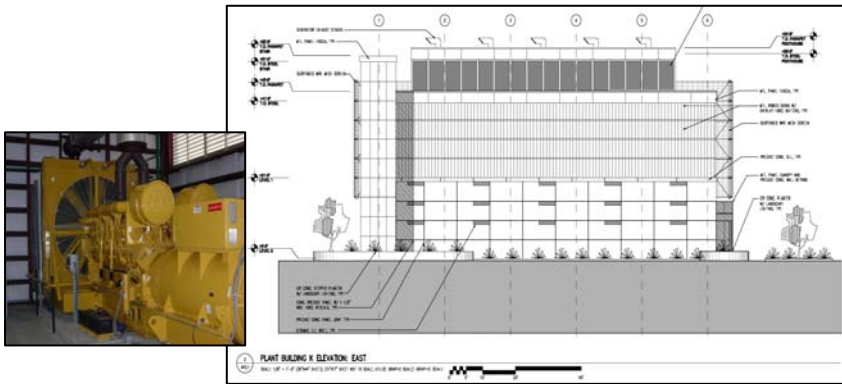


Emergency Power Supply System



Certificate of Need Application
submitted to
Alaska Department of Health & Social Services
April 2010




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Section I
General applicant information

Section I. General applicant information

	CERTIFICATE OF NEED APPLICATION APPLICANT IDENTIFICATION AND CERTIFICATION OF ACCURACY
1. Applicant Identification	
Facility Name Providence Alaska Medical Center	Medicaid Provider Number HP11IP; HS11OP
Facility Address (Street/City/State/Zip Code) 3200 Providence Drive, Anchorage, AK 99508	Medicare Provider Number 020001
Name and mailing address of organization that operates the facility (if different from above) P.O. Box 196604, Anchorage, AK 99519-6604	
Facility Administrator (Name, title, mailing address, including City/State/Zip Code) Dr. Richard Mandsager, Chief Executive Providence Alaska Medical Center P.O. Box 196604, Anchorage, AK 99519-6604	Telephone 907-212-8450 Facsimile 907-212-3041 E-mail: richard.mandsager@providence.org
Applicant (Name, title, mailing address, including City/State/Zip Code) Dr. Richard Mandsager, Chief Executive Providence Alaska Medical Center P.O. Box 196604, Anchorage, AK 99519-6604	Telephone 907-212-8450 Facsimile 907-212-3041 E-mail: richard.mandsager@providence.org
Principal Contact Person (Name, title, physical address, mailing address, including City/State/Zip Code) Gretchen Guess, Regional Director, Business Development Providence Health & Services Alaska P.O. Box 196604, Anchorage, AK 99519	Telephone 907-212-6204 Mobile Phone 907-242-2411 Facsimile 907-212-2884 E-mail gretchen.guess@providence.org
2. Ownership Information	
A. Type of Ownership (check applicable category) <div style="display: flex; justify-content: space-between;"> <div> <input type="checkbox"/> For profit: individual <input type="checkbox"/> For profit: partnership <input type="checkbox"/> For profit: corporation </div> <div> <input type="checkbox"/> Not for profit: government <input checked="" type="checkbox"/> Not for profit: corporation <input type="checkbox"/> Other (specify): _____ </div> </div>	
B. List of all Owners (Page 2 of application) C. Accreditation Information (Page 2 of application)	
3. Certification of Accuracy by Certifying Officer of the Organization	
I hereby certify that the information contained in this application, including all documents that form any part of it, is true, to the best of my knowledge and belief. I agree to provide, within 60 days from receipt of a request from the department under 7 AAC 07.050(b), any additional information needed by the department to make a decision.	
Name Richard Mandsager, MD	Title Chief Executive Providence Alaska Medical Center
Signature	Date

Section I
General applicant information

Part 2.B. provide the following ownership information under each requirement, using as much space as necessary to provide complete information:

- (1) For individual owners and partnerships, list the names, titles, organizational name, mailing and street addresses, and telephone and facsimile numbers of the owners or partners.**
- (2) For corporations, list the names, titles, and addresses of the corporate officers and Board of Directors. If the facility is a subsidiary of another company or has multiple owners, provide the names and addresses of the all of companies that have ownership in the facility.**
- (3) For governmental or other nonprofit owners, list the names and addresses of hospital board members.**

**Providence Health & Services
Board of Directors**

Effective: Jan. 1, 2010

All Directors use this official address:

1801 Lind Ave. SW, #9016
Renton, WA 98057-9016

Jeffrey Clode, MD	Jim Roberts, MD
M. Adrian Davis, LCM	Owen Robinson
Lucille Dean, SP	Cheryl M. Scott
Mary Corita Heid, RSM	Peter J. Snow
Michael Holcomb	Michael A. Stein
Dana Rasmussen	Ellen Wolf
Paul Redmond	

Section I
General applicant information

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Executive Vice President/Finance &
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Section I
General applicant information

**Providence Health & Services Alaska
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2010**

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Section I
General applicant information

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Regional President, Wells Fargo Bank
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Section I
General applicant information

For Part 2.C.

Is this facility accredited or certified by a recognized national organization? Yes

If yes, identify the organization, the date of accreditation or certification, and attach as an appendix to this application a copy of the most current accreditation or certification.

Providence Alaska Medical Center (PAMC) is accredited by the Joint Commission. PAMC was surveyed in July 2008 and received accreditation through October 2011. A copy of the recent survey accreditation is in Appendix A.

Section II.
General applicant information

Section II. General applicant information

Provide a one page summary of the proposed project including a brief description of each proposed service, including whether equipment will be purchased or replaced and a list of that equipment; the number of square feet of construction/renovation; number and type of beds/surgery suites/specialty rooms; services to be expanded, added or reduced; the total cost of the project; how it will be financed; and completion date.

An Emergency Power Supply System (EPSS) provides the backup power for maintaining critical hospital operations associated with patient care¹ during power disruptions. The EPSS has two main components: a generator plant (which includes generators and fuel) to create power and a medium voltage power distribution system in loop configuration to distribute power.

The decision to utilize backup power depends on the situation. The Joint Commission standard states that a hospital must be able to operate for 96 hours in the event of an emergent or disastrous event when electrical power is unavailable from external sources. It does not, however, define the level of operations, leaving hospitals the flexibility to respond to the immediate and predicted patient care needs of their community.

PAMC's current EPSS components are 24 to 36 years old. Instead of replacing the current system, PAMC proposes increasing capacity to cover more functionality during a power outage. This increased functionality over the current code is recommended by the Joint Commission in Sentinel Event Alert Issue 37, September 6, 2006 (See Appendix B).

Toward this end, PAMC proposes an EPSS that increases capacity from 3.2 megawatts to 4.0 megawatts, provides for a 2.0 megawatt backup generator (in case a generator is down), and triples fuel storage from 30,000 to 90,000 gallons. The size of this new generator system requires a new building of 19,278 square feet that will be adjacent to the current plant and will include new electrical switchboards. In addition, as part of this project but separate from the certificate of need given its replacement nature, is the replacement of the current automated transfer switches.

As the largest health care provider and only tertiary care facility in the Alaska, PAMC must have both an adequate and reliable supply of electrical power in the event of a natural disaster, emergency, or power outage. The proposed EPSS project is appropriately sized to provide power to sustain patient care in the event of a natural disaster or extended utility outage well into the future.

PAMC will carefully phase all portions of the proposed EPSS project to ensure minimal disruption to patient care throughout the construction period. The proposed EPSS project would be fully financed through the use of internal capital and operating funds (no debt financing). PAMC proposes to spend \$36,102,750 on the new EPSS services. Final completion will be no later than March 2013.

¹ For this Certificate of Need, patient care is defined as life safety, emergency, and essential equipment as defined by National Fire Protection Association standards, Chapter 4, found in Appendix B.

Section II.
General applicant information

The proposed EPSS project does not impact PAMC's number and type of beds, surgery suites, specialty rooms or services to be expanded, added or reduced.

Section III.
Description of facilities and capacity indicators

Section III. Description of facilities and capacity indicators

A. Proposed changes in service capacity. Provide either the number of beds, surgery suites, rooms, pieces of equipment, or other service.

The proposed EPSS project does not impact PAMC's number and type of beds, surgery suites, specialty rooms or services to be expanded, added or reduced.

Type of Service	Current Capacity	Added, Expanded, or Replacement Capacity	TOTAL PROPOSED CAPACITY
IN-PATIENT ACUTE CARE HOSPITALS			
Med/Surg Beds			
1-bed room/unit	167	0	167
2-bed room/unit	14	0	14
Other (list):	0	0	0
ICU Beds	28	0	28
NICU Bassinets	47	0	47
Obstetrics Beds	23	0	23
Prenatal Beds	11	0	11
Pediatric Beds	32	0	32
Acute Rehab Beds	10	0	10
Ancillary Services (list)	0	0	0
BEHAVIORAL HEALTH CARE			
In-patient Acute Psychiatric Beds	27	0	27
RPTC Beds	0	0	0
In-patient Substance Abuse Beds	0	0	0
LONG-TERM CARE			
Acute Beds	0	0	0
Nursing Beds	0	0	0
DIAGNOSTIC AND DIAGNOSTIC IMAGING SERVICES			
CT Scanner	2	0	2
MRI	1	0	1
PET or PET/CT	0	0	0
Cath/EP/IR Laboratory	6	0	6

Section III.
Description of facilities and capacity indicators

Type of Service	Current Capacity	Added, Expanded, or Replacement Capacity	TOTAL PROPOSED CAPACITY
SURGICAL CARE			
Dedicated OP	0	0	0
Dedicated IP	0	0	0
Both IP & OP	15	0	15
Endoscopy	4	0	4
Open-Heart Surgery	1	0	1
Organ Transplantation	0	0	0
Other Services (list): Dedicated Cysto Room	1	0	1
THERAPEUTIC CARE			
Radiation Therapy	3	0	3
Lithotripsy	0	0	0
Renal Dialysis	4	0	4
Other (List)			
Total Capacity	326 licensed beds 47 NICU Bassinets	0 0	326 licensed beds 47 NICU Bassinets

**Does not include proposed capacity in PAMC Generations project as submitted by February 2010*

Section III.
Description of facilities and capacity indicators

B. Provide a detailed narrative description of each service identified in "A" above, including the type of change (addition, expansion, conversion, reduction, replacement, elimination). Include, as appropriate, detailed information relative to the scope and level of service.

The proposed EPSS project does not impact PAMC's number and type of beds, surgery suites, specialty rooms or services to be expanded, added or reduced.

C. Provide in the following table information regarding equipment to be purchased.

Equipment to be Purchased				
Equipment Description	Make	Model	Cost	
Diesel Engine Generator 2000EKW	Caterpillar	3516C TA	\$471,196	
Diesel Engine Generator 2000EKW	Caterpillar	3516C TA	\$471,196	
Diesel Engine Generator w/switchgear/breakers	Caterpillar	3516C TA	\$494,435	
Custom EGP Switchgear	Caterpillar	n/a	\$790,545	
Additional Switchgear	Caterpillar	n/a	\$ 25,876	
Exhaust silencer mounting provisions	Caterpillar	n/a	\$ 4,100	
Exhaust silencer mounting provisions	Caterpillar	n/a	\$ 4,100	
Exhaust silencer mounting provisions	Caterpillar	n/a	\$ 4,100	
Exhaust silencer mounting provisions	Caterpillar	n/a	\$ 4,100	
24 VDC manual pre-lube pump	Caterpillar	n/a	\$ 3,000	
24 VDC manual pre-lube pump	Caterpillar	n/a	\$ 3,000	
24 VDC manual pre-lube pump	Caterpillar	n/a	\$ 3,000	
24 VDC manual pre-lube pump	Caterpillar	n/a	\$ 3,000	

D. Provide in the following table information regarding equipment to be replaced or retired.

Equipment to be Replaced or Retired				
Equipment Description	Make	Model	Date Placed Into Service	Reason for Replacement or Retirement
Generator	Cummins	KTA 50G1	1/1/86	Past Useful Life
Generator	Cummins	KTA 50G1	1/1/86	Past Useful Life
Generator	Solar Turbine	ASS494526	2/28/76	Past Useful Life
Generator	Detroit Diesel	71237305	12/10/82	Past Useful Life

Section III.
Description of facilities and capacity indicators

E. Describe replacement or upgrading of utilities including the electrical, heating, ventilation, and air conditioning systems.

Electrical

1. Three (3) new EPA Tier II diesel electric generator sets, each rated 2,000 KW, 12,470 volts, three phase.
2. Medium voltage switchgear to serve all generators.
3. Medium voltage power distribution to deliver the power to the hospital and partial distribution to future buildings. Service transformers, switch cabinets and medium voltage cabling will be upgraded to support the new arrangement.
4. Control wiring between the generator switchgear and automatic transfer switches in the hospital.
5. Medium Voltage Power reconfiguration and equipment relocations in Services Building J. Inside work also includes installation of service transformer secondary conductors, new service switchgear and switchboards in Building D and J.
6. Four existing emergency generators will be removed, including their exhaust stacks and all associated wiring and appurtenances.
7. Existing Normal Power Service Transformers, Generators, Switchgear and Fuel Oil System in Services Building J will be demolished.
8. Existing Building D, F and J service transformers, switchgear and switchboards will be disconnected and removed.

Mechanical

1. Two concrete vaults each protect a separate 45,000 gallon above ground fuel oil storage tank to provide 90,000 gallons of useful fuel oil supply.
2. The new fuel oil pumping system serves both the new EPSS building generators and the existing Services Building J steam boilers.
3. Existing Fuel Oil Piping and Day Tanks in Building J serving existing generators and reconfigure piping will be demolished after the EPSS Plant is fully commissioned, operational, training is complete, and Owner has taken Beneficial Occupancy.
4. Two existing underground storage tanks (30,000 gallons total) will remain in service.

Section III.
Description of facilities and capacity indicators

Heating

1. The EPSS Plant Building will normally be heated by a high efficiency, condensing type natural gas fired boiler. Heat distribution includes unit heaters, hydronic heating coils in ductwork, and other hydronic terminal units.
2. A standby oil fired boiler is provided to allow full operation in the event of a failure of the natural gas system.

Ventilation

1. EPSS Plant Building ventilation includes two constant volume variable temperature fans systems, one with air conditioning to serve the control room and other occupied zones, and the second to serve switchgear and electrical spaces.
2. Generator ventilation is designed to strictly limit the escape of sound from operating generators to the outside environment. The system includes acoustical louvers, large sound lined ductwork, and an extensive array of acoustical silencers.

Air conditioning

1. A small roof top air conditioning compressor-condensing unit will serve the new EPSS Building.
2. Existing Chiller CH-13 and ACU-01A/B fluid coolers in Building J will be relocated to the roof to create space for new medium voltage electrical transformers.

F. Describe the structural framing, floor system, and number of floors (including the basement).

Structural

1. Grade to finish floor: Concrete foundation wall providing a solid base to the building (All elevations).
2. First level finish floor to top of parapet: Ten-foot wide by forty six-foot high precast concrete sandwich panels with acid etched finish and horizontal reveals providing a modular pattern language to the elevations (North, east and partial west elevations).
3. First level finish floor to second level finish floor: Ten-foot wide by twenty-one foot high precast concrete sandwich panels with acid etched finish and horizontal reveals providing a modular pattern language to the elevations (Partial south and west elevations).

Section III.
Description of facilities and capacity indicators

4. Second level finish floor to bottom of metal deck: Continuous four foot-wide by twenty-foot high acoustic louvers with matt charcoal finish, minimizing shade and shadow lines at the louver blades to provide a more monochromatic finish. A clear anodized mill finished horizontal aluminum sun-screen has been provided at 5'-0" on center to de-emphasize the verticality of the facade (Partial south and west elevations).
5. Parapet construction: Ten-foot wide by five-foot high acid etched precast concrete panels (Partial south and west elevations over louvers).
6. Stair tower construction - finish floor to top of parapet: Nominal thirty-inch by thirty-inch matte grey to charcoal aluminum panels with clear anodized mill finished trim on substrate board, on metal furring, on precast concrete panels (Stair tower east, south and west elevations).
7. Ground Floor: concrete
8. Second level finished floor: sandwich construction consisting of concrete on insulation on waterproof membrane on concrete.
9. Roof: Roofing membrane over insulation on metal pan deck supported by steel beams and joists.

G. Total square footage in current facility/project.

The total gross square footage of the current programs in the proposed project is 2,430 gross square feet.

H. Total square footage of proposed facility/project.

The total gross square footage of the proposed project is 19,278 gross square feet.

I. Area per bed, service unit, or surgery suite (if applicable).

Not applicable to this proposed project.

J. Percentage of total floor area used for direct service (non-bed activity).

Not applicable to this proposed project.

K. Additional volume of service (non-bed activity) expected.

Not applicable to this proposed project.

Section III.
Description of facilities and capacity indicators

- L. Provide a brief history of expansion and construction for the past five years, including new equipment purchases, additional beds, and new services. Describe how this project fits into the facility's long-range plans, including potential projects planned for development within the next five years.**

Providence is the largest and most thoroughly integrated health care system in Alaska. PAMC is the anchor of this health care system, offering distinctive quality and the most comprehensive services in the state. The facility serves 44 percent of inpatients statewide and 77 percent of inpatients in its primary Anchorage market when excluding inpatients receiving treatment at the Alaska Native Medical Center and military service hospitals.

As the tertiary care facility for the State of Alaska, PAMC plays a unique role. PAMC accepts patients from as close as the Matanuska Valley, 40 miles away, to Barrow and Metlakatla, which are more than 2,000 miles apart and more than four hours by fixed-wing medical evacuation planes from Anchorage.

Over the last five years, PAMC has completed the following projects.

- Upgraded pharmacy (2005)
- Replacement of linear accelerator (2005)
- Replacement of catheterization lab (2005)
- Addition of an medical office building (2005)
- Addition of a surgical robot and its replacement (2005, 2009)
- Replacement of catheterization lab (2006)
- Addition of an electrophysiology lab (2009)

Through the Certificate of Need process, PAMC has completed the following.

- Expansion of the Post-Anesthesia Care Unit (2006)
- Relocation and expansion of the Cancer Center (2006)
- Expansion of the Cardiovascular Observation Unit (2007)
- Expansion and relocation of sports medicine/rehabilitation therapy (2007)
- Expansion of the Neonatal Intensive Care Unit (2007)
- Addition of a cardiac catheterization laboratory (2007)
- Relocation of the sleep lab (2009)
- Addition of an electrophysiology lab (2009)

PAMC has a three-year strategic plan that is updated each year. Since PAMC serves patients from all over the state and is the only provider in the state of some services, the strategic plan incorporates projected changes in population, health services, and economic conditions of communities across Alaska to determine medical needs.

At this time, additional projects at PAMC include an electronic medical record infrastructure project. PAMC has also submitted a Certificate of Need for proposed campus expansion.

Section IV.
Narrative review questions

Section IV. Narrative review questions

A. RELATIONSHIP TO APPLICABLE PLANS AND NATIONAL TRENDS

Indicate how the application relates to any relevant plans, including the applicant's long-range plans, appropriate local, regional, or state government plans, the current Alaska Certificate of Need Review Standards and Methodologies, adopted by reference in 7 AAC 07.025, and current planning guidelines of recognized national medical and health care groups. If the proposal is at variance with any of these documents, explain why. (See the department's website for state planning processes and materials and links to federal websites.)

As a Catholic not-for-profit health care provider, Providence Health & Services Alaska (Providence) has been serving Alaskans for more than 100 years. Our commitment to meet Alaskans' health care needs, both now and in the future, requires that Providence connect with our communities and have a deep understanding of their current and future health care needs. The proposed EPSS project is consistent with the need Providence has identified for an emergency electrical infrastructure to support uninterrupted provision of high quality health care services to all Alaskans.

In securing the approval of the Governing Board of Providence Health & Services to proceed, the proposed project was required to be consistent with the Providence mission, core values, and operating commitments.

Consistency with Providence Mission

The Providence Mission is:

"As people of Providence, we reveal God's love for all, especially the poor and vulnerable, through our compassionate service."

Providence serves all Alaskans, regardless of ability to pay, by providing acute and emergency care, outpatient services, home and hospice care, long-term care and wellness-oriented services.

As the state's largest health care provider and largest private sector employer, Providence holds an unmatched role in Alaska's health care delivery system. As the state's health care leader, Providence works to provide proximal, convenient care whenever it can best meet a community need, contribute to the continuum of care, contain health care costs and enhance the organization's financial stability which enables it to continue providing these services.

Furthermore, PAMC, as Alaska's tertiary care hospital and primary hospital in case of a natural disaster, requires a consistent, adequate and reliable supply of electrical power to fulfill its mission.

Section IV.
Narrative review questions

Consistency with Providence Core Values

The core values of Providence are respect, compassion, justice, excellence and stewardship.

As the only tertiary care hospital serving Alaska, PAMC has the obligation to plan for both the local community needs of Anchorage and those of the entire state. PAMC is called upon to look into the future to prepare to meet the myriad of challenges facing health care delivery in Alaska, including those challenges from natural disasters. The proposed EPSS project emerged in direct response to the PAMC's requirement for an electrical power infrastructure to maintain a high standard of patient care especially during a natural disaster.

As a not-for-profit institution, Providence reinvests dollars spent on health care back into the community. Reinvesting in infrastructure to ensure patient safety, quality and service excellence through updating and modernizing emergency electrical equipment is at the heart of this proposal. Good stewardship demands that Providence not overextend its ministry or burden the community with excessive health care costs or unnecessary facilities. The proposed project is scoped to ensure Providence meets community need now and into the future while not overbuilding its facilities.

Consistency with Providence Operating Commitments

The operating commitments of Providence are people-centered, service-oriented, quality-focused, financially responsible and growing to serve. By updating and modernizing the EPSS, Providence ensures it has the emergency power that is critical to ensuring high-quality service to the community especially during disasters. In addition, this proposed new system is the most cost effective alternative to supporting this community need.

Consistency with Local, Regional and State Governmental Plans

The proposed EPSS project is consistent with the Joint Commission, which requires that hospitals plan for self-sufficiency for 96 hours of some type of patient care in the event that they cannot be supported by the local community. That said, after Hurricane Katrina, the Joint Commission set forth a Sentinel Even Alert (See Appendix B) urging health care organizations to take steps beyond these minimums to keep patients safe in the event that normal electrical power is not available.

Consistency with Alaska Certificate of Need Review Standards and Methodologies

There are no service-specific review standards or methodologies for the proposed EPSS projects. Section IV addresses consistency of the Certificate of Need general review standards.

Section IV.
Narrative review questions

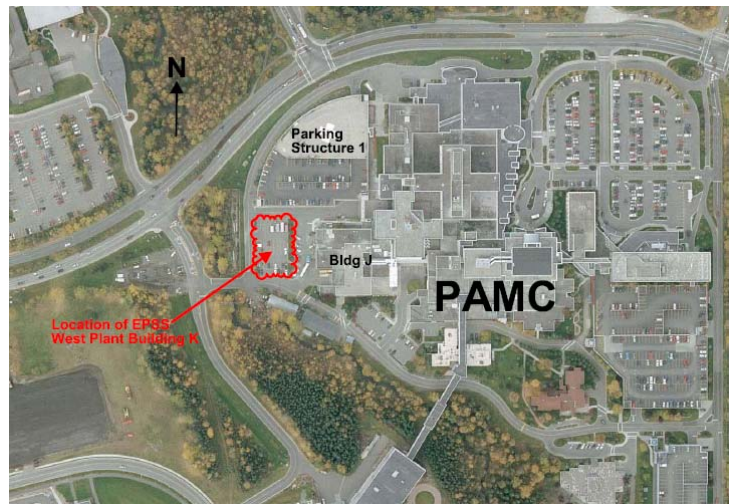
B. DEMONSTRATION OF NEED

- 1. Identify the problems being addressed by the project. For example, identify whether this project is for (a) a new service; (b) an expanded service; or (c) an upgrade of an existing service.**

PAMC's current EPSS components are 24 to 36 years old. Instead of replacing the current system, PAMC proposes increasing capacity to cover more functionality during a power outage. This increased functionality over the current code is recommended by the Joint Commission in Sentinel Event Alert Issue 37, September 6, 2006 (See Appendix B).

Towards this end, PAMC proposes an EPSS which increases capacity from 3.2 megawatts to 4.0 megawatts, provides for a 2.0 megawatt backup generator (in case a generator is down), and triples fuel storage from 30,000 to 90,000 gallons. The size of this new generator system requires a new building of 19,278 square feet that will be adjacent to the current plant and will include new electrical switchboards. In addition, as part of this project but separate from the certificate of need given its replacement nature, is the replacement of the current automated transfer switches.

PAMC requires a new building (Building K) for three primary reasons: (1) the new equipment is larger and requires more space than is currently available in the existing square footage; (2) an EPSS system must be operational at all times and therefore the old system cannot be down to allow a new system to be replaced in its footprint; and (3) the project expansion provides for an additional generator which increased required square footage.



The existing generators will be removed as part of this project and this space used for the proposed project.

The proposed EPSS project will serve the electrical needs of PAMC's existing main hospital facility. It will not serve of the Health Park, includes outpatient and ancillary services, has its own EPSS.

Section IV.
Narrative review questions

- 2. Describe whether (and how) this project (a) addresses an unmet community need; (b) satisfies an increasing demand for services; (c) follows a national trend in providing this type of service; or (d) meets a higher quality or efficiency standard.**

Increased capacity over the current code is recommended by the Joint Commission in Sentinel Event Alert (Issue 37, September 6, 2006). (See Appendix B)

- 3. Describe any internal deficiencies of the facility that will be corrected, and document which of these deficiencies have been noted by regulatory authorities. Note any deficiencies that will not be corrected by this project, what efforts have been taken to correct the deficiencies, and how this project will affect the deficiencies. Attach any pertinent inspection records and other relevant reports as an appendix to the application.**

While PAMC has never been cited for deficiencies by The Centers for Medicare and Medicaid Services and the Joint Commission, the existing EPSS does not cover all the functionality PAMC desires given its role as the largest health care provider and only tertiary care facility in the Alaska.

Section IV.
Narrative review questions

4. Identify the target population to be served by this project. The "target population" is the population that is or may reasonably be expected to be served by a specific service at a particular site. Explain whether this is a local program, or a program that serves a population outside of the proposed service area. Use the most recent Alaska Department of Labor and Workforce Development statistics for population data and projections. Explain and document any variances from those projections.

As the largest health care provider, only tertiary care facility in the State of Alaska, PAMC must have both an adequate and reliable supply of electrical power in the event of a natural disaster, emergency, or power outage. As such, the target population is the entire state of Alaska.

**Providence Alaska Medical Center
Total Patient Days**

	2005	2006	2007	2008	2009	2010 (January, February)	2010 (budget)
PAMC Total Patient days	88,521	90,862	92,043	91,506	88,587	13,504	91,463

	2011 (forecast)	2012 (forecast)	2013 (forecast)	2014 (forecast)	2015 (forecast)	2016 (forecast)	2017 (forecast)
PAMC Total Patient days	91,464	91,464	91,923	92,112	93,008	93,683	93,946

5. Describe the projected utilization of the proposed services and the method by which this projection was derived. Include the last complete year of operation (indicate if it is a calendar year or fiscal year) and as many prior years as is feasible to show trends.

Not applicable to this proposed project.

5a. Include evidence of the number of persons from the target population who are currently using these services and who are expected to continue to use the service, including individuals served out of the service area or out of state.

Not applicable to this proposed project.

5b. Include evidence of the number of persons who will begin to use any new services that are not now available, accessible, or acceptable to the target population.

Not applicable to this proposed project.

5c. Provide annual utilization data and demand trends for the five most recent years and monthly utilization data for the most recent incomplete year prior to the application for each existing facility offering a similar service in the service area. Provide projections for utilization

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for three years (or the appropriate planning horizon set out in the review standards related to this project) after construction, and show methodology used to determine use, including the math.

Not applicable to this proposed project.

- 5d. If the project is an acquisition of a new piece of major equipment or a new service, provide utilization data for similar services, existing equipment, or older technology. Indicate whether similar existing equipment will continue to be used and the project's effect on utilization of similar services. If this service or equipment was not in place in the service area, compare the expected utilization with other similar communities in Alaska or in other states.**

The proposed project is to increase the capacity of the PAMC EPSS.

PAMC's current EPSS components are 24 to 36 years old. Instead of replacing the current system, PAMC proposes increasing capacity to cover more functionality during a power outage. This increased functionality over the current code is recommended by the Joint Commission in Sentinel Event Alert Issue 37, September 6, 2006 (See Appendix B).

Towards this end, PAMC proposes an EPSS which increases capacity from 3.2 megawatts to 4.0 megawatts, provides for a 2.0 megawatt backup generator (in case a generator is down), and triples fuel storage from 30,000 to 90,000 gallons. The size of this new generator system requires a new building of 19,278 square feet that will be adjacent to the current plant and will include new electrical switchboards.

See Section III for more detail requiring acquisition and retirement of equipment

As part of this project but separate from the proposed CON project, is the replacement of the current automated transfer switches.

- 5e. If an increase in utilization is projected, list the factors that will affect the increase.**

Increased utilization is based on increased megawatt usage during backup power situations. In these cases, the proposed EPSS will have the increased capacity and therefore possible utilization, to provide more functionality for patient care needs.

- 5f. If any services will be reduced, indicate how the proposed reduction will affect the service area needs and patient access.**

Not applicable to this proposed project.

- 5g. Provide any other information that may be pertinent to establishing the need for this project.**

Not applicable to this proposed project.

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5h. Attach letters of support from local and regional agencies, other health care facilities, individuals, governmental bodies, etc.

Not applicable to this proposed project.

B. DEMONSTRATION OF NEED

- 1. Include your calculations of numerical need for each proposed activity for your service area. If the proposed project is expected to have a larger capacity than that projected by (and available from) the department, explain the rationale and provide documentation to support the larger capacity.**

Not applicable to this proposed project.

C. AVAILABILITY OF LESS COSTLY OR MORE EFFECTIVE ALTERNATIVES

- 1. Describe the different alternatives considered in developing this project. Explain why the particular alternative for providing the services proposed by this application was selected. Include as an alternative a discussion of the effect of doing nothing.**

ALTERNATIVE ONE - Do Nothing

PAMC's current EPSS components are 24 to 36 years old. It needs to be replaced. Instead of replacing the current system, PAMC proposes increasing capacity to cover more functionality during a power outage. This increased functionality over the current code is recommended by the Joint Commission in Sentinel Event Alert Issue 37, September 6, 2006 (See Appendix B).

THEREFORE, ALTERNATIVE #1 IS NOT ACCEPTABLE.

ALTERNATIVE TWO – Separate new generators and fuel storage into their own buildings

This alternative locates the new generator plant in one location and three above ground fuel tanks in proximity to, but not co-located with, the generators. This option was not selected due to its higher cost and the environmental risk associated with the fuel pipeline which would run adjacent to the Chester Creek wetlands and through the PAMC campus.

THEREFORE, ALTERNATIVE #2 IS NOT ACCEPTABLE.

ALTERNATIVE THREE - A joint venture with Municipal Light & Power and the University of Alaska Anchorage to operate a Combined Heat and Power (CHP) plant

The use of a CHP plant was analyzed. This option was not selected because it does not meet the NFPA time requirements for coming online following a power failure.

THEREFORE, ALTERNATIVE #3 IS NOT ACCEPTABLE.

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ALTERNATIVE FOUR – Use of modular Generator buildings for the EPSS

This alternative consisted of six separate custom built modules housing the generators, switchgear and electrical distribution equipment. This alternative required a much larger footprint, was more expensive than other alternatives, and was not cost effective to run; therefore, this option was not selected.

THEREFORE, ALTERNATIVE #4 IS NOT ACCEPTABLE.

ALTERNATIVE FIVE – Comprehensive backup for both essential and normal electrical uses

This alternative included a generator building, two generators, space for three additional generators, chiller building core and shell, and generator medium voltage loop options. This alternative was more expensive than the other alternatives; therefore, this option was not selected.

THEREFORE, ALTERNATIVE #5 IS NOT ACCEPTABLE.

ALTERNATIVE SIX – New generator plant with adjacent fuel storage for essential uses

This alternative, which is the proposed project presented for CON approval, includes a new generator building containing three generators including one backup generator that is adjacent to both fuel storage, to mitigate environmental concerns, and the existing PAMC plant for efficient electrical connections. This alternative is appropriately sized to provide power to sustain patient care in the event of a natural disaster or extended utility outage well into the future along with being the most cost effective; therefore, this alternative was selected.

**THEREFORE, THIS ALTERNATIVE WAS THE MOST
APPROPRIATE FOR THIS PROPOSED PROJECT.**

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2. **Describe any special needs and circumstances. Special needs may include special training, research, Health Maintenance Organizations (HMOs), managed care, access issues, or other needs.**

Not applicable to this proposed project.

D. THE RELATIONSHIP OF THE PROPOSED PROJECT TO EXISTING HEALTH CARE SYSTEM AND TO ANCILLARY OR SUPPORT SERVICES

1. **Identify any existing comparable services within the service area and describe any significant differences in population served or service delivery. If there are no existing comparable services in the area, describe the unmet need and how the target population currently accesses the services. Describe significant factors affecting utilization, including cost, accessibility, and acceptability.**

Each hospital in the service area should have an EPSS to support its operations.

2. **Describe the probable effect on other community resources, including any anticipated impact on existing facilities offering the same/similar services or alternatives locally or statewide if applicable.**

The proposed EPSS project would only be used by PAMC.

Describe how each proposed new or expanded service will:

- a. **complement existing services**
- b. **provide an alternative or unique service**
- c. **provide a service for a specific target population**
- d. **provide needed competition**

Not applicable to this proposed project.

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- 3 Identify existing working relationships the applicant has with hospitals, nursing homes, and other resources serving the target population in the service area. Include a discussion of cooperative planning activities, shared services (i.e. agreements assigning services such as emergency or obstetrics), and patient transfer agreements. If other organizations provide ancillary or support services to your facility, describe the relationship. Attach copies of relevant agreements in an appendix in the application. If a service requires support from another agency but does not have an agreement, explain why.**

Not applicable to this proposed project. There are no plans or arrangements with other facilities to use the EPSS beyond PAMC.

E. FINANCIAL FEASIBILITY

- 1. Demonstrate how the project will ensure financial feasibility, including long-term viability, and what the financial effect will be on consumers and the state, region, or community served.**

As the largest health care provider and only tertiary care facility in the State of Alaska, PAMC is obligated to keep its doors open and ensure an enduring, adequate and reliable supply of electrical power. Keeping PAMC operative, especially in the case of a natural disaster, is essential to meet community need and ensure the facility's financial feasibility.

- 2. Discuss how the project construction and operation is expected to be financed. Demonstrate access to sufficient financial resources and the financial stability to build and operate this project.**

The proposed project will be financed through the use of internal capital funds. No borrowing of funds will be required. PAMC has sufficient cash, cash equivalents and board-designated investments to successfully undertake the proposed project.

As financial statement in Section IX indicates, PAMC has the financial resources to undertake and operate the proposed project successfully.

- 3. Provide a description and estimate of:**

- a. the probable impact of the proposal on the annual increase on the overall costs of the health services to the target population to be served;**

Impact of the EPSS project on PAMC operations is a non-cash operating depreciation expense of \$1.9M for 2013-2016 and \$1.8M there after. There is no anticipated increase in the pricing of services as a result of this project.

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- b. If applying to build a residential psychiatric treatment centers, nursing homes, or additional nursing home beds the annual increase to Medicaid required to support the new project, and the projected cost of and charges for providing the health care services in the first year of operation (per diem rate, scan, surgery etc);**

Not applicable to the proposed project.

- c. The immediate and long-term financial feasibility of continuing operations of the proposal.**

The projected financial statements included in Section IX indicate the financial feasibility of the proposed project. PAMC projects to realize an excess of revenues over expenses from operations after taking into account the additional operating costs associated with the proposed project.

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F. ACCESS TO SERVICE BY THE GENERAL POPULATION AND UNDER-SERVED GROUPS

1. **Provide information on service needs and access of under-served groups of people such as low-income persons, racial and ethnic minorities, women, and persons with a disability. Discuss any plans to overcome language and cultural barriers of groups to be served.**

PAMC maintains an open-door philosophy consistent with the Providence Mission to provide quality health care to all individuals with special concern for the poor and vulnerable. Over the last three years, PAMC has provided more than \$134 million in charity care. Total deductions from revenue are expected to increase 45 percent over the next four years. See Table IV.F.1 below.

PAMC interpreters are available by phone 24 hours a day. Speaker phones are used to permit patient, family and staff participation.

2. **Indicate the annual amount of charity care provided in each of the last five years with projections for the next three years. Include columns for revenue deductions, contractual allowances, and charity care.**

**Table IV.F.1.
Providence Alaska Medical Center
Total Deductions from Revenue (in thousands)
Actual 2004-2009, Projected 2010-2013**

	Year	Charity Care	Contractual Allowances	Other	Total Deductions from Revenue
Actual	2005	\$27,874	\$89,394	\$260,558	\$377,826
	2006	\$26,776	\$102,396	\$303,461	\$432,633
	2007	\$31,200	\$107,505	\$354,814	\$493,519
	2008	\$47,125	\$120,034	\$394,718	\$561,877
Unaudited	2009	\$55,863	\$134,060	\$430,710	\$620,633
January & February	2010	\$11,688	\$20,556	\$75,296	\$107,540
Budget	2010	\$48,967	\$133,897	\$486,009	\$668,873
Projected	2011	\$51,068	\$162,262	\$536,403	\$749,733
	2012	\$55,828	\$184,450	\$592,836	\$833,114
	2013	\$67,744	\$208,354	\$625,696	\$901,793
	2014	\$72,167	\$228,906	\$681,913	\$982,986
	2015	\$77,344	\$253,248	\$747,824	\$1,078,416
	2016	\$82,699	\$277,390	\$819,435	\$1,179,524
	2017	\$88,234	\$303,424	\$892,852	\$1,284,511

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3. Address the following access issues:

- a) transportation and travel time to the facility;**
- b) special architectural provisions for the aged and persons with a disability;**
- c) hours of operation; and**
- d) the institution's policies for nondiscrimination in patient services.**

Transportation and travel time to the facility

PAMC is located in Anchorage, Alaska's largest city and home to 42 percent of the state's population. Transportation to the facility can be provided by private vehicles, public transportation (only available in certain areas), medical transport and community van pools. PAMC is served by the city transit system. In the geographic center of Anchorage, PAMC is easily within a half hour's drive for most residents and from the international airport. Anchorage city police and the Alaska State Troopers provide custody and transport of committed mental health patients.

Access from the secondary service area can be costly, time consuming, and sometimes undependable. Various modes of transportation, including private vehicles, air and ground medical transport, small planes, large planes and boats may be used. Travel time to the PAMC campus may range from one hour to several days.

Special architectural provisions for the handicapped and aged

PAMC complies with the rules and regulations of the Federal Register Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities; the Joint Commission on Accreditation of Healthcare Organizations; and Alaska State Department of Health & Social Services, which oversees hospital licensing.

Service hours of operation

Providence provides care 24 hours a day, seven days a week.

Institutional policies for non-discrimination in patient services

PAMC maintains an open-door philosophy consistent with the Providence Mission of the Sisters of Providence to provide quality health care to all individuals regardless of their race, creed or ability to pay.

PAMC will not discriminate against a patient because of race, creed, color, national origin, ability to pay or because a patient is covered by a program such as Medicaid or Medicare. Under no circumstances will treatment be delayed or denied in a life-threatening situation due to a payment source, lack of insurance or ability to pay.

PAMC does not deny services to any person who needs services but cannot pay for them.

Section V. Considerations of quality, effectiveness, efficiency, and benefits of the applicant's services

1. ACCREDITATION AND LICENSURE:

The current status, source, date, length, etc., of the applicant's license and certification. Include information on Medicaid and Medicare Certification.

PAMC is licensed as an acute care hospital by the State of Alaska. It is also fully certified by Medicare and Medicaid. The Medicare Provider Number is 020001. The PAMC Medicaid ID numbers are HP11IP and HP11OP. A copy of license can be found in Appendix A.

PAMC is accredited by The Joint Commission. The most recent accreditation was granted July 19, 2008, and is valid for 39 months. A copy of the accreditation can be found in Appendix A. In addition, the hospital is licensed by the Nuclear Regulatory Commission and accredited by the College of American Pathologists.

2. QUALITY CONTROL How the applicant plans to ensure high quality service?

CMS and the Joint Commission require monthly tests of the EPSS. Relative to the current EPSS, both agencies have reviewed monthly EPSS test logs in 2008 and 2009 and found no deficiencies. PAMC will continue its current testing procedures and protocols when the new EPSS system is operational.

3. PERSONNEL: Plans for optimum utilization and appropriate ratios of professional, sub-professional and ancillary personnel.

There are no changes in total personnel or staff duties and responsibilities based on the proposed EPSS. The personnel overseeing and maintaining EPSS will continue to be the Director of Hospital Engineering, Electrician, and Plant Engineer II (See Appendix C for job descriptions and resume).

4. APPROPRIATE UTILIZATION: Development of programs such as ambulatory care, assisted living, home health services, and preventive health care that will eliminate or reduce inappropriate use of inpatient services.

Not applicable to this proposed project.

Section V.

Considerations of quality, effectiveness, efficiency, and benefits of the applicant's services

5. NEW TECHNOLOGY AND TREATMENT MODES:

Plans to use modern diagnostic and treatment devices to enhance the accuracy and reliability of diagnostic and treatment procedures.

Not applicable to this proposed project.

6. LABOR SAVING DEVICES AND EFFICIENCY:

The employment of labor-saving equipment and programs to provide operating economies.

There will be no change from the current practice of ongoing maintenance and preventative maintenance per equipment manufacturers' recommendations.

7. PROGRAM EVALUATION:

Future plans for evaluation of the proposed activity to ensure that it fulfills present expectations and benefits.

CMS and the Joint Commission require monthly tests of the EPSS.

8. ORGANIZATIONAL STRUCTURE:

Include an organizational chart, descriptions of major position requirements and board representation; show representation from community economic and ethnic groups.

PAMC organizational charts are located in Appendix A. A detailed listing of the members of the Providence Health System Board of Directors and Officers and the Providence Alaska Region Community Board is located in Section I.

9. STAFF SKILLS:

Provide descriptions of major position requirements, appropriate staff-to-patient ratios to maintain quality, and the minimal level of utilization that must be maintained to ensure that staff skills are maintained. Provide a source for the staffing standards.

The following positions are accountable and provide the maintenance required to keep the EPSS maintained: Director of Hospital Engineering and Plant Engineer II (see Appendix C for job descriptions and resume).

10. ECONOMIES OF SCALE:

The minimum and maximum size of facility or unit required to ensure optimum efficiency. If the planned project is significantly smaller or larger, explain the effect and why the size was chosen.

The decision to utilize back up power depends on the situation. The Joint Commission standard states that a hospital must be able to operate for 96 hours in the event of an emergent or disastrous event when electrical power is unavailable from external sources. It does not, however, define the level of operations leaving hospitals the flexibility to respond to the immediate and predicted patient care needs of their community.

PAMC's current EPSS components are 24 to 36 years old. Instead of replacing the current system, PAMC proposes increasing capacity to cover more functionality during a power outage. This increased functionality over the current code is recommended by the Joint Commission in Sentinel Event Alert Issue 37, September 6, 2006 (See Appendix B).

Towards this end, PAMC proposes an EPSS that increases capacity from 3.2 megawatts to 4.0 megawatts, provides for a 2.0 megawatt backup generator (in case a generator is down), and triples fuel storage from 30,000 to 90,000 gallons. The size of this new generator system requires a new building of 19,278 square feet that will be adjacent to the current plant and will include new electrical switchboards. In addition, as part of this project but separate from the certificate of need given its replacement nature, is the replacement of the current automated transfer switches.

PAMC requires a new building (Building K) for three primary reasons: (1) the new equipment is larger and requires more space than is currently available in the existing square footage; (2) an EPSS system must be operational at all times and therefore the old system cannot be down to allow a new system to be replaced in its footprint; and (3) the project expansion provides for an additional generator which increased required square footage.

The existing generators will be removed as part of this project and this space used for the current project.

The proposed EPSS project will serve the electrical needs of PAMC's existing main hospital facility. It will not serve the needs of medical office buildings. The Health Park, includes outpatient and ancillary services, has its own EPSS.

Section VI.
Narrative description of how project meets applicable review standards

Section VI. Narrative description of how project meets applicable review standards

Describe in this section of the application how the proposed project meets each review standard applicable to all activities, and each specific review standard applicable to the proposed activity. Some of this information will duplicate information required elsewhere in the application packet; that duplication is intentional.

Section VI.
Narrative description of how project meets applicable review standards

Consistency with Alaska General Review Standards

The department will apply the following general review standards, the applicable service-specific review standards set out in this document, the standards set out in AS 18.07.043, and the requirements of 7 AAC 07 in its evaluation of each certificate of need application:

- 1. The applicant documents need for the project by the population served, or to be served, including, but not limited to, the needs of rural populations in areas having distinct or unique geographic, socioeconomic, cultural, transportation, and other barriers to care.**

See Section IV.B.4

- 2. The applicant demonstrates that the project, including the applicant's long-range development plans, augments and integrates with relevant community, regional, state, and federal health planning, and incorporates or reflects evidence-based planning and service delivery. A demonstration under this standard should show that the applicant has checked with the department regarding any relevant state plan, with appropriate federal agencies for relevant federal plans, and with appropriate communities regarding community or regional plans.**

PAMC examined best industry practices and regulatory requirements related to the provisioning of emergency electrical power. Planning for the proposed EPSS project also involved production of numerous engineering studies including schematic designs that were reviewed by not only PAMC but also the PH&S Construction Sustainability Office resulting in the most cost efficient design applicable to PAMC's emergency electrical power needs.

- 3. The applicant demonstrates evidence of stakeholder participation in planning for the project and in the design and execution of services.**

Not applicable to this proposed project. PAMC asks the state make an exception and this standard to be waived.

- 4. The applicant demonstrates that they have assessed alternative methods of providing the proposed services and demonstrates that the proposed services are the most suitable approach.**

See Section IV.C.1

- 5. The applicant briefly describes the anticipated impact on existing health care systems within the project's service area that serve the target population in the service area, and the anticipated impact on the statewide health care system.**

Not applicable to this proposed project. PAMC asks the state make an exception and this standard to be waived.

Section VI.

Narrative description of how project meets applicable review standards

- 6. The applicant demonstrates that the project's location is accessible to patients and clients, their immediate and extended families and community members, and to ancillary services. This includes the relocation of existing services or facilities.**

Not applicable to this proposed project. PAMC asks the state make an exception and this standard to be waived.

The proposed EPSS project is fully consistent with the relevant Alaska Certificate of Need Review Standards and Methodologies. Furthermore, the proposed project is reasonable, conservative and responsible. It is consistent with the tenets of good stewardship while meeting community needs and expectations.

Section VII
Financial data - Construction

Section VII. Construction Data

A. Please check appropriate boxes:

- | | | | |
|-----------------------------|---|------------------------------------|--|
| 1. Construction type | <input checked="" type="checkbox"/> New | <input type="checkbox"/> Expansion | <input type="checkbox"/> Renovation |
| 2. Basement | <input type="checkbox"/> Full | <input type="checkbox"/> Partial | <input checked="" type="checkbox"/> None |

B. Project Development Schedule

Date

- | | |
|---|---------|
| 1. Estimated completion of final drawings and specifications | 2/26/10 |
| 2. Estimated construction begun by | 5/03/10 |
| 3. Estimated construction complete by | 9/23/11 |
| 4. Estimated opening of proposed services | 3/09/12 |

C. Facility site data: Provide the following as attachments (referenced by the subsection and item number): (All Attachments are shown in Appendix D)

- 1. A legal description and area of the proposed site. Is the site now owned by the facility?
If not, how secure are the arrangements to acquire the site?**

Yes

Providence Chester Creek, Tract A.
90,996.31 SF or 2.08 Acres

- 2. Diagrammatic plan showing: (See Appendix D)**
a. dimensions and location of structures, easements, rights-of-way or encroachments;

Refer to drawing C2.0 in Appendix D

- b. location of all utility services available to the site; and**

Refer to drawings C2.0, C3.0 and C3.1 in Appendix D

- c. Location of service roads, parking facilities, and walkways within site boundaries.**

Refer to drawings L2.1 and C3.0

3. Document clearances regarding zone restrictions, fire protection, sewage, and other waste disposal arrangements (under special circumstances, it is acceptable to present evidence of conditional approvals from local government and regulatory agencies). Refer to approved Conditional Use Permit attached

Refer to drawings A0.1, A0.2, A0.3 and C3.0 in Appendix D

4. An architectural master plan including long-range concept and development of total facility.

Refer to Master Plan – Long range concept – Figure 4 in Appendix D

5. Schematic floor plan drawings (or conceptual drawings) of proposed activity, including functional use of various rooms.

