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South African Tap and Flow Rate Gap Analysis

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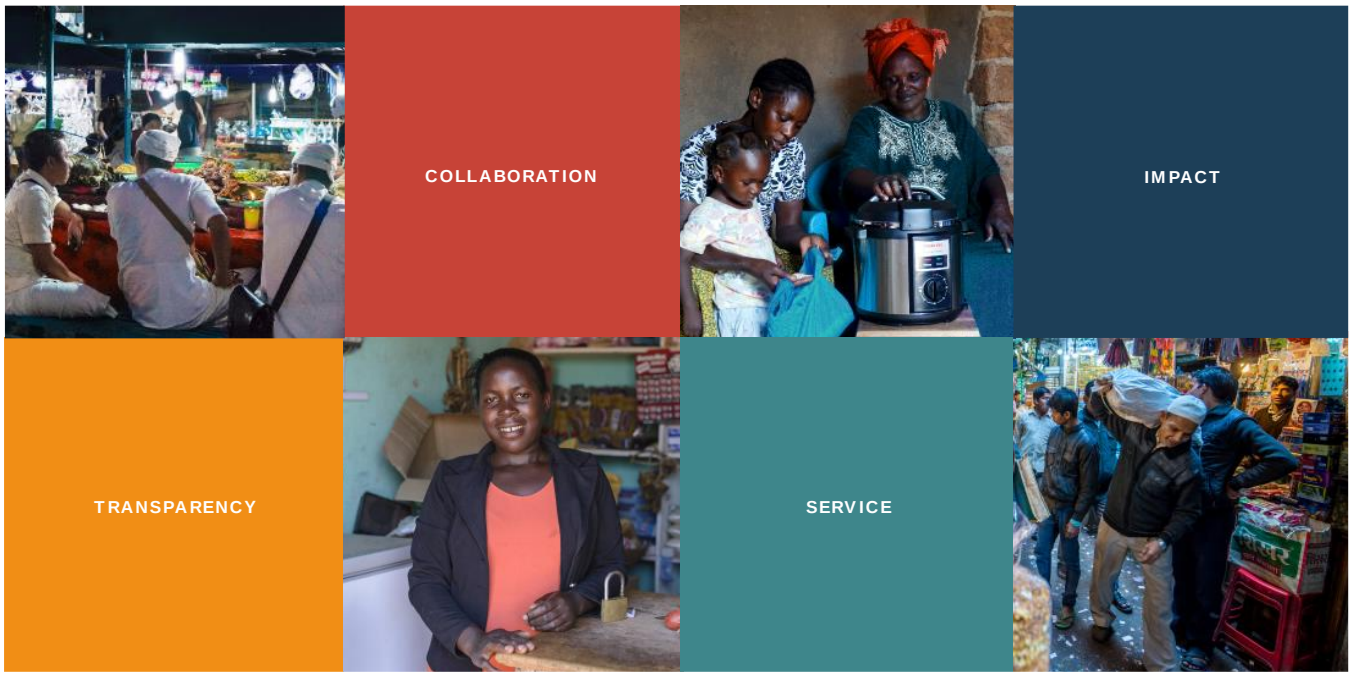

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Acronyms and Abbreviations

SANS	South African National Standards
SABS	South Africa Bureau of Standards
ISO	International Standards Organization
kPa	Kilo Pascal. (1 bar=100kPa)

Executive Summary

CLASP's 2021 report titled *"In-depth Assessment of Water Efficiency Opportunities in South Africa"* found that standards for taps and showerheads could address the country's linked water and energy crises by reducing the use of water and electricity needed to heat some of that water. As a next step, the report recommended a gap analysis between the various South African National Standards that were perceived to require high flow rates, in contrast to international trend of standards requiring decreasing flow rates in support of sustainability.

The scope of this study was based on the recommendations of the 2021 report and expanded to include:

- Evaluation of the various South African National Standards (SANS) for taps.
- Evaluation of the various South African National Standards (SANS) for water installation and efficiency.
- Evaluation of relevant international standards for taps.
- Compilation of a gap analysis between all evaluated standards, and
- Providing recommendations for amendments to the SANS standards to align among national standards and with international standards.

This study aims to clear the way for a water efficiency labelling program to be introduced in South Africa. The South African Water and Sanitation Master Plan 10.1, published by the Department of Water and Sanitation, indicates that a water efficiency labeling scheme will be established by 2025. In response to this goal, the SABS Special Committee, TC0138/SC02, participated in the International Standards Organization project (ISO/PC 316) to develop an ISO standard for water labeling systems. The SABS considers the ISO standard, once published, to be applied to establish a water efficiency labeling program in South Africa.

