



**NATIONAL
BUILDING
REVIEW
BOARD**

Safe Building, Better Living

**SAFETY
GUIDELINES FOR
DESIGN,
INSTALLATION,
OPERATION AND
MAINTENANCE OF
BIOMASS-FIRED
SAUNA, STEAM
AND HOT WATER
GENERATION
EQUIPMENT FOR
HEALTH CLUBS**

NOVEMBER, 2023

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FOREWORD

The National Building Review Board (hereafter, NBRB), a semi-autonomous body under the Ministry of Works and Transport, was established under section 3 of the Building Control Act, 2013 to among others, monitor building developments; and as such promote and ensure planned, decent and safe building structures that are developed in harmony with the environment.

On July 2, 2021, a local health club in Wakiso called Experience Inn was in operation when an explosion occurred claiming two lives. The investigation revealed that the primary cause of the explosion was over-pressure resulting from over-heating the water in the steam tank that had no pressure release mechanism.

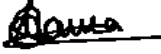
The NBRB then commissioned a study of sample health clubs in Central, Western and Eastern Uganda with the main aim of preventing re-occurrence of similar incidents in the future by:

- (1) Examining the safety of the design and installation methods around the country;
- (2) Carrying out a comparative evaluation of the different steam and sauna heating equipment;
- (3) Evaluating the technical skills required for operating the steam and sauna heating equipment;
- (4) Recommending to stakeholders on how to make the different installations safe for both the users and the operators.

The study, which sampled 21 health clubs, revealed that most of the health clubs in Uganda were installed with wood fired steam baths and sauna heaters as opposed to the other types available for instance electric or gas fired, among others. The electric types had been standardised with precautionary measures against system overloads which was not the case with the wood fired ones. Many of the designs and installation methods were not based on engineering principles but rather obtained skills learnt on-job. This resulted in unsafe installations with no monitoring and control mechanisms; and hence increased risks of explosions and fire outbreaks.

A Risk Assessment done as part of the study concluded that for every 10 health clubs, 9 are potentially explosive and require corrective action. Among the proposed interventions was to prepare Safety guidelines for Health Clubs. These guidelines were approved by the 28th National Building Review Board meeting held on October 31, 2023, under minute 28/6/3.

Finally, the material and information contained in these guidelines is for general information and ease of reference only. The information in the guide is not intended to substitute the laws, regulations and code cited in this guide. Users of the guide are encouraged to refer to the detailed text of the relevant law.



Eng. Flavia G. Bwire (Mrs.)
EXECUTIVE SECRETARY

CITATION

These guidelines shall be cited as the 'guidelines for design, installation, operation and maintenance of biomass-fired sauna, steam and hot water generation equipment for health clubs.

The guidelines shall be read in consultation with the provisions of the Occupational Safety and Health Act (OSHA), 2006 section 76.

Doc No. NBRB/BM/001	Prep. Date:	Review Due Date: November 2028
Rev. No.	Effective Date:	

1. Purpose

This is a guidance document intended to assist the designers, developers, managers, operators, and maintenance personnel of new and existing biomass fired steam and sauna heating equipment in addressing the following issues:

- The safe and efficient design, installation and operation of the equipment;
- Determining adequate supervision and maintenance requirements (levels and competence) that are consistent with the installed plant and its location;
- Reducing the likelihood of explosion or other dangers from events such as:
 - Loss of feed water or low water level;
 - Over-pressure;
 - Overheating e.g. due to excessive scale.

The guidance document is primarily intended for Health clubs but may be applicable to other institutions with similar equipment such as Hospitals, Hotels, Schools, among others.

2. Definitions

2.1 Sauna

A Sauna consists of an insulated enclosure made of wood, together with heat generating equipment usually in the form of a heat-generating stove. Benches are provided within the sauna enclosure. Saunas provide a dry heat and the temperature may range from 85°C to 100°C for up to a 10-minute treatment.

