Build Health International

PSA Plant Repair Assessment

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

This form is used to gather information about an existing PSA plant. The information gathered (the form and the accompanying photos) should be sent to Build Health International for further analysis.

Facility Information			
Form Completed By	**Name**		**Title**
Hospital/Facility Name			
Hospital Address (District, Town, Region, etc)			
Date of visit			
Hospital Contact Information	**Name**		**Title**
	Number (include country code)		**Email**
	Preferred contact method	☐	**Phone**
		☐	**WhatsApp**
		☐	**Email**
PSA Plant Operator / Engineer Contact Information	**Name**		**Title**
	Number		**Email**
	Best mode of contact	☐	**Phone**
		☐	**Whatsapp**
		☐	**Email**
Total Bed Capacity of Hospital			

Preliminary Information		
Drop a GPS pin at the hospital entrance	☐	**Completed**
The following questions are best answered by asking hospital administrators and staff.		
Name of oxygen plant installer		
Year of installation		
Does the hospital supply cylinders to other facilities?	☐	**Yes**
	☐	**No**
IF YES: How many facilities?		
Take a walkthrough video of the entire plant	☐	**Completed**
Hospital Oxygen Diagram: Either draw or provide in writing, a "one-line" of the oxygen system identifying what is piped to or connected to what, and how oxygen gets to bedside in different wards. (graph paper provided on the following page) *Include a key for any symbols you create and label every component*		
Describe oxygen consumption and demand at the hospital (try to quantify—for example, how many cylinders/week do they use? How many patients need oxygen each week? Is the current supply able to meet demand?) *It may be necessary to ask clinical staff about oxygen use and PSA plant operators about oxygen production to understand the full context.*		

PSA Plant Information		
Drop a GPS pin at the PSA plant location	☐	**Completed**
Describe the location of the plant on the hospital compound (e.g. behind maternity block, east of administration, etc.)		
Type of PSA plant installation	☐	**Individual components in plant house or room**
	☐	**Skid-mounted in plant house or room**
	☐	**Containerized**
	☐	**Other (Please specify)**
Is the PSA plant a duplex plant?		
If the PSA plant is a duplex, with two independent lines producing oxygen that may or may not converge into a single oxygen output, assign each side of the duplex a name. Line A and Line B, or Line 1 and Line 2, etc. In the fields below, note the information for both sides of the duplex plant.		
Manufacturer of PSA plant		
Model # of PSA plant		
Serial # of PSA plant		
Capacity of the plant [SCFH, Nm3/hr, LPM, cyl/day]		
PSA Plant Diagram: For the oxygen generating system, draw a line diagram. This diagram should capture all equipment inside the PSA plant house or container and how it is connected. If the plant is a duplex or has more than one instance of a piece of equipment, use names like “Air Compressor 1” and “Air Compressor 2” to differentiate.		

Complete the following sections for each component of the PSA plant. If the PSA plant is a duplex, complete the following fields for one side of the duplex. Then, collect the information for the other side using the additional space in Annex 1. If there is more than one instance of a piece of equipment, be sure to mark which section is completed for which piece of equipment. Naming conventions used below should match the PSA Plant Diagram.

Air Compressor		
What is the type of air compressor? Check the compressor manual to confirm.	☐	**Oil-injected**
	☐	**Oil-free**
If you are assessing an oil-free compressor, some of the fields below will not apply. Write N/A where necessary.		
Manufacturer of air compressor		
Model # of air compressor		
Running hours of air compressor		

Size of Compressor Motor [hp or kW]		
Take clear photo(s) of the air compressor	☐	**Completed**
Take a clear photo of the air compressor nameplate	☐	**Completed**

Do any air compressor components need replacement or service?
Ask the operator when the last service was for each component and write findings from visual inspections.