To establish such a water efficiency labeling program, there must be uniformity between the requirements of all related SANS standards and international tap standards. Therefore, the gap analysis performed in this study aims to present recommendations to allow for such uniformity.

The gap analysis was performed by recording and collating all flow rate requirements and test conditions for determining the flow rates and was done for all SANS tap and SANS installation standards with flow rate requirements. Similarly, the requirements from international standards that could influence the taps supplied in South Africa have been recorded and collated.

The differences in flow rates, test methods, and testing conditions have been evaluated and modeled to allow for a single reference to compare all requirements. This modeling aimed to establish the likelihood that taps tested internationally, at the test conditions applicable to the country of origin, would comply with the equivalent requirements of the applicable SANS standard.

This study indicated several misalignments between SANS and international standards. The project team's view is that these misalignments could be addressed effectively through amendments of the selected requirements of the SANS standards.

This report provides recommendations on how flow rates should be evaluated to determine appropriate flow rate requirements. A maximum flow rate is recommended for each type of tap to align with similar international requirements. Target water-saving flow rates are recommended for future implementation to improve water efficiency. Such modifications will aid South Africa's programs to improve the sustainability of water supply resources.

NOTE: This report uses the terminology "tap" as this is the terminology used in South Africa referring to what is known as a "faucet" in several other countries.

1. Evaluation of South Africa's Tap Standard Requirements

1.1 Identification of standards

Legislation in South Africa mandates that most plumbing components comply with the national standard for the component and must be installed in compliance with the national standard for plumbing installations.

The various national component standards applicable to water taps are:

- SANS 1480:2005 “Single control mixer taps.”
- SANS 1808-37:2005 “Water supply and distribution system components Part 37: Single-control mixer taps (plastics).”
- SANS 226:2016 “Water taps (metallic bodies).”
- SANS 1021:2007 “Water taps (plastic bodies).”
- SANS 1808-9:2017 “Water supply and distribution system components Part 9: Metering taps and valves (metallic bodies).”
- SANS 1808-66:2005 “Water supply and distribution system components Part 66: Demand type water taps.”
- SANS 1808-35:2010 “Water supply and distribution system components Part 35: Electronically operated taps and valves.”
- SANS 1808-16:2017 “Water supply and distribution system components Part 16: Drinking fountain taps.”
- SANS 1808-30:2004 “Water supply and distribution system components Part 30: Laboratory water taps.”

The national standards applicable to plumbing installations are:

- SANS 10252-1:2018 “Water supply and drainage for buildings Part 1: Water supply installations for buildings.” This standard establishes general principles for designing, installing, and testing potable water installations for buildings. The standard does not address water installations for industrial or other applications. This standard has been incorporated into the Water Services Regulations, making it a legal requirement that all related installations must comply with this standard.

- SANS 3088:2019 “Water Efficiency in buildings.”

  This standard provides minimum requirements for plumbing fixtures and fittings, and water usage in buildings. This is a voluntary standard.

1.2 Overview of standards

1.2.1 Tap standards

Most taps used for residential installations and ablution facilities in commercial buildings fall within the scopes of SANS 226 and SANS 1480.

It is worth noting that the South African tap standards differ from the standards of other countries as it does not address all mixer taps in a single standard. The tap standards are generally differentiated by the method of operation or the operating mechanism of the tap. Most of the tap standards addressed below could include mixing taps.

The scope of SANS 1480 includes mixer taps (mixers) that are manually operated using a single control lever. This standard applies to taps manufactured from metal (typically brass).
Plastic taps of similar functionality are included in SANS 1808-37.

Figure 1 Depiction Of A Sans 1480 Or Sans 1808-37 Tap

Taps that use separate hot and cold-water controls are addressed by SANS 226, including metallic bodied taps and SANS 1021 for plastic-bodied taps. These include the traditional screw-down and the recently popular quarter-turn type taps. These standards apply to both mixer taps and individual taps.

Figure 2 Depiction of a SANS 226 or SANS 1021 Tap

Note: While no standard addresses the specific requirements of thermostatic mixer taps, indirectly, these taps are included in the scopes of SANS 226 and SANS 1021.

Taps that operate with a manually activated push button are addressed in two different standards. Such taps, intended to deliver a set **volume** of water, are included in SANS 1808-9, while similar taps intended to provide flow for a specified **time** are included in SANS 1808-66. It is usually impossible to differentiate between the visual appearances of the two tap types.

