Upgrade Electrical Utilities, Phase 4
Malcom Randall VA Medical Center, Gainesville, FL

Contract VA248-13-C-0134, Project 573-13-603

DESIGN ANALYSIS REPORT
Final Design Submittal

Prepared for
Dept. of Veterans Affairs
1601 SW Archer Rd.
Gainesville, FL 32608

Prepared by
AKEA Inc.
3603 NW 98th St., Suite B
Gainesville, FL 32606

March 4, 2015

Project Introduction

Prepared by:
Chad J. Fralick, P.E.
AKEA, Inc.

Overview

This project involves all disciplines and work required to replace the existing E-Wing normal power distribution gear at the Malcom Randal VA Medical Center. The existing low- and medium-voltage equipment located in room EB66-1 will be replaced with new equipment. The abandoned incinerator slab located south of EB66-1 has been selected by the VA as the location for the new equipment.

The abandoned incinerator structure will be demolished and the slab will be used to support the New Electrical Building. The new building will be complete with new electrical distribution equipment, lighting, HVAC, fire alarm, and sprinkler system.

The layouts shown on the construction documents are based upon the future (as of this submittal date) work of others involving the relocation of the cart wash chemical feed system, the partial demolition of the platform currently used to store carts over the incinerator slab, and the completion of the Upgrade Electrical Utilities Phase 3 project.

See the following narratives for additional basis of design information, design rationale, and calculations.

Bid Alternates

The base bid includes all work as shown on the plans and as described in the specifications. Deductive bid alternates are described in the specifications and drawings.

NEPTUNE
FIRE PROTECTION ENGINEERING LLC

March 3, 2015

Mr. Chad Fralick, PE
Electrical Engineer
AKEA, Inc.
3603 NW 98 St., Suite B
Gainesville, FL 32606

Dear Chad,

I have completed my life safety review of the Phase 4 Electrical Upgrade 573-13-603 project at the Malcolm Randall VA Medical Center in Gainesville, Florida. The review was based on the final construction design drawings and specifications issued on 03/04/15. I have found this design to be fully compliant with the applicable life safety requirements of the NFPA codes, as well as the requirements of the 2010 Florida Building Code, the 2010 Florida Fire Prevention Code, ADA, JCAHO, OSHA, environmental restrictions, emergency preparedness, and infrastructure management guidelines.

Please feel free to contact me with any questions or concerns.

Sincerely,

Stephen Kowkabany

Steve Kowkabany, P.E.
Senior Fire Protection Engineer
Neptune Fire Protection Engineering

60 Ocean Boulevard, Suite 6, Atlantic Beach, Florida 32233
PH: 904-652-4200 FAX: 904-212-0868

Architectural Narrative

Prepared by:

Paige Poole
AKEA, Inc.

The new electric upgrade will be housed in a space previously used as an incinerator area which has been vacated. The previous area was a pre-engineered semi-enclosed structure. It consisted only of a roof and side walls extending from the roof line only about 6 feet. The remaining 10 feet of wall area was open on all sides. The existing metal cover was approximately 22 ft high. The structure was placed on a structural slab with column supports in each corner. The existing structural columns and beams appear to have been subject to a lot of corrosion from the gases of the incinerator causing significant surface rust. A few columns have suffered corrosion where they rest on the base plates; this compromises the structural integrity. The base of these columns can be reinforced by use of splice plates. Total column replacement will also be an option, but is likely more labor intensive. Upon closer observation of the existing structure it is now recommended that the entire metal building structure be demolished instead of salvaging the existing structure. The reuse of the very high existing structure also resulted in new construction much higher than was actually needed, which increased construction cost with no added value.

New construction will consist of CMU walls placed on the existing structural slab. This will require the removal of the existing raised 6" wide curb since the 8" masonry units can not fit adequately on the curb. The entire metal frame structure will be removed and the existing anchors and base plates will be removed or ground down flush with the floor. The existing slab will be degreased and generally cleaned up, although this will not be the finished floor. The roofing will be steel joist spanning from the north and south load-bearing masonry walls and slope 8" across the building towards the south face. All masonry walls will have filled cells at 48"oc. The dowel bars for the reinforced masonry will be secured to the existing structural slab with dowels set in two-part epoxy mortar. The roof deck will be a structural steel deck with a mechanically attached insulation with a three-ply cold-application of a modified SBS roofing product. The cold application system was chosen for its ease of installation and lack of objectionable fumes (being so close to possible air intake systems). The system is also very easy to bring on the site with a small foot print in this crowded area.

