

ELECTRICAL BASIS OF DESIGN

Design Standards

The following is a list of all design standards used in the design and decision making process:

UFC 3-500-10N	Electrical Engineering
UFC 3-501-03N	Electrical Engineering Preliminary Considerations
UFC 3-520-01	Interior Electrical Systems
UFC 3-530-01	Interior and Exterior Lighting and Controls
UFC 3-580-01	Telecommunications Building Cabling Systems Planning and Design
UFC 3-600-01	Fire Protection Engineering for Facilities
UFC 4-010-01	DoD Minimum Anti-Terrorism Standards for Buildings
UFC 4-021-01	Design and O&M: Mass Notification Systems

Power Distribution

The primary source for power to the facility shall be the existing overhead distribution lines on Lower Gainesville Road. The overhead distribution is 13.8 kV, 3-phase delta. This represents a change from the RFP, which has been approved by the Engineering Department at Stennis Space Center, and the Contracting Officer. The change provided a shorter route to the facility, which stays within the limits of construction. The overhead connection and riser pole was installed for temporary construction power, and permanent power, and has been fully inspected and approved.

The Engineering Department at Stennis Space Center has determined that the overhead distribution is adequate to handle the load of the Facility, based upon an estimate of 300 KVA.

Permanent underground conduit to the facility transformer shall be installed in accordance with Stennis Space Center standards SSTD-8070-0081-ELEC, and consists of 2-4" conduits, concrete encased, with #1/0 AWG, type MV-105, 15kV cables, insulated with 133% EPR.

The pad-mount transformer shall be provided and installed in accordance with Stennis Space Center Standards SSTD-8070-0081-ELEC, with manufacturer submittal approved prior to order. The installation shall include a digital multi-measurement meter, mounted to the pad-mount transformer, also in accordance with Stennis Space Center Standards.

The connected load for the Facility is currently calculated at 459 KVA, which includes all loads based upon actual manufacturer data for all contractor provided equipment. Government furnished equipment is currently estimated, as minimal manufacturer data has been provided at this time. The connected load includes both heating and air-conditioning loads. All loads are listed in the attachment entitled "Electrical Load Analysis" at the end of this document. Based upon and analysis of the loads, in accordance with UFC 3-501-03N Electrical Engineering Preliminary Considerations, and further considerations of end user utilization, the estimated maximum demand load for the facility is 223 KVA.

Based upon these results, the size of the pad-mount transformer shall be 300 KVA. With a total building square footage of 24,005 sq. ft., this represents 12.49 VA/sq. ft., which is under the maximum allowable 13 VA/sq. ft. The next size smaller pad-mount transformer is 225 KVA, which does not provide adequate capacity to satisfy the future growth requirements of 25%.

The primary utilization voltage for the facility shall be 277/480V, 3-phase, 4-wire. This selection is based primarily on the HVAC loads, which consist of a single packaged air-cooled chiller, and electric heat. The most economical and efficient operating voltage for these loads is 480 volts, 3-phase. The use of 277/480V, 3-phase, 4-wire service limits the incoming service capacity to 500 amps, which is most economically provided using panelboard construction.

The service entrance is sized at 277/480V, 3-phase, 4-wire, 500 amps, solid-grounded wye. The calculated fault current at the service entrance is 9021 amps maximum, and is currently based upon infinitely availability on the 13.8 kV distribution system, and a transformer impedance estimated at 4.00 %Z. The impedance will be updated with manufacturer nameplate data when available. The calculations are listed in the attachment entitled "Three Phase calculations short circuit and voltage drop" at the end of this document.

The service entrance equipment will have a bus rating of 600 amps, with 14 KIAC interrupting capacity. All wiring shall be copper, with 600V type THHN insulation, with the exception of the service entrance conductors for both normal and emergency services. These conductors shall be 250 kcmil A-8800 aluminum alloy. All conductors shall be installed in conduit, PVC for below grade, and EMT/rigid above grade.

All transformers shall be copper wound, high efficiency, includes both the pad-mount and dry-type distribution transformers.

An emergency generator, sized at 250 kW, 312.5 KVA at 0.8 power factor, shall be provided to back up the entire facility. This will be accomplished through a 600A transfer switch with by-pass isolation. Generator shall be diesel-driven, with a sub-base fuel tank. The fuel tank capacity shall be selected in accordance with user requirements, and due consideration of emergency operational needs and re-fueling criteria.

