

GENERAL NOTES

- I. THE GROUND CONDUCTOR SHALL BE CONNECTED TO THE NEUTRAL IN ONLY TWO LOCATION - ON THE SUPPLY SIDE OF THE SERVICE DISCONNECT MEANS PER NEC-250-23 AND ON SEPARATELY DERIVED SYSTEMS PER NEC-250-26. BECAUSE THE GROUND IS LOST THROUGH THE TRANSFORMER, IT MUST BE RE-ESTABLISHED BY USE OF A GROUND CONDUCTOR, MINIMUM SIZE PER NEC TABLE 250-94 (A), CONNECTING THE TRANSFORMER SECONDARY NEUTRAL POINT TO THE TRANSFORMER ENCLOSURE AND TO THE INTERIOR COLD WATER SYSTEM OR TO BUILDING STRUCTURE GROUND.
- J. THE CONTRACTOR SHALL, IN THE PRESENCE OF THE ENGINEER, TEST ALL SYSTEM NEUTRALS TO PROVE THEY ARE FREE OF GROUND EXCEPT AT THE SOURCE.
- K. ALL CONDUITS ENTERING PANELBOARDS, SWITCHBOARDS, MOTOR CONTROL CENTERS, CONTROL PANELS, AND SIMILAR EQUIPMENT, OR EQUIPMENT ENCLOSURES SHALL BE EQUIPPED WITH LIQUID TIGHT HUBS (MEYERS HUBS OR T & B SERIES 401), BOTH OUTDOORS AND INDOORS, WHEN ENTERING FROM TOP OR SIDEWALLS.

25. HORIZONTAL UNIT HEATERS

- A. FURNISH AND INSTALL CHROMALOX TYPE LUH HORIZONTAL UNIT HEATERS, CATALOG NUMBER LUH-05-13, COMPLETE WITH INTEGRAL THERMOSTAT, CATALOG NUMBER LUH-TK1, AND WALL MOUNTING BRACKET, CATALOG NUMBER WUH-01 FOR OPERATION FROM A 460 VOLT, 3 PHASE, 3 WIRE, 60 HERTZ ELECTRICAL DISTRIBUTION SYSTEM. HEATER FAN SHALL HAVE BUILT IN 120V CONTROL TRANSFORMER, DUAL PRIMARY FUSES, HEATING CONTRACTOR WITH 120V COIL, TOTALLY ENCLOSED CONTINUOUS DUTY FAN, BUILT IN THERMAL OVERLOAD PROTECTION WHICH SHUTS DOWN CONTROL CIRCUIT AND HEATER POWER ON OVER TEMPERATURE OF UNIT. AIR FLOW SHALL BE DIRECTED BY ADJUSTABLE LOUVERS. FAN SHALL HAVE THERMAL OVERLOAD PROTECTOR. FAN BLADE SHALL BE GUARDED. HEATER SHALL BE UL LISTED AND MEET ALL REQUIREMENTS OF THE NATIONAL ELECTRIC CODE.
- B. PROVIDE AND INSTALL A FUSED DISCONNECT SWITCH, FUSED AT 10 AMPERES, RATED NEMA HEAVY DUTY, 480 VAC, 30, 3 POLE, 30 AMP., NEMA 1 ENCLOSURE, NEAR THE UNIT HEATERS AND FLEX CONNECT SWITCH TO HEATER. PROVIDE SUFFICIENT SLACK IN FLEX TO ENABLE ADJUSTMENT OF HEATER. PROVIDE GROUND WIRE BETWEEN HEATER AND A GROUNDING BUSHING INSTALLED ON THE CONDUIT FEEDING THE FUSED SWITCH.
- C. COMPARABLE UNITS BY SINGER AND BRYANT MEETING THESE SPECIFICATIONS ARE ACCEPTABLE.
- D. HEATER SHALL BE RATED 5 KW AT 480 VOLTS; 17,000 BTU/HR., WITH FAN HORIZONTAL FLOW OF 420 CFM AND 42°F TEMPERATURE RISE THROUGH HEATER.