2.2 Steam room/bath

This consists of an enclosure made of an impervious material and steam generating equipment. It is designed to operate at temperatures of up to 50°C regulated by a thermostat with relative humidity of 80 to 100%. Wet humid

heat is produced as well as intended for indoor use usually lasting 6 to 12-minute treatment.

2.3 Cleaning

This is a physical process which removes soil e.g. dust, dirt and organic matter, along with a large proportion of germs. Cleaning with hot water and detergent breaks up grease and dirt on floors and surfaces. Cleaning is also essential prior to disinfection and sterilisation of instruments and equipment.

2.4 Disinfectant

For the purposes of cleaning, a high-level disinfectant relates to disinfectants capable of reducing the number of viable bacteria and blood borne viruses including Hepatitis B & C and HIV but may not necessarily inactivate some viruses and bacterial spores. Where the disinfectant requires dilution, this must be carried out in accordance with the manufacturer's instructions using clean potable water. Once diluted the disinfectant must be used in accordance with the manufacturer's instructions.

2.5 Biomass

Biomass energy is a renewable and sustainable source of energy derived from organic matter. Biomass energy includes energy generated from wood and wood waste, biogas from landfill waste, sewage and industrial wastewater, animal waste, and solid waste (household garbage like paper, cardboard, food waste, plastics, glass and metals).

2.6 Hydro pneumatic device

A device that maintains the pressure of a system within a selected pressure range.

2.7 Developer/ Owner

A person or organization to whom the development belongs and/or operates the health club.

2.8 Employers

A person or organization that hires the workers at the health club.

2.9 Equipment Operator Manager

A qualified and trained person in line with Occupational Safety and Health Act, 2006, S. 76.

2.10 Competent Equipment Operator

A qualified and trained person in line with Occupational Safety and Health Act, 2006, S. 76 with a license to operate boiler equipment.

3. Recommended Safety Considerations in the Design and Construction of the Steam Bath and Sauna Equipment

3.1 General

Unlike the electric steam and hot water generators that are manufactured with standardized precautionary measures against system overloads, the locally fabricated biomass fired steam and hot water generation systems designs and installation methods are not based on engineering principles but rather obtained skills on-job. This has resulted in unsafe installations with no monitoring devices (temperature, pressure) and control mechanisms thus increasing the risks of explosions and fire outbreaks in health clubs and putting the safety of the users at stake.

Many trades and professions are involved in the design, construction, operation and maintenance of steam and hot water generator systems, so it is essential that all equipment, instrumentation, and controls are designed and installed by suitably qualified and experienced personnel.

The design should be based on the results of a risk assessment and relevant information from the appropriate design standards. Steam and sauna system designs shall address the following safety issues as a minimum:

- Ventilation - ensure adequate air supply for combustion in line with the National Building Code.
- Electrical installation - designs to comply with the National Building Code.
- Pressure management mechanism.
- Temperature monitoring mechanism.

The design, installation and operation of a wood fired steam and sauna equipment shall consider the requirement of the Building Control Act, 2013, Building Control Regulations, 2020 and the National Building Code, 2019.

3.2 Common System Components

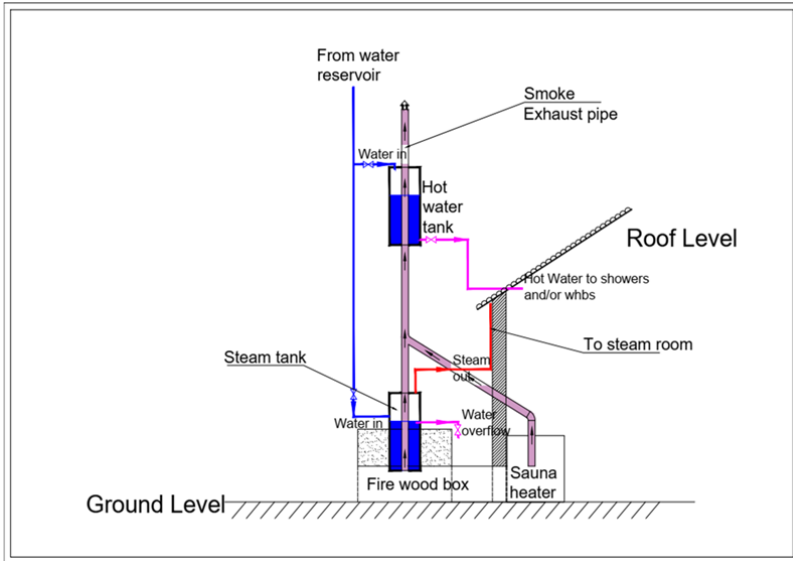


Figure 1 : The main Components of a steam and hot water generation as well as a sauna heater

