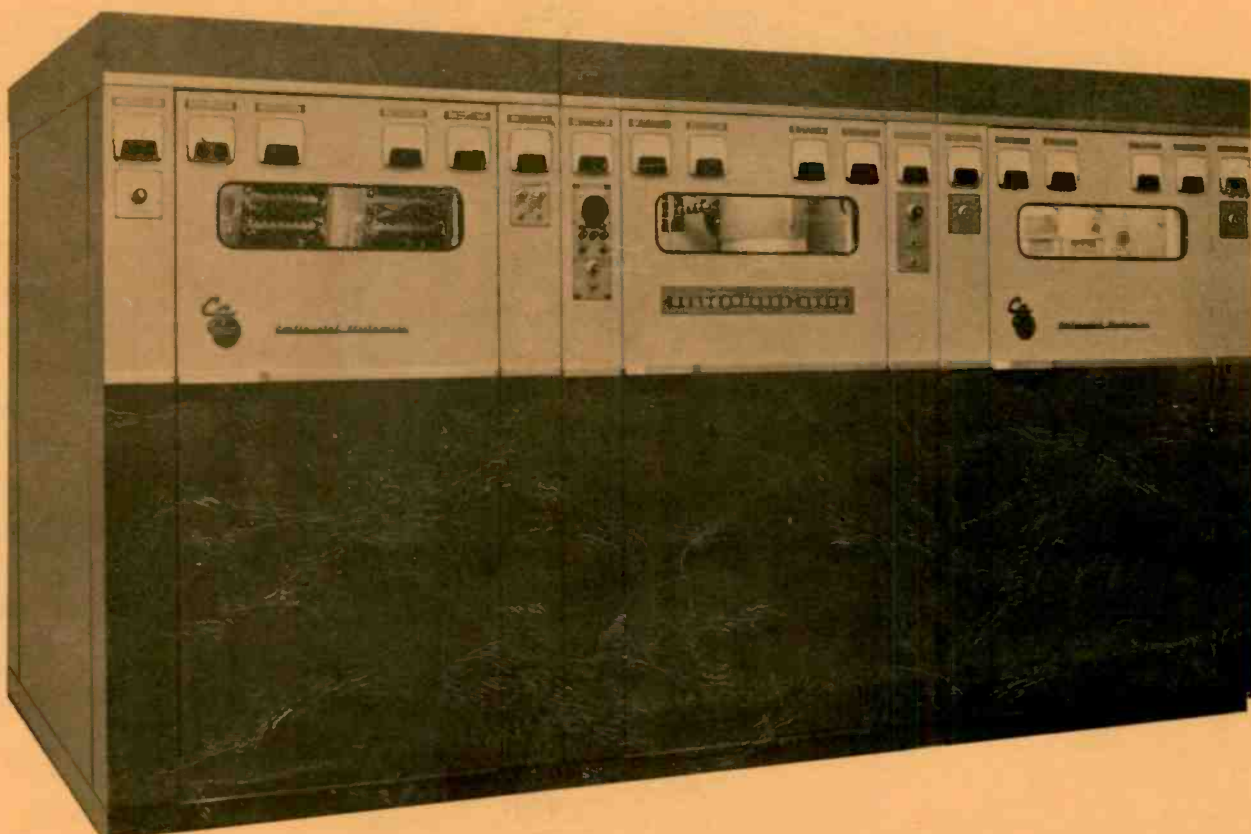
# 317C-1 AM BROADCAST TRANSMITTER

## INSTRUCTION MANUAL



73000-5

PUBLICATION DATE, 1 APRIL 1975

Continental Electronics MFG. CO.
4212 S. BUCKNER BLVD. DALLAS, TEXAS 75217

REV B EQ1-27

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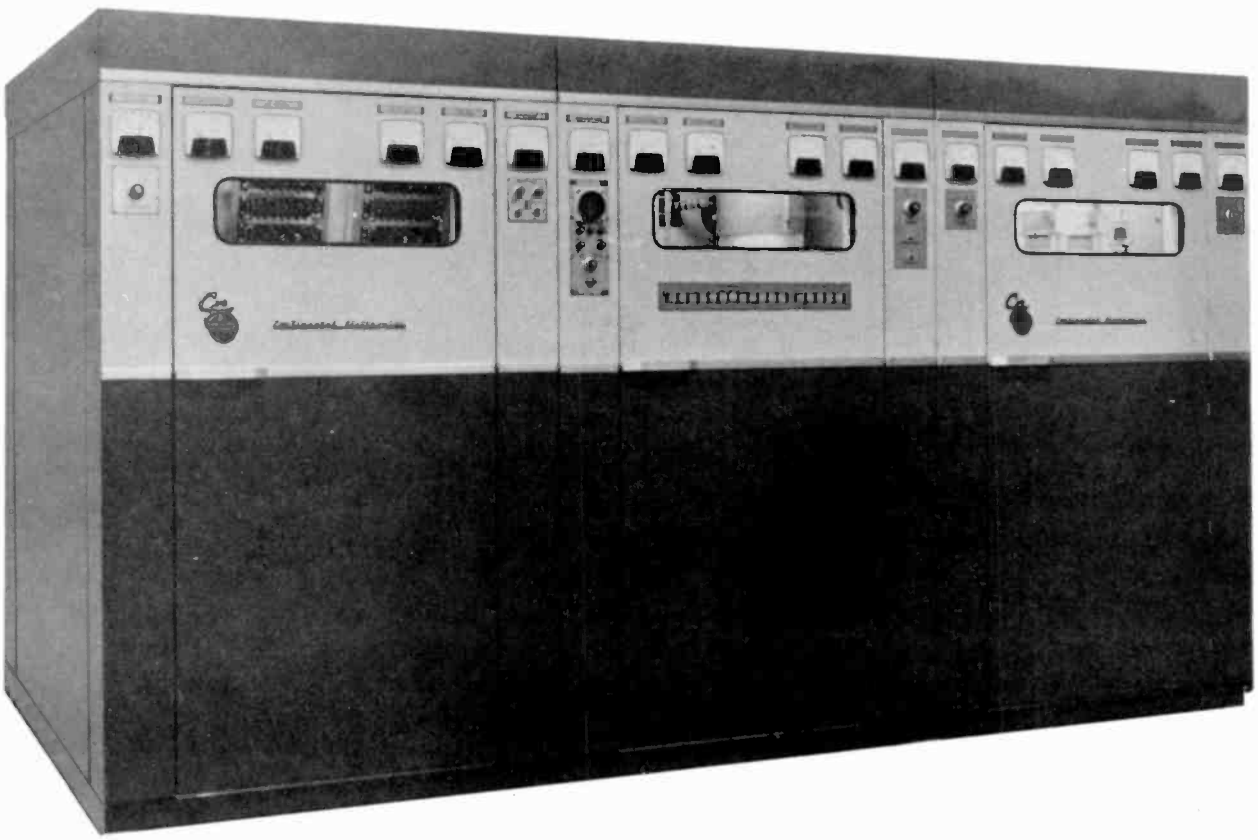

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REV B EQ1-27

#1 CAP IS 0.0082

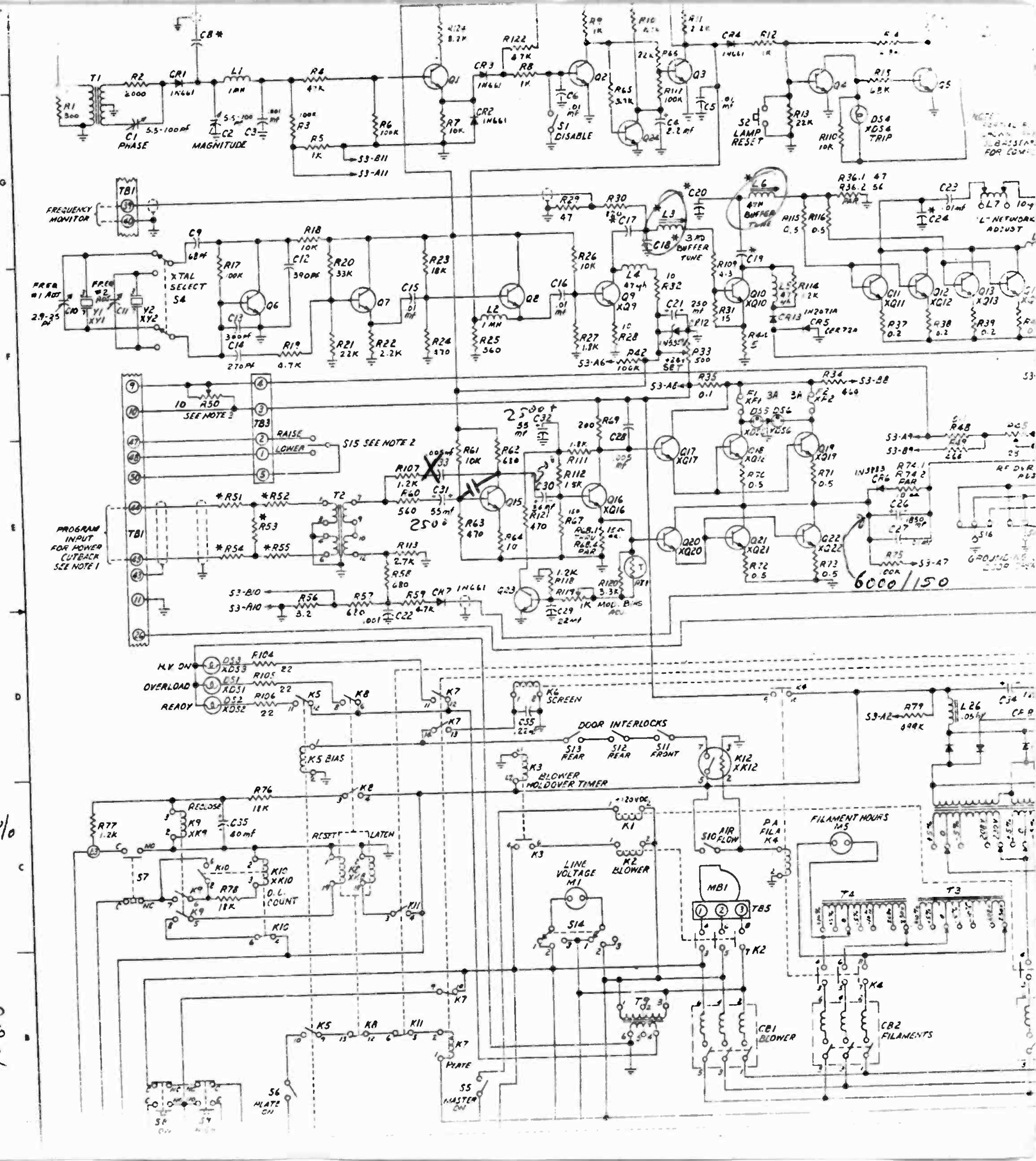
#2 CORRECTED FOR DIR
IT IS 0.012

NON-D SAME AS #1

USE 85°C COMPUTER GRADES

USE 120/7000 Im TYP 2.5%

ADJUST L3 (SOMEWHAT) AND L6 FOR LOWEST Im. TWO NULLS ON L6, USE FIRST. CHECK (+) PKS AND ADJUST ?
ALSO CHECK AMOUNT OF SLATTER



BROADCAST TRANSMITTER CUSTOMER LIST SEPT 1976

## MEDIUM FREQUENCY

| | LOCATION | CUSTOMER | TYPE | FREQ. KHz |
|---|---|---|---|---|
| | | **2000 kW** | | |
| 1. | Belgrade, Yugoslavia | Radio-TV Beograd | D323A | 683 |
| 2. | Saudi Arabia | Northern Project | D323C | – |
| 3. | Saudi Arabia | Northern Project | D323C | – |
| 4. | Saudi Arabia | Northern Project | D323C | – |
| | | **1000 kW** | | |
| 1. | Munich, Germany | VOA | (L.F.)105B | 173 |
| 2. | Okinawa, Ryukyu Is. | VOA | 105B | 1178 |
| 3. | Poro, Philippines | VOA | 105B | 1140 |
| 4. | Ban Phachi, Thailand | VOA | 105B | 1580 |
| 5. | Alexandria, Egypt | UAR | 323B | 773 |
| 6. | San Jose, Costa Rica | LaVoz de la Victor | D320C | 625 |
| 7. | Taipei, Taiwan | BCC | D320D | 600/1000 |
| 8. | Saudi Arabia | Northern Project | D320E | – |
| | | **500 kW** | | |
| 1. | Isle of Rhodes | VOA | (1/2)105B | 1259 |
| 2. | Kavala, Greece | VOA | (1/2)105B | 791 |
| 3. | Bonaire, Neth. Antilles | TWR | 320A | 800 |
| 4. | Enugu, E. Nigeria | ENBC | D319A | 620 |
| 5. | Seoul, Korea | KBS | D319C | 1060 |
| | | **250 kW** | | |
| 1. | Bogota, Colombia | Radio Sutatenza | 319B | 810 |
| 2. | Taipei, Taiwan | Kuang-Hua Station | 319D | 800 |
| | | **200 kW** | | |
| 1. | Hue, South Vietnam | VOF | D318A | 655 |
| | | **150 kW** | | |
| 1. | Juarez, Mexico | XEROK | 318.5A | 800 |
| 2. | Frankfurt, Germany | AFNE | 318.5A | 872 |



PAGES 2 & 3

| | Location | Customer | Type | Freq. kHz |
|---|---|---|---|---|
| | | **100 kW** | | |
| 1. | Taipei, Taiwan | BCC | 318A | 900 |
| 2. | Mexico City, Mexico | XEX | 318A | 730 |
| 3. | Villa de Cura, Venezuela | Radio Rumbos | 318A | 570 |
| 4. | Taipei, Taiwan | Chinese Government | 318A | 1250 |
| 5. | Medellin, Colombia | Acción Cultural Popular | 318A | 590 |
| 6. | Mexico City, Mexico | XEW | 318A | 900 |
| 7. | Karachi, Pakistan | Radio Pakistan | 318A | 830 |
| 8. | Lusaka, Zambia | ZBS | 318A | 629 |
| 9. | Kitwe, Zambia | ZBS | 318A | 1071 |
| | | **50 kW** | | |
| 1. | Tampa, Fla. | WINQ | 101 | 1010 |
| 2. | Memphis, Tenn. | WDIA | 317 | 1070 |
| 3. | Vancouver, B.C. | CKWX | 317 | 1130 |
| 4. | Pasadena, Calif. | KRLA | 317 | 1110 |
| 5. | Detroit, Mich. | WJR | 317B | 760 |
| 6. | San Antonio, Texas | WOAI | 317B | 1200 |
| 7. | Dallas, Texas | KLIF | 317B | 1190 |
| 8. | Los Angeles, Calif. | KFI | 317B | 640 |
| 9. | New York, N.Y. | WOR | 317B | 710 |
| 10. | New York, N.Y. | WHN | 317B | 1050 |
| 11. | Tulsa, Okla. | KVOO | 317B | 1170 |
| 12. | San Francisco, Calif. | KFAX | 317B | 1100 |
| 13. | Tucson, Arizona | KUAT | 317B | 1550 |
| 14. | Shreveport, La. | KEEL | 317B | 710 |
| 15. | Atlanta, Ga. | WSB | 317B | 750 |
| 16. | Harlingen, Texas | KGBT | 317B | 1530 |
| 17. | San Jose, Costa Rica | La Voz de la Victor | 317B | 625 |
| 18. | Alexandria, Egypt | UAR | 317B | 773 |
| 19. | Alexandria, Egypt | UAR | 317B | 773 |
| 20. | Bonaire, Neth., Antilles | TWR | 317B | 800 |
| 21. | Tijuana, Mexico | XETRA | 317C | 690 |
| 22. | Boston, Mass. | WRKO | 317C | 680 |
| 23. | Barquisimeto, Venezuela | YVMR | 317C | 690 |
| 24. | San Juan, P. R. | WKVM | 317C | 810 |
| 25. | Portland, Oregon | KWJJ | 317C | 1080 |
| 26. | Cyprus | DWS | 317C | 602 |
| 27. | Sussex, United Kingdom | DWS | 317C | 926 |
| 28. | Mobile, Alabama | WMOO | 317C | 1550 |
| 29. | Caracas, Venezuela | YVLL | 317C | 670 |
| 30. | Manzini, Swaziland | Trans World Radio | 317C | |
| 31. | Mbabane, Swaziland | Swaziland Commercial | 317C | 539 |
| 32. | International | Radio Caroline | 317C | 1187 |
| 33. | Saigon, So. Vietnam | AFRS | 317C | 540 |
| 34. | Rangoon, Burma | Burma Bcstg. Service | 317C | 955 |
| 35. | Minneapolis, Minn. | WCCO | 317C | 830 |
| 36. | Minneapolis, Minn. | WCCO | 317C | 830 |
| 37. | Saigon, So. Vietnam | AFRS | 317C | 540 |
| 38. | Tokyo, Japan | AFRS | 317C | 810 |
| 39. | Vancouver, B.C. | CHQM | 317C | 1320 |
| 40. | Brindisi, Italy | RAI | 317C | 1448 |
| 41. | Oklahoma City, Okla. | KOMA | 317C | 1520 |

| | Location | Customer | Type | Freq. kHz |
|---|---|---|---|---|
| | | 50 kW Cont'd | | |
| 42. | El Aiun, Spanish Sahara | Radio Sahara | 317C | 656 |
| 43. | Munich, Germany | AFRS | 317C | 1106 |
| 44. | Philadelphia, Pa. | KYW | 317C | 1060 |
| 45. | New York, N.Y. | WOR | 317C | 710 |
| 46. | New York, N.Y. | WNEW | 317C | 1130 |
| 47. | New York, N.Y. | WNEW | 317C | 1130 |
| 48. | Nashville, Tenn. | WLAC | 317C | 1510 |
| 49. | Vancouver, B.C. | CBU | 317C | 690 |
| 50. | Victoria, B.C. | CKDA | 317C | 1220 |
| 51. | Boston, Mass. | WBZ | 317C | 1030 |
| 52. | Fayetteville, N.C. | WFNC | 317C | 940 |
| 53. | Anchorage, Alaska | KYAK | 317C | 650 |
| 54. | Chicago, Illinois | WCFL | 317C | 1000 |
| 55. | Boston, Mass. | WHDH | 317C | 850 |
| 56. | Calgary, Alberta | CFAC | 317C | 960 |
| 57. | Fort Worth, Texas | WBAP | 317C | 820 |
| 58. | Fort Worth, Texas | WBAP | 317C | 820 |
| 59. | Dubia, Arabian Gulf | DBS | 317C | 1250 |
| 60. | Caracas, Venezuela | Radio Capital | 317C | 710 |
| 61. | Toronto, Ontario | CKFH | 317C | 1430 |
| 62. | San Diego, Calif. | KSDO | 317C | 1130 |
| 63. | Atlanta, Georgia | WSB | 317C | 750 |
| 64. | Hartford, Conn. | WTIC | 317C | 1080 |
| 65. | Quebec City, Quebec | CJRP | 317C | 1060 |
| 66. | Ottawa, Ontario | CJRC | 317C | 1150 |
| 67. | Caracas, Venezuela | Radio Rumbos | 317C | 670 |
| 68. | New Delhi, India | All India Radio | 317C | 600 |
| 69. | Toronto, Ontario | CBL | 317C | 740 |
| 70. | Toronto, Ontario | CJBC | 317C | 860 |
| 71. | Toronto, Ontario | CBL | 317C | 740 |
| 72. | Toronto, Ontario | CJBC | 317C | 860 |
| 73. | Mexico City | XEQ | 317C | 940 |
| 74. | Montreal, Quebec | CBF | 317C | 690 |
| 75. | Montreal, Quebec | CBF | 317C | 690 |
| 76. | Montreal, Quebec | CBM | 317C | 940 |
| 77. | Montreal, Quebec | CBM | 317C | 940 |
| 78. | Norfolk, Va. | WZAM | 317C | 1110 |
| 79. | Monterrey, Mexico | XEMR | 317C | 1140 |
| 80. | Winnipeg, Manitoba | CBW | 317C | 990 |
| 81. | Louisville, Kentucky | WHAS | 317C | 840 |
| 82. | Seoul, Korea | HLKV | 317C | 900/710 |
| 83. | Seattle, Washington | KIRO | 317C-1 | 710 |
| 84. | Regina, Saskatchewan | CBK | 317C | 540 |
| 85. | Calgary, Alberta | CHQR | 317C-1 | 810 |
| 86. | Winnipeg, Manitoba | CKY | 317C-1 | 580 |
| 87. | Vancouver, B. C. | CKLG | 317C-1 | 730 |
| 88. | Cincinnati, Ohio | WLW | 317C-1 | 700 |
| 89. | Edmonton, Alta | CHED | 317C-1 | 630 |
| 90. | Ottawa, Ont. | CBO | 317C-1 | 920 |
| 91. | Ottawa, Ont. | CBOF | 317C-1 | 1250 |
| 92. | Dallas, Tex. | KLIF | 317C-1 | 1190 |
| 93. | Edmonton, Alta. | CJCA | 317C-1 | 930 |
| 94. | Coral Gables, Fla. | WVCG | 317C-1 | 1080 |
| 95. | Edmonton, Alta. | CHQT | 317C-1 | 1110 |
| 96. | Toronto, Ont. | CHUM | 317C-1 | 1050 |
| 97. | Rio de Janerio, Br. | Radio Eldorado | 317C-1 | 1180 |

DALLAS

| | Location | Customer | Type | Freq. kHz |
|---|---|---|---|---|
| | | **20 kW** | | |
| 1. | Belgrade, Yugoslavia | RTB | D316F | 1061 |
| 2. | Plymouth, Montseratt West Indies | ARC | D316F | 740 |
| | | **10 kW** | | |
| 1. | Trois-Rivieres, Quebec | CHLN | 316 | 550 |
| 2. | Trois-Rivieres, Quebec | CHLN | 316 | 550 |
| 3. | Prince Albert, Sask. | CKBI | 316 | 900 |
| 4. | Juarez, Mexico | XEJ | 316 | 970 |
| 5. | Kaiserslautern, Germany | AFRS | 316 | 611 |
| 6. | Berlin, Germany | AFRS | 316 | 935 |
| 7. | Nurnberg, Germany | AFRS | 316 | 611 |
| 8. | Grafenwohr, Germany | AFRS | 316 | 611 |
| 9. | Stuttgart, Germany | AFRS | 316 | 1142 |
| 10. | Bremenhaven, Germany | AFRS | 316 | 1142 |
| 11. | Winnipeg, Manitoba | CKRC | 316B | 630 |
| 12. | Regina, Saskatchewan | CKRM | 316B | 980 |
| 13. | Edmonton, Alberta | CJCA | 316B | 903 |
| 14. | No. Battleford, Sask. | CJNB | 316B | 1050 |
| 15. | Montreal, Quebec | CJAD | 316B | 800 |
| 16. | Chatham, Ontario | CFCO | 316B | 630 |
| 17. | St. Boniface, Manitoba | CKSB | 316B | 1050 |
| 18. | Lethbridge, Alberta | CJOC | 316B | 1220 |
| 19. | Flin Flon, Manitoba | CFAR | 316B | 590 |
| 20. | San Francisco, Calif. | KCBS | 316B | 740 |
| 21. | Los Angeles, Calif. | KNX | 316B | 1070 |
| 22. | Los Angeles, Calif. | KFI | 316B | 640 |
| 23. | Salt Lake City, Utah | KSL | 316B | 1160 |
| 24. | St. Louis, Missouri | KMOX | 316B | 1120 |
| 25. | Chicago, Illinois | WBBM | 316B | 780 |
| 26. | Philadelphia, Pa. | WCAU | 316B | 1210 |
| 27. | Dallas, Texas | KLIF | 316B | 1190 |
| 28. | New York,N.Y. | WHN | 316B | 1050 |
| 29. | Calgary, Alberta | CKXL | 316B | 1140 |
| 30. | Havana, Cuba | CMZ | 316B | 1010 |
| 31. | Caracas, Venezuela | Radio Capital | 316B | 710 |
| 32. | Caracas,Venezuela | Radio Rumbos | 316B | 670 |
| 33. | Mesa, Arizona | KDKB | 316B | 1510 |
| 34. | San Francisco, Calif. | KGO | 316B | 810 |
| 35. | Valencia, Venezuela | Radio America | 316B | 890 |
| 36. | Hamilton, Ontario | CKOC | 316B | 1150 |
| 37. | Seattle, Wash. | KIRO | 316B | 710 |
| 38. | Halifax, N.S. | CBH | 316B | 860 |
| 39. | Barinas, Venezuela | Radio Barinas | 316B | 1190 |
| 40. | Maracaibo, Venezuela | Radio Maracaibo | 316B | 740 |
| 41. | Aswan, Egypt | UAR | 316B | 1178 |
| 42. | Alexandria, Egypt | UAR | 316B | 1277 |
| 43. | Seattle, Washington | KOMO | 316B | 1000 |
| 44. | Halifax, N.S. | CHNS | 316B | 960 |
| 45. | Kitchener, Ontario | CHYM | 316B | 1490 |
| 46. | Quito, Ecuador | Radiodifusora Nacional | 316B | 640 |
| 47. | International | Radio Caroline | 316B | 1520 |
| 48. | International | Radio Caroline | 316B | 1520 |
| 49. | International | Radio Caroline | 316B | 1169 |
| 50. | International | Radio Caroline | 316B | 1169 |
| 51. | Mexico City, Mexico | XERC | 316C | 790 |
| 52. | Mexico City, Mexico | XEQR | 316C | 1030 |
| 53. | Mexico City, Mexico | XEJP | 316C | 1150 |
| 54. | Mexico City, Mexico | XELZ | 316C | 1440 |

| | Location | Customer | Type | Freq. kHz |
|---|---|---|---|---|
| | | 10 kW Cont'd | | |
| 55. | Portland, Oregon | KWJJ | 316C | 1080 |
| 56. | Boston, Mass. | WRKO | 316C | 680 |
| 57. | Maracaibo, Venezuela | La Voz de la Fe | 316C | 580 |
| 58. | International | Radio Veronica | 316C | 1562 |
| 59. | International | Radio Veronica | 316C | 1562 |
| 60. | New Orleans, La. | WTIX | 316C | 690 |
| 61. | Lisbon, Portugal | Emissora Nacional | 316C | 620 |
| 62. | Leon, Mexico | XEX | 316C | 730 |
| 63. | Dallas, Texas | KSKY | 316C | 660 |
| 64. | Rosetown, Sask. | CKKR | 316C | 1330 |
| 65. | Punto Fijo, Venezuela | Radio Tropical | 316C | 830 |
| 66. | Maracaibo, Venezuela | RT Circuito | 316C | 980 |
| 67. | Maracaibo, Venezuela | Rt Circuito | 316C | 1180 |
| 68. | Villa Cisneros, Sahara | Radio Sahara | 316C | 998 |
| 69. | Lima, Peru | Radio Popular | 316C | 1040 |
| 70. | Nashville, Tenn. | WLAC | 316C | 1510 |
| 71. | Kansas City, Mo. | WHB | 316C | 710 |
| 72. | Amman, Jordan | HBS | 316C | 1949 |
| 73. | Jacksonville, Fla. | WAPE | 316C | 690 |
| 74. | Amman, Jordan | HBS | 316C | 856 |
| 75. | Calgary, Alberta | CHQR | 316C | 810 |
| 76. | Amman, Jordan | HBS | 316C | 856 |
| 77. | Winnipeg, Manitoba | CJOB | 316F | 680 |
| 78. | Caracas, Venezuela | Radio Uno | 316F | 1340 |
| 79. | Monterrey, Mexico | XEFB | 316F | 630 |
| 80. | Boissevain, Manitoba | CJRB | 316F | 1220 |
| 81. | Oak Hill, W. Va. | WOAY | 316F | 860 |
| 82. | Kitchener, Ont. | CKKW | 316F | 1090 |
| 83. | Kitchener, Ont. | CKKW | 316F | 1090 |
| 84. | Winnipeg, Man. | CKRC | 316F | 630 |
| 85. | Trail, B.C. | CJAT | 316F | 610 |
| 86. | Cranbrook, B.C. | CKEK | 316F | 570 |
| 87. | St. John, N.B. | CHSJ | 316F | 1150 |
| 88. | Simcoe, Ontario | CHNR | 316F | 1600 |
| 89. | Orillia, Ontario | CFOR | 316F | 1570 |
| 90. | Chitre, Panama | Radio Republica | 316F | 720 |
| 91. | Chitre, Panama | Radio Reforma | 316F | 860 |
| 92. | Hato Rey, Puerto Rico | WRAI | 316F | 1520 |
| 93. | Winnipeg, Manitoba | CKY | 316F | 580 |
| 94. | Moose Jaw, Sask | CHAB | 316F | 800 |
| 95. | Chatham, Ont. | CFCO | 316F | 630 |
| 96. | Kitchener, Ont. | CHYM | 316F | 1490 |
| 97. | Winnipeg, Man. | CFRW | 316F | 1470 |
| 98. | Saskatoon, Sask. | CJWW | 316F | 1370 |
| 99. | Tacoma, Wash. | KTAC | 316F | 850 |
| 100. | Saskatoon, Sask. | CFNS | 316F | 860 |
| 101. | Edmonton, Alberta | CHFA | 316F | 680 |
| 102. | Toronto, Ont. | CHIN | 316F | 1540 |
| 103. | Ottawa, Ont. | CBOF | 316F | 1250 |

| | Location | Customer | Type | Freq. kHz |
|---|---|---|---|---|
| | | **10 kW Cont'd** | | |
| 104. | Ottawa, Ont. | CBO | 316F | 920 |
| 105. | Saskatoon, Sask | CKOM | 316F | 1250 |
| 106. | Victoria, B. C. | CFAX | 316F | 1070 |
| 107. | Caracas, Ven. | CRN | 316F | 960 |
| 108. | Caracas, Ven. | CRN | 316F | 1080 |
| 109. | Peterborough, Ont. | CKPT | 316F | 1420 |
| 110. | Hempstead, N. Y. | WHLI | 316F | 1100 |
| 111. | Sioux Falls, S. Dak. | KSOO | 316F | 1140 |
| 112. | Caracas, Ven. | YVKH | 316F | 1300 |
| 113. | Caracas, Ven. | YVRT | 316F | 990 |
| 114. | Taipel, Taiwan | CAR | 316F | 590 |
| 115. | Taipel, Taiwan | CAR | 316F | 590 |
| 116. | Taipel, Taiwan | CAR | 316F | 590 |
| 117. | Taipel, Taiwan | CAR | 316F | 910 |
| 118. | Coral Gables, Fla. | WVCG | 316F | 1080 |
| 119. | Bonavista, Nfld. | CBC | 316F | 750 |
| 120. | Hamilton, Ont. | CHAM | 316F | 1280 |
| 121. | Regina, Sask | CJME | 316F | 1300 |
| 122. | Prince Albert, Sask | CKBI | 316F | 900 |
| 123. | Swift Current, Sask | CKSW | 316F | 570 |
| 124. | Altona, Man. | CFAM | 316F | 950 |
| 125. | Yorkton, Sask | CJGX | 316F | 940 |
| 126. | Sarnia, Ont. | CKJD | 316F | 1110 |
| 127. | Vancouver, Wash. | KGAR | 316F | 1550 |
| | | **5 kW** | | |
| 1. | Gilmer, Tex. | KHYM | 315 | 1060 |
| 2. | Montgomery, Ala. | WHHY | 315 | 1440 |
| 3. | Logan, W. Va. | WVOW | 315 | 1230 |
| 4. | Detroit, Michigan | WWJ | 315 | 950 |
| 5. | Seattle, Washington | KAYO | 315 | 1150 |
| 6. | Anchorage, Alaska | KBYR | 315 | 700 |
| 7. | Villa de Cura, Venezuela | Radio Rumbos | 315 | 560 |
| 8. | Portland, Oregon | KPAM | 315B | 1410 |
| 9. | Regina, Sask. | CKCK | 315B | 620 |
| 10. | Toledo, Ohio | WSPD | 315B | 1370 |
| 11. | San Juan, P.R. | WHOA | 315B | 870 |
| 12. | Mayaguez, P.R. | WORA | 315B | 760 |
| 13. | Denver, Colorado | KOA | 315B | 850 |
| 14. | Tulsa, Oklahoma | KVOO | 315B | 1170 |
| 15. | Oklahoma City, Oklahoma | KTOK | 315B | 1000 |
| 16. | Atlanta, Georgia | WAOK | 315B | 1380 |
| 17. | Ponce, P.R. | WPRP | 315B | 910 |
| 18. | Luxor, Egypt | UAR | 315B | 1079 |
| 19. | Sohag, Egypt | UAR | 315B | 1142 |
| 20. | Assut, Egypt | UAR | 315B | 980 |
| 21. | El-Minya, Egypt | UAR | 315B | 1079 |
| 22. | Miami, Florida | WQAM | 315B | 560 |
| 23. | Salem, Indiana | WSLM | 315B | 1220 |
| 24. | Modesto, Calif. | KFIV | 315B | 1360 |
| 25. | Johannesburg, S. Africa | SABC | 315B | 1034 |
| 26. | Johannesburg, S. Africa | SABC | 315B | 827 |

| | Location | Customer | Type | Freq. kHz |
|---|---|---|---|---|
| | | 5 kW Cont'd | | |
| 27. | Johannesburg, S. Africa | SABC | 315B | 1286 |
| 28. | Abilene, Texas | KRBC | 315B | 1470 |
| 29. | Houston, Texas | KXYZ | 315B | 1320 |
| 30. | Portland, Oregon | KPOK | 315B | 1320 |
| 31. | Waterbury, Conn. | WQQM | 315B | 1590 |
| 32. | Nashville, Tenn. | WMAK | 315C | 1300 |
| 33. | Albuquerque, N. M. | KRKE | 315C | 610 |
| 34. | Chicago, Ill. | WCFL | 315C | 1000 |
| 35. | Dallas, Texas | WRR | 315C | 1310 |
| 36. | Siloam Springs, Ark. | KUOA | 315F | 1290 |
| 37. | Hartford, Conn. | WPOP | 315F | 1410 |
| 38. | Endicott, N. Y. | WENE | 315F | 1430 |
| 39. | Pittsburg, Pa. | WTAE | 315F | 1250 |
| 40. | Pittsburg, Pa. | WTAE | 315F | 1250 |
| 41. | Englewood, Colo. | KWBZ | 315F | 1150 |
| 42. | Aberdeen, So. Dak. | KKAA | 315F | 1560 |
| 43. | San Antonio, Texas | KITE | 315F | 930 |
| 44. | Springfield, Missouri | KWTO | 315F | 560 |
| 45. | Oklahoma City, Oklahoma | WKY | 315F | 930 |
| 46. | Saskatoon, Sask. | CFQC | 316F* | 600 |
| 47. | Regina, Sask. | CKCK | 316F* | 630 |
| 48. | Huntington, W. Va. | WKEE | 316F* | 800 |
| 49. | Seattle, Wash. | KAYO | 316F* | 1150 |
| 50. | Pittsburgh, Pa. | WWSW | 315F | 970 |
| 51. | Okla. City, Oklahoma | WKY | 315F | 930 |
| 52. | Moncton, N.B. | CBAF | 315F | 1300 |
| 53. | Saudi Arabia | M.O.I. | 315F | Mobile |
| 54. | Saudi Arabia | M.O.I. | 315F | Mobile |
| 55. | Saudi Arabia | M.O.I. | 315F | Mobile |
| 56. | Saudi Arabia | M.O.I. | 315F | Mobile |
| 57. | Saudi Arabia | M.O.I. | 315F | Mobile |
| 58. | Saudi Arabia | M.O.I | 315F | Mobile |
| 59. | Dearborn, Mich. | WNIC | 316* | 1310 |
| 60. | Vancouver, Wash. | KVAN | 316* | 1480 |

* 316F 10 kW Transmitters Wired for 5 kW operation

| Location | Customer | Type | Freq. kHz |
|---|---|---|---|
| | **1 kW** | | |
| 1. Kaiserslauten, Germany | AFRS | 314-2 | 611 |
| 2. Hiedelburg, Germany | AFRS | 314-2 | 1304 |
| 3. Berlin, Germany | AFRS | 314-2 | |
| 4. Bremerhaven, Germany | AFRS | 314-2 | |
| 5. Grafenwoehr, Germany | AFRS | 314-2 | |
| 6. Hof, Germany | AFRS | 314-2 | 1142 |
| 7. Ulm, Germany | AFRS | 314-2 | 1142 |
| 8. Garmisch, Germany | AFRS | 314-2 | 1502 |
| 9. San Juan, P. R. | AFRS | 314-2 | |
| 10. Akron, Ohio | WHLO | 314-2 | 640 |
| 11. Albany, Oregon | KWIL | 314-2 | 790 |
| 12. Owen Sound, Ont. | CFOS | 314-2 | 560 |
| 13. Havana, Cuba | Radio Mamba | 314-C | 730 |
| 14. Lima, Peru | Radio Juz | 314-C | 590 |
| 15. Detroit, Mich. | WWJ | 314-C | 950 |
| 16. Tillsonburg, Ont. | CHOT | 314-C | 1510 |
| 17. Maracibo, Venezuela | Radio Reloj | 314D | 1330 |
| 18. Chatham, Ont. | CFCO | 314D | 630 |
| 19. Juarez, Mexico | XECJC | 314D | 1490 |
| 20. Caracas, Venezuela | Radio Uno | 314D | 1300 |
| 21. St. Paul, Minn. | WMIN | 314D | 1400 |
| 22. Aiken, S. C. | WLOW | 314D | 1300 |
| 23. Langley, B. C. | CJJC | 314D | 850 |
| 24. San Juan, P. R. | WIAC | 314D | 740 |
| | **500 Watt** | | |
| 1. Bissau, Guinea | Emissora Provincial | 313D | |
| | **250 Watt** | | |
| 1. Houghton, Mich. | WHDF | 312 | 1400 |
| 2. Clarksville, Tenn. | WDXN | 312 | 540 |
| 3. Tillsonburg, Ont. | CKOT | 312 | 1510 |
| 4. Devils Lake, N. D. | KDLR | 312 | 1240 |

# HIGH FREQUENCY

## 500kW

| Location | | Customer | Type |
|---|---|---|---|
| 1. | Greenville, N. Car. | VOA | 420A |
| 2. | Greenville, N. Car. | VOA | 420A |
| 3. | Greenville, N. Car. | VOA | 420A |
| 4. | Greenville, N. Car. | VOA | 420A |
| 5. | Greenville, N. Car. | VOA | 420A |
| 6. | Greenville, N. Car. | VOA | 420A |
| 7. | Barcelona, Spain | Radio Liberty | 420A |
| 8. | Barcelona, Spain | Radio Liberty | 420A |

## 250 kW

| Location | | Customer | Type |
|---|---|---|---|
| 1. | Bonaire, Neth. Antilles | Trans World Radio | 419C |
| 2. | Kavala, Greece | VOA | 419D |
| 3. | Kavala, Greece | VOA | 419D |
| 4. | Kavala, Greece | VOA | 419D |
| 5. | Kavala, Greece | VOA | 419D |
| 6. | Kavala, Greece | VOA | 419D |
| 7. | Kavala, Greece | VOA | 419D |
| 8. | Kavala, Greece | VOA | 419D |
| 9. | Kavala, Greece | VOA | 419D |
| 10. | Kavala, Greece | VOA | 419D |
| 11. | Kavala, Greece | VOA | 419D |
| 12. | Seoul, Korea | KBS | 419D |

## 100 kW

| Location | | Customer | Type |
|---|---|---|---|
| 1. | Dacca, Pakistan | Radio Pakistan | 418A/B |
| 2. | Lisbon, Portugal | Emissora Nacional | 418B |
| 3. | Lisbon, Portugal | Emissora Nacional | 418B |
| 4. | Lisbon Portugal | Emissora Nacional | 418B |
| 5. | Lisbon, Portugal | Emissora Nacional | 418B |
| 6. | Rawalpindi, Pakistan | Radio Pakistan | 418B |
| 7. | Salman Pak, Iraq | Radio Baghdad | 418C |
| 8. | Salman Pak, Iraq | Radio Baghdad | 418C |
| 9. | Lourenco Marques, Mozambique | Radio Clube Mozambique | 418C |
| 10. | Fu Wei, Taiwan | Central Broadcasting Station | 418D |
| 11. | Fu Wei, Taiwan | Central Broadcasting Station | 418D |
| 12. | Fu Wei, Taiwan | Central Broadcasting Station | 418D |
| 13. | Fu Wei, Taiwan | Central Broadcasting Station | 418D |
| 14. | Scituate, Mass. | WYFR | 418D |
| 15. | Scituate, Mass. | WYFR | 418D |
| 16. | Lampertheim, Germany | Radio Liberty | 418D |
| 17. | Lampertheim, Germany | Radio Liberity | 418D |

| | Location | Customer | Type |
|---|---|---|---|
| | | **100 kW (continued)** | |
| 18. | Bilbis, Germany | Radio Liberty | 418D-1 |
| 19. | Bilbis, Germany | Radio Liberty | 418D-1 |
| 20. | Bilbis, Germany | Radio Liberty | 418D-1 |
| 21. | Bilbis, Germany | Radio Liberty | 418D-1 |
| 22. | Bilbis, Germany | Radio Liberty | 418D-1 |
| 23. | Bilbis, Germany | Radio Liberty | 418D-1 |
| 24. | Bilbis, Germany | Radio Liberty | 418D-1 |
| 25. | Bilbis, Germany | Radio Liberty | 418D-1 |
| 26. | Lampertheim, Germany | Radio Liberty | 418D-1 |
| 27. | Lampertheim, Germany | Radio Liberty | 418D-1 |
| | | **50 kW** | |
| 1. | Red Lion, Pa. | WINB | 417B |
| 2. | Bonaire, Neth. Antilles | Trans World Radio | 417B |
| 3. | San Jose, Costa Rica | LaVoz de la Victor | 417B |
| 4. | Scituate, Mass. | WYFR | 417B |
| 5. | Montserrat, W. Indies | (ARC) Deutsche-Welle | 417C |
| | | **10 kW** | |
| 1. | Caracas, Venezuela | La Voz de la Patria | 416B |
| 2. | Bissau, Guinea | Emissora Provincial | 416B |
| 3. | Sao Tome | Emissora Provincial | 416B |
| 4. | Guatemala City, Guat. | La Voz de la Guatemala | 416B |
| 5. | Quito, Ecuador | Radiodifusora Nacional | 416B |
| 6. | U. S. Government | | 416D |
| 7. | U. S. Government | | 416D |
| 8. | Innsbruck, Austria | ORF | 416D |
| | | **5 kW** | |
| 1. | Torino, Italy | Galileo Ferraris | 415C |
| | | **1 kW** | |
| 1. | Overseas | AFRTS | 412-2 |
| 2. | Lima, Peru | Radio Luz | 414C |
| 3. | Bissau, Guinea | Emissora Provincial | 414D |
| 4. | Sao Tome | Emissora Provincial | 414D |

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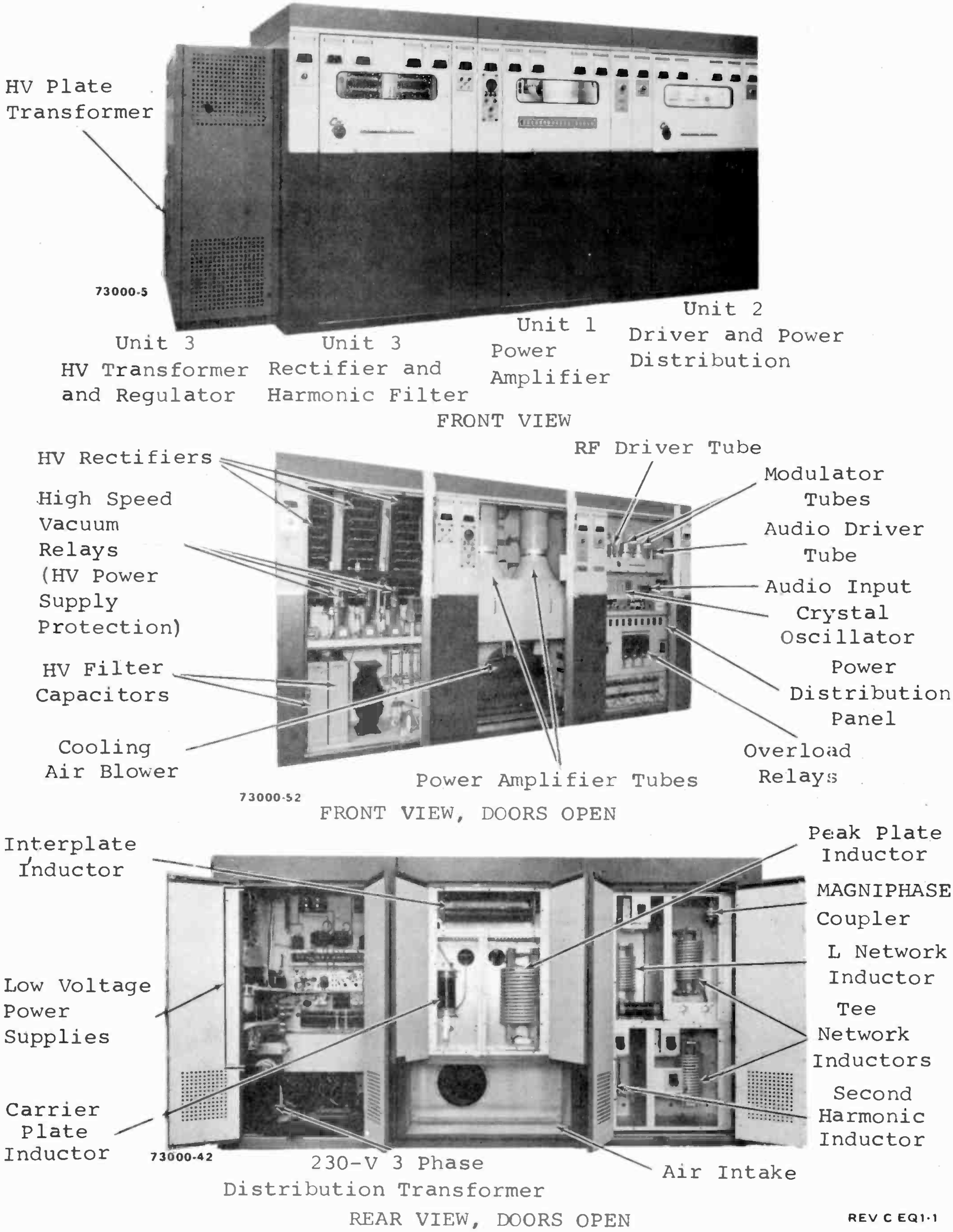
# LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Continued)



SCHEMATICS




REV C EQ1-1

Figure 1. Type 317C-1 AM Broadcast Transmitter

# SECTION 1 - DESCRIPTION

## 1.1 INTRODUCTION

This handbook contains instructions for the installation, operation and maintenance of the Continental Electronics Type 317C-1 50 kW AM Broadcast Transmitter. It is effective on S/N 65 and above and should not be used for transmitters with lower serial numbers.

The Type 317C-1 Transmitter can be tuned to operate on any fixed frequency between 535 and 1620 kHz.

The Type 317C-1 Transmitter consists of a main cabinet group and the associated High Voltage Transformer and Regulator cabinet (Figure 1).

The main cabinet group consists of three separate cabinets each of which is 48" wide, 54" deep and 78" high. These cabinets are located side-by-side and are bolted together. The right end cabinet houses the Driver and Power Distribution which is designated Unit 2. The center cabinet houses the Power Amplifier and is designated Unit 1. The left end cabinet houses the H.V. Rectifier and Harmonic Filter and is designated Unit 3. The H.V. Transformer and Regulator cabinet is also designated Unit 3 and is generally located adjacent to the Rectifier and Harmonic Filter cabinet, although it may be located wherever the customer desires.

The Type 317C-1 Transmitter is completely self-contained, in that no external driver or exciter unit is required. Only an audio input, a transmitting antenna, and a source of 4160 Volt, three phase, primary power are required for operation.

Electrical parts lists and other supplementary data are supplied within this handbook.

Throughout the descriptive pages of this handbook, a symbol number, when referred to, will carry the unit number as a prefix to the symbol number in order to simplify location on one of the schematics or Electrical Parts Lists. Separate schematics and Electrical Parts Lists are used for each of the three units.

## 1.2 GENERAL DESCRIPTION OF CIRCUITRY (Figure 2)

a. RF Circuits. Solid state circuitry is employed in the low level stages which consists of an oscillator, RF switch, RF amplifier and RF output. A 4-400A is used as a Driver Amplifier for the Final Power Amplifier. The final power amplifier configuration is a combination of the screen-grid modulated amplifier and the high-efficiency Doherty amplifier.

Overall rf feedback is tapped from the output of the transmitter, rectified and applied as negative feedback to the first

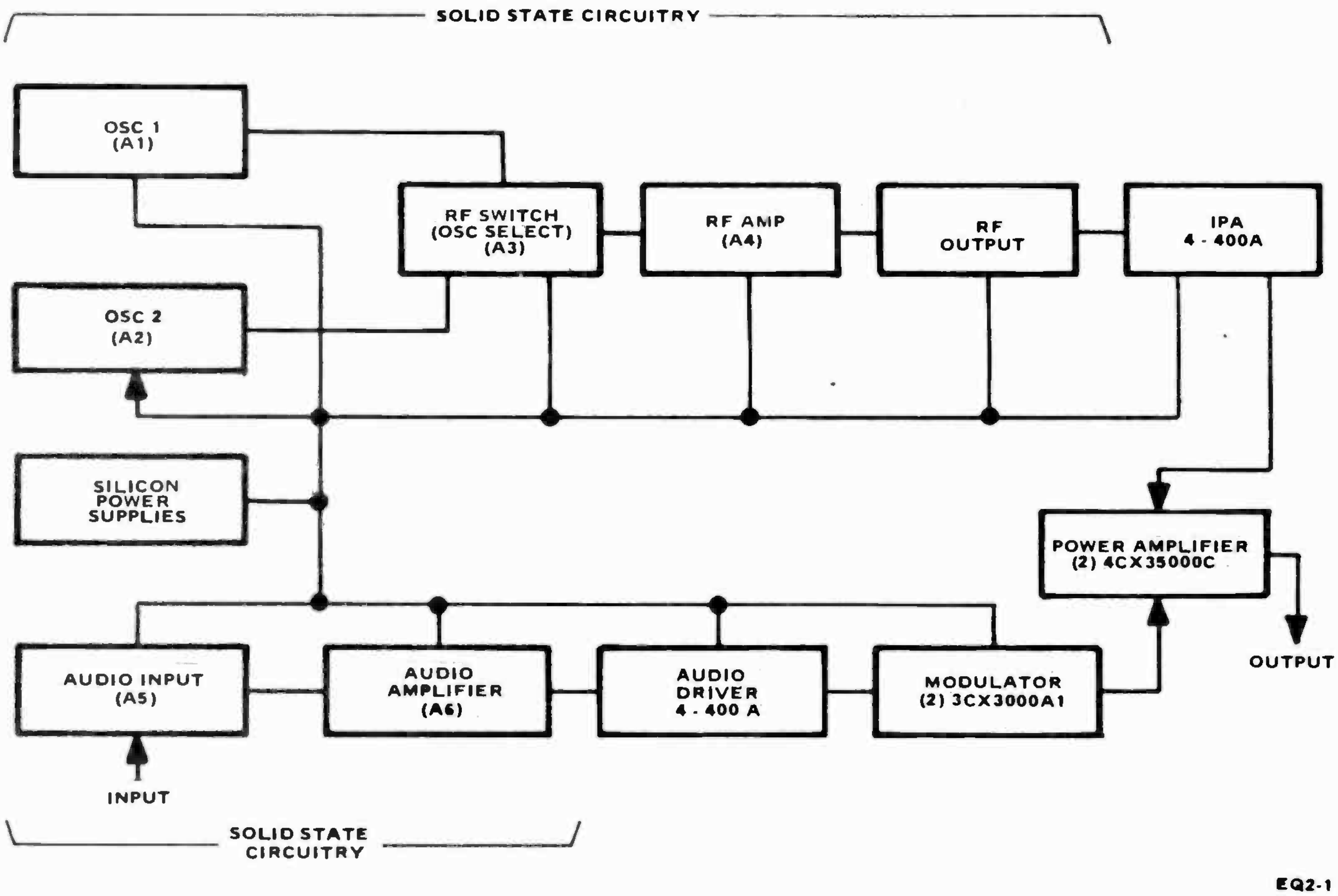



Figure 2. Simplified Block Diagram, Type 317C-1 AM Broadcast Transmitter

audio amplifier stage to reduce noise and improve linearity.

b. Tetrode Final Amplifier. The use of tetrode tubes in the final power amplifier stage offers many advantages:

(1) A minimum of rf driving power is required, since a tetrode is inherently a high gain tube.

(2) Modulator power requirements are greatly reduced. Constant rf excitation is applied to the control grid of the tetrode tube while audio modulation is applied to the screen grid. Since rf output is controlled linearly by screen grid potential, with relatively low values of screen current, an excellent method of modulation is possible with very little power being consumed in the modulator.

(3) The screen grid is operated at ground potential with respect to the rf signal and serves as a shield between the control

grid and the plate of the tube, thereby eliminating the necessity of neutralization.

(4) Slightly higher efficiency than that obtained from a high-level plate modulated transmitter is possible through the use of a tetrode tube in the high efficiency Doherty amplifier circuit.

c. Screen Grid Modulation. Screen grid modulation as used in the Type 317C-1 Transmitter offers the following advantages:

(1) Since the required modulation power is very low, small audio components may be used. Large transformers and chokes are not used in the resistance-coupled audio system. Harmonic distortion and distortion due to intermodulation are very low, therefore better transmitter performance is realized.

(2) Through the use of screen grid modulation, the audio and modulation system can be designed with full control of phase-shift characteristics, making possible the use of overall feedback in the transmitter. Transmitter performance is thereby further improved. Overall feedback can not be used in high-level plate-modulated transmitters.

d. Power Supplies. Semiconductor rectifiers are used in the high voltage, low voltage and bias power supplies. Semiconductor rectifiers require no warmup, and can be operated efficiently at temperatures below 32 degrees Fahrenheit. The semiconductor rectifiers produce a minimum amount of heat, can be packaged more compactly, and have very long life characteristics.

In unattended or remote operation, the semiconductor characteristics become even more attractive.

Since semiconductor rectifiers are used in the Continental Electronics broadcast transmitters, no damage will result when the equipment is turned on from a cold start.

Continental Electronics AM broadcast transmitters are also well suited for high ambient temperature operation and tropical climates.

## 1.3 OPTIONAL EQUIPMENT AND CIRCUITRY

The necessary circuitry for connection of optional equipment is provided in the Type 317C-1 Transmitter.

The Type 317C-1 can easily be connected to operate with any remote control, automatic logging and sub-audible telemetering equipment currently available.

The Type 317C-1 can be supplied with automatic Power Cutback to 25 kW or 10 kW.

The Type 317C-1 can be supplied for operation with 380 V to 600 V, 3 phase, 50 Hz or 60 Hz primary power source.

