



UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

Annexure A

Hot Water Solar System Service and Maintenance Scope of Work

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1 BACKGROUND & PURPOSE

Solar hot water systems are an essential part of sustainable energy solutions, providing an eco-friendly and cost-effective method for heating water. These systems require regular maintenance to ensure optimal performance, efficiency, and longevity.

The scope of work document details the maintenance requirements for solar hot water systems to ensure they operate at peak efficiency. This includes determining a thorough maintenance schedule, appointing qualified personnel to perform the maintenance, and enforcing safety measures throughout the maintenance process. The primary goals are to maintain system efficiency, prevent Downtime, and ensure compliance with all relevant regulations and standards. By following this maintenance plan, the operators of the system can reduce the risk of failure, increase energy savings, and support the organization's sustainability objectives.

The University intends to maintain its hot water systems on different campuses. It is critical to have all hot water systems available and reliable. The hot water systems cater for:

- Barnato Hall, West Campus, Braamfontein.
- David Webster Building, West Campus, Braamfontein.
- Parktown Junction Campus, Parktown.



Figure 1: Barnato Hall and David Webster building

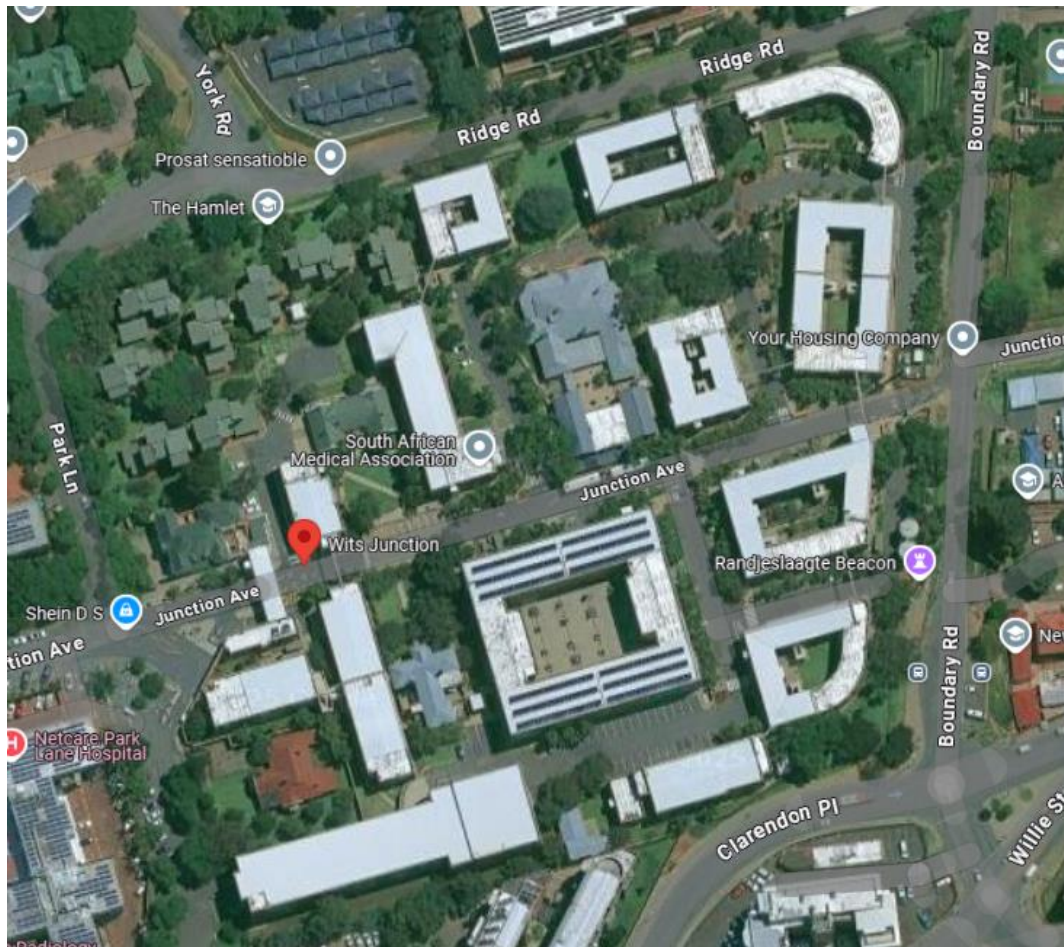


Figure 2: Parktown Junction Campus

2 DEFINITIONS AND ABBREVIATIONS

Definitions and applicable documents section provides contextual information at both the tender and contract stages to ensure clarity in the interpretation of the Scope of Works (SOW) and identification of overarching legislation, policies, procedures and guidelines that will govern the resulting work. The purpose of this section is to mitigate ambiguity and misunderstanding that could lead to poor proposals at the tender stage or default, breach or dispute at the contract stage.

