

BHI Electrical Assessment Form

Existing PSA Plant

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This document was developed by [Build Health International](http://www.bhioxygen.org) to support global medical oxygen infrastructure planning, site preparation, operation, maintenance, and sustainability. Additional technical resources are available at www.bhioxygen.org.

Hospital Information			
Form Completed By	Name		
	Title		
Hospital / Facility Name			
Date of Visit			
Hospital Contact Information	Name		
	Title		
	Number (include country code)		
	Email		
	Preferred contact method	<input type="checkbox"/>	Phone
		<input type="checkbox"/>	WhatsApp
<input type="checkbox"/>		Email	
Drop a GPS pin at the hospital	<input type="checkbox"/>	Completed	
Drop a GPS pin at the PSA plant	<input type="checkbox"/>	Completed	
Photo of Hospital/Facility Sign	<input type="checkbox"/>	Completed	
Ask for a single-line diagram, if one was not provided before the assessment.	<input type="checkbox"/>	Completed	

Ask the hospital technician to describe the electrical system layout, from the existing power supplies (transformers, generators, solar) to the PSA plant loads. Cable sizes, breakers, switches, and other protections should be included. Provide a high-level overview here, sketched or written, to be confirmed later.

Power Supply Sources		
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Main Power Supply Overview		
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What is the main power supply to the PSA plant?	<input type="checkbox"/>	Utility (Transformers)
	<input type="checkbox"/>	Generator
	<input type="checkbox"/>	Solar
Is this power supply shared with other areas of the hospital?	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No (dedicated to the PSA plant)
If YES, list the other areas/loads connected to this power source.		

Backup Power Supply Overview		
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What is the backup power supply to the PSA plant? <i>Check all that apply.</i>	<input type="checkbox"/>	Generator(s)
	<input type="checkbox"/>	Solar
Is the backup power supply dedicated to the PSA plant or shared?	<input type="checkbox"/>	Dedicated
	<input type="checkbox"/>	Shared (if shared, specify which loads it shares with)

Transformers		
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With the hospital technician, identify the transformer(s) that are connected to the PSA plant, as primary or backup power supply. Repeat this section for multiple transformers.

Mark on a map of the hospital where the transformer is located.	<input type="checkbox"/>	Completed
Drop a GPS pin at the transformer	<input type="checkbox"/>	Completed
Measure the distance from the transformer to the transfer switch (ATS or MTS) and/or main distribution panel (MDP).	Distance to transfer switch:	
	Distance to MDP:	
Is the transformer dedicated to the hospital? <small>(the transformer is not shared with the community or another facility)</small>	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No
Who has ownership of the transformer? (in case an upgrade is needed, this will guide who is responsible financially)	<input type="checkbox"/>	Hospital
	<input type="checkbox"/>	Utility
Add the name and contact information of the point of contact for the transformer (hospital focal or utility company contact).		



Is the transformer accessible?	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No
IF YES: Take a clear picture of the transformer nameplate. For safety, keep a distance of 1-3 meters from the transformer.	<input type="checkbox"/>	Completed
IF NO: Please explain why the transformer is not accessible.		
<p><i>Using the picture of the transformer nameplate, fill in the fields below. If the transformer nameplate is not accessible (pole-mounted transformers), ask hospital staff if they know the following information. If the hospital staff does not know the transformer rating, they must contact the utility company to get the information.</i></p>		
If the transformer nameplate was not available, where / who did you get the following information from?		
What is the transformer's power rating? [in kVA or kW]		
Record the manufacturer name and model #		
Record the primary voltage [V]		
Record the secondary voltage [V]		
Record the number of phases		
Record the frequency [Hz]		
Take a clear picture of the outgoing transformer feeder (outgoing from transformer to the hospital)	<input type="checkbox"/>	Completed
<p><i>Information on the feeder can be found on a label on the cable sheath/insulation. If the label is not accessible, the feeder size can be estimated by measuring the outside diameter with calipers and taking note of the type of cable (armored/non-armoured, copper/aluminum etc, number of cores, etc.)</i></p>		
What is the outgoing transformer feeder size and type? (outgoing from transformer to the hospital)		