3.3 Safety Considerations for Steam Room Design and Construction

Steam rooms can be constructed in virtually all sizes and shapes as long as they meet the minimum requirements. The following considerations shall be made:

- a) The Steam Room must be fully enclosed, complete with walls, door, flooring and ceiling;
- b) Materials used for the walls and ceiling should have water-resistant, non-corrosive surfaces such as tiles, marbles, molded acrylic, or other non-porous materials;
- c) If tiles are used for the flooring or some other smooth surface material, provide suitable anti-skid strips or rubberized mats to prevent slipping resulting to injury;
- d) The ceiling should be dome-shaped or laid to a slope to prevent the dripping of condensate;

- e) The Steam Room ceiling height should be limited to a maximum height of 2.5 meters to maximize efficiency and avoid larger capacity steam generators;
- f) A drain must be provided in the flooring;
- g) Heating, ventilation or air conditioning devices should not be installed inside the Steam Room;
- h) Rubber linings (e.g. gaskets) are recommended for the door to effectively seal the heat and the steam inside the Steam Room;
- i) A flap vent of a size equivalent to the size of steam inlet pipe shall be installed at high level in the steam room;
- j) A temperature gauge should be installed in the steam room (the sensor within the room with the reading just outside the room) for the users to monitor the temperature and prevent overheating;
- k) The Pressure and Temperature gauges should be marked with green for the low reading and red with the high reading so that operators and users can easily determine the status of the system;
- l) a clock/timer shall be visible to users of the facility to ensure they are aware of their usage time;
- m) For efficiency, it is recommended that the steam generator be installed outside the steam room within 15 meters.

3.4 Safety Considerations for Water Supply Piping

- a) It is not advisable to use black or galvanized pipe for the plumbing as it can easily crack or get damaged. PPR, cPVC or even copper may be used.
- b) Install stop valve in the water supply line. The stop valve should be installed in a place where it is easily accessible in case of an emergency.
- c) Flush the water supply line completely before connecting the water pipe to the steam generator, to remove any sediments in the water.
- d) The water pressure should be at best between 15(1bar) and 20 PSI(1.4bars). If necessary, decrease the pressure accordingly.
- e) If necessary, install a Hydro pneumatic device to help reduce pressure spikes.

- f) Tap water contains impurities, for example, lime, that can cause calcium deposits and block the internal parts of the steam generator. To prevent this and prolong the lifespan of the steam generator, it is recommended to install a water filter and water softener.

3.5 Safety Considerations for Steam Piping

- a) Do not install any stop valves in the steam pipes. The steam should never be obstructed.
- b) Install a copper pipe as the steam pipe between the steam generator and the steam nozzle.
- c) The heat insulation material used to insulate the steam pipe should be resistant to temperatures as high as 120°C or higher.
- d) Slope the steam pipe by 20mm per meter towards the steam head to avoid trapping of the condensate and eliminate steam trap that blocks the flow of the steam. Do not bend it in a shape to make sure that cooled water will not stay in the curve of the steam pipe.
- e) The shorter the distance, the better. Try to decrease the number of elbows to prevent creating valleys or traps.
- f) Valves and piping must be selected to work within the expected operating pressure and flow rates.
- g) Pipe sizing and valve selection require careful study of the pressure drops to provide the required pressure at the operating equipment with the expected flow rates.