Lighting

All interior lighting consists of fluorescent lamps operated by electronic ballasts. The design follows the criteria as set forth in UFC 3-530-01 Interior and Exterior Lighting and Controls, and matching the existing facilities on site where appropriate. The illuminance calculations, including target and calculated footcandles are listed in the attachment entitled "Illuminance Calculation Schedule" at the end of this document. Full point-by-point calculations are provided in the "supplemental documents" portion of the pre-final submittal.

All exterior lighting consists of high-pressure sodium lamps, either building mounted or pole mounted. Full point-by-point calculations are provided in the "supplemental documents" portion of the pre-final submittal.

Lighting controls shall be accomplished in accordance with ASHRAE 90.1 –2004, through the use of a lighting control relay panel. The relay panel shall provide the capability to automatically turn on or shut off all or select lighting loads per the end users needs, and includes all lighting loads (interior and exterior), with the exception of the Boat Storage Building. The Boat Storage Building lighting shall be controlled through the use of mechanical timer switches, which is appropriate given the very limited occupancy periods expected. Exterior wall-mounted HPS fixtures shall be controlled by photocell.

Fire Alarm/Mass Notification System

A complete electrically supervised, addressable intelligent, manual and automatic, fire alarm system has been designed in accordance with respective NFPA/UFC standards and the RFP. Compliance with the requirements for the fire alarm/Mass notification system will be determined by a review of the design and shop drawing submittals by a registered fire protection engineer.

The primary system in the Operations/Maintenance Building consists of a fire alarm control panel, remote annunciator, manual pull stations, smoke detectors, duct detectors, A/V devices, radio transmitter, and supervision of the sprinkler system. The radio transmitter provides reporting to the Base Fire Department. All audio devices in the Operations/Maintenance Building are speakers which will provide Mass notification for the interior and exterior areas around the building.

The Boat Storage Building system consists of a fire alarm control panel, manual pull stations, A/V devices, and supervision of the sprinkler system. All audio devices are horns, as no mass notification is required in the Storage Building.

Telecommunications Cabling System

A telecommunications distribution system shall be provided, consisting of a single distribution frame on the second floor, and horizontal cabling to all outlets as shown on the plans. Per notification by the end user, tempest 2-95 requirements do not apply to this facility. However the horizontal cabling shall still be separated between secure and non-secure systems. Secure cabling shall now be unshielded in lieu of shielding as required by Tempest. All secure and non-secure horizontal cables shall be installed in separate sides of the center hung cable tray on the second floor. Separate outlets shall be provided for secure and non-secure cabling. All outlets have been shown on the drawings per direction of the end user, and coordinated with the concept design submittal of the interior furnishings. Upon acceptance of the interior furnishings, final coordination shall be performed, and all riser diagrams shall be prepared and submitted as shop drawings.

The distribution frame shall be connected to the head end equipment in Building 2606 via an underground ductbank consisting of 6-4" conduits per the RFP and Stennis Space Center Standards. Due to the distance between the New Facility and Building 2606, no multi-mode fiber will be installed as requested in the RFP due to the distance limitations of multi-mode fiber. All fiber shall now be single mode, and consist of two cables, 1-24 strand and 1-48 strand. An additional copper cable, 25-pair, 24 AWG, CAT3, shall also be provided in accordance with the RFP.

CATV

CATV distribution shall be provided in the Operations Facility, utilizing a star topology, with the source in the telecommunications room on the second floor. Cable shall be RG-6 Quad shield. All outlets have been shown on the drawings per direction of the end user, and coordinated with the concept design submittal of the interior furnishings. Upon acceptance of the interior furnishings, final coordination shall be performed, and all riser diagrams shall be prepared and submitted as shop drawings. All equipment shall be installed in the telecommunications room, including amplifiers, taps, compensators, and filters as necessary. Connection to the head end located in Building 2606 shall be accomplished via single mode fiber, with media converters provided at both ends.

Intercom/Public Address System

The RFP requested the installation of an Aiphone system, interconnected to the head end at Building 2606. A request for change has been submitted to upgrade the system to a digital system by Linel, which will integrate into the Electronic Security system. The Aiphone system in the existing buildings may potentially be removed and replaced by the Linel system. At this time, no specifications or equipment submittals have been provided, pending the resolution of the request for change. Device locations have been provided on the drawings, and coordination with the end user will continue while the request for change is considered.

Electronic Security System

An interior/exterior integrated electronic security system device layout has been provided in the pre-final submittal, and consists of access control devices, intrusion detection devices, and CCTV cameras. Further coordination and review with the end user is needed prior to development of specifications, riser diagrams, and shop drawings. All of the above shall be accomplished and submitted under separate cover prior to Final submittal.

