ESKOM SOLAR WATER HEATING PROGRAM

Background

Eskom requested the South African Bureau of Standards (SABS) to provide regulations for the installation of solar water heating units; that will serve as a guideline to Installers contracted for purposes of the Solar Water Heating (SWH) Program. Eskom hereby present the requirements that apply to *solar water heaters*. Installers of solar water heaters must be compliant with the requirements stipulated in this document. This document is compiled in consultation with an *industry task group* representing SABS, Eskom, IOPSA, PIRB, JASWIC, and NRCS. The document contains the following:

1. Mandatory standards
2. Laws and regulations
3. Summary of mandatory standards
4. Compliance Check list

1. MANDATORY STANDARDS

1.1. South African National Standard (SANS)

The following SANS standards apply to all solar water heaters and will be summarized below and also incorporated into a check list for use by installers and auditors:

1.2. SANS 1307:2009 - Domestic solar water heaters.

The scope of this standard specifies the requirements of domestic solar water heating systems.

1.3. SANS 10106 – The installation, maintenance, repair and replacement of domestic solar water heating systems, edition three.

1.4. SANS 10252 – part 1- Water Supply & Drainage for Buildings. Part 1 Water Supply installations for Buildings

1.5. SANS 10254 – the installation, maintenance, replacement and repair of fixed electric storage water heating systems.

1.6. SANS 10400 – Parts A, B, L, XA

2. LAWS AND REGULATIONS

2.1. Occupational Health and Safety Act (Act 85 of 1993, Clause 10)

A. General conditions

10. General duties of manufacturers and others regarding articles and substances for use at work

1) Any person who designs, manufactures, imports, sells or supplies any article for use at work shall ensure, as far as is reasonably practicable, that the article is safe and without risks to health when properly used and that it complies with all prescribed requirements.

2) Any person who erects or installs any article for use at work on or in shall ensure, as far as is reasonably practicable, that nothing about the manner in which it is erected or installed makes it unsafe or creates a risk to health when properly used on any premises

Clause 22. Sale of certain articles prohibited

Subject to the provisions of section 10(4), if any requirement (including any health and safety standard) in respect of any article, substance, plant, machinery or health and safety equipment or for the use or application thereof has been prescribed, no person shall sell or market in any manner whatsoever such article, substance, plant, machinery or health and safety equipment unless it complies with that requirement.

B. Pressure Equipment Regulations

Most water heating systems are subject to these regulations by definition and by direct reference. However and exemption is made in these regulations for heating systems using fixed electric storage heaters that comply with SANS 151 and that are installed and maintained according to SANS 10254 as been acceptably safe in terms of requirements of the OHS Act.

2.2. National Buildings Regulations Act 103 of 1977 and the Regulations proclaimed in 2008 hereby applies, PART A, PART L AND PART XA

Part A sets the requirements as to who may do plumbing work it requires that it should be done by or under an adequate control of a qualified plumber.

Part L and Part B sets the requirements for roofs and the structural loading of elements in the building. It also stipulates the qualifications of persons who may do designs and assessments of such structures and loads.

Part XA sets the requirements for energy efficiency of buildings and stipulates that Solar Water Heating systems shall comply with SANS 1307, SANS 10106 and SANS 10254 and that all hot water pipes shall be insulated to an R-value of 1,00.

2.3. LOCAL GOVERNMENT: MUNICIPAL SYSTEMS ACT (ACT 32 OF 2000)

This act empowers local authorities to issue a gazette by laws to regulate standards and practices within their areas of jurisdiction. Most bylaws for water and sanitation require that all components for use in installations shall be listed on their schedule of approved or accepted products. That schedule is normally the JASWIC acceptance list. www.jaswic.co.za

2.4. WATER SERVICES ACT (ACT NO 108 OF 1977)

Section 14 requires that all consumer installations must comply with SANS 10252 – Water supply and drainage to buildings; and SANS 10254 Installation of electric storage water heaters.

