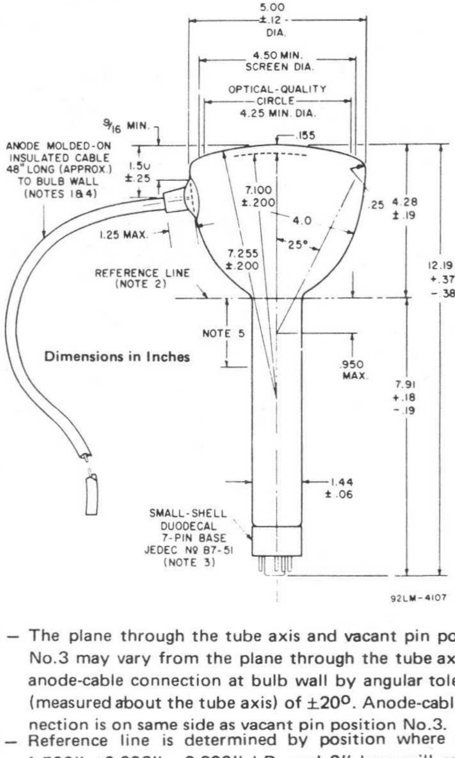
Basing Diagram, Bottom View



Pin 1: Heater
Pin 2: Grid No.1
Pin 6: Grid No.3
Pin 7: Internal Connection — Do not use
Pin 10: Grid No.2
Pin 11: Cathode
Pin 12: Heater
Flexible Cable: Anode

Note: Socket contacts for vacant pin positions No.3, 4, 5, 8, and 9 should be removed so that maximum insulation is provided for pins No.6 and 7.

Dimensional Outline



Note 1 – The plane through the tube axis and vacant pin position No.3 may vary from the plane through the tube axis and anode-cable connection at bulb wall by angular tolerance (measured about the tube axis) of ±20°. Anode-cable connection is on same side as vacant pin position No.3.

Note 2 – Reference line is determined by position where gauge 1.500" +0.003" –0.000" I.D. and 2" long will rest on bulb cone.

Note 3 – Socket for this base should not be rigidly mounted; it should have flexible leads and be allowed to move freely. Socket contacts corresponding to vacant pin positions No.3, 4, 5, 8 and 9 should be removed in order to provide maximum insulation for pins No.6 and 7.

Note 4 – Anode cable should not be sharply bent within 3" of bulb wall.

Note 5 – To avoid excessive interaction between the deflecting and focusing fields, the windings of the deflecting yoke should not extend more than 2 inches from the reference line toward the base.

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CHARGE STORAGE TUBE

SINGLE-BEAM, BARRIER-GRID TYPE

NON-EQUILIBRIUM WRITING CAPACITANCE-DISCHARGE READING

DATA

General:

Heater, for Unipotential Cathode:		
Voltage	6.3	ac or dc volts
Current	0.6	amp
Direct Interelectrode Capacitances (Approx.):		
Grid No.1 to all other electrodes	9	$\mu\mu$f
Deflecting electrode DJ_1 to all other electrodes	13	$\mu\mu$f
Deflecting electrode DJ_2 to all other electrodes	13	$\mu\mu$f
Deflecting electrode DJ_3 to all other electrodes	11.5	$\mu\mu$f
Deflecting electrode DJ_4 to all other electrodes	11.5	$\mu\mu$f
DJ_1 to DJ_2	3	$\mu\mu$f
DJ_3 to DJ_4	3	$\mu\mu$f
Grid No.5 to backing-electrode	800	$\mu\mu$f
Grid No.5 and backing-electrode to collector	4	$\mu\mu$f
Collector to all other electrodes & external cylindrical shield		*See Curve*

Focusing Method . . . . Electrostatic

Deflection Method . . . . Electrostatic

Overall Length . . . . 11-27/32" ± 3/8"

Greatest Diameter of Tube . . . . 3.30" ± 0.05"

Minimum Useful Storage-Surface Diameter . . . . 2-1/4"

Mounting Position . . . . . . Any except those positions where the diheptal base is up and the tube axis is at an angle of less than 60° from the vertical.

Weight (Approx.) . . . . 1 lb

Base:

On large end of tube . . . . Small-Button Twentyninar 8-Pin (JETEC No.E8-19)

VIEW OF TWENTYNINAR-BASE END OF TUBE

Pin 2, Pin 6, Pin 10, Pin 14, Pin 18 — Multiple Connections to Backing-Electrode. Only One Need be Used

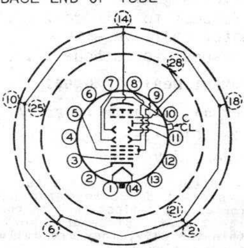
Pin 21 - No Connection

Pin 25 - No Connection

Pin 28 - Grid No.5

PINS 2,6,10,14,18: ON 1-7/8" DIA. PIN CIRCLE

PINS 21,25,28: ON 7/8" DIA. PIN CIRCLE



SOLID-LINE CIRCLES DEPICT DIHEPTAL BASE; BROKEN-LINE CIRCLES DEPICT TWENTYNINAR BASE

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On small end of tube. . . . . . Small-Shell Diheptal 14-Pin (JETEC No.B14-45)

VIEW OF DIHEPTAL-BASE END OF TUBE

Pin 1 - Heater
Pin 2 - Cathode
Pin 3 - Grid No.1
Pin 4 - Internal Connection-Do Not Use
Pin 5 - Grid No.3
Pin 6 - No Connection
Pin 7 - Deflecting Electrode DJ_4
Pin 8 - Deflecting Electrode DJ_3
Pin 9 - Ultor (Grids No.2 & No.4)
Pin 10 - Deflecting Electrode DJ_2
Pin 11 - Deflecting Electrode DJ_1
Pin 12 - No Connection
Pin 13 - Same as Pin 4
Pin 14 - Heater
C,CL - External Conductive Coating, Collector, Internal Shield, Flange between Neck and Large Part of Tube

All voltages are with respect to cathode unless otherwise specified

Maximum Ratings, *Absolute Values:*

BACKING-ELECTRODE-TO-GRID-No.5 (BARRIER-GRID) VOLTAGE:		
Backing-electrode positive with respect to grid No.5	100 max.	volts
Backing-electrode negative with respect to grid No.5	100 max.	volts
COLLECTOR-TO-GRID-No.5 VOLTAGE:		
Positive value	100 max.	volts
Negative value	0 max.	volts
ULTOR• VOLTAGE	1500 max.	volts
GRID-No.3 VOLTAGE.	500 max.	volts
GRID-No.1 VOLTAGE:		
Negative bias value.	200 max.	volts
Positive bias value.	0 max.	volts
Positive peak value.	2 max.	volts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	125 max.	volts
Heater positive with respect to cathode	10 max.	volts

Equipment Design Ranges:

*For any ultor voltage (E_{c_4}) between 1000 and 1500 volts**

Backing-Electrode-to-Grid-No.5 Voltage. . . . See Note 1

• The "ultor" in a storage tube is the electrode to which is applied the highest dc voltage for accelerating the electrons in the beam prior to its deflection. In the 6499, the ultor function is performed by grid No.4. Since grid No.4 and grid No.2 are connected together within the 6499, they are collectively referred to simply as "ultor" for presenting data.

*: See next page.

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Collector-to-Grid-No.5 Voltage.	0 to 50	volts
Grid-No.3 Voltage for Focus with grid-No.1 volts = 0	14% to 26% of E_{C_4}	volts
Grid-No.1 Voltage for collector-current cutoff	-2.5% to -4.7% of E_{C_4}	volts
Collector Current for grid-No.1 volts = 0. . .	20 to 50	μamp
Max. Cathode Current for grid-No.1 volts = 0.	*See Curve*	
Deflection Factors:		
DJ_1 and DJ_2.	85 to 105 v dc/in./kv of E_{C_4}	
DJ_3 and DJ_4.	78 to 96 v dc/in./kv of E_{C_4}	
Spot Position.	See Note 2	
Signal-Uniformity Ratio. .	See Note 3	

Examples of Use Design Ranges:

For ultor voltage of	*1000*	*volts*
Grid-No.3 Voltage for Focus with grid-No.1 volts = 0	140 to 260	volts
Grid-No.1 Voltage for collector-current cutoff	-25 to -47	volts
Deflection Factors:		
DJ_1 and DJ_2.	85 to 105	v dc/in.
DJ_3 and DJ_4.	78 to 96	v dc/in.

Maximum Circuit Values:

Grid-No.1-Circuit Resistance	1.5 max.	megohms
Resistance in Any Deflecting-Electrode Circuit#	1.0 max.	megohm

* In general, the recommended minimum ultor voltage should not be less than 1000 volts. Signal output and resolution decrease with decreasing ultor voltage. Secondary emission characteristics of the dielectric layer limit the maximum ultor voltage to 1500 volts.

\# It is recommended that all deflecting-electrode-circuit resistances be approximately equal.

Note 1: The backing-electrode, grid No.5, and ultor are usually operated at the same dc potential. During the writing cycle, the backing-electrode may be pulsed to ±60 volts with respect to grid No.5.

Note 2: The undeflected focused spot will fall within a circle having a diameter equal to 10% of the minimum storage-surface diameter and having its center coincident with the center of the storage surface.

Spot position is calculated as follows: With heater voltage of 6.3 volts, ultor voltage of 1000 volts, grid-No.5 voltage of 1000 volts, collector voltage of 1050 volts, grid-No.3 voltage adjusted to give focus, grid-No.1 voltage adjusted for 15 microamperes peak collector current, each deflecting electrode connected through a 1-megohm resistor to ultor, and the tube shielded from all extraneous fields, the voltages

Note 3: See next page.

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required to displace the beam from its undeflected position to the edge of the storage surface in the direction of each deflecting electrode are recorded as *a* for DJ_1, *b* for DJ_2, *c* for DJ_3, and *d* for DJ_4.

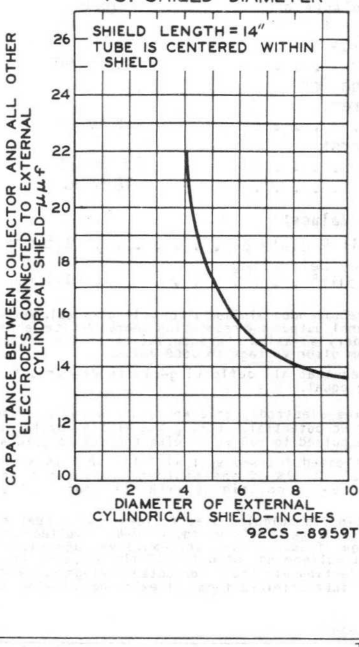
$$\text{Spot Position in \% of Storage-Surface Diameter} = 1/2\sqrt{\left(\frac{b-a}{b+a}\right)^2 + \left(\frac{d-c}{d+c}\right)^2} \times 100$$

Note 3: With voltages as specified in Note 2, and with a signal written into storage by applying a series of well-formed symmetrical square waves to grid No.1 such that a series of 25 equally spaced stored elements are written across a single line scan, the ratio of the maximum to minimum signal amplitude observed as the single line scan is moved across the storage surface will not exceed 1.35.

OPERATING CONSIDERATIONS

Shielding. The use of a magnetic shield of high-permeability material surrounding the tube is recommended. This shield prevents the effect of stray fields in causing unwanted deflection of the electron beam.

INDICATED CAPACITANCE VS. SHIELD DIAMETER



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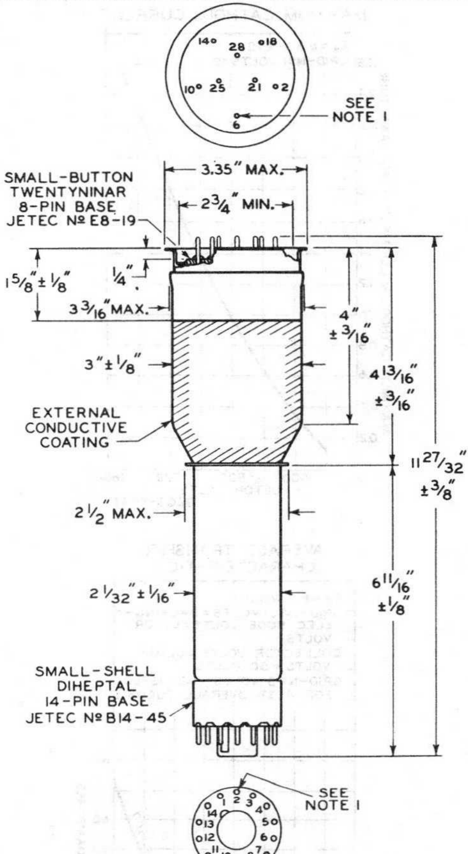
RADECHON



92CM-8891

NOTE 1: THE ANGLE BETWEEN PLANE THROUGH PIN 6 OF TWENTYNINAR BASE AND TUBE AXIS, AND PLANE THROUGH PIN 2 OF DIHEPTAL BASE AND TUBE AXIS WILL NOT EXCEED 10°. THE INDICATED PINS ARE BOTH ON THE SAME SIDE OF THE TUBE.

NOTE 2: DEFLECTING ELECTRODES DJ_1 & DJ_2 ARE NEARER THE TARGET. DEFLECTING ELECTRODES DJ_3 & DJ_4 ARE NEARER THE DIHEPTAL BASE.

NOTE 3: ANGLE BETWEEN DJ_1 & DJ_2 DEFLECTION PATH AND DJ_3 & DJ_4 DEFLECTION PATH IS 90° ± 3°.