Lightning Protection

Lighting protection design has been provided per the RFP for the Operations Facility, Boat Maintenance and Boat Storage Buildings. Installation shall be in accordance with LPI and UL, and receive the UL Master Label. Specifications, shop drawings, and equipment data have been provided in the pre-final submittal.

THREE PHASE CALCULATIONS
SHORT CIRCUIT AND VOLTAGE DROP

TRANSFORMER: T1

Primary volts:	13800	8,747 Secondary SC amps (known primary)
Primary SC amps available:	10000	
Secondary volts:	480	9,021 Secondary SC amps (infinite primary)
Rated KVA:	300	
Impedance (%Z):	4.00	

FEEDER: SERVICE TO ECB

SC amps available at start:	9021 amps	Row= 250C
Phase conductor size:	250 AWG/KCMIL	Col= 600VN
Conductor type:	C (C=copper, A=aluminum)	C= 18593
Insulation class:	600V (600V, 5KV, 15KV)	
Number per phase:	2	Row= 250N
Conductor length:	165 feet	Col= 80C
Conduit type:	N (S=steel/magnetic, N=nonmagnetic)	VL= 114
Design FLA:	350 amps	
Lagging power factor:	80 (percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **7883** amps Voltage drop = **0.69** %

FEEDER: ECB TO MDP

SC amps available at start:	7883 amps	Row= 250C
Phase conductor size:	250 AWG/KCMIL	Col= 600VN
Conductor type:	C (C=copper, A=aluminum)	C= 18593
Insulation class:	600V (600V, 5KV, 15KV)	
Number per phase:	2	Row= 250N
Conductor length:	10 feet	Col= 80C
Conduit type:	N (S=steel/magnetic, N=nonmagnetic)	VL= 114
Design FLA:	350 amps	
Lagging power factor:	80 (percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **7823** amps Voltage drop = **0.04** %

FEEDER: MDP TO T2

SC amps available at start:	7823	amps	Row= 4/0C
Phase conductor size:	4/0	AWG/KCMIL	Col= 600VS
Conductor type:	C	(C=copper, A=aluminum)	C= 15082
Insulation class:	600V	(600V, 5KV, 15KV)	
Number per phase:	1		Row= 4/0S
Conductor length:	6	feet	Col= 80C
Conduit type:	S	(S=steel/magnetic, N=nonmagnetic)	VL= 140
Design FLA:	180	amps	
Lagging power factor:	80	(percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **7736** amps Voltage drop = **0.03** %

FEEDER: MDP TO AC1

SC amps available at start:	7823	amps	Row= 2C
Phase conductor size:	2	AWG/KCMIL	Col= 600VS
Conductor type:	C	(C=copper, A=aluminum)	C= 5906
Insulation class:	600V	(600V, 5KV, 15KV)	
Number per phase:	1		Row= 2S
Conductor length:	12	feet	Col= 80C
Conduit type:	S	(S=steel/magnetic, N=nonmagnetic)	VL= 336
Design FLA:	60	amps	
Lagging power factor:	80	(percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **7398** amps Voltage drop = **0.05** %

FEEDER: MDP TO AC2

SC amps available at start:	7823	amps	Row= 2C
Phase conductor size:	2	AWG/KCMIL	Col= 600VS
Conductor type:	C	(C=copper, A=aluminum)	C= 5906
Insulation class:	600V	(600V, 5KV, 15KV)	
Number per phase:	1		Row= 2S
Conductor length:	20	feet	Col= 80C
Conduit type:	S	(S=steel/magnetic, N=nonmagnetic)	VL= 336
Design FLA:	74	amps	
Lagging power factor:	80	(percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **7140** amps Voltage drop = **0.10** %

FEEDER: MDP TO H

SC amps available at start:	7823	amps	Row= 2C
Phase conductor size:	2	AWG/KCMIL	Col= 600VS
Conductor type:	C	(C=copper, A=aluminum)	C= 5906
Insulation class:	600V	(600V, 5KV, 15KV)	
Number per phase:	1		Row= 2S
Conductor length:	12	feet	Col= 80C
Conduit type:	S	(S=steel/magnetic, N=nonmagnetic)	VL= 336
Design FLA:	40	amps	
Lagging power factor:	80	(percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **7398** amps Voltage drop = **0.03** %