The exterior walls will be stucco finished and will have expansion/control joints to relate to the existing building façade. The interior wall finish will be exposed CMU. The wall will be painted with semi-gloss paint for easy of cleaning. The lower portion of the wall will be painted a darker color to hide any dirt and damage (like a wainscot).

The floor of the existing slab is badly damaged beyond reasonable repair. The easiest solution is to pour a new floor on top of the existing slab. This provides a suitable floor finish, allowing housekeeping pads under the new equipment. It also allows the existing floor to be trenched as needed without any messy patches. The floor will receive an epoxy finish for an easy-to-clean floor without seams or joints.

This room's doors are arranged so that the two required paths to safety, if ever necessary, are as short as possible.

A double door is provided on the south wall for general equipment access into the room. The second exist door on the east wall is a single door with a set of new steps and landing. A roll up door is aligned with the aisle between the equipment so that removal or replacement of heavy bulky equipment can be facilitated. This roll up door opens out onto a change in elevation which will also serve as a loading dock, making transfer of equipment to a truck easier and safer.

Mechanical Narrative

Prepared by:

Tim Murray
Senior Mechanical Designer
AKEA, Inc.

New HVAC

The new E-wing Switchgear Building will be equipped with a new central station, constant volume, chilled water cooling/steam pre-heating unit. Load calculations indicate that the unit is to be sized to provide approximately 15 tons of cooling.

Chilled water will be brought to the unit via new piping intended to connect to existing capped valves located within room EB65. Steam pre-heating piping will connect to the existing steam piping, located below the loading dock area, and piped to the new unit.

Controls for the new unit are designed to be compatible with the existing building automation system and are to be connected to the existing system for full control and monitoring.

Supply air ductwork is routed such that no ductwork passes directly overhead of electrical equipment. A supply air branch will serve the control room.

The proposed battery station in the control room is provided with standalone exhaust via a welded galvanized exhaust hood place overhead. The exhaust fan is a sidewall, belt-driven fan that will discharge exhaust air at a point below the existing roof, or approximately 18-20' above finished grade on the east end of the building.

The existing cart wash system consists of a washing station and a chemical feed station. The current location of the washing station will not be impacted by this work. The existing chemical feed station will be relocated to the dock area adjacent to the new E-wing Switchgear Building. New piping will connect the existing chemical feed station to the existing washing station as well as the existing steam-to-water heat exchanger.

Existing Sprinkler System

The existing fire protection sprinkler heads and associated sprinkler piping shall be demolished back to the existing 2 ½" main piping located above the loading dock. The exiting sprinkler drain valve and piping shall be demolished.

New Sprinkler System

The new fire protection system shall include new sprinkler heads located below the roof deck and shall be connected to the existing freeze protected sprinkler piping located above the loading dock. A new sprinkler drain valve and sprinkler drain piping shall be connected to the new main end piping and dropped to grade and routed through exterior wall.

Air System Information

Air System Name	AHU1	Number of zones	1
Equipment Class	CW AHU	Floor Area	1416.0 ft²
Air System Type	SZCAV	Location	Gainesville, Florida

Sizing Calculation Information

Zone and Space Sizing Method:

Zone CFM	Sum of space airflow rates	Calculation Months	Jan to Dec
Space CFM	Individual peak space loads	Sizing Data	Calculated

Central Cooling Coil Sizing Data

Total coil load	15.5	Tons	Load occurs at	Aug 1500	
Total coil load	186.0	MBH	OA DB / WB	94.0 / 77.0	°F
Sensible coil load	182.8	MBH	Entering DB / WB	81.6 / 63.5	°F
Coil CFM at Aug 1500	6405	CFM	Leaving DB / WB	55.0 / 53.3	°F
Max block CFM	6780	CFM	Coil ADP	52.0	°F
Sum of peak zone CFM	6780	CFM	Bypass Factor	0.100	
Sensible heat ratio	0.983		Resulting RH	36	%
ft²/Ton	91.4		Design supply temp.	55.0	°F
BTU/(hr-ft²)	131.4		Zone T-stat Check	1 of 1	OK
Water flow @ 12.0 °F rise	31.02	gpm	Max zone temperature deviation	0.0	°F

Supply Fan Sizing Data

Actual max CFM	6780	CFM	Fan motor BHP	0.00	BHP
Standard CFM	6743	CFM	Fan motor kW	0.00	kW
Actual max CFM/ft²	4.79	CFM/ft²	Fan static	0.00	in wg