Refer to drawings A0.1, A0.2, A0.3, A1.1, A1.2 and A1.3 in Appendix D

D. Describe the plan for completing construction and the effect (disruption) construction activities will have on existing services.

Contractor will maintain a well-planned and accurate construction critical path method (CPM) scheduling system for sequencing the work and carefully coordinate all activity with the PAMC Construction Coordinator to assure the preservation of safe and reliable hospital operations.

Project Milestones

- Complete the site work (except landscaping and paving) during summer of 2010
- Complete footings, foundations, steel erection and building closure by October 12, 2010
- Receive generators, switchgear and appurtenances by November 1, 2010
- Complete landscaping and paving by September 2, 2011
- Complete pre-functional Testing of all systems by October 1, 2011
- Commissioning complete January 27, 2012
- Substantial completion February 10, 2012
- Final completion March 9, 2012

Section VIIIA
Financial data - Acquisitions

Section VIIIA. Financial data – Acquisitions

Not applicable to this proposed project

Section VIIIB
Financial data – Construction only

Section VIIIB. Financial data – Construction only

1. Construction Method (Please check)

- | | | |
|---------------------|---|---|
| a. Conventional bid | <input checked="" type="checkbox"/> Contract management | <input type="checkbox"/> Design and build |
| b. Phased | <input checked="" type="checkbox"/> Single project | <input type="checkbox"/> Fast Track |

2. Construction Cost (New Activity)

(Omit cents)

- | | |
|---|-------------------------|
| a. Site acquisition (Section VIIIA.2.f) | \$ n/a |
| b. Estimated general construction** | \$ 28,997,332.88 |
| c. Fixed equipment, not included in a** | \$ 2,281,648.00 |
| d. Total construction costs (sum of items a, b, and c)** | \$ 31,278,980.88 |
| e. Major movable equipment** | \$ na |
| f. Other cost:** | |
| (1) Administration expense | \$ 961,405.00 |
| (2) Site survey, soils investigation, and materials testing | \$ 90,704.00 |
| (3) Architects and engineering fees | \$ 2,789,682.14 |
| (4) Other consultation fees (preparation of application included) | \$ 76,200.00 |
| (5) Legal fees | \$ na |
| (6) Land development and landscaping | \$ 85,160.12 |
| (7) Building permits and utility assessments (including water, sewer, electrical, phones, etc.) | \$ 547,644.00 |
| (8) Additional inspection fees (clerk of the works) | \$ 137,973.83 |
| (9) Insurance (required during construction period) | \$ 135,000.00 |
| g. Total project cost (sum of items d, e, f) | \$ 36,102,749.97 |
| h. Amount to be financed | \$ 0 |
| i. Difference between 2.g and 2.h (list, as Schedule 1, available resources to be used, e.g., available cash, investments, grants funds, community contributions, etc.) | \$ 36,102,749.97 |
| j. Anticipated long-term interest rate | na |
| k. Anticipated interim (construction) interest rate | na |
| l. Anticipated long-term interest amount | \$0 |
| m. Anticipated interim interest amount | \$0 |
| n. Total items g, l, and m | \$ 36,102,749.97 |
| o. Estimated annual debt service requirement | \$ na |
| p. Construction cost per sq. ft. | \$ 1,883 per sq foot |
| q. Construction cost per bed | na |
| r. Project cost per sq. ft. | \$ 2,173 per sq foot |
| s. Project cost per bed (if applicable) | na |

*Site acquisition should be stated as "book" value, i.e., actual purchase price (or estimate of value if donated) plus costs of development. If desired, the applicant may elect to state as "fair market value" (in which case, so indicate). See Section VIIIA for how to determine fair market value.

** Items must be certified estimates from an architect or other professional. Major medical equipment may be documented by bid quotes from suppliers.

Section IX
Financial data – All proposed activities

Section IX. Financial data – All proposed activities
Schedule I – Facility Income Sheet

Schedule I
INCOME STATEMENTS PAMC (in 000's)

	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009 (Unaudited)
GROSS PATIENT REVENUE:					
INPATIENT	\$ 540,260	\$ 606,096	\$ 684,827	\$ 741,222	\$ 777,319
OUTPATIENT	\$ 231,949	\$ 256,288	\$ 293,642	\$ 335,422	\$ 372,763
LONG-TERM CARE	\$ -	\$ -	\$ -	\$ -	\$ -
SWING BEDS	\$ -	\$ -	\$ -	\$ -	\$ -
OTHER	\$ 9,806	\$ 12,375	\$ 14,857	\$ 16,098	\$ 17,091
TOTAL PATIENT REVENUE	\$ 782,015	\$ 874,759	\$ 993,326	\$ 1,092,742	\$ 1,167,173
LESS DEDUCTIONS	\$ -	\$ -	\$ -	\$ -	\$ -
CHARITY CARE	\$ 27,874	\$ 26,776	\$ 31,200	\$ 47,125	\$ 55,863
CONTRACTUAL ALLOWANCES	\$ 349,952	\$ 405,857	\$ 462,319	\$ 514,752	\$ 564,770
BAD DEBT	\$ 36,818	\$ 30,628	\$ 51,812	\$ 42,180	\$ 43,824
TOTAL DEDUCTIONS	\$ 414,644	\$ 463,261	\$ 545,331	\$ 604,057	\$ 664,457
NET OPERATING REVENUES	\$ 367,371	\$ 411,498	\$ 447,995	\$ 488,685	\$ 502,716
ALL OTHER REVENUES	\$ 18,668	\$ 26,848	\$ 17,609	\$ 28,913	\$ 29,315
EXPENSES:	\$ -	\$ -	\$ -	\$ -	\$ -
SALARIES	\$ 141,697	\$ 156,677	\$ 160,111	\$ 166,624	\$ 176,917
BENEFITS	\$ 37,059	\$ 40,743	\$ 42,674	\$ 48,122	\$ 51,961
SUPPLIES	\$ 70,941	\$ 76,223	\$ 79,350	\$ 85,523	\$ 87,959
PURCHASED SERVICE	\$ 63,349	\$ 79,179	\$ 82,796	\$ 92,642	\$ 90,761
PROFESSIONAL FEES	\$ 7,230	\$ 7,092	\$ 6,953	\$ 7,186	\$ 9,102
OTHER EXPENSES	\$ 18,689	\$ 19,233	\$ 19,509	\$ 20,680	\$ 19,965
DEPRECIATION	\$ 24,216	\$ 26,313	\$ 30,508	\$ 36,013	\$ 37,630
INTEREST	\$ 1,231	\$ 2,654	\$ 6,408	\$ 8,010	\$ 8,053
TOTAL EXPENSES	\$ 364,412	\$ 408,114	\$ 428,309	\$ 464,800	\$ 482,348
NET OPERATING INCOME	\$ 21,627	\$ 30,232	\$ 37,295	\$ 52,798	\$ 49,683

Schedule I
PAMC PROJECTED INCOME STATEMENT (in 000's)

	FY 2010 -		FY 2011	FY 2012	FY 2013
	January, February	Budget			
GROSS PATIENT REVENUE:					
INPATIENT	\$ 128,689	\$ 861,455	\$ 930,371	\$ 1,004,801	\$ 1,078,697
OUTPATIENT	\$ 65,271	\$ 383,566	\$ 413,500	\$ 445,638	\$ 471,436
LONG-TERM CARE					
SWING BEDS					
OTHER	\$ 2,805	\$ 20,280	\$ 20,468	\$ 20,952	\$ 21,512
TOTAL PATIENT REVENUE	\$ 196,765	\$ 1,265,301	\$ 1,364,340	\$ 1,471,391	\$ 1,571,645
LESS DEDUCTIONS					
CHARITY CARE	\$ 11,688	\$ 48,967	\$ 51,068	\$ 55,828	\$ 67,744
CONTRACTUAL ALLOWANCES	\$ 95,852	\$ 619,906	\$ 698,665	\$ 777,286	\$ 834,050
BAD DEBT	\$ 7,196	\$ 65,835	\$ 64,827	\$ 69,951	\$ 74,747
TOTAL DEDUCTIONS	\$ 114,736	\$ 734,708	\$ 814,560	\$ 903,065	\$ 976,540
NET OPERATING REVENUES	\$ 82,029	\$ 530,593	\$ 549,779	\$ 568,326	\$ 595,104
ALL OTHER REVENUES	\$ 4,122	\$ 23,616	\$ 24,232	\$ 24,652	\$ 24,652
EXPENSES:					
SALARIES	\$ 28,109	\$ 185,110	\$ 195,373	\$ 204,880	\$ 216,191
BENEFITS	\$ 8,740	\$ 54,377	\$ 56,964	\$ 59,300	\$ 65,882
SUPPLIES	\$ 14,755	\$ 93,734	\$ 96,898	\$ 100,168	\$ 103,665
PURCHASED SERVICE	\$ 14,554	\$ 90,413	\$ 93,428	\$ 96,546	\$ 100,136
PROFESSIONAL FEES	\$ 1,382	\$ 6,807	\$ 7,011	\$ 7,222	\$ 7,438
LEASE					
OTHER EXPENSES	\$ 4,592	\$ 18,066	\$ 15,152	\$ 12,223	\$ 12,589
DEPRECIATION	\$ 6,165	\$ 39,979	\$ 41,868	\$ 43,629	\$ 44,652
INTEREST	\$ 1,265	\$ 8,909	\$ 10,139	\$ 10,082	\$ 9,986
TOTAL EXPENSES	\$ 79,562	\$ 497,395	\$ 516,833	\$ 534,049	\$ 560,539
NET OPERATING INCOME	\$ 6,589	\$ 56,814	\$ 57,178	\$ 58,929	\$ 59,217

Section IX
Financial data – All proposed activities

Schedule II – Facility Balance Sheet

Schedule II. Facility Balance Sheet

PAMC BALANCE SHEET	FY 2005	FY 2006	FY 2007	FY 2008
CURRENT ASSETS				
CASH & EQUIVALENTS	\$ 12,376	\$ 35,129	\$ 32,668	\$ 28,588
ACCOUNTS RECEIVABLE	\$ 63,352	\$ 76,551	\$ 73,639	\$ 84,642
SUPPLIES INVENTORY	\$ 11,564	\$ 13,269	\$ 13,423	\$ 12,897
OTHER CURRENT ASSETS	\$ 16,263	\$ 3,035	\$ 25,732	\$ 26,435
TOTAL CURRENT ASSETS	\$ 103,555	\$ 133,984	\$ 145,462	\$ 152,622
PROPERTY AND EQUIPMENT				
LAND & IMPROVEMENTS	\$ 32,901	\$ 32,169	\$ 30,710	\$ 30,860
BUILDING	\$ 157,082	\$ 168,859	\$ 175,861	\$ 182,655
FIXED AND MOVABLE EQUIPMENT	\$ 225,357	\$ 244,676	\$ 252,927	\$ 260,179
RENTAL PROPERTY	\$ 79,805	\$ 103,008	\$ 162,321	\$ 149,803
CIP	\$ 77,214	\$ 140,725	\$ 100,789	\$ 96,663
ACCUMULATED DEPRECIATION	\$ 301,448	\$ 322,616	\$ 348,385	\$ 372,581
NET PROPERTY AND EQUIPMENT	\$ 270,911	\$ 366,821	\$ 374,223	\$ 347,579
OTHER ASSETS	\$ 226,190	\$ 243,083	\$ 246,050	\$ 222,387
TOTAL ASSETS	\$ 600,656	\$ 743,888	\$ 765,735	\$ 722,588
LIABILITIES/FUND BALANCE				
CURRENT LIABILITIES				
ACCOUNTS PAYABLE	\$ 27,833	\$ 35,913	\$ 27,480	\$ 15,635
ACCRUED EXPENSES	\$ 11,403	\$ 9,144	\$ 17,747	\$ 54,329
ACCRUED COMPENSATION/OTHER	\$ 20,373	\$ 21,917	\$ 21,906	\$ 22,207
TOTAL CURRENT LIABILITIES	\$ 59,609	\$ 66,974	\$ 67,133	\$ 92,171
LONG TERM LIABILITIES				
LONG TERM DEBT	\$ 113,517	\$ 209,753	\$ 197,896	\$ 149,356
OTHER	\$ 40,430	\$ 37,972	\$ 15,875	\$ 14,158
TOTAL LONG TERM LIABILITIES	\$ 213,956	\$ 314,639	\$ 280,904	\$ 256,285
FUND BALANCE	\$ 387,100	\$ 429,189	\$ 484,831	\$ 466,303
TOTAL LIABILITIES & FUND BALANCE	\$ 600,656	\$ 743,888	\$ 765,735	\$ 722,588

Schedule II. Facility Balance Sheet

PAMC BALANCE SHEET	FY 2009 (unaudited)	FY 2010 (February)
CURRENT ASSETS		
CASH & EQUIVALENTS	\$ 52,122	\$ 56,476
ACCOUNTS RECEIVABLE	\$ 80,767	\$ 80,078
SUPPLIES INVENTORY	\$ 14,605	\$ 14,735
OTHER CURRENT ASSETS	\$ 11,549	\$ 14,162
TOTAL CURRENT ASSETS	\$ 159,043	\$ 165,451
PROPERTY AND EQUIPMENT		
LAND & IMPROVEMENTS	\$ 29,753	\$ 29,714
BUILDING	\$ 203,635	\$ 203,635
FIXED AND MOVABLE EQUIPMENT	\$ 274,282	\$ 274,330
RENTAL PROPERTY	\$ 207,276	\$ 210,846
CIP	\$ 37,914	\$ 35,052
ACCUMULATED DEPRECIATION	\$ 401,546	\$ 405,535
NET PROPERTY AND EQUIPMENT	\$ 351,314	\$ 348,642
OTHER ASSETS	\$ 277,639	\$ 284,199
TOTAL ASSETS	\$ 787,996	\$ 798,292
LIABILITIES/FUND BALANCE		
CURRENT LIABILITIES		
ACCOUNTS PAYABLE	\$ 19,687	\$ 13,595
ACCRUED EXPENSES	\$ 56,095	\$ 57,152
ACCRUED COMPENSATION/OTHER	\$ 24,416	\$ 26,735
TOTAL CURRENT LIABILITIES	\$ 100,198	\$ 97,482
LONG TERM LIABILITIES		
LONG TERM DEBT	\$ 186,612	\$ 186,540
OTHER	\$ 13,426	\$ 13,458
TOTAL LONG TERM LIABILITIES	\$ 300,236	\$ 297,480
FUND BALANCE	\$ 487,760	\$ 500,812
TOTAL LIABILITIES & FUND BALANCE	\$ 787,996	\$ 798,292

Section IX
Financial data – All proposed activities

Schedule III – Average Patient Cost Per Day and Revenue Amounts

Schedule III. Average Patient Cost Per Day (per Diem Rate if applicable) and Revenue									
PAMC, HHC and EPSS project									
\$ Amounts in 000's except for per Day Calculations and Patient Days									
	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009 (unaudited)	FY 2010 - January, February	FY 2010 - Budget	FY 2011 - Forecast	FY 2012 - Forecast
GROSS PATIENT REVENUE	\$ 782,015	\$ 874,759	\$ 993,326	\$ 1,092,742	\$ 1,167,173	\$ 196,765	\$ 1,265,301	\$ 1,364,340	\$ 1,471,391
OTHER OPERATING REVENUE	\$ 18,668	\$ 26,848	\$ 17,609	\$ 28,913	\$ 29,315	\$ 4,122	\$ 23,616	\$ 24,232	\$ 24,652
EXPENSES	\$ 364,412	\$ 408,114	\$ 428,309	\$ 464,800	\$ 482,348	\$ 79,562	\$ 497,395	\$ 516,833	\$ 534,049
TOTAL PATIENT DAYS	88,521	90,862	92,043	91,506	88,587	13,504	91,463	91,464	91,464
REVENUE PER PATIENT DAY	\$ 8,834	\$ 9,627	\$ 10,792	\$ 11,942	\$ 13,175	\$ 14,571	\$ 13,834	\$ 14,917	\$ 16,087
OPERATING & CAPITAL BUDGET SUMMARY									
GROSS REVENUES	\$ 782,015	\$ 874,759	\$ 993,326	\$ 1,092,742	\$ 1,167,173	\$ 196,765	\$ 1,265,301	\$ 1,364,340	\$ 1,471,391
DEDUCTIONS FROM REVENUE	\$ 414,644	\$ 463,261	\$ 545,331	\$ 604,057	\$ 664,457	\$ 114,736	\$ 734,708	\$ 814,560	\$ 903,065
NET REVENUE	\$ 367,371	\$ 411,498	\$ 447,995	\$ 488,685	\$ 502,716	\$ 82,029	\$ 530,593	\$ 549,779	\$ 568,326
DIRECT EXPENSE	\$ 364,412	\$ 408,114	\$ 428,309	\$ 464,800	\$ 482,348	\$ 79,562	\$ 497,395	\$ 516,833	\$ 534,049
NET OPERATING INCOME PROJECTED	\$ 21,627	\$ 30,232	\$ 37,295	\$ 52,798	\$ 49,682	\$ 6,589	\$ 56,814	\$ 57,178	\$ 58,929
TOTAL PATIENT DAYS (Including Nursery & Medicaid Days)	93,347	96,105	97,046	96,257	93,509	14,247	96,363	96,363	96,363
MEDICAID DAYS	24,000	24,652	23,637	23,435	23,776	3,589	24,275	24,275	24,275
	FY 2013 - Forecast	FY 2014 - Forecast	FY 2015 - Forecast	FY 2016 - Forecast	FY 2017 - Forecast				
GROSS PATIENT REVENUE	\$ 1,571,645	\$ 1,674,522	\$ 1,794,918	\$ 1,919,467	\$ 2,048,226				
OTHER OPERATING REVENUE	\$ 24,652	\$ 24,652	\$ 24,652	\$ 24,652	\$ 24,652				
EXPENSES	\$ 560,539	\$ 580,601	\$ 600,100	\$ 621,773	\$ 642,498				
TOTAL PATIENT DAYS	91,923	92,112	93,008	93,683	93,946				
REVENUE PER PATIENT DAY	\$ 17,097	\$ 18,179	\$ 19,299	\$ 20,489	\$ 21,802				
OPERATING & CAPITAL BUDGET									
GROSS REVENUES	\$ 1,571,645	\$ 1,674,522	\$ 1,794,918	\$ 1,919,467	\$ 2,048,226				
DEDUCTIONS FROM REVENUE	\$ 976,540	\$ 1,062,654	\$ 1,163,846	\$ 1,270,916	\$ 1,382,065				
NET REVENUE	\$ 595,104	\$ 611,867	\$ 631,072	\$ 648,552	\$ 666,162				
DIRECT EXPENSE	\$ 560,539	\$ 580,601	\$ 600,100	\$ 621,773	\$ 642,498				
NET OPERATING INCOME PROJECTED	\$ 59,217	\$ 55,919	\$ 55,623	\$ 51,431	\$ 48,316				
TOTAL PATIENT DAYS (Including Nursery & Medicaid Days)	96,822	97,011	97,907	98,582	98,845				
MEDICAID DAYS	24,391	24,438	24,664	24,834	24,900				

RATE COMPUTATION FOR CAPITAL ADD-ON MEDICAID RATE

	FY 2011 - Forecast	FY 2012 - Forecast	FY 2013 - Forecast	FY 2014 - Forecast	FY 2015 - Forecast	FY 2016 - Forecast	FY 2017 - Forecast	FY 2018 - Forecast	FY 2019 - Forecast
PROJECT EPSS COSTS									
TOTAL DEPRECIATION	\$ -	\$ 1,542	\$ 1,850	\$ 1,850	\$ 1,850	\$ 1,850	\$ 1,824	1,819	1,819
TOTAL CAPITAL COSTS	-	1,542	1,850	1,850	1,850	1,850	1,824	1,819	1,819
% PROJECT RELATED TO INPATIENT*	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
TOTAL INPATIENT CAPITAL COSTS	-	1,542	1,850	1,850	1,850	1,850	1,824	1,819	1,819
INCREMENTAL MEDICAID CAPITAL ADD-ON RATE PER INPATIENT DAY	-	8.83	10.59	10.59	10.59	10.89	11.04	11.20	11.35
MEDICAID CAPITAL ROUTINE ADD-ON RATE PER INPATIENT DAY		90.68	90.68	90.68	90.68	90.68	90.68	90.68	90.68
MEDICAID CAPITAL ANCILLARY ADD-ON RATE PER INPATIENT DAY		56.88	56.88	56.88	56.88	56.88	56.88	56.88	56.88
TOTAL MEDICAID REIMBURSEMENT RATE PER INPATIENT DAY		156.39	158.15	158.15	158.15	158.45	158.60	158.76	158.91

Footnotes

EXPENSES does not include Bad Debt. Bad Debt is included in DEDUCTIONS FROM REVENUE
PATIENT DAYS include Nursery Days

Section IX
Financial data – All proposed activities

Schedule IV – Operating Budget

Schedule IV. Operating Budget - PAMC, HHC and EPSS. Provide Last Five Years Actual and Projections for Three Years Beyond Project Completion												
Description:	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
GROSS PATIENT REVENUE:												
INPATIENT	\$ 540,280	\$ 606,096	\$ 684,827	\$ 741,222	\$ 777,319	\$ 861,455	\$ 930,371	\$ 1,004,801	\$ 1,078,697	\$ 1,144,992	\$ 1,225,437	\$ 1,307,650
OUTPATIENT	231,949	250,268	283,642	335,422	372,703	383,366	413,000	445,038	471,436	501,439	546,791	586,508
LONG-TERM CARE	-	-	-	-	-	-	-	-	-	-	-	-
SWING BEDS	-	-	-	-	-	-	-	-	-	-	-	-
OTHER	9,806	12,375	14,857	16,098	17,091	20,280	20,468	20,952	21,512	22,091	22,690	23,309
TOTAL PATIENT REVENUE	782,015	874,759	983,326	1,092,742	1,167,173	1,265,301	1,364,340	1,471,391	1,571,645	1,674,522	1,794,918	1,918,467
LESS DEDUCTIONS												
CHARITY CARE	27,874	25,776	31,200	47,125	55,863	49,867	51,068	55,828	67,744	72,167	77,344	82,699
GRANTUAL ALLOWANCES	38,635	42,319	48,339	54,522	59,570	63,635	68,635	73,706	84,120	91,619	100,612	108,557
DISCOUNT	38,816	30,828	45,112	42,186	63,595	63,595	69,085	69,085	70,857	70,857	85,431	91,691
TOTAL DEDUCTIONS	414,644	463,261	545,331	604,557	694,457	734,398	814,860	903,065	976,540	1,062,654	1,163,846	1,270,916
NET OPERATING REVENUES	367,371	411,498	447,995	488,685	502,716	530,903	549,779	568,326	595,104	611,867	631,072	646,552
ALL OTHER REVENUES	18,668	26,848	17,609	28,913	28,315	23,616	24,232	24,652	24,652	24,652	24,652	24,652
EXPENSES:												
SALARIES	141,697	156,677	160,111	166,624	176,917	185,110	195,373	204,880	216,191	224,013	232,217	240,937
RENT	70,949	76,574	76,574	76,574	76,574	76,574	76,574	76,574	76,574	76,574	76,574	76,574
SUPPLIES	70,949	76,574	76,574	76,574	76,574	76,574	76,574	76,574	76,574	76,574	76,574	76,574
PURCHASED SERVICE	63,349	79,179	82,798	82,798	90,761	90,413	93,428	96,546	100,136	103,902	107,893	112,016
PROFESSIONAL FEES	7,230	7,092	6,553	7,186	9,102	6,807	7,011	7,222	7,438	7,662	7,891	8,128
LEASE	-	-	-	-	-	-	-	-	-	-	-	-
OTHER EXPENSES	18,689	19,233	19,509	20,680	19,965	18,066	15,152	12,223	12,589	12,965	13,353	13,753
DEPRECIATION	24,216	26,313	30,508	36,013	37,630	39,979	41,688	43,629	44,652	46,239	46,235	47,025
INTEREST	1,231	2,654	6,408	8,010	8,053	8,909	10,139	10,092	9,886	9,690	8,976	8,714
TOTAL EXPENSES	384,472	403,114	423,308	464,800	482,348	497,395	516,533	534,049	560,601	580,100	600,100	621,773
NET OPERATING INCOME	21,667	30,232	37,259	32,786	49,863	36,814	37,778	36,949	39,217	35,919	35,023	31,431
												46,316

Section IX
Financial data – All proposed activities

Schedule IV. Operating Budget - PAMC and HHC Only												
Provide Last Five Years Actual and Projections for Three Years Beyond Project Completion												
Description:	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
GROSS PATIENT REVENUE:												
INPATIENT	\$ 540,260	\$ 606,096	\$ 684,827	\$ 741,222	\$ 777,319	\$ 861,455	\$ 930,371	\$ 1,004,601	\$ 1,078,697	\$ 1,144,892	\$ 1,226,437	\$ 1,307,650
OUTPATIENT	231,949	236,286	236,642	335,422	372,763	393,566	413,500	443,638	471,436	507,439	546,791	588,508
LONG-TERM CARE	-	-	-	-	-	-	-	-	-	-	-	-
SWING BEDS	-	-	-	-	-	-	-	-	-	-	-	-
OTHER	9,806	12,375	14,857	16,098	17,091	20,280	20,488	20,952	21,512	22,091	22,690	23,309
TOTAL PATIENT REVENUE	782,015	874,759	950,326	1,092,742	1,167,173	1,265,301	1,364,340	1,471,331	1,571,645	1,674,522	1,794,918	1,919,467
LESS DEDUCTIONS												
CHARITY CARE	27,874	26,776	31,200	47,125	55,863	48,987	51,088	55,828	67,744	72,167	77,344	82,689
ACTUAL ALLOWANCES	34,540	40,540	42,516	51,175	54,540	63,835	68,835	77,000	85,435	91,750	1,007,435	1,078,435
DISCOUNTS	36,816	30,628	51,812	42,180	43,824	65,835	64,827	69,951	74,747	79,659	85,431	91,396
BAD DEBTS	414,644	463,261	545,331	604,657	664,457	734,708	814,560	903,279	976,739	1,062,913	1,164,108	1,271,186
TOTAL DEDUCTIONS	533,874	561,201	620,865	645,137	664,457	713,365	759,310	805,054	863,916	916,489	1,034,928	1,133,704
NET OPERATING REVENUES	248,141	313,558	329,461	447,605	502,716	551,936	604,988	666,277	707,729	758,603	760,010	785,763
ALL OTHER REVENUES	18,668	26,848	17,609	28,913	29,315	23,616	24,232	24,652	24,652	24,652	24,652	24,652
EXPENSES:												
SALARIES	141,697	156,677	160,111	186,624	176,917	185,110	195,373	204,980	216,191	224,013	232,217	240,937
PHYSICIAN FEES	51,569	54,569	57,569	60,569	63,569	66,569	69,569	72,569	75,569	78,569	81,569	84,569
SUPPLIES	70,941	76,223	79,360	85,523	87,959	93,734	96,898	100,168	103,665	107,864	112,804	117,776
PURCHASED SERVICE	63,349	79,179	82,796	92,842	90,761	90,413	93,428	96,546	100,136	103,902	107,858	112,016
PROFESSIONAL FEES	7,230	7,092	6,953	7,186	9,102	6,807	7,011	7,222	7,438	7,662	7,891	8,128
LEASE	-	-	-	-	-	-	-	-	-	-	-	-
OTHER EXPENSES	18,689	19,233	19,509	20,680	19,965	17,942	15,117	12,223	12,589	12,965	13,353	13,753
DEPRECIATION	24,216	26,313	30,508	36,013	37,630	39,979	41,868	42,087	42,802	44,369	44,385	45,175
INTEREST	1,231	2,654	6,408	8,010	8,053	8,939	10,139	10,082	9,986	9,690	9,976	8,714
OTHER DEDUCTIONS	364,742	436,144	426,369	464,503	462,538	497,221	516,798	536,235	558,689	576,700	599,250	619,973
NET OPERATING INCOME	2,162	30,232	37,255	52,798	49,663	56,538	57,213	60,257	60,669	57,510	57,214	50,010

Section IX
Financial data – All proposed activities

Schedule IV, Operating Budget - EPSS													
Provide Last Five Years Actual and Projections for Three Years Beyond Project Completion													
Description:	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
GROSS PATIENT REVENUE:													
INPATIENT			\$	\$	-	\$	\$	-	-	-	-	-	-
OUTPATIENT			-	-	-	-	-	-	-	-	-	-	-
LONG-TERM CARE			-	-	-	-	-	-	-	-	-	-	-
SWING BEDS			-	-	-	-	-	-	-	-	-	-	-
OTHER			-	-	-	-	-	-	-	-	-	-	-
TOTAL PATIENT REVENUE			-	-	-	-	-	-	-	-	-	-	-
LESS DEDUCTIONS													
CHARITY CARE			-	-	-	-	-	-	-	-	-	-	-
CONTRACTUAL ALLOWANCES			-	-	-	-	-	(214)	(258)	(259)	(261)	(270)	(275)
DISCOUNTS			-	-	-	-	-	-	-	-	-	-	-
TOTAL DEDUCTIONS			-	-	-	-	-	(214)	(258)	(259)	(261)	(270)	(275)
NET OPERATING REVENUES			-	-	-	-	-	214	258	259	261	270	275
ALL OTHER REVENUES			-	-	-	-	-	-	-	-	-	-	-
EXPENSES:													
SALARIES			-	-	-	-	-	-	-	-	-	-	-
BENEFITS			-	-	-	-	-	-	-	-	-	-	-
SUPPLIES			-	-	-	-	-	-	-	-	-	-	-
PURCHASED SERVICE			-	-	-	-	-	-	-	-	-	-	-
PROFESSIONAL FEES			-	-	-	-	-	-	-	-	-	-	-
LEASE			-	-	-	-	-	-	-	-	-	-	-
OTHER EXPENSES			-	-	-	124	35	-	-	-	-	-	-
DEPRECIATION			-	-	-	-	-	-	-	-	-	-	-
INTEREST			-	-	-	-	-	-	-	-	-	-	-
TOTAL EXPENSES			-	-	-	124	35	1,542	1,850	1,850	1,850	1,850	1,824
NET OPERATING INCOME			-	-	-	(124)	(35)	(1,327)	(1,592)	(1,591)	(1,589)	(1,580)	(1,550)

Section IX
Financial data – All proposed activities

Schedule VA – Debt Service Summary

Schedule V-A. Debt Service Summary
Provide Current Debt Data and Projections For the Next Three Years

Principal Payments							
Five Year Payout of LTD	1985	2003C	2003H	2005DC	2006H	2009A	Total Master Trust
2009	885,000	7,509,486	-	1,440,000	-	-	9,834,486
2010	970,000	7,882,886	-	1,505,000	-	-	10,357,886
2011	-	-	-	1,580,000	-	-	1,580,000
	-	-	9,300,000	1,655,000	-	-	10,955,000
2013	-	-	10,000,000	1,735,000	-	-	11,735,000
2014	-	-	3,900,000	1,825,000	-	16,269,000	21,994,000
2015	-	-	4,600,000	1,915,000	-	12,441,000	18,956,000
2016	-	-	-	2,010,000	-	-	2,010,000
2017	-	-	-	2,115,000	-	-	2,115,000

Interest Payments							
Five Year Payout of LTD	1985	2003C	2003H	2005DC	2006H	2009A	Total Master Trust
2009	-	769,619	1,411,875	2,943,424	2,717,750	943,575	8,786,243
2010	-	394,144	1,411,875	2,876,320	2,717,750	2,739,413	10,139,501
2011	-	-	1,411,875	2,805,886	2,717,750	2,739,413	9,674,923
2012	-	-	1,411,875	2,730,204	2,717,750	2,739,413	9,599,241
2013	-	-	946,875	2,648,612	2,717,750	2,739,413	9,052,650
2014	-	-	421,875	2,561,168	2,717,750	2,739,413	8,440,206
2015	-	-	241,500	2,468,823	2,717,750	1,917,828	7,345,901
2016	-	-	-	2,371,541	2,717,750	1,917,828	7,007,119
2017	-	-	-	2,268,428	2,717,750	1,196,250	6,182,428

Total							
Five Year Payout of LTD	1985	2003C	2003H	2005DC	2006H	2009A	Total Master Trust
2009	885,000	8,279,105	1,411,875	4,383,424	2,717,750	943,575	18,620,728
2010	970,000	8,277,030	1,411,875	4,381,320	2,717,750	2,739,413	20,497,387
2011	-	-	1,411,875	4,385,886	2,717,750	2,739,413	11,254,923
2012	-	-	10,711,875	4,385,204	2,717,750	2,739,413	20,554,241
2013	-	-	10,946,875	4,383,612	2,717,750	2,739,413	20,787,650
2014	-	-	4,321,875	4,386,168	2,717,750	19,008,413	30,434,206
2015	-	-	4,841,500	4,383,823	2,717,750	14,358,828	26,301,901
2016	-	-	-	4,381,541	2,717,750	1,917,828	9,017,119
2017	-	-	-	4,383,428	2,717,750	1,196,250	8,297,428

Section IX
Financial data – All proposed activities

Schedule VB – New Project Debt Service

Schedule V-B. New Project Debt Service Summary					
Attach a debt service cash flow schedule over the life of the debt for the new project					
Break out principal, interest and Other					
year	Item	Principal	Interest	Other	Total
2005		\$ -	\$ -	\$ -	
2006	PAYMENT	No new debt issued for this project.			
2007	PAYMENT				
2008	PAYMENT				
2009	PAYMENT				
2010	PAYMENT				
2011	PAYMENT				
2012	PAYMENT				
2013	PAYMENT				
2014	PAYMENT				
2015	PAYMENT				
2016	PAYMENT				
2017	PAYMENT				

Section IX
Financial data – All proposed activities

Schedule VI – Reimbursement Sources

Schedule VI. Reimbursement Sources

Show reimbursement sources for the previous five years and projections for three years after the new project opens

Fiscal Year 2005				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 135,094	\$ 77,922	\$ 57,172
Medicare		\$ 220,546	\$ 144,036	\$ 76,510
Commercial		\$ 319,443	\$ 89,394	\$ 230,049
Self Pay		\$ 59,400	\$ 27,874	\$ 31,526
Other Government		\$ 47,532	\$ 29,436	\$ 18,096
Other		\$ -	\$ 9,165	\$ (9,165)
Total		\$ 782,015	\$ 377,827	\$ 404,188

Fiscal Year 2006				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 153,836	\$ 92,143	\$ 61,693
Medicare		\$ 245,161	\$ 161,055	\$ 84,106
Commercial		\$ 354,900	\$ 102,396	\$ 252,504
Self Pay		\$ 65,258	\$ 26,775	\$ 38,483
Other Government		\$ 55,603	\$ 37,416	\$ 18,187
Other		\$ -	\$ 12,847	\$ (12,847)
Total		\$ 874,758	\$ 432,632	\$ 442,126

Fiscal Year 2007				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 172,984	\$ 107,570	\$ 65,414
Medicare		\$ 275,358	\$ 182,917	\$ 92,441
Commercial		\$ 396,251	\$ 107,505	\$ 288,746
Self Pay		\$ 84,198	\$ 31,200	\$ 52,998
Other Government		\$ 64,535	\$ 42,531	\$ 22,004
Other		\$ -	\$ 21,795	\$ (21,795)
Total		\$ 993,326	\$ 493,518	\$ 499,808

Fiscal Year 2008				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 192,877	\$ 119,253	\$ 73,624
Medicare		\$ 299,643	\$ 201,848	\$ 97,795
Commercial		\$ 424,178	\$ 120,034	\$ 304,144
Self Pay		\$ 88,886	\$ 47,125	\$ 41,761
Other Government		\$ 87,158	\$ 57,761	\$ 29,397
Other		\$ -	\$ 15,856	\$ (15,856)
Total		\$ 1,092,742	\$ 561,877	\$ 530,865

Section IX
Financial data – All proposed activities

Schedule VI. Reimbursement Sources

Fiscal Year 2009 (Unaudited)				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 207,893	\$ 133,413	\$ 74,480
Medicare		\$ 322,911	\$ 219,881	\$ 103,030
Commercial		\$ 455,886	\$ 134,060	\$ 321,826
Self Pay		\$ 96,986	\$ 55,863	\$ 41,123
Other Government		\$ 83,497	\$ 56,652	\$ 26,845
Other		\$ -	\$ 20,765	\$ (20,765)
Total		\$ 1,167,173	\$ 620,634	\$ 546,539

Fiscal Year 2010 (January & February)				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 34,985	\$ 23,333	\$ 11,652
Medicare		\$ 53,674	\$ 37,608	\$ 16,066
Commercial		\$ 73,354	\$ 20,556	\$ 52,798
Self Pay		\$ 19,906	\$ 11,688	\$ 8,218
Other Government		\$ 14,846	\$ 10,557	\$ 4,289
Other			\$ 3,796	\$ (3,796)
Total		\$ 196,765	\$ 107,538	\$ 89,227

Fiscal Year 2010 (Budget)				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 234,349	\$ 149,897	\$ 84,452
Medicare		\$ 355,237	\$ 249,023	\$ 106,214
Commercial		\$ 475,407	\$ 133,897	\$ 341,510
Self Pay		\$ 110,974	\$ 48,968	\$ 62,006
Other Government		\$ 89,337	\$ 58,974	\$ 30,363
Other		\$ (3)	\$ 28,113	\$ (28,116)
Total		\$ 1,265,301	\$ 668,872	\$ 596,429

Fiscal Year 2011 (Forecast)				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 250,407	\$ 166,986	\$ 83,421
Medicare		\$ 385,113	\$ 278,112	\$ 107,001
Commercial		\$ 509,345	\$ 162,262	\$ 347,083
Self Pay		\$ 120,678	\$ 51,068	\$ 69,610
Other Government		\$ 98,796	\$ 67,493	\$ 31,304
Other		\$ -	\$ 23,812	\$ (23,812)
Total		\$ 1,364,340	\$ 749,733	\$ 614,607

Section IX
Financial data – All proposed activities

Schedule VI. Reimbursement Sources

Fiscal Year 2012 (Forecast)				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 270,169	\$ 183,211	\$ 86,958
Medicare		\$ 417,572	\$ 308,991	\$ 108,581
Commercial		\$ 545,764	\$ 184,450	\$ 361,314
Self Pay		\$ 131,252	\$ 55,828	\$ 75,424
Other Government		\$ 106,634	\$ 74,704	\$ 31,930
Other		\$ -	\$ 25,930	\$ (25,930)
Total		\$ 1,471,391	\$ 833,114	\$ 638,277

Fiscal Year 2013 (Forecast)				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 290,295	\$ 189,747	\$ 100,548
Medicare		\$ 450,432	\$ 338,791	\$ 111,641
Commercial		\$ 600,913	\$ 208,354	\$ 392,559
Self Pay		\$ 127,533	\$ 67,744	\$ 59,789
Other Government		\$ 102,471	\$ 72,843	\$ 29,628
Other		\$ -	\$ 24,314	\$ (24,314)
Total		\$ 1,571,645	\$ 901,793	\$ 669,851

Fiscal Year 2014 (Forecast)				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 307,428	\$ 203,675	\$ 103,753
Medicare		\$ 493,643	\$ 375,199	\$ 118,444
Commercial		\$ 627,734	\$ 228,906	\$ 398,828
Self Pay		\$ 137,441	\$ 72,167	\$ 65,274
Other Government		\$ 108,277	\$ 77,801	\$ 30,476
Other		\$ -	\$ 25,238	\$ (25,238)
Total		\$ 1,674,522	\$ 982,986	\$ 691,536

Fiscal Year 2015 (Forecast)				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 326,285	\$ 219,104	\$ 107,181
Medicare		\$ 543,309	\$ 419,179	\$ 124,129
Commercial		\$ 662,185	\$ 253,248	\$ 408,937
Self Pay		\$ 148,886	\$ 77,344	\$ 71,543
Other Government		\$ 114,253	\$ 83,298	\$ 30,955
Other		\$ -	\$ 26,244	\$ (26,244)
Total		\$ 1,794,918	\$ 1,078,416	\$ 716,502

Section IX
Financial data – All proposed activities

Schedule VI. Reimbursement Sources

Fiscal Year 2016 (Forecast)				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 343,816	\$ 233,938	\$ 109,878
Medicare		\$ 598,822	\$ 468,491	\$ 130,331
Commercial		\$ 694,271	\$ 277,390	\$ 416,881
Self Pay		\$ 160,960	\$ 82,699	\$ 78,261
Other Government		\$ 121,599	\$ 89,888	\$ 31,711
Other		\$ -	\$ 27,119	\$ (27,119)
Total		\$ 1,919,467	\$ 1,179,524	\$ 739,943

Fiscal Year 2017 (Forecast)				
Reimbursement Source	Number of Patients	Gross Patient Charges	Deductions	Net Patient Revenues
Medicaid		\$ 361,322	\$ 249,018	\$ 112,304
Medicare		\$ 656,601	\$ 520,579	\$ 136,022
Commercial		\$ 729,060	\$ 303,424	\$ 425,636
Self Pay		\$ 173,868	\$ 88,234	\$ 85,633
Other Government		\$ 127,376	\$ 95,402	\$ 31,973
Other		\$ -	\$ 27,854	\$ (27,854)
Total		\$ 2,048,226	\$ 1,284,511	\$ 763,716

Section IX
Financial data – All proposed activities

Schedule VII – Depreciation Schedule

Schedule VII. Depreciation Schedule			
Use the straight-line method. Provide a separate schedule for any pieces of major moveable equipment.			
Equipment to be Purchased			
Equipment Description	Unit Cost	AHA	Depreciation Per Year
CPI Concrete	\$ 1,639,709	40	40,993
Structural Steel	\$ 470,000	40	11,750
Precast Material	\$ 800,000	40	20,000
Miscellaneous Metals	\$ 57,235	40	1,431
Rough Carpentry	\$ 143,088	40	3,577
Waterproofing	\$ 46,204	40	1,155
Building & Slab Insulation	\$ 41,509	40	1,038
Metal Wall Panels	\$ 265,000	40	6,625
Roofing	\$ 158,000	25	6,320
Firestop & Sealants	\$ 67,613	25	2,705
Doors & HDW & Glazing	\$ 145,631	15	9,709
Framing & GWB	\$ 225,000	20	11,250
ACT Ceilings	\$ 4,950	8	619
Resilient Base	\$ 2,360	10	236
Tape & Paint	\$ 165,000	40	4,125
Intake & Muffler Ducts	\$ 30,000	20	1,500
Epoxy Floors	\$ 72,000	40	1,800
Floor Sealer	\$ 28,000	5	5,600
Louvers & Vents	\$ 251,750	20	12,588
Interior Signage	\$ 5,250	10	525
Fire Extinguishers	\$ 3,900	5	780
Toilet Accessories	\$ 1,875	15	125
Corner Guards	\$ 3,000	10	300
Institutional Casework	\$ 15,000	15	1,000
Fire Protection	\$ 165,000	25	6,600
Mechanical	\$ 4,467,338	15	297,823
Electrical	\$ 12,000,450	18	666,692
Caterpillar 3561C TA Diesel Using Power Lynx 3000	\$ 552,889	20	27,644
Caterpillar 3561C TA Diesel Using Power Lynx 3000	\$ 552,889	20	27,644
Caterpillar 3561C TA Diesel Using Power Lynx 3000	\$ 552,889	20	27,644
Caterpillar Switchgear using Power Lynx 3000	\$ 622,981	12	51,915
Excavation and Embankment	\$ 1,107,082	40	27,677
Waterline	\$ 161,303	25	6,452
Storm Drain	\$ 298,561	40	7,464
Sewer Line	\$ 186,350	40	4,659
Traffic Control and Maintenance	\$ 15,028	18	835
Dust Control	\$ 25,047	5	5,009
Landscape	\$ 50,094	5	10,019
Concrete Miscellaneous	\$ 165,311	40	4,133
Total Capital Equipment	25,565,287		1,317,960
Expensed			
Demolition Expense	88,166		
Miscellaneous Landscape	35,066		
Total Expensed Equipment	123,232		
Total Equipment	25,688,519		

Appendices

List of Appendices

Appendix A – Administrative

Hospital License
Joint Commission Accreditation
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Certified Construction Cost Estimates

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National Fire Protection Association (NEFA) Standards, Chapter 4: Electrical Systems
NEFA Standards, Chapter 8: Routine Maintenance and Operational Testing
Joint Commission Sentinel Event Alert (Issue 37, September 6, 2006)

Appendix C – Staffing

Director, Hospital Engineering - Job Description
Plant Operator II - Job Description
Electrician - Job Description
Resume for Director, Hospital Engineering

Appendix D - Drawings

Site Plan
Site Utility Plan
Landscape Planting Plan
Level 0, Life Safety Plan
Level 1, Life Safety Plan
Penthouse Level, Life Safety Plan
Master Site Plan CUP
Level 0, Floor Plan
Level 1, Floor Plan
Penthouse Level, Floor Plan

Appendices

Appendix A – Administrative

Hospital License

Joint Commission Accreditation

Organizational Chart

Certified Construction Cost Estimates

STATE OF ALASKA
DEPARTMENT OF HEALTH AND SOCIAL SERVICES
Sarah Palin, Governor

This is to *Certify* that a license is hereby granted by the Department of Health and Social Services to

Providence Alaska Medical Center

To conduct and maintain a 326 Bed Acute Care Hospital including 27 Psychiatric Beds
and 10 Rehabilitation Beds
In the premises located at 3200 Providence Drive, Anchorage, Alaska

This License is effective July 1, 2008 through June 30, 2010
of ALASKA STATUTES 47.32. This License shall not be assignable or transferable and shall be subject to revocation at any time
by the Department of Health and Social Services for failure to comply with the laws of Alaska or rules and regulations as
provided under the Alaska Administrative Code.

In Witness Whereof I have hereunto set my hand and seal of the Department of Health and Social Services this
first day of July, 2008

By Sarah Palin
DEPARTMENT OF HEALTH AND SOCIAL SERVICES

This License shall be null and void if a Complaint is filed on the premises



Providence Alaska Medical Center
Anchorage, AK
has been Accredited by



The Joint Commission

Which has surveyed this organization and found it to meet the requirements for the
Hospital Accreditation Program

July 19, 2008

Accreditation is customarily valid for up to 39 months.