FEEDER: MDP TO HS

SC amps available at start:	7823	amps	Row= 2C
Phase conductor size:	2	AWG/KCMIL	Col= 600VN
Conductor type:	C	(C=copper, A=aluminum)	C= 6044
Insulation class:	600V	(600V, 5KV, 15KV)	
Number per phase:	1		Row= 2N
Conductor length:	270	feet	Col= 80C
Conduit type:	N	(S=steel/magnetic, N=nonmagnetic)	VL= 310
Design FLA:	60	amps	
Lagging power factor:	80	(percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **3460** amps Voltage drop = **1.05** %

FEEDER: HS TO T3

SC amps available at start:	3460	amps	Row= 10C
Phase conductor size:	10	AWG/KCMIL	Col= 600VS
Conductor type:	C	(C=copper, A=aluminum)	C= 981
Insulation class:	600V	(600V, 5KV, 15KV)	
Number per phase:	1		Row= 10S
Conductor length:	8	feet	Col= 80C
Conduit type:	S	(S=steel/magnetic, N=nonmagnetic)	VL= 1728
Design FLA:	16	amps	
Lagging power factor:	80	(percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **3140** amps Voltage drop = **0.05** %

THREE PHASE CALCULATIONS
SHORT CIRCUIT AND VOLTAGE DROP

TRANSFORMER: T2

Primary volts:	480	4,082 Secondary SC amps (known primary)
Primary SC amps available:	7736	
Secondary volts:	208	5,293 Secondary SC amps (infinite primary)
Rated KVA:	112.5	
Impedance (%Z):	5.90	

FEEDER: T2 TO L1

SC amps available at start:	5293 amps	Row= 500C
Phase conductor size:	500 AWG/KCMIL	Col= 600VS
Conductor type:	C (C=copper, A=aluminum)	C= 22185
Insulation class:	600V (600V, 5KV, 15KV)	
Number per phase:	1	Row= 500S
Conductor length:	8 feet	Col= 80C
Conduit type:	S (S=steel/magnetic, N=nonmagnetic)	VL= 90
Design FLA:	300 amps	
Lagging power factor:	80 (percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **5210** amps Voltage drop = **0.10** %

FEEDER: L1 TO LB

SC amps available at start:	5210 amps	Row= 2C
Phase conductor size:	2 AWG/KCMIL	Col= 600VN
Conductor type:	C (C=copper, A=aluminum)	C= 6044
Insulation class:	600V (600V, 5KV, 15KV)	
Number per phase:	1	Row= 2N
Conductor length:	60 feet	Col= 80C
Conduit type:	N (S=steel/magnetic, N=nonmagnetic)	VL= 310
Design FLA:	50 amps	
Lagging power factor:	80 (percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **3642** amps Voltage drop = **0.45** %

FEEDER: L1 TO L2

SC amps available at start:	5210	amps	Row= 3/0C
Phase conductor size:	3/0	AWG/KCMIL	Col= 600VS
Conductor type:	C	(C=copper, A=aluminum)	C= 12843
Insulation class:	600V	(600V, 5KV, 15KV)	
Number per phase:	1		Row= 3/0S
Conductor length:	35	feet	Col= 80C
Conduit type:	S	(S=steel/magnetic, N=nonmagnetic)	VL= 163
Design FLA:	160	amps	
Lagging power factor:	80	(percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **4659** **amps** Voltage drop = **0.44** %

FEEDER: L2 TO L2A

SC amps available at start:	5210	amps	Row= 2C
Phase conductor size:	2	AWG/KCMIL	Col= 600VS
Conductor type:	C	(C=copper, A=aluminum)	C= 5906
Insulation class:	600V	(600V, 5KV, 15KV)	
Number per phase:	1		Row= 2S
Conductor length:	8	feet	Col= 80C
Conduit type:	S	(S=steel/magnetic, N=nonmagnetic)	VL= 336
Design FLA:	60	amps	
Lagging power factor:	80	(percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **4921** **amps** Voltage drop = **0.08** %

FEEDER: L2 TO L2B

SC amps available at start:	5210	amps	Row= 2C
Phase conductor size:	2	AWG/KCMIL	Col= 600VN
Conductor type:	C	(C=copper, A=aluminum)	C= 6044
Insulation class:	600V	(600V, 5KV, 15KV)	
Number per phase:	1		Row= 2N
Conductor length:	120	feet	Col= 80C
Conduit type:	N	(S=steel/magnetic, N=nonmagnetic)	VL= 310
Design FLA:	40	amps	
Lagging power factor:	80	(percentile; 100, 90, 80, 70, 60)	