Outdoor Ventilation Air Data

Design airflow CFM	85	CFM	CFM/person	84.96	CFM/person
CFM/ft²	0.06	CFM/ft²			

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Aug 1500 COOLING OA DB / WB 94.0 °F / 77.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB 30.0 °F / 25.3 °F		
ZONE LOADS	Details	Sensible (BTU/hr)	Latent (BTU/hr)	Details	Sensible (BTU/hr)	Latent (BTU/hr)
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	1483 ft²	1900	-	1483 ft²	2663	-
Roof Transmission	1416 ft²	3083	-	1416 ft²	1945	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	0 ft²	0	-	0 ft²	0	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	1354 W	4620	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	200 W	682	-	0	0	-
People	1	245	205	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	171400	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	-	181930	205	-	4607	0
Zone Conditioning	-	181715	205	-	0	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	6405 CFM	0	-	0 CFM	0	-
Ventilation Load	80 CFM	1085	2987	0 CFM	0	0
Supply Fan Load	6405 CFM	0	-	0 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	-	182800	3192	-	0	0
Central Cooling Coil	-	182800	3192	-	0	0
>> Total Conditioning	-	182800	3192	-	0	0
Key:	Positive values are clg loads Negative values are htg loads			Positive values are htg loads Negative values are clg loads		

Electrical Narrative

Prepared by:

Chad J. Fralick, P.E.
AKEA, Inc.

Overview

The project involves the upgrade of the normal power electrical equipment serving the E-Wing portion of the main hospital building at the Malcom Randall VA Medical Center. It includes the construction of a new electrical enclosure with new equipment to completely replace the existing main switchgear and substations in room EB66-1.

Phasing and timing shall be a priority during construction. Every effort shall be made to ensure the medical center experiences minimal downtime on all normal and essential branch circuits. A proposed construction sequence is included on the plans; however, phasing and construction sequence shall be closely coordinated between the selected contractor and the VA.

Demolition

Electrical demolition will include removal of existing lighting and power equipment located in the abandoned incinerator enclosure. Existing panelboards and transformer located at the incinerator pad shall be removed and delivered to the VA.

After the new gear has been installed and connected, the existing switchgear and substation equipment in EB66-1 shall be demolished. Demolished circuits and feeders shall be removed completely (raceway, conductors, hangers, etc.), unless noted otherwise. Openings created as a result of demolition shall be patched and finished to match existing adjacent areas.

There is an existing feeder that begins at the CAT Scan breaker in EB66-1 and ends at Panel PX E195-1 in room E195-1 on the first floor. It appears the existing feeder is installed above portions of the O.R. suite on the first floor. It is recommended that the existing feeder be abandoned in place to minimize unnecessary impact to the E-Wing O.R.'s. The new replacement feeder shall be routed below the first floor slab, over the engineering offices, and turn up to feed PX E195-1 from below.

Existing Normal Power Loads

The maximum recorded loads on the existing medium voltage feeders extending from Main Electrical Room D088-1 to EB66-1, obtained from the existing power monitoring system, provided by VA, are as follows:

39A @ 12,470V – 842KVA (West Wing Feeder 1) observed on 6/5/2010
13A @ 12,470V – 281KVA (West Wing Feeder 2) observed on 7/20/2009

The design intent is to provide the smallest transformers that will meet the requirements of the VA for future capacity and redundancy. Each of the two new proposed transformers will be 1000KVA (capable of delivering 1333KVA with fans running). This will allow all existing loads to be powered by one of the two transformers, with at least 20% spare capacity. Under normal operation, both transformers will be partially loaded, with well over 30% spare capacity each (without the use of fans).

Medium Voltage Equipment

New medium voltage (MV) feeders will be provided from the existing breakers in D088-1 to the new gear. As directed by the VA at the 50% Design Review Meeting, the configuration of the new MV switches will be similar to the existing configuration of the equipment in the ACA electrical room; the MV switches will have a fused load-interrupter switch on the front and a non-load break source-selector switch on the back. Each substation will be capable of being powered from either one of the two MV feeders; the MV switches will be manually operated to select the feeder for each substation.

The substation shall be capable of bypassing either transformer. Each transformer will be provided with fans and temperature sensors. High temperature alarms shall be relayed to the existing building automation system and made visible at the graphics control room.

Low Voltage Switchgear

The new low voltage switchgear was initially intended to mimic the configuration of the low voltage switchgear in D088-1 per VA direction. Each branch breaker was to have a dedicated maintenance transfer space adjacent to the breaker. The arrangement would allow a spare breaker to temporarily be installed and the existing breaker removed for service (without downtime). Controls were to be provided in the switchgear that would allow remote switching of the breakers from an adjacent control room. A new HMI screen was to be added to the adjacent room; the screen would provide control and annunciation capability.