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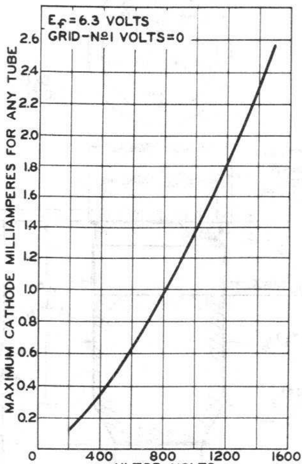
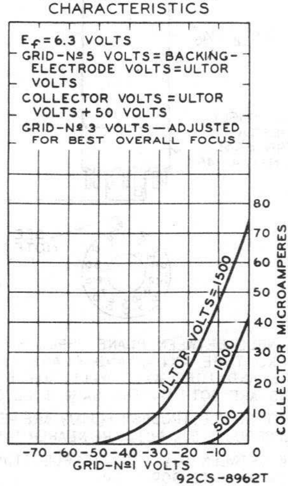
MAXIMUM CATHODE CURRENT



92CS-8949T

AVERAGE TRANSFER CHARACTERISTICS



92CS-8962T

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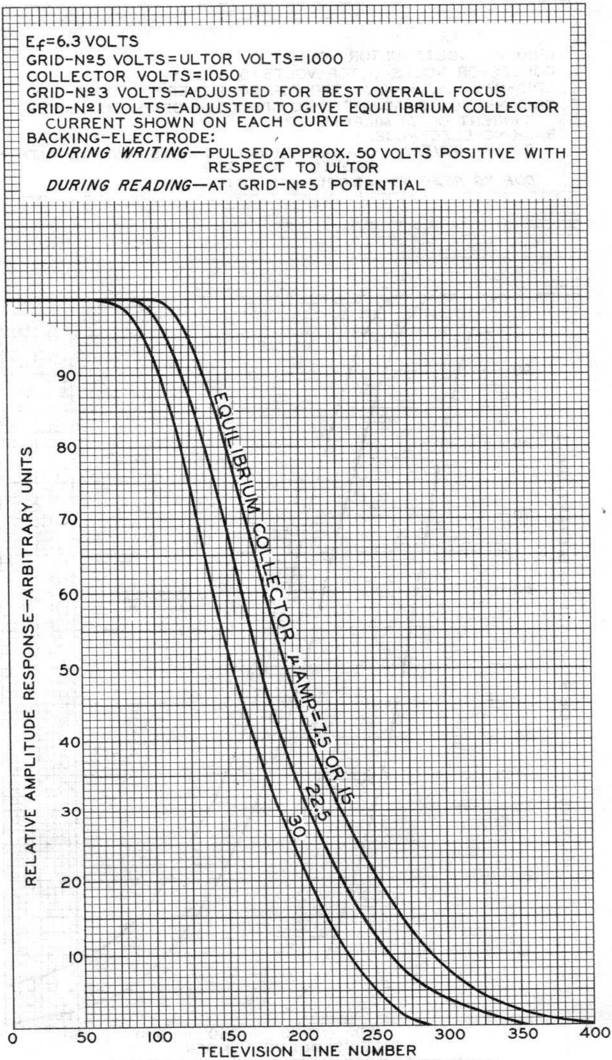
RESOLUTION CHARACTERISTICS



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92CM-8948

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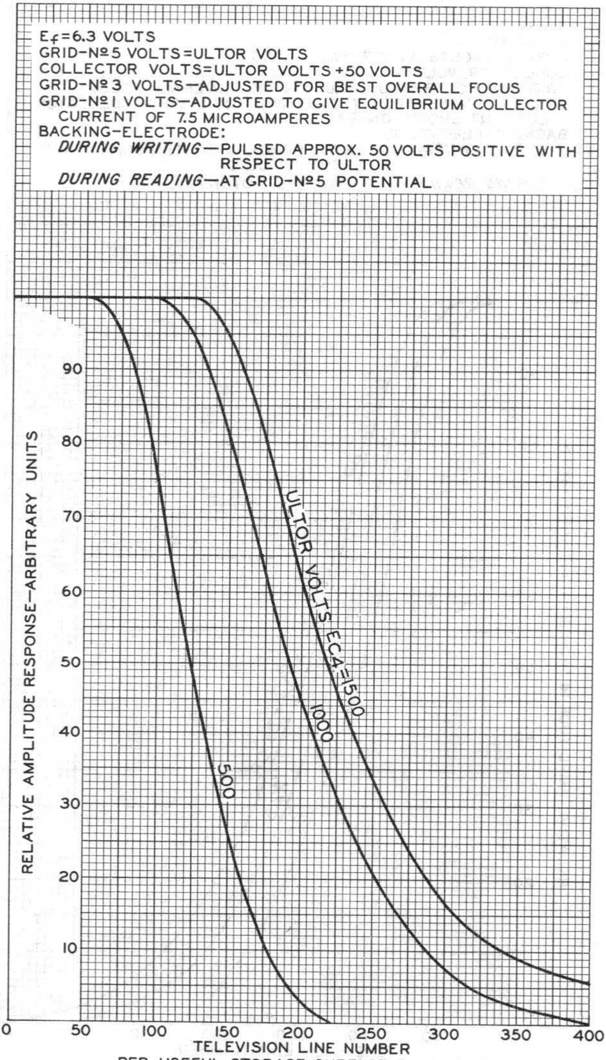
RESOLUTION CHARACTERISTICS



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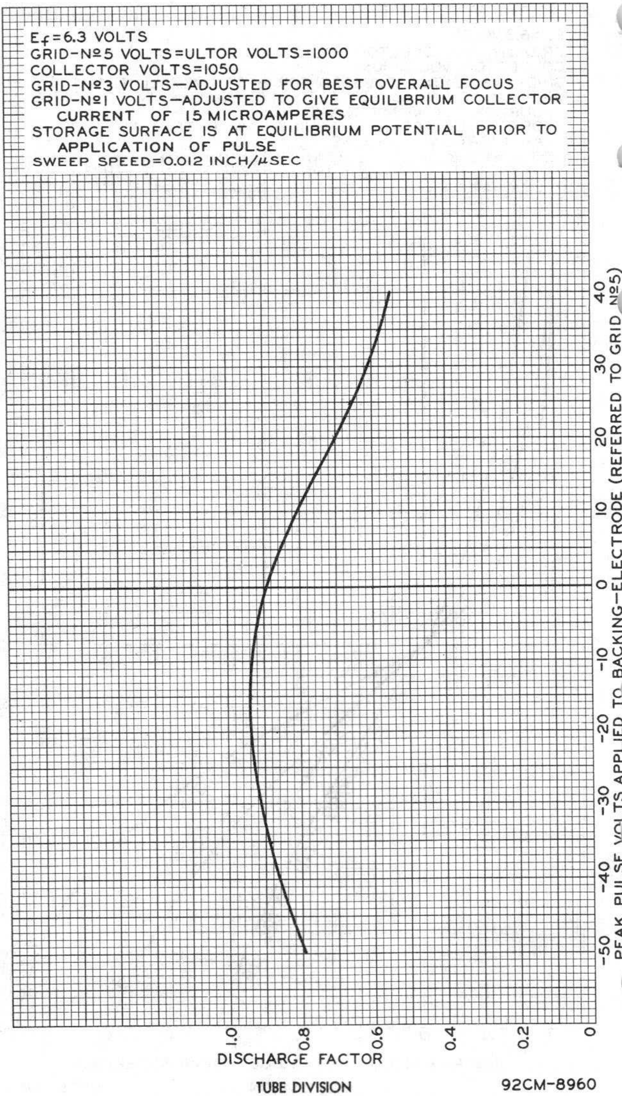
APPROXIMATE DISCHARGE-FACTOR CHARACTERISTIC



92CM-8960

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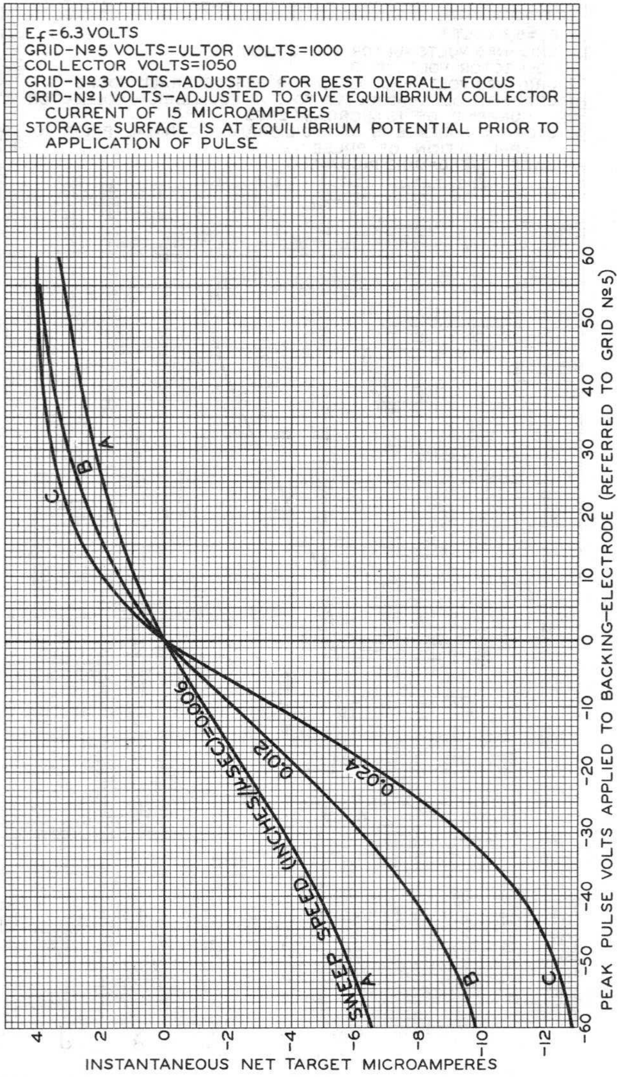
TYPICAL TARGET CHARACTERISTICS



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DISPLAY STORAGE TUBE

DIRECT-VIEW TYPE
4"-DIAMETER DISPLAY
NON-EQUILIBRIUM WRITING GRID-CONTROL READING (VIEWING)

DATA

General:

	Writing Section	Viewing Section	
Heater, for Unipotential Cathode:			
Voltage (AC or DC)	6.3	6.3	volts
Current	0.6	0.6	amp
Minimum Cathode Heating Time before other electrode voltages are applied	-	30	sec
Direct Interelectrode Capacitances (Approx.):°			
Grid No. 1 to all other tube electrodes	6	18	μμf
Cathode to all other tube electrodes	4.2	6.5	μμf
Deflecting electrode DJ_1 to deflecting electrode DJ_2	1.8	-	μμf
Deflecting electrode DJ_3 to deflecting electrode DJ_4	1.8	-	μμf
DJ_1 to all other tube electrodes	7.5	-	μμf
DJ_2 to all other tube electrodes	8	-	μμf
DJ_3 to all other tube electrodes	6	-	μμf
DJ_4 to all other tube electrodes	7.	-	μμf
Focusing Method	Electrostatic	None	
Deflection Method	Electrostatic	None	
Deflecting-Electrode Arrangement	*See Dimensional Outline*	-	
Phosphor	-	High-Visual-Efficiency Type, Aluminized	
Fluorescence	-	Yellow	
Phosphorescence	-	Yellow	

Minimum Useful Screen Diameter . . . . . 4"
Maximum Overall Length . . . . . 15-1/2"
Seated Length . . . . . 14" ± 3/8"
Maximum Tube Radius . . . . . 3-5/32"
Bulb-Flange Diameter . . . . . 5-1/8" ± 1/16"
Greatest Bulb Diameter . . . . . 5" ± 1/16"
Bulb Terminals:
Caps (Two) . . . . . Recessed Small Cavity (JETEC No. J1-21)
Flange . . . . . *See Dimensional Outline*
Flexible cable . . . . . *See Dimensional Outline*
Ambient-Temperature Range . . . . . -65° to +100 °C
Mounting Position . . . . . Any
Weight (Approx.) . . . . . 2 lbs
Socket . . . . . Alden Part No. 435SBA, or equivalent
Base . . . . . Small-Button Thirtyfivar 31-Pin (JETEC No. E31-36)

° Without external shield.

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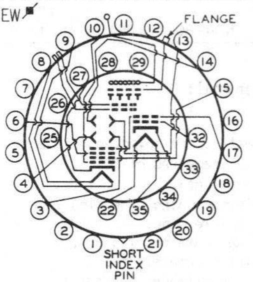
DISPLAY STORAGE TUBE

BOTTOM VIEW*



Pin 1 - No Connection
Pin 2 - Same as Pin 1
Pin 3 - Deflecting Electrode DJ_4 of Writing Gun
Pin 4 - Deflecting Electrode DJ_3 of Writing Gun
Pin 5 - Same as Pin 1
Pin 6 - Grid No.3 of Writing Gun
Pin 7 - Same as Pin 1
Pin 8 - Heater of Writing Gun
Pin 9 - Heater of Writing Gun
Pin 10 - Grid No.1 of Writing Gun
Pin 11 - Same as Pin 1
Pin 12 - Same as Pin 1
Pin 13 - Deflecting Electrode DJ_1 of Writing Gun
Pin 14 - Deflecting Electrode DJ_2 of Writing Gun
Pin 15 - Grid No.2 of Writing Gun
Pin 16 - Internal Connection—Do Not Use
Pin 17 - Grid No.4 of Writing Gun, Grid No.2 of Viewing Gun
Pin 18 - Same as Pin 1
Pin 19 - Same as Pin 1
Pin 20 - Same as Pin 16
Pin 21 - Same as Pin 1
Pin 22 - Heater of Viewing Gun
Pin 25 - Same as Pin 1
Pin 26 - Same as Pin 1
Pin 27 - Cathode of Writing Gun
Pin 28 - Same as Pin 1
Pin 29 - Same as Pin 1
Pin 32 - Grid No.1 of Viewing Gun
Pin 33 - Cathode of Viewing Gun
Pin 34 - Same as Pin 1
Pin 35 - Heater of Viewing Gun
Flexible Cable - Connection to Screen
Flange - Backing-Electrode
Recessed Cavity Cap -
Nearer Tube Face--Grid No.4 of Viewing Gun
Nearer Electron Guns--Grid No.3 of Viewing Gun

Maximum Ratings, ***Absolute Values:***

	Writing Section	Viewing Section**	
SCREEN VOLTAGE	-	11000 max.	volts
PEAK BACKING-ELECTRODE VOLTAGE.	-	20 max	volts

* Pins 23 and 31 are not shown because they are trimmed to the same dimension as the short index pin and are not to be used.

**: See next page.

TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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DISPLAY STORAGE TUBE

	Writing Section		Viewing Section**	
	Equivalent Values			
GRID-No.4 VOLTAGE	2900 max.*	150 max.**	300 max.	volts
GRID-No.3 VOLTAGE	1000 max.*	–	300 max.	volts
GRID-No.2 VOLTAGE	2750 max.*	–	150 max.	volts
CATHODE VOLTAGE	–	–2900 max.**	–	volts
GRID-No.1 VOLTAGE:				
Negative bias value . .	200 max.*		100 max.	volts
Positive bias value . .	0 max.*		0 max.	volts
Positive peak value . .	2 max.*		0 max.	volts
PEAK VOLTAGE BETWEEN GRID No.4 AND ANY DEFLECTING ELECTRODE. .	500 max.		–	volts
PEAK HEATER-CATHODE VOLTAGE:				
Heater negative with respect to cathode. .	125 max.*		125 max.	volts
Heater positive with respect to cathode. .	125 max.*		125 max.	volts

VIEWING SECTION**

Operating Values and Typical Performance Characteristics:

Screen Voltage	5000	10000	10000	volts
DC Backing-Electrode Voltage	5	5	5	volts
Grid-No.4 Voltage	150	210	150	volts
Grid-No.3 Voltage#.	25 to 125	50 to 150	25 to 125	volts
Grid-No.2 Voltage†#	50 to 75	70 to 105	50 to 75	volts
Grid-No.1 Voltage#.	0 to –50	0 to –75	0 to –50	volts
Maximum Screen Current. . .	350	600	350	µamp
Maximum Peak Backing-Electrode Current	1.5	2	1.5	ma
Maximum Grid-No.4 Current●.	2	3	2	ma
Maximum Grid-No.3 Current●.	1.5	2	1.5	ma
Maximum Cathode Current●. .	3	4	3	ma
Writing Speed††	300000	300000	300000	in./sec
Number of Half-Tone Steps□ .	5	5	5	
Viewing Duration▲	40	20	40	sec
Maximum Erasing-Uniformity Factor□□.	0.5	0.5	0.5	
Resolution⊕.	50	50	50	lines/in.
Brightness●●.	275	2750	1500	fl ←

** Voltages are shown with respect to cathode of Viewing Gun.

Adjusted for brightest, most uniform pattern.