Figure 3 Depiction of a SANS 1808-9 or SANS 1808-66 Tap

All types of taps and valves that activate based on an electronic signal are covered under SANS 1808-35. These include mixers and single-type taps. Touch, non-touch sensor, or any other mechanism can activate the taps, allowing for various tap or valve types. e.g., taps with the same mechanical function as a SANS 1808-9 or SANS 1808-66. This could also include a solenoid valve.

Figure 4 Depiction of a SANS 1808-66 Tap

The other two tap standards are for taps with specific functions.
SANS 1808-16 addresses water fountain taps. However, the scope of this standard is limited to domestic installations and taps with an inlet size of 15mm. As such, drinking fountain taps in public buildings is not addressed in this standard.

Figure 5 Depiction of a SANS 1808-16 Tap

SANS 1808-30 addresses water taps used in laboratories. While not clarified in the scope of this standard, the requirements are aligned with single-channel taps and not with mixer taps.

Figure 6 Depiction of a SANS 1808-30 Tap

1.2.2 Installation Standards

The water services regulations published on 8 June 2001 incorporated the installation standard SANS 10252-1 as a legal requirement. This standard provides design and installation requirements for all water supply installations. Section 5.3.3 of this standard makes it a legal requirement that all taps installed in a building comply with at least one of the tap standards listed in the previous section.

This installation standard also provides some additional flow rate requirements.

SANS 3088 is a voluntary standard; therefore, compliance is not compulsory.

1.3 Water flow requirements of standards

The flow rate and volume requirements of the various SANS tap standards are as follows:

a) SANS 1480 (Single-lever mixer - Metal)

Tap type definition	Test Pressure (kPa)	Minimum flow rate (L/min)	Maximum flow rate (L/min)
Bath	300	18	not specified
Shampoo	300	6	not specified
Basin	300	not specified	12
All other	300	12	not specified

Table 1: sans 1480 flow rate requirements

b) SANS 1808-37 (single-lever mixer - Plastic)

Tap type definition	Test Pressure (kPa)	Minimum flow rate (L/min)	Maximum flow rate (L/min)
Bath	300	16	20
Shampoo mixer	300	5	7
Other mixers	300	0	7

Table 2: SANS 1808-37 flow rate requirements

c) SANS 226 (Separate control - Metal), and SANS 1021 (Separate control - Plastic)

Tap type definition	Test Pressure (kPa)	Minimum flow rate (L/min)	Maximum flow rate (L/min)
Class 1 - 15mm	10	9	not specified
Class 2 - 15mm	50	9	not specified
Class 3 - 15mm	50	7	11
Class 4 - 15mm	900	7	9
Class 1 - 20mm	10	15	not specified
Class 2 - 20mm	50	18	not specified
Class 3 - 20mm	50	20	30
Class 1 - 25mm	10	23	not specified
Class 2 - 25mm	50	25	not specified

Table 3: SANS 226 & SANS 1021 flow rate requirements

d) SANS 1808-9 (Metering Taps), and SANS 1808-66 (Demand Taps)

Tap type definition	Test Pressure (kPa)	Minimum flow rate or volume	Maximum flow rate or volume
Metering Taps	600	1.8 liters	2.2 liters
Demand Taps	300	5 L/min	7 L/min

Table 4: SANS 1808-9 & SANS 1808-66 flow rate requirements

e) SANS 1808-35 (Electronically operated)

Tap type definition	Test Pressure (kPa)	Minimum flow rate or volume	Maximum flow rate or volume
Basin	600	5 L/min	7 L/min
Urinal	600	1.8 liters	2.2 liters
Toilet	600	8.8 liters	9.2 liters
Shower	600	9 L/min	11 L/min

Table 5: SANS 1808-35 flow rate requirements

f) SANS 1808-16 (Drinking fountain)

Tap type definition	Test Pressure (kPa)	Minimum flow rate (L/min)	Maximum flow rate (L/min)
Domestic Drinking fountain	50 - 600	0.9	1.1

Table 6: SANS 1808-16 flow rate requirements

It is a legal requirement for the relevant installations to comply with SANS 10252-1. This standard includes the following flow rate requirements:

g) SANS 10252-1 (Installation flow restrictions)

Tap type	Test Pressure (kPa)	Minimum flow rate (L/min)	Maximum flow rate (L/min)
Shower	not specified	not specified	10
Hand wash-basin	not specified	not specified	6

Table 7: SANS 10252-1 flow rate requirements

NOTE: The standard does not specify the pressure at which the flow rate maximums shall apply. Thus, the maximum must apply at any pressure up to 600 kPa, the highest installation pressure allowed by the installation standard.