During the 50% Review Meeting, the VA directed AKEA to remove the maintenance transfer provision (MTP) spaces from the switchgear and to remove the remote control capability – based on VA experience with the existing gear in D088-1 and based on consideration of construction costs. The specifications and drawings were edited accordingly. The removal of the MTP spaces reduces the overall size of the switchgear and reduces the cost of the gear. The switchgear will be provided with one spare section with compartments for future breakers.

The new switchgear shall be provided with power-monitoring modules that are 100% compatible with the medical center's metering system (Square D Power Logic). The meters shall communicate with the metering network to providing real-time information for all branch feeders in the new switchgear.

A new, 125V DC system shall be provided in the new building to include batteries, charger, battery rack, and a DC panel. The DC system will provide un-interrupted power to breaker trip units and power monitoring equipment.

The VA requested an electrically-powered winch for the overhead breaker-lift trolley. The basis of design (Square D Power Zone-4) model does not have an electric trolley as an available standard or custom option.

Raceway to E-Wing

Proposed raceway routing depicted on the plans is the latest coordination between VA and AKEA. The options considered for getting the conduits to the E-Wing are described below.

Underground conduits are not the proposed routing. There are large existing footers and pile caps underground along the southern E-Wing wall and there is a concrete drainage area between the incinerator and E-Wing. In addition to this, the incinerator slab is elevated above grade and may require substantial demolition work to get underground conduits into the gear.

Overhead conduits are the proposed method for spanning the two buildings. The entry points considered included EB65-1, EB66-1, and the Pipe Basement below the cart wash area. To avoid the cart wash and to avoid running under the cart wash (to avoid anticipated dripping), the conduits will need to leave the electrical building near the east end. Per VA preference, to allow for future work east of the electrical building, the conduits shall leave the north wall of the electrical building and extend to the outside of EB66-1. Coordination will be required for conduits entering EB66-1 to avoid the existing components.

Details are provided in the drawings for the conduit support and building entrances. The structural components and details indicated on sheet E500 were designed by a structural engineer; see the Structural Narrative. Spare conduits shall be installed with the bridge to allow for future feeder installations to be accomplished more easily.

Branch Circuitry

All conductors shall be copper; aluminum conductors are not allowed. Branch circuits shall extend from the designated panelboard to supply end utilization equipment/devices. Branch circuit conductors shall be sized for a voltage drop of not larger than 3%.

Lighting

New lighting will be provided in the new electrical enclosure: LED-type lighting fixtures by CREE.

Coordination Study

A coordination study shall be provided by the contractor based on approved circuit breaker, switchgear and panelboard shop drawings. The scope of the coordination study shall begin at the utility and generators sources to the first downstream devices un-affected by the project.

Calculations

Short circuit calculations are included after the narrative. The calculations in the design are based on basis of design components and will change based on the actual equipment provided. The calculations will be performed again by the contractor as part of the Coordination Study, based upon approved shop drawings.

Lightning Protection

The new enclosure lies within the zone of protection created by the smoke stack, the E-wing, and the MEP building. Therefore, a lightning protection system is not required.

Fire Alarm

A new, fire alarm control panel will be provided in the electrical building. The intent is for the new panel to communicate via fiber optic to the main campus control unit. To match VA direction related to a separate Fire Alarm upgrade project, the new control panel will be specified as a Notifier NFS-320. The system will be fully addressable with voice evacuation.

Per the VA Fire Protection Manual, smoke detectors and sprinklers shall be provided in electrical rooms.

Compatibility Statements

Brand names or proprietary items have not been used in plans or specifications to prefer any single supplier, unless specifically indicated by the VA, or as necessitated by existing equipment compatibility requirements. Model numbers are shown in some instances to indicate the basis of design quality, style, dimensions and/or configuration, such as switchgear and lighting fixtures. Efforts shall be taken to ensure 100% compatibility of new power meters with existing systems.

SHORT CIRCUIT CALCULATIONS (HIGHEST WORST CASE)

UPGRADE ELECTRICAL UTILITIES PHASE 4
AKEA #066-13

SUBSTATION TRANSFORMER TO NORTH SWGR BUS (IDENTICAL FOR SOUTH SWGR)

THREE-PHASE ISC CALC		
TRANSFORMER		
KVA	GIVEN PARAMETER	1333
V-LL	GIVEN PARAMETER	480
FLA	= KVA*1000 / (V-LL*1.732)	1603.3
Z	GIVEN PARAMETER	5
INITIAL SHORT-CKT. CURRENT		
MC	GIVEN PARAMETER	500
MSC	= MC*4	2000
SCA	= FLA*100 / Z + MSC	34,067
CONDUCTORS		
WIRE	GIVEN PARAMETER	600 Cu
COND	GIVEN PARAMETER	NON
L	GIVEN PARAMETER	1
C	GIVEN PARAMETER	28033
N	GIVEN PARAMETER	6
f	= 1.732*L*SCA / (C*N*V-LL)	0.0007
M	= 1 / (1+f)	0.9993
RESULTING FAULT CURRENT		
ISC	= SCA*M	**34,042**

