Eskom	Standard	Technology

Title: **MAINTENANCE OF HVAC EQUIPMENT – WINDOW / CONSOLE / SPLIT UNITS**

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Content

1. Introduction

This standard is compiled to assist staff in performing maintenance activities on HVAC & R plant in an identical way and consistent manner.

2. Supporting Clauses

2.1 Scope

To formalize the required tests to be done, as well as methods, precautions and check sheets to be adhered to when maintenance is performed on window / console / split units.

2.1.1 Purpose

The purpose of this document is to capture general guidelines and rules to be adhered to when performing work activities on mentioned HVAC & R plant.

2.1.2 Applicability

This standard is applicable where PTM (including contractors in PTM service or under PTM supervision) is rendering a service to a client with regards to maintenance of HVAC equipment – window / console / split units.

2.2 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] ISO 9001 Quality Management Systems

[2] TOPAC-001, Maintenance of HVAC equipment

2.2.2 Informative

[1] None

2.2.3 General

Definition	Description
Check	Examination, recording, deduction or calculation and proposal for corrective action if necessary.
Components	The individual parts which each piece of equipment exists out of.
Condition	The state in which equipment and components have to perform to optimum.
Equipment	All the structures as well as electrical and mechanical machinery required to obtain the expected level of performance applicable.
Mechanisms	Clusters or groups of components or even one component to perform a specific action or task at a given time.

Definition	Description
Preventative maintenance	The wear and changes that a system will undergo during operation is anticipated and continuous corrective action is taken to minimize deterioration. This would require periodic inspections and replacements of components as normal wear occurs to prevent equipment failure. Preventative maintenance involves a planned and controlled programme of inspections, adjustments, repairs and analysis of performance designed to keep a system operating at peak efficiency.

2.3 Abbreviations

Abbreviation	Description
HIRA	Hazard identification and risk assessment
OHS Act	Occupational Health and Safety Act
ORHVS	Operating Regulations for High Voltage Systems
PPE	Personal Protective Equipment

3. Document Content

3.1 Safety

It is the responsibility of each person to ensure that the correct plant is isolated according to a specific regulation (ORHVS or Plant Safety) a permit has been issued, all staff has signed the workers register, a proper job brief has been done and that the days HIRA were completed. Adhere to the OHS Act.

No	Possible risks, hazards and danger	Compulsory required precautionary measures
1	Physical electrical contact during testing.	a) All equipment used must adhere to OHS Act. b) Use all test equipment according to prescribed procedures and manuals. c) Unauthorised access prohibited (Only PTM staff, barricading tape, lock gates, etc.) d) Ensure that plant is properly earthed and that the earthing arrangement meets the requirement of the isolations and at the point where work has to be performed. On the LV supply there is no earth facility and isolation is still required.

2	Safe Handling of Refrigerants	a) Ensure that safe handling of refrigerants certificate is valid and MSDS for the refrigerant are reviewed. b) Wear safety goggles and gloves at all times when handling refrigerants or servicing a refrigeration system. c) Wear the proper respiratory protection while working with refrigerants. Check the MSDS for the proper level of protection required. d) Proper ventilation or respiratory protection is required for any work on equipment in an enclosed area where a leak is suspected. e) Always ventilate or test the atmosphere of an enclosed area before beginning work. Many refrigerants which may be undetectable by human senses are heavier than air and will replace the oxygen in an enclosed area causing loss of consciousness. f) Inhaling refrigerants can cause sudden death. Intentional inhalation of refrigerants to produce intoxication can cause the heart to cease functioning properly and may be fatal. g) Refrigerant cylinders should never be filled over 80% of their capacity (liquid expansion may cause the cylinder to burst). h) Inspect refrigerant cylinders regularly. Do not use the cylinders if they show signs of rust, distortion, denting, or corrosion. Store cylinders secured and upright in an area where they will not be knocked over or damaged.
3	High elevated position. Work that needs to be performed at an elevated level.	a) Compulsory use of safety belt / harness is required when the possibility exists that a person can fall from an elevated position. b) Complete Q-411 and send to SHEQ office
4	Slippery surfaces, oil spillages, leaks, etc.	a) All slippery surfaces to be kept clean before commencing with work. b) Avoid spillages.
5	Use of scaffolding.	a) Safe for use sign displayed. b) Access ladder fitted. c) No openings in/on platform. d) Kick plates fitted. e) Handrails fitted.
6	Personnel injury.	e) Wear PPE.
8	Unsafe working conditions.	f) Report any unsafe act / condition.