SANS 3088 “Water Efficiency in Buildings” was a voluntary standard when generating this report. As such, compliance to this standard was encouraged but not a legal requirement. However, it was understood that it was intended for this standard to be incorporated into the national building regulations, which would make it a legal requirement.

Whether compliance to the standard is a legal requirement, or not, should not influence the alignment between this standard and the tap standards. Water efficiency in South Africa will be advanced if it is possible for plumbing installations to comply with SANS 3088.

The flow rate requirements listed in SANS 3088 are:

Tap Type	Area of use	Area	Reference Test Pressure (kPa)	Minimum flow rate (L/min)	Maximum flow rate (L/min)
Demand Tap	Wash Hand basin	Public	300	Not specified	6
		Domestic	600		5
Metering Tap	Wash Hand basin	Public	600		2
		Domestic	600		5
Electronic Tap	Wash Hand basin	Public	Not Specified		5
		Domestic	100		5
All Taps	Bath				No restrictions
All Taps	Kitchen	Commercial	Not Specified		15
		Domestic	Not Specified		15
Tap with spray nozzle	Kitchen sink		Not Specified		10
Drinking fountains	All areas		Not Specified		2
All Taps	Outdoor	Including landscaping and gardens, but other than irrigation of sports fields and agriculture, and other than community standpipes			No restrictions
All Taps	Outdoor	Residential dwelling			No restrictions
All Taps	Outdoor	Community standpipes			No restrictions
All Taps and shower heads	Shower	Emergency showers and eyewash stations			No restrictions
		Public showers			2 liters per cycle
		Domestic			9 L/min
Flush tap	Urinal wall mount		User Activated		2 liters per flush
Flush tap	Urinal trough type		User Activated		2 liters per flush / 1.6m stall
All Types	Bidet				5 L/min

Table 8: SANS 3088 flow rate requirements

1.4 Comparison of requirements

The requirements for tap standards were compared with each other and with the requirements for installing such components. This comparison revealed several misaligned conditions making it challenging to comply with mandated requirements.

The following misalignments have been identified:

1.4.1 Tap Definitions

The tap type definitions presented in tables 1 to 7 are as reflected in the different product standards. The majority of taps fall within the scopes of SANS 1480 (metal single lever mixers) and SANS 226 (metal separate control taps and mixers). In many instances' suppliers are selling SANS 1480 and SANS 226 taps in the same range. It is therefore generally considered that these two tap standards should have equivalent performance requirements, and that the differences between the standards should vary only with regard to the testing requirements for the different types of operating mechanisms.

SANS 1480 singles outflow rate requirements for bath taps, shampoo taps, and basin taps, with all other taps like bidet taps, kitchen sink taps, and taps for clothes washing areas having to comply with a single flow requirement (See table 1). In contrast, SANS 1808-37 is considered to be the equivalent of SANS 1480 for taps made of plastic, singles out bath and shampoo taps but not basin taps. SANS 1808-37 does not provide a definition for shampoo taps. These are taps with a hand shower attached to a flexible hose.
Other tap configurations could be identified as shampoo mixers by the tap manufacturer.

SANS 226 identifies taps by class and inlet size, and there is no guidance in any product or installation standards relating the classes to the definitions used in SANS 1480. (See table 3). SANS 226 also does not provide any definitions for the different classes. In general terms, the classes refer to the following types:

- Class 1: Taps used with low pressure or gravity fed plumbing systems
- Class 2: Taps used on pressurized plumbing installations
- Class 3: Specialized taps that could be designed for any pressure up to 900 kPa

SANS 1021, which is considered the equivalent of SANS 226 for taps made of plastic, uses the equivalent definitions of SANS 226.

The installation standards SANS 10252-1 and SANS 3088 use 12 different definitions for taps. Of these 12 definitions, five do not occur in any of the tap standards.

SANS 3088 further references public areas, commercial areas, and domestic installations. Different requirements are set for the same tap as installed in the other places. None of the tap standards have conditions that make similar distinctions.

