ELECTRICAL SYMBOLS LIST
(NOT ALL SYMBOLS ARE NECESSARILY USED ON THIS PROJECT)

POWER SYMBOLS

	20A, 125V DUPLEX RECEPTACLE – WALL MOUNTED MOUNTING AT 18" A.F.F. UNLESS OTHERWISE NOTED
WP	20A, 125V GFCI TYPE, DUPLEX RECEPTACLE – WALL MOUNTED WP = WEATHER PROOF DENOTES WHILE-IN-USE METALLIC COVER
	20A, 125V QUADRUPLEX RECEPTACLE – WALL MOUNTED
	SINGLE RECEPTACLE – WALL MOUNTED
	SPECIAL PURPOSE RECEPTACLE – WALL MOUNTED
	PANELBOARD
1,2,3	HOMERUN-NUMERAL WHERE USED INDICATES CIRCUIT NUMBER FOR REFERENCE PURPOSES ONLY 2#12+#12-3/4"C FOR ONE CKT HOMERUN UON 4#12+#12G-3/4"C FOR TWO CKT HOMERUN UON 6#12+#12G-3/4"C FOR THREE CKT HOMERUN UON
S_T	DISCONNECT SWITCH – TOGGLE TYPE WITH THERMAL OVERLOAD
T	DRY TYPE TRANSFORMER, SIZE AS INDICATED
	MOTOR STARTER OR CONTROLLER
	COMBINATION MOTOR CONTROLLER/DISCONNECT SWITCH
30/3	UNFUSED DISCONNECT SWITCH SWITCH AMPS/# OF POLES, VOLTAGE RATING AS REQUIRED
100/60	3-POLE FUSED DISCONNECT SWITCH UON 100/60: 100AMP SWITCH FRAME, 60 AMP FUSES
J	WALL MOUNTED JUNCTION BOX WITH FINAL EQUIPMENT CONNECTION AS NOTED ON PLANS

POWER RISER DIAGRAM SYMBOLS

	MOTOR
	CONTROLLER
	GROUNDING PER ELECTRICAL CODE
	ENCLOSED SWITCH & FUSE DISCONNECT (AMP SIZE AND POLES AS INDICATED)
100	UNFUSED SWITCH – 100 AMP SWITCH
100/90	CIRCUIT BREAKER – MOLDED CASE TYPE 100 AMP FRAME / 90 AMP TRIP ST = SHUT TRIP
ELP-1	PANELBOARD
	AUTOMATIC TRANSFER SWITCH (AMP SIZE AND POLES AS INDICATED)
	DRY TYPE TRANSFORMER
	SOLID LINETYPE DENOTES NEW WORK
	BROKEN LINETYPE DENOTES EXISTING WORK TO REMAIN
	CROSSED LINETYPE DENOTES EXISTING WORK TO BE REMOVED

ABBREVIATIONS
(NOT ALL ABBREVIATIONS ARE NECESSARILY USED)

1P	SINGLE POLE
2P	TWO POLE
3P	THREE POLE
A	AMPERE
AF	AMPERE FRAME
AFF	ABOVE FINISHED FLOOR
AIC	AMPERE INTERRUPTING CAPACITY
ALT	ALTERNATE
AT	AMPERE TRIP
ATS	AUTO TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
C	CONDUIT
CB	CIRCUIT BREAKER
CKT	CIRCUIT
CLG	CEILING
CU	COPPER
DEG	DEGREE
°C	DEGREE CELSIUS
°F	DEGREE FAHRENHEIT
DISC	DISCONNECT
DIV	DIVISION
DP	DISTRIBUTION PANEL BOARD
EA	EACH
EC	EMPTY CONDUIT
ELEC	ELECTRICAL
EMERG	EMERGENCY
EQUIP	EQUIPMENT
EXIST	EXISTING
FA	FIRE ALARM
FDR	FEEDER
FLA	FULL LOAD AMPERES
G	GROUND
GFI	GROUND FAULT INTERRUPTER
HP	HORSE POWER
HZ	HERTZ
JB	JUNCTION BOX
KCM	THOUSAND CIRCULAR MILS
KV	KILOVOLT
KVA	KILOVOLT AMPERE
LS	LIFE SAFTEY
KWH	KILOWATT HOUR
KWH	KILOWATT HOUR
LTG	LIGHTING
MCB	MAIN CIRCUIT BREAKER
MDB	MAIN DISTRIBUTION BOARD
MLO	MAIN LUG ONLY
MOCP	MAXIMUM OVER CURRENT PROTECTION
MTD	MOUNTED
N	NEUTRAL
OCP	OVER CURRENT PROTECTION
PB	PULL BOX
ø	PHASE
P	POLE
RECPT	RECEPTACLE
SPEC	SPECIFICATION
TBD	TO BE DETERMINED
UON	UNLESS OTHERWISE NOTED
V	VOLT OR VOLTAGE
XFMR	TRANSFORMER
WP	WEATHERPROOF

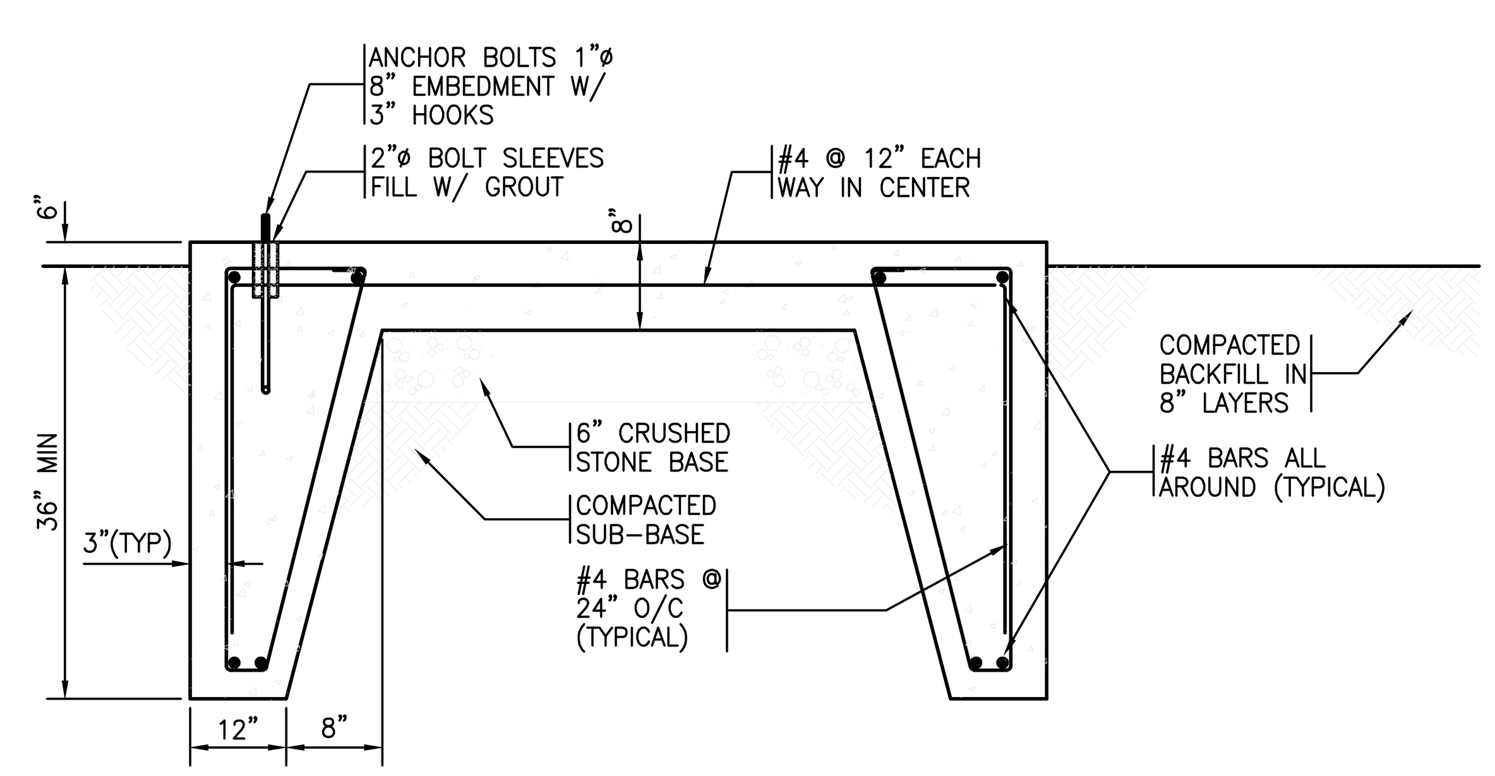
ELECTRICAL DEMOLITION NOTES

1. THE CONTRACTOR SHALL INCLUDE IN HIS BID ALL COSTS ASSOCIATED WITH REMOVALS AND RELOCATIONS OF WORK AS DESCRIBED IN THE SPECIFICATIONS WITH ALLOWANCES FOR EXPECTED OR UNFORESEEN DIFFICULTIES WHEN CONCEALED WORK HAS BEEN OPENED. NO CLAIMS FOR ADDITIONAL WORK ASSOCIATED WITH DEMOLITION WILL BE ACCEPTED, EXCEPT IN CERTAIN CASES CONSIDERED JUSTIFIABLE BY THE ARCHITECT.
2. THE CONTRACTOR SHALL REMOVE AND/OR RELOCATE ALL EXISTING WORK WHICH INTERFERES WITH THE NEW EQUIPMENT AND SYSTEM LAYOUTS IN FULL COORDINATION WITH THE DEMOLITION PLANS. ALL SYSTEMS WHICH ARE NO LONGER REQUIRED TO FUNCTION SHALL BE DE-ENERGIZED AND DISCONNECTED AT THE SOURCE OF POWER SUPPLY.
3. THE CONTRACTOR SHALL PERFORM DEMOLITION AND REMOVAL WORK WITH MINIMUM INTERFERENCE WITH FUNCTIONING ELECTRICAL SYSTEMS. ALL AFFECTED SYSTEMS SHALL BE RECONNECTED AND RESTORED.
4. DEMOLITION AND REMOVAL WORK SHALL BE PERFORMED IN A NEAT AND WORKMANLIKE MANNER. THE CONTRACTOR SHALL PATCH, REPAIR OR OTHERWISE RESTORE ANY DAMAGED INTERIOR OR EXTERIOR BUILDING SURFACE TO ITS ORIGINAL CONDITION.
5. THE CONTRACTOR SHALL REMOVE ALL ELECTRICAL OUTLETS, SWITCHES AND OTHER DEVICES, COMPLETE WITH ASSOCIATED WIRING, CONDUITS, ETC., FROM PARTITIONS THAT ARE TO BE REMOVED. WHERE THE REMOVAL OF THESE ITEMS DISRUPTS EXISTING WIRING THAT IS TO REMAIN, THE CONTRACTOR SHALL INSTALL JUNCTION BOXES AND OTHER DEVICES AND PROVIDE BYPASS CONNECTIONS NECESSARY TO MAKE CIRCUITS AFFECTED CONTINUOUS AND READY FOR OPERATION. OTHERWISE, WIRING SHALL BE REMOVED BACK TO THE NEAREST ELECTRICAL JUNCTION BOX THAT IS TO REMAIN OR TO PANELBOARD.
6. ALL RACEWAYS WHICH BECOME EXPOSED DURING THE ALTERATION WORK SHALL BE REMOVED AND REROUTED CONCEALED BEHIND FINISHED SURFACES.
7. ALL UNUSED OUTLET BOXES OR CAPPED FLOOR OUTLETS SHALL BE PROVIDED WITH MATCHING BLANK COVERS.
8. EXISTING PANEL DIRECTORIES AFFECTED BY THE ALTERATION WORK SHALL BE MODIFIED TO REFLECT THE BRANCH CIRCUIT WIRING CHANGES.
9. PORTIONS OF FEEDER RUNS TO BE REMOVED OR ABANDONED AS A RESULT OF DEMOLITION WORK, BUT WHICH ARE REQUIRED TO REMAIN ENERGIZED, SHALL BE CUT AT CONVENIENT LOCATIONS, REROUTED AND RECONNECTED. NEW FEEDER EXTENSIONS SHALL MATCH EXISTING ONES IN ALL RESPECTS, CABLE TYPE, CONDUCTOR AMPACITY, CONDUIT SIZES, ETC.
10. THE CONTRACTOR SHALL NOTIFY THE OWNER AT THE APPROPRIATE TIME OF THE PROJECTED DEMOLITION AND PHASING SCHEDULE SO THAT REMOVAL OR RELOCATION OF AFFECTED UTILITIES MAY BE CARRIED OUT IN COORDINATION WITH THE PROJECT REQUIREMENTS. THE CONTRACTOR SHALL FOLLOW CLOSELY THE ARCHITECT'S DEMOLITION AND PHASING SCHEDULE AND PROCEED IN THE SPECIFIED SEQUENCE.
11. ALL EXISTING MATERIAL AND EQUIPMENT IN USABLE CONDITION, WHICH IS TO BE REMOVED UNDER THIS CONTRACT, SHALL REMAIN THE PROPERTY OF THE OWNER OR SHALL BE DISPOSED OF BY THE ELECTRICAL CONTRACTOR, AS DIRECTED BY THE OWNER.
12. ARRANGE TO WORK CONTINUOUSLY, INCLUDING OVER TIME, IF REQUIRED, TO ASSURE THAT SYSTEMS WILL BE SHUT DOWN ONLY DURING THE TIME ACTUALLY REQUIRED TO MAKE THE NECESSARY CONNECTIONS TO THE EXISTING SYSTEMS.
13. THE SHUTDOWN OF EXISTING ELECTRICAL SERVICES SHALL BE DONE DURING OFF HOURS AND SHALL BE COORDINATED WITH OWNER AND LOCAL FIRE DEPARTMENT. MAKE ARRANGEMENTS AT LEAST FOURTEEN DAYS PRIOR.
14. PROVIDE FIRE WATCH DURING ALL TIMES WHILE BUILDING IS SHUTDOWN. PROVIDE SHUTDOWN PROCEDURES TO OWNER AND LOCAL FIRE DEPARTMENT FOR REVIEW AND APPROVAL.
15. REMOVAL OF EQUIPMENT SHALL BE PERMITTED THROUGH ELEVATORS AND STAIR SYSTEMS DURING OFF HOURS AND SHALL BE COORDINATED WITH THE OWNER WITH AT LEAST FOURTEEN DAYS PRIOR TO A SHUTDOWN.
16. REMOVAL OF EQUIPMENT BY BOOME, CRANE, AND SIMILAR SHALL BE A CONTRACTORS OPTION WITH ALL COSTS INCLUDED IN CONTRACT. MOBILIZATION AND PICK UP POINTS FOR SUCH MECHANISMS SHALL BE DONE FROM GRADE AND ALONG ROUTE AS APPROVED BY OWNER.