David L. Nelson

David L. Nelson, M.D.
Chairman of the Board

10000
Organization

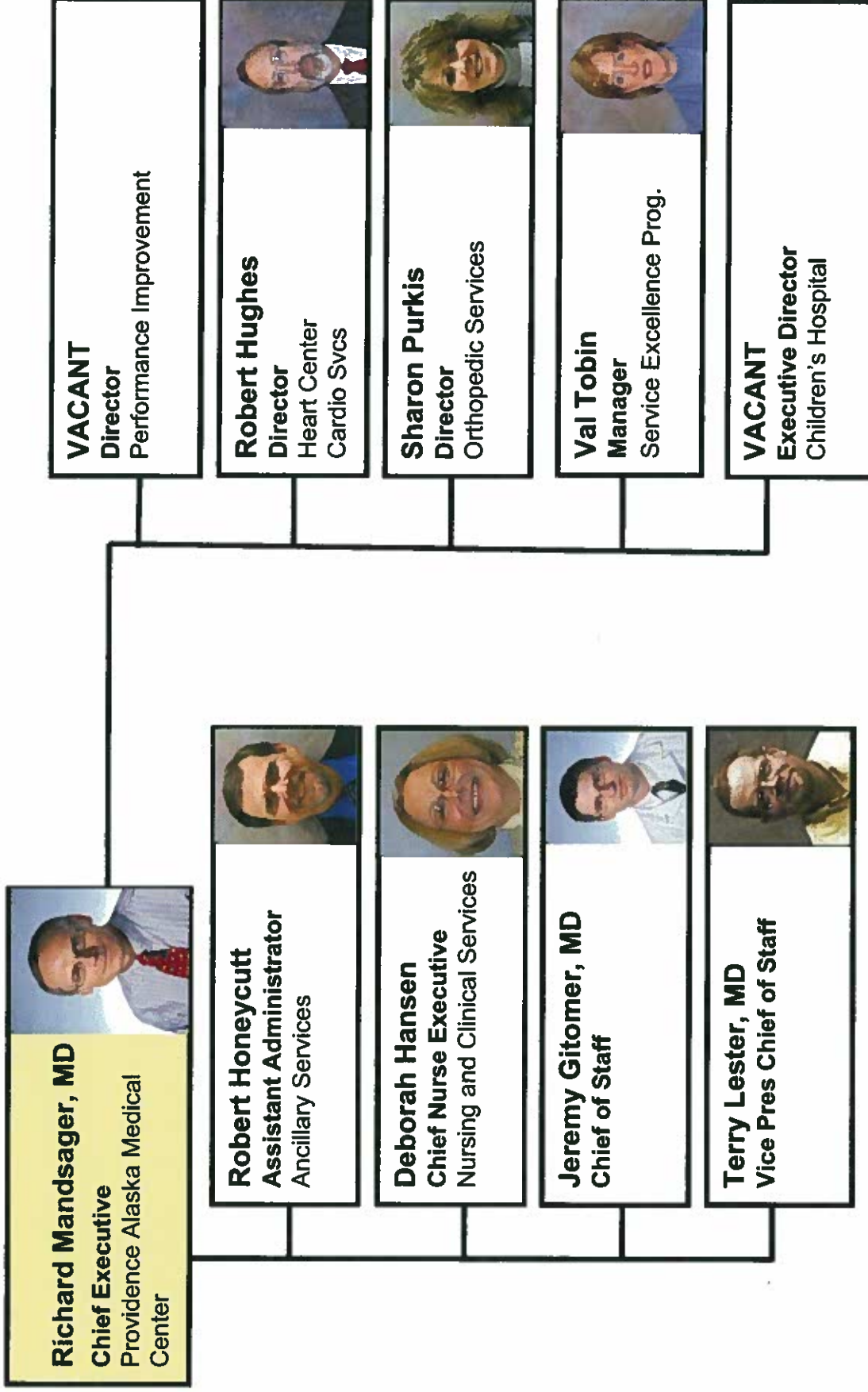
Mark Chassin

Mark Chassin, M.D.
President

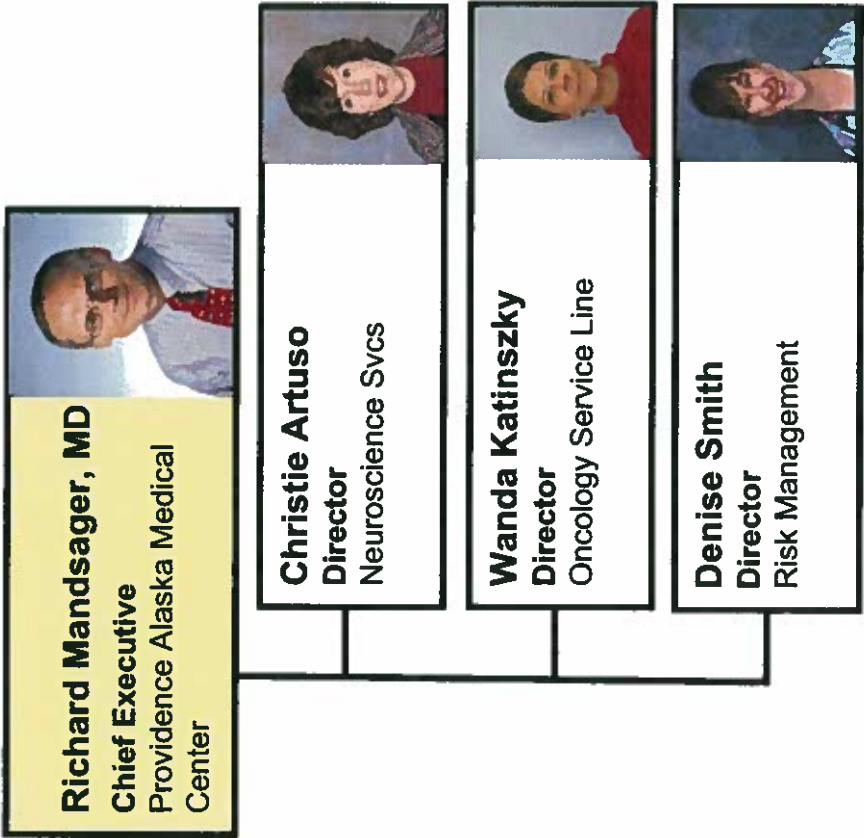
The Joint Commission is an independent, not for profit, national body that oversees the safety and quality of health care and other services provided in accredited organizations. Information about accredited organizations may be provided directly to The Joint Commission at 1-800-994-6610. Information regarding accreditation and the accreditation performance of individual organizations can be obtained through The Joint Commission's web site at www.jointcommission.org.



Providence Health & Services Alaska



Providence Health & Services Alaska (Mandsager continued)



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graph TD
    RA[Robert Honeycutt  
Assistant Administrator  
Ancillary Services] --- D1[Donald Long  
Director  
Hospital Engineering]
    RA --- D2[Marian Veuthey  
Director  
Hospitality House Svcs]
    RA --- D3[Stephen Katzenson  
Director  
Radiology]
    RA --- D4[Andre Neptune  
Director  
Pharmacy]
    RA --- D5[Vicki Faciane  
Director  
Safety/Emergency Preparedness]
  
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Robert Honeycutt
Assistant Administrator
Ancillary Services

Donald Long
Director
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Pharmacy

Vicki Faciane
Director
Safety/Emergency Preparedness

Forney Ingram
Director
Dietary Services

James Paapke
Director
Guest Services

Jo Norton
Director
Laboratory/Respiratory Care Services

Steve Ross
Clinical Manager
Rehab Services

Susan Bailey
Clinical Manager
Cardiopulmonary Rehab

CORNERSTONE CONSTRUCTION

5050 Cordova Street
Anchorage, Alaska 99503
(907) 561-1993
Fax: (907) 561-7899

Providence Alaska Medical Center - Emergency Power Supply System			
Certified Cost Estimate for CON			
Tuesday, February 09, 2010			
Description			2010 Estimated Construction Costs
Baseline Package:			\$ 21,068,233
1	Plant Building Core and Shell and High Voltage Pathways		\$ 18,911,010
	Division 01	General Conditions	\$ 3,756,077
		Permit & Fee's	\$ 178,620
	Division 02	Sitework & Demo	\$ 2,610,909
	Division 03	Concrete	\$ 1,639,709
	Division 05	Structural Steel	\$ 470,000
		Precast Material	\$ 800,000
		Misc Metals	\$ 57,235
	Division 06	Rough Carpentry	\$ 143,088
	Division 07	Waterproofing	\$ 46,204
		Traffic & Graffiti Coatings	\$ 58,980
		Bldg & Slab Insulation	\$ 41,509
		Metal Wall Panels	\$ 265,000
		Roofing	\$ 158,000
		Firestop & Jt. Sealants	\$ 67,613
	Division 08	Doors & HDW & Glazing	\$ 145,631
	Division 09	Framing & GWB	\$ 225,000
		ACT Ceilings	\$ 4,950
		Resilient Base	\$ 2,360
		Tape & Paint	\$ 165,000
		Pnt Intake & Muffler Ducts	\$ 30,000
		Epoxy Floors	\$ 72,000
		Floor Sealer	\$ 28,000
		Sandblast & Paint Fuel Tanks	\$ 36,000
	Division 10	Louvers & Vents	\$ 251,750
		Interior Signage	\$ 5,250
		Fire Extinguishers	\$ 3,900
		Toilet Accessories	\$ 1,875
		Corner Guards	\$ 3,000
	Division 11	Loading Dock Equipment	\$ 15,000
	Division 12	Institutional Casework	\$ 15,000
	Division 15	Fire Protection	\$ 165,000
	Division 15	Mechanical	\$ 4,431,500
	Division 16	Electrical	\$ 3,016,850
2	High Voltage Build Out (Electrical Only)		\$ 2,157,223
	Division 01	General Conditions	\$ 36,293
		Permit & Fee's	\$ 19,330
	Division 16	Electrical	\$ 2,101,600
Estimated Construction Costs =			\$ 21,068,233

- Notes:**
- 1) All estimates have been developed in today dollars.
 - 2) Range for escalation 6% - 12% per year
 - 3) Range for contingency 10% - 20%
 - 4) Range for profit and overhead 5% - 10%



Joe Jolley

Appendices

Appendix B – Regulatory Recommendations

National Fire Protection Association (NEFA) Standards, Chapter 4: Electrical Systems

NEFA Standards, Chapter 8: Routine Maintenance and Operational Testing

Joint Commission Sentinel Event Alert (Issue 37, September 6, 2006)

Chapter 4 Electrical Systems

4.1* Applicability.

4.1.1 Wiring and installation requirements on equipment shall be in accordance with NFPA 70, *National Electrical Code*.

4.1.2 Requirements for illumination and identification of means of egress in health care shall be in accordance with NFPA 101, *Life Safety Code*.

4.1.3 The alternate source of emergency power for illumination and identification of means of egress shall be from the essential electrical system.

4.1.4 Requirements for the installation of stationary engines and gas turbines shall be in accordance with NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*.

4.2 Nature of Hazards.

See Section B.1.

4.2.1* Fire and Explosions.

4.2.2 Shock.

4.2.2.1 General.

4.2.2.2 Control. See B.1.2.2.2.

4.2.3 Thermal. (Reserved)

4.2.4 Interruption of Power. See B.1.4.1.

4.3 Electrical System Requirements.

4.3.1 Sources. Each appliance of a hospital requiring electrical line power for operation shall be supported by power sources and distribution systems that provide power adequate for each service.

4.3.1.1 Power/Utility Company. (Reserved)

4.3.1.2 On-Site Generator Set. (Reserved)

4.3.2 Distribution.

4.3.2.1 Electrical Installation. Installation shall be in accordance with NFPA 70, *National Electrical Code*.

4.3.2.2 All Patient Care Areas.

4.3.2.2.1* Regular voltage wiring shall comply with the requirements in 4.3.2.2.1(A) through (C).

(A)* Circuits. Branch circuits serving a given patient bed location shall be fed from not more than one normal branch circuit distribution panel. When required, branch circuits serving a given patient bed location shall be permitted to be fed from more than one emergency branch circuit distribution panel.

(B) Critical Care Areas. These areas shall be served by circuits from critical branch panel(s) served from a single automatic transfer switch and a minimum of one circuit served by the normal power distribution system or by a system originating from a second critical branch transfer switch.

(C) Special Purpose Outlets. Branch circuits serving only special-purpose outlets or receptacles (e.g., portable X-ray receptacles) shall not be rewired to conform to the requirements of 4.3.2.2.1(B).

4.3.2.2.2 Grounding requirements shall comply with the requirements in 4.3.2.2.2(A) through (C).

(A) Grounding Circuitry Integrity. Grounding circuits and conductors in patient care areas shall be installed in such a way that the continuity of other parts of those circuits cannot be interrupted nor the resistance raised above an acceptable level by the installation, removal, and replacement of any installed equipment, including power receptacles.

(B)* Reliability of Grounding. Where used, the reliability of installed grounding circuits to a power receptacle in all patient care areas shall be at least equivalent to that provided by an electrically continuous copper conductor of appropriate ampacity run from the receptacle to a grounding bus in the distribution panel. The grounding conductor shall conform to NFPA 70, *National Electrical Code*.

(C) Separate Grounding Conductor. When existing construction does not use a separate grounding conductor the continued use of the system shall be permitted to be used provided it meets the performance requirements in 4.3.3.1, Grounding System in Patient Care Areas.

(D) Metal Receptacle Boxes. Where metal receptacle boxes are used, the performance of the connection between the receptacle grounding terminal and the metal box shall be equivalent to the performance provided by copper wire no smaller than 12 AWG.

4.3.2.2.3* Grounding Interconnects. In patient care areas supplied by the normal distribution system and any branch of the essential electrical system, the grounding system of the normal distribution system and that of the essential electrical system shall be interconnected.

4.3.2.2.4 Circuit Protection.

4.3.2.2.4.1* The main and downstream ground-fault protective devices (where required) shall be coordinated as required in 4.3.2.5.

4.3.2.2.4.2* If used, ground-fault circuit interrupters (GFCIs) shall be approved for the purpose.

4.3.2.2.5 Low-voltage wiring shall comply with either of the following:

- (1) Fixed systems of 30 V (dc or ac rms) or less shall be ungrounded, provided the insulation between each ungrounded conductor and the primary circuit, which is supplied from a conventionally grounded distribution system, is the same protection as required for the primary voltage.
- (2) A grounded low-voltage system shall be permitted provided that load currents are not carried in the grounding conductors.

4.3.2.2.5.1 Wiring for low-voltage control systems and nonemergency communications and signaling systems shall not be required to be installed in metal raceways in anesthetizing locations.

4.3.2.2.6 Switches in Anesthetizing Locations. Switches controlling ungrounded circuits within or partially within an inhalation anesthetizing location shall have a disconnecting pole for each conductor.

4.3.2.2.7 Receptacles.

4.3.2.2.7.1* Types of Receptacles. Each power receptacle shall provide at least one separate, highly dependable grounding pole capable of maintaining low-contact resistance with its mating plug despite electrical and mechanical abuse. Special receptacles such as the following shall be permitted:

- (1) Four-pole units providing an extra pole for redundant grounding or ground continuity monitoring
- (2) Locking-type receptacles
- (3) Where required for reduction of electrical noise on the grounding circuit, receptacles in which the grounding terminals are purposely insulated from the receptacle yoke.

4.3.2.2.7.2 Minimum Number of Receptacles. The number of receptacles shall be determined by the intended use of the patient care areas in accordance with 4.3.2.2.7.2(A) through (D).

(A) Receptacles for Patient Bed Locations in General Care Areas. Each patient bed location shall be provided with a minimum of four receptacles.

(B) Receptacles for Patient Bed Locations in Critical Care Areas. Each patient bed location shall be provided with a minimum of six receptacles.

(C) Receptacles for Bathrooms or Toilets. Receptacles shall not be required in bathrooms or toilet rooms.

(D) Receptacles for Special Areas. Receptacles shall not be required in areas where medical

requirements mandate otherwise (e.g., certain psychiatric, pediatric, or hydrotherapy areas).

4.3.2.2.7.3 Polarity of Receptacles. Each receptacle shall be wired in accordance with NFPA 70, *National Electrical Code*, to ensure correct polarity.

4.3.2.2.7.4 Anesthetizing Location Receptacles. Receptacles for use in anesthetizing locations shall be listed for the use. In anesthetizing locations of new and existing construction having receptacles on isolated and grounded power, all receptacles shall be identified as to whether they are on isolated or grounded power.

4.3.2.2.7.5 Receptacles and Amperage. Receptacles for use with 250-V, 50-A, and 60-A ac service shall be designed for use in anesthetizing locations and shall be so designed that the 60-A receptacle will accept either the 50-A or the 60-A plug. Fifty-ampere receptacles shall be designed so as not to accept the 60-A attachment plug. These receptacles shall be of the two-pole, three-wire design with the third contact connecting to the grounding wire (green or green with yellow stripe) of the electrical system.

4.3.2.2.7.6 Other Services Receptacles. Receptacles provided for other services having different voltages, frequencies, or types on the same premises shall be of such design that attachment plugs and caps used in such receptacles cannot be connected to circuits of a different voltage, frequency, or type, but shall be interchangeable within each classification and rating required for two-wire, 125-V, single-phase ac service.

4.3.2.2.8 Special Grounding.

4.3.2.2.8.1* Use of Quiet Grounds. A quiet ground, if used, shall not defeat the purposes of the safety features of the grounding systems detailed herein.

4.3.2.2.8.2 Patient Equipment Grounding Point. A patient equipment grounding point comprising one or more grounding terminals or jacks shall be permitted in an accessible location in the patient care vicinity.

4.3.2.2.8.3* Special Grounding in Patient Care Areas. In addition to the grounding required to meet the performance requirements of 4.3.3.1, additional grounding shall be permitted where special circumstances so dictate.

4.3.2.2.9 Wet Locations.

4.3.2.2.9.1* Wet location patient care areas shall be provided with special protection against electric shock. This special protection shall be provided as follows:

- (1) A power distribution system that inherently limits the possible ground-fault current due to a first fault to a low value, without interrupting the power supply
- (2) A power distribution system in which the power supply is interrupted if the ground-fault current does, in fact, exceed a value of 6 mA

4.3.2.2.9.2 Patient beds, toilets, bidets, and wash basins shall not be required to be considered

wet locations.

4.3.2.2.9.3 In existing construction, the requirements of 4.3.2.2.9.1 are not required when written inspection procedure, acceptable to the authority having jurisdiction, is continuously enforced by a designated individual at the hospital, to indicate that equipment-grounding conductors for 120-V, single-phase, 15- and 20-A receptacles, equipment connected by cord and plug, and fixed electrical equipment are installed and maintained in accordance with NFPA 70, *National Electrical Code*, and applicable performance requirements of this chapter.

(A) The procedure shall include electrical continuity tests of all required equipment, grounding conductors, and their connections.

(B) Fixed receptacles, equipment connected by cord and plug, and fixed electrical equipment shall be tested as follows:

- (1) When first installed
- (2) Where there is evidence of damage
- (3) After any repairs
- (4) At intervals not exceeding 6 months

4.3.2.2.9.4 The use of an isolated power system (IPS) shall be permitted as a protective means capable of limiting ground fault current without power interruption. When installed, such a power system shall conform to the requirements of 4.3.2.2.

4.3.2.2.9.5 Where power interruption under first fault condition (line-to-ground fault) is tolerable, the use of a ground-fault circuit interrupter (GFCI) shall be permitted as the protective means that monitors the actual ground-fault current and interrupts the power when that current exceeds 6 mA.

4.3.2.2.10 Isolated Power. An isolated power system shall not be required to be installed in any patient care area except as specified in 4.3.2.2.9. The system shall be permitted to be installed where it conforms to the performance requirements specified in 4.3.2.6.

4.3.2.3 Laboratories. Power outlets shall be installed in accordance with NCCLS Standard *ASI-5, Power Requirements for Clinical Laboratory Instruments and for Laboratory Power Sources*. Outlets with two to four receptacles, or an equivalent power strip, shall be installed every 0.5 to 1.0 m (1.6 to 3.3 ft) in instrument usage areas, and either installation is to be at least 8 cm (3.15 in.) above the countertop.

4.3.2.4 Other Nonpatient Areas. (Reserved)

4.3.2.5 Ground-Fault Protection. When ground-fault protection is provided for operation of the service or feeder disconnecting means, an additional step of ground-fault protection shall be provided in the next level of feeder downstream toward the load. Ground-fault protection for operation of the service and feeder disconnecting means shall be fully selective such that the downstream device and not the upstream device shall open for downstream ground faults. The

additional step of ground-fault protection shall not be required where the service or feeder disconnecting means does not serve patient care areas or equipment intended to support life, such as clinical air compressors and vacuum pumps. When equipment ground-fault protection is first installed, each level shall be performance tested to ensure compliance with 4.3.2.5.

4.3.2.6* Isolated Power Systems.

4.3.2.6.1 Isolation Transformer.

4.3.2.6.1.1 The isolation transformer shall be approved for the purpose.

4.3.2.6.1.2 The primary winding shall be connected to a power source so that it is not energized with more than 600 V (nominal). The neutral of the primary winding shall be grounded in an approved manner. If an electrostatic shield is present, it shall be connected to the reference grounding point.

4.3.2.6.1.3 Wiring of isolated power systems shall be in accordance with Section 517.62 of NFPA 70, *National Electrical Code*.

4.3.2.6.2 Impedance of Isolated Wiring.

4.3.2.6.2.1* The impedance (capacitive and resistive) to ground of either conductor of an isolated system shall exceed 200,000 ohms when installed. The installation at this point shall include receptacles but is not required to include lighting fixtures or components of fixtures. This value shall be determined by energizing the system and connecting a low-impedance ac milliammeter (0 to 1 mA scale) between the reference grounding point and either conductor in sequence. This test shall be permitted to be performed with the line isolation monitor (*see* 4.3.2.6.3) connected, provided the connection between the line isolation monitor and the reference grounding point is open at the time of the test. After the test is made, the milliammeter shall be removed and the grounding connection of the line isolation monitor shall be restored. When the installation is completed, including permanently connected fixtures, the reading of the meter on the line isolation monitor, which corresponds to the unloaded line condition, shall be made. This meter reading shall be recorded as a reference for subsequent line-impedance evaluation. This test shall be conducted with no phase conductors grounded.

4.3.2.6.2.2 An approved capacitance suppressor shall be permitted to be used to improve the impedance of the permanently installed isolated system; however, the resistive impedance to ground of each isolated conductor of the system shall be at least 1 megohm prior to the connection of the suppression equipment. Capacitance suppressors shall be installed so as to prevent inadvertent disconnection during normal use.

4.3.2.6.3 Line Isolation Monitor.

4.3.2.6.3.1* In addition to the usual control and protective devices, each isolated power system shall be provided with an approved continually operating line isolation monitor that indicates possible leakage or fault currents from either isolated conductor to ground.

4.3.2.6.3.2 The monitor shall be designed such that a green signal lamp, conspicuously visible

to persons in the anesthetizing location, remains lighted when the system is adequately isolated from ground; and an adjacent red signal lamp and an audible warning signal (remote if desired) shall be energized when the total hazard current (consisting of possible resistive and capacitive leakage currents) from either isolated conductor to ground reaches a threshold value of 5.0 mA under normal line voltage conditions. The line isolation monitor shall not alarm for a fault hazard current of less than 3.7 mA.

4.3.2.6.3.3* The line isolation monitor shall comply with either of the following:

- (1) It shall have sufficient internal impedance such that, when properly connected to the isolated system, the maximum internal current that will flow through the line isolation monitor, when any point of the isolated system is grounded, shall be 1 mA.
- (2) It shall be permitted to be of the low-impedance type such that the current through the line isolation monitor, when any point of the isolated system is grounded, will not exceed twice the alarm threshold value for a period not exceeding 5 msec.

4.3.2.6.3.4* An ammeter connected to indicate the total hazard current of the system (contribution of the fault hazard current plus monitor hazard current) shall be mounted in a plainly visible place on the line isolation monitor with the "alarm on" zone (total hazard current = 5.0 mA) at approximately the center of the scale. It is desirable to locate the ammeter such that it is conspicuously visible to persons in the anesthetizing location.

4.3.2.6.3.5 Means shall be provided for shutting off the audible alarm while leaving the red warning lamp activated. When the fault is corrected and the green signal lamp is reactivated, the audible alarm silencing circuit shall reset automatically, or an audible or distinctive visual signal shall indicate that the audible alarm is silenced.

4.3.2.6.3.6 A reliable test switch shall be mounted on the line isolation monitor to test its capability to operate (i.e., cause the alarms to operate and the meter to indicate in the "alarm on" zone). This switch shall transfer the grounding connection of the line isolation monitor from the reference grounding point to a test impedance arrangement connected across the isolated line; the test impedance(s) shall be of the appropriate magnitude to produce a meter reading corresponding to the rated total hazard current at the nominal line voltage, or to a lesser alarm hazard current if the line isolation monitor is so rated. The operation of this switch shall break the grounding connection of the line isolation monitor to the reference grounding point before transferring this grounding connector to the test impedance(s), so that making this test will not add to the hazard of a system in actual use, nor will the test include the effect of the line to ground stray impedance of the system. The test switch shall be of a self-restoring type.

4.3.2.6.3.7 The line isolation monitor shall not generate energy of sufficient amplitude or frequency, as measured by a physiological monitor with a gain of at least 10^4 with a source impedance of 1000 ohms connected to the balanced differential input of the monitor, to create interference or artifact on human physiological signals. The output voltage from the amplifier shall not exceed 30 mV when the gain is 10^4 . The 1000 ohms impedance shall be connected to the ends of typical unshielded electrode leads that are a normal part of the cable assembly

furnished with physiological monitors. A 60-Hz notch filter shall be used to reduce ambient interference as is typical in physiological monitor design.

4.3.2.6.4 Identification of Conductors for Isolated (Ungrounded) Systems. The isolated conductors shall be identified in accordance with Section 517.160(a)(5) of NFPA 70, *National Electrical Code*.

4.3.3 Performance Criteria and Testing.

4.3.3.1 Grounding System in Patient Care Areas.

4.3.3.1.1* Grounding System Testing. The effectiveness of the grounding system shall be determined by voltage measurements and impedance measurements.

4.3.3.1.1.1 For new construction, the effectiveness of the grounding system shall be evaluated before acceptance.

4.3.3.1.1.2 Small, wall-mounted conductive surfaces, not likely to become energized, such as surface-mounted towel and soap dispensers, mirrors, and so forth, shall not be required to be intentionally grounded or tested.

4.3.3.1.1.3 Large, metal conductive surfaces not likely to become energized, such as windows, door frames, and drains, shall not be required to be intentionally grounded or periodically tested.

4.3.3.1.1.4* Whenever the electrical system has been altered or replaced, that portion of the system shall be tested.

4.3.3.1.2 Reference Point. The voltage and impedance measurements shall be taken with respect to a reference point. The reference point shall be one of the following:

- (1) A reference grounding point (*see Chapter 3, Definitions*)
- (2) A grounding point, in or near the room under test, that is electrically remote from receptacles, for example, an all-metal cold-water pipe
- (3) The grounding contact of a receptacle that is powered from a different branch circuit from the receptacle under test

4.3.3.1.3* Voltage Measurements. The voltage measurements shall be made under no-fault conditions between a reference point and exposed fixed electrical equipment with conductive surfaces in a patient care vicinity. The voltage measurements shall be made with an accuracy of ± 20 percent. Voltage measurements for faceplates of wiring devices shall not be required.

4.3.3.1.4* Impedance Measurements. The impedance measurement shall be made with an accuracy of ± 20 percent. For new construction, the impedance measurement shall be made between the reference point and the grounding contact of 10 percent of all receptacles in each patient care vicinity. The impedance measurement shall be the ratio of voltage developed (either 60 Hz or dc) between the point under test and the reference point to the current applied

between these two points.

4.3.3.1.5 Test Equipment. Electrical safety test instruments shall be tested periodically, but not less than annually, for acceptable performance.

4.3.3.1.5.1 Voltage measurements specified in 4.3.3.1.3 shall be made with an instrument having an input resistance of 1000 ohms ± 10 percent at frequencies of 1000 Hz or less.

4.3.3.1.5.2 The voltage across the terminals (or between any terminal and ground) of resistance-measuring instruments used in occupied patient care areas shall not exceed 500 mV rms or 1.4 dc or peak to peak.

4.3.3.1.6 Criteria for Acceptability for New Construction.

4.3.3.1.6.1 Voltage limit shall be 20 mV.

4.3.3.1.6.2 Impedance limit shall be 0.2 ohms for quiet ground systems, and 0.1 ohms for all others.

4.3.3.2 Receptacle Testing in Patient Care Areas.

4.3.3.2.1 The physical integrity of each receptacle shall be confirmed by visual inspection.

4.3.3.2.2 The continuity of the grounding circuit in each electrical receptacle shall be verified.

4.3.3.2.3 Correct polarity of the hot and neutral connections in each electrical receptacle shall be confirmed.

4.3.3.2.4 The retention force of the grounding blade of each electrical receptacle (except locking-type receptacles) shall be not less than 115 g (4 oz).

4.3.3.3 Isolated Power Systems.

4.3.3.3.1 Patient Care Areas. If installed, the isolated power system shall be tested in accordance with 4.3.3.3.2.

4.3.3.3.2 Line Isolation Monitor Tests.

4.3.3.3.2.1 The Line Isolation Monitor (LIM) circuit shall be tested after installation, and prior to being placed in service, by successively grounding each line of the energized distribution system through a resistor of $200 \times V$ ohms, where V equals measured line voltage. The visual and audible alarms (*see 4.3.2.6.3.2*) shall be activated.

4.3.3.3.2.2 The LIM circuit shall be tested at intervals of not more than 1 month by actuating the LIM test switch (*see 4.3.2.6.3.6*). For a LIM circuit with automated self-test and self-calibration capabilities, this test shall be performed at intervals of not more than 12 months. Actuation of the test switch shall activate both visual and audible alarm indicators.

4.3.3.3.2.3 After any repair or renovation to an electrical distribution system and at intervals of not more than 6 months, the LIM circuit shall be tested in accordance with 4.3.3.3.2.1 and only when the circuit is not otherwise in use. For a LIM circuit with automated self-test and

self-calibration capabilities, this test shall be performed at intervals of not more than 12 months.

4.3.4* Administration of Electrical System.

4.3.4.1 Maintenance and Testing of Electrical System.

4.3.4.1.1 Testing intervals for hospital grade receptacles in patient care areas shall be performed after initial installation, replacement, or servicing of the device.

4.3.4.1.2 Additional testing shall be performed at intervals defined by documented performance data.

4.3.4.1.3 Receptacles not listed as hospital-grade shall be tested at intervals not exceeding 12 months.

4.3.4.2 Recordkeeping.

4.3.4.2.1* General. A record shall be maintained of the tests required by this chapter and associated repairs or modification. At a minimum, this record shall contain the date, the rooms or areas tested, and an indication of which items have met or have failed to meet the performance requirements of this chapter.

4.3.4.2.2 Isolated Power System (Where Installed). A permanent record shall be kept of the results of each of the tests.

4.4 Essential Electrical System Requirements — Type 1.

4.4.1 Sources (Type 1 EES).

4.4.1.1 On-Site Generator Set.

4.4.1.1.1* Design Considerations. Dual sources of normal power shall be considered but shall not constitute an alternate source of power as described in this chapter.

(A) Distribution system arrangements shall be designed to minimize interruptions to the electrical systems due to internal failures by the use of adequately rated equipment.

(B) The following factors shall be considered in the design of the distribution system:

- (1) Abnormal voltages such as single phasing of three-phase utilization equipment, switching and/or lightning surges, voltage reductions, and so forth
- (2) Capability of achieving the fastest possible restoration of any given circuit(s) after clearing a fault
- (3) Effects of future changes, such as increased loading and/or supply capacity
- (4) Stability and power capability of the prime mover during and after abnormal conditions
- (5)* Sequence reconnection of loads to avoid large current inrushes that trip overcurrent devices or overload the generator(s)

- (6) Bypass arrangements to permit testing and maintenance of system components that could not otherwise be maintained without disruption of important hospital functions
- (7) Effects of any harmonic currents on neutral conductors and equipment

4.4.1.1.2 Current-sensing devices, phase and ground, shall be selected to minimize the extent of interruption to the electrical system due to abnormal current caused by overload and/or short circuits.

4.4.1.1.3 Generator load shed circuits designed for the purpose of load reduction or for load priority systems shall not shed life safety branch loads, critical branch loads serving critical care areas, medical air compressors, medical–surgical vacuum pumps, pressure maintenance (jockey) pump(s) for water-based fire protection systems, generator fuel pumps, or other generator accessories.

4.4.1.1.4 Essential electrical systems shall have a minimum of two independent sources of power: a normal source generally supplying the entire electrical system and one or more alternate sources for use when the normal source is interrupted.

4.4.1.1.5 Batteries for on-site generators shall be maintained in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.1.1.6 Where the normal source consists of generating units on the premises, the alternate source shall be either another generating set or an external utility service.

4.4.1.1.7 General. Generator sets installed as an alternate source of power for essential electrical systems shall be designed to meet the requirements of such service.

4.4.1.1.7.1 Type 1 and Type 2 essential electrical system power sources shall be classified as Type 10, Class X, Level 1 generator sets per NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.1.1.7.2 Type 3 essential electrical system power sources shall be classified as Type 10, Class X, Level 2 generator sets per NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.1.1.8 Uses for Essential Electrical System.

4.4.1.1.8.1 The generating equipment used shall be either reserved exclusively for such service or normally used for other purposes of peak demand control, internal voltage control, load relief for the external utility, or cogeneration. If normally used for the other purposes listed above, two or more sets shall be installed, such that the maximum actual demand likely to be produced by the connected load of the emergency system as well as medical air compressors, medical–surgical vacuum pumps, electrically operated fire pumps, jockey pumps, fuel pumps, and generator accessories shall be met with the largest single generator set out-of-service. The alternate source of emergency power for illumination and identification of means of egress shall be the essential electrical system. The alternate power source for fire protection signaling

systems shall be the essential electrical systems.

4.4.1.1.8.2 A single generator set that operates the essential electrical system shall be permitted to be part of the system supplying the other purposes as listed in 4.4.1.1.8.1, provided any such use will not decrease the mean period between service overhauls to less than three years.

4.4.1.1.8.3* Optional loads shall be permitted to be served by the essential electrical system generating equipment. Optional loads shall be served by their own transfer means such that these loads shall not be transferred onto the generating equipment if the transfer will overload the generating equipment and shall be shed upon a generating equipment overload. Use of the generating equipment to serve optional loads shall not constitute "other purposes" as described in 4.4.1.1.8.1 and therefore shall not require multiple generator sets.

4.4.1.1.9 Work Space or Room.

(A) Energy converters shall be located in a separate service room dedicated to the generating equipment, separated from the remainder of the building by fire separations having a minimum 2-hour fire rating, or located in an adequate enclosure outside the building capable of preventing the entrance of snow or rain and resisting maximum wind velocity required by the local building code. Rooms for such equipment shall not be shared with other equipment or electrical service equipment that is not a part of the essential electrical system.

(B) The generating equipment shall be installed in a location that will permit ready accessibility and adequate [minimum of 30 in. (76 cm)] working space around the unit for inspection, repair, maintenance, cleaning, or replacement.

4.4.1.1.10* Capacity and Rating. The generator set(s) shall have sufficient capacity and proper rating to meet the maximum actual demand likely to be produced by the connected load of the essential electrical system(s) at any one time.

4.4.1.1.11 Load Pickup. The generator set(s) shall have sufficient capacity to pick up the load and meet the minimum frequency and voltage stability requirements of the emergency system within 10 seconds after loss of normal power.

4.4.1.1.12 Maintenance of Temperature. Provisions shall be made to maintain the generator room at not less than 10°C (50°F) or the engine water-jacket temperature at not less than 32°C (90°F).

4.4.1.1.13 Ventilating Air. Provision shall be made to provide adequate air for cooling and to replenish engine combustion air.

4.4.1.1.14 Cranking Batteries. Internal combustion engine cranking batteries shall be in accordance with the battery requirements of NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.1.1.15 Compressed Air Starting Devices. Internal combustion engine air starting devices shall have sufficient capacity to supply five 10-second cranking attempts, with not more than a

10-second rest between attempts, with the compressor not operating.

4.4.1.1.16 Fuel Supply. The fuel supply for the generator set shall comply with Sections 5.5 and 7.9 of NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.1.1.17 Requirements for Safety Devices.

(A) Internal Combustion Engines. Internal combustion engines serving generator sets shall be equipped with the following:

- (1) A sensor device plus visual warning device to indicate a water-jacket temperature below those required in 4.4.1.1.12
- (2) Sensor devices plus visual prealarm warning device to indicate the following:
 - (a) High engine temperature (above manufacturer's recommended safe operating temperature range)
 - (b) Low lubricating oil pressure (below manufacturer's recommended safe operating range)
 - (c) Low water coolant level
- (3) An automatic engine shutdown device plus visual device to indicate that a shutdown took place due to the following:
 - (a) Overcrank (failed to start)
 - (b) Overspeed
 - (c) Low lubricating oil pressure
 - (d) Excessive engine temperature
- (4) A common audible alarm device to warn that any one or more of the prealarm or alarm conditions exist

(B) Other Types of Prime Movers. Prime movers, other than internal combustion engines, serving generator sets shall have appropriate safety devices plus visual and audible alarms to warn of alarm or approaching alarm conditions.

(C) Liquid Fuel Supplies. Liquid fuel supplies for emergency or auxiliary power sources shall be equipped with a sensor device to warn that the main fuel tank contains less than a 4-hour operating supply.

4.4.1.1.18 Alarm Annunciator. A remote annunciator, storage battery-powered, shall be provided to operate outside of the generating room in a location readily observed by operating personnel at a regular work station (*see NFPA 70, National Electrical Code, Section 700.12*). The annunciator shall indicate alarm conditions of the emergency or auxiliary power source as follows:

- (1) Individual visual signals shall indicate the following:
 - (a) When the emergency or auxiliary power source is operating to supply power to load
 - (b) When the battery charger is malfunctioning
- (2) Individual visual signals plus a common audible signal to warn of an engine-generator alarm condition shall indicate the following:
 - (a) Low lubricating oil pressure
 - (b) Low water temperature (below those required in 4.4.1.1.12)
 - (c) Excessive water temperature
 - (d) Low fuel — when the main fuel storage tank contains less than a 4-hour operating supply
 - (e) Overcrank (failed to start)
 - (f) Overspeed

4.4.1.1.18.1 Where a regular work station will be unattended periodically, an audible and visual derangement signal, appropriately labeled, shall be established at a continuously monitored location. This derangement signal shall activate when any of the conditions in 4.4.1.1.18(1) and (2) occur, but need not display these conditions individually.

4.4.1.2 Battery. Battery systems shall meet all requirements of Article 700 of NFPA 70, *National Electrical Code*.

4.4.2* Distribution (Type 1 EES).

4.4.2.1 General Requirements.

4.4.2.1.1 Electrical characteristics of the transfer switches shall be suitable for the operation of all functions and equipment they are intended to supply.

4.4.2.1.2 Switch Rating. The rating of the transfer switches shall be adequate for switching all classes of loads to be served and for withstanding the effects of available fault currents without contact welding.

4.4.2.1.3 Automatic Transfer Switch Classification. Each automatic transfer switch shall be approved for emergency electrical service (*see NFPA 70, National Electrical Code, Section 700.3*) as a complete assembly.

4.4.2.1.4 Automatic Transfer Switch Features.

(A) General. Automatic transfer switches shall be electrically operated and mechanically held. The transfer switch shall transfer and retransfer the load automatically.

Exception: It shall be permitted to program the transfer switch (1) for a manually initiated retransfer to the normal source, or (2) for an automatic intentional "off" delay, or (3) for an in-phase monitor relay or similar automatic delay method, so as to provide for a planned momentary interruption of the load. If used, this arrangement shall be provided with a bypass feature to permit automatic retransfer in the event that the alternate source fails and the normal source is available.

(B) Interlocking. Reliable mechanical interlocking, or an approved alternate method, shall be inherent in the design of transfer switches to prevent the unintended interconnection of the normal and alternate sources of power, or any two separate sources of power.

(C)* Voltage Sensing. Voltage sensing devices shall be provided to monitor all ungrounded lines of the normal source of power.

(D) Time Delay on Starting of Alternate Power Source. A time delay device shall be provided to delay starting of the alternate source generator. The timer is intended to prevent nuisance starting of the alternate source generator with subsequent load transfer in the event of harmless momentary power dips and interruptions of the normal source. The time range shall be short enough so that the generator can start and be on the line within 10 seconds of the onset of failure.

(E) Time Delay on Transfer to Alternate Power. An adjustable time delay device shall be provided for those transfer switches requiring "delayed-automatic" operation. The time delay shall commence when proper alternate source voltage and frequency are achieved. The delay device shall prevent transfer to the alternate power source until after expiration of the preset delay.

(F)* Time Delay on Retransfer to Normal Power. An adjustable timer with a bypass shall be provided to delay retransfer from the alternate source of power to the normal. This timer will permit the normal source to stabilize before retransfer to the load and help to avoid unnecessary power interruptions. The bypass shall operate similarly to the bypass in 4.4.2.1.4(A).

(G)* Test Switch. A test switch shall be provided on each automatic transfer switch that will simulate a normal power source failure to the switch.

(H)* Indication of Switch Position. Two pilot lights, properly identified, shall be provided to indicate the transfer switch position.

(I) Manual Control of Switch. A means for the safe manual operation of the automatic transfer switch shall be provided.

(J) Time Delay on Engine Shutdown. A time delay of 5 minutes minimum to allow engine cooldown shall be provided for unloaded running of the alternate power source generator set prior to shutdown.

Exception: Time delay need not be provided on small (15 kW or less) air-cooled prime movers or if included with the engine control panel.

(K)* Motor Load Transfer. Provisions shall be included to reduce excessive currents resulting from motor load transfer if such currents can damage essential electrical system equipment or cause nuisance tripping of essential electrical system overcurrent protective devices.

(L) Isolation of Neutral Conductors. Provisions shall be included for ensuring proper continuity, transfer, and isolation of the normal and the alternate power source neutral conductors whenever they are separately grounded, if needed, to achieve proper ground-fault sensing. *[See NFPA 70, National Electrical Code, Section 230.95(b).]*

4.4.2.1.5 Nonautomatic Transfer Device Classification. Nonautomatic transfer devices shall be approved for emergency electrical service (*see NFPA 70, National Electrical Code, Section 700.3*).

4.4.2.1.6 Nonautomatic Transfer Device Features.

(A) General. Switching devices shall be mechanically held. Operation shall be by direct manual or electrical remote manual control. Electrically operated switches shall derive their control power from the source to which the load is being transferred. A means for safe manual operation shall be provided.

(B) Interlocking. Reliable mechanical interlocking, or an approved alternate method, shall be inherent in the design in order to prevent the unintended interconnection of the normal and alternate sources of power, or of any two separate sources of power.

(C) Indication of Switch Position. Pilot lights, properly identified, shall be provided to indicate the switch position.

4.4.2.1.7 Bypass-Isolation Switches. Bypass-isolation switches shall be permitted for bypassing and isolating the transfer switch. If installed, they shall be in accordance with 4.4.2.1.7(A) through (C).

(A) Bypass-Isolation Switch Rating. The bypass-isolation switch shall have a continuous current rating and withstand current rating compatible with that of the associated transfer switch.

(B) Bypass-Isolation Switch Classification. Each bypass-isolation switch shall be listed for emergency electrical service as a completely factory-assembled and tested apparatus. (*See NFPA 70, National Electrical Code, Section 700.3.*)

(C)* Operation. With the transfer switch isolated or disconnected or both, means shall be provided so the bypass-isolation switch can function as an independent nonautomatic transfer switch and allow the load to be connected to either power source. Reconnection of the transfer switch shall be possible with a load interruption no greater than the maximum time, in seconds, by the type of essential electrical system.

4.4.2.2 Specific Requirements.

4.4.2.2.1* General.

4.4.2.2.1.1 The emergency system shall be limited to circuits essential to life safety and critical patient care and are designated the life safety branch and the critical branch.

4.4.2.2.1.2 The equipment system shall supply major electrical equipment necessary for patient care and basic Type 1 operation.

4.4.2.2.1.3 Both systems shall be arranged for connection, within time limits specified in this chapter, to an alternate source of power following a loss of the normal source.

4.4.2.2.1.4 The number of transfer switches to be used shall be based upon reliability, design, and load considerations. Each branch of the emergency system and each equipment system shall have one or more transfer switches. One transfer switch shall be permitted to serve one or more branches or systems in a facility with a continuous load on the switch of 150 kVA (120 kW) or less.

4.4.2.2.2 Emergency System.

4.4.2.2.2.1 General. Those functions of patient care depending on lighting or appliances that shall be permitted to be connected to the emergency system are divided into two mandatory branches, described in 4.4.2.2.2.2 and 4.4.2.2.2.3.

4.4.2.2.2.2 Life Safety Branch. The life safety branch of the emergency system shall supply power for the following lighting, receptacles, and equipment:

- (1) Illumination of means of egress as required in NFPA 101, *Life Safety Code*
- (2) Exit signs and exit direction signs required in NFPA 101, *Life Safety Code*
- (3) Alarm and alerting systems including the following:
 - (a) Fire alarms
 - (b) Alarms required for systems used for the piping of nonflammable medical gases as specified in Chapter 5, Gas and Vacuum Systems
- (4)* Hospital communication systems, where used for issuing instruction during emergency conditions
- (5) Generator Set Location: Task illumination, battery charger for emergency battery-powered lighting unit(s), and selected receptacles at the generator set location and essential electrical system transfer switch locations
- (6) Elevator cab lighting, control, communication, and signal systems
- (7) Automatically operated doors used for building egress
- (8) The auxiliary functions of fire alarm combination systems complying with NFPA 72,®*National Fire Alarm Code*®

No function other than those listed in items (1) through (8) shall be connected to the life safety branch.

4.4.2.2.2.3* Critical Branch. The critical branch shall be permitted to be subdivided into two or more branches. The critical branch of the emergency system shall supply power for task illumination, fixed equipment, selected receptacles, and selected power circuits serving the following areas and functions related to patient care:

- (1) Critical care areas that utilize anesthetizing gases, task illumination, selected receptacles, and fixed equipment
- (2) The isolated power systems in special environments
- (3) Task illumination and selected receptacles in the following:
 - (a) Patient care areas including infant nurseries, selected acute nursing areas, psychiatric bed areas (omit receptacles), and ward treatment rooms
 - (b) Medication preparation areas
 - (c) Pharmacy dispensing areas
 - (d) Nurses' stations (unless adequately lighted by corridor luminaires)
- (4) Additional specialized patient care task illumination and receptacles, where needed
- (5) Nurse call systems
- (6) Blood, bone, and tissue banks
- (7)* Telephone equipment rooms and closets
- (8) Task illumination, selected receptacles, and selected power circuits for the following areas:
 - (a) General care beds with at least one duplex receptacle per patient bedroom, and task illumination as required by the governing body of the health care facility
 - (b) Angiographic labs
 - (c) Cardiac catheterization labs
 - (d) Coronary care units
 - (e) Hemodialysis rooms or areas
 - (f) Emergency room treatment areas (selected)
 - (g) Human physiology labs
 - (h) Intensive care units
 - (i) Postoperative recovery rooms (selected)

- (9) Additional task illumination, receptacles, and selected power circuits needed for effective facility operation. Single-phase fractional horsepower motors shall be permitted to be connected to the critical branch.

4.4.2.2.3 Equipment System.

4.4.2.2.3.1 General. The equipment system shall be connected to equipment described in 4.4.2.2.3.3 through 4.4.2.2.3.5.

4.4.2.2.3.2 Connection to Alternate Power Source. The equipment system shall be installed and connected to the alternate power source, such that equipment described in 4.4.2.2.3.4 is automatically restored to operation at appropriate time lag intervals following the energizing of the emergency system. Its arrangement shall also provide for the subsequent connection of equipment described in 4.4.2.2.3.5.

4.4.2.2.3.3 AC Equipment for Nondelayed Automatic Connection. Generator accessories including, but not limited to, the transfer fuel pump, electrically operated louvers, and other generator accessories essential for generator operation, shall be arranged for automatic connection to the alternate power source.

4.4.2.2.3.4* Equipment for Delayed-Automatic Connection. The following equipment shall be permitted to be arranged for delayed-automatic connection to the alternate power source:

- (1) Central suction systems serving medical and surgical functions, including controls. It shall be permitted to place such suction systems on the critical branch.
- (2) Sump pumps and other equipment required to operate for the safety of major apparatus, including associated control systems and alarms.
- (3) Compressed air systems serving medical and surgical functions, including controls. It shall be permitted to place such air systems on the critical branch.
- (4) Smoke control and stair pressurization systems.
- (5) Kitchen hood supply and/or exhaust systems, if required to operate during a fire in or under the hood.
- (6) Supply, return, and exhaust ventilating systems for airborne infectious/isolation rooms, protective environment rooms, exhaust fans for laboratory fume hoods, nuclear medicine areas where radioactive material is used, ethylene oxide evacuation, and anesthetic evacuation. Where delayed automatic connection is not appropriate, such ventilation systems shall be permitted to be placed on the critical branch.

4.4.2.2.3.5* Equipment for Delayed-Automatic or Manual Connection. The following equipment shall be permitted to be arranged for either delayed-automatic or manual connection to the alternate power source (*also see A.4.4.2.2.3.4*):

- (1) Heating equipment to provide heating for operating, delivery, labor, recovery, intensive

care, coronary care, nurseries, infection/isolation rooms, emergency treatment spaces, and general patient rooms, and pressure maintenance (jockey or make-up) pump(s) for water-based fire protection systems.

- (2)* Heating of general patient rooms during disruption of the normal source shall not be required under any of the following conditions:
 - (a) The outside design temperature is higher than -6.7°C ($+20^{\circ}\text{F}$).
 - (b) The outside design temperature is lower than -6.7°C ($+20^{\circ}\text{F}$) and a selected room(s) is provided for the needs of all confined patients [then only such room(s) need be heated].
 - (c) The facility is served by a dual source of normal power as described in 4.3.2.1.
- (3) Elevator(s) selected to provide service to patient, surgical, obstetrical, and ground floors during interruption of normal power.
- (4) Supply, return, and exhaust ventilating systems for surgical and obstetrical delivery suites, intensive care, coronary care, nurseries, and emergency treatment spaces.
- (5) Hyperbaric facilities.
- (6) Hypobaric facilities.
- (7) Autoclaving equipment shall be permitted to be arranged for either automatic or manual connection to the alternate source.
- (8) Controls for equipment listed in 4.4.2.2.3
- (9)* Other selected equipment shall be permitted to be served by the equipment system.

