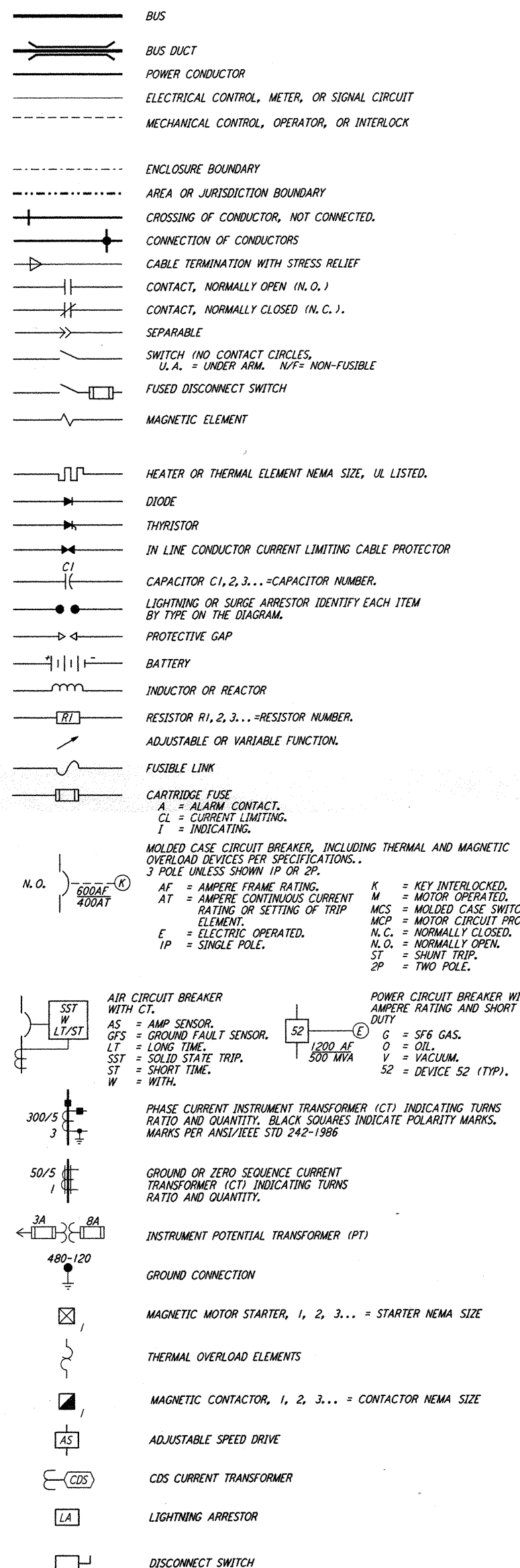
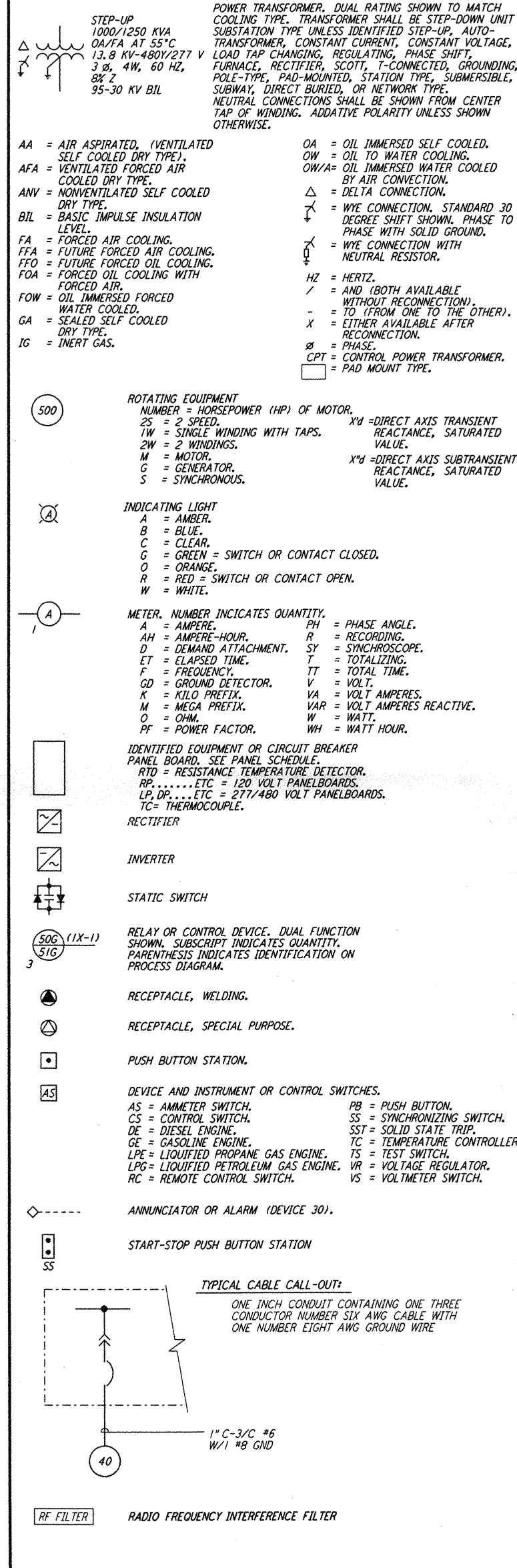