3. SUMMARY OF SANS STANDARDS RELATING TO SOLAR WATER HEATERS

SANS 10106 The installation, maintenance, repair and replacement of domestic solar water heating systems

4.2.1 All components to be acceptable and approved by the Local Authority and or

3.2 SABS and comply with SANS standards

4.2.2a) Fittings and components of which the type and quality shall apply with appropriate standards.

5.4.1 Control systems components shall comply with the relevant acceptable or acceptable international standards.

4.2.2b) The solar water heater shall comply with SANS 1307

5.1.1 A solar water heater installed in areas where freezing is known to occur shall be protected against freezing

5.1.2 The methods of freeze protection shall be in accordance to SANS 1307

5.2.2 An assessment of the roof structure that will support the anticipated loads, wind and rain to be carried out by a competent person in accordance with SANS 10400

5.2.3 The unit shall be fixed to the roof and supported to maintain the

5.2.4 correct orientation(north or within 45 º east or west of north) and tilt

5.2.5 angle, without causing deterioration of roofing material or collecting of

5.2.6 access to components that require maintenance and repair shall be provided

5.2.7 water on the roof

5.3.2 Were heat losses may occur the storage tanks shall be thermally insulated in an acceptable manner to prevent heat loss

5.5.3 The piping shall be insulated against heat loss and freezing

5.3.4 The overflow outlet shall be directed to where it shall not cause damage to the building

5.4.5 Systems with stored water over 60℃ to be fit ted with mixing valve

6 The installer must furnish the owner with an operation manual (written and schematic) containing operating, safety emergency shut down and routine maintenance procedures and instructions

SANS 1307 Domestic solar water heaters

4.4 Hot water storage tank shall comply fully with the relevant mechanical and design requirements of SANS 151

4.6 **Thermal insulation of the system shall be stable when exposed to UV radiation**

4.8.1 All components shall be of such construction, quality and designed to be sturdy and acceptable to the Local Authority and or SABS

4.11.1 The solar water heater shall be resistant to rain penetration when tested to SANS 6210 clause 4.4

4.5 The solar water heater shall be resistant to hail when tested to SANS 6210 clause 4.5

5.5 Joule impact) when tested to SANS 6210

4.11.3 The solar water heater shall be resistant to freezing when tested to SANS 6210 clause 4.6

5.6 intended for installation in areas where freezing occurs

4.11.4 The system shall comply with the appropriate fatigue and pressure test requirements in SANS 151 clause 6.3

4.11.5 The system shall be so designed, constructed and protected to withstand physical damage after handling, transport and installation

4.11.6 Hot water storage tanks of all solar water heaters shall comply with the safety requirements of SANS 60355-2-21

4.13.1 The thermal performance of the solar water heater shall be at least 9MJ/m2/d when tested to SANS 6211-1

4.13.2 The standing loss and mixing factor shall comply with SANS 1307 when the latest revision is published

4.14.1 Materials for waterways shall be intrinsically corrosion resistant and copper alloy materials shall be DZR

4.14.2 External surfaces shall be corrosion resistant/protected

6.1 Markings of hot water storage tank shall comply with SANS 151 and collectors shall be marked indicating : working pressure; manufactures name or trade mark; aperture area; freeze resistant or not (in addition to marking plate on collector in letters 30 mm high); energy rating; should hail cover (grid) be fitted or not.

6.3 An instruction booklet incorporating marking label information, thermal performance, safe and correct installation safety and maintenance instructions shall be attached to each solar water heater.

DI Normative installation, replacement and retrofit requirements. Solar water heating installations shall comply with SANS 10106, SANS 10254, SANS 10252-1, SANS 10400 and SANS 10142 as applicable

D4 Retrofit installations onto existing electrical hot water systems can be (D5)

D5 either solar pre-heater or circulating options. Pipes from solar water heater may not be connected to hot water outlet pipes of existing electrical water heater and pressure rating of solar water must be matched to the existing electrical water heater.