3.2 Window / Console / Split units maintenance

3.2.1 Minor service

The following steps should be followed and checks sheets completed:

1. Check air filter and clean where necessary. Should the filter be torn or damaged it will be necessary to provide a new filter.
2. Check condensate drains and clear if necessary to prevent internal water leaks.
3. Clean equipment generally and observe its operation in all its functions.
4. Check amperage readings on cooling/heating - fan only operation and compare to name plate ratings.

3.2.2 Major service

The following steps should be followed and check sheets completed:

1. Check air filter and clean where necessary. Should the filter be torn or damaged it will be necessary to provide a new filter.
2. CHECK CONDITION OF EVAPORATOR COIL and clean. Straighten fins with fin comb where necessary. Clean equipment generally and observe its operation in all its functions. Ensure unobstructed gravity flow on drainpipe.
3. CHECK CONDITION OF CONDENSOR COIL and clean. Straighten fins with fin comb where necessary.
4. CHECK CONDENSATE DRIP TRAYS and treat for corrosion if necessary. Ensure unobstructed gravity flow.
5. CHECK CONDENSATE DRAINS and clear if necessary to prevent internal water leaks.
6. CHECK FANS to ensure that they are secured to the fan shafts not out of alignment and are free of corrosion, chips, dents, etc.
7. CHECK FAN MOTOR (S) to ensure that it (they) is (are) running freely and true and that the bearings show no signs of wear. Oil where applicable. Ensure that the baffle plates are secured between in and outlet air.
8. CHECK COMPRESSOR to ensure that it is suspended freely, that all grommets and bushes are in good condition, that the klixton (overload protector) is operating efficiently, that the compressor is operating.
9. CHECK THERMOSTAT/S SWITSHES / CONTACTORS and the wiring thereto to ensure that all electrical connections are secure and clean.
10. CHECK REFRIGERANT SYSTEM for leaks and repair where necessary and recharge. Ensure all tubing is clear of other components. Always check for the correct operating pressure of the refrigerant used. Use gauges to monitor the system pressure. Always charge refrigerant into the low side of the system to avoid damaging the compressor, or causing the system to rupture. If contact with the skin occurs, wash immediately with water, treat any damaged skin area for frostbite, and seek medical treatment. Never cut or drill into an absorption refrigeration mechanism. Ensure that all liquid refrigerants are removed and the pressure is at 0 psi before disassembling a system. Do not smoke, braze, or weld when refrigerant vapours are present. When soldering, brazing, or welding on refrigeration lines, the lines should be continuously purged with low pressure nitrogen. Following work, the lines should be pressure tested with nitrogen.
11. CLEAN EQUIPMENT generally and observe its operation in all its functions.
12. CHECK AMPERAGE readings on cooling/heating fan only operation and compare to name plate ratings.
13. FOR SPLIT UNITS ONLY: The above services (points 1 to 12 plus, CHECK & TIGHTEN where necessary all refrigerant pipefittings. CHECK discharge head and suction pressures and ensure that these are in accordance with specifications. If not, check for possible causes. Please note any refrigerant gas is for client's accounts. The above minor services will be carried out 1 (one) times per annum minimum. Where conditions change due to excavating construction or any kind of extraordinary exercises, the cycle of Service may be adjusted to maintain healthy performance coefficient. The above major service will be carried out at least once per annum minimum.

3.2.3 Air filters

3.2.3.1 Air filter cleaning

1. The air filters supplied with the unit are high efficiency washable and recyclable filters.
2. To establish, how frequently these should be cleaned, the operating conditions must be taken in to account (see table under 3.2.4).

3.2.3.2 Removal of air filter for cleaning

1. Open the return grille without removing the two screws and the central clamp from their position.
2. Remove acrylic-fibre filters for cleaning.

3.2.3.3 Cleaning of acrylic-fibre standard filters

1. First clean the filter with vacuum cleaner. Rinse filter under running water, and dry it.
2. After cleaning, put the filters back in the correct positions. Before operating the air conditioner, check that air filters are in their place inside the unit

3.2.4 Periodical checks

For a good operation of the air conditioner it is recommended to carry out checks maintained as indicated. Recommended maintenance intervals may vary depending on the installation environment e.g. dusty zones, etc.

Indoor Unit	**Every month**	**Every 4 months**	**Every year**
Clean air filter	•		
Clean drain pipes		•	
Change controller batteries			•
Clean outdoor coil from outside			•
Check electric connection tightening			•
Check fan wheels			•
Outdoor Unit			
Clean outdoor coil from outside		•	
Clean outdoor coil from inside			•
Blow air over electric parts			•
Check electric connection tightening			•
Check fan wheels			•
Check fan tightening			•
Clean drain pan			

Table 1: Periodical checks

3.2.5 Fault finding

See table 2 below.