4.4.2.2.4 Wiring Requirements.

4.4.2.2.4.1* Separation from Other Circuits. The life safety branch and critical branch of the emergency system shall be kept entirely independent of all other wiring and equipment.

4.4.2.2.4.2 Receptacles. The requirements for receptacles shall comply with 4.4.2.2.4.2(A) and (B).

(A) The number of receptacles on a single branch circuit for areas described in 4.4.2.2.2.3(8) shall be minimized to limit the effects of a branch circuit outage. Branch circuit overcurrent devices shall be readily accessible to nursing and other authorized personnel.

(B)* The electrical receptacles or the cover plates for the electrical receptacles supplied from the emergency system shall have a distinctive color or marking so as to be readily identifiable.

4.4.2.2.4.3 Switches. Switches installed in the lighting circuits connected to the essential electrical system shall comply with Article 700, Section E, of NFPA 70, *National Electrical Code*.

4.4.2.2.4.4 Mechanical Protection of the Emergency System. The wiring of the emergency system shall be mechanically protected by raceways, as defined in NFPA 70, *National Electrical Code*.

4.4.2.2.4.5 Flexible power cords of appliances or other utilization equipment connected to the emergency system shall not be required to be enclosed in raceways.

4.4.2.2.4.6 Secondary circuits of transformer-powered communication or signaling systems shall not be required to be enclosed in raceways unless otherwise specified by Chapters 7 or 8 of NFPA 70, *National Electrical Code*.

4.4.3 Performance Criteria and Testing (Type 1 EES).

4.4.3.1 Source. The branches of the emergency system shall be installed and connected to the alternate power source specified in 4.4.1.1.4 and 4.4.1.1.6 so that all functions specified herein for the emergency system shall be automatically restored to operation within 10 seconds after interruption of the normal source.

4.4.3.2 Transfer Switches.

4.4.3.2.1 All ac-powered support and accessory equipment necessary to the operation of the EPS shall be supplied from the load side of the automatic transfer switch(es), or the output terminals of the EPS, ahead of the main EPS overcurrent protection, as necessary, to ensure continuity of the EPSS operation and performance. [110: 5.12.5]

4.4.3.2.2 The essential electrical system shall be served by the normal power source except when the normal power source is interrupted or drops below a predetermined voltage level. Settings of the sensors shall be determined by careful study of the voltage requirements of the load.

4.4.3.2.3 Failure of the normal source shall automatically start the alternate source generator after a short delay as described in 4.4.2.1.4(D). When the alternate power source has attained a voltage and frequency that satisfies minimum operating requirements of the essential electrical system, the load shall be connected automatically to the alternate power source.

4.4.3.2.4 Upon connection of the alternate power source, the loads comprising the emergency system shall be automatically reenergized. The load comprising the equipment system shall be connected either automatically after a time delay as described in 4.4.2.1.4(E) or nonautomatically and in such a sequential manner as not to overload the generator.

4.4.3.2.5 When the normal power source is restored, and after a time delay as described in 4.4.2.1.4(F), the automatic transfer switches shall disconnect the alternate source of power and connect the loads to the normal power source. The alternate power source generator set shall continue to run unloaded for a preset time delay as described in 4.4.2.1.4(J).

4.4.3.2.6 If the emergency power source fails and the normal power source has been restored, retransfer to the normal source of power shall be immediate, bypassing the retransfer delay

timer.

4.4.3.2.7 If the emergency power source fails during a test, provisions shall be made to immediately retransfer to the normal source.

4.4.3.2.8 Nonautomatic transfer switching devices shall be restored to the normal power source as soon as possible after the return of the normal source or at the discretion of the operator.

4.4.4 Administration (Type 1 EES).

4.4.4.1 Maintenance and Testing of Essential Electrical System.

4.4.4.1.1 Maintenance and Testing of Alternate Power Source and Transfer Switches.

4.4.4.1.1.1 Maintenance of Alternate Power Source. The generator set or other alternate power source and associated equipment, including all appurtenant parts, shall be so maintained as to be capable of supplying service within the shortest time practicable and within the 10-second interval specified in 4.4.1.1.11 and 4.4.3.1. Maintenance shall be performed in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*, Chapter 6.

4.4.4.1.1.2 Inspection and Testing. Criteria, conditions, and personnel requirements shall be in accordance with 4.4.4.1.1.2(A) through (C).

(A)* Test Criteria. Generator sets shall be tested 12 times a year with testing intervals between not less than 20 days or exceeding 40 days. Generator sets serving emergency and equipment systems shall be in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*, Chapter 6.

(B) Test Conditions. The scheduled test under load conditions shall include a complete simulated cold start and appropriate automatic and manual transfer of all essential electrical system loads.

(C) Test Personnel. The scheduled tests shall be conducted by competent personnel. The tests are needed to keep the machines ready to function and, in addition, serve to detect causes of malfunction and to train personnel in operating procedures.

4.4.4.1.2 Maintenance and Testing of Circuitry.

4.4.4.1.2.1* Circuit Breakers. Main and feeder circuit breakers shall be inspected annually and a program for periodically exercising the components shall be established according to manufacturer's recommendations.

4.4.4.1.2.2 Insulation Resistance. The resistance readings of main feeder insulation shall be taken prior to acceptance and whenever damage is suspected.

4.4.4.1.3 Maintenance of Batteries. Batteries for on-site generators shall be maintained in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.4.2 Recordkeeping. A written record of inspection, performance, exercising period, and repairs shall be regularly maintained and available for inspection by the authority having

jurisdiction.

4.5 Essential Electrical System Requirements — Type 2.

4.5.1 Sources (Type 2 EES). The requirements for sources for Type 2 essential electrical systems shall conform to those listed in 4.4.1.

4.5.2 Distribution (Type 2 EES).

4.5.2.1 General. The distribution requirements for Type 2 essential electrical systems shall conform to those listed in 4.4.2.1.

4.5.2.2 Specific Requirements.

4.5.2.2.1* General. The number of transfer switches to be used shall be based upon reliability, design, and load considerations. Each branch of the emergency system and each critical system shall have one or more transfer switches. One transfer switch shall be permitted to serve one or more branches or systems in a facility with a continuous load on the switch of 150 kVA (120 kW) or less.

4.5.2.2.2 Emergency System. The emergency system shall supply power for lighting, receptacles, and equipment as follows:

- (1) Illumination of means of egress in accordance with NFPA 101, *Life Safety Code*
- (2) Exit signs and exit directional signs in accordance with NFPA 101, *Life Safety Code*
- (3) Alarm and alerting systems, including the following:
 - (a) Fire alarms
 - (b) Alarms required for systems used for the piping of nonflammable medical gases as specified in Chapter 5, Gas and Vacuum Systems
- (4)* Communication systems, where used for issuing instructions during emergency conditions
- (5) Sufficient lighting in dining and recreation areas to provide illumination to exit ways of a minimum of 5 ft-candles
- (6) Task illumination and selected receptacles at the generator set location
- (7) Elevator cab lighting, control, communication, and signal systemsNo function other than those listed in items (1) through (7) shall be connected to the emergency system.

4.5.2.2.3 Critical System.

4.5.2.2.3.1 General. The critical system shall be so installed and connected to the alternate power source that equipment listed in 4.5.2.2.3.2 shall be automatically restored to operation at appropriate time-lag intervals following the restoration of the emergency system to operation. Its arrangement shall also provide for the additional connection of equipment listed in

4.5.2.2.3.2.

4.5.2.2.3.2 Delayed-Automatic Connections to Critical System. The following equipment shall be permitted to be connected to the critical system and be arranged for delayed-automatic connection to the alternate power source:

- (1) Task illumination and selected receptacles in the following:
 - (a) Patient care areas
 - (b) Medication preparation areas
 - (c) Pharmacy dispensing areas
 - (d) Nurses' stations (unless adequately lighted by corridor luminaires)
- (2) Supply, return, and exhaust ventilating systems for airborne infectious isolation rooms
- (3) Sump pumps and other equipment required to operate for the safety of major apparatus and associated control systems and alarms
- (4) Smoke control and stair pressurization systems
- (5) Kitchen hood supply and/or exhaust systems, if required to operate during a fire in or under the hood

4.5.2.2.3.3* Delayed-Automatic or Manual Connections to Critical System. The equipment in 4.5.2.2.3.3(A) and (B) shall be permitted to be connected to the critical system and be arranged for either delayed-automatic or manual connection to the alternate power source.

(A) Heating Equipment to Provide Heating for General Patient Rooms. Heating of general patient rooms during disruption of the normal source shall not be required under any of the following conditions:

- (1)* The outside design temperature is higher than -6.7°C (+20°F).
- (2) The outside design temperature is lower than -6.7°C (+20°F) and, where a selected room(s) is provided for the needs of all confined patients, then only such room(s) need be heated.
- (3) The facility is served by a dual source of normal power as described in A.4.4.1.1.1.

(B)* Elevator Service. In instances where interruptions of power would result in elevators stopping between floors, throw-over facilities shall be provided to allow the temporary operation of any elevator for the release of passengers.

(C) Optional Connections to the Critical System. Additional illumination, receptacles, and equipment shall be permitted to be connected only to the critical system.

(D) Multiple Systems. Where one switch serves multiple systems as permitted under 4.5.2.2, transfer for all loads shall be non-delayed automatic.

4.5.2.2.4 Wiring Requirements.

4.5.2.2.4.1* Separation from Other Circuits. The emergency system shall be kept entirely independent of all other wiring and equipment.

4.5.2.2.4.2* Receptacles. The electrical receptacles or the cover plates for the electrical receptacles supplied from the emergency system shall have a distinctive color or marking so as to be readily identifiable.

4.5.3 Performance Criteria and Testing (Type 2 EES).

4.5.3.1 Source. The emergency system shall be installed and connected to the alternate source of power specified in 4.4.1.1.4 and 4.4.1.1.6 so that all functions specified herein for the emergency system will be automatically restored to operation within 10 seconds after interruption of the normal source.

4.5.3.2 Transfer Switches.

4.5.3.2.1 The essential electrical system shall be served by the normal power source until the normal power source is interrupted or drops below a predetermined voltage level. Settings of the sensors shall be determined by careful study of the voltage requirements of the load.

4.5.3.2.2 Failure of the normal source shall automatically start the alternate source generator, after a short delay as described in 4.4.2.1.4(D). When the alternate power source has attained a voltage and frequency that satisfies minimum operating requirements of the essential electrical system, the load shall be connected automatically to the alternate power source.

4.5.3.2.2.1 All ac-powered support and accessory equipment necessary to the operation of the EPS shall be supplied from the load side of the automatic transfer switch(es), or the output terminals of the EPS, ahead of the main EPS overcurrent protection, as necessary, to ensure continuity of the EPSS operation and performance.

4.5.3.2.3 Upon connection of the alternate power source, the loads comprising the emergency system shall be automatically reenergized. The loads comprising the critical system shall be connected either automatically after a time delay as described in 4.4.2.1.4(E) or nonautomatically and in such a sequential manner as not to overload the generator.

4.5.3.2.4 When the normal power source is restored, and after a time delay as described in 4.4.2.1.4(F), the automatic transfer switches shall disconnect the alternate source of power and connect the loads to the normal power source. The alternate power source generator set shall continue to run unloaded for a preset time delay as described in 4.4.2.1.4(J).

4.5.3.2.5 If the emergency power source fails and the normal power source has been restored, retransfer to the normal source of power shall be immediate, bypassing the retransfer delay timer.

4.5.3.2.6 If the emergency power source fails during a test, provisions shall be made to immediately retransfer to the normal source.

4.5.3.2.7 Nonautomatic transfer switching devices shall be restored to the normal power source as soon as possible after the return of the normal source or at the discretion of the operator.

4.5.4 Administration (Type 2 EES).

4.5.4.1 Maintenance and Testing of Essential Electrical System.

4.5.4.1.1 Maintenance and Testing of Alternate Power Source and Transfer Switches.

4.5.4.1.1.1 Maintenance of Alternate Power Source. The generator set or other alternate power source and associated equipment, including all appurtenant parts, shall be so maintained as to be capable of supplying service within the shortest time practicable and within the 10-second interval specified in 4.4.1.1.8 and 4.4.3.1.

4.5.4.1.1.2 Inspection and Testing. Generator sets shall be inspected and tested in accordance with 4.4.4.1.1.2.

4.5.4.1.2 Maintenance and Testing of Circuitry. Circuitry shall be maintained and tested in accordance with 4.4.4.1.2.

4.5.4.1.3 Maintenance of Batteries. Batteries shall be maintained in accordance with 4.4.4.1.3.

4.5.4.2 Recordkeeping. A written record of inspection, performance, exercising period, and repairs shall be regularly maintained and available for inspection by the authority having jurisdiction.

4.6 Essential Electrical System Requirements — Type 3.

4.6.1 Sources (Type 3 EES). The alternate source of power for the system shall be specifically designed for this purpose and shall be either a generator, battery system, or self-contained battery integral with the equipment.

4.6.1.1 Generators shall conform to 4.4.1.1.

4.6.1.2 Battery systems shall conform to 4.4.1.2.

4.6.2 Distribution (Type 3 EES).

4.6.2.1 General. The distribution requirements for Type 3 essential electrical systems shall conform to those listed in 4.4.2.1.

4.6.2.2 Specific Requirements.

4.6.2.2.1* General.

4.6.2.2.2 Connection to the Essential Electrical System. The system shall supply power for task illumination that is related to the safety of life and that is necessary for the safe cessation of procedures in progress.

4.6.2.2.3 Wiring Requirements.

4.6.2.2.3.1 General. The design, arrangement, and installation of the system shall be in accordance with NFPA 70, *National Electrical Code*.

4.6.2.2.3.2* Receptacles. The cover plates for the electrical receptacles or the electrical receptacles themselves supplied from the emergency system shall have a distinctive color or marking so as to be readily identifiable.

4.6.3 Performance Criteria and Testing (Type 3 EES).

4.6.3.1 Source.

4.6.3.1.1 The emergency system shall have an alternate source of power separate and independent from the normal source that will be effective for a minimum of 1½ hours after loss of the normal source.

4.6.3.1.2 The emergency system shall be so arranged that, in the event of failure of normal power source, the alternate source of power shall be automatically connected to the load within 10 seconds.

4.6.3.2 Transfer Switches with Engine Generator Sets.

4.6.3.2.1 The operation of the equipment shall be arranged such that the load will be served by the normal source until the normal source is interrupted, or when the voltage drops below the setting of the voltage sensing device. The settings of the voltage sensing relays shall be determined by careful study of the voltage requirements of the load.

4.6.3.2.2 When the normal source is restored, and after a time delay as described in 4.4.2.1.4(F), the automatic transfer switch shall disconnect the alternate source of power and connect the loads to the normal power source.

4.6.3.2.3 If the alternate power source fails and the normal power source has been restored, retransfer to the normal source of power shall be immediate.

4.6.3.3 Transfer Switches with Battery System.

4.6.3.3.1 Failure of the normal source shall automatically transfer the load to the battery system.

4.6.3.3.2 Retransfer to the normal source shall be automatic upon restoration of the normal source.

4.6.4 Administration (Type 3 EES).

4.6.4.1 Maintenance and Testing.

4.6.4.1.1 Maintenance and Testing of Alternate Power Source and Transfer Switches.

4.6.4.1.1.1 Maintenance of Alternate Power Source. The generator set or other alternate power source and associated equipment, including all appurtenant parts, shall be so maintained as to be capable of supplying service within the shortest time practicable and within the

10-second interval specified in 4.4.1.1.11 and 4.6.3.1.

4.6.4.1.1.2 Inspection and Testing. Generator sets shall be inspected and tested in accordance with 4.4.4.1.1.2.

4.6.4.1.1.3 Stored Energy Power Source. Maintenance and testing of stored emergency power supply systems shall be in accordance with NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, Section 6.1 through 6.4.5.

4.6.4.1.2 Maintenance and Testing Circuitry. Circuitry shall be maintained and tested in accordance with 4.4.4.1.2.

4.6.4.1.3 Maintenance of Batteries. Batteries shall be maintained in accordance with 4.4.4.1.3.

4.6.4.2 Recordkeeping. A written record of inspection, performance, exercising period, and repairs shall be regularly maintained and available for inspection by the authority having jurisdiction.

Chapter 8 Routine Maintenance and Operational Testing

8.1* General.

8.1.1 The routine maintenance and operational testing program shall be based on all of the following:

- (1) Manufacturer's recommendations
- (2) Instruction manuals
- (3) Minimum requirements of this chapter
- (4) The authority having jurisdiction

8.1.2 Consideration shall be given to temporarily providing a portable or alternate source whenever the emergency generator is out of service.

8.2* Manuals, Special Tools, and Spare Parts.

8.2.1 At least two sets of instruction manuals for all major components of the EPSS shall be supplied by the manufacturer(s) of the EPSS and shall contain the following:

- (1) A detailed explanation of the operation of the system
- (2) Instructions for routine maintenance
- (3) Detailed instructions for repair of the EPS and other major components of the EPSS
- (4) An illustrated parts list and part numbers
- (5) Illustrated and schematic drawings of electrical wiring systems, including operating and safety devices, control panels, instrumentation, and annunciators

8.2.2 For Level 1 systems, instruction manuals shall be kept in a secure, convenient location, one set near the equipment, and the other set in a separate location.

8.2.3 Special tools and testing devices necessary for routine maintenance shall be available for use when needed.

8.2.4 Replacement for parts identified by experience as high mortality items shall be maintained in a secure location(s) on the premises.

8.2.4.1 Consideration shall be given to stocking spare parts as recommended by the manufacturer.

8.3 Maintenance and Operational Testing.

8.3.1* The EPSS shall be maintained to ensure to a reasonable degree that the system is

capable of supplying service within the time specified for the type and for the time duration specified for the class.

8.3.2 A routine maintenance and operational testing program shall be initiated immediately after the EPSS has passed acceptance tests or after completion of repairs that impact the operational reliability of the system.

8.3.2.1 The operational test shall be initiated at an automatic transfer switch and shall include testing of each EPSS component on which maintenance or repair has been performed, including the transfer of each automatic and manual transfer switch to the alternate power source, for a period of not less than 30 minutes under operating temperature.

8.3.3 A written schedule for routine maintenance and operational testing of the EPSS shall be established.

8.3.4 A written record of the EPSS inspections, tests, exercising, operation, and repairs shall be maintained on the premises.

8.3.4.1 The written record shall include the following:

- (1) The date of the maintenance report
- (2) Identification of the servicing personnel
- (3) Notation of any unsatisfactory condition and the corrective action taken, including parts replaced
- (4) Testing of any repair for the time as recommended by the manufacturer

8.3.5* Transfer switches shall be subjected to a maintenance program that includes all of the following operations:

- (1) Checking of connections
- (2) Inspection or testing for evidence of overheating and excessive contact erosion
- (3) Removal of dust and dirt
- (4) Replacement of contacts when required

8.3.6* Storage batteries, including electrolyte levels, used in connection with Level 1 and Level 2 systems shall be inspected weekly and shall be maintained in full compliance with manufacturer's specifications.

8.3.6.1 Maintenance of lead-acid batteries shall include the monthly checking and recording of electrolyte specific gravity.

8.3.6.2 Defective batteries shall be replaced immediately upon discovery of defects.

8.4 Operational Inspection and Testing.

8.4.1* Level 1 and Level 2 EPSSs, including all appurtenant components, shall be inspected weekly and exercised under load at least monthly.

8.4.1.1 If the generator set is used for standby power or for peak load shaving, such use shall be recorded and shall be permitted to be substituted for scheduled operations and testing of the generator set, providing the same record as required by 8.3.4.

8.4.2* Generator sets in Level 1 and Level 2 service shall be exercised at least once monthly, for a minimum of 30 minutes, using one of the following methods:

- (1) Under operating temperature conditions and at not less than 30 percent of the EPS nameplate kW rating
- (2) Loading that maintains the minimum exhaust gas temperatures as recommended by the manufacturer

8.4.2.1 The date and time of day for required testing shall be decided by the owner, based on facility operations.

8.4.2.2 Equivalent loads used for testing shall be automatically replaced with the emergency loads in case of failure of the primary source.

8.4.2.3* Diesel-powered EPS installations that do not meet the requirements of 8.4.2 shall be exercised monthly with the available EPSS load and exercised annually with supplemental loads at 25 percent of nameplate rating for 30 minutes, followed by 50 percent of nameplate rating for 30 minutes, followed by 75 percent of nameplate rating for 60 minutes, for a total of 2 continuous hours.

8.4.3 Load tests of generator sets shall include complete cold starts.

8.4.4 Time delays shall be set as follows:

- (1) Time delay on start:
 - a. 1 second minimum
 - b. 0.5 second minimum for gas turbine units
- (2) Time delay on transfer to emergency: no minimum required
- (3) Time delay on restoration to normal: 5 minutes minimum
- (4) Time delay on shutdown: 5 minutes minimum

8.4.5 Level 1 and Level 2 transfer switches shall be operated monthly.

8.4.5.1 The monthly test of a transfer switch shall consist of electrically operating the transfer switch from the standard position to the alternate position and then a return to the standard position.

8.4.6* EPSS circuit breakers for Level 1 system usage, including main and feed breakers

between the EPS and the transfer switch load terminals, shall be exercised annually with the EPS in the “off” position.

8.4.6.1 Medium- and high-voltage circuit breakers for Level 1 system usage shall be exercised every 6 months and shall be tested under simulated overload conditions every 2 years.

8.4.7 The routine maintenance and operational testing program shall be overseen by a properly instructed individual.

8.4.8* The EPSS shall be tested for the duration of its assigned class (*see Section 4.2*), or for a duration agreed to by the authority having jurisdiction for at least 4 hours, at least once within every 36–48 months.

8.4.8.1 The load shall be the EPSS system load running at the time of the test. The test shall be initiated by opening all switches or breakers supplying normal power to the EPSS.

8.4.8.2 A power interruption to non-EPSS loads shall not be required.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.4 See NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*.

A.1.1.5(3) See Chapter 4.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.1 Battery Certification. One such certifier of batteries is the American Association of Battery Manufacturers.

A.3.3.2 Emergency Power Supply (EPS). For rotary energy converters, components of an EPS include the following:

- (1) Prime mover
- (2) Cooling system
- (3) Generator
- (4) Excitation system
- (5) Starting system
- (6) Control system
- (7) Fuel system
- (8) Lube system, if required

The EPS includes all the related electrical and mechanical components of the proper size and/or capacity required for the generation of the required electrical power at the EPS output terminals.

A.3.3.3 Emergency Power Supply System (EPSS). See Annex B for diagrams of typical systems.

A.4.1 This standard specifies requirements for the EPSS as a complete functioning system in terms of types, classes, and levels. It is not the intent of this standard to recommend the EPSS most suitable for any given application. The terms *emergency power supply systems* and *standby power supply systems* as used in this standard include, but are not limited to, such terms as the following:

- (1) Alternate power systems
- (2) Standby power systems
- (3) Legally required standby systems
- (4) Alternate power sources

Since this standard specifies the installation, performance, maintenance, and test requirements in terms of types, classes, and levels, any of these terms might be appropriate for describing the application or use, depending on the need and the preference of the parties involved.

A.4.2 Selection of the class of the EPSS should take into account past outage records and fuel delivery problems due to weather, shortages, and other geographic/environmental conditions.

A.4.4 It is recognized that EPSSs are utilized in many different locations and for many different purposes. The requirement for one application might not be appropriate for other applications.

A.4.4.1 Typically, Level 1 systems are intended to automatically supply illumination or power, or both, to critical areas and equipment in the event of failure of the primary supply or in the event of danger to elements of a system intended to supply, distribute, and control power and

illumination essential for safety to human life.

Level 1 systems generally are installed in places of assembly where artificial illumination is required by other standards for safe exiting and for panic control in buildings subject to occupancy by large numbers of people.

Emergency systems can also provide power for such functions as ventilation when essential to maintain the following, as well as other similar functions:

- (1) Life
- (2) Fire detection and alarm systems
- (3) Elevators
- (4) Fire pumps
- (5) Public safety communications systems
- (6) Industrial processes where current interruption would produce serious life safety or health hazards

See NFPA 101®, *Life Safety Code*®, and Chapter 3, Electrical Systems, of NFPA 99, *Standard for Health Care Facilities*.

A.4.4.2 Typically, Level 2 systems are intended to supply power automatically to selected loads (other than those classed as emergency systems) in the event of failure of the primary source.

Level 2 systems typically are installed to serve loads such as the following, that, when stopped due to any interruption of the primary electrical supply, could create hazards or hamper rescue or fire-fighting operations:

- (1) Heating and refrigeration systems
- (2) Communications systems
- (3) Ventilation and smoke removal systems
- (4) Sewerage disposal
- (5) Lighting
- (6) Industrial processes

A.4.4.4 It is important to recognize that an EPSS might react substantially different from commercial power during transient and short circuit conditions due to the relatively small capacities of the EPSS as compared to the primary commercial power source. (See ANSI C84.1, *Standard for Electric Power Systems and Equipment Voltage Ratings*.)

A.5.1.1 Examples of probability of interruption could include the following: earthquake, flood damage, or a demonstrated utility unreliability.

A.5.1.1(1) See A.5.5.3 for shelf-life precautions for fuel supplies.

A.5.1.2 The seismic risk areas that should be addressed specifically are those designated as Zones 3 and 4 of the *Uniform Building Code*, as modified by the authorities having jurisdiction.

A.5.1.4 On-site energy conversion is not restricted to rotating-type generating systems. Other types of continuous energy conversion systems can be used, including fuel-cell systems.

A.5.2.2 The following devices are typical of energy converters and energy sources that should be reviewed carefully as part of Level 1 EPSs:

- (1) Motor-generator/engine
- (2) Motor-generator/flywheel
- (3) Steam turbine

Connection to the primary power source ahead of the primary source main service disconnect and a separate service should be excluded as a sole source of EPS.

A.5.4 It is recognized that in some installations part or all of the output of the EPS might be used for peak shaving or that part of the output might be used for driving nonessential loads during loss of the primary power source. Load-shedding of these loads when the output of the energy converter is needed is one way of meeting the requirements of Section 5.4. The load should be reviewed to ascertain that load growth has not exceeded EPS capability.

A.5.5.2 The low-fuel alarm point for liquid-fueled engines is defined as the point when the main fuel tank contains insufficient fuel to meet the required full load operating hours and is the point at which this condition is signaled.

A.5.5.3 Consideration should be given to sizing tanks in order to meet minimum fuel supplier delivery requirements, particularly for small tanks. Consideration also should be given to oversizing tanks, because many fuels have a shelf life and deteriorate with age. Where large tanks are required, it is recommended that fuels be periodically pumped out and used in other services and replaced with fresh fuel. Prudent disaster management could require much larger on-site temporary or permanent fuel storage.

A.5.6.4.2 See Figure A.5.6.4.2 for a diagram of cranking cycles.

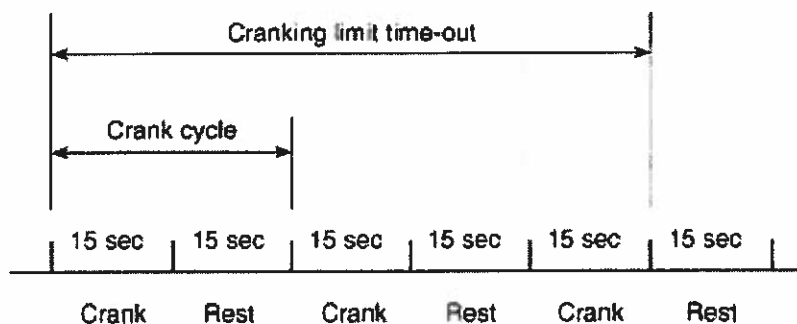


FIGURE A.5.6.4.2 Diagram of Cranking Cycles.

A.5.6.4.3 A battery unit is one or more batteries or a group of cells, a series, or a parallel series connected to provide the required battery unit voltage and capacity.

A.5.6.4.4 Cold-cranking amperes, or cranking performance, are the number of amperes a fully charged battery at -17.8°C (0°F) can continuously deliver for 30 seconds while maintaining 1.2 V per cell.

A.5.6.4.5.1 It is recommended that lead-acid starting batteries be replaced every 24 to 30 months.

A.5.6.4.6 It is intended that the battery charger be factory-built, adjusted, and approved for the specific type, construction, and capacity of the battery. For lead-acid batteries, the battery charger should be tested for the specific gravity, type, and concentration of grid alloys, such as high or low gravity, high or low antimony, calcium, or none.

A.5.6.5.6 For Level 1 and Level 2 systems located outdoors, the manual shutdown should be located external to the weatherproof enclosure and should be appropriately identified.

A.5.6.9.1 See ANSI/NEMA MG1, *Standard for Motors and Generators*, and ANSI/NEMA MG2, *Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators*.

A.5.6.10.3 Where unusual vibration conditions are anticipated, adequate isolation treatment should be supplied.

A.6.1.1 Electrical switching is electrical equipment or devices used to do any or all of the following:

- (1) Transfer connected electrical loads from one power source to another
- (2) Perform load-switching functions
- (3) Bypass, isolate, and test the transfer switch

A.6.1.2 Electrical protection equipment is sensing and overcurrent protective devices used to protect against damage due to fault or overload to conductors and equipment connected to the output of the emergency energy source, up to and including the load terminals of the transfer switch(es).

A.6.1.6 See Section 700-6 of NFPA 70, *National Electrical Code*, and Section 7.8 of NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, for listing and installation requirements for transfer switches used with fire pumps.

A.6.2.1 For most applications in this standard, the automatic transfer switch is used to transfer a load from a primary source of supply to an engine generator set.

An automatic transfer switch might include circuit breakers, contactors, switches, or vacuum

and solid-state power devices operating in conjunction with automatic-sensing and logic devices to perform the defined function.

A.6.2.2.1 Where special loads require more rapid detection of power loss, underfrequency monitoring also might be provided. Upon frequency decay below the lower limit necessary for proper operation of the loads, the transfer switch should automatically initiate transfer to the alternate source. (See A.6.2.15.)

A.6.2.2.1(2) See 6.2.5 and 6.2.7.

A.6.2.4 Authorized personnel should be available and familiar with manual operation of the transfer switch and should be capable of determining the adequacy of the alternate source of power prior to manual transfer.

A.6.2.5 For most applications, a nominal delay of 1 second is adequate. The time delay should be short enough so that the generator can start and be on the line within the time specified for the type classification.

A.6.2.8 It is recommended that the timer for delay on retransfer to the primary source be set for 30 minutes. The 30-minute recommendation is to establish a “normalized” engine temperature, when it is beneficial for the engine. NFPA 70, *National Electrical Code*, establishes a minimum time requirement of 15 minutes.

A.6.2.13 For maintenance purposes, consideration should be given to a transfer switch counter.

A.6.2.15 Automatic transfer switches (ATS) can be provided with accessory controls that provide a signal to operate remote motor controls that disconnect motors prior to transfer, and to reconnect them after transfer when the residual voltage has been substantially reduced. Another method is to provide in-phase monitors within the ATS in order to prevent retransfer to the primary source until both sources are nearly synchronized. A third method is to use a programmed neutral position transfer switch. See Section 230-95(b) of NFPA 70, *National Electrical Code*.

A.6.2.16 Standards for nonautomatic transfer switches are similar to those for automatic transfer switches, as defined in 3.3.7.1 and 3.3.7.3, with the omission of automatic controls.

A.6.4.3 See Section 700-3 of NFPA 70, *National Electrical Code*.

A.6.4.4 Consideration should be given to the effect that load interruption could have on the load during maintenance and service of the transfer switch.

A.6.5.1 It is important that the various overcurrent devices be coordinated, as far as practicable, to isolate faulted circuits and to protect against cascading operation on short circuit faults. In many systems, however, full coordination is not practicable without using equipment that could be undesirable for other reasons or prohibitively costly. Primary consideration also should be given to prevent overloading of equipment by limiting the possibilities of large current inrushes due to instantaneous reestablishment of connections to heavy loads.

A.6.5.3 See 6.6.5 of NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*.

A.7.1.1 The performance of the EPS and the EPSS is dependent on many factors, one of which is correct initial installation, primarily as the installation relates to the location and environmental conditions. Although this standard is not intended to serve as a design standard for EPSS installation and environmental considerations, certain minimum standards are recognized as essential for successful start-up and performance, safe operation, and utilization of the EPSS where required.

A.7.1.2 The environmental conditions to be considered in the EPSS design should include, but not be limited to, heating, ventilating, and air-conditioning systems, protection from floods, fire, vandalism, wind, earthquakes, lightning, and other similar or applicable environmental conditions common to geographic locations and other factors affecting the location of the EPSS equipment.

The probability and frequency of power failures that do or can occur as a result of lightning, wind, and rain produced by thunderstorms, hurricanes, tornadoes, and similar weather conditions associated with the user's geographic location should be considered.

A.7.2.3 EPSS equipment should be located above known previous flooding elevations where possible.

A.7.2.4 When installing the EPSS equipment and related auxiliaries, environmental considerations should be given, particularly with regard to the installation of the fuel tanks and exhaust lines, or the EPS building, or both.

To protect against disruption of power in the facility, it is recommended that the transfer switch be located as close to the load as possible. The following are examples of external influences:

- (1) Natural conditions
 - (a) Storms
 - (b) Floods
 - (c) Earthquakes
 - (d) Tornadoes
 - (e) Hurricanes
 - (f) Lightning
 - (g) Ice storms
 - (h) Wind
 - (i) Fire

- (2) Human-caused conditions
 - (a) Vandalism
 - (b) Sabotage
 - (c) Other similar occurrences
- (3) Material and equipment failures

For natural conditions, EPSS design should consider the “100-year storm” flooding level or the flooding level predicted by the SLOSH models for a Class 4 hurricane.

A.7.3.3 Where units housed outdoors are used, it is recommended that a flashlight or battery-powered light with a flexible cord be maintained in the housing.

A.7.5 Generally, integral rubber vibration isolators are used on the rotating energy converters and spring-type or pad-type isolators are used on the larger energy converter units. In some cases, high deflection spring-type isolators should be used where a high degree of vibration attenuation is required. The EPS manufacturer should be consulted when considering the specific type of vibration control. Inertia bases should be considered where unusual vibration conditions are anticipated.

A.7.6 Generally, exhaust noises can be attenuated by using the proper mufflers. The mufflers used should be in accordance with the EPS manufacturer's recommendations. Depending on the degree of silencing required, the muffler should be rated accordingly for “commercial,” “semicritical,” and “critical” (high degree of silencing) service. To attenuate other noises, line-of-sight barriers having acoustical treatment or total acoustical enclosures can be used. The EPS should be installed away from critical areas.

A.7.7.1 During operation, EPS and related equipment reject considerable heat that needs to be removed by proper ventilation or air-cooling. In some cases, outdoor installations rely on natural air circulation, but enclosed installations need properly sized, properly positioned ventilation facilities, to prevent recirculation of cooling air. The optimum position of air-supply louvers and radiator air discharge is on opposite walls, both to the outdoors.

A.7.8.2 It should be recognized that the reliability of municipal water-cooling is strictly dependent upon the reliability of the water utility. It should also be recognized that, during such natural disasters as earthquakes and floods, the water supply can be interrupted simultaneously with the primary electric power supply. Methods of cooling the energy converter(s) consist of radiator cooling, either unit-mounted or remote, utility-furnished (city) water-cooling, heat exchangers, and air-cooling.

A.7.9.1.2 See Table A.7.9.1.2.

Table A.7.9.1.2 ASTM Fuel Oil Rating (Diesel)

Rating	Fuel Description
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Table A.7.9.1.2 ASTM Fuel Oil Rating (Diesel)

Rating	Fuel Description
A-2	Refinery fresh fuel
A-3	Good
A-4	Watch closely — aging has begun
A-5	Advanced aging and oxidization
A-6	Badly aged — not recommended
A-7	Severe aging — do not use

A.7.9.6 See NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*; NFPA 54, *National Fuel Gas Code*; and NFPA 58, *Liquefied Petroleum Gas Code*.

A.7.9.7 Valving for natural gas-fueled prime movers should be configured so that the gas supply to the prime mover cannot be inadvertently or intentionally shut off by anyone other than the qualified personnel such as the gas supplier. Placing valves in an isolated area, a secure area or locking the valve(s) open is recommended.

A.7.10.1 See NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*.

A.7.10.3 Consideration should also be given to utilizing dampening supports where it is necessary to reduce exhaust noise vibration transmission.

A.7.11.2 If a fire suppression system is used in EPS rooms or separate buildings housing EPS equipment, consideration should be given to preaction-type suppression systems.

A.7.11.3 See NFPA 72, *National Fire Alarm Code*.

A.7.11.5 Consideration should be given to the location of the EPS equipment, both as it relates to the building structure and to the effects of an earthquake.

All emergency power equipment support or subsupport systems should be designed and constructed so that they can withstand static or anticipated seismic forces, or both, in any direction, with the minimum force value used being equal to the equipment weight.

Bolts, anchors, hangers, braces, and other restraining devices should be provided to limit earthquake-generated differential movements between the EPS nonstructural equipment and the building structure. However, the degree of isolation required for vibration and acoustical control of the EPS equipment and other equipment should be maintained.

Suspended items such as piping, conduit, ducts, and other auxiliary equipment related to the EPSS should be braced in two directions to resist swaying and excessive movement in earthquake risk areas.

Battery racks for EPS equipment and electrical items or related auxiliaries, or both, should be designed to resist internal damage and damage at the equipment supports resulting from earthquake-generated motion. Battery racks should be capable of withstanding seismic forces equal to the supported weight in any direction. Batteries should be restrained to their support to prevent vibration damage, and electrical interconnections should be provided with adequate slack to accommodate all relative deflections.

Transfer switch enclosures should be mounted so that their anchors and support structures can withstand static forces equal to the anticipated seismic shock in any direction.

Transfer switch components should be of the type that resist malfunction during dynamic excitation and should be designed to resist the anticipated seismic shock.

Where possible, EPS equipment and associated cooling systems and controls should be mounted on a single frame. The frame, in turn, should be rigidly attached to its foundation so that its anchorage can withstand static forces equal to the equipment weight in any direction. Where engine generator sets and associated cooling systems' controls cannot be mounted as an integral unit, each should be secured to meet the above floating requirements. Equipment not using the preferred rigid mounting should have vibration isolators with restraints capable of withstanding static forces equal to twice the weight of the supported equipment in any direction. In addition, interconnecting power, fuel, and cooling lines should be provided with adequate flexibility to allow maximum anticipated excursions without damage.

Appendages to the EPS equipment, such as day tanks, should be mounted to withstand static forces equal to the anticipated seismic shock in any direction.

A.7.11.6 Seismic shock should be simulated at the factory or in a testing laboratory on a prototype unit. Simulation should consist of a test(s) approximating actual time-history records of known seismic shocks applied to the equipment under test. Subassemblies of the total equipment could be tested separately where it is neither practical nor feasible to test the complete unit.

A.7.12.2 See Chapter 4 of NFPA 99, *Standard for Health Care Facilities*.

A.8.1 The continuing reliability and integrity of the EPSS are dependent on an established program of routine maintenance and operational testing.

A.8.2 Where adequately secured from public access, it is desirable to locate an instruction manual, special tools and testing devices, and spare parts in the room in which the emergency power supply is located. The articles should be mounted at a convenient location on a wall and should be enclosed in a metal or other suitable cabinet. The cabinet should accommodate the instruction manual on the inside of the door.

A.8.3.1 The suggested maintenance procedure and frequency should follow those recommended by the manufacturer. In the absence of such recommendations, Figure A.8.3.1(a) and Figure A.8.3.1(b) indicate alternate suggested procedures.

Maintenance Schedule

Component (as applicable)	Procedure X — Action R — Replace, if needed					Frequency W — Weekly M — Monthly Q — Quarterly S — Semiannually A — Annually Nos. indicate hours	
	Visual Inspection	Check	Change	Clean	Test	Level 1	Level 2
1. Fuel							
(a) Main supply tank level		X				W	M
(b) Day tank level	X	X				W	M
(c) Day tank float switch	X				X	W	Q
(d) Supply or transfer pump operation	X				X	W	Q
(e) Solenoid valve operation	X				X	W	Q
(f) Strainer, filter, dirt leg, or combination				X		Q	Q
(g) Water in system		X		X		W	Q
(h) Flexible hose and connectors	X		R			W	M
(i) Tank vents and overflow piping unobstructed		X			X	A	A
(j) Piping	X					A	A
(k) Gasoline in main tank (when used)			R			A	A
2. Lubrication System							
(a) Oil level	X	X				W	M
(b) Oil change			R			50 or A	50 or A
(c) Oil filter(s)			X			50 or A	50 or A
(d) Lube oil heater		X				W	M
(e) Crankcase breather	X		R	X		Q	S
3. Cooling System							
(a) Level	X	X				W	M
(b) Antifreeze protection level					X	S	A
(c) Antifreeze			X			A	A
(d) Adequate cooling water to heat exchanger		X				W	M
(e) Rod out heat exchanger				X		A	A
(f) Adequate fresh air through radiator		X				W	M
(g) Clean exterior of radiator				X		A	A
(h) Fan and alternator belt	X	X				M	Q
(i) Water pump(s)	X					W	Q
(j) Condition of flexible hoses and connection	X	X				W	M
(k) Jacket water heater		X				W	M
(l) Inspect duct work, clean louvers	X	X	X			A	A
(m) Louver motors and controls	X			X	X	A	A
4. Exhaust System							
(a) Leakage	X	X				W	M
(b) Drain condensate trap		X				W	M

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FIGURE A.8.3.1(a) Suggested Maintenance Schedule for Level 1 and Level 2 Emergency Power Supply Systems.

Maintenance Schedule (continued)

Component (as applicable)	Procedure X — Action R — Replace, if needed					Frequency W — Weekly S — Semiannually M — Monthly A — Annually Q — Quarterly Nos. indicate hours	
	Visual Inspection	Check	Change	Clean	Test	Level 1	Level 2
(c) Insulation and fire hazards	X					Q	Q
(d) Excessive backpressure					X	A	A
(e) Exhaust system hangers and supports	X					A	A
(f) Flexible exhaust section	X					S	S
5. Battery System							
(a) Electrolyte level		X				W	M
(b) Terminals clean and tight	X	X				Q	Q
(c) Remove corrosion, case exterior clean and dry	X			X		M	M
(d) Specific gravity or state of charge					X	M	M
(e) Charger and charge rate	X					M	M
(f) Equalize charge		X				M	M
6. Electrical System							
(a) General inspection	X					W	M
(b) Tighten control and power wiring connections		X				A	A
(c) Wire chafing where subject to movement	X	X				Q	S
(d) Operation of safeties and alarms		X			X	S	S
(e) Boxes, panels, and cabinets				X		S	S
(f) Circuit breakers, fuses Note: Do not break manufacturer's seals or perform internal inspection on these devices.	X	X	R	X	X	2 or M	2 or A
(g) Transfer switch main contacts	X			X		A	A
(h) Calibration of voltage-sensing relays/devices		X			X	5 or A	5 or A
(i) Wire insulation breakdown					X	5/500 ^a	3/500 ^b
7. Prime Mover							
(a) General inspection	X					W	M
(b) Service air cleaner			X	X		S	S
(c) Governor oil level and linkage	X	X				M	M
(d) Governor oil			X			A	A
(e) Ignition system — plugs, points, coil, cap, rotor, secondary wire insulation	X	X	R	X	X	A	A
(f) Choke setting and carburetor adjustment		X				S	S
(g) Injector pump and injectors for flow rate pressure, and/or spray pattern					X	A	A
(h) EPS at minimum of 80% nameplate rating					X	3/4 ^c	3/4 ^c

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FIGURE A.8.3.1(a) *Continued*

Maintenance Schedule (continued)							
Component (as applicable)	Procedure X — Action R — Replace, if needed					Frequency W — Weekly S — Semiannually M — Monthly A — Annually Q — Quarterly Nos. indicate hours	
	Visual Inspection	Check	Change	Clean	Test	Level 1	Level 2
(i) Valve clearance					X	3/500 ^b	3/500 ^b
(j) Torque bolts					X	3/500 ^b	3/500 ^b
8. Generator							
(a) Brush length, appearance, free to move in holder	X	X		X		S	S
(b) Commutator and slip rings	X			X		A	A
(c) Rotor and stator	X			X		A	A
(d) Bearing(s)	X		R			A	A
(e) Bearing grease		X	R			A	A
(f) Exciter	X	X		X		A	A
(g) Voltage regulator	X	X		X		A	A
(h) Measure and record resistance readings of windings with insulation tester (Megger)					X	A	A
9. (a) General condition of EPSS, any unusual condition of vibration, leakage, noise, temperature, or deterioration	X			X		W	M
(b) Service room or housing house-keeping	X			X		W	M
10. Restore system to automatic operation condition	X					W	M
^a Every 5 years or 500 hours ^b Every 3 years or 500 hours ^c Every 3 years for 4 hours							
(NFPA 110, 3 of 3)							

FIGURE A.8.3.1(a) *Continued*

Maintenance Log

Frequency

W — Weekly S — Semiannually
M — Monthly A — Annually
Q — Quarterly Nos. indicate hours

Performed by

Item No.	Service Frequency		Date																			
	Level 1	Level 2	Fill in Appropriate Readings																			
1. (a)	W	M																				
(b)	W	M																				
(c)	W	Q																				
(d)	W	Q																				
(e)	W	Q																				
(f)	Q	Q																				
(g)	W	Q																				
(h)	A	A																				
(i)	A	A																				
(j)	A	A																				
(k)	A	A																				
2. (a)	W	M																				
(b)	50 or A	50 or A																				
(c)	50 or A	50 or A																				
(d)	W	M																				
(e)	Q	S																				
3. (a)	W	M																				
(b)	S	A																				
(c)	A	A																				
(d)	W	M																				
(e)	A	A																				
(f)	W	M																				
(g)	A	A																				
(h)	M	Q																				
(i)	W	Q																				
(j)	W	M																				
(k)	W	M																				
(l)	A	A																				
(m)	A	A																				
4. (a)	W	M																				
(b)	W	M																				
(c)	Q	Q																				
(d)	A	A																				
(e)	A	A																				
(f)	S	S																				
5. (a)	W	M																				
(b)	Q	Q																				

FIGURE A.8.3.1(b) Sample Maintenance Log — Routine Maintenance, Operation, and Testing (RMOT).

FIGURE A.8.3.1(b) *Continued*

A.8.3.5 Where sealed devices are used, replacement of the complete device might be necessary. (See NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*.)

A.8.3.6 A battery load test should be performed quarterly.

A.8.4.1 See Figure A.8.4.1(a) and Figure A.8.4.1(b).

Operation and Testing Log

Performed by[illegible]

Date _____

[illegible]

Items

Fill in Appropriate Readings

[illegible]

FIGURE A.8.4.1(a) Sample Operation and Testing Log for Rotating Equipment.

Suggested Operation and Testing Procedures

Item Number	Function	Item Number	Function
1.	Perform maintenance per Figure A.8.3.1(a).	8.	Record initial oil pressure and battery-charging rate.
2.	Record running time meter reading at start and end of test.	9.	Record oil pressure, battery-charging rate, and water or air temperature after 15 minutes running time.
3.	Simulate normal power failure from a "cold start" by use of the test switch in automatic transfer switch or by opening normal power supply to EPSS.	10.	Return test switch to normal or reestablish normal power supply at such time to cause a minimum running time of 30 minutes under load.
4.	Observe and record time delay on start.	11.	Record prime mover and ac instruments just prior to transfer.
5.	Record cranking time (terminates when engine starts).	12.	Record time delay on retransfer.
6.	Transfer load to EPS. (See 8.4.1 and 8.4.2.)	13.	Record time delay on shutdown for units so equipped.
7.	Record ac voltage, frequency, amperage.	14.	Place unit in automatic operation mode.

FIGURE A.8.4.1(b) Operation and Testing Procedures Suggested for Level 1 and Level 2 Rotating Equipment.