NOTE: FIRST TRANSFORMER CALCULATION ASSUMES INFINITE PRIMARY CURRENT (CONSERVATIVELY WORST CASE FOR SHORT CIRCUIT ANALYSIS)
KVA = TRANSFORMER SIZE
V-LL = VOLTAGE (LINE-TO-LINE ON SECONDARY SIDE OF TRANSFORMER)
FLA = FULL LOAD CURRENT OF TRANSFORMER ON SECONDARY SIDE (A)
Z = IMPEDANCE OF TRANSFORMER (%)
MC = TOTAL MOTOR CURRENT OF LOAD (A)
MSC = MOTOR SHORT CIRCUIT CONTRIBUTION ESTIMATE (A)
SCA = AVAILABLE SHORT CIRCUIT CURRENT AT BEGINNING OF CIRCUIT (A)
WIRE = TRADE SIZE AND TYPE OF CONDUCTORS (Cu = COPPER, Al = ALUMINUM)
COND = CONDUIT TYPE (MAG = MAGNETIC, NON = NONMAGNETIC)
L = LENGTH (FT) OF CONDUCTOR TO FAULT
C = CONSTANT VALUE FOR SPECIFIC CONDUCTOR (1 / IMPEDANCE PER FT)
N = NUMBER OF CONDUCTORS PER PHASE
f = "f" FACTOR VALUE USED TO DETERMINE MULTIPLIER
M = MULTIPLIER TO DETERMINE
ISC = SHORT CIRCUIT CURRENT AT FAULT

NORTH SWGR TO PNL FP4

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	350 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	85
C	GIVEN PARAMETER	19703
N	GIVEN PARAMETER	2
f	= 1.732*L*SCA / (C*N*V-LL)	0.2650
M	= 1 / (1+f)	0.7905
RESULTING FAULT CURRENT		
ISC	= SCA*M	**26,911**

SOUTH SWGR TO MCC-N1

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	500 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	290
C	GIVEN PARAMETER	22185
N	GIVEN PARAMETER	2
f	= 1.732*L*SCA / (C*N*V-LL)	0.8029
M	= 1 / (1+f)	0.5547
RESULTING FAULT CURRENT		
ISC	= SCA*M	**18,882**

NORTH SWGR TO ATS-E

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	1/0 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	95
C	GIVEN PARAMETER	8924
N	GIVEN PARAMETER	1
f	= 1.732*L*SCA / (C*N*V-LL)	1.3077
M	= 1 / (1+f)	0.4333
RESULTING FAULT CURRENT		
ISC	= SCA*M	**14,752**

SOUTH SWGR TO ATS-Q2

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	3/0 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	110
C	GIVEN PARAMETER	12843
N	GIVEN PARAMETER	2
f	= 1.732*L*SCA / (C*N*V-LL)	0.5261
M	= 1 / (1+f)	0.6553
RESULTING FAULT CURRENT		
ISC	= SCA*M	**22,307**

NORTH SWGR TO MCC-N

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	500 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	230
C	GIVEN PARAMETER	22185
N	GIVEN PARAMETER	1
f	= 1.732*L*SCA / (C*N*V-LL)	1.2735
M	= 1 / (1+f)	0.4398
RESULTING FAULT CURRENT		
ISC	= SCA*M	14,973

SOUTH SWGR TO ATS-E2

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	4/0 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	110
C	GIVEN PARAMETER	15082
N	GIVEN PARAMETER	1
f	= 1.732*L*SCA / (C*N*V-LL)	0.8959
M	= 1 / (1+f)	0.5274
RESULTING FAULT CURRENT		
ISC	= SCA*M	17,955

NORTH SWGR TO ATS-Q

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	300 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	95
C	GIVEN PARAMETER	18176
N	GIVEN PARAMETER	3
f	= 1.732*L*SCA / (C*N*V-LL)	0.2140
M	= 1 / (1+f)	0.8237
RESULTING FAULT CURRENT		
ISC	= SCA*M	28,041

SOUTH SWGR TO ATS-C2

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	3/0 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	110
C	GIVEN PARAMETER	12843
N	GIVEN PARAMETER	2
f	= 1.732*L*SCA / (C*N*V-LL)	0.5261
M	= 1 / (1+f)	0.6553
RESULTING FAULT CURRENT		
ISC	= SCA*M	22,307