FAULT	REASON	ACTION
Compressor and outdoor fan will not start	Power failure	Investigate reason
	Fuse blown or/and circuit breaker tripped	Replace fuse circuit breaker
	Detective contactor	Replace
	Low line voltage	Determine cause and eliminate
	Incorrect or loose wiring	Check wiring diagram and rewire correctly
	Temp. setting too low	Reset temp. setting
Compressor will not start , but outdoor fan runs	Faulty wiring or loose connections in compressor circuit	Check wiring and repair or correct
	Compressor motor burned out stuck or internal over-load open	Replace compressor and determine cause
	Detective run capacitor	Replace
	Restriction in refrigerant system	Locate restriction and remove
	Capillary or accurate restricted or ice clogged.	Recover refrigerant and flush system, evacuate system and recharge
Compressor operates continuously	System undersized for load	Decrease load or increase system size
	Temp. setting too low	Reset temp. setting
	Defective outdoor fan	Check for source and replacement
	Air or non-condensable refrigerant in system	Recover refrigerant, evacuate system and recharge
	Air restricted or indoor / outdoor section filter dirty	Clean filter or remove restriction
Excessive head pressure	Dirty outdoor coil	Clean coil

	Detective outdoor fan	Check fan capacitor and fuse
	Refrigerant over charged	Purge excess refrigerant
	Air or non-condensable refrigerant in system	Recover refrigerant, evacuate system and recharge
	Outdoor section air restricted	Remove restriction
Head pressure too low	Low refrigerant charge	Check for leaks, repair and recharge
	Restriction in liquid tube	Recover refrigerant, evacuate system and recharge
	Indoor section air filter dirty	Clear filter
Excessive section pressure	Reversing valve hung up or internal leak	Replace
	Internal pressure relief open	Check for source and eliminate
	Refrigerant over charged	Purge excess refrigerant High Load
Suction pressure too low(low pressure control cut- out & pilot light for low pressure control lights off)	Low refrigerant charge	Check for leaks , repair and recharge
	Indoor unit frosted	Filter & Air flow
		Fan not running
	Low indoor air or short cycling	Eliminate cause, check for fan working
	Restriction in suction tube	Recover refrigerant, evacuate system and recharge
	Capillary or accurate restricted or ice clogged	Recover refrigerant, evacuate system and recharge
Outdoor fan stopped or cycling on overload	Detective fan motor capacitor	Replace
	Loose leads at fan motor	Check for cause and eliminate
	Fan motor burned out	Replace

	Motor bearing sized	Check for cause and eliminate
After batteries have been placed into the remote control, the display is not lit	Batteries are exhausted or have the wrong polarity	Replace batteries or check polarity
When pressing the recessed lock adjustment button ,hour figures on display do not flash	Recessed button has not been pressed correctly	Pressed with a round point, avoid exerting strong pressure
When pressing any button, all symbols appear on display.	Recessed button for time setting is blocked due to excessive pressure during use.	Check and repair
	Remote control has been irreversibly damaged	Replace with a new one
When pressing start button, unit does not acknowledge signal with a beep	Main switch is off	Switch it to the ON position.
	Remote control batteries are exhausted.	Replace batteries. Turn remote control OFF and
	Remote control has not been pointed correctly to the receiver of indoor unit	Repeat the operation in the control direction.
	There are obstacles (curtains, walls, etc.) between the remote control and the indoor unit.	Repeat the Operation after having removed the obstacles.
	Receiver on the indoor unit or the remote control is under intense sun radiation.	Avoid direct sun on the unit shut, curtains or shades.
	Signal transmission is obstructed by severe interference from an electromagnetic field.	Avoid sending signals when computers or household appliances (food processors, coffee makers etc.) are operating close by cellular or cordless telephone may also interfere with the control
When pressing stop button, unit does not acknowledge signal with a beep.	Remote control batteries are exhausted.	Replace batteries.
	Remote control has not been pointed correctly to the receiver of indoor unit.	Turn the remote control OFF and repeat the operation in the correct direction.
	There are obstacles (curtain, wall, etc.) between the remote and the indoor unit.	Repeat the operation after having removed the obstacles