A.8.4.2 Light loading creates a condition termed *wet stacking*, indicating the presence of unburned fuel or carbon, or both, in the exhaust system. Its presence is readily indicated by the presence of continual black smoke during engine-run operation. The testing requirements of 8.4.2 are intended to reduce the possibility of wet stacking.

A.8.4.2.3 The EPS should be exercised for the duration of its assigned class (*see Section 4.2*), or for a duration agreed to by the authority having jurisdiction not to exceed 6 hours, at least once annually under the conditions required by this section.

The intent of this requirement is to provide reasonable assurance that the EPS with all of its auxiliary subsystems is capable of running for the duration of its assigned class.

A.8.4.6 Circuit breakers should be tested under simulated overload conditions every 2 years.

A.8.4.8 The intent of this requirement is to provide reasonable assurance that the EPSS with all of its auxiliary subsystems is capable of running for the duration of its assigned Class with its running load. A full facility power outage is not intended for this test, but is recommended where a total facility power outage has not occurred within the last 48 months. Supplemental load banks are not required. After the test, the fuel supply should be replenished if necessary.



Advisory Group

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Issue 37, September 6, 2006

Preventing adverse events caused by emergency electrical power system failures

Health care facilities are highly dependent on reliable sources of electrical power. Therefore, electric power is a mission-critical resource. Each health care facility must assess the risk of electrical power failure – at various degrees of magnitude and impact severity – and make plans to deal with such an emergency. Planning and implementation of risk reduction approaches to addressing electrical power failure are the responsibility of the facility engineer, as well as organization management, the risk manager, incident command leaders, and the medical staff. By assuming access to emergency electrical power systems and implementing contingency plans for clinicians to follow during both short-term and sustained losses of power, health care organizations can reduce the risk of adverse patient care events.

September 06, 2006



A power failure can range in magnitude and impact from a relatively modest curtailment of power caused by a local power disruption to a catastrophic regional blackout caused by a violent storm or terrorist attack. As reflected in numerous media reports, clinical operations were negatively affected when normal power was lost during the Houston floods of 2001, the northeastern United States blackout in 2003, and major hurricanes Charlie, Francis, Ivan and Jean in 2004 and Katrina and Rita in 2005. Three incidents relating to failures of emergency electrical power systems are in the Joint Commission's Sentinel Event Database (reporting period from January 1995 to the present). These range from single unit failures to entire large medical centers, and each was associated with one or more patient deaths.

Meeting NFPA codes and standards only a start

Each health care facility must have an emergency power testing program that includes generator load testing and Emergency Power Supply System (EPSS) maintenance. The National Fire Protection Association (NFPA) establishes codes and standards on the minimum design, installation, and testing of these systems in the National Electric Code (NFPA 70), the Standard on Health Care Facilities (NFPA 99), and the Standard for Emergency and Standby Power Systems (NFPA 110). EPSSs meeting the NFPA codes and standards are designed for immediate life safety – in other words, to complete surgical or other procedures where lives are in balance or to evacuate the building in case of fire. These systems should be designed to “hold out” until normal power is restored.

However, recent experiences demonstrate that emergency power systems that meet these standards are not always sufficient during major catastrophes. This is because they can only support the power needs of a small percentage of the needed equipment and systems, or they are unable to supply power for an extended period of time. For example, in the wake of hurricane Katrina, many health care organizations did not have sufficient emergency power to cool or ventilate their facilities. In other instances, evacuation of patients was delayed because only one or two elevators could be operated. To assure optimal safety during catastrophes, health care organizations are encouraged to go beyond the minimum NFPA life safety requirements and to conduct thorough vulnerability analyses of their facilities.

The Joint Commission addresses emergency electrical power systems in standards EC.7.20 and EC.7.40 and addresses emergency procedures for utility system disruptions in standard EC.7.10. To address the need to provide emergency power for an extended period of time, an additional Element of Performance (EP) for standard EC.7.40 was recently approved and will appear in the 2007 standards. The new EP requires each organization to test its emergency generators at least once every 36 months for a minimum of four continuous hours. This testing is over and beyond the current requirement to test emergency generators for 30 continuous minutes 12 times each year. In addition, if a test(s) required by standard EC.7.40 fails, the organization is required to implement interim measures to compensate for the risk to patients, visitors, and staffs until necessary repairs or corrections are completed.

Risk reduction strategies

Important suggestions for proactively assessing a facility's vulnerabilities, helping to assure sufficient electrical power during emergencies, and facilitating the development of contingency plans for clinicians to follow in the event of short-term or sustained power loss include the following:

- Meet with your local utility provider and assess the reliability of the existing power system. Many facilities are served by overloaded power grids that have transformers and distribution equipment that date back to the 1950s. In other cases, expansions to the original power system have resulted in a "patchwork" system that may not operate reliably during periods of peak loads.
- Respond to facility brown-outs or black-outs as symptoms of marginal power supply. These may be related to the recent addition of new equipment.
- Fully test the entire emergency power supply system against the requirements of NFPA 110 to ensure minimum acceptable performance. Because appropriate testing may impact operations for periods of four hours or more, it is important that organization management, the medical staff, nursing, respiratory therapy, and other key staff participate in the test. The test should be scheduled well in advance of carrying it out, in the same way as any disaster drill would be planned. Electricians, mechanics, and other maintenance technicians should be stationed in strategic locations throughout the facility during testing to monitor the functioning of critical equipment and to minimize response time for problems that may occur. After testing, all fuel supplies should be replenished.
- For any new construction, undertake relevant infrastructure planning as part of a master facility plan. This will assure optimal location of the generator, fuel tank, and support equipment (for example, in flood prone areas, above potential flood levels) and proper redundancy (multiple generators feeding loads versus loads dedicated to a single generator). Such planning will also permit the addition of loads over time and will identify security needs respecting access to generators and other critical equipment such as fuel tanks and radiators, which are essential to generator function.
- Assess the need for additional redundancy through portable, truck-mounted generators and develop procedures to isolate generators from problem areas and to tie in supplemental equipment not normally fed by emergency power. Also, consider designing in emergency connection panels. These might, for example, be used to hook up a truck-mounted unit during construction or renovation.
- Maintain written procedures and record all test data. Written procedures help facility managers control the testing process and require testing personnel to take responsibility for performing required tasks. Many facilities use standardized testing forms to collect test-related data. Unanticipated occurrences should be reported immediately or right after the test for analysis by the supervisor in charge of the test. Mechanical system interactions can be recorded during the test on simple data forms to facilitate both data recording and system recovery. This information can also be used for performance improvement purposes.

Joint Commission Recommendations

In addition to the current standards requirements that address emergency electrical power systems and current NFPA testing requirements, the Joint Commission recommends the following to help prevent adverse events caused by an emergency electrical power system failure:

1. Perform a gap analysis on the emergency power system that matches the critical equipment and systems needed in an extended emergency against the equipment and systems actually on the emergency power system. Use disaster scenario planning to identify critical systems that could potentially be lost (for example, potable water or elevators). This kind of planning will help assure that emergency power feeds critical systems such as water pumps in high-rise facilities; sewer pumps in low areas; heating, air conditioning and fan units in intense climate regions; and air handlers in isolation rooms (to minimize the risk of airborne infections), in protective environment rooms, and in laboratory and pharmacy hoods.
2. Maintain a complete, labeled inventory of all emergency power systems and the loads they serve.
3. Provide competency training and testing for all operators and others responsible for system maintenance of the emergency power supply system.
4. Test generator fuel oil, track expiration dates, and replace stale fuel oil not consumed within its storage life.
5. Ensure that engineering staff communicate the capabilities and limitations of the emergency power supply system to the organization's management and clinical leaders. These communications should cover how long emergency power will be available, how long it will take the generators to provide

Clinical Contingency Plans

Examples of provisions to include:

- Rapid deployment of battery- powered equipment (e.g., portable suction units).
- Assessment of critical equipment to ensure it is plugged into back-up power outlets.
- Identification of available HIT systems or manual back-up systems.
- Establishment of timelines and pre-arranged options for diverting, transferring or evacuating patients.

power if and when the utility company's power is lost, and what locations within the facility will and will not be powered by the emergency power.

6. Establish contingency plans for clinicians to follow during brief or sustained losses of emergency power and include this as part of the orientation and periodic continuing educational activities for medical and other clinical staff. These plans should focus on the requirements set forth in standard EC.7.20, to wit: organizations must supply reliable emergency power to alarm systems; exit sign and exit route illumination; emergency communication systems; blood, bone and tissue storage units; emergency/urgent care areas; at least one elevator for non-ambulatory patients; medical air compressors; medical and surgical vacuum systems; areas where electrically powered life-support equipment is used; and operating rooms, post-op recovery rooms, obstetrical delivery rooms, and newborn nurseries. Contingency plans must also address continued availability of essential health information technology (HIT) systems or of alternate (e.g., paper) systems. See sidebar box for examples of measures to include in the clinical contingency plan.

References and resources

Joint Commission, *Emergency Power: Testing and Maintenance*. PTSM Series, No. 1, 1994

Stymiest, David L., *Managing Hospital Emergency Testing Programs*, American Society of Healthcare Engineering (ASHE) Management Monograph, July 2003

NFPA 70, *National Electric Code*, 2002 Edition, Quincy, MA: NFPA, 2002

NFPA 99, *Standard on Health Care Facilities*, 2002 Edition, Quincy, MA: NFPA, 2002

NFPA 110, *Standard for Emergency and Standby Power Systems*, 2002 Edition, Quincy, MA: NFPA, 2002

Joint Commission, *Standing Together: An Emergency Planning Guide for America's Communities*, 2005

Joint Commission, *Health Care at the Crossroads: Strategies for Creating and Sustaining Community-wide Emergency Preparedness Systems*, 2003

- Care for ventilator-dependent patients and telemetry patients.
- Establishment of a command center.
- Provision for open lines of communication between on-site staff and any organization leaders who may be off-site.
- Access to and use of two-way radios.
- Establishment of a disaster bin for flashlights, extension cords, etc.
- Definition of precautions for immuno-compromised patients during HVAC failure.
- In the event of HVAC failure, provision for careful, manual monitoring of patient body temperatures.
- Establishment of a critical supply center for food, water, pharmaceuticals and linen.
- Assessment of critical refrigerators (pharmacy, lab, blood bank, etc.) to confirm power supply.
- Assessment of automated drug supply cabinets to confirm power supply.

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Appendices

Appendix C – Staffing

Director, Hospital Engineering - Job Description

Plant Operator II - Job Description

Electrician - Job Description

Resume for Director, Hospital Engineering

PROVIDENCE HEALTH SYSTEM IN ALASKA JOB DESCRIPTION

JOB CODE:	14105-198
JOB TITLE:	DIRECTOR, HOSPITAL ENGINEERING
PROCESS LEVEL:	198-PROVIDENCE MEDICAL CENTER
REPORTS TO:	ASSISTANT ADMINISTRATOR, SUPPORT SERVICES
SUPERVISES:	FACILITIES SUPPORT TEAM LEADERS
DESCRIPTION STATUS: NEW: 10/96; 9/04; 3/09	
SUPERSEDES:	ALL PREVIOUS VERSIONS

POSITION SUMMARY

The Director of Hospital Engineering is responsible for providing leadership in an environment, which promotes teamwork, continuous improvement, learning, customer satisfaction and standards of service for the activities in which the department is involved. The Director of Facilities is responsible for all facilities support functions for all facilities within the Alaska Service Area.

ESSENTIAL JOB FUNCTIONS:

(Responsibilities, Accountabilities, and Competencies; May not include all duties of this job)

A. JOB DUTIES: (For performance review, access competency for each essential function using "C" for competent and "NI" for needs improvement)

1. **SERVICE:** Understands the needs of the Facilities customer and continuously assesses the service needs of the customer related to his/her area of responsibility. Ensures the existence of processes, systems and tools that enable the Facilities team to support customer and hospital needs. Assists with the coordination of Facilities work activities affecting other areas in a manner that minimizes disruptions and inconveniences felt by the customer. Responds to customer complaints and concerns timely and in a manner, which demonstrates the mission core values.
2. **DEVELOPMENT & LEARNING:** Coaches and supports appropriate Facilities supervisors and staff in the process of making decisions which support teamwork and produce intended outcomes. Supports the planning and implementation of staff training sessions which provide learning and education opportunities for all appropriate Facilities team members. Provides constructive feedback to team leaders at least quarterly throughout the year, supporting the annual staff evaluation process. Develops and supports activities which promote continuous quality improvement. Reviews team accomplishments and facilitate team discussion for the improvement of outcomes of the Facilities team. Attends and

participates in organized learning opportunities which promote a learning organization. Selects and develops team leaders and staff who will meet the organizational objectives and purpose.

3. **LEADERSHIP & COMMUNICATION:** Clearly and consistently communicates agreed priorities and desired outcomes to Facilities team leaders and staff. Attempts to resolve Facilities staff and supervisor conflicts and concerns in a helpful, calm and consistent manner. Communicates in a precise and articulate manner, which promotes interactive dialog with the audience. Communicate to staff all appropriate hospital issues, data trends, and changes on a routine basis and in a manner, which fosters understanding and feedback. Appropriately credits team members for effort and the accomplishment of desired outcomes. Envisions future Facilities needs and prepares for any changes, which may be required.
4. **TEAMWORK:** Effectively interacts with other departments to accomplish outcomes in a way, which promotes teamwork. Recognizes the need for support and provides leadership among related departments. Encourages and, if necessary, directs team leaders and staff to work directly with other team members when resolving issues. Helps team leaders with work activities as a team member when needed and allows team leaders to make decisions relating to daily work activities. Supports all hospital departments in the accomplishments of desired outcomes in a positive manner. Reviews team accomplishments and facilitate team discussion for the improvement of outcomes for the Facilities teams.
5. **OPERATIONS:** Routinely reviews and formally reports on the appropriate Facilities team performance against key indicators and takes necessary actions to improve outcomes. Routinely assesses the relevance, importance and meaning of key quality indicators and when necessary develops alternative indicators. Make cost effective decisions that have a positive effect on the operation budget. Reviews and prioritizes listings of needed capital equipment and projects for appropriate Facilities teams. Reviews documentation periodically to ensure that records meet all applicable standards. Reviews and develops policies and procedures for the facilities areas.
6. **WORKING ENVIRONMENT:** Provides a pleasant work environment for appropriate Facilities teams. Fosters a calm, balanced and focused approach for the team when working in crisis situations or when resolving tense or emotional situations. Fosters and support the mission through respectful words and deeds. Consistently integrates Providence core values into daily activities. Provides an environment and opportunity for self-directed problem solving and encourages ownership of outcomes. Encourages questions from team members and creates an atmosphere of approachability around himself/herself.
7. **TECHNICAL:** Understands and stays current on relevant standards, advancements and industry trends for general facilities management. Understands and assists with the updating of the Equipment, Plant Utility, Life Safety, Construction management programs. Resolves issues by logically investigating and analyzing symptoms to accurately identify problems on a system level. Demonstrates good project management skills and hospital construction knowledge. Demonstrates good working knowledge of building and plant system functions and maintenance. Has a good working knowledge of JCAHO, NFPA, NEC and other codes and standards relating to the facility. Demonstrates good organizational skills by the

appropriate organization of Facilities information and data and its use in supporting the Facilities processes.

8. Implement care/services that recognize age/diversity specific need/issues of customers served.
9. Performs other related duties as required.

B. IDENTIFIED COMPETENCIES

Completes initial and annual Competency Plan for assigned job and department.

C. CORE VALUES

Demonstrates personal and interpersonal qualities that support the Core Values of Providence Health System.

D. ESSENTIAL JOB QUALIFICATIONS: (Any equivalent Combination of Knowledge, Skills, Abilities, Education, and Experience)

1. **Education:** Bachelor's degree in mechanical, electrical, civil or industrial engineering is preferred.
2. **Experience:** At least five years of progressively responsible general facilities management experience, including one-year supervision. Previous health care facility management experience is preferred.
3. **Licensure/Certification:** N/A
4. **Other Qualifications:** N/A
5. **Attendance:** Regular attendance is a requirement of this position.
6. **English Language:** Must be able to read, write, and speak English.

PROVIDENCE HEALTH SYSTEM IN ALASKA JOB DESCRIPTION

JOB CODE:	679
JOB TITLE:	PLANT OPERATOR I I
DEPARTMENT:	8435 - PLANT OPERATIONS
REPORTS TO:	BUILDING & PLANT SUPERVISOR
SUPERVISES:	N/A
FLSA STATUS:	NON-EXEMPT
DESCRIPTION STATUS:	NEW: 10/96
SUPERSEDES:	N/A

POSITION SUMMARY

The Plant Operator II is responsible for planning, coordinating, inspection and performance of maintenance and repair of the physical plant equipment and systems.

ESSENTIAL JOB FUNCTIONS:

(Responsibilities, Accountabilities, and Competencies; May not include all duties of this job)

A. JOB DUTIES

1. **TEAMWORK:** Communicates symptoms and problems with appropriate hospital team members for development and implementation of solutions. When requested, supports other team members by the performance of other mechanical maintenance duties and duties supporting hospital and departmental functions. Coordinates tasks affecting other teams or departments to minimize overall disruption and inconveniences.
2. **QUANTITY:** Plans activities to efficiently utilize work time. Provides steady work effort during paid work hours. Takes initiative to identify tasks that need to be accomplished. Takes responsibility for maintaining appropriate inventories of parts and supplies.
3. **QUALITY:** Completes projects and repairs in a manner that seldom requires follow-up or corrections. Seeks technical support & assistance from co-workers and/or outside sources when appropriate and without unnecessary delays. Completes all service and work order documentation in an accurate and timely manner, according to hospital procedures and specified customer requirements. Performs utility system and equipment preventative maintenance inspections in a manner which produces a safe and functional outcome. Uses effective methods for controlling maintenance costs while maintaining an acceptable level of quality.

4. **SERVICE:** Takes responsibility for problems encountered and follows through to conclusion. Provides service in a calm manner with an objective of customer satisfaction. Promotes customer satisfaction by effectively communicating the status of requested service. Conducts oneself as a hospital representative at all times. Monitors equipment awaiting parts or out of service with the intent to return the unit to service in a timely manner.
5. **SAFETY & TRAINING:** Initiates & participates in training of other staff members. Follows proper safety precautions and uses appropriate equipment during the performance of work duties. Maintains a safe and clean work environment. Takes initiative to learn new skills, systems and information pertaining to facilities functions.
6. **RELIABILITY:** Ensures continuity of problem resolution, even if beyond normally scheduled work hours. Is a dependable team member capable of being relied upon to be at work when scheduled. Demonstrates a willingness to work beyond scheduled work hours when needed due to workload demands.
7. **TECHNICAL:** Logically investigates and analyzes symptoms to accurately identify problems. Demonstrates competence and knowledge in the use of standard test equipment. Demonstrates advanced knowledge for the steam generation system, including the operation and repair of boilers, pressure reducing stations, piping, de-aeration/feedwater systems, condensate pumps and heat exchangers; pneumatic tube systems and building automation systems; HVAC systems at Providence including air distribution, heat recover, chiller operation and cooling systems, and terminal and radiant heating systems; facility life safety systems and how each works together, including fire detection systems, sprinkler systems, smoke control and fan shut down sequencing; medical air and gas systems and emergency generation systems; and ability for the repair of appropriate plant utility systems and miscellaneous equipment assigned such as sterilizers, laundry, housekeeping, dietary, and physical therapy equipment. Effectively interprets manuals and schematics, including blueprint drawings and emergency procedures.
8. Implements care/services that recognize age specific need/issues of customers served.
9. Performs other related duties as required.

B. IDENTIFIED COMPETENCIES

Completes Competency Plan for assigned job and department.

C. CORE VALUES

Demonstrates personal and interpersonal qualities that support the Core Values of Providence Health System.

ESSENTIAL JOB QUALIFICATIONS:

(Any equivalent Combination of Knowledge, Skills, Abilities, Education, and Experience)

1. **Education:** Completion of high school or the equivalent.

2. **Experience:** Five years of mechanical experience, including boiler operation.
3. **Licensure/Certification:** Second Class Alaska Boiler License.
4. **Other Qualifications:** Must be able to read blueprints, use and interpret repair manual, operate power and hand tools, and use a variety of calibration devices and meters. Must have a basic understanding of steam generation and HVAC theory.
5. **Attendance:** Regular attendance is a requirement of this position.
6. **English Language:** Must be able to read, write, and speak English.

This Job Description reflects Providence Health System in Alaska's best effort to describe the essential functions and qualifications of the job described. It is not an exhaustive statement of all the duties, responsibilities or qualifications of the job. This document is not intended to exclude an opportunity for modifications consistent with providing reasonable accommodation. This is not intended to be a contract. Your signature indicates you have read this Job Description and understand the essential functions and essential qualifications of the job.

Employee Printed Name: _____	Date: _____
Employee Signature: _____	SSN: _____

PROVIDENCE HEALTH SYSTEM IN ALASKA JOB DESCRIPTION

JOB CODE:	94010-198
JOB TITLE:	ELECTRICIAN
PROCESS LEVEL:	198-PROVIDENCE ALASKA MEDICAL CENTER
REPORTS TO:	BUILDING AND PLANT SUPERVISOR
SUPERVISES:	N/A
FLSA STATUS:	NON-EXEMPT
DESCRIPTION STATUS:	NEW 10/96
SUPERSEDES:	N/A

POSITION SUMMARY

Plans, coordinates, performs and inspects the installation and maintenance of all electrical distribution systems and equipment, in the complex, under the supervision of the Building and Plant Supervisor.

ESSENTIAL JOB FUNCTIONS:

(Responsibilities, Accountabilities, and Competencies; May not include all duties of this job)

A. JOB DUTIES: (For performance review, assess competence for each essential function using "C" for competent and "NI" for needs improvement)

1. **TEAMWORK:** Communicates symptoms & problems with appropriate hospital team member for development and implementation of solutions. When requested, supports other team members by the performance of other general maintenance mechanical duties and other duties supporting hospital and departmental functions. Coordinates tasks affecting other teams or departments to minimize overall disruption & inconveniences. Interacts and co-operates well with all hospital staff.
2. **QUANTITY:** Plans activities to efficiently utilize work time. Provides steady work effort during paid work hours. Takes initiative to identify tasks that need to be accomplished, maximizing productivity. Takes responsibility for maintaining appropriate inventories of parts and supplies. Effectively follows the work order and part/supply requisition process.
3. **QUALITY:** Completes projects and repairs in a manner that seldom requires follow-up or corrections. Seeks technical support & assistance from co-workers and/or outside sources when appropriate and without unnecessary delays to patient or customer service. Completes all service and work order documentation in an accurate & timely manner, according to

hospital procedures and specified customer requirements. Performs building and equipment preventative maintenance inspections in a manner which produces a safe and functional outcome. Utilizes effective methods for controlling maintenance costs while maintaining an acceptable level of quality.

4. **SERVICE:** Takes responsibility for problems encountered. Provides service in a calm manner with an objective of customer satisfaction. Promotes customer satisfaction by effectively communicating the status of requested service. Conducts one self as a hospital representative at all times while on campus. Fosters and supports the mission through respectful words and deeds. Consistently integrates core values of mission (Respect, Compassion, Justice & Excellence), in daily activities. Monitors equipment awaiting parts or our service with intent to return the unit to service in a timely manner.
5. **SAFETY & TRAINING:** Initiates & participates in training of other staff members. Follows safety precautions and uses appropriate equipment during the performance of work duties. Maintains a safe and clean work environment. Takes initiative to learn new skills, systems and information pertaining to facilities functions.
6. **RELIABILITY:** Ensures continuity of problem resolution, even if beyond normally scheduled work hours. Is a dependable team member capable of being relied upon to be at work when needed due to workload demands.
7. Implements care/services that recognize age/diversity specific needs/issues of customers served.
8. Performs other related duties as required.

B. IDENTIFIED COMPETENCIES

Completes initial and annual Competency Plan for assigned job and department.

C. CORE VALUES

Demonstrates personal and interpersonal qualities that support the Core Values of Providence Health System.

D. ESSENTIAL JOB QUALIFICATIONS: (Any equivalent Combination of Knowledge, Skills, Abilities, Education, and Experience)

1. **Education:** Completion of high school or equivalent.
2. **Experience:** Five years experience spanning from high voltage electrical equipment to small electrical appliances.
3. **Licensure/Certification:** Journeyman Electricians license.
4. **Other Qualifications:**

5. **Attendance:** Regular attendance is a requirement of this position.

6. **English Language:** Must be able to read, write, and speak English.

This Job Description reflects Providence Health System in Alaska's best effort to describe the essential functions and qualifications of the job described. It is not an exhaustive statement of all the duties, responsibilities or qualifications of the job. This document is not intended to exclude an opportunity for modifications consistent with providing reasonable accommodation. This is not intended to be a contract. Your signature indicates you have read this Job Description and understand the essential functions and essential qualifications of the job.

Employee Printed Name: _____ Date: _____

Employee Signature: _____ SSN: _____

Donald G. Long

6545 Cimarron Cr., Anchorage, AK 99504*907-677-1307

Objective	To obtain the Director of Hospital Engineering position
Experience	<p>Facilities Manager 2002 - Present Providence Alaska Medical Center, Anchorage, AK</p> <ul style="list-style-type: none">▪ Understand the needs of their customers and prioritizes work assignments and team efforts to meet those needs. Ensures that processes, systems and tools which enable the Facilities team to support the customer and hospital needs are available and used. Assists in the coordination of facilities work activities so that there is minimal disruption and inconvenience to the customer. Serves as second in command to the Director of Hospital Engineering and Facilities. Acts in his place during his absence.▪ Reviews customer needs, regulatory requirements and changes and recommends policies and develops programs and policies to meet their need. Periodically reviews documentation to ensure that all meet regulatory standards.▪ Coaches and supports staff. Implements and directs service and educational training and opportunities. <p>Facilities Director (Interim Director) 8/2004 – 3/2005 Providence Alaska Medical Center, Anchorage, AK</p> <p>Facilities Planner 12/2000 – 12/2002 Providence Alaska Medical Center, Anchorage, AK</p> <p>Facilities Manager 1982 - 1999 Evergreen Hospital Medical Center, Kirkland, WA</p>
Education	<p>Glacier High School, Seattle, WA 1966-1970</p> <ul style="list-style-type: none">▪ High School Diploma <p>University of Washington School of Architecture, Facilities and Property Management 1994</p> <p>United States Navy 1971 - 1975</p> <ul style="list-style-type: none">▪ Trained in Boiler Operation, Steam Turbine Operation▪ Operation and Maintenance of Engine Room
Interests	Outdoor activities

Appendices

Appendix D - Drawings

Site Plan

Site Utility Plan

Landscape Planting Plan

Level 0, Life Safety Plan

Level 1, Life Safety Plan

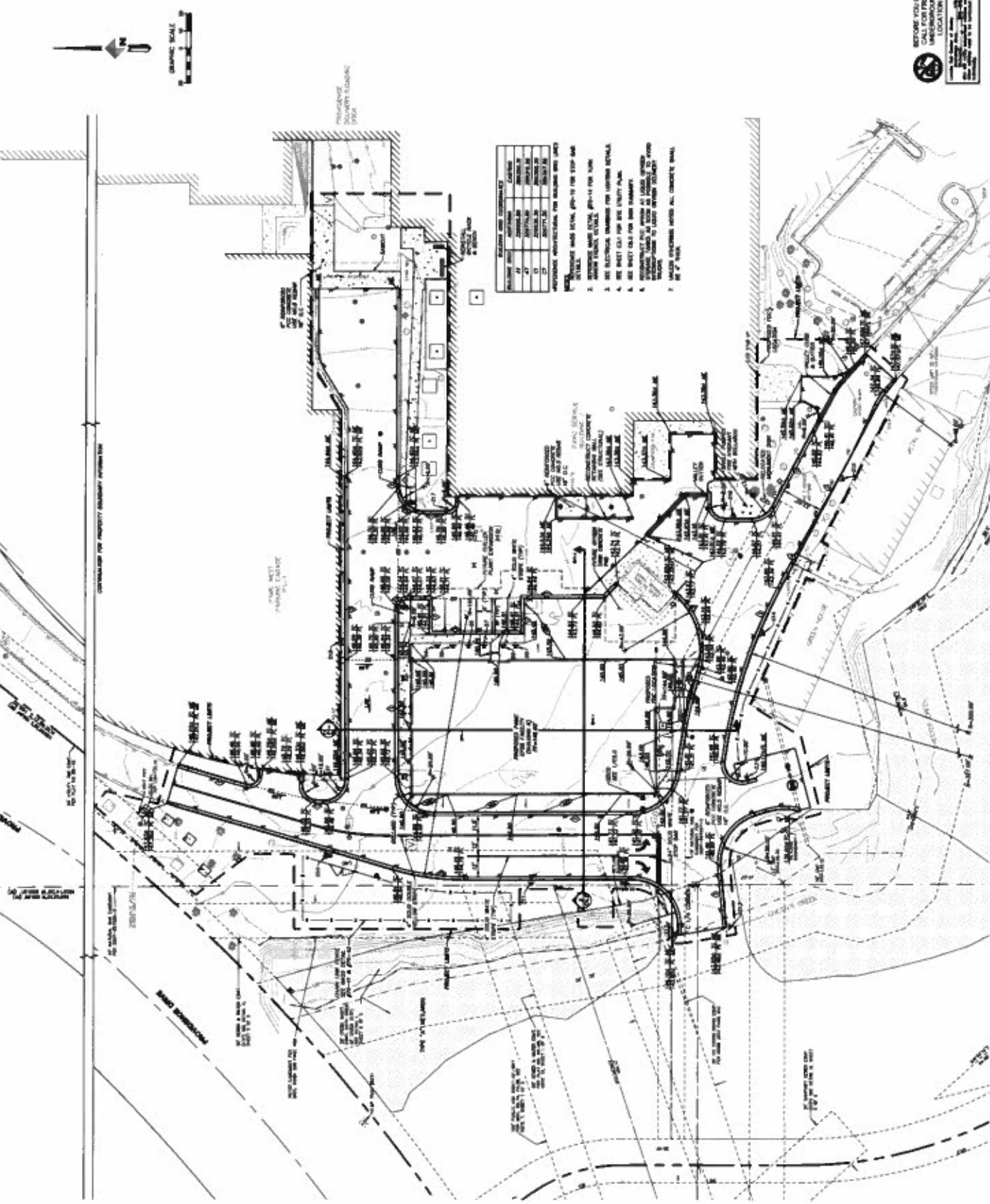
Penthouse Level, Life Safety Plan

Master Site Plan CUP

Level 0, Floor Plan

Level 1, Floor Plan

Penthouse Level, Floor Plan



- REVISIONS AND COMMENTS**
- | NO. | DATE | DESCRIPTION |
|-----|---------|--------------------------|
| 1 | 10/1/00 | ISSUED FOR PERMIT |
| 2 | 10/1/00 | REVISED TO SHOW AS BUILT |
| 3 | 10/1/00 | REVISED TO SHOW AS BUILT |
| 4 | 10/1/00 | REVISED TO SHOW AS BUILT |
| 5 | 10/1/00 | REVISED TO SHOW AS BUILT |
| 6 | 10/1/00 | REVISED TO SHOW AS BUILT |
| 7 | 10/1/00 | REVISED TO SHOW AS BUILT |
- NOTES:**
1. SEE ELECTRICAL DRAWINGS FOR WIRING DETAILS.
 2. SEE MECHANICAL DRAWINGS FOR HVAC DETAILS.
 3. SEE STRUCTURAL DRAWINGS FOR FOUNDATION DETAILS.
 4. SEE CIVIL DRAWINGS FOR SITE DETAILS.
 5. SEE SANITARY DRAWINGS FOR PLUMBING DETAILS.
 6. SEE FIRE PROTECTION DRAWINGS FOR FIRE ALARM AND SMOKE DETECTOR DETAILS.
 7. SEE FINISHES DRAWINGS FOR INTERIOR FINISHES.

EMERGENCY POWER SUPPLY SYSTEM
PROVIDENCE ALASKA MEDICAL CENTER
ANCHORAGE, ALASKA
PROVIDENCE CENTER CLINICAL SERVICES, TRACT A

C3.0

Sheet Number
Sheet Name
Project Name
Location

REVISIONS

Revised By
Revised Date
Revised Description

APPROVED

Approved By
Approved Date
Approved Description

DESIGNED

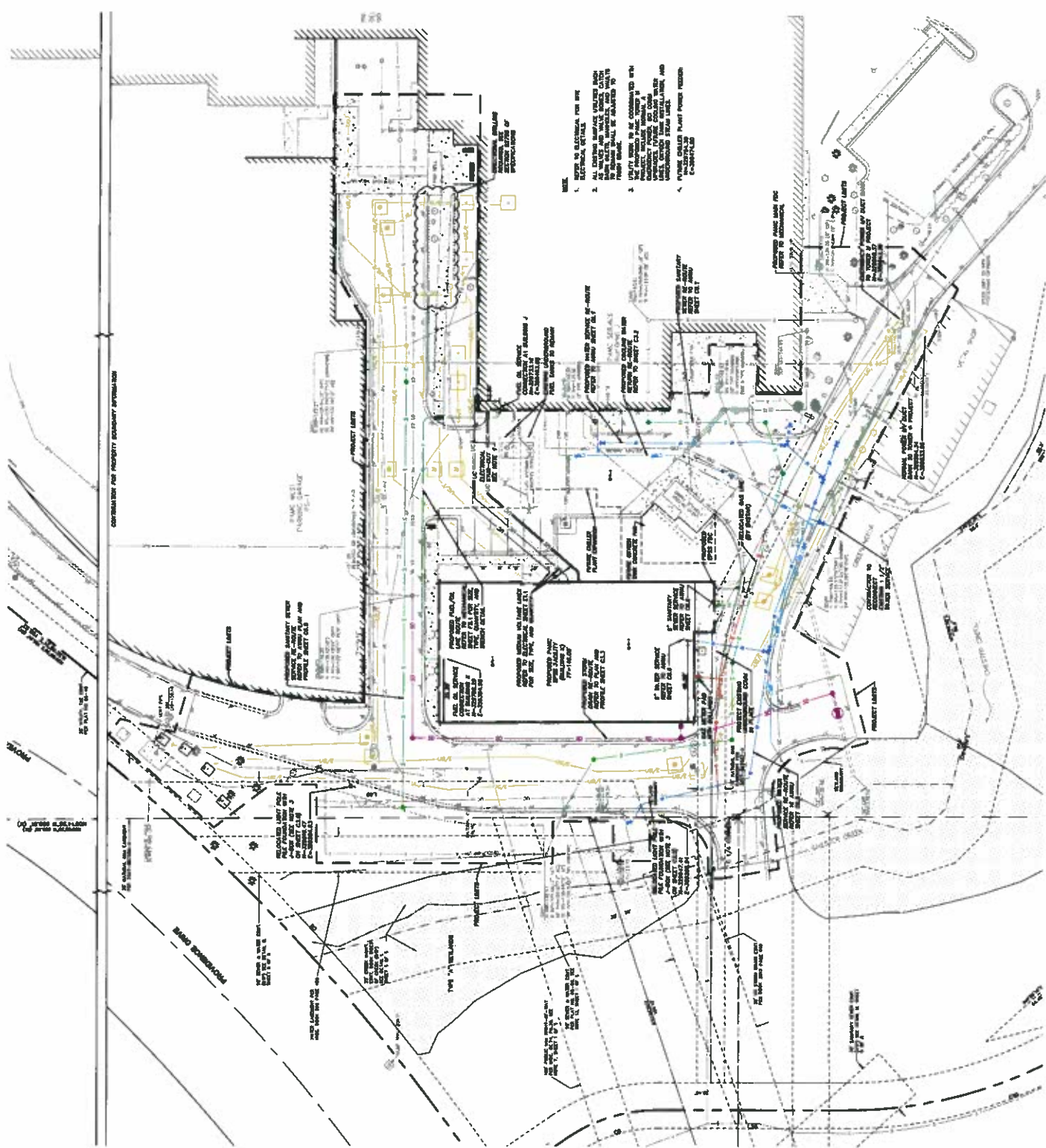
Designed By
Designed Date
Designed Description

CHECKED

Checked By
Checked Date
Checked Description

PERMIT

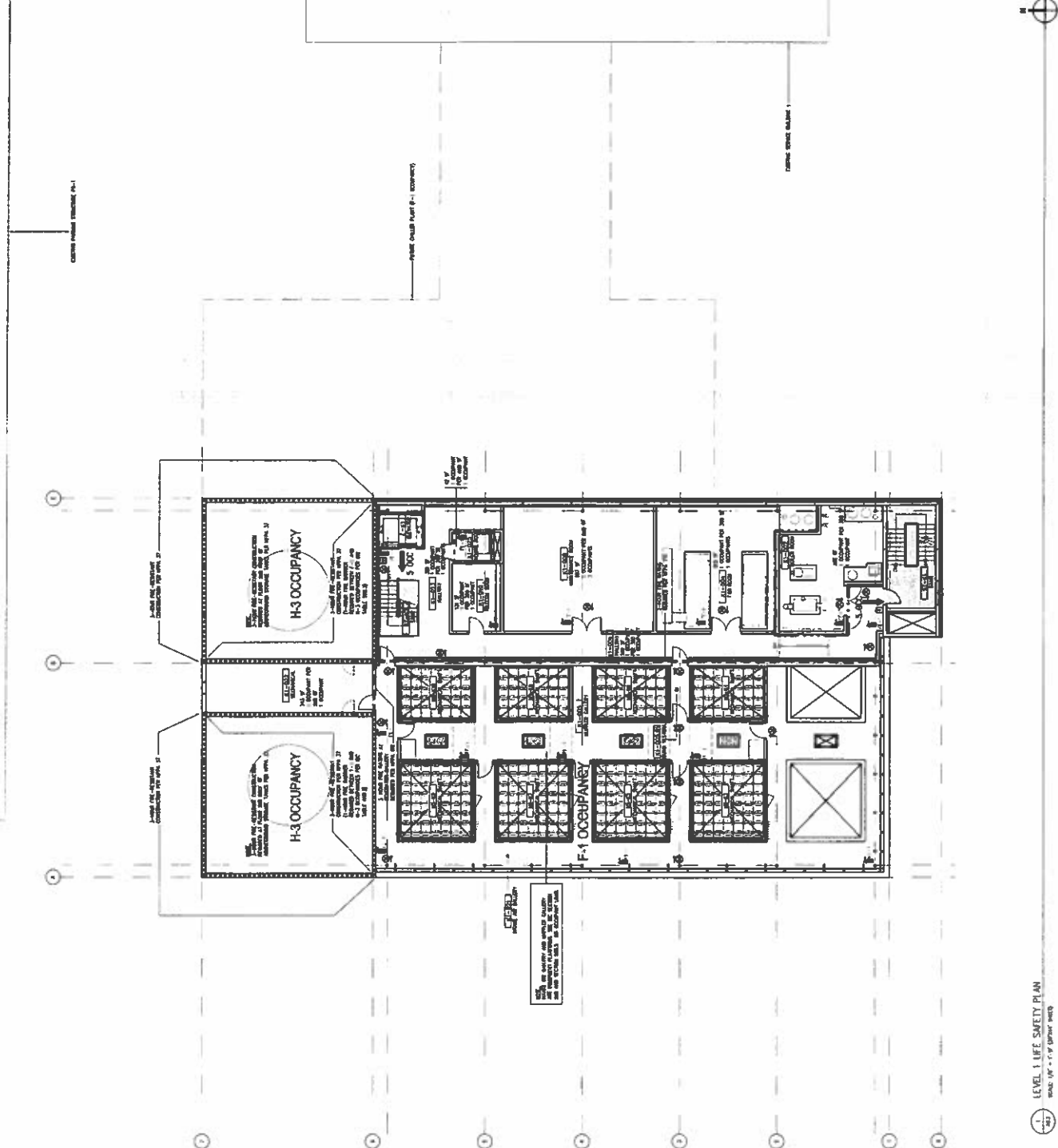
Permit Number
Permit Date
Permit Description



LIFE SAFETY LEGEND

[illegible]

CODE SUMMARY

[illegible]

LEVEL 1 LIFE SAFETY PLAN

Sheet Contents
DOWNHOUSE LEVEL
LIFE SAFETY PLAN

Revisions	Datenblätter	Dat
1		
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Effective Date
FEBRUARY 19, 2010

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1007 5th St. N.E. • 405 277-2700

Alaska.
 Approved Alaska 2001
 www.alaska.org

 Architects

Dr. W. H. Langston Engineering
COIN 1046

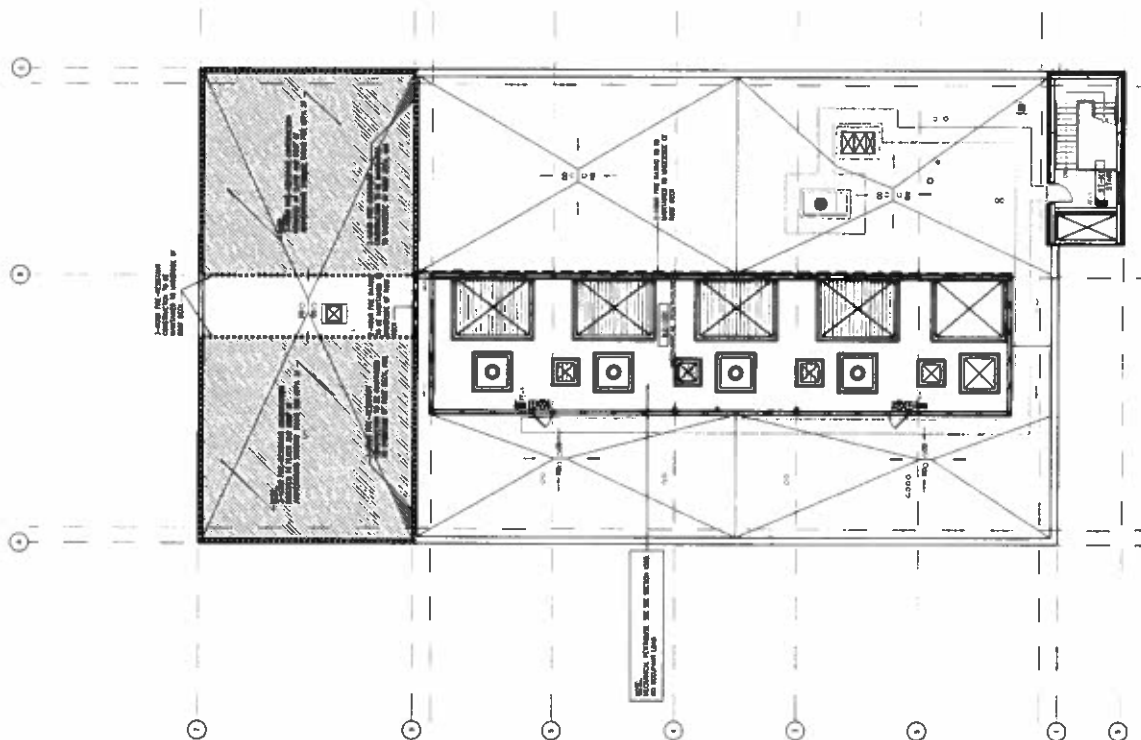
Chief Executive
JOCK MACDONALD

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AMC
American Medical Council

EVIDENCE
Alaska
Medical Center
2001 Providence Ave
P.O. Box 10000
Anchorage, Alaska 99512

LIFE SAFETY LEGEND

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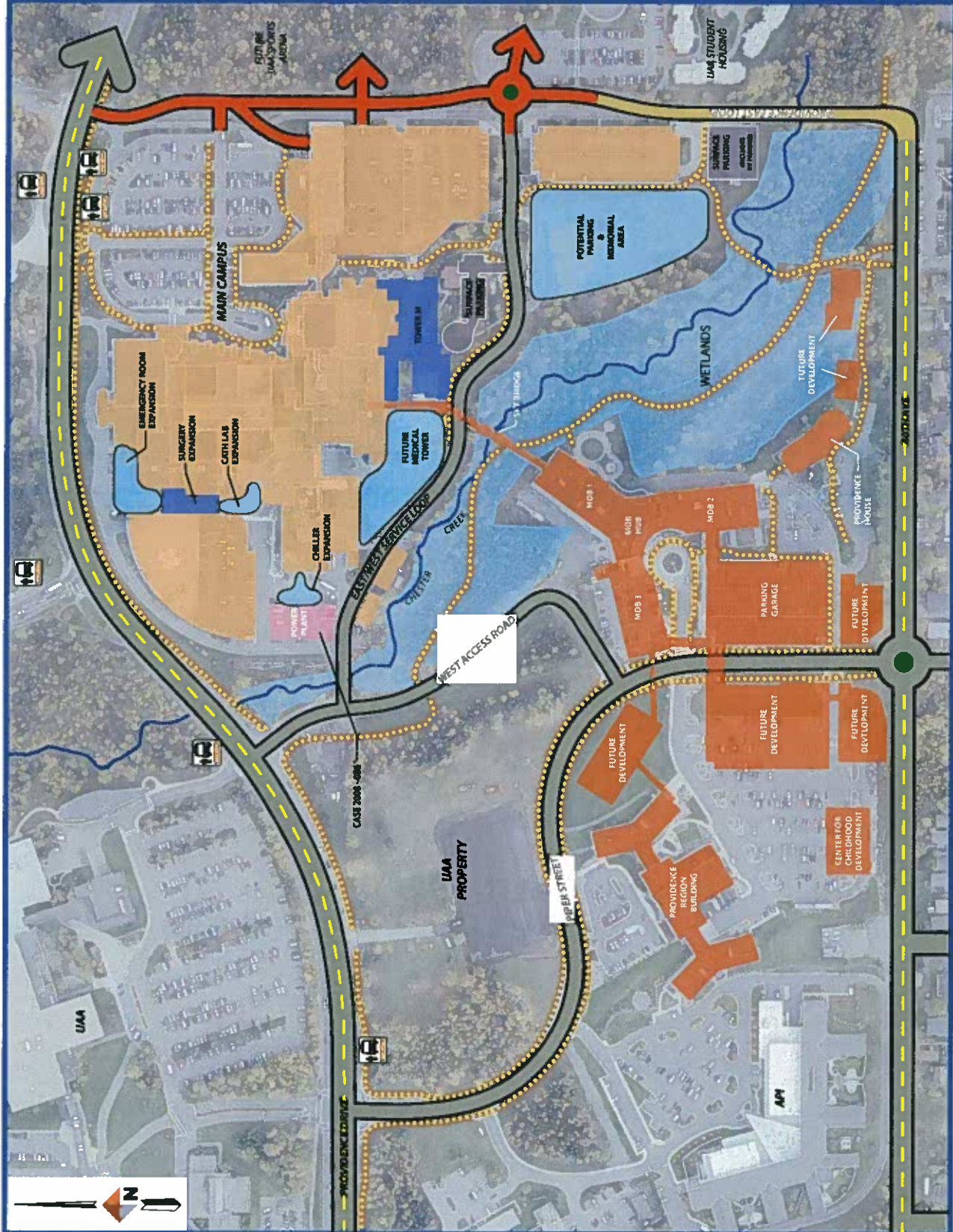
LEGEND

- CHESTER CREEK
- PEDESTRIAN CIRCULATION
- FUTURE PARK UPGRADE (2010)
- FUTURE UPGRADE (BY OTHERS)
- EXISTING HOSPITAL DEVELOPMENT
- DEVELOPMENT PERMITTED PER MOA CASE 2006-14
- DEVELOPMENT PROPOSED UNDER THIS MASTER PLAN
- PROPOSED PARKING LOCATIONS
- POTENTIAL FUTURE DEVELOPMENT AREAS
- WETLAND BOUNDARY
- PEOPLE MOVER BUS STOP

JANUARY 2010

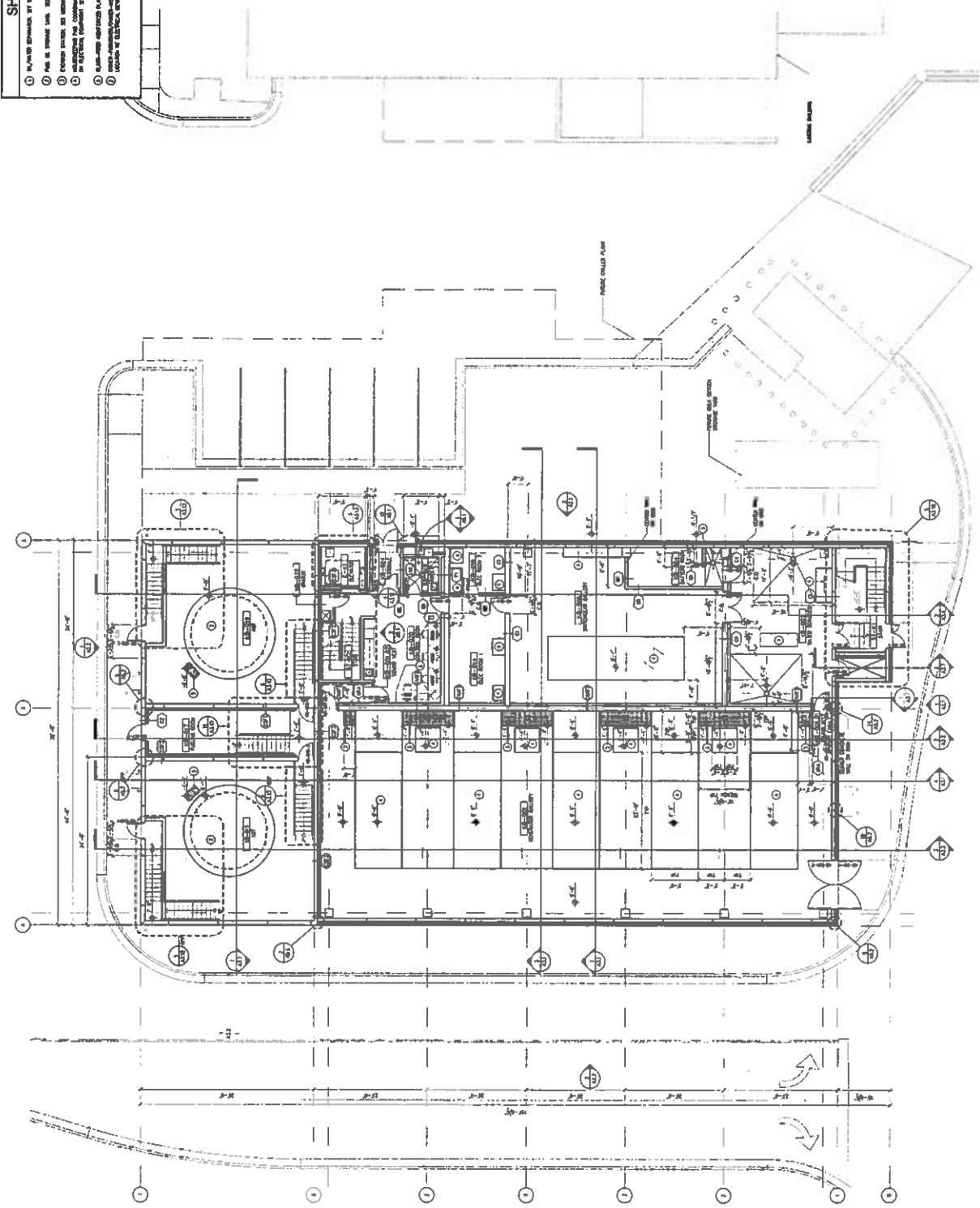
**Figure 4:
PROPOSED MASTER
SITE PLAN CUP
(FUTURE PHASES)**

PROVIDENCE
CAMPUS MASTER PLAN



- SHEET NOTES**
1. ALL WORK SHOWN ON THIS DRAWING IS TO BE CONSIDERED AS A PART OF THE PROJECT AND IS TO BE COMPLETED BY THE CONTRACTOR.
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PROVIDENCE HEALTH SYSTEM PROJECT NUMBER 2008-04-15 EMERGENCY POWER SUPPLY SYSTEM ANCHORAGE, ALASKA		Architects Alaska 1000 West 10th Avenue Anchorage, Alaska 99501 907.562.2400	Client: Providence Health System Project Manager: DON LONG	Engineer: AMC ENGINEERS 1000 West 10th Avenue Anchorage, Alaska 99501 907.562.2400	Design Date: FEBRUARY 19, 2010 Designed by: [Signature] Checked by: [Signature] Reviewed by: [Signature]	Revision: No. Description Date 1. [Description] [Date]	Sheet Contents: LEVEL 0 FLOOR PLAN	Sheet Number: A1.1
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LEVEL 0 FLOOR PLAN
 SCALE: 1/8" = 1'-0"



- SHEET NOTES**
1. ALL WORK SHOWN ON THIS DRAWING IS TO BE CONSIDERED AS A PART OF THE PROJECT AND IS TO BE COMPLETED BY THE CONTRACTOR.
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Appendices

Appendix A – Administrative **Hospital License** **Joint Commission Accreditation** **Organizational Chart** **Certified Construction Cost Estimates**

STATE OF ALASKA
DEPARTMENT OF HEALTH AND SOCIAL SERVICES
Sarah Palin, Governor

This is to *Certify* that a license is hereby granted by the Department of Health and Social Services to

Providence Alaska Medical Center

To conduct and maintain a 326 Bed Acute Care Hospital including 27 Psychiatric Beds
and 10 Rehabilitation Beds
In the premises located at 3200 Providence Drive, Anchorage, Alaska

This License is effective July 1, 2008 through June 30, 2010
of ALASKA STATUTES 47.32. This License shall not be assignable or transferable and shall be subject to revocation at any time
by the Department of Health and Social Services for failure to comply with the laws of Alaska or rules and regulations as
provided under the Alaska Administrative Code.