<u>SANS 10252-1 Water Supply to Buildings</u>

5.1.1 All components and materials shall be selected to be suitable for the expected conditions of use and approved by the Local Authority where it will be used and (5.2.1)

5.2.1 Copper pipes to comply with SANS 460 and fittings with SANS 1067 and with (5.2.5)

5.2.5 Galvanized steel pipes and fittings shall comply with SANS 62 and SANS 14

5.2.3.1 Plastic materials, pipes and fittings shall be selected and used in accordance with the relevant standards. **Plastic pipes** for use with hot and cold water systems **inside buildings** are:
SANS 15874-PP polypropylene
SANS 15875-PE-X cross linked polyethylene
SANS 15876-PB polybutylene
SANS 15877-PVC-C chlorinated polyvinyl choridne
SANS 22391-PE-RT raised temperature cross linked polyethylene
SANS 21003-PE-X multi-layer

5.2.4.1 Stainless steel pipes and fittings complying with SANS 965, ASTM A312 or BS 970-1 and ASTM A 403 are deemed acceptable.

5.3.3.1.1 Taps and mixers shall comply with SANS 226, float valves to SANS752

5.4.12a) Gate valves shall comply with SANS 776 and SANS 1857

5.4.12b) Ball shut off valves shall comply with SANS 1053-3

5.4.6.2.1c) Storage tank (cisterns) lids designed not to be left open, with screwed
+d) on and close fittings

5.4.7.1 Fixed water heaters shall comply with SANS 151

5.4.7.2 Drain valves for water heaters shall comply with SANS 1808-35

6.1.3.1j) Specific isolating valve shall be provided next to and upstream of the valve controlling the valve to any storage tank

6.6.5.3a)+b) Any vent from a fixed water heater shall extend on a rising grade from the highest point of the container and be as short as practicable, and it shall extend to at least 80 mm above the water level in the cold water feed tank and shall be turned downwards to pass through the cover of the feed tank, terminating above the level of the water supply inlet, clear of the level control valve.

6.7.5.1 Pipes and components shall when necessary be protected against freezing, appropriate to the minimum expected temperatures expected in that geographical area.

5.4.10.1 Recommended temperature for storage of water is 60º C and be (7.1.2.f)

7.1.2.f) maintained at a minimum of 55º C to prevent the conditions (7.5.1.4)

7.5.1.4. that could allow for the development of the bacterium Legionaella Pneumophila. Maximum discharge temperatures from terminal fittings shall be 55 ºC. Minimum discharge temperatures at sinks should be 45 º C (to melt fats).

7.2.1.2 The velocity of water flow in any pipe shall not exceed 2,5 m/sec.

6.7.5.4 Ingress of moisture into insulating materials shall be prevented

8.3.1.3 All pipework connected to water heaters and associated valves shall be connected by means of flush unions or similar connectors to facilitate replacement

8.4.4.3 Pipes shall be securely fixed with pipe supports to any structural member of a building with which they come into contact

8.4.4.8 Maximum spacing of pipe supports shall be (tables 21 + 22)
Metal pipes up to 25 mm diameter : 1,6 m non-vertically; 3,0 m vertically
Plastic pipes up to 20 mm diameter : 0,3 m non-vertically; 0,6 m vertically
Plastic pipes 21 mm to 32 mm diameter : 0,4 m non-vertically; 0,8 m vertically

9.2.1 The installation shall be inspected to detect faults in construction or (9.2.2)

9.2.2 materials and for compliance with drawings, specifications and requirements and subjected to pressure tests. There shall be no loss of water or visual evidence of leakage.

SANS 10254 Installation, maintenance, replacement and repair of fixed electric storage water heating systems

4.1.1.1 All components used in system shall be approved by the Local Authority and or (4.1.3)

4.1.3 by SABS; pipes and fittings to comply with applicable SANS standards; storage water heater to comply with SANS 151; float valve complying with SANS 752; close fitting cistern lid.

4.3.1.1 All components shall be installed to ensure safe and effective.

5.4 operation, easy removal and maintenance, including union type couplings for tank and components for replacement and maintenance

4.3.1.2 Water heater and ancillary components shall be replaced, maintained and repaired to comply with this standard and only non-compliance shall be reported by the person carrying out such maintenance, replacement, or repair to the owner in writing.