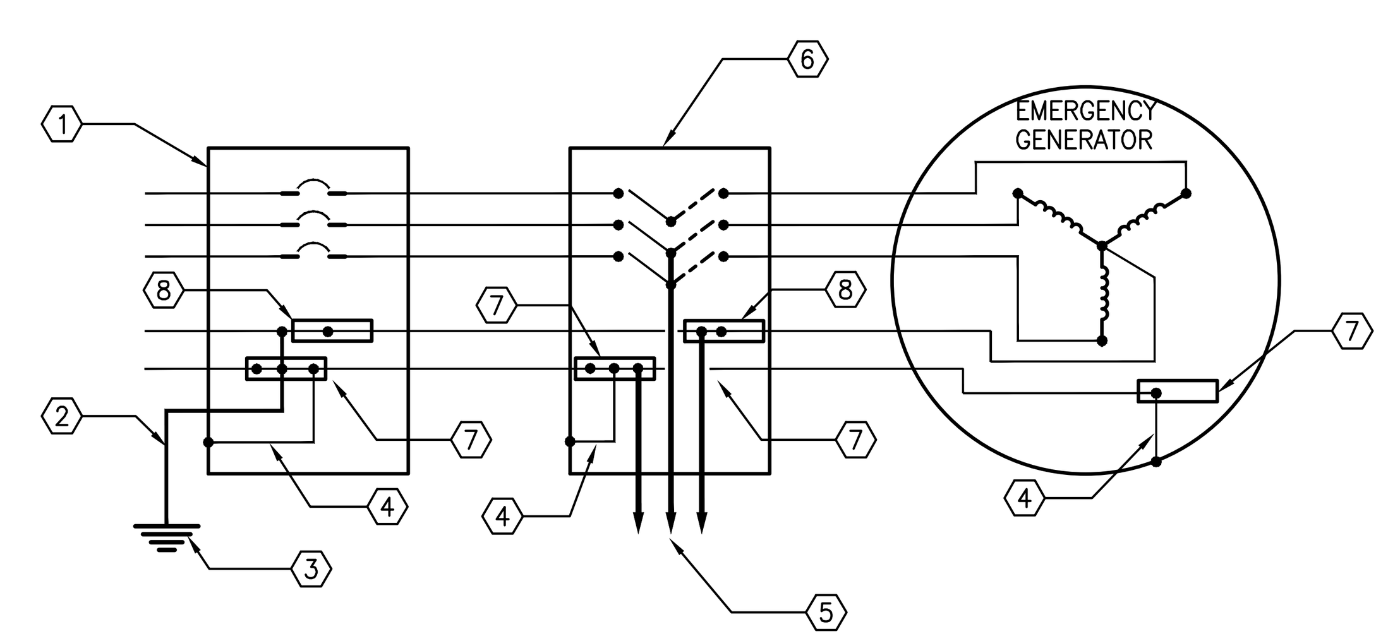
ELECTRICAL DRAWING INDEX	
DWG NO.	DRAWING TITLE
E-000	ELECTRICAL SYMBOLS, NOTES, ABBREVIATIONS, AND DETAILS
E-100	ELECTRICAL SITE PLAN, SERVER/IT ROOM PLAN, AND PART POWER RISER
E-101	ELECTRICAL BASEMENT PLAN, ELECTRIC ROOM PLAN, AND PART POWER RISER
E-200	ELECTRICAL SPECIFICATIONS SHEET 1 OF 3
E-201	ELECTRICAL SPECIFICATIONS SHEET 2 OF 3
E-202	ELECTRICAL SPECIFICATIONS SHEET 3 OF 3

ELECTRICAL GENERAL NOTES

1. DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF SYSTEMS AND WORK. FOLLOW DRAWINGS IN LAYING OUT WORK AND CHECK DRAWINGS OF OTHER TRADES TO VERIFY SPACE CONDITIONS. MAINTAIN HEADROOM AND SPACE CONDITIONS.
2. SECURE ALL SUPPORTS TO BUILDING STRUCTURE UTILIZING TOGGLE BOLTS (HOLLOW MASONRY), EXPANSION SHIELDS OR INSERTS (CONCRETE AND BRICK), MACHINE SCREWS (METAL), BEAM CLAMPS (FRAMEWORK), WOOD SCREWS (WOOD) OR PAN THRU STRAPS (METAL DECK). NAILS, RAWL PLUGS AND WOOD PLUGS ARE NOT PERMITTED. WHERE REQUIRED BY STRUCTURE, PROVIDE THRU BOLTS AND FISH PLATES. SUPPORT HORIZONTAL RUNS OF METALLIC RACEWAYS NOT MORE THAN 10 FT APART. SUPPORT RACEWAY RISERS AT EACH FLOOR LEVEL. RUN EXPOSED RACEWAYS PARALLEL WITH OR AT RIGHT ANGLES TO WALLS.
3. PASS RACEWAYS OVER WATER, STEAM OR OTHER PIPING WHEN PULL BOXES ARE NOT REQUIRED. NO RACEWAY WITHIN 3 INCHES OF STEAM OR HOT WATER PIPES OR APPLIANCES (EXCEPT PIPE CROSSINGS WHERE RACEWAY SHALL BE AT LEAST 1 INCH FROM PIPE COVERS).
4. CUT CONDUIT ENDS SQUARE. REAM SMOOTH. PAINT MALE THREAD OF FIELD THREADED RACEWAYS WITH GRAPHITE BASE PIPE COMPOUND. DRAW UP TIGHT WITH RACEWAY COUPLING.
5. HORIZONTAL OR CROSS RUNS IN PARTITIONS AND WALLS ARE NOT PERMITTED. DO NOT RUN CONDUIT IN PRECAST ROOF SLABS, IN 2 INCH SLABS OR IN TERRAZZO FLOOR FINISH.
6. LEAVE WIRES WITH SUFFICIENT SLACK TO PERMIT MAKING FINAL CONNECTIONS. RACEWAYS OVER 10 FT LONG IN WHICH WIRING IS NOT INSTALLED: FURNISH FISH WIRE.
7. SET BOXES SQUARE AND TRUE WITH BUILDING FINISH. SECURE TO BUILDING STRUCTURE BY ADJUSTABLE STRAP IRONS.
8. COVERS OF JUNCTION AND PULLBOXES SHALL BE READILY ACCESSIBLE.
9. PROVIDE PULLBOXES WHERE INDICATED, WHERE REQUIRED BY CODE AND WHEREVER NECESSARY TO FACILITATE PULLING OF WIRE. COORDINATE PULLBOX LOCATIONS WITH OTHER TRADES.
10. EMPTY RACEWAY RUNS: PROVIDE PULLBOXES EVERY 100 FT AND AS INDICATED. COORDINATE LOCATIONS WITH OTHER TRADES.
11. JUNCTION AND PULLBOXES: LOCATE GENERALLY NOT EXPOSED IN FINISHED SPACES. WHERE NECESSARY, REROUTE RACEWAYS OR MAKE OTHER ARRANGEMENTS FOR CONCEALMENT.
12. SUPPORT PANEL, JUNCTION AND PULLBOXES INDEPENDENTLY TO BUILDING STRUCTURE WITH NO WEIGHT BEARING ON RACEWAYS.
13. ALL ACCESS DOOR LOCATIONS SHALL BE REVIEWED BY OWNER PRIOR TO INSTALLATION.
14. CONNECT CONDUIT TO MOTOR CONDUIT TERMINAL BOXES WITH FLEXIBLE CONDUIT (MINIMUM 18 IN. LENGTH AND 50% SLACK). DO NOT TERMINATE IN OR FASTEN RACEWAYS TO MOTOR FOUNDATION.
15. PULL NO THERMOPLASTIC WIRES AT TEMPERATURES LOWER THAN 32°F (0C). PROVIDE CABLE SUPPORTS FOR WIRE IN RISER CONDUITS AS REQUIRED BY CODE.
16. WIRE COLOR CODING : AS PER CODE. WHERE COLOR-CODED CABLE IS NOT AVAILABLE, CERTIFY IN WRITING AND REQUEST PERMISSION FOR OVERLAP COLOR TAPING OF CONDUCTORS (MINIMUM LENGTH 6") IN ACCESSIBLE LOCATIONS. COLOR CODING, ONCE SELECTED, MUST BE USED CONSISTENTLY FOR THE ENTIRE PROJECT.
17. IDENTIFICATION: LABEL ALL BOXES ENCLOSING EMERGENCY GENERATOR SYSTEM WIRING AND TAG CONDUCTORS THEREIN TO INCLUDE WHERE THEY ORIGINATE AND TERMINATE.
18. FIRESTOPPING SHALL BE INSTALLED WHENEVER WIRING OR RACEWAYS CROSS FIRE RATED CONSTRUCTION.
19. ALL TESTING AND COMMISSIONING OF EQUIPMENT AND SYSTEMS IN THIS PROJECT SHALL BE INCLUDED IN THE ELECTRICAL CONTRACT.
20. ALL COORDINATION AND FILING OF THIS PROJECT TO APPLICABLE AUTHORITIES AND REVIEW BOARDS SHALL BE INCLUDED IN THE ELECTRICAL CONTRACT.



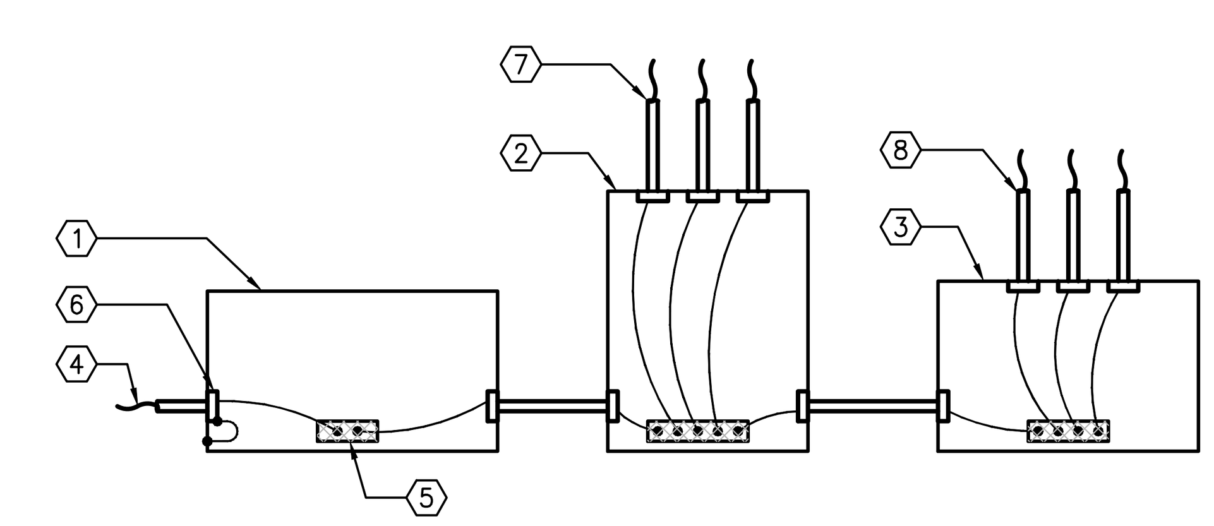
CONCRETE PAD DETAIL



NOTES:

1 SERVICE EQUIPMENT ENCLOSURE	5 TO LIFE SAFETY LOADS
2 GROUNDING ELECTRODE CONDUCTOR	6 AUTO TRANSFER SWITCH (3 POLE SHOWN)
3 GROUNDING ELECTRODE	7 GROUNDING TERMINAL BAR
4 BONDING CONDUCTOR TO ENCLOSURE	8 NEUTRAL TERMINAL BAR

GENERATOR GROUNDING



NOTES:

1 SERVICE EQUIPMENT ENCLOSURE	5 GROUND BUS (TYPICAL)
2 DISTRIBUTION PANELBOARD	6 GROUNDING BUSHING
3 LIGHTING/APPLIANCE PANELBOARD	7 FEEDER CONDUIT (TYPICAL)
4 SYSTEM GROUNDING ELECTRODE CONDUCTOR	8 BRANCH CIRCUIT CONDUIT (TYPICAL)

SEPARATE CONDUCTOR EQUIPMENT GROUNDING SYSTEM

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No.	Date	Description
1	10/21/2013	PROGRESS-80% CD

ISSUE

PROJECT
Trumbull Board of Education Generator

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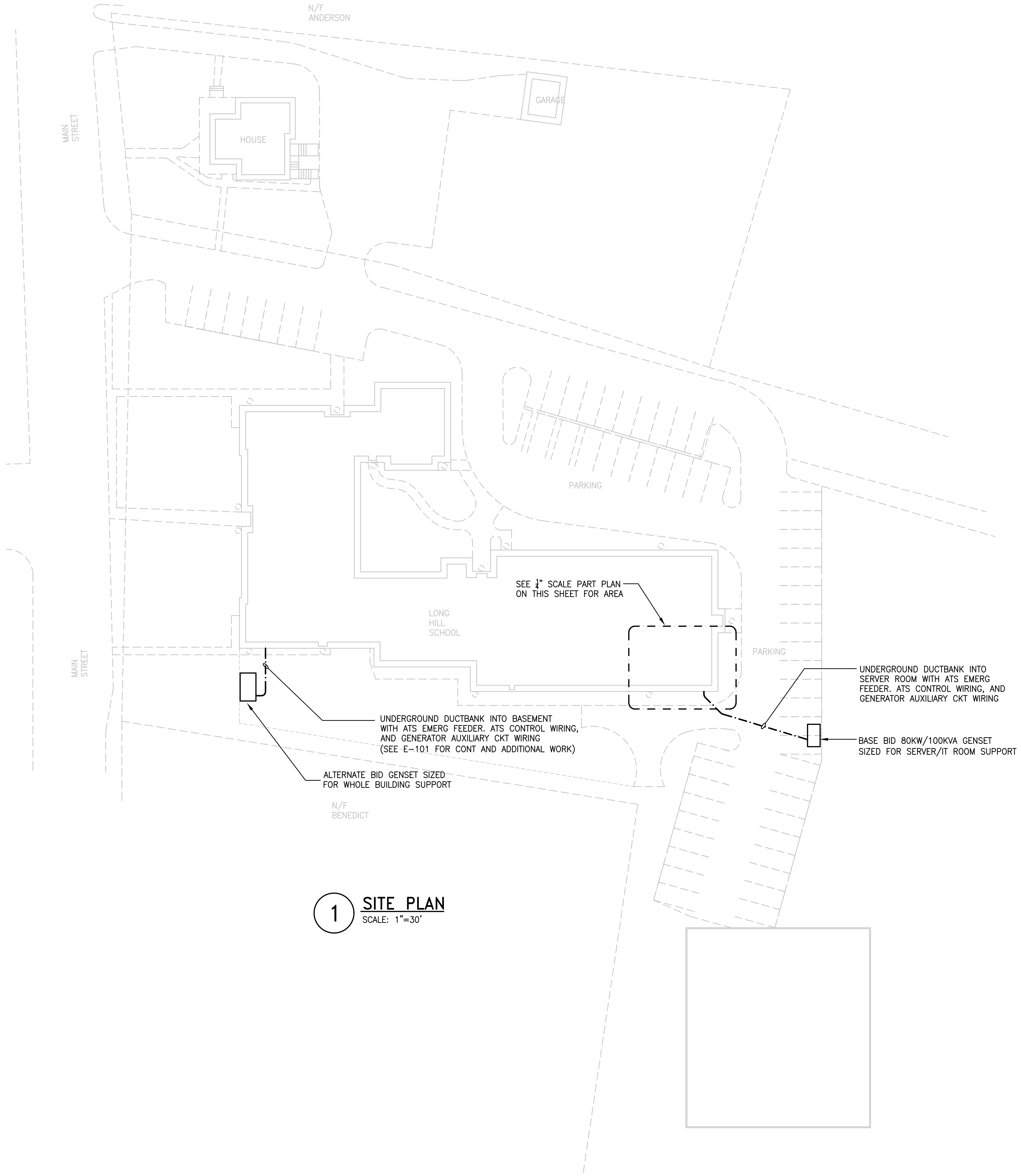
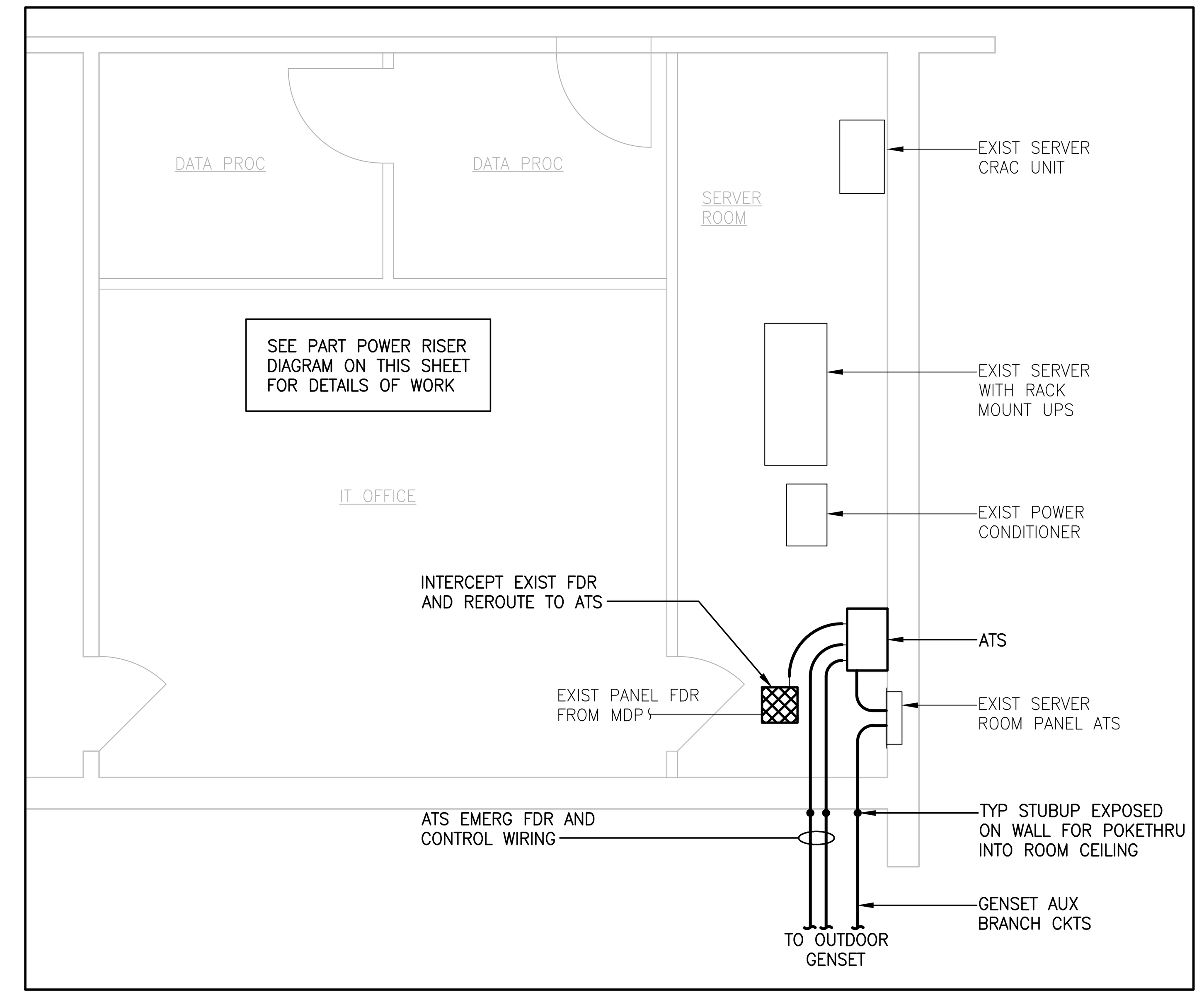
DRAWING TITLE
ELECTRICAL SYMBOLS, NOTES, ABBREVIATIONS, AND DETAILS