† Grid No.2 of the Viewing Gun is connected internally to grid No.4 of the Writing Gun.

● For conditions with combined adjustment of grid-No.1 voltage, grid-No.2 voltage, and grid-No.3 voltage to give brightest, most uniform pattern.

*, ††, □, ▲, □□, ⊕, ●●: See next page.

← Indicates a change.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

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DISPLAY STORAGE TUBE

WRITING SECTION●

Range Values for Equipment Design:*

With any grid-No.2 voltage (Ec_2) between 500 and 2750 volts

Grid-No.4 Voltage (Ec_4)	95% to 105% of Ec_2	volts
Grid-No.3 Voltage for Focus	14% to 28% of Ec_2	volts
Maximum Grid-No.1 Voltage for Cutoff of Undeflected Focused Spot.	−4.6% of Ec_2	volts
Maximum Grid-No.3 Current	−15 to +10	μamp
Maximum Cathode Current	*See Curve*	
Deflection Factors:		
DJ_1 and DJ_2	28 to 38	v dc/in./kv of Ec_4
DJ_3 and DJ_4	28 to 38	v dc/in./kv of Ec_4
Focused Beam Position	##	

Examples of Use of Design Ranges:*

With grid-No.2 voltage of	*1500*	*2500*	*volts*
Grid-No.4 Voltage (Ec_4)	1425 to 1575	2375 to 2625	volts
Grid-No.3 Voltage for Focus . .	210 to 420	350 to 700	volts
Maximum Grid-No.1 Voltage for Cutoff of Undeflected Focused Spot.	−69	−115	volts
Deflection Factors when $Ec_4 = Ec_2$:			
DJ_1 and DJ_2	42 to 57	70 to 95	v dc/in.
DJ_3 and DJ_4	42 to 57	70 to 95	v dc/in.

Equivalent Values for Examples of Writing-Gun Voltages Referred to Cathode of Viewing Gun:

Cathode Voltage	−1450 to −1395	−2450 to −2395	volts
Grid-No.2 Voltage	−25 to +180	−75 to +230	volts
Grid-No.3 Voltage for Focus . .	−1240 to −975	−2100 to −1695	volts
Grid-No.4 Voltage	50 to 105	50 to 105	volts

VIEWING SECTION and WRITING SECTION

Circuit Values:

Grid-No.1-Circuit Resistance (Either gun)	1.0 max.	megohm
Resistance in Any Deflecting-Electrode Circuit■ . . .	0.1 max.	megohm
Backing-Electrode-Circuit Resistance.	0.005 max.	megohm
Series Current-Limiting Resistance in Screen Circuit.	1.0 min.	megohm

* Voltages are shown with respect to cathode of Writing Gun.

†† Measured under conditions of writing from just zero brightness (viewing-beam cutoff) to maximum brightness with grid No.1 of Writing Gun at −10 volts with respect to cathode of Writing Gun, and grids No.2 and No.4 of Writing Gun at +2500 volts with respect to cathode of Writing Gun.

□ Observed with an RCA-2F21 Monoscope display.

▲, □□, ⊕, ●●, ●, ##, ■: See next page.

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DISPLAY STORAGE TUBE

▲ Expressed in terms of the time required for the brightness of the unwritten background to rise from just zero brightness (viewing-beam cutoff) to 10% of the maximum brightness.

□□ Defined as $(t_2 - t_1)/t_2$, where

t_1 = time measured from start of erasing to instant at which any screen area is reduced to zero brightness.

t_2 = time measured from start of erasing to instant at which entire screen area is reduced to zero brightness.

Measured by shrinking-raster method at a display brightness of 50% of saturated brightness and with grids No.2 and No.4 of Writing Gun at +2500 volts with respect to cathode of Writing Gun. ←

Measured with entire storage grid written to produce maximum brightness and with screen at indicated voltage.

● The cathode of the Writing Gun is operated at about −2500 volts with respect to the cathode of the Viewing Gun which is usually operated at ground potential.

The center of the undeflected focused beam will fall within a circle having a 10-mm radius concentric with the center of the face under the following conditions: grids No.2 and No.4 of Writing Gun at +2500 volts with respect to cathode of Writing Gun, grid No.3 of Writing Gun at voltage to give focus, grid No.1 of Writing Gun at voltage which will permit storage of a charge just sufficient to give a barely perceptible spot on screen, Viewing Section operating under normal conditions, and tube shielded against extraneous fields.

■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

OPERATING CONSIDERATIONS

Magnetic shielding must be provided to prevent external fields from interfering with the required accurate control of the low-velocity viewing beam. A cylindrical shield of properly annealed high-permeability material about 1/16-inch thick is usually satisfactory. The screen cable should be placed outside the shield.

The *metal flange* at the face end of the tube requires the use of a spring-contact ring bearing against the edge of the flange.

To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing beam on until the writing beam is turned off.

← Indicates a change.

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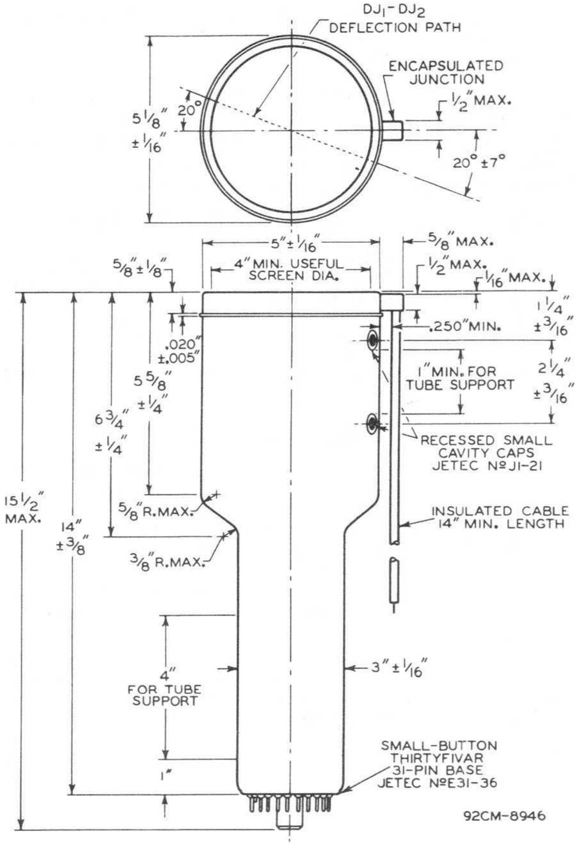
DISPLAY STORAGE TUBE



CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 3° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF FACEPLATE.

THE PLANE THROUGH TUBE AXIS AND EACH OF THE FOLLOWING ITEMS MAY VARY FROM THE DEFLECTION PATH PRODUCED BY DJ_1 AND DJ_2 BY THE FOLLOWING ANGULAR TOLERANCES (MEASURED ABOUT THE TUBE AXIS): PIN 27, ± 10°; EACH CAVITY CAP (ON SAME SIDE AS PIN 27), ± 17°; ENCAPSULATED JUNCTION, + 10°. ANGLE BETWEEN DJ_1 – DJ_2 DEFLECTION PATH AND DJ_3 – DJ_4 DEFLECTION PATH IS 90° ± 3°.

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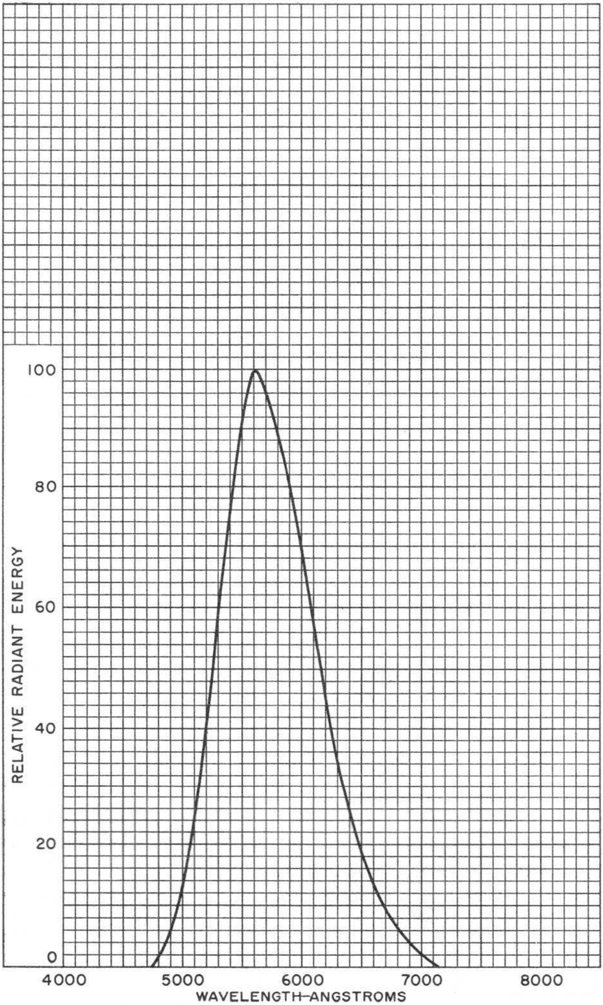
SPECTRAL-ENERGY EMISSION CHARACTERISTIC OF PHOSPHOR



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92CM-9042

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AVERAGE CHARACTERISTIC

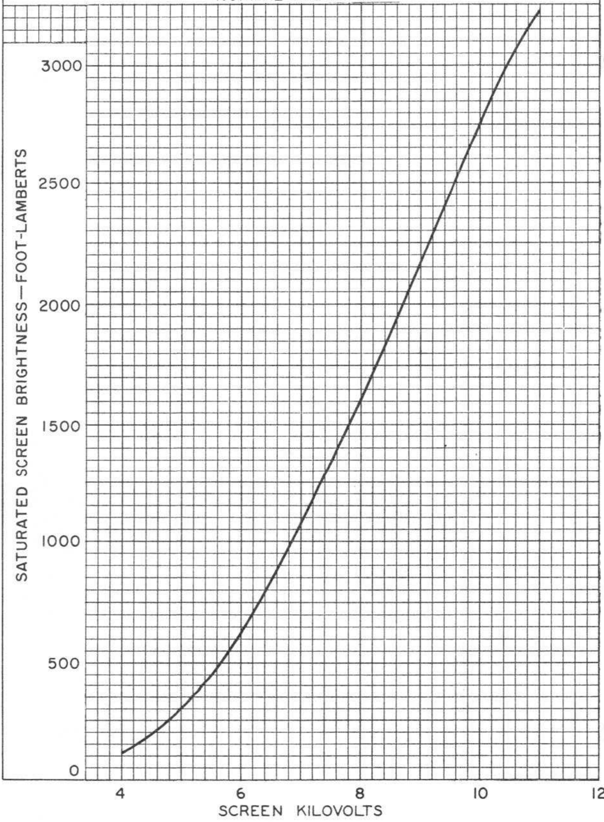
VIEWING SECTION

E_f = 6.3 VOLTS
BACKING-ELECTRODE VOLTS* = 5
GRID-No 4 VOLTS* = 210
GRID-No 2 VOLTS* = 85
GRID-No 3 VOLTS* } ADJUSTED FOR BRIGHTEST,
GRID-No 1 VOLTS* } MOST UNIFORM DISPLAY.

*REFERRED TO CATHODE OF VIEWING GUN.

WRITING SECTION

NORMAL OPERATION



ELECTRON TUBE DIVISION
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92CM-9043R1

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AVERAGE CHARACTERISTICS

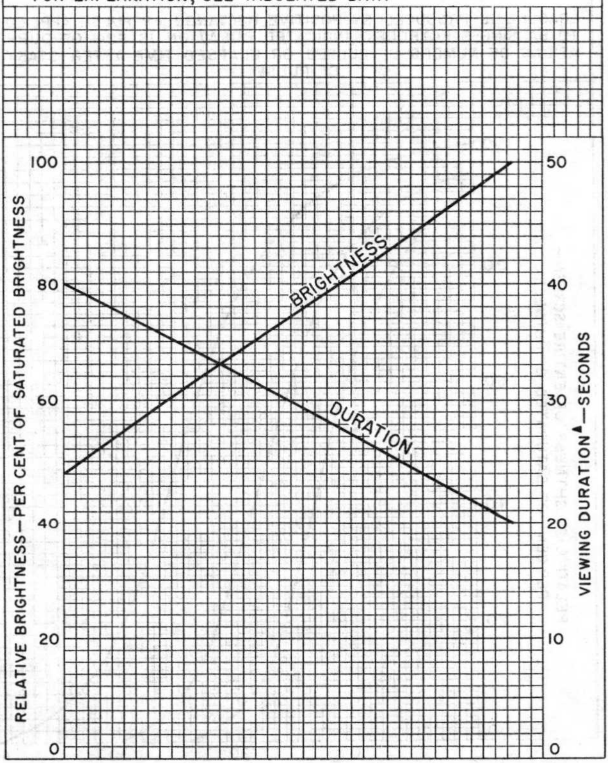
VIEWING SECTION

E_f = 6.3 VOLTS
SCREEN KILOVOLTS* = 5 TO 10
BACKING-ELECTRODE VOLTS* = 5
GRID-No 2 VOLTS* = 85
GRID-No 3 VOLTS* } ADJUSTED FOR BRIGHTEST,
GRID-No 1 VOLTS* } MOST UNIFORM DISPLAY
* REFERRED TO CATHODE OF VIEWING GUN

WRITING SECTION

NORMAL OPERATION

▲ FOR EXPLANATION, SEE TABULATED DATA



92CM-9044

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TYPICAL ERASURE CHARACTERISTICS

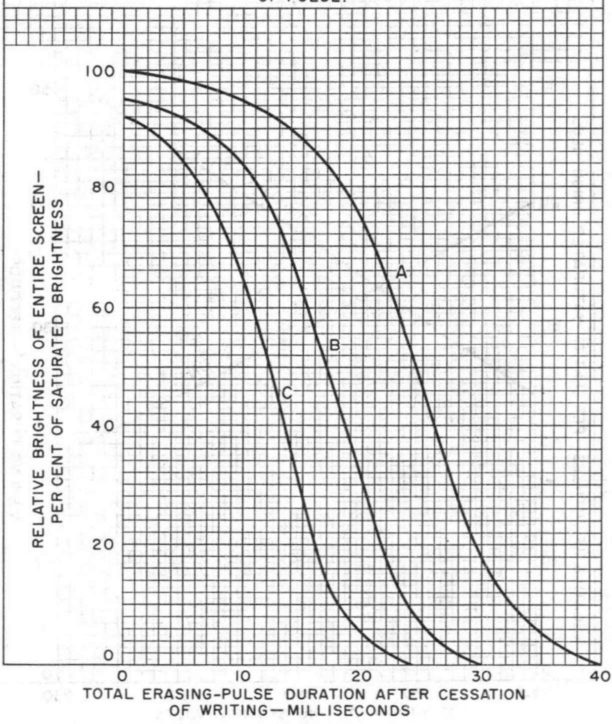
VIEWING SECTION

E_f=6.3 VOLTS
GRID-Nº 4 VOLTS*=210
SCREEN KILOVOLTS*=10
GRID-Nº 2 VOLTS*=85
GRID-Nº 3 VOLTS*, GRID-Nº 1 VOLTS* } ADJUSTED FOR BRIGHTEST, MOST UNIFORM DISPLAY

*REFERRED TO CATHODE OF VIEWING GUN

CURVE	BACKING-ELECTRODE VOLTS	
	DC	POSITIVE RECTANGULAR PULSE AMPLITUDE (APPROX.)
A	10	10
B	5	8
C	2	7

ERASURE IS PRODUCED BY POSITIVE RECTANGULAR PULSE APPLIED TO BACKING-ELECTRODE. INDICATED DURATION IS SUM OF DURATIONS OF NUMBER OF PULSES OR ELAPSED TIME AFTER START OF PULSE.