ONE AND THREE LINE DIAGRAM SYMBOLS



ONE AND THREE LINE DIAGRAM SYMBOLS



DEVICE FUNCTION NUMBERS

- ADAPTED FROM ANSI C37. 2-1987, USAGE PER IEEE STD. 242-1986
1. MASTER ELEMENT OR INITIATING DEVICE SUCH AS FLOAT SWITCH.
 2. TIME DELAY STARTING OR CLOSING RELAY.
 3. CHECKING OR INTERLOCKING RELAY. (AND GATE).
 4. MASTER CONTACTOR.
 5. STOPPING DEVICE.
 6. STARTING CIRCUIT BREAKER.
 7. AND/OR CIRCUIT BREAKER.
 8. CONTROL POWER DISCONNECTING DEVICE.
 9. REVERSING DEVICE.
 10. UNIT SEQUENCE SWITCH.
 11. THREE OR MORE FUNCTIONS PER LEGEND.
 12. OVER SPEED DEVICE.
 13. SYNCHRONOUS SPEED DEVICE.
 14. UNDER SPEED DEVICE.
 15. SPEED OR FREQUENCY MATCHING DEVICE.
 16. RESERVED FOR FUTURE APPLICATION.
 17. SHUNTING OR DISCHARGE SWITCH.
 18. ACCELERATING OR DECELERATING DEVICE.
 19. STARTING TO RUNNING TRANSITION DEVICE.
 20. ELECTRICALLY OPERATED VALVE.
 21. DISTANCE RELAY. (IMPEDANCE CHANGE DETECTOR).
 22. COUPLER CIRCUIT BREAKER.
 23. TEMPERATURE CONTROL DEVICE. (SPACE HEATER THERMOSTAT).
 24. VOLTS PER HERTZ RATIO RELAY.
 25. SYNCHRONIZING OR SYNCHRONISM CHECK DEVICE.
 26. APPARATUS THERMAL DEVICE. (FIELD OR COOLANT OVERTEMPERATURE).
 27. UNDERVOLTAGE RELAY.
 28. FLAME DETECTOR.
 29. ISOLATING CONTACTOR.
 30. ANNUNCIATOR RELAY.
 31. SEPARATE EXCITATION DEVICE.
 32. DIRECTIONAL POWER RELAY. (ANTI MOTORING).
 33. POSITION INDICATOR SWITCH. (CELL SWITCH).
 34. MASTER RELAY.
 35. BRUSH OPERATING OR SLIP RING SHORT CIRCUITING DEVICE.
 36. POLARITY OR POLARIZING VOLTAGE DEVICE.
 37. UNDERCURRENT OR UNDERPOWER DEVICE (GROUND CONTINUITY MONITOR).
 38. BEARING PROTECTIVE DEVICE.
 39. MECHANICAL CONDITION (VIBRATION ETC.) MONITOR.
 40. FIELD RELAY. (EXCITATION LOSS).
 41. FIELD CIRCUIT BREAKER.
 42. RUNNING CIRCUIT BREAKER.
 43. CONTROL CIRCUIT MANUAL TRANSFER OR SELECTOR DEVICE.
 44. UNIT SEQUENCE STARTING RELAY.
 45. ATMOSPHERIC CONDITION MONITOR.
 46. REVERSE PHASE OR PHASE BALANCE CURRENT RELAY.
 47. PHASE SEQUENCE VOLTAGE RELAY.
 48. INCOMPLETE SEQUENCE RELAY. (ARMATURE OR LOAD WINDING) THERMAL RELAY.
 49. MACHINE OR TRANSFORMER (ARMATURE OR LOAD WINDING) THERMAL RELAY.
 50. INSTANTANEOUS OVERCURRENT RELAY.
 51. AC TIME OVERCURRENT RELAY.
 52. AC CIRCUIT BREAKER.
 53. EXCITER OR DC GENERATOR RELAY.
 54. TURNING GEAR ENGAGING DEVICE.
 55. POWER FACTOR RELAY.
 56. FIELD APPLICATION RELAY.
 57. SHORT CIRCUITING OR GROUNDING DEVICE.
 58. RECTIFIER FAILURE RELAY.
 59. OVERVOLTAGE RELAY.
 60. VOLTAGE BALANCE RELAY.
 61. GAS DENSITY SWITCH.
 62. TIME DELAY STOPPING OR OPENING RELAY.
 63. LIQUID OR GAS SUDDEN PRESSURE RELAY. MANUAL RESET.
 64. GROUND PROTECTION RELAY (UNDERVOLTAGE = INSULATION FAILURE).
 65. GOVERNOR.
 66. NOTCHING OR JOGGING DEVICE.
 67. AC DIRECTIONAL OVERCURRENT RELAY.
 68. BLOCKING RELAY.
 69. PERMISSIVE CONTROL DEVICE.
 70. ELECTRICALLY OPERATED RHEOSTAT.
 71. LEVEL SWITCH.
 72. DC CIRCUIT BREAKER.
 73. LOAD RESISTOR CONTACTOR.
 74. ALARM RELAY. (ALARMS OTHER THAN ANNUNCIATOR, DEVICE 30).
 75. POSITION CHANGING MECHANISM.
 76. DC OVERCURRENT RELAY.
 77. TELEMETERING DEVICE.
 78. PHASE ANGLE MEASURING OR OUT-OF-STEP RELAY.
 79. AC RE-CLOSING RELAY.
 80. FLOW SWITCH.
 81. FREQUENCY RELAY.
 82. DC RE-CLOSING RELAY.
 83. AUTOMATIC SELECTIVE CONTROL OR TRANSFER RELAY.
 84. OPERATING MECHANISM.
 85. CARRIER OR PILOT WIRE RECEIVER RELAY.
 86. LOCKOUT AUXILIARY RELAY. MANUAL RESET.
 87. DIFFERENTIAL PROTECTING RELAY.
 88. AUXILIARY MOTOR OR MOTOR GENERATOR.
 89. LINE SWITCH.
 90. REGULATING DEVICE.
 91. VOLTAGE DIRECTIONAL RELAY.
 92. VOLTAGE AND POWER DIRECTIONAL RELAY.
 93. FIELD CHANGING CONTACTOR.
 94. TRIPPING OR TRIP FREE RELAY.
 95. OPEN FOR SPECIFIC APPLICATIONS.
 96. OPEN FOR SPECIFIC APPLICATIONS.
 97. OPEN FOR SPECIFIC APPLICATIONS.
 98. OPEN FOR SPECIFIC APPLICATIONS.
 99. OPEN FOR SPECIFIC APPLICATIONS.