## 1.4 TECHNICAL CHARACTERISTICS

| | |
|---|---|
| AF Input Impedance | 150/600 ohms |
| AF Input Level (100% Modulation) | +10 ±2 dBm |
| AF Frequency Response 30-10,000 cps | ±1.5 dB |
| AF Harmonic Distortion 50-7,500 cps (95% Modulation) | Less than 3% |
| Noise, unweighted (below 100% Modulation at 1,000 cps) | 60 dB |
| Carrier Shift (100% Modulation) | Less than 3% |
| Modulation Type | High Level Screen |
| Type of Emission | A3 |
| Frequency Range | 535-1620 KHz |
| Frequency Stability | ±5 Hz |
| Output Impedance | 50 ohms to 230 ohms (as specified by customer) |
| Power Output Capability | 56,000 watts |
| Maximum Ambient Operating Temperature | 122°F (50°C) |
| Power Consumption at 0% Modulation | 82 kw |
| (100% Modulation) | 120 kw |
| Power Supply | 460 volts, 3 phase, 3 wire, 50/60 Hz |
| Power Factor | 0.9 lagging |
| Permissible Combined Voltage Variation and Regulation | ±5% Voltage<br>±2.5% Frequency |

DIMENSIONS

| UNIT | WIDTH | HEIGHT | DEPTH |
|---|---|---|---|
| Power Amplifier Unit | 48" | 78" | 54" |
| Driver and Power Distribution Unit | 48" | 78" | 54" |

## 1.4 TECHNICAL CHARACTERISTICS (Continued)

DIMENSIONS (Cont)

| UNIT | WIDTH | HEIGHT | DEPTH |
|---|---|---|---|
| Rectifier and Harmonic Filter Unit | 48" | 78" | 54" |
| HV Transformer and Regulator Unit | 24" | 67" | 46" |

| | |
|---|---|
| NET WEIGHT OF MAIN CABINET GROUP | 5,000 lbs. |
| NET WEIGHT OF HV TRANSFORMER AND REGULATOR UNIT | 2,300 lbs. |

## 1.5 TUBES, PC BOARDS AND SEMICONDUCTORS

| FUNCTION | QUANTITY | TYPE |
|---|---|---|
| Oscillator (PC Board) | 2 | CEMC Type 121832 |
| RF Switch (PC Board) | 1 | CEMC Type 123578 |
| RF Amplifier (PC Board) | 1 | CEMC Type 119941 |
| RF Output Circuit | 2 | 2N3584 |
| RF Driver | 1 | 4-400A |
| Power Amplifier | 2 | 4CX35000C |
| Audio Input (PC Board) | 1 | CEMC Type 119936 |
| Audio Amplifier (PC Board) | 1 | CEMC Type 119915 |
| Audio Driver | 1 | 4-400A |
| Modulator | 2 | 3CX3000A1 |
| Magniphase, Sampling and Protection | 4 | 1N661 silicon diode |
| Magniphase Regulator | 1 | 1N5359B Zener diode |
| Feedback Rectifier | 1 | 1N661 silicon diode |
| Magniphase Amplifiers & Timing | 7 | 2N3133 PNP silicon transistors |
| Magniphase Output | 1 | 2N5344 PNP silicon power transistor |
| Scope Rectifiers | 4 | 67D100H04TNN |

## 1.5 TUBES, PC BOARDS AND SEMICONDUCTORS (Continued)

| FUNCTION | QUANTITY | TYPE |
|---|---|---|
| Audio Cathode | 1 | 1N3883 |
| Regulator | 1 | 1N2996B |
| -150 Volt Rectifiers | 6 | 67C024H20TTS |
| -600 Volt Rectifiers | 6 | 67C024H20TTS |
| +750 Volt Rectifiers | 6 | 67C024H20TTS |
| +3 KV Rectifiers | 6 | 67C075H20TTS |
| +5.5 KV Rectifiers | 6 | 67C075H20TTS |
| +16 KV Rectifiers | 36 | CR286 silicon diode |

## 1.6 RF EXCITER (Figure 3)

The solid state rf exciter consists of four printed circuit cards; two oscillators, one rf switch, one rf amplifier, and a rf output stage, which is not a printed circuit card.

### RF OSCILLATOR 1 and 2

These two cards are identical and interchangeable.

An International Crystal Mfg. Co., high accuracy, high frequency crystal is used in the oscillator circuit. The frequenty range is 5.040 MHz to 7.5 MHz. The frequency stability is .0005% over a range of -10° +60°C.

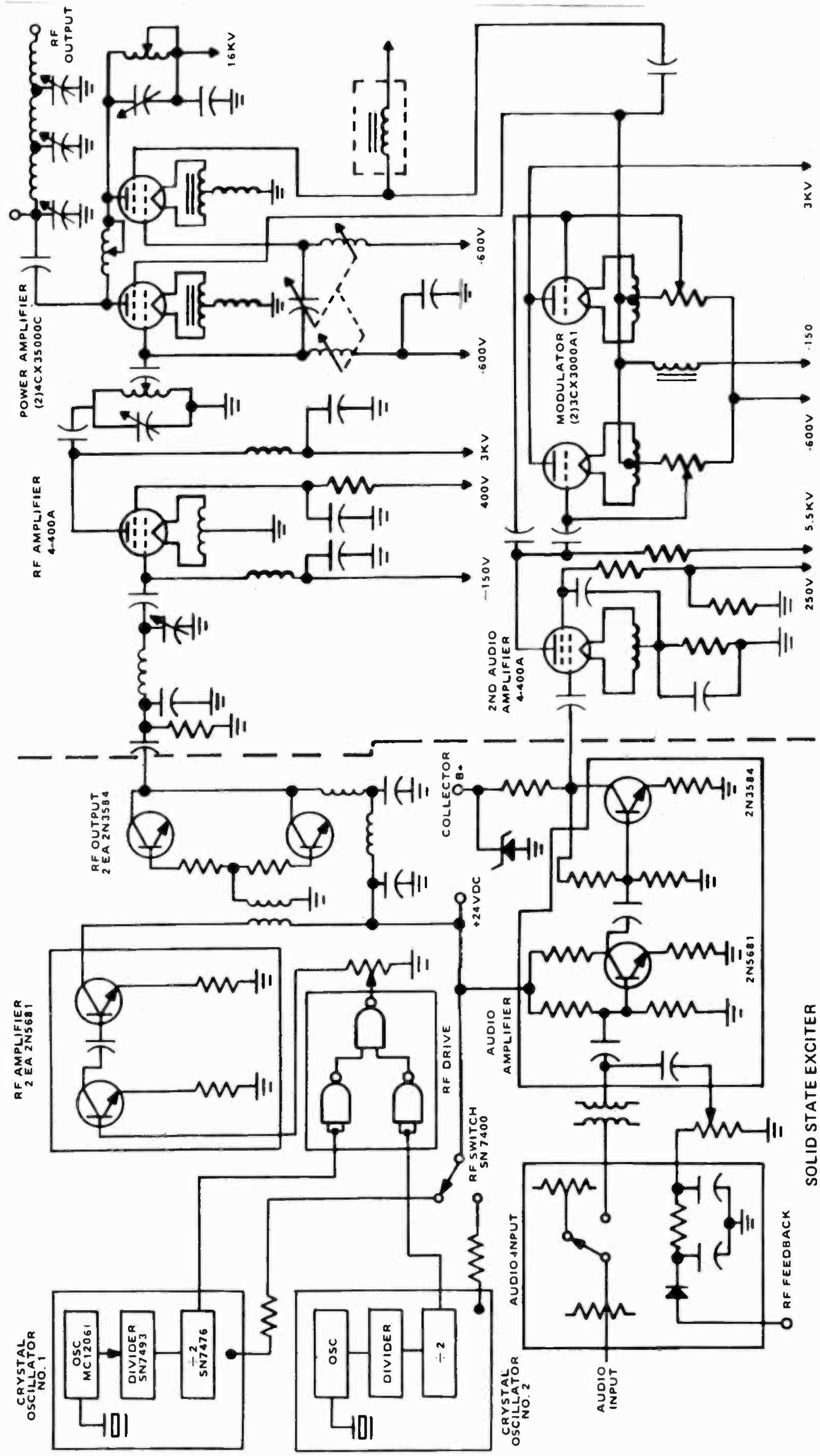
The oscillator is a Motorola integrated circuit crystal oscillator, MC12061. This oscillator chip requires only two external components in addition to the crystal and trimmer capacitors.

The output of this oscillator is compatible with ECL or TTL logic. The output is on the crystal fundamental frequency.

The oscillator is followed by two integrated circuit dividers. The first is a 4 bit binary counter, SN 74931, programmed to divide by 2, 3, 4 or 5 depending on the operating frequenty. Strap connections are provided to connect for any of these divide-by ratios. The final integrated circuit, a SN 7476, is a dual J-K flip-flop with both clock inputs tied together.

This circuit provides a divide-by ratio of 2 at all times giving a final output on the operating frequency.

Magniphase cutoff of the output RF is accomplished by placing a logical zero to the clear input of the number 2 flip-flop.




EQ2-2

Figure 3. Simplified Schematic Diagram, Type 317C-1 AM Broadcast Transmitter

RF SWITCH

The oscillator is followed by an RF switch which utilizes a quad 2-input "Nand" gate integrated circuit, an SN 7400. This gate will allow one oscillator signal to pass on to the RF amplifier. When no signal is present on one input of this card, pull down resistors hold this input to logical zero allowing the other signal to toggle the switch. By using this method of switching, no mechanical contacts are involved in the RF signal path.

RF AMPLIFIER

The RF amplifier is composed of two 2N5681 transistors. The first stage operates Class A to provide sufficient gain to drive the second Class C stage. The input drive level is controlled by a potentiometer mounted external to this card. The collector of the second stage is transformer coupled to the base of the RF drive stage. The toroid transformer is broadband and requires no tuning.

RF OUTPUT

The RF output stage is not a printed circuit card. This stage consists of two 2N3584 transistors connected in parallel. Base drive is equalized by series resistors in each base lead. The output of this stage is coupled through a pi network to the grid of the 4-400 IPA. This network is adjusted to provide approximately 10 ma grid current in the IPA stage. A small pickup coil, coupled to the pi-network inductance provides a sample of unmodulated RF for frequency monitoring purposes.

1.7 RF DRIVER AMPLIFIER (Figure 3)

The rf driver amplifier stage utilizes a type 4-400A tube. The plate circuit of this stage is shunt fed. Coupling to the grids of the final power amplifier stage is accomplished by tapping the inductor in the tuned driver plate circuit. The cathode current of the driver stage is monitored on IPA CATHODE CURRENT meter 2M2. The grid current of this stage is monitored on TEST METER 2M1 when TEST METER switch 2S7 is in the $I_g$ IPA position.

1.8 FINAL POWER AMPLIFIER (Figure 3)

The rf power amplifier stage utilizes two type 4CX35000 ceramic tetrode tubes connected in a high-efficiency screen-modulated amplifier configuration*. The output of one tube is connected directly to the load. This tube is referred to as the peak tube, since it supplies power on the positive peaks of modulation. The output of the second tube, which is referred to as the carrier tube, is separated from the load by a quarter wave line or 90° network. The carrier tube

*Patent Nos. U.S. - 3,314,024, Canada - 764,605, Great Britain - 1,044,479, France - 1,432,543.

is a conventional grounded cathode class C amplifier that supplies the full 50-kw of carrier power when no modulation is applied. The screen of this tube is maintained at +750 Vdc by a separate low voltage power supply. When modulation is applied, the positive portion of the audio signal has no effect on the carrier tube, since the plate "swing" cannot be increased with an increase in screen voltage. The negative portion of the modulating signal will cause a linear decrease in the plate "swing". In order to completely cut the tube off for 100% negative modulation, the screen must be modulated pass zero volts or cathode potential. Carrier cut-off occurs with approximately -150 volts applied to the screen grid, thus, a negative going half sine wave of 900 volts peak amplitude is sufficient to modulate the carrier tube.

The same dc plate voltage and rf grid excitation which is applied to the carrier tube is also applied to the peak tube, but the peak tube delivers no power at carrier condition, as its plate current is cutoff by the -150 volts screen potential. As the modulating signal starts its "swing" above carrier level toward peak positive condition, the peak tube begins to deliver power to the load until, at peak positive crest, the tube is delivering twice the carrier level power into the load. The impedance inverting characteristic of the 90° plate network reflects an impedance of one-half that of the carrier tube at carrier conditions to the carrier tube. The carrier tube plate swing remains the same as at carrier level so that power delivered to the load is twice carrier level because the impedance is effectively halved. With both tubes delivering twice carrier power to the load, the necessary four-times-carrier-power for 100% modulation is obtained.

Since the voltage contributed by the carrier tube undergoes a 90° phase lag by the time it appears across the load, it is necessary to introduce a 90° phase advance in the carrier-tube grid driving voltage so that the power output of both tubes will combine in the proper phase relationship. This is accomplished by a leading 90° grid network. This network has a 1:1 transformation ratio so that both tubes receive equal drive.

Individual power amplifier grid current meters (PEAK GRID CURRENT meter 1M3 and CARRIER GRID CURRENT meter 1M4) are located on the front door of the Power Amplifier unit.

A combination of fixed and grid-leak bias is used in the power amplifier stage. The fixed bias is sufficient to protect the tubes in the event of loss of excitation.

The carrier tube is operated as a class C amplifier. This is possible, since the linearity of the positive peaks is dependent upon the linearity of the screen-grid, rather than the control-grid operating conditions. Since the plate voltage "swing" does not increase with positive modulation, a much higher dc plate voltage can be used than in a plate-modulated transmitter. With 16 kVdc, a plate efficiency of 75% is achieved. The final power amplifier tubes are rated at a plate dissipation of 35,000 watts each; however, only 14 kW is dissipated with this efficiency. A smaller tube would not be satisfactory because there must be filament emission sufficient for 100-kW output on positive modulation peaks.

An improvement in carrier shift is accomplished by adding 10 ohms resistance in the cathode of the carrier tube. This small amount of degeneration does not affect other performance.

Cooling requirements for the final power amplifier are reduced due to the high efficiency of the stage. A single low-pressure blower is quite sufficient to cool both power amplifier tubes, the rf driver amplifier tube and the modulator tubes.

## 1.9 OUTPUT NETWORKS (Figure 3)

The output network of the Type 317C-1 Transmitter includes a Pi network to match the plate circuit of the rf power amplifier to the input of an "L" section. The "L" section is followed by a "tee" network which is capable of matching a wide range of load impedances.

The shunt arm of the "L" network includes a series resonant trap for the second harmonic of the carrier frequency. The "tee" network input arm includes a parallel resonant trap tuned to the third harmonic of the carrier frequency. These harmonic filter circuits ensure proper attenuation of all harmonic frequencies in compliance with Federal Communications Commission rule; Section 73.40, Subparagraph 14.

## 1.10 AUDIO AMPLIFIERS (Figure 3)

Audio is fed to the audio input card which contains the input audio pad, audio and RF cutoff relay and the overall feedback rectifier circuit.

Audio output goes to the input transformer which, because of weight, is mounted on the chassis. The secondary of the transformer is connected to the audio amplifier card which contains the first two audio amplifiers and the magniphase audio cutoff transistor.

The first audio stage, a 2N5681 transistor, is a Class A amplifier with a high frequency roll-off circuit connected from collector to base. Feedback is applied to the lower terminal of the input transformer secondary.

The second audio stage, a 2N3584 transistor, is operated Class A from a +120V zener regulated voltage dropped from the power amplifier screen supply. This stage also has high frequency roll-off connected collector to base. Output of this stage is RC coupled to the 4-400A audio driver tube. The output of the second audio amplifier is resistance coupled to the grids of the modulator tubes. With a cathode follower type modulator, the second audio amplifier stage is required to develop a large audio voltage "swing."

Compensation for the non-linearity of the carrier tube is accomplished in the cathode of the second audio stage. A diode is connected across the cathode resistor and biased so as to conduct when the audio signal approaches 95% modulation. This effectively shorts out the second audio cathode resistor causing an increase in gain of the stage.

## 1.11 MODULATOR (Figure 3)

The modulator stage utilizes two type 3CX3000A1 tubes which are connected in a conventional cathode follower circuit. An audio impedance is placed in the cathode circuit to obtain sufficient audio "swing." A bias potential of -150 Vdc is applied to the cathodes of the modulator tubes. The modulator audio output is coupled through capacitors to the rf power-amplifier carrier-tube screen grid and connected directly to the rf power-amplifier peak-tube screen grid.

## 1.12 FEEDBACK AND NOISE REDUCTION

Corrective networks and interstage feedback circuits are employed to shape the response of the audio amplifier for correct performance on application of overall feedback. A sample of the rf output is taken from a static drain choke, rectified, and applied as negative audio feedback to the first audio stage. Feedback in the order of 12 dB is normally applied, for improved linearity and noise reduction. The applied feedback can be adjusted by means of a front panel control.

Noise reduction is accomplished in the cathode of the audio driver stage with a hum balance control (2R52) across the second audio stage filament transformer 2T11. Additional noise reduction is accomplished by sampling the filament voltage of 2T14. The sampling diodes provide a half sine wave output $180^{\circ}$ out of phase with the carrier tube filament voltage. The phase of this voltage is selected by the phase control and the amplitude is adjusted by the amplitude control. All three controls are adjusted for minimum noise with no feedback applied.

If no reduction in noise can be accomplished, the phase of the incoming main power must be changed. Pull the main breaker and change two wires either at the load side of the main fuse box or at the input connection on the back of 2CB11. Phase rotation must now be changed for the main blower motor at 1TB3. After this has been accomplished readjust all controls for minimum noise. This figure should be approximately -60 dB or better.

## 1.13 POWER SUPPLIES (Figures 21 to 23)

All power supplies in the Type 317C-1 Transmitter employ semiconductor rectifiers. The power supplies are protected by magnetic circuit breakers. The contactors which energize these power supplies have auxiliary contacts which are connected in series to form an interlock sequence for protection of equipment and operating personnel.

a. The High Voltage Power Supply (Figure 24). The high voltage power supply provides plate voltage for the rf power amplifier tubes. The power transformer for the high voltage power supply is located in the HV Transformer and Regulator Cabinet. Three-phase 460-volt primary power is applied to the primary windings of the hv transformer. A delta-wye switch is provided on the HV Transformer and Regulator Unit to connect the primary windings of the plate transformer in a wye configuration for reduced power operation or in a delta configuration for normal operation at full power. In the wye position approximately 10 kV dc is applied to the rf power amplifier tubes. This reduced plate voltage is useful in preliminary tuning and testing. In the delta position, full plate voltage of 16 kV is applied to the rf power amplifier tubes.

Power amplifier plate voltage and power-amplifier carrier-tube screen voltage are varied simultaneously to adjust (regulate) transmitter output power. This is accomplished by motor-driven variable transformers which supply input voltage to the High-Voltage Power Supply and to the +750-Volt Power Supply. The drive motors of these variable transformers are controlled simultaneously by front panel controls on the Power Amplifier Unit.

Dc overload protection is provided in the negative lead of the high voltage power supply. The total rf power-amplifier plate current is metered in the negative lead.

Vacuum switches are provided in each of the ac lines from the transformer secondary windings to the high voltage rectifiers. These high-speed vacuum breakers, operating in a few milliseconds, will open in the event of an overload in the rectifier or in the rf power amplifier. When opened, the vacuum switches connect 400 ohms of resistance into the hv transformer secondary ac line, eliminating the possibility of sustained damaging current flow through the fault point and at the same time providing transient protection. When an overload occurs, causing one of the vacuum switches to open, the plate contactor is also opened. Since protection is provided by the rapid operation of the vacuum switches, a standard magnetic contactor is used for closing and opening the plate transformer primary circuit.

b. The 5.5-kV/3-kV Power Supply. The 3-kV power supply provides plate voltage for the modulator tubes and the RF driver stage. The 5.5-kV power supply provides plate voltage for the second audio amplifier stage. These power supplies utilize a single three-phase transformer. The 3-kV power supply secondary winding is wye connected to a three-phase bridge rectifier. The current capacity of the 3-kV supply is sufficient to operate as the "lower half" of the 5.5-kV power supply. The 5.5-kV power supply is composed of a 2.5-kV delta-connected secondary with the negative side of its three-phase bridge rectifier connected to the positive side of the 3-kV supply to obtain a total of 5.5-kV.

c. The +750-Volt Power Supply. The +750-Volt Power Supply utilizes a three-phase transformer with both the primary and secondary windings connected in a delta configuration. The secondary windings of this transformer are connected to a full-wave bridge rectifier. This power supply provides +750 volts for the rf power-amplifier carrier-tube screen grid. A motor-driven three-phase variable transformer is connected to the input of this power supply which is controlled simultaneously with the plate voltage for transmitter output power adjustment.

d. The -600 Volt Power Supply. The -600 Volt Power Supply provides fixed bias voltages for the rf power amplifier and rf driver tubes. (These tubes are also connected to obtain some grid-leak bias.) This supply also provides fixed bias for the modulator tubes. PA and MOD BIAS meter 2M5 indicates the fixed bias voltage applied to the rf power amplifier and modulator tubes. The -600 Volt Power Supply utilizes a three-phase full-wave rectifier. Both the primary and secondary windings of the power transformer are connected delta.

e. The -150 Volt Power Supply. The -150 Volt Power Supply provides screen voltage for the rf power amplifier peak tube. This power supply utilizes a three-phase full-wave bridge rectifier with the primary and secondary of the power transformer connected delta. Primary power is supplied to the -150 Volt Power Supply through SCREEN SUPPLIES circuit breaker 2CB9 and contactor 2K21. Primary power is also supplied through circuit breaker 2CB9 and relay 2K21 to the +750-Volt Power Supply which supplies screen voltage for the rf power amplifier carrier tube.

1.14 PROTECTIVE CIRCUITS

The protective circuits incorporated in the Type 317C-1 Transmitter are of three basic types:

(1) Fully automatic circuit breakers provide ac overload protection for the filament, low voltage, high voltage, and control circuitry and for the bias power supplies. The 230-volt ac distribution circuit is also protected. The magnetic circuit breakers can be reset immediately after an overload tripoff. Magnetic circuit breakers protect the following circuits:

2CB1 - CONTROL - Protects control circuitry, relay coils, oscilloscope, and tuning motors.

2CB2 - LAMPS & MOTORS - Protects primary of indicator-lamp transformer 2T2.

2CB3 - LOW LEVEL FILA - Protects primaries of filament transformers 2T11, 2T12, 2T13, 2T14, 2T15 and PS1.

2CB4 - CARRIER FILA - Protects primary of filament transformer 2T7.

2CB5 - PEAK FILA - Protects primary of filament transformer 2T8.

2CB6 - BLOWER - Protects cooling air blower motor 1MB1.

2CB7 - BIAS SUPPLY - Protects primary of bias transformer 2T3.

2CB8 - LV SUPPLY - Protects primary of low voltage transformer 2T4.

2CB9 - SCREEN SUPPLIES - Protects primaries of power amplifier screen voltage transformers 2T5, 2T6 and variable transformer 2T16.

2CB10 - 230 VOLT SUPPLY - Protects primary of the distribution transformer 2T1.

2CB11 - PLATE SUPPLY - Protects "hv regulator" variable transformers 3T4 through 3T9 and the primary of hv power supply transformer 3T3.

(2) Dc overcurrent relays protect the individual power amplifier tubes and the High Voltage Power Supply. There are three dc overcurrent relays: 2K23, 2K24, and 2K25, which protect the rf power-amplifier carrier tube, the rf

power-amplifier peak tube, and the High Voltage Power Supply, respectively. Relays 2K23 and 2K24 are connected in the cathode leads of the carrier and peak tubes. Relay 2K25 is connected in the negative return lead of the high voltage power supply. The overload relays in the Type 317C-1 Transmitter are fast-acting sensitive relays, equipped with current shunts which set their adjustment.

### 1.15 MAGNIPHASE LINE PROTECTION SYSTEM

The Magniphase Line Protection System protects the radio frequency transmission lines, antennas, and antenna tuning equipment from damage due to line faults, or to arcs and overloads at any of these points. An arc-over is usually caused by a lightning discharge, which in itself may do little damage. The major damage occurs if the transmitter is allowed to remain on, supplying energy to sustain this arc. The energy may be a small percent of the total output of the transmitter, and damage may occur before the arc-over is "detected" by overload devices in the transmitter.

The Magniphase System is designed to detect an impedance change in the load presented to the transmitter. The most common disturbance in an atenna system is an arc-over caused by a nearby lightning discharge. Such an arcover will cause an impedance change which is sensed by the Magniphase System as an unbalance condition at the input of the Magniphase bridge circuit. The Magniphase System will then initiate control circuit functions to shut the transmitter down for a period of approximately 60 milliseconds. The transmitter will then be re-energized, but if the arc still exists, it will be shut down again. An arc of this type should burn itself out very rapidly without sustaining rf energy.

The Magniphase Line Coupler consists of a capacitor and an inductor which samples transmission line voltage and current respectively. The two rf samples from the coupler are fed to a balanced bridge circuit which is located in the Rectifier and Harmonic Filter Unit on the right side of the front door. The two rf samples are balanced by means of controls on the front panel of the Magniphase Unit so no direct current flows in the bridge output circuit unless there is a change in one or both of the samples. In this manner, the bridge is sensitive to either a change in voltage and current magnitude or to a change in phase. An arc or other disturbance at any point in the system will cause either or both of these changes to occur.

The diode current is drawn through a resistor (R13) in a direction that causes a positive pulse to be applied to the base of the fault pulse amplifier Q1 which is connected in an emitter follower configuration to provide isolation between the diode circuit and the one-shot multivibrator Q2, Q3, and Q4. Transistor Q2, which is normally cut-off due to lack of base bias, is driven into conduction by the pulse from the fault pulse amplifier and in turn drives Q4, which is in saturation, toward cut-off. Transistor Q3, also in saturation, is cut-off allowing C17 to charge thru R24, which gives the time constant. When C17 has charged sufficiently to cause Q4 to go into saturation, the timing cycle is completed. A positive rectangular pulse of approximately 150 milliseconds duration appears at the collector Q4 during its cut-off interval. This pulse is applied to the base of transistor Q5. Transistor Q5, which is normally cut-off, applies a positive voltage to the base of transistor 2A4Q3. When 2A4Q3 conducts, a ground is applied to oscillators 2A1 and 2A2 which inhibits oscillator output for the duration of the timed pulse.

Transistor Q5 also applies a positive voltage to the base of transistor 2A6Q3 for timed duration. Transistor 2A6Q3 conducts and applies a ground to the base of transistor 2A6Q2 causing 2A6Q2 to stop conducting and interrupting the audio to the grid of the 2nd audio amplifier.

The pulse from Q4 is also coupled to the base of Q7. Transistors Q7 and Q8 are connected in a direct coupled multivibrator with a 28-volt lamp used as the collector load for Q7 which is normally cut-off. Transistor Q8 is in saturation due to bias provided by resistor R36. As Q7 is driven into conduction by the pulse from Q4, the two transistors (Q7 and Q8) reverse operating modes and the trip lamp (DS2) is lighted by the collector current of Q7. The transistors remain in this condition until the lamp reset switch (S3) is depressed. When depressed, it grounds the base of transistor Q7 and restores the transistors (Q7 and Q8) to their normal operating condition.

The output of the magniphase circuit removes rf excitation and audio modulation for approximately 150 milliseconds the pulse is on.

This allows any arc or fault on the antenna system time to clear before rf power is reapplied. If the fault remains, the rf bridge is again unbalanced and another fault pulse is applied to Q1 and circuit action is repeated.

### 1.16 CONTROL CIRCUITS

a. General. An understanding of the control circuits of the Type 317C-1 Transmitter will be helpful when it is necessary to locate control malfunctions.

Refer to paragraph 3.1 CONTROLS AND INDICATORS of this handbook which lists the operating controls and indicators and their functions. Also refer to Figure 25, Control Ladder Diagram.

b. Control Voltage. A center-tapped winding on 230-volt distribution transformer 2T1 provides 115-Vac control voltage, which is applied to the control circuitry when CONTROL circuit breaker 2CB1 is set to the on position. When LAMPS & MOTORS circuit breaker 2CB2 is set to the on position, 115-Vac control voltage is applied to the primary of indicator-lamp transformer 2T2. Control voltage and indicator-lamp voltage are supplied to all units in the transmitter.

c. Transmitter Starting Sequence. When CONTROL circuit breaker 2CB1 and LAMPS & MOTORS circuit breaker 2CB2 are closed, MASTER ON lamp 1DS1 will light green and MASTER OFF lamp 1DS2 will light yellow. The other indicator lamps will provide the indications listed in paragraph 3.1 CONTROLS AND INDICATORS of this handbook for "transmitter shut-down" conditions.

When MASTER ON switch 1S1 is depressed, the "on" coil of latching relay 2K1 will be energized. Normally-open contacts 3 and 4 of relay 2K1 will close in the filament interlock circuit, applying 115 Vac to blower holdover time-delay relay 2K14. Contacts 8 and 9 of relay 2K1 will also close, lighting MASTER ON lamp 1DS1 yellow, and lighting MASTER OFF lamp 1DS2 green.

When blower holdover relay 2K14 is energized, normally open contacts 6 and 4 of relay 2K14 will close, applying 115 Vac to the blower contactor 2K19. Blower holdover relay 2K14 keeps the blowers running for a period of time after the transmitter is shut down to allow the tubes to cool slowly after operation. The time delay period of relay 2K14 is adjustable from 1 minute to 20 minutes. When blower contactor 2K19 is energized, blower motor 1MB1 will be energized and cooling air will be supplied to the PA plenum and the rf driver and modulator stages. Air pressure switch 1S17 will close, applying control voltage to the coil of air-auxiliary relay 2K2. When relay 2K2 is energized, normally-open contacts 1 and 3 of relay 2K2 will close in the filament interlock circuit. Double-throw contacts 5, 6 and 7 of relay 2K2 will operate to change the color of BLOWER lamp 1DS12 from green to yellow. At this point, the filament interlock circuit is complete. When FILAMENT switch 1S10 is depressed control voltage will be applied to the coils of low-level filament contactor 2K17, PA filament contactor 2K18, PA filament indicator relay 2K29, and plate delay relay 2K15.

FILAMENT switch 1S10 is an alternate-action switch with double-pole double-throw contacts. When switch 1S10 is depressed, one set of its normally-open contacts close, applying control voltage to the filament contactors and relays mentioned above. Another set of normally-closed contacts of switch 1S10 lights FILAMENT lamp 1DS10 green, when FILAMENT switch 1S10 is in the off position. When FILAMENT switch 1S10 is depressed to the on position and the filament interlock circuit is not complete, FILAMENT lamp 1DS10 will not light. When the filament interlock circuit is complete, and filament contactor 2K17 and PA filament indicator relay 2K29 are energized, FILAMENT lamp 1DS10 will light yellow.

When the low-level filament contactor and the PA filament contactor are energized, tube filaments of all stages and +28 volt supply are energized through LOW LEVEL FILA circuit breaker 2CB4 and PEAK FILA circuit breaker 2CB5.

The coil of plate time-delay relay 2K15 is energized when FILAMENT switch 1S10 is depressed. When energized, relay 2K15 will begin its timing cycle. The time delay period of relay 2K15 can be adjusted from 10 seconds to 200 seconds. When relay 2K15 completes its timing cycle, its normally-open contacts 1 and 5 close, energizing the coil of plate-delay auxiliary relay 2K11. Double-throw contacts 8, 9 and 11 of relay 2K11 light DELAY RELEASE lamp 1DS3 green until plate time-delay relay 2K15 reaches the end of its timing cycle. When relay 2K15 reaches the end of its timing cycle, and the coil of relay 2K11 is energized, contacts 9 and 11 of relay 2K11 close to light DELAY RELEASE lamp 1DS3 yellow. Normally-open contacts 6 and 7 of relay 2K11 are connected in the bias interlock circuit.

If necessary, the time delay period of plate time-delay relay 2K15 can be bypassed to turn the transmitter on immediately without waiting for relay 2K15 to complete its timing cycle. When DELAY RELEASE switch 1S3 is depressed, the coil of plate time-delay auxiliary relay 2K11 is energized. Normally-open contacts 1 and 3 of relay 2K11 are connected in parallel with contacts 1 and 5 of relay 2K15. When relay 2K11 is energized, its normally-open contacts 1 and 3 close, bypassing contacts 1 and 5 of relay 2K15, thereby allowing the coil of relay 2K11 to remain energized during the time delay period of relay 2K15, after DELAY RELEASE switch 1S3 has been released.

Relay 2K33 is a time delay relay which will allow the transmitter to come back on automatically after power failures of 2 to 5 seconds.

When the main power fails or the filament on/off switch is operated to the off position plate delay timer 2K15 drops out removing coil voltage from plate delay auxiliary relay 2K11. All voltages in the transmitter are turned off until plate delay time relay 2K15 times out. This means that if a power failure of 1 or 2 seconds occurs the transmitter must wait until the delay time runs out before high voltage is restored to the final tubes.

Relay 2K33 will time the power outage (from .2 to 5 seconds). If power is restored before 2K33 completes its timing cycle (usually 2 to 3 seconds) contacts 3 and 5 of 2K33 defeats the plate delay time cycle and the transmitter is restored to operating condition as soon as power is restored.

If, however, 2K33 completes its timing cycle before power is restored contacts 3 and 5 open allowing the plate delay timer to hold all voltages off until the filaments have returned to their operating temperature.

For protection of human life, the doors of the Type 317C-1 Transmitter are provided with interlock switches which remove all hazardous voltages when any one of the doors is opened.

The door interlocks utilize double-pole, double-throw switches. One set of normally-open contacts of each switch, 1S14, 1S15, 1S16, 2S1, 2S2, 2S3, 3S6, 3S5 and 3S4, is connected in series with contacts 7 and 8 of the three overload relays, 2K23, 2K24 and 2K25; the plate delay auxiliary relay 2K11 and the auxiliary switch of 2CB11 to make up the complete bias interlock circuit.

The other sets of contacts of the door interlock switches light the door-indicator lamps. The two rear door interlock switches of each unit are connected in series with their associated rear door-interlock lamp circuit. The front door has a separate lamp indicator.

NOTE

The door indicator lamps light yellow when the doors are closed and are extinguished when the doors are opened.

When the bias interlock circuit is complete, modulator bias and PA bias contactor 2K3 is energized, applying bias voltages to the respective stages. At the same time, through contacts 9 and 10, the bias indicator relay 2K27 is also energized closing contacts 9 and 11 which lights BIAS lamp 1DS11 yellow.

Normally-open contacts 6 and 7 of bias indicator relay 2K27 are connected in series with LOW VOLTAGE switch 1S11 to prevent application of low level plate voltage before bias is applied. Contacts 1 and 3 of 2K27 are also connected in series with the plate interlock circuit.

When LOW VOLTAGE switch 1S11 is depressed, control voltage will be applied to the coils of PA screen contactor 2K21, low voltage contactor 2K20, PA screen indicator relay 2K31 and low voltage indicator relay 2K30. When contactor 2K21 is energized, primary power will be applied to the transformers 2T6 and 2T16 through SCREEN

SUPPLIES circuit breaker 2CB9. Normally open contacts 1 and 3 of 2K31, and 1 and 3 of 2K30 will close in the lamp circuit lighting LOW VOLTAGE lamp DS17 yellow. Normally-open contacts 9 and 10 of 2K20 and 9 and 10 of 2K21 will close in the HIGH VOLTAGE interlock circuit.

When LOW VOLTAGE switch 1S11 is in the "off" position, normally-closed contacts 4 and 6 of 1S11 light LOW VOLTAGE lamp 1DS17 green. Lamp 1DS17 is extinguished when siwtch 1S11 is in the "on" position and 2K30 or 2K31 are deenergized.

Normally closed contacts 9 and 10 of overload relays 2K23, 2K24 and 2K25 are connected in series in the high-voltage interlock circuit. Normally-closed contacts 7 and 8 of these overload relays are connected in the bias interlock circuit. When an overload occurs in any circuit protected by one of these relays, contacts 9 and 10 of that relay open the high-voltage interlock circuit, and contacts 7 and 8 of that relay open the bias interlock circuit.

Normally-closed contacts 5 and 6 of overheat auxiliary relay 2K10 are also connected in series with the high-voltage interlock circuit, as are normally-closed contacts 9 and 10 of overload lockout relay 2K13, normally-open contacts 9 and 10 of PA screen relay 2K21, and normally-open contacts 9 and 10 of 3-kV/5.5-kV relay 2K20.

When the coil of plate voltage contactor 2K26 is deenergized, its contacts 9 and 10 are closed to complete the high-voltage interlock circuit. This is a safety feature which assures that plate voltage contactor 2K26 will complete its travel to the off position before starting to reclose to the on position.

When PLATE VOLTAGE switch 1S4 is depressed, its contacts 1 and 2 close, applying control voltage to the coil of plate auxiliary relay 2K22, to PLATE HOURS meter 2M7, and to high voltage indicator relay 2K32. Single-pole double-throw contacts 4, 5 and 6 of switch 1S4 apply lamp voltage to HIGH VOLTAGE lamp 1DS4. When switch 1S4 is in the "off" position, its contacts 4 and 6 close, lighting HIGH VOLTAGE lamp 1DS4 green. When switch 1S4 is in the "on" position, HIGH VOLTAGE lamp 1DS4 will be extinguished until HIGH VOLTAGE indicator relay 2K32 is energized. When control voltage is applied to the coil of relay 2K32, normally-open contacts 1 and 3 close, lighting HIGH VOLTAGE indicator lamp 1DS4 red and lamp voltage is applied to auxiliary contacts of surge vacuum relay 3K4. Normally closed contacts 2 and 3 of 3K4 apply lamp voltage to Cond. Charged indicator to light it red.

When the coil of relay 2K22 is energized, its normally-open contacts 3 and 4 close, paralleling the already-closed contacts 9 and 10 of relay 2K26 which open when the coil of relay 2K26 is energized. Normally-open contacts 7 and 8 of relay 2K22 will close, energizing the coil of relay 2K26. When relay 2K26 closes, 460-Vac primary power is pplied to High Voltage Power Supply transformer 3T3 through delta-wye switch 3S8. The 460-Vac primary power is also applied to "hv regulator" variable transformers 3T4 through 3T9. The primary windings of the plate voltage transformers are protected by PLATE SUPPLY circuit breaker 2CB11.

When normally-open contacts 5 and 6 of relay 2K22 close, surge time-delay relay 2K16 and plate-voltage vacuum breakers 3K1, 3K2 and 3K3 are energized. Plate-voltage vacuum breakers 3K1, 3K2 and 3K3 short out resistors 3R1, 3R2 and 3R3 to apply the full a.c. high voltage to high voltage rectifiers 3CR1 thru 3CR36.

The timing cycle of surge time-delay relay 2K16 is adjustable from 0.2 to 5 seconds. When relay 2K16 completes its timing cycle, its normally-open contacts 1 and 5 close, energizing surge vacuum breaker 3K4. When vacuum breaker 3K4 closes, its contacts short surge resistor 3R4 which is connected in the ground side of the charge path of the high-voltage filter capacitors.

When 3K4 is energized the normally open contacts 1 and 2 close lighting the Cond. Charged lamp 1DS13 yellow.

Lamp 1DS13 is extinguished until the coil of high voltage indicator relay 2K32 is energized. Lamp 1DS13 lights red when plate voltage is applied, and lights yellow when contacts of surge vacuum relay 3K4 short the surge resistor.

Another set of contacts, 2 and 6, of surge time-delay relay 2K16 also closes to apply a +28 VDC to the coil of 2A5K1. Upon operation of this relay, contacts 12 and 4 open allowing rf excitation to be applied to the final amplifier tubes.

Another pair of contacts on 2A5K1 close connecting the audio input to the transmitter.

When plate auxiliary relay 2K22 closes, 230 volts, which is obtained from one phase of the peak-tube filament circuit, is applied to the coil of plate contactor 2K26.

At this point, the transmitter starting sequence is complete and the transmitter is in operation.

The transmitter can be shut down by depressing MASTER OFF switch 1S2. When switch 1S2 is depressed, the "off" coil of relay 2K1 is energized. Contacts 3 and 4 of relay 2K1 open, removing control voltage from the filament interlock circuit, thus removing all other voltages and shutting the transmitter down.

With contacts 3 and 4 of relay 2K1 open, control voltage from vlower holdover time-delay relay 2K14 is removed and relay 2K14 begins its timing cycle. Normally-open contacts 4 and 6 of relay 2K14 remain closed, causing the blower to continue to run after the transmitter has been shut down, until relay 2K14 reaches the end of its timing cycle. At this point the control circuit shutdown sequence is complete.

d. Overload and Lockout Circuits. The overload relays in the Type 317C-1 Transmitter are fast-acting sensitive relays, equipped with current shunts which set the adjustment of each relay.

WARNING

DO NOT REMOVE THE COVERS OF ANY OF THE OVERLOAD RELAYS FOR ADJUSTMENT PURPOSES WHILE CONTROL VOLTAGE IS APPLIED TO THE CONTROL CIRCUITRY. THE CONTACTS OF THESE OVERLOAD RELAYS ARE EXPOSED WHEN THE OVERLOAD RELAY COVERS ARE REMOVED. THESE CONTACTS ARE CONNECTED TO THE 115 VAC CONTROL CIRCUITRY.

CARRIER OVERLOAD relay 2K23, PEAK OVERLOAD relay 2K24, and DC OVERLOAD relay 2K25 are located behind the lower front door of the Driver and Power Distribution Unit. When an overload occurs in a circuit protected by one of these overload relays, normally-open contacts 5 and 6 of that overload relay close, energizing the step coil of overload lockout relay 2K13. This relay will count four consecutive overloads before shutting the transmitter down so that it must be turned on again manually.

Normally-closed contacts 9 and 10 of each overload relay are connected in series with the plate-voltage interlock circuit. These contacts open when an overload occurs, also breaking the plate voltage interlock circuit. Normally-closed contacts 7 and 8 of each overload relay are connected in series with the bias interlock circuit. When an overload occurs, these contacts open removing all bias voltages, and, since the low voltage power supplies are interlocked with the bias interlock circuit, the low voltages are also removed.

When an overload occurs, normally-open contacts 3 and 4 of the overload relay which protects the circuit in which the overload occurred, close, applying control voltage to the coil of the associated overload auxiliary relay.

When an overload occurs in the carrier-tube circuit, contacts 3 and 4 of CARRIER OVERLOAD relay 2K23, close, applying control voltage to the coil of carrier overload auxiliary relay 2K4.

When an overload occurs in the peak-tube circuit, contacts 3 and 4 of PEAK OVERLOAD relay 2K24 close, applying control voltage to the coil of peak overload auxiliary relay 2K5.

When an overload occurs in the high voltage power supply circuitry, contacts 3 and 4 of DC OVERLOAD relay 2K25 close, applying control voltage to the coil of DC overload auxiliary relay 2K6.

When the coil of an overload auxiliary relay is energized, contacts 1 and 3 of that overload auxiliary relay close, applying "holding" control voltage to its coil.

When an overload occurs and an overload relay is energized, in turn energizing an overload auxiliary relay, a set of double-throw contacts 5, 6 and 7 of the overload auxiliary relay are "reversed", changing the color of the respective overload lamp from yellow to red. The lamp circuit can be reset by depressing the switch on the indicator-lamp/switch assembly.

As successive overloads occur, the step coil of overload lockout relay 2K13 is energized and relay 2K13 advances one step with each overload occurrence until it reaches the fourth step. In this position, normally-closed contacts 9 and 10 of relay 2K13 open in the plate voltage interlock circuit, removing plate voltage. To restore plate voltage at this point overload lockout relay 2K13 must be manually reset by depressing OVERLOAD RESET switch 1S5.

When the fourth overload has occurred, normally-open contacts 5 and 6 of relay 2K13 close which in turn supply control voltage to the coil of overload indicator relay 2K28. Upon operation of 2K28, a set of double-throw contacts 1, 3 and 4 will close contacts 1 and 3 lighting OVERLOAD LOCKOUT lamp 1DS5 red.

Normally-closed contacts 1 and 4 light 1DS5 yellow until the fourth overload has occurred.

Connections for remote control overload indication and reset functions are provided in the Type 317C-1 Transmitter. The individual overload indications are not arranged to be reset by remote control; however, if this is desired, minor circuit changes can be made in order to provide this function.

e. <u>Automatic Overload Reset</u>.

Relay 2K9 is a time delay relay which will reset the overload lockout relay 2K13 if the fourth overload does not occur before the preset time delay runs out.

When an overload occurs and 2K13 steps, contacts 7 and 8 of 2K13 close applying coil voltage to time delay relay 2K9 and the timing cycle begins. The timing cycle may be set from 10 to 200 seconds. If the timing cycle is completed before the fourth overload contacts 1 and 5 of 2K9 close applying 115 Vac to the reset coil of 2K13 resetting the count to zero. The overload auxiliary relays are not reset allowing a visual indication that an overload has occurred and will indicate which overload had operated.

When the fourth overload occurs before the timing cycle runs out contacts 9 and 10 of 2K13 open breaking the interlock circuit to the high voltage auxiliary relay 2K22 which turns off the high voltage. Voltage is also removed from the coil of 2K9 which prevents the timing cycle from being completed therefore the overload lockout relay will not be automatically reset.

f. Overtemperature Switch. Overtemperature switch 1S18 is located above the carrier tube to protect against over dissipation of the tube. A sample of the cooling air exhaust actuates this switch when the air temperature exceeds a preset value. When an overtemperature condition occurs, switch 1S18 energizes overtemperature auxiliary relay 2K10. Normally-open contacts 1 and 3 of relay 2K10 close, applying a holding voltage to the relay to keep it closed. Normally-closed contacts 5 and 6 of relay 2K10 open in the high-voltage interlock circuit, thus removing plate voltage. Double-throw contacts 8, 9 and 11 of relay 2K10 are connected to apply voltage to OVERTEMP lamp 1DS9. Lamp 1DS9 lights yellow under normal conditions and red after an overtemperature condition has occurred. A set of normally-closed contacts of overtemperature reset switch 1S9, and normally-closed contacts 1 and 4 of remote-control plate-reset relay 2K12, are connected in series with the holding contacts of the overtemp auxiliary relay 2K10. Switch 1S9 and relay 2K12 remove the holding voltage from overtemp auxiliary relay 2K10, allowing plate voltage to be reapplied. If the over-temperature condition still exists the overtemp auxiliary relay cannot be reset.

g. Delta-Wye Switch Circuit. The output voltage of the High Voltage Power Supply can be reduced to facilitate transmitter tuning. The primary windings of the high voltage plate transformer are connected to delta-wye switch 3S8. Switch 3S8 is a manually operated switch located on the HV Transformer and Regulator Unit. The primary windings of the high voltage transformers are connected in a wye configuration for operation with reduced plate voltage (WYE position of switch) and in a delta configuration for operation at normal plate voltage (DELTA position of switch).

1.17 AIR COOLING SYSTEM

A single large high-pressure low-speed blower is provided to supply cooling air to the rf driver, rf power amplifier, audio driver, and modulator tubes. This blower is located in the lower front portion of the Power Amplifier Unit.

Inlet air for this blower can be provided from behind the transmitter or from under the floor of the power amplifier unit as a customer option. The power amplifier air should be exhausted outside through a duct placed over the exhaust opening of the final tubes. See "G" on Drawing No. D-73060, Figure 5.

A separate exhaust duct should be placed over the driver tube section of the power distribution unit. See "H" on Drawing No. D-73010, Figure 5.

Additional cooling is required to insure air flow through each cubicle. This can be provided in various ways and is dictated by existing facilities, customer preference, local conditions, etc. A typical installation is shown on Drawing No. D-73011, Figure 4.

# SECTION 2 - INSTALLATION

## 2.1 GENERAL

The Typical Equipment Layout (Figure 4) shows the relative location of the units which comprise the Type 317C Transmitter and the proper positioning of other items which should be included in the transmitter building. Dimensions, wiring conduit, air plenums and air filters are shown in the Assembly Diagram (Figure 5). The relative positions of components are shown in Figures 10 through 18 of this handbook.

## 2.2 TRANSMITTER BUILDING REQUIREMENTS

The size and typical entrance requirements of the transmitter building are shown in Figure 4. Make sure that the available electric-power facilities are adequate.

## 2.3 CONDUIT AND WIRING

The required primary supply voltage for the Type 317C Transmitter is normally 460-volts, 3-phase, 3-wire, 60-Hertz. The transmitter primary power should be routed through a customer-furnished panel-board disconnect switch with a capacity of 300 amperes. It may be fused with 250-ampere super-lag 600-volt fuses or protected with a 200-ampere circuit breaker, preferably of the fully magnetic type.

The wiring from the panel board to transmitter must be in accordance with the local electrical code for the type of panel-board disconnect switch in use. Do not use wire smaller than #4/0 for transmitter primary power connections.

The 460-volt power feed is terminated in the Driver and Power Distribution Unit of the transmitter, on the line-side studs of circuit breaker 2CB11. A 4-3/4-inch hole is provided in the base of this unit for entrance of these leads. The conduit must be properly terminated at this hole.

Provision is also made near the entrance of the 460V primary feed to connect a 4 inch copper ground strap to the station ground. Refer to Drawing, D-73010, Figure 5.

Primary and secondary wires to the plate transformer are designed to be routed out of the left end of the Rectifier and Harmonic Filter Unit.

No trenches or inter-cubicle conduit are required, since the inter-unit wiring is contained within the transmitter. This wiring is furnished by the manufacturer.

A small customer-furnished wall disconnect switch should be provided for the transmitter cabinet-lights circuit.

The speech input and monitor wiring is routed into the

Driver and Power Distribution Unit at the right front corner. Two 2-inch diameter holes are provided for conduit connections to the customer furnished equipment rack. One conduit is required for the speech and monitoring lines and the other for remote control lines. Connections for all these functions are provided on the transmitter terminal boards.

## 2.4 TRANSMITTER COOLING AND AIR EXHAUST

The cooling-air exhaust from the transmitter should be removed from the building by duct work and a plenum housing above the transmitter. See Figure 4. This type installation provides two separate air exhausts, whereby the PA air is exhausted out a separate duct through the roof of the building, and the driver air and cooling of the cubicles which are not provided with forced air are exhausted via a plenum to an outside wall. This type installation requires a 2000 cfm fan to assure the forced driver air (approximately 900 cfm) is pulled from the building, in addition to pulling air through the other exhausts for component cooling.

An alternate method is to pressurize the rear of the transmitter by utilizing a 3000 cfm fan pulling air into the building. The PA air (center unit) should still be exhausted through a separate duct, and the plenum housing on top of the transmitter should be ducted to outside, but would not require an exhaust fan.

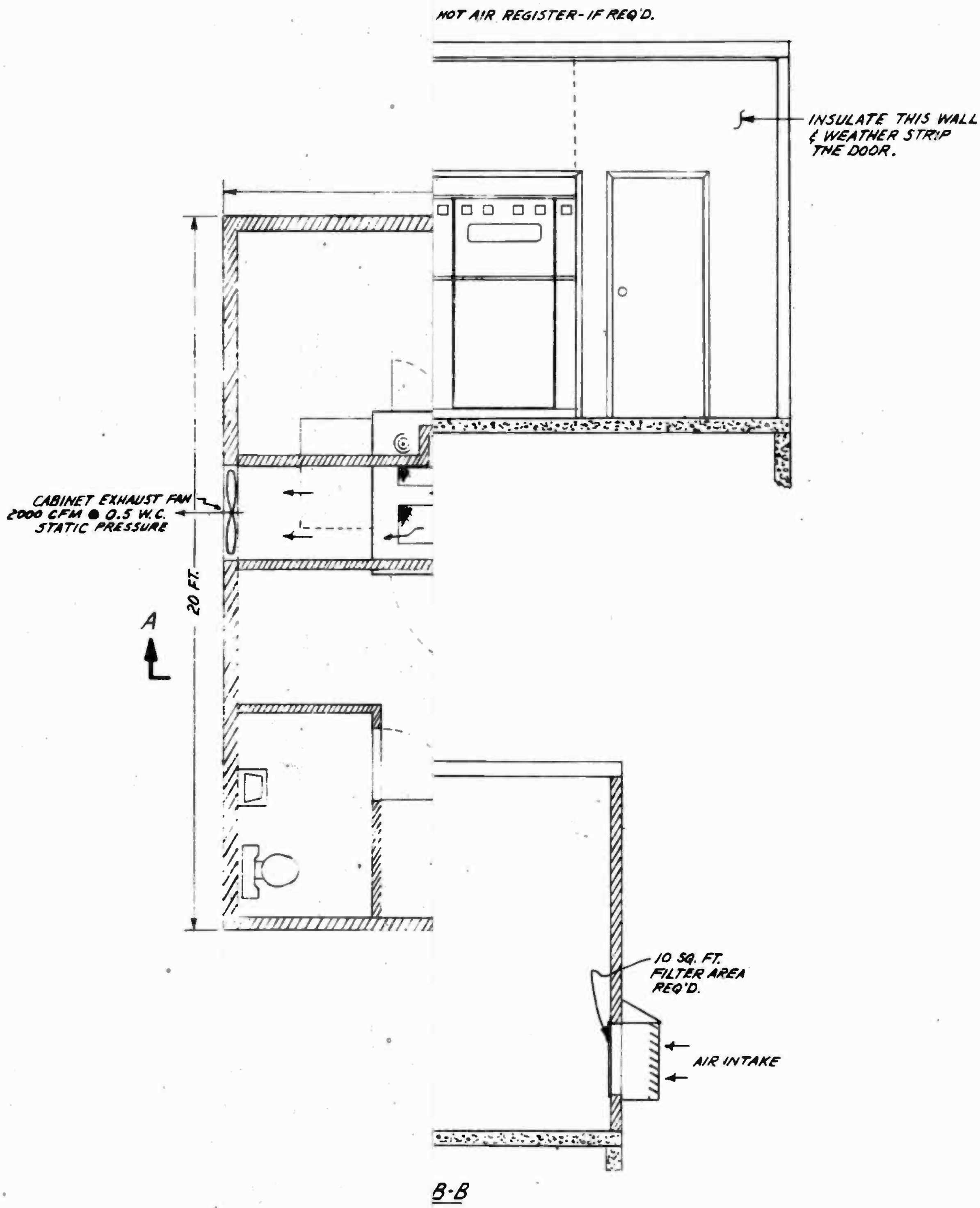
A filter bank should be used in the outside wall. The main transmitter blower inlet is filtered at the rear of the Power Amplifier Unit (center), however, there is no filtering provided for air entering the louvers on the rear doors of the cabinets.

Heat dissipated by the transmitter cooling system can be used to supplement heating of the transmitter building during the wintertime. This is accomplished by the use of louvers attached to the air exhaust ductwork of the power amplifier cabinet. The total heat available from the transmitter is approximately 21 kW/hour or 72,000 btu/hour (no modulation applied).

## 2.5 UNPACKING AND ASSEMBLY

All components which are fragile or might be damaged in shipment are removed from the cabinets at the factory and packed in separate boxes. Heavy items such as transformers and chokes are removed and shipped separately. Inspect all units of the shipment. If there is any evidence of damage to any part of the shipment, file a claim with the transportation company.

After the main cabinet group is placed in position and bolted together, the other items can be located and positioned.




CEMC DWG. NO. 73011 REV A EQ1-4

Figure 4. Typical Equipment Layout, Type 317C AM Broadcast Transmitter

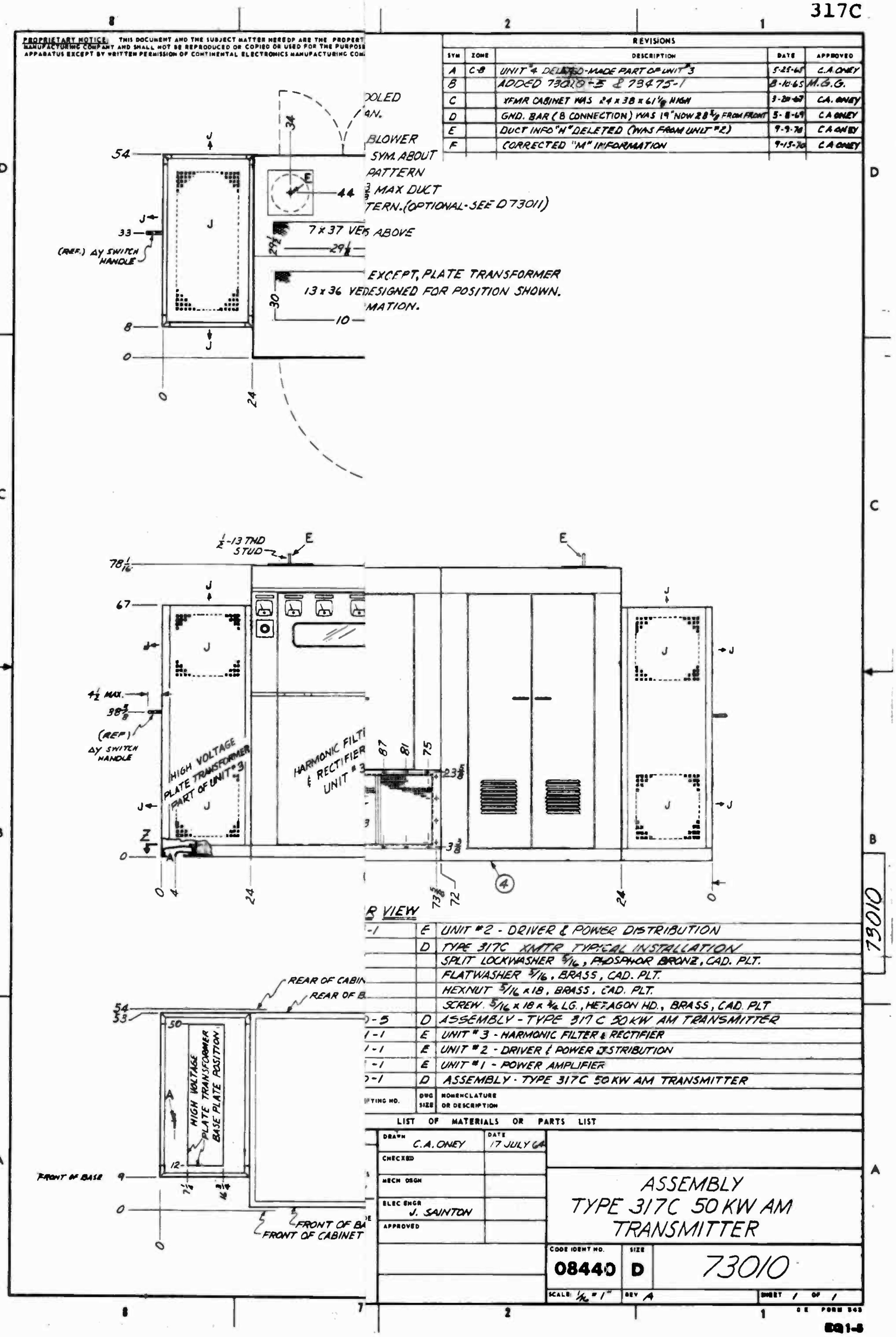



Figure 5. Assembly Diagram, Type 317C AM Broadcast Transmitter

Connect all necessary wiring to the appropriate terminals. All components which were removed for shipment are tagged with their component symbol numbers and their unit number such as 2T1, 3C6, 1L7, etc.