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CURRENT CHARACTERISTIC
FOR WRITING GUN

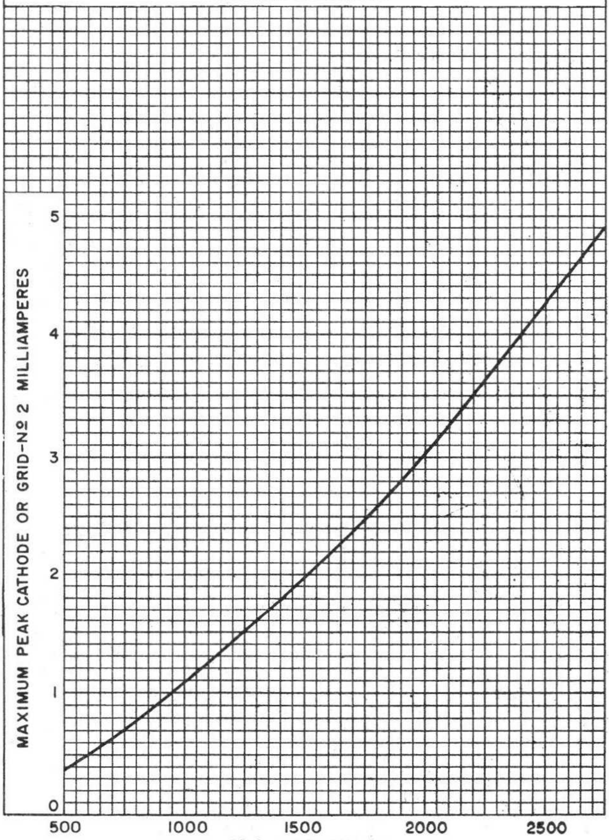
WRITING SECTION

E_f = 6.3 VOLTS
GRID-No 4 VOLTS* = GRID-NO. 2 VOLTS
GRID-No 3 VOLTS* = ADJUSTED FOR FOCUS
GRID-No 1 VOLTS* = 0

*REFERRED TO CATHODE OF WRITING GUN

VIEWING SECTION

NORMAL OPERATION



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TYPICAL DRIVE CHARACTERISTIC
FOR WRITING GUN

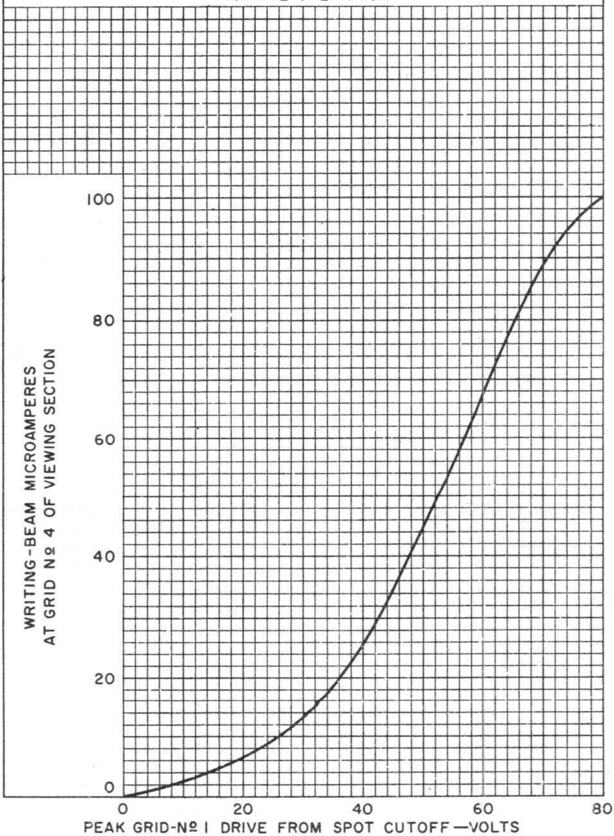
WRITING SECTION

E_f = 6.3 VOLTS
GRID-Nº 4 VOLTS* = 2500
GRID-Nº 3 VOLTS* = ADJUSTED FOR FOCUS
GRID-Nº 2 VOLTS* = 2500
GRID-Nº 1* BIASED TO SPOT CUTOFF

*REFERRED TO CATHODE OF WRITING GUN

VIEWING SECTION

NORMAL OPERATION



Display-Storage Tube

5-Inch Diameter **High Display Uniformity**

Improved Collimation System Design

Typical Luminance of 1300 Footlamberts

For use in radar and other information-handling systems requiring bright non-flickering displays of stored information, including half-tones, for relatively long periods.

The 7183A is Directly Interchangeable with Type 7183.

GENERAL

	Writing Section	Viewing Section	
Heater, for Unipotential Cathode:			
Voltage (AC or DC)	6.3 ± 10%	6.3 ± 10%	V
Current at 6.3 volts	0.6	0.6	A
Cathode Heating Time (Minimum) before other electrode voltages are applied	–	60	s
Direct Interelectrode Capacitances:			
Grid No.1 to all other electrodes	7	–	pF
Cathode to all other electrodes	5	–	pF
Backplate to all other electrodes	–	100	pF
Focusing Method	Electrostatic	–	
Deflection Method	Magnetic	–	
Phosphor.	–	P20, Aluminized	

Minimum Useful Viewing Diameter . . . . 4"
Maximum Overall Length . . . . 11.62"
Maximum Seated Length . . . . 11.25"
Maximum Diameter (Excluding Screen Connector Assembly) . . . . 5.06"

Bases:
Writing Gun . . . . Small-Button Neoditetrar 8-Pin (JEDEC No.E8-49)
Viewing Gun . . . . Small-Button Miniature 7-Pin (JEDEC No.E7-1)
Bulb Terminals (Five) . . . . Recessed Small Cavity (JEDEC No.J1-21)

Screen Connector Assembly . . . . Aircraft-Marine Products, Inc.,[a] Type LGH, Part No.832692[b], or equivalent
Operating Position . . . . Any
Weight (Approx.) . . . . 1-3/4 lb

ABSOLUTE MAXIMUM AND MINIMUM RATINGS

All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified

	Minimum	Maximum	
Screen Voltage:			
Peak	0	10,000	V
DC	0	9,000	V
Backplate Voltage:			
Peak	0	30	V
DC	-30	10	V
Collector (Viewing-Grid-No.5) Voltage	180	300	V
Collimator (Viewing-Grid-No.4) Voltage	50	150	V
Viewing-Grid-No.3 Voltage, Writing-Grid-No.4 and Writing-Grid-No.2 Voltage[d] . .	10	150	V
Viewing-Grid-No.2 Voltage . . .	100	150	V
Viewing-Grid-No.1 Voltage . . .	0	-100	V
Viewing-Gun Heater-to-Cathode Voltage	-125	125	V
Writing-Grid-No.3 Voltage[e] . . .	0	1200	V
Writing-Grid-No.1 Voltage[e] . . .	-200	(f)	V
Writing-Gun Cathode Voltage . .	-2750	145	V
Writing-Gun Heater-to-Cathode Voltage	-125	125	V
Series Current-Limiting Resistor (Unbypassed) in Screen Circuit	1	–	MΩ
Series Current-Limiting Resistor (Unbypassed) in Collector (Viewing-Grid-No.5) Circuit	0.005	–	MΩ

RECOMMENDED OPERATING VALUES

All voltages are shown with respect to the cathode of the viewing gun unless otherwise specified

Screen Voltage	8500	V
Backplate Voltage[g]	0	V
Collector Voltage	250	V
Collimator Voltage[h]	40 to 115	V

Viewing-Grid-No.3 Voltage[d,h]	10 to 40	V
Viewing-Grid-No.2 Voltage	100	V
Viewing-Grid-No.1 Voltage[h]	-40 to 0	V
Writing-Grid-No.3 Voltage[i]	-1925 to -1675	V
Writing-Grid-No.1 Voltage	(f,k)	V
Writing-Gun Cathode Voltage	-2500	V
Circuit Values:		
Grid-No.1 circuit resistance (Either gun)	1 max.	MΩ
Backplate-circuit resistance	0.005 max.	MΩ
Series current-limiting resistor (Unbypassed) in screen circuit	1	MΩ
Series current-limiting resistor (Unbypassed) in collector (Viewing-grid-No.5) circuit	0.01	MΩ

PERFORMANCE DATA AND CHARACTERISTICS

	Min.	Typ.	Max.	
Useful Viewing Diameter	4.0	–	–	in
Luminance (Brightness)[m]	–	1300	–	fL
Viewing Duration[n]	10	–	–	s
Erase Time[p]	–	35	200	ms
Erasing Uniformity Factor: For 4"-diameter area[q]	–	–	0.35	
Resolution[r]	50	–	–	lines/in
Undeflected Spot Position	–	–	(s)	
Screen Current[m]	–	300	750	μA
Viewing-Gun Grid-No.5 Current[t]	–	1.0	2.4	mA
Maximum Viewing-Gun Cathode Current[u]	–	2.5	4	mA
Maximum Writing-Gun Cathode Current[v]	–	2.5	5.0	mA

[a] Aircraft-Marine Products, Inc., Capitron Division, 155 Park St., Elizabethtown, Pa.

[b] This part mates with Aircraft-Marine Products, Inc., Part No.AMP833589, ceramic terminal, or equivalent.

[d] Grids No.4 and No.2 of Writing Gun and grid No.3 of Viewing Gun are connected within the tube.

[e] Voltages are shown with respect to cathode of Writing Gun.

[f] The writing-gun grid No.1 should never be more positive than necessary to write the display to saturated brightness

for a given scanning and drive condition. In no case should the writing-gun grid-No.1 voltage have a value greater than zero with respect to the writing-gun cathode.

g Dynamic erasure and bright-ring elimination circuitry are recommended. Dynamic erasure is accomplished by a series of rectangular pulses. The backplate should be maintained at zero volts between erase pulses. Bright-ring elimination is accomplished by connecting an 0.1 μF, 200 VDC capacitor between the backplate electrode and the collimator electrode.

h Adjusted for brightest, most uniform, full-size pattern.

i Adjusted for the smallest, most circular spot.

k The maximum bias-voltage value for writing-beam cutoff is -130 volts with respect to writing-gun cathode.

m Luminance (Brightness) and screen current are measured after the entire display is written to saturated brightness, the writing gun has been turned off, and with no erasing pulse applied.

n The time required for any 1.5-inch diameter area of the useful 4-inch diameter viewing area to spontaneously rise (with no writing or erasing) from zero brightness (viewing-beam cutoff) to 10% of saturated brightness.

p With the display at saturated brightness, a series of rectangular pulses 5 milliseconds in width and at a repetition frequency of 2 pps is applied to the backplate. The number of pulses required to just erase completely the center of the display is noted. This number is multiplied by 5 milliseconds to obtain the erase time. The amplitude of the erase pulses is adjusted to obtain the minimum erase time.

q Determined as follows: With no erasing pulse, overscan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam and adjust erasing pulse to obtain complete erasure in approximately 10 seconds. Measure time (t_1) from start of erasing to the instant at which any area within the 4" diameter is reduced to background-brightness level, and time (t_2) from start of erasing to the instant at which the entire area within the 4" diameter area is reduced to background-brightness level. The erasing-uniformity factor is defined as $(t_2-t_1)/t_2$.

r Measured by shrinking-raster method at a display brightness of 50% of saturated brightness and with grids No.2 and No.4 of Writing Gun at about +2500 volts with respect to cathode of Writing Gun.

[s] The undeflected spot position must fall within a circle having a 5/16-inch radius (maximum), 1-3/4-inches from the geometric center of the tube face, on the radius passing through the center of the neck of the writing gun.

[t] With writing gun turned off, with no erasing pulse applied, and display erased to cutoff.

[u] Measured with viewing-gun grid No.1 at zero volts and with all other electrodes at voltages shown under *Recommended Operating Values*.

[v] Measured with writing-gun grid No.1 at zero volts while writing an overscanned TV-type raster.

ENVIRONMENTAL TESTS

The 7183A is designed to withstand the following environmental tests:

Vibration parallel to each of the three orthogonal axes shown in *Fig.1*, and as specified in the schedule below:

Axis of Vibration	Double Amplitude inches	Frequency in Hz	Cycle Duration minutes
X	0.08	30	30
Y	0.08	30	30
Z	0.08	30	30

High and Low Temperature Storage for at least 24 hours at a temperature of +100° C and for at least 24 hours at a temperature of -65° C.

Temperature and Low Pressure (Altitude) in three concurrent phases as specified below:

Phase 1. Storage for one hour at a temperature of -40° C followed by tube operation for five minutes under the conditions shown under *Recommended Operating Values*.

Phase 2. Temperature is increased from -40^{o} C at a rate of 2^{o} C per minute until a temperature of +86^{o} C is reached. Following one hour storage at +86^{o} C, the tube is operated for five minutes under the conditions shown under *Recommended Operating Values*.

Phase 3. Barometric pressure is next reduced until a pressure equivalent to an altitude of 20,000 feet is attained. The tube is then operated for five minutes under the conditions shown under *Recommended Operating Values*. Upon completion of the third phase of this test, pressure is increased and temperature decreased, at a rate of 2^{o} C per minute, until ambient pressure-temperature conditions are reached.

PRECAUTIONS

The following operating precautions must be followed to protect the 7183A from inadvertent damage –

1. Do not exceed maximum ratings.
2. Be sure to include the screen resistor.
3. Be sure to include the collector resistor.
4. Do not apply excessive writing-beam current density.
5. Protect against scanning failure.
6. Protect against loss of bias.
7. Apply voltages to tube in correct order.
8. Never write unless viewing beam is on.
9. Stay within recommended viewing-grid voltage ranges.