The various tap definitions as they occur in the different standards are shown in table 9 below:

	SANS Standard number									
Type Description	**1480**	**1808-37**	**226**	**1021**	**1808-9**	**1808-66**	**1808-16**	**1808-35**	**10252-1**	**3088**
Bath	✓	✓								✓
Shampoo	✓	✓								

Basin	✓							✓	✓	✓
Shower								✓	✓	✓
Urinal								✓		✓
Toilet								✓		
Bidet										✓
Kitchen Sink										✓
Kitchen Sink with spray nozzle										✓
Class 1 - 15mm			✓	✓						
Class 2 - 15mm			✓	✓						
Class 3 - 15mm			✓	✓						
Class 4 - 15mm			✓	✓						
Class 1 - 20mm			✓	✓						
Class 2 - 20mm			✓	✓						
Class 3 - 20mm			✓	✓						
Class 1 - 25mm			✓	✓						
Class 2 - 25mm			✓	✓						
Metering Taps					✓					✓
Demand Taps						✓				✓
Outdoor										✓
Domestic Drinking fountain										✓
Other	✓	✓								

Table 10: Summary of tap definitions

1.4.2 Installation versus Product standards

The mandated installation standard, SANS 10252-1, requires maximum flow rates for two applications. “Hand-wash” basins are limited to 6 L/min, while showers are limited to 10 L/min.

There are no tap standards that limit the flow rates to these specified values. On the contrary, single-lever mixing taps for basins will comply with the product standard SANS 1480 if the flow rate from the tap is up to 12 L/min. In addition, SANS 10252-1 requires that these taps comply with SANS 1480, making this a mandated requirement. It is, therefore, possible for a tap supplier to legally supply a tap that will provide double the maximum allowed flow rate when installed.

Another example is SANS 226, where a hand-wash basin tap could be a class 2 tap (for use with pressurized plumbing installation). However, the smallest class 2 tap (15mm) must have a **minimum** flow rate of at least 9 L/min in order to comply, which is 50% more than the **maximum** flow rate mandated in SANS 10252-1.
SANS 10252-1 also requires that such a tap complies with SANS 226, making this a mandated requirement. It is therefore physically impossible to comply with both mandated requirements.

There is **no standard for showerheads in South Africa**; therefore, suppliers can sell open flow rate showerheads.

SANS 10252-1 recommends that a “terminal fitting flow controller” should be used to limit maximum flow rates. The clause that refers to such devices (clause 6.1.4.4) does not specify where these flow controllers should be used. However, it implies that it should at least be used with taps fitted to hand-wash basins and showerheads. This is a duplication of the requirements of the tap standards that also address flow restrictors fitted to taps. As shown in this report, this duplication is not aligned with the flow rate requirements of the individual tap standards.

1.4.3 Test pressures for determining flow rate

The physics of fluid dynamics demands that a flow rate should never be specified without defining the water pressure. Multiple characteristics, including tap design, materials, temperatures, and atmospheric conditions, affect flow rates.

However, water pressure is the predominant factor. Therefore, for product compliance, the influences of all other factors can be regarded as negligent.

By testing a taps' flow rate under two different water pressures, the flow rate will be different for each water pressure. The higher the water pressure, the higher the flow rate. The magnitude of the differences could result in unintended compliance or failures, additional water waste at higher pressures, and unsatisfactory performance at lower pressures.

For fixtures with fixed orifices, the relationship between pressure and flow rate are based on the Bernoulli equation[1] that is widely published and will therefore not be elaborated on in this paper.

However, some tap designs incorporate pressure compensating components to limit the fluctuation of flow rates with changes in pressure. Such a device might allow a tap to comply with flow rate requirements over a more extensive range of dynamic pressures, as illustrated by the green line in figure 7: below.

Figure 8: Illustration of flow rate versus pressure. *(The blue line is a traditional fixed-orifice aerator that may meet a flow-rate specification at one pressure but deliver unsatisfactory flow at lower pressures while wasting water at higher pressures. The green line shows the desired performance that maintains a satisfactory flow rate across various pressures, achievable with a pressure-compensating aerator.)*

The different product standards require flow rates to be tested at pressures of 10 kPa, 50 kPa, 300 kPa, and 600 kPa. The lower test pressures are representative of gravity-fed systems, where the pressure is provided by a rooftop storage tank; while the higher pressures are representative of municipal water systems.

[1] https://openstax.org/books/university-physics-volume-1/pages/14-6-bernoullis-equation?

There is a noticeable misalignment between SANS 1480 & SANS 1808-37 (metal and plastic mixer taps) that require all tests to be conducted at 300 kPa, compared to SANS 226 & SANS 1021 (screw-down and quarter-turn metal and plastic taps) that require similar taps to be tested at 10 kPa, 50 kPa or any pressure between 0 kPa and 900 kPa.