26. POWER FACTOR CORRECTION CAPACITORS

- A. FURNISH AND INSTALL POWER FACTOR CORRECTION CAPACITOR ASSEMBLIES AT EACH MOTOR RATED OVER TWO (2) HORSEPOWER ON THE PROJECT, WHETHER SUCH MOTOR IS SUPPLIED BY THIS CONTRACTOR OR OTHERS.
- B. REDUCE THE VALUE OF ALL MOTOR STARTER OVERLOADS OR MOTOR RUNNING OVER LOAD PROTECTIVE DEVICES TO REFLECT THE REDUCED COMBINED MOTOR PLUS CAPACITOR CURRENTS. ADJUSTMENT SHALL BE IN ACCORDANCE WITH PUBLISHED REDUCTION FACTOR TABLES OR CONSULTATION WITH EQUIPMENT MOTOR MANUFACTURERS.
- C. CONTRACTOR SHALL PROVIDE ALL MISCELLANEOUS CABLE, LIQUID-TIGHT FLEXIBLE METAL CONDUIT, FITTINGS, CAPACITOR MOUNTING FRAMES AND MISCELLANEOUS HARDWARE REQUIRED TO MAKE A COMPLETE INSTALLATION.
- D. INSTALLATION AND EQUIPMENT SHALL BE IN PARTICULAR COMPLIANCE WITH ARTICLE 460, "CAPACITORS", OF THE NATIONAL ELECTRICAL CODE.
- E. MANUFACTURERS:

SPRAGUE
GENERAL ELECTRIC
WESTINGHOUSE
- F. CAPACITOR CONSTRUCTION

UNITS SHALL BE EITHER "WEATHERPROOF" OR OF DUAL RATED "INDOOR-OUTDOOR" CONSTRUCTION, HAVE A MINIMUM OF TWO CURRENT LIMITING FUSES OF THE "BLOWN FUSE INDICATOR" TYPE, AND HAVE INTERNAL DISCHARGE RESISTORS. INSULATING OIL SHALL NOT EXCEED THREE GALLONS TOTAL IN ANY SINGLE MOTOR CAPACITOR ASSEMBLY. UNITS SHALL BE METAL ENCLOSED WITH THE ENCLOSURE SOLIDLY GROUNDED. UNITS SHALL HAVE SNAP HELD COVERS FOR QUICK INSPECTION.

- G. CONTRACTOR SHALL CONSULT WITH A CAPACITOR ASSEMBLY VENDOR AND SUPPLY CAPACITOR UNITS THAT ARE APPROPRIATE FOR THE MOTOR AND ITS ASSOCIATED EQUIPMENT. IN PARTICULAR, THE KVAC RATING OF THE CAPACITOR UNIT SHALL BE CHOSEN AS APPROPRIATE FOR THE OPERATING VOLTAGE, NEMA MOTOR ENCLOSURE TYPE, NEMA MOTOR TYPE CODE, NEMA MOTOR DESIGN CODE, NUMBER OF MOTOR POLES (SPEED), STARTING TORQUE AND CURRENT CHARACTERISTICS, AND YEAR OF MANUFACTURE.

- H. CONTRACTOR SHALL DETERMINE FROM EQUIPMENT SUPPLIERS THE APPROPRIATE KVAC CAPACITOR RATINGS FOR ALL EQUIPMENT USING PROPRIETARY OR SPECIAL DESIGN MOTORS. DAMAGE TO EQUIPMENT CAUSED BY IMPROPERLY SIZED OR APPLIED CAPACITORS, SUCH AS SHEARED MOTOR OR EQUIPMENT SHAFTS OR PARTS, OR OVER VOLTAGE STRESSED INSULATION, SHALL BE REPAIRED OR REPLACED AT THIS CONTRACTOR'S EXPENSE AT NO ADDITIONAL COST TO OWNER.

- I. WHEN NOT CONTRAINDICATED BY THE EQUIPMENT MANUFACTURER, THE POWER FACTOR CAPACITOR ASSEMBLY SHALL BE SIZED TO PROVIDE FULL NEUTRALIZATION OF THE MOTOR NO LOAD MAGNETIZATION CURRENT. THE POWER FACTOR AT FULL LOAD SHALL NOT BE LESS THAN 95%. (EXCEPTION: WHERE STANDARD COMMERCIAL CAPACITORS OF THE REQUIRED VALUE ARE NOT MANUFACTURED.)

- J. DEFINITION KVAC - MEANS KILO VOLT AMPERES REACTIVE CAPACITIVE.