SCHEMATIC DIAGRAM

Showing Orthogonal Axes of 7183A
Used during Environmental Tests

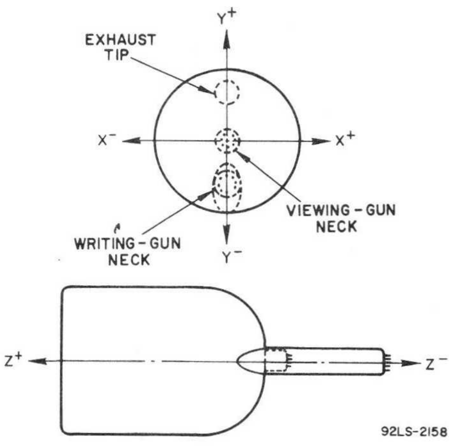
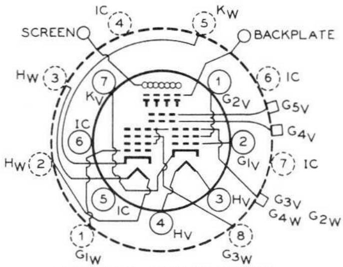


Fig.1

TERMINAL DIAGRAM (Bottom View)



SOLID-LINE CIRCLES DEPICT
MINIATURE 7-PIN BASE
BROKEN-LINE CIRCLES DEPICT
NEODITETRAR 8-PIN BASE

VIEWING SECTION

Small-Button Miniature 7-Pin Base

Pin 1: Grid No.2
Pin 2: Grid No.1
Pin 3: Heater
Pin 4: Heater
Pin 5: Internal Connection– Do Not Use
Pin 6: Internal Connection– Do Not Use
Pin 7: Cathode
Flexible Lead (Large): Screen
Flexible Lead (Small): Backplate

Recessed Cavity Caps:
Collector (Grid No.5) – Located 1.25" from tube face; 15° from center line through writing and viewing gun necks away from screen connector.
Collimator (Grid No.4) – located 3" from tube face; 15° from center line through writing and viewing gun necks away from screen connector.
Located near viewing gun– Grid No.3 and Grids No.4 & No.2 of writing gun.

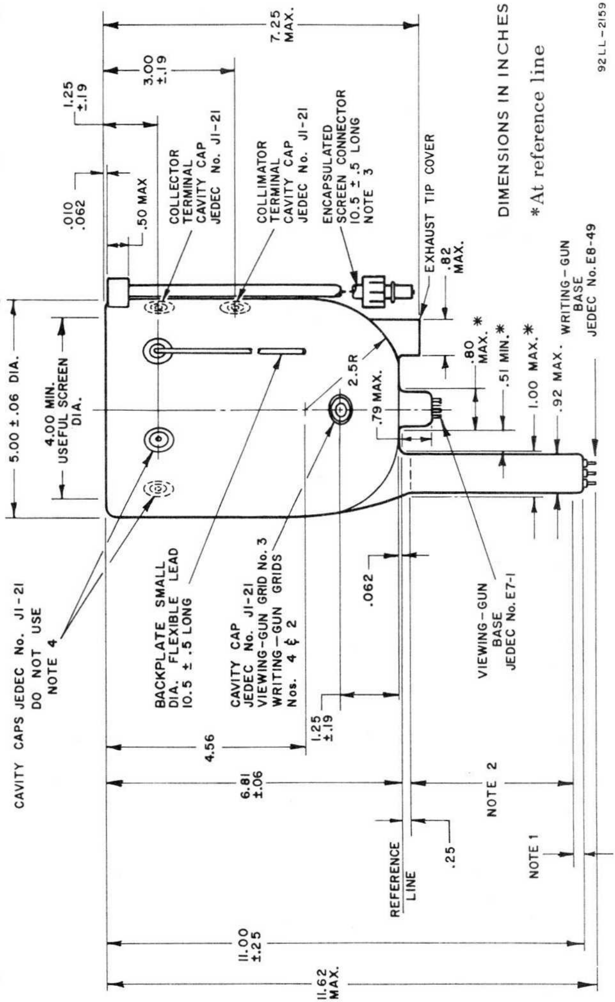
WRITING SECTION

Small-Button Neoditetrar 8-Pin Base

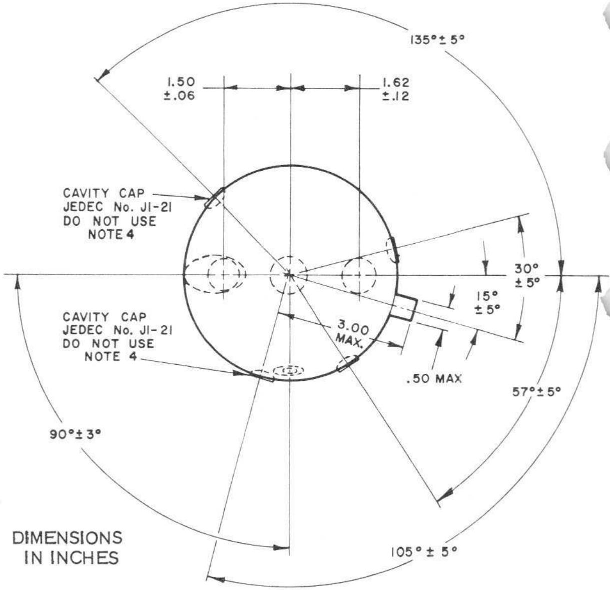
Pin 1: Grid No.1
Pin 2: Heater
Pin 3: Heater
Pin 4: Internal Connection – Do Not Use
Pin 5: Cathode
Pin 6: Internal Connection– Do Not Use
Pin 7: Internal Connection– Do Not Use
Pin 8: Grid No.3

Note : Grids No.4 & No.2 are connected internally to Grid No.3 of viewing gun

DIMENSIONAL OUTLINE (Front View)



DIMENSIONAL OUTLINE (Top View)



DIMENSIONS IN INCHES

NOTES FOR DIMENSIONAL OUTLINE

Note 1: Within this distance, neck diameter is .920" max.

Note 2: Within this distance, neck diameter is .950" max.

Note 3: Aircraft-Marine Products, Inc., type LGH Part No. 832692, or equivalent. This part mates with Aircraft-Marine Products, Inc., Part No.AMP833589, ceramic terminal, or equivalent.

Note 4: Do not use these cavity caps for connection. The caps are connected internally and may be at a potential which could constitute a shock hazard. It is recommended that these caps be covered with electrical insulation.

7268B

Display-Storage Tube

FACTORY-COLLIMATED "RUGGEDIZED" TYPE
TWO WRITING GUNS
ONE VIEWING GUN
5-INCH DIAMETER
4-INCH-DIAMETER DISPLAY
INTEGRAL MAGNETIC SHIELD

For Use in Military and Commercial Information Handling Displays Where Rough Tube Usage May Be Encountered. The 7268B is Unilaterally Interchangeable with Types 7268 and 7268A.

ELECTRICAL

Heater, for Unipotential Cathode (All guns)		
Voltage (AC or DC)	6.3 ± 10%	V
Current at 6.3 V	0.6	A
Cathode Heating Time (Minimum)	30	s
Before other electrode voltages are applied		

Writing Section—Each Gun

Focusing Method	Electrostatic	
Deflection Method	Electrostatic	
Deflecting-Electrode Arrangement	See *Dimensional Outline*	
Direct Interelectrode Capacitances		
Grid No.1 to all other electrodes	15 max	pF
Cathode to all other electrodes	8 max	pF
Deflecting electrode DJ1 to deflecting electrode DJ2	3 max	pF
Deflecting electrode DJ3 to deflecting electrode DJ4	2 max	pF
DJ1 to all other electrodes	10 max	pF
DJ2 to all other electrodes	10 max	pF
DJ3 to all other electrodes	10 max	pF
DJ4 to all other electrodes	10 max	pF

Viewing Section

Direct Interelectrode Capacitance		
Backplate to all other electrodes	110 max	pF

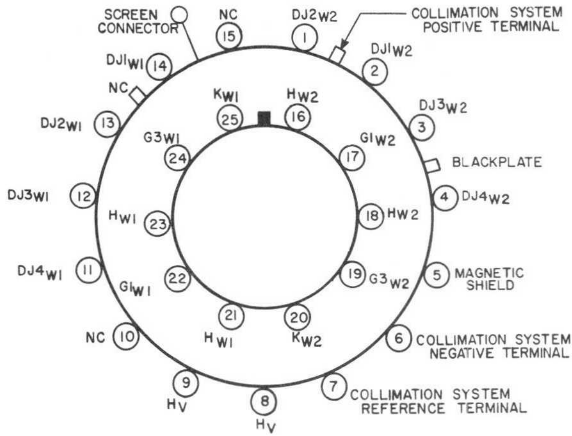
OPTICAL

Phosphor	P20, Aluminized

MECHANICAL

Operating Position	Any
Minimum Useful Viewing Diameter	4 in
Maximum Overall Length	16 in
Maximum Diameter	5.28 in
Excluding screen lead	
Screen-Connector Assembly	See *Dimensional Outline*
Weight	5-1/4 lb
Bulb Terminals	
Caps (Three)	Recessed Small Ball (JEDEC No.J1-22)
Base	JEDEC No.B25-216

TERMINAL DIAGRAM (Bottom View)



92LS-1218

Pin 1 - Deflecting Electrode DJ2 of Writing Gun No. 2
Pin 2 - Deflecting Electrode DJ1 of Writing Gun No. 2
Pin 3 - Deflecting Electrode DJ3 of Writing Gun No. 2
Pin 4 - Deflecting Electrode DJ4 of Writing Gun No. 2
Pin 5 - Integral Magnetic Shield
Pin 6 - Collimation System Negative Terminal
Pin 7 - Collimation System Reference Terminal
Pin 8 - Heater of Viewing Gun
Pin 9 - Heater of Viewing Gun
Pin 10 - NC—No Internal Connection
Pin 11 - Deflecting Electrode DJ4 of Writing Gun No. 1
Pin 12 - Deflecting Electrode DJ3 of Writing Gun No. 1
Pin 13 - Deflecting Electrode DJ2 of Writing Gun No. 1
Pin 14 - Deflecting Electrode DJ1 of Writing Gun No. 1
Pin 15 - NC—No Internal Connection
Pin 16 - Heater of Writing Gun No. 2
Pin 17 - Grid No. 1 of Writing Gun No. 2
Pin 18 - Heater of Writing Gun No. 2
Pin 19 - Grid No. 3 of Writing Gun No. 2
Pin 20 - Cathode of Writing Gun No. 2
Pin 21 - Heater of Writing Gun No. 1
Pin 22 - Grid No. 1 of Writing Gun No. 1
Pin 23 - Heater of Writing Gun No. 1
Pin 24 - Grid No. 3 of Writing Gun No. 1
Pin 25 - Cathode of Writing Gun No. 1
Flexible Lead - Screen (Encapsulated)
Recessed Small Ball Caps -

Over Pin No. 3
NC—No Internal Connection

Over Pin No. 13
Collimation System Positive Terminal

Over Pin No. 14
Backplate

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.

MAXIMUM AND MINIMUM RATINGS, ABSOLUTE MAXIMUM VALUES

All voltages are shown with respect to the reference terminal of the collimation system unless otherwise specified. The reference terminal must be grounded.

	Min	Max	
Screen Voltage			
Peak	-	11500	V
DC	0	11000	V
DC Backplate Voltage	0	35	V
Collimation System[a]			
Positive-terminal voltage	0	300	V
Negative-terminal voltage	-100	-50	V
Viewing-Gun Heater	-125	125	V
Magnetic Shield Voltage	-200	200	V
Deflecting-Electrode Voltage	-600	600	V
Each gun			
Writing-Grid-No.3 Voltage	0	2000	V
Each gun[b]			
Writing-Grid-No.1 Voltage	-200	(c)	V
Each gun[b]			
Writing-Gun Cathode Voltage	-2800	0	V
Each gun			
Writing-Gun Heater-to-Cathode Voltage	-125	125	V
Each gun			
Series Current-Limiting Resistor			
Unbypassed, in screen circuit	1	-	MΩ
Unbypassed, in collimation system positive terminal circuit	0.005	-	MΩ

RECOMMENDED OPERATING VALUES

All voltages are shown with respect to the reference terminal of the collimation system unless otherwise specified.

Screen Voltage	10000	V
Backplate Voltage[d]	2	V
Collimation System[a]		
Positive-terminal voltage	265	V
Negative-terminal voltage	-55	V
Reference terminal	grounded	
Writing-Grid-No.3 Voltage	-2325 to -1975	V
Each gun[e]		
Writing-Grid-No.1 Voltage	(c, f)	V
Each gun		
Writing-Gun Cathode Voltage	-2400	V
Magnetic Shield Voltage	0	V
Average Deflecting Plate Voltage[g]	100	V
Circuit Values		
Grid-No.1 circuit resistance (Either gun)	1 max	MΩ
Impedance in any deflecting electrode circuit[h]	0.01 max	MΩ
Backplate-circuit resistance	0.005 max	MΩ
Series current-limiting resistor:		
Unbypassed, in screen circuit	1	MΩ
Unbypassed, in collimation system positive terminal circuit	0.005	MΩ

CHARACTERISTICS

	Min	Typ	Max	
Useful Viewing Diameter	4	-	-	in
Brightness (Luminance)[j]	-	2500	-	fL
Viewing Duration[k]	15	-	-	s
Erase Time[m]	-	28	-	ms
Resolution[n]	70	-	-	lines/in
Undeflected Spot Position	-	-	(p)	mm
Deflection Factors				
DJ1 & DJ2	82	-	100	V/in
DJ3 & DJ4	82	-	100	V/in

[a] The collimation system includes a passive internal network which provides the proper voltages for all viewing gun electrodes; except screen, backplate and heater; as well as grids No.2 and 4 of the writing gun.

[b] Voltages are shown with respect to cathode of writing gun.

[c] The writing-gun grid No.1 should never be more positive than necessary to write the display to saturated brightness for a given scanning and drive condition. In no case should the writing-gun grid No.1 voltage have a value greater than zero with respect to the writing-gun cathode.

[d] The backplate should be maintained at 2 volts between erasing pulses when dynamic erasure is employed.

[e] Adjusted for the smallest, most circular spot.

[f] The bias-voltage value for writing-beam cutoff is between -60 and -100 volts with respect to writing-gun cathode.

[g] With respect to the reference terminal of the collimation system for each pair of deflecting electrodes.

[h] Recommended value for minimum distortion because of viewing-beam collection by the deflecting plates. Where strict display accuracy and display uniformity are not required, the impedance value for any deflecting-electrode circuit may be as high as 0.1 megohm maximum. For optimum performance, it is recommended that the deflecting-electrode-circuit impedances be approximately equal.

[j] Brightness (Luminance) is measured after the entire display is written to saturated brightness, the writing gun has been turned off, and with no erasing pulse applied.

[k] The time required for any 0.5-inch-diameter area of the 4-inch-diameter viewing area to rise spontaneously (with no writing or erasing) from zero brightness (viewing-beam visual cutoff) to 10% of saturated brightness.

[m] With the display at saturated brightness, a series of rectangular pulses 5 milliseconds in width and at a repetition frequency of 2 p/s is applied to the backplate. The number of pulses required to just erase completely the center of the display is noted. This number is multiplied by 5 milliseconds to obtain the erase time. The amplitude of the erase pulses is adjusted to obtain the minimum erase time.

[n] Measured by the "shrinking" raster method under conditions of continuous writing and erasing, with erase pulses of 60 microseconds width and a repetition frequency of 300 p/s. The amplitude of the erase pulses is adjusted to provide 3.5-second erasure and grid No.1 is adjusted to provide 1000 footlamberts brightness of the just "shrunken" raster.

[p] The undeflected spot position must fall within a square having a 15 millimeter side (maximum) centered on the tube face and parallel to a trace produced by one set of deflecting plates.