Main Distribution Panel (MDP)		
Mark on a map of the hospital where the MDP is located.	<input type="checkbox"/>	Completed
Drop a GPS pin of the MDP location (If it is at the same location as an existing pin, add it to the name of the pin)	<input type="checkbox"/>	Completed
Take a complete picture of the MDP	<input type="checkbox"/>	Completed
Take a clear photo of the bus bars to assess the current carrying capacity. If possible, hold up an object for scale reference. Be extremely careful not to contact the bus bars.		
MDP number of phases	<input type="checkbox"/>	Single-phase
	<input type="checkbox"/>	Three-phase



MDP rating [A]	
Number of connected circuits in the MDP	
Is there space to add an additional breaker or a spare breaker?	
What is the condition of the MDP? Perform a visual inspection. Record if it is well-organized, labeled, damaged, properly enclosed, any visibly loose connections, signs of overheating etc.	
Main Breaker	
Main breaker location (At times main breaker will be outside MDP)	
Take a picture of the main breaker	<input type="checkbox"/> Completed
Take a picture of the main breaker nameplate	<input type="checkbox"/> Completed
<i>Using the picture of the main breaker nameplate, fill in the fields below.</i>	
Main breaker manufacturer name & model #	
Main breaker amperage [A] rating	
Main breaker voltage [V] rating	
Number of breaker poles	
Breaker curve type (for Miniature Circuit Breakers (MCBs) only)	
Category of breaker (Often Type A or Type B)	
What is the condition of the main breaker? Perform visual inspection. Record any signs of damage, overheating, improper mounting, is it bypassed, etc.	
Take a picture of the adjustment dials	<input type="checkbox"/> Completed
<i>Using the picture of the main breaker adjustment dial, fill in the field below.</i>	
Record breaker adjustable ratings & range (I _r , I _n , etc.)	

Using a clamp meter, record amperage readings at main feeder (All phases and neutral)	L1: L2: L3: N:
Using a multimeter, record voltage readings at main breaker (All phases)	L1-N: L2-N: L3-N: L1-L2: L1-L3: L2-L3:
<i>Information on the feeder can be found on a label on the cable sheath/insulation. If the label is not accessible, the feeder size can be estimated by measuring the outside diameter with calipers and asking about the cable sheath type (XLD, armored, etc.).</i>	
Main breaker incoming feeder size (usually incoming from the transformer)	
Main breaker outgoing feeder size (usually outgoing to the transfer switch or MDP busbars)	

Generators		
<i>With the hospital technician, identify the generator(s) that are connected to the PSA plant, as primary or backup power supply. Repeat this section for multiple generators.</i>		
Is the generator the main power supply or a backup power supply?	<input type="checkbox"/>	Main Power Supply
	<input type="checkbox"/>	Backup Power Supply
Does it support the entire facility, or only a portion? If a portion, please elaborate. A portion could be defined as wards or equipment like CT scanner, MRI machine, X-ray, etc. <i>If portion of hospital; explain further:</i>	<input type="checkbox"/>	Entire Hospital
	<input type="checkbox"/>	Portion of Hospital:
Drop a GPS pin at the generator (If it is at the same location as an existing pin, add it to the name of the pin)	<input type="checkbox"/>	Completed
Take a picture of the nameplate. If for some reason you cannot see the nameplate, ask hospital staff for this information.	<input type="checkbox"/>	Completed