4.3.3 Hot and cold delivery pressures to mixing components shall be balanced

5.4 Union type couplings shall be used on tanks and all operating components for easy replacement or maintenance.

5.5 Connecting pipes shall be firmly anchored

5.6.1 Inlet pipe to float valve shall be fitted with an isolating valve

5.6.2 A specific isolating valve shall be provided where a pipe enters any building or part of a building in separate occupation.

SANS 10400 PART XA Energy efficiency in buildings

4.1d) Solar water heating systems shall comply with SANS 1307, SANS 10106 and SANS 10254

4.1e) All hot water service pipes up to 80 mm internal diameter shall be clad with insulation with minimum R- valve of 1,00 and be installed in accordance with the manufacturer's instructions.

SANS 151 Fixed electric storage water heaters

4.5 Storage water heaters shall comply with the safety requirements of SANS 60335-2-21

5.4 In a cistern type water heater, heated water can expand back into the cistern, or an expansion or vent pipe of minimum 12,5 mm inside diameter shall be fitted to the water container and may discharge into the feed cistern above the level of the overflow. The cistern shall allow for the

connection of an overflow pipe of at least 20 mm so positioned that the body of the inlet valve cannot become submerged.

5.7.1 Pipe connectors shall be such that connection and disconnection can only be affected by the use of tools.

5.7.5 In cistern type water heaters with stainless steel containers only, where the pipe connections are not fixed to the tank but uses a seal, the pipe must have a means for clamping when the connection is made i.e. depressed flat sections at least 20 mm wide. A note to be provided near the pipe to indicate that the pipe shall be clamped.

5.8 Minimum supply flow rate for cistern type water heaters. Each cistern shall be finished with a float valve complying with SANS 752 and supplying at least 18L/min. The invert of the overflow shall be lower than the invert of the float valve body.

5.9.2 The drain valve shall comply with SANS 1808-53. The drain valve pipe connection and outlet may not be situated in the terminal box.

8.1.1 In addition to the markings required in SANS 60335-2-21, the water heater shall bear the following indelible markings on yellow background: capacity in liters; cistern type marked O kPa working pressure; solar water heater type; standing loss per 24 hr in kilowatt hours; moisture resistance IPX 4 for solar.

8.1.2 Connections shall be clearly indicated; inlet and outlet; connection to the collector and return from the collector.

8.2 Each water heater shall be supplied with a leaflet or label stuck on the water heater that contains instructions to install, operate, maintain and repair the water heater strictly in accordance with SANS 10254 to ensure its safe and effective performance.

We trust that the above information is understood and that the standards are applied conscientiously. Please contact us should you require further clarity on any matter.

Kind Regards

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APPENDIX A:

4. INSTALLATION CHECK LIST FOR SOLAR WATER HEATERS

SANS Std	Ref no		Requirement	Comply ☑ Not comply ☒ Not applicable N
1 THERMAL INSULATION				
10106	5.3.2 + 5.1	1.1	Are correct pipes and fittings insulated	
10400-XA	4.1e	1.2	Is insulation resistance minimum R-1,00	
		1.3	Insulation installed to manufacturer's requirements, mitred + taped	
1307	4.6	1.4	Is insulation UV and weather protected?	
		1.4	Does insulation comply with SANS Standards (Check marking)?	
2 ORIENTATION and INCLINATION				
10106	5.2.4	2.1	Is collector tilt angle to º latitude (+10° if required)?	
10106	5.2.4	2.2	Is collector orientation facing North (Max deviation 45° East or West of North)?	
3 HAIL + FREEZE RESISTANCE				
1307	6.1	3.1	Is hail cover grid fitted as required on collector marking?	
1307 10106	6.1 + 4.11.3 + 5.6 + 5.1.1 + 5.5.7	3.2	Is collector marked freeze resistant if installed in areas where frost/freezing occurs?	
10106 10252-1	5.5.1 + 5.5.7 + 6.7.5.1	3.3	Are pipes and fittings insulated against freezing in areas where frost/freezing occurs?	
4. METAL PIPEWORK				
10106 10254 10252-1	4.2.1 + 4.2.2a) + 4.1.1.1 + 5.1.2	4.1	In areas where by laws do not allow galvanized steel pipes & fittings, have they not been fitted ?	
10252-1	5.2.5	4.2	Do the galvanized steel pipes & fittings comply with SANS 62 and SANS 14 ?	
10252-1	5.2.1	4.3	Do the copper pipes comply with SANS 460 and fittings with SANS 1067?	
10252-1	5.1.1 + 5.1.2	4.4	Have metallic pipes only been used outside buildings?	
10106 10254 10252-1	4.2.1 + 4.2.2 a) + 4.1.1.1 + 5.1.2 + 5.2.4.1	4.5	Are copper pipes connected to hot water tanks in compliance with SABS? Do the stainless steel pipes and fittings comply with SANS 965, ASTMA 3122, BS 9704 or ASTMA 403?	