“Breakdowns” Defined as an event which prevents equipment from providing its required service (attributed break-down) and which was not because of an external factor, misuse/abuse of the equipment or at the specific direction of the University.

“Call-out” A demand on the Service Provider to act because of equipment or related failure, requiring the Service Provider to visit the site outside of scheduled maintenance.

“Down time” The period the equipment is not in operation due to equipment failure, Breakdowns, unplanned repairs and periodic re-commissioning/re-adjusting of the equipment systems. This includes the response and repair time.

“Safety” The operational requirements regarding the Occupational Health and Safety Act 85 of 1993, current relevant regulations, codes and standards.

“Unit” The equipment in its singular form.

“University” Is the University of the Witwatersrand, Johannesburg.

“Visits” The scheduled visits to the premises to verify the equipment and space has been used and maintained in accordance with the Agreement.

The table below is terms and acronyms used in the SOW.

Table 1: Acronyms

Term / Acronym	Definition
ISO	International Organization for Standardization
kW	Kilo Watts
kPA	Kilo Pascal
SANS	South African National Standards
SOW	Scope of Work
W	Watt

3 THE UNIVERSITY'S OBJECTIVES

To appoint a Service Provider to maintain solar hot water systems to the University of the Witwatersrand in Johannesburg Braamfontein and Parktown Campuses. The hot water systems are for Barnato Hall and David Webster Building located at the West Campus, Braamfontein and Parktown Junction Campus, Parktown.

4 SCOPE OF WORK

This work covers preventative and corrective maintenance of hot water systems for the University of the Witwatersrand. The Service Provider shall inspect the hot water systems at Barnato Hall, David Webster Building and Parktown Junction Campus. The Service Provider shall develop maintenance schedules that will also indicate the order of priority of tasks. Once maintenance work has been carried out by the Service Provider, maintenance reports must be submitted to the University representative for acceptance. Additionally, the Service Provider shall meet with the facilities management of the University representative to review maintenance work carried out and develop maintenance strategies to optimise the use of the systems.

This work covers maintenance of the following equipment:

Table 2: Hot water system equipment details

No.	Unit Name	Qty	Make	Type/Serial No.	Year
1	Heat Exchanger – Solar stratified charging module	1	Solar Schichtlademodul	LME-150M	2017
2	Heat Exchanger – Solar stratified charging module	1	Solar Schichtlademodul	LME-150M	2018
3	Heat Exchanger – Solar stratified charging module	1	Solar Schichtlademodul	LME-300M	2018
4	Heat Exchanger – Solar stratified charging module	1	Solar Schichtlademodul	LME-400M	2018
5	Expansion Vessels/Glycol tanks	4	Global Water Solution	MUPA-300-10	2018
6	Expansion Vessels/Glycol tanks	7	Global Water Solution	MUPA-450-10	2018
7	Circulating Pump	1	Wilo	Para 25/1-11 T2/20000100000	2018
8	Circulating Pump	1	Wilo	Para 25/1-9 T2/20000100063	2018
9	Circulating Pump	1	Wilo	Para Maxo 25-180-11- F021/231156370011	2025
10	Circulating Pump	1	Wilo	Para Maxo 25-180-11- F021/231156370010	2025
11	Circulating Pump	1	Wilo	Stratos 40/1-12 (DE)/10001154593	2018
12	Circulating Pump	1	Wilo	Stratos Para 30/1-12 T2/20000100048	2018
13	Circulating Pump	1	Wilo	Stratos Para 30/1-8 T2/20000100031	2018
14	Circulating Pump	1	Wilo	Stratos Para 30/1-12 T2/20000100049	2018
15	Return Pumps	2	Wilo	No details	
16	Pressure Pumps	2	Grundfos	No details	
17	Circulating Pumps	5	Grundfos	No details	
18	Tanks Under Pressure	3			
19	Thermal cubes -with coils inside- Not under pressure	2			
20	Tank Under Pressure	1	“Blackdot Energy”		
32	Solar Collectors - Junction Campus, Parktown	240	Global Water Solutions	MUPA-450-10	2018
33	Solar Collectors – David Webster Residence	72			2018
34	Solar Collectors - Barnato Hall Residence	64			2017