Component	Visual Inspection	Last Service Date/Findings	Photo Taken?
Dryer (if internal)	Is the radiator dirty? **If running:** Is pressure dew point temperature 3-6C? (give it a while to run)		☐
Auto Drains	Do they come on? Does air and water come out? Do you see the hose move?		☐
Aftercooler	Are the grates of the fan clean? **If running:** Do the fans run?		☐
Drive belt (if present)	Are there any signs of wear? Is it loose or shredded?		☐
Air inlet filter	Is the filter dirty or clogged?		☐
Oil air separator	No visual inspection. Mark last service only.		☐
Oil filter			☐
Inlet valve			☐
Thermostatic valve			☐
Minimum pressure valve			☐
Other			

If the air compressor is functioning optimally, skip the following section:

How long has the compressor been faulty?		
Are there alarms / errors / error codes on the display?	☐	**Yes**
	☐	**No**
	☐	**N/A**
IF YES: Provide photos of all error messages and note them.	☐	**Completed**

Does the compressor build pressure? Check the display screen. Take a photo	☐	**Yes**
	☐	**No**
Are there signs of air leaks in the line? Listen for the sound of gas escaping, with the compressor on and immediately after the compressor turns off. Feel with your hands for signs of gas leaks.	☐	**Yes**
	☐	**No**
IF YES: Take clear photos or videos and provide a description of the areas specified.	☐	**Completed**
Are there signs of oil leaks in the compressor?	☐	**Yes**
	☐	**No**
	☐	**N/A (oil-free compressors)**
IF YES: Take a clear photo or video of the oil leak(s)	☐	**Completed**
Are there signs of oil on the outlet air fittings?	☐	**Yes**
	☐	**No**
	☐	**N/A (oil-free compressors)**
IF YES: Take a clear photo or video where possible.	☐	**Completed**
If the unit is depressurized, check for signs of oil in the inline/coalescing filters.		
IF YES: Take a clear photo or video where possible.	☐	**Completed**
Take a video of quickly opening a valve at the bottom of the air tank	☐	**Completed**

If there is an external dryer, complete the following section:

External Dryer		
Manufacturer of air dryer		
Model # of air dryer		
Serial # of air dryer		
Take a clear photo of the air dryer	☐	**Completed**
Take a clear photo of the air dryer nameplate	☐	**Completed**
Take a clear photo of filter housing on the outlet of the air compressor showing the filter information	☐	**Completed**
What is the status of the air compressor?	☐	**Operating optimally**

	☐	Fault, but operating
	☐	Receiving power, will not cycle
	☐	Will not power on

In-line Coalescing Filters		
Take a clear picture of inline/coalescing filters	☐	Completed
Take a clear picture of inline/coalescing filters serial number or model number	☐	Completed
Open the inline/coalescing filters and take a photo of the inside. Only possible if the plant is not running.	☐	Completed
What kind of drain does the inline/coalescing filter have?	☐	Manual
	☐	Automatic mechanical (automatic with no wire)
	☐	Automatic electrical (automatic with a wire running to it)
Test the drain, if possible. Is it functioning optimally? IF NO, provide a detailed description of issues	☐	Yes
	☐	No _____ _____
Move down the line from the in-line filters to the air tank. Is there an excessive amount of oil and water draining from the air tank?	☐	Yes
	☐	No

Oxygen Concentrator		
Manufacturer of oxygen concentrator		
Model # of oxygen concentrator		
Serial # of oxygen concentrator		
Running hours of oxygen concentrator		
Take a clear picture of the oxygen concentrator	☐	Completed
Take a clear picture of the oxygen concentrator nameplate	☐	Completed
Take a clear photo of all pneumatic valves (solenoid valves)	☐	Completed
Does the PSA display turn on (regardless of concentrator condition)?	☐	Yes
	☐	No
	☐	N/A
If the display does not turn on, is the PLC getting power?	☐	Yes
	☐	No