If the variable vacuum capacitors in the plate and output networks were removed for shipping, install these carefully. These components have been factory adjusted to have the proper reactance for the customer's operating frequency and antenna impedance. When removed from the transmitter for shipment, these capacitors are taped so that their factory settings will not be changed. Set the position indicators for these capacitors to the settings listed in the Factory Test Data, which is supplied with the transmitter, then remove the tape from the capacitors and install them, being careful not to change their factory settings during installation. Use extreme care in handling and installing the glass vacuum padding capacitors. The shorting taps on the inductors are factory set and shipped in the proper position. This information is also recorded in the Factory Test Data. Refer to the relative positions of components shown in Figures 10 through 18 of this handbook.

After the assembly is complete, the following items must be checked before attempting transmitter operation.

(1) Check the travel of the motor-driven variable tuning capacitors. Observe the associated position-indicating counters and record the points (numbers) at which the plates of each capacitor reach the limits of their travel (maximum and minimum capacity).

CAUTION

THE TUNING CAPACITOR DRIVE MECHANISMS ARE NOT EQUIPPED WITH LIMIT STOP SWITCHES. DO NOT DRIVE THE CAPACITORS BEYOND THE LIMITS OF MAXIMUM OR MINIMUM CAPACITY. THE CAPACITORS AND THEIR DRIVE MECHANISMS CAN BE DAMAGED IF THEY ARE DRIVEN BEYOND THESE LIMITS.

The position-indicating counter for the carrier-tube plate capacitor will indicate zero when their associated capacitors are set to maximum capacity.

(2) Check all wiring which connects to the terminal boards and components to make sure that it is tightened securely.

(3) Check all bus work in the plate output networks for tightness.

(4) Make sure that the 5 inch diameter sleeve connecting

the shielded compartments of the power amplifier and harmonic output networks cabinets are tightly installed.

(5) Set all tuning-capacitor position indicators to the values indicated in the Factory Test Data which is provided with each transmitter.

2.6 INITIAL ADJUSTMENTS

(1) Make sure that all circuit breakers are in their off positions.

(2) Apply the 460-Vac primary power to the transmitter.

(3) Set 230 VOLT SUPPLY circuit breaker 2CB10 to the on position and check the meter indications on 230 VOLT SUPPLY meter 2M6 for each phase as switched and indicated by LINE VOLTMETER switch 2S4. Also check the meter indications on 460 VOLT SUPPLY meter 3M1 for each phase as switched and indicated by LINE VOLTMETER switch 3S1.

(4) Using a volt-ohm-milliammeter, check the phasing of the 115 Vac control circuit wiring from terminals 10, 12 and 13 of transformer 2T1. Terminal 13 should be grounded.

(5) Check for 115 Vac on terminal 1 of CONTROL circuit breaker 2CB1 using the cabinet ground for reference.

(6) Check for 115 Vac on terminal 3 of LAMP circuit breaker 2CB2, using the cabinet ground for reference.

(7) Check for 230 Vac between terminal 1 of 2CB1 and terminal 3 of 2CB2.

(8) If the voltmeter indications listed in steps (4) through (7) of this procedure are not obtained, check the wiring of the secondary of 230-volt distribution transformer 2T1.

WARNING

REMOVE 460 VOLT PRIMARY POWER BEFORE REMOVING THE COVER FROM THE DISTRIBUTION TRANSFORMERS AND CIRCUIT BREAKERS.

(9) Set LAMP circuit breaker 2CB2 to the on position and make sure that all indicator lamps provide the indications listed in paragraphs 3.1 CONTROLS AND INDICATORS of this handbook for "transmitter shut-down" conditions.

(10) Set CONTROL circuit breaker 2CB1 to the on position.

(11) Set BLOWER circuit breaker 2CB6 to the on position.

Depress MASTER ON switch 1S1. The blower should start. Make sure that the blower motor is rotating in the proper direction. If it is not rotating in the proper direction depress the MASTER OFF switch 1S2. The blower will remain energized until blower holdover time-delay relay 2K14 times out. When the blower stops, reverse any two of the three-phase primary power connections to the motor.

(12) Depress the MASTER ON switch 1S1. Recheck the blower for proper direction of rotation. Make sure BLOWER lamp 1DS12 is lighted yellow to indicate sufficient air flow.

(13) Depress FILAMENT switch 1S10 to the "on" position. FILAMENT lamp 1DS10 should light yellow. If FILAMENT lamp 1DS10 is extinguished, check the operation of relays 2K17, 2K18 and 2K29.

(14) Set LOW LEVEL FILA circuit breaker 2CB3 to the "on" position. Using a volt-ohm-milliammeter, check the filament voltages at the tube sockets of tubes 2V3, 2V5, 2V6 and 2V7. The filament voltage applied to 2V3 and 2V5 should be approximately 5 Vac. The filament applied to 2V6 and 2V7 should be 7.5 Vac. If the meter indications on 2V3, 2V5, 2V6 and 2V7 show deviations greater than ±2.5%, set circuit breaker 2CB3 to the off position and reconnect the primary taps on filament transformers 2T15, 2T11, 2T12 and 2T13, respectively, to obtain the proper filament voltage at the sockets of these tubes. Reset 2CB3 to "on". Voltage is also applied to the transistorized stages and is metered on TEST METER switch 2S7, position 7.

(15) Set FILAMENT VOLTMETER switch 1S12 to the CARRIER position. Set CARRIER FILA circuit breaker 2CB4 to the "on" position. PWR AMP FILAMENT VOLTS meter 1M5 should indicate approximately 10 volts. Check this voltage at the tube socket of rf power-amplifier carrier tube 1V2 using a volt-ohm-milliammeter. Taps are provided for ±2-1/2, 5 and 7-1/2% adjustment of the filament voltage. Set circuit breaker 2CB4 to the "off" position and reconnect the primary taps of transformer 2T7 to obtain an indication of 9.3 to 10 volts at the tube socket. Record the indication on PWR AMP FILAMENT VOLTS meter 1M5 for future reference. Reset 2CB4 to "on".

(16) Set FILAMENT VOLTMETER switch 1S12 to the PEAK

position. Set PEAK FILA circuit breaker 2CB5 to the "on" position. PWR AMP FILAMENT VOLTS meter 1M5 should indicate approximately 10 volts. Check this voltage at the tube socket of rf power-amplifier peak tube 1V1 using a volt-ohm-milliammeter. Taps are provided on transformer 2T8 for ±2-1/2, 5 and 7-1/2% adjustment of the filament voltage. Set 2CB5 to the "off" position and reconnect the primary taps of 2T8 to obtain an indication of 9.3 to 10 volts at the tube socket. Record the exact indication on PWR AMP FILAMENT VOLTS meter 1M5 for future reference. Reset 2CB5 to "on".

(17) Close all cabinet doors and make sure that the door indicator lamp for each door is lighted yellow. Open each door and check that its lamp is extinguished.

(18) Allow time for plate delay-timer 2K15 to time out. When 2K15 times out, DELAY RELEASE lamp 1DS3 and BIAS lamp 1DS11 will light yellow.

(19) Set BIAS SUPPLY circuit breaker 2CB7 to the "on" position. PA and MOD BIAS meter 2M5 should indicate approximately 600 volts.

(20) Depress LOW VOLTAGE switch 1S11 to the "on" position. LOW VOLTAGE lamp 1DS17 should light yellow.

(21) Set SCREEN SUPPLIES circuit breaker 2CB9 to the "on" position. CARRIER SCREEN VOLTAGE meter 2M4 should indicate approximately 750 volts.

NOTE

This voltage may vary considerably, since it is adjusted simultaneously with the plate voltage to control transmitter power output.

An indication of 150 volts should be obtained on PEAK SCREEN VOLTAGE meter 2M3.

(22) Set LV SUPPLY circuit breaker 2CB8 to the "on" position. 5500 VOLT SUPPLY meter 3M3 should indicate 5 kV and 3000 VOLT SUPPLY meter 3M4 should indicate 3 kV.

(23) Adjust MODULATOR BIAS controls 2R61 and 2R69 to obtain an indication of 0.5 amperes on MODULATOR PLATE CURRENT meters 2M8 and 2M9. (There may be a small amount of interaction between the two controls.)

(24) Check the center taps on power-amplifier filament transformers 2T7 and 2T8 to make sure that they are properly connected to the ground return. Check the negative side of the high-voltage power supply for proper ground return.

(25) The transmitter is now ready for application of plate voltage. Set DELTA-WYE switch 3S8 to the WYE position. Set TUNING SELECTOR switch 1S26 to the POWER ADJUST position. Move the switch handle of TUNING switch 1S27 left and adjust the carrier screen voltage 2M4 to minimum output. Depress HIGH VOLTAGE switch 1S4. Check quickly for "self oscillation" and other malfunctions. Check the power amplifier plate voltage on 16000 VOLT SUPPLY meter 3M2. An indication of approximately 9 to 10 kV is normal.

(26) Check all positions of TEST METER switch 2S7 for typical readings on TEST METER 2M1 as listed in paragraph 3.5 TYPICAL METER READINGS in this handbook. Some meter readings will be lower than normal, since the 750 Volt Power Supply Variac is set to a relatively low position.

(27) Check the tuning patterns on the oscilloscope and make the necessary adjustments to obtain the proper patterns listed in paragraph 3.4 TUNING PROCEDURE.

(28) Depress HIGH VOLTAGE switch 1S4 to remove the plate voltage. Set DELTA-WYE switch 3S8 to the DELTA position.

(29) Depress HIGH VOLTAGE switch 1S4. Check the patterns on the oscilloscope to make sure they are correct. Perform any necessary tuning adjustments.

## 2.7 ADJUSTMENT OF OVER-TEMPERATURE SWITCH

During factory tests of the 317C Transmitter, the over-temperature switch has been adjusted. Generally this setting will be sufficient for operation at most locations. However, since the adjustment depends on the ambient temperature, the sensitivity of the switch may need to be decreased under some conditions. Since the setting made at the factory leaves a good safety margin before over-dissipation occurs, it will always be safe to decrease the sensitivity by at least a half turn of the adjust ment knob in a counter-clockwise rotation. If, however, a complete calibration is desired, the following procedure may be used.

1. Remove the knob from over-temp switch 1S18.

2. With filaments on for at least 10 minutes, adjust over-temp switch to point just where switch operates. This can be noted by observing over-temp lamp, 1DS9. Note: Clockwise rotation of the adjusting screw of the over-temp switch increases sensitivity. When the over-temp lamp (1DS9) changes to RED, this indicates the over-temp switch has operated. Reset by pressing 1DS9.

3. When adjustment is made whereby the switch just operates as mentioned above, replace knob, aligning the index of the knob at zero on the calibration dial.

4. Now adjust switch one complete turn counter-clockwise.

5. Disconnect buss from bottom of carrier tube grid leak resistor 1R36 which connects to 1L13 and 1R33. Ground 1L13 and 1R33 where buss was disconnected.

6. Disconnect the motor control leads at the plate power adjust motor. This will allow the screen voltage to be adjusted independently of the plate voltage. Before changing the carrier screen voltage, note screen voltage meter 2M4 and record. This should be done with the transmitter in a "ready" condition, no plate voltage. This will allow the carrier screen voltage to be reset to the same place after over-temp switch adjustment is made.

7. Decrease screen voltage to 50 volts or less by adjustment of the power adjust switch, 1S27. Since there is now no limit switch circuit on the screen voltage variac, take precaution not to run the variac, 2T16, beyond the end of its travel on the winding.

8. Remove excitation from the transmitter by removing oscillator card which is selected.

9. Place Delta-Wye switch 3S8 in Wye position.

10. With transmitter in ready condition, press high voltage switch 1S4 to ON.

11. Observe plate voltage and total plate current meters. The plate voltage meter 3M2, should read approximately 9 KV and the total plate current meter 1M2, approximately 2 amps.

By multiplying plate voltage times the total plate current will give the power input to the carrier tube. Since there is no power taken from the tube, this is the power being dissipated by the tube. Raise the carrier screen voltage by operating the power adjust switch 1S27 for a power input of 25 kw.

If the over-temp indicator lamp 1DS9 lights immediately, the over-temp switch must be made less sensitive by rotating the knob counter-clockwise from zero to one. If the over-temp will not reset (change color from RED to YELLOW), the sensitivity of the over-temp switch must be further decreased. This should be done by counter-clockwise rotation of the knob one number at a time and again checking.

12. The adjustment is complete when the setting has been found whereby the over-temp switch does not operate with 25 kw input. Allow the transmitter to operate for 15 minutes under this condition to insure the temperature has stablilized.

If the over-temp switch operates before 15 minutes of operation, decrease the sensitivity by again rotating the knob to the next highest number. Generally, the point for 25 kw dissipation will be found to be between 1-1/4 turn to 1-3/4 turn from the initial setting as described in step 3 above.

13. A good check of the setting after completion of step 12 is to raise the power to 30-33 kw input and the over-temp switch should operate within one minute.

## 2.8 EXTERNAL CONNECTIONS TO 317C TRANSMITTER

Cabinet Lights and Accessory Outlet

| | |
|---|---|
| 115VAC Hot | 2TB1-72 |
| 115VAC Ground | 2TB1-71 |

Audio Input

| | |
|---|---|
| Balanced Input Pair | 2TB1-89 & 2TB1-90 |
| Shield | 2TB1-88 |

Modulation Monitor Output

| | |
|---|---|
| Coax Conductor | 2TB1-84 |
| Shield | 2TB1-86 |

Frequency Monitor Output

| | |
|---|---|
| Coax Conductor | 2TB1-85 |
| Shield | 2TB1-86 |

| | |
|---|---|
| Plate Breaker Trip<br>Provides 115VAC output when Plate Breaker is tripped | 2TB1-79 |
| External Blower Holdover Voltage<br>Provides 115VAC for external Blower holdover | 2TB1-55 |

Remote Control Connections

| | | |
|---|---|---|
| Master ON | 115VAC Momentary | 2TB1-73 |
| Master OFF | 115VAC Momentary | 2TB1-74 |
| Plate ON/OFF | 115VAC Continuous-ON<br>0VAC - OFF | 2TB1-81 |
| Power Raise | 115VAC Momentary | 2TB1-57 |
| Power Lower | 115VAC Momentary | 2TB1-58 |
| Overload Reset | 115VAC Momentary | 2TB1-80 |

Remote Control Metering Connections

| | |
|---|---|
| Plate Voltage | 2TB1-64 |
| Total Plate Current | 2TB1-65 |

# SECTION 3 - OPERATION

## 3.1 CONTROLS AND INDICATORS

a. General. The following tables list the controls and indicators of the Type 317C Transmitter and indicate their functions. A separate table is provided for each unit and the controls and indicators are listed by symbol number in alphabetical-numerical order.

b. Power Amplifier Unit Controls and Indicators (Figure 6).

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| MASTER ON lamp/switch 1DS1/1S1 | Switch energizes cooling system, then filaments, and after time delay energizes bias power supplies. Lamp lights yellow while transmitter is in operation. Lights green when transmitter is shut down. |
| MASTER OFF lamp/switch 1DS2/1S2 | Switch removes all control voltages, deenergizing all power supplies, filament voltages and after a hold-over time delay deenergizes cooling air blower motor 1MB1. Lamp lights green while transmitter is in operation. Lights yellow when transmitter is shut down. |
| DELAY RELEASE lamp/switch 1DS3/1S3 | Switch bypasses plate time delay and energizes Low Voltage and Bias Supplies. Lamp lights green during time delay, lights yellow when time delay is bypassed. Bias and Low Voltage Lamps 1DS11 and 1DS17 light yellow. |
| HIGH VOLTAGE lamp/switch 1DS4/1S4 | Switch applies plate voltage if preceeding control circuit sequence is complete. Lamp lights green when switch 1S4 is open, lights red when switch 1S4 is closed, and extinguishes if switch 1S4 is closed but preceeding control circuit sequence is not complete. |

Power Amplifier Unit Controls and Indicators (Cont'd)

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| OVERLOAD RESET lamp/switch 1DS5/1S5 | Switch resets overload lockout relay and deenergizes overload indicator relay after a series of overloads have occurred. Lamp lights red when overload lockout relay is energized and lights yellow when overload lockout relay is reset. |
| DC OVERLOAD lamp/switch 1DS6/1S6 | Switch resets dc overload auxiliary relay after an overload has occurred. Lamp lights red when overload auxiliary relay is energized and lights yellow during normal operation. |
| PEAK OVERLOAD lamp/switch 1DS7/1S7 | Switch resets peak overload auxiliary relay after an overload has occurred. Lamp lights red when overload auxiliary relay is energized and lights yellow during normal operation. |
| CARRIER OVERLOAD lamp/switch 1DS8/1S8 | Switch resets carrier overload auxiliary relay after an overload has occurred. Lamp lights red when overload auxiliary relay is energized and lights yellow during normal operation. |
| OVERTEMP lamp/switch 1DS9/1S9 | Switch resets overtemp auxiliary relay when an overtemperature condition has occurred. Lamp lights red when overtemperature condition has occurred and lights yellow during normal operation. |
| FILAMENT lamp/switch 1DS10/1S10 | Switch energizes tube filaments. Lamp lights yellow while tube filaments are energized, lights green when filaments are deenergized, extinguishes when switch is in on position and transmitter is shut down. |
| BIAS lamp 1DS11 | Lamp is extinguished until plate delay auxiliary relay operates; lights yellow |

Power Amplifier Unit Controls and Indicators (Cont'd)

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| BIAS (Cont'd) lamp 1DS11 | to indicate that transmitter is ready for application of plate voltage. |
| BLOWER lamp 1DS12 | Lights green until air auxiliary relay is energized by air pressure switch in power amplifier plenum. Lights yellow to indicate sufficient air flow. |
| CONDENSERS CHARGED lamp 1DS13 | Lights red when plate voltage is applied. Lights yellow when vacuum switch shorts high-voltage power-supply surge resistors. Extinguished when plate voltage is not applied. |
| DOORS | |
| RECTIFIER FRONT/REAR lamp 1DS14 | Upper half of assembly is extinguished when rectifier unit front door is open, lights yellow when door is closed. Lower half of assembly is extinguished when Rectifier Unit rear doors are open, lights yellow when doors are closed. |
| DRIVER FRONT/REAR lamp 1DS15 | Upper half of assembly is extinguished when Driver and Power Distribution Unit front door is open, lights yellow when door is closed. Lower half of assembly is extinguished when Driver and Power Distribution Unit rear doors are open, lights yellow when doors are closed. |
| PWR AMP FRONT/REAR lamp 1DS16 | Upper half of assembly is extinguished when Power Amplifier Unit front door is open, lights yellow when door is closed. Lower half of assembly is extinguished when Power Amplifier Unit rear doors are open, lights yellow when doors are closed. |

Power Amplifier Unit Controls and Indicators (Cont'd)

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| LOW VOLTAGE lamp/switch 1DS17/1S11 | Switch energizes the low voltage power supplies. Lamp lights green when control voltage is applied and switch 1S11 is in the off position. Lamp extinguishes when switch 1S11 is closed and plate time delay has not timed out; lights yellow when switch 1S11 is closed and preceding control circuit sequence is complete. |
| CARRIER SCREEN CURRENT meter 1M1 | Indicates screen current of rf power-amplifier carrier tube. Meter range 0-2 amperes dc. |
| TOTAL PLATE CURRENT meter 1M2 | Indicates plate current of both carrier and peak tubes in rf power amplifier. Meter range 0-10 amperes dc. |
| PEAK GRID CURRENT meter 1M3 | Indicates control grid current of rf power-amplifier peak tube. Meter range 0-500 ma dc. |
| CARRIER GRID CURRENT meter 1M4 | Indicates control grid current of rf power-amplifier carrier tube. Meter range 0-500 ma dc. |
| PWR AMP FILAMENT VOLTS meter 1M5 | Indicates filament voltage of power amplifier tubes as selected by FILAMENT VOLTMETER switch 1S12. Meter range 0-15 Vac. |
| TEST METER meter 1M6 | Indicates currents and voltages designated and switched by TEST METER switch 1S13. Meter face marked 0-1 and 0-5 (two scales). |
| INT potentiometer 1R14 | Controls brightness of oscilloscope cathode-ray tube beam. Clockwise rotation increases brightness. |

Power Amplifier Unit Controls and Indicators (Cont'd)

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| FOCUS potentiometer 1R16 | Controls sharpness-of-focus of oscilloscope cathode-ray tube beam. |
| VERT potentiometer 1R22 | Controls vertical centering of oscilloscope cathode-ray tube beam. |
| HORIZ potentiometer 1R23 | Controls the horizontal centering of oscilloscope cathode-ray tube beam. |
| SCALE potentiometer 1R26 | Controls illumination of oscilloscope scale gradicule. |
| ASTIG potentiometer 1R38 | (Located inside scope.) Operates in conjunction with the focus control to control the shape of oscilloscope cathode-ray tube beam. |
| FILAMENT VOLTMETER switch 1S12 | Switches PWR AMP FILAMENT VOLTS meter 1M5 into the appropriate circuits to obtain the following indications: |
| Position: | |
| PEAK | Selects filament voltage of rf power-amplifier peak-tube 1V1. |
| CARRIER | Selects filament voltage of rf power-amplifier carrier tube 1V2. |
| TEST METER switch 1S13 | Switches TEST METER 1M6 into the appropriate circuits to obtain the following indications: |

NOTE

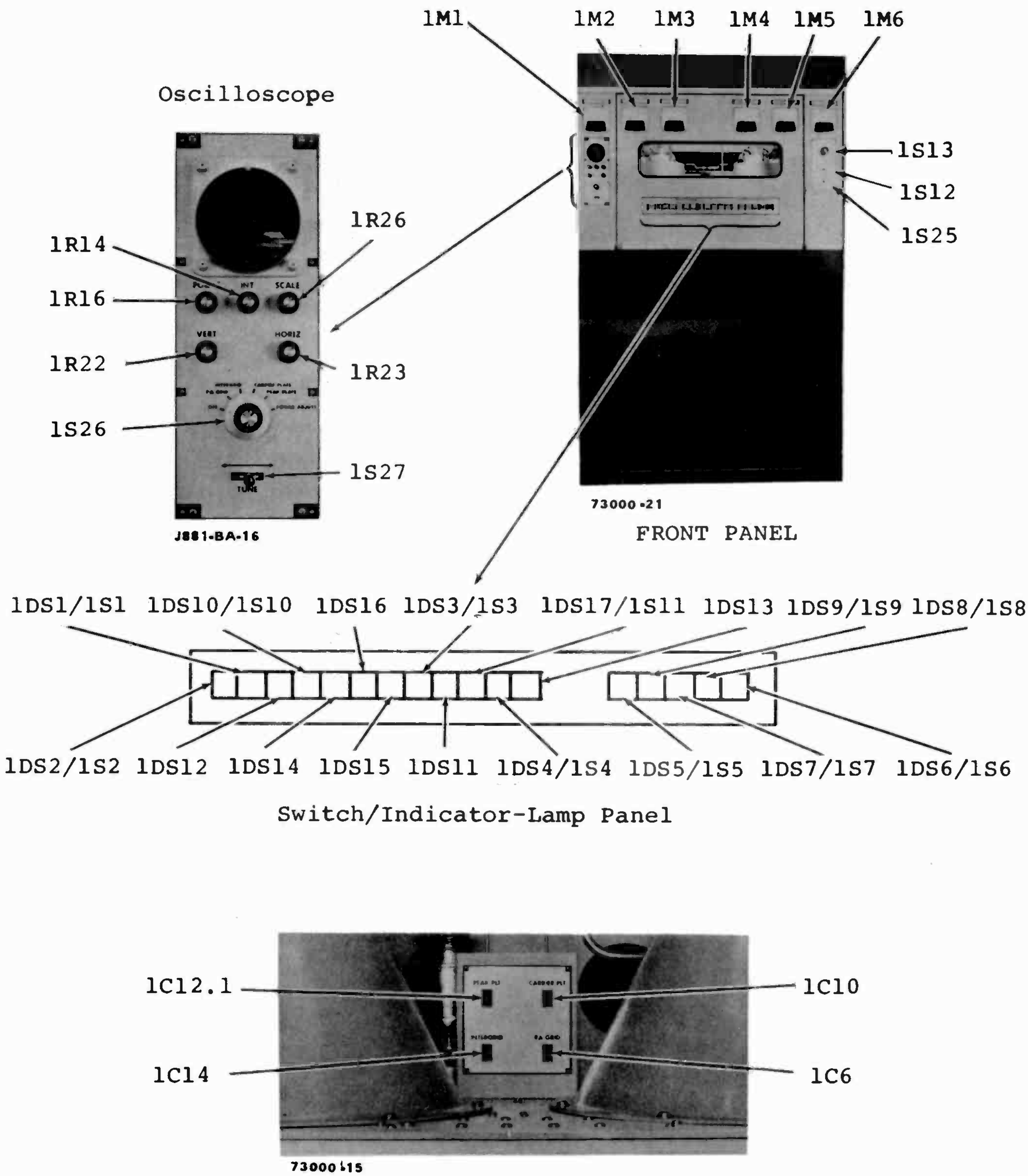
The full scale indications listed in the various positions of 1S13 must be used to obtain realistic readings on meter 1M6.

Power Amplifier Unit Controls and Indicators (Cont'd)

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| TEST METER switch 1S13 (Cont'd) | |
| Position: | |
| $I_{k_{5a}}$ PEAK | Selects cathode current of rf power amplifier peak tube 1V1. |
| $I_{k_{10a}}$ CARRIER | Selects cathode current of rf power amplifier carrier tube 1V2. |
| CABINET LIGHTS switch 1S25 | Energizes all cabinet lights. |
| TUNING SELECTOR switch 1S26 | Switches oscilloscope into the appropriate circuits to obtain standard oscilloscope patterns to facilitate transmitter tuning. Also, connects TUNING switch 1S27 to energize tuning-capacitor drive motors selected and indicated by switch 1S26. |
| Position: | |
| OFF | Disconnects oscilloscope and TUNING switch 1S27 from all circuits. |
| PA GRID | Connects TUNING switch 1S27 to energize motor 1B2 to vary the capacity of 1C6 in carrier-grid network. Connects oscilloscope to display power amplifier rf voltage pattern. |
| INTERGRID | Connects TUNING switch 1S27 to energize motor 1B4 to vary the capacity of 1C14 in the intergrid network. Connects oscilloscope to display power amplifier rf voltage pattern. |

Power Amplifier Unit Controls and Indicators (Cont'd)

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| TUNING SELECTOR switch 1S26 (Cont'd) | |
| CARRIER PLATE | Connects TUNING switch 1S27 to energize motor 1B1 to vary the capacity of 1C10 in the rf power-amplifier carrier-tube plate tank circuit. Connects oscilloscope to display carrier-tube rf plate voltage versus carrier-tube rf grid voltage. |
| PEAK PLATE | Connects TUNING switch 1S27 to energize drive motor 1B3 which varies the capacity of 1C12 in the pi network. Connects oscilloscope to display peak-tube rf plate voltage versus carrier-tube rf plate voltage. |
| POWER ADJUST | Connects TUNING switch 1S27 to energize motor 2B1 and the motor control of 3T4 for adjusting power output. Connects oscilloscope to display peak tube rf plate voltage versus carrier-tube rf plate voltage. |
| TUNING switch 1S27 | Energizes tuning motors as selected by TUNING selector switch 1S26. |



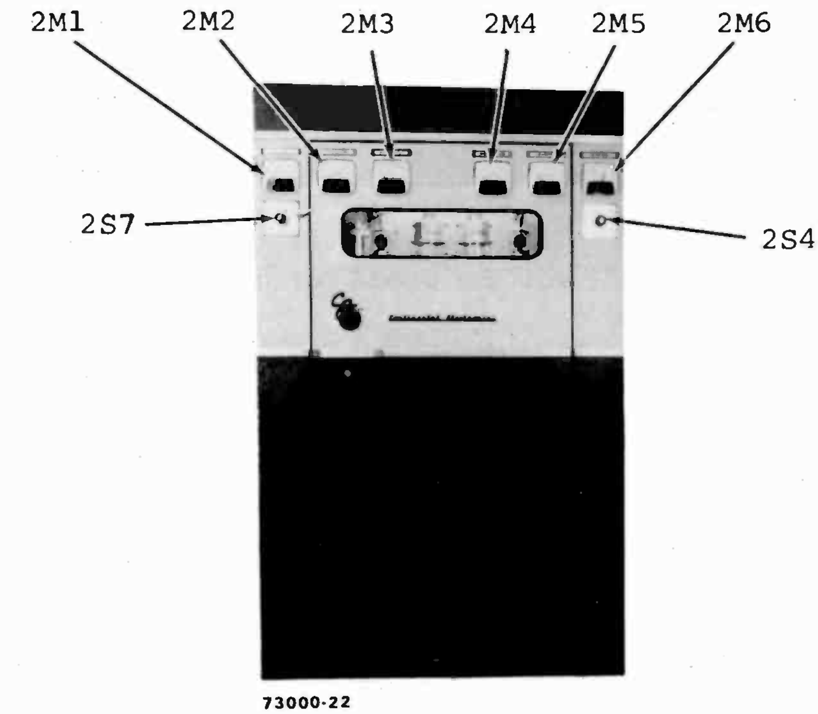

UPPER FRONT INTERIOR, MOTOR-DRIVEN
TUNING-CAPACITOR POSITION INDICATORS

EQ1-6

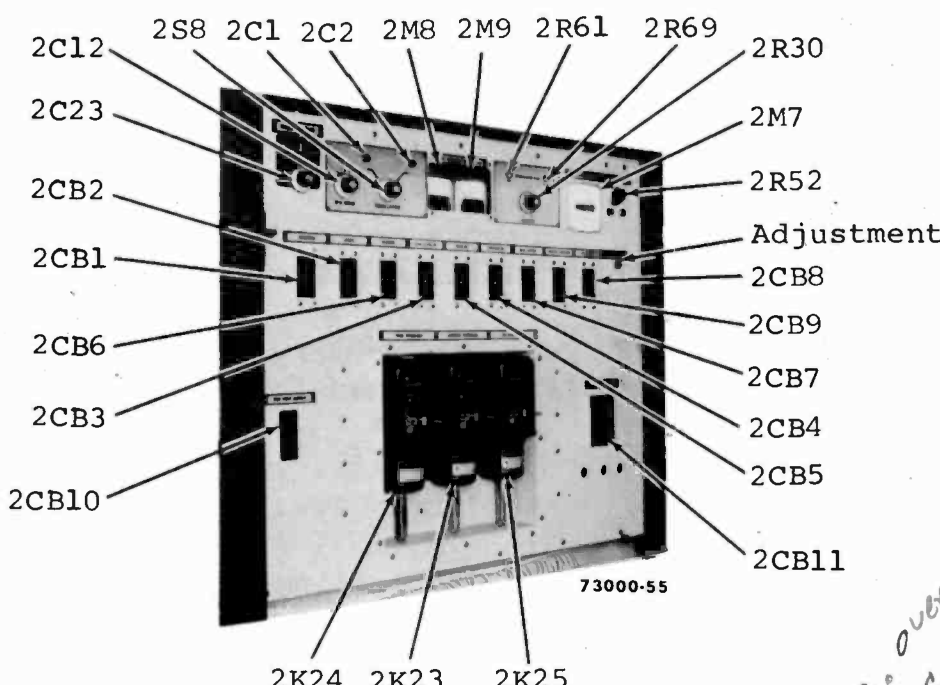
Figure 6. Power Amplifier Unit, Controls and Indicators

c. Driver and Power Distribution Unit Controls and Indicators (Figure 7).

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| OSCILLATOR SELECTOR switch 2S8 | Selects oscillator 1 or 2 when momentarily set to oscillator desired. |
| OSCILLATOR 1 capacitor 2A1C1 & lamp 2DS4 | Provides fine control of crystal oscillator for precise frequency adjustment when oscillator 1 is in use as denoted by lamp. |
| OSCILLATOR 2 capacitor 2A2C1 & lamp 2DS3 | Provides fine control of crystal oscillator for precise frequency adjustment when oscillator 2 is in use as denoted by lamp. |
| IPA GRID capacitor 2C12 | Tunes grid circuit of IPA (2V3). |
| IPA PLATE capacitor 2C23 | Tunes plate circuit of driver amplifier (2V3). |
| CONTROL circuit breaker 2CB1 | Protects control circuitry and oscilloscope. |
| LAMPS & MOTORS circuit breaker 2CB2 | Protects primary of lamp transformer, 2T2. |
| LOW LEVEL FILA circuit breaker 2CB3 | Protects primary of low-level filament transformers 2T11 thru 2T15. |
| CARRIER FILA circuit breaker 2CB4 | Protects primary of carrier-tube filament transformer 2T7. |
| PEAK FILA circuit breaker 2CB5 | Protects primary of peak-tube filament transformer 2T8. |
| BLOWER circuit breaker 2CB6 | Protects cooling-air blower motor 1MB1. |
| BIAS SUPPLY circuit breaker 2CB7 | Protects primary of rf driver and power-amplifier, and modulator bias power supply transformer. |
| LV SUPPLY circuit breaker 2CB8 | Protects primary of 3 kV/5.5 kV Power Supply transformer |




FRONT VIEW




FRONT INTERIOR PANEL

AE. D.C. overload verify
12 PAC 14B2

REV B EQ1-7

Figure 7. Driver and Power Distribution Unit, Controls and Indicators

Driver and Power Distribution Unit Controls and Indicators (Cont'd)

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| SCREEN SUPPLIES circuit breaker 2CB9 | Protects primary of +750 Volt Power Supply and primary of -150 Volt Power Supply transformers. |
| 230 VOLT SUPPLY circuit breaker 2CB10 | Protects primary of 230 volt distribution transformer. |
| PLATE SUPPLY circuit breaker | Protects primary of high voltage power supply transformer 3T3 and variable transformers 3T4 through 3T9. |
| CARRIER OVERLOAD relay 2K23 | Current-sensitive overload relay protects power-amplifier carrier-tube circuitry. |
| PEAK OVERLOAD relay 2K24 | Current-sensitive overload relay protects power-amplifier peak-tube circuitry. |
| DC OVERLOAD relay 2K25 | Current-sensitive overload relay provides dc overload protection. |
| TEST METER meter 2M1 | Indicates currents and voltages designated and switched by TEST METER switch 2S7. Meter face marked 0-1 and 0-5 (two scales). |
| IPA CATHODE CURRENT meter 2M2 | Indicates cathode current of the rf driver amplifier tube. Meter range 0-1 ampere dc. |
| PEAK SCREEN VOLTAGE meter 2M3 | Indicates screen grid voltage of peak tube 1V1. Meter range 0-600 Vdc. |
| CARRIER SCREEN VOLTAGE meter 2M4 | Indicates screen grid voltage of carrier tube 1V2. Meter range 0-1 kV dc. |
| PA AND MOD BIAS meter 2M5 | Indicates power-amplifier and modulator bias power supply voltage. Meter range 0-1 kV dc. |

Driver and Power Distribution Unit Controls and Indicators (Cont'd)

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| 230 VOLT SUPPLY meter 2M6 | Indicates line voltage designated and switched by LINE VOLTMETER switch 2S4. Meter range 0-300 Vac. |
| PLATE HOURS meter 2M7 | Indicates operating time in which plate voltage is applied to power amplifier. Meter range 0-99,999.9 hours. |
| MODULATOR PLATE CURRENT | |
| LEFT, meter 2M8 | Indicates plate current of left modulator tube 2V6. Meter range 0-1 ampere dc. |
| RIGHT, meter 2M9 | Indicates plate current of right modulator tube 2V7. Meter range 0-1 ampere dc. |
| FEEDBACK potentiometer 2R30 | Adjusts level of overall feedback. |
| MODULATOR BIAS | |
| LEFT potentiometer 2R61 | Adjusts static current of left modulator tube 2V6. |
| RIGHT potentiometer 2R69 | Adjusts static current of right modulator tube 2V7. |
| HUM BALANCE potentiometers 2R52, 2R84, 2R85 | Balances out hum |
| NEGATIVE PEAK ADJUST potentiometer 2R45 | Adjust bias on diode in cathode of 2V5 for negative peak linearity. |
| LINE VOLTMETER & switch 2S4 | Switches 230 VOLT SUPPLY meter 2M6 into the appropriate circuits to obtain the following indications: |
| Position: | |
| OFF | Disconnects meter. |
| A-B | Indicates line voltage phases A to B. |

Driver and Power Distribution Unit Controls & Indicators (Cont'd)

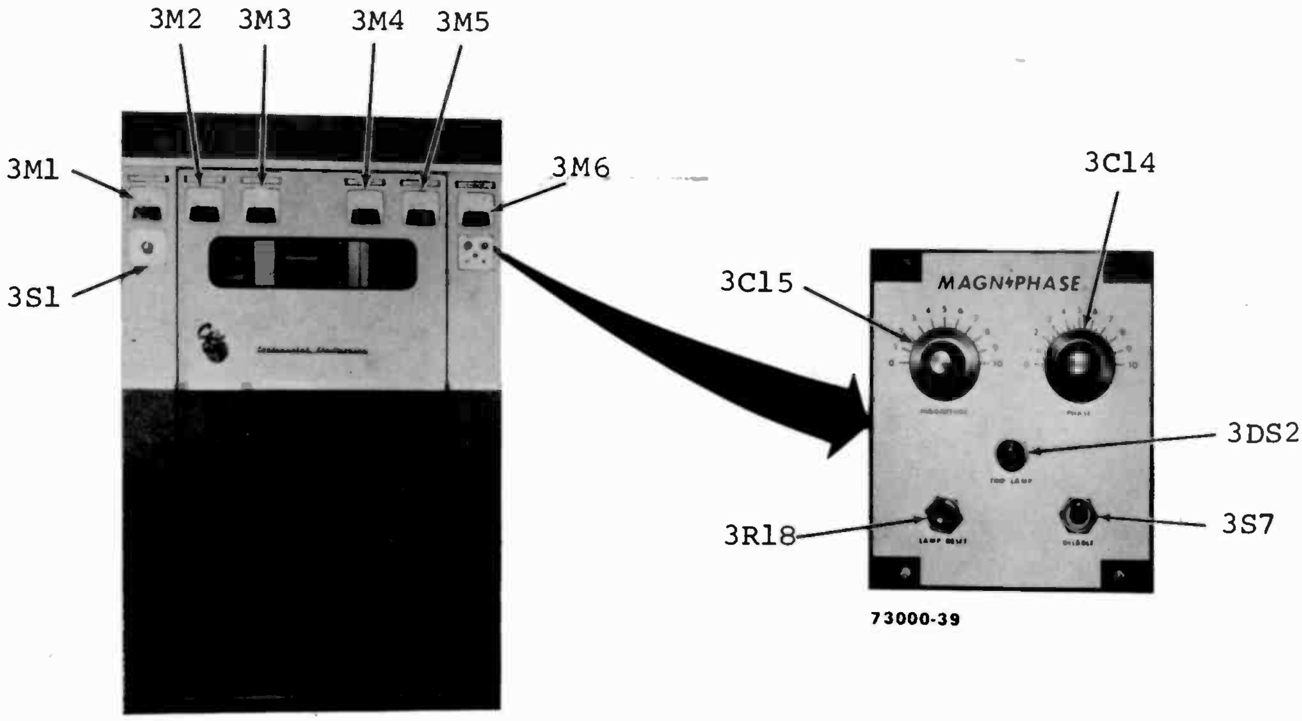
| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| LINE VOLTMETER (cont'd) | |
| B-C | Indicates line voltage phases B to C. |
| C-A | Indicates line voltage phases C to A. |
| TEST METER 2M1 & switch 2S7 | Switches TEST meter 2M1 into the appropriate circuits to obtain the following indications: |
| | NOTE |
| The full scale indications listed in the various positions of 2S7 must be used to obtain realistic readings on 1M1. | |
| Position: | |
| $I_t$ OSC 500 mA | |
| $I_c$ RF DVR 50 mA | |
| $I_c$ RF OUTPUT 1 AMP | |
| $I_g$ IPA GRID 50 mA | |
| $I_c$ 1st AUDIO 10 mA | |
| $I_c$ 2nd AUDIO 100 mA | |
| E 2nd AUDIO 500 V | |
| $I_k$ AUDIO DVR 100 mA | |
| FB RECT 10 mA | |
| 28 V SUPPLY 50 V | |

d. Rectifier and Harmonic Filter Unit Controls and Indicators (Figure 8).

| CONTROL OR INDICATOR | FUNCTION |
|---|---|
| | NOTE |
| The following controls are located in the rear of the Rectifier and Harmonic Filter Unit. | |
| PI NETWORK capacitor 3C4.1 | Varies capacity of 3C4.1 for loading adjusting on output of pi network. |
| SECOND HARMONIC TRAP capacitor 3C5.1 | Varies capacity of 3C5.1 for resonance with inductor 3L3 at second harmonic of operating frequency. |
| TEE NETWORK CAPACITOR capacitor 3C6.1 | Varies capacity of 3C6.1 for adjustment of shunt arm of Tee network. |
| THIRD HARMONIC TRAP capacitor 3C7 | Varies capacity of 3C7 for resonance with a part of inductor 3L4 at the third harmonic of operating frequency. |
| | NOTE |
| The following controls and indicators are located on the front panel of the Rectifier and Harmonic Filter Unit. | |
| PHASE capacitor 3C14 | Adjusts the phase of the Magniphase bridge input signal for a balance across the bridge circuit. |
| MAGNITUDE capacitor 3C15 | Adjusts the amplitude of the Magniphase input signal for balance across the Magniphase bridge circuit. |
| TRIP LAMP lamp 3DS2 | Lamp lights when a magniphase unbalance occurs. |
| 460 VOLT SUPPLY meter 3M1 | Indicates line voltage designated and switched by LINE VOLTMETER switch 3S1. Meter range 0-600 Vac. |
| LAMP RESET switch 3S3 | Resets trip lamp after magniphase unbalance has occured. |

Rectifier and Harmonic Filter Unit Controls and Indicators (Cont'd)

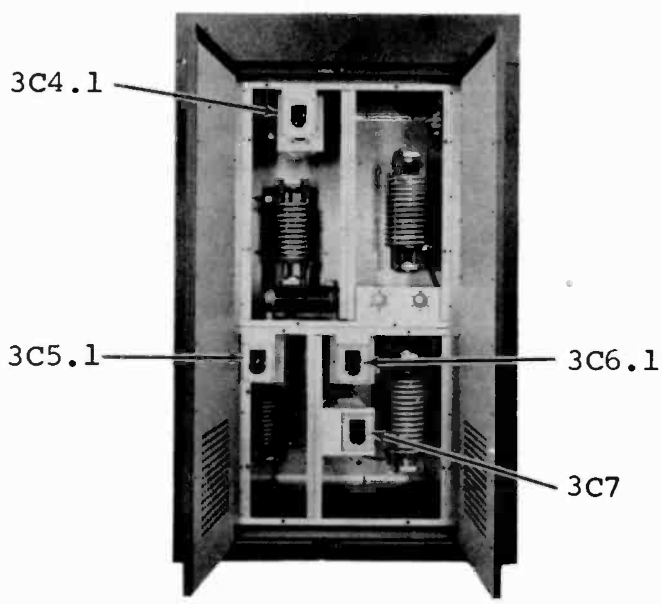
| CONTROL OR INDICATOR | FUNCTION |
| --- | --- |
| 16000 VOLT SUPPLY meter 3M2 | Indicates output voltage of High-Voltage Power Supply (PA plate voltage). Meter range 0-20 kV dc. |
| 5500 VOLT SUPPLY meter 3M3 | Indicates output voltage of 5.5-kV power supply (2nd audio-plate voltage). Meter range 0-10 kV dc. |
| 3000 VOLT SUPPLY meter 3M4 | Indicates output voltage of 3-kV power supply (modulator plate voltage) and RF driver. Meter range 0-5 kV dc. |
| RF LINE CURRENT meter 3M5 | Indicates rf output current. Special connections must be made to antenna base, common point or other metering point. Meter range 0-50 amperes rf. 0-1 ma basic movement. |
| MAGNIPHASE NULL meter 3M6 | Indicates null setting of Magniphase bridge circuit. Meter range 0-200 microamperes. |
| LINE VOLTMETER switch 3S1 | Switches 460 VOLT SUPPLY meter 3M1 into the following circuits: |
| Position: | |
| A-B | Selects line voltage across lines A and B. |
| B-C | Selects line voltage across lines B and C. |
| C-A | Selects line voltage across lines C and A. |
| DISABLE switch 3S7 | Disables Magniphase Unit during testing and adjustment. |




73000-14

73000-39

FRONT VIEW




73000-43

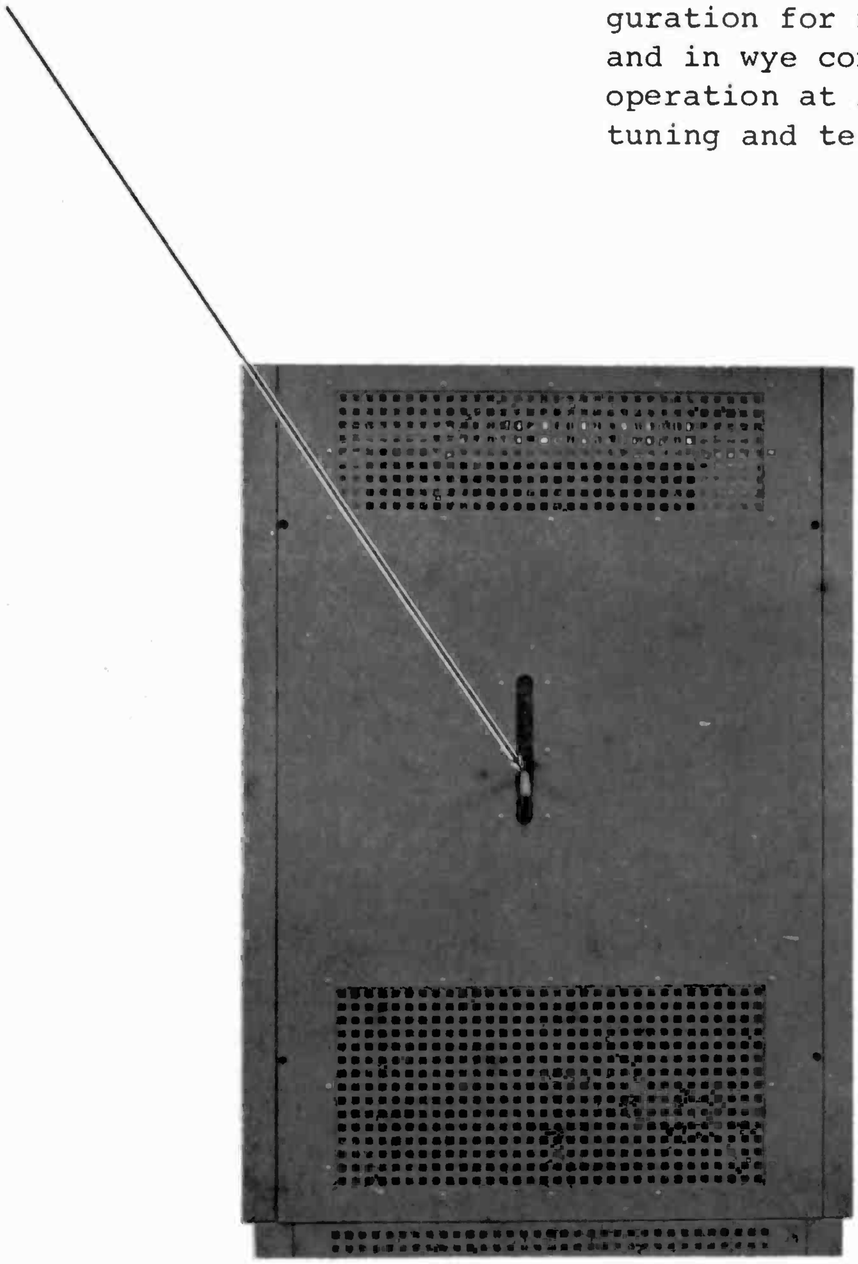
REAR VIEW, DOORS OPEN

REV A EQ1-8

Figure 8. Rectifier and Harmonic Filter Unit, Controls and Indicators

e. HV Transformer and Regulator Unit, Controls and Indicators.

| CONTROL OR INDICATOR | FUNCTION |
| --- | --- |
| DELTA-WYE switch 3S8 | Connects primary windings of hv transformer 3T3 in delta configuration for normal operation and in wye configuration for operation at reduced power for tuning and test purposes. |



73000 —10

EQ1 -9

Figure 9. HV Transformer and Regulator Unit, Controls and Indicators

## 3.2 STARTING PROCEDURE

The Type 317C Transmitter can be left in the prepared condition when it is shutdown at the end of each period of operation. The transmitter is in the prepared condition when all circuit breakers are set to their on positions, and FILAMENT switch 1S10 and LOW VOLTAGE switch 1S11 are set to their "on" positions. In the prepared condition, all circuits are ready for the application of power. The transmitter can be turned on by depressing MASTER ON switch 1S2, and after the filament warmup time has elapsed, depressing HIGH VOLTAGE switch 1S4.

At the beginning of each period of operation check all meter indications and adjust the tuning controls for optimum performance if necessary, using the procedure outlined in paragraph 3.4, subparagraph h. Tuning with Power Applied.

## 3.3 STOPPING PROCEDURE

In normal operation, when the Type 317C Transmitter is to be left in the prepared condition, depress HIGH VOLTAGE switch 1S4, then depress MASTER OFF switch 1S1 to shut the transmitter down. The cooling system motors will continue to run until the blower holdover relay times out.

In an emergency, when it is necessary to shut the entire transmitter down instantaneously, set the main primary-power customer-furnished disconnect switch to its "off" position. This will disable the entire transmitter with exception of the cabinet lamps circuit, which can be turned off by setting the customer-furnished lamp-circuit wall disconnect switch to its off position.

CAUTION

DO NOT USE THE MAIN PRIMARY-POWER DISCONNECT SWITCH TO SHUT THE TRANSMITTER DOWN EXCEPT IN AN EMERGENCY. REMOVAL OF COOLING AIR AT THE SAME TIME THE TRANSMITTER IS SHUT DOWN CAN DAMAGE THE AIR COOLED COMPONENTS.

NOTE

When the main primary-power disconnect switch is used to shut the transmitter down, be sure to depress HIGH VOLTAGE switch 1S4 so that high voltage will not be reapplied when the main primary-power disconnect switch is returned to the on position.

## 3.4 TUNING PROCEDURE

a. General. The initial tuning procedure outlined in this handbook begins with the output networks, and proceeds back to the interplate and intergrid networks. A thorough understanding of the operation of the interplate and intergrid networks is necessary to understand the tuning patterns which are displayed on the built-in oscilloscope.

An rf impedance bridge with an oscillator and detector capable of operation on the operating frequency is required for the initial tuning procedure. A grid-dip meter may be used to adjust the third-harmonic trap close to its proper setting, then a field strength meter can be used to tune this trap to the exact frequency.

The transmitter should be operated into a suitable phantom antenna for testing and tuning.

b. Tee Network. Connect the transmitter output to the phantom antenna. Disconnect the Tee network from the L network at the lower end of inductor 3L4. Record the relative positions of the straps which are connected to THIRD HARMONIC TRAP capacitor 3C7, then remove them. These straps will be replaced later. Measure the impedance at the input to the Tee network by connecting the bridge leads from inductor 3L4 (where the bus was removed) to ground. This impedance should be 100 ohms +j zero. All arms of this network are adjustable; therefore, the correct impedance of 100 ohms with zero reactance should be obtainable. If the load resistance has no reactive component, inductors 3L5 and 3L4 should have the same number of turns in use, since this network is designed to have a phase shift of 90 degrees. Any reactive component in the load or antenna will be in series with inductor 3L5, therefore its inductance must be increased or decreased to include the load reactance.

Record the number of turns shorted on inductors 3L4 and 3L5 and the dial reading of TEE NETWORK CAPACITOR 3C6.1 for future reference.

Connect THIRD HARMONIC TRAP capacitor 3C7 across approximately one third of the active part of inductor 3L4. Resonate the capacitor with this portion of the inductor. Record the tap setting of inductor 3L4 and the dial setting of capacitor 3C7.

Check the input impedance and make any necessary adjustments (other than the THIRD HARMONIC TRAP adjustment) to return the impedance to 100 ohms with zero reactance. Reconnect the bus to inductor 3L4. Make sure all clamps and connections are tight.

c. L Network. Remove the bus and connections to all capacitors from the top end of inductor 3L2. This is the input to the L section. Connect a short across second harmonic inductor 3L3. Measure the impedance at the input of the L network. Adjust inductor 3L2 and capacitor 3C5 to obtain an impedance of 50 ohms with zero reactance. Disconnect the bus from the bottom end of inductor 3L3 and, with inductor 3L3 still shorted, measure the capacitive reactance of the shunt arm of the L network. This is the reactance at which the shunt arm must be maintained. The capacitive reactance must be increased to maintain the proper total reactance at the operating frequency after the inductance is inserted and resonated to the second harmonic of the operating frequency. Divide the reactance of the shunt arm by 0.75. Decrease the capacity until this value is reached with a short connected across inductor 3L3, then adjust the tap until the shunt arm reactance is adjusted to its original value. At this point the reactance of the shunt arm at the second harmonic should be zero or very near zero. Adjust this arm to obtain zero reactance at the second harmonic. Recheck the reactance at the operating frequency. If any change is made in these components at any time be sure to check the reactance at both the operating frequency and the second harmonic.

Reconnect the bus to the lower end of inductor 3L3. Check the impedance at the input of the L network. If necessary make minor adjustments to bring the impedance to 50 ohms +j zero.

d. Carrier Plate Network. Remove the bus connections from the left end of inductor 1L5. Separate the two bus connections. Connect the bridge leads to the top end of inductor 1L6 and to ground. Adjust the tap on inductor 1L6 until an inductive reactance of 500 ohms is reached. Connect the two bus leads with a clip. Do not connect to inductor 1L5. Connect the bridge to the "top" of inductor 1L6. Set TUNING SELECTOR switch 1S26 to the CARRIER PLATE position and operate TUNING switch 1S27 left or right to adjust motor-driven capacitor 1C10 to obtain an indication of -j 1000 ohms on the bridge. The carrier plate is now adjusted.

e. Interplate Network. Connect the bus back to the left end of inductor 1L5. Connect a clip lead from this point to ground. Remove the bus connections from inductor 1L5 to the peak-tube anode where they connect at capacitor 1C13. Connect the bridge to the right end of inductor 1L5 and adjust the tap of inductor 1L5 to obtain an inductive reactance of 1000 ohms. Reconnect the bus to capacitor 1C13. Leave the short connected to the left end of inductor 1L5.

f. Peak Plate Network. Connect the bridge to the top end of inductor 1L7 and ground. Adjust capacitors 1C12, 3C4 and inductor 1L7 for an impedance of 500 ohms with zero reactance.