The misalignment extends further to SANS 10252-1 that limits the design pressure of an installation to 600 kPa but does not specify the pressure at which maximum flow rates must be achieved. However, clause 7.2.1.1of SANS 10252-1 allows for structures to be designed for static pressures of up to 600 kPa.

As reflected in the Bernoulli equation, dynamic pressures are lower than static pressures. As required by SANS 10252-1, most domestic installations use pressure reducing valves that comply with the national standard SANS 198 “Functional-control valves and safety valves for domestic hot and cold-water supply systems”. Clause 4.3.3.1 and 4.3.3.2 of SANS 198 use color identifications to define nominal working pressures of pressure control valves. It also defines the maximum dynamic pressures for each designation implying that the full flow rate requirements specified in SANS 10252-1 apply to whatever system pressure the installation has been designed for.

Domestic installations in urban areas are mostly 400 kPa or 600 kPa nominal pressure systems. Therefore, the dynamic pressures should not reach the maximum flow rate of 340 kPa and 510 kPa, respectively.

None of the product standards require taps to be tested at either of these pressures. As such, compliance with the legally incorporated installation standard SANS 10252-1 cannot be confirmed using a tap that complies with the product standard. It implies that all taps installed must be subject to additional tests to verify compliance with SANS 10252-1 after installation.

Figure 9 explains the pressures anticipated for most installations as defined in SANS 198, with the corresponding values provided in the following table.