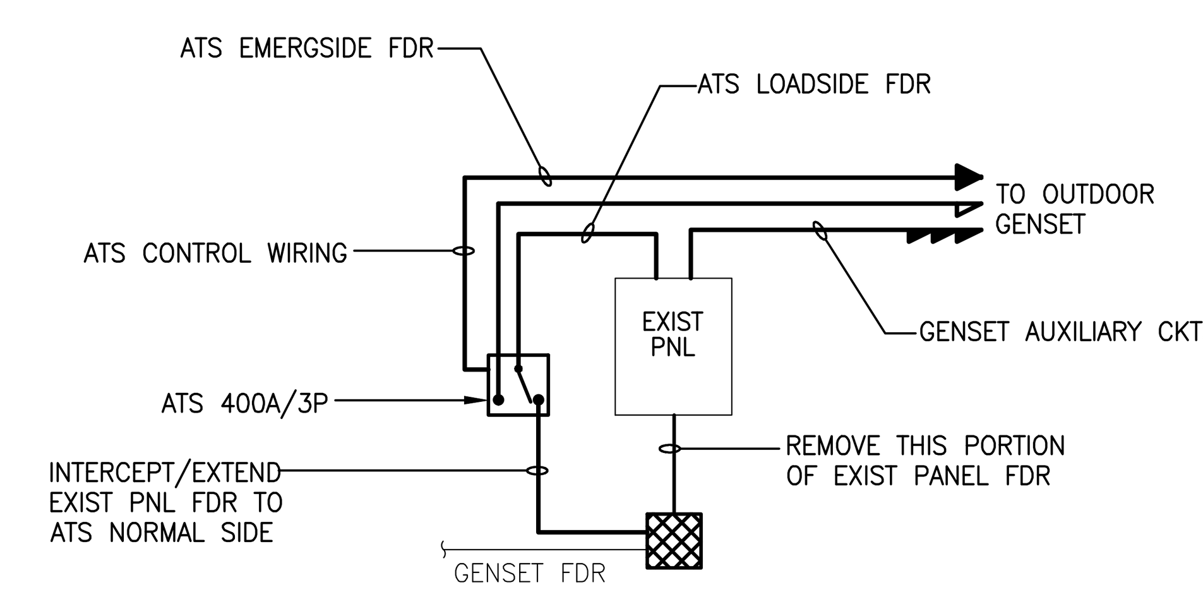
Drawn By	dwn
Checked By	chk
Date	10/15/2013
Scale	NONE
Project No.	S130021-000
Drawing No.	E-000



1 **SITE PLAN**
SCALE: 1"=30'



2 **SERVER/IT ROOM PLAN**
SCALE: 1/4"=1'-0"



3 **PART POWER RISER**
SCALE: NONE

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No.	Date	Description
1	10/21/2013	PROGRESS-80% CD

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Generator

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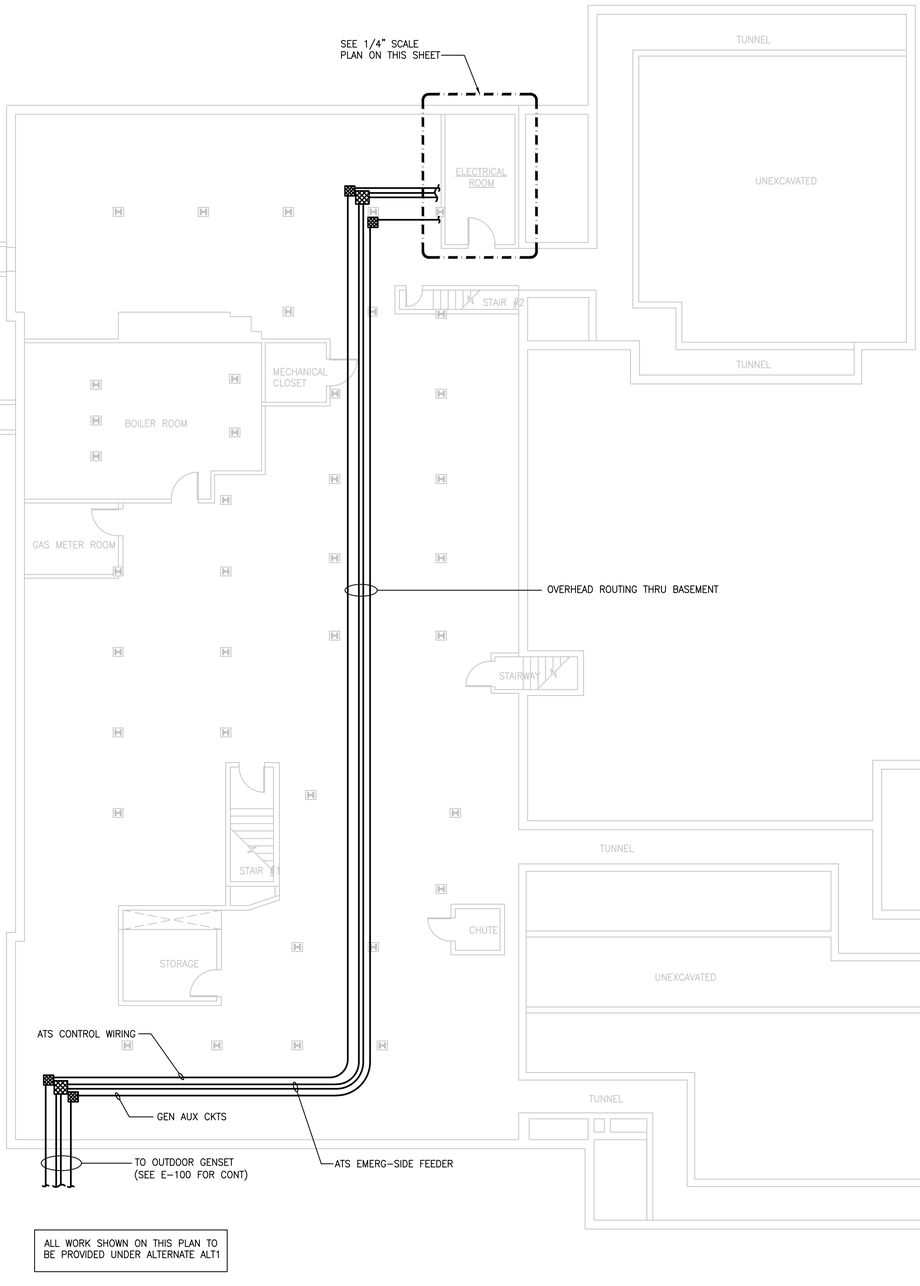
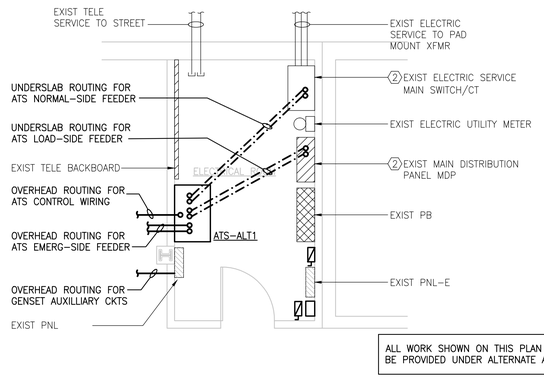
DRAWING TITLE
ELECTRICAL
SITE PLAN,
SERVER/IT ROOM PLAN,
AND PART POWER RISER

Drawn By	dwn	Drawing No.
Checked By	chk	E-100
Date	10/15/2013	
Scale	AS NOTED	
Project No.	S130021-000	



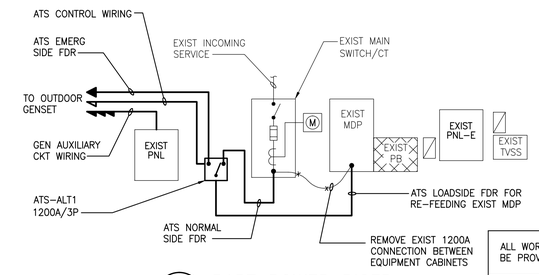
ALL WORK SHOWN ON THIS PLAN TO BE PROVIDED UNDER ALTERNATE ALT1

1 BASEMENT PLAN
SCALE: 1/8"=1'-0"



ALL WORK SHOWN ON THIS PLAN TO BE PROVIDED UNDER ALTERNATE ALT1

2 ELECTRIC ROOM PLAN
SCALE: 1/4"=1'-0"



ALL WORK SHOWN ON THIS RISER TO BE PROVIDED UNDER ALTERNATE ALT1

3 PART POWER RISER
SCALE: N.T.S.

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No.	Date	Description
1	10/21/2013	PROGRESS-80% CD

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PROJECT
Trumbull Board of Education
Generator

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DRAWING TITLE
ELECTRICAL
BASEMENT PLAN,
ELECTRIC ROOM PLAN,
AND PART POWER RISER

Drawn By	dwn
Checked By	chk
Date	10/15/2013
Scale	AS NOTED
Project No.	S130021-000

Drawing No.
E-101

1. GENERAL:

A. ALL APPLICABLE CODES, LAWS AND REGULATIONS GOVERNING OR RELATING TO ANY PORTION OF WORK ARE HEREBY INCORPORATED INTO AND MADE A PART OF THESE SPECIFICATIONS.

B. INVESTIGATE EACH SPACE THROUGH WHICH EQUIPMENT MUST BE MOVED. WHERE NECESSARY, SHIP EQUIPMENT FROM MANUFACTURER IN SECTIONS OF SIZE SUITABLE FOR MOVING THROUGH AVAILABLE RESTRICTIVE SPACES.

C. DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF SYSTEMS AND WORK.

D. INSTALL WORK SO AS TO BE READILY ACCESSIBLE FOR OPERATION, MAINTENANCE AND REPAIR.

E. KEEP ALL EQUIPMENT AND MATERIALS, AND ALL PARTS OF BUILDING, EXTERIOR SPACES AND ADJACENT STREETS, SIDEWALKS AND PAVEMENTS, FREE FROM MATERIAL AND DEBRIS RESULTING FROM EXECUTION OF WORK.

F. SEAL OPENINGS THROUGH PARTITIONS, WALLS AND FLOORS WITH MINERAL WOOL OR OTHER NONCOMBUSTIBLE MATERIAL.

G. PROVIDE ALL NECESSARY FLASHING AND COUNTERFLASHING TO MAINTAIN WATERPROOFING INTEGRITY OF BUILDING AS REQUIRED BY THE INSTALLATION OR REMOVAL OF CONDUIT AND EQUIPMENT.

H. PERFORM WORK DURING REGULAR WORKING HOURS. WHEN DIRECTED, HOWEVER, INSTALL WORK DURING OVERTIME HOURS AND ADDITIONAL COST TO BE CHARGED THEREFORE SHALL BE ONLY "PREMIUM" PORTION OF WAGES PAID.

I. ALL MATERIAL AND EQUIPMENT SHALL BE NEW EXCEPT AS NOTED AND SHALL BE IN ACCORDANCE WITH BUILDING STANDARDS.

J. INSURANCE: IN ACCORDANCE WITH BUILDING REQUIREMENTS AND SHALL INCLUDE A ?HOLD HARMLESS? CLAUSE FOR OWNER AND ENGINEER.

K. REMOVAL AND RELOCATION OF EXISTING WORK MAY BE NECESSARY FOR THE PERFORMANCE OF THE GENERAL WORK.

L. INSTALL NEW WORK AND CONNECT TO EXISTING WORK WITH MINIMUM INTERFERENCE TO EXISTING FACILITIES. TEMPORARY SHUTDOWNS OF EXISTING SERVICES SHALL BE PERFORMED AT NO ADDITIONAL CHARGES, AT TIMES NOT TO INTERFERE WITH NORMAL OPERATION OF EXISTING FACILITIES AND ONLY WITH WRITTEN CONSENT OF OWNER. ALARM AND EMERGENCY SYSTEMS SHALL NOT BE INTERRUPTED. MAINTAIN CONTINUOUS OPERATION OF EXISTING FACILITIES AS REQUIRED WITH NECESSARY TEMPORARY CONNECTIONS BETWEEN NEW AND EXISTING WORK. RESTORE EXISTING DISTURBED WORK TO ORIGINAL CONDITION.

M. DISCONNECT, REMOVE AND/OR RELOCATE EXISTING MATERIAL AND EQUIPMENT AS NOTED OR REQUIRED FOR PROPER INSTALLATION OF NEW WORK.

N. EXISTING MATERIAL, EQUIPMENT AND CONSTRUCTION DEBRIS TO BE REMOVED SHALL BECOME THE PROPERTY OF THE CONTRACTOR EXCEPT AS NOTED.

O. EXCEPT AS NOTED, INCLUDE ALL CUTTING AND PATCHING OF EXISTING FLOORS, WALLS, PARTITIONS AND OTHER MATERIALS IN EXISTING BUILDING. RESTORE THESE AREAS TO ORIGINAL CONDITION.

P. CAREFULLY EXAMINE PORTIONS OF EXISTING BUILDING, EQUIPMENT, ETC., ANT ITS ACCESS WHICH AFFECT THIS WORK. INDICATE ANY DISCREPANCIES BETWEEN THE CONTRACT DRAWINGS AND ACTUAL FIELD CONDITIONS PRIOR TO SUBMITTAL OF BID.

Q. FINAL ACCEPTANCE SHALL BE MADE AFTER ADJUSTMENT AND TESTING OF EQUIPMENT AND SYSTEMS. FURNISHED ALL REQUIRED CERTIFICATES OF INSPECTION AND APPROVAL.

2. SCOPE OF WORK:

A. PROVIDE LABOR, MATERIALS, EQUIPMENT, SERVICES AND FEES NECESSARY FOR COMPLETE AND SAFE INSTALLATION IN CONFORMITY WITH THE NATIONAL ELECTRICAL CODE (NEC) AND ALL OTHER APPLICABLE INDUSTRY, NATIONAL AND LOCAL CODES AND AUTHORITIES HAVING JURISDICTION.

B. ALL DRAWINGS, PLANS, DETAILS, SPECIFICATIONS AND ADDENDA ARE MADE PART OF THIS CONTRACT AND SHALL APPLY TO ALL WORK.

C. FURNISH A WRITTEN GUARANTEE TO REPLACE OR REPAIR PROMPTLY AND ASSUME RESPONSIBILITY FOR ALL EXPENSES INCURRED FOR ANY WORKMANSHIP AND EQUIPMENT IN WHICH DEFECTS DEVELOP WITHIN ONE YEAR FROM THE DATE OF FINAL CERTIFICATE FOR PAYMENT AND/OR FROM DATE OR ACTUAL USE OF EQUIPMENT OR OCCUPANCY OF SPACES BY OWNER INCLUDED UNDER THE VARIOUS PARTS OF THE WORK, WHICHEVER DATE IS EARLIER. WORK SHALL BE DONE AS DIRECTED BY OWNER. GUARANTEE SHALL ALSO PROVIDE FOR ALL EXPENSES INCURRED IN REPAIRING AND REPLACING WORK OF OTHER TRADES AFFECTED BY DEFECTS, REPAIRS OR REPLACEMENTS TO EQUIPMENT SUPPLIED BY THE CONTRACTOR.

D. GIVE NECESSARY NOTICE, FILE DRAWINGS AND SPECIFICATIONS WITH ALL DEPARTMENTS HAVING JURISDICTION, OBTAIN PERMITS OR LICENSES NECESSARY TO CARRY OUT WORK AND PAY ALL FEES THEREFORE. ARRANGE FOR INSPECTION AND TESTS OF ANY OR ALL PARTS OF THE WORK IF REQUIRED BY AUTHORITIES AND PAY ALL CHARGES FOR SAME. PAY ALL COSTS FOR, AND FURNISH TO THE OWNER BEFORE FINAL BILLING, ALL CERTIFICATES NECESSARY AS EVIDENCE THAT THE WORK INSTALLED CONFORMS WITH ALL REGULATIONS WHERE THEY APPLY TO WORK.