5 PLASTIC PIPEWORK				
10106 10254 10252-1	4.2.1 + 4.2.2a) + 4.8.1 + 5.2.3.1	5.1	Are plastic pipes and fittings only inside the buildings?	
		5.2	Do polypropylene pipe systems comply with SANS 15874?	
		5.3	Do cross-linked polyethylene pipe systems comply with SANS 15875?	
		5.4	Do polybutylene pipe systems comply with SANS 15876?	
		5.5	Do PVC-C pipe systems comply with SANS 15877?	
		5.6	Do PE-RT pipe systems comply with SANS 22391?	
		5.7	Do PE-X multilayer pipe systems comply with SANS 21003?	
		5.8	Do compression fittings used on plastic pipes have internal inserts?	
		5.9	Are the fittings used as approved by SABS as a system?	
6 PIPEWORK GENERAL				
10252-1 10254	8.4.4.8 + 8.4.4.3 5.5	6.1	Are all pipes fixed with manufacturer's clips within the minimum spacing: Metal up to 25mm 1,6m non-vertically, 3,0m vertically? Plastic up to 20mm 0,3m non-vertically, 0,6m vertically? Plastic 21mm to 32mm 0,4m non-vertically, 0,8m vertically?	
10252-1 10254	8.3.1.3 5.4	6.2	Are only union type fittings used at all connections to the tank, collectors and valves? Not soldered, glued, welded, crimped fittings?	
		6.3	Are formed bends in Multi-layer PE-X pipes within the radius specified by the manufacturer?	
151	8.1.2	6.4	Are connections to tank and collector done as marked on the tank?	
7 STAND AND MOUNTING				
10106 1307	5.2.2 4.8.1	7.1	Has the roof structure that will carry the anticipated loads, wind and rain been assessed by a competent person (structures) in accordance with SANS 1400?	
10106	4.3	7.2	Are the stand footplates of acceptable size and design for the cover material to bear the load?	
10106	5.2.5	7.3	Does the section of the stand bearing most of the load of the storage tank rest on a load spreading beam?	
10106	5.2.7	7.4	Are the stand footings secured or fastened on the peaks of the roof cover material not in the waterways?	
10106	5.2.5 + 5.2.7	7.5	Are the roof penetrations done on the peaks of the roofing cover material and not in the waterways?	
10106	5.2.5 + 5.2.7	7.6	Do the sealing methods and materials comply with SANS 10400 part L, regarding clamping, coving and dressing around pipes?	
10106	5.2.2	7.7	Is the stand sturdy with adequate bracing to withstand loads?	