5 SCOPE FOR MAINTENANCE OF HOT WATER SYSTEM

- 5.1 All preventive maintenance activities must be performed in accordance with the operation and maintenance manuals which feature a similar system configuration to the plumbing system, as well as the maintenance guidelines provided by the manufacturers.

- 5.2 The University representative and system operators shall be informed in advance of any testing or system shutdown.
- 5.3 Before system inspection and maintenance, appropriate safety measures to prevent overheating must be implemented.
- 5.4 Maintenance work shall be carried out by an appropriate technician who shall perform a risk assessment before initiating any work.
- 5.5 All testing instruments shall be calibrated before use.
- 5.6 The maintenance schedule and procedures shall be periodically reviewed and updated to align with the latest statutory requirements, international standards, and maintenance history.
- 5.7 Monitor temperature pressure relief of all valves regularly.
- 5.8 Hot water storage tanks shall be thermally insulated in an acceptable manner to prevent heat loss
- 5.9 Drain the tanks and wash out sediments.
- 5.10 Check all anode rods annually.
- 5.11 All pipework shall be kept in a clean and sound condition to maintain maximum efficiency.
- 5.12 Insulate and/repair all hot water pipes.
- 5.13 Check for leaks on all hot water plants.
- 5.14 Adjust all water temperatures according to the University's needs.
- 5.15 Test and commission the system in accordance with relevant regulations as per its design.
- 5.16 When access covers or caps or cleaning eyes are removed, damaged packings, joint rings, washers or any other damaged Component shall be renewed before replacement.
- 5.17 Care shall be taken with the use of chemical descaling agents, which are often corrosive. Pipework materials used in the installation shall be clearly identified before treatment to ensure that they are not subject to damage by chemical attack.
- 5.18 Hand-operated rods for removing blockages in discharge pipes shall be capable of passing through the installation without damaging the internal surfaces of pipes and fittings.
- 5.19 Mechanized rodding equipment shall only be used by properly trained operators. The pipework to be cleared shall be thoroughly examined beforehand to enable the selection of appropriate cleaning attachments.

- 5.20 Cleaning the solar collectors should also be scheduled bi-annually, along with checking for loose connections and cracks. The function of the overall system in terms of yield should be assessed annually.
- 5.21 Every pressure vessel shall be subjected to an internal and external inspection and a hydraulic test to a pressure of 1.25 times the design pressure by an approved inspection authority for in-service inspection appointed by the University in writing at intervals not exceeding 36 months as per the Occupation Health and Safety Act, Act 85 of 1993 - Guidance Notes to the Pressure Equipment Regulations.
- 5.22 As per Occupation Health and Safety Act, Act 85 of 1993 - Guidance Notes to the Pressure Equipment Regulations: All piping and pipelines to be inspected and tested following the relevant in-service health and safety standard: Provided that where the health and safety standard does not prescribe in-service inspections and test intervals, such intervals shall be determined by a risk-based inspection applying sound engineering practice: Provided further that such inspection and test for Category II equipment and higher as categorized in terms of SANS 347 shall be performed by a competent person referred to in regulations 1 of the General Machinery Regulations, 1988.
- 5.23 The maintenance schedule shall include, but is not limited to, the following tasks:

Table 3: Hot water system maintenance task descriptions and intervals

No.	Equipment	Description	Service intervals				
			3 years	Annually	Bi-Annually	Monthly	Weekly
1	Solar Collectors	Cleaning of the solar collectors.			✓		
		Visually inspect for loose connections, cracks and any other damage.			✓		
		Over system functionality assessment		✓			
2	Heat Exchangers	Check the heat exchanger for signs of leakage or corrosion and the associated supports.		✓			
		Test the flow rate for compliance with the manufacturer's recommendations.		✓			
		Visual inspections, checking for leaks		✓		✓	✓
		Cleaning components		✓		✓	
3	Pumps	General cleaning and re-painting. Check the piping connections for leakages.		✓			