Note:

- i. *The single largest issue with piping is proper sizing, which enables the system to work properly. Obtaining the proper flow without too much pressure drop is the key issue. Care must be taken to be make sure that the requirements of the piping are met.*
- ii. *The design of the steam and hot water piping, including the type and thickness of the materials, is covered in the American Society of Mechanical Engineers (ASME) code – ASME B31, BPVC.*

3.6 Safety Considerations for Steam Head

- a) Steam Head and the steam outlet get very hot, try to avoid installing the steam head in a position which will easily come into contact with the person bathing.
- b) Install the steam head at least 6 inches above the ground. If the steam room material is acrylic or non-heat resistant sheet, please consult with material manufacturer about steam room applications.
- c) The steam head outlet should be installed face down. To prevent scalding a bather with steam or hot water.
- d) Tighten steam head by hand. Do not use a spanner or other tools, use a little soap water and soft sponge to wipe, and do not use erosive chemical solutions or crude cleaning tools.

Note:

- i. Please consult manufacturer of materials like acrylic, fiber glass or other anti-heat sheet about the installation of the steam head.
- ii. In the entire steam room, it is required that steam does not leak out. The pipes, its accessories and the holes should be air-proof by applying glue so that no steam will enter the holes in the wall.

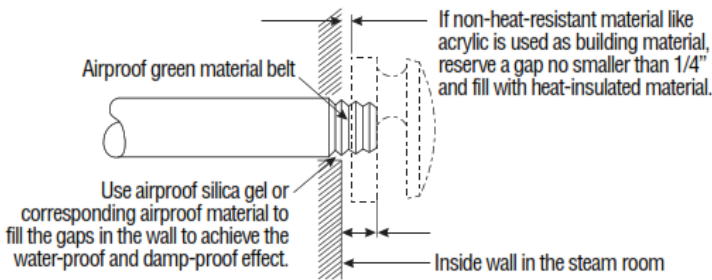


Figure 2: Illustration of Steam Head Installation inside the Room (Steam Spa)

3.7 Safety Considerations for Drainpipe

The steam generator drain valve should be equipped with a drain pipe. It drains the water by gravity, and pitch is required. Check the National Building (Standards for Mechanical Installations in

Buildings) Code, 2019, paragraph 11 for requirements for drain valves. Do not connect the safety valve or steam line to drain line.

3.8 Considerations for Safety Valve

- a) Safety valve is an automatic system that is actuated by pressure in order to prevent steam pressure increasing in the interior of the steam generator.
- b) The pressure limit range of the safety valve is 15 PSI (1bar); if the pressure were to increase beyond this value, the safety valve would immediately begin to release the excess.
- c) Do not dismantle the pressure relief valve while generator is in operation.
- d) To maintain the proper automatic operation of the safety valve, make sure the safety valve connection pipe is smooth.
- e) The safety valve incapable of being isolated by any stop-valve, shall be adjusted to prevent the boiler from being worked at a pressure greater than the maximum permissible working pressure and shall be fixed directly to, or as close as practicable to the boiler.

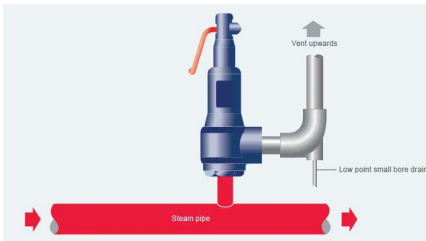


Figure 3: Illustration of Safety valve Installation along the steam pipe (Spirax-Sarco Limited)



Figure 4: Illustration of Safety valve Installation on the boiler (Spirax-Sarco Limited)

3.9 Consideration for Lighting

Lighting shall be in accordance with paragraph 65 of the National Building (Electrical installations) Code, 2019.

1. For the Sauna, the light can be installed almost anywhere but never above or too close to the sauna heater.

2. For the Steam room, only vapor sealed lighting fixtures may be used for lighting.
3. The Ingress Protection (IP) rating of light fixtures in sauna rooms should be a minimum of IP56.
4. The Ingress Protection (IP) rating of light fixtures in steam rooms should be a minimum of IP67.
5. There should be a dedicated lighting circuit for lights in the sauna and steam room only. No other lights or sockets in the health club should be connected to this circuit. The circuit should be protected by a Residual Current Device (RCD) in addition to a Miniature Circuit Breaker (MCB).