NORTH SWGR TO ATS-C

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	3/0 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	95
C	GIVEN PARAMETER	12843
N	GIVEN PARAMETER	2
f	= 1.732*L*SCA / (C*N*V-LL)	0.4543
M	= 1 / (1+f)	0.6876
RESULTING FAULT CURRENT		
ISC	= SCA*M	23,408

SOUTH SWGR TO NF-3

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	250 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	340
C	GIVEN PARAMETER	16483
N	GIVEN PARAMETER	2
f	= 1.732*L*SCA / (C*N*V-LL)	1.2669
M	= 1 / (1+f)	0.4411
RESULTING FAULT CURRENT		
ISC	= SCA*M	15,017

NORTH SWGR TO NF-2

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	600 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	155
C	GIVEN PARAMETER	22965
N	GIVEN PARAMETER	3
f	= 1.732*L*SCA / (C*N*V-LL)	0.2764
M	= 1 / (1+f)	0.7835
RESULTING FAULT CURRENT		
ISC	= SCA*M	26,671

SOUTH SWGR TO PX E195-1

THREE-PHASE ISC CALC		
INITIAL SHORT-CKT. CURRENT		
V-LL	GIVEN PARAMETER	480
SCA	= FLA*100 / Z + MSC	34,042
CONDUCTORS		
WIRE	GIVEN PARAMETER	500 Cu
COND	GIVEN PARAMETER	MAG
L	GIVEN PARAMETER	115
C	GIVEN PARAMETER	22185
N	GIVEN PARAMETER	1
f	= 1.732*L*SCA / (C*N*V-LL)	0.6368
M	= 1 / (1+f)	0.6110
RESULTING FAULT CURRENT		
ISC	= SCA*M	20,799

LitePro 2.025 Point-By-Point Results 11/21/2014

PROJECT: Phase IV Electrical Upgrade/055-13 GROUP: Elec AREA: Electric Rm GRID: New Grid
PREPARED BY: KLL
VALUES ARE FC, SCALE: 1 IN= 6.0FT, HORZ GRID (U), HORZ CALC, Z= 0.0
ROOM REFLECTANCES: 80 / 50 / 20 (Ceiling/Walls/Floor)
Computed in accordance with IES recommendations

Statistics

GROUP	MIN	MAX	AVE	AVE/MIN	MAX/MIN
(+)	7.97	54.28	36.74	4.61	6.81

Y-AXIS \ X-AXIS	0.38	2.38	4.38	6.38	8.38	10.38	12.38	14.38	16.38	18.38	20.38	22.38	24.38	26.38	28.38	30.38	32.38	34.38	36.38	38.38	40.38	42.38	44.38	46.38
30.38	19.6	26.1	31.8	35.6	37.6	38.3	38.9	40.1	41.9	42.8	42.4	41.9	41.8	41.7	41.1	39.8	36.6	34.9	33.9	34.0	33.5	31.8	28.3	22.3
28.38	22.7	30.7	37.6	41 A	44.1	44.7	45.0	47.0	48.8	A9.8	49.5	48.6	48.6	48.8	A.6	45.8	43.3	41.2	40.3	40.5	40.A	38.3	34.3	26.8
26.38	22.1	29.2															44.3	42.3	42.3	42.3	42.3	40.1	36.3	28.3
24.38	15.8	17.1															29.0	34.4	38.8	41.3	42.0	40.2	36.8	29.0
22.38	14.4	16.0															27.4	33.4	37.3	40.6	41.2	39.9	36.6	29.5
20.38	16.6	18.3															26.1	37.2	40.2	42.1	43.2	41.4	38.0	30.3
18.38	19.7	24.9	27.4	30.0	32.0	33.1	33.7	35.1	36.3	37.1	37.4	37.5	37.6	37.7	37.5	36.2	40.8	42.4	43.8	45.0	45.8	43.9	39.9	31.6
16.38	20.4	26.8	31.8	34 A	37.1	38.2	39.0	40.4	41.7	A 2.7	42.8	42.6	43.0	43.6	A .5	44.2	43.3	44.5	46.0	47.6	48. A	46.5	42.1	33.2
14.38	19.8	26.4	31.6	35.0	37.3	38.4	39.1	40.6	42.0	42.9	42.7	42.3	42.3	42.9	44.8	44.4	44.0	45.6	47.3	49.7	50.4	48.4	43.8	34.2
12.38	17.9	23.5	26.3	28.4	30.2	31.1	31.8	33.0	34.0	34.7	34.7	34.3	34.5	34.6	34.3	32.9	43.4	45.2	47.5	50.2	51.1	49.0	44.1	34.3
10.38	14.7	14.3															31.4	38.9	45.5	48.5	50.2	48.1	42.6	32.8
8.38	11.4	10.3															27.6	36.2	42.1	45.3	A 47.0	43.4	38.0	29.6
6.38	12.8	12.2															26.1	34.5	39.5				32.3	25.3
4.38	17.0	22.7	26.8	32.4	37.2	40.1	41.4	42.6	44.3	45.4	45.9	45.3	44.2	42.6	39.4	34.3	40.1	36.4	32.2				18.0	17.6
2.38	17.5	24.2	31.5	38.3	A 44.0	47.4	49.0	50.5	52.4	A 54.0	54.3	53.7	52.7	51.4	A 49.2	45.5	38.7	33.3	25.4				12.7	11.5
0.38	15.2	21.2	27.7	33.7	38.9	41.8	43.1	44.2	46.0	47.5	48.0	47.4	46.7	46.1	43.5	39.7	33.3	27.5	20.3				8.55	7.97