No.	Equipment	Description	Service intervals				
			3 years	Annually	Bi-Annually	Monthly	Weekly
		Check that the electrical connections are securely fastened and the earth bonding conductors are properly connected.		✓			
		Check that the pumps are operating correctly without abnormal movement or water leakage.		✓			
		Lubricate the moving parts.		✓			
		Check the pressure and flow to ensure the operation condition of the pump is in order.		✓			
		Checking for leaks, cleaning components, lubricating bearings, etc				✓	
		Visual inspections		✓		✓	✓
4	Expansion Vessel and Glycol Tanks	Pressure vessel testing	✓				
		Check the expansion tanks with diaphragms in by briefly depressing the Schrader valve for leaks of fluid.		✓			
		Drain the system and ensure the expansion vessel is working under correct pressure.		✓			
		Visual inspections and ensure the expansion vessel is working under correct pressure.				✓	
6	Tanks Under Pressure	Pressure Vessel Testing	✓				
		Check storage tanks for cracks, leaks, rust or signs of corrosion.		✓			
		Check the system pressure and temperature and depressurise the excessive system pressure if any.		✓			
		Check that provisions have been made to prevent reverse heating of the solar thermal storage by the hot water backup heater.		✓			
		Check the thermostat and control of the backup heating element.		✓			
7	Thermal cubes	Check for leaks and corrosion.		✓		✓	✓



No.	Equipment	Description	Service intervals				
			3 years	Annually	Bi-Annually	Monthly	Weekly
		Cleaning components		✓			✓
		Test pressure relief valves		✓			
		Visual inspection		✓		✓	✓
8	Monitoring equipment	Check the monitoring instruments (e.g., temperature sensors) to make sure they are operational.				✓	
9	Plant area	Check ventilation conditions and dust cleaning.				✓	
		Check for corrosion and water damage.				✓	
10	Heat transfer fluid	Check heat transfer fluid conditions, concentration and degradation for indirect type; refill the heat transfer fluid if necessary. Check the water quality. Check that provisions are made for draining and filling the system (air vents, drains, pipes correctly graded in-between)		✓			
11	Pipework	Pipe work - Check pipework for signs of cracks, defects and leaks, damage, blockage, or degradation of thermal insulation. Inspect for signs of defects, sagging, and cracks; replace if necessary. Check the airlocks or blockages of the pipework. Check for signs of deformation not holding slopes to drain. Check for abnormal operation temperature, stop circulation in the collection loop, and release the excessive pressure inside the pipework, if any.	✓	✓			
12	Strainers	General cleaning and checking for signs of corrosion and getting stuck			✓		
13	System Monitoring and Data Logging System	Maintain a log of cumulative electrical energy consumption (kWh to date), operating temperature, and flow rate against date.				✓	
14	Valves	Visual inspection: Check valves for any damage, leakage, getting stuck or signs of corrosion.				✓	

No.	Equipment	Description	Service intervals				
			3 years	Annually	Bi-Annually	Monthly	Weekly
		Check valve settings and valve position					
		Valves functional test: test valve operation according to the O&M manual and manufacturer's recommendations				✓	
15	Breathers	Visual inspection: Check valves for any damage, leakage, getting stuck or signs of corrosion. Check valve settings and valve position				✓	
		Clean the Breather Vent to ensure the breather port is not clogged with dust, insects, or debris.			✓		
		Functional test: test operation according to the O&M manual and manufacturer's recommendations		✓		✓	
16	Electrical connections and wiring	Check Electrical Connections		✓		✓	
		Check Earthing and bonding		✓		✓	
		Check for correct operation - Test panel for the correct operating sequences and functions of all controls and safeties. Test and verify the operation of all amp and volt meters. Test all indicator lamps		✓		✓	

5.24 Pressure Testing and certification

Tests shall be performed by the manufacturer/supplier or by an approved inspection authority for in-service inspection appointed by the University in writing as applicable standards.

