Attached you will find the technical description of the facility for which you will be designing the power distribution system. Assume that this is a new facility and that all equipment has to be specified so that the electrical contractor can obtain and install it.

The attached description includes a dimensioned floor plan and a listing of the electrical loads. Some loads are indicated as critical. These will need to be provided with an emergency power supply of some type that you will determine.

**Project Schedule**

1. **1st Submittal:** January 19, load center calculations and preliminary one-line diagram.
2. **2nd Submittal:** February 2, final one-line configuration, all equipment sizes, initial load-flow, and initial fault study results.
3. **3rd Submittal:** February 11, final load-flow study results with taps & pf correction, final fault study results, and initial TCC study.

**Final Report:** This will be due during the scheduled final exam period. This is a “hard deadline” and no late submittals will be accepted. The report format will be specified later.

**INSTRUCTIONS**

A building floor plan is shown on the attached drawing. The numbered circles indicate locations of loads. Load specifications and additional load data are included with this document. You are to do the following:

1. Find the load center(s) for the facility. Determine suitable locations and sizes for the electrical equipment.
2. Specify all equipment to the panel level including protective devices, starters, conductors, lighting panel requirements etc. The voltage at switch 76 is 13.8 kV.
3. Show the location of all transformers, panels, and motor control centers on the plant drawing.
4. Develop a complete one-line diagram for the three-phase system.
5. Perform load flow and short circuit studies.
6. Verify that no equipment is overloaded.
7. Verify that no motor starting conditions cause more than 10% voltage drop (NEC criteria) anywhere on the system. Current limited starting may be needed.
8. Provide two example protection schemes, one at 2.4 kV and the other at 600 V, that are coordinated from their largest load up to and including switch 76.
9. Verify that NEC voltage regulation criteria is observed.
10. Provide power factor correction so that the overall facility power factor is at least 0.96 lag. Specify total system losses.
11. Submit a professional report that fully describes and justifies your design.
GENERAL INFORMATION

1. The facility is fed from switch 76. This is an S & C Electric switch that accommodates SM-4, 5 fuses. The fuse that provides power to switch 76 is a SM-5, 400A slow; the utility engineer is having a problem co-coordinating this fuse, so suggest an alternative (the fuse may need to be replaced with a circuit breaker). The fault capacity at switch 76 is 22 kA, 3φ and 11 kA, 1φ-G. The X/R ratio is 10.0.

2. The height of the trusses in the chiller bay is 20 feet. The ceiling height in the office and computer room is 10 feet.

3. All induction motors are 4 pole squirrel cage, NEMA Design B. For 2.4 kV assume 0.93 lag power factor and 93% efficiency, while those below 2.4 kV have 0.85 lag power factor and 85% efficiency.

4. The MV cables are EPR and the LV cables are THHN.

LOAD DATA

1 & 2. 2 - 500 hp chillers, 2.4 kV.
3. 10 hp pump, 600 V.
4. 150 hp pump, 600 V.
5, 6 & 7. 3 - 15 hp pumps, 600 V.
8, 9 & 10. 3 - 20 hp pumps, 600 V.
11 & 12. 2 - 20 hp motors for the water treatment plant, 208 V (critical).
13. 1000 hp chiller, 2.4 kV
14, 15 & 16. 3 - 300 hp pumps, 600 V.
17 & 18. 2 - 75 hp pumps, 600 V.
19. Cooling tower, 50 hp, 600 V, motor and 20 hp, 600 V motor, model as one 70 hp motor.
20. Air compressor, 400 hp, 2.4 kV, synchronous motor capable of operating between 0.85 lag and 0.85 lead power factor.
21. Diesel generator for backup of critical loads (you need to specify voltage and kVA).
22. 300 foot-candle lighting, fluorescent.
23. Air conditioner, 50 tons (critical).
24. Computer, 30 kVA, 208 V (critical).
25. Air conditioner, 20 tons (critical).
26. 200 foot-candle lighting, fluorescent.

In addition to the above, the chiller bay area is illuminated to 150 foot-candle by metal halide lamps, and has 120 V convenience outlets as needed in appropriate locations along with small lights for doors etc., these have to be fed from one of the panels you have designated. For compressors assume 1 ton requires 1 hp motor load.