	☐	**N/A**
Are there any error codes? (Look at the PSA display)	☐	**Yes**
	☐	**No**
IF YES: Provide error codes		
Take a clear picture of the pre-oxygen concentrator filters. These are filters between the air tank and oxygen concentrator.	☐	**Completed**
Take a clear picture of pre-oxygen concentrator filters' serial numbers or model numbers.	☐	**Completed**
Open the pre-oxygen concentrator filters and take a photo of the inside. Only possible if the plant is not running.	☐	**Completed**
Take a clear picture of the bacteria/oxygen filter. This is the filter after the oxygen concentrator.	☐	**Completed**
Take a clear picture of the bacteria/oxygen filter's serial number or model number	☐	**Completed**
Take a clear photo of the state of the bacteria/oxygen filter. Only possible if the plant is not running.	☐	**Completed**

	Component	**Service Notes** Mark last serviced date and indicate if service is due
Check the service logs and oxygen concentrator manual. Are any components due for service?	**Pre-oxygen concentrator filters**	
	Valves	
	Zeolite	
	Bacteria/oxygen filter	
	Other:	

Is the oxygen concentrator operational?	☐	**Yes**
	☐	**No**
If NO: what is the cause or suspected cause?		
How long has the oxygen concentrator been broken?		
Additional description of oxygen		

concentrator		
Are there signs of oil or dusting on the muffler? If yes, take a clear photo.	☐	**Yes**
	☐	**No**
IF YES: Take a clear photo of muffler	☐	**Completed**
*Complete the following section if the oxygen concentrator **turns on**.*		
Take a video of the generator going through an entire cycle (including pressure gauges for both sieve beds)	☐	**Completed**
Are the valves cycling properly? If you are not sure, be certain to take a video to share with other biomedical engineers to confirm.		
Record the oxygen purity as shown on the oxygen concentrator display.		
Record the oxygen purity as shown by a handheld oxygen analyzer.		

Low Pressure Booster		
Manufacturer of low pressure booster		
Model # of low pressure booster		
Serial # of low pressure booster		
Running hours of low pressure booster		
Take a clear photo of the low pressure booster compressor.	☐	**Completed**
Take a clear photo of the low pressure booster compressor	☐	**Completed**
What pressure does it build to?		
Does the compressor make any knocking sounds?		

High Pressure Booster Compressor (Cylinder-Filling)		
Does the plant fill cylinders?	☐	**Yes**
	☐	**No**
If the plant does not fill cylinders, skip this section.		
Manufacturer of oxygen booster compressor		

Model # of oxygen booster compressor		
Serial # of oxygen booster compressor		
Size of cylinders being filled		
Take a clear photo of the oxygen booster compressor	☐	**Completed**
Running hours booster compressor		
How long does it take to fill one cylinder?		
What does the pressure build to at each stage? Note: Your booster compressor may have any number of stages.	**Suction/Inlet**	
	Stage 1	
	Stage 2	
	Stage 3	
	Stage 4	
Does the compressor make any knocking sounds?		
Does the fly belt need to be replaced? (is it shredded or loose)		
When was the last service completed on components that receive preventative maintenance?		
Are there any other components that need to be replaced? For example: Pressure gauges, pressure relief valves, pressure switches, cooling fans, etc.		

Oxygen Cylinders and Manifolds		
How many cylinders per header does the filling manifold have? (if cylinder filling is present)		
Take clear photos of cylinder name tags	☐	**Completed**
Take clear photos of cylinder valve, including the letters and numbers on the valve	☐	**Completed**
Take clear photos of the manifold gauges/regulators	☐	**Completed**
Take clear photos of cylinder manifold header bar	☐	**Completed**
If present, take clear photos of the manifold nameplates	☐	**Completed**
Take clear photo of manifold pigtails/whips	☐	**Completed**
Take clear photo of the end of the pigtails/whips (the connection point to the cylinder)	☐	**Completed**
What type of pigtails/whips are present? (This may require contacting the vendor and comparing with the photo after assessment is complete.)		
Describe the other types of manifolds on site and their quantities (backup, supply, filling)		