3. SHOP DRAWINGS

A. PRIOR TO PERFORMING ANY WORK PROVIDE COMPLETE SETS OF COORDINATED SHOP DRAWINGS OF NEW AND EXISTING EQUIPMENT, INDICATING CAPACITY, DIMENSIONS AND SEQUENCE OF OPERATION FOR WRITTEN APPROVAL.

B. INDICATE ON EACH SHOP DRAWINGS SUBMITTED:

1) PROJECT NAME AND LOCATION

2) NAME OF ARCHITECT AND ENGINEER

3) ITEM IDENTIFICATION

4) APPROVAL STAMP OF PRIME CONTRACTOR

C. SUBMISSIONS:

1) SUBMISSIONS 11 IN. X 17 IN. OR SMALLER: IF THE SUBMISSION IS A CATALOG CUT, THEN SUBMIT ONE ORIGINAL AND TWO COPIES. OTHERWISE, SUBMIT THREE COPIES. ARCHITECT WILL FORWARD THE ORIGINAL AND ONE COPY (TWO COPIES WHEN NO ORIGINAL IS RECEIVED) TO THE ENGINEER. ALL CATALOG CUTS SHALL BE COMPLETE.

2) SUBMISSIONS LARGER THAN 11 IN. X 17 IN.: SUBMIT TWO PRINTS AND ONE PAPER SEPIA TO THE ARCHITECT. THE ARCHITECT WILL FORWARD ONE PRINT AND THE PAPER SEPIA TO THE ENGINEER.

D. SUBMIT SHOP DRAWINGS FOR ALL EQUIPMENT.

4. AS-BUILT DRAWINGS AND EQUIPMENT OPERATIONAL INSTRUCTIONS

A. UPON COMPLETION AND ACCEPTANCE OF WORK, FURNISH WRITTEN INSTRUCTIONS AND EQUIPMENT MANUALS AND DEMONSTRATING OPERATION AND MAINTENANCE OF ALL EQUIPMENT.

B. TYPE INSTRUCTIONS ON 8-1/2 X 11 PAPER, BOUND IN THREE RING BINDERS WITH CLEAR ACETATE COVERS. PROVIDE THREE COPIES OF THE INSTRUCTIONS TO THE OWNER AND ONE COPY TO THE ENGINEER.

C. INSTRUCTION BOOKLET SHALL BEAR THE NAME, ADDRESS AND TELEPHONE NUMBER OF THE PROJECT, ARCHITECT AND ENGINEER.

D. PROVIDE REPRODUCIBLE "AS-BUILT" DRAWINGS INDICATING AS INSTALLED CONDITIONS OF THE WORK TO ARCHITECT AFTER COMPLETION OF THE INSTALLATION.

5. GENERAL PROVISIONS FOR ELECTRICAL WORK:

A. SPECIFICATIONS ARE OF SIMPLIFIED FORM AND INCLUDE INCOMPLETE SENTENCES. WORDS OR PHRASES SUCH AS "THE CONTRACTOR SHALL," "SHALL BE," "FURNISH," "PROVIDE," "A," "THE," AND "ALL" HAVE BEEN OMITTED FOR BREVITY.

B. DEFINITIONS:

1) "PROVIDE": TO SUPPLY, INSTALL AND CONNECT UP COMPLETE AND READY FOR SAFE AND REGULAR OPERATION THE PARTICULAR WORK REFERRED TO UNLESS SPECIFICALLY OTHERWISE NOTED.

2) "INSTALL": TO ERECT, MOUNT AND CONNECT COMPLETE WITH RELATED ACCESSORIES.

3) "FURNISH" OR "SUPPLY: TO PURCHASE, PROCURE, ACQUIRE AND DELIVER COMPLETE WITH RELATED ACCESSORIES.

4) "WORK": LABOR, MATERIALS, EQUIPMENT, APPARATUS, CONTROLS, ACCESSORIES AND OTHER ITEMS REQUIRED FOR PROPER AND COMPLETE INSTALLATION.

5) "WIRING": RACEWAY, FITTINGS, WIRE, BOXES AND RELATED ITEMS.

6) "CONCEALED": EMBEDDED IN MASONRY OR OTHER CONSTRUCTION, INSTALLED IN FURRED SPACES, WITHIN DOUBLE PARTITIONS OR HUNG CEILINGS, IN TRENCHES, IN CRAWL SPACES, OR IN ENCLOSURES.

7) "EXPOSED": NOT INSTALLED UNDERGROUND OR "CONCEALED" AS DEFINED ABOVE.

8) "SIMILAR" OR "EQUAL": EQUAL IN MATERIALS, WEIGHT, SIZE, DESIGN AND EFFICIENCY OF SPECIFIED PRODUCT.

C. TEMPORARY LIGHT AND POWER: PROVIDE AT EARLIEST POSSIBLE DATE WITHIN CONSTRUCTION AREAS FOR REQUIREMENTS OF ALL TRADES AS HEREIN DESCRIBED. EXTEND SYSTEMS TO NEW CONSTRUCTION AS SOON AS PHYSICALLY POSSIBLE. MAINTAIN SYSTEM DURING WORKING HOURS OF ALL TRADES. COST OF ENERGY WILL BE PAID FOR BY OWNER. PROVIDE ALL REQUIRED MAINTENANCE, INCLUDING LAMPS AND SOCKETS.

D. QUALITY ASSURANCE

1) QUALITY AND GAUGE OF MATERIALS: NEW, BEST OF THEIR RESPECTIVE KINDS, FREE FROM DEFECTS AND LISTED BY UNDERWRITERS LABORATORIES, INC., OR OTHER NATIONALLY APPROVED TESTING AGENCY AND BEARING THEIR LABEL. MATERIALS AND EQUIPMENT OF SIMILAR APPLICATION SHALL BE OF SAME MANUFACTURER, EXCEPT AS NOTED.

2) GUARANTEE: ALL MATERIALS AND WORKMANSHIP SHALL BE GUARANTEED.

E. MATERIALS

1) NAMEPLATES: BLACK LAMICOID SHEET WITH 3/4 IN. WHITE LETTERING, FASTENED WITH EPOXY CEMENT FOR EACH DISCONNECT SWITCH, CIRCUIT BREAKER, PANEL, SWITCHBOARD, CABINET, TRANSFORMER, AND THE LIKE. NAMEPLATES SHALL DESCRIBE THE NAME AND NUMBER OF EACH COMPONENT.

2) CABLE TAGS: TAG EACH CONDUCTOR PASSING THROUGH SPLICE OR PULLBOX WITH A WHITE LINEN TAG, INDICATING SYSTEM POINT OF ORIGIN AND TERMINATION.

3) INSERTS AND SUPPORTS:

a) INSERTS: STEEL, SLOTTED TYPE, FACTORY PAINTED.

– SINGLE ROD: SIMILAR TO GRINNELL FIG. 281.

– MULTI-ROD: SIMILAR TO FEE AND MASON SERIES 9000 WITH END CAPS AND CLOSURE STRIPS.

– CLIP FORM NAILS FLUSH WITH INSERTS.

– MAXIMUM LOADING 75 PERCENT OF RATING.

b) SUPPORTS FROM BUILDING CONSTRUCTION: INSERTS, BEAM CLAMPS, STEEL FISHPLATES (IN CONCRETE FILL ONLY), CANTILEVER BRACKETS OR OTHER MEANS. SUBMIT FOR REVIEW.

c) GROUPED LINES AND SERVICES: TRAPEZE HANGERS OF BOLTED ANGLES OR CHANNELS.

d) WHERE BUILDING CONSTRUCTION IS INADEQUATE: PROVIDE ADDITIONAL FRAMING. SUBMIT FOR REVIEW.

F. PAINT: BEST GRADE FOR ITS PURPOSE. DELIVER IN ORIGINAL SEALED CONTAINERS AND APPLY IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. COLORS SHALL BE AS SELECTED BY ARCHITECT OR ENGINEER. UTILIZE GALVANIZED IRON PRIMER ON PANEL AND PULL BOXES, AFTER FABRICATION. UTILIZE HOT DIPPED GALVANIZED OR DIPPED IN ZINC CHROMATE FOR: OUTLET BOXES, JUNCTION BOXES, CONDUIT HANGERS, RODS, INSERTS AND SUPPORTS. ZINC CHROMATE WITH FINISH TO MATCH SURROUNDINGS SHALL BE USED FOR MARRED SURFACES OF STEEL EQUIPMENT AND RACEWAYS. A FIELD-APPLIED ZINC CHROMATE PRIME COAT SHALL BE UTILIZED FOR STEEL OR IRON WORK.

G. BRUSH AND CLEAN WORK PRIOR TO CONCEALING, PAINTING AND ACCEPTANCE. PAINTED EXPOSED WORK SOILED OR DAMAGED; CLEAN AND REPAIR TO MATCH ADJOINING WORK BEFORE FINAL ACCEPTANCE.

H. REMOVE DEBRIS FROM INSIDE AND OUTSIDE OF MATERIAL AND EQUIPMENT.

I. ALL ACCESS DOOR LOCATIONS SHALL BE REVIEWED BY OWNER PRIOR TO INSTALLATION.

6. LOW-VOLTAGE DISTRIBUTION EQUIPMENT:

A. EQUIPMENT SHALL CONFORM TO NEMA, ANSI AND IEEE STANDARDS.

B. DISCONNECT SWITCHES SHALL BE FUSED OR NONFUSED AS NOTED. SWITCHES: HEAVY DUTY, AND HORSEPOWER RATED FOR MOTOR LOADS. TOGGLE TYPE SWITCHES: LOAD BREAK, 20 AMP AT 600 VOLTS AND 30 AMP AT 240 VOLTS.

1) KNIFE-BLADE SWITCHES: LOAD BREAK, QUICK-MAKE-QUICK-BREAK, UL CLASS R UP TO 600 AMP. MAXIMUM RATING: 800 AMP. SWITCHES SHALL BE SIMILAR TO GENERAL ELECTRIC QMR. SWITCH ENCLOSURES SHALL BE DEAD FRONT, NEMA TYPE 1, EXCEPT AS NOTED.

C. FUSES:

1) CIRCUITS 0 TO 600 AMPERES: FUSES SIMILAR TO CURRENT LIMITING BUSSMAN LOW-PEAK DUAL-ELEMENT TIME-DELAY WITH AN INTERRUPTING RATING OF 300,000 AMPERES RMS SYMMETRICAL.

2) CIRCUIT 601 TO 6000 AMPERES: FUSES SIMILAR TO CURRENT LIMITING BUSSMANN LOW-PEAK TIME-DELAY AN INTERRUPTING RATING OF 300,000 AMPERES RMS SYMMETRICAL.

3) ALL FUSES SHALL BE PROVIDED BY SAME MANUFACTURER.

4) PROVIDE 1 SPARE MATCHING FUSE FOR EACH SET OF 3.

D. CIRCUIT BREAKERS: MOLDED CASE THERMAL-MAGNETIC, QUICK-MAKE-QUICK-BREAK, BOLT-ON TYPE, MANUALLY OPERATED WITH INSULATED TRIP-FREE HANDLE. MULTI-POLE TYPE BREAKERS WITH INTERNAL TRIP BAR. TERMINALS SHALL BE SUITABLE FOR COPPER OR ALUMINUM CABLE. FURNISH AUXILIARY DEVICES WHERE REQUIRED FOR SHUNT-TRIPPING, OPEN AND CLOSE MOTOR OPERATOR AND ALARM INDICATION. ENCLOSURES SHALL BE DEAD FRONT, NEMA TYPE 1, EXCEPT AS NOTED. FRAMES, IC AND INTERCHANGEABLE TRIPS SHALL BE MINIMUM AS FOLLOWS, UNLESS OTHERWISE NOTED:

1) 120 VOLTS, 100-AMP FRAME: 10,000 AMPS, 1 POLE.

2) 240 VOLTS, 100-AMP FRAME: 18,000 AMPS, 2 AND 3 POLES.

3) 277 VOLTS, 100-AMP FRAME: 14,000 AMPS, 1 POLE.

4) 277 VOLTS, 200-AMP FRAME: 50,000 AMPS, 2 POLES WITH INTERCHANGEABLE TRIP.

5) 480 VOLTS, 100-AMP FRAME: 20,000 AMPS, 3 POLES.

6) 480 VOLTS, 200-AMP FRAME: 65,000 AMPS, 3 POLES WITH INTERCHANGEABLE TRIP.

E. DISTRIBUTION PANELS: SWITCHING UNITS: 3 PHASE, 4 WIRE CIRCUIT-BREAKER TYPE UNLESS OTHERWISE NOTED. BUS BARS: HARD DRAWN COPPER, MINIMUM 98 PERCENT CONDUCTIVITY, SILVER OR TIN-PLATED JOINTS. CABINETS: GALVANIZED SHEET STEEL BACK BOX, WITH DOOR AND TRIM AND LAPPED AND WELDED CORNERS. HARDWARE: CHROME-PLATED WITH FLUSH LOCK/LATCH HANDLE ASSEMBLY (UP TO 48 IN. HIGH DOORS) OR VAULT HANDLE, LOCK AND 3-POINT CATCH (LARGER THAN 48 IN. HIGH DOORS). HINGES: SEMI-CONCEALED, 5-KNUCKLE STEEL WITH NONFERROUS PINS, 180-DEG OPENING, LOCATED A MAXIMUM 26 IN. ON CENTERS. MINIMUM GUTTER SPACES FOR LIGHTING PANELS SHALL BE 5-3/4 IN. SIDES, TOP AND BOTTOM. DIRECTORY HOLDER: METAL FRAME WITH CLEAR PLASTIC, TRANSPARENT COVER. A TYPEWRITTEN LIST INDICATING FEEDER CABLE AND CONDUIT SIZE, POINT OF ORIGIN AND TERMINATION, CIRCUIT NUMBERS, OUTLETS SUPPLIED AND THEIR LOCATIONS.

F. TRANSFORMERS: OPEN-VENTILATED, DRY TYPE, CLASS H INSULATION, 1150C TEMPERATURE RISE. WINDINGS SHALL BE COPPER. PRIMARY AND SECONDARY VOLTAGES: AS NOTED. PRIMARY TAPS: 6-2 1/2% TAPS, 2 ABOVE AND 4 BELOW RATED VOLTAGE. ADJUST FOR REQUIRED VOLTAGE. HARMONIC CAPABILITY: ?K13?.

G. BALANCE LOAD OVER PHASES. PROVIDE MULTI-CABLE LUGS WHERE REQUIRED. DOUBLE LUGGING SHALL NOT BE PERMITTED. MOUNTING HEIGHT A MAXIMUM 6 FT-6 IN. FROM FLOOR TO TOP SWITCH UNIT. UPDATE DIRECTORIES ON EXISTING PANELBOARDS WHERE CIRCUITING IS CHANGED.

H. TESTS: OPEN AND CLOSE LOAD BREAK SWITCHING DEVICES UNDER LOAD.

7. LIFE SAFETY AUTOMATIC TRANSFER SWITCH:

A. EXISTING TO BE REUSED AND TESTED WITH NEW EMERGENCY GENERATOR.

B. TESTING

1) ENGAGE A FACTORY-AUTHORIZED SERVICE REPRESENTATIVE TO INSPECT, TEST, AND ADJUST COMPONENTS, ASSEMBLIES, AND EQUIPMENT INSTALLATIONS, INCLUDING CONNECTIONS. REPORT RESULTS IN WRITING.

2) PERFORM EACH VISUAL AND MECHANICAL INSPECTION AND ELECTRICAL TEST STATED IN NETA ACCEPTANCE TESTING SPECIFICATION. CERTIFY COMPLIANCE WITH TEST PARAMETERS.

3) MEASURE INSULATION RESISTANCE PHASE-TO-PHASE AND PHASE-TO-GROUND WITH INSULATION-RESISTANCE TESTER. INCLUDE EXTERNAL ANNUNCIATION AND CONTROL CIRCUITS. USE TEST VOLTAGES AND PROCEDURE RECOMMENDED BY MANUFACTURER. COMPLY WITH MANUFACTURER'S SPECIFIED MINIMUM RESISTANCE.

a) CHECK FOR ELECTRICAL CONTINUITY OF CIRCUITS AND FOR SHORT CIRCUITS.

b) INSPECT FOR PHYSICAL DAMAGE, PROPER INSTALLATION AND CONNECTION, AND INTEGRITY OF BARRIERS, COVERS, AND SAFETY FEATURES.

c) VERIFY THAT MANUAL TRANSFER WARNINGS ARE PROPERLY PLACED.

d) PERFORM MANUAL TRANSFER OPERATION.