SC amps available at finish: **2799** **amps** Voltage drop = **0.72** %

THREE PHASE CALCULATIONS
SHORT CIRCUIT AND VOLTAGE DROP

TRANSFORMER: T3

Primary volts:	480	728 Secondary SC amps (known primary)
Primary SC amps available:	3460	
Secondary volts:	208	801 Secondary SC amps (infinite primary)
Rated KVA:	15	
Impedance (%Z):	5.20	

FEEDER: T3 TO LS

SC amps available at start:	801	amps	Row= 6C
Phase conductor size:	6	AWG/KCMIL	Col= 600VS
Conductor type:	C	(C=copper, A=aluminum)	C= 2425
Insulation class:	600V	(600V, 5KV, 15KV)	
Number per phase:	1		Row= 6S
Conductor length:	6	feet	Col= 80C
Conduit type:	S	(S=steel/magnetic, N=nonmagnetic)	VL= 745
Design FLA:	40	amps	
Lagging power factor:	80	(percentile; 100, 90, 80, 70, 60)	
SC amps available at finish:	788	amps	Voltage drop = 0.09 %

ILLUMINANCE CALCULATION SCHEDULE

RM. No.	NAME	CEILING TYPE	CEILING HEIGHT	MOUNTING HEIGHT	FIXTURE TYPE	TARGET FC	CALC FC
FIRST FLOOR							
100	ENTRANCE CANOPY	MS	11'-4"	11'-4"	M	8	9
101	REAR ENTRANCE CANOPY	MS	11'-4"	11'-4"	M	8	8
102	ENTRY	GWB	9'	9'	B	15	27
103	LOBBY	GWB	10'	10'	B	15	37
104	SIDE ENTRY	MS	8'	8'	M	8	12
105	CAGES	PS	12'-6"	9'	E	60	63
106	CSS	ACT	9'	9'	A	50	60
107	ARMORY	PS	12'-6"	12'-6"	E	45	51
108	SHOWER	GWB	9'	9'	D/G	15	43
109	HEAD	GWB	9'	9'	I	20	22
110	JANITOR	PS	12'-6"	11'	E	20	12
111	MALE HEAD	GWB	9'	9'	D/I	30	26
112	MALE SHOWER	GWB	9'	9'	G	20	25
113	MAIN ELECTRICAL ROOM	PS	12'-6"	11'	E	30	22
114	MECHANICAL ROOM	PS	12'-6"	11'	E	30	27
115	INTERIOR STAIRS	PS	XX	XX	I	10	8
116	VESTIBULE	ACT	10'	10'	I	15	20
SECOND FLOOR							
200	CORRIDOR	ACT	9'-6"	9'-6"	B	15	21
201	TELCOMM ROOM	GWB	10'-6"	10'-6"	E	30	36
202	RADIO ROOM	GWB	9'-6"	9'-6"	E	30	35
203	MISSION BRIEFING ROOM(S)	ACT	9'-6"	9'-6"	F/H/P	5-50	55
204	SITUCO	ACT	9'-6"	9'-6"	A	40	42
205	SITUO	ACT	9'-6"	9'-6"	A	40	49
206	RIVER OPS WATCH STATION	ACT	9'-6"	9'-6"	F	40	39
207	RTUCO	ACT	9'-6"	9'-6"	A	40	43
208	RTUO	ACT	9'-6"	9'-6"	A	40	48
209	RTUCO	ACT	9'-6"	9'-6"	A	40	43
210	RTUO	ACT	9'-6"	9'-6"	A	40	49
211	MALE HEAD	GWB	9'-6"	9'-6"	I/O	20	28
212	FEMALE HEAD	GWB	9'-6"	9'-6"	I	20	30
213	MECH/ELEC ROOM	PS	9'-6"	9'-6"	E	30	30
214	JANITOR	PS	9'-6"	9'-6"	E	20	20
215	INTERIOR STAIRS	PS	9'-6"	9'-6"	I	10	15
BOAT MAINTENANCE AND STORAGE AREAS							
	BOAT MAINTENANCE	PS	VARIES	VARIES	N	30	41
	BOAT STORAGE	PS	VARIES	21'-8"	N	30	35

LEGEND:

ACT	ACOUSTICAL CEILING TILE
GWB	GYPSUM WALL BOARD
IRWT	IMPACT RESISTANT WALL TREATMENT
MS	METAL SOFFIT
PS	PAINTED STRUCTURE