In Witness Whereof I have hereunto set my hand and seal of the Department of Health and Social Services this
First day of
July, 2008

By 
DEPARTMENT OF HEALTH AND SOCIAL SERVICES

This License shall be Printed in a Comprehensive Place On The Premises



Providence Alaska Medical Center
Anchorage, AK
has been Accredited by



The Joint Commission

Which has surveyed this organization and found it to meet the requirements for the
Hospital Accreditation Program

July 19, 2008

Accreditation is customarily valid for up to 39 months.


David L. Nelson, M.D.
Chairman of the Board

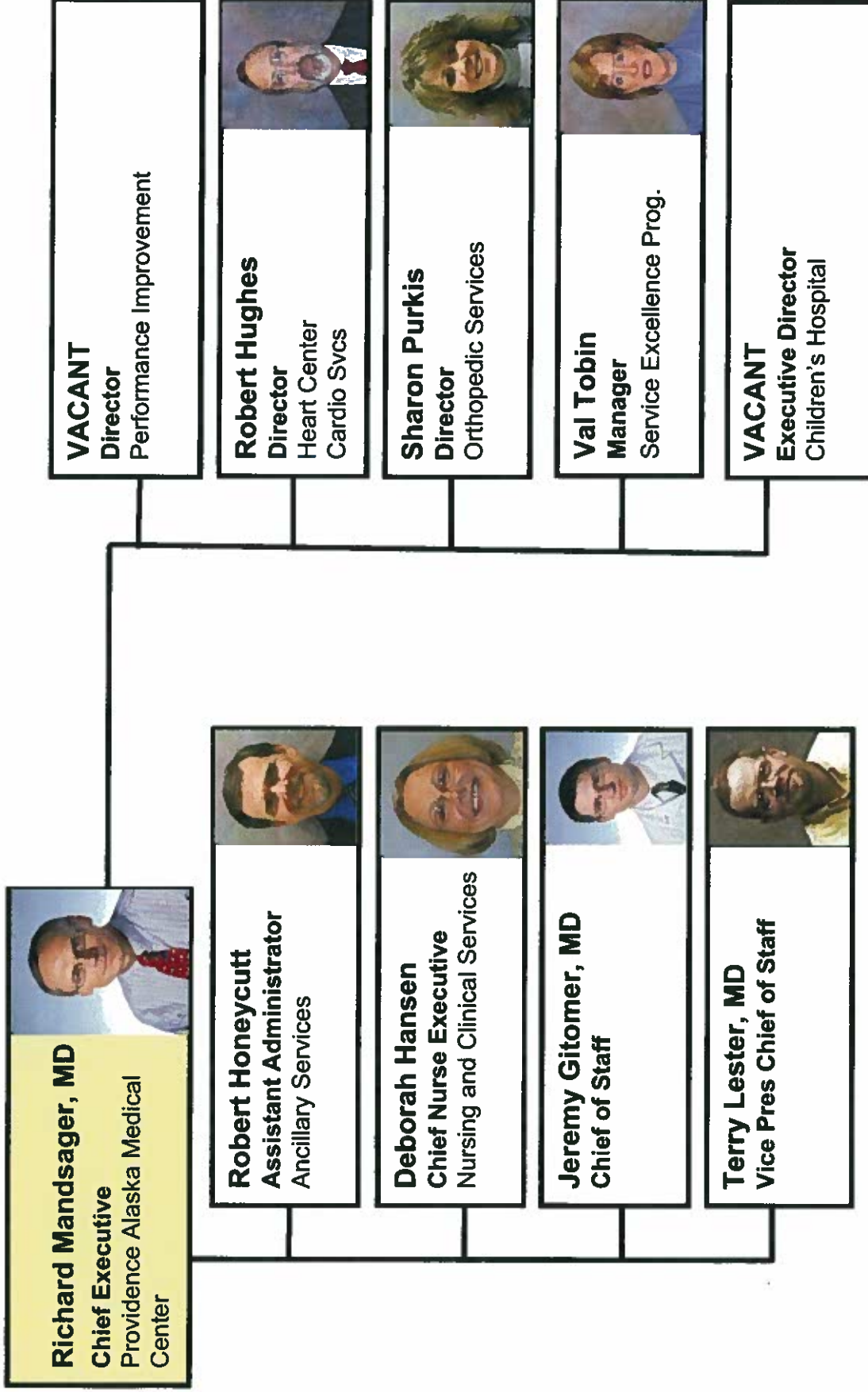
Initial
Organization ID #


Mark Chasins, M.D.
President

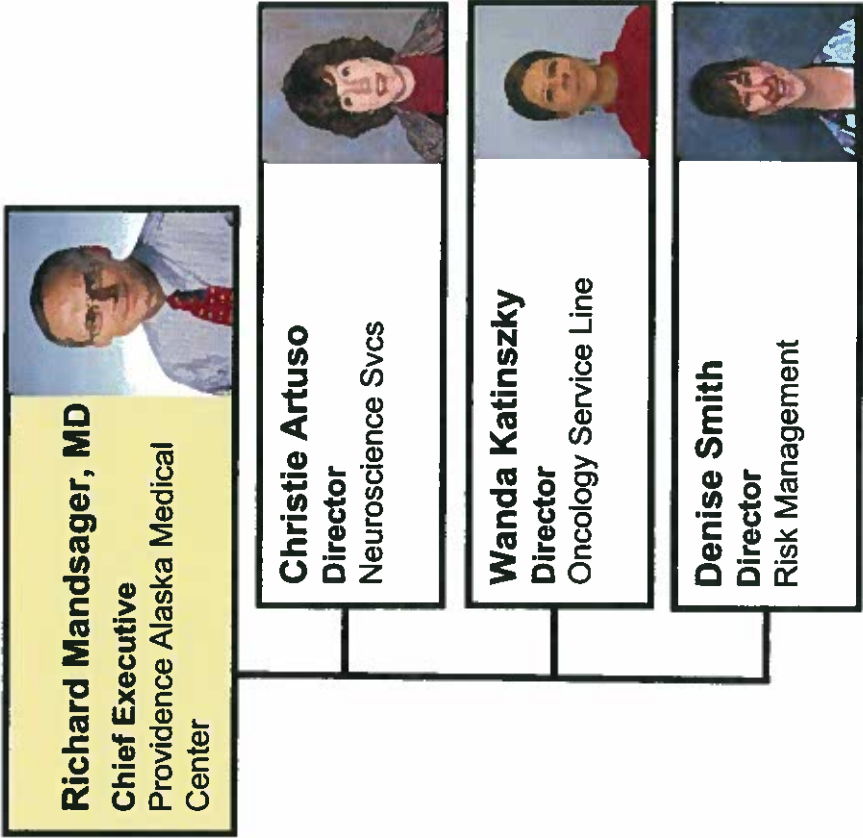
The Joint Commission is an independent, not-for-profit, national body that oversees the safety and quality of health care and other services provided in accredited organizations. Information about accredited organizations may be provided directly to The Joint Commission at 1-800-994-6610. Information regarding accreditation and the accreditation performance of individual organizations can be obtained through The Joint Commission's web site at www.jointcommission.org.



Providence Health & Services Alaska



Providence Health & Services Alaska (Mandsager continued)



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graph TD; RH[Robert Honeycutt  
Assistant Administrator  
Ancillary Services] --- DL[Donald Long  
Director  
Hospital Engineering]; RH --- MV[Marian Veuthey  
Director  
Hospitality House Svcs]; RH --- SK[Stephen Katzenson  
Director  
Radiology]; RH --- AN[Andre Neptune  
Director  
Pharmacy]; RH --- VF[Vicki Faciane  
Director  
Safety/Emergency Preparedness]; DL --- FI[Forney Ingram  
Director  
Dietary Services]; DL --- JP[James Paapke  
Director  
Guest Services]; DL --- JN[Jo Norton  
Director  
Laboratory/Respiratory Care Services]; DL --- SR[Steve Ross  
Clinical Manager  
Rehab Services]; DL --- SB[Susan Bailey  
Clinical Manager  
Cardiopulmonary Rehab];
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Robert Honeycutt
Assistant Administrator
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Clinical Manager
Cardiopulmonary Rehab

Ancillary Services

Hospital Engineering

Hospitality House Svcs

Radiology

Pharmacy

Safety/Emergency Preparedness

CORNERSTONE CONSTRUCTION

5050 Cordova Street
Anchorage, Alaska 99503
(907) 561-1993
Fax: (907) 561-7899

Providence Alaska Medical Center - Emergency Power Supply System			Certified Cost Estimate for CON		2010 Estimated Construction Costs
Tuesday, February 09, 2010			Description		
Baseline Package:					\$ 21,068,233
1	Plant Building Core and Shell and High Voltage Pathways				\$ 18,911,010
	Division 01	General Conditions			\$ 3,756,077
		Permit & Fee's			\$ 178,620
	Division 02	Sitework & Demo			\$ 2,610,909
	Division 03	Concrete			\$ 1,639,709
	Division 05	Structural Steel			\$ 470,000
		Precast Material			\$ 800,000
		Misc Metals			\$ 57,235
	Division 06	Rough Carpentry			\$ 143,088
	Division 07	Waterproofing			\$ 46,204
		Traffic & Graffiti Coatings			\$ 58,980
		Bldg & Slab Insulation			\$ 41,509
		Metal Wall Panels			\$ 265,000
		Roofing			\$ 158,000
		Firestop & Jt. Sealants			\$ 67,613
	Division 08	Doors & HDW & Glazing			\$ 145,631
	Division 09	Framing & GWB			\$ 225,000
		ACT Ceilings			\$ 4,950
		Resilient Base			\$ 2,360
		Tape & Paint			\$ 165,000
		Pnt Intake & Muffler Ducts			\$ 30,000
		Epoxy Floors			\$ 72,000
		Floor Sealer			\$ 28,000
		Sandblast & Paint Fuel Tanks			\$ 36,000
	Division 10	Louvers & Vents			\$ 251,750
		Interior Signage			\$ 5,250
		Fire Extinguishers			\$ 3,900
		Toilet Accessories			\$ 1,875
		Corner Guards			\$ 3,000
	Division 11	Loading Dock Equipment			\$ 15,000
	Division 12	Institutional Casework			\$ 15,000
	Division 15	Fire Protection			\$ 165,000
	Division 15	Mechanical			\$ 4,431,500
	Division 16	Electrical			\$ 3,016,850
2	High Voltage Build Out (Electrical Only)				\$ 2,157,223
	Division 01	General Conditions			\$ 36,293
		Permit & Fee's			\$ 19,330
	Division 16	Electrical			\$ 2,101,600
Estimated Construction Costs =					\$ 21,068,233

- Notes:**
- 1) All estimates have been developed in today dollars.
 - 2) Range for escalation 6% - 12% per year
 - 3) Range for contingency 10% - 20%
 - 4) Range for profit and overhead 5% - 10%



Joe Jolley

**Providence Alaska Medical Center - Emergency Power Supply System
Certified Cost Estimate for CON - PAMC Infrastructure Upgrades
Thursday, March 18, 2010**

Description			2010 Estimated Construction Costs
1	Building J Normal Power Back up option		\$ 1,014,743
	Division 01	General Conditions	\$ 106,536
		Permit & Fee's	\$ 7,907
	Division 16	Electrical	\$ 840,000
2	Building J Normal Electrical Power System		\$ 4,731,842
	Division 01	General Conditions	\$ 777,973
		Permit & Fee's	\$ 36,889
	Division 16	Electrical	\$ 3,917,000
3	Building J Essential Electrical Power System		\$ 2,114,047
	Division 01	General Conditions	\$ 347,575
		Permit & Fee's	\$ 16,472
	Division 16	Electrical	\$ 1,750,000
4	Removal of existing gensets		\$ 400,173
	Division 01	General Conditions	\$ 4,139
		Permit & Fee's	\$ 196
	Division 15	Mechanical	\$ 20,838
	Division 16	Electrical	\$ 375,000
Estimated Construction Costs			\$ 8,260,806

- Notes:
- 1) All estimates have been developed in today dollars.
 - 2) Range for escalation 6% - 12% per year
 - 3) Range for contingency 10% - 20%
 - 4) Range for profit and overhead 5% - 10%


Don Jolley

Appendices

Appendix B – Regulatory Recommendations

National Fire Protection Association (NEFA) Standards, Chapter 4: Electrical Systems

NEFA Standards, Chapter 8: Routine Maintenance and Operational Testing

Joint Commission Sentinel Event Alert (Issue 37, September 6, 2006)

Chapter 4 Electrical Systems

4.1* Applicability.

4.1.1 Wiring and installation requirements on equipment shall be in accordance with NFPA 70, *National Electrical Code*.

4.1.2 Requirements for illumination and identification of means of egress in health care shall be in accordance with NFPA 101, *Life Safety Code*.

4.1.3 The alternate source of emergency power for illumination and identification of means of egress shall be from the essential electrical system.

4.1.4 Requirements for the installation of stationary engines and gas turbines shall be in accordance with NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*.

4.2 Nature of Hazards.

See Section B.1.

4.2.1* Fire and Explosions.

4.2.2 Shock.

4.2.2.1 General.

4.2.2.2 Control. See B.1.2.2.2.

4.2.3 Thermal. (Reserved)

4.2.4 Interruption of Power. See B.1.4.1.

4.3 Electrical System Requirements.

4.3.1 Sources. Each appliance of a hospital requiring electrical line power for operation shall be supported by power sources and distribution systems that provide power adequate for each service.

4.3.1.1 Power/Utility Company. (Reserved)

4.3.1.2 On-Site Generator Set. (Reserved)

4.3.2 Distribution.

4.3.2.1 Electrical Installation. Installation shall be in accordance with NFPA 70, *National Electrical Code*.

4.3.2.2 All Patient Care Areas.

4.3.2.2.1* Regular voltage wiring shall comply with the requirements in 4.3.2.2.1(A) through (C).

(A)* Circuits. Branch circuits serving a given patient bed location shall be fed from not more than one normal branch circuit distribution panel. When required, branch circuits serving a given patient bed location shall be permitted to be fed from more than one emergency branch circuit distribution panel.

(B) Critical Care Areas. These areas shall be served by circuits from critical branch panel(s) served from a single automatic transfer switch and a minimum of one circuit served by the normal power distribution system or by a system originating from a second critical branch transfer switch.

(C) Special Purpose Outlets. Branch circuits serving only special-purpose outlets or receptacles (e.g., portable X-ray receptacles) shall not be rewired to conform to the requirements of 4.3.2.2.1(B).

4.3.2.2.2 Grounding requirements shall comply with the requirements in 4.3.2.2.2(A) through (C).

(A) Grounding Circuitry Integrity. Grounding circuits and conductors in patient care areas shall be installed in such a way that the continuity of other parts of those circuits cannot be interrupted nor the resistance raised above an acceptable level by the installation, removal, and replacement of any installed equipment, including power receptacles.

(B)* Reliability of Grounding. Where used, the reliability of installed grounding circuits to a power receptacle in all patient care areas shall be at least equivalent to that provided by an electrically continuous copper conductor of appropriate ampacity run from the receptacle to a grounding bus in the distribution panel. The grounding conductor shall conform to NFPA 70, *National Electrical Code*.

(C) Separate Grounding Conductor. When existing construction does not use a separate grounding conductor the continued use of the system shall be permitted to be used provided it meets the performance requirements in 4.3.3.1, Grounding System in Patient Care Areas.

(D) Metal Receptacle Boxes. Where metal receptacle boxes are used, the performance of the connection between the receptacle grounding terminal and the metal box shall be equivalent to the performance provided by copper wire no smaller than 12 AWG.

4.3.2.2.3* Grounding Interconnects. In patient care areas supplied by the normal distribution system and any branch of the essential electrical system, the grounding system of the normal distribution system and that of the essential electrical system shall be interconnected.

4.3.2.2.4 Circuit Protection.

4.3.2.2.4.1* The main and downstream ground-fault protective devices (where required) shall be coordinated as required in 4.3.2.5.

4.3.2.2.4.2* If used, ground-fault circuit interrupters (GFCIs) shall be approved for the purpose.

4.3.2.2.5 Low-voltage wiring shall comply with either of the following:

- (1) Fixed systems of 30 V (dc or ac rms) or less shall be ungrounded, provided the insulation between each ungrounded conductor and the primary circuit, which is supplied from a conventionally grounded distribution system, is the same protection as required for the primary voltage.
- (2) A grounded low-voltage system shall be permitted provided that load currents are not carried in the grounding conductors.

4.3.2.2.5.1 Wiring for low-voltage control systems and nonemergency communications and signaling systems shall not be required to be installed in metal raceways in anesthetizing locations.

4.3.2.2.6 Switches in Anesthetizing Locations. Switches controlling ungrounded circuits within or partially within an inhalation anesthetizing location shall have a disconnecting pole for each conductor.

4.3.2.2.7 Receptacles.

4.3.2.2.7.1* Types of Receptacles. Each power receptacle shall provide at least one separate, highly dependable grounding pole capable of maintaining low-contact resistance with its mating plug despite electrical and mechanical abuse. Special receptacles such as the following shall be permitted:

- (1) Four-pole units providing an extra pole for redundant grounding or ground continuity monitoring
- (2) Locking-type receptacles
- (3) Where required for reduction of electrical noise on the grounding circuit, receptacles in which the grounding terminals are purposely insulated from the receptacle yoke.

4.3.2.2.7.2 Minimum Number of Receptacles. The number of receptacles shall be determined by the intended use of the patient care areas in accordance with 4.3.2.2.7.2(A) through (D).

(A) Receptacles for Patient Bed Locations in General Care Areas. Each patient bed location shall be provided with a minimum of four receptacles.

(B) Receptacles for Patient Bed Locations in Critical Care Areas. Each patient bed location shall be provided with a minimum of six receptacles.

(C) Receptacles for Bathrooms or Toilets. Receptacles shall not be required in bathrooms or toilet rooms.

(D) Receptacles for Special Areas. Receptacles shall not be required in areas where medical

requirements mandate otherwise (e.g., certain psychiatric, pediatric, or hydrotherapy areas).

4.3.2.2.7.3 Polarity of Receptacles. Each receptacle shall be wired in accordance with NFPA 70, *National Electrical Code*, to ensure correct polarity.

4.3.2.2.7.4 Anesthetizing Location Receptacles. Receptacles for use in anesthetizing locations shall be listed for the use. In anesthetizing locations of new and existing construction having receptacles on isolated and grounded power, all receptacles shall be identified as to whether they are on isolated or grounded power.

4.3.2.2.7.5 Receptacles and Amperage. Receptacles for use with 250-V, 50-A, and 60-A ac service shall be designed for use in anesthetizing locations and shall be so designed that the 60-A receptacle will accept either the 50-A or the 60-A plug. Fifty-ampere receptacles shall be designed so as not to accept the 60-A attachment plug. These receptacles shall be of the two-pole, three-wire design with the third contact connecting to the grounding wire (green or green with yellow stripe) of the electrical system.

4.3.2.2.7.6 Other Services Receptacles. Receptacles provided for other services having different voltages, frequencies, or types on the same premises shall be of such design that attachment plugs and caps used in such receptacles cannot be connected to circuits of a different voltage, frequency, or type, but shall be interchangeable within each classification and rating required for two-wire, 125-V, single-phase ac service.

4.3.2.2.8 Special Grounding.

4.3.2.2.8.1* Use of Quiet Grounds. A quiet ground, if used, shall not defeat the purposes of the safety features of the grounding systems detailed herein.

4.3.2.2.8.2 Patient Equipment Grounding Point. A patient equipment grounding point comprising one or more grounding terminals or jacks shall be permitted in an accessible location in the patient care vicinity.

4.3.2.2.8.3* Special Grounding in Patient Care Areas. In addition to the grounding required to meet the performance requirements of 4.3.3.1, additional grounding shall be permitted where special circumstances so dictate.

4.3.2.2.9 Wet Locations.

4.3.2.2.9.1* Wet location patient care areas shall be provided with special protection against electric shock. This special protection shall be provided as follows:

- (1) A power distribution system that inherently limits the possible ground-fault current due to a first fault to a low value, without interrupting the power supply
- (2) A power distribution system in which the power supply is interrupted if the ground-fault current does, in fact, exceed a value of 6 mA

4.3.2.2.9.2 Patient beds, toilets, bidets, and wash basins shall not be required to be considered

wet locations.

4.3.2.2.9.3 In existing construction, the requirements of 4.3.2.2.9.1 are not required when written inspection procedure, acceptable to the authority having jurisdiction, is continuously enforced by a designated individual at the hospital, to indicate that equipment-grounding conductors for 120-V, single-phase, 15- and 20-A receptacles, equipment connected by cord and plug, and fixed electrical equipment are installed and maintained in accordance with NFPA 70, *National Electrical Code*, and applicable performance requirements of this chapter.

(A) The procedure shall include electrical continuity tests of all required equipment, grounding conductors, and their connections.

(B) Fixed receptacles, equipment connected by cord and plug, and fixed electrical equipment shall be tested as follows:

- (1) When first installed
- (2) Where there is evidence of damage
- (3) After any repairs
- (4) At intervals not exceeding 6 months

4.3.2.2.9.4 The use of an isolated power system (IPS) shall be permitted as a protective means capable of limiting ground fault current without power interruption. When installed, such a power system shall conform to the requirements of 4.3.2.2.

4.3.2.2.9.5 Where power interruption under first fault condition (line-to-ground fault) is tolerable, the use of a ground-fault circuit interrupter (GFCI) shall be permitted as the protective means that monitors the actual ground-fault current and interrupts the power when that current exceeds 6 mA.

4.3.2.2.10 Isolated Power. An isolated power system shall not be required to be installed in any patient care area except as specified in 4.3.2.2.9. The system shall be permitted to be installed where it conforms to the performance requirements specified in 4.3.2.6.

4.3.2.3 Laboratories. Power outlets shall be installed in accordance with NCCLS Standard ASI-5, *Power Requirements for Clinical Laboratory Instruments and for Laboratory Power Sources*. Outlets with two to four receptacles, or an equivalent power strip, shall be installed every 0.5 to 1.0 m (1.6 to 3.3 ft) in instrument usage areas, and either installation is to be at least 8 cm (3.15 in.) above the countertop.

4.3.2.4 Other Nonpatient Areas. (Reserved)

4.3.2.5 Ground-Fault Protection. When ground-fault protection is provided for operation of the service or feeder disconnecting means, an additional step of ground-fault protection shall be provided in the next level of feeder downstream toward the load. Ground-fault protection for operation of the service and feeder disconnecting means shall be fully selective such that the downstream device and not the upstream device shall open for downstream ground faults. The

additional step of ground-fault protection shall not be required where the service or feeder disconnecting means does not serve patient care areas or equipment intended to support life, such as clinical air compressors and vacuum pumps. When equipment ground-fault protection is first installed, each level shall be performance tested to ensure compliance with 4.3.2.5.

4.3.2.6* Isolated Power Systems.

4.3.2.6.1 Isolation Transformer.

4.3.2.6.1.1 The isolation transformer shall be approved for the purpose.

4.3.2.6.1.2 The primary winding shall be connected to a power source so that it is not energized with more than 600 V (nominal). The neutral of the primary winding shall be grounded in an approved manner. If an electrostatic shield is present, it shall be connected to the reference grounding point.

4.3.2.6.1.3 Wiring of isolated power systems shall be in accordance with Section 517.62 of NFPA 70, *National Electrical Code*.

4.3.2.6.2 Impedance of Isolated Wiring.

4.3.2.6.2.1* The impedance (capacitive and resistive) to ground of either conductor of an isolated system shall exceed 200,000 ohms when installed. The installation at this point shall include receptacles but is not required to include lighting fixtures or components of fixtures. This value shall be determined by energizing the system and connecting a low-impedance ac milliammeter (0 to 1 mA scale) between the reference grounding point and either conductor in sequence. This test shall be permitted to be performed with the line isolation monitor (*see* 4.3.2.6.3) connected, provided the connection between the line isolation monitor and the reference grounding point is open at the time of the test. After the test is made, the milliammeter shall be removed and the grounding connection of the line isolation monitor shall be restored. When the installation is completed, including permanently connected fixtures, the reading of the meter on the line isolation monitor, which corresponds to the unloaded line condition, shall be made. This meter reading shall be recorded as a reference for subsequent line-impedance evaluation. This test shall be conducted with no phase conductors grounded.

4.3.2.6.2.2 An approved capacitance suppressor shall be permitted to be used to improve the impedance of the permanently installed isolated system; however, the resistive impedance to ground of each isolated conductor of the system shall be at least 1 megohm prior to the connection of the suppression equipment. Capacitance suppressors shall be installed so as to prevent inadvertent disconnection during normal use.

4.3.2.6.3 Line Isolation Monitor.

4.3.2.6.3.1* In addition to the usual control and protective devices, each isolated power system shall be provided with an approved continually operating line isolation monitor that indicates possible leakage or fault currents from either isolated conductor to ground.

4.3.2.6.3.2 The monitor shall be designed such that a green signal lamp, conspicuously visible

Appendices

Appendix C – Staffing

Director, Hospital Engineering - Job Description

Plant Operator II - Job Description

Electrician - Job Description

Resume for Director, Hospital Engineering

PROVIDENCE HEALTH SYSTEM IN ALASKA JOB DESCRIPTION

JOB CODE:	14105-198
JOB TITLE:	DIRECTOR, HOSPITAL ENGINEERING
PROCESS LEVEL:	198-PROVIDENCE MEDICAL CENTER
REPORTS TO:	ASSISTANT ADMINISTRATOR, SUPPORT SERVICES
SUPERVISES:	FACILITIES SUPPORT TEAM LEADERS

DESCRIPTION STATUS: NEW: 10/96; 9/04; 3/09

SUPERSEDES: ALL PREVIOUS VERSIONS

POSITION SUMMARY

The Director of Hospital Engineering is responsible for providing leadership in an environment, which promotes teamwork, continuous improvement, learning, customer satisfaction and standards of service for the activities in which the department is involved. The Director of Facilities is responsible for all facilities support functions for all facilities within the Alaska Service Area.

ESSENTIAL JOB FUNCTIONS:

(Responsibilities, Accountabilities, and Competencies; May not include all duties of this job)

A. JOB DUTIES: (For performance review, assess competency for each essential function using "C" for competent and "NI" for needs improvement)

1. **SERVICE:** Understands the needs of the Facilities customer and continuously assesses the service needs of the customer related to his/her area of responsibility. Ensures the existence of processes, systems and tools that enable the Facilities team to support customer and hospital needs. Assists with the coordination of Facilities work activities affecting other areas in a manner that minimizes disruptions and inconveniences felt by the customer. Responds to customer complaints and concerns timely and in a manner, which demonstrates the mission core values.
2. **DEVELOPMENT & LEARNING:** Coaches and supports appropriate Facilities supervisors and staff in the process of making decisions which support teamwork and produce intended outcomes. Supports the planning and implementation of staff training sessions which provide learning and education opportunities for all appropriate Facilities team members. Provides constructive feedback to team leaders at least quarterly throughout the year, supporting the annual staff evaluation process. Develops and supports activities which promote continuous quality improvement. Reviews team accomplishments and facilitate team discussion for the improvement of outcomes of the Facilities team. Attends and

participates in organized learning opportunities which promote a learning organization. Selects and develops team leaders and staff who will meet the organizational objectives and purpose.

3. **LEADERSHIP & COMMUNICATION:** Clearly and consistently communicates agreed priorities and desired outcomes to Facilities team leaders and staff. Attempts to resolve Facilities staff and supervisor conflicts and concerns in a helpful, calm and consistent manner. Communicates in a precise and articulate manner, which promotes interactive dialog with the audience. Communicate to staff all appropriate hospital issues, data trends, and changes on a routine basis and in a manner, which fosters understanding and feedback. Appropriately credits team members for effort and the accomplishment of desired outcomes. Envisions future Facilities needs and prepares for any changes, which may be required.
4. **TEAMWORK:** Effectively interacts with other departments to accomplish outcomes in a way, which promotes teamwork. Recognizes the need for support and provides leadership among related departments. Encourages and, if necessary, directs team leaders and staff to work directly with other team members when resolving issues. Helps team leaders with work activities as a team member when needed and allows team leaders to make decisions relating to daily work activities. Supports all hospital departments in the accomplishments of desired outcomes in a positive manner. Reviews team accomplishments and facilitate team discussion for the improvement of outcomes for the Facilities teams.
5. **OPERATIONS:** Routinely reviews and formally reports on the appropriate Facilities team performance against key indicators and takes necessary actions to improve outcomes. Routinely assesses the relevance, importance and meaning of key quality indicators and when necessary develops alternative indicators. Make cost effective decisions that have a positive effect on the operation budget. Reviews and prioritizes listings of needed capital equipment and projects for appropriate Facilities teams. Reviews documentation periodically to ensure that records meet all applicable standards. Reviews and develops policies and procedures for the facilities areas.
6. **WORKING ENVIRONMENT:** Provides a pleasant work environment for appropriate Facilities teams. Fosters a calm, balanced and focused approach for the team when working in crisis situations or when resolving tense or emotional situations. Fosters and support the mission through respectful words and deeds. Consistently integrates Providence core values into daily activities. Provides an environment and opportunity for self-directed problem solving and encourages ownership of outcomes. Encourages questions from team members and creates an atmosphere of approachability around himself/herself.
7. **TECHNICAL:** Understands and stays current on relevant standards, advancements and industry trends for general facilities management. Understands and assists with the updating of the Equipment, Plant Utility, Life Safety, Construction management programs. Resolves issues by logically investigating and analyzing symptoms to accurately identify problems on a system level. Demonstrates good project management skills and hospital construction knowledge. Demonstrates good working knowledge of building and plant system functions and maintenance. Has a good working knowledge of JCAHO, NFPA, NEC and other codes and standards relating to the facility. Demonstrates good organizational skills by the

appropriate organization of Facilities information and data and its use in supporting the Facilities processes.

8. Implement care/services that recognize age/diversity specific need/issues of customers served.
9. Performs other related duties as required.

B. IDENTIFIED COMPETENCIES

Completes initial and annual Competency Plan for assigned job and department.

C. CORE VALUES

Demonstrates personal and interpersonal qualities that support the Core Values of Providence Health System.

D. ESSENTIAL JOB QUALIFICATIONS: (Any equivalent Combination of Knowledge, Skills, Abilities, Education, and Experience)

1. **Education:** Bachelor's degree in mechanical, electrical, civil or industrial engineering is preferred.
2. **Experience:** At least five years of progressively responsible general facilities management experience, including one-year supervision. Previous health care facility management experience is preferred.
3. **Licensure/Certification:** N/A
4. **Other Qualifications:** N/A
5. **Attendance:** Regular attendance is a requirement of this position.
6. **English Language:** Must be able to read, write, and speak English.

PROVIDENCE HEALTH SYSTEM IN ALASKA JOB DESCRIPTION

JOB CODE:	679
JOB TITLE:	PLANT OPERATOR I I
DEPARTMENT:	8435 - PLANT OPERATIONS
REPORTS TO:	BUILDING & PLANT SUPERVISOR
SUPERVISES:	N/A
FLSA STATUS:	NON-EXEMPT
DESCRIPTION STATUS:	NEW: 10/96
SUPERSEDES:	N/A

POSITION SUMMARY

The Plant Operator II is responsible for planning, coordinating, inspection and performance of maintenance and repair of the physical plant equipment and systems.

ESSENTIAL JOB FUNCTIONS:

(Responsibilities, Accountabilities, and Competencies; May not include all duties of this job)

A. JOB DUTIES

1. **TEAMWORK:** Communicates symptoms and problems with appropriate hospital team members for development and implementation of solutions. When requested, supports other team members by the performance of other mechanical maintenance duties and duties supporting hospital and departmental functions. Coordinates tasks affecting other teams or departments to minimize overall disruption and inconveniences.
2. **QUANTITY:** Plans activities to efficiently utilize work time. Provides steady work effort during paid work hours. Takes initiative to identify tasks that need to be accomplished. Takes responsibility for maintaining appropriate inventories of parts and supplies.
3. **QUALITY:** Completes projects and repairs in a manner that seldom requires follow-up or corrections. Seeks technical support & assistance from co-workers and/or outside sources when appropriate and without unnecessary delays. Completes all service and work order documentation in an accurate and timely manner, according to hospital procedures and specified customer requirements. Performs utility system and equipment preventative maintenance inspections in a manner which produces a safe and functional outcome. Uses effective methods for controlling maintenance costs while maintaining an acceptable level of quality.

4. **SERVICE:** Takes responsibility for problems encountered and follows through to conclusion. Provides service in a calm manner with an objective of customer satisfaction. Promotes customer satisfaction by effectively communicating the status of requested service. Conducts oneself as a hospital representative at all times. Monitors equipment awaiting parts or out of service with the intent to return the unit to service in a timely manner.
5. **SAFETY & TRAINING:** Initiates & participates in training of other staff members. Follows proper safety precautions and uses appropriate equipment during the performance of work duties. Maintains a safe and clean work environment. Takes initiative to learn new skills, systems and information pertaining to facilities functions.
6. **RELIABILITY:** Ensures continuity of problem resolution, even if beyond normally scheduled work hours. Is a dependable team member capable of being relied upon to be at work when scheduled. Demonstrates a willingness to work beyond scheduled work hours when needed due to workload demands.
7. **TECHNICAL:** Logically investigates and analyzes symptoms to accurately identify problems. Demonstrates competence and knowledge in the use of standard test equipment. Demonstrates advanced knowledge for the steam generation system, including the operation and repair of boilers, pressure reducing stations, piping, de-aeration/feedwater systems, condensate pumps and heat exchangers; pneumatic tube systems and building automation systems; HVAC systems at Providence including air distribution, heat recover, chiller operation and cooling systems, and terminal and radiant heating systems; facility life safety systems and how each works together, including fire detection systems, sprinkler systems, smoke control and fan shut down sequencing; medical air and gas systems and emergency generation systems; and ability for the repair of appropriate plant utility systems and miscellaneous equipment assigned such as sterilizers, laundry, housekeeping, dietary, and physical therapy equipment. Effectively interprets manuals and schematics, including blue-line drawings and emergency procedures.
8. Implements care/services that recognize age specific need/issues of customers served.
9. Performs other related duties as required.

B. IDENTIFIED COMPETENCIES

Completes Competency Plan for assigned job and department.

C. CORE VALUES

Demonstrates personal and interpersonal qualities that support the Core Values of Providence Health System.

ESSENTIAL JOB QUALIFICATIONS:

(Any equivalent Combination of Knowledge, Skills, Abilities, Education, and Experience)

1. **Education:** Completion of high school or the equivalent.

2. **Experience:** Five years of mechanical experience, including boiler operation.
3. **Licensure/Certification:** Second Class Alaska Boiler License.
4. **Other Qualifications:** Must be able to read blueprints, use and interpret repair manual, operate power and hand tools, and use a variety of calibration devices and meters. Must have a basic understanding of steam generation and HVAC theory.
5. **Attendance:** Regular attendance is a requirement of this position.
6. **English Language:** Must be able to read, write, and speak English.

This Job Description reflects Providence Health System in Alaska's best effort to describe the essential functions and qualifications of the job described. It is not an exhaustive statement of all the duties, responsibilities or qualifications of the job. This document is not intended to exclude an opportunity for modifications consistent with providing reasonable accommodation. This is not intended to be a contract. Your signature indicates you have read this Job Description and understand the essential functions and essential qualifications of the job.

Employee Printed Name: _____	Date: _____
Employee Signature: _____	SSN: _____

PROVIDENCE HEALTH SYSTEM IN ALASKA JOB DESCRIPTION

JOB CODE:	94010-198
JOB TITLE:	ELECTRICIAN
PROCESS LEVEL:	198-PROVIDENCE ALASKA MEDICAL CENTER
REPORTS TO:	BUILDING AND PLANT SUPERVISOR
SUPERVISES:	N/A
FLSA STATUS:	NON-EXEMPT
DESCRIPTION STATUS:	NEW 10/96
SUPERSEDES:	N/A

POSITION SUMMARY

Plans, coordinates, performs and inspects the installation and maintenance of all electrical distribution systems and equipment, in the complex, under the supervision of the Building and Plant Supervisor.

ESSENTIAL JOB FUNCTIONS:

(Responsibilities, Accountabilities, and Competencies; May not include all duties of this job)

A. JOB DUTIES: (For performance review, assess competence for each essential function using "C" for competent and "NI" for needs improvement)

1. **TEAMWORK:** Communicates symptoms & problems with appropriate hospital team member for development and implementation of solutions. When requested, supports other team members by the performance of other general maintenance mechanical duties and other duties supporting hospital and departmental functions. Coordinates tasks affecting other teams or departments to minimize overall disruption & inconveniences. Interacts and co-operates well with all hospital staff.
2. **QUANTITY:** Plans activities to efficiently utilize work time. Provides steady work effort during paid work hours. Takes initiative to identify tasks that need to be accomplished, maximizing productivity. Takes responsibility for maintaining appropriate inventories of parts and supplies. Effectively follows the work order and part/supply requisition process.
3. **QUALITY:** Completes projects and repairs in a manner that seldom requires follow-up or corrections. Seeks technical support & assistance from co-workers and/or outside sources when appropriate and without unnecessary delays to patient or customer service. Completes all service and work order documentation in an accurate & timely manner, according to

hospital procedures and specified customer requirements. Performs building and equipment preventative maintenance inspections in a manner which produces a safe and functional outcome. Utilizes effective methods for controlling maintenance costs while maintaining an acceptable level of quality.

4. **SERVICE:** Takes responsibility for problems encountered. Provides service in a calm manner with an objective of customer satisfaction. Promotes customer satisfaction by effectively communicating the status of requested service. Conducts one self as a hospital representative at all times while on campus. Fosters and supports the mission through respectful words and deeds. Consistently integrates core values of mission (Respect, Compassion, Justice & Excellence), in daily activities. Monitors equipment awaiting parts or our service with intent to return the unit to service in a timely manner.
5. **SAFETY & TRAINING:** Initiates & participates in training of other staff members. Follows safety precautions and uses appropriate equipment during the performance of work duties. Maintains a safe and clean work environment. Takes initiative to learn new skills, systems and information pertaining to facilities functions.
6. **RELIABILITY:** Ensures continuity of problem resolution, even if beyond normally scheduled work hours. Is a dependable team member capable of being relied upon to be at work when needed due to workload demands.
7. Implements care/services that recognize age/diversity specific needs/issues of customers served.
8. Performs other related duties as required.

B. IDENTIFIED COMPETENCIES

Completes initial and annual Competency Plan for assigned job and department.

C. CORE VALUES

Demonstrates personal and interpersonal qualities that support the Core Values of Providence Health System.

D. ESSENTIAL JOB QUALIFICATIONS: (Any equivalent Combination of Knowledge, Skills, Abilities, Education, and Experience)

1. **Education:** Completion of high school or equivalent.
2. **Experience:** Five years experience spanning from high voltage electrical equipment to small electrical appliances.
3. **Licensure/Certification:** Journeyman Electricians license.
4. **Other Qualifications:**

5. **Attendance:** Regular attendance is a requirement of this position.

6. **English Language:** Must be able to read, write, and speak English.

This Job Description reflects Providence Health System in Alaska's best effort to describe the essential functions and qualifications of the job described. It is not an exhaustive statement of all the duties, responsibilities or qualifications of the job. This document is not intended to exclude an opportunity for modifications consistent with providing reasonable accommodation. This is not intended to be a contract. Your signature indicates you have read this Job Description and understand the essential functions and essential qualifications of the job.