4) AFTER ENERGIZING CIRCUITS, DEMONSTRATE INTERLOCKING SEQUENCE AND OPERATIONAL FUNCTION FOR EACH SWITCH AT LEAST THREE TIMES.

a) SIMULATE POWER FAILURES OF NORMAL SOURCE TO AUTOMATIC TRANSFER SWITCHES AND OF EMERGENCY SOURCE WITH NORMAL SOURCE AVAILABLE.

b) SIMULATE LOSS OF PHASE-TO-GROUND VOLTAGE FOR EACH PHASE OF NORMAL SOURCE.

c) VERIFY TIME-DELAY SETTINGS.

d) VERIFY PICKUP AND DROPOUT VOLTAGES BY DATA READOUT OR INSPECTION OF CONTROL SETTINGS.

e) PERFORM CONTACT-RESISTANCE TEST ACROSS MAIN CONTACTS AND CORRECT VALUES EXCEEDING 500 MICROHMS AND VALUES FOR 1 POLE DEVIATING BY MORE THAN 50 PERCENT FROM OTHER POLES.

f) VERIFY PROPER SEQUENCE AND CORRECT TIMING OF AUTOMATIC ENGINE STARTING, TRANSFER TIME DELAY, RETRANSFER TIME DELAY ON RESTORATION OF NORMAL POWER, AND ENGINE COOL-DOWN AND SHUTDOWN.

5) COORDINATE TESTS WITH TESTS OF GENERATOR AND RUN THEM CONCURRENTLY.

6) REPORT RESULTS OF TESTS AND INSPECTIONS IN WRITING. RECORD ADJUSTABLE RELAY SETTINGS AND MEASURED INSULATION AND CONTACT RESISTANCES AND TIME DELAYS. ATTACH A LABEL OR TAG TO EACH TESTED COMPONENT INDICATING SATISFACTORY COMPLETION OF TESTS.

7) REMOVE AND REPLACE MALFUNCTIONING UNITS AND RETEST AS SPECIFIED ABOVE.

8) INFRARED SCANNING: AFTER SUBSTANTIAL COMPLETION, BUT NOT MORE THAN 60 DAYS AFTER FINAL ACCEPTANCE, PERFORM AN INFRARED SCAN OF EACH SWITCH. REMOVE ALL ACCESS PANELS SO JOINTS AND CONNECTIONS ARE ACCESSIBLE TO PORTABLE SCANNER.

9) FOLLOW-UP INFRARED SCANNING: PERFORM AN ADDITIONAL FOLLOW-UP INFRARED SCAN OF EACH SWITCH 11 MONTHS AFTER DATE OF SUBSTANTIAL COMPLETION.

10) INSTRUMENT: USE AN INFRARED SCANNING DEVICE DESIGNED TO MEASURE TEMPERATURE OR TO DETECT SIGNIFICANT DEVIATIONS FROM NORMAL VALUES. PROVIDE CALIBRATION RECORD FOR DEVICE.

11) RECORD OF INFRARED SCANNING: PREPARE A CERTIFIED REPORT THAT IDENTIFIES SWITCHES CHECKED AND THAT DESCRIBES SCANNING RESULTS. INCLUDE NOTATION OF DEFICIENCIES DETECTED, REMEDIAL ACTION TAKEN, AND OBSERVATIONS AFTER REMEDIAL ACTION.

C. DEMONSTRATION

1) ENGAGE A FACTORY-AUTHORIZED SERVICE REPRESENTATIVE TO TRAIN OWNER'S MAINTENANCE PERSONNEL TO ADJUST, OPERATE, AND MAINTAIN TRANSFER SWITCHES AND RELATED EQUIPMENT AS SPECIFIED BELOW. REFER TO DIVISION 01 SECTION "DEMONSTRATION AND TRAINING."

2) COORDINATE THIS TRAINING WITH THAT FOR GENERATOR EQUIPMENT.

8. MATERIALS

A. RACEWAYS:

1) RIGID STEEL CONDUIT: FULL-WEIGHT PIPE, GALVANIZED, THREADED.

2) ELECTROMETALLIC TUBING (EMT): THIN WALL PIPE, GALVANIZED, THREADLESS.

3) FLEXIBLE STEEL CONDUIT: CONTINUOUS SINGLE STRIP, GALVANIZED.

4) WIREWAYS: SIZE AS NOTED, MINIMUM NO. 16 GAUGE STEEL WITH GROUND CONTINUITY. BAKED ENAMEL FINISH AND SCREW-ON COVERS.

B. BOXES:

1) OUTLET BOXES: STAMPED STEEL, 4 IN. SQUARE OR OCTAGON FOR FIXTURES. WITHOUT FIXTURE OR DEVICE: BLANK COVER.

2) JUNCTION AND PULL BOXES: GALVANIZED SHEET STEEL WITH SCREW-ON COVERS, EXCEPT AS NOTED. INSULATED SUPPORTS FOR CABLES. LOCATE AS NOTED OR REQUIRED AND ACCESSIBLE. PROVIDE BARRIERS IN NEW AND RENOVATED BOXES BETWEEN 120/208 VOLT AND 277/480 VOLT WIRING AND BETWEEN EMERGENCY AND NORMAL WIRING.

C. RACEWAY SUPPORTS:

1) VERTICAL RISERS: AT FLOOR LEVEL; RISER CLAMPS RESTING ON SLAB AND ABOVE FLOOR LEVEL U-BOLTS CONNECTED TO THE APPROVED SUPPORTS.

2) HORIZONTAL RUNS: SECURE WITH PIPE STRAPS OR U-BOLTS TO APPROVED SUPPORTS. SPACING OF SUPPORTS: MINIMUM OF 10 FT ON CENTER

3) EXPOSED RACEWAYS: RUN PARALLEL WITH OR AT RIGHT ANGLES TO WALLS. PROVIDE CLEARANCE WITH WATER, STEAM OR OTHER PIPING (MINIMUM 3 IN. SEPARATION FROM STEAM AND HOT WATER PIPES. HUNG CEILING OUTLETS: RUN IN HUNG CEILING AND CONNECT TO CEILING SUPPORT CHANNELS. IN MASONRY AND POURED CONCRETE, RUN VERTICALLY ONLY.

4) MAINTAIN GROUNDING CONTINUITY OF INTERRUPTED METALLIC RACEWAYS WITH GROUND CONDUCTOR, AND IN FLEXIBLE CONDUIT FOR FEEDERS AND MOTOR TERMINAL CONNECTIONS.

5) RIGID STEEL CONDUIT: OUTDOORS, IN WET OR DAMP LOCATIONS. PAINT MALE THREADS OF FIELD-THREADED CONDUIT WITH GRAPHITE-BASE PIPE COMPOUND AND BUTT CONDUIT ENDS. TOUCH UP MARRED SURFACES AND FIELD-CUT THREADS, CRC-COLD GALVANIZED, ZINC-FREE TO INCLUDE ALL ASSOCIATED COUPLINGS, CONNECTORS AND BOXES.

6) EMT: ONLY IN DRY LOCATIONS, DRY WALLS, HUNG CEILINGS, HOLLOW BLOCK WALLS AND FURRED SPACES.

7) FLEXIBLE STEEL CONDUIT: FOR SHORT CONNECTIONS WHERE RIGID CONDUIT IS IMPRACTICAL. FOR FINAL CONNECTION TO MOTOR TERMINAL BOX, TRANSFORMER AND OTHER VIBRATING EQUIPMENT: WITH POLYVINYL SHEATHING AND GROUND CONDUCTOR. MINIMUM LENGTH: 18 IN. WITH SLACK. CONNECT GROUND CONDUCTOR TO ENCLOSURE OR RACEWAY AT EACH END. FOR EXPANSION JOINT CROSSINGS, CROSS AT RIGHT ANGLES AND ANCHOR ENDS.

8) CUT CONDUIT ENDS SQUARE. REAM SMOOTH. PAINT MALE THREADS OF FIELD THREADED RACEWAYS WITH GRAPHITE BASE PIPE COMPOUND. DRAW UP TIGHT WITH RACEWAY COUPLING.

9) ALL COUPLINGS: COMPRESSION TYPE. NO SET SCREW FITTINGS.

10) EXPANSION FITTINGS: INSTALLED AT RIGHT ANGLES WITH CLIP JOINT CENTERED IN EXPANSION JOINT. PROVIDE A LENGTH OF RUN IN ACCORDANCE MANUFACTURER'S RECOMMENDATIONS. PRESET FITTINGS: ALLOW FOR TEMPERATURE VARIATION.

11) RACEWAYS PASSING THROUGH FIRE-RATED CONSTRUCTION: SEAL OPENING WITH FIRE SEALANT.

D. PANEL, JUNCTION AND PULL BOXES: LOCATED CLEAR OF OTHER TRADES. CONCEAL JUNCTION AND PULL BOXES IN FINISHED SPACES. BOXES: ACCESSIBLE. SUPPORT BOXES FROM BUILDING STRUCTURE, INDEPENDENT OF CONDUIT. PROVIDE FLOOR-TO-CEILING CHANNELS FOR MOUNTING ON DRYWALL AND LIGHTWEIGHT CONSTRUCTION. OUTLET BOXES FOR FIXTURES RECESSED IN HUNG CEILINGS: ACCESSIBLE THROUGH OPENING CREATED BY REMOVAL OF FIXTURE. SECURE TO BLACK IRON SUPPORT. MOTOR TERMINAL BOXES: COORDINATE WITH MOTOR BRANCH CIRCUIT CONDUIT AND WIRING; ADD BOX VOLUME WHERE REQUIRED.

E. FIRE SEALANTS: FOR RACEWAYS AND WIRE PASSING THROUGH FLOOR SLOTS, SLEEVES OR OPENINGS IN FIRE-PARTITIONS ROOMS.

F. PERFORM CONTINUITY TESTS OF RESISTANCE OF FEEDER CONDUITS FROM SOURCE OF SERVICE TO POINT OF FINAL DISTRIBUTION USING 1 CONDUCTOR RETURN. MAXIMUM RESISTANCE SHALL BE 25 OHMS.

9. WIRE AND CABLE:

A. SIZE REFERENCE: AWG EXCEPT AS NOTED.

B. CONDUCTORS: COPPER, ASTM STANDARD SOLID (NO. 10 AND SMALLER) OR STRANDED (NO. 8 AND LARGER). GENERAL USE: NO. 12 MINIMUM. AT 120 VOLTS AND OVER 100 FT CIRCUIT LENGTH: NO. 10 MINIMUM. AT 277 VOLTS AND OVER 200 FT CIRCUIT LENGTH: NO. 10 MINIMUM.

C. CONTROL CABLING, EXCEPT AS NOTED: NO MINIMUM. AT 120 VOLTS AND OVER 200 FT CIRCUIT LENGTH: NO. 12 MINIMUM.

D. OTHER VOLTAGES AND PHASES: ADJUST CABLE SIZING AS REQUIRED TO MAINTAIN VOLTAGE DROP. INCREASE RACEWAY SIZES FOR LARGER WIRE AS REQUIRED.

E. INSULATION: TYPE THHN/THWN, RUBBER AND THERMOPLASTIC MEETING ASTM AND IPCEA STANDARDS. TYPE RHH-2 UL CLASSIFIED FIRE RESISTIVE CABLE (FHJR) FOR FIRE PUMP POWER FEEDERS INDICATED ON DRAWINGS AND CONTROL WIRING BETWEEN AUTO TRANSFER SWITCH AND EMERGENCY GENERATOR, 2-HOUR FIRE RATED PER UL 1296, MEETS STANDARD FOR TESTING ULC S-139, AND INSTALLED PER MANUFACTURER?S GUIDELINES. CABLE USE SHALL BE BASED ON A MANUFACTURING DATE PRIOR TO SEPTEMBER 12, 2012 AND ACCEPTANCE BY THE AUTHORITY HAVING JURISDICTION. UNDER ALTERNATE PRICING STATE THE COST DIFFERENCE TO PROVIDE STANDARD BUILDING WIRE WITH FIRE WRAP BLANKETS HAVING AT LEAST A 1 HOUR FIRE RATING.

F. COLOR CODING S AS FOLLOWS:

1) 120/208 VOLT SYSTEM:
BLACK FOR A PHASE
RED FOR B PHASE
BLUE FOR C PHASE

2) NEUTRAL WIRE: WHITE OUTER COVERING THROUGHOUT. EQUIPMENT GROUND WIRE: GREEN OUTER COVERING THROUGHOUT.

3) WHERE COLOR-CODED CABLE IS NOT AVAILABLE, CERTIFY IN WRITING AND REQUEST PERMISSION TO OVERLAP CONDUCTORS WITH 6 IN. OF COLOR TAPING IN ACCESSIBLE LOCATIONS.

G. PROVIDE FLAMEPROOF LINEN OR FIBER TAGS IN ACCESSIBLE LOCATIONS. FOR FEEDERS INDICATE FEEDER NUMBER, SIZE, POINT OF ORIGIN AND TERMINATION AND PHASE. FOR CONTROL AND ALARM WIRING INDICATE TYPE (CONTROL OR ALARM), SIZE OF WIRE, AND POINTS OF ORIGIN AND TERMINATIONS.

H. TERMINATIONS, SPLICES AND TAPS UNDER 600 VOLTS: COPPER CONDUCTORS NO. 10 AND SMALLER: COMPRESSION-TYPE OF TWIST-ON SPRING-LOADED CONNECTORS AND CLEAR NYLON-INSULATED COVERING. COPPER CONDUCTORS NO. 8 AND LARGER: MECHANICAL BOLTED PRESSURE OR HYDRAULIC COMPRESSION TYPE USING MANUFACTURER'S RECOMMENDED TOOLING. CABLE LUGS AND CONNECTORS: COMPRESSION TYPE OF SAME METAL AS CONDUCTOR.

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No.	Date	Description
1	10/21/2013	PROGRESS-80% CD

ISSUE

PROJECT

Trumbull Board of Education
Generator

-

DRAWING TITLE

ELECTRICAL
SPECIFICATIONS SHEET 1 OF 3

Drawn By	dwn	Drawing No.
Checked By	chk	E-200
Date	10/15/2013	
Scale	NONE	
Project No.	S130021-000	

I. LEAVE WIRES WITH SUFFICIENT SLACK TO PERMIT MAKING FINAL CONNECTIONS.

J. PERFORM CONTINUITY AND INSULATION TESTS. MEGGER TEST 100 PERCENT OF FEEDERS AND ALL MOTOR BRANCH CIRCUITS OVER 25 HP.

K. PERFORM TESTS PRIOR TO CONNECTING EQUIPMENT AND IN PRESENCE OF AUTHORIZED REPRESENTATIVES. SUBMIT WRITTEN REPORT OF RESULTS. CORRECT OR REPLACE CABLE TESTING BELOW MANUFACTURER'S STANDARDS.

10. GROUNDING SYSTEM

A. GROUND OUTDOOR EMERGENCY GENERATOR SET, SERVICE, EQUIPMENT AND SYSTEMS NOTED.

B. SUBMIT SHOP DRAWINGS FOR ALL EQUIPMENT PROVIDED.

C. CONDUCTORS: COPPER AS FOLLOWS:

1) SERVICE: INSULATED, 25 PERCENT OF SERVICE CAPACITY, MAXIMUM 1-500 MCM PER SERVICE IN RIGID METALLIC CONDUIT.

2) OUTDOOR METALLIC EQUIPMENT AND HARDWARE: BARE NO. 1/0.

3) METALLIC RACEWAY CONTINUITY: BARE NO. 6.

D. GROUND CLAMPS: BRONZE, SOLDERLESS TYPE WITH BRONZE SCREWS, SUITABLE NOTED CONDUCTORS.

E. GROUND RODS:

1) 10 FT BY ? IN. DIAMETER SOLID COPPER.

F. SERVICE AND EQUIPMENT:

1) GROUND AS FOLLOWS:

a) NEUTRAL CONDUCTOR: THROUGH DISCONNECTING LINK AND GROUND TERMINAL TO WATER SERVICE GROUND CLAMPS, BUILDING STEEL AND DRIVEN GROUND RODS OR BUILDING STEEL.

b) NEUTRAL BUS TO GROUND BUS: AT BOTH ENDS AND GROUND BUS TO WATER SERVICE GROUND CLAMP AND DRIVEN GROUND RODS.

2) RUN INSULATED GROUND CONDUCTOR IN RIGID METALLIC CONDUIT WITH CONDUCTOR CONNECTED TO CONDUIT, THROUGH GROUND FITTING AT EACH END.

3) GROUND CABLE SHIELDING, SHEATHING AND SERVICE EQUIPMENT AT SERVICE ENTRANCE.

4) GROUND NON-CURRENT CARRYING METAL PARTS OF ELECTRICAL EQUIPMENT, RACEWAYS, BUSWAY ENCLOSURES, CONTROLLER ENCLOSURES AND MOTOR FRAMES AND OTHER ELECTRICAL EQUIPMENT.