PI NETWORK capacitor 3C4 is adjusted from the rear of the Rectifier and Harmonic Filter Unit. Capacitor 1C12 is adjusted by motor control from the front panel of the Power Amplifier Unit. Set TUNING SELECTOR switch 1S26 to the PEAK PLATE position and operate TUNING switch 1S27 left or right to adjust motor-driven capacitor 1C12. Inductor 1L7 is adjusted from the rear of the Power Amplifier Unit by means of an adjustable tap.

g. Intergrid Network. Initial adjustments of the intergrid network should be made using a grid dip meter, since all final adjustments will be made using the built-in oscilloscope.

The carrier grid circuit must be resonated first. Disconnect intergrid capacitor 1C14 from the carrier-tube grid circuit. Set TUNING SELECTOR switch 1S26 to the CARRIER GRID position. Operate TUNING switch 1S27 left or right to set motor-driven capacitor 1C6 to the center of its range of travel. Using the grid dip meter, resonate the carrier-grid circuit by adjusting the tap on inductor 1L4.

Disconnect capacitor 1C14 from the peak-tube grid circuit. Resonate the plate tank circuit of the rf driver tube, using the grid dip meter. Adjust the tap on rf driver tank inductor 2L9 to a point two or three turns from the "cold" end of the inductor. Set the tap on power amplifier grid inductor 1L3 to a point two or three turns from the "cold" end of the inductor. Resonate the peak-tube grid circuit consisting of inductor 1L3, capacitor 1C5 and the tube capacitance. Adjust only the tap on inductor 1L3 for resonance.

Set motor-driven intergrid capacitor 1C14 (by means of the TUNING switch 1S27) at approximately half capacity.

Resonate the buffer plate tank circuit by selecting the required number of padder capacitors and by tuning capacitor 2C12.

This completes the tuning procedure. All final adjustments must be made with power applied.

h. Tuning with Power Applied.

NOTE

The initial adjustments made by bridge and grid dip measurements will generally prove satisfactory for operation at low power.

Set delta-wye switch 3S8 to the wye position for low power operation. Set TEST METER switch 2S7 on the Driver and Power Distribution Unit to the $I_g$ IPA position.

Turn the transmitter on and wait for the filament warm-up time-delay relay to "time out". When the bias and low voltage supplies are energized, check all meter indications.

Depress HIGH VOLTAGE switch 1S4. Check the meter readings on 16000 VOLT SUPPLY meter 3M2 and TOTAL PLATE CURRENT meter 1M2. 16000 VOLT SUPPLY meter 3M2 should indicate 9 to 10 kV. TOTAL PLATE CURRENT meter 1M2 should indicate less than 4 amperes.

Check the tuning patterns on the built-in oscilloscope and make any necessary adjustments. The following table lists the oscilloscope tuning patterns for the various positions of TUNING SELECTOR switch 1S26:

OSCILLOSCOPE TUNING PATTERNS

Positions of TUNING SELECTOR switch 1S26:

PA GRID

(1) The oscilloscope will display an elliptical pattern. A sample of the carrier-tube rf drive voltage is applied to the oscilloscope cathode-ray tube vertical deflection plates. A sample of the peak-tube rf drive voltage is applied to the oscilloscope cathode-ray tube horizontal deflection plates. Since the peak grid voltage is 90 degrees out of phase with the carrier grid voltage, the pattern will be an upright ellipse. Operating TUNING switch 1S27 will activate tuning motor 1B2 which will vary the capacitance in the carrier-tube grid circuit. Adjust the carrier-tube grid circuit to obtain a vertical ellipse.

INTERGRID

(2) The oscilloscope will display the same elliptical patterns as it displays when switch 1S26 is in the PA GRID position. However, TUNING switch 1S27 will energize the tuning motor which varies intergrid capacitor 1C14. Adjust capacitor 1C14 to obtain equal current indications on PEAK GRID CURRENT meter 1M3 and CARRIER GRID CURRENT meter 1M4, then repeat step (1) of this procedure.

Oscilloscope Tuning Patterns (Continued)

CARRIER PLATE (3) The oscilloscope will display a diagonal line pattern. A sample of the carrier-tube rf plate voltage is applied to the oscilloscope cathode-ray tube vertical deflection plates. A sample of the carrier-tube rf grid voltage is applied to the oscilloscope cathode-ray tube horizontal deflection plates. There will be a 180° phase difference so that a diagonal line oscilloscope pattern should be displayed on the oscilloscope. Operate the TUNING switch 1S27 left or right until a straight line pattern is obtained. A dip will also be obtained in the indication on TOTAL PLATE CURRENT meter 1M2.

PEAK PLATE (4) The oscilloscope will display an upright ellipse pattern. A sample of the carrier-tube rf plate voltage is applied to the oscilloscope cathode-ray tube vertical deflection plates. A sample of the peak-tube rf plate voltage is applied to the oscilloscope cathode-ray tube horizontal deflection plates. In this position TUNING switch 1S27 will energize the tuning motor for peak-plate capacitor 1C12. Operate switch 1S27 left or right to obtain an upright ellipse pattern on the oscilloscope.

NOTE

The oscilloscope patterns for all positions of TUNING SELECTOR switch 1S26 should be checked after an adjustment has been made in any one position.

POWER ADJUST (5) The oscilloscope will display the same upright ellipse pattern as displayed when switch 1S26 is in the PEAK PLATE position. In this position TUNING switch 1S27 will energize the plate-voltage and screen-voltage motor controls to

Oscilloscope Tuning Patterns (Continued)

POWER ADJUST (Cont'd) adjust the output power of the transmitter. Operate TUNING switch 1S27 left or right to obtain an output power of 50-kW.

## 3.5 TYPICAL METER READINGS

a. General. The following table lists typical values of voltage and current as read on the panel meters of the Type 317C Transmitter. These readings are approximations and are intended as average readings in a normal situation, with the transmitter operating CW at 50 kW average power (no modulation applied) except when otherwise specified. For specific meter readings, refer to the Factory Test Data which is supplied with each transmitter.

b. Power Amplifier Unit.

| METER | METER SCALE | TYPICAL READING |
|---|---|---|
| CARRIER SCREEN CURRENT meter 1M1 | 0-1 ampere dc | |
| 0% Modulation | | 250 ma |
| 95% Modulation | | 400 ma |
| TOTAL PLATE CURRENT meter 1M2 | 0-10 amperes dc | |
| 0% Modulation | | 4.15 amperes |
| 95% Modulation | | 6.2 amperes |
| PEAK GRID CURRENT meter 1M3 | 0-500 ma dc | 150 ma |
| CARRIER GRID CURRENT meter 1M4 | 0-500 ma dc | 150 ma |
| PWR AMP FILAMENT VOLTS meter 1M5 | 0-15 Vac | Rf power amplifier filament voltage as switched and designated by FILAMENT VOLTMETER switch 1S12 |

Typical Meter Readings (Cont'd)

| METER | METER SCALE | TYPICAL READING |
|---|---|---|
| Positions of switch 1S12: | | |
| PEAK | | 9.65 Vac |
| CARRIER | | 9.60 Vac |
| TEST METER meter 1M6 | Marked 0-1 and 0-5 | Currents and voltages switched and desiga-ted by TEST METER switch 1S13 |
| Positions of switch 1S13: | | |
| $I_{k_{5a}}$ PEAK | 0-5 ampere dc | |
| 0% Modulation<br>95% Modulation | | 0.5 amperes<br>2.65 amperes |
| $I_{k_{10a}}$ CARRIER | 0-10 amperes dc | |
| 0% Modulation<br>95% Modulation | | 4.0 amperes<br>4,25 amperes |

c. Driver and Power Distribution Unit.

| METER | METER SCALE | TYPICAL READING |
|---|---|---|
| TEST METER meter 2M1 | Marked 0-1 and 0-5 | Currents and voltages switched and designa-ted by TEST METER switch 2S7 |
| Positions of TEST METER switch 2S7: | | |
| $I_t$ OSC 500 mA | 0-500 mA | 100 mA |
| $I_c$ RF DVR 50 mA | 0-50 mA | 25 mA |
| $I_c$ RF OUTPUT 1 Amp. | 0-1 Amp. | .51 A |
| $I_g$ IPA GRID 50 mA | 0-50 mA | 12.5 mA |

Typical Meter Reading (Cont'd)

| METER | METER SCALE | TYPICAL READING |
|---|---|---|
| $I_c$ 1st AUDIO 10 mA | 0-10 mA | 6.8 mA |
| $I_c$ 2nd AUDIO 100 mA | 0-100 mA | 33 mA |
| E 2nd AUDIO 500 V | 0-500 V | 120 V |
| $I_k$ AUDIO DVR 100 mA | 0-100 mA | 50 mA |
| FB RECT 10 mA | 0-10 mA | 5.7 mA |
| 28V SUPPLY 50 V | 0-50 V | 27.5 V |
| IPA CATHODE CURRENT meter 2M2 | 0-1 ampere dc | .29 amperes |
| PEAK SCREEN VOLTAGE meter 2M3 | 0-600 Vdc | 150 Vdc |
| CARRIER SCREEN VOLTAGE meter 2M4 | 0-1 kV dc | |
| 0% Modulation | | 650 Vdc |
| 95% Modulation | | 680 Vdc |
| PA AND MOD BIAS meter 2M5 | 0-1 kV dc | -700 Vdc |
| 230 VOLT SUPPLY meter 2M6 | 0-300 Vac | Primary line voltage switched and designated by LINE VOLTMETER switch 2S4 |
| Positions of switch 2S4: | | |
| A-B | | 228 Vac |
| B-C | | 230 Vac |
| C-A | | 230 Vac |

Typical Meter Readings (Cont'd)

d. Rectifier and Harmonic Filter Unit.

| METER | METER SCALE | TYPICAL READING |
|---|---|---|
| 460V SUPPLY meter 3M1 | 0-600 Vac | Primary line voltage switched and designated by LINE VOLTMETER switch 3S1. |
| Positions of LINE VOLTMETER switch, 3S1: | | |
| A-B | | 456 Vac |
| B-C | | 459 Vac |
| C-A | | 458 Vac |
| 16000 VOLT SUPPLY meter 3M2 | 0-20 kV dc | 15.5 kV |
| 5000 VOLT SUPPLY meter 3M3 | 0-10 kV dc | 5.4 kV |
| 2500 VOLT SUPPLY meter 3M4 | 0-5 kV dc | 2.9 kV |
| RF LINE CURRENT meter 3M5 | 0-50 amperes rf | 31.7 amperes rf |
| MAGNIPHASE NULL meter 3M6 | 0-200 micro-amperes | 0 |

# SECTION 4 - MAINTENANCE

## 4.1 PREVENTIVE MAINTENANCE

a. General. Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdown and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent certain troubles from occurring. A regular schedule of preventive maintenance items should be established based on transmitter use, location, and available manpower.

The relative positions of components are shown in Figures 10 through 18 of this handbook. Also, refer to the schematic diagrams (Figures 20 through 25).

b. Preventive Maintenance Techniques. Use #000 sandpaper to remove corrosion from the cabinets or other metal parts. Use a clean, dry, lint-free cloth or a dry brush for cleaning. If the dry cloth or brush will not remove the dirt, use a high-quality commercial solvent such as Chlorothene. When cleaning electrical contacts, use a cloth or brush moistened with Chlorothene; when the contacts are clean, wipe them dry with a dry cloth. If available, dry compressed air may be used at a line pressure not exceeding 60 psi to remove dust from any accessible places.

CAUTION

WHEN USING COMPRESSED AIR FOR CLEANING PURPOSES BE CAREFUL NOT TO DAMAGE DELICATE PARTS WITH THE AIR BLAST. WHEN USING COMPRESSED AIR, ALWAYS DIRECT THE FIRST BLAST OF THE AIR LINE TOWARD THE FLOOR TO CLEAR CONDENSED MOISTURE FROM THE LINE.

c. Exterior Items.

(1) Check the completeness and general condition of the equipment.

(2) Inspect the control panels, and where necessary, clean jacks, plugs, knobs, etc., and remove dirt or stains from the panels.

(3) Inspect the seating of all accessible indicator lamps and fuses. Check external coaxial connectors for looseness. Repair or replace faulty components.

(4) Operate all controls used in the normal operational procedure, and check for looseness, binding,

sticking, etc. Lubricate or replace faulty controls, as necessary.

(5) Check the performance of the equipment for normal operation of the system. Take corrective measures as necessary.

(6) Check for loose screws or bolts on the exterior of the equipment (mounting) screws, large hardware etc.), and tighten loose fasteners. Check door panels and control panels.

CAUTION

TIGHTEN SCREWS, NUTS AND BOLTS CAREFULLY. FITTINGS TIGHTENED BEYOND THE PRESSURE FOR WHICH THEY WERE DESIGNED WILL BE DAMAGED OR BROKEN.

(7) Check the exterior of all units for scratches. Clean marred areas with sandpaper and then repaint.

(8) Check external cabling for kinks, breaks, cuts or fraying. Replace or repair damaged cables.

(9) Inspect the antenna system for damaged components. Replace damaged cables, broken insulators, etc.

(10) Tighten loose lock nuts (switches, jacks, indicator lamps, etc.), and tighten loose knobs.

(11) Clean all air filters using the procedure outlined in paragraph 4.2 of this handbook.

(12) Inspect meters for broken glass or cracked cases. Replace damaged parts.

d. Interior Items.

WARNING

SHUTDOWN OR DISCONNECT ALL POWER INPUT TO THE EQUIPMENT BEFORE PERFORMING THE FOLLOWING PROCEDURES. UPON COMPLETION RECONNECT POWER AND CHECK FOR SATISFACTORY OPERATION OF THE SYSTEM.

(1) Inspect electron tubes for loose envelopes, connectors, cracked sockets, or insufficient socket spring tension. Check receiving type tubes in a standard tube checker. Replace faulty tubes.

(2) Inspect fixed capacitors for leaks, bulges or discoloration. Replace faulty components.

(3) Clean the glass envelopes of vacuum capacitors and tubes when necessary.

(4) Inspect resistors and resistor mountings for cracks, chipping, blistering, discoloration. Replace faulty resistors or mountings.

(5) Inspect terminals of large fixed capacitors and resistors for corrosion, dirt, and loose contacts. Clean, tighten and repair as necessary.

(6) Clean and tighten mountings of larger interior equipment.

(7) Inspect terminal boards for loose connections, cracks, and breaks. Replace faulty terminal boards.

(8) Lubricate moving parts as necessary.

(9) Tighten mounting bolts on large transformers and chokes.

(10) After the equipment has been in operation, inspect transformers, chokes, potentiometers, etc., for leakage or overheating. Determine the cause of the trouble and take corrective measures.

(11) Examine sliding or moving coil contacts. Replace any contacts that are worn, bent or broken.

(12) Check all meters for correct zero setting. Adjust as necessary.

(13) Check all door interlocks. Repair if inoperative.

(14) Lubricate each motor drive mechanism when necessary.

During long periods of normal service, the character of the emitted signals from the Type 317C Transmitter should be checked periodically. Indication of trouble during these checks often will lead to the discovery of impending equipment failure before it occurs.

e. Lubrication of Blower Shaft Bearings. The shaft bearings of cooling air blower 1MB1 of the 317C Transmitter is initially lubricated at the factory. If subjected to continuous service or exposed to water, dirt or corrosive chemicals these bearings must be lubricated every six months. For normal service they must be lubricated once each year.

Use a neutral grease which is free from moisture and acid, and is non-separable under service conditions. For normal ambient temperatures of 20°F to 180°F, LUBRICO M-21, KEYSTONE 44, ALEMITE 38 or equivalent greases are suitable.

A grease-fitting hole is provided in the bearing housing for a customer furnished grease fitting.

## 4.2 CLEANING AIR FILTERS

Normally, the transmitter air filters will require cleaning every 30 to 60 days. In abnormally dusty climates, they should be visibly inspected every two weeks and cleaned if required. The filters are of the permanent washable type. Use the following procedure to clean the air filters:

(1) Wash with warm clean water. If a coating of dirt remains, a detergent can be used, followed by a rinse.

(2) If it is impossible to immerse the filter, accumulation maybe washed out by using a fine spray of water passed through the filter in a direction opposite to that indicated by the air flow arrows. Direct the water flow from the cleaner side to the dirty side of the filter.

CAUTION

DO NOT DIRECT A HIGH-VELOCITY STREAM OF WATER AGAINST THE FILTER. DO NOT DISTURB THE SHREDDED MATERIAL IN THE FILTER. THE FILTER MAY BE DAMAGED IF THESE PRECAUTIONS ARE NOT OBSERVED.

(3) Gently shake the water out of the filter.

(4) Replace the filter with the air-flow arrows pointing in the direction of the air flow.

## 4.3 LAMP ASSEMBLY MAINTENANCE

The 28-volt indicator lamps in the Transmitter are operated at reduced voltage (24 volts) thus increasing bulb life expectancy from 500 to greater than 4,000 hours. Use the following procedure to replace the bulbs in the indicator lamp assemblies:

(1) The display screen can be easily removed by grasping the top and bottom of the screen and gently pulling forward. This removes both the screen and the lamp assembly. The base of the lamps will be exposed and can be removed by grasping the base flange with a pair of long nose pliers.

(2) To replace the bulb, press it in securely from the rear side.

(3) Color filters are placed over the lamp flanges to provide color indication when the lamps are illuminated. If these color filters become streched the color will not be uniform. The filters may be replaced by removing the old filter with long nose pliers and placing a new filter over the lamp flange.

Under normal operating conditions very little maintenance is required for the lamp housing modules and their associated switches. If maintenance is required, use the following procedure:

(1) Any switch/indicator-lamp unit mounted independently in a single hole can be removed by pushing the entire assembly out through the front of the cabinet.

(2) When two or more units are connected together in a single hole, all units must be pushed out of the common mounting hole together. The faulty unit can then be removed by unsnapping the associated units.

(3) The associated switches can be removed from the switch-indicator unit before the assembly has been withdrawn from the cabinet. Gently pry with a small screwdriver between the switch housing and the module switch-mounting extension on the side where the two "fingers" of the mounting clip are located.

The three-piece display screens are provided by the manufacturer with the recommended designation strips inserted. The designation strips may be changed to comply with a particular installation by using the following procedure:

(1) Remove the screen unit from the switch-indicator as outlined in this procedure.

(2) The transparent cap can then be removed by sliding it off the top. This removes the designation strip and translucent insert also. The translucent insert can be removed by sliding it out one end of the transparent cap and the designation strip will then be freed. (If the translucent insert will not readily slide out, a thin knife blade can be used to start it.)

(3) A new designation strip can be made from a piece of thin, clear plastic. First, roughen the surface of the plastic with pounce. Then, the appropriate designation can be lettered with india ink. The clear plastic insert can be used as a guide for cutting out the new designation.

4.4 TROUBLE SHOOTING

Trouble shooting must be systematic to be effective. It is seldom possible to observe a symptom and diagnose the trouble immediately. Generally, a sequence of operational checks, observations, and measurements are required before the reason for the fault is apparent.

The first step in servicing defective equipment is to localize the fault. Observe the meter readings and indicator lamps for abnormal indications. A log of meter readings should be kept to locate minor troubles before they can cause serious loss-of-air time. Once the fault is localized, it becomes a problem of replacing the defective part and, if necessary, re-alignment of the section.

## 4.5. ADJUSTMENTS.

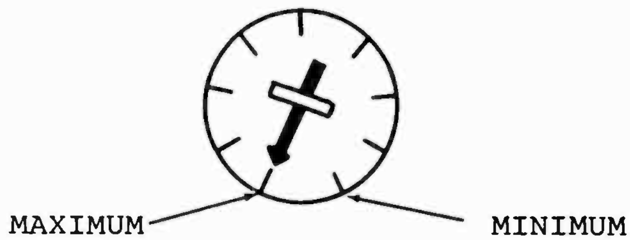
The following list of components are adjustable. They were factory adjusted; however, on replacement, the new component should be adjusted to the values indicated.

| Component | Use | Adjustment |
|---|---|---|
| Circuit Breaker, 2CB11 | Plate Breaker | See Procedure Below |
| Relay, 2K14 | Blower Holdover Delay | 15 Min. |
| Relay, 2K15 | Plate Delay | 120 Sec |
| Relay, 2K16 | Surge-Limit Delay | 1 Sec |
| Relay, 2K23 | Carrier Overload | 6 Amps |
| Relay, 2K24 | Peak Overload | 5 Amps |
| Relay, 2K25 | DC Overload | 8 Amps |

### 4.5.1. CIRCUIT BREAKER, 2CB11 PLATE

Each of the three poles of this breaker is provided with adjustment of the magnetic trip. They are accessible from the front of the power and distribution unit. (See Figure 15.) If a replacement breaker is ordered, it is shipped with these adjustments at maximum and, further, since the breaker is designed with a ±15% tolerance, it is necessary that the following procedure be followed to ensure proper adjustment.

This procedure is described for a transmitter known to be in proper operating condition. Each adjustment screw is provided with 9 detents as shown in the enlarged view below.



With the adjustment screw adjusted to the maximum point as shown above, the magnetic trip of the breaker is at maximum current. Set each adjustment screw to minimum (clockwise 8 detents from that shown).

NOTE

The adjustment screw does not stop at minimum or maximum, however, the spacing is wider between the maximum and minimum detents and is easily located since these two points are at the bottom of the adjustment circle.

With the transmitter set for full power, turn on. If the breaker trips, move each adjustment screw counterclockwise to the next detent. Again, try the transmitter at full power. This procedure should be followed until the breaker will not trip on turn on.

After this point is found, apply 100-cycle tone at 100% modulation or normal program. Again, turn the transmitter on and off.

The proper adjustment is defined as the minimum setting of the three adjustments which will allow the transmitter to come on as outlined above without nuisance tripping of the plate breaker. The transmitter should be turned off and on at least fifteen times to assure there will be no tripping due to the surge current which occurs on turn on. If the breaker trips one time in the fifteen times, the adjustment screws should again be rotated one detent counterclockwise.

Due to the tolerance on the breaker, the setting of the magnetic trips vary widely from breaker to breaker; however, past experience has found the point described above usually to be from the third detent above minimum to the 6th detent above minimum.

## 4.6. PROCEDURE FOR REPLACING SCREEN BY-PASS CAPACITORS FOR TYPE 4CX35000 TUBES

1. Remove tube, air skirt and tube socket. Due to the various connections to the tube socket, note orientation so that it can be re-installed in the same position.

2. Thoroughly clean both surfaces where the insulating rings mount. Remove any abrasions or sharp points that may be found.

3. Clean each of the teflon spacers and each socket mounting bolt.

4. Either 2 or 3 insulating rings are used to form the screen bypass capacitor. The rings are supplied in .010" and .005" thickness. Since .015" should be used, this can be made up by using 3 each of the .005" type or, 1 each of the .005" type and 1 each of the .010" type.

5. Make sure that the insulating rings to be used are free of punctures or any foreign matter.

6. Align the new rings over the socket mounting holes and hold in place by temporarily inserting the mounting bolts through the ring into the mounting hole.

7. With the rings in place as above, align the socket over the insulating rings. Make sure the orientation is the same as when removed.

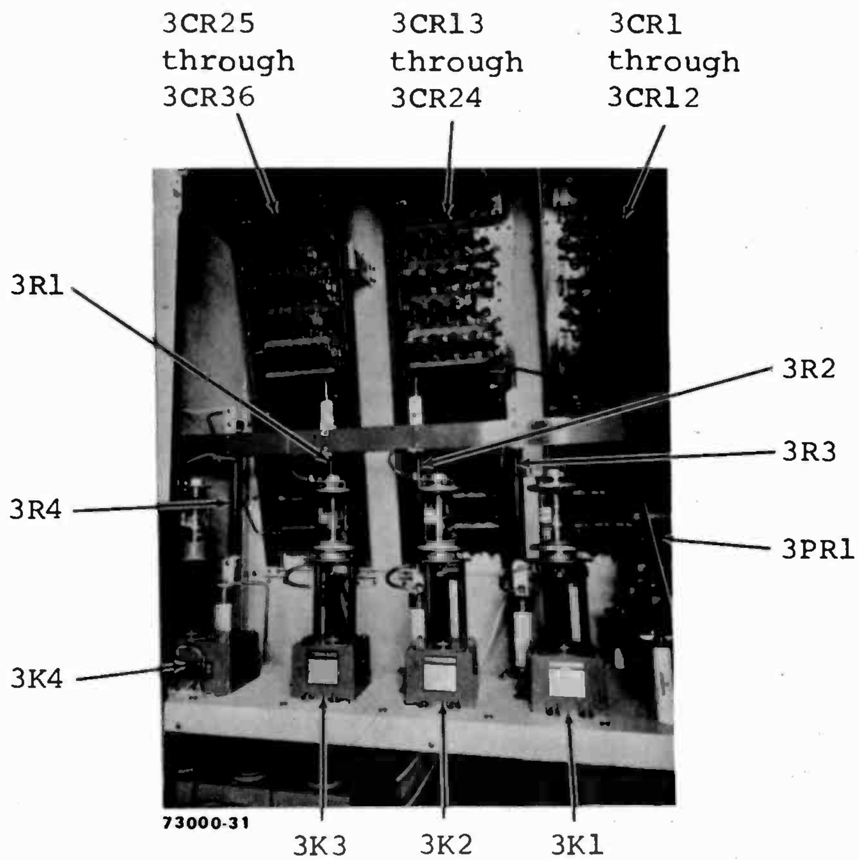
8. Remove one mounting bolt at a time and install each teflon spacer and mounting bolt before installing the mounting bolt, coat the threads of the bolt with DC4 compound.

9. After all teflon spacers and bolts are installed as above, install all hardware to mounting bolts and tighten.

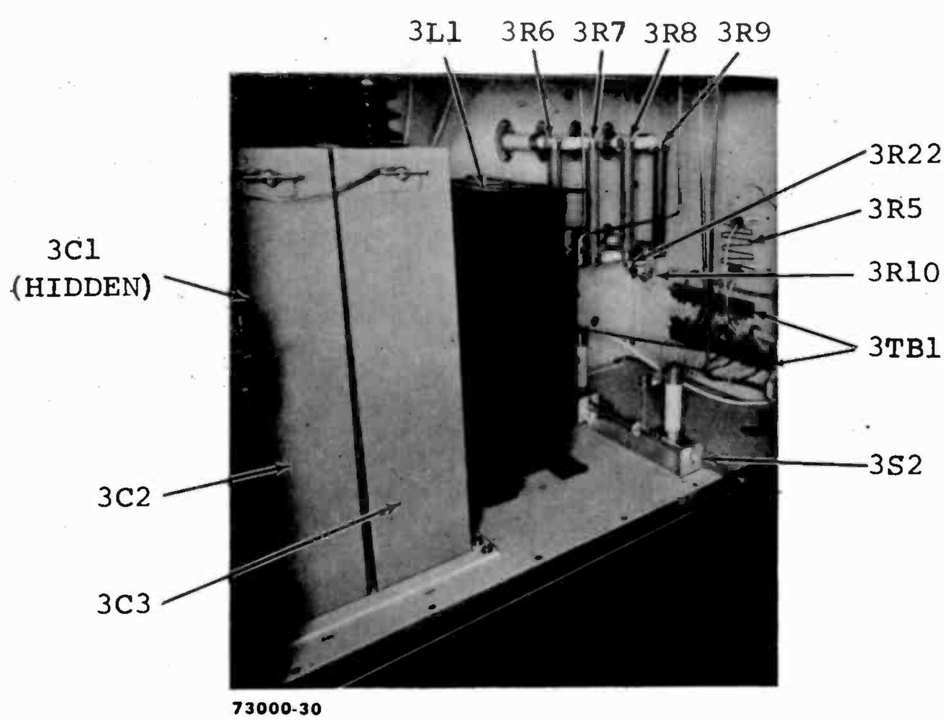
10. Wipe clean all surplus DC4 from the top of each teflon spacer.

11. Re-install <u>all</u> connections to bottom of tube socket.

12. Re-install tube air skirt and tube. Re-connect plate of tube.



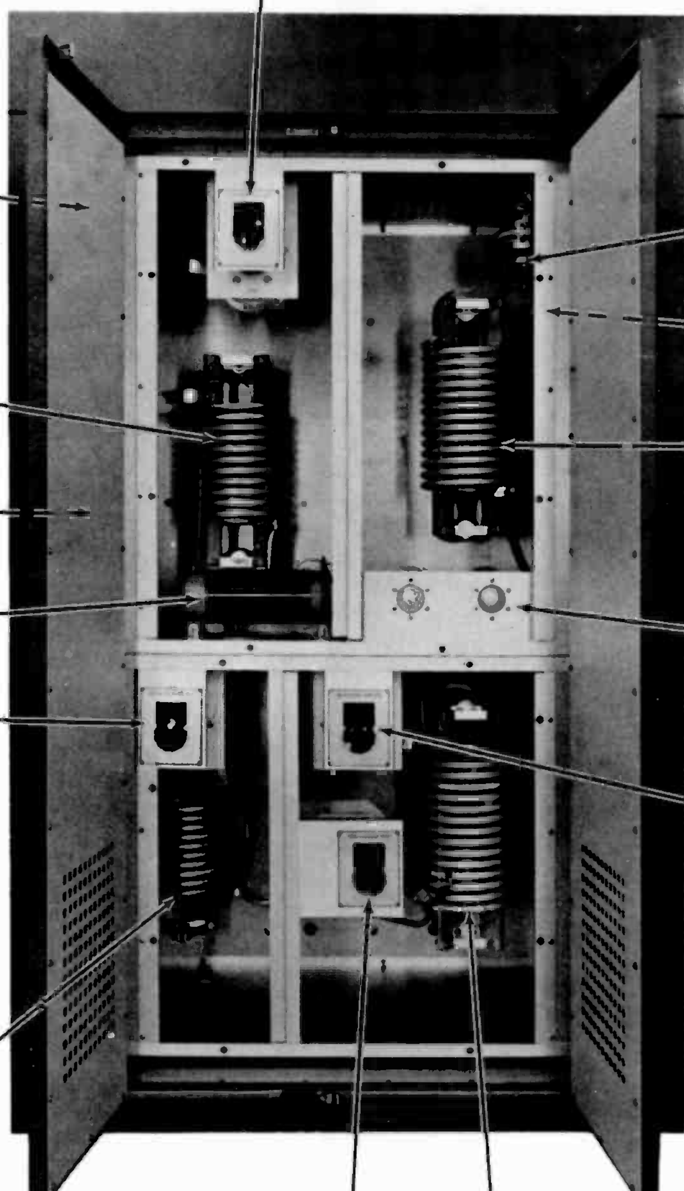

UPPER FRONT COMPARTMENT




LOWER FRONT COMPARTMENT

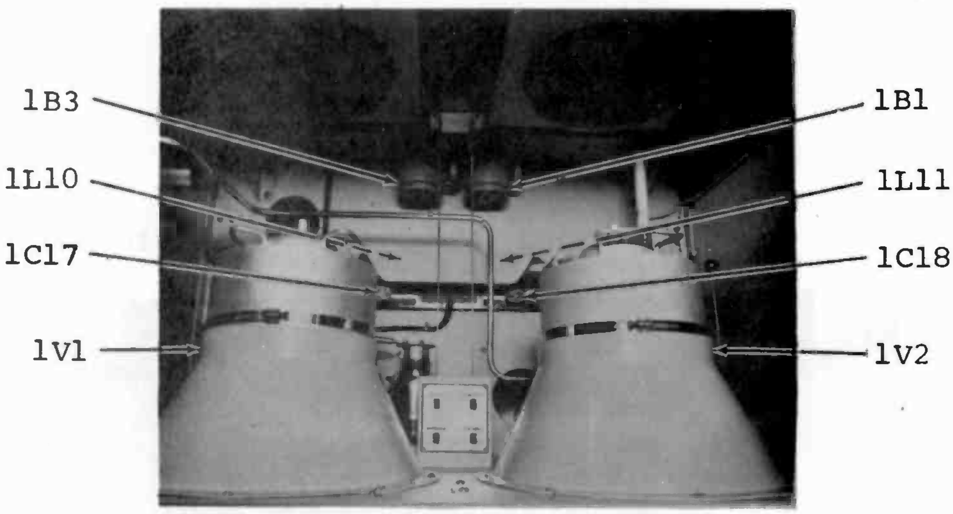
REV B EQ1-10

Figure 10. Rectifier and Harmonic Filter Unit, Front Door Open, Interior Views

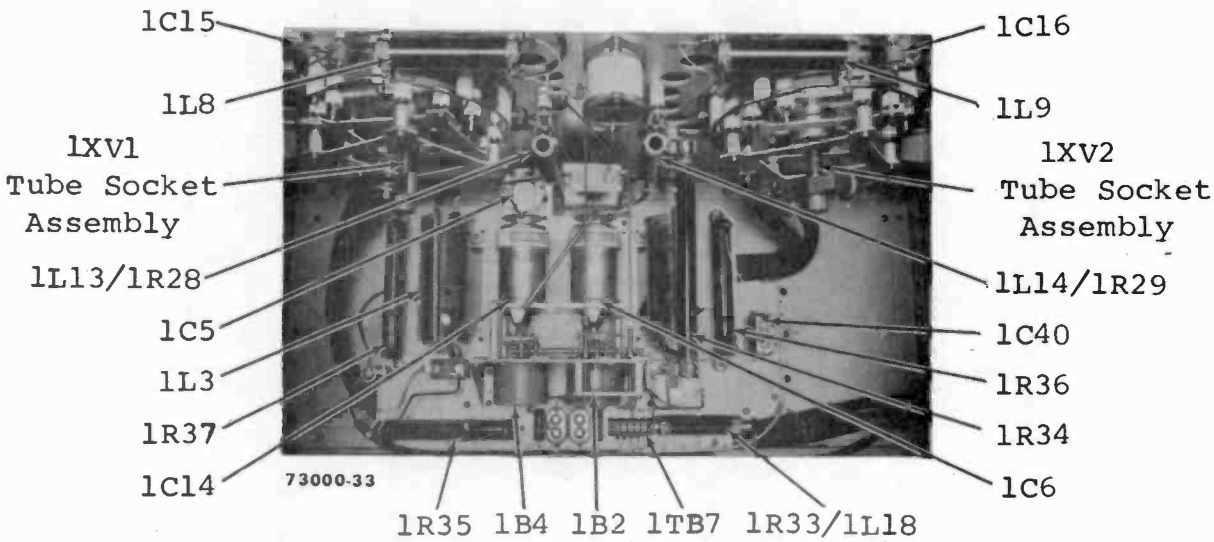



REV B EQ1-11

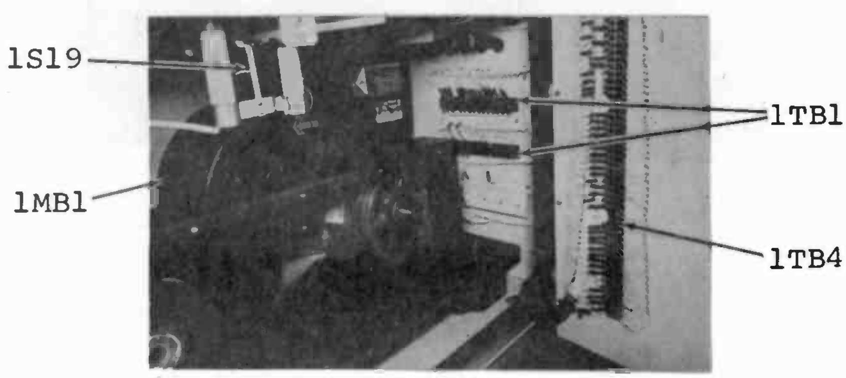
Figure 11. Rectifier and Harmonic Filter Unit, Rear Door Open, Interior View




UPPER FRONT COMPARTMENT



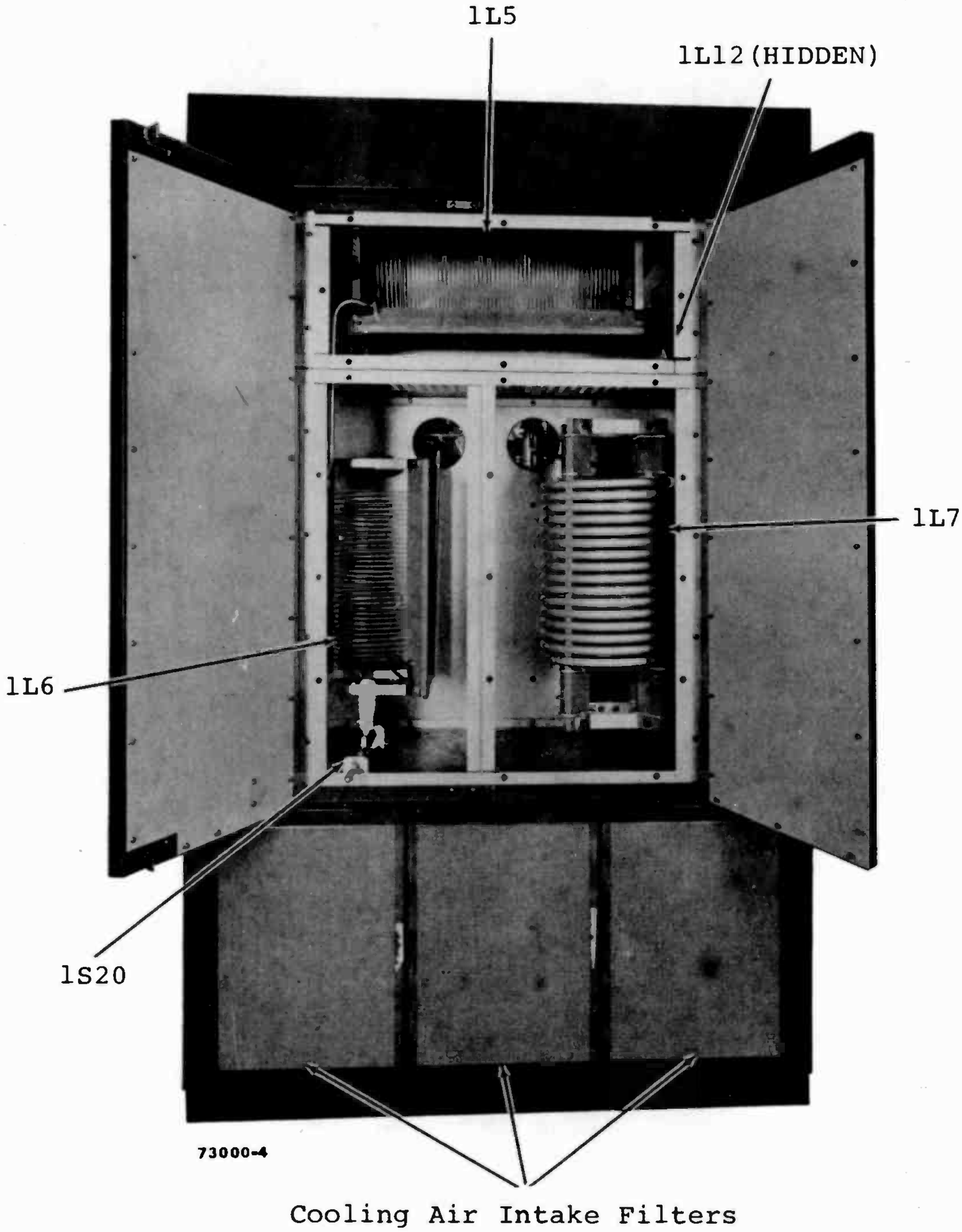

CENTER FRONT COMPARTMENT, COVER OPEN




REV A EQ1-12

LOWER FRONT COMPARTMENT

Figure 12. Power Amplifier Unit, Front Door Open, Interior Views




REV A EQ1-13

Figure 13. Power Amplifier Unit, Rear Doors Open, Interior Views

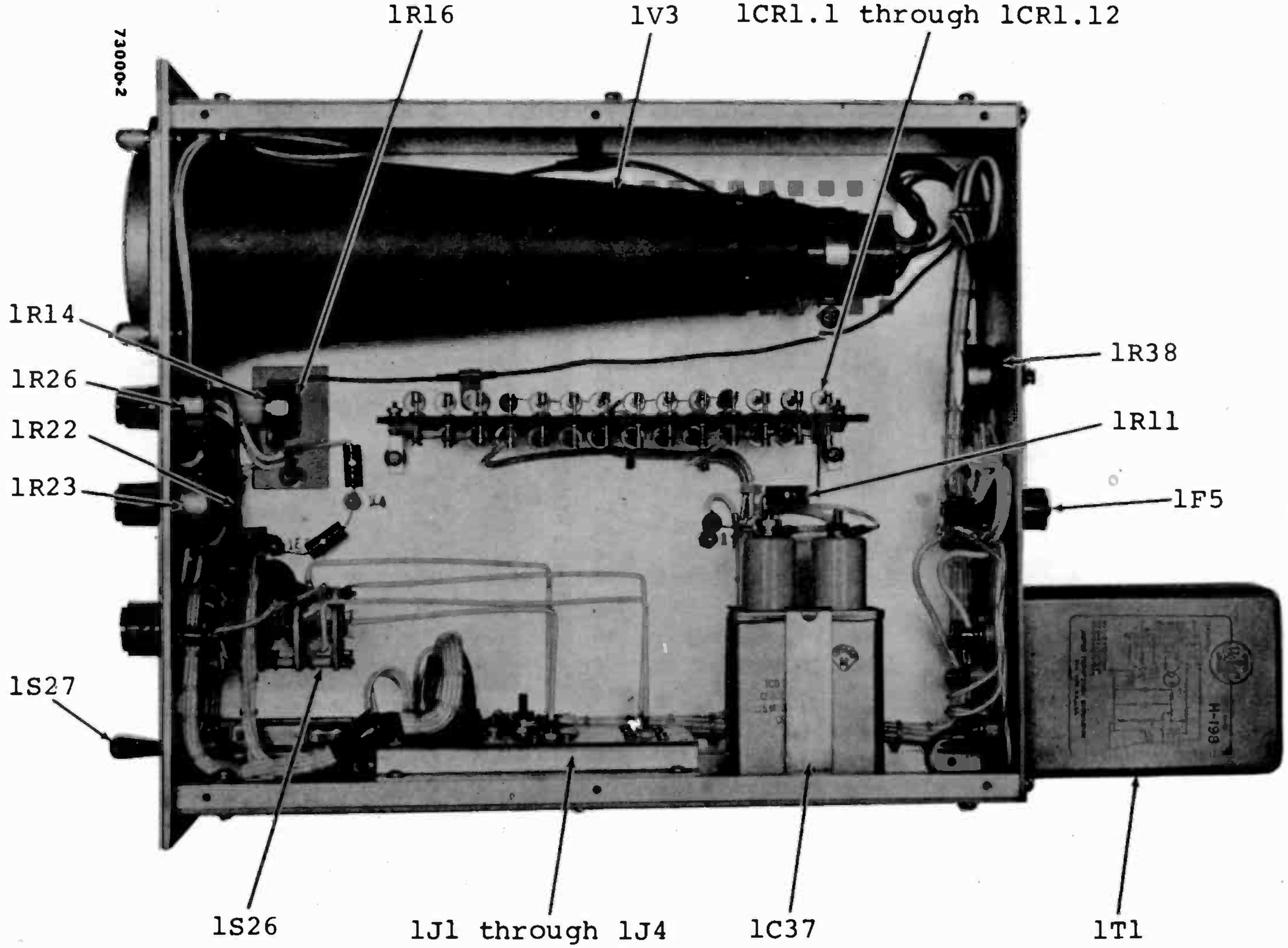
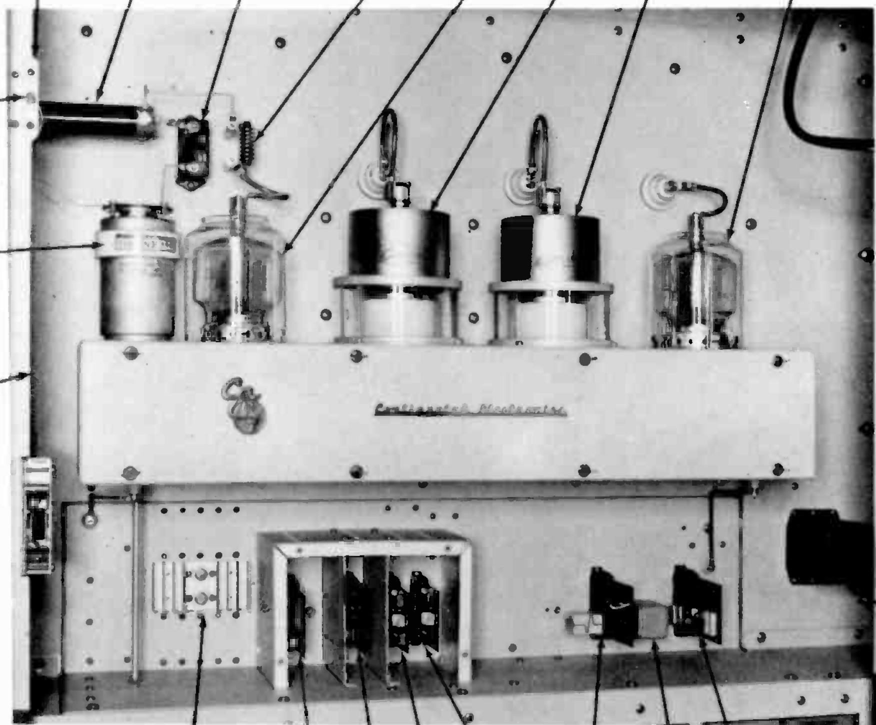



Figure 14. Power Amplifier Unit Oscilloscope, Side Interior View

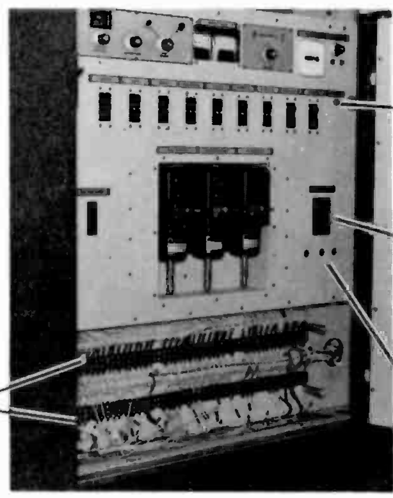




UPPER FRONT SECTION

NOTE

See Figure 7 for interior panel controls and indicators.





LOWER FRONT SECTION

REV C EQ1-15

Figure 15. Driver and Power Distribution Unit, Front Door Open, Interior Views

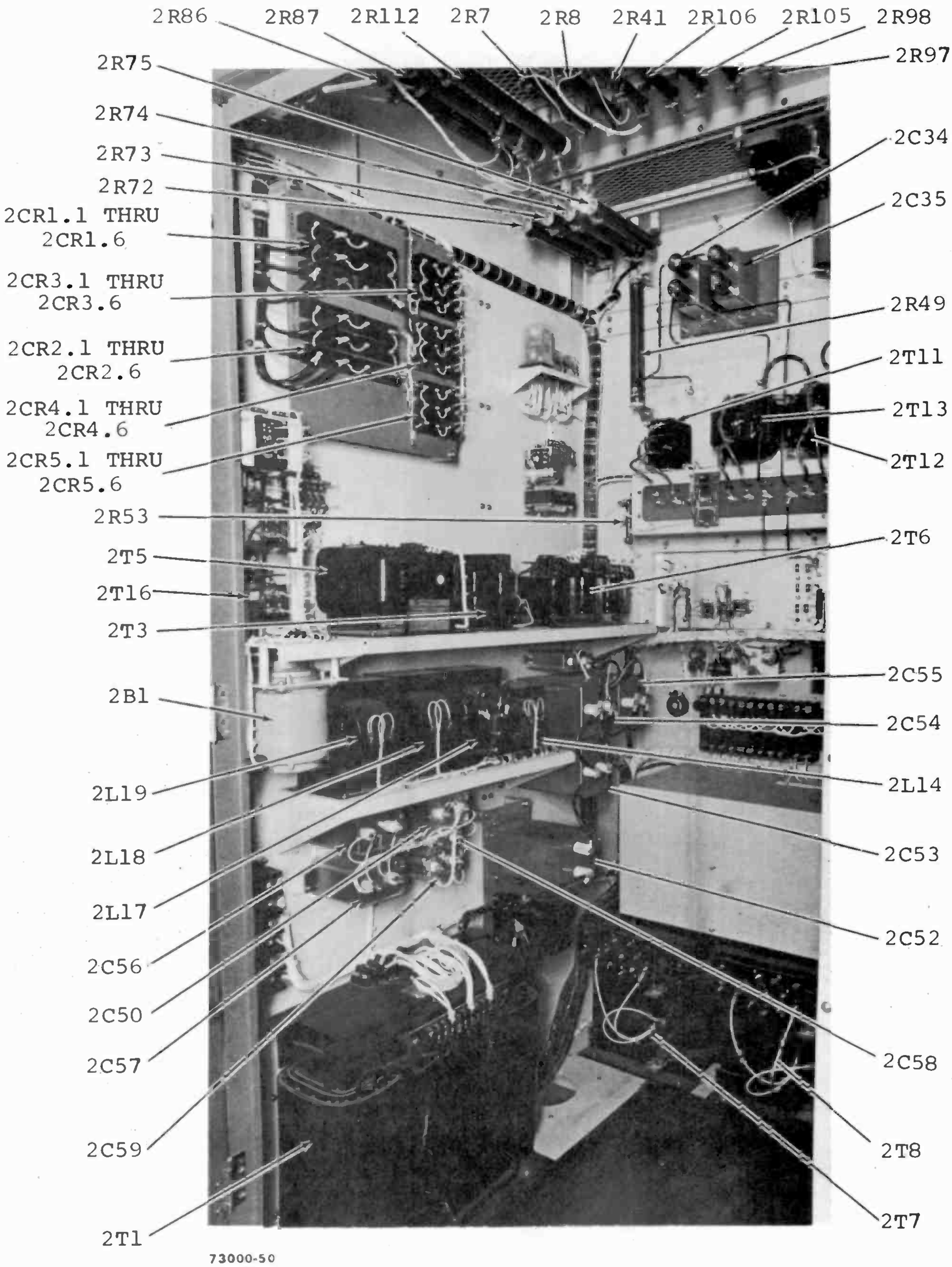



Figure 16. Driver and Power Distribution Unit, Rear Doors Open, Left Interior View

REV C EQ1-16

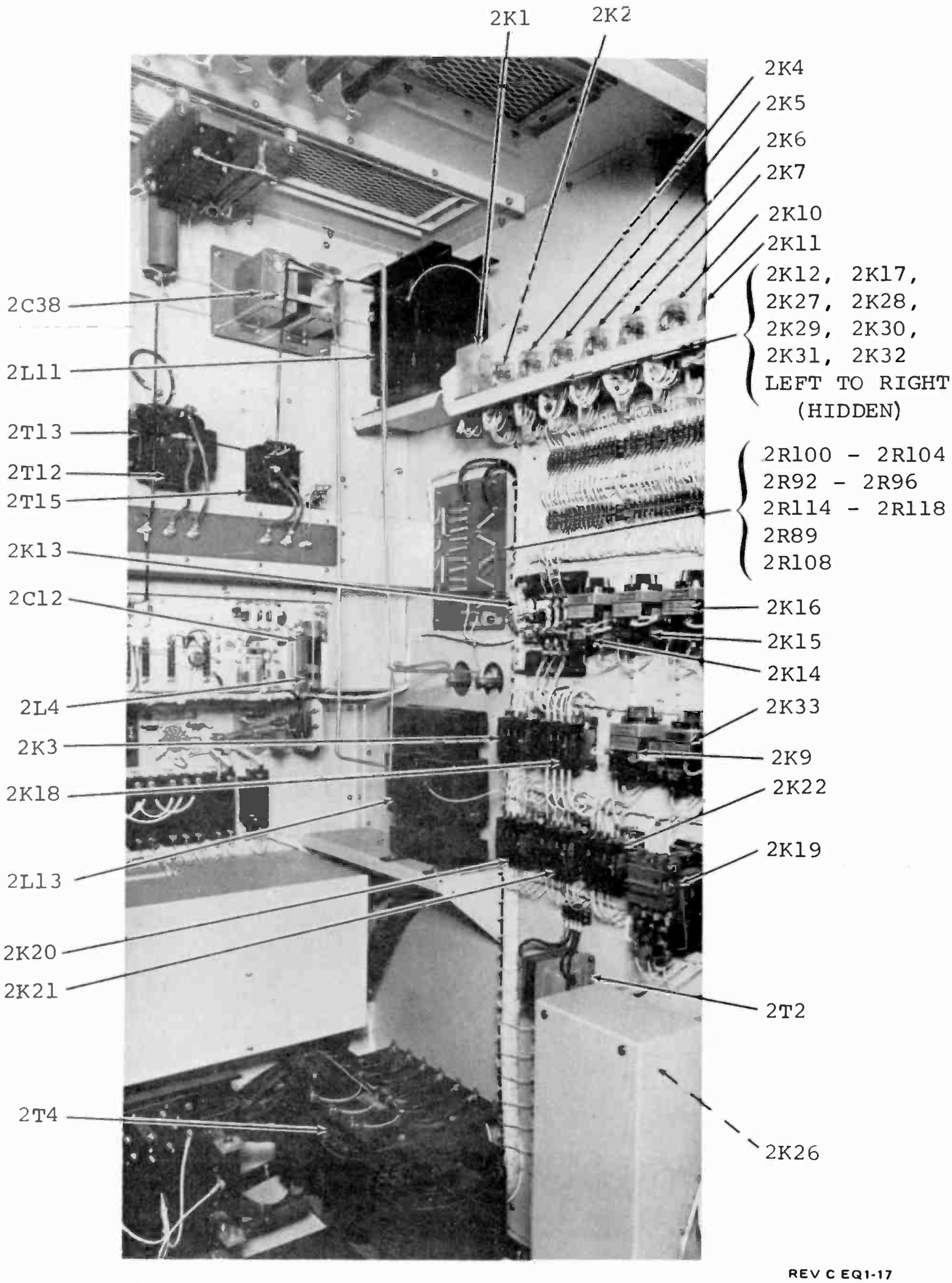
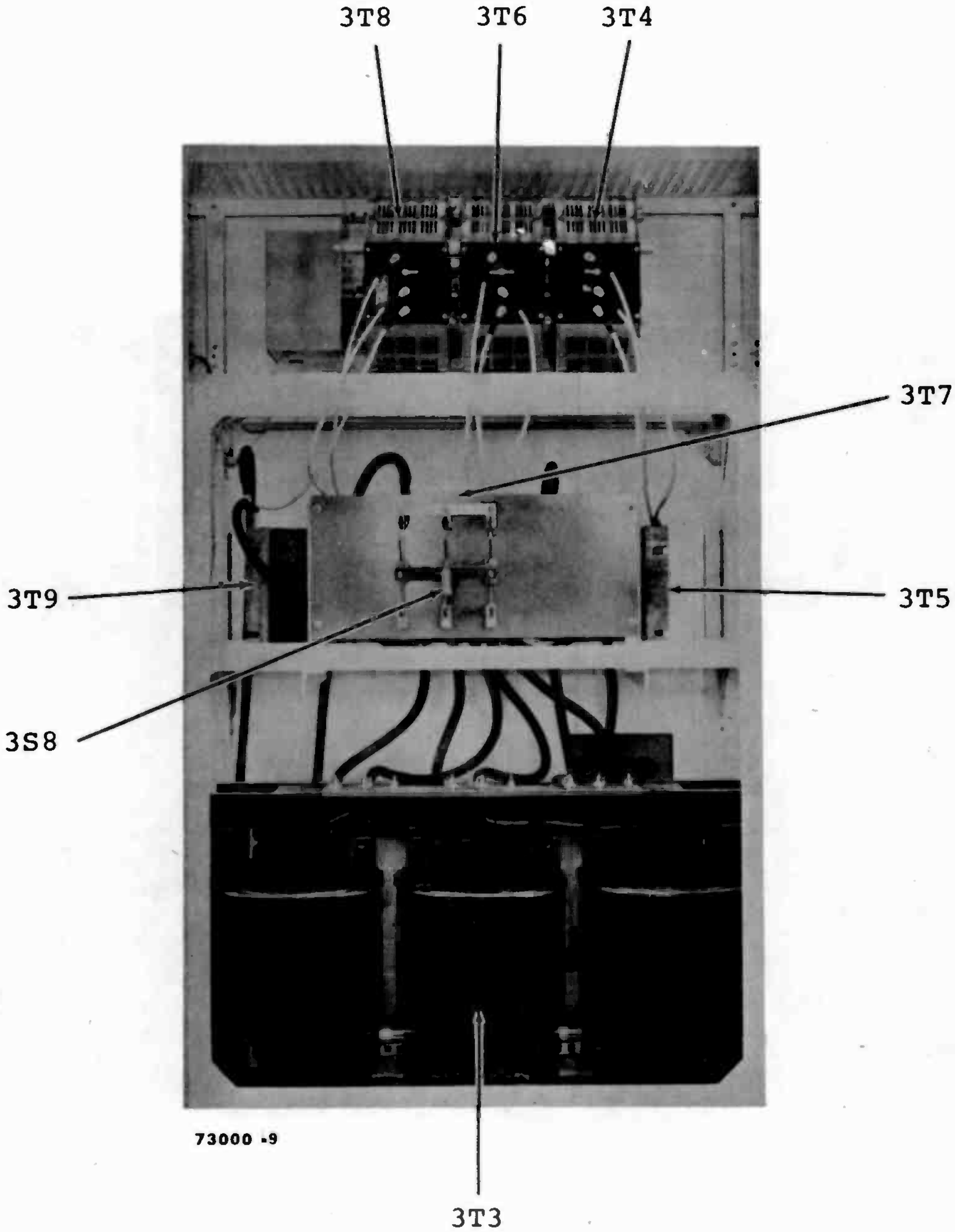
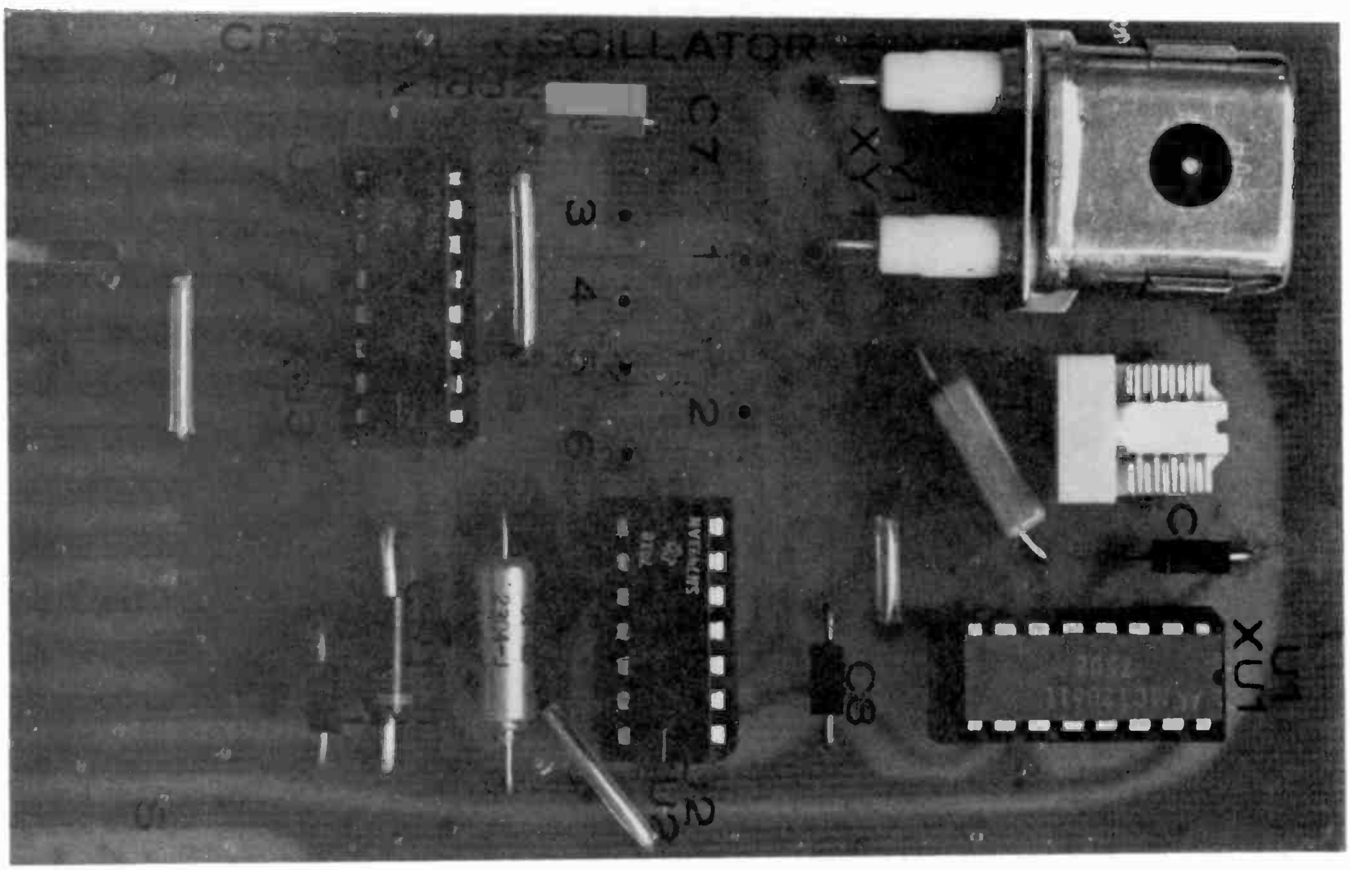