Generator prime [kVA or kW]		
Generator standby [kVA or kW]		
Generator manufacturer name & model #		
<i>Information on the feeder can be on a label on the cable sheath/insulation. If the label is not accessible, the feeder size can be estimated by measuring the outside diameter with calipers and asking about the cable sheath type (XLD, armored, etc.).</i>		
Generator outgoing feeder size and number of feeders (from the generator to the ATS)		
Generator running hours		
Backup system external tank?	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No
External tank size [Gallons or Liters]		
Were you able to test the generator without disrupting clinical operations?	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No
IF YES: How is the generator functioning?		
Generator Circuit Breaker <i>(The circuit breaker where feeder from the generator terminates)</i>		
Take a picture of the generator breaker	<input type="checkbox"/>	Completed
Take a picture of the generator breaker nameplate	<input type="checkbox"/>	Completed
<i>Using the picture of the generator breaker nameplate, fill in the fields below.</i>		
Generator breaker manufacturer & model #		
Generator breaker amperage [A] rating		
Generator breaker voltage [V] rating		
Number of breaker poles		
Breaker curve type (for Miniature Circuit Breakers (MCBs) only)		
Breaker trip curve type		
What is the condition of the generator breaker? Perform visual inspection. Record any signs of damage, overheating, mounting issues, is it bypassed, etc.		
Take a picture of the adjustment dials	<input type="checkbox"/>	Completed
<i>Using the picture of the generator breaker adjustment dial, fill in the field below.</i>		

Record breaker adjustable ratings & range (I _r , I _n , etc.)	
If possible (if the generator is running), use a multimeter to record amperage readings at generator breaker (All phases and neutral)	L1: L2: L3: N:
Using a multimeter, record voltage readings at generator breaker (All phases)	L1-N: L2-N: L3-N: L1-L2: L1-L3: L2-L3:
Generator breaker outgoing feeder size (usually outgoing to the transfer switch)	

Transfer Switch	
What two sources of power does the transfer switch change between?	
Where is the transfer switch located?	<input type="checkbox"/> It is part of the generator
	<input type="checkbox"/> With the Main Distribution Panel (MDP)
	<input type="checkbox"/> Wall-mounted apart from the MDP and generator
IF wall-mounted, measure the distance from the transfer switch to the MDP.	Distance to transfer switch (for backup system):
Transfer switch type	<input type="checkbox"/> ATS (Automatic Transfer Switch)
	<input type="checkbox"/> MTS (Manual Transfer Switch)
Mark on a map of the hospital where the ATS/MTS is located or drop a GPS pin. (If it is at the same location as an existing pin, add it to the name of the pin)	<input type="checkbox"/> Completed
Take a picture of the ATS/MTS nameplate	<input type="checkbox"/> Completed
Record the amperage [A] of ATS/MTS	
ATS/MTS manufacturer name & model #:	
How many poles does the ATS/MTS have? (Typically, 3 or 4)	



Is the ATS/MTS working?	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No

Solar (skip section if no solar power available at facility)

Panel rating [kW]	
Number of panels	
Batteries	
If there is a battery bank, record its capacity	
How old are the batteries?	
If it is visible on the battery label, record the chemistry of the batteries (Typically, lithium or acid)	

Grounding Configuration

Identify the type of earthing arrangement (typically able to do this at the MDP by checking the grounding cables from the utility)	<input type="checkbox"/>	TN-S
	<input type="checkbox"/>	TN-C
	<input type="checkbox"/>	TN-C-S
	<input type="checkbox"/>	TT
	<input type="checkbox"/>	IT
Identify location of earthing electrode(s) relevant to the PSA plant connection (the panel feeding that would likely the plant). Earthing electrode may not be present depending on the type of earth arrangement.		
If there is an earth electrode, measure earthing resistance of the earth electrode(s) [Ω]		
Take a picture of the clamp meter measuring the earthing resistance of the earth electrode.	<input type="checkbox"/>	Complete
What is the size of earth cable(s) linking the panel feeding the PSA plant to the earth electrode?		
Is the earth electrode(s) properly connected to the MDP earth bar and/or transformer neutral? (Follow cable from the earth electrode(s) to the transformer and/or MDP)		
Take a photo of the connection at the MDP earth bar.	<input type="checkbox"/>	Complete
Does the generator have its own earth electrode?		