G. TESTS: FOR GROUND CONTINUITY AT SWITCHBOARDS, AND PANELBOARDS. PROVIDE WRITTEN CERTIFICATION OF COMPLIANCE.

11. EMERGENCY GENERATOR

A. SUBMITTALS

1) PRODUCT DATA: FOR EACH TYPE OF PACKAGED ENGINE GENERATOR INDICATED. INCLUDE RATED CAPACITIES, OPERATING CHARACTERISTICS, AND FURNISHED SPECIALTIES AND ACCESSORIES. IN ADDITION, INCLUDE THE FOLLOWING:

a) THERMAL DAMAGE CURVE FOR GENERATOR.

b) TIME-CURRENT CHARACTERISTIC CURVES FOR GENERATOR PROTECTIVE DEVICE.

2) SHOP DRAWINGS: DETAIL EQUIPMENT ASSEMBLIES AND INDICATE DIMENSIONS, WEIGHTS, LOADS, REQUIRED CLEARANCES, METHOD OF FIELD ASSEMBLY, COMPONENTS, AND LOCATION AND SIZE OF EACH FIELD CONNECTION.

a) DIMENSIONED OUTLINE PLAN AND ELEVATION DRAWINGS OF ENGINE-GENERATOR SET AND OTHER COMPONENTS SPECIFIED.

b) DESIGN CALCULATIONS: SIGNED AND SEALED BY A QUALIFIED PROFESSIONAL ENGINEER. CALCULATE REQUIREMENTS FOR SELECTING VIBRATION ISOLATORS AND SEISMIC RESTRAINTS AND FOR DESIGNING VIBRATION ISOLATION BASES.

c) VIBRATION ISOLATION BASE DETAILS: SIGNED AND SEALED BY A QUALIFIED PROFESSIONAL ENGINEER. DETAIL FABRICATION, INCLUDING ANCHORAGES AND ATTACHMENTS TO STRUCTURE AND TO SUPPORTED EQUIPMENT. INCLUDE BASE WEIGHTS.

d) WIRING DIAGRAMS: POWER, SIGNAL, AND CONTROL WIRING.

3) MANUFACTURER SEISMIC QUALIFICATION CERTIFICATION: SUBMIT CERTIFICATION THAT SUB-BASE TANK, ENGINE-GENERATOR SET, BATTERIES, BATTERY RACKS, ACCESSORIES, AND COMPONENTS WILL WITHSTAND SEISMIC FORCES APPLICABLE TO THE AREA. INCLUDE THE FOLLOWING:

a) BASIS FOR CERTIFICATION: INDICATE WHETHER WITHSTAND CERTIFICATION IS BASED ON ACTUAL TEST OF ASSEMBLED COMPONENTS OR ON CALCULATION.

– THE TERM "WITHSTAND" MEANS "THE UNIT WILL REMAIN IN PLACE WITHOUT SEPARATION OF ANY PARTS FROM THE DEVICE WHEN SUBJECTED TO THE SEISMIC FORCES AND THE UNIT WILL BE FULLY OPERATIONAL AFTER THE SEISMIC EVENT."

b) DIMENSIONED OUTLINE DRAWINGS OF EQUIPMENT UNIT: IDENTIFY CENTER OF GRAVITY AND LOCATE AND DESCRIBE MOUNTING AND ANCHORAGE PROVISIONS.

c) DETAILED DESCRIPTION OF EQUIPMENT ANCHORAGE DEVICES ON WHICH THE CERTIFICATION IS BASED AND THEIR INSTALLATION REQUIREMENTS.

4) SOURCE QUALITY-CONTROL TEST REPORTS.

a) CERTIFIED SUMMARY OF PROTOTYPE-UNIT TEST REPORT.

b) CERTIFIED TEST REPORTS: FOR COMPONENTS AND ACCESSORIES THAT ARE EQUIVALENT, BUT NOT IDENTICAL, TO THOSE TESTED ON PROTOTYPE UNIT.

c) CERTIFIED SUMMARY OF PERFORMANCE TESTS: CERTIFY COMPLIANCE WITH SPECIFIED REQUIREMENT TO MEET PERFORMANCE CRITERIA FOR SENSITIVE LOADS.

d) REPORT OF FACTORY TEST ON UNITS TO BE SHIPPED FOR THIS PROJECT, SHOWING EVIDENCE OF COMPLIANCE WITH SPECIFIED REQUIREMENTS.

e) REPORT OF SOUND GENERATION.

f) REPORT OF EXHAUST EMISSIONS SHOWING COMPLIANCE WITH APPLICABLE REGULATIONS.

g) CERTIFIED TORSIONAL VIBRATION COMPATIBILITY: COMPLY WITH NFPA 110.

5) FIELD QUALITY-CONTROL TEST REPORTS.

6) OPERATION AND MAINTENANCE DATA: FOR PACKAGED ENGINE GENERATORS TO INCLUDE IN EMERGENCY, OPERATION, AND MAINTENANCE MANUALS. INCLUDE THE FOLLOWING:

a) LIST OF TOOLS AND REPLACEMENT ITEMS RECOMMENDED TO BE STORED AT PROJECT FOR READY ACCESS. INCLUDE PART AND DRAWING NUMBERS, CURRENT UNIT PRICES, AND SOURCE OF SUPPLY.

B. QUALITY ASSURANCE

1) INSTALLER QUALIFICATIONS: MANUFACTURER'S AUTHORIZED REPRESENTATIVE WHO IS TRAINED AND APPROVED FOR INSTALLATION OF UNITS REQUIRED FOR THIS PROJECT.

a) MAINTENANCE PROXIMITY: NOT MORE THAN FOUR HOURS' NORMAL TRAVEL TIME FROM INSTALLER'S PLACE OF BUSINESS TO PROJECT SITE.

b) ENGINEERING RESPONSIBILITY: PREPARATION OF DATA FOR VIBRATION ISOLATORS AND SEISMIC RESTRAINTS OF ENGINE SKID MOUNTS, INCLUDING SHOP DRAWINGS, BASED ON TESTING AND ENGINEERING ANALYSIS OF MANUFACTURER'S STANDARD UNITS IN ASSEMBLIES SIMILAR TO THOSE INDICATED FOR THIS PROJECT.

2) MANUFACTURER QUALIFICATIONS: A QUALIFIED MANUFACTURER. MAINTAIN, WITHIN 50 MILES OF PROJECT SITE, A SERVICE CENTER CAPABLE OF PROVIDING TRAINING, PARTS, AND EMERGENCY MAINTENANCE REPAIRS.

3) SOURCE LIMITATIONS: OBTAIN PACKAGED GENERATOR SETS AND AUXILIARY COMPONENTS THROUGH ONE SOURCE FROM A SINGLE MANUFACTURER.

4) ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, ARTICLE 100, BY A TESTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, AND MARKED FOR INTENDED USE.

5) COMPLY WITH ASME B15.1, NFPA 37, NFPA 70, NFPA 110 REQUIREMENTS FOR LEVEL 1 EMERGENCY POWER SUPPLY SYSTEM, UL 2200, AND NFPA 20 FOR FIRE PUMP.

6) ENGINE EXHAUST EMISSIONS: COMPLY WITH APPLICABLE STATE AND LOCAL GOVERNMENT REQUIREMENTS.

7) NOISE EMISSION: COMPLY WITH APPLICABLE STATE AND LOCAL GOVERNMENT REQUIREMENTS FOR MAXIMUM NOISE LEVEL DUE TO SOUND EMITTED BY GENERATOR SET INCLUDING ENGINE, ENGINE EXHAUST, ENGINE COOLING-AIR INTAKE AND DISCHARGE, AND OTHER COMPONENTS OF INSTALLATION.

C. PROJECT CONDITIONS:

1) ENVIRONMENTAL CONDITIONS: ENGINE-GENERATOR SYSTEM SHALL WITHSTAND THE FOLLOWING ENVIRONMENTAL CONDITIONS WITHOUT MECHANICAL OR ELECTRICAL DAMAGE OR DEGRADATION OF PERFORMANCE CAPABILITY:

a) AMBIENT TEMPERATURE: 5 TO 40 DEG C.

b) RELATIVE HUMIDITY: 0 TO 95 PERCENT.

c) ALTITUDE: SEA LEVEL TO 1000 FEET.

D. COORDINATION

1) SIZE AND LOCATION OF EXISTING CONCRETE PAD TO BE MODIFIED AND EXTENDED AS REQUIRED FOR PACKAGED ENGINE GENERATOR. CAST ANCHOR-BOLT INSERTS INTO PAD. CONCRETE TO BE 3000 PSI WITH REINFORCEMENT AS DETAILED ON DRAWINGS. FORM PAD EXTEND 12? AROUND ALL SIDES OF GENERATOR BASE.

E. WARRANTY

1) SPECIAL WARRANTY: MANUFACTURER'S STANDARD FORM IN WHICH MANUFACTURER AGREES TO REPAIR OR REPLACE COMPONENTS OF PACKAGED ENGINE GENERATORS AND ASSOCIATED AUXILIARY COMPONENTS THAT FAILS IN MATERIALS OR WORKMANSHIP WITHIN SPECIFIED WARRANTY PERIOD.

a) WARRANTY PERIOD: 5 YEARS FROM DATE OF SUBSTANTIAL COMPLETION.

F. MAINTENANCE SERVICE

1) INITIAL MAINTENANCE SERVICE: BEGINNING AT SUBSTANTIAL COMPLETION, PROVIDE 12 MONTHS' FULL MAINTENANCE BY SKILLED EMPLOYEES OF MANUFACTURER'S DESIGNATED SERVICE ORGANIZATION. INCLUDE QUARTERLY EXERCISING TO CHECK FOR PROPER STARTING, LOAD TRANSFER, AND RUNNING UNDER LOAD. INCLUDE ROUTINE PREVENTIVE MAINTENANCE AS RECOMMENDED BY MANUFACTURER AND ADJUSTING AS REQUIRED FOR PROPER OPERATION. PROVIDE PARTS AND SUPPLIES SAME AS THOSE USED IN THE MANUFACTURE AND INSTALLATION OF ORIGINAL EQUIPMENT.

G. EXTRA MATERIALS

1) FURNISH EXTRA MATERIALS DESCRIBED BELOW THAT MATCH PRODUCTS INSTALLED AND THAT ARE PACKAGED WITH PROTECTIVE COVERING FOR STORAGE AND IDENTIFIED WITH LABELS DESCRIBING CONTENTS.

a) FUSES: ONE FOR EVERY 10 OF EACH TYPE AND RATING, BUT NO FEWER THAN THREE OF EACH.

b) INDICATOR LAMPS: TWO FOR EVERY SIX OF EACH TYPE USED, BUT NO FEWER THAN TWO OF EACH.

c) FILTERS: ONE SET EACH OF LUBRICATING OIL, FUEL, AND COMBUSTION-AIR FILTERS.

H. ENGINE-GENERATOR SET

1) THE FACTORY ASSEMBLED AND TESTED ENGINE-GENERATOR SET SHALL BE A TIER-3 SERIES.

2) MOUNTING FRAME: MAINTAIN ALIGNMENT OF MOUNTED COMPONENTS WITHOUT DEPENDING ON CONCRETE FOUNDATION AND HAVE LIFTING ATTACHMENTS.

a) RIGGING DIAGRAM: INSCRIBED ON METAL PLATE PERMANENTLY ATTACHED TO MOUNTING FRAME TO INDICATE LOCATION AND LIFTING CAPACITY OF EACH LIFTING ATTACHMENT AND GENERATOR-SET CENTER OF GRAVITY.

3) CAPACITIES AND CHARACTERISTICS:

a) OUTPUT RATING: AS INDICATED ON DRAWINGS WITH STANDBY CAPACITY AT 0.8PF TO OPERATE AS A UNIT AS EVIDENCED BY RECORDS OF PROTOTYPE TESTING.

b) OUTPUT CONNECTIONS: WIRED FOR 120/208 VOLT, THREE-PHASE, FOUR-WIRE, 60 HERTZ.

c) ALTERNATOR: OVERSIZED, 4 POLE, REVOLVING FIELD TYPE, CLASS-H INSULATION, STANDBY TEMP RISE, THD AND TIF AS INDICATED ELSEWHERE HEREIN, SYNCHRONOUS BRUSHLESS EXCITATION, SINGLE SEALED CARTRIDGE BEARINGS, DIRECT FLEXIBLE DISC COUPLING, AND 100% LAD CAPACITY STANDBY.

d) NAMEPLATES: FOR EACH MAJOR SYSTEM COMPONENT TO IDENTIFY MANUFACTURER'S NAME AND ADDRESS, AND MODEL AND SERIAL NUMBER OF COMPONENT.

4) GENERATOR-SET PERFORMANCE:

a) STEADY-STATE VOLTAGE OPERATIONAL BANDWIDTH: LESS THAN 3 PERCENT OF RATED OUTPUT VOLTAGE FROM NO LOAD TO FULL LOAD.

b) TRANSIENT VOLTAGE PERFORMANCE: NOT MORE THAN 15 PERCENT VARIATION FOR 50 PERCENT STEP-LOAD INCREASE OR DECREASE. VOLTAGE SHALL RECOVER AND REMAIN WITHIN THE STEADY-STATE OPERATING BAND WITHIN THREE SECONDS.

c) STEADY-STATE FREQUENCY OPERATIONAL BANDWIDTH: 0.5 PERCENT OF RATED FREQUENCY FROM NO LOAD TO FULL LOAD.

d) STEADY-STATE FREQUENCY STABILITY: WHEN SYSTEM IS OPERATING AT ANY CONSTANT LOAD WITHIN THE RATED LOAD, THERE SHALL BE NO RANDOM SPEED VARIATIONS OUTSIDE THE STEADY-STATE OPERATIONAL BAND AND NO HUNTING OR SURGING OF SPEED.

e) TRANSIENT FREQUENCY PERFORMANCE: LESS THAN 5 PERCENT VARIATION FOR 50 PERCENT STEP-LOAD INCREASE OR DECREASE. FREQUENCY SHALL RECOVER AND REMAIN WITHIN THE STEADY-STATE OPERATING BAND WITHIN FIVE SECONDS.

f) OUTPUT WAVEFORM: AT NO LOAD, HARMONIC CONTENT MEASURED LINE TO LINE OR LINE TO NEUTRAL SHALL NOT EXCEED 5 PERCENT TOTAL AND 3 PERCENT FOR SINGLE HARMONICS. TELEPHONE INFLUENCE FACTOR, DETERMINED ACCORDING TO NEMA MG 1, SHALL BE LESS THAN 50 PERCENT.

g) SUSTAINED SHORT-CIRCUIT CURRENT: FOR A 3-PHASE, BOLTED SHORT CIRCUIT AT SYSTEM OUTPUT TERMINALS, SYSTEM SHALL SUPPLY A MINIMUM OF 250 PERCENT OF RATED FULL-LOAD CURRENT FOR NOT LESS THAN 10 SECONDS AND THEN CLEAR THE FAULT AUTOMATICALLY, WITHOUT DAMAGE TO GENERATOR SYSTEM COMPONENTS.

h) START TIME: COMPLY WITH NFPA 110, TYPE 10, SYSTEM REQUIREMENTS.

I. ENGINE

1) FUEL: ULTRA LOW SULFUR DIESEL IN ACCORD WITH STM SPECIFICATIONS.

2) RATED ENGINE SPEED: 1800 RPM.

3) HORSEPOWER AT RATED KW: 240 STANDBY/216 PRIME.

4) MAXIMUM PISTON SPEED: 1559 FPM.

5) CYLINDERS: 6 IN-LINE.

6) DISPLACEMENT: 6.7L (CU.IN.)

7) STROKE: 128 MM (5.2 IN).

8) COMPRESSION RATIO: 16.5:1

9) INTAKE AIR METHOD: TURBOCHARGED AFTERCOOLED.

10) LUBRICATION SYSTEM: THE FOLLOWING ITEMS ARE MOUNTED ON ENGINE OR SKID:

a) FILTER AND STRAINER: RATED TO REMOVE 90 PERCENT OF PARTICLES 5 MICROMETERS AND SMALLER WHILE PASSING FULL FLOW.

b) THERMOSTATIC CONTROL VALVE: CONTROL FLOW IN SYSTEM TO MAINTAIN OPTIMUM OIL TEMPERATURE. UNIT SHALL BE CAPABLE OF FULL FLOW AND IS DESIGNED TO BE FAIL-SAFE.

c) CRANKCASE DRAIN: ARRANGED FOR COMPLETE GRAVITY DRAINAGE TO AN EASILY REMOVABLE CONTAINER WITH NO DISASSEMBLY AND WITHOUT USE OF PUMPS, SIPHONS, SPECIAL TOOLS, OR APPLIANCES.