Performance Data

Writing Ability and *Writing Uniformity* Characteristics are measured singly for both guns. A 3.5" x 3.5" raster is centered on the tube face. Vertical scanning is accomplished by an interrupted linear sawtooth waveform having a scan time of 625 microseconds and a prf of 500 p/s. Horizontal scanning is provided by a triangular waveform having a scan rate of 3.5 inches per second.

Writing Ability. The writing-gun grid No.1 of the gun under test is driven above cutoff during the vertical scan time by white noise, of approximately 5 megacycle bandwidth, having a zero-to-peak amplitude of approximately 35 volts. The display brightness under these conditions shall be at least 20% of saturated brightness.

Writing Uniformity. This characteristic is determined under the same conditions as specified above except that the rms amplitude of the white noise is adjusted to produce brightness of 40% of saturated brightness at the dimmest area in the display. The measured brightness at the brightest area of the display shall be not more than 60% of the saturated brightness.

Environmental Tests

The 7268B is designed to withstand the following operational and non-operational environmental tests.

Operational Tests

Sinusoidal Vibration: This test consists of tube vibration in each of three orthogonal axes. One of these axes is in the plane passing through the major axis of the tube and the center of the tube-base key. The tube is mounted so that its major axis is parallel to the plane of the earth. A total of 6 cycles of swept sinusoidal vibration, from 10 to 500 and back to 10 cycles per second, is performed. The duration of a sweep cycle is 15 minutes. The frequencies of any resonant points are noted. The sinusoidal vibration schedule is shown below.

Double Amplitude inches	Peak Acceleration g's	Sweep Frequency c/s	Sweep Cycle Duration minutes
0.27	-	10 to 20	15
-	4	20 to 46	
-	2	46 to 500	
-	2	500 to 46	
-	4	46 to 20	
0.27	-	20 to 10	

Vibration at Resonance. This test consists of tube vibration at the resonant point or points determined in *Sinusoidal Vibration* for a period of 30 minutes. If more than one resonant point is noted for a given axis, the tube is vibrated for a total of 30 minutes at that resonant point in each axis most likely to produce tube failure. If no resonant points are determined in *Sinusoidal Vibration,* the tube is vibrated for 60 minutes at a frequency of 55 cycles per second.

Low Pressure-High Temperature. This test consists of tube storage for a period of not less than one hour at a temperature of +100°C. At the termination of this storage period, the tube is operated with the values shown under *Recommended Operating Values* applied and at a pressure equivalent to an altitude of 32,000 feet. The temperature is then reduced to +53°C. The tube is stored at this temperature for 1 hour and then is operated with normal voltages applied at a pressure equivalent to an altitude of 60,000 feet.

Low Temperature. This test consists of the tube being maintained at a temperature of -65°C for 48 hours. At the end of this period and while the tube is still at -65°C, the tube is operated with recommended voltages applied for 15 minutes.

Non-Operational Tests

Temperature Cycling. This test consists of tube storage for a period of not less than 2 hours at a temperature of -65°C followed within 5 minutes by storage for a period of 2 hours at a temperature of +100°C. A minimum of five consecutive cycles are performed.

High Pressure. This test consists of tube exposure to an absolute pressure of 45 pounds per square inch for a period of at least 60 seconds. This pressure shall be attained within 60 seconds.

Torque. This test consists of the application of a torque of 40 inch-pounds between the integral magnetic shield and the tube base.

Salt Spray. This test consists of tube exposure to a fine spray from a salt solution for a period of 48 hours. The ambient temperature is maintained at approximately 35°C.

OPERATING PROCEDURE

The following steps should be followed when the 7268B is first placed in operation. Refer to the precautions shown under *Operating Considerations* in the publication 1CE-277 "RCA Display-Storage Tubes". *Note that all electrode voltages are referred to the reference terminal of the collimation system unless otherwise specified.*

1. *Viewing Gun* — Ground the collimation system reference terminal and magnetic shield. Apply power to the heater of the

viewing gun and allow 60 seconds for the cathode to reach normal operating temperature. Next apply the following voltages, in the indicated order: +2 volts to the backplate, -55 volts to the collimation system negative terminal, and +265 volts to the collimation system positive terminal (be sure a minimum resistance of 5000 ohms is in this circuit). Then increase screen voltage slowly from 0 to 10,000 volts (be sure a minimum resistance of 1 megohm is in the screen circuit). Next apply dynamic erasing pulses to the backplate.

The storage property of the tube can be observed by setting the amplitude of the dynamic erasing pulses at +8 volts for several seconds and by then reducing it to zero volts. As the erasing pulse amplitude is reduced the screen should go dark. The 7268B is now storing an overall "black picture" and stays in this condition until the screen begins to brighten as a result of the storage grid being gradually discharged by positive ions landing on it.

2. *Writing Gun* — Apply power to the heater of the writing gun and allow 60 seconds for the cathode to reach normal operating temperature. Then, with reference to the typical operating values shown in the tabulated data under *Recommended Operating Values*, set the grid-No.1 voltage to cutoff, and apply dc voltages to the electrodes of the writing gun. With the screen made dark by the charging method described under (1), the grid-No.1 bias is reduced until the writing beam is seen as a spot on the screen. If the beam is caused to move, either by centering adjustment or by application of deflection voltage, it should leave a bright trace. After an area has been written to full brightness, the writing-beam spot may be seen as a slightly brighter spot on the bright background. Writing-beam focus can then be optimized by adjusting the grid-No.3 voltage.

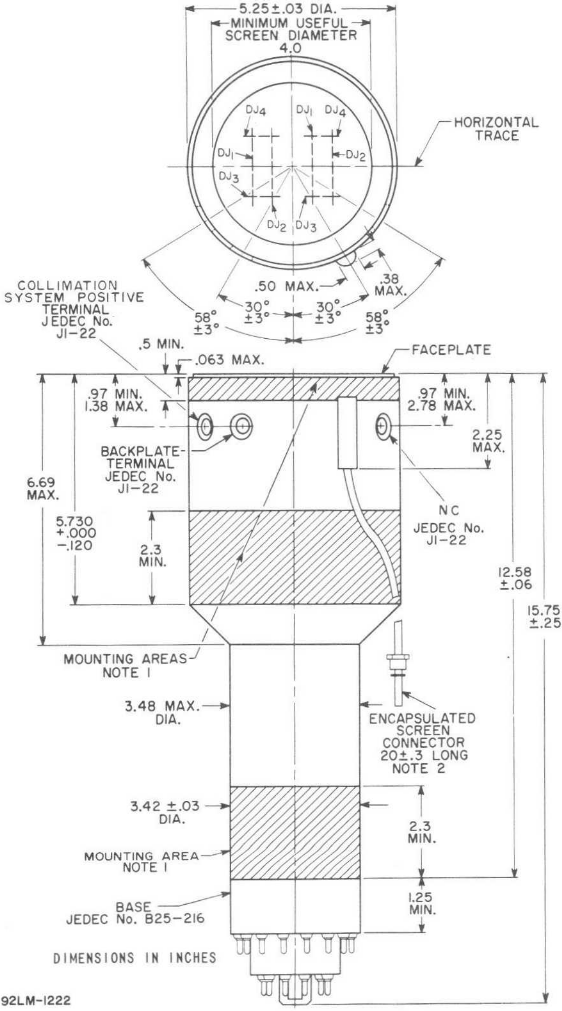
3. *Final Display Adjustments* — The dc bias and the video-signal amplitude applied to grid No.1 or cathode of the writing gun should be adjusted to set the black level and and the highlight level in the display. These adjustments depend on the scanning rate used. Resolution decreases with increasing writing-gun beam current. Excessive writing-gun beam current will produce screen saturation and any further beam-current increase will not produce additional highlight brightness and may also decrease half-tone rendition. It is recommended that the writing-beam current always be adjusted to a minimum value to produce the best display without saturation of highlight brightness. The dynamic erasing-pulse amplitude and duty cycle should be adjusted in accordance with the information contained in 1CE-277.

The following operating precautions must be followed to protect the 7268B from inadvertent damage —

1. Do not exceed maximum ratings.
2. Be sure to include the screen resistor.

3. Be sure to include the collimation system positive terminal resistor.
4. Do not apply excessive writing-beam current density.
5. Protect against scanning failure.
6. Protect against loss of bias.
7. Apply voltages to tube in correct order.
8. Never write unless viewing beam is on.

DIMENSIONAL OUTLINE



92LM-1222

Note 1: The indicated areas are recommended for mounting purposes.

Note 2: Amp Part No. AMP 832 692-0; manufactured by Aircraft Marine Products, Inc., Harrisburg, Pa., or equivalent.

7315
DISPLAY STORAGE TUBE

DIRECT-VIEW TYPE
3.8"-DIAMETER DISPLAY

WRITING GUN:
ELECTROSTATIC DEFLECTION
ELECTROSTATIC FOCUS

VIEWING GUN:
NO DEFLECTION
NO FOCUS

DATA

General:

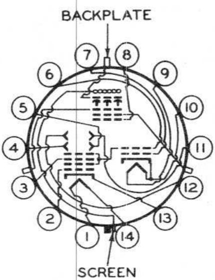
	Writing Section	Viewing Section	
Heater, for Unipotential Cathode:			
Voltage (AC or DC)	6.3	6.3	volts
Current	0.6	0.6	amp
Minimum Cathode Heating Time before other electrode voltages are applied	–	30	sec
Direct Interelectrode Capacitances (Approx.):°			
Grid No. 1 to all other tube electrodes	6.5	11	μμf
Cathode to all other tube electrodes	5.5	8	μμf
Backplate to all other tube electrodes	–	116	μμf
Deflecting electrode DJ_1 to deflecting electrode DJ_2	1.9	–	μμf
Deflecting electrode DJ_3 to deflecting electrode DJ_4	2	–	μμf
DJ_1 to all other tube electrodes	6	–	μμf
DJ_2 to all other tube electrodes	7	–	μμf
DJ_3 to all other tube electrodes	5.5	–	μμf
DJ_4 to all other tube electrodes	4.8	–	μμf
Focusing Method	Electrostatic	None	
Deflection Method	Electrostatic	None	
Deflecting-Electrode Arrangement	*See Dimensional Outline*	–	
Phosphor (For Curves, see front of this Section)	–	P20, Aluminized	
Fluorescence	–	Yellow-Green	
Phosphorescence	–	Yellow-Green	

Minimum Useful Viewing Diameter♥ . . . . . 3.8"
Maximum Overall Length . . . . . 13.64"
Seated Length . . . . . 12.50" ± 0.39"
Greatest Bulb Diameter . . . . . 5.25" ± 0.06"
Maximum Tube Radius . . . . . 2.69"
Bulb Terminals:
Caps (Three) . . . . . Recessed Small Ball (JEDEC No.J1-22)
Cap . . . . . Recessed Small Cavity (JEDEC No.J1-21)
Temperature Range:
Operating . . . . . -65° to +100° C
Storage . . . . . -55° to +85° C
Operating Position . . . . . Any
Weight (Approx.) . . . . . 2-3/4 lbs
Base . . . . . Medium-Shell Diheptal 14-Pin (JEDEC Group 5, No.B14-38)

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7315
DISPLAY STORAGE TUBE

BOTTOM VIEW



Pin 1 – Heater of Writing Gun
Pin 2 – Grid No. 1 of Writing Gun
Pin 3 – Grid No. 3 of Writing Gun
Pin 4 – Deflecting Electrode DJ_3 of Writing Gun
Pin 5 – Deflecting Electrode DJ_4 of Writing Gun
Pin 6 – Grid No. 2 of Viewing Gun, Grid No. 2 and Grid No. 4 of Writing Gun
Pin 7 – Grid No. 1 of Viewing Gun
Pin 8 – Grid No. 3 of Viewing Gun
Pin 9 – Heater of Viewing Gun
Pin 10 – Heater and Cathode of Viewing Gun
Pin 11 – Deflecting Electrode DJ_1 of Writing Gun
Pin 12 – Deflecting Electrode DJ_2 of Writing Gun
Pin 13 – Cathode of Writing Gun
Pin 14 – Heater of Writing Gun

Recessed Ball Cap:
Over Pin 3 — Grid No. 5 of Viewing Gun
Over Pin 12 — Grid No. 4 of Viewing Gun
On Side of Tube Opposite Base Key — Backplate

Recessed Cavity Cap:
Over Base Key — Screen

Maximum and Minimum Ratings, *Absolute-Maximum Values:*

For altitudes up to 10,000 feet

	Writing Section		Viewing Section		
SCREEN VOLTAGE.	–		11000 max.**		volts
BACKPLATE VOLTAGE (Peak). .	–		20 max.**		volts
	Equivalent Values		*Equivalent Values*		
GRID-No. 5 VOLTAGE	–	–	–	300 max.**	volts
GRID-No. 4 VOLTAGE	2950 max.*▲	200 max.**	–	300 max.**	volts
GRID-No. 3 VOLTAGE	1200 max.*	–1550 max.**	–	200 max.** 10 min.**	volts
PEAK VOLTAGE BETWEEN GRID No. 3 AND GRIDS No. 2 & No. 4.	–	2950 max.	–	–	volts

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7315

DISPLAY STORAGE TUBE

	Writing Section		Viewing Section		
GRID-No.2 VOLTAGE	2950 max.*▲	200 max.**	2950 max.*▲	200 max.**	volts
CATHODE VOLTAGE	–	-2750 max.**	–	–	volts
GRID-No.1 VOLTAGE:					
Negative-bias value . . .	200 max.*		200 max.**		volts
Positive-bias value . . .	0 max.*		0 max.**		volts
Positive-peak value . . .	2 max.*		0 max.**		volts
PEAK VOLTAGE BETWEEN GRIDS No.2 & No.4 AND ANY DEFLECTING ELECTRODE . .	500 max.		–		volts
PEAK HEATER-CATHODE VOLTAGE:					
Heater negative with respect to cathode . .	125 max.*		–		volts
Heater positive with respect to cathode . .	125 max.*		–		volts

VIEWING SECTION**

Operating Values and Typical Performance Characteristics:

To prevent possible damage to the tube, allow the viewing-gun beam current to reach normal operating value before turning on the writing-gun beam current, and keep the viewing-gun beam on till the writing beam is turned off

Screen Voltage.	10000	10000	volts
Backplate Voltage (DC).	2	2	volts
Grid-No.5 Voltage	210	150	volts
Grid-No.4 Voltage#.	50 to 150	30 to 90	volts
Grid-No.3 Voltage#.	10 to 50	10 to 40	volts
Grid-No.2 Voltage▲.	150	125	volts
Grid-No.1 Voltage#.	0 to -80	0 to -60	volts
Maximum Screen Current.	0.75	0.5	ma
Maximum Backplate Current (Peak). . . .	2	1.5	ma
Maximum Grid-No.5 Current	3	2.5	ma
Maximum Grid-No.4 Current	3	2.5	ma
Maximum Grid-No.3 Current	5	4	ma