Oxygen Plant Subpanel		
Drop a GPS pin at the location of the oxygen plant subpanel	<input type="checkbox"/>	Completed
Number of circuits in oxygen plant panel		
Take a photo of the panel showing all breakers. If available, include the panel schedule or any circuit labels.	<input type="checkbox"/>	Completed
If it is not possible to take a photo, identify the different breakers in the panel and record the load they are feeding. Note Amp rating, type, and feeder size.		
Are the rotary screw compressor(s), booster compressor(s), and oxygen concentrator(s) each on their own circuit?	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No
Take a photo of the oxygen panel main breaker	<input type="checkbox"/>	Completed
Oxygen panel main breaker size [Amps]		
Oxygen panel main breaker trip type		
Oxygen panel main breaker # of poles		
Take a photo of panel condition	<input type="checkbox"/>	Completed
Note the condition of the panel. Elaborate if it is very poor (visual inspection, is it waterproof, exposed, etc.)		
Take a photo showing condition of breakers	<input type="checkbox"/>	Completed
Note the condition of the breakers. Elaborate if it is very poor (evidence of overheating, are they properly installed, etc.)		
Size of incoming feeder to oxygen panel		
Approximate length of incoming feeder to oxygen panel		
Type of incoming feeder to oxygen panel		
Method of installation of feeder? For example: underground, in conduit, in trays, etc.		
Is it earthed (is there an earth rod)?	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No
Identify extra capacity in the PSA sub-panel: Is there a blanking space or free breaker that would allow for upgrade or additional PSA machinery?	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No

Any additional details of note?	
Using a clamp meter, record amperage readings at the incoming feeder while the plant is running (All phases and neutral)	L1: L2: L3: N:
Using a multimeter, record voltage readings at the oxygen plant main breaker while the plant is running (All phases)	L1-N: L2-N: L3-N: L1-L2: L1-L3: L2-L3:

Oxygen Plant Subpanel (Continued)			
Does the plant have a surge suppressor/protector?	<input type="checkbox"/>	Yes	
	<input type="checkbox"/>	No	
If YES:	What does it cover?	<input type="checkbox"/>	PSA Plant only
		<input type="checkbox"/>	Entire facility
	Current rating (kA)		
	Location in system		
	Make & model		
	Take a photo of the nameplate	<input type="checkbox"/>	Completed
Does the plant have an automatic voltage stabilizer?	<input type="checkbox"/>	Yes	
	<input type="checkbox"/>	No	
If YES:	What does it cover?	<input type="checkbox"/>	PSA Plant only
		<input type="checkbox"/>	Entire facility

	Size (kVA)		
	Location in system		
	Make & model		
	Take a photo of the nameplate	<input type="checkbox"/>	Completed

Circuit - Rotary Screw Compressor
Repeat this section for any additional rotary screw compressors

Compressor Nameplate Photo (showing make, model, serial, and power information)	<input type="checkbox"/>	Completed
Does the compressor have a VSD?	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No
Does the plant have a phase monitoring/phase protection relay?	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No
IF YES: Is it original or was it added after installation?	<input type="checkbox"/>	Original
	<input type="checkbox"/>	Added after installation
Compressor kVA Rating		
Compressor Number of Phases		
Compressor Voltage		
Circuit Breaker Size		
Circuit Breaker # of poles		
Circuit Breaker Type		
Circuit Breaker Photo	<input type="checkbox"/>	Completed
Feeder Size (incoming to circuit breaker)		
Feeder Size (to equipment)		
Method of installation of feeder? For example: underground, in conduit, in trays, etc.		
Is the rotary screw compressor grounded (does it have a ground wire)?	<input type="checkbox"/>	Yes
	<input type="checkbox"/>	No

Circuit - Oxygen Concentrator
Repeat this section for any additional oxygen concentrators

Oxygen Concentrator Nameplate Photo (showing make, model, serial, and power information)	<input type="checkbox"/>	Completed
Oxygen Concentrator kVA Rating		