11) ENGINE FUEL SYSTEM:

a) FUEL PUMP: ENGINE DRIVEN GEARTO ENSURE ADEQUATE PRIMARY FUEL FLOW UNDER STARTING AND LOAD CONDITIONS.

b) RELIEF-BYPASS VALVE: AUTOMATICALLY REGULATES PRESSURE IN FUEL LINE AND RETURNS EXCESS FUEL TO SOURCE.

12) COOLANT JACKET BLOCK HEATER: ELECTRIC-IMMERSION TYPE, FACTORY INSTALLED IN COOLANT JACKET SYSTEM. COMPLY WITH NFPA 110 REQUIREMENTS FOR LEVEL 1 EQUIPMENT FOR HEATER CAPACITY.

13) GOVERNOR: ADJUSTABLE ELECTRONIC ISOCHRONOUS WITH SPEED SENSING, FREQUENCY REGULATION, NO-LOAD TO FULL-LOAD 0.50% AND STEADY STATE REGULATION +/- 0.25%.

14) COOLING SYSTEM: CLOSED LOOP RECOVERY, LIQUID COOLED, WITH RADIATOR FACTORY MOUNTED ON ENGINE-GENERATOR-SET MOUNTING FRAME AND INTEGRAL ENGINE-DRIVEN COOLANT PUMP.

a) COOLANT: SOLUTION OF 50 PERCENT ETHYLENE-GLYCOL-BASED ANTIFREEZE AND 50 PERCENT WATER, WITH ANTICORROSION ADDITIVES AS RECOMMENDED BY ENGINE MANUFACTURER.

b) SIZE OF RADIATOR: ADEQUATE TO CONTAIN EXPANSION OF TOTAL SYSTEM COOLANT FROM COLD START TO 110 PERCENT LOAD CONDITION.

c) EXPANSION TANK: CONSTRUCTED OF WELDED STEEL PLATE AND RATED TO WITHSTAND MAXIMUM CLOSED-LOOP COOLANT SYSTEM PRESSURE FOR ENGINE USED. EQUIP WITH GAGE GLASS AND PETCOCK.

d) TEMPERATURE CONTROL: SELF-CONTAINED, THERMOSTATIC-CONTROL VALVE MODULATES COOLANT FLOW AUTOMATICALLY TO MAINTAIN OPTIMUM CONSTANT COOLANT TEMPERATURE AS RECOMMENDED BY ENGINE MANUFACTURER.

e) COOLANT HOSE: FLEXIBLE ASSEMBLY WITH INSIDE SURFACE OF NONPOROUS RUBBER AND OUTER COVERING OF AGING-, ULTRAVIOLET-, AND ABRASION-RESISTANT FABRIC.

– RATING: 50-PSIG MAXIMUM WORKING PRESSURE WITH COOLANT AT 180 DEG F, AND NONCOLLAPSIBLE UNDER VACUUM.

– END FITTINGS: FLANGES OR STEEL PIPE NIPPLES WITH CLAMPS TO SUIT PIPING AND EQUIPMENT CONNECTIONS.

15) MUFFLER/SILENCER: CRITICAL TYPE, MOUNTED WITHIN TOP DISCHARGE AIR SECTION OF ENCLOSURE, SIZED AS RECOMMENDED BY ENGINE MANUFACTURER AND SELECTED WITH EXHAUST PIPING SYSTEM TO NOT EXCEED ENGINE MANUFACTURER'S ENGINE BACKPRESSURE REQUIREMENTS.

16) AIR-INTAKE FILTER: HEAVY-DUTY, ENGINE-MOUNTED AIR CLEANER WITH REPLACEABLE DRY-FILTER ELEMENT AND "BLOCKED FILTER" INDICATOR.

17) STARTING SYSTEM: 12-VDC ELECTRIC WITH NEGATIVE GROUND POLARITY.

a) CRANKING MOTOR: HEAVY-DUTY UNIT THAT AUTOMATICALLY ENGAGES AND RELEASES FROM ENGINE FLYWHEEL WITHOUT BINDING.

b) CRANKING CYCLE: AS REQUIRED BY NFPA 110 FOR SYSTEM LEVEL SPECIFIED.

c) BATTERY: 110AH CAPACITY AT 0°C TO PROVIDE 995CCA WITHOUT RECHARGING.

d) BATTERY CABLE: SIZE AS RECOMMENDED BY ENGINE MANUFACTURER FOR CABLE LENGTH INDICATED. INCLUDE REQUIRED INTERCONNECTING CONDUCTORS AND CONNECTION ACCESSORIES.

e) BATTERY-CHARGING ALTERNATOR: FACTORY MOUNTED ON ENGINE WITH SOLID-STATE VOLTAGE REGULATION AND 35-A MINIMUM CONTINUOUS RATING.

f) BATTERY CHARGER: CURRENT-LIMITING, AUTOMATIC-EQUALIZING AND FLOAT-CHARGING TYPE. UNIT SHALL COMPLY WITH UL 1236 AND INCLUDE THE FOLLOWING FEATURES:

– OPERATION: EQUALIZING-CHARGING RATE OF 10 A SHALL BE INITIATED AUTOMATICALLY AFTER BATTERY HAS LOST CHARGE UNTIL AN ADJUSTABLE EQUALIZING VOLTAGE IS ACHIEVED AT BATTERY TERMINALS. UNIT SHALL THEN BE AUTOMATICALLY SWITCHED TO A LOWER FLOAT-CHARGING MODE AND SHALL CONTINUE TO OPERATE IN THAT MODE UNTIL BATTERY IS DISCHARGED AGAIN.

– AUTOMATIC TEMPERATURE COMPENSATION: ADJUST FLOAT AND EQUALIZE VOLTAGES FOR VARIATIONS IN AMBIENT TEMPERATURE FROM MINUS 40 DEG C TO PLUS 60 DEG C TO PREVENT OVERCHARGING AT HIGH TEMPERATURES AND UNDERCHARGING AT LOW TEMPERATURES.

– AUTOMATIC VOLTAGE REGULATION: MAINTAIN CONSTANT OUTPUT VOLTAGE REGARDLESS OF INPUT VOLTAGE VARIATIONS UP TO PLUS OR MINUS 10 PERCENT.

– AMMETER AND VOLTMETER: FLUSH MOUNTED IN DOOR. METERS SHALL INDICATE CHARGING RATES.

– SAFETY FUNCTIONS: SENSE ABNORMALLY LOW BATTERY VOLTAGE AND CLOSE CONTACTS PROVIDING LOW BATTERY VOLTAGE INDICATION ON CONTROL AND MONITORING PANEL. SENSE HIGH BATTERY VOLTAGE AND LOSS OF AC INPUT OR DC OUTPUT OF BATTERY CHARGER. EITHER CONDITION SHALL CLOSE CONTACTS THAT PROVIDE A BATTERY-CHARGER MALFUNCTION INDICATION AT SYSTEM CONTROL AND MONITORING PANEL.

– MOUNTING: IN GENERATOR SET CONTROL PANEL.

J. FUEL OIL STORAGE

1) COMPLY WITH NFPA 30.

2) SUB-BASE DAY TANK: COMPLY WITH UL 142, FUEL TANK ASSEMBLY, WITH INTEGRAL, FLOAT-CONTROLLED TRANSFER PUMP AND THE FOLLOWING FEATURES:

a) CONTAINMENT: INTEGRAL RUPTURE BASIN WITH A CAPACITY OF 110 PERCENT OF NOMINAL CAPACITY OF DAY TANK.

b) LEAK DETECTOR: LOCATE IN RUPTURE BASIN AND CONNECT TO PROVIDE AUDIBLE AND VISUAL ALARM IN THE EVENT OF DAY-TANK LEAK.

c) TANK CAPACITY: SIZED FOR 24 HOURS OF FULL LOAD RUNTIME OPERATION. UNDER AN ALTERNATE PRICE, STATE THE NET COST DIFFERENCE FOR PROVISIONS OF TANK SIZED FOR 48 HOURS OF RUNTIME.

d) PUMP CAPACITY: EXCEEDS MAXIMUM FLOW OF FUEL DRAWN BY ENGINE-MOUNTED FUEL SUPPLY PUMP AT 110 PERCENT OF RATED CAPACITY, INCLUDING FUEL RETURNED FROM ENGINE.

e) LOW-LEVEL ALARM SENSOR: LIQUID-LEVEL DEVICE OPERATES ALARM CONTACTS AT 25 PERCENT OF NORMAL FUEL LEVEL.

f) HIGH-LEVEL ALARM SENSOR: LIQUID-LEVEL DEVICE OPERATES ALARM AND REDUNDANT FUEL SHUTOFF CONTACTS AT MIDPOINT BETWEEN OVERFLOW LEVEL AND 100 PERCENT OF NORMAL FUEL LEVEL.

g) REDUNDANT HIGH-LEVEL FUEL SHUTOFF: ACTUATED BY HIGH-LEVEL ALARM SENSOR IN DAY TANK TO OPERATE A SEPARATE MOTOR DEVICE THAT DISCONNECTS DAY-TANK PUMP MOTOR. SENSOR SHALL SIGNAL SOLENOID VALVE, LOCATED IN FUEL SUCTION LINE BETWEEN FUEL STORAGE TANK AND DAY TANK, TO CLOSE. BOTH ACTIONS SHALL REMAIN IN SHUTOFF STATE UNTIL MANUALLY RESET. SHUTOFF ACTION SHALL INITIATE AN ALARM SIGNAL TO CONTROL PANEL BUT SHALL NOT SHUT DOWN ENGINE-GENERATOR SET.

h) ACCESSORIES: FUEL FILL EXTENSION KIT AND EMERGENCY VENT.

K. SOUND ATTENUATED OUTDOOR ENCLOSURE

1) DESCRIPTION: PREFABRICATED OR PRE-ENGINEERED REACH-IN ENCLOSURE WITH THE FOLLOWING FEATURES:

a) CONSTRUCTION: UNDER AN ALTERNATE PRICE STATE THE NET COST DIFFERENCE FOR ALUMINUM CONSTRUCTION.

b) STRUCTURAL DESIGN AND ANCHORAGE: COMPLY WITH ASCE 7 FOR WIND LOADS.

c) LOUVERS: EQUIPPED WITH SOUND ATTENUATION, BIRD SCREEN, AND FILTER ARRANGED TO PERMIT AIR CIRCULATION WHEN ENGINE IS NOT RUNNING WHILE EXCLUDING EXTERIOR DUST, BIRDS, AND RODENTS.

d) HINGED DOORS: WITH PADLOCKING PROVISIONS.

e) VENTILATION: LOUVERS EQUIPPED WITH BIRD SCREEN AND FILTER ARRANGED TO PERMIT AIR CIRCULATION WHILE EXCLUDING EXTERIOR DUST, BIRDS, AND RODENTS.

f) THERMAL INSULATION: MANUFACTURER'S STANDARD MATERIALS AND THICKNESS SELECTED TO MAINTAIN WINTER INTERIOR TEMPERATURE WITHIN OPERATING LIMITS REQUIRED BY ENGINE-GENERATOR-SET COMPONENTS.

g) RECEPTACLE OUTLETS: ONE 120V, 20A, GFCI AND ONE 250V, 15A ON GENSET WITHIN ENCLOSURE.

2) ENGINE COOLING AIRFLOW THROUGH TOP-DISCHARGE SECTION OF ENCLOSURE: MAINTAIN TEMPERATURE RISE OF SYSTEM COMPONENTS WITHIN REQUIRED LIMITS WHEN UNIT OPERATES AT 100 PERCENT OF RATED LOAD FOR 2 HOURS WITH AMBIENT TEMPERATURE AT TOP OF RANGE SPECIFIED IN SYSTEM SERVICE CONDITIONS.

a) LOUVERS: FIXED-ENGINE, COOLING-AIR INLET AND DISCHARGE. STORM-PROOF AND DRAINABLE LOUVERS PREVENT ENTRY OF RAIN AND SNOW.

3) SOUND ATTENUATION LEVEL-1: PERFORMANCE TESTED TO ACHIEVE 81.0 dBA (AVERAGE) IN ALL POSITIONS AT 23 FEET (7M) FROM SIDE FACES OF GENERATOR SET. UNDER AN ALTERNATE PRICE, STATE THE NET COST DIFFERENCE FOR PROVISIONS OF A LEVEL-2 ENCLOSURE TO ACHIEVE 77.7 dBA (AVERAGE).

L. CONTROL AND MONITORING

1) AUTOMATIC STARTING SYSTEM SEQUENCE OF OPERATION: WHEN MODE-SELECTOR SWITCH ON THE CONTROL AND MONITORING PANEL IS IN THE AUTOMATIC POSITION, REMOTE-CONTROL CONTACTS IN ONE OR MORE SEPARATE AUTOMATIC TRANSFER SWITCHES INITIATE STARTING AND STOPPING OF GENERATOR SET. WHEN MODE-SELECTOR SWITCH IS SWITCHED TO THE ON POSITION, GENERATOR SET STARTS. THE OFF POSITION OF SAME SWITCH INITIATES GENERATOR-SET SHUTDOWN. WHEN GENERATOR SET IS RUNNING, SPECIFIED SYSTEM OR EQUIPMENT FAILURES OR DERANGEMENTS AUTOMATICALLY SHUT DOWN GENERATOR SET AND INITIATE ALARMS. OPERATION OF A REMOTE EMERGENCY-STOP SWITCH ALSO SHUTS DOWN GENERATOR SET.

2) MANUAL STARTING SYSTEM SEQUENCE OF OPERATION: SWITCHING ON-OFF SWITCH ON THE GENERATOR CONTROL PANEL TO THE ON POSITION STARTS GENERATOR SET. THE OFF POSITION OF SAME SWITCH INITIATES GENERATOR-SET SHUTDOWN. WHEN GENERATOR SET IS RUNNING, SPECIFIED SYSTEM OR EQUIPMENT FAILURES OR DERANGEMENTS AUTOMATICALLY SHUT DOWN GENERATOR SET AND INITIATE ALARMS. OPERATION OF A REMOTE EMERGENCY-STOP SWITCH ALSO SHUTS DOWN GENERATOR SET.

3) CONFIGURATION: OPERATING AND SAFETY INDICATIONS, PROTECTIVE DEVICES, BASIC SYSTEM CONTROLS, AND ENGINE GAGES SHALL BE GROUPED IN A COMMON CONTROL AND MONITORING PANEL MOUNTED ON THE GENERATOR SET. MOUNTING METHOD SHALL ISOLATE THE CONTROL PANEL FROM GENERATOR-SET VIBRATION.

a) CONTROL PANEL: DIGITAL MICROPROCESSOR DESIGN, MEETS NFPA 99 AND 110 REQUIREMENTS. TWO 4 LINE X 20 DISPLAYS, FULL SYSTEM STATUS, TEMP RANGE – 40°C TO 70°C, PROGRAMMABLE CRANK LIMITER, 7-DAY PROGRAMMABLE EXERCISOR, ALL PHASE SENSING SERVICE REMINDERS, TRENDING, FAULT HISTORY, 12T FUNCTION FOR GENERATOR PROTECTION ATS MONITORING AND CONTROL, AND REGULATION AS INDICATED ELSEWHERE HEREIN.

b) WALL-MOUNTING CABINET CONSTRUCTION: RIGID, SELF-SUPPORTING STEEL UNIT COMPLYING WITH NEMA ICS 6. POWER BUS SHALL BE COPPER. BUS, BUS SUPPORTS, CONTROL WIRING, AND TEMPERATURE RISE SHALL COMPLY WITH UL 891.

c) CURRENT AND POTENTIAL TRANSFORMERS: INSTRUMENT ACCURACY CLASS.

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PROJECT

Trumbull Board of Education
Generator

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DRAWING TITLE

ELECTRICAL SPECIFICATIONS SHEET 2 OF 3

Drawn By	dwn
Checked By	chk
Date	10/15/2013
Scale	NONE
Project No.	S130021-000

Drawing No. E-201

SAVE DATE: 10/21/2013 9:33 AM
PLOT DATE: 10/21/2013 10:53 AM
LOGIN: Bowman, Kiron
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4) INDICATING AND PROTECTIVE DEVICES AND CONTROLS: AS REQUIRED BY NFPA 110 FOR LEVEL 1 SYSTEM, AND THE FOLLOWING:

a) AC VOLTMETER.

b) AC AMMETER.

c) AC FREQUENCY METER.

d) DC VOLTMETER (ALTERNATOR BATTERY CHARGING).

e) ENGINE–COOLANT TEMPERATURE GAGE.

f) ENGINE LUBRICATING–OIL PRESSURE GAGE.

g) RUNNING–TIME METER.

h) AMMETER–VOLTMETER, PHASE–SELECTOR SWITCH(ES).

i) GENERATOR–VOLTAGE ADJUSTING RHEOSTAT.

j) FUEL TANK DERANGEMENT ALARM.

k) FUEL TANK HIGH–LEVEL SHUTDOWN OF FUEL SUPPLY ALARM.

l) GENERATOR OVERLOAD.