K. DATA REQUIREMENTS

- PRIOR TO CAPACITOR INSTALLATION OR PURCHASE, SUBMIT FOR OWNER'S APPROVAL A SCHEDULE OF ALL MOTORS, THEIR SPEED, VOLTAGE, NEMA ENCLOSURE, NEMA DESIGN TYPE, SPECIAL STARTING TORQUE OR CURRENT DATA, MOTOR NP, FLC, SERVICE FACTOR, HEATER CURRENT REDUCTION FACTORS AND CAPACITOR UNIT MODEL OR CATALOG NUMBER ASSOCIATED THEREWITH.
- SUBMIT CATALOG CUTS FOR ENGINEER'S APPROVAL OF ALL CAPACITORS TO BE USED ALONG WITH THE SCHEDULE REQUIRED IN PARAGRAPH A, ABOVE.
- SUBMIT TO THE ENGINEER FOR HIS INFORMATION COPIES OF ALL RELEVANT CORRESPONDENCE BETWEEN THE CONTRACTOR AND EQUIPMENT MANUFACTURERS CONCERNING RECOMMENDED CAPACITOR SIZES FOR PROPRIETARY AND SPECIAL DESIGN MOTORS (SUCH AS HERMETICALLY SEALED COMPRESSOR MOTORS, ROTARY COMPRESSOR MOTORS, HYDRAULIC PRESS MOTORS, ETC.)

L. INSTALLATION

INSTALL CAPACITORS AS NEAR TO MOTORS AS IS PHYSICALLY PRACTICAL OR AS SHOWN ON DRAWINGS. HOWEVER, DO NOT MOUNT THEM ON A VIBRATING STRUCTURE OR MOTOR.

PROVIDE RIGID MOUNTING BRACKETS OR STANDS AS REQUIRED. SECURELY GROUND ALL NON-CURRENT CARRYING METAL PARTS TO MOTOR BRANCH CIRCUIT CONDUIT.

CONNECT CAPACITOR LEADS TO EITHER MOTOR TERMINAL COMPARTMENT PIGTAILS, THE LOAD SIDE OF MOTOR DISCONNECT SWITCH TERMINALS OR AS SHOWN ON THE DRAWINGS. ENCLOSE LEADS IN LIQUID TIGHT FLEXIBLE METAL CONDUIT. PROVIDE BARE OR GREEN COLOR CODED GROUND WIRE INSIDE FLEXIBLE CONDUIT. SIZE CAPACITOR WIRES IN COMPLIANCE WITH NEC ARTICLE 460-8.

CLEAN CAPACITOR LEAD COMPARTMENT OF ALL FOREIGN MATERIAL, WIPE CAPACITOR BUSHINGS CLEAN AND CHECK FUSES AND CONNECTIONS BEFORE ENERGIZING.

M. TESTING

DEMONSTRATE TO ENGINEER, THE POWER FACTOR IMPROVEMENT REQUIRED BY THIS SPECIFICATION THROUGH THE USE OF CLIP-ON AMMETERS, POWER FACTOR METERS, ETC. AT NO ADDITIONAL COST TO OWNER.

27. MOTOR CONTROL CENTER

1.0 GENERAL

- 1.1 MOTOR CONTROL CENTER(S) SHALL BE ALLEN-BRADLEY COMPANY BULLETIN 2100. THE ENCLOSURE(S) SHALL BE NEMA 12. MOTOR STARTER UNITS SHALL BE OF THE COMBINATION TYPE WITH FUSIBLE DISCONNECT SWITCH OR MOLDED CASE CIRCUIT BREAKER AND SHALL BE MOUNTED FRONT OF BOARD. WIRING SHALL BE NEMA CLASS (1), TYPE (B). EACH MOTOR CONTROL CENTER SHALL BE OF DEAD FRONT CONSTRUCTION AND

SHALL INCORPORATE VERTICAL BUSES CONNECTED TO THE HORIZONTAL BUS. THE HORIZONTAL BUS SHALL BE LOCATED AT THE CENTER OF EACH VERTICAL SECTION. THE MOTOR CONTROL CENTER SHALL CONSIST OF ONE OR MORE VERTICAL SECTIONS BOLTED TOGETHER TO FORM A RIGID, FREE STANDING ASSEMBLY AND SHALL BE SO DESIGNED AS TO PERMIT FUTURE ADDITIONS OR CHANGES OF UNITS BY THE USER. MOTOR CONTROL CENTER(S) SHALL BE CONSTRUCTED TO MEET THE MINIMUM REQUIREMENTS OF THE LATEST PUBLISHED STANDARDS OF NEMA AND U.L. PUBLICATION 845 FOR MOTOR CONTROL CENTERS.