Figure 17. Driver and Power Distribution Unit, Rear Doors Open, Right Interior View




EQ1-18

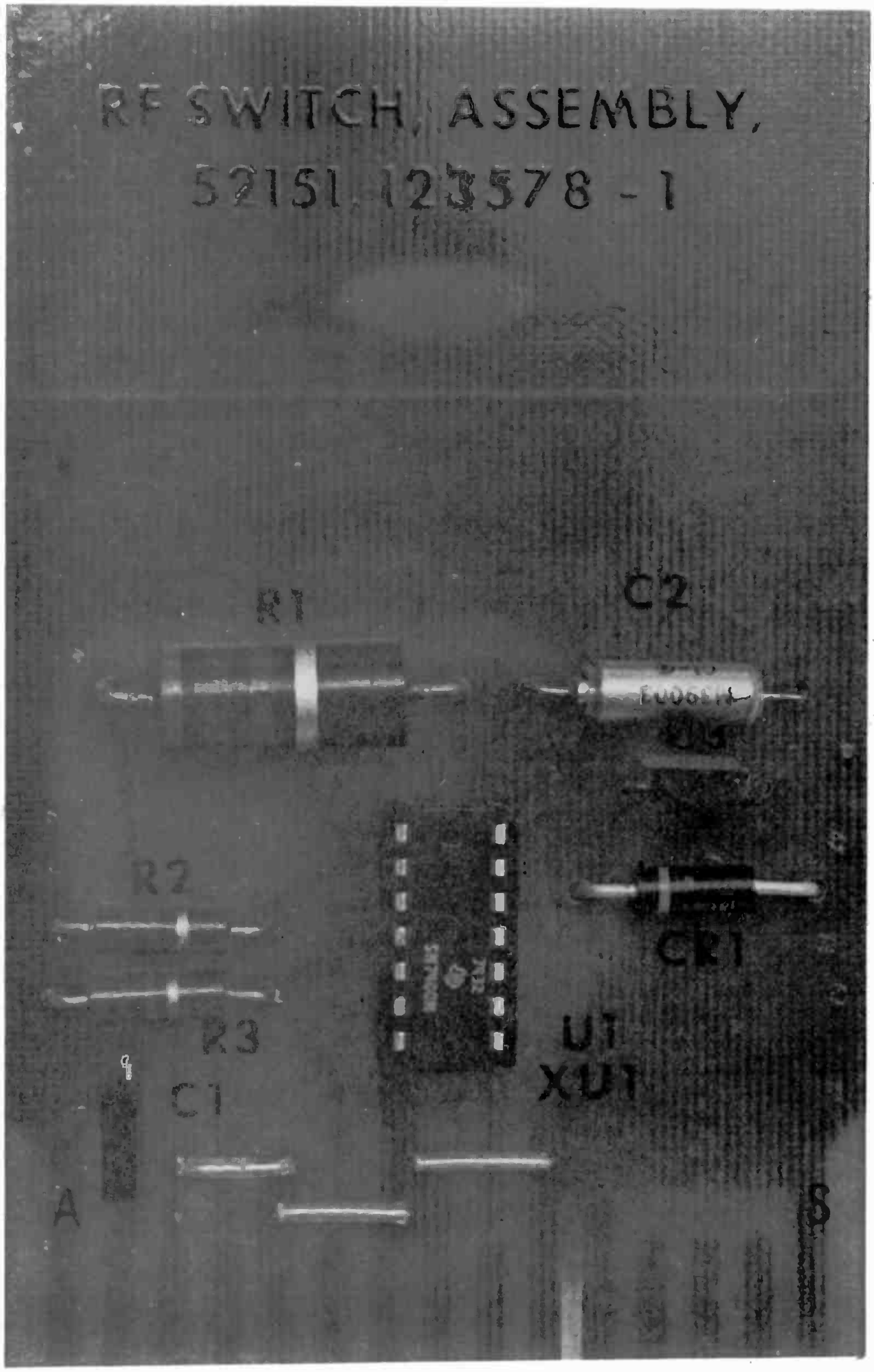
Figure 18. HV Transformer and Regulator Unit, Partially Assembled, Interior View




121832-1

EQ2-3

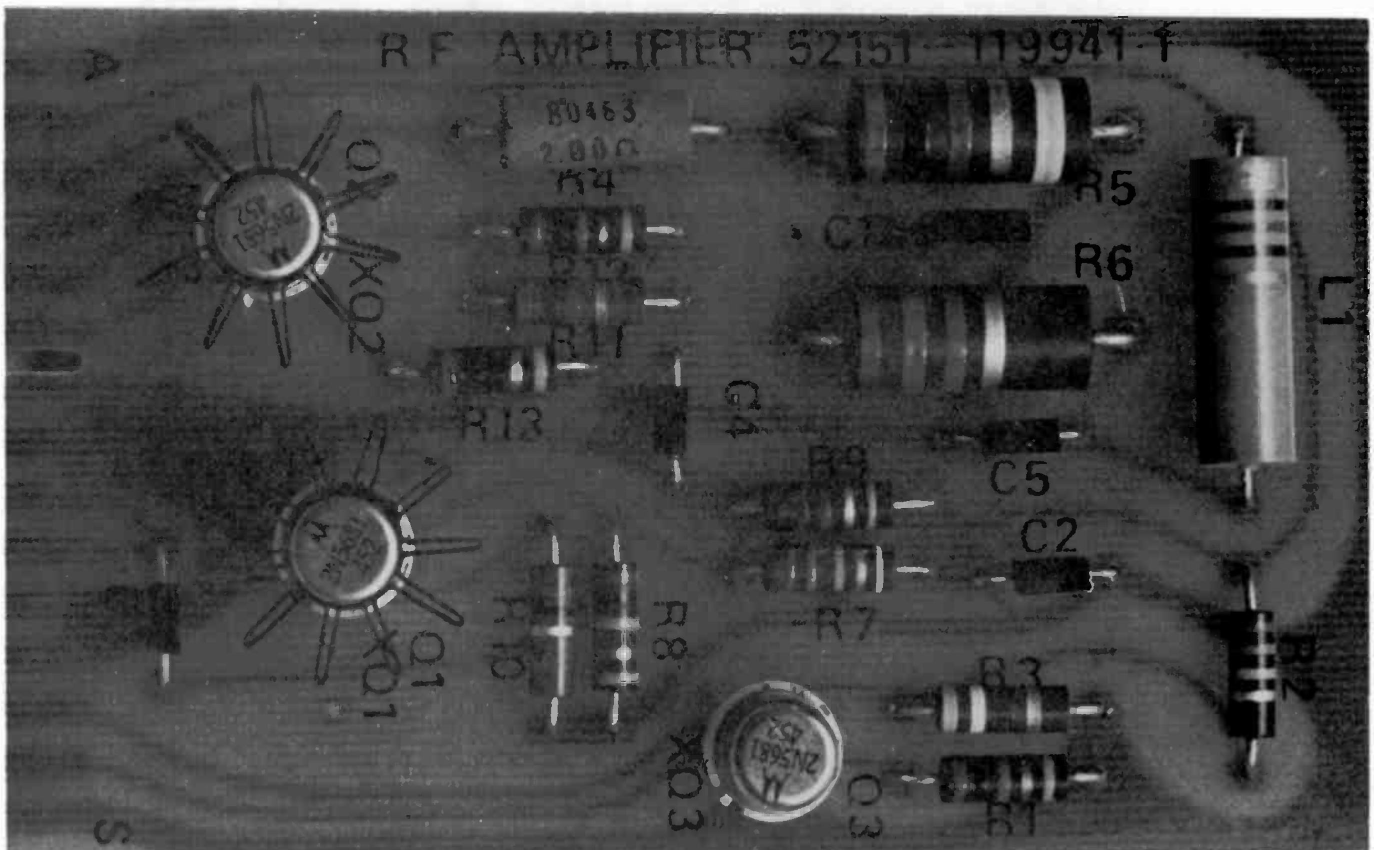
Figure 19. Oscillator (PC Board), 2A1/2A2




123578-1

EQ2-4

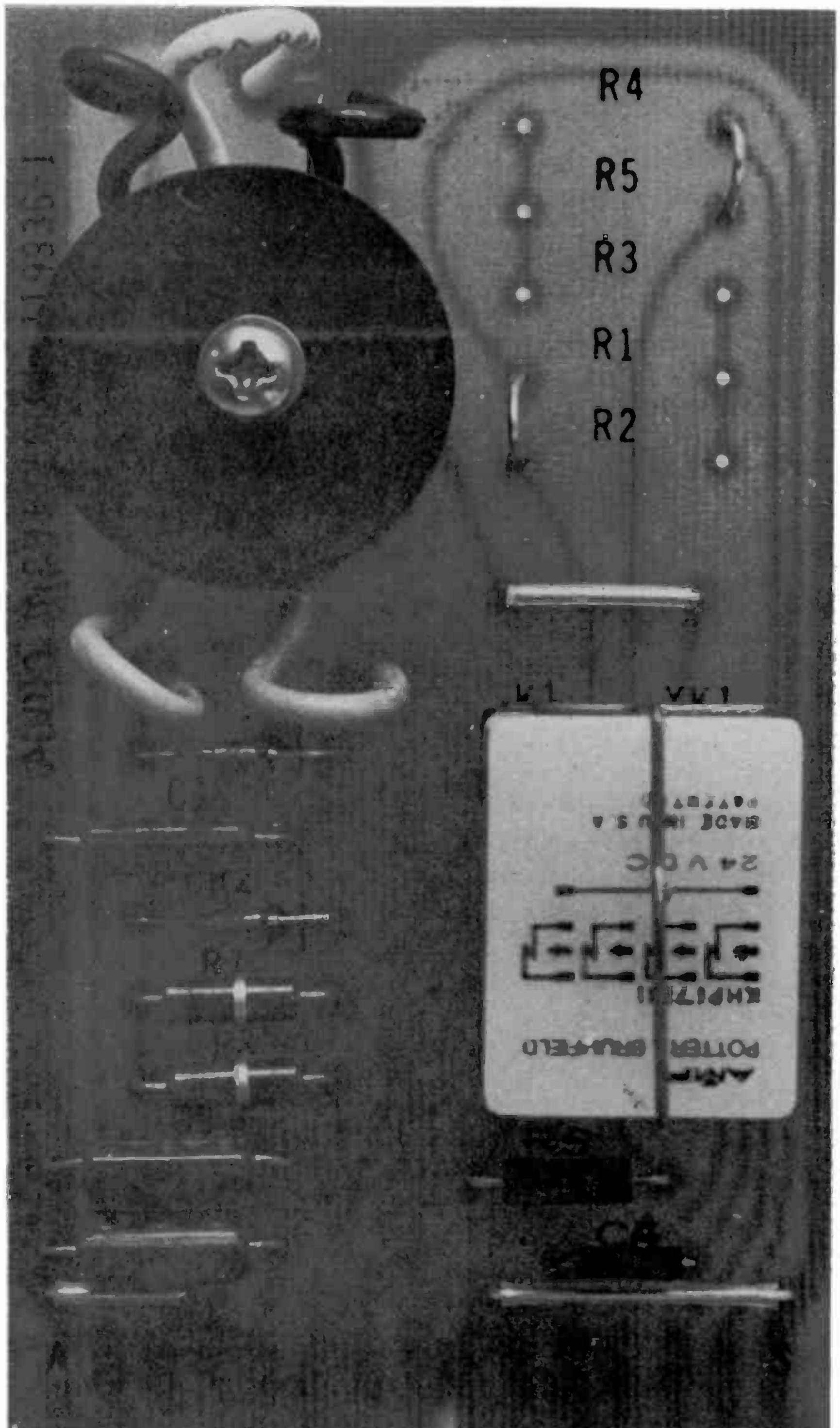
Figure 20. RF Switch (PC Board), 2A3




119941-1

EQ2-5

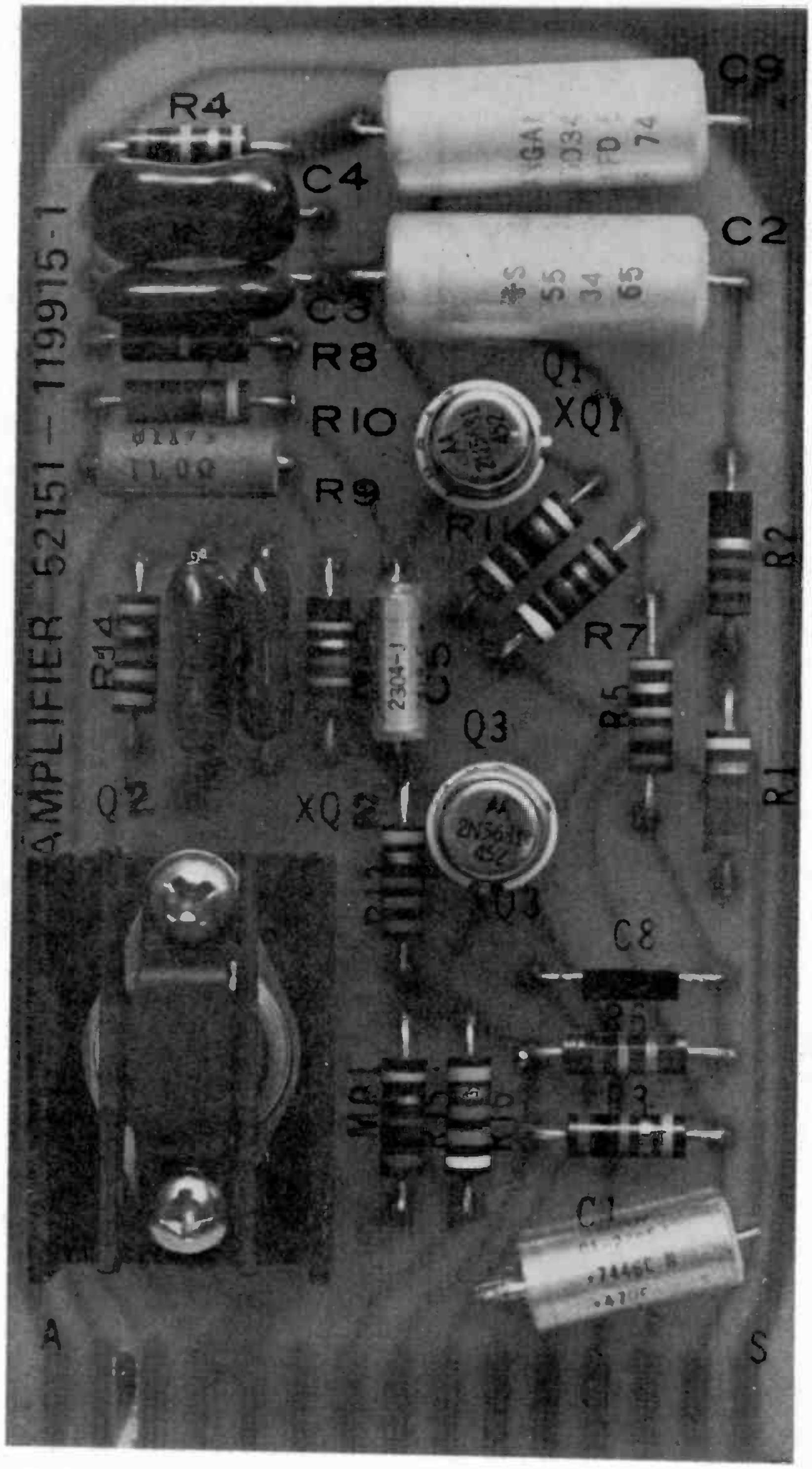
Figure 21. RF Amplifier (PC Board), 2A4




119936-1

EQ2-6

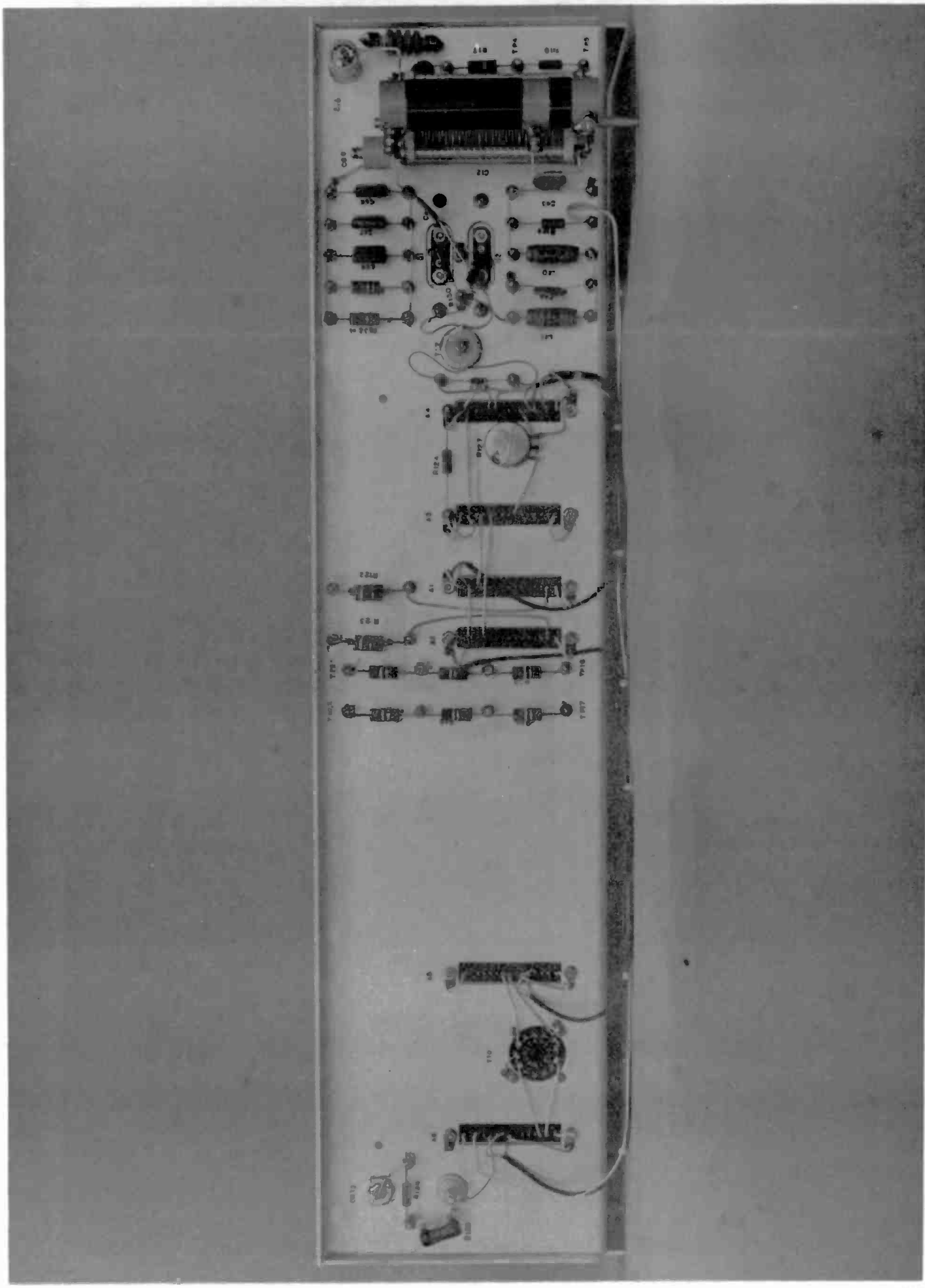
Figure 22. Audio Input (PC Board), 2A5




119915-1

EQ2-7

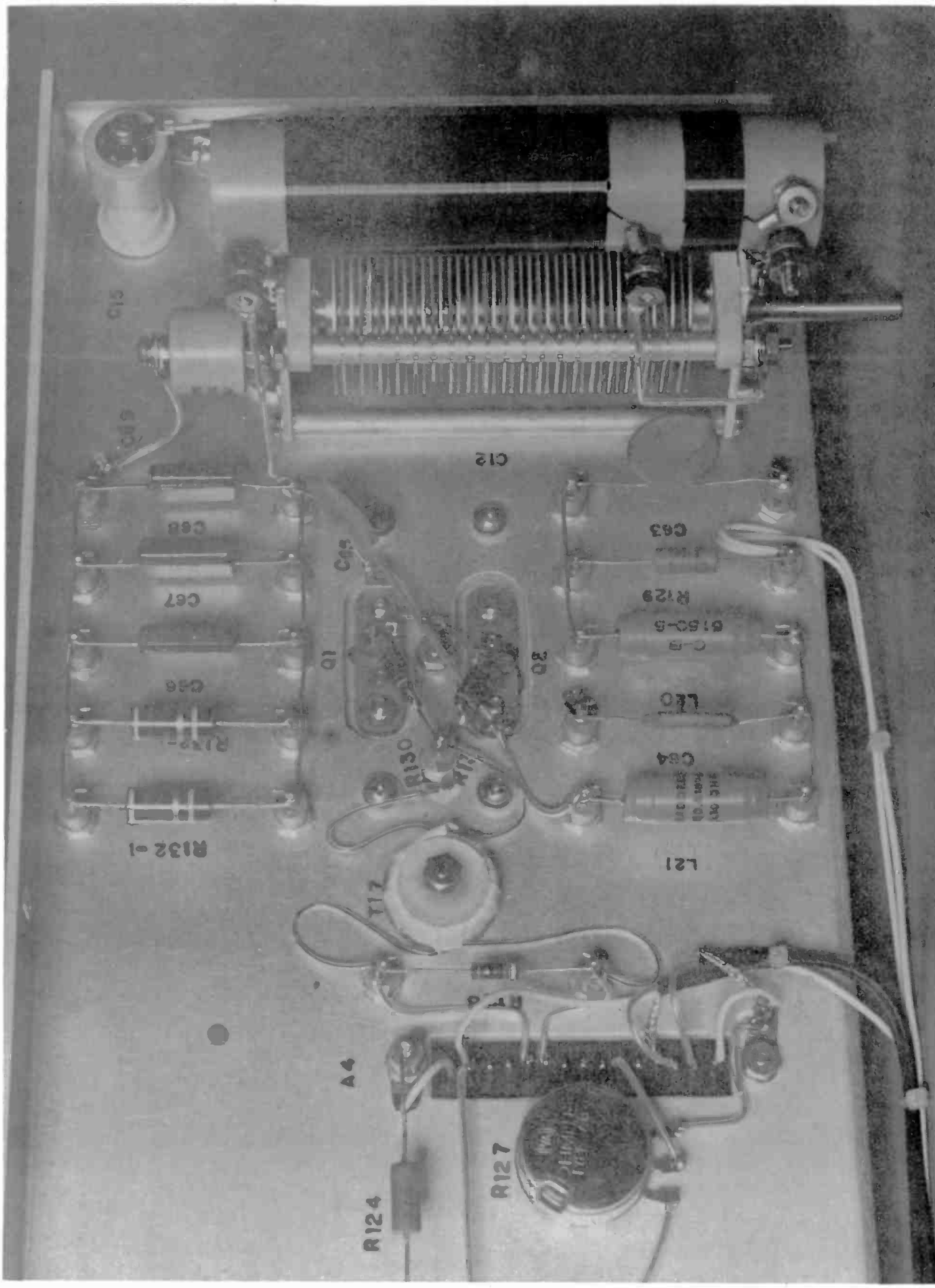
Figure 23. Audio Amplifier (PC Board), 2A6



73484-1

Figure 24. Oscillator Assembly

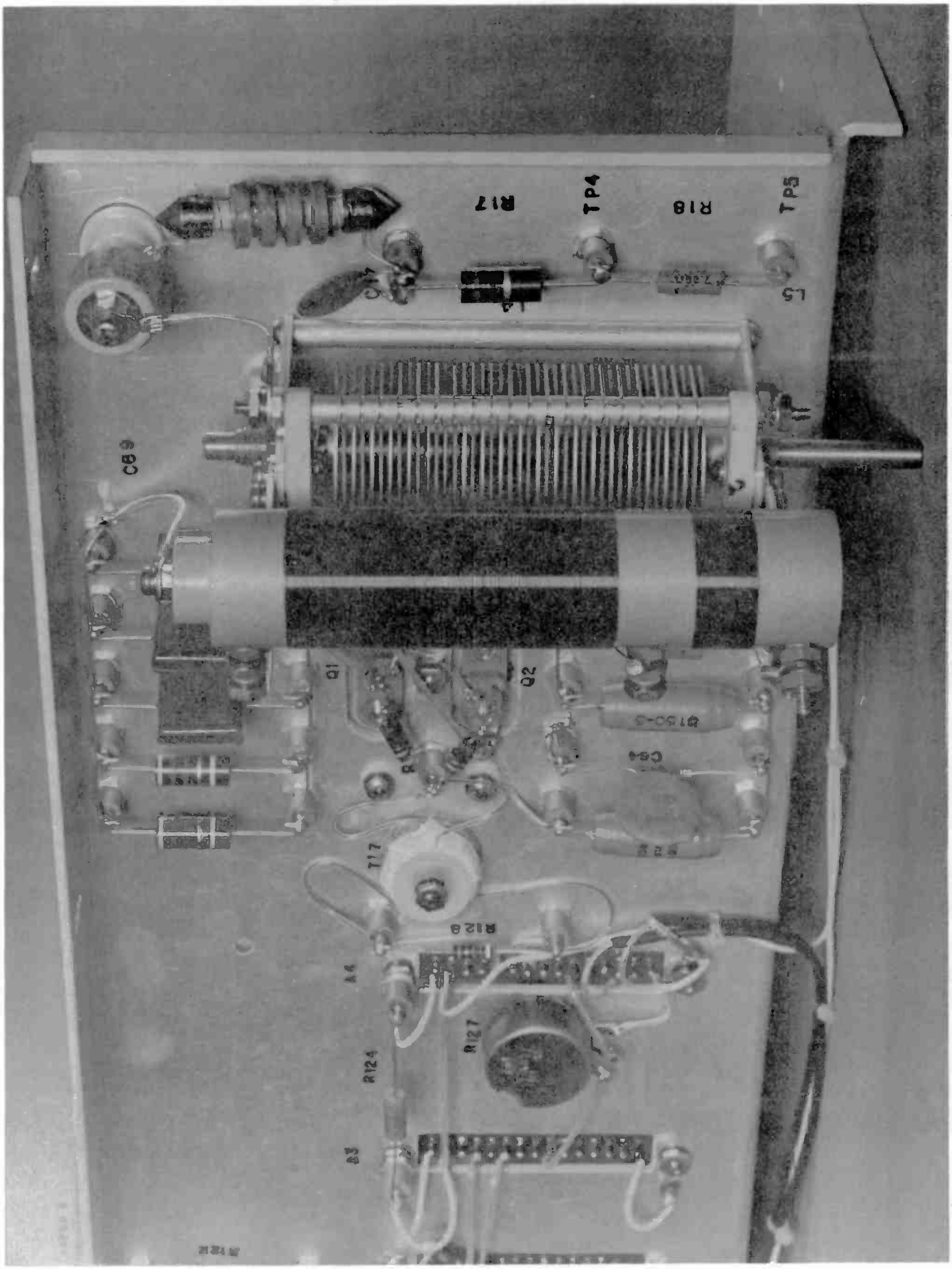
EQ2-8




73484-2

Figure 25. Oscillator Assembly Components, Left

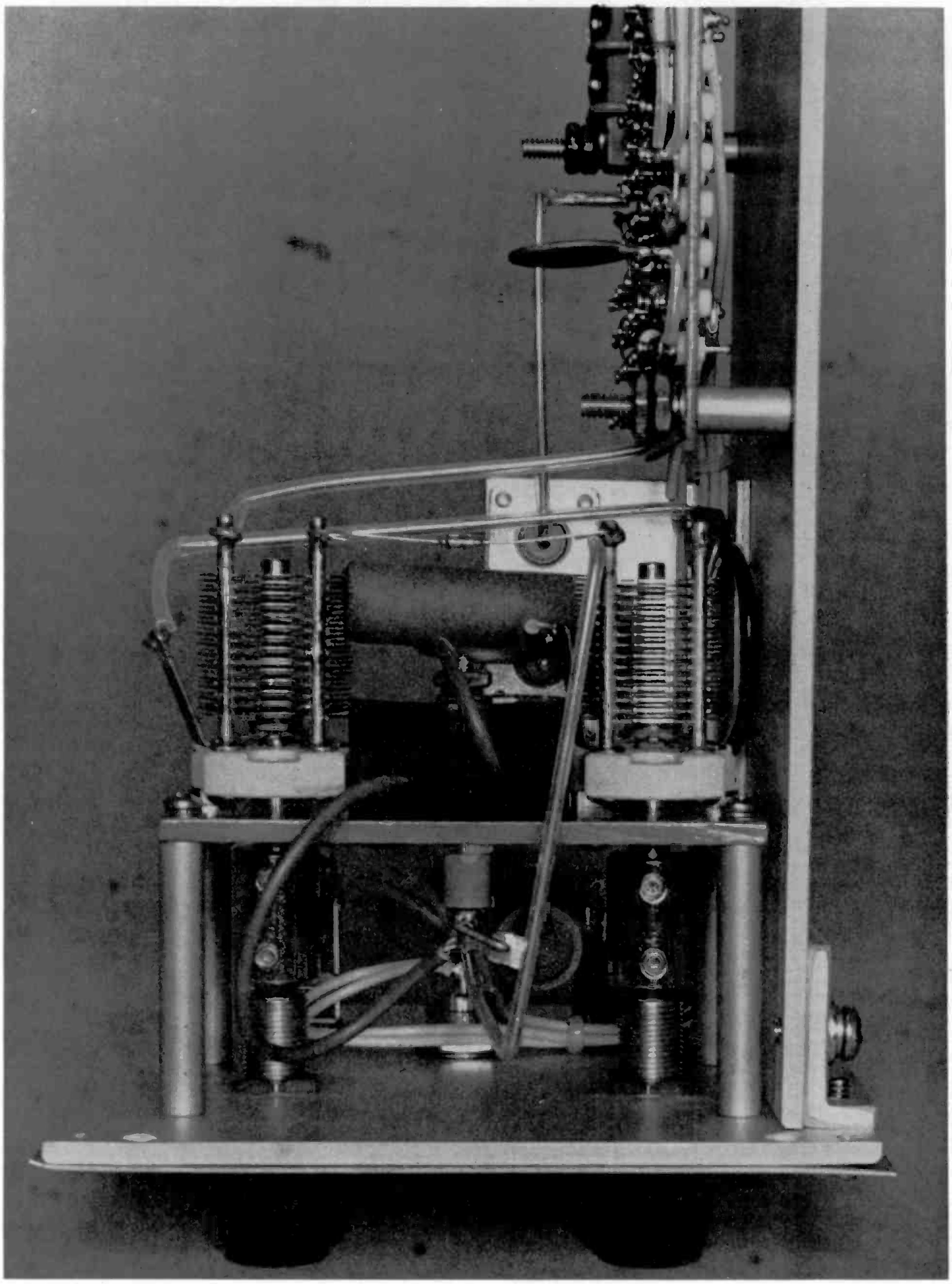
EQ2-9




73484-3

EQ2-10

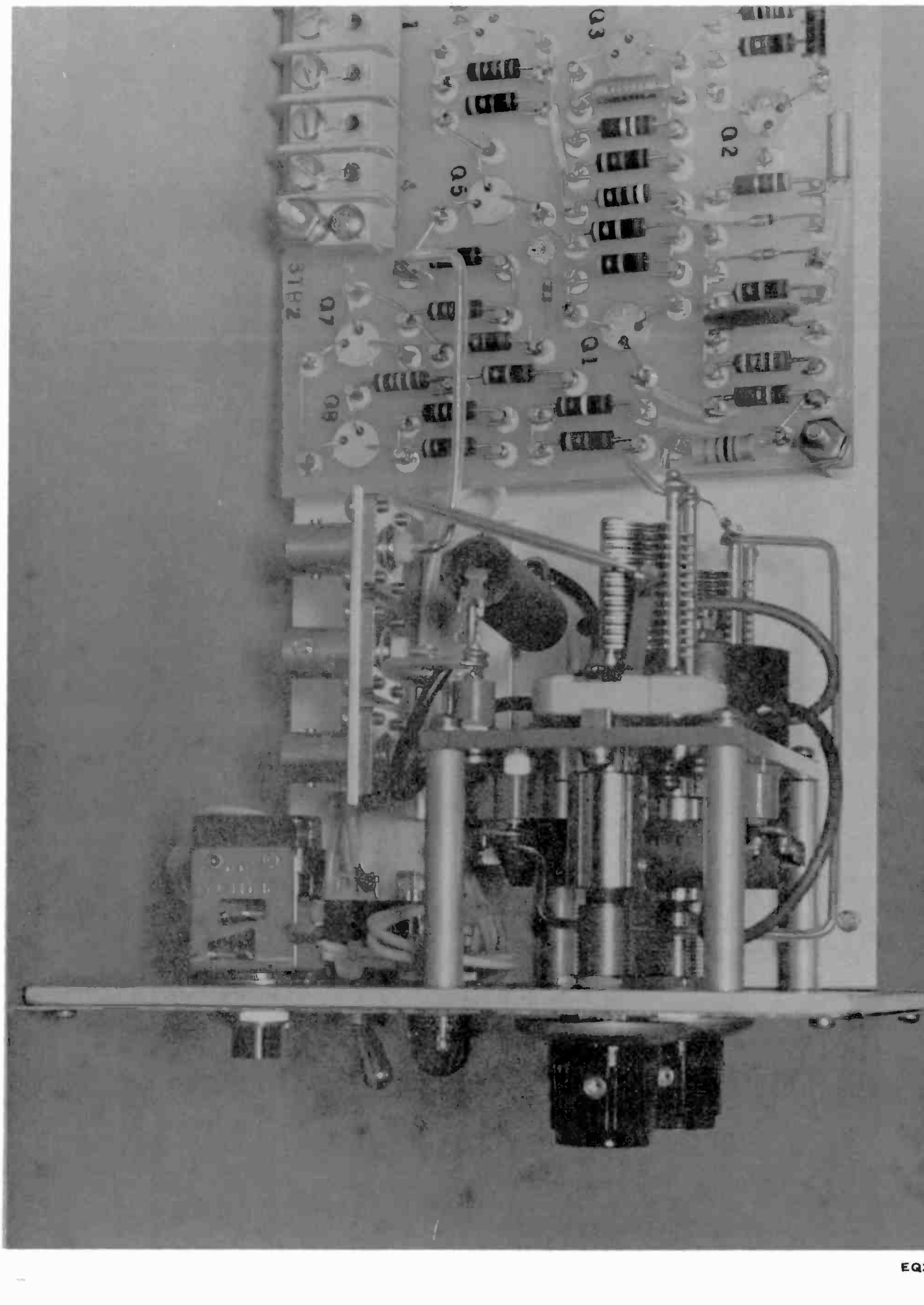
Figure 26. Oscillator Assembly Components, Right



123999-4

EQ2-11

Figure 27. Magniphase Assembly Components, Top




123999-3

Figure 28. Magniphase Assembly Components, Left

EQ2-12

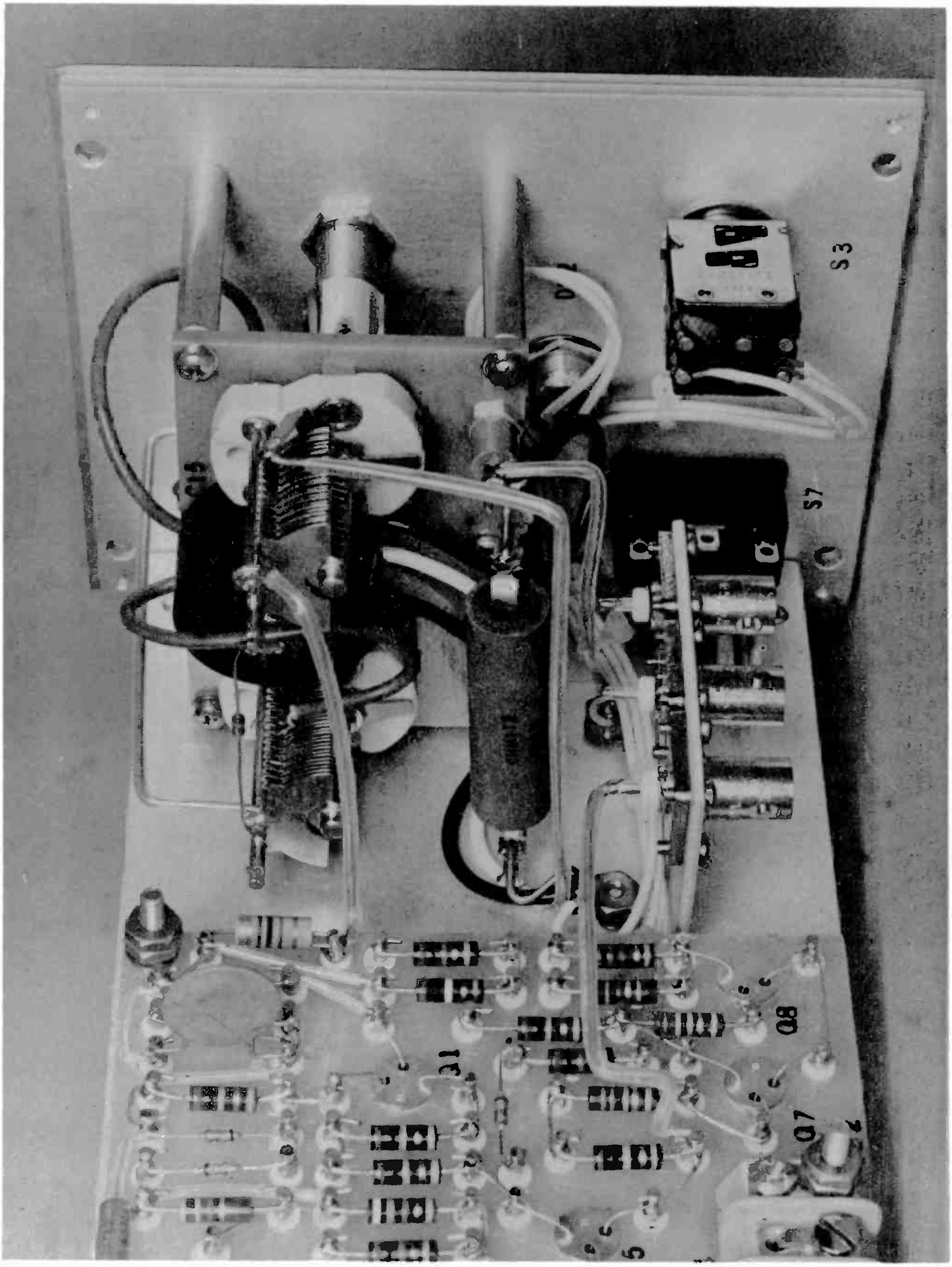



Figure 29. Magniphase Assembly Components, Left Rear

123999-2

EQ2-13

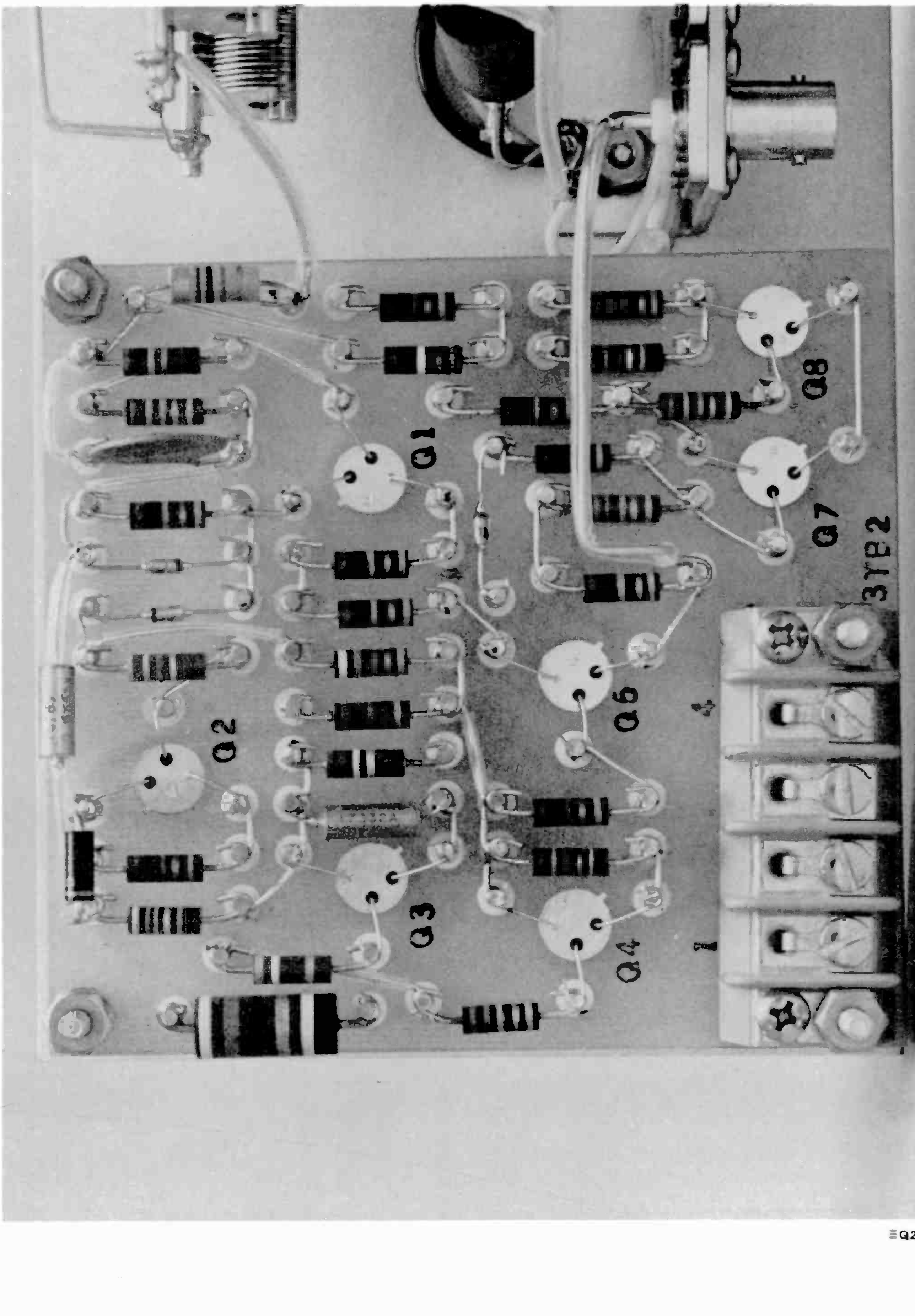


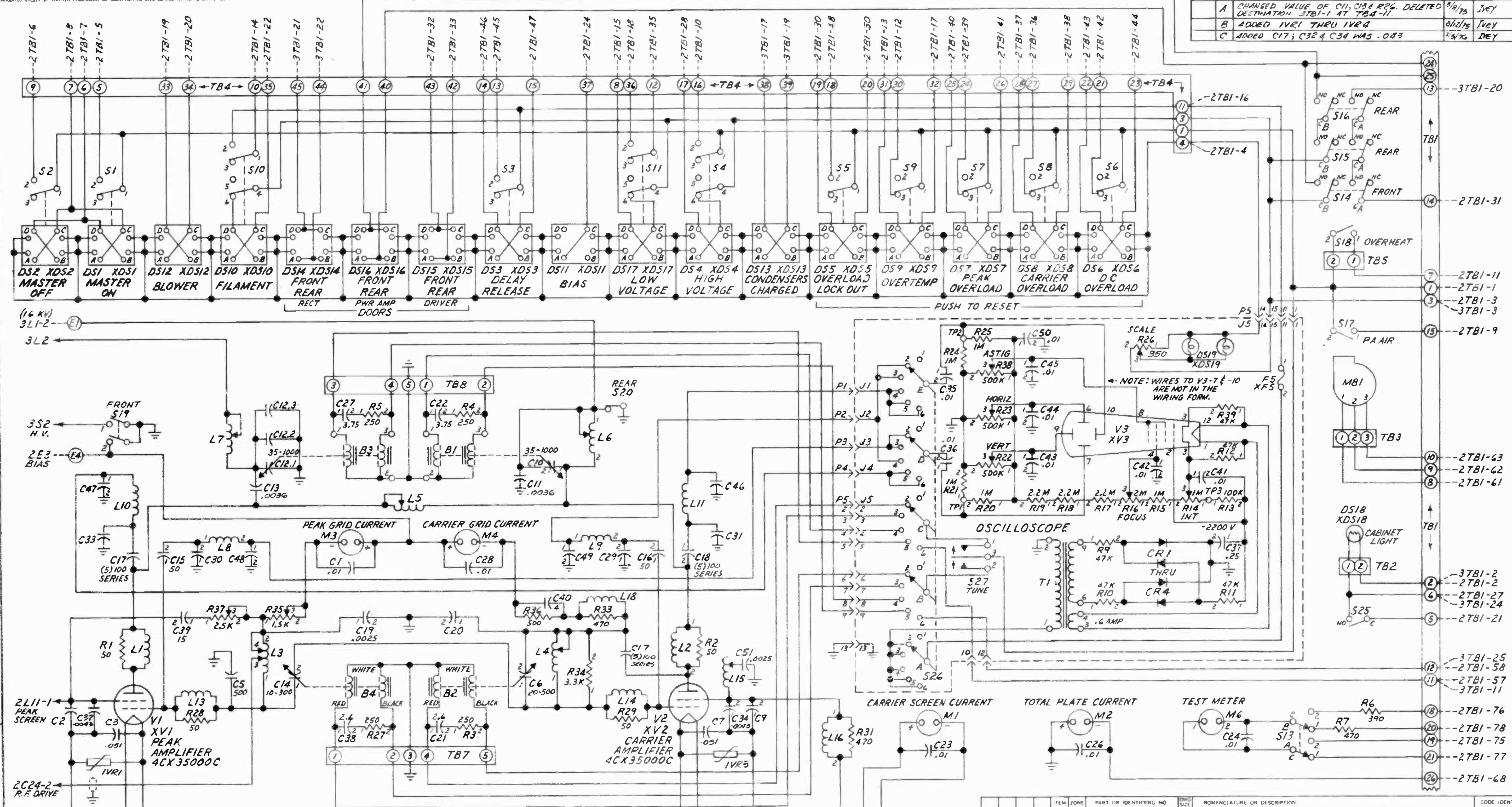

Figure 30. Magniphase Assembly Circuit Board

123993-1

EQ2-14

REVISIONS

| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | A | CHANGED VALUE OF C11, C13 & R26. DELETED DESTINATION 3TB1-1 AT TB4-11 | 5/8/75 | Ivey |
| | B | ADDED 1VR1 THRU 1VR4 | 8/12/75 | Ivey |
| | C | ADDED C17; C32 & C34 WAS .043 | 2/5/76 | Ivey |




| | | | | |
|---|---|---|---|---|
| QTY REQD PER DASH NO | ITEM | ZONE | PART OR IDENTIFYING NO | DWG SIZE | 

LIST OF MATERIAL OR PARTS LIST (ITEM / ZONE / PART OR IDENTIFYING NO / DWG SIZE / NOMENCLATURE OR DESCRIPTION / CODE IDENT)

| NEXT ASSY | DWG SIZE | USED ON |
|---|---|---|
| | | 2017-01 |

UNLESS OTHERWISE SPECIFIED
TOLERANCE ON FRAC
2 PLACE DEC 3 PLACE DEC ANGLES
MACHINED SURFACE FINISH 125
ALL DIMENSIONS ARE IN INCHES AND INCLUDE APPLIED FINISH.
REMOVE ALL BURRS AND SHARP EDGES

| | | |
|---|---|---|
| DRAWN | C. ONEY | DATE 10-18 74 |
| CHECKED | | |
| MECH DSGN | | |
| ELEC ENGR | J. SAINTON | |
| APPROVED | | |

Continental Electronics MANUFACTURING COMPANY DALLAS TEXAS

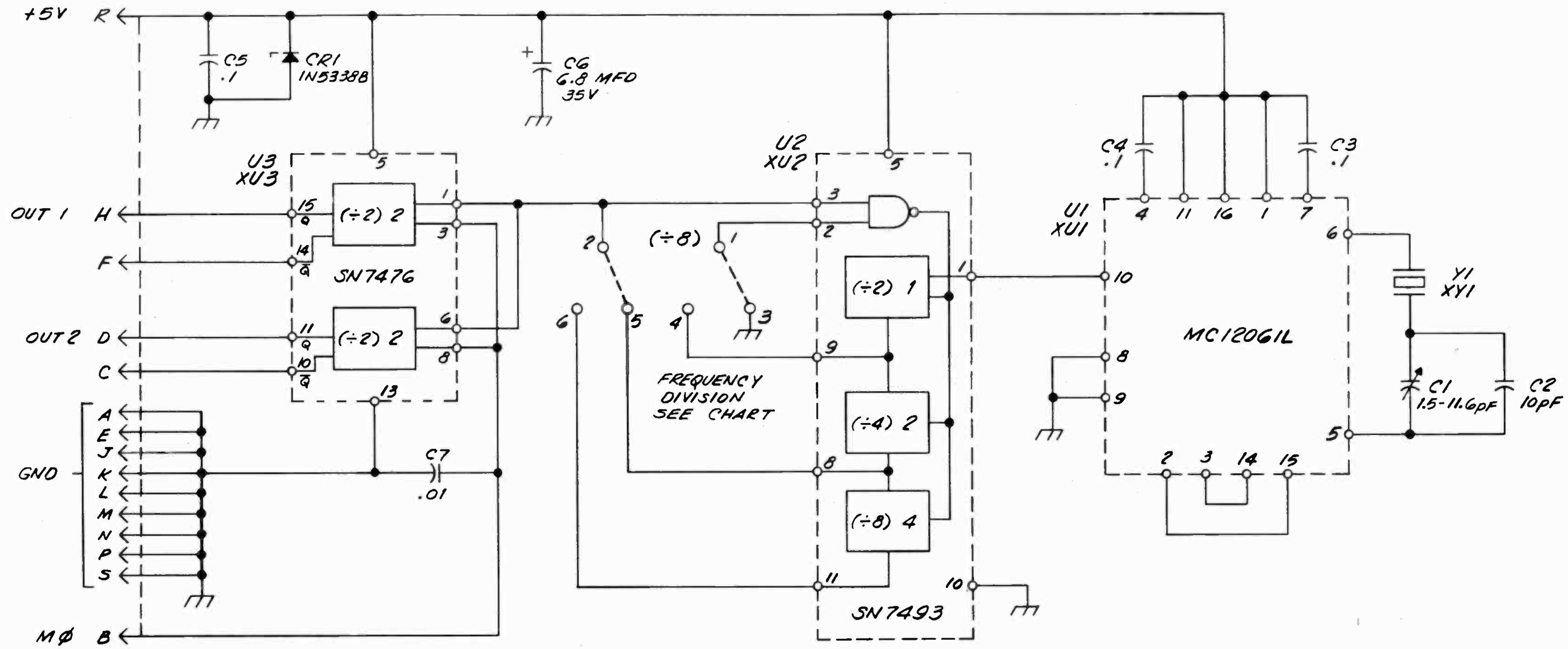
# UNIT 1 SERIAL 65 & ABOVE POWER AMPLIFIER TYPE 317C 50KW TRANSMITTER

| SIZE | CODE IDENT NO | |
|---|---|---|
| D | 52151 | 119946 |
| SCALE | WT | SHEET 1 OF 1 |

CEMC FORM 3073

REVISIONS

| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | A | ADDED C7 AND CHANGED PIN NO'S. | 11-13-74 | IVEY |
| | B | C1 WAS 1.4-9.2PF | 5-7-75 | IVEY |




NOTE:

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH UNIT NUMBER OR SUB-ASSEMBLY DESIGNATIONS OR BOTH FOR COMPLETE DESIGNATION.