TOTAL WEIGHT CALCULATION FOR BANK OF CONDUITS AND PIPING

AKEA #055-13, Upgrade Electrical Utilities Phase 4

Size	Item	LBS per 100 ft	LBS per 1000 ft	LBS per ft	600/N/G	150/N/G	400/N/G	800/N/G	1200/N/G	225/N/G	MV150/N/G	MECH	MISC.	FUTURE
3/4	RMC RGS	109		*1.09*									4	
1	RMC RGS	161		*1.61*									8	
1-1/2	RMC RGS	263		*2.63*									2	
2	RMC RGS	350		*3.5*		1								
2-1/2	RMC RGS	559		*5.59*						1				
3	RMC RGS	727		*7.27*			2	3						3
3-1/2	RMC RGS	880		*8.8*	2									
4	RMC RGS	1030		*10.3*					3		1			
5	RMC RGS	1400		*14*										
6	RMC RGS	1840		*18.4*										
#2	EPR MV Cable		641	*0.641*							4			
#12	THHN-THWN		24	*0.024*									60	
#8	THHN-THWN		62	*0.062*									2	
#6	THHN-THWN		95	*0.095*		1					1			
#4	THHN-THWN		152	*0.152*			2			1				
#3	THHN-THWN		188	*0.188*	2								6	
#1	THHN-THWN		299	*0.299*										
1/0	THHN-THWN		371	*0.371*	2	4		3						3
3/0	THHN-THWN		574	*0.574*					3					
4/0	THHN-THWN		717	*0.717*						4				
250	THHN-THWN		850	*0.85*			8							
300	THHN-THWN		1011	*1.011*				12						12
500	THHN-THWN		1653	*1.653*	6									
600	THHN-THWN		1985	*1.985*					12					
MECH	PIPING AND LIQUID			30.603								1		

QTY.	2	2	5	1	1	1	2	1	1	4
Weight per FT	*57.3*	*10.2*	*108.2*	*35.1*	*56.4*	*8.6*	*25.9*	*30.6*	*25.2*	*140.2*

GRAND TOTAL	***498*** **LBS PER FT**

The GRAND TOTAL Value does not include the weights of couplings, unistrut, straps, or the structural support. A safety margin will be applied for the sizing of the structural support.

Calculated values are shown in *italics*. All other values were inputs.

The material weights were obtained from standard material cut sheets applicable for this project.

To allow for future expansion, the calculation above includes provisions for several additional 800A feeders

Structural Narrative & Calculations

Prepared by:
Richard G. Wheeler, P.E.
AKEA, Inc.

A number of conduits are to be routed from a new electrical building to the existing upper transformer room of the Gainesville VAMC. It was desired that the conduits and piping will span the 15'4" between these buildings without additional supports from below. Therefore a structural steel frame has been designed and will be constructed to span this distance.

The attached calculations and drawings included in the construction documents are intended to serve the stated purpose.