5) SUPPORTING ITEMS: INCLUDE SENSORS, TRANSDUCERS, TERMINALS, RELAYS, AND OTHER DEVICES AND INCLUDE WIRING REQUIRED TO SUPPORT SPECIFIED ITEMS. LOCATE SENSORS AND OTHER SUPPORTING ITEMS ON ENGINE OR GENERATOR, UNLESS OTHERWISE INDICATED.

6) REMOTE EMERGENCY STOP SWITCH: OUTDOOR RATED RED MUSHROOM STYLE BUTTON WITH LABELING IN WEATHERPROOF SURFACE MOUNTED BOX.

7) COMMON REMOTE AUDIBLE ALARM: SIGNAL THE OCCURRENCE OF ANY EVENTS LISTED BELOW WITHOUT DIFFERENTIATING BETWEEN EVENT TYPES. CONNECT SO THAT AFTER AN ALARM IS SILENCED, CLEARING OF INITIATING CONDITION WILL REACTIVATE ALARM UNTIL SILENCING SWITCH IS RESET.

a) ENGINE HIGH–TEMPERATURE SHUTDOWN.

b) LUBE–OIL, LOW–PRESSURE SHUTDOWN.

c) OVERSPEED SHUTDOWN.

d) REMOTE EMERGENCY–STOP SHUTDOWN.

e) ENGINE HIGH–TEMPERATURE PREALARM.

f) LUBE–OIL, LOW–PRESSURE PREALARM.

g) FUEL TANK, LOW–FUEL LEVEL.

h) LOW COOLANT LEVEL.

8) REMOTE COMMUNICATIONS: MODEM INSTALLED WITH RS232.RS485 AND CAN BUS PORTS.

9) GENERATOR OVERCURRENT AND FAULT PROTECTION:

a) GENERATOR CIRCUIT BREAKERS: MOLDED–CASE, COMPLYING WITH UL 489 OF TYPE NOTED IN OTHER SECTION OF SPECIFICATIONS AND OF QUANTITY/SIZE INDICATED ON DRAWINGS.

– TRIPPING CHARACTERISTICS: ADJUSTABLE LONG–TIME, SHORT–TIME, AND INSTANTANEOUS.

– TRIP SETTINGS: SELECTED TO COORDINATE WITH GENERATOR THERMAL DAMAGE CURVE AND DOWNSTREAM GENERATOR DISTRIBUTION PANELBOARD CIRCUIT BREAKERS.

– SHUNT TRIP: CONNECTED TO TRIP BREAKER WHEN GENERATOR SET IS SHUT DOWN BY OTHER PROTECTIVE DEVICES.

– MOUNTING: IN HIGH VOLTAGE CONNECTION BOX ON GENSET WITHIN ENCLOSURE.

10) GENERATOR, EXCITER, AND VOLTAGE REGULATOR

a) COMPLY WITH NEMA MG 1.

b) DRIVE: GENERATOR SHAFT SHALL BE DIRECTLY CONNECTED TO ENGINE SHAFT. EXCITER SHALL BE ROTATED INTEGRALLY WITH GENERATOR ROTOR. ELECTRICAL INSULATION: CLASS H OR CLASS F.

c) STATOR–WINDING LEADS: BROUGHT OUT TO TERMINAL BOX TO PERMIT FUTURE RECONNECTION FOR OTHER VOLTAGES IF REQUIRED.

d) CONSTRUCTION SHALL PREVENT MECHANICAL, ELECTRICAL, AND THERMAL DAMAGE DUE TO VIBRATION, OVERSPEED UP TO 125 PERCENT OF RATING, AND HEAT DURING OPERATION AT 110 PERCENT OF RATED CAPACITY.

e) ENCLOSURE: DRIPPROOF.

f) INSTRUMENT TRANSFORMERS: MOUNTED WITHIN GENERATOR ENCLOSURE.

g) VOLTAGE REGULATOR: SOLID–STATE TYPE, SEPARATE FROM EXCITER, PROVIDING PERFORMANCE AS SPECIFIED.

– ADJUSTING RHEOSTAT ON CONTROL AND MONITORING PANEL SHALL PROVIDE PLUS OR MINUS 5 PERCENT ADJUSTMENT OF OUTPUT–VOLTAGE OPERATING BAND.

h) WINDINGS: TWO–THIRDS PITCH STATOR WINDING AND FULLY LINKED AMORTISSEUR WINDING.

i) SUBTRANSIENT REACTANCE: 15 PERCENT, MAXIMUM.

11) VIBRATION ISOLATION DEVICES

a) RESTRAINED SPRING ISOLATORS: FREESTANDING, STEEL, OPEN–SPRING ISOLATORS WITH SEISMIC RESTRAINT.

– HOUSING: STEEL WITH RESILIENT VERTICAL–LIMIT STOPS TO PREVENT SPRING EXTENSION DUE TO WIND LOADS OR IF WEIGHT IS REMOVED; FACTORY–DRILLED BASEPLATE BONDED TO 1/4–INCH– THICK, ELASTOMERIC ISOLATOR PAD ATTACHED TO BASEPLATE UNDERSIDE; AND ADJUSTABLE EQUIPMENT MOUNTING AND LEVELING BOLT THAT ACTS AS BLOCKING DURING INSTALLATION.

– OUTSIDE SPRING DIAMETER: NOT LESS THAN 80 PERCENT OF COMPRESSED HEIGHT OF THE SPRING AT RATED LOAD.

– MINIMUM ADDITIONAL TRAVEL: 50 PERCENT OF REQUIRED DEFLECTION AT RATED LOAD.

– LATERAL STIFFNESS: MORE THAN 80 PERCENT OF RATED VERTICAL STIFFNESS.

– OVERLOAD CAPACITY: SUPPORT 200 PERCENT OF RATED LOAD, FULLY COMPRESSED, WITHOUT DEFORMATION OR FAILURE.

12) FINISHES

a) MANUFACTURER'S STANDARD FINISH OVER CORROSION–RESISTANT PRETREATMENT AND COMPATIBLE PRIMER.

13) SOURCE QUALITY CONTROL

a) PROTOTYPE TESTING: FACTORY TEST ENGINE–GENERATOR SET USING SAME ENGINE MODEL, CONSTRUCTED OF IDENTICAL OR EQUIVALENT COMPONENTS AND EQUIPPED WITH IDENTICAL OR EQUIVALENT ACCESSORIES.

– TESTS: COMPLY WITH NFPA 110, LEVEL 1 ENERGY CONVERTERS AND WITH IEEE 115.

b) PROJECT–SPECIFIC EQUIPMENT TESTS: BEFORE SHIPMENT, FACTORY TEST ENGINE–GENERATOR SET AND OTHER SYSTEM COMPONENTS AND ACCESSORIES MANUFACTURED SPECIFICALLY FOR THIS PROJECT. PERFORM TESTS AT RATED LOAD AND POWER FACTOR. INCLUDE THE FOLLOWING TESTS:

– TEST COMPONENTS AND ACCESSORIES FURNISHED WITH INSTALLED UNIT THAT ARE NOT IDENTICAL TO THOSE ON TESTED PROTOTYPE TO DEMONSTRATE COMPATIBILITY AND RELIABILITY.

– FULL LOAD RUN.

– MAXIMUM POWER.

– VOLTAGE REGULATION.

– TRANSIENT AND STEADY–STATE GOVERNING.

– SINGLE–STEP LOAD PICKUP.

– SAFETY SHUTDOWN.

– PROVIDE 14 DAYS' ADVANCE NOTICE OF TESTS AND OPPORTUNITY FOR OBSERVATION OF TESTS BY OWNER'S REPRESENTATIVE.

– REPORT FACTORY TEST RESULTS WITHIN 10 DAYS OF COMPLETION OF TEST.

M. EXAMINATION

1) EXAMINE AREAS, EQUIPMENT BASES, AND CONDITIONS, WITH INSTALLER PRESENT, FOR COMPLIANCE WITH REQUIREMENTS FOR INSTALLATION AND OTHER CONDITIONS AFFECTING PACKAGED ENGINE–GENERATOR PERFORMANCE.

2) EXAMINE ROUGHING–IN OF PIPING SYSTEMS AND ELECTRICAL CONNECTIONS. VERIFY ACTUAL LOCATIONS OF CONNECTIONS BEFORE PACKAGED ENGINE–GENERATOR INSTALLATION.

3) PROCEED WITH INSTALLATION ONLY AFTER UNSATISFACTORY CONDITIONS HAVE BEEN CORRECTED.

N. INSTALLATION

1) COMPLY WITH PACKAGED ENGINE–GENERATOR MANUFACTURERS' WRITTEN INSTALLATION AND ALIGNMENT INSTRUCTIONS AND WITH NFPA 110.

2) INSTALL PACKAGED ENGINE GENERATOR TO PROVIDE ACCESS, WITHOUT REMOVING CONNECTIONS OR ACCESSORIES, FOR PERIODIC MAINTENANCE.

3) INSTALL PACKAGED ENGINE GENERATOR WITH RESTRAINED SPRING ISOLATORS HAVING A MINIMUM DEFLECTION OF 1 INCH ON 4–INCH– HIGH CONCRETE PAD. SECURE SET TO ANCHOR BOLTS INSTALLED IN CONCRETE BASES.

4) INSTALL PACKAGED ENGINE GENERATOR SO BOTTOM IS CLOSED TO PREVENT PEST INTRUSION AND RECIRCULATION OF DISCHARGE AIR AND/OR IMPROPER COOLING AIR FLOW.

5) ELECTRICAL WIRING: INSTALL ELECTRICAL DEVICES FURNISHED BY EQUIPMENT MANUFACTURERS BUT NOT SPECIFIED TO BE FACTORY MOUNTED.

O. CONNECTIONS

1) COORDINATE FUEL, COOLING–SYSTEM, AND EXHAUST–SYSTEM PIPING CONNECTIONS TO PACKAGED ENGINE GENERATOR TO ALLOW SERVICE AND MAINTENANCE.

2) CONNECT ENGINE EXHAUST PIPE TO ENGINE WITH FLEXIBLE CONNECTOR.

3) GROUND EQUIPMENT ACCORDING TO OTHER SECTIONS HEREIN AND AS SHOWN ON DRAWINGS.

4) CONNECT WIRING ACCORDING TO OTHER SECTIONS HEREIN AND AS SHOWN ON DRAWINGS.

P. IDENTIFICATION

1) IDENTIFY SYSTEM COMPONENTS ACCORDING TO OTHER SECTIONS HEREIN AND AS SHOWN ON DRAWINGS.

Q. FIELD QUALITY CONTROL

1) PERFORM TESTS AND INSPECTIONS AND PREPARE TEST REPORTS.

a) MANUFACTURER'S FIELD SERVICE: ENGAGE A FACTORY–AUTHORIZED SERVICE REPRESENTATIVE TO INSPECT COMPONENTS, ASSEMBLIES, AND EQUIPMENT INSTALLATIONS, INCLUDING CONNECTIONS, AND TO ASSIST IN TESTING.

2) TESTS AND INSPECTIONS:

a) PERFORM TESTS RECOMMENDED BY MANUFACTURER AND EACH ELECTRICAL TEST AND VISUAL AND MECHANICAL INSPECTION (EXCEPT THOSE INDICATED TO BE OPTIONAL) FOR "AC GENERATORS AND FOR EMERGENCY SYSTEMS" SPECIFIED IN NETA ACCEPTANCE TESTING SPECIFICATION. CERTIFY COMPLIANCE WITH TEST PARAMETERS.

b) PERFORM BUILDING LOAD TEST AFTER THE INSTALLATION OF SET IS INSTALLED.

c) BATTERY TESTS: EQUALIZE CHARGING OF BATTERY CELLS ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS. RECORD INDIVIDUAL CELL VOLTAGES.

– MEASURE CHARGING VOLTAGE AND VOLTAGES BETWEEN AVAILABLE BATTERY TERMINALS FOR FULL–CHARGING AND FLOAT–CHARGING CONDITIONS. CHECK ELECTROLYTE LEVEL AND SPECIFIC GRAVITY UNDER BOTH CONDITIONS.

– TEST FOR CONTACT INTEGRITY OF ALL CONNECTORS. PERFORM AN INTEGRITY LOAD TEST AND A CAPACITY LOAD TEST FOR THE BATTERY.

– VERIFY ACCEPTANCE OF CHARGE FOR EACH ELEMENT OF THE BATTERY AFTER DISCHARGE.

– VERIFY THAT MEASUREMENTS ARE WITHIN MANUFACTURER'S SPECIFICATIONS.

d) BATTERY–CHARGER TESTS: VERIFY SPECIFIED RATES OF CHARGE FOR BOTH EQUALIZING AND FLOAT–CHARGING CONDITIONS.

e) SYSTEM INTEGRITY TESTS: METHODICALLY VERIFY PROPER INSTALLATION, CONNECTION, AND INTEGRITY OF EACH ELEMENT OF ENGINE–GENERATOR SYSTEM BEFORE AND DURING SYSTEM OPERATION. CHECK FOR AIR, EXHAUST, AND FLUID LEAKS.

f) EXHAUST EMISSIONS TEST: COMPLY WITH APPLICABLE STATE AND LOCAL GOVERNMENT TEST CRITERIA.

3) COORDINATE TESTS WITH TESTS FOR TRANSFER SWITCHES AND RUN THEM CONCURRENTLY.

4) LEAK TEST: AFTER INSTALLATION, CHARGE SYSTEM AND TEST FOR LEAKS. REPAIR LEAKS AND RETEST UNTIL NO LEAKS EXIST.

5) OPERATIONAL TEST: AFTER ELECTRICAL CIRCUITRY HAS BEEN ENERGIZED, START UNITS TO CONFIRM PROPER MOTOR ROTATION AND UNIT OPERATION.

6) TEST AND ADJUST CONTROLS AND SAFETIES. REPLACE DAMAGED AND MALFUNCTIONING CONTROLS AND EQUIPMENT.

7) REMOVE AND REPLACE MALFUNCTIONING UNITS AND RETEST AS SPECIFIED ABOVE.

8) RETEST: CORRECT DEFICIENCIES IDENTIFIED BY TESTS AND OBSERVATIONS AND RETEST UNTIL SPECIFIED REQUIREMENTS ARE MET.

9) REPORT RESULTS OF TESTS AND INSPECTIONS IN WRITING. RECORD ADJUSTABLE RELAY SETTINGS AND MEASURED INSULATION RESISTANCES, TIME DELAYS, AND OTHER VALUES AND OBSERVATIONS. ATTACH A LABEL OR TAG TO EACH TESTED COMPONENT INDICATING SATISFACTORY COMPLETION OF TESTS.

10) INFRARED SCANNING: AFTER SUBSTANTIAL COMPLETION, BUT NOT MORE THAN 60 DAYS AFTER FINAL ACCEPTANCE, PERFORM AN INFRARED SCAN OF EACH POWER WIRING TERMINATION AND EACH BUS CONNECTION. REMOVE ALL ACCESS PANELS SO TERMINATIONS AND CONNECTIONS ARE ACCESSIBLE TO PORTABLE SCANNER.

a) FOLLOW–UP INFRARED SCANNING: PERFORM AN ADDITIONAL FOLLOW–UP INFRARED SCAN 11 MONTHS AFTER DATE OF SUBSTANTIAL COMPLETION.

b) INSTRUMENT: USE AN INFRARED SCANNING DEVICE DESIGNED TO MEASURE TEMPERATURE OR TO DETECT SIGNIFICANT DEVIATIONS FROM NORMAL VALUES. PROVIDE CALIBRATION RECORD FOR DEVICE.

c) RECORD OF INFRARED SCANNING: PREPARE A CERTIFIED REPORT THAT IDENTIFIES TERMINATIONS AND CONNECTIONS CHECKED AND THAT DESCRIBES SCANNING RESULTS. INCLUDE NOTATION OF DEFICIENCIES DETECTED, REMEDIAL ACTION TAKEN AND OBSERVATIONS AFTER REMEDIAL ACTION.

R. DEMONSTRATION

1) ENGAGE A FACTORY–AUTHORIZED SERVICE REPRESENTATIVE TO TRAIN OWNER'S MAINTENANCE PERSONNEL TO ADJUST, OPERATE, AND MAINTAIN PACKAGED ENGINE GENERATORS. REFER TO DIVISION 01 SECTION "DEMONSTRATION AND TRAINING."

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PROJECT

Trumbull Board of Education Generator

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DRAWING TITLE

ELECTRICAL SPECIFICATIONS SHEET 3 OF 3

Drawn By	dwn
Checked By	chk
Date	10/15/2013
Scale	NONE
Project No.	S130021–000

Drawing No. E-202

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