3.10 Consideration for Air Supply and Ventilation Requirements

The biomass fired equipment requires an air source for combustion. If the air supply is restricted, it can result in high levels of unburned fuel (emissions and lost energy), the generation of Carbonmonoxide (CO) and potentially an explosive situation.

The equipment needs an unrestricted source of fresh air for combustion, can be installed on the outside or internally provided by louvered opening in the room wall. Blocking these openings can be dangerous, covering these vents can result in unburned fuel, high emissions, the generation of CO, and potentially explosive conditions.

The safe handling of the products of combustion must be carefully considered. Poor combustion, and poorly constructed chimneys and flues, can give rise to life threatening accumulations of CO and other pollutants. Chimneys will need to be designed to cope with the expected products of combustion under normal and abnormal operating conditions.

Structural requirements may require the advice of specialists in supporting the loads, providing safe access to work on the chimneys, and providing access platforms for emissions monitoring activities.

3.11 Consideration for Fire detection and fire fighting

1. Firefighting equipment should be provided near the firing point of the steam and sauna rooms, in the form of Type ABC portable fire extinguishers.
2. The Sauna Room should be protected with a smoke detector (capable of operating in a high temperature environment) to be able to give early warning before a fire occurs

4. Testing of Installations

1. Pressure tests should be carried out for the water supply pipework in accordance with paragraph 23 of the National Building (Standards for Mechanical Installations) Code, 2019.
2. Testing of the steam supply pipework should be carried out, which should include: (i) visual inspection; and (ii) hydraulic pressure testing using compressed air. The test pressure shall be at least one and a half the maximum working pressure of the system.
3. Testing of the lighting circuit should be carried out in accordance with paragraph 37 of the National Building (Standards for Electrical Installations) Code, 2019.
4. Test results should be reviewed and certified by a Registered Engineer in line with the Building Control Act, 2013 and Building Control Regulations, 2020 thereunder.
5. The frequency of testing the boiler and all its fittings shall be done at least once every fourteen months or after any extensive repairs in accordance with the OSH Act, 2006

5. Maintenance Requirements

The equipment handles a large quantity of energy, and because of this, it can be dangerous if not properly maintained. Its safety is a major concern for all parties and needs to be treated accordingly. One of the actions that promote safety is the

formal documentation that owners and users should have to address and maintain the safety controls of the equipment.

The equipment should be equipped with numerous safety controls that can prevent hazardous conditions. These controls need to be checked at installation, after any control change or upgrade and annually, at a minimum. Also, over time, these controls may need to be replaced. Failure to maintain and test the operation of these safety controls can lead to serious safety problems.

Maintenance shall be carried out regularly. Maintenance work packages shall include the boiler, safety valves, chimney, electrical installations, among others. All maintenance requirements and repair activities shall be fully documented, including the frequency that maintenance should take place, and maintenance logs must be kept up-to-date.

The protective devices that must be checked and/or tested periodically (at least annually including the boiler) include:

- Pressure sensors and gauges;
- Temperature gauges;
- Pressure controller;
- Safety relief valve;
- Water level controls/limiters;

The installing contractor should deliver instructions, together with shop drawings and a written precaution that the operating, testing and servicing only be performed by a qualified individual to the owner/user and to obtain a receipt for the instructions.

Annual checks of the installation shall be carried out together with the responsible authority including a Building Control Officer, Safety Inspector; in line with the regulatory framework. It is the responsibility of the Owner/ User to invite the responsible authority for inspection (a plant inspection requisition form (Appendix - OSH. Form 7. 107) shall be filled and given to the labour officer at the Local Authority).

6. Environmental Issues

All combustion plants have an impact on the environment through a combination of emissions to air, land and water. All installations will be regulated by local authorities under the National Environment Management Act, 2019.