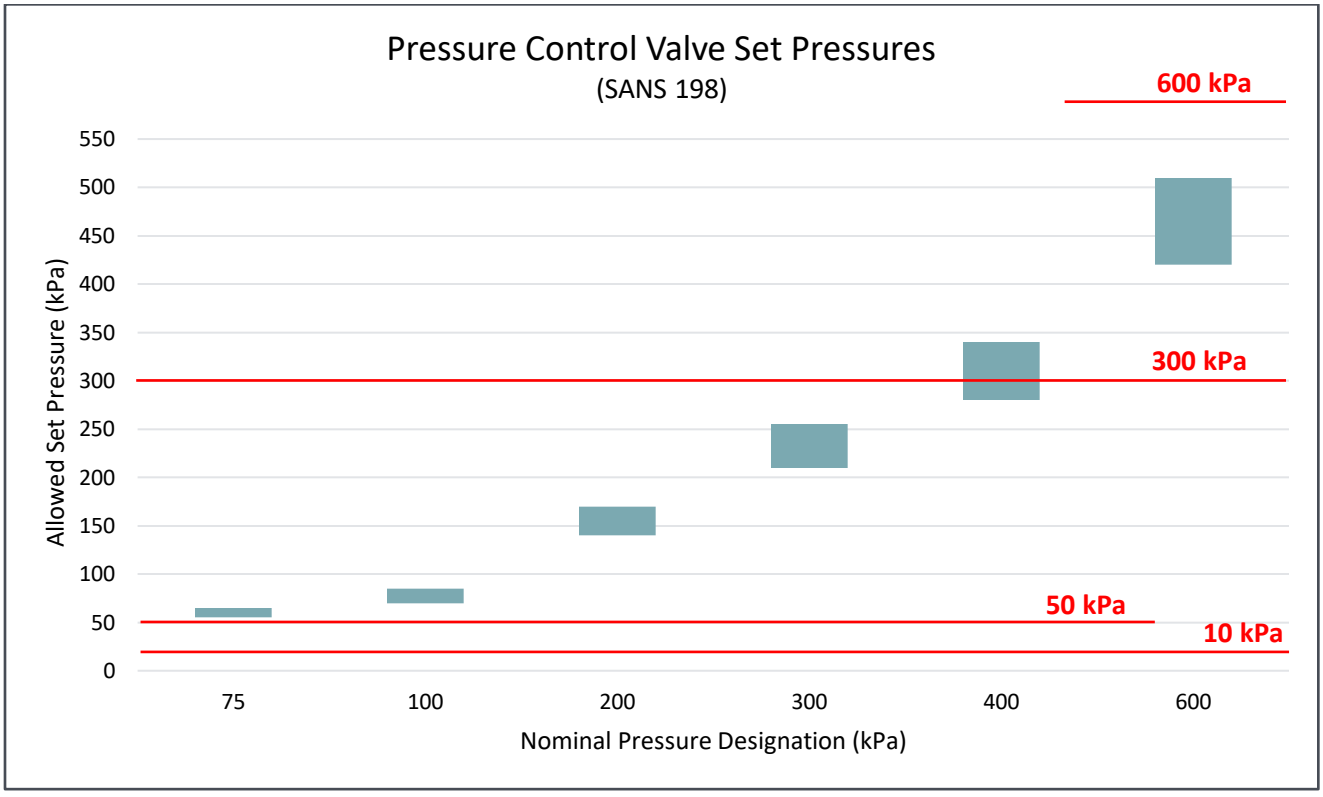

Figure 10: pressures anticipated for most installations as defined in SANS 198. Operating pressures of sans 198 pressure control valves (blue vertical bars) compared to pressures for test in sans 1480 & sans 1808-37, sans 226 & sans 1021, and maximum installation pressure in sans 10252-1 (red horizontal lines).

Nominal working pressure (kPa)	Color Designation of Pressure Control Valves	Minimum set pressure (kPa)	Maximum set pressure (kPa)
75	Light orange	55	65
100	Ultramarine	70	85
200	Black	140	170
300	Golden brown	210	255
400	Flag red	280	340
600	Brilliant green	420	510

Table 11: Working pressures defined by SANS 198

In turn, SANS 3088, the voluntary water efficiency in buildings standard, specifies the reference pressures for most of its flow rate requirements. The specified forces are 100 kPa, 300 kPa, or 600 kPa. For the flow rate requirements where reference pressures are not specified, the SANS 198 pressure control valve standard should apply. As with SANS 10252-1, this implies that compliance cannot be confirmed by referencing compliance with the product standard for the tap.

While domestic and other residential installations typically rely on utilizing a SANS 198 pressure control valve to manage the pressures, bulk installations can make use of alternative components that control water pressures up to a maximum of 600 kPa. For example, installing a public ablution facility that typically includes hand washbasin, demand, or metering taps. This could potentially be applied to all tap types.

Tap components can incorporate different designs to regulate flow rates to the dynamic test pressures. Typically, one of the following mechanisms control the flow rates:

- **Orifice mechanism:** The adequate size of an orifice controls the flow. For this type of mechanism, the flow rate changes exponentially with a change in pressure.
- **Pressure compensating mechanism**: The mechanism changes proportionally to the dynamic pressure, resulting in a more consistent flow rate across a more comprehensive pressure range.

To uniformly compare taps, all comparisons made assume the orifice type mechanism. Unfortunately, this accounts for a worst-case scenario. Taps incorporating a pressure compensating mechanism will perform at least equivalent or better.

1.4.4 Flow rate requirements

In addition to the misalignment of flow rate measurements at different test pressures, the flow rates specified in the various product standards are often not aligned with the installation standards' requirements. The table below provides a summary of the different flow rate requirements.

The following misalignments were identified:

Type Description	SANS Standard number									
	1480	1808-37	226	1021	1808-9	1808-66	1808-16	1808-35	10252-1	3088
Bath	Min: 18 L/min	16 - 20 L/min								not restricted
Shampoo	Min: 6 L/min	5 - 7 L/min								

Type Description	SANS Standard number									
	1480	1808-37	226	1021	1808-9	1808-66	1808-16	1808-35	10252-1	3088
Basin	Max: 12 L/min							5 - 7 L/min	Max: 6 L/min	Max: 5 L/min[#1]
Shower								9 - 11 L/min	Max: 10 L/min	2 liter[#2] 9 L/min[#3]
Urinal								1.8 - 2.2 liters		Max: 2 liter
Toilet								8.8 - 9.2 liters		
Bidet										Max: 5 L/min
Kitchen Sink										Max: 15 L/min
Kitchen Sink with spray nozzle										Max: 10 L/min
Class 1 - 15mm			Min: 9 L/min	Min: 9 L/min						
Class 2 - 15mm			Min: 9 L/min	Min: 9 L/min						
Class 3 - 15mm			7 - 11 L/min	7 - 11 L/min						
Class 4 - 15mm			7 - 9 L/min	7 - 9 L/min						
Class 1 - 20mm			Min: 15 L/min	Min: 15 L/min						
Class 2 - 20mm			Min: 18 L/min	Min: 18 L/min						
Class 3 - 20mm			20 - 30 L/min	20 - 30 L/min						
Class 1 - 25mm			Min: 23 L/min	Min: 23 L/min						
Class 2 - 25mm			Min: 25 L/min	Min: 25 L/min						
Metering Taps					1.8 - 2.2 liter					Max: 2 liter

Type Description	SANS Standard number									
	1480	1808-37	226	1021	1808-9	1808-66	1808-16	1808-35	10252-1	3088
Demand Taps						5 - 7 L/min				Max: 6 L/min
Outdoor										not restricted
Domestic Drinking fountain							0.9 - 1.1 L/min			Max: 2 L/min
Other	Min: 12 L/min	5 - 7 L/min								

Table 12: Summary of flow rate requirements

Bath taps: The minimum flow for a metal tap is 18 L/min while a plastic tap may be as low as 16 L/min. The maximum flow rate of a metal tap is not restricted while that of a plastic tap is limited to 20 L/min.