Employee Printed Name: _____ Date: _____

Employee Signature: _____ SSN: _____

Donald G. Long

6545 Cimarron Cr., Anchorage, AK 99504*907-677-1307

Objective	To obtain the Director of Hospital Engineering position
Experience	<p>Facilities Manager 2002 - Present Providence Alaska Medical Center, Anchorage, AK</p> <ul style="list-style-type: none">▪ Understand the needs of their customers and prioritizes work assignments and team efforts to meet those needs. Ensures that processes, systems and tools which enable the Facilities team to support the customer and hospital needs are available and used. Assists in the coordination of facilities work activities so that there is minimal disruption and inconvenience to the customer. Serves as second in command to the Director of Hospital Engineering and Facilities. Acts in his place during his absence.▪ Reviews customer needs, regulatory requirements and changes and recommends policies and develops programs and policies to meet their need. Periodically reviews documentation to ensure that all meet regulatory standards.▪ Coaches and supports staff. Implements and directs service and educational training and opportunities. <p>Facilities Director (Interim Director) 8/2004 – 3/2005 Providence Alaska Medical Center, Anchorage, AK</p> <p>Facilities Planner 12/2000 – 12/2002 Providence Alaska Medical Center, Anchorage, AK</p> <p>Facilities Manager 1982 - 1999 Evergreen Hospital Medical Center, Kirkland, WA</p>
Education	<p>Glacier High School, Seattle, WA 1966-1970</p> <ul style="list-style-type: none">▪ High School Diploma <p>University of Washington School of Architecture, Facilities and Property Management 1994</p> <p>United States Navy 1971 - 1975</p> <ul style="list-style-type: none">▪ Trained in Boiler Operation, Steam Turbine Operation▪ Operation and Maintenance of Engine Room
Interests	Outdoor activities

Appendices

Appendix D - Drawings

Site Plan

Site Utility Plan

Landscape Planting Plan

Level 0, Life Safety Plan

Level 1, Life Safety Plan

Penthouse Level, Life Safety Plan

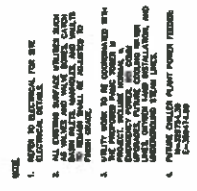
Master Site Plan CUP

Level 0, Floor Plan

Level 1, Floor Plan

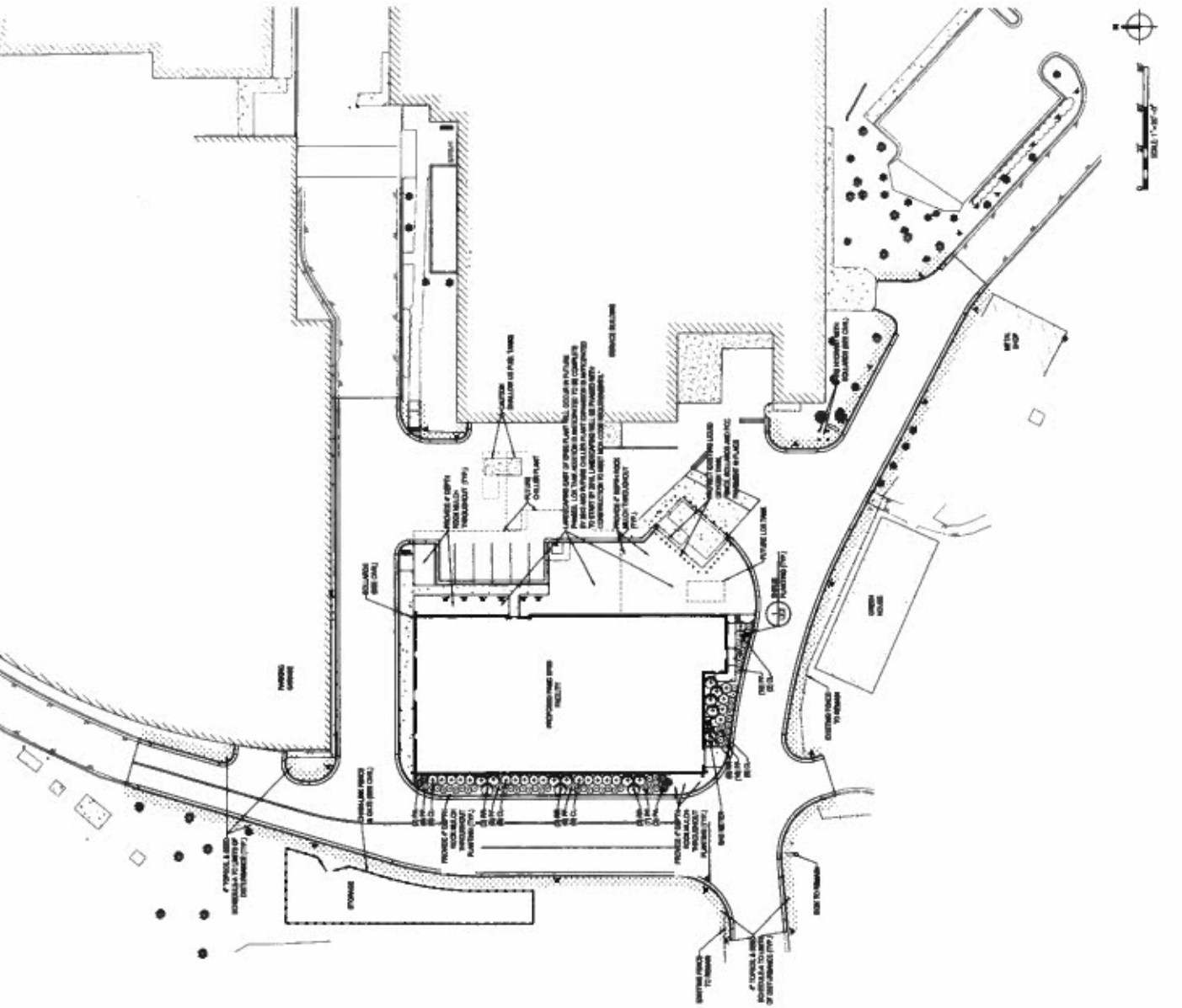
Penthouse Level, Floor Plan

BEFORE YOU DIE
CALL FOR FREEDOM

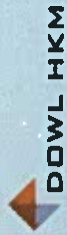


GRAPHIC SCALE
(color copy)

0 10 20 30



[illegible]



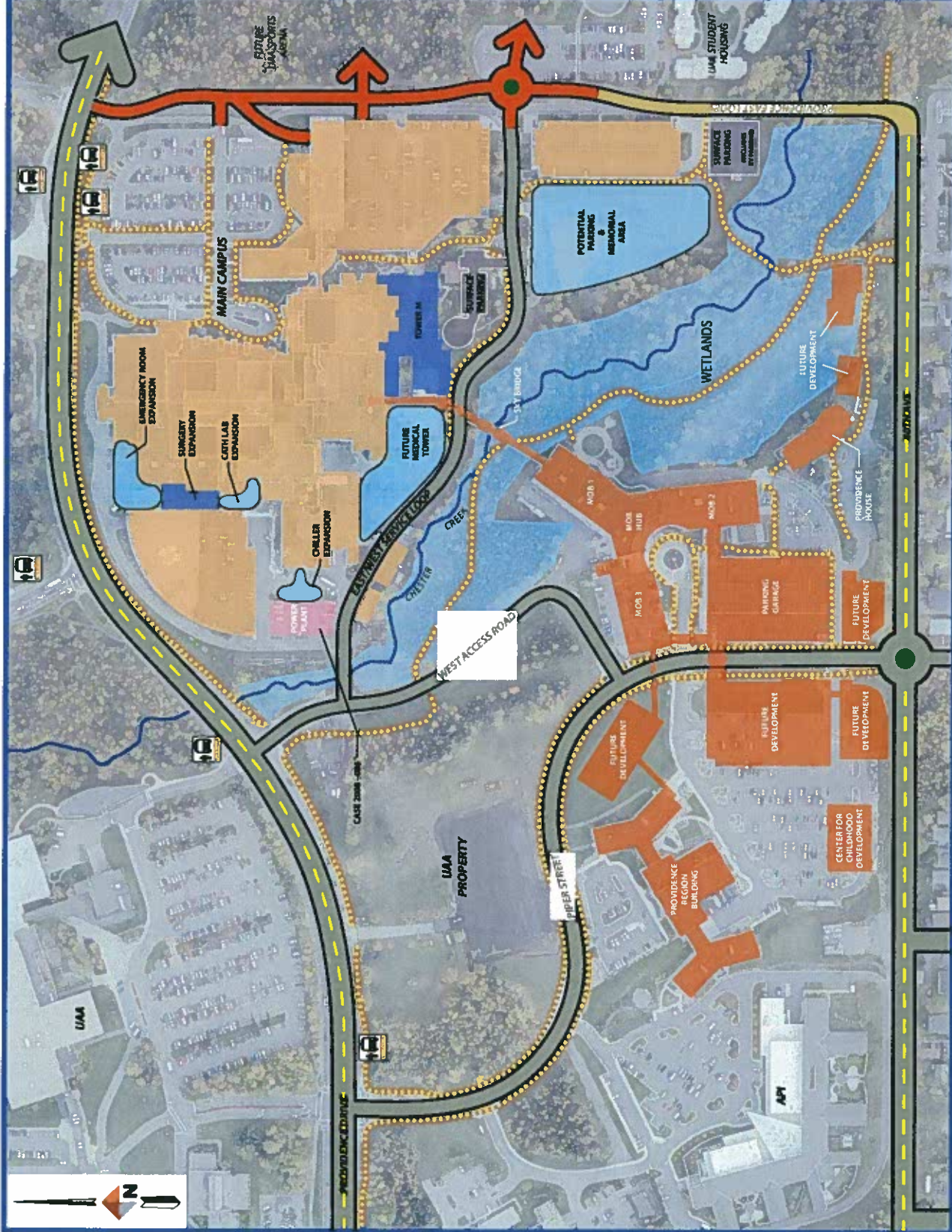
LEGEND

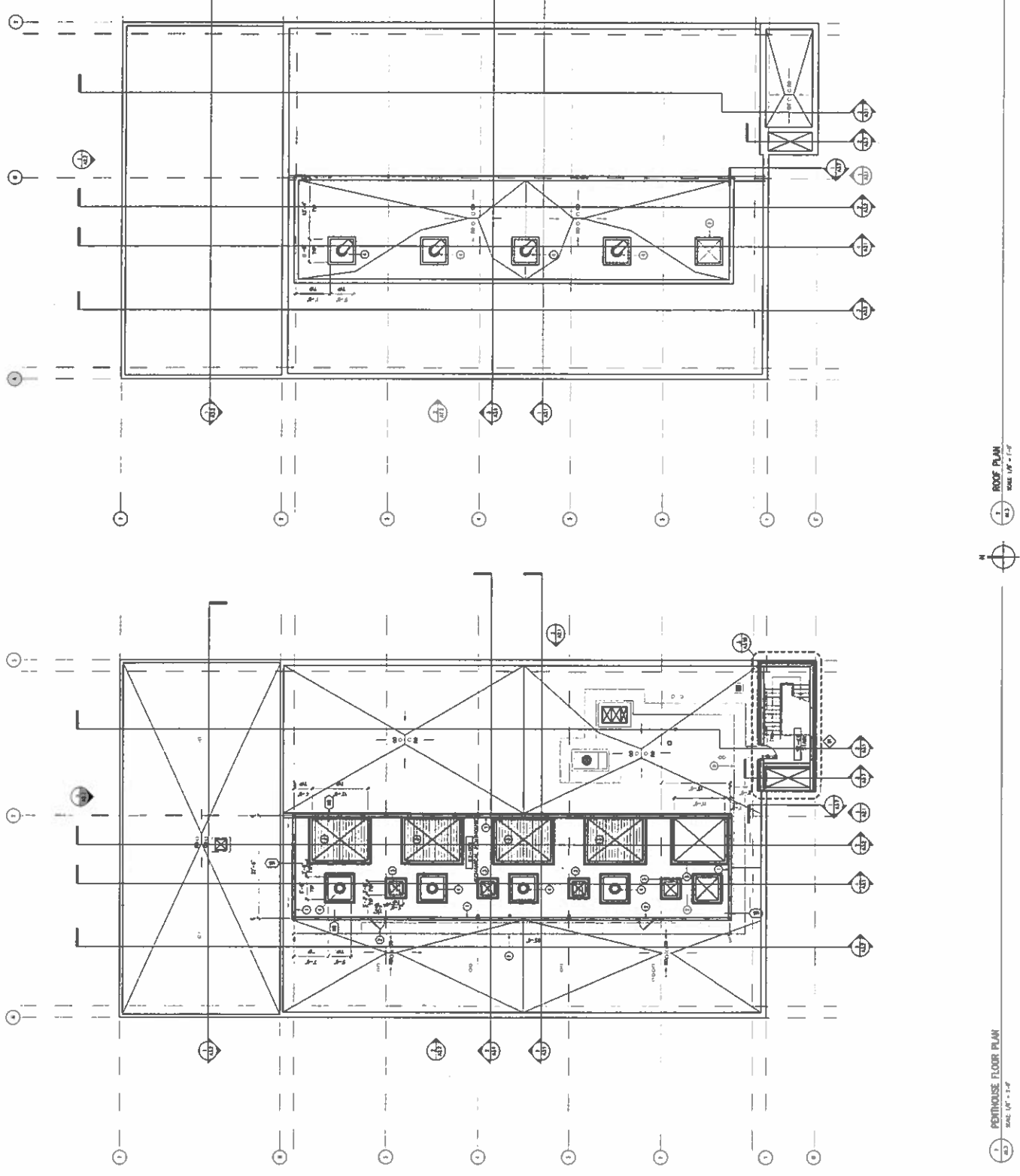
- CHESTER CREEK
- PEDESTRIAN CIRCULATION
- FUTURE PMAC UPGRADE (2010)
- FUTURE UPGRADE (BY OTHERS)
- EXISTING HOSPITAL DEVELOPMENT
- DEVELOPMENT PERMITTED PER MCA CASE 2006-14
- DEVELOPMENT PROPOSED UNDER THIS MASTER PLAN
- PROPOSED PARKING LOCATIONS
- POTENTIAL FUTURE DEVELOPMENT AREAS
- WETLAND BOUNDARY
- PEOPLE MOVER BUS STOP

JANUARY 2010

Figure 4: PROPOSED MASTER SITE PLAN CUP (FUTURE PHASES)

PROVIDENCE
CAMPUS MASTER PLAN





to persons in the anesthetizing location, remains lighted when the system is adequately isolated from ground; and an adjacent red signal lamp and an audible warning signal (remote if desired) shall be energized when the total hazard current (consisting of possible resistive and capacitive leakage currents) from either isolated conductor to ground reaches a threshold value of 5.0 mA under normal line voltage conditions. The line isolation monitor shall not alarm for a fault hazard current of less than 3.7 mA.

4.3.2.6.3.3* The line isolation monitor shall comply with either of the following:

- (1) It shall have sufficient internal impedance such that, when properly connected to the isolated system, the maximum internal current that will flow through the line isolation monitor, when any point of the isolated system is grounded, shall be 1 mA.
- (2) It shall be permitted to be of the low-impedance type such that the current through the line isolation monitor, when any point of the isolated system is grounded, will not exceed twice the alarm threshold value for a period not exceeding 5 msec.

4.3.2.6.3.4* An ammeter connected to indicate the total hazard current of the system (contribution of the fault hazard current plus monitor hazard current) shall be mounted in a plainly visible place on the line isolation monitor with the “alarm on” zone (total hazard current = 5.0 mA) at approximately the center of the scale. It is desirable to locate the ammeter such that it is conspicuously visible to persons in the anesthetizing location.

4.3.2.6.3.5 Means shall be provided for shutting off the audible alarm while leaving the red warning lamp activated. When the fault is corrected and the green signal lamp is reactivated, the audible alarm silencing circuit shall reset automatically, or an audible or distinctive visual signal shall indicate that the audible alarm is silenced.

4.3.2.6.3.6 A reliable test switch shall be mounted on the line isolation monitor to test its capability to operate (i.e., cause the alarms to operate and the meter to indicate in the “alarm on” zone). This switch shall transfer the grounding connection of the line isolation monitor from the reference grounding point to a test impedance arrangement connected across the isolated line; the test impedance(s) shall be of the appropriate magnitude to produce a meter reading corresponding to the rated total hazard current at the nominal line voltage, or to a lesser alarm hazard current if the line isolation monitor is so rated. The operation of this switch shall break the grounding connection of the line isolation monitor to the reference grounding point before transferring this grounding connector to the test impedance(s), so that making this test will not add to the hazard of a system in actual use, nor will the test include the effect of the line to ground stray impedance of the system. The test switch shall be of a self-restoring type.

4.3.2.6.3.7 The line isolation monitor shall not generate energy of sufficient amplitude or frequency, as measured by a physiological monitor with a gain of at least 10^4 with a source impedance of 1000 ohms connected to the balanced differential input of the monitor, to create interference or artifact on human physiological signals. The output voltage from the amplifier shall not exceed 30 mV when the gain is 10^4 . The 1000 ohms impedance shall be connected to the ends of typical unshielded electrode leads that are a normal part of the cable assembly

furnished with physiological monitors. A 60-Hz notch filter shall be used to reduce ambient interference as is typical in physiological monitor design.

4.3.2.6.4 Identification of Conductors for Isolated (Ungrounded) Systems. The isolated conductors shall be identified in accordance with Section 517.160(a)(5) of NFPA 70, *National Electrical Code*.

4.3.3 Performance Criteria and Testing.

4.3.3.1 Grounding System in Patient Care Areas.

4.3.3.1.1* Grounding System Testing. The effectiveness of the grounding system shall be determined by voltage measurements and impedance measurements.

4.3.3.1.1.1 For new construction, the effectiveness of the grounding system shall be evaluated before acceptance.

4.3.3.1.1.2 Small, wall-mounted conductive surfaces, not likely to become energized, such as surface-mounted towel and soap dispensers, mirrors, and so forth, shall not be required to be intentionally grounded or tested.

4.3.3.1.1.3 Large, metal conductive surfaces not likely to become energized, such as windows, door frames, and drains, shall not be required to be intentionally grounded or periodically tested.

4.3.3.1.1.4* Whenever the electrical system has been altered or replaced, that portion of the system shall be tested.

4.3.3.1.2 Reference Point. The voltage and impedance measurements shall be taken with respect to a reference point. The reference point shall be one of the following:

- (1) A reference grounding point (*see Chapter 3, Definitions*)
- (2) A grounding point, in or near the room under test, that is electrically remote from receptacles, for example, an all-metal cold-water pipe
- (3) The grounding contact of a receptacle that is powered from a different branch circuit from the receptacle under test

4.3.3.1.3* Voltage Measurements. The voltage measurements shall be made under no-fault conditions between a reference point and exposed fixed electrical equipment with conductive surfaces in a patient care vicinity. The voltage measurements shall be made with an accuracy of ± 20 percent. Voltage measurements for faceplates of wiring devices shall not be required.

4.3.3.1.4* Impedance Measurements. The impedance measurement shall be made with an accuracy of ± 20 percent. For new construction, the impedance measurement shall be made between the reference point and the grounding contact of 10 percent of all receptacles in each patient care vicinity. The impedance measurement shall be the ratio of voltage developed (either 60 Hz or dc) between the point under test and the reference point to the current applied

between these two points.

4.3.3.1.5 Test Equipment. Electrical safety test instruments shall be tested periodically, but not less than annually, for acceptable performance.

4.3.3.1.5.1 Voltage measurements specified in 4.3.3.1.3 shall be made with an instrument having an input resistance of 1000 ohms ± 10 percent at frequencies of 1000 Hz or less.

4.3.3.1.5.2 The voltage across the terminals (or between any terminal and ground) of resistance-measuring instruments used in occupied patient care areas shall not exceed 500 mV rms or 1.4 dc or peak to peak.

4.3.3.1.6 Criteria for Acceptability for New Construction.

4.3.3.1.6.1 Voltage limit shall be 20 mV.

4.3.3.1.6.2 Impedance limit shall be 0.2 ohms for quiet ground systems, and 0.1 ohms for all others.

4.3.3.2 Receptacle Testing in Patient Care Areas.

4.3.3.2.1 The physical integrity of each receptacle shall be confirmed by visual inspection.

4.3.3.2.2 The continuity of the grounding circuit in each electrical receptacle shall be verified.

4.3.3.2.3 Correct polarity of the hot and neutral connections in each electrical receptacle shall be confirmed.

4.3.3.2.4 The retention force of the grounding blade of each electrical receptacle (except locking-type receptacles) shall be not less than 115 g (4 oz).

4.3.3.3 Isolated Power Systems.

4.3.3.3.1 Patient Care Areas. If installed, the isolated power system shall be tested in accordance with 4.3.3.3.2.

4.3.3.3.2 Line Isolation Monitor Tests.

4.3.3.3.2.1 The Line Isolation Monitor (LIM) circuit shall be tested after installation, and prior to being placed in service, by successively grounding each line of the energized distribution system through a resistor of $200 \times V$ ohms, where V equals measured line voltage. The visual and audible alarms (*see* 4.3.2.6.3.2) shall be activated.

4.3.3.3.2.2 The LIM circuit shall be tested at intervals of not more than 1 month by actuating the LIM test switch (*see* 4.3.2.6.3.6). For a LIM circuit with automated self-test and self-calibration capabilities, this test shall be performed at intervals of not more than 12 months. Actuation of the test switch shall activate both visual and audible alarm indicators.

4.3.3.3.2.3 After any repair or renovation to an electrical distribution system and at intervals of not more than 6 months, the LIM circuit shall be tested in accordance with 4.3.3.3.2.1 and only when the circuit is not otherwise in use. For a LIM circuit with automated self-test and

self-calibration capabilities, this test shall be performed at intervals of not more than 12 months.

4.3.4* Administration of Electrical System.

4.3.4.1 Maintenance and Testing of Electrical System.

4.3.4.1.1 Testing intervals for hospital grade receptacles in patient care areas shall be performed after initial installation, replacement, or servicing of the device.

4.3.4.1.2 Additional testing shall be performed at intervals defined by documented performance data.

4.3.4.1.3 Receptacles not listed as hospital-grade shall be tested at intervals not exceeding 12 months.

4.3.4.2 Recordkeeping.

4.3.4.2.1* General. A record shall be maintained of the tests required by this chapter and associated repairs or modification. At a minimum, this record shall contain the date, the rooms or areas tested, and an indication of which items have met or have failed to meet the performance requirements of this chapter.

4.3.4.2.2 Isolated Power System (Where Installed). A permanent record shall be kept of the results of each of the tests.

4.4 Essential Electrical System Requirements — Type 1.

4.4.1 Sources (Type 1 EES).

4.4.1.1 On-Site Generator Set.

4.4.1.1.1* Design Considerations. Dual sources of normal power shall be considered but shall not constitute an alternate source of power as described in this chapter.

(A) Distribution system arrangements shall be designed to minimize interruptions to the electrical systems due to internal failures by the use of adequately rated equipment.

(B) The following factors shall be considered in the design of the distribution system:

- (1) Abnormal voltages such as single phasing of three-phase utilization equipment, switching and/or lightning surges, voltage reductions, and so forth
- (2) Capability of achieving the fastest possible restoration of any given circuit(s) after clearing a fault
- (3) Effects of future changes, such as increased loading and/or supply capacity
- (4) Stability and power capability of the prime mover during and after abnormal conditions
- (5)* Sequence reconnection of loads to avoid large current inrushes that trip overcurrent devices or overload the generator(s)

- (6) Bypass arrangements to permit testing and maintenance of system components that could not otherwise be maintained without disruption of important hospital functions
- (7) Effects of any harmonic currents on neutral conductors and equipment

4.4.1.1.2 Current-sensing devices, phase and ground, shall be selected to minimize the extent of interruption to the electrical system due to abnormal current caused by overload and/or short circuits.

4.4.1.1.3 Generator load shed circuits designed for the purpose of load reduction or for load priority systems shall not shed life safety branch loads, critical branch loads serving critical care areas, medical air compressors, medical–surgical vacuum pumps, pressure maintenance (jockey) pump(s) for water-based fire protection systems, generator fuel pumps, or other generator accessories.

4.4.1.1.4 Essential electrical systems shall have a minimum of two independent sources of power: a normal source generally supplying the entire electrical system and one or more alternate sources for use when the normal source is interrupted.

4.4.1.1.5 Batteries for on-site generators shall be maintained in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.1.1.6 Where the normal source consists of generating units on the premises, the alternate source shall be either another generating set or an external utility service.

4.4.1.1.7 General. Generator sets installed as an alternate source of power for essential electrical systems shall be designed to meet the requirements of such service.

4.4.1.1.7.1 Type 1 and Type 2 essential electrical system power sources shall be classified as Type 10, Class X, Level 1 generator sets per NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.1.1.7.2 Type 3 essential electrical system power sources shall be classified as Type 10, Class X, Level 2 generator sets per NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.1.1.8 Uses for Essential Electrical System.

4.4.1.1.8.1 The generating equipment used shall be either reserved exclusively for such service or normally used for other purposes of peak demand control, internal voltage control, load relief for the external utility, or cogeneration. If normally used for the other purposes listed above, two or more sets shall be installed, such that the maximum actual demand likely to be produced by the connected load of the emergency system as well as medical air compressors, medical–surgical vacuum pumps, electrically operated fire pumps, jockey pumps, fuel pumps, and generator accessories shall be met with the largest single generator set out-of-service. The alternate source of emergency power for illumination and identification of means of egress shall be the essential electrical system. The alternate power source for fire protection signaling

systems shall be the essential electrical systems.

4.4.1.1.8.2 A single generator set that operates the essential electrical system shall be permitted to be part of the system supplying the other purposes as listed in 4.4.1.1.8.1, provided any such use will not decrease the mean period between service overhauls to less than three years.

4.4.1.1.8.3* Optional loads shall be permitted to be served by the essential electrical system generating equipment. Optional loads shall be served by their own transfer means such that these loads shall not be transferred onto the generating equipment if the transfer will overload the generating equipment and shall be shed upon a generating equipment overload. Use of the generating equipment to serve optional loads shall not constitute “other purposes” as described in 4.4.1.1.8.1 and therefore shall not require multiple generator sets.

4.4.1.1.9 Work Space or Room.

(A) Energy converters shall be located in a separate service room dedicated to the generating equipment, separated from the remainder of the building by fire separations having a minimum 2-hour fire rating, or located in an adequate enclosure outside the building capable of preventing the entrance of snow or rain and resisting maximum wind velocity required by the local building code. Rooms for such equipment shall not be shared with other equipment or electrical service equipment that is not a part of the essential electrical system.

(B) The generating equipment shall be installed in a location that will permit ready accessibility and adequate [minimum of 30 in. (76 cm)] working space around the unit for inspection, repair, maintenance, cleaning, or replacement.

4.4.1.1.10* Capacity and Rating. The generator set(s) shall have sufficient capacity and proper rating to meet the maximum actual demand likely to be produced by the connected load of the essential electrical system(s) at any one time.

4.4.1.1.11 Load Pickup. The generator set(s) shall have sufficient capacity to pick up the load and meet the minimum frequency and voltage stability requirements of the emergency system within 10 seconds after loss of normal power.

4.4.1.1.12 Maintenance of Temperature. Provisions shall be made to maintain the generator room at not less than 10°C (50°F) or the engine water-jacket temperature at not less than 32°C (90°F).

4.4.1.1.13 Ventilating Air. Provision shall be made to provide adequate air for cooling and to replenish engine combustion air.

4.4.1.1.14 Cranking Batteries. Internal combustion engine cranking batteries shall be in accordance with the battery requirements of NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.1.1.15 Compressed Air Starting Devices. Internal combustion engine air starting devices shall have sufficient capacity to supply five 10-second cranking attempts, with not more than a

10-second rest between attempts, with the compressor not operating.

4.4.1.1.16 Fuel Supply. The fuel supply for the generator set shall comply with Sections 5.5 and 7.9 of NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.1.1.17 Requirements for Safety Devices.

(A) Internal Combustion Engines. Internal combustion engines serving generator sets shall be equipped with the following:

- (1) A sensor device plus visual warning device to indicate a water-jacket temperature below those required in 4.4.1.1.12
- (2) Sensor devices plus visual prealarm warning device to indicate the following:
 - (a) High engine temperature (above manufacturer's recommended safe operating temperature range)
 - (b) Low lubricating oil pressure (below manufacturer's recommended safe operating range)
 - (c) Low water coolant level
- (3) An automatic engine shutdown device plus visual device to indicate that a shutdown took place due to the following:
 - (a) Overcrank (failed to start)
 - (b) Overspeed
 - (c) Low lubricating oil pressure
 - (d) Excessive engine temperature
- (4) A common audible alarm device to warn that any one or more of the prealarm or alarm conditions exist

(B) Other Types of Prime Movers. Prime movers, other than internal combustion engines, serving generator sets shall have appropriate safety devices plus visual and audible alarms to warn of alarm or approaching alarm conditions.

(C) Liquid Fuel Supplies. Liquid fuel supplies for emergency or auxiliary power sources shall be equipped with a sensor device to warn that the main fuel tank contains less than a 4-hour operating supply.

4.4.1.1.18 Alarm Annunciator. A remote annunciator, storage battery-powered, shall be provided to operate outside of the generating room in a location readily observed by operating personnel at a regular work station (*see NFPA 70, National Electrical Code, Section 700.12*). The annunciator shall indicate alarm conditions of the emergency or auxiliary power source as follows:

- (1) Individual visual signals shall indicate the following:
 - (a) When the emergency or auxiliary power source is operating to supply power to load
 - (b) When the battery charger is malfunctioning
- (2) Individual visual signals plus a common audible signal to warn of an engine-generator alarm condition shall indicate the following:
 - (a) Low lubricating oil pressure
 - (b) Low water temperature (below those required in 4.4.1.1.12)
 - (c) Excessive water temperature
 - (d) Low fuel — when the main fuel storage tank contains less than a 4-hour operating supply
 - (e) Overcrank (failed to start)
 - (f) Overspeed

4.4.1.1.18.1 Where a regular work station will be unattended periodically, an audible and visual derangement signal, appropriately labeled, shall be established at a continuously monitored location. This derangement signal shall activate when any of the conditions in 4.4.1.1.18(1) and (2) occur, but need not display these conditions individually.

4.4.1.2 Battery. Battery systems shall meet all requirements of Article 700 of NFPA 70, *National Electrical Code*.

4.4.2* Distribution (Type 1 EES).

4.4.2.1 General Requirements.

4.4.2.1.1 Electrical characteristics of the transfer switches shall be suitable for the operation of all functions and equipment they are intended to supply.

4.4.2.1.2 Switch Rating. The rating of the transfer switches shall be adequate for switching all classes of loads to be served and for withstanding the effects of available fault currents without contact welding.

4.4.2.1.3 Automatic Transfer Switch Classification. Each automatic transfer switch shall be approved for emergency electrical service (*see NFPA 70, National Electrical Code, Section 700.3*) as a complete assembly.

4.4.2.1.4 Automatic Transfer Switch Features.

(A) General. Automatic transfer switches shall be electrically operated and mechanically held. The transfer switch shall transfer and retransfer the load automatically.

Exception: It shall be permitted to program the transfer switch (1) for a manually initiated retransfer to the normal source, or (2) for an automatic intentional "off" delay, or (3) for an in-phase monitor relay or similar automatic delay method, so as to provide for a planned momentary interruption of the load. If used, this arrangement shall be provided with a bypass feature to permit automatic retransfer in the event that the alternate source fails and the normal source is available.

(B) Interlocking. Reliable mechanical interlocking, or an approved alternate method, shall be inherent in the design of transfer switches to prevent the unintended interconnection of the normal and alternate sources of power, or any two separate sources of power.

(C)* Voltage Sensing. Voltage sensing devices shall be provided to monitor all ungrounded lines of the normal source of power.

(D) Time Delay on Starting of Alternate Power Source. A time delay device shall be provided to delay starting of the alternate source generator. The timer is intended to prevent nuisance starting of the alternate source generator with subsequent load transfer in the event of harmless momentary power dips and interruptions of the normal source. The time range shall be short enough so that the generator can start and be on the line within 10 seconds of the onset of failure.

(E) Time Delay on Transfer to Alternate Power. An adjustable time delay device shall be provided for those transfer switches requiring "delayed-automatic" operation. The time delay shall commence when proper alternate source voltage and frequency are achieved. The delay device shall prevent transfer to the alternate power source until after expiration of the preset delay.

(F)* Time Delay on Retransfer to Normal Power. An adjustable timer with a bypass shall be provided to delay retransfer from the alternate source of power to the normal. This timer will permit the normal source to stabilize before retransfer to the load and help to avoid unnecessary power interruptions. The bypass shall operate similarly to the bypass in 4.4.2.1.4(A).

(G)* Test Switch. A test switch shall be provided on each automatic transfer switch that will simulate a normal power source failure to the switch.

(H)* Indication of Switch Position. Two pilot lights, properly identified, shall be provided to indicate the transfer switch position.

(I) Manual Control of Switch. A means for the safe manual operation of the automatic transfer switch shall be provided.

(J) Time Delay on Engine Shutdown. A time delay of 5 minutes minimum to allow engine cooldown shall be provided for unloaded running of the alternate power source generator set prior to shutdown.

Exception: Time delay need not be provided on small (15 kW or less) air-cooled prime movers or if included with the engine control panel.

(K)* Motor Load Transfer. Provisions shall be included to reduce excessive currents resulting from motor load transfer if such currents can damage essential electrical system equipment or cause nuisance tripping of essential electrical system overcurrent protective devices.

(L) Isolation of Neutral Conductors. Provisions shall be included for ensuring proper continuity, transfer, and isolation of the normal and the alternate power source neutral conductors whenever they are separately grounded, if needed, to achieve proper ground-fault sensing. *[See NFPA 70, National Electrical Code, Section 230.95(b).]*

4.4.2.1.5 Nonautomatic Transfer Device Classification. Nonautomatic transfer devices shall be approved for emergency electrical service (*see NFPA 70, National Electrical Code, Section 700.3*).

4.4.2.1.6 Nonautomatic Transfer Device Features.

(A) General. Switching devices shall be mechanically held. Operation shall be by direct manual or electrical remote manual control. Electrically operated switches shall derive their control power from the source to which the load is being transferred. A means for safe manual operation shall be provided.

(B) Interlocking. Reliable mechanical interlocking, or an approved alternate method, shall be inherent in the design in order to prevent the unintended interconnection of the normal and alternate sources of power, or of any two separate sources of power.

(C) Indication of Switch Position. Pilot lights, properly identified, shall be provided to indicate the switch position.

4.4.2.1.7 Bypass-Isolation Switches. Bypass-isolation switches shall be permitted for bypassing and isolating the transfer switch. If installed, they shall be in accordance with 4.4.2.1.7(A) through (C).

(A) Bypass-Isolation Switch Rating. The bypass-isolation switch shall have a continuous current rating and withstand current rating compatible with that of the associated transfer switch.

(B) Bypass-Isolation Switch Classification. Each bypass-isolation switch shall be listed for emergency electrical service as a completely factory-assembled and tested apparatus. (*See NFPA 70, National Electrical Code, Section 700.3.*)

(C)* Operation. With the transfer switch isolated or disconnected or both, means shall be provided so the bypass-isolation switch can function as an independent nonautomatic transfer switch and allow the load to be connected to either power source. Reconnection of the transfer switch shall be possible with a load interruption no greater than the maximum time, in seconds, by the type of essential electrical system.

4.4.2.2 Specific Requirements.

4.4.2.2.1* General.

4.4.2.2.1.1 The emergency system shall be limited to circuits essential to life safety and critical patient care and are designated the life safety branch and the critical branch.

4.4.2.2.1.2 The equipment system shall supply major electrical equipment necessary for patient care and basic Type 1 operation.

4.4.2.2.1.3 Both systems shall be arranged for connection, within time limits specified in this chapter, to an alternate source of power following a loss of the normal source.

4.4.2.2.1.4 The number of transfer switches to be used shall be based upon reliability, design, and load considerations. Each branch of the emergency system and each equipment system shall have one or more transfer switches. One transfer switch shall be permitted to serve one or more branches or systems in a facility with a continuous load on the switch of 150 kVA (120 kW) or less.

4.4.2.2.2 Emergency System.

4.4.2.2.2.1 General. Those functions of patient care depending on lighting or appliances that shall be permitted to be connected to the emergency system are divided into two mandatory branches, described in 4.4.2.2.2.2 and 4.4.2.2.2.3.

4.4.2.2.2.2 Life Safety Branch. The life safety branch of the emergency system shall supply power for the following lighting, receptacles, and equipment:

- (1) Illumination of means of egress as required in NFPA 101, *Life Safety Code*
- (2) Exit signs and exit direction signs required in NFPA 101, *Life Safety Code*
- (3) Alarm and alerting systems including the following:
 - (a) Fire alarms
 - (b) Alarms required for systems used for the piping of nonflammable medical gases as specified in Chapter 5, Gas and Vacuum Systems
- (4)* Hospital communication systems, where used for issuing instruction during emergency conditions
- (5) Generator Set Location: Task illumination, battery charger for emergency battery-powered lighting unit(s), and selected receptacles at the generator set location and essential electrical system transfer switch locations
- (6) Elevator cab lighting, control, communication, and signal systems
- (7) Automatically operated doors used for building egress
- (8) The auxiliary functions of fire alarm combination systems complying with NFPA 72, *National Fire Alarm Code*®

No function other than those listed in items (1) through (8) shall be connected to the life safety branch.

4.4.2.2.2.3* Critical Branch. The critical branch shall be permitted to be subdivided into two or more branches. The critical branch of the emergency system shall supply power for task illumination, fixed equipment, selected receptacles, and selected power circuits serving the following areas and functions related to patient care:

- (1) Critical care areas that utilize anesthetizing gases, task illumination, selected receptacles, and fixed equipment
- (2) The isolated power systems in special environments
- (3) Task illumination and selected receptacles in the following:
 - (a) Patient care areas including infant nurseries, selected acute nursing areas, psychiatric bed areas (omit receptacles), and ward treatment rooms
 - (b) Medication preparation areas
 - (c) Pharmacy dispensing areas
 - (d) Nurses' stations (unless adequately lighted by corridor luminaires)
- (4) Additional specialized patient care task illumination and receptacles, where needed
- (5) Nurse call systems
- (6) Blood, bone, and tissue banks
- (7)* Telephone equipment rooms and closets
- (8) Task illumination, selected receptacles, and selected power circuits for the following areas:
 - (a) General care beds with at least one duplex receptacle per patient bedroom, and task illumination as required by the governing body of the health care facility
 - (b) Angiographic labs
 - (c) Cardiac catheterization labs
 - (d) Coronary care units
 - (e) Hemodialysis rooms or areas
 - (f) Emergency room treatment areas (selected)
 - (g) Human physiology labs
 - (h) Intensive care units
 - (i) Postoperative recovery rooms (selected)

- (9) Additional task illumination, receptacles, and selected power circuits needed for effective facility operation. Single-phase fractional horsepower motors shall be permitted to be connected to the critical branch.

4.4.2.2.3 Equipment System.

4.4.2.2.3.1 General. The equipment system shall be connected to equipment described in 4.4.2.2.3.3 through 4.4.2.2.3.5.

4.4.2.2.3.2 Connection to Alternate Power Source. The equipment system shall be installed and connected to the alternate power source, such that equipment described in 4.4.2.2.3.4 is automatically restored to operation at appropriate time lag intervals following the energizing of the emergency system. Its arrangement shall also provide for the subsequent connection of equipment described in 4.4.2.2.3.5.

4.4.2.2.3.3 AC Equipment for Nondelayed Automatic Connection. Generator accessories including, but not limited to, the transfer fuel pump, electrically operated louvers, and other generator accessories essential for generator operation, shall be arranged for automatic connection to the alternate power source.

4.4.2.2.3.4* Equipment for Delayed-Automatic Connection. The following equipment shall be permitted to be arranged for delayed-automatic connection to the alternate power source:

- (1) Central suction systems serving medical and surgical functions, including controls. It shall be permitted to place such suction systems on the critical branch.
- (2) Sump pumps and other equipment required to operate for the safety of major apparatus, including associated control systems and alarms.
- (3) Compressed air systems serving medical and surgical functions, including controls. It shall be permitted to place such air systems on the critical branch.
- (4) Smoke control and stair pressurization systems.
- (5) Kitchen hood supply and/or exhaust systems, if required to operate during a fire in or under the hood.
- (6) Supply, return, and exhaust ventilating systems for airborne infectious/isolation rooms, protective environment rooms, exhaust fans for laboratory fume hoods, nuclear medicine areas where radioactive material is used, ethylene oxide evacuation, and anesthetic evacuation. Where delayed automatic connection is not appropriate, such ventilation systems shall be permitted to be placed on the critical branch.

4.4.2.2.3.5* Equipment for Delayed-Automatic or Manual Connection. The following equipment shall be permitted to be arranged for either delayed-automatic or manual connection to the alternate power source (*also see A.4.4.2.2.3.4*):

- (1) Heating equipment to provide heating for operating, delivery, labor, recovery, intensive

care, coronary care, nurseries, infection/isolation rooms, emergency treatment spaces, and general patient rooms, and pressure maintenance (jockey or make-up) pump(s) for water-based fire protection systems.

- (2)* Heating of general patient rooms during disruption of the normal source shall not be required under any of the following conditions:
 - (a) The outside design temperature is higher than -6.7°C ($+20^{\circ}\text{F}$).
 - (b) The outside design temperature is lower than -6.7°C ($+20^{\circ}\text{F}$) and a selected room(s) is provided for the needs of all confined patients [then only such room(s) need be heated].
 - (c) The facility is served by a dual source of normal power as described in 4.3.2.1.
- (3) Elevator(s) selected to provide service to patient, surgical, obstetrical, and ground floors during interruption of normal power.
- (4) Supply, return, and exhaust ventilating systems for surgical and obstetrical delivery suites, intensive care, coronary care, nurseries, and emergency treatment spaces.
- (5) Hyperbaric facilities.
- (6) Hypobaric facilities.
- (7) Autoclaving equipment shall be permitted to be arranged for either automatic or manual connection to the alternate source.
- (8) Controls for equipment listed in 4.4.2.2.3
- (9)* Other selected equipment shall be permitted to be served by the equipment system.

4.4.2.2.4 Wiring Requirements.

4.4.2.2.4.1* Separation from Other Circuits. The life safety branch and critical branch of the emergency system shall be kept entirely independent of all other wiring and equipment.

4.4.2.2.4.2 Receptacles. The requirements for receptacles shall comply with 4.4.2.2.4.2(A) and (B).

(A) The number of receptacles on a single branch circuit for areas described in 4.4.2.2.2.3(8) shall be minimized to limit the effects of a branch circuit outage. Branch circuit overcurrent devices shall be readily accessible to nursing and other authorized personnel.

(B)* The electrical receptacles or the cover plates for the electrical receptacles supplied from the emergency system shall have a distinctive color or marking so as to be readily identifiable.

4.4.2.2.4.3 Switches. Switches installed in the lighting circuits connected to the essential electrical system shall comply with Article 700, Section E, of NFPA 70, *National Electrical Code*.

4.4.2.2.4.4 Mechanical Protection of the Emergency System. The wiring of the emergency system shall be mechanically protected by raceways, as defined in NFPA 70, *National Electrical Code*.

4.4.2.2.4.5 Flexible power cords of appliances or other utilization equipment connected to the emergency system shall not be required to be enclosed in raceways.

4.4.2.2.4.6 Secondary circuits of transformer-powered communication or signaling systems shall not be required to be enclosed in raceways unless otherwise specified by Chapters 7 or 8 of NFPA 70, *National Electrical Code*.

4.4.3 Performance Criteria and Testing (Type 1 EES).

4.4.3.1 Source. The branches of the emergency system shall be installed and connected to the alternate power source specified in 4.4.1.1.4 and 4.4.1.1.6 so that all functions specified herein for the emergency system shall be automatically restored to operation within 10 seconds after interruption of the normal source.

4.4.3.2 Transfer Switches.

4.4.3.2.1 All ac-powered support and accessory equipment necessary to the operation of the EPS shall be supplied from the load side of the automatic transfer switch(es), or the output terminals of the EPS, ahead of the main EPS overcurrent protection, as necessary, to ensure continuity of the EPSS operation and performance. [110: 5.12.5]

4.4.3.2.2 The essential electrical system shall be served by the normal power source except when the normal power source is interrupted or drops below a predetermined voltage level. Settings of the sensors shall be determined by careful study of the voltage requirements of the load.

4.4.3.2.3 Failure of the normal source shall automatically start the alternate source generator after a short delay as described in 4.4.2.1.4(D). When the alternate power source has attained a voltage and frequency that satisfies minimum operating requirements of the essential electrical system, the load shall be connected automatically to the alternate power source.

4.4.3.2.4 Upon connection of the alternate power source, the loads comprising the emergency system shall be automatically reenergized. The load comprising the equipment system shall be connected either automatically after a time delay as described in 4.4.2.1.4(E) or nonautomatically and in such a sequential manner as not to overload the generator.

4.4.3.2.5 When the normal power source is restored, and after a time delay as described in 4.4.2.1.4(F), the automatic transfer switches shall disconnect the alternate source of power and connect the loads to the normal power source. The alternate power source generator set shall continue to run unloaded for a preset time delay as described in 4.4.2.1.4(J).

4.4.3.2.6 If the emergency power source fails and the normal power source has been restored, retransfer to the normal source of power shall be immediate, bypassing the retransfer delay

timer.

4.4.3.2.7 If the emergency power source fails during a test, provisions shall be made to immediately retransfer to the normal source.

4.4.3.2.8 Nonautomatic transfer switching devices shall be restored to the normal power source as soon as possible after the return of the normal source or at the discretion of the operator.

4.4.4 Administration (Type 1 EES).

4.4.4.1 Maintenance and Testing of Essential Electrical System.

4.4.4.1.1 Maintenance and Testing of Alternate Power Source and Transfer Switches.

4.4.4.1.1.1 Maintenance of Alternate Power Source. The generator set or other alternate power source and associated equipment, including all appurtenant parts, shall be so maintained as to be capable of supplying service within the shortest time practicable and within the 10-second interval specified in 4.4.1.1.11 and 4.4.3.1. Maintenance shall be performed in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*, Chapter 6.

4.4.4.1.1.2 Inspection and Testing. Criteria, conditions, and personnel requirements shall be in accordance with 4.4.4.1.1.2(A) through (C).

(A)* Test Criteria. Generator sets shall be tested 12 times a year with testing intervals between not less than 20 days or exceeding 40 days. Generator sets serving emergency and equipment systems shall be in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*, Chapter 6.

(B) Test Conditions. The scheduled test under load conditions shall include a complete simulated cold start and appropriate automatic and manual transfer of all essential electrical system loads.

(C) Test Personnel. The scheduled tests shall be conducted by competent personnel. The tests are needed to keep the machines ready to function and, in addition, serve to detect causes of malfunction and to train personnel in operating procedures.

4.4.4.1.2 Maintenance and Testing of Circuitry.

4.4.4.1.2.1* Circuit Breakers. Main and feeder circuit breakers shall be inspected annually and a program for periodically exercising the components shall be established according to manufacturer's recommendations.

4.4.4.1.2.2 Insulation Resistance. The resistance readings of main feeder insulation shall be taken prior to acceptance and whenever damage is suspected.

4.4.4.1.3 Maintenance of Batteries. Batteries for on-site generators shall be maintained in accordance with NFPA 110, *Standard for Emergency and Standby Power Systems*.

4.4.4.2 Recordkeeping. A written record of inspection, performance, exercising period, and repairs shall be regularly maintained and available for inspection by the authority having

jurisdiction.

4.5 Essential Electrical System Requirements — Type 2.

4.5.1 Sources (Type 2 EES). The requirements for sources for Type 2 essential electrical systems shall conform to those listed in 4.4.1.

4.5.2 Distribution (Type 2 EES).

4.5.2.1 General. The distribution requirements for Type 2 essential electrical systems shall conform to those listed in 4.4.2.1.

4.5.2.2 Specific Requirements.

4.5.2.2.1* General. The number of transfer switches to be used shall be based upon reliability, design, and load considerations. Each branch of the emergency system and each critical system shall have one or more transfer switches. One transfer switch shall be permitted to serve one or more branches or systems in a facility with a continuous load on the switch of 150 kVA (120 kW) or less.

4.5.2.2.2 Emergency System. The emergency system shall supply power for lighting, receptacles, and equipment as follows:

- (1) Illumination of means of egress in accordance with NFPA 101, *Life Safety Code*
- (2) Exit signs and exit directional signs in accordance with NFPA 101, *Life Safety Code*
- (3) Alarm and alerting systems, including the following:
 - (a) Fire alarms
 - (b) Alarms required for systems used for the piping of nonflammable medical gases as specified in Chapter 5, Gas and Vacuum Systems
- (4)* Communication systems, where used for issuing instructions during emergency conditions
- (5) Sufficient lighting in dining and recreation areas to provide illumination to exit ways of a minimum of 5 ft-candles
- (6) Task illumination and selected receptacles at the generator set location
- (7) Elevator cab lighting, control, communication, and signal systemsNo function other than those listed in items (1) through (7) shall be connected to the emergency system.

4.5.2.2.3 Critical System.

4.5.2.2.3.1 General. The critical system shall be so installed and connected to the alternate power source that equipment listed in 4.5.2.2.3.2 shall be automatically restored to operation at appropriate time-lag intervals following the restoration of the emergency system to operation. Its arrangement shall also provide for the additional connection of equipment listed in

4.5.2.2.3.2.

4.5.2.2.3.2 Delayed-Automatic Connections to Critical System. The following equipment shall be permitted to be connected to the critical system and be arranged for delayed-automatic connection to the alternate power source:

- (1) Task illumination and selected receptacles in the following:
 - (a) Patient care areas
 - (b) Medication preparation areas
 - (c) Pharmacy dispensing areas
 - (d) Nurses' stations (unless adequately lighted by corridor luminaires)
- (2) Supply, return, and exhaust ventilating systems for airborne infectious isolation rooms
- (3) Sump pumps and other equipment required to operate for the safety of major apparatus and associated control systems and alarms
- (4) Smoke control and stair pressurization systems
- (5) Kitchen hood supply and/or exhaust systems, if required to operate during a fire in or under the hood

4.5.2.2.3.3* Delayed-Automatic or Manual Connections to Critical System. The equipment in 4.5.2.2.3.3(A) and (B) shall be permitted to be connected to the critical system and be arranged for either delayed-automatic or manual connection to the alternate power source.

(A) Heating Equipment to Provide Heating for General Patient Rooms. Heating of general patient rooms during disruption of the normal source shall not be required under any of the following conditions:

- (1)* The outside design temperature is higher than -6.7°C ($+20^{\circ}\text{F}$).
- (2) The outside design temperature is lower than -6.7°C ($+20^{\circ}\text{F}$) and, where a selected room(s) is provided for the needs of all confined patients, then only such room(s) need be heated.
- (3) The facility is served by a dual source of normal power as described in A.4.4.1.1.1.

(B)* Elevator Service. In instances where interruptions of power would result in elevators stopping between floors, throw-over facilities shall be provided to allow the temporary operation of any elevator for the release of passengers.

(C) Optional Connections to the Critical System. Additional illumination, receptacles, and equipment shall be permitted to be connected only to the critical system.

(D) Multiple Systems. Where one switch serves multiple systems as permitted under 4.5.2.2, transfer for all loads shall be non-delayed automatic.

4.5.2.2.4 Wiring Requirements.

4.5.2.2.4.1* Separation from Other Circuits. The emergency system shall be kept entirely independent of all other wiring and equipment.

4.5.2.2.4.2* Receptacles. The electrical receptacles or the cover plates for the electrical receptacles supplied from the emergency system shall have a distinctive color or marking so as to be readily identifiable.

4.5.3 Performance Criteria and Testing (Type 2 EES).

4.5.3.1 Source. The emergency system shall be installed and connected to the alternate source of power specified in 4.4.1.1.4 and 4.4.1.1.6 so that all functions specified herein for the emergency system will be automatically restored to operation within 10 seconds after interruption of the normal source.

4.5.3.2 Transfer Switches.

4.5.3.2.1 The essential electrical system shall be served by the normal power source until the normal power source is interrupted or drops below a predetermined voltage level. Settings of the sensors shall be determined by careful study of the voltage requirements of the load.

4.5.3.2.2 Failure of the normal source shall automatically start the alternate source generator, after a short delay as described in 4.4.2.1.4(D). When the alternate power source has attained a voltage and frequency that satisfies minimum operating requirements of the essential electrical system, the load shall be connected automatically to the alternate power source.