7. Duties and Responsibilities

7.1 Developer/ Owner

The legal responsibilities of the owner towards safety of the system cannot be transferred e.g. by an owner to the operator. The owner may make use of **Form 2; Self-Check** (Appendix) to check for compliance of the installation.

7.2 Employers

Employers have general duties, amongst other things, to provide safe places of work and adequate training for employees. This responsibility cannot be transferred to employees or third parties.

7.3 Equipment Operator Manager

Employers must appoint suitably trained and competent persons in line with OSHA to be responsible for the safe management and operation of the system. These supervisors or managers must be adequately trained to carry out all the duties they are expected to perform at each specific site.

The duties of the manager may include but are not limited to:

- Ensuring compliance with relevant law;
- Risk assessment and risk management;
- Ensuring that manning levels are sufficient;
- Ensuring that plant is maintained correctly;
- Oversight on operators;
- Record keeping;
- Keeping in place a suitable and sufficiently stocked first aid box in the premises at all times;

- Training at least two people in basic first aid techniques and have one of them around the premises at all times.

7.4 Competent Equipment Operator

It is a requirement for the employer/owner to appoint sufficiently trained persons in line with Occupational Safety and Health Act, 2006, S. 76 to be responsible for the daily safe operation of the system. These operators must be adequately trained and certified to carry out all the duties they are expected to perform. The training should enable the operators to recognize when the limits of their own expertise are reached and when to call for assistance.

The duties of the operator should be determined as a logical outcome of a site-specific risk assessment. These may include, but are not limited to:

- Shutdown in an emergency or if it is unsafe;
- Carrying out all functional tests of limiters & controls where required. Records of all these tests must be maintained;
- Identification of maintenance requirements and faults;
- Investigation of abnormal operating conditions;
- Recording the results of checks and tests.

7.5 Maintenance personnel

All maintenance personnel must possess sufficient knowledge and training to be able to carry out their expected duties in line with requirements from Occupational Safety and Health Act, 2006 S. 76. Maintenance personnel must only carry out the maintenance work for which they have been trained and are deemed competent.

Regular preventive maintenance and a mandatory inspection annually should be undertaken.

APPENDIX



**SAFETY GUIDELINES FOR DESIGN, INSTALLATION, OPERATION AND MAINTENANCE OF
BIOMASS-FIRED SAUNA, STEAM AND HOT WATER GENERATION EQUIPMENT FOR
HEALTH CLUBS – DOC NO. NBRB/BM/001-FORM 1**

INSTALLATION CHECKLIST

1. Name of Owner

2. Location where installation is situated

3. Type and description of Installation

4. Name of Installer and year of installation

(The history should be briefly given and the BCO should state whether he/she has seen the previous report)

5. Date of last hydraulic test (if any) and pressure applied

6. Name of Professional in charge of installation

7. Quality and source of feed water

8. Is the Equipment installed externally or internally?

9. Name of the Operator and details of his/her competence

10. Name of the Maintenance Personnel and details of his/her competence

11. What is the condition of the following?

Pressure gauge;

Temperature gauge;

Pressure controller;

Safety relief valve;

Water level controls/limiters

Exhaust pipe/ flue

Pipework

12. General Checks of the Installation

(a) What examination and tests were made?

b) What parts were inaccessible at this examination?

c) Condition of Installation. *(State any defects observed)*

13. Repairs (if any) required and period within which they should be executed and any other conditions which the BCO thinks is necessary to specify for safe working

I CERTIFY THAT the above is a true report of the result.

Name & Signature of authorised person

Date of visit

ADDITIONAL INFORMATION

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.