EPL NO. 110412

FREQUENCY DIVISION CHART

| DIVISION | CONNECTIONS |
|---|---|
| ÷ 4 | 1 TO 3 AND 2 TO 4 |
| ÷ 6 | 1 TO 4 AND 2 TO 5 |
| ÷ 8 | 1 TO 3 AND 2 TO 5 |
| ÷ 10 | 1 TO 4 AND 2 TO 6 |

| ITEM | ZONE | PART OR IDENTIFYING NO. | DWG SIZE | NOMENCLATURE OR DESCRIPTION | CODE IDENT |
|---|---|---|---|---|---|

QTY REQD PER DASH NO. — LIST OF MATERIAL OR PARTS LIST

| NEXT ASSY | DWG SIZE | USED ON |
|---|---|---|
| | | 2017-01 |
| 121832 | C | 2087-10 |

UNLESS OTHERWISE SPECIFIED

TOLERANCE ON: FRAC ±

2 PLACE DEC ± 3 PLACE DEC ± ANGLES ±

MACHINED SURFACE FINISH 125

ALL DIMENSIONS ARE IN INCHES AND INCLUDE APPLIED FINISH.

REMOVE ALL BURRS AND SHARP EDGES.

| | | DATE |
|---|---|---|
| DRAWN | JAMES IVEY | 6-13-74 |
| CHECKED | | |
| MECH DSGN | | |
| ELEC ENGR | J. PATE | |
| APPROVED | | |

Continental Electronics MANUFACTURING COMPANY DALLAS TEXAS

SCHEMATIC, CRYSTAL OSCILLATOR

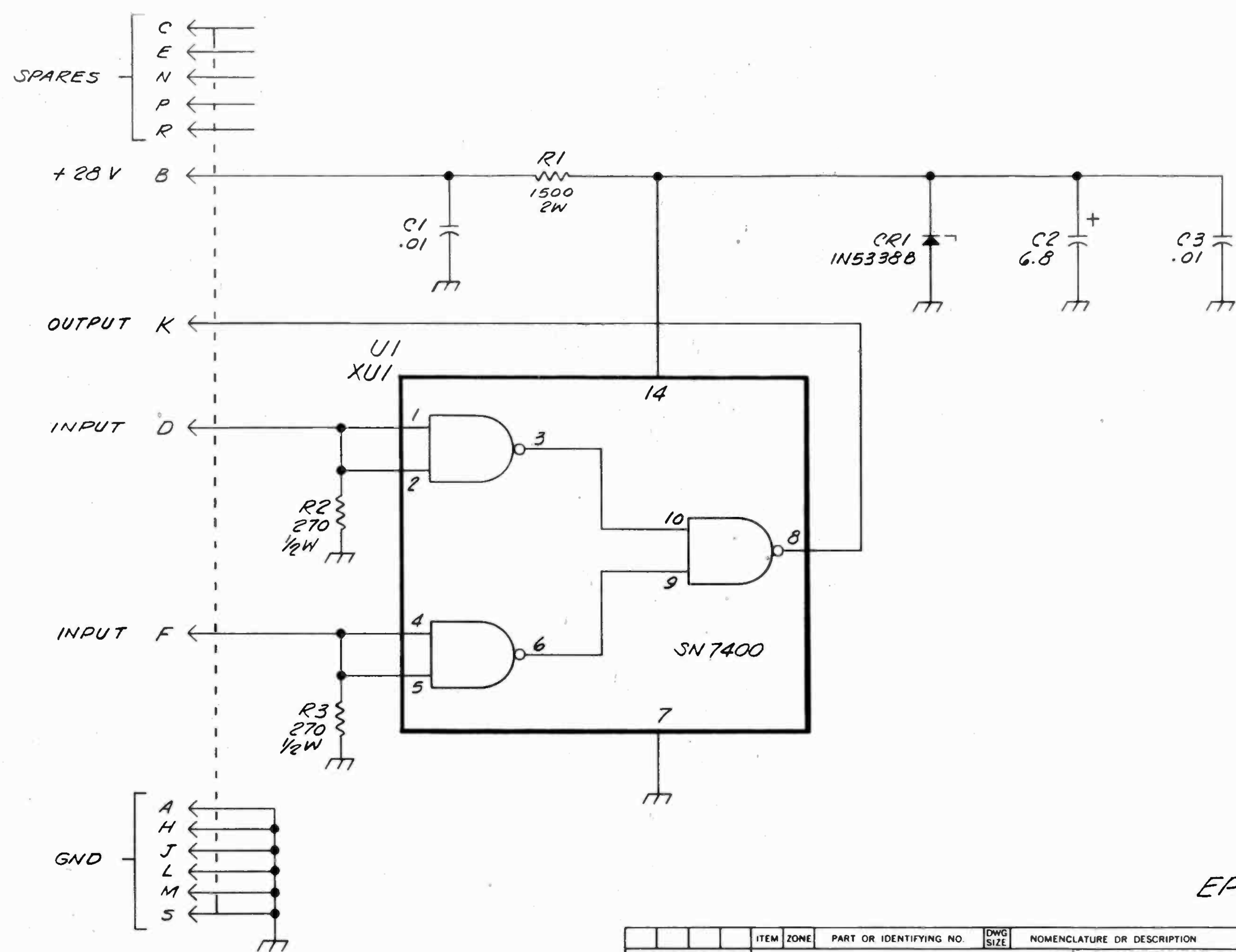
| SIZE | CODE IDENT NO. | |
|---|---|---|
| C | 52151 | 121099 |

SCALE: ~ WT ~ SHEET 1 OF 1

121099

CEMC FORM 386B

| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
| | A | ADDED MISC VALUES | 5-7-75 | IVEY |




EPL NO. 110509

NOTES:
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH UNIT NUMBER OR SUB-ASSEMBLY DESIGNATIONS OR BOTH FOR COMPLETE DESIGNATION.

| QTY REQD PER DASH NO. | ITEM | ZONE | PART OR IDENTIFYING NO. | DWG SIZE | NOMENCLATURE OR DESCRIPTION | CODE IDENT |
|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| NEXT ASSY | DWG SIZE | USED ON |
|---|---|---|
| 123578 | C | 2017-01 |

UNLESS OTHERWISE SPECIFIED
TOLERANCE ON: FRAC ±
2 PLACE DEC ± 3 PLACE DEC ± ANGLES ±
MACHINED SURFACE FINISH 125
ALL DIMENSIONS ARE IN INCHES AND INCLUDE APPLIED FINISH.
REMOVE ALL BURRS AND SHARP EDGES.

| | | DATE |
|---|---|---|
| DRAWN | JAMES IVEY | 10-21-74 |
| CHECKED | | |
| MECH DSGN | | |
| ELEC ENGR | J. PATE | |
| APPROVED | | |

Continental Electronics MANUFACTURING COMPANY DALLAS TEXAS

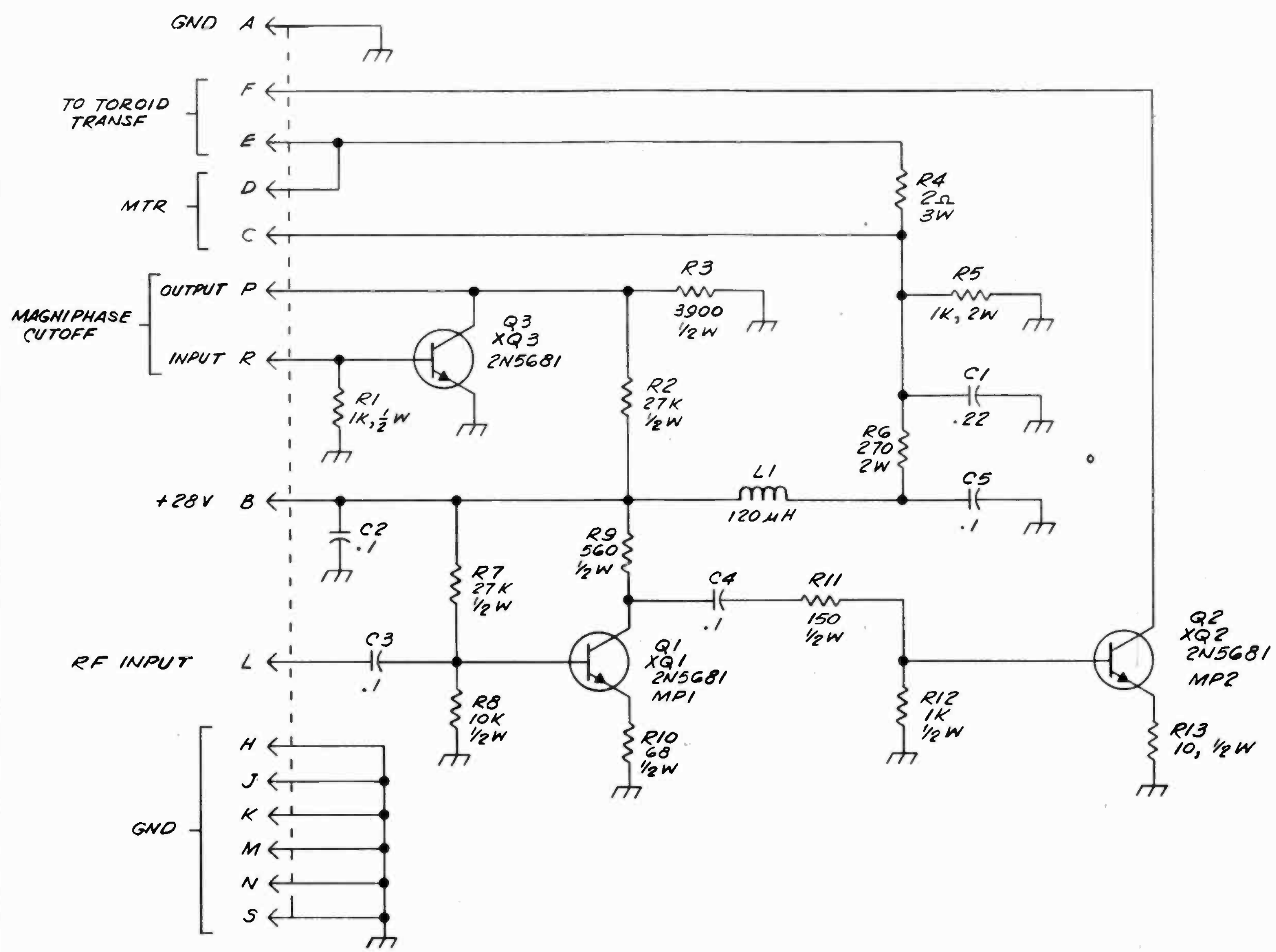
SCHEMATIC, RF SWITCH 317 C TRANSMITTER

| SIZE | CODE IDENT NO. | |
|---|---|---|
| C | 52151 | 119918 |
| SCALE: ~ | WT ~ | SHEET 1 OF 1 |

119918

CEMC FORM 3868

| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
| | A | R4 WAS 2W | 5-7-75 | Ivey |




EPL NO. 110437

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH UNIT NUMBER OR SUB-ASSEMBLY DESIGNATIONS OR BOTH FOR COMPLETE DESIGNATION.

| QTY REQD PER DASH NO. | ITEM | ZONE | PART OR IDENTIFYING NO. | DWG SIZE | NOMENCLATURE OR DESCRIPTION | CODE IDENT |
|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| NEXT ASSY | DWG SIZE | USED ON |
|---|---|---|
| 119941 | C | 2017-01 |

UNLESS OTHERWISE SPECIFIED
TOLERANCE ON: FRAC ±
2 PLACE DEC ± 3 PLACE DEC ± ANGLES ±
MACHINED SURFACE FINISH 125
ALL DIMENSIONS ARE IN INCHES AND INCLUDE APPLIED FINISH.
REMOVE ALL BURRS AND SHARP EDGES.

| | | DATE |
|---|---|---|
| DRAWN | JAMES IVEY | 7-26-74 |
| CHECKED | | |
| MECH DSGN | | |
| ELEC ENGR | J. PATE | |
| APPROVED | | |

Continental Electronics MANUFACTURING COMPANY DALLAS TEXAS

SCHEMATIC, R.F. AMPLIFIER

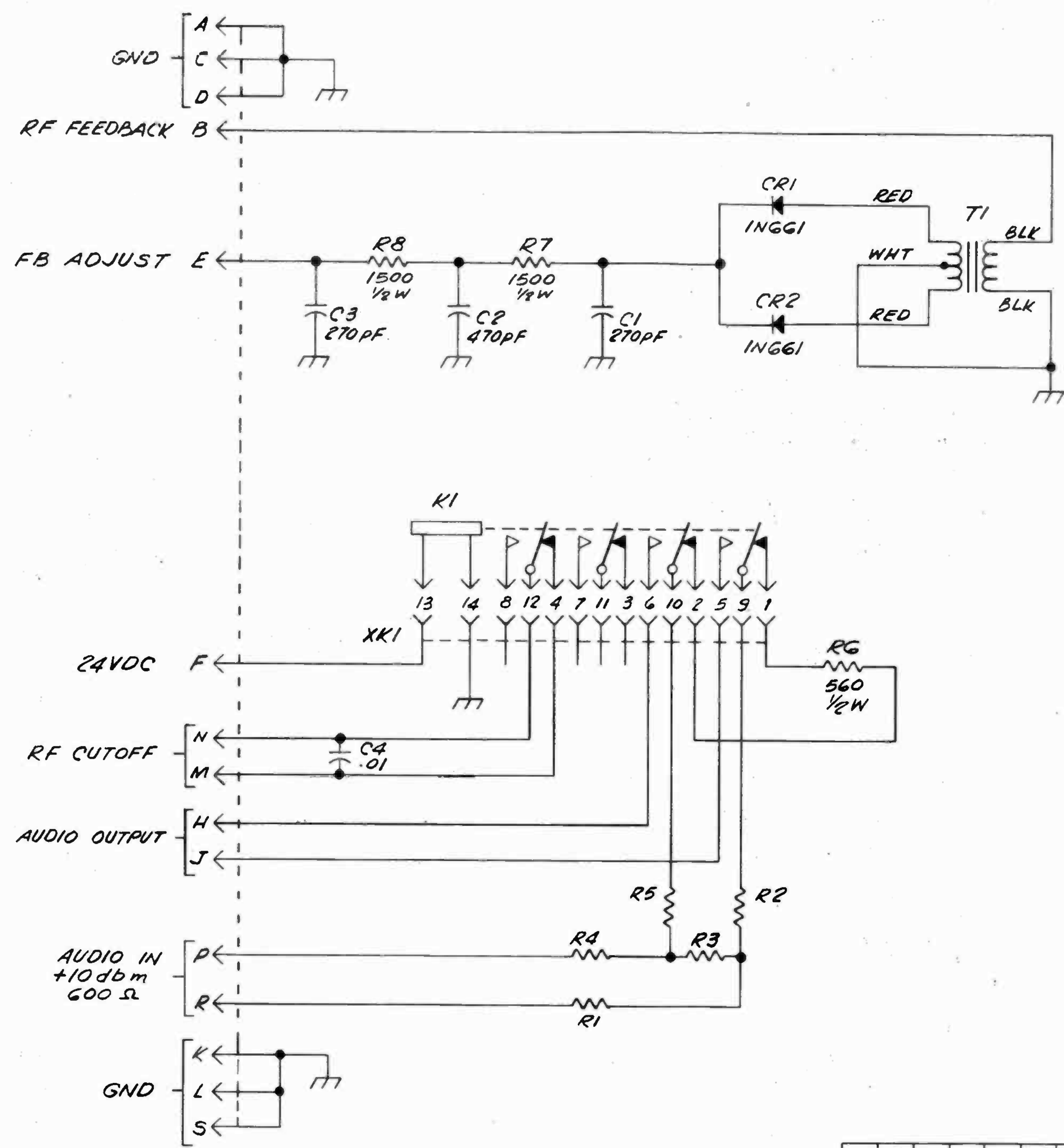
| SIZE | CODE IDENT NO. | |
|---|---|---|
| C | 52151 | 119943 |
| SCALE: ~ | WT ~ | SHEET 1 OF 1 |

119943

CEMC FORM 3868

REVISIONS

| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | A | ADDED ½W TO R6 | 5-7-75 | IVEY |




EPL NO. 110438

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH UNIT NUMBER OR SUB-ASSEMBLY DESIGNATIONS OR BOTH FOR COMPLETE DESIGNATION.

| QTY REQD PER DASH NO. | ITEM | ZONE | PART OR IDENTIFYING NO. | DWG SIZE | NOMENCLATURE OR DESCRIPTION | CODE IDENT |
|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| NEXT ASSY | DWG SIZE | USED ON |
|---|---|---|
| 119936 | C | 2017-01 |

UNLESS OTHERWISE SPECIFIED
TOLERANCE ON: FRAC ±
2 PLACE DEC ± 3 PLACE DEC ± ANGLES ±
MACHINED SURFACE FINISH 125
ALL DIMENSIONS ARE IN INCHES AND INCLUDE APPLIED FINISH.
REMOVE ALL BURRS AND SHARP EDGES.

| | | DATE |
|---|---|---|
| DRAWN | JAMES IVEY | 7-24-74 |
| CHECKED | | |
| MECH DSGN | | |
| ELEC ENGR | J. PATE | |
| APPROVED | | |

Continental Electronics MANUFACTURING COMPANY DALLAS TEXAS

SCHEMATIC, AUDIO INPUT

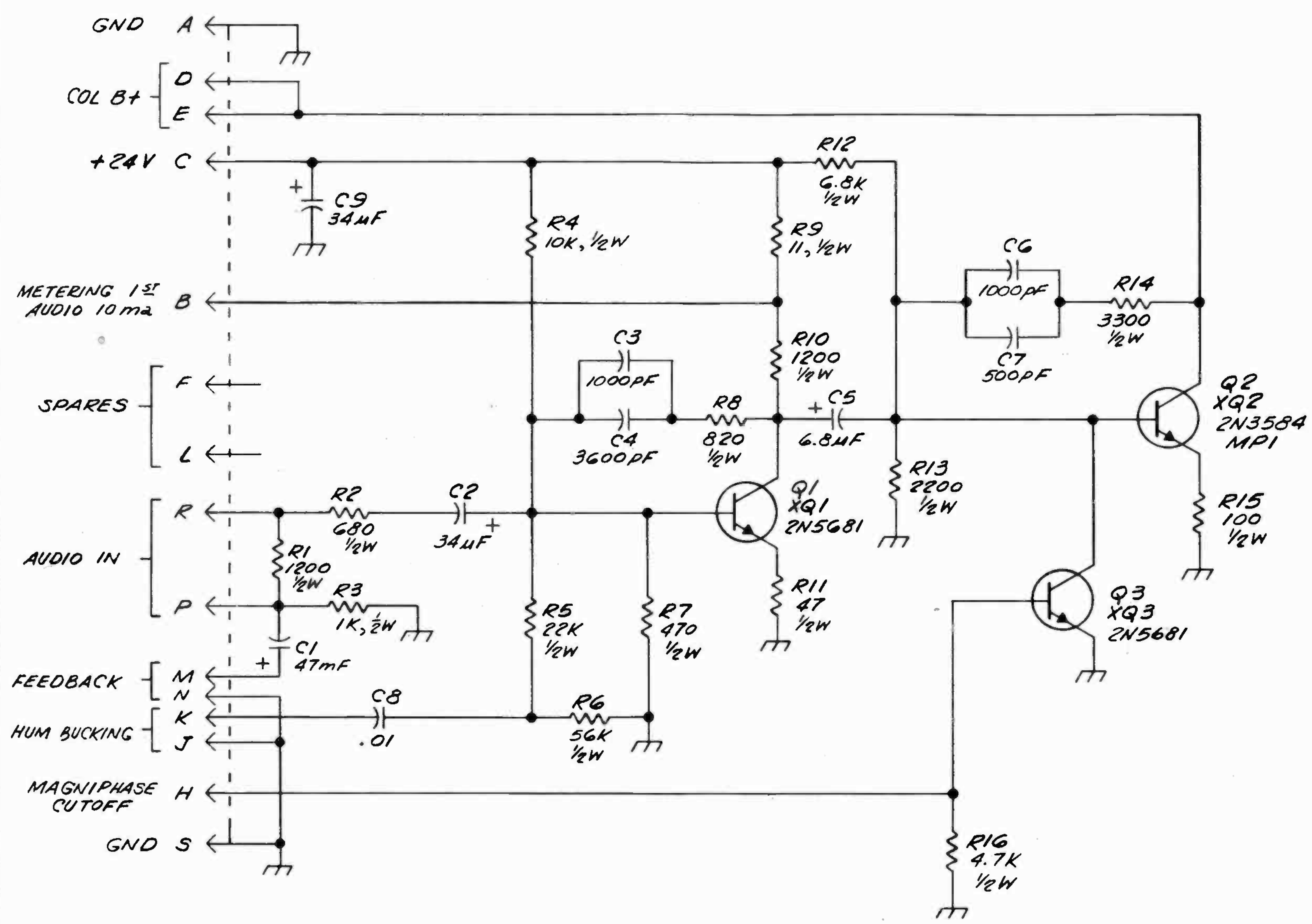
| SIZE | CODE IDENT NO. | |
|---|---|---|
| C | 52151 | 119938 |
| SCALE: N | WT N | SHEET 1 OF 1 |

119938

CEMC FORM 3868

REVISIONS

| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | A | ADDED MISC VALUES | 5-7-75 | IVEY |




EPL NO. 110439

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH UNIT NUMBER OR SUB-ASSEMBLY DESIGNATIONS OR BOTH FOR COMPLETE DESIGNATION.

| QTY REQD PER DASH NO. | ITEM | ZONE | PART OR IDENTIFYING NO. | DWG SIZE | NOMENCLATURE OR DESCRIPTION | CODE IDENT |
|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

| NEXT ASSY | DWG SIZE | USED ON |
|---|---|---|
| 119915 | C | 2017-01 |

UNLESS OTHERWISE SPECIFIED

TOLERANCE ON: FRAC ±

2 PLACE DEC ± 3 PLACE DEC ± ANGLES ±

MACHINED SURFACE FINISH 125

ALL DIMENSIONS ARE IN INCHES AND INCLUDE APPLIED FINISH.

REMOVE ALL BURRS AND SHARP EDGES.

| | | DATE |
|---|---|---|
| DRAWN | JAMES IVEY | 7-19-74 |
| CHECKED | | |
| MECH DSGN | | |
| ELEC ENGR | J. PATE | |
| APPROVED | | |

Continental Electronics MANUFACTURING COMPANY DALLAS TEXAS

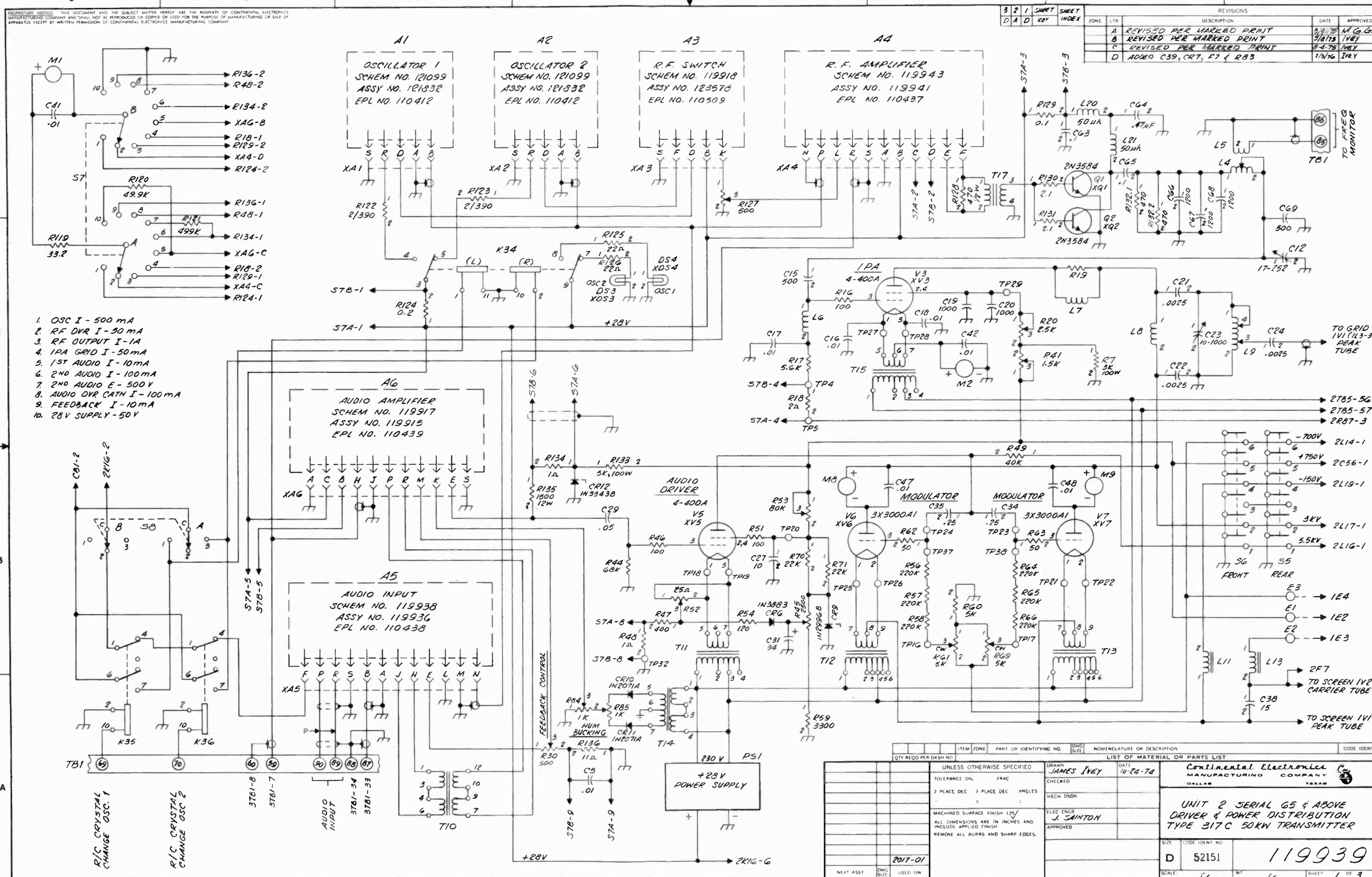
SCHEMATIC, AUDIO AMPLIFIER

| SIZE | CODE IDENT NO. | |
|---|---|---|
| C | 52151 | 119917 |

SCALE ~ WT ~ SHEET 1 OF 1

CEMC FORM 386

119917

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| ZONE | LTR | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | A | REVISED PER MARKED PRINT | 3/3/75 | M.G.G. |
| | B | REVISED PER MARKED PRINT | 3/6/75 | IVEY |
| | C | REVISED PER MARKED PRINT | 8-4-75 | IVEY |
| | D | ADDED C39, CR7, F7 & R83 | 1/5/76 | IVEY |

UNLESS OTHERWISE SPECIFIED

DRAWN: JAMES IVEY — DATE: 10-24-74

ELEC ENGR: J. SAINTON

NEXT ASSY: 2017-01

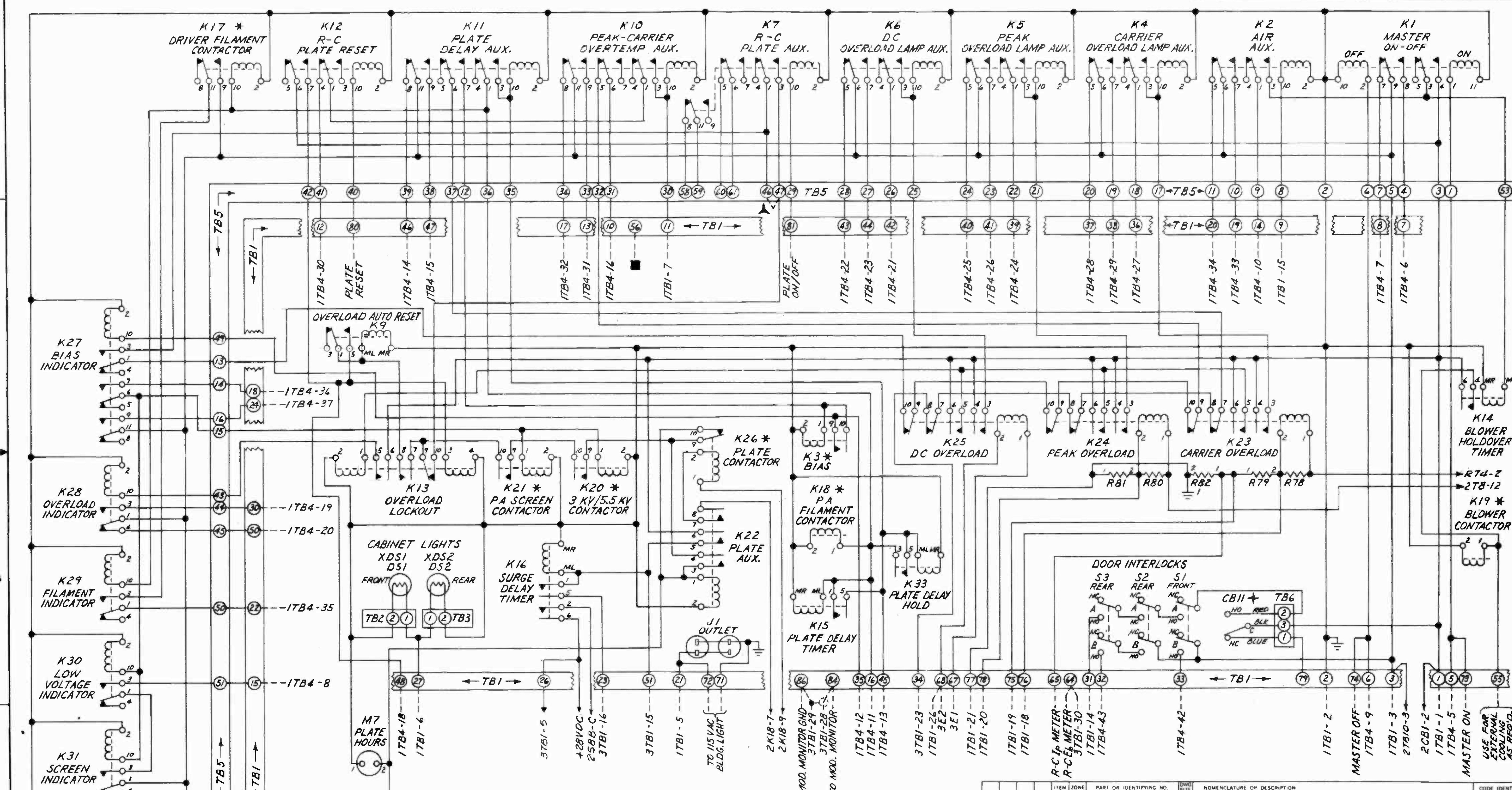
Continental Electronics Manufacturing Company, Dallas, Texas

UNIT 2 SERIAL 65 & ABOVE
DRIVER & POWER DISTRIBUTION
TYPE 317C 50KW TRANSMITTER

SIZE D — CODE IDENT NO 52151 — 119939 — SHEET 1 OF 3

CEMC FORM 5878

| ZONE | LTR | REVISIONS DESCRIPTION | DATE | APPROVED |
|---|---|---|---|---|
| | A | REVISED PER MARKED PRINT | 3/8/75 | IVEY |




NOTE:

* POWER POLES FOR K3, 17, 18, 19, 20, 21, & 26 APPEAR ON SHEET 3 OF THIS DRAWING.

✚ AUXILIARY SWITCH IS PART OF CB11 WHICH APPEARS ON SHEET 3 OF THIS DRAWING.

▲ REMOVE STRAP FOR REMOTE CONTROL OPERATION (TB5-46 TO TB5-47).

■ WHEN USING EXTERNAL PLATE CONTROL INTERLOCK, DISCONNECT LEAD FROM 1TB4-16 AT 2TB1-10 & RECONNECT LEAD TO 2TB1-56. CONNECT EXTERNAL CIRCUIT TO 2TB1-10 & 2TB1-56.

| QTY REQD PER DASH NO. | ITEM | ZONE | PART OR IDENTIFYING NO. | DWG SIZE | NOMENCLATURE OR DESCRIPTION | CODE IDENT |
|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

UNLESS OTHERWISE SPECIFIED
TOLERANCE ON: FRAC
2 PLACE DEC 3 PLACE DEC ANGLES
± ± ±
MACHINED SURFACE FINISH 125
ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING FINISH
REMOVE ALL BURRS AND SHARP EDGES.

| | | |
|---|---|---|
| DRAWN | C. ONEY | DATE 10-18-74 |
| CHECKED | | |
| MECH DSGN | | |
| ELEC ENGR | J. SAINTON | |
| APPROVED | | |

| NEXT ASSY | DWG SIZE | USED ON |
|---|---|---|
| 2017-01 | | |

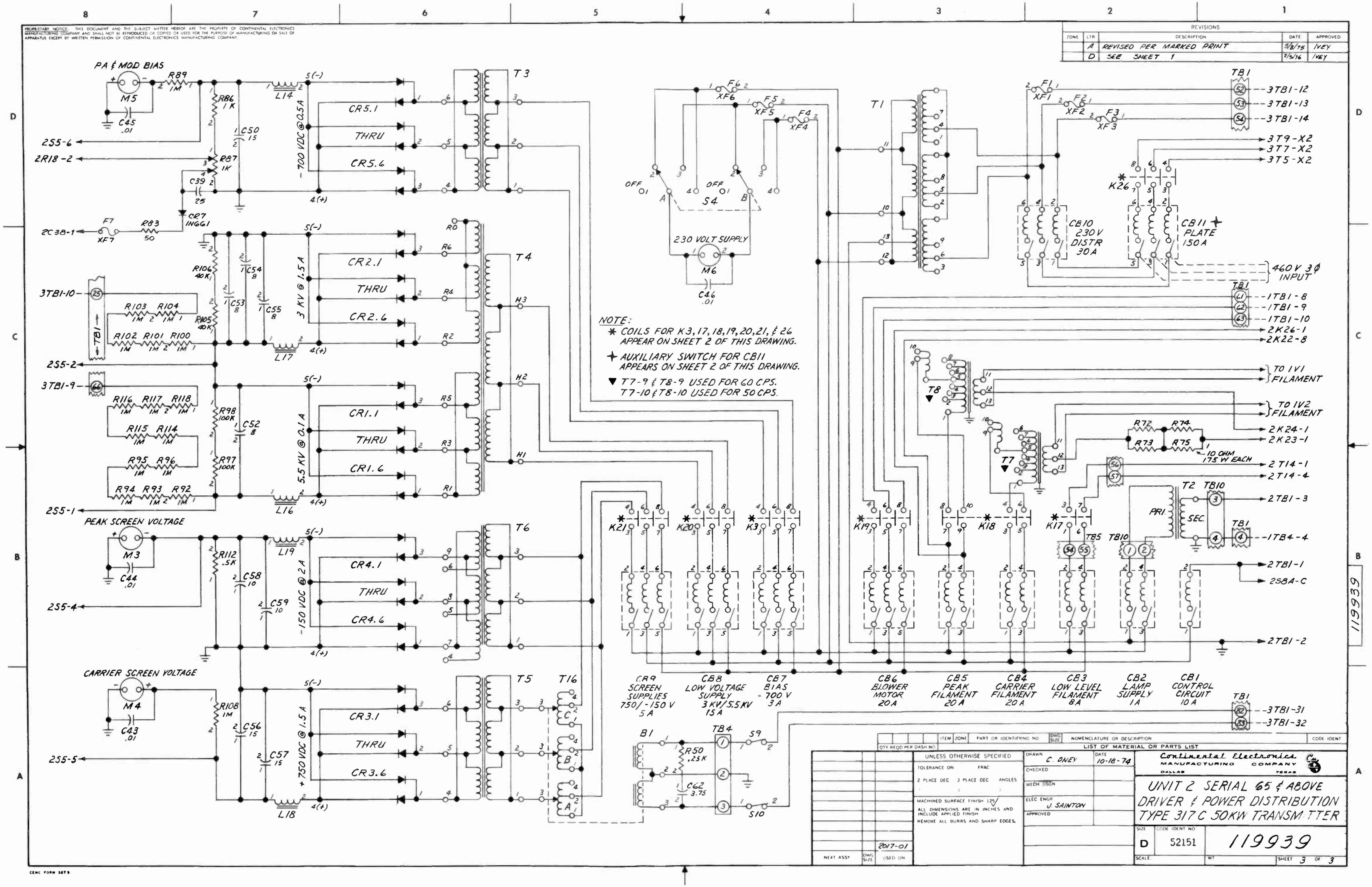
Continental Electronics MANUFACTURING COMPANY DALLAS TEXAS

UNIT 2 SERIAL 65 & ABOVE
DRIVER & POWER DISTRIBUTION
TYPE 317C 50KW TRANSMITTER

| SIZE | CODE IDENT NO. | |
|---|---|---|
| D | 52151 | 119939 |

SCALE  WT  SHEET 2 OF 3

CEMC FORM 387B



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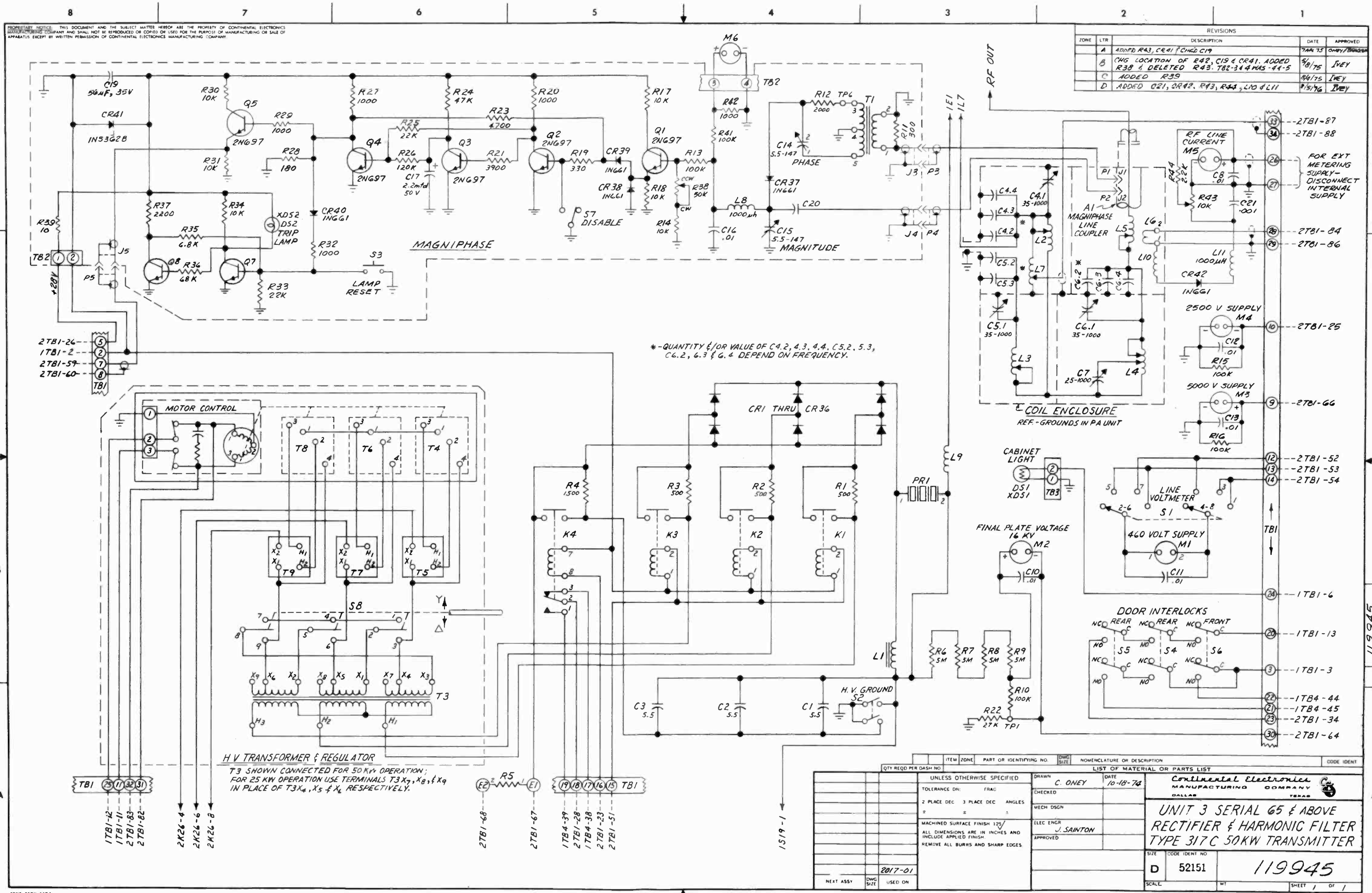
REVISIONS
A REVISED PER MARKED PRINT 5/8/75 IVEY
D SEE SHEET 1 7/5/76 IVEY
PA & MOD BIAS
PEAK SCREEN VOLTAGE
CARRIER SCREEN VOLTAGE
-700 VDC @ 0.5A
3 KV @ 1.5A
5.5 KV @ 0.1A
-150 VDC @ 2A
+750 VDC @ 1.5A
230 VOLT SUPPLY
NOTE:
✱ COILS FOR K3,17,18,19,20,21, & 26 APPEAR ON SHEET 2 OF THIS DRAWING.
✚ AUXILIARY SWITCH FOR CB11 APPEARS ON SHEET 2 OF THIS DRAWING.
▼ T7-9 & T8-9 USED FOR 60 CPS. T7-10 & T8-10 USED FOR 50 CPS.
CB10 230V DISTR 30A
CB11 PLATE 150A
460V 3Ø INPUT
TO 1V1 FILAMENT
TO 1V2 FILAMENT
10 OHM 175 W EACH
CB9 SCREEN SUPPLIES 750/-150 V 5A
CB8 LOW VOLTAGE SUPPLY 3KV/5.5KV 15A
CB7 BIAS -700 V 3A
CB6 BLOWER MOTOR 20A
CB5 PEAK FILAMENT 20A
CB4 CARRIER FILAMENT 20A
CB3 LOW LEVEL FILAMENT 8A
CB2 LAMP SUPPLY 1A
CB1 CONTROL CIRCUIT 10A
LIST OF MATERIAL OR PARTS LIST
DRAWN C. ONEY DATE 10-16-74
ELEC ENGR J. SAINTON
Continental Electronics MANUFACTURING COMPANY DALLAS TEXAS
UNIT 2 SERIAL 65 & ABOVE
DRIVER & POWER DISTRIBUTION
TYPE 317C 50KW TRANSMITTER
SIZE D CODE IDENT NO 52151 119939
2017-01
SHEET 3 OF 3
CEMC FORM 387B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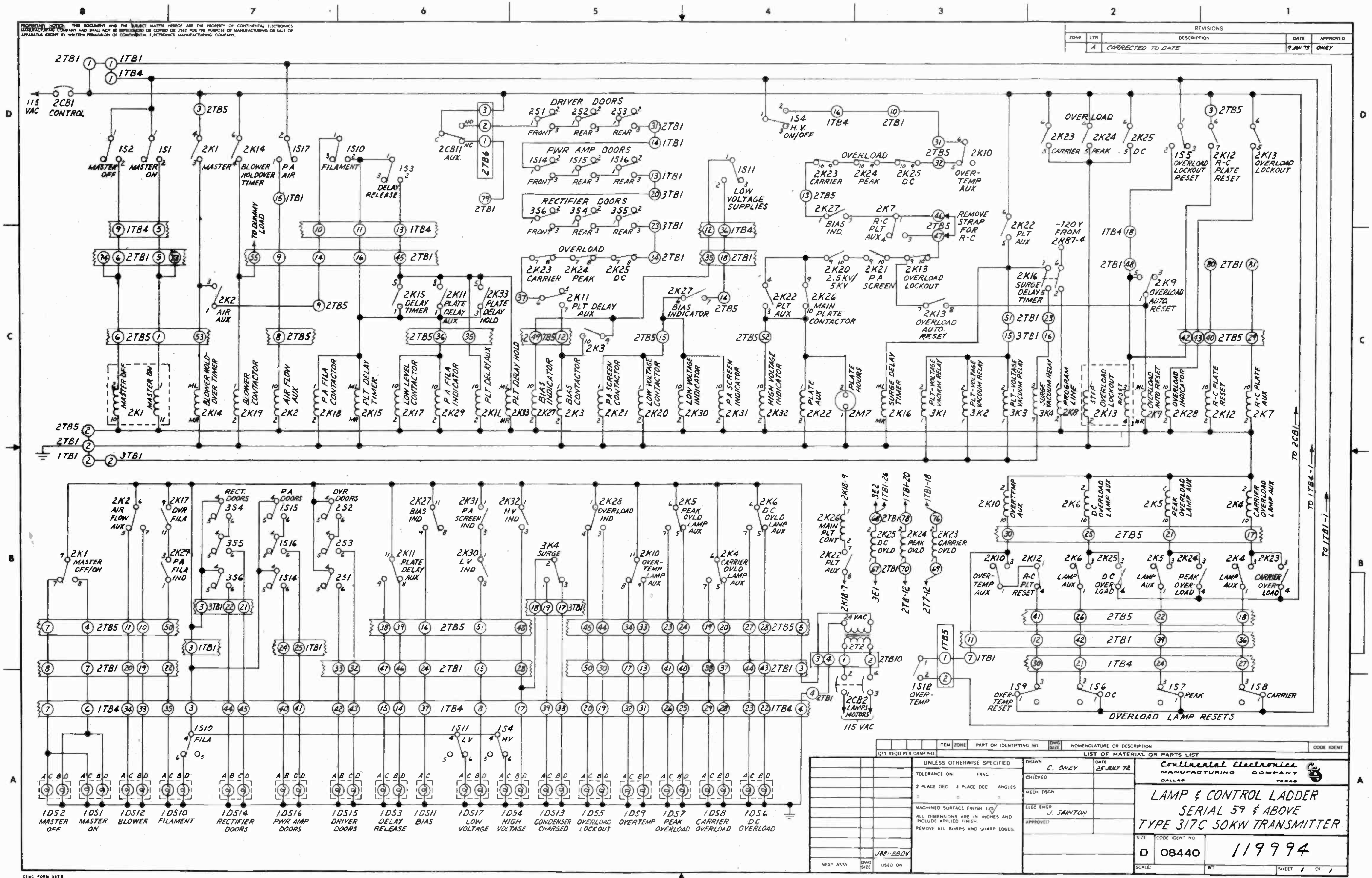
REVISIONS
A ADDED R43, CR41 & CHGD C19
B CHG LOCATION OF R42, C19 & CR41. ADDED R38 & DELETED R43. TB2-3&4 WAS -4&-5 6/8/75 IVEY
C ADDED R39 8/4/75 IVEY
D ADDED Q21, 2R42, R43, R44, L10 & L11 IVEY
MAGNIPHASE
S7 DISABLE
TRIP LAMP
LAMP RESET
PHASE
MAGNITUDE
RF OUT
RF LINE CURRENT M5
FOR EXT METERING SUPPLY — DISCONNECT INTERNAL SUPPLY
A1 MAGNIPHASE LINE COUPLER
COIL ENCLOSURE
REF. - GROUNDS IN PA UNIT
2500 V SUPPLY M4
5000 V SUPPLY M3
CABINET LIGHT DS1 XDS1
LINE VOLTMETER S1
460 VOLT SUPPLY M1
FINAL PLATE VOLTAGE 16 KV M2
DOOR INTERLOCKS
REAR REAR FRONT
H.V. GROUND S2
MOTOR CONTROL
CR1 THRU CR36
* - QUANTITY &/OR VALUE OF C4.2, 4.3, 4.4, C5.2, 5.3, C6.2, 6.3 & 6.4 DEPEND ON FREQUENCY.
H V TRANSFORMER & REGULATOR
T3 SHOWN CONNECTED FOR 50 KW OPERATION; FOR 25 KW OPERATION USE TERMINALS T3 X7, X8, & X9 IN PLACE OF T3 X4, X5 & X6 RESPECTIVELY.
UNLESS OTHERWISE SPECIFIED
DRAWN C. ONEY 10-18-74
ELEC ENGR J. SAINTON
LIST OF MATERIAL OR PARTS LIST
2017-01
Continental Electronics MANUFACTURING COMPANY DALLAS TEXAS
UNIT 3 SERIAL 65 & ABOVE
RECTIFIER & HARMONIC FILTER
TYPE 317C 50KW TRANSMITTER
SIZE D CODE IDENT NO 52151 119945
SHEET 1 OF 1
119945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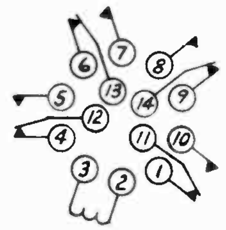
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
A CORRECTED TO DATE 9 JAN 73 ONEY
115 VAC
2CB1 CONTROL
DRIVER DOORS
PWR AMP DOORS
RECTIFIER DOORS
OVERLOAD
OVERLOAD LAMP RESETS
TO 2CB1
TO 1TB4-1
TO 1TB1-1
1DS2 MASTER OFF
1DS1 MASTER ON
1DS12 BLOWER
1DS10 FILAMENT
1DS14 RECTIFIER DOORS
1DS16 PWR AMP DOORS
1DS15 DRIVER DOORS
1DS3 DELAY RELEASE
1DS11 BIAS
1DS17 LOW VOLTAGE
1DS4 HIGH VOLTAGE
1DS13 CONDENSER CHARGED
1DS5 OVERLOAD LOCKOUT
1DS9 OVERTEMP
1DS7 PEAK OVERLOAD
1DS8 CARRIER OVERLOAD
1DS6 DC OVERLOAD
2CB2 LAMPS MOTORS
115 VAC
LIST OF MATERIAL OR PARTS LIST
UNLESS OTHERWISE SPECIFIED
DRAWN C. ONEY 25 JULY 72
ELEC ENGR J. SAINTON
Continental Electronics MANUFACTURING COMPANY DALLAS TEXAS
LAMP & CONTROL LADDER
SERIAL 59 & ABOVE
TYPE 317C 50KW TRANSMITTER
SIZE D
CODE IDENT NO 08440
119994
SHEET 1 OF 1
J881-88DV
NEXT ASSY USED ON
CEMC FORM 3678

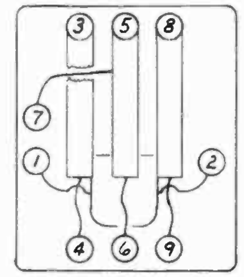
| REVISIONS | | | | |
|---|---|---|---|---|
| ZONE | LTR | DESCRIPTION | DATE | APPROVED |

GENERAL ELECTRIC
CR2791G122AL1



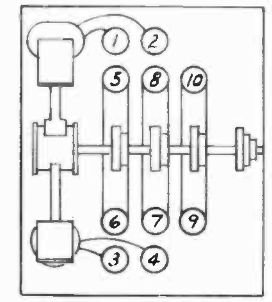
3K5
2K33

STRUTHERS-DUNN
A1BAX



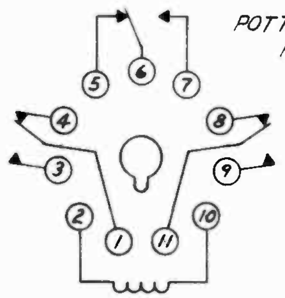
2K8

STRUTHERS-DUNN
99AXB126



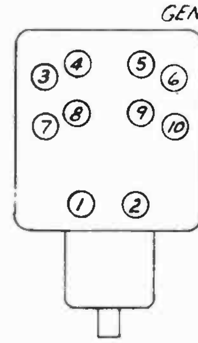
2K13

POTTER & BRUMFIELD
KRP14AG



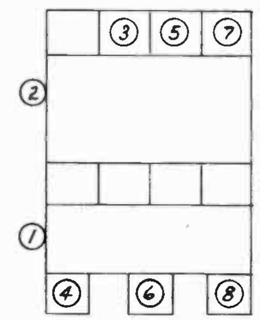
2K2
2K4
2K5
2K6
2K7
2K10
2K11
2K12
2K17
2K27
2K28
2K29
2K30
2K31
2K32

GENERAL ELECTRIC
PAC14B



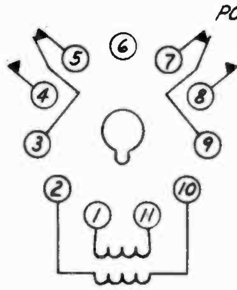
2K23
2K24
2K25

WESTINGHOUSE
A200MOCAC



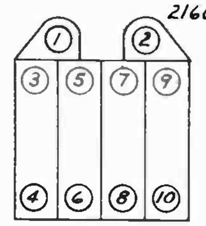
2K19

POTTER & BRUMFIELD
KRP11AG



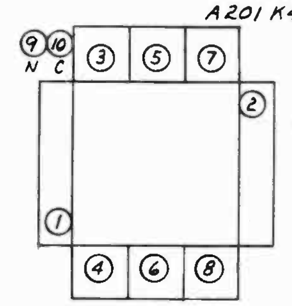
2K1

ROWAN
2160-B240AA



2K3
2K18
2K20
2K21
2K22

WESTINGHOUSE
A201K4CW



2K26

| QTY REQD PER DASH NO | ITEM | ZONE | PART OR IDENTIFYING NO. | DWG SIZE | NOMENCLATURE OR DESCRIPTION | CODE IDENT |
|---|---|---|---|---|---|---|

LIST OF MATERIAL OR PARTS LIST

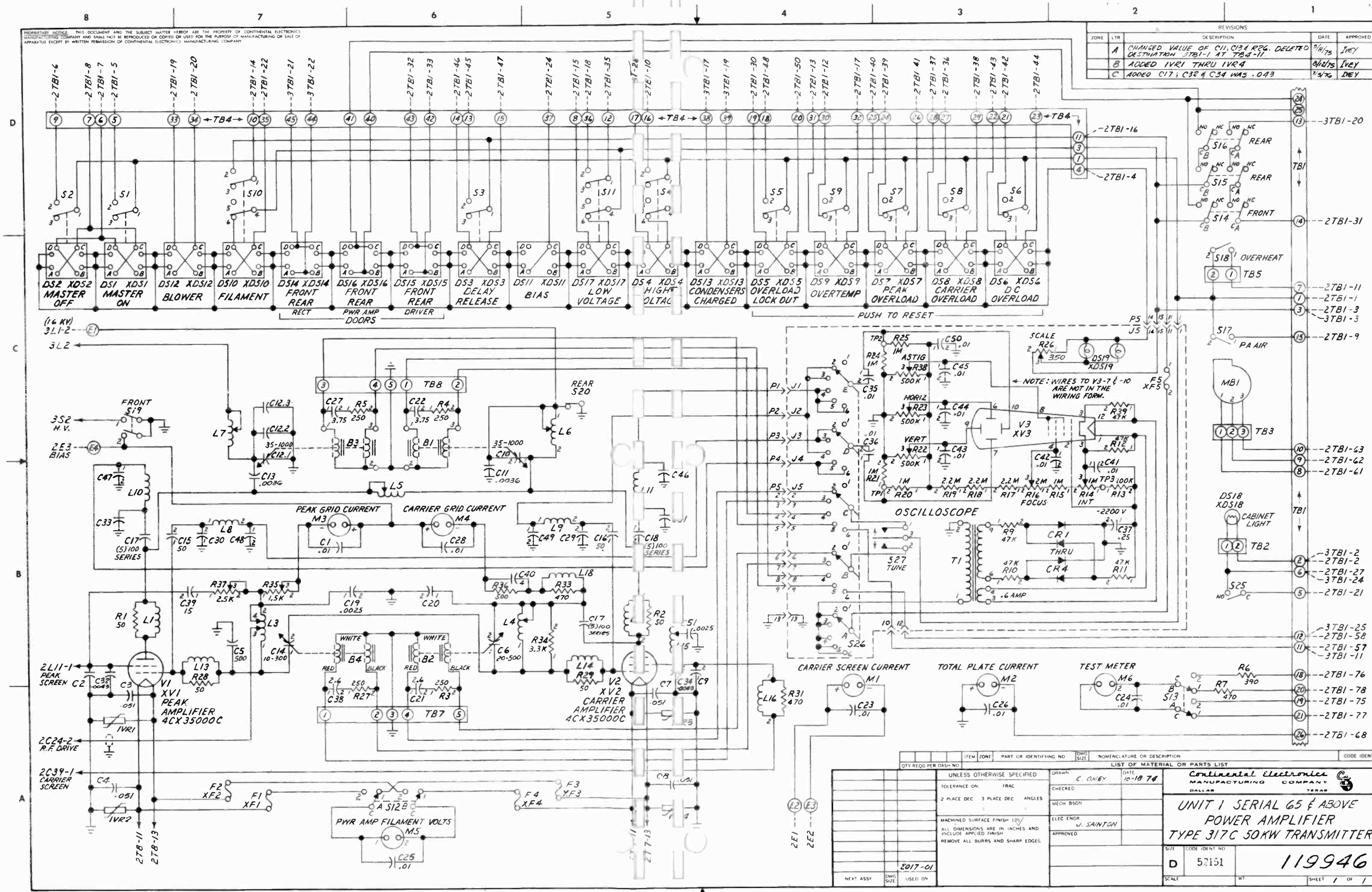
| | |
|---|---|
| UNLESS OTHERWISE SPECIFIED | TOLERANCE ON: FRAC ± / 2 PLACE DEC ± / 3 PLACE DEC ± / ANGLES ± |
| MACHINED SURFACE FINISH 125 | ALL DIMENSIONS ARE IN INCHES AND INCLUDE APPLIED FINISH. REMOVE ALL BURRS AND SHARP EDGES |
| DRAWN | C. ONEY |
| CHECKED | |
| MECH DSGN | |
| ELEC ENGR | R. BRACKEN |
| APPROVED | |
| NEXT ASSY | |
| DWG SIZE | |
| USED ON | J881-8A |