5.25 Documentation

- 5.25.1 A maintenance schedule must be provided, detailing materials, quantities, and costs.
- 5.25.2 A copy of all type test and routine test reports shall be provided.
- 5.25.3 Written report or service sheet of any testing, inspection, examination, investigation and/or assessment undertaken and execution of any repairs by the Service Provider.

6 TASK IDENTIFICATION

- 6.1 The contract scope of work and tasks includes:
- 6.2 Once-off inspection of the equipment for hot water systems.
- 6.3 Carrying out servicing, preventative maintenance and corrective maintenance or repairs of the equipment for hot water systems.
- 6.4 Supply and installation of all mechanical and electrical spare parts for the hot water systems as and when recommended by the Service Provider during the periodic reviews or for emergencies.
- 6.5 The required service also includes a 24-hour, Monday to Sunday emergency services as and when required by the University at the hot water systems located in Barnato Hall, David Webster Building and Parktown Junction Campus.
- 6.6 It is also a requirement that the health and safety protocols are observed to prevent injury to personnel and workers.
- 6.7 The required response time for Call-outs for faults and other events is as follows:
- Priority 1 – Emergencies – Service Provider shall be on site within 1 hour.
 - Priority 2 – Urgent (In the case of an alarm on the system) – Service Provider shall be on site within 3 hours.
 - Priority 3 – General – Service Provider shall be on site within 6 hours.
- 6.8 Any work/event requiring extended repair time shall be discussed and agreed upon with the University representative.

7 STANDARDS & REGULATIONS

The following documents contain provisions that, through reference in the text, constitute requirements of this specification. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below. The work to be carried out must also conform to any other municipal by-laws, national and international standards that may be applicable to the systems and equipment installed. The work must conform to the Service Level Agreement.

- SANS 10252-1: 2018 Edition 3.2 Water supply and drainage for buildings, Part 1: Water supply installations for buildings.
- SANS 10103, The measurement and rating of environmental noise with respect to land
- SANS 347, Categorization and conformity assessment criteria for all pressure equipment.
- SANS 10106: The installation, maintenance, repair and replacement of domestic solar water heating systems.

- Occupation Health and Safety Act, Act 85 of 1993 - Guidance Notes to the Pressure Equipment Regulations 17 July 2009
- SANS 10087: The handling, storage, distribution and maintenance of liquefied petroleum gas in domestic, commercial, and industrial installations
- SANS 10142: The wiring of premises

8 WARRANTY

All equipment supplied and work done under this contract shall be guaranteed by the Service Provider to give at least Twelve (12) months of trouble-free and accurate service under operation conditions. Equipment that failed to give such service will be examined by an independent testing facility and, if found to be defective in workmanship or materials, shall be replaced by the Service Provider free of charge with equipment with the same guarantee as per the original offer.

9 CHANGE MANAGEMENT

Any changes to the maintenance schedule or adjustments to the tasks being performed must be communicated to the University representative in advance. This process ensures that the necessary review and approval can take place, allowing for a smooth operation and minimal disruption to services.

10 TIMEFRAMES AND DELIVERABLES

Table 4: Time frames and deliverables

#	Services / Deliverables	Deliverable Due Date	Acceptance Criteria
0	Once-off inspection	Upon contract commencement	Report
1	Compliance with Health and Safety Requirements	Annually	Report
2	Provide preventative maintenance	Every week over a 5-year period	Maintenance Report
3	Provide preventative maintenance	Monthly over a 5-year period	Maintenance Report
4	Provide preventative maintenance	Bi-annually over a 5-year period	Maintenance Report
5	Provide preventative maintenance	Annually over a 5-year period	Maintenance Report
6	Provide major service for all pressure vessels	Upon contract commencement and in 3 years	Report and service certificate

10.1 **Project Plan**

The service provider will be required to provide a maintenance schedule within two (2) weeks of issuing a purchase order.

Upon completion of preventative and corrective maintenance activities, a report shall be submitted to the University representative, including but not limited to:

- The equipment being serviced
- The maintenance tasks performed such as inspections, repairs, or replacements, etc. This will include readings, test results and checklists.
- Issues that were encountered during the service and the actions taken to resolve them.
- Recommendations for future maintenance.
- Materials used, including quantity and cost.
- Record of the personnel involved in the maintenance activities.
- Faults found and their priority.