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DISPLAY STORAGE TUBE

Maximum Grid-No.2 Current	3	2.5	ma
Maximum Cathode Current	8	6.5	ma
Number of Half-Tone Steps□	5	5	
Viewing Duration▲▲	20	40	sec
Maximum Erasing-Uniformity Factor□□	0.45	0.4	
Resolution⊕	50	50	lines/in.
Brightness●●	2750	1500	fl

WRITING SECTION●

Range Values for Equipment Design:*

For any grids-No.2 & No.4 voltage ($E_{c_{2+4}}$) between 1500 and 2750 volts▲

Grid-No.3 Voltage for focus	17.5% to 37.5% of $E_{c_{2+4}}$	volts
Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot	-4.6% of $E_{c_{2+4}}$	volts
Maximum Grid-No.3 Current	-15 to +10	µa
Maximum Cathode Current	*See Curve*	
Deflection Factors:		
DJ_1 & DJ_2	36 to 48	v dc/in./kv of $E_{c_{2+4}}$
DJ_3 & DJ_4	35 to 47	v dc/in./kv of $E_{c_{2+4}}$
Focused Beam Position	##	
Writing Speed††	3000	in./sec

Examples of Use of Design Ranges:*

For grids-No.2 & No.4 voltage ($E_{c_{2+4}}$)▲	*2000*	*volts*
Grid-No.3 Voltage for focus	350 to 750	volts
Maximum Grid-No.1 Voltage for cutoff of undeflected focused spot	-92	volts
Deflection Factors:		
DJ_1 & DJ_2	72 to 96	volts
DJ_3 & DJ_4	70 to 94	volts

Equivalent Values of Writing-Gun Voltages Referred to Cathode of Viewing Gun:

Cathode Voltage	-1875	-1850	volts
Grid-No.3 Voltage for focus	-1125 to -1525	-1100 to -1500	volts
Grids-No.2 & No.4 Voltage▲	+125	+150	volts

VIEWING SECTION and WRITING SECTION

Circuit Values:

Grid-No.1-Circuit Resistance (Either gun)	1 max.	megohm
Resistance in Any Deflecting-Electrode Circuit■	0.1 max.	megohm
Series Current-Limiting Resistor (Unbypassed) in Grid-No.5 (Viewing-Section) Circuit	0.01 min.	megohm

DISPLAY STORAGE TUBE

Backplate-Circuit Resistance.	0.005 max.	megohm
Series Current-Limiting Resistance in Screen Circuit.	1 min.	megohm

○ Without external shield.

♥ Minimum useful viewing area may be eccentric with respect to the tube face.

** Voltages are shown with respect to cathode of Viewing Gun.

* Voltages are shown with respect to cathode of Writing Gun.

▲ Grids No.2 and No.4 of Writing Gun are connected together and to grid No.2 of Viewing Gun within the tube.

\# Adjusted for brightest, most uniform pattern.

□ Observed with an RCA-2F21 Monoscope display.

▲▲ Expressed in terms of the time required for the brightness of the unwritten background to rise from just zero brightness (viewing-beam cutoff) to 10 per cent of saturated brightness.

◫ Determined as follows: With no erasing pulse, overscan the storage surface with writing beam to obtain maximum pattern brightness. Then cut off writing beam. Apply erasing pulses having an amplitude of between 8 to 10 volts and adjust duty cycle to obtain complete erasure in approximately 10 seconds. Measure time (t_1) from start of erasing to the instant at which any area within the minimum useful viewing diameter is reduced to background-brightness level, and time (t_2) from start of erasing to the instant at which the entire area within the minimum useful viewing-diameter area is reduced to background-brightness level. The erasing-uniformity factor is defined as $(t_2 - t_1)/t_2$.

✣ Measured by shrinking-raster method at a display brightness of 50 per cent of saturated brightness and with grids No.2 & No.4 of Writing Gun at about +2000 volts with respect to cathode of Writing Gun.

♣♣ Measured with entire storage grid written to produce saturated brightness and with screen at indicated voltage.

● The cathode of the Writing Gun is operated at about -2000 volts with respect to the cathode of the Viewing Gun which is usually operated at ground potential.

\## The center of the undeflected focused beam will fall within a circle having a 10-mm radius and having its center on the Writing-Gun axis (*See Dimensional Outline*) under the following conditions: grids No.2 & No.4 of Writing Gun at +2000 volts with respect to cathode of Writing Gun, grid No.3 of Writing Gun at voltage to give focus, grid No.1 of Writing Gun at voltage which will permit storage of a charge just sufficient to give a barely perceptible spot on screen, Viewing Section operating under normal conditions, and tube shielded against extraneous fields.

†† Measured under conditions of writing from just zero brightness (viewing-beam cutoff) to maximum brightness with grid No.1 of Writing Gun at -10 volts with respect to cathode of Writing Gun, and grids No.2 & No.4 of Writing Gun at +2000 volts with respect to cathode of Writing Gun.

■ It is recommended that the deflecting-electrode-circuit resistances be approximately equal.

OPERATING CONSIDERATIONS

Shielding. Magnetic shielding must be provided to prevent external fields from interfering with the required accurate control of the low-velocity viewing beam. A cylindrical shield of properly annealed high-permeability material about 1/16-inch thick is usually satisfactory.

Terminal Connections. The *base pins* of the 7315 fit the Diheptal 14-contact socket. The *Recessed Small Ball caps* and the *Recessed Small Cavity cap* require standard flexible-lead connectors.

RCA

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DISPLAY STORAGE TUBE

The high voltages at which the 7315 is operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Safety precautions include the enclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is desired.

In the use of high-voltage tubes, it should always be remembered that high voltages may appear at normally low-potential points in the circuit as a result of capacitor breakdown or incorrect circuit connections. Therefore, before any part of the circuit is touched, the power-supply switch should be turned off, and both terminals of any capacitors grounded.

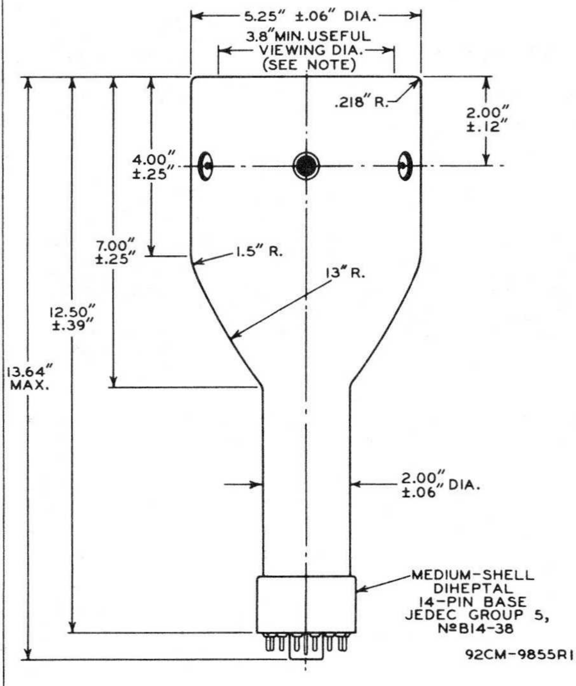
To prevent possible damage to the tube, allow the Viewing-Gun beam current to reach normal operating value before turning on the Writing-Gun beam current, and keep the viewing beam on till the writing beam is turned off.

Failure of scanning while the writing beam is turned on may permanently damage the storage grid. Therefore, provision should be made to cut off automatically the writing-beam current in case of a scanning failure. The writing-beam current can be cut off by an electronic switch which applies -200 volts bias to grid No. 1 of the Writing Gun. This switch should be actuated by a portion of the scanning voltages applied to both sets of deflecting electrodes.

RCA

7315

DISPLAY STORAGE TUBE



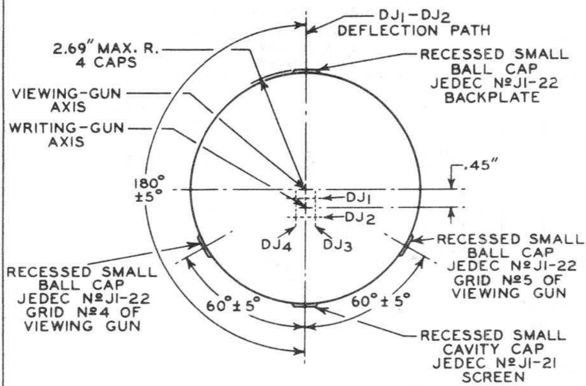
ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

RCA

7315

DISPLAY STORAGE TUBE

TOP VIEW



NOTE: MINIMUM USEFUL VIEWING AREA MAY BE ECCENTRIC WITH RESPECT TO THE TUBE FACE. THE MINIMUM USEFUL VIEWING AREA WILL HAVE DIAMETER OF 3.8".

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.

DEFLECTING ELECTRODES DJ_1 AND DJ_2 ARE NEARER THE SCREEN; DEFLECTING ELECTRODES DJ_3 AND DJ_4 ARE NEARER THE BASE. WITH DJ_1 POSITIVE WITH RESPECT TO DJ_2, THE SPOT WILL BE DEFLECTED TOWARD PIN 8; LIKEWISE, WITH DJ_3 POSITIVE WITH RESPECT TO DJ_4, THE SPOT WILL BE DEFLECTED TOWARD PIN 4.

THE ANGLE BETWEEN THE DEFLECTION PATH PRODUCED BY DJ_1 AND DJ_2 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE BASE KEY BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°. ANGLE BETWEEN DJ_1 – DJ_2 DEFLECTION PATH AND DJ_3 – DJ_4 DEFLECTION PATH IS 90° ± 3°.

THE ANGLE BETWEEN THE DEFLECTION PATH PRODUCED BY DJ_1 AND DJ_2 MAY VARY FROM THE PLANE THROUGH THE TUBE AXIS AND THE SCREEN CAP BY ANGULAR TOLERANCE (MEASURED ABOUT THE TUBE AXIS) OF ± 10°.

7315

7315

TYPICAL CHARACTERISTICS

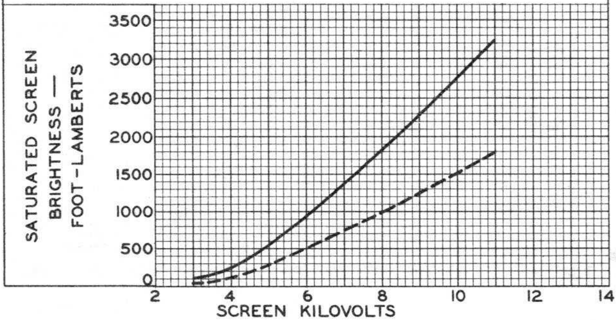
VIEWING SECTION

E$_f$ = 6.3 VOLTS
BACKPLATE VOLTS* = 2

GRID-№ 4 VOLTS*
GRID-№ 3 VOLTS*
GRID-№ 1 VOLTS*
} ADJUSTED FOR BRIGHTEST, MOST UNIFORM DISPLAY.

——— GRID-№ 5 VOLTS* = 210; GRID-№ 2 VOLTS* = 150
- - - - GRID-№ 5 VOLTS* = 150; GRID-№ 2 VOLTS* = 125
* REFERRED TO CATHODE OF VIEWING GUN.

WRITING SECTION
NORMAL OPERATION



92CS-9858

TYPICAL STORAGE-GRID CHARACTERISTIC

VIEWING SECTION

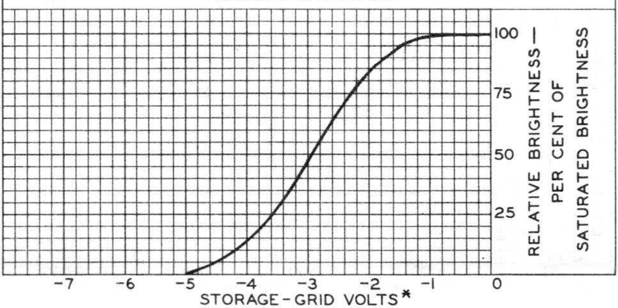
E$_f$ = 6.3 VOLTS
SCREEN VOLTS* = 10000
BACKPLATE VOLTS* = 2
GRID-№ 5 VOLTS* = 150

GRID-№ 4 VOLTS
GRID-№ 3 VOLTS
GRID-№ 1 VOLTS
} ADJUSTED FOR BEST COLLIMATION.

GRID-№ 2 VOLTS* = 125

* REFERRED TO CATHODE OF VIEWING GUN.

WRITING SECTION
NORMAL OPERATION

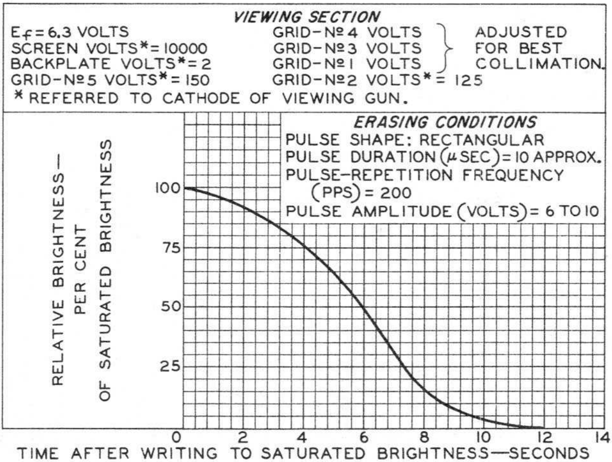


92CS-9861

RCA

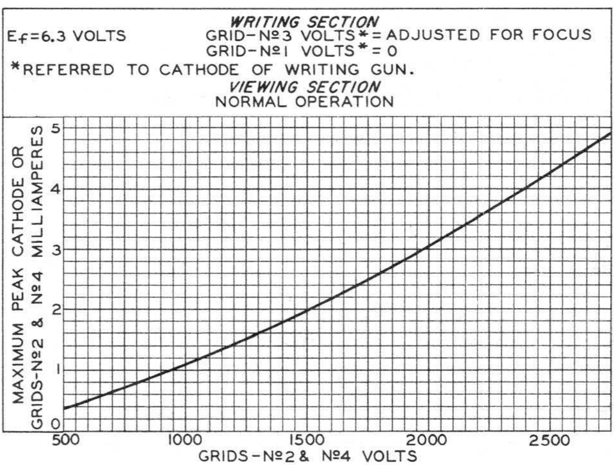
7315

TYPICAL ERASURE CHARACTERISTIC



92CS-9860

WRITING-GUN-CURRENT CHARACTERISTIC



92CS-9859

NUMITRON Digital Display Devices

Segmented Incandescent Types

FEATURES:

- high brightness — fully adjustable
- low voltage operation
- high contrast — segmented digits viewed against a dark background
- compatible with IC Decoder/Drivers such as the RCA CD2500E family
- high-reliability — rugged construction
- wide-spectrum light emission permits unlimited filter selection
- DR2200 Series have a recommended DC segment operating voltage range of 1.5 to 3V
- wide viewing angle
- void of "clutter"
- solderable base pins permits direct PC board mounting
- DR2000 Series fits popular low cost 9-pin miniature socket
- DR2100 and DR2200 Series fit popular TO-5 style, 10-pin socket
- DR2100V1 and DR2200V1 Series have formed lead to facilitate direct PC-board mounting