Take clear photos of all manifolds on site	☐	**Completed**
Drop a GPS pin of all manifolds on site	☐	**Completed**
If there are supply manifolds, what is the output pressure to the piping network?		
Number of working cylinders available in the facility?		
Are there safety carts for transporting cylinders?	☐	**Yes**
	☐	**No**
	☐	**N/A**
IF YES: How many?		
Were there any damaged cylinders found?	☐	**Yes**
	☐	**No**
	☐	**N/A**
IF YES: How many damaged cylinders were found? What type of damage was found?		
IF YES: Take a clear photo of cylinder damage.	☐	**Completed**
Where are cylinders stored?		
Drop a GPS pin at the cylinder storage location	☐	**Completed**
Take a clear photo of the cylinder storage location	☐	**Completed**
Are the cylinders stored properly? (Properly means: upright and restrained, filled cylinders stored separate from empty cylinders and clearly labeled, not mixed with other gas types)	☐	**Yes**
	☐	**No**
	☐	**N/A**

Piping & Outlets		
Number of hospital beds and types of beds receiving piped oxygen. Ask hospital staff for this information.		
Drop and label GPS pins at buildings with direct piping connections	☐	**Completed**
Drop and label GPS pins in wards receiving oxygen piped from supply manifolds	☐	**Completed**
Standard of oxygen outlets being used (if available) The outlet should say the standard on it.	☐	**British Standard**
	☐	**French Standard**
	☐	**German Standard**
	☐	**Other (please specify)**
What types of pipes are installed?	☐	**Copper Pipes**
	☐	**Aluminum Pipes**

	☐	**Other (please specify)**
Are the pipes correctly labeled? (pipes should be labeled for oxygen with directional arrows)	☐	**Yes**
	☐	**No**
	☐	**N/A**
Please comment on the general piping system condition (Presence of zone valves and alarms, adequate piping size, reported leaks, pressure drops, adequate supports)		

Building Infrastructure		
How is ventilation provided in the plant?	☐	**Windows**
	☐	**Extractor Fan**
	☐	**Air Conditioning**
	☐	**Other (please specify)**
Take a photo of how ventilation is provided	☐	**Completed**
What is the temperature in the plant room or container?		
Is the air compressor ducted outside the building?	☐	**Yes**
	☐	**No**
Describe the overall cleanliness/condition of the plant.		
Is there sufficient lighting in the plant room?	☐	**Yes**
	☐	**No**
Is there sufficient dust control in the plant room?	☐	**Yes**
	☐	**No**
Are there any pollution sources nearby (i.e generator exhaust, idling cars, incinerators)	☐	**Yes**
	☐	**No**
Is there an alarm system at the PSA plant?	☐	**Yes**
	☐	**No**
Is there safety signage visible in the plant room?	☐	**Yes**
	☐	**No**
Is there a fire extinguisher in the plant room?	☐	**Yes**
	☐	**No**
IF YES, is the fire extinguisher expired?	☐	**Yes**
	☐	**No**
Are there flammable items in the plant room? (for example: oily rags, paper, wood)	☐	**Yes**
	☐	**No**

Maintenance		
Describe the spare parts available at the facility.		
Who, of the hospital or facility staff, performs maintenance on the plant?		
Who, from the supplier, manufacturer, or external / third party service provider performs maintenance on the plant? Please provide name and contact information.		
Is there a log book available?	☐	Yes
	☐	No
IF YES: Take a clear photo of the log book.	☐	Completed
Are there any challenges with maintenance?	☐	Yes
	☐	No
IF YES: Describe the challenges observed.		
Are the plant equipment manuals accessible?	☐	Yes
	☐	No
Does the facility maintenance team have appropriate tools?	☐	Yes
	☐	No
IF NO: What tools does the team need?		
Additional notes about maintenance:		