The report must be submitted to the University representative, and the subsequent services must be aligned accordingly.

11 **CONTRACTUAL MATTERS**

11.1 **Contract duration**

The contract duration will be 5 years.

11.2 **Maintenance Approach**

The service provider shall provide preventative maintenance support every week over a 5-year period. The major services will occur annually, with monthly and bi-annual manual maintenance tasks also taking place as per the OEM requirements.

All planned work shall be carried out during normal working hours (7:00 to 17:00, Monday to Friday) at the cost tendered for in the Bill of Quantities. Visits to the premises will be as scheduled for the Service Provider to carry out maintenance work as per the specification.

The Service Provider shall produce and issue to the University representative a written report or service sheet of any testing, inspection, examination, investigation and/or assessment undertaken and execution of any repairs by the Service Provider.

11.3 **Housekeeping**

All rubbish and waste arising from the work must be removed and the site and buildings left in a clean and tidy condition.

11.4 **Sub-Contracting**

Any work requiring the use of a subcontractor shall be subject to prior approval of the University. For any tasks that require subcontracting, the Service Provider needs to provide three quotations and submit them to the University representative for approval. This requirement applies to services related to pressure vessel testing of the equipment.

11.5 Workmanship

Works with poor workmanship and unauthorized spares will not be accepted. Acceptance of the maintenance work shall be by means of review and approval of the submitted and fully completed service log by the University representative. The University representative may, from time to time, elect to witness any of the tests or inspections relating to the maintenance activities or request a retest to satisfy the University personnel of satisfactory functioning of the equipment.

The University representative reserves the right to withhold payments until the quality of the Services is acceptable. The Service Provider must have a quality management system such as ISO9001:2015 or similar in place, and proof of such is to be provided with the bid. The quality management system must encompass, but not be limited to:

- Structured record keeping and retrieval.
- Record keeping for an established duration.
- Issuance of reviewed service logs by authorised personnel.

In addition to the services being fit for purpose, they should also meet the manufacturer's performance standards.

11.6 Failure to Comply

The Services will be monitored, and penalties will be imposed. Penalties will be imposed as follows:

If the service provider fails to adhere to the provisions of the priority levels described herein, the University reserves the right to levy a penalty fee against the service provider (in line with university policy). Continuous violation of these provisions will result in the contract being terminated.

11.7 Health and Safety

The Service Provider must submit to the University's authorized representative and maintain a health and safety file every year for the duration of the contract.

The Service Provider must ensure that:

- A second person present during maintenance activities in the event of an accident, to ensure the emergency will be detected and help will take place.
- Its personnel wear personal protective clothing and safety equipment.
- Suitably trained personnel perform the Services.

11.8 **Qualified personnel**

It is a requirement that personnel performing and overseeing works that the Service Provider is appointed for be suitably qualified and accredited in the specific trade as required by this specification.

Service/ contracts manager:

NQF 5 or higher in mechanical engineering

Licensed Plumber:

- Minimum of 5 years' experience post qualification
- Relevant training certificates,
- Relevant trade qualification

All electrical work on water heating systems must be performed by a qualified registered electrical worker and comply with the relevant wiring codes of practice and standards.

Electrician:

- Minimum of 5 years' experience post registration
- Relevant hot water system experience
- Registration with the Department of Labour – Wireman's Licence
- Trade Qualification with NQF Level 5 or higher

11.9 **Service Levels**

11.9.1 **Technical Support**

The tender shall be inclusive of all Breakdown maintenance, 24-hour emergency Call-out and preventative maintenance visits every week over a 5-year period on hot water systems. A fully priced pro-forma maintenance agreement must be submitted with the tender, catering for preventative visits and a 24-hour emergency Call-out facility. The number of bona fide service technicians employed and stationed in Gauteng shall be stated in the tender, including response time.

11.10 **Payment/spend analysis**

Please note that the University does not allow upfront payments. All payments will be made within 30 (thirty) days of submission of an invoice. However, where an EME, as per the B-BBEE Codes, has been appointed as a successful service provider, shorter payments may be considered as part of supplier development, subject to Central Finance (Creditors) approval.