	Receiver on the indoor unit or the remote control is under intense sun radiation.	Avoid direct sun on the unit, shut curtains or shades.
	Signal transmission is obstructed by severe interference from an electromagnetic field	Avoid sending signals when computers or household appliances (food processers, coffee makers, etc. are operating close by cellular or cordless telephones may also interfere with the controls
When pressing any function button, the remote control shows the function requested on the display, but unit does not acknowledge signal recipient with a beep and does not carry out the function	Main switch OFF.	Switch it ON position.
	Remote control batteries are exhausted.	Replace batteries.
	Remote control has not been pointed correctly to the receiver of indoor unit.	Turn remote control OFF and repeat the operation in the correct direction.
	There are obstacles (curtains, walls etc.) between the remote control, and the indoor unit.	Repeat the operation after having removed the obstacles.
	Receiver on the indoor unit is the remote control is under intense sum radiation.	Avoid direct sun on the unit, shut curtains or shades.
	Signal transmission is obstructed by severe interference from an electromagnetic field.	Avoid sending signals when computers or household appliance's (food processors, coffee makers, etc.) are operating close by cellular or cordless telephone may also interfere with the control.
Air conditioner will not start.	Main supply switch is OFF.	Switch it ON.
	Fuses or main switch are blown.	Replace fuses.
	Protection against frequent compressor cycling is ON.	Wait for 3 minutes.
	Selected temperature is higher than the room temperature in the cooling mode(or lower in the heating mode)	Correct selected temperature
	Air flow cannot circulate freely.	Remove obstructions.

Air conditioner is not supplying enough cooling	Dirty filters reduce air quantity circulating.	Clean air filters.
	Doors and / or windows are open.	Close doors and windows.
	Fan speed has been set to “low”.	Set fan speed at high speed.
	Air flow direction is not correct.	Adjust airflow direction as per the mode chosen.
	Selected temperature is higher	Correct selected temperature
Air conditioner is not supplying enough heating	Air float cannot circulate freely.	Remove obstructions.
	Dirty filters reduce air quantity circulating.	Clean filters.
	Doors and/or windows are open.	Close doors and windows.
	Fan speed has been to “low”.	Set fan speed at high speed.
	Air flow direction is not correct.	Adjust air flow direction as per the mode chosen.
	Select temperature is lower than the room temperature in the heating mode.	Correct selected temperature.
A slight mist is emitted from the indoor unit during cooling	The cool air from the indoors unit is coming into contact with the room air	Normal operation
A slight whistling noise is heard when the air conditioner starts or stops	This is due to the refrigerant beginning to circulate or an adjustment of the refrigerant pressures	Normal operation
Water vapor (mist) emanating from the outdoor unit	It is normal to heat pump operation, when defrost is automatically activated	Normal operation
Unpleasant smell coming from the indoor unit	Unpleasant smell can be caused by substances accumulated in the air filters.	Switch the system OFF and contact an authorized service center to have filters cleaned. Restart unit in the ventilation (fan only)mode and open windows to change room air

Strange noises coming from the indoor unit	Occasionally the indoor unit can emit some strange short noises during operation or when it has stopped. These are generally due to the temperature changes on the plastic parts	Normal operation
Starting in the heating mode for heat pump system	If the system starts at low ambient temperatures, it takes a little while to reach a comfortable room temperature. When the system is started by the remote control, it emits a signal beep, but the louvre does not swing and the fan does not run until the operating temperature has been reached	Normal operation
Timer led is blinking	Faulty return air sensor.	Determine reason and replace
	Faulty return indoor coil sensor.	Determine reason and replace
	Faulty return outdoor coil sensor	Determine reason and replace
Power led is blinking	Compressor overheat	Determine reason and replace
	Anti over heat	Determine reason and replace
	Low ambient	Determine reason and replace

Table 2: Fault finding

3.3 Maintenance records

1. Maintenance records should be completed in accordance with the approved check sheet – TOPAC-001/1or related PM (Preventative Maintenance) record.
2. Check sheet TOPAC-001/1 or PM must be completed in full, with accurate and relevant information in neat legible hand writing.
3. The latest revision of the check sheet is saved on Hyperwave and may be printed in order to keep records of maintenance and breakdown work completed.
4. The serial numbers of evaporator and condenser units are compulsory. Location and model numbers are equally important for record purposes.
5. All maintenance records to be kept for a period of three years from date of maintenance.
6. Document or records older than three years must be archived appropriately. It should be noted that all results obtained from any test done should be recorded. If the check sheet used does not make provision for the measurement recorded it should be added.

4. Training Providers

Where possible, course should be provided internally at Eskom Academy of Learning (EAL). In the event, that this is not possible, external training providers that are appointed according to Eskom's procedures and standards could be used.

5. Authorisation

This document has been seen and accepted by:

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6. Revisions

Date	Rev	Compiler	Remarks
18 January 2018	0.1	R Niranjan	Document revised and transferred to Eskom format.
12 April 2024	0.2	R Niranjan	Document reviewed.

7. Development team

The development team consisted of:

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