4.5.3.2.2.1 All ac-powered support and accessory equipment necessary to the operation of the EPS shall be supplied from the load side of the automatic transfer switch(es), or the output terminals of the EPS, ahead of the main EPS overcurrent protection, as necessary, to ensure continuity of the EPSS operation and performance.

4.5.3.2.3 Upon connection of the alternate power source, the loads comprising the emergency system shall be automatically reenergized. The loads comprising the critical system shall be connected either automatically after a time delay as described in 4.4.2.1.4(E) or nonautomatically and in such a sequential manner as not to overload the generator.

4.5.3.2.4 When the normal power source is restored, and after a time delay as described in 4.4.2.1.4(F), the automatic transfer switches shall disconnect the alternate source of power and connect the loads to the normal power source. The alternate power source generator set shall continue to run unloaded for a preset time delay as described in 4.4.2.1.4(J).

4.5.3.2.5 If the emergency power source fails and the normal power source has been restored, retransfer to the normal source of power shall be immediate, bypassing the retransfer delay timer.

4.5.3.2.6 If the emergency power source fails during a test, provisions shall be made to immediately retransfer to the normal source.

4.5.3.2.7 Nonautomatic transfer switching devices shall be restored to the normal power source as soon as possible after the return of the normal source or at the discretion of the operator.

4.5.4 Administration (Type 2 EES).

4.5.4.1 Maintenance and Testing of Essential Electrical System.

4.5.4.1.1 Maintenance and Testing of Alternate Power Source and Transfer Switches.

4.5.4.1.1.1 Maintenance of Alternate Power Source. The generator set or other alternate power source and associated equipment, including all appurtenant parts, shall be so maintained as to be capable of supplying service within the shortest time practicable and within the 10-second interval specified in 4.4.1.1.8 and 4.4.3.1.

4.5.4.1.1.2 Inspection and Testing. Generator sets shall be inspected and tested in accordance with 4.4.4.1.1.2.

4.5.4.1.2 Maintenance and Testing of Circuitry. Circuitry shall be maintained and tested in accordance with 4.4.4.1.2.

4.5.4.1.3 Maintenance of Batteries. Batteries shall be maintained in accordance with 4.4.4.1.3.

4.5.4.2 Recordkeeping. A written record of inspection, performance, exercising period, and repairs shall be regularly maintained and available for inspection by the authority having jurisdiction.

4.6 Essential Electrical System Requirements — Type 3.

4.6.1 Sources (Type 3 EES). The alternate source of power for the system shall be specifically designed for this purpose and shall be either a generator, battery system, or self-contained battery integral with the equipment.

4.6.1.1 Generators shall conform to 4.4.1.1.

4.6.1.2 Battery systems shall conform to 4.4.1.2.

4.6.2 Distribution (Type 3 EES).

4.6.2.1 General. The distribution requirements for Type 3 essential electrical systems shall conform to those listed in 4.4.2.1.

4.6.2.2 Specific Requirements.

4.6.2.2.1* General.

4.6.2.2.2 Connection to the Essential Electrical System. The system shall supply power for task illumination that is related to the safety of life and that is necessary for the safe cessation of procedures in progress.

4.6.2.2.3 Wiring Requirements.

4.6.2.2.3.1 General. The design, arrangement, and installation of the system shall be in accordance with NFPA 70, *National Electrical Code*.

4.6.2.2.3.2* Receptacles. The cover plates for the electrical receptacles or the electrical receptacles themselves supplied from the emergency system shall have a distinctive color or marking so as to be readily identifiable.

4.6.3 Performance Criteria and Testing (Type 3 EES).

4.6.3.1 Source.

4.6.3.1.1 The emergency system shall have an alternate source of power separate and independent from the normal source that will be effective for a minimum of 1½ hours after loss of the normal source.

4.6.3.1.2 The emergency system shall be so arranged that, in the event of failure of normal power source, the alternate source of power shall be automatically connected to the load within 10 seconds.

4.6.3.2 Transfer Switches with Engine Generator Sets.

4.6.3.2.1 The operation of the equipment shall be arranged such that the load will be served by the normal source until the normal source is interrupted, or when the voltage drops below the setting of the voltage sensing device. The settings of the voltage sensing relays shall be determined by careful study of the voltage requirements of the load.

4.6.3.2.2 When the normal source is restored, and after a time delay as described in 4.4.2.1.4(F), the automatic transfer switch shall disconnect the alternate source of power and connect the loads to the normal power source.

4.6.3.2.3 If the alternate power source fails and the normal power source has been restored, retransfer to the normal source of power shall be immediate.

4.6.3.3 Transfer Switches with Battery System.

4.6.3.3.1 Failure of the normal source shall automatically transfer the load to the battery system.

4.6.3.3.2 Retransfer to the normal source shall be automatic upon restoration of the normal source.

4.6.4 Administration (Type 3 EES).

4.6.4.1 Maintenance and Testing.

4.6.4.1.1 Maintenance and Testing of Alternate Power Source and Transfer Switches.

4.6.4.1.1.1 Maintenance of Alternate Power Source. The generator set or other alternate power source and associated equipment, including all appurtenant parts, shall be so maintained as to be capable of supplying service within the shortest time practicable and within the

10-second interval specified in 4.4.1.1.11 and 4.6.3.1.

4.6.4.1.1.2 Inspection and Testing. Generator sets shall be inspected and tested in accordance with 4.4.4.1.1.2.

4.6.4.1.1.3 Stored Energy Power Source. Maintenance and testing of stored emergency power supply systems shall be in accordance with NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, Section 6.1 through 6.4.5.

4.6.4.1.2 Maintenance and Testing Circuitry. Circuitry shall be maintained and tested in accordance with 4.4.4.1.2.

4.6.4.1.3 Maintenance of Batteries. Batteries shall be maintained in accordance with 4.4.4.1.3.

4.6.4.2 Recordkeeping. A written record of inspection, performance, exercising period, and repairs shall be regularly maintained and available for inspection by the authority having jurisdiction.

Chapter 8 Routine Maintenance and Operational Testing

8.1* General.

8.1.1 The routine maintenance and operational testing program shall be based on all of the following:

- (1) Manufacturer's recommendations
- (2) Instruction manuals
- (3) Minimum requirements of this chapter
- (4) The authority having jurisdiction

8.1.2 Consideration shall be given to temporarily providing a portable or alternate source whenever the emergency generator is out of service.

8.2* Manuals, Special Tools, and Spare Parts.

8.2.1 At least two sets of instruction manuals for all major components of the EPSS shall be supplied by the manufacturer(s) of the EPSS and shall contain the following:

- (1) A detailed explanation of the operation of the system
- (2) Instructions for routine maintenance
- (3) Detailed instructions for repair of the EPS and other major components of the EPSS
- (4) An illustrated parts list and part numbers
- (5) Illustrated and schematic drawings of electrical wiring systems, including operating and safety devices, control panels, instrumentation, and annunciators

8.2.2 For Level 1 systems, instruction manuals shall be kept in a secure, convenient location, one set near the equipment, and the other set in a separate location.

8.2.3 Special tools and testing devices necessary for routine maintenance shall be available for use when needed.

8.2.4 Replacement for parts identified by experience as high mortality items shall be maintained in a secure location(s) on the premises.

8.2.4.1 Consideration shall be given to stocking spare parts as recommended by the manufacturer.

8.3 Maintenance and Operational Testing.

8.3.1* The EPSS shall be maintained to ensure to a reasonable degree that the system is

capable of supplying service within the time specified for the type and for the time duration specified for the class.

8.3.2 A routine maintenance and operational testing program shall be initiated immediately after the EPSS has passed acceptance tests or after completion of repairs that impact the operational reliability of the system.

8.3.2.1 The operational test shall be initiated at an automatic transfer switch and shall include testing of each EPSS component on which maintenance or repair has been performed, including the transfer of each automatic and manual transfer switch to the alternate power source, for a period of not less than 30 minutes under operating temperature.

8.3.3 A written schedule for routine maintenance and operational testing of the EPSS shall be established.

8.3.4 A written record of the EPSS inspections, tests, exercising, operation, and repairs shall be maintained on the premises.

8.3.4.1 The written record shall include the following:

- (1) The date of the maintenance report
- (2) Identification of the servicing personnel
- (3) Notation of any unsatisfactory condition and the corrective action taken, including parts replaced
- (4) Testing of any repair for the time as recommended by the manufacturer

8.3.5* Transfer switches shall be subjected to a maintenance program that includes all of the following operations:

- (1) Checking of connections
- (2) Inspection or testing for evidence of overheating and excessive contact erosion
- (3) Removal of dust and dirt
- (4) Replacement of contacts when required

8.3.6* Storage batteries, including electrolyte levels, used in connection with Level 1 and Level 2 systems shall be inspected weekly and shall be maintained in full compliance with manufacturer's specifications.

8.3.6.1 Maintenance of lead-acid batteries shall include the monthly checking and recording of electrolyte specific gravity.

8.3.6.2 Defective batteries shall be replaced immediately upon discovery of defects.

8.4 Operational Inspection and Testing.

8.4.1* Level 1 and Level 2 EPSSs, including all appurtenant components, shall be inspected weekly and exercised under load at least monthly.

8.4.1.1 If the generator set is used for standby power or for peak load shaving, such use shall be recorded and shall be permitted to be substituted for scheduled operations and testing of the generator set, providing the same record as required by 8.3.4.

8.4.2* Generator sets in Level 1 and Level 2 service shall be exercised at least once monthly, for a minimum of 30 minutes, using one of the following methods:

- (1) Under operating temperature conditions and at not less than 30 percent of the EPS nameplate kW rating
- (2) Loading that maintains the minimum exhaust gas temperatures as recommended by the manufacturer

8.4.2.1 The date and time of day for required testing shall be decided by the owner, based on facility operations.

8.4.2.2 Equivalent loads used for testing shall be automatically replaced with the emergency loads in case of failure of the primary source.

8.4.2.3* Diesel-powered EPS installations that do not meet the requirements of 8.4.2 shall be exercised monthly with the available EPSS load and exercised annually with supplemental loads at 25 percent of nameplate rating for 30 minutes, followed by 50 percent of nameplate rating for 30 minutes, followed by 75 percent of nameplate rating for 60 minutes, for a total of 2 continuous hours.

8.4.3 Load tests of generator sets shall include complete cold starts.

8.4.4 Time delays shall be set as follows:

- (1) Time delay on start:
 - a. 1 second minimum
 - b. 0.5 second minimum for gas turbine units
- (2) Time delay on transfer to emergency: no minimum required
- (3) Time delay on restoration to normal: 5 minutes minimum
- (4) Time delay on shutdown: 5 minutes minimum

8.4.5 Level 1 and Level 2 transfer switches shall be operated monthly.

8.4.5.1 The monthly test of a transfer switch shall consist of electrically operating the transfer switch from the standard position to the alternate position and then a return to the standard position.

8.4.6* EPSS circuit breakers for Level 1 system usage, including main and feed breakers

between the EPS and the transfer switch load terminals, shall be exercised annually with the EPS in the “off” position.

8.4.6.1 Medium- and high-voltage circuit breakers for Level 1 system usage shall be exercised every 6 months and shall be tested under simulated overload conditions every 2 years.

8.4.7 The routine maintenance and operational testing program shall be overseen by a properly instructed individual.

8.4.8* The EPSS shall be tested for the duration of its assigned class (*see Section 4.2*), or for a duration agreed to by the authority having jurisdiction for at least 4 hours, at least once within every 36–48 months.

8.4.8.1 The load shall be the EPSS system load running at the time of the test. The test shall be initiated by opening all switches or breakers supplying normal power to the EPSS.

8.4.8.2 A power interruption to non-EPSS loads shall not be required.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.4 See NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*.

A.1.1.5(3) See Chapter 4.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.1 Battery Certification. One such certifier of batteries is the American Association of Battery Manufacturers.

A.3.3.2 Emergency Power Supply (EPS). For rotary energy converters, components of an EPS include the following:

- (1) Prime mover
- (2) Cooling system
- (3) Generator
- (4) Excitation system
- (5) Starting system
- (6) Control system
- (7) Fuel system
- (8) Lube system, if required

The EPS includes all the related electrical and mechanical components of the proper size and/or capacity required for the generation of the required electrical power at the EPS output terminals.

A.3.3.3 Emergency Power Supply System (EPSS). See Annex B for diagrams of typical systems.

A.4.1 This standard specifies requirements for the EPSS as a complete functioning system in terms of types, classes, and levels. It is not the intent of this standard to recommend the EPSS most suitable for any given application. The terms *emergency power supply systems* and *standby power supply systems* as used in this standard include, but are not limited to, such terms as the following:

- (1) Alternate power systems
- (2) Standby power systems
- (3) Legally required standby systems
- (4) Alternate power sources

Since this standard specifies the installation, performance, maintenance, and test requirements in terms of types, classes, and levels, any of these terms might be appropriate for describing the application or use, depending on the need and the preference of the parties involved.

A.4.2 Selection of the class of the EPSS should take into account past outage records and fuel delivery problems due to weather, shortages, and other geographic/environmental conditions.

A.4.4 It is recognized that EPSSs are utilized in many different locations and for many different purposes. The requirement for one application might not be appropriate for other applications.

A.4.4.1 Typically, Level 1 systems are intended to automatically supply illumination or power, or both, to critical areas and equipment in the event of failure of the primary supply or in the event of danger to elements of a system intended to supply, distribute, and control power and

illumination essential for safety to human life.

Level 1 systems generally are installed in places of assembly where artificial illumination is required by other standards for safe exiting and for panic control in buildings subject to occupancy by large numbers of people.

Emergency systems can also provide power for such functions as ventilation when essential to maintain the following, as well as other similar functions:

- (1) Life
- (2) Fire detection and alarm systems
- (3) Elevators
- (4) Fire pumps
- (5) Public safety communications systems
- (6) Industrial processes where current interruption would produce serious life safety or health hazards

See NFPA 101®, *Life Safety Code*®, and Chapter 3, Electrical Systems, of NFPA 99, *Standard for Health Care Facilities*.

A.4.4.2 Typically, Level 2 systems are intended to supply power automatically to selected loads (other than those classed as emergency systems) in the event of failure of the primary source.

Level 2 systems typically are installed to serve loads such as the following, that, when stopped due to any interruption of the primary electrical supply, could create hazards or hamper rescue or fire-fighting operations:

- (1) Heating and refrigeration systems
- (2) Communications systems
- (3) Ventilation and smoke removal systems
- (4) Sewerage disposal
- (5) Lighting
- (6) Industrial processes

A.4.4.4 It is important to recognize that an EPSS might react substantially different from commercial power during transient and short circuit conditions due to the relatively small capacities of the EPSS as compared to the primary commercial power source. (See ANSI C84.1, *Standard for Electric Power Systems and Equipment Voltage Ratings*.)

A.5.1.1 Examples of probability of interruption could include the following: earthquake, flood damage, or a demonstrated utility unreliability.

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A.5.1.1(1) See A.5.5.3 for shelf-life precautions for fuel supplies.

A.5.1.2 The seismic risk areas that should be addressed specifically are those designated as Zones 3 and 4 of the *Uniform Building Code*, as modified by the authorities having jurisdiction.

A.5.1.4 On-site energy conversion is not restricted to rotating-type generating systems. Other types of continuous energy conversion systems can be used, including fuel-cell systems.

A.5.2.2 The following devices are typical of energy converters and energy sources that should be reviewed carefully as part of Level 1 EPSs:

- (1) Motor-generator/engine
- (2) Motor-generator/flywheel
- (3) Steam turbine

Connection to the primary power source ahead of the primary source main service disconnect and a separate service should be excluded as a sole source of EPS.

A.5.4 It is recognized that in some installations part or all of the output of the EPS might be used for peak shaving or that part of the output might be used for driving nonessential loads during loss of the primary power source. Load-shedding of these loads when the output of the energy converter is needed is one way of meeting the requirements of Section 5.4. The load should be reviewed to ascertain that load growth has not exceeded EPS capability.

A.5.5.2 The low-fuel alarm point for liquid-fueled engines is defined as the point when the main fuel tank contains insufficient fuel to meet the required full load operating hours and is the point at which this condition is signaled.

A.5.5.3 Consideration should be given to sizing tanks in order to meet minimum fuel supplier delivery requirements, particularly for small tanks. Consideration also should be given to oversizing tanks, because many fuels have a shelf life and deteriorate with age. Where large tanks are required, it is recommended that fuels be periodically pumped out and used in other services and replaced with fresh fuel. Prudent disaster management could require much larger on-site temporary or permanent fuel storage.

A.5.6.4.2 See Figure A.5.6.4.2 for a diagram of cranking cycles.

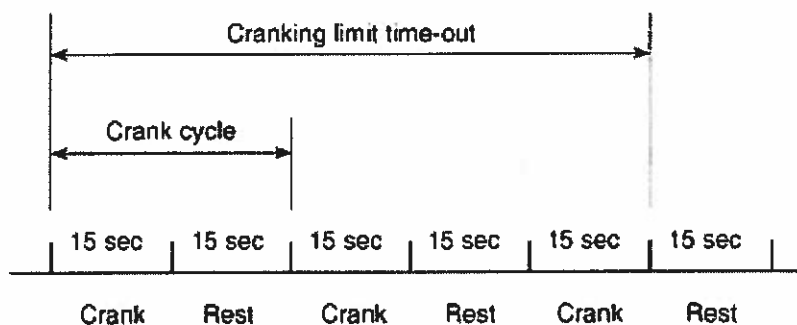


FIGURE A.5.6.4.2 Diagram of Cranking Cycles.

A.5.6.4.3 A battery unit is one or more batteries or a group of cells, a series, or a parallel series connected to provide the required battery unit voltage and capacity.

A.5.6.4.4 Cold-cranking amperes, or cranking performance, are the number of amperes a fully charged battery at -17.8°C (0°F) can continuously deliver for 30 seconds while maintaining 1.2 V per cell.

A.5.6.4.5.1 It is recommended that lead-acid starting batteries be replaced every 24 to 30 months.

A.5.6.4.6 It is intended that the battery charger be factory-built, adjusted, and approved for the specific type, construction, and capacity of the battery. For lead-acid batteries, the battery charger should be tested for the specific gravity, type, and concentration of grid alloys, such as high or low gravity, high or low antimony, calcium, or none.

A.5.6.5.6 For Level 1 and Level 2 systems located outdoors, the manual shutdown should be located external to the weatherproof enclosure and should be appropriately identified.

A.5.6.9.1 See ANSI/NEMA MG1, *Standard for Motors and Generators*, and ANSI/NEMA MG2, *Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators*.

A.5.6.10.3 Where unusual vibration conditions are anticipated, adequate isolation treatment should be supplied.

A.6.1.1 Electrical switching is electrical equipment or devices used to do any or all of the following:

- (1) Transfer connected electrical loads from one power source to another
- (2) Perform load-switching functions
- (3) Bypass, isolate, and test the transfer switch

A.6.1.2 Electrical protection equipment is sensing and overcurrent protective devices used to protect against damage due to fault or overload to conductors and equipment connected to the output of the emergency energy source, up to and including the load terminals of the transfer switch(es).

A.6.1.6 See Section 700-6 of NFPA 70, *National Electrical Code*, and Section 7.8 of NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, for listing and installation requirements for transfer switches used with fire pumps.

A.6.2.1 For most applications in this standard, the automatic transfer switch is used to transfer a load from a primary source of supply to an engine generator set.

An automatic transfer switch might include circuit breakers, contactors, switches, or vacuum

and solid-state power devices operating in conjunction with automatic-sensing and logic devices to perform the defined function.

A.6.2.2.1 Where special loads require more rapid detection of power loss, underfrequency monitoring also might be provided. Upon frequency decay below the lower limit necessary for proper operation of the loads, the transfer switch should automatically initiate transfer to the alternate source. (*See A.6.2.15.*)

A.6.2.2.1(2) See 6.2.5 and 6.2.7.

A.6.2.4 Authorized personnel should be available and familiar with manual operation of the transfer switch and should be capable of determining the adequacy of the alternate source of power prior to manual transfer.

A.6.2.5 For most applications, a nominal delay of 1 second is adequate. The time delay should be short enough so that the generator can start and be on the line within the time specified for the type classification.

A.6.2.8 It is recommended that the timer for delay on retransfer to the primary source be set for 30 minutes. The 30-minute recommendation is to establish a “normalized” engine temperature, when it is beneficial for the engine. NFPA 70, *National Electrical Code*, establishes a minimum time requirement of 15 minutes.

A.6.2.13 For maintenance purposes, consideration should be given to a transfer switch counter.

A.6.2.15 Automatic transfer switches (ATS) can be provided with accessory controls that provide a signal to operate remote motor controls that disconnect motors prior to transfer, and to reconnect them after transfer when the residual voltage has been substantially reduced. Another method is to provide in-phase monitors within the ATS in order to prevent retransfer to the primary source until both sources are nearly synchronized. A third method is to use a programmed neutral position transfer switch. See Section 230-95(b) of NFPA 70, *National Electrical Code*.

A.6.2.16 Standards for nonautomatic transfer switches are similar to those for automatic transfer switches, as defined in 3.3.7.1 and 3.3.7.3, with the omission of automatic controls.

A.6.4.3 See Section 700-3 of NFPA 70, *National Electrical Code*.

A.6.4.4 Consideration should be given to the effect that load interruption could have on the load during maintenance and service of the transfer switch.

A.6.5.1 It is important that the various overcurrent devices be coordinated, as far as practicable, to isolate faulted circuits and to protect against cascading operation on short circuit faults. In many systems, however, full coordination is not practicable without using equipment that could be undesirable for other reasons or prohibitively costly. Primary consideration also should be given to prevent overloading of equipment by limiting the possibilities of large current inrushes due to instantaneous reestablishment of connections to heavy loads.

A.6.5.3 See 6.6.5 of NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*.

A.7.1.1 The performance of the EPS and the EPSS is dependent on many factors, one of which is correct initial installation, primarily as the installation relates to the location and environmental conditions. Although this standard is not intended to serve as a design standard for EPSS installation and environmental considerations, certain minimum standards are recognized as essential for successful start-up and performance, safe operation, and utilization of the EPSS where required.

A.7.1.2 The environmental conditions to be considered in the EPSS design should include, but not be limited to, heating, ventilating, and air-conditioning systems, protection from floods, fire, vandalism, wind, earthquakes, lightning, and other similar or applicable environmental conditions common to geographic locations and other factors affecting the location of the EPSS equipment.

The probability and frequency of power failures that do or can occur as a result of lightning, wind, and rain produced by thunderstorms, hurricanes, tornadoes, and similar weather conditions associated with the user's geographic location should be considered.

A.7.2.3 EPSS equipment should be located above known previous flooding elevations where possible.

A.7.2.4 When installing the EPSS equipment and related auxiliaries, environmental considerations should be given, particularly with regard to the installation of the fuel tanks and exhaust lines, or the EPS building, or both.

To protect against disruption of power in the facility, it is recommended that the transfer switch be located as close to the load as possible. The following are examples of external influences:

- (1) Natural conditions
 - (a) Storms
 - (b) Floods
 - (c) Earthquakes
 - (d) Tornadoes
 - (e) Hurricanes
 - (f) Lightning
 - (g) Ice storms
 - (h) Wind
 - (i) Fire

- (2) Human-caused conditions
 - (a) Vandalism
 - (b) Sabotage
 - (c) Other similar occurrences
- (3) Material and equipment failures

For natural conditions, EPSS design should consider the “100-year storm” flooding level or the flooding level predicted by the SLOSH models for a Class 4 hurricane.

A.7.3.3 Where units housed outdoors are used, it is recommended that a flashlight or battery-powered light with a flexible cord be maintained in the housing.

A.7.5 Generally, integral rubber vibration isolators are used on the rotating energy converters and spring-type or pad-type isolators are used on the larger energy converter units. In some cases, high deflection spring-type isolators should be used where a high degree of vibration attenuation is required. The EPS manufacturer should be consulted when considering the specific type of vibration control. Inertia bases should be considered where unusual vibration conditions are anticipated.

A.7.6 Generally, exhaust noises can be attenuated by using the proper mufflers. The mufflers used should be in accordance with the EPS manufacturer's recommendations. Depending on the degree of silencing required, the muffler should be rated accordingly for “commercial,” “semicritical,” and “critical” (high degree of silencing) service. To attenuate other noises, line-of-sight barriers having acoustical treatment or total acoustical enclosures can be used. The EPS should be installed away from critical areas.

A.7.7.1 During operation, EPS and related equipment reject considerable heat that needs to be removed by proper ventilation or air-cooling. In some cases, outdoor installations rely on natural air circulation, but enclosed installations need properly sized, properly positioned ventilation facilities, to prevent recirculation of cooling air. The optimum position of air-supply louvers and radiator air discharge is on opposite walls, both to the outdoors.

A.7.8.2 It should be recognized that the reliability of municipal water-cooling is strictly dependent upon the reliability of the water utility. It should also be recognized that, during such natural disasters as earthquakes and floods, the water supply can be interrupted simultaneously with the primary electric power supply. Methods of cooling the energy converter(s) consist of radiator cooling, either unit-mounted or remote, utility-furnished (city) water-cooling, heat exchangers, and air-cooling.

A.7.9.1.2 See Table A.7.9.1.2.

Table A.7.9.1.2 ASTM Fuel Oil Rating (Diesel)

Rating	Fuel Description
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Table A.7.9.1.2 ASTM Fuel Oil Rating (Diesel)

Rating	Fuel Description
A-2	Refinery fresh fuel
A-3	Good
A-4	Watch closely — aging has begun
A-5	Advanced aging and oxidization
A-6	Badly aged — not recommended
A-7	Severe aging — do not use

A.7.9.6 See NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*; NFPA 54, *National Fuel Gas Code*; and NFPA 58, *Liquefied Petroleum Gas Code*.

A.7.9.7 Valving for natural gas-fueled prime movers should be configured so that the gas supply to the prime mover cannot be inadvertently or intentionally shut off by anyone other than the qualified personnel such as the gas supplier. Placing valves in an isolated area, a secure area or locking the valve(s) open is recommended.

A.7.10.1 See NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*.

A.7.10.3 Consideration should also be given to utilizing dampening supports where it is necessary to reduce exhaust noise vibration transmission.

A.7.11.2 If a fire suppression system is used in EPS rooms or separate buildings housing EPS equipment, consideration should be given to preaction-type suppression systems.

A.7.11.3 See NFPA 72, *National Fire Alarm Code*.

A.7.11.5 Consideration should be given to the location of the EPS equipment, both as it relates to the building structure and to the effects of an earthquake.

All emergency power equipment support or subsupport systems should be designed and constructed so that they can withstand static or anticipated seismic forces, or both, in any direction, with the minimum force value used being equal to the equipment weight.

Bolts, anchors, hangers, braces, and other restraining devices should be provided to limit earthquake-generated differential movements between the EPS nonstructural equipment and the building structure. However, the degree of isolation required for vibration and acoustical control of the EPS equipment and other equipment should be maintained.

Suspended items such as piping, conduit, ducts, and other auxiliary equipment related to the EPSS should be braced in two directions to resist swaying and excessive movement in earthquake risk areas.

Battery racks for EPS equipment and electrical items or related auxiliaries, or both, should be designed to resist internal damage and damage at the equipment supports resulting from earthquake-generated motion. Battery racks should be capable of withstanding seismic forces equal to the supported weight in any direction. Batteries should be restrained to their support to prevent vibration damage, and electrical interconnections should be provided with adequate slack to accommodate all relative deflections.

Transfer switch enclosures should be mounted so that their anchors and support structures can withstand static forces equal to the anticipated seismic shock in any direction.

Transfer switch components should be of the type that resist malfunction during dynamic excitation and should be designed to resist the anticipated seismic shock.

Where possible, EPS equipment and associated cooling systems and controls should be mounted on a single frame. The frame, in turn, should be rigidly attached to its foundation so that its anchorage can withstand static forces equal to the equipment weight in any direction. Where engine generator sets and associated cooling systems' controls cannot be mounted as an integral unit, each should be secured to meet the above floating requirements. Equipment not using the preferred rigid mounting should have vibration isolators with restraints capable of withstanding static forces equal to twice the weight of the supported equipment in any direction. In addition, interconnecting power, fuel, and cooling lines should be provided with adequate flexibility to allow maximum anticipated excursions without damage.

Appendages to the EPS equipment, such as day tanks, should be mounted to withstand static forces equal to the anticipated seismic shock in any direction.

A.7.11.6 Seismic shock should be simulated at the factory or in a testing laboratory on a prototype unit. Simulation should consist of a test(s) approximating actual time-history records of known seismic shocks applied to the equipment under test. Subassemblies of the total equipment could be tested separately where it is neither practical nor feasible to test the complete unit.

A.7.12.2 See Chapter 4 of NFPA 99, *Standard for Health Care Facilities*.

A.8.1 The continuing reliability and integrity of the EPSS are dependent on an established program of routine maintenance and operational testing.

A.8.2 Where adequately secured from public access, it is desirable to locate an instruction manual, special tools and testing devices, and spare parts in the room in which the emergency power supply is located. The articles should be mounted at a convenient location on a wall and should be enclosed in a metal or other suitable cabinet. The cabinet should accommodate the instruction manual on the inside of the door.

A.8.3.1 The suggested maintenance procedure and frequency should follow those recommended by the manufacturer. In the absence of such recommendations, Figure A.8.3.1(a) and Figure A.8.3.1(b) indicate alternate suggested procedures.

Maintenance Schedule

Component (as applicable)	Procedure X — Action R — Replace, if needed					Frequency W — Weekly S — Semiannually M — Monthly A — Annually Q — Quarterly Nos, indicate hours	
	Visual Inspection	Check	Change	Clean	Test	Level 1	Level 2
1. Fuel							
(a) Main supply tank level		X				W	M
(b) Day tank level	X	X				W	M
(c) Day tank float switch	X				X	W	Q
(d) Supply or transfer pump operation	X				X	W	Q
(e) Solenoid valve operation	X				X	W	Q
(f) Strainer, filter, dirt leg, or combination				X		Q	Q
(g) Water in system		X		X		W	Q
(h) Flexible hose and connectors	X		R			W	M
(i) Tank vents and overflow piping unobstructed		X			X	A	A
(j) Piping	X					A	A
(k) Gasoline in main tank (when used)			R			A	A
2. Lubrication System							
(a) Oil level	X	X				W	M
(b) Oil change			R			50 or A	50 or A
(c) Oil filter(s)			X			50 or A	50 or A
(d) Lube oil heater		X				W	M
(e) Crankcase breather	X		R	X		Q	S
3. Cooling System							
(a) Level	X	X				W	M
(b) Antifreeze protection level					X	S	A
(c) Antifreeze			X			A	A
(d) Adequate cooling water to heat exchanger		X				W	M
(e) Rod out heat exchanger				X		A	A
(f) Adequate fresh air through radiator		X				W	M
(g) Clean exterior of radiator				X		A	A
(h) Fan and alternator belt	X	X				M	Q
(i) Water pump(s)	X					W	Q
(j) Condition of flexible hoses and connection	X	X				W	M
(k) Jacket water heater		X				W	M
(l) Inspect duct work, clean louvers	X	X	X			A	A
(m) Louver motors and controls	X			X	X	A	A
4. Exhaust System							
(a) Leakage	X	X				W	M
(b) Drain condensate trap		X				W	M

(NFPA 110, 1 of 3)

FIGURE A.8.3.1(a) Suggested Maintenance Schedule for Level 1 and Level 2 Emergency Power Supply Systems.

Maintenance Schedule (continued)

Component (as applicable)	Procedure X — Action R — Replace, if needed					Frequency W — Weekly M — Monthly Q — Quarterly S — Semiannually A — Annually Nos. indicate hours	
	Visual Inspection	Check	Change	Clean	Test	Level 1	Level 2
(c) Insulation and fire hazards	X					Q	Q
(d) Excessive backpressure					X	A	A
(e) Exhaust system hangers and supports	X					A	A
(f) Flexible exhaust section	X					S	S
5. Battery System							
(a) Electrolyte level		X				W	M
(b) Terminals clean and tight	X	X				Q	Q
(c) Remove corrosion, case exterior clean and dry	X			X		M	M
(d) Specific gravity or state of charge					X	M	M
(e) Charger and charge rate	X					M	M
(f) Equalize charge		X				M	M
6. Electrical System							
(a) General inspection	X					W	M
(b) Tighten control and power wiring connections		X				A	A
(c) Wire chafing where subject to movement	X	X				Q	S
(d) Operation of safeties and alarms		X			X	S	S
(e) Boxes, panels, and cabinets				X		S	S
(f) Circuit breakers, fuses Note: Do not break manufacturer's seals or perform internal inspection on these devices.	X	X	R	X	X	2 or M	2 or A
(g) Transfer switch main contacts	X			X		A	A
(h) Calibration of voltage-sensing relays/devices		X			X	5 or A	5 or A
(i) Wire insulation breakdown					X	5/500 ^a	3/500 ^b
7. Prime Mover							
(a) General inspection	X					W	M
(b) Service air cleaner			X	X		S	S
(c) Governor oil level and linkage	X	X				M	M
(d) Governor oil			X			A	A
(e) Ignition system — plugs, points, coil, cap, rotor, secondary wire insulation	X	X	R	X	X	A	A
(f) Choke setting and carburetor adjustment		X				S	S
(g) Injector pump and injectors for flow rate pressure, and/or spray pattern					X	A	A
(h) EPS at minimum of 80% nameplate rating					X	3/4 ^c	3/4 ^c

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FIGURE A.8.3.1(a) *Continued*

Maintenance Schedule (continued)							
Component (as applicable)	Procedure X — Action R — Replace, if needed					Frequency W — Weekly S — Semiannually M — Monthly A — Annually Q — Quarterly Nos. indicate hours	
	Visual Inspection	Check	Change	Clean	Test	Level 1	Level 2
(i) Valve clearance					X	3/500 ^b	3/500 ^b
(j) Torque bolts					X	3/500 ^b	3/500 ^b
8. Generator							
(a) Brush length, appearance, free to move in holder	X	X		X		S	S
(b) Commutator and slip rings	X			X		A	A
(c) Rotor and stator	X			X		A	A
(d) Bearing(s)	X		R			A	A
(e) Bearing grease		X	R			A	A
(f) Exciter	X	X		X		A	A
(g) Voltage regulator	X	X		X		A	A
(h) Measure and record resistance readings of windings with insulation tester (Megger)					X	A	A
9. (a) General condition of EPSS, any unusual condition of vibration, leakage, noise, temperature, or deterioration	X			X		W	M
(b) Service room or housing house-keeping	X			X		W	M
10. Restore system to automatic operation condition	X					W	M

^a Every 5 years or 500 hours
^b Every 3 years or 500 hours
^c Every 3 years for 4 hours

(NFPA 110, 3 of 3)

FIGURE A.8.3.1(a) *Continued*

Maintenance Log

Frequency

W — Weekly S — Semiannually
M — Monthly A — Annually
Q — Quarterly Nos. indicate hours

Performed by

Item No.	Service Frequency		Date																											
	Level 1	Level 2	Fill in Appropriate Readings																											
1. (a)	W	M																												
(b)	W	M																												
(c)	W	Q																												
(d)	W	Q																												
(e)	W	Q																												
(f)	Q	Q																												
(g)	W	Q																												
(h)	A	A																												
(i)	A	A																												
(j)	A	A																												
(k)	A	A																												
2. (a)	W	M																												
(b)	50 or A	50 or A																												
(c)	50 or A	50 or A																												
(d)	W	M																												
(e)	Q	S																												
3. (a)	W	M																												
(b)	S	A																												
(c)	A	A																												
(d)	W	M																												
(e)	A	A																												
(f)	W	M																												
(g)	A	A																												
(h)	M	Q																												
(i)	W	Q																												
(j)	W	M																												
(k)	W	M																												
(l)	A	A																												
(m)	A	A																												
4. (a)	W	M																												
(b)	W	M																												
(c)	Q	Q																												
(d)	A	A																												
(e)	A	A																												
(f)	S	S																												
5. (a)	W	M																												
(b)	Q	Q																												

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FIGURE A.8.3.1(b) Sample Maintenance Log — Routine Maintenance, Operation, and Testing (RMOT).

Maintenance Log (continued)

Frequency

W — Weekly S — Semiannually
M — Monthly A — Annually
Q — Quarterly Nos. indicate hours

Performed by

Item No.	Service Frequency		Date																											
	Level 1	Level 2	Fill in Appropriate Readings																											
(c)	M	M																												
(d)	M	M																												
(e)	M	M																												
(f)	M	M																												
6. (a)	W	M																												
(b)	A	A																												
(c)	Q	S																												
(d)	S	S																												
(e)	S	S																												
(f)	2 or M	2 or A																												
(g)	A	A																												
(h)	5 or A	5 or A																												
(i)	5/500 ^a	3/500 ^b																												
7. (a)	W	M																												
(b)	S	S																												
(c)	M	M																												
(d)	A	A																												
(e)	A	A																												
(f)	S	S																												
(g)	A	A																												
(h)	3/4 ^c	3/4 ^c																												
(i)	3/500 ^b	3/500 ^b																												
(j)	3/500 ^b	3/500 ^b																												
8. (a)	W	M																												
(b)	S	S																												
(c)	A	A																												
(d)	A	A																												
(e)	A	A																												
(f)	A	A																												
(g)	A	A																												
(h)	A	A																												
(i)	A	A																												
9. (a)	W	M																												
(b)	W	M																												
10.	W	M																												

^a Every 5 years or 500 hours

^b Every 3 years or 500 hours

^c Every 3 years for 4 hours

(NFPA 110, 2 of 2)

FIGURE A.8.3.1(b) *Continued*

A.8.3.5 Where sealed devices are used, replacement of the complete device might be necessary. (See NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance*.)

A.8.3.6 A battery load test should be performed quarterly.

A.8.4.1 See Figure A.8.4.1(a) and Figure A.8.4.1(b).

Operation and Testing Log

Performed by[illegible]

Date _____

[illegible]

Items

Fill in Appropriate Readings

[illegible]

FIGURE A.8.4.1(a) Sample Operation and Testing Log for Rotating Equipment.

Suggested Operation and Testing Procedures

Item Number	Function	Item Number	Function
1.	Perform maintenance per Figure A.8.3.1(a).	8.	Record initial oil pressure and battery-charging rate.
2.	Record running time meter reading at start and end of test.	9.	Record oil pressure, battery-charging rate, and water or air temperature after 15 minutes running time.
3.	Simulate normal power failure from a "cold start" by use of the test switch in automatic transfer switch or by opening normal power supply to EPSS.	10.	Return test switch to normal or reestablish normal power supply at such time to cause a minimum running time of 30 minutes under load.
4.	Observe and record time delay on start.	11.	Record prime mover and ac instruments just prior to transfer.
5.	Record cranking time (terminates when engine starts).	12.	Record time delay on retransfer.
6.	Transfer load to EPS. (See 8.4.1 and 8.4.2.)	13.	Record time delay on shutdown for units so equipped.
7.	Record ac voltage, frequency, amperage.	14.	Place unit in automatic operation mode.

FIGURE A.8.4.1(b) Operation and Testing Procedures Suggested for Level 1 and Level 2 Rotating Equipment.

A.8.4.2 Light loading creates a condition termed *wet stacking*, indicating the presence of unburned fuel or carbon, or both, in the exhaust system. Its presence is readily indicated by the presence of continual black smoke during engine-run operation. The testing requirements of 8.4.2 are intended to reduce the possibility of wet stacking.

A.8.4.2.3 The EPS should be exercised for the duration of its assigned class (*see Section 4.2*), or for a duration agreed to by the authority having jurisdiction not to exceed 6 hours, at least once annually under the conditions required by this section.

The intent of this requirement is to provide reasonable assurance that the EPS with all of its auxiliary subsystems is capable of running for the duration of its assigned class.

A.8.4.6 Circuit breakers should be tested under simulated overload conditions every 2 years.

A.8.4.8 The intent of this requirement is to provide reasonable assurance that the EPSS with all of its auxiliary subsystems is capable of running for the duration of its assigned Class with its running load. A full facility power outage is not intended for this test, but is recommended where a total facility power outage has not occurred within the last 48 months. Supplemental load banks are not required. After the test, the fuel supply should be replenished if necessary.



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Issue 37, September 6, 2006

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Preventing adverse events caused by emergency electrical power system failures

Health care facilities are highly dependent on reliable sources of electrical power. Therefore, electric power is a mission-critical resource. Each health care facility must assess the risk of electrical power failure – at various degrees of magnitude and impact severity – and make plans to deal with such an emergency. Planning and implementation of risk reduction approaches to addressing electrical power failure are the responsibility of the facility engineer, as well as organization management, the risk manager, incident command leaders, and the medical staff. By assuming access to emergency electrical power systems and implementing contingency plans for clinicians to follow during both short-term and sustained losses of power, health care organizations can reduce the risk of adverse patient care events.



A power failure can range in magnitude and impact from a relatively modest curtailment of power caused by a local power disruption to a catastrophic regional blackout caused by a violent storm or terrorist attack. As reflected in numerous media reports, clinical operations were negatively affected when normal power was lost during the Houston floods of 2001, the northeastern United States blackout in 2003, and major hurricanes Charlie, Francis, Ivan and Jean in 2004 and Katrina and Rita in 2005. Three incidents relating to failures of emergency electrical power systems are in the Joint Commission's Sentinel Event Database (reporting period from January 1995 to the present). These range from single unit failures to entire large medical centers, and each was associated with one or more patient deaths.

Meeting NFPA codes and standards only a start

Each health care facility must have an emergency power testing program that includes generator load testing and Emergency Power Supply System (EPSS) maintenance. The National Fire Protection Association (NFPA) establishes codes and standards on the minimum design, installation, and testing of these systems in the National Electric Code (NFPA 70), the Standard on Health Care Facilities (NFPA 99), and the Standard for Emergency and Standby Power Systems (NFPA 110). EPSSs meeting the NFPA codes and standards are designed for immediate life safety – in other words, to complete surgical or other procedures where lives are in balance or to evacuate the building in case of fire. These systems should be designed to “hold out” until normal power is restored.

However, recent experiences demonstrate that emergency power systems that meet these standards are not always sufficient during major catastrophes. This is because they can only support the power needs of a small percentage of the needed equipment and systems, or they are unable to supply power for an extended period of time. For example, in the wake of hurricane Katrina, many health care organizations did not have sufficient emergency power to cool or ventilate their facilities. In other instances, evacuation of patients was delayed because only one or two elevators could be operated. To assure optimal safety during catastrophes, health care organizations are encouraged to go beyond the minimum NFPA life safety requirements and to conduct thorough vulnerability analyses of their facilities.

The Joint Commission addresses emergency electrical power systems in standards EC.7.20 and EC.7.40 and addresses emergency procedures for utility system disruptions in standard EC.7.10. To address the need to provide emergency power for an extended period of time, an additional Element of Performance (EP) for standard EC.7.40 was recently approved and will appear in the 2007 standards. The new EP requires each organization to test its emergency generators at least once every 36 months for a minimum of four continuous hours. This testing is over and beyond the current requirement to test emergency generators for 30 continuous minutes 12 times each year. In addition, if a test(s) required by standard EC.7.40 fails, the organization is required to implement interim measures to compensate for the risk to patients, visitors, and staffs until necessary repairs or corrections are completed.

Risk reduction strategies

Important suggestions for proactively assessing a facility's vulnerabilities, helping to assure sufficient electrical power during emergencies, and facilitating the development of contingency plans for clinicians to follow in the event of short-term or sustained power loss include the following:

- Meet with your local utility provider and assess the reliability of the existing power system. Many facilities are served by overloaded power grids that have transformers and distribution equipment that date back to the 1950s. In other cases, expansions to the original power system have resulted in a "patchwork" system that may not operate reliably during periods of peak loads.
- Respond to facility brown-outs or black-outs as symptoms of marginal power supply. These may be related to the recent addition of new equipment.
- Fully test the entire emergency power supply system against the requirements of NFPA 110 to ensure minimum acceptable performance. Because appropriate testing may impact operations for periods of four hours or more, it is important that organization management, the medical staff, nursing, respiratory therapy, and other key staff participate in the test. The test should be scheduled well in advance of carrying it out, in the same way as any disaster drill would be planned. Electricians, mechanics, and other maintenance technicians should be stationed in strategic locations throughout the facility during testing to monitor the functioning of critical equipment and to minimize response time for problems that may occur. After testing, all fuel supplies should be replenished.
- For any new construction, undertake relevant infrastructure planning as part of a master facility plan. This will assure optimal location of the generator, fuel tank, and support equipment (for example, in flood prone areas, above potential flood levels) and proper redundancy (multiple generators feeding loads versus loads dedicated to a single generator). Such planning will also permit the addition of loads over time and will identify security needs respecting access to generators and other critical equipment such as fuel tanks and radiators, which are essential to generator function.
- Assess the need for additional redundancy through portable, truck-mounted generators and develop procedures to isolate generators from problem areas and to tie in supplemental equipment not normally fed by emergency power. Also, consider designing in emergency connection panels. These might, for example, be used to hook up a truck-mounted unit during construction or renovation.
- Maintain written procedures and record all test data. Written procedures help facility managers control the testing process and require testing personnel to take responsibility for performing required tasks. Many facilities use standardized testing forms to collect test-related data. Unanticipated occurrences should be reported immediately or right after the test for analysis by the supervisor in charge of the test. Mechanical system interactions can be recorded during the test on simple data forms to facilitate both data recording and system recovery. This information can also be used for performance improvement purposes.

Joint Commission Recommendations

In addition to the current standards requirements that address emergency electrical power systems and current NFPA testing requirements, the Joint Commission recommends the following to help prevent adverse events caused by an emergency electrical power system failure:

- t. Perform a gap analysis on the emergency power system that matches the critical equipment and systems needed in an extended emergency against the equipment and systems actually on the emergency power system. Use disaster scenario planning to identify critical systems that could potentially be lost (for example, potable water or elevators). This kind of planning will help assure that emergency power feeds critical systems such as water pumps in high-rise facilities; sewer pumps in low areas; heating, air conditioning and fan units in intense climate regions; and air handlers in isolation rooms (to minimize the risk of airborne infections), in protective environment rooms, and in laboratory and pharmacy hoods.
2. Maintain a complete, labeled inventory of all emergency power systems and the loads they serve.
3. Provide competency training and testing for all operators and others responsible for system maintenance of the emergency power supply system.
4. Test generator fuel oil, track expiration dates, and replace stale fuel oil not consumed within its storage life.
5. Ensure that engineering staff communicate the capabilities and limitations of the emergency power supply system to the organization's management and clinical leaders. These communications should cover how long emergency power will be available, how long it will take the generators to provide

Clinical Contingency Plans

Examples of provisions to include:

- Rapid deployment of battery-powered equipment (e.g., portable suction units).
- Assessment of critical equipment to ensure it is plugged into back-up power outlets.
- Identification of available HIT systems or manual back-up systems.
- Establishment of timelines and pre-arranged options for diverting, transferring or evacuating patients.

power if and when the utility company's power is lost, and what locations within the facility will and will not be powered by the emergency power.

6. Establish contingency plans for clinicians to follow during brief or sustained losses of emergency power and include this as part of the orientation and periodic continuing educational activities for medical and other clinical staff. These plans should focus on the requirements set forth in standard EC.7.20, to wit: organizations must supply reliable emergency power to alarm systems; exit sign and exit route illumination; emergency communication systems; blood, bone and tissue storage units; emergency/urgent care areas; at least one elevator for non-ambulatory patients; medical air compressors; medical and surgical vacuum systems; areas where electrically powered life-support equipment is used; and operating rooms, post-op recovery rooms, obstetrical delivery rooms, and newborn nurseries. Contingency plans must also address continued availability of essential health information technology (HIT) systems or of alternate (e.g., paper) systems. See sidebar box for examples of measures to include in the clinical contingency plan.

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- Care for ventilator-dependent patients and telemetry patients.
- Establishment of a command center.
- Provision for open lines of communication between on-site staff and any organization leaders who may be off-site.
- Access to and use of two-way radios.
- Establishment of a disaster bin for flashlights, extension cords, etc.
- Definition of precautions for immuno-compromised patients during HVAC failure.
- In the event of HVAC failure, provision for careful, manual monitoring of patient body temperatures.
- Establishment of a critical supply center for food, water, pharmaceuticals and linen.
- Assessment of critical refrigerators (pharmacy, lab, blood bank, etc.) to confirm power supply.
- Assessment of automated drug supply cabinets to confirm power supply.

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