Continental Electronics
MANUFACTURING COMPANY
DALLAS TEXAS

# TERMINAL LAYOUT
# RELAYS & CONTACTORS
# TYPE 317C XMTR - SERIAL #38 & ABOVE

| SIZE | CODE IDENT NO | |
|---|---|---|
| D | 08440 | 93966 |

SCALE | WT | SHEET 1 OF 1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REVISIONS
A CHANGED VALUE OF C11, C13 & R26. DELETED DESTINATION 3TB1-1 AT TB4-11. 3/11/75 IVEY
B ADDED 1VR1 THRU 1VR4 8/12/75 IVEY
C ADDED C17; C32 & C34 WAS .043 3/5/76 IVEY
DS2 XDS2 MASTER OFF
DS1 XDS1 MASTER ON
DS12 XDS12 BLOWER
DS10 XDS10 FILAMENT
DS14 XDS14 FRONT REAR RECT
DS16 XDS16 FRONT REAR PWR AMP
DS15 XDS15 FRONT REAR DRIVER
DOORS
DS3 XDS3 DELAY RELEASE
DS11 XDS11 BIAS
DS17 XDS17 LOW VOLTAGE
DS4 XDS4 HIGH VOLTAGE
DS13 XDS13 CONDENSERS CHARGED
DS5 XDS5 OVERLOAD LOCK OUT
DS9 XDS9 OVERTEMP
DS7 XDS7 PEAK OVERLOAD
DS8 XDS8 CARRIER OVERLOAD
DS6 XDS6 DC OVERLOAD
PUSH TO RESET
S18 OVERHEAT
S17 PA AIR
S16 REAR
S15 REAR
S14 FRONT
MB1
TB3
DS18 XDS18 CABINET LIGHT
TB2
NOTE: WIRES TO V3-7 & -10 ARE NOT IN THE WIRING FORM.
OSCILLOSCOPE
V3 XV3
S27 TUNE
S26
PEAK GRID CURRENT M3
CARRIER GRID CURRENT M4
FRONT S19
REAR S20
3S2 H.V.
2E3 BIAS
(16 KV) 3L1-2
V1 XV1 PEAK AMPLIFIER 4CX35000C
V2 XV2 CARRIER AMPLIFIER 4CX35000C
2L11-1 PEAK SCREEN
2C24-2 R.F. DRIVE
2C39-1 CARRIER SCREEN
CARRIER SCREEN CURRENT M1
TOTAL PLATE CURRENT M2
TEST METER M6
PWR AMP FILAMENT VOLTS M5
LIST OF MATERIAL OR PARTS LIST
UNLESS OTHERWISE SPECIFIED
DRAWN C. OWEY 10-18-74
ELEC ENGR J. SAINTON
Continental Electronics MANUFACTURING COMPANY DALLAS TEXAS
UNIT 1 SERIAL 65 & ABOVE
POWER AMPLIFIER
TYPE 317C 50KW TRANSMITTER
D 52151 119946
SHEET 1 OF 1
2017-01
CEMC FORM 307B

FACTORY TEST DATA

# FACTORY TEST DATA

Date ______________

Type ______________ Ser No. ______________ Freq. ______________

Power Output ______________ Kw Phantom Ant. Impedance ______________

Station ______________

Mod. Mon. ______________

Oscillator ______________

Distortion Mtr. ______________

Percent Distortion At

| Audio Frequency | 25% Mod. | 50% Mod. | 85% Mod. | 95% Mod. |
|---|---|---|---|---|
| 50 | | | | |
| 100 | | | | |
| 400 | | | | |
| 1000 | | | | |
| 5000 | | | | |
| 7500 | | | | |
| 10,000 | | | | |

Audio Frequency Response @ 70% Mod.

| | |
|---|---|
| 30 | |
| 50 | |
| 100 | |
| 400 | |
| 1000 | |
| 5000 | |
| 7500 | |
| 10,000 | |

Carrier Shift at 95% Mod. (400 ~) ______________ %

Noise Level Below 100% Mod. ______________ db

Feedback ______________ db

Plate Hours ______________

Type ______________ Ser. No. ______________ Freq. ______________

| Meter | Meter readings Switch Position | 0% Mod. | Reading 100% Mod. (Req'd.) Where Noted * ) |
|---|---|---|---|
| 460V Supply | A-B | | |
| | B-C | | |
| | C-A | | |
| Final Amp. Plate Voltage | | | * |
| 5500 V. Supply | | | |
| 3000 V. Supply | | | |
| RF Line Current | | | |
| Magniphase Null | | | |
| Carrier Screen Current | | | * |
| Total Plate Current | | | * |
| Peak Grid Current | | | * |
| Carrier Grid Current | | | * |
| Pwr. Amp. Fil. Volts | Peak | | |
| | Carrier | | |
| Testmeter | $I_k$ Peak | | |
| | $I_k$ Carrier | | |
| | $E_{sq}$ Peak | | |
| Test Meter | $I_t$ OSC. | | |
| | $I_c$ RF DVR. | | |
| | $I_c$ RF OUTPUT | | |
| | $I_g$ IPA GRID | | |
| | $I_c$ 1st AUDIO | | |
| | $I_c$ 2nd AUDIO | | |
| | E 2nd AUDIO | | |
| | $I_k$ AUDIO DVR. | | |
| | FB RECT. | | |
| | 28V SUPPLY | | |
| IPA Cath. Current | | | |
| Peak Screen Voltage | | | * |
| Carrier Screen Voltage | | | |
| PA & Modulator Bias | | | |
| 230V Supply | A-B | | |
| | B-C | | |
| | C-A | | |
| Left Mod. Plate Current | | | |
| Right Mod. Plate Current | | | |

## Tuned Circuit Data

**Buffer Plate Tank**

| | | |
|---|---|---|
| 2L4 | Dia. of Coil | ____ |
| | Size Wire | ____ |
| | Winding Length | ____ |
| | Pickup Coil-Size Wire | ____ |
| | -Winding Length | ____ |
| 2C12 | Buffer Plate-Dial Rdg. | ____ |
| | Padding Capacity (if used) | ____ |

**Driver Plate Tank**

| | | |
|---|---|---|
| 2L9 | Type of Coil | ____ |
| | No. of Turns Shorted | ____ |
| | Drive Tap (from ground end) | ____ |
| 2C23 | IPA Plate-Dial Rdg. | ____ |

**Power Amp. Grid Circuit**

| | | |
|---|---|---|
| 1L3 | Type of Coil | ____ |
| | No. of Turns Shorted | ____ |
| | Drive Tap (from short) | ____ |
| 1L4 | Type of Coil | ____ |
| | No. of Turns Shorted | ____ |
| 1C5 | Peak Grid Padder | ____ |
| 1C6 | P.A. Grid-Dial Rdg. | ____ |
| 1C14 | Intergrid Coupl.-Dial Rdg. | ____ |
| 1C19 | Grid Bypass | ____ |
| 1C20 | Grid Bypass | ____ |
| 1R36 | Resistance Used | ____ |
| 1R35 | Resistance Used | ____ |
| 1R37 | Resistance Used | ____ |
| 1C32 | Peak Screen Bypass | ____ |
| 1C34 | Carr. Screen Bypass | ____ |
| 1R34 | Carrier Grid Loading | ____ |
| 1L15 | Active Turns ____, 1C51 | ____ |

**Carr. Plate Tank**

| | | |
|---|---|---|
| 1C10 | Carr. Plate-Dial Rdg. | ____ |
| 1L6 | Type | ____ |
| | No. of Turns Shorted | ____ |

## Tuned Circuit Data (Cont'd.)

### Interplate

| | | |
|---|---|---|
| 1L5 | Type | ________ |
| | No. of Turns Shorted | ________ |

### "Pi" Section

| | | |
|---|---|---|
| 1C12.1 | Peak Plate-Dial Rdg. | ________ |
| 1C12.2 | Type (if used) | ________ |
| 1C12.3 | Type (if used) | ________ |
| 1L7 | Type | ________ |
| | No. of Turns Shorted | ________ |
| 3C4.1 | Pi Network Cap.-Dial Rdg. | ________ |
| 3C4.2 | Type (if used) | ________ |
| 3C4.3 | Type (if used) | ________ |
| 3C4.4 | Type (if used) | ________ |

### "L" Section

| | | |
|---|---|---|
| 3L2 | Type | ________ |
| | No. of Turns Shorted | ________ |
| 3L3 | Type | ________ |
| | No. of Turns Shorted | ________ |
| 3C5.1 | 2nd Harmonic Trap-Dial Rdg. | ________ |
| 3C5.2 | Type (if used) | ________ |
| 3C5.3 | Type (if used) | ________ |

### "T" Section

| | | |
|---|---|---|
| 3L4 | Type | ________ |
| | No. of Turns Shorted | ________ |
| | 3rd Harmonic Tap On Turn from Bottom | ________ |
| 3C6.1 | "T" Network Cap.-Dial Rdg. | ________ |
| 3C6.2 | Type (if used) | ________ |
| 3C6.3 | Type (if used) | ________ |
| 3C6.4 | Type (if used) | ________ |
| 3C7 | 3rd Harmonic Trap-Dial Rdg. | ________ |
| 3L5 | Type | ________ |
| | No. of Turns Shorted | ________ |

## Operating Voltages (Tube Electrodes)

### I.P.A.

Screen to Gnd. ____________
Fixed Bias ____________

### 2nd Audio

Cathode to Gnd. ____________
Screen to Gnd. ____________
Plate to Gnd. ____________

### Modulator

Grid-Cathode ____________

---

### Magniphase Unit Data

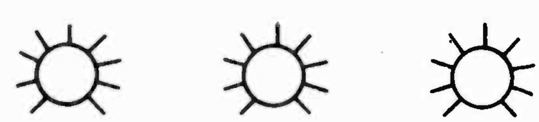
Series Cond. for Volt. Pick-up (if used) ____________
Dia. of Coupler Center Rod ____________
Magnitude Dial Rdg. ____________
Phase Dial Rdg. ____________

### Feedback Coil Type ____________

### Feedback Dial Rdg.

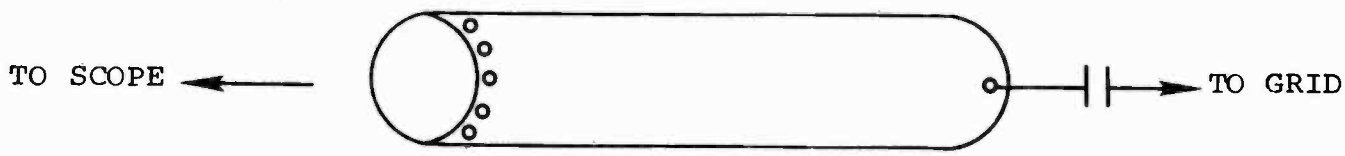
Feedback Connected to What Turn from Gnd. End ____________

### Plate Breaker Settings

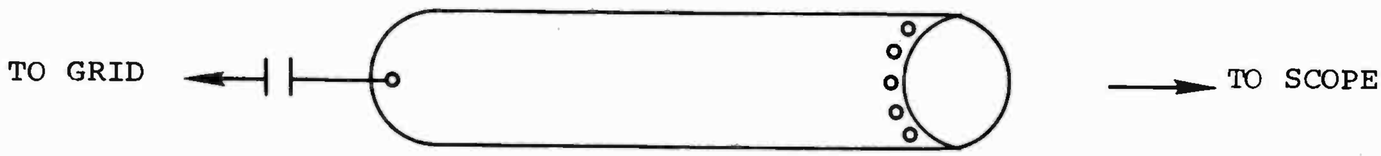


## Scope Sampling Circuits

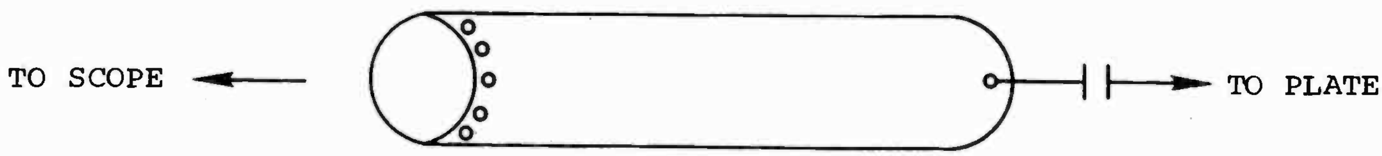
### Carrier Grid



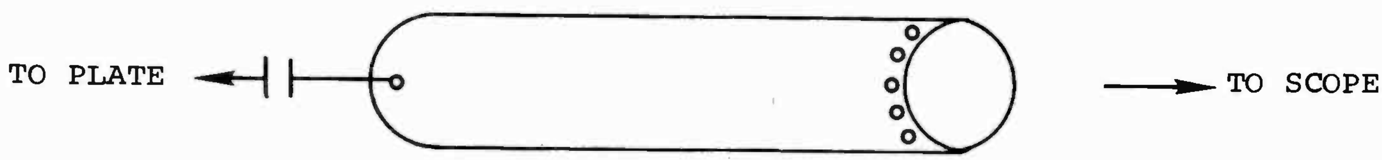

### Peak Grid




### Carrier Plate




### Peak Plate




### Notes

TUBE DATA SHEETS

# 8349
# 4CX35,000C

## RADIAL-BEAM POWER TETRODE

The EIMAC 8349/4CX35,000C is a ceramic/metal, forced-air cooled power tetrode intended for use at the 50 to 150 kilowatt output power level. It is recommended for use as a Class-C rf amplifier or oscillator, a Class-AB rf linear amplifier, or a Class-AB push-pull af amplifier or modulator. The 8349/4CX35,000C is also useful as a plate and screen modulated Class-C rf amplifier.

The forced-air cooled anode is rated at 35 kilowatts maximum dissipation.

## GENERAL CHARACTERISTICS [1]

### ELECTRICAL

Filament: Thoriated Tungsten
- Voltage . . . . . . . . . . . . . . . . . . 10.0 V
- Current, at 10.0 volts . . . . . . . . . . . . 295 A

Amplification Factor (Average):
- Grid to Screen . . . . . . . . . . . . . . . 4.5

Direct Interelectrode Capacitances (grounded cathode)[2]
- Cin . . . . . . . . . . . . . . . . . . . . 440 pF
- Cout . . . . . . . . . . . . . . . . . . . . 55 pF
- Cgp . . . . . . . . . . . . . . . . . . . . 2.3 pF

Frequency of Maximum Rating:
- CW . . . . . . . . . . . . . . . . . . . . 30 MHz

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

### MECHANICAL

Maximum Overall Dimensions:
- Length . . . . . . . . . . . . . . . . . . 17.34 in; 440.4 mm
- Diameter . . . . . . . . . . . . . . . . . 9.75 in; 247.7 mm

Net Weight . . . . . . . . . . . . . . . . . . 50 lb; 22.7 kg

Operating Position . . . . . . . . . . . . . . Vertical, base up or down

Maximum Operating Temperature:
- Ceramic/Metal Seals . . . . . . . . . . . . 250°C
- Anode Core . . . . . . . . . . . . . . . . 250°C

Cooling . . . . . . . . . . . . . . . . . . . Forced Air

Base . . . . . . . . . . . . . . . . . . . . Special, graduated rings

Recommended Socket . . . . . . . . . . . . . EIMAC SK-1500 Series

## RADIO FREQUENCY LINEAR AMPLIFIER GRID DRIVEN
Class AB

MAXIMUM RATINGS:

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 20,000 | VOLTS |
| DC SCREEN VOLTAGE | 2500 | VOLTS |
| DC PLATE CURRENT | 15.0 | AMPERES |
| PLATE DISSIPATION | 35,000 | WATTS |
| SCREEN DISSIPATION | 1750 | WATTS |
| GRID DISSIPATION | 500 | WATTS |

1. Adjust to specified zero-signal dc plate current.
2. Approximate value.

TYPICAL OPERATION (Frequencies to 30 MHz)
Class $AB_1$, Grid Driven, Peak Envelope or Modulation Crest Conditions

| | | |
|---|---|---|
| Plate Voltage | 15.0 | kVdc |
| Screen Voltage | 1.5 | kVdc |
| Grid Voltage [1] | -400 | Vdc |
| Zero-Signal Plate Current | 1.0 | Adc |
| Single Tone Plate Current | 5.7 | Adc |
| Single-Tone Screen Current [2] | 0.9 | Adc |
| Peak rf Grid Voltage [2] | 250 | v |
| Peak Driving Power [2] | 0 | w |
| Plate Dissipation | 30 | kW |
| Plate Output Power | 55 | kW |
| Resonant Load Impedance | 1280 | Ω |

---

## RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR
Class C Telegraphy or FM
(Key-Down Conditions)

MAXIMUM RATINGS:

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 20,000 | VOLTS |
| DC SCREEN VOLTAGE | 2500 | VOLTS |
| DC PLATE CURRENT | 15.0 | AMPERES |
| PLATE DISSIPATION | 35,000 | WATTS |
| SCREEN DISSIPATION | 1750 | WATTS |
| GRID DISSIPATION | 500 | WATTS |

TYPICAL OPERATION (Frequencies to 30 MHz)

| | | | | |
|---|---|---|---|---|
| Plate Voltage | 10.0 | 15.0 | 19.0 | kVdc |
| Screen Voltage | 750 | 750 | 750 | Vdc |
| Grid Voltage | -425 | -480 | -550 | Vdc |
| Plate Current | 7.5 | 6.8 | 6.96 | Adc |
| Screen Current [1] | 0.84 | 0.51 | 0.80 | Adc |
| Grid Current [1] | 0.29 | 0.23 | 0.35 | Adc |
| Peak rf Grid Voltage [1] | 600 | 660 | 730 | v |
| Calculated Driving Power [1] | 180 | 150 | 258 | W |
| Plate Dissipation | 19.3 | 19.0 | 21.0 | kW |
| Plate Output Power | 55.5 | 82.5 | 110 | kW |

1. Approximate value.

---

## PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER-GRID DRIVEN
Class C Telephony (Carrier Conditions)

MAXIMUM RATINGS:

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 14,000 | VOLTS |
| DC SCREEN VOLTAGE | 2000 | VOLTS |
| DC PLATE CURRENT | 15.0 | AMPERES |
| PLATE DISSIPATION [1] | 23,000 | WATTS |
| SCREEN DISSIPATION [2] | 1750 | WATTS |
| GRID DISSIPATION [2] | 500 | WATTS |

1. Corresponds to 35,000 watts at 100% sine-wave modulation.
2. Average, with or without modulation.

TYPICAL OPERATION (Frequencies to 30 MHz)

| | | |
|---|---|---|
| Plate Voltage | 12.0 | kVdc |
| Screen Voltage | 750 | Vdc |
| Grid Voltage | -600 | Vdc |
| Plate Current | 5.4 | Adc |
| Screen Current [1] | 0.52 | Adc |
| Grid Current [1] | 0.16 | Adc |
| Peak af Screen Voltage [2] (100% modulation) | 500 | v |
| Peak rf Grid Voltage [1] | 740 | v |
| Calculated Driving Power | 125 | W |
| Plate Dissipation | 13.2 | kW |
| Plate Output Power | 55.0 | kW |
| Resonant Load Impedance | 1120 | Ω |

1. Approximate value.

2. Approximate value, depending upon degree of driver modulation.

**AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR**

Class AB, Grid Driven (Sinusoidal Wave)

MAXIMUM RATINGS (Per Tube):

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 20,000 | VOLTS |
| DC SCREEN VOLTAGE | 2,500 | VOLTS |
| DC PLATE CURRENT | 15.0 | AMPERES |
| PLATE DISSIPATION | 35,000 | WATTS |
| SCREEN DISSIPATION | 1750 | WATTS |
| GRID DISSIPATION | 500 | WATTS |

1. Approximate value.

TYPICAL OPERATION (Two Tubes)

| | | |
|---|---|---|
| Plate Voltage | 12.0 | kVdc |
| Screen Voltage | 1.5 | kVdc |
| Grid Voltage[1/3] | -400 | Vdc |
| Zero-Signal Plate Current | 3.0 | Adc |
| Max Signal Plate Current | 9.2 | Adc |
| Max Signal Screen Current[1] | 1.8 | Adc |
| Peak af Grid Voltage[2] | 280 | v |
| Max Signal Plate Dissipation[2] | 20 | kW |
| Plate Output Power | 70 | kW |
| Load Resistance (plate to plate) | 2860 | Ω |

2. Per Tube
3. Adjust to give stated zero-signal plate current.

NOTE: TYPICAL OPERATION data are obtained from direct measurement or by calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, screen and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid and screen current. The grid and screen currents which result when the desired plate current is obtained are incidental and vary from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. In the case of Class C Service, if grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

**RANGE VALUES FOR EQUIPMENT DESIGN**

| | Min. | Max. | |
|---|---|---|---|
| Heater: Current at 10.0 volts | 280 | 310 | A |
| Interelectrode Capacitances (grounded cathode connection)[2] | | | |
| Cin | 410 | 470 | pF |
| Cout | 50 | 60 | pF |
| Cgp | 1.5 | 3.2 | pF |

2. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

# APPLICATION

## MECHANICAL

*MOUNTING* - The 4CX35,000C must be operated with its axis vertical. The base of the tube may be down or up at the convenience of the circuit designer.

*SOCKET* - The EIMAC sockets, type SK-1500, and SK-1510 have been designed especially for the concentric base terminals of the 4CX35,000C.

*COOLING* - The maximum temperature rating for the external surfaces of the 4CX35,000C is 250°C. Sufficient forced-air circulation must be provided to keep the temperature of the anode at the base of the cooling fins and the temperature of the ceramic/metal seals below 250°C.

Air-flow requirements to maintain core temperature at 225°C in 40° ambient air are tabulated below (for operation below 30 megahertz.) These data are for air flowing in the base-to-anode direction.

| | Base-to-Anode Air Flow | | | |
|---|---|---|---|---|
| | Sea Level | | 10,000 Feet | |
| Plate Dissipation* (Watts) | Air Flow (CFM) | Pressure Drop (Inches of Water) | Air Flow (CFM) | Pressure Drop (Inches of Water) |
| 15,000 | 440 | 1.0 | 635 | 1.44 |
| 20,000 | 650 | 2.0 | 935 | 2.9 |
| 25,000 | 975 | 3.8 | 1400 | 5.5 |
| 30,000 | 1300 | 6.0 | 1870 | 8.6 |
| 35,000 | 1760 | 9.6 | 2535 | 13.8 |

* Since the power dissipated by the filament represents about 3000 watts and since grid-plus-screen dissipation can, under some conditions, represent another 2250 watts, allowance has been made in preparing this tabulation for an additional 5250 watts dissipation.

The blower selected in a given application must be capable of supplying the desired air flow at a back pressure equal to the pressure drop shown above plus any drop encountered in ducts and filters.

Separate cooling of the tube base is required and is accomplished by directing approximately 120 cfm of air horizontally through the socket from the side. It is preferable to direct this air through three equally spaced ducts.

The well in the center of the baseplate of the tube is a critical area which requires cooling to maintain envelope temperatures less than 250°C. For most applications, 1 to 2 CFM of air directed through the center of the socket is sufficient for this purpose.

At other altitudes and ambient temperatures the flow rate must be modified to obtain equivalent cooling. The flow rate and corresponding pressure differential must be determined individually in such cases, using rated maximum temperatures as the criteria for satisfactory cooling.

## ELECTRICAL

*FILAMENT OPERATION* - The peak emission at rated filament voltage of the EIMAC 4CX35,000C is normally many times the peak emission required for communication service. A small decrease in filament temperature due to reduction of filament voltage can increase the life of the 4CX35,000C by a substantial percentage. It is good practice to determine the nominal filament voltage for a particular application that will not affect the operation of the equipment. This is done by measuring some important parameter of performance such as plate current, power output, or distortion while filament voltage is reduced on the 4CX35,000C. At some point in filament voltage there will be a noticeable reduction in plate current, or power output, or an increase in distortion. Operation may be at a filament voltage slightly higher than that point at which performance appears to deteriorate. This voltage should be measured at the socket with a 1% meter and periodically checked to maintain proper operation.

Filament starting current must be limited to a maximum of 900 amperes.

Voltage between filament and the base plates of tube and SK-1500 socket, must not exceed 100 volts.

*GRID OPERATION* - The 4CX35,000C grid has a maximum dissipation rating of 500 watts. Precautions should be observed to avoid exceeding this rating. The grid bias and driving power should be kept near the values shown in the "Typical Operation" sections of the data sheet whenever possible. The maximum grid circuit resistance should not exceed 100,000 ohms per tube.

*SCREEN OPERATION* - The power dissipated by the screen of the 4CX35,000C must not exceed 1750 watts.

Screen dissipation, in cases where there is no ac applied to the screen, is the simple product of the screen voltage and the screen current. If the screen voltage is modulated, the screen dissipation will depend upon loading, driving power, and carrier screen voltage.

Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage, or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit the screen dissipation to 1750 watts in the event of circuit failure.

*PLATE DISSIPATION* - The plate-dissipation rating for the 4CX35,000C is 35,000 watts. When the 4CX35,000C is operated as a plate-modulated rf amplifier, under carrier conditions, the maximum plate dissipation is 23,000 watts.

*INTERELECTRODE CAPACITANCE* - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures which effectively shield all external tube leads from each other and eliminates any capacitance reading to "ground". The test is performed on a cold tube. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even when the tube may be made by different manufacturers. The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191.

The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with the socket and mounting which represent approximate final layout if capacitance values are highly significant in the design.

*HIGH VOLTAGE* - Normal operating voltages used with the 4CX35,000C are deadly, and the equipment must be designed properly and operating precautions must be followed. Design all equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open primary circuits of the power supply and to discharge high-voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

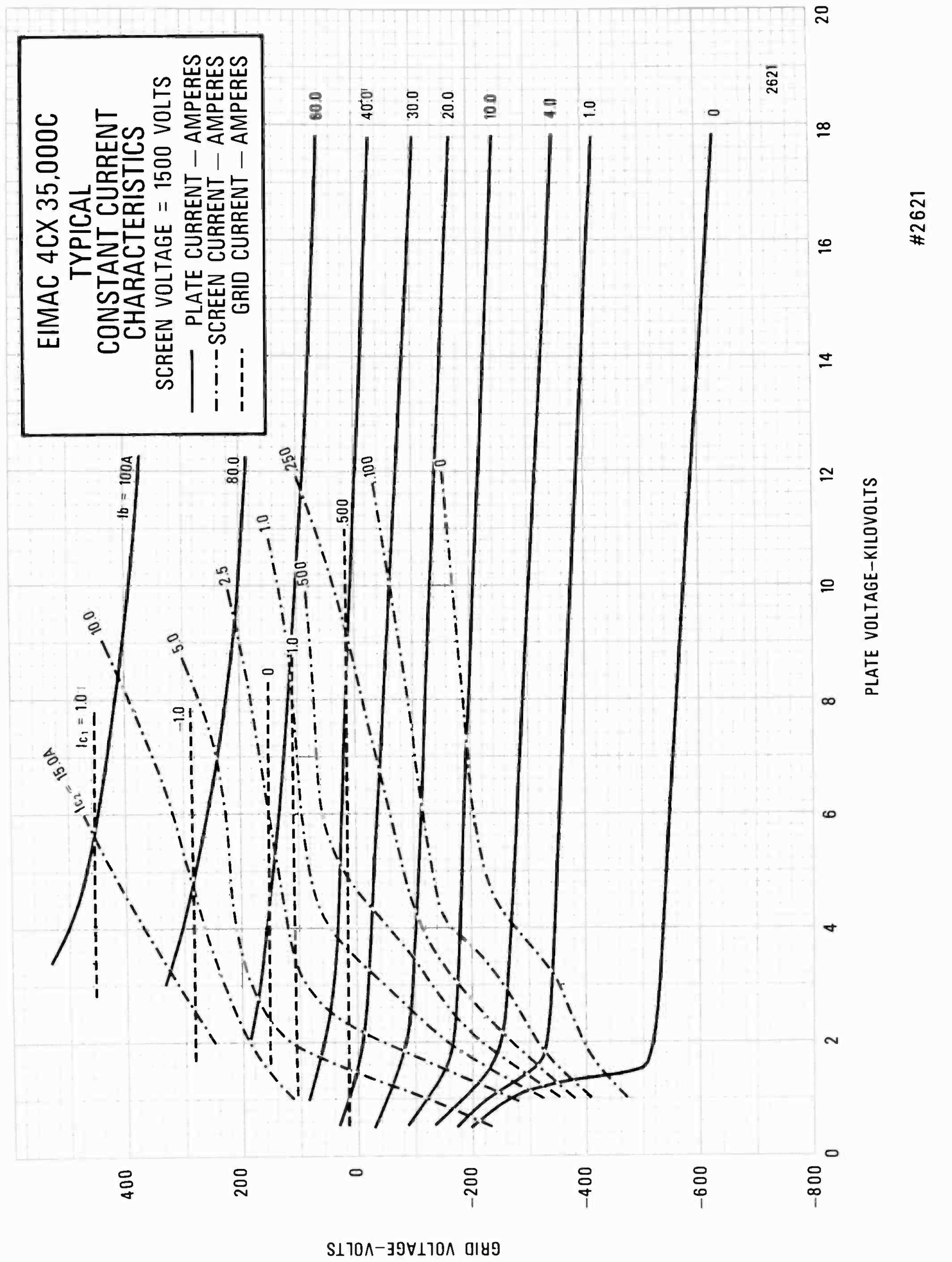
*FAULT PROTECTION* - In addition to normal cooling airflow interlock and plate and screen over-current interlocks, it is good practice to protect the tube from internal damage which could result from occasional plate arcing at high plate voltage.

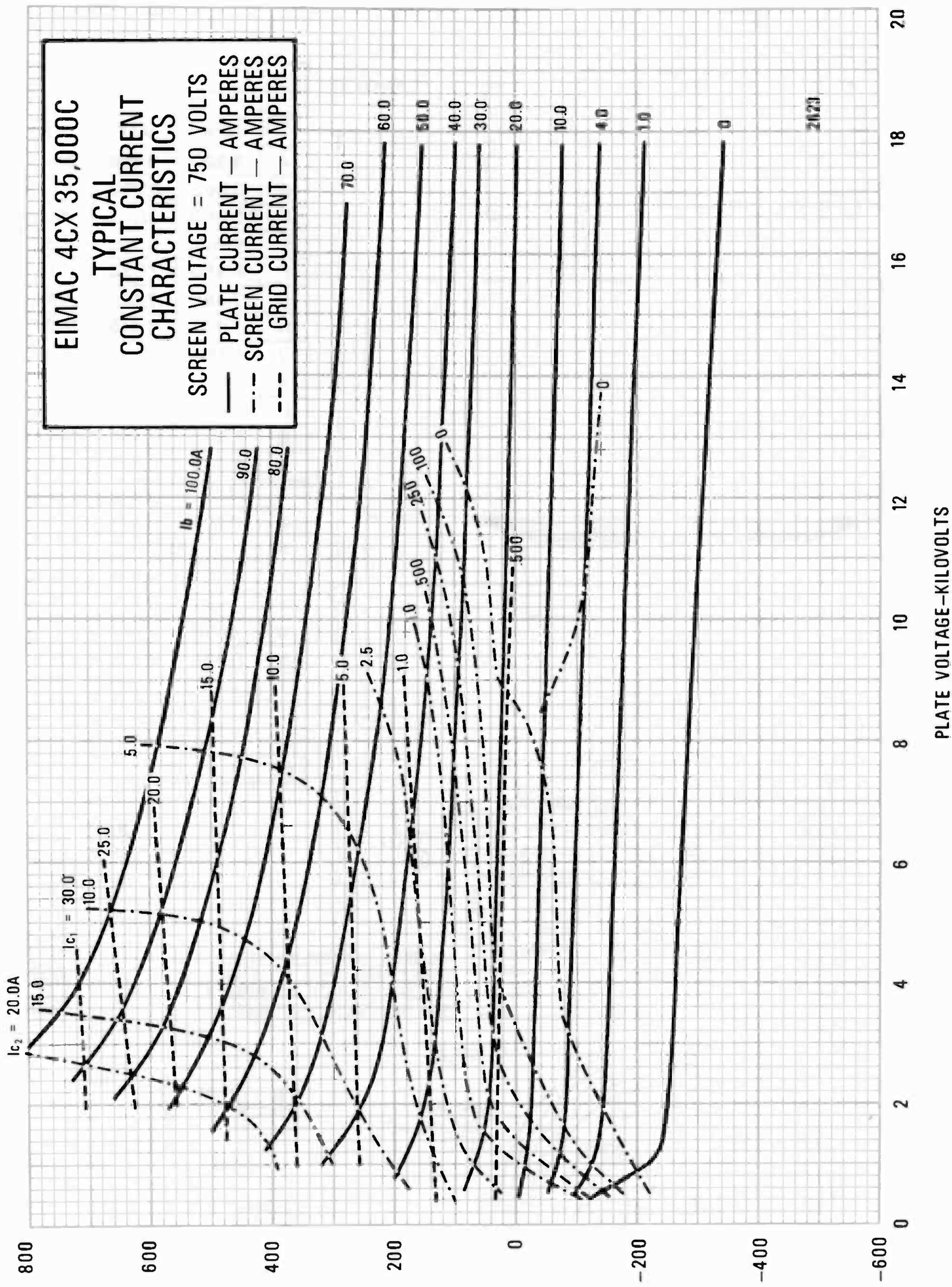
In all cases some protective resistance, at least one or two ohms, should be used in series with the tube anode to absorb power supply stored energy in case a plate arc should occur. Where stored energy is high, it is recommended that some form of electronic crowbar be used which will discharge power supply capacitors in as short a time as possible following indication of start of a plate arc.

*X-RADIATION* - High-vacuum tubes operating at voltages higher than 10 kilovolts produce progressively more dangerous X-ray radiation as the voltage is increased. The 4CX35,000C, operating at its rated voltages and currents, is a potential X-ray hazard. Only limited shielding is afforded by the tube envelope. Moreover, the X-ray radiation level can increase significantly with aging and gradual deterioration, due to leakage paths or emission characteristics as they are affected by the high voltage. X-ray shielding must be provided on all sides of tubes operating at these voltages to provide adequate protection throughout the tube's life. Periodic checks on the X-ray level should be made, and the tube should never be operated without adequate shielding in place when voltages above 10 kilovolts are in use. Lead glass, which attenuates X-rays, is available for viewing windows. If there is any doubt as to the requirement for or the adequacy of shielding, an expert in this field should be contacted to perform an X-ray survey of the equipment.

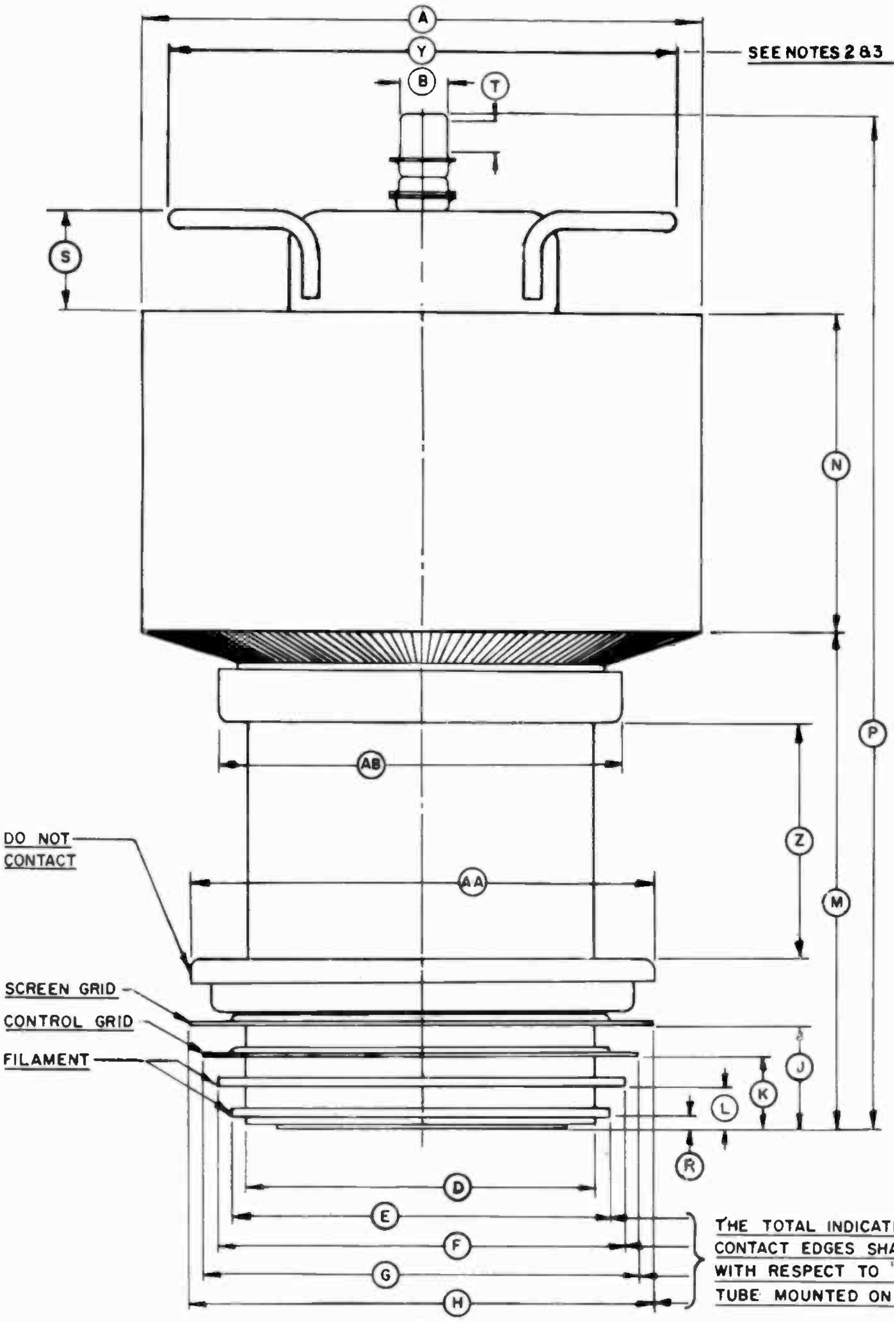
Operation of high-voltage equipment with interlock switches "cheated" and cabinet doors open in order to be better able to locate an equipment malfunction can result in serious X-ray exposure.

*SPECIAL APPLICATIONS* - If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Product Manager, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070 for information and recommendations.

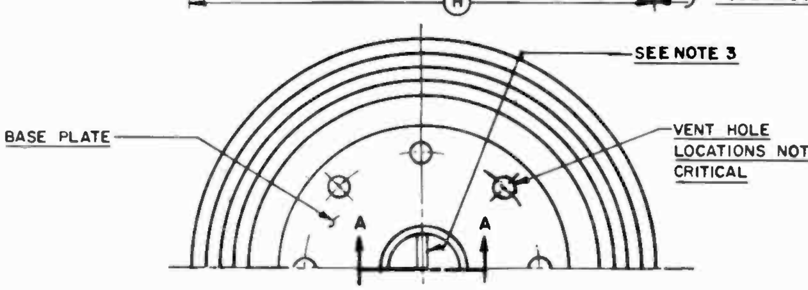

EIMAC 4CX 35,000C
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 1500 VOLTS
PLATE CURRENT — AMPERES
SCREEN CURRENT — AMPERES
GRID CURRENT — AMPERES
PLATE VOLTAGE—KILOVOLTS
GRID VOLTAGE—VOLTS
Ib = 100A
80.0
60.0
40.0
30.0
20.0
10.0
4.0
1.0
0
Ic2 = 15.0A
Ic1 = 1.0
10.0
5.0
2.5
1.0
.500
.250
.100
0
-1.0
2621
#2621

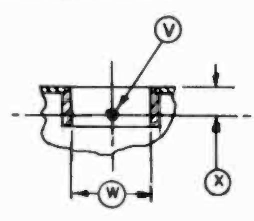

EIMAC 4CX 35,000C
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 750 VOLTS
PLATE CURRENT — AMPERES
SCREEN CURRENT — AMPERES
GRID CURRENT — AMPERES
Ib = 100.0A
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
4.0
1.0
0
$Ic_2$ = 20.0A
15.0
$Ic_1$ = 30.0
10.0
25.0
20.0
5.0
15.0
10.0
5.0
2.5
1.0
1.0
.500
.250
.100
0
.500
0
PLATE VOLTAGE–KILOVOLTS
GRID VOLTAGE–VOLTS
800
600
400
200
0
−200
−400
−600
0
2
4
6
8
10
12
14
16
18
20

#2623




THE TOTAL INDICATED RUNOUT OF THESE CONTACT EDGES SHALL NOT EXCEED .125 WITH RESPECT TO "W" MEASURED WITH TUBE MOUNTED ON BOTTOM CERAMIC




SECTION A–A

| DIMENSIONAL DATA | | | | |
|---|---|---|---|---|
| DIM. | INCHES | | MILLIMETERS | |
| | MIN. | MAX. | MIN. | MAX. |
| A | 9.500 | 9.750 | 241.30 | 247.65 |
| B | 0.860 | 0.890 | 21.84 | 22.60 |
| D | 5.980 | 6.020 | 151.89 | 152.91 |
| E | 6.510 | 6.560 | 165.35 | 166.62 |
| F | 6.980 | 7.020 | 177.29 | 178.31 |
| G | 7.480 | 7.520 | 189.99 | 191.01 |
| H | 7.975 | 8.015 | 202.57 | 203.58 |
| J | 1.750 | 1.800 | 44.45 | 45.72 |
| K | 1.220 | 1.270 | 30.99 | 32.26 |
| L | 0.690 | 0.740 | 17.53 | 18.80 |
| M | 8.442 | 8.692 | 214.43 | 220.78 |
| N | 5.375 | 5.625 | 136.52 | 142.88 |
| P | 17.070 | 17.340 | 433.58 | 440.44 |
| R | 0.173 | 0.213 | 4.40 | 5.41 |
| S | 1.750 | | 44.45 | |
| T | 0.485 | 0.515 | 12.32 | 13.08 |
| V | — — | 0.135 | — — | 3.43 |
| W | 1.250 | 1.270 | 31.75 | 32.26 |
| X | 0.490 | 0.530 | 12.45 | 13.46 |
| Y | — — | 8.750 | — — | 222.25 |
| Z | 3.750 | | 95.25 | |
| AA | 8.000 | | 203.20 | |
| AB | 6.875 | | 174.63 | |

NOTES:

1. REFERENCE DIMENSIONS ARE FOR INFORMATION ONLY AND ARE NOT REQUIRED FOR INSPECTION PURPOSES.
2. DIM. Y IS MAXIMUM DIA. ACROSS CORNERS
3. HANDLE LATERAL AXIS ORIENTATION WITH BASE LOCK PIN IS AS SHOWN.

# 8349
# 4CX35,000C

TECHNICAL DATA

RADIAL-BEAM POWER TETRODE

The EIMAC 8349/4CX35,000C is a ceramic/metal, forced-air cooled power tetrode intended for use at the 50 to 150 kilowatt output power level. It is recommended for use as a Class-C rf amplifier or oscillator, a Class-AB rf linear amplifier, or a Class-AB push-pull af amplifier or modulator. The 8349/4CX35,000C is also useful as a plate and screen modulated Class-C rf amplifier.

The forced-air cooled anode is rated at 35 kilowatts maximum dissipation.

## GENERAL CHARACTERISTICS [1]

### ELECTRICAL

Filament: Thoriated Tungsten

| | |
|---|---|
| Voltage | 10.0 V |
| Current, at 10.0 volts | 295 A |

Amplification Factor (Average):

| | |
|---|---|
| Grid to Screen | 4.5 |

Direct Interelectrode Capacitances (grounded cathode)[2]

| | |
|---|---|
| Cin | 440 pF |
| Cout | 55 pF |
| Cgp | 2.3 pF |

Frequency of Maximum Rating:

| | |
|---|---|
| CW | 30 MHz |

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

### MECHANICAL

Maximum Overall Dimensions:

| | |
|---|---|
| Length | 17.34 in; 440.4 mm |
| Diameter | 9.75 in; 247.7 mm |
| Net Weight | 50 lb; 22.7 kg |
| Operating Position | Vertical, base up or down |

Maximum Operating Temperature:

| | |
|---|---|
| Ceramic/Metal Seals | 250°C |
| Anode Core | 250°C |
| Cooling | Forced Air |
| Base | Special, graduated rings |
| Recommended Socket | EIMAC SK-1500 Series |

**RADIO FREQUENCY LINEAR AMPLIFIER GRID DRIVEN**
Class AB

MAXIMUM RATINGS:

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 20,000 | VOLTS |
| DC SCREEN VOLTAGE | 2500 | VOLTS |
| DC PLATE CURRENT | 15.0 | AMPERES |
| PLATE DISSIPATION | 35,000 | WATTS |
| SCREEN DISSIPATION | 1750 | WATTS |
| GRID DISSIPATION | 500 | WATTS |

1. Adjust to specified zero-signal dc plate current.
2. Approximate value.

TYPICAL OPERATION (Frequencies to 30 MHz)
Class $AB_1$, Grid Driven, Peak Envelope or Modulation Crest Conditions

| | | |
|---|---|---|
| Plate Voltage | 15.0 | kVdc |
| Screen Voltage | 1.5 | kVdc |
| Grid Voltage [1] | -400 | Vdc |
| Zero-Signal Plate Current | 1.0 | Adc |
| Single Tone Plate Current | 5.7 | Adc |
| Single-Tone Screen Current [2] | 0.9 | Adc |
| Peak rf Grid Voltage [2] | 250 | v |
| Peak Driving Power [2] | 0 | w |
| Plate Dissipation | 30 | kW |
| Plate Output Power | 55 | kW |
| Resonant Load Impedance | 1280 | Ω |

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**RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR**
Class C Telegraphy or FM
(Key-Down Conditions)

MAXIMUM RATINGS:

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 20,000 | VOLTS |
| DC SCREEN VOLTAGE | 2500 | VOLTS |
| DC PLATE CURRENT | 15.0 | AMPERES |
| PLATE DISSIPATION | 35,000 | WATTS |
| SCREEN DISSIPATION | 1750 | WATTS |
| GRID DISSIPATION | 500 | WATTS |

TYPICAL OPERATION (Frequencies to 30 MHz)

| | | | | |
|---|---|---|---|---|
| Plate Voltage | 10.0 | 15.0 | 19.0 | kVdc |
| Screen Voltage | 750 | 750 | 750 | Vdc |
| Grid Voltage | -425 | -480 | -550 | Vdc |
| Plate Current | 7.5 | 6.8 | 6.96 | Adc |
| Screen Current [1] | 0.84 | 0.51 | 0.80 | Adc |
| Grid Current [1] | 0.29 | 0.23 | 0.35 | Adc |
| Peak rf Grid Voltage [1] | 600 | 660 | 730 | v |
| Calculated Driving Power [1] | 180 | 150 | 258 | W |
| Plate Dissipation | 19.3 | 19.0 | 21.0 | kW |
| Plate Output Power | 55.5 | 82.5 | 110 | kW |

1. Approximate value.

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**PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER-GRID DRIVEN**
Class C Telephony (Carrier Conditions)

MAXIMUM RATINGS:

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 14,000 | VOLTS |
| DC SCREEN VOLTAGE | 2000 | VOLTS |
| DC PLATE CURRENT | 15.0 | AMPERES |
| PLATE DISSIPATION [1] | 23,000 | WATTS |
| SCREEN DISSIPATION [2] | 1750 | WATTS |
| GRID DISSIPATION [2] | 500 | WATTS |

1. Corresponds to 35,000 watts at 100% sine-wave modulation.
2. Average, with or without modulation.

TYPICAL OPERATION (Frequencies to 30 MHz)

| | | |
|---|---|---|
| Plate Voltage | 12.0 | kVdc |
| Screen Voltage | 750 | Vdc |
| Grid Voltage | -600 | Vdc |
| Plate Current | 5.4 | Adc |
| Screen Current [1] | 0.52 | Adc |
| Grid Current [1] | 0.16 | Adc |
| Peak af Screen Voltage [2] (100% modulation) | 500 | v |
| Peak rf Grid Voltage [1] | 740 | v |
| Calculated Driving Power | 125 | W |
| Plate Dissipation | 13.2 | kW |
| Plate Output Power | 55.0 | kW |
| Resonant Load Impedance | 1120 | Ω |

1. Approximate value.

2. Approximate value, depending upon degree of driver modulation.

**AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR**
Class AB, Grid Driven (Sinusoidal Wave)

MAXIMUM RATINGS (Per Tube):

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 20,000 | VOLTS |
| DC SCREEN VOLTAGE | 2,500 | VOLTS |
| DC PLATE CURRENT | 15.0 | AMPERES |
| PLATE DISSIPATION | 35,000 | WATTS |
| SCREEN DISSIPATION | 1750 | WATTS |
| GRID DISSIPATION | 500 | WATTS |

1. Approximate value.

TYPICAL OPERATION (Two Tubes)

| | | |
|---|---|---|
| Plate Voltage | 12.0 | kVdc |
| Screen Voltage | 1.5 | kVdc |
| Grid Voltage [1/3] | -400 | Vdc |
| Zero-Signal Plate Current | 3.0 | Adc |
| Max Signal Plate Current | 9.2 | Adc |
| Max Signal Screen Current [1] | 1.8 | Adc |
| Peak af Grid Voltage [2] | 280 | v |
| Max Signal Plate Dissipation [2] | 20 | kW |
| Plate Output Power | 70 | kW |
| Load Resistance (plate to plate) | 2860 | Ω |

2. Per Tube
3. Adjust to give stated zero-signal plate current.

NOTE: TYPICAL OPERATION data are obtained from direct measurement or by calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, screen and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid and screen current. The grid and screen currents which result when the desired plate current is obtained are incidental and vary from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. In the case of Class C Service, if grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

**RANGE VALUES FOR EQUIPMENT DESIGN**

| | Min. | Max. | |
|---|---|---|---|
| Heater: Current at 10.0 volts | 280 | 310 | A |
| Interelectrode Capacitances (grounded cathode connection) [2] | | | |
| Cin | 410 | 470 | pF |
| Cout | 50 | 60 | pF |
| Cgp | 1.5 | 3.2 | pF |

2. Capacitance values are for a cold tube as measured in a special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

# APPLICATION

## MECHANICAL

*MOUNTING* - The 4CX35,000C must be operated with its axis vertical. The base of the tube may be down or up at the convenience of the circuit designer.

*SOCKET* - The EIMAC sockets, type SK-1500, and SK-1510 have been designed especially for the concentric base terminals of the 4CX35,000C.

*COOLING* - The maximum temperature rating for the external surfaces of the 4CX35,000C is 250°C. Sufficient forced-air circulation must be provided to keep the temperature of the anode at the base of the cooling fins and the temperature of the ceramic/metal seals below 250°C.

Air-flow requirements to maintain core temperature at 225°C in 40° ambient air are tabulated below (for operation below 30 megahertz.) These data are for air flowing in the base-to-anode direction.

| | Base-to-Anode Air Flow | | | |
|---|---|---|---|---|
| | Sea Level | | 10,000 Feet | |
| Plate Dissipation • (Watts) | Air Flow (CFM) | Pressure Drop(Inches of Water) | Air Flow (CFM) | Pressure Drop(Inches of Water) |
| 15,000 | 440 | 1.0 | 635 | 1.44 |
| 20,000 | 650 | 2.0 | 935 | 2.9 |
| 25,000 | 975 | 3.8 | 1400 | 5.5 |
| 30,000 | 1300 | 6.0 | 1870 | 8.6 |
| 35,000 | 1760 | 9.6 | 2535 | 13.8 |

• Since the power dissipated by the filament represents about 3000 watts and since grid-plus-screen dissipation can, under some conditions, represent another 2250 watts, allowance has been made in preparing this tabulation for an additional 5250 watts dissipation.

The blower selected in a given application must be capable of supplying the desired air flow at a back pressure equal to the pressure drop shown above plus any drop encountered in ducts and filters.

Separate cooling of the tube base is required and is accomplished by directing approximately 120 cfm of air horizontally through the socket from the side. It is preferable to direct this air through three equally spaced ducts.

The well in the center of the baseplate of the tube is a critical area which requires cooling to maintain envelope temperatures less than 250°C. For most applications, 1 to 2 CFM of air directed through the center of the socket is sufficient for this purpose.

At other altitudes and ambient temperatures the flow rate must be modified to obtain equivalent cooling. The flow rate and corresponding pressure differential must be determined individually in such cases, using rated maximum temperatures as the criteria for satisfactory cooling.

## ELECTRICAL

*FILAMENT OPERATION* - The peak emission at rated filament voltage of the EIMAC 4CX35,000C is normally many times the peak emission required for communication service. A small decrease in filament temperature due to reduction of filament voltage can increase the life of the 4CX35,000C by a substantial percentage. It is good practice to determine the nominal filament voltage for a particular application that will not affect the operation of the equipment. This is done by measuring some important parameter of performance such as plate current, power output, or distortion while filament voltage is reduced on the 4CX35,000C. At some point in filament voltage there will be a noticeable reduction in plate current, or power output, or an increase in distortion. Operation may be at a filament voltage slightly higher than that point at which performance appears to deteriorate. This voltage should be measured at the socket with a 1% meter and periodically checked to maintain proper operation.

Filament starting current must be limited to a maximum of 900 amperes.

Voltage between filament and the base plates of tube and SK-1500 socket, must not exceed 100 volts.

*GRID OPERATION* - The 4CX35,000C grid has a maximum dissipation rating of 500 watts. Precautions should be observed to avoid exceeding this rating. The grid bias and driving power should be kept near the values shown in the "Typical Operation" sections of the data sheet whenever possible. The maximum grid circuit resistance should not exceed 100,000 ohms per tube.

*SCREEN OPERATION* - The power dissipated by the screen of the 4CX35,000C must not exceed 1750 watts.

Screen dissipation, in cases where there is no ac applied to the screen, is the simple product of the screen voltage and the screen current. If the screen voltage is modulated, the screen dissipation will depend upon loading, driving power, and carrier screen voltage.

Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage, or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit the screen dissipation to 1750 watts in the event of circuit failure.

*PLATE DISSIPATION* - The plate-dissipation rating for the 4CX35,000C is 35,000 watts. When the 4CX35,000C is operated as a plate-modulated rf amplifier, under carrier conditions, the maximum plate dissipation is 23,000 watts.