11/17/14
RGW
1/3

STAEDTLER® No. 937 811E Engineer's Computation Pad

UPGRADE ELECTRICAL UTILITIES, PHASE 4
MALCOM RANDALL VAMC
GAINESVILLE, FL

STRUCTURAL SUPPORT OF CONDUITS
E-WING ELECTRICAL BLDG

CALCULATIONS BY
RICHARD L. WHEELER
FL P.E. #23064
11/17/2014

REF: AISC, STEEL CONSTRUCTION MANUAL, 14th ED.
ASCE 7-10

11/17/14 RAW | 2/3

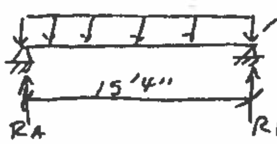
ASCE 7-10 ; ALLOWABLE STRESS DESIGN

¶ 2.4.1

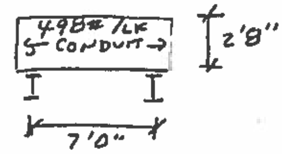
D + 0.6W
D + 0.75(0.6W)
0.6D + 0.6W
D

} BY INSPECTION; LOAD CASES FOR CONSIDERATION ¶ 2.4.1

WT OF CONDUIT = 498 #/LF
WT OF SUPPORT STRUCTURE ≈ 30 #/LF
DL = 530 #/LF



w = 530 #/LF / 2
w = 265 #/LF
= 0.0221 K/in



$M = wl^2/8 = 265\#/LF(15.33')/8 = 7785'LB = 93.4"K$

$S_{REQD} = M/F_b'' = 93.4/22\ KSI = 4.25\ IN^3$

check deflection

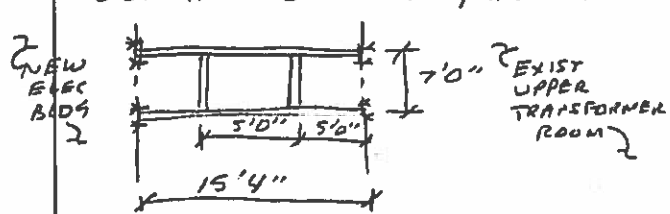
$\Delta = 5wl^4/384EI$; $l/240 = 184"/240 = 0.77"$

$I_{REQD} = \dfrac{5(0.0221\ K/")(184")^4}{384(29000\ KSI)(0.77")} = 14.77\ IN^4$

— W5x16
$S_x = 8.55\ IN^3$
$S_y = 3.00\ IN^3$
$I_x = 21.4\ IN^4$

— HSS 5x5x 1/4 ; wt = 15.62 #/LF
$S = 6.41\ IN^3$
$I = 16.0\ IN^4$

USE HSS 5x5x 1/4 ; ADD CROSS BRACING FOR STABILITY



7' SPAN OK FOR BENDING & DEFLECTION (BY INSPECTION)

$R_A = R_B = (265\#/LF)(15.33)/2 = 2.03\ K$

FULLY WELDED CONSTRUCTION
2-5/8" ⌀ WEDGE ANCHORS @ EA WALL ← OK BY INSPECTION

STAEDTLER® No. 937 811E Engineer's Computation Pad

RAW 11/17/14 3/3

CHECK WIND LOAD

$q_z = 0.00256\,K_z K_{zt} K_d V^2$ (EQN 29.3-1)

$V^2 = (120)^2$ FIG 26.5-1C

$K_d = 0.85$ TABLE 26.6-1

$K_{zt} = 1.0$ ¶ 26.8.2

$K_z = 0.85$ TABLE 29.3-1

$q_z = 0.00256(0.85)(1.0)(0.85)(120)^2 = 26.63$ PSF

$F = q_z\, G C_f A_f$

$G = 0.85$ · ¶ 26.9.1

C_f → ASSUME 1.0; ASSUME ALL CONDUITS BUNDLED TOGETHER ACT AS A SOLID

$F = 26.63(0.85)A_f = 22.64$ PSF (A_f)

UPLIFT = 22.67 PSF (7') = 158.5 #/LF ↑

#1 • DL = 530 #/LF ↓ ÷ 2 SUPPORTS = 265 #/LF ↓ ← REFER TO PG 2 OF CALCS

#2 • D + 0.6W = 530 − 95 = 435 #/LF ↓ ÷ 2 = 217.5 #/LF ↓

#3 • D + 0.6 W(0.75) = 530 − 71 = 459 #/LF ↓ ÷ 2 = 229.5 #/LF ↓

WL IN Y-DIRECTION = 22.64(2.67') = 60.4 #/LF ←
÷ 2 = 30.2 #/LF ← = 0.00252 K/IN

CASE #2: $S_{X\,REQD} = \frac{(0.0181)(184)^2/8}{22} = 3.48\ IN^3$

$S_{Y\,REQD} = \frac{(.00252)(184)^2/8}{22}(0.6) = 0.29\ IN^3$

$\frac{3.48}{6.41} + \frac{0.29}{6.41} = 0.59 < 1.0$ OK

(6.41 = S_X PROVIDED; 6.41 = S_Y PROVIDED)

CASE #3 OK BY INSPECTION

USE HSS 5x5x1/4 FRAMING