2.0 POWER REQUIREMENTS

- 2.1 MOTOR CONTROL CENTER(S) SHALL BE SUITABLE FOR OPERATION ON 480 VOLTS, 3 WIRE, 3 PHASE, 60 HERTZ. THE CONTROL VOLTAGE SHALL BE 120 VOLTS, AT 60 HERTZ.

3.0 VERTICAL SECTIONS

- 3.1 VERTICAL SECTIONS SHALL BE OF A RIGID, FREESTANDING CONSTRUCTION. FORMED STEEL MOUNTING CHANNELS 1-1/2" x 3" SHALL BE PROVIDED. TWO CLEARANCE HOLES SHALL BE PROVIDED PER EACH VERTICAL SECTION FOR THE PURPOSE OF SECURING THE CONTROL CENTER(S) TO THE FLOOR. A REMOVABLE STRUCTURAL STEEL LIFTING ANGLE SHALL BE PROVIDED MOUNTED ON THE TOP OF THE SECTION(S). STANDARD SHIPPING BLOCKS SHALL BE COMPRISED OF A MAXIMUM OF (4) VERTICAL SECTIONS, WITH A CONTINUOUS ONE PIECE LIFTING ANGLE.

- 3.1.1 EACH VERTICAL SECTION SHALL BE 90" HIGH EXCLUDING LIFTING ANGLES AND MOUNTING CHANNELS. IT SHALL BE 20" DEEP FRONT ACCESS ONLY REQUIRED FOR INSTALLATION AND MAINTENANCE.

- 3.1.2 THE VERTICAL SECTIONS SHALL BE DIVIDED INTO SIX SPACE FACTORS, EACH SPACE FACTOR BEING 13" HIGH. SIZE 1 AND SIZE 2 ACROSS-THE-LINE, NON-REVERSING COMBINATION STARTER UNITS, EXCEPT THOSE WITH 100 AMPERE 600 VOLT CLASS H FUSE CLIPS, SHALL FIT INTO ONE SPACE FACTOR.

- 3.1.3 END VERTICAL SECTIONS SHALL HAVE END CLOSING PLATES, WHICH SHALL PROVIDE ACCESS TO HORIZONTAL WIREWAYS AND THE HORIZONTAL BUS. THE BOTTOM CLOSING PLATE SHALL BE DESIGNED FOR INSTALLATION IN EITHER OF TWO POSITIONS, TO PROVIDE A RODENT BARRIER WHEN SO INTENDED. THE TOP PLATE SHALL BE OF A REMOVABLE ONE PIECE CONSTRUCTION. HINGED REMOVABLE BLANK DOORS SHALL COVER ALL UNUSED UNIT SPACES AND SHALL BE PROVIDED WITH 1/4 TURN PAWL TYPE LATCHES.

4.0 INCOMING LINE COMPARTMENT

- 4.1 THE TOP OR BOTTOM INCOMING LINE COMPARTMENT RATED AT 600 AMPS., SHALL BE FRONT ACCESSIBLE AND EITHER 13" OR 19-1/2" HIGH. THE ADDITION OF THE 6" HORIZONTAL WIREWAY SHALL RESULT IN A TOTAL OF 18" OR 24-1/2" OF COMPLETELY UNOBSTRUCTED HEIGHT AVAILABLE FOR CABLE, CABLE PULLING AND TERMINATING INCOMING LINES. INCOMING LINE TERMINALS SHALL BE SUITABLE FOR EITHER ALUMINUM OR COPPER CONDUCTORS AND SHALL COMPLY WITH NEMA SPACING DIMENSIONS. THIS COMPARTMENT SHALL BE LOCATED EITHER IN THE TOP MOST OR BOTTOM MOST UNIT SPACE OF THE VERTICAL SECTION. THE COMPARTMENT SHALL BE COVERED BY A HINGED DOOR AND SHALL BE HELD CLOSED WITH 1/4 TURN PAWL TYPE LATCHES.

- 4.1.1 THE INCOMING LINE COMPARTMENT SHALL BE CONVERTIBLE FROM TOP TO BOTTOM ENTRY IN THE FIELD WITHOUT ADDITIONAL PARTS.