MECHANICAL	DR2000 Series	DR2100 DR2200 Series	DR2100V1 DR2200V1 Series
Mounting Position	Any	Any	Any
Maximum Overall Length	1.875 in.	1.660 in.	1.705 in
Maximum Seated Length	1.625 in.	1.450 in.	1.540 in
Maximum Diameter	0.785 in.	0.485 in.	0.485 in
Base	9-pin min.	9-pin, 0.230 in. pin circle	9-pin, 0.380 in pin circle

CHARACTERISTICS	DR2000 Series	DR2100 Series	DR2200 Series	
ELECTRICAL				
Recommended DC Segment Operating Voltage Range	3.5 to 5.0	3.5 to 5.0	1.5 to 3.0	V
DC Segment Voltage unless otherwise specified	4.5	4.5	2.5	/
Segment Current	24	24	14	mA
Mean Life Expectancy (at 95% confidence)	100 k	100 k	100 k	h
VISUAL				
Viewing Angle (including angle)	140	120	120	o
Segment Luminance (typ.)	7000	7000	4000	fL
Response Times:				
Ascent to Visibility (typ.)	15	15	8	ms
Descent to 50% of Luminance	<20	<20	<10	ms
Maximum Segment Deflection From a Straight Line	0.005	0.004	0.004	in
Contrast Ratio	30:1	30:1	20:1	

Mechanical Characteristics
DR2000 and DR2100 Series

TEST	CONDITIONS	DC Segment Volts
SHOCK*		
a)	100g, 1 ms, Half-Sine Wave	4.5
b)	50g, 11 ms, Half-Sine Wave	Not Applied
VIBRA-TION		
a)	Variable Frequency: 10 to 44 Hz, 0.1-inch DA	4.5
b)	Variable Frequency: 44 to 200 Hz, 10g	4.5
c)	Variable Frequency: 200 to 800 Hz, 1g	4.5
d)	Variable Frequency: 800 to 2000 Hz, 10g	4.5
e)*	Fatigue: 25 Hz, 2.5g, 96 hr	4.5

DR2200 Series

SHOCK*		
a)	200g, 1 ms, Half-Sine Wave	2.5
b)	50g, 11 ms, Half-Sine Wave	Not Applied
VIBRA-TION		
a)	Variable Frequency: 5 to 60 Hz, 0.1-inch DA	2.5
b)	Variable Frequency: 60 to 500 Hz, 20g	2.5
c)*	Fatigue: 25 Hz, 2.5g, 96 hr	2.5

* Performed in Accordance with MIL-E-1F

The NUMITRON digital display devices will meet the Specifications for operational and crash safety tests; standard environmental vibration for instrument panel location in all types of aircraft, as set by the Radio Technical Commission for Aeronautics (RTCA). Document No. DO-138 Dated June 27, 1968.

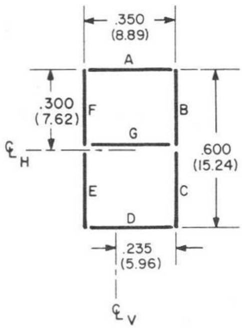
Base Pin Number And Segment Designation Chart

Display	Type	Segment Designations A–H: Base Pin Number 1	2	3	4	5	6	7	8	9
	DR2000 DR2100 DR2200	NC	COMMON	E	D	C	G	A	B	F
with decimal	DR2010 DR2110 DR2115 DR2210 DR2215	H	COMMON	E	D	C	G	A	B	F
	DR2020 DR2120 DR2220	NC	COMMON	NC	NC	NC	D	B	C	A
	DR2030	NC	COMMON	NC	NC	NC	B	NC	A	NC
	DR2130 DR2230	NC	COMMON	NC	NC	NC	NC	B	NC	A

NC = no connection – may be used as tie point.

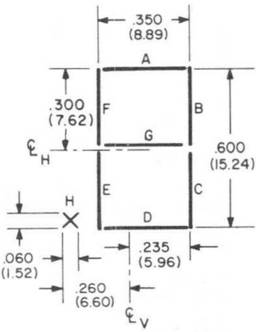
Segment Dimensions and Designations

DR2000



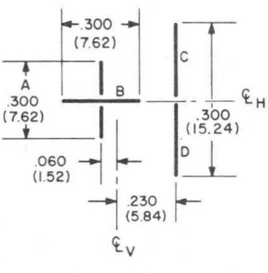
92CS-15754R1

DR2010



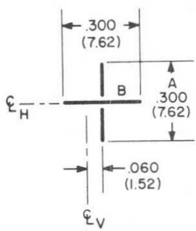
92CS-15755R1

DR2020



92CS-15756R1

DR2030



92CS-15757R1

℄H = Horizontal center line of display (bulb outline dimension F) with pin No. 3 toward viewer. Segment "G" is 0.030" above ℄H.

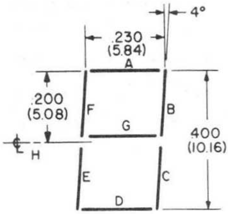
℄H = Vertical center line of device.

DR2100 and DR2200 series; vertical center line of display coincides with vertical center line of device.

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated.

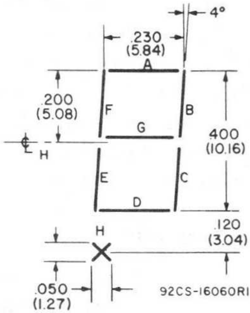
Segment Dimensions And Designations – Cont'd

DR2100
DR2200



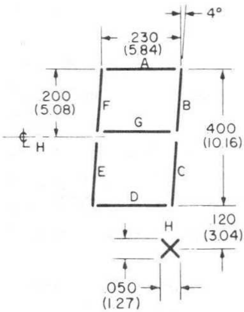
92CS-16059RI

DR2110
DR2210



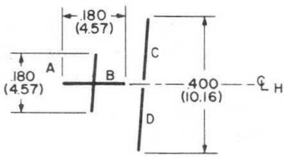
92CS-16060RI

DR2115
DR2215



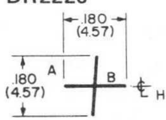
92CS-18023RI

DR2130
DR2230



92CS-16061RI

DR2120
DR2220



92CS-16062RI

OPERATING CONSIDERATIONS

Integrated Circuit Decoder/Driver

The NUMITRON series devices are compatible with the RCA Integrated Circuit Decoder/Driver types CD2500E and CD2501E. The integrated circuit decoder/driver accepts four inputs in BCD (8-4-2-1 code) and decodes them into outputs representing a decimal number from 0 to 9 on a 7-segment display. For basic interconnection of decoder/driver and the NUMITRON display devices see Fig. 4.

Mounting Arrangements

The NUMITRON devices are designed for mounting in either commercially available sockets or directly on printed circuit boards. The DR2000 series devices fit into a standard 9-pin miniature electron tube socket. A commercial PC board socket which permits 0.8-inch center-to-center mounting is available. (See Hardware and Accessories.) The DR2100 and DR2200 series devices are available in two versions: straight leads and V1 versions with formed leads: The straight lead versions may be mounted on 0.5-inch centers directly on PC boards or may be used with standard TO-5 style, 10-pin sockets. The V1 versions facilitate direct PC board mounting on 0.5-inch centers. To use the light shield, DR3000+, the center-to-center mounting must be increased to 0.515-inch.

Figure 5 shows the base diagram and pin-circle dimensions for the various NUMITRON devices.

Character Formation

The following chart gives the base pin connections for forming the various character displays for each device. Pin No. 2 is the common connection for all segments in each device. For example, to form a numeral one using type DR2000, connect the segment voltage between pin No. 2 (common) and pin Nos. 5 and 8.

Digital Character Formation

Display	Device Pin Number Pin No. 2 Common For All Types				
	DR2000 DR2100 DR2200	DR2010 DR2110 DR2115 DR2210 DR2215	DR2020 DR2120 DR2220	DR2030	DR2130 DR2230
0	3,4,5,7, 8,9	3,4,5,7, 8,9			
1	5,8	5,8	6,8		
2	3,4,6, 7,8	3,4,6, 7,8			
3	4,5,6, 7,8	4,5,6, 7,8			
4	5,6,8,9	5,6,8,9			
5	4,5,6, 7,9	4,5,6, 7,9			
6	3,4,5,6, 7,9	3,4,5,6, 7,9			
7	5,7,8	5,7,8			
8	3,4,5,6, 7,8,9	3,4,5,6, 7,8,9			
9	4,5,6,7, 8,9	4,5,6,7, 8,9			
+			7,9	6,8	7,9
−			7	6	7
decimal		1			

Power Supply Requirements
The NUMITRON Series devices do not require critical voltage regulation over the useable operating range. As is the case with any incandescent type device, dc voltage operation above the recommended value may result in reduced life expectancy. For multiplex operation, segment voltage above the normal range may be used provided that the appropriate duty factor is observed. (See NUMITRON Display Device Booklet, NUM-421).

Display
Because these NUMITRON devices have a wide-band light spectrum emission, filters can be used to produce any desired color display. (See Hardware and Accessories.) A display having a broader stroke can be obtained with an etched glass such as "Trusite"* or a diffused filter. For a larger size display, a Fresnel lens may be used.

---

*Trademark "Trusite" Dearborn Glass Co., Chicago, Illinois.

Hardware and Accessories

Sockets

Noval 9-pin Types

DR2000 Series

- Methode Electronics, Inc., M8610 (For 0.8-inch centers) and P460 (standard)
- Cinch Mfg. Co., 121-51-00-040 (standard)

TO-5 10-Lead Types

DR2100, DR2200 Series

- Methode Electronics, Inc., M8620
- Cinch Mfg. Co., 133-99-92-054 and 133-99-92-065
  133-99-92-065 (spread-lead socket)

Filters

Polaroid Corp., Cambridge Mass. 02139

Circular Polarizer:

Standard and Diffused Surface for Broader Stroke

Panelgraphic Corp., West Caldwell, N.J. 07006

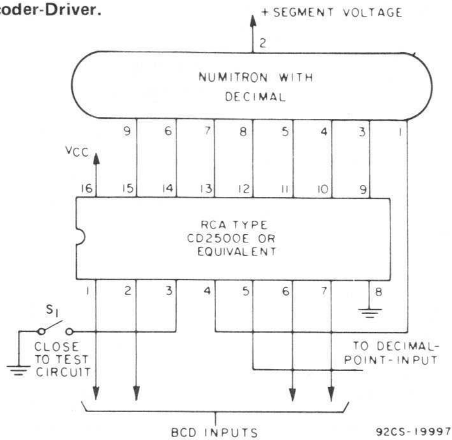
Chromafilter CF-131: Anti-Reflection Filters

Plastic Light Shield to Reduce Side Reflections

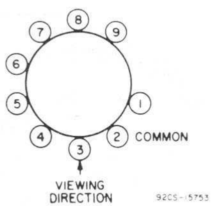
DR2100, DR2200 Series

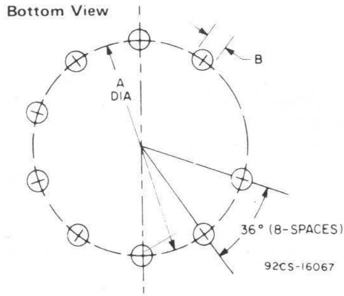
- RCA DS3000

Basic Interconnection Circuit of NUMITRON Device and Decoder-Driver.



Base Diagram and Pin Circle Dimensions — All Series.

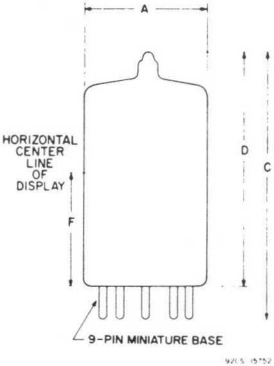




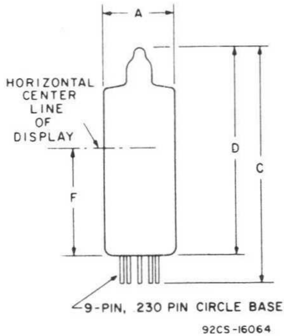
NUMITRON SERIES	DIMENSION (INCHES)		
	A	B	
	NOMINAL	MIN.	MAX.
DR2000	0.468	0.038	0.042
DR2100 and DR2200	0.230	0.018	0.022
DR2100V1 and DR2200V1	0.380	0.018	0.022

Dimensional Outlines

DR2000 Series



DR2100, DR2200 Series

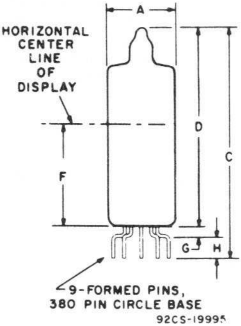


DI-MEN-SION	DR2000 Series				DR2100 and DR2200 Series			
	INCHES		MILLIMETERS		INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
A		0.800		20.32		0.485		12.32
C		1.875		47.62		1.660		42.16
D		1.625		41.27		1.450		36.83
F	0.700	0.730	17.78	18.54	0.625	0.655	15.87	16.64

MILLIMETER DIMENSION DERIVED FROM INCH DIMENSION

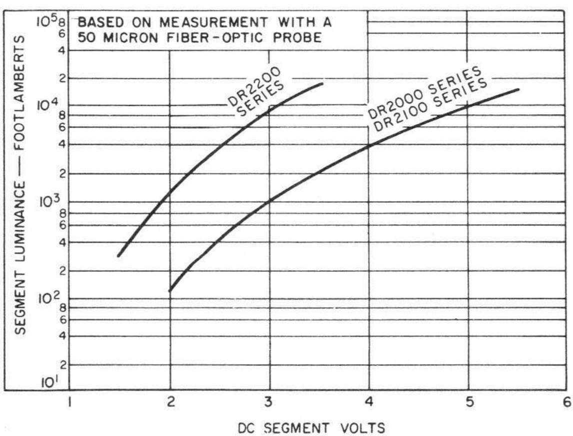
Dimensional Outlines – Cont'd

DR2100V1, DR2200V1 Series

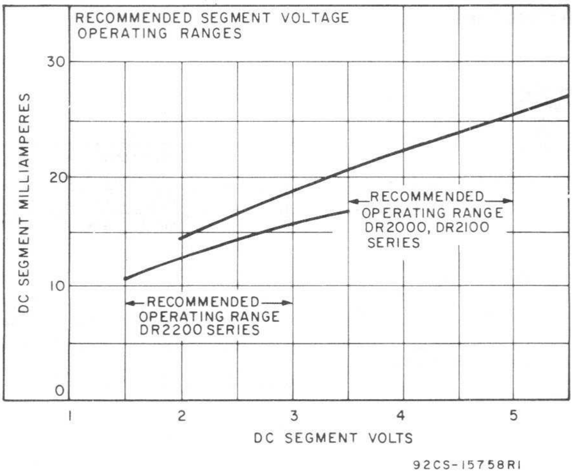


DIMENSION	DR2100V1 and DR2200V1 Series			
	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A		0.485		12.32
C		1.705		43.30
D		1.450		36.83
F	0.625	0.655	15.87	16.64
G	0.060	0.090	1.52	2.28
H	0.135	0.165	3.43	4.19

Segment Luminance Characteristics



Segment Current Characteristics



Envelope Temperature Characteristics