*INTERELECTRODE CAPACITANCE* - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures which effectively shield all external tube leads from each other and eliminates any capacitance reading to "ground". The test is performed on a cold tube. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even when the tube may be made by different manufacturers. The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191.

The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with the socket and mounting which represent approximate final layout if capacitance values are highly significant in the design.

*HIGH VOLTAGE* - Normal operating voltages used with the 4CX35,000C are deadly, and the equipment must be designed properly and operating precautions must be followed. Design all equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open primary circuits of the power supply and to discharge high-voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

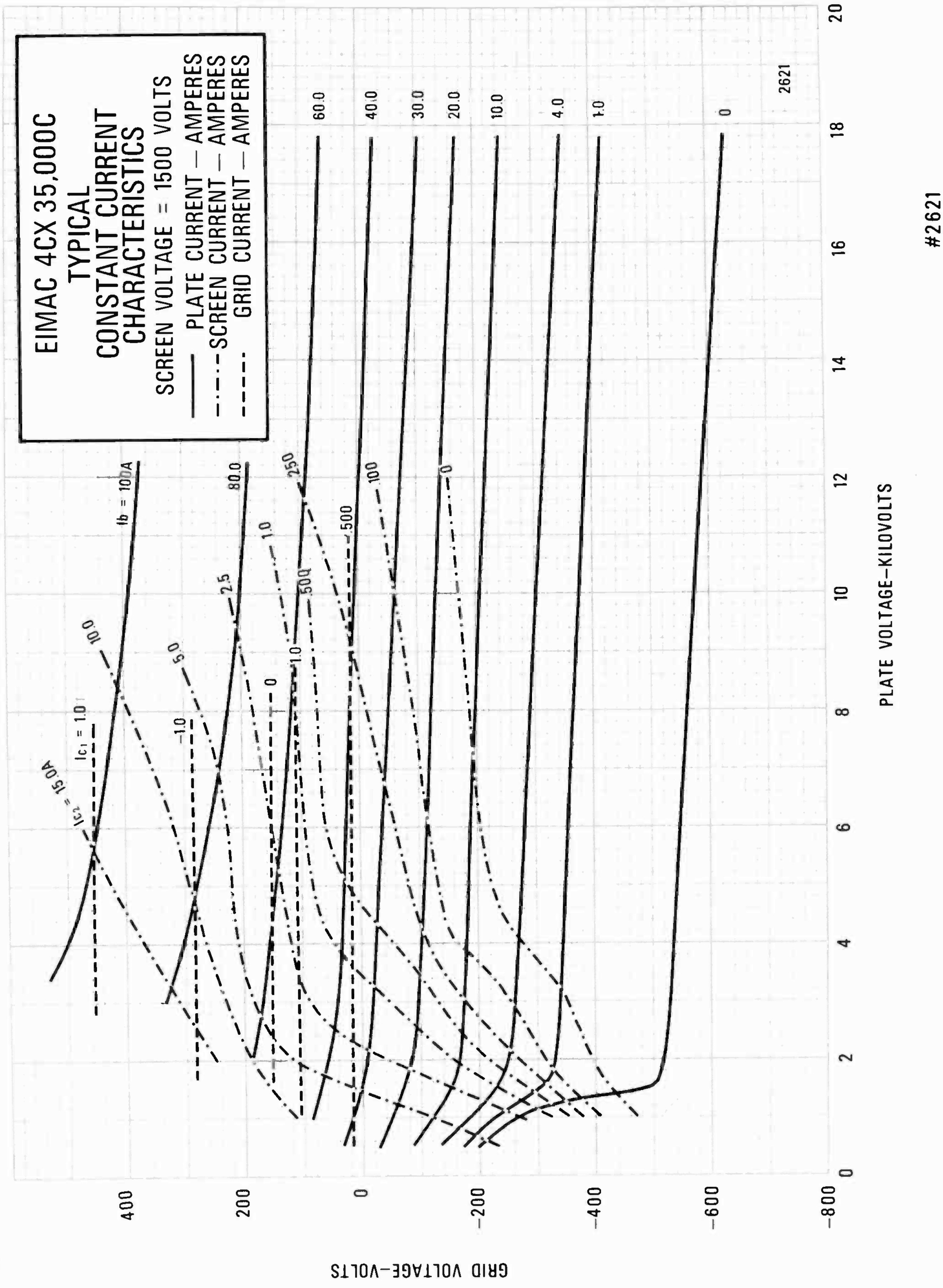
*FAULT PROTECTION* - In addition to normal cooling airflow interlock and plate and screen over-current interlocks, it is good practice to protect the tube from internal damage which could result from occasional plate arcing at high plate voltage.

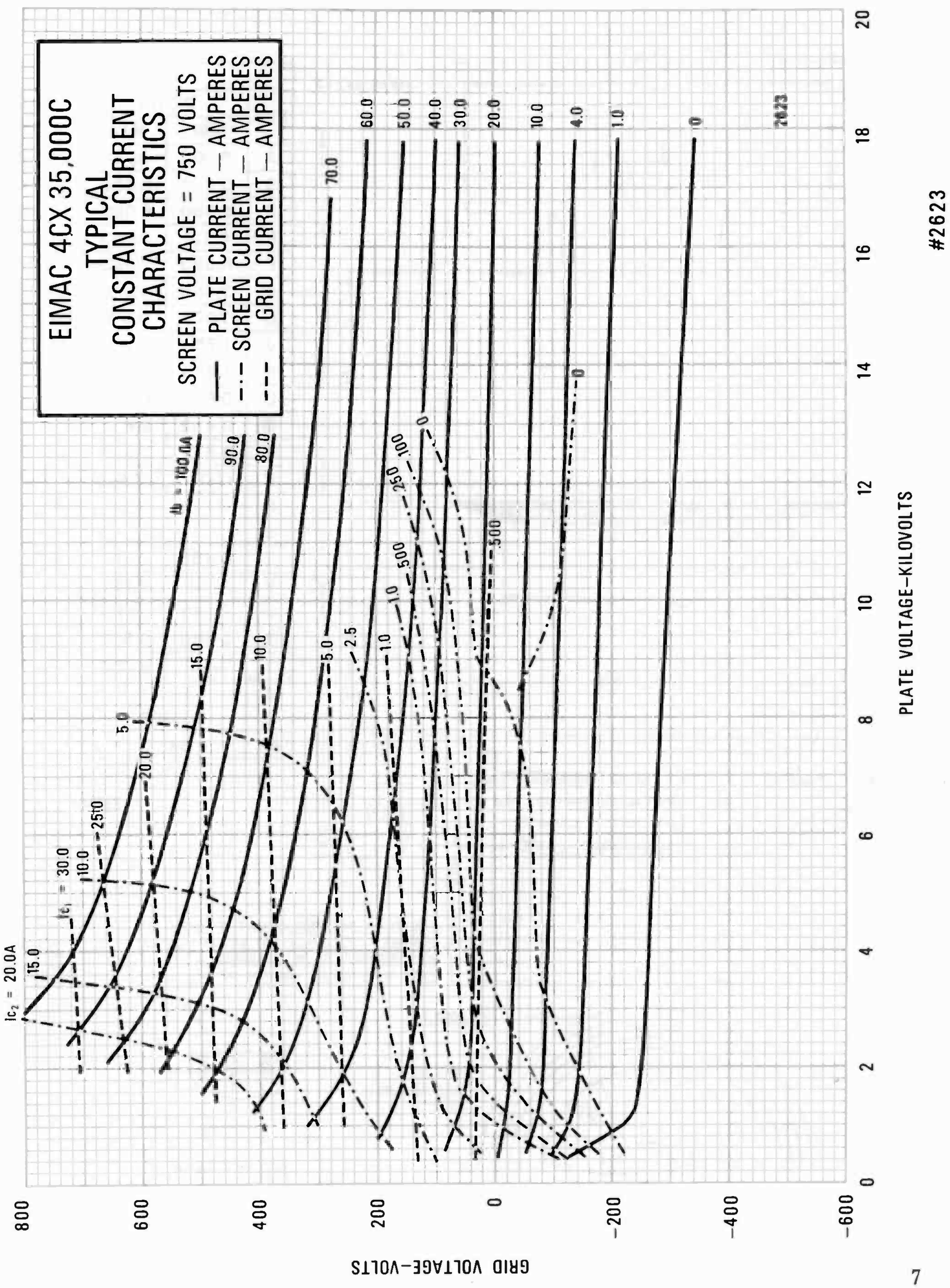
In all cases some protective resistance, at least one or two ohms, should be used in series with the tube anode to absorb power supply stored energy in case a plate arc should occur. Where stored energy is high, it is recommended that some form of electronic crowbar be used which will discharge power supply capacitors in as short a time as possible following indication of start of a plate arc.

*X-RADIATION* - High-vacuum tubes operating at voltages higher than 10 kilovolts produce progressively more dangerous X-ray radiation as the voltage is increased. The 4CX35,000C, operating at its rated voltages and currents, is a potential X-ray hazard. Only limited shielding is afforded by the tube envelope. Moreover, the X-ray radiation level can increase significantly with aging and gradual deterioration, due to leakage paths or emission characteristics as they are affected by the high voltage. X-ray shielding must be provided on all sides of tubes operating at these voltages to provide adequate protection throughout the tube's life. Periodic checks on the X-ray level should be made, and the tube should never be operated without adequate shielding in place when voltages above 10 kilovolts are in use. Lead glass, which attenuates X-rays, is available for viewing windows. If there is any doubt as to the requirement for or the adequacy of shielding, an expert in this field should be contacted to perform an X-ray survey of the equipment.

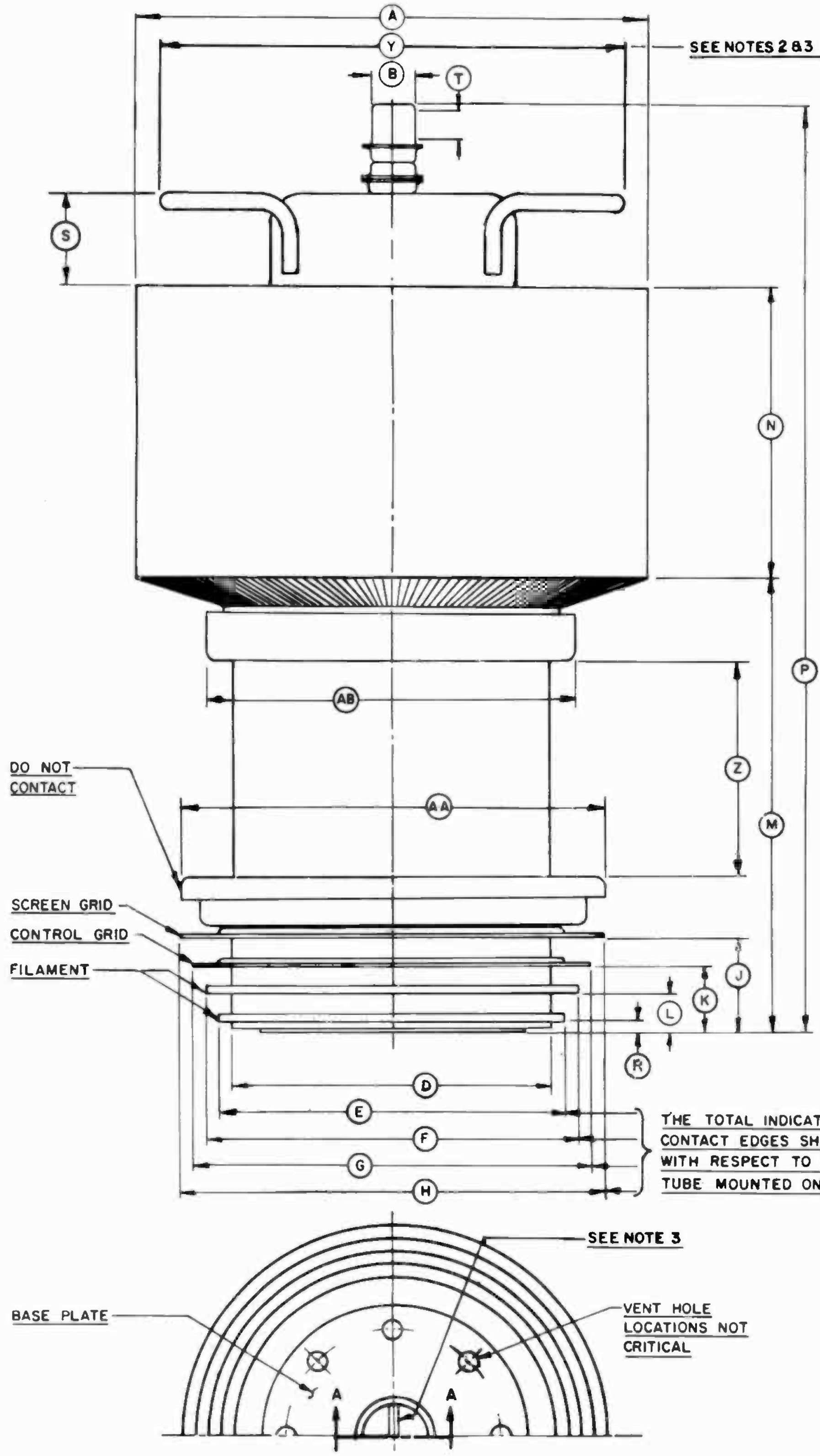
Operation of high-voltage equipment with interlock switches "cheated" and cabinet doors open in order to be better able to locate an equipment malfunction can result in serious X-ray exposure.

*SPECIAL APPLICATIONS* - If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Product Manager, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070 for information and recommendations.


EIMAC 4CX 35,000C
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 1500 VOLTS
PLATE CURRENT — AMPERES
SCREEN CURRENT — AMPERES
GRID CURRENT — AMPERES
Ib = 100A
80.0
60.0
40.0
30.0
20.0
10.0
4.0
1.0
0
Ic2 = 15.0A
10.0
5.0
2.5
1.0
.500
.250
.100
0
Ic1 = 1.0
-1.0
1.0
.500
0
2621
PLATE VOLTAGE—KILOVOLTS
0
2
4
6
8
10
12
14
16
18
20
GRID VOLTAGE—VOLTS
400
200
0
-200
-400
-600
-800
#2621


EIMAC 4CX 35,000C
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 750 VOLTS
PLATE CURRENT — AMPERES
SCREEN CURRENT — AMPERES
GRID CURRENT — AMPERES
PLATE VOLTAGE—KILOVOLTS
GRID VOLTAGE—VOLTS
#2623

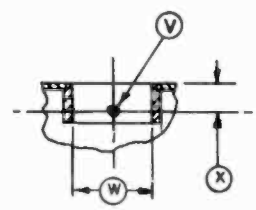
# 4CX35,000C




| DIM. | DIMENSIONAL DATA | | | |
|---|---|---|---|---|
| | INCHES | | MILLIMETERS | |
| | MIN. | MAX. | MIN. | MAX. |
| A | 9.500 | 9.750 | 241.30 | 247.65 |
| B | 0.860 | 0.890 | 21.84 | 22.60 |
| D | 5.980 | 6.020 | 151.89 | 152.91 |
| E | 6.510 | 6.560 | 165.35 | 166.62 |
| F | 6.980 | 7.020 | 177.29 | 178.31 |
| G | 7.480 | 7.520 | 189.99 | 191.01 |
| H | 7.975 | 8.015 | 202.57 | 203.58 |
| J | 1.750 | 1.800 | 44.45 | 45.72 |
| K | 1.220 | 1.270 | 30.99 | 32.26 |
| L | 0.690 | 0.740 | 17.53 | 18.80 |
| M | 8.442 | 8.692 | 214.43 | 220.78 |
| N | 5.375 | 5.625 | 136.52 | 142.88 |
| P | 17.070 | 17.340 | 433.58 | 440.44 |
| R | 0.173 | 0.213 | 4.40 | 5.41 |
| S | 1.750 | | 44.45 | |
| T | 0.485 | 0.515 | 12.32 | 13.08 |
| V | — — | 0.135 | — — | 3.43 |
| W | 1.250 | 1.270 | 31.75 | 32.26 |
| X | 0.490 | 0.530 | 12.45 | 13.46 |
| Y | — — | 8.750 | — — | 222.25 |
| Z | 3.750 | | 95.25 | |
| AA | 8.000 | | 203.20 | |
| AB | 6.875 | | 174.63 | |

NOTES:

1. REFERENCE DIMENSIONS ARE FOR INFORMATION ONLY AND ARE NOT REQUIRED FOR INSPECTION PURPOSES.
2. DIM. Y IS MAXIMUM DIA. ACROSS CORNERS
3. HANDLE LATERAL AXIS ORIENTATION WITH BASE LOCK PIN IS AS SHOWN.



SECTION A—A

TECHNICAL DATA

# 8438
# 4-400A

RADIAL BEAM POWER TETRODE

The EIMAC 8438/4-400A is a compact, ruggedly constructed power tetrode having a maximum plate dissipation rating of 400 watts. It is intended for use as an amplifier, oscillator or modulator. The low grid-plate capacitance of this tetrode coupled with its low driving-power requirement allows considerable simplification of the associated circuit and driver stage.

The 8438/4-400A is cooled by radiation from the plate and by circulation of forced-air through the base, around the envelope, and over the plate seal. Cooling can be greatly simplified by using an EIMAC SK-400 Series Air System Socket and its accompanying glass chimney. This socket is designed to maintain the correct balance of cooling air between the component parts of the tube.[3]

## GENERAL CHARACTERISTICS[1]

### ELECTRICAL

Filament: Thoriated Tungsten

| | |
|---|---|
| Voltage | 5.0 ± 0.25 V |
| Current, at 5.0 volts | 14.5 A |

Transconductance (Average):

| | |
|---|---|
| $I_b$ = 100 mA, $E_{c2}$ = 500 volts | 4000 μmhos |

Amplification Factor (Average):

| | |
|---|---|
| Grid to Screen | 5.1 |

Direct Interelectrode Capacitances (grounded filament)[2]

| | |
|---|---|
| Input | 12.5 pF |
| Output | 4.7 pF |
| Feedback | 0.12 pF |

Frequency of Maximum Rating:

| | |
|---|---|
| CW | 110 MHz |

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.
2. In Shielded Fixture.
3. Guarantee applies only when the 4-400A is used as specified with adequate air in the SK-400 or SK-410 Air-System Socket and associated chimney or equivalent.

### MECHANICAL

Maximum Overall Dimensions:

| | |
|---|---|
| Length | 6.375 in; 161.93 mm |
| Diameter | 3.563 in; 90.50 mm |

| | |
|---|---|
| Net Weight | 9.0 oz; 255 gm |
| Operating Position | Vertical, base down or up |
| Maximum Operating Temperature: | |
| Plate Seal | 225°C |
| Base Seals | 200°C |
| Cooling | Radiation and forced air |
| Base | Special 5-pin |
| Recommended Socket | EIMAC SK-400 Series |
| Recommended Chimney | EIMAC SK-406 |
| Recommended Heat-Dissipating Connectors: | |
| Plate | HR-6 |

**RADIO FREQUENCY LINEAR AMPLIFIER GRID DRIVEN**
Class $AB_1$

ABSOLUTE MAXIMUM RATINGS

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 4000 | VOLTS |
| DC SCREEN VOLTAGE | 800 | VOLTS |
| DC PLATE CURRENT | 0.350 | AMPERE |
| PLATE DISSIPATION | 400 | WATTS |
| SCREEN DISSIPATION | 35 | WATTS |
| GRID DISSIPATION | 10 | WATTS |

TYPICAL OPERATION (Frequencies to 75 MHz)
Class $AB_1$, Grid Driven, Peak Envelope or Modulation Crest Conditions

| | | |
|---|---|---|
| Plate Voltage | 3000 | Vdc |
| Screen Voltage | 750 | Vdc |
| Grid Voltage[1] | -130 | Vdc |
| Zero-Signal Plate Current | 80 | mAdc |
| Single Tone Plate Current | 290 | mAdc |
| Single-Tone Screen Current[2] | 13 | mAdc |
| Useful Output Power | 470 | W |
| Resonant Load Impedance | 5000 | Ω |

1. Adjust to specified zero-signal dc plate current.
2. Approximate value.

**RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR** Class C Telegraphy or FM Telephony (Key-Down Conditions)

ABSOLUTE MAXIMUM RATINGS

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 4000 | VOLTS |
| DC SCREEN VOLTAGE | 600 | VOLTS |
| DC PLATE CURRENT | 0.350 | AMPERE |
| PLATE DISSIPATION | 400 | WATTS |
| SCREEN DISSIPATION | 35 | WATTS |
| GRID DISSIPATION | 10 | WATTS |

TYPICAL OPERATION (Frequencies to 75 MHz)

| | | | | |
|---|---|---|---|---|
| Plate Voltage | 2500 | 3000 | 4000 | Vdc |
| Screen Voltage | 500 | 500 | 500 | Vdc |
| Grid Voltage | -200 | -220 | -220 | Vdc |
| Plate Current | 350 | 350 | 350 | mAdc |
| Screen Current[1] | 46 | 46 | 40 | mAdc |
| Screen Dissipation | 23 | 23 | 20 | W |
| Grid Current[1] | 18 | 19 | 18 | mAdc |
| Peak rf Grid Voltage[1] | 300 | 320 | 320 | v |
| Grid Dissipation | 1.8 | 1.9 | 1.8 | W |
| Calculated Driving Power[2] | 5.4 | 6.1 | 5.8 | W |
| Plate Input Power | 875 | 1050 | 1400 | W |
| Plate Dissipation | 235 | 250 | 300 | W |
| Plate Output Power | 640 | 800 | 1100 | W |

1. Approximate value.
2. Driving Power increases with frequency. At 75 MHz driving power is approximately 12 watts.

TYPICAL OPERATION (110 MHz, two tubes)

| | | | |
|---|---|---|---|
| Plate Voltage | 3500 | 4000 | Vdc |
| Screen Voltage | 500 | 500 | Vdc |
| Grid Voltage | -170 | -170 | Vdc |
| Plate Current | 500 | 540 | mAdc |
| Screen Current | 34 | 31 | mAdc |
| Grid Current | 20 | 20 | mAdc |
| Driving Power[1] | 20 | 20 | W |
| Plate Output Power[1] | 1300 | 1600 | W |
| Useful Output Power | 1160 | 1440 | W |

1. Approximate value.

## PLATE MODULATED RADIO FREQUENCY POWER AMPLIFIER-GRID DRIVEN Class C Telephony (Carrier Conditions)

ABSOLUTE MAXIMUM RATINGS

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 3200 | VOLTS |
| DC SCREEN VOLTAGE | 600 | VOLTS |
| DC GRID VOLTAGE | -500 | VOLTS |
| DC PLATE CURRENT | 0.275 | AMPERE |
| PLATE DISSIPATION[1] | 270 | WATTS |
| SCREEN DISSIPATION[2] | 35 | WATTS |
| GRID DISSIPATION[2] | 10 | WATTS |

1. Corresponds to 400 watts at 100% sine-wave modulation.
2. Average, with or without modulation.

TYPICAL OPERATION (Frequencies to 75 MHz)

| | | | | |
|---|---|---|---|---|
| Plate Voltage | 2000 | 2500 | 3000 | Vdc |
| Screen Voltage | 500 | 500 | 500 | Vdc |
| Grid Voltage | -220 | -220 | -220 | Vdc |
| Plate Current | 275 | 275 | 275 | mAdc |
| Screen Current[1] | 30 | 28 | 26 | mAdc |
| Screen Dissipation | 15 | 14 | 13 | W |
| Grid Current[1] | 12 | 12 | 12 | mAdc |
| Grid Dissipation | 1.1 | 1.1 | 1.1 | W |
| Peak af Screen Voltage[1] (100% modulation) | 350 | 350 | 350 | v |
| Peak rf Grid Voltage[1] | 290 | 290 | 290 | v |
| Calculated Driving Power[1] | 3.5 | 3.5 | 3.5 | W |
| Plate Input Power | 550 | 688 | 825 | W |
| Plate Dissipation | 170 | 178 | 195 | W |
| Plate Output Power | 380 | 510 | 630 | W |

1. Approximate value.

## MAXIMUM RATINGS (Frequencies to 30 MHz, Intermittent Service

ABSOLUTE MAXIMUM RATINGS

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 4000 | VOLTS |
| DC SCREEN VOLTAGE | 600 | VOLTS |
| DC GRID VOLTAGE | -500 | VOLTS |
| DC PLATE CURRENT | 0.275 | AMPERE |
| PLATE DISSIPATION[1] | 270 | WATTS |
| SCREEN DISSIPATION[2] | 35 | WATTS |
| GRID DISSIPATION[2] | 10 | WATTS |

TYPICAL OPERATION (Frequencies to 30 MHz, Intermittent Service)

| | | | | | |
|---|---|---|---|---|---|
| Plate Voltage | 2000 | 2500 | 3000 | 3650 | Vdc |
| Screen Voltage | 500 | 500 | 500 | 500 | Vdc |
| Grid Voltage | -220 | -220 | -220 | -225 | Vdc |
| Plate Current | 275 | 275 | 275 | 275 | mAdc |
| Screen Current[1] | 30 | 28 | 26 | 23 | mAdc |
| Screen Dissipation | 15 | 14 | 13 | 12 | W |
| Grid Current[1] | 12 | 12 | 12 | 13 | mAdc |
| Grid Dissipation | 1.1 | 1.1 | 1.1 | 1.2 | W |
| Peak Screen Voltage (100% modulation) | 350 | 350 | 350 | 350 | v |
| Peak rf Grid Voltage[1] | 290 | 290 | 290 | 315 | v |
| Calculated Driving Power[1] | 3.5 | 3.5 | 3.5 | 4.0 | W |
| Plate Input Power | 550 | 688 | 825 | 1000 | W |
| Plate Dissipation | 170 | 178 | 195 | 235 | W |
| Plate Output Power | 380 | 510 | 630 | 765 | W |

## AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR Class AB, Grid Driven (Sinusoidal Wave)

ABSOLUTE MAXIMUM RATINGS (Per Tube)

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 4000 | VOLTS |
| DC SCREEN VOLTAGE | 800 | VOLTS |
| DC PLATE CURRENT | 0.350 | AMPERE |
| PLATE DISSIPATION | 400 | WATTS |
| SCREEN DISSIPATION | 35 | WATTS |
| GRID DISSIPATION | 10 | WATTS |

TYPICAL OPERATION (Two Tubes) Class $AB_1$

| | | | | | |
|---|---|---|---|---|---|
| Plate Voltage | 2500 | 3000 | 3500 | 4000 | Vdc |
| Screen Voltage | 750 | 750 | 750 | 750 | Vdc |
| Grid Voltage[1/4] | -130 | -137 | -145 | -150 | Vdc |
| Zero-Signal Plate Current | 190 | 160 | 140 | 120 | mAdc |
| Max. Signal Plate Current | 635 | 635 | 610 | 585 | mAdc |
| Zero-Signal Screen Current | 0 | 0 | 0 | 0 | mAdc |
| Max. Signal Screen Current[1] | 28 | 26 | 32 | 40 | mAdc |
| Peak af Grid Voltage[2] | 130 | 137 | 145 | 150 | v |
| Peak Driving Power[3] | 0 | 0 | 0 | 0 | w |
| Max Signal Plate Dissipation[2] | 370 | 400 | 400 | 400 | W |
| Plate Output Power | 850 | 1100 | 1330 | 1540 | W |
| Load Resistance (plate to plate) | 6800 | 8900 | 11,500 | 14,000 | Ω |

TYPICAL OPERATION (Two Tubes) Class $AB_2$

| | | | | | |
|---|---|---|---|---|---|
| Plate Voltage | 2500 | 3000 | 3500 | 4000 | Vdc |
| Screen Voltage | 500 | 500 | 500 | 500 | Vdc |
| Grid Voltage[1/4] | -75 | -80 | -85 | -90 | Vdc |
| Zero-Signal Plate Current | 190 | 160 | 140 | 120 | mAdc |
| Max. Signal Plate Current | 700 | 700 | 700 | 638 | mAdc |
| Zero-Signal Screen Current | 0 | 0 | 0 | 0 | mAdc |
| Max. Signal Screen Current | 50 | 40 | 38 | 32 | mAdc |
| Peak af Grid Voltage[2] | 133 | 140 | 145 | 140 | v |
| Peak Driving Power[3] | 8.6 | 9.0 | 10.2 | 7.0 | W |
| Max. Signal Plate Dissipation[2] | 320 | 363 | 400 | 400 | W |
| Plate Output Power | 1110 | 1375 | 1650 | 1750 | W |
| Load Resistance (plate to plate) | 7200 | 9100 | 10,800 | 14,000 | Ω |

1. Approximate value.
2. Per tube.
3. Nominal drive power is one-half peak power.
4. Adjust to give stated zero-signal plate current.

NOTE: TYPICAL OPERATION data are obtained from direct measurement or by calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, screen and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid and screen current. The grid and screen currents which result when the desired plate current is obtained are incidental and vary from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. In the case of Class C Service, if grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf grid voltage is applied.

## RANGE VALUES FOR EQUIPMENT DESIGN

| | Min. | Max. | |
|---|---|---|---|
| Filament: Current at 5.0 volts | 13.5 | 14.7 | A |
| Interelectrode Capacitances [1] (grounded filament connection): | | | |
| Input | 10.7 | 14.5 | pF |
| Output | 4.2 | 5.6 | pF |
| Feedback | ---- | 0.17 | pF |

1. In Shielded Fixture.

# APPLICATION

## MECHANICAL

*MOUNTING* - The 4-400A must be mounted vertically, base up or down. The socket must be constructed so as to allow an unimpeded flow of air through the holes in the base of the tube and must also provide clearance for the glass tip-off which extends from the center of the base. The metal tube-base shell should be grounded by means of suitable spring fingers. The above requirements are met by the EIMAC SK-400 and SK-410 Air-System Sockets. A flexible connecting strap should be provided between the EIMAC HR-6 cooler on the plate terminal and the external plate circuit. The tube must be protected from severe vibration and shock.

*COOLING* - Adequate forced-air cooling must be provided to maintain the base seals at a temperature below 200°C, and the plate seal at a temperature below 225°C.

When the EIMAC SK-400 or SK-410 Air-System Socket is used, a minimum air flow of 14 cubic feet per minute at a static pressure of 0.25 inches of water or less, as measured in the socket or plenum chamber at sea level, is required to provide adequate cooling under all conditions of operation. Seal temperature limitations may require that cooling air be supplied to the tube even when the filament alone is on during standby periods.

In the event an Air-System Socket is not used, provision must be made to supply equivalent cooling of the base, the envelope, and the plate lead.

Tube temperatures may be measured with a temperature sensitive paint, spray or crayon, such as manufactured by Tempil Division, Big Three Industrial Gas & Equipment Co., Hamilton Blvd., So. Plainfield, N.J. 07080.

## ELECTRICAL

*FILAMENT VOLTAGE* - For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated voltage of 5.0 volts. Variations in filament voltage must be kept within the range from 4.75 to 5.25 volts.

*BIAS VOLTAGE* - The dc bias voltage for the 4-400A should not exceed 500 volts. If grid resistor bias is used, suitable means must be provided to prevent excessive plate or screen dissipation in the event of loss of excitation, and the grid resistor should be made adjustable to facilitate maintaining the bias voltage and plate current at the desired values from tube to tube. In operation above 50 MHz, it is advisable to keep the bias voltage as low as is practicable.

*SCREEN VOLTAGE* - The dc screen voltage for the 4-400A should not exceed 800 volts. The screen voltages shown under Typical Operation are representative voltages for the type of operation involved.

*PLATE VOLTAGE* - The plate-supply voltage for the 4-400A should not exceed 4000 volts in CW and audio applications. In plate-modulated telephony service the dc plate-supply voltage should not exceed 3200 volts, except below 30 MHz, intermittent service, where 4000 volts may be used.

*GRID DISSIPATION* - Grid dissipation for the 4-400A should not be allowed to exceed 10 watts. Grid dissipation may be calculated from the following expression:

$$P_g = e_{gk} \times I_c$$

where $P_g$ = Grid dissipation

$e_{gk}$ = Peak positive grid to cathode voltage, and

$I_c$ = dc grid current

$e_{cmp}$ may be measured by means of a suitable peak voltmeter connected between filament and grid.

*SCREEN DISSIPATION* - The power dissipated by the screen of the 4-400A must not exceed 35 watts. Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit screen dissipation to 35 watts in event of circuit failure.

*PLATE DISSIPATION* - Under normal operating conditions, the plate dissipation of the 4-400A should not be allowed to exceed 400 watts. The anode of the 4-400A operates at a visibly red color at its maximum rated dissipation of 400 watts.

In plate modulated amplifier applications, the maximum allowable carrier-condition plate dissipation is 270 watts. The plate dissipation will rise to 400 watts under 100% sinusoidal modulation.

Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

*PULSE SERVICE* - For pulse service, the EIMAC 4PR400A should be used.

*MULTIPLE OPERATION* - To obtain maximum power output with minimum distortion from tubes operated in multiple, it is desirable to adjust individual screen or grid bias voltages so that the peak plate current for each tube is equal at the crest of the exciting voltage. Under these conditions, individual dc plate currents will be approximately equal for full input signal for class $AB_1$ operation.

*CAUTION - GLASS IMPLOSION* - The EIMAC 4-400A is pumped to a very high vacuum, which is contained by a glass envelope. When handling a glass tube, remember that glass is a relatively fragile material, and accidental breakage can result at any time. Breakage will result in flying glass fragments, so safety glasses, heavy clothing, and leather gloves are recommended for protection.

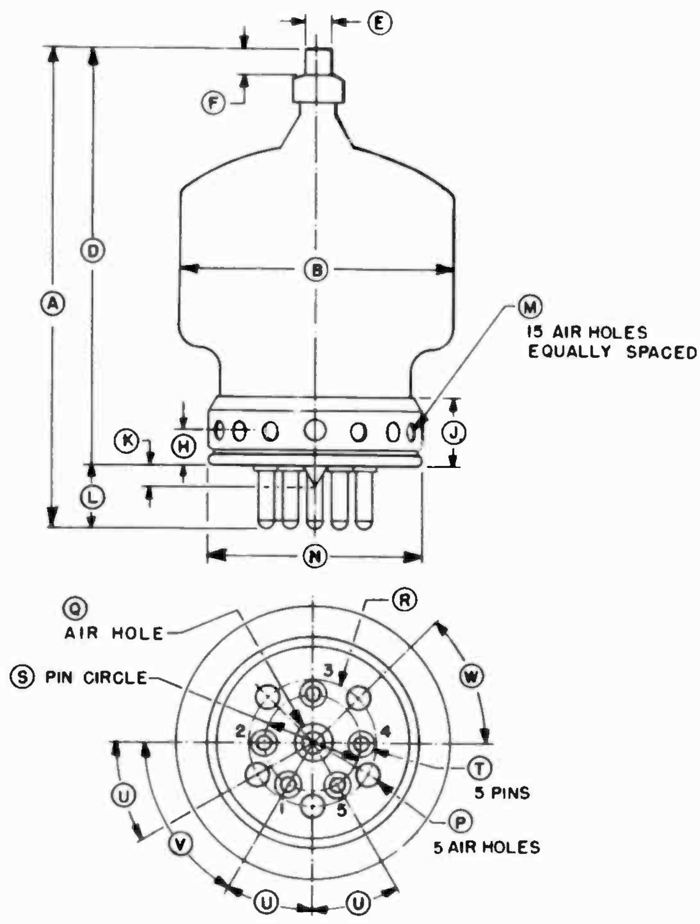
*CAUTION-HIGH VOLTAGE* - Operating voltage for the 4-400A can be deadly, so the equipment must be designed properly and operating precautions must be followed. Design equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high voltage circuits and terminals, with interlock switches to open the primary circuits of the power supply and to discharge high voltage capacitors whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

*SPECIAL APPLICATION* - If it is desired to operate this tube under conditions widely different from those listed here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070, for information and recommendations.

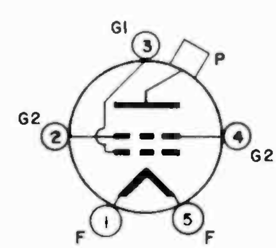
DIMENSIONAL DATA

| DIM. | INCHES | | | MILLIMETERS | | |
|---|---|---|---|---|---|---|
| | MIN. | MAX. | REF. | MIN. | MAX. | REF. |
| A | 5.875 | 6.375 | -- | 149.23 | 161.93 | -- |
| B | -- | 3.563 | -- | -- | 90.50 | -- |
| | | | | | | |
| D | 5.125 | 5.625 | -- | 130.18 | 142.88 | -- |
| E | 0.350 | 0.365 | -- | 8.89 | 9.27 | -- |
| F | 0.328 | -- | -- | 8.33 | -- | -- |
| | | | | | | |
| H | -- | -- | 0.438 | -- | -- | 11.13 |
| J | -- | 0.969 | -- | -- | 24.61 | -- |
| K | -- | 0.250 | -- | -- | 6.35 | -- |
| L | -- | -- | 0.750 | -- | -- | 19.05 |
| M | -- | -- | 0.250 | -- | -- | 6.35 |
| N | -- | 2.750 | -- | -- | 69.85 | -- |
| P | -- | -- | 0.312 | -- | -- | 7.92 |
| Q | -- | -- | 0.500 | -- | -- | 12.70 |
| R | -- | -- | 1.625 | -- | -- | 41.28 |
| S | -- | -- | 1.250 | -- | -- | 31.75 |
| T | 0.185 | 0.191 | -- | 4.70 | 4.85 | -- |
| U | -- | -- | 30° | -- | -- | 30° |
| V | -- | -- | 60° | -- | -- | 60° |
| W | -- | -- | 45° | -- | -- | 45° |
| | | | | | | |
| | | | | | | |

NOTES:
1. REF. DIMENSIONS ARE FOR INFO. ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.

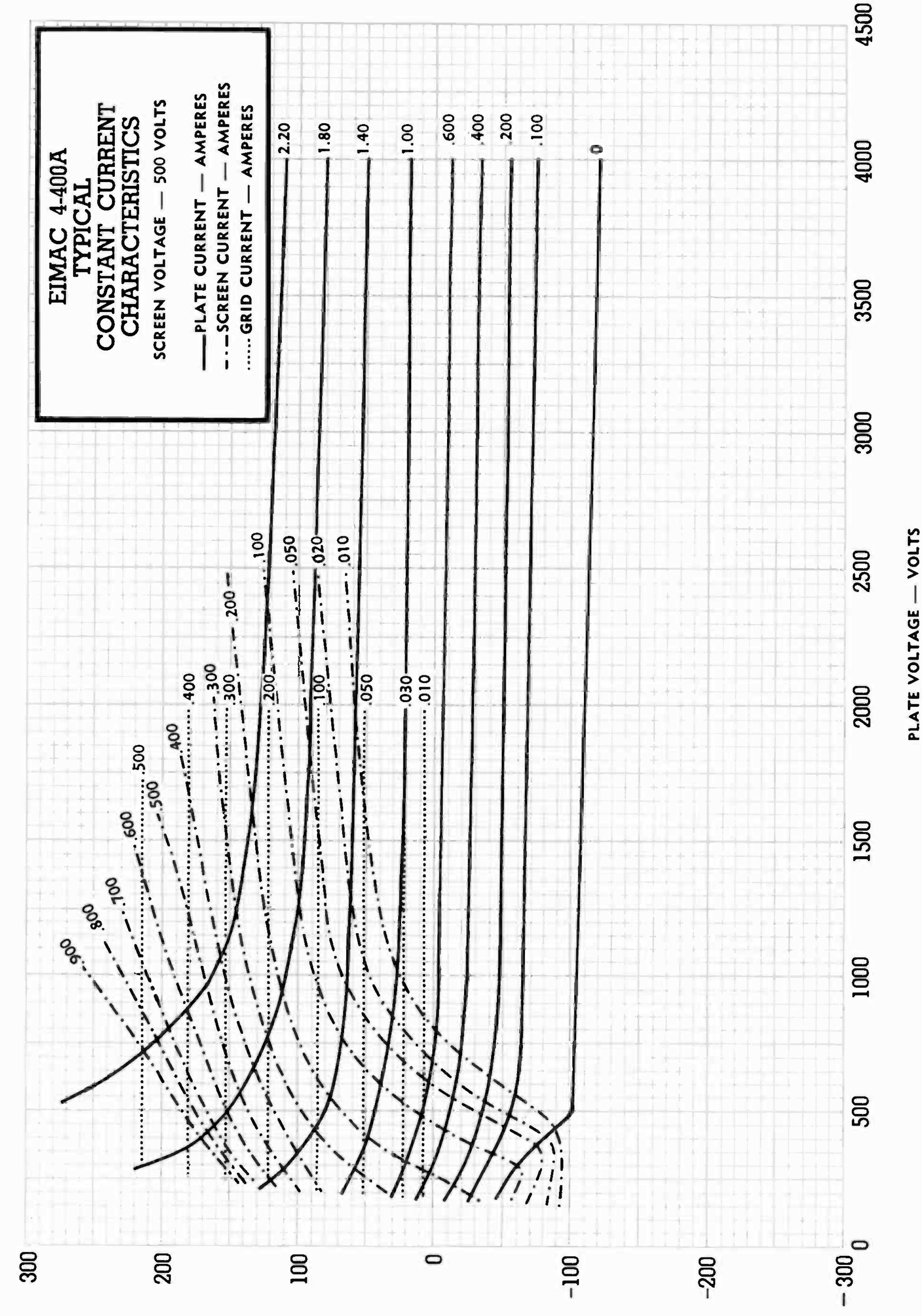



BOTTOM VIEW




NOTE:

Base pins T and tubulation K are so alined that they can be freely inserted in a gage ¼ inch (6.35 mm) thick with hole diameters of .204 (5.18 mm) and .500 (12.70 mm), respectively, located on the true centers by the given dimensions S, U, V.


EIMAC 4-400A
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE — 500 VOLTS
PLATE CURRENT — AMPERES
SCREEN CURRENT — AMPERES
GRID CURRENT — AMPERES
PLATE VOLTAGE — VOLTS
GRID VOLTAGE — VOLTS
0
500
1000
1500
2000
2500
3000
3500
4000
4500
300
200
100
0
-100
-200
-300
2.20
1.80
1.40
1.00
.600
.400
.200
.100
0
.100
.050
.020
.010
.200
.400
.300
.300
.200
.100
.050
.030
.010
.500
.400
.500
.600
.700
.800
.900

# 8238
# 3CX3000A1
**LOW-MU TRIODE**

**Eimac®**

TECHNICAL DATA


The Eimac 8238/3CX3000A1 is a low-mu forced-air cooled power triode intended for use as an audio amplifier or modulator. The maximum rated plate dissipation is 3000 watts.

Available high plate current under Class $AB_1$ operating conditions permits high power gain with a minimum of distortion.

The ceramic envelope is rugged and permits high temperature processing leading to reliable service.

## GENERAL CHARACTERISTICS

### ELECTRICAL

| | *Min.* | *Nom.* | *Max.* | |
|---|---|---|---|---|
| Filament: Thoriated Tungsten | | | | |
| Voltage | | 7.5 | | V |
| Current | 49 | | 54 | A |
| Amplification Factor | 4.3 | | 5.6 | |
| Direct Interelectrode Capacitances (Average) | | | | |
| Grid-Plate | | 17 | | pF |
| Grid-Filament | | 29 | | pF |
| Plate-Filament | | 2.5 | | pF |
| Transconductance ($_b$ = 1.0 A, $E_b$ = 3000V) | | 11,000 | | umhos |

### MECHANICAL

| | |
|---|---|
| Base | See outline drawing |
| Mounting Position | Vertical, base down or up |
| Cooling | Forced Air |
| Maximum Temperatures: | |
| Grid and Filament Seals | 250°C |
| Anode Cooler Core | 250°C |
| Maximum Diameter | 4.16 in. |
| Maximum Height | 8.59 in. |
| Net Weight | 6.25 lbs. |
| Shipping Weight | 16 lbs. |

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### AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR

Class-$AB_1$

MAXIMUM RATINGS (Per tube)

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 6000 | VOLTS |
| DC PLATE CURRENT | 2.5 | AMPERES |
| PLATE DISSIPATION | 3000 | WATTS |
| GRID DISSIPATION | 50 | WATTS |

*Adjust to stated Zero-Signal DC Plate Current. Can be expected to vary ±15%. Effective grid-current resistance must not exceed 200,000 ohms.

TYPICAL OPERATION (Sinusoidal wave, two tubes)

Class $AB_1$

| | | | |
|---|---|---|---|
| DC Plate Voltage | 4.0 | 5.5 | kV |
| DC Grid Voltage (Approx)* | -750 | -1070 | Volts |
| Zero-Signal DC Plate Current | 500 | 500 | mA |
| Max-Signal DC Plate Current | 2.75 | 2.2 | Amps |
| Effective Load, Plate-to-Plate | 2120 | 4000 | Ohms |
| Peak AF Grid Input Voltage (per tube) | 750 | 1070 | Volts |
| Max-Signal Driving Power | 0 | 0 | Watts |
| Max-Signal Plate Input Power | 11.0 | 13.1 | kW |
| Max-Signal Plate Dissipation (per tube) | 2.75 | 2.55 | kW |
| Max-Signal Plate Output Power | 5.5 | 8.25 | kW |



EIMAC division of varian/301 industrial way/san carlos/california 94070

# APPLICATION

## MECHANICAL

*Mounting*: The 3CX3000A1 must be mounted vertically with its base up or down at the convenience of the designer. The filament connections should be made through spring collets and care must be taken not to impart strain to the terminals or base assembly.

The tube must be protected from severe shock and vibration during shipment and operation.

*Cooling*: Sufficient forced air cooling must be provided to maintain seal and anode core temperature at 250°C or below. Air-flow must be started when filament power is applied and it is advisable to continue air-cooling for two minutes after all voltages are removed.

The table below lists minimum air-flow requirements to maintain tube temperatures below 250°C with air flowing in both the base-to-anode and anode-to-base directions. This tabulation presumes air at 50°C and sea level. A separate supply of approximately 3 cubic feet per minute, directed into the filament structure is also required to maintain rated filament seal temperatures. This is best accomplished using a small diameter insulating tubing directed into the stem, between the filament seals.

| | MINIMUM COOLING AIR-FLOW REQUIREMENTS | | | |
|---|---|---|---|---|
| | BASE-TO-ANODE FLOW | | ANODE-TO-BASE FLOW | |
| Plate Dissipation (Watts) | AIR-FLOW (CFM) | PRESSURE DROP (inches of water) | AIR-FLOW (CFM) | PRESSURE DROP (inches of water) |
| 1000 | 32 | 0.49 | 39 | 0.65 |
| 2000 | 67.5 | 1.52 | 85 | 2.16 |
| 3000 | 106 | 3.15 | 138 | 4.55 |

**NOTE:**
An extra 450 watts have been added to these plate dissipation figures in preparing this tabulation, to compensate for grid and filament dissipation.

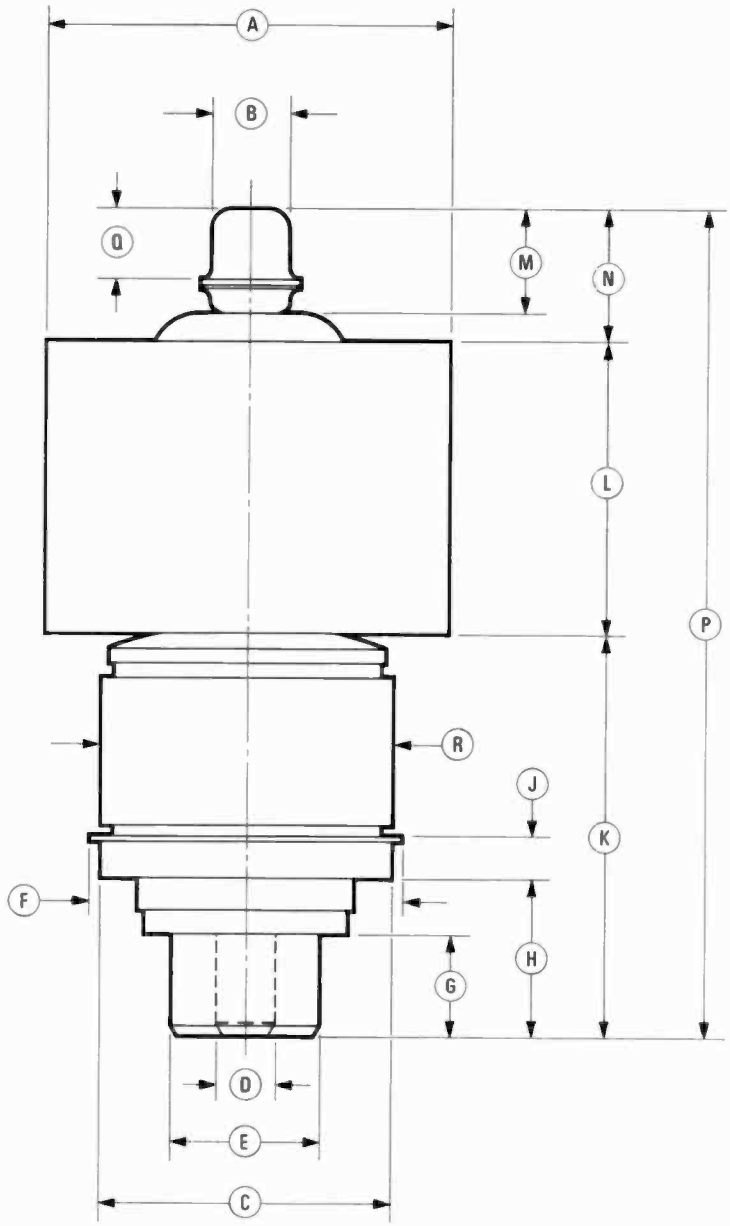
For operation at high altitudes or higher ambient temperatures, these quantities should be increased. In all cases it is suggested that actual temperatures be measured to insure adequate cooling.

## ELECTRICAL

*Filament*: The rated filament voltage for the 3CX3000A1 is 7.5 volts and should not be exceeded by more than five percent if maximum tube life is to be realized. Reduction of filament voltage to about 7.2 volts will actually enhance tube life and provision should be made for this adjustment where the lower emission can be tolerated.

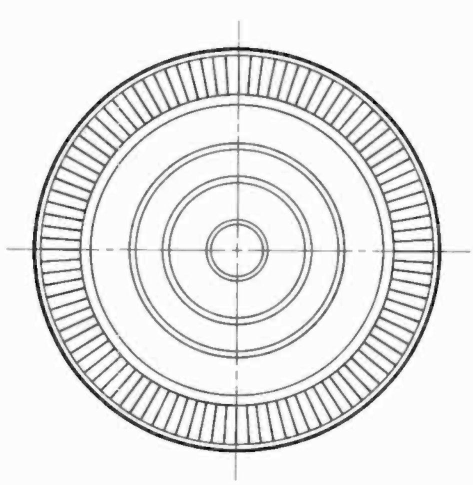
*Grid Operation*: The grid dissipation rating of the 3CX3000A1 is 50 watts. This is the product of the peak positive grid voltage and average dc grid current. When tubes are used in parallel in amplifier or modulator service, provision should be made for individual adjustment of bias voltage, in order to match the tubes.

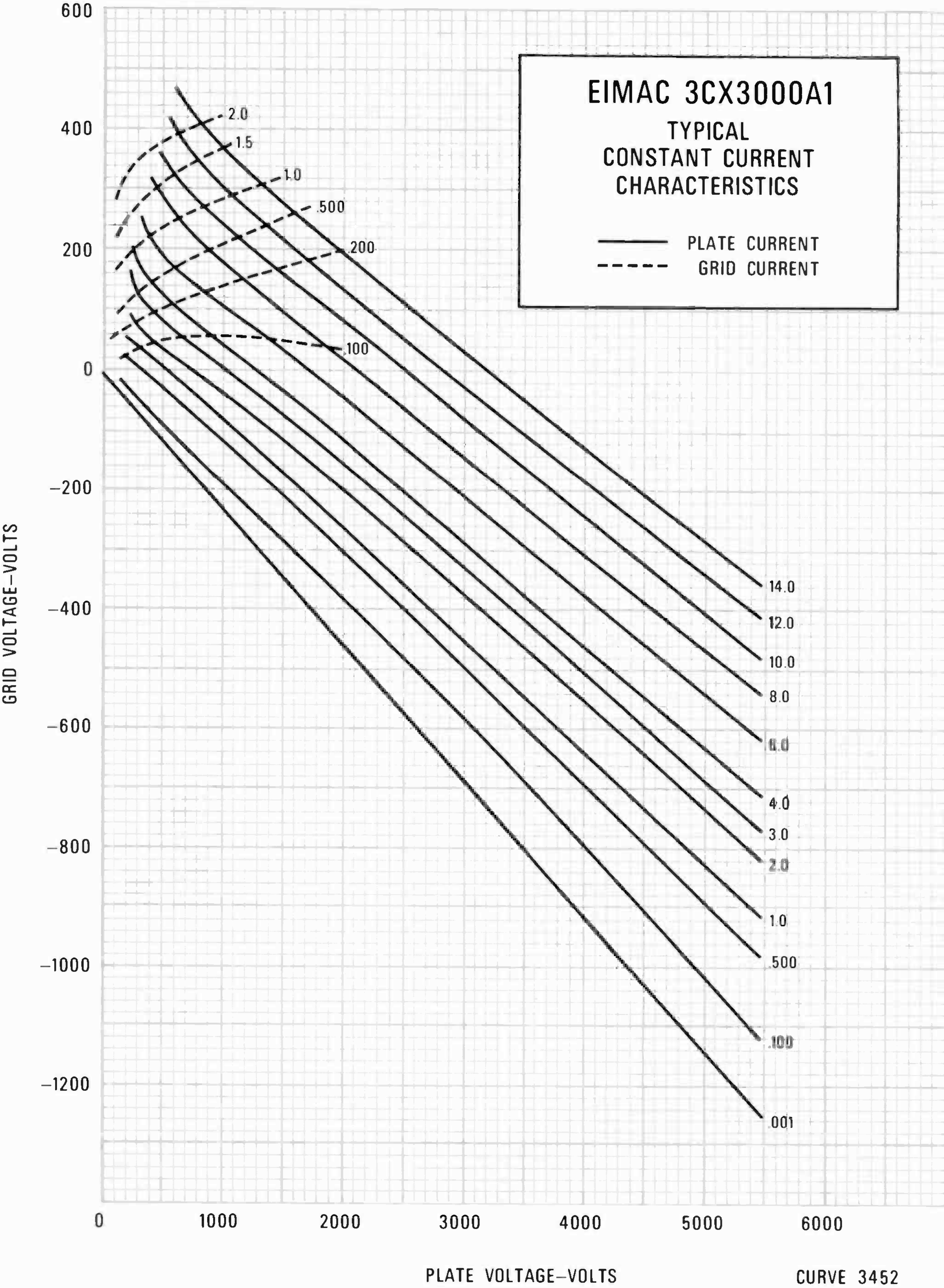
*Special Applications*: If it is desired to operate the tube under conditions widely different from those given here, write to Eimac Division of Varian Assoc., 301 Industrial Way, San Carlos, California, for information and recommendations.




DIMENSIONS IN INCHES

| DIMENSIONAL DATA | | | |
|---|---|---|---|
| REF. | MIN. | MAX. | NOM. |
| A | 4 3/32 | 4 5/32 | |
| B | 25/32 | 27/32 | |
| C | 2.990 | 3.010 | |
| D | .615 | .635 | |
| E | 1.490 | 1.510 | |
| F | | 3 5/8 | |
| G | 13/16 | 15/16 | |
| H | 1 3/8 | 1 5/8 | |
| J | 25/64 | 27/64 | |
| K | 3 7/8 | 4 1/4 | |
| L | 2 15/16 | 3 1/16 | |
| M | 1 | 1 1/8 | |
| N | 1 3/16 | 1 11/16 | |
| P | 8 | 9 | |
| Q | 11/16 | 13/16 | |
| R | 2.998 | 3.002 | |




EIMAC 3CX3000A1
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT
GRID CURRENT
GRID VOLTAGE–VOLTS
PLATE VOLTAGE–VOLTS
600
400
200
0
–200
–400
–600
–800
–1000
–1200
0
1000
2000
3000
4000
5000
6000
2.0
1.5
1.0
.500
.200
.100
14.0
12.0
10.0
8.0
6.0
4.0
3.0
2.0
1.0
.500
.100
.001

CURVE 3452