1307 10254	4.8.1 4.3.1.1			
1307 10254	4.8.1 4.3.1.1	7.8	The base of the stand must be secured and sealed securely onto the roof structure and must not be fitted onto softwood stands or beavers on top of the roof covering material.	
8 TAPS AND VALVES				
10254	5.6.2	8.1	Is there an isolating valve where the pipe enters the building?	
10254 10254-1	5.6.1+ 6.1.3.1j)	8.2	Is there an isolating valve on the separate pipeline (or next) to the floor valve?	
10252-1	5.3.3.1.1	8.3	Does the top comply with SANS 226?	
10254 10252-1	4.1.3 + 5.3.4	8.4	Does the float valve comply with SANS 752?	
10252-1	5.3.3.1.1 + 5.4.12a) + 5.4.12b)	8.5	Does the isolating valve comply with SANS 776 or SANS 1857 if a gate valve or to SANS 1056-3 if a ball valve or to SANS 226 if a stopcock?	
10254	4.3.1.1	8.6	Does the isolating valve have a lever or handle for emergency shut down? (SAFETY)	
10252-1 10254	5.4.7.2 + 5.9.2	8.7	Does the drain-cock on the storage tank comply with SANS 1808-35?	
10106	5.4.5	8.8	Has a thermostatic tempering valve been fitted on the correct pipework at the correct height, if the water in the hot water storage tank can heat to above 60ºC?	
9 HOT WATER STORAGE TANK AND COLLECTOR				
10254 1307 10252-1	4.1.3 + 4.4 + 5.4.7.1 + 5.4.10.1	9.1	Does the hot water storage tank comply with SANS 151?	
10106	4.2.2.6	9.2	Does the system comply with SANS 1307?	
151	5.9.2	9.3	Check that the hot water storage tank does not have provision (connection) for the connection of an electrical element – even if it is plugged off and is not fitted with an electrical element. If the connection is there, the tank does not comply.	
1307	6.1	9.4	Do the markings on the storage tank and on the collector comply with SANS 151 and SANS 1307?	
151 10252-1	5.4.1 + 6.6.5.3a)	9.5	Does the tank have a separate vent pipe that may either have a return bend on top, or be fed into the top of the feed cistern above the overflow level?	

10 CISTERN FEED TANK				
151	5.4.6.2.1c) + 5.4.6.2.1d)	10.1	Is the cistern tank lid tight fitting and secured with screws?	
10252-1	5.1.1	10.2	Is the float valve made of metal to deal with hot water? Plastic float valves do not comply if the water in the cistern can reach temp above 50º C	
151	5.4.1	10.3	Does the supply pipe from the cistern feed to the bottom of storage tank through a “drop tube”?	
10252-1	5.1.1	10.4	Cistern tank material must be suitable for high temperatures.	
1307	4.8.1	10.5	The cistern tank must not rest all of its weight on the connecting nipple but must have additional acceptable fixed support e.g. collar or frame, which will carry the downward load and other applied loads like wind.	
151	5.4.1 + 5.8	10.6	The over flow level must be lower than the invert of the inlet valve. The cistern tank capacity must allow for the expansion volume (between the float shut off level and the overflow). Heating from 10ºC to 95ºC this would require 4.4% of the capacity of the storage tank plus the collector.	
10252-1	8.4.4.3 + 8.4.4.8	10.7	All pipe work connected to the cistern must be fixed to the structure or frame.	
11 INSTALLATION REQUIREMENTS				
10400	A18	11.1	Was the installation carried out by, or under the adequate supervision, of a qualified plumber?	
10400 1307 10106	A18 + 4.8.1 + 4.2.1 + 4.2.2a)	11.2	Did the plumber ensure that all materials used and work that was done to comply with the mandatory standards, regulations, laws and bylaws that apply to these installation/s.	
10106	4.2.1 + 4.2.2a)	11.3	Was the certificate of compliance logged to enable compliance auditing of the work?	
10252-1 10106 1307	5.1.1 + 4.2.1 + 3.2 + 4.2.2a) + 5.4.1 + 4.8.1	11.4	Were all the materials used on the installation checked against the JASWIC database for Local Authority acceptance?	
10252-1	9.2.1 + 9.2.2	11.5	Was the installation flushed out, inspected and pressure tested to check for compliance to the standards?	
1307 10106 151	6.3 6 8.2	11.6	Did he plumber hand over the safety, maintenance and operation manuals to the home owner?	
10254	4.3.1.2	11.7	Did the plumber report any non-compliances on the installation to the home owner in writing?	