**SAFETY GUIDELINES FOR DESIGN, INSTALLATION, OPERATION AND MAINTENANCE OF
BIOMASS-FIRED SAUNA, STEAM AND HOT WATER GENERATION EQUIPMENT FOR
HEALTH CLUBS – DOC NO. NBRB/BM/001 – Form 2**

SELF-CHECK

S/N	Detail	Done	Not Done	Not Applicable
1.	Is the ceiling dome-shaped or laid to a slope to prevent the dripping of condensate?			
2.	Is there a drain in the floor?			
3.	Does the steam room have a vent installed at high level?			
4.	Is there a temperature gauge for the steam room with the reading display outside the room?			
5.	Is there a clock/timer visible to users of the steam and sauna rooms to ensure they are aware of their usage time?			
6.	Are the Pressure and Temperature gauges installed on the system and clearly marked with green for the low reading and red with the high reading			
7.	Is water used in the facility treated to address the impurities that could clog the pipework?			
8.	Is the plumbing pipework resilient and resistant to corrosion?			
9.	Is there a control valve in the water supply line and is it easily accessible in case of an emergency?			
10.	Has the Pipe sizing and valve selection (including the safety valve) been done by a qualified professional?			
11.	Is the steam pipe installed at a gradient so as to avoid trapping condensate?			
12.	Is the steam pipe insulated?			
13.	Is the steam line free of any stop valves?			
14.	Is the Steam Head or outlet installed at a position which will not easily come into contact with the user?			
15.	Is the steam head or outlet installed face down to prevent scalding of a user?			
16.	Is the Safety valve installed directly on the boiler or as close as practicable (Not more than a meter from the boiler)?			
17.	Is there a standby safety valve installed?			
18.	Is the Ingress Protection (IP) rating of light fixtures in the sauna IP56 or higher?			
19.	Is the Ingress Protection (IP) rating of light fixtures in steam room IP67 or higher?			
20.	Is there a dedicated lighting circuit for lights in the sauna and steam room only?			
21.	Is the Chimney adequately sized? (get opinion from qualified professional)			

S/N	Detail	Done	Not Done	Not Applicable
22.	Is the equipment adequately ventilated? (get opinion from qualified professional)			
23.	Are the fire extinguishers installed and serviced?			
24.	Have Pressure tests been carried out for all the pipework in line with standards?			
25.	Have the test results been reviewed and certified by a Registered Engineer?			
26.	Are the tests done frequently - at least once every fourteen months or after any extensive repairs?			
27.	Are all maintenance requirements and repair activities fully documented, including the frequency that maintenance, and maintenance logs must be kept?			
28.	Were the following protective devices checked? <ul style="list-style-type: none"> • Pressure gauge • Temperature gauges • Safety relief valve • Water level controls/limiters 			
29.	Were you given written instructions by the Installing Contractor on the Operation and maintenance of the equipment?			
30.	Do you have permission to install the equipment or utilize the premises as a health club from the local authority?			
31.	Does the Operator have a certificate from MoGLSD indicating that he is competent to operate the equipment?			
32.	Are the maintenance personnel qualified to undertake maintenance on the installation?			
33.	Do you have a license to run equipment with such quantity of energy			

<p>CHECKED BY (<i>Name & Signature</i>):</p> <p>.....</p> <p>DATE OF CHECK:</p> <p>.....</p>	<p>BUILDING CONTROL OFFICER (BCO)</p> <p>SIGN-OFF: (<i>Name & Signature</i>)</p> <p>.....</p> <p>DATE:</p> <p>.....</p>
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PLANT INSPECTION REQUISITION

Occupier:

Office Address:

Phone:

THE COMMISSIONER FOR OCCUPATIONAL SAFETY AND HEALTH
P.O. Box 227,
KAMPALA.


I/We the undersigned here by request the services of an Inspector (Engineering) to examine and/or certify the following plant in accordance with the requirements of the Occupational Safety and Health Act No.9, 2006 and agree to pay to the Uganda Administration the appropriate fees in accordance with the Occupational Safety and Health (Plant Examination Fees) Rules (S.I. 2014 No. 87).


PLANT TO BE INSPECTED	LOCATION OF PLANT

For Official Use
P.I.R. No.
Fees Est.
Files F.
F


Signature of Occupier or Representative


Date:



 2nd floor Southwing Rumeo
Plot 19 Lumumba Avenue,
Nakasero Kampala, Uganda

 info@nbrb.go.ug

 0312421600

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