DEVICE SUFFIX DESIGNATIONS:

- SPECIFIC USAGE SHALL BE IDENTIFIED IN A LEGEND ON THE DIAGRAM.
- A = AIR.
 - B = BUS.
 - C = CURRENT.
 - CS = CONTROL SWITCH.
 - E = ELECTRIC.
 - F = FREQUENCY.
 - G = GROUND. CONNECTION ON NEUTRAL OF WYE POWER TRANSFORMER.
 - GS = GROUND SENSOR. ZERO SEQUENCE WINDOW TYPE CT ENCLOSING ALL PHASE CONDUCTORS AND NO GROUND PATH.
 - HR = HAND RESET.
 - J = DIFFERENTIAL.
 - L = LIQUID. LEVEL. OR LINE.
 - M = MANUAL.
 - N = RESIDUAL CURRENT CONNECTION ON WYE OF THREE 1Ø CTS.
 - P = POWER.
 - PR = PRESSURE RELIEF.
 - O = OIL.
 - S = SYNCHRONIZING.
 - T = TEMPERATURE OR TRANSFORMER.
 - 2 = SEQUENTIAL NUMBER OF IDENTICAL UNITS.
 - V = VOLTAGE.
 - X = AUXILIARY (ENERGIZING) RELAY.
 - Y = AUXILIARY (ANTI-PUMPING) RELAY.
 - Z = AUXILIARY RELAY.

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| LA-E-001 | ABBREVIATIONS & ACRONYMS |
| LA-E-002 | STANDARD PLAN SYMBOLS |
| LA-E-003 | SCHEMATIC & WIRING SYMBOLS |

| NO. | DATE | BY | CHKD | ENGR | PROJ | DESCRIPTION |
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| 1 | 8-7-98 | JE | D.K. | AB | WU | ISSUED FOR AS-BUILT |

ISSUED FOR CONSTRUCTION
 DRAWN M.M. 11-15-98
 CHECKED JCL 7-24-98
 ENGINEER KCR 10-25-98
 PROJ T.D.M. 11-15-98

AS-BUILT DRAWINGS

100 WEST WALNUT STREET
 PASADENA, CALIFORNIA

CALIFORNIA INSTITUTE OF TECHNOLOGY
 MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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| TITLE | ELECTRICAL STANDARD ONE & THREE LINE DIAGRAM SYMBOLS | SCALE | NONE | CONTRACT NUMBER | PP150969 | PROJECT NUMBER | 8094 |
| SHEET NUMBER | LA-E-004 | REVISIONS | | | | | |