Oxygen Concentrator Number of Phases	
Oxygen Concentrator Voltage	
Circuit Breaker Size	
Circuit Breaker # of poles	
Circuit Breaker Type	
Circuit Breaker Photo	<input type="checkbox"/> Completed
Feeder Size (incoming to circuit breaker)	
Feeder Size (to equipment)	
Method of installation of feeder? For example: underground, in conduit, in trays, etc.	
Does the PSA plant have an internal UPS or backpack battery for the controls?	<input type="checkbox"/> Dedicated UPS
	<input type="checkbox"/> Backpack battery
	<input type="checkbox"/> Neither
Is the oxygen concentrator grounded (does it have a ground wire)?	<input type="checkbox"/> Yes
	<input type="checkbox"/> No

Circuit - Cylinder Filling Booster Compressor (if applicable) <i>Repeat this section for any additional booster compressors</i>	
Booster Compressor Nameplate Photo (showing make, model, serial, and power information)	<input type="checkbox"/> Completed
Booster Compressor kVA Rating	
Booster Compressor Number of Phases	
Booster Compressor Voltage	
Circuit Breaker Size	
Circuit Breaker # of poles	
Circuit Breaker Type	
Circuit Breaker Photo	<input type="checkbox"/> Completed
Feeder Size (incoming to circuit breaker)	
Feeder Size (to equipment)	

Method of installation of feeder? For example: underground, in conduit, in trays, etc.	
Is the booster compressor grounded (does it have a ground wire)?	<input type="checkbox"/> Yes
	<input type="checkbox"/> No

Circuit - Low-Pressure Booster Compressor (if applicable)	
<i>Repeat this section for any additional low-pressure booster compressors. These will be used to adjust delivery pressure to the Medical Gas Distribution System (MGPS) in some cases.</i>	
Low-Pressure Booster Compressor Nameplate Photo (showing make, model, serial, and power information)	<input type="checkbox"/> Completed
Low-Pressure Booster Compressor kVA Rating	
Low-Pressure Booster Compressor Number of Phases	
Low-Pressure Booster Compressor Voltage	
Circuit Breaker Size	
Circuit Breaker # of poles	
Circuit Breaker Type	
Circuit Breaker Photo	<input type="checkbox"/> Completed
Feeder Size (incoming to circuit breaker)	
Feeder Size (to equipment)	
Method of installation of feeder? For example: underground, in conduit, in trays, etc.	
Is the low-pressure booster compressor grounded (does it have a ground wire)?	<input type="checkbox"/> Yes
	<input type="checkbox"/> No

Overview	
Utility Power Supply	
<i>When applicable, obtain information by asking hospital staff the following questions and record their responses in detail</i>	
How reliable is electricity at the facility?	
How often is electricity lost on average? (number of times per day or per week)	



When electricity is lost, how long is it lost for? (minutes, hours, etc.)	
Any other observations on power usage and quality?	
<i>General</i>	
Any major electrical safety concerns at time of assessment (even if unrelated to the PSA plant)?	
Any major concerns of the electrical infrastructure from the transformer to the MDP?	
Any major concerns of the electrical infrastructure from the backup system to the MDP?	
Any major concerns of the electrical infrastructure from the MDP to the PSA plant?	
Do the current primary and backup power supplies have adequate capacity to support the PSA plant? If NO, please identify other potential sources of power.	
Please comment on the capacity of the electrical system for an expansion of the medical oxygen system and/or additional machinery.	
Any further information?	

For all electrical systems, fill in the tables below.

Additional Elements			
<i>Repeat this section for all additional elements. Additional elements include capacitor bank, Automatic Voltage Regulator (AVR), surge arrester, large UPS, etc.</i>			
	AVR	Additional Element #2	Additional Element #3
Additional Element Type			
Manufacturer			



Model #			
Electrical Characteristics			
Location in system			
What is the reason why this element was installed?			