Basin taps: While a tap can comply with the product standard at a flow rate of 12 L/min, such a tap may not be installed as SANS 10252-1 set at a maximum flow rate of 6 L/min.

Electronic Basin taps: A tap can comply with the product standard at a flow rate of 7 L/min, such a tap will fail to comply with SANS 3088, which set a maximum flow rate of 5 L/min

Electronic Shower taps: Such a tap can comply with the product standard at a flow rate of 11 L/min. However, it may not be installed as SANS 10252-1, which sets a maximum flow rate of 10 L/min, and SANS 3088 sets a maximum of 9 L/min. Furthermore, the maximum limit set by SANS 3088 is the same as the minimum limit of SANS 1808-35 making it unlikely for any electronic tap to comply with the requirements of the product standard and the conditions of SANS 3088.
Furthermore, SANS 3088 introduces requirements for automatic shut-off of a shower tap that is not in any product standard.

Electronic Urinal taps: A tap can comply with the product standard at a flow volume of 2.2 liters, but fail to comply with SANS 3088, which set a maximum flow volume of 2 liters.

Metering taps: A tap can comply with the product standard at a flow volume of 2.2 liters, but fail to comply with SANS 3088, which set a maximum flow volume of 2 liters.

Demand taps: A tap can comply with the product standard at a flow volume of 7 liters, but fail to comply with SANS 3088, which set a maximum flow volume of 6 liters.

Domestic Drinking fountain tap: The product standard for a drinking fountain tap sets a narrow tolerance for an allowed flow rate of 1 L/min +- 0.1 L/min. However, SANS 3088 allows such a tap to have a flow rate of up to 2 L/min, creating the impression that a tap can comply with the product standard at 2 L/min which is not possible.

1.5 Consistency of requirements

To provide requirements that will align across all standards, be measurable without the need for duplication of testing, and not be misinterpreted, the following is required:

- The identification of taps and areas of use of taps must be uniform in all standards.
- Test results obtained from testing a product standard can confirm compliance with the flow rate requirements of installation standards.
- The pressures for testing taps must be uniform between tap standards and installation standards.

NOTE: While this study evaluated the flow rate requirements, it noted that SANS 10252-1 includes several tables with recommended flow rates to be used in association with different types of taps and applications as reference information for designing pipe systems. These flow rates do not align with the required rates in the product and installation standards. Therefore, further evaluation of these recommended rates is advised.

2. Evaluation of International Tap Standards and Requirements

As reflected in the CLASP report titled "*In-depth Assessment of Water Efficiency Opportunities in South Africa,*" published in January 2021, South Africa predominantly imports commercially available taps. Since the publication of this report the supplier, LIXIL, announced that manufacturing in the South African factories is likely to be suspended so that all the LIXIL products be imported. This includes the established brand name “COBRA”.

The Standards Act of 2008 (section 23) requires South African National Standards to harmonize with international standards. Therefore, while most taps are imported, harmonization with international standards is applicable and of critical importance. Related international standards were selected to evaluate the flow rate requirements to inform harmonized requirements to be considered for inclusion into the South African National Standards.

The countries whose standards were evaluated were selected based on opinions expressed by market players. However, due to the confidentiality of competitive information, statistical data was not available to evaluate the technical correctness of the views. The accessibility of standards information was used as a guide to confirm the validity of the opinions. The countries' standards recommended for evaluation were readily available, seeming to indicate that they were active internationally. Attempts were made to source standards from other countries as well. However, such standards were not readily available. Therefore, it was considered that excluding such policies from this study is not likely to impact the outcome of this study significantly.

The standards selected for evaluation are listed below, indicating the relevance of the policy and providing relevant commentary.

Country/Region	**European Union**
Standard	EN 200:2008 “Sanitary tapware - Single taps and combination taps for water supply systems of type 1 and type 2 - General technical specification”
Relevance:	South Africa is known to import a significant number of taps from European countries such as Spain, Italy, and Germany.

The flow rate requirements are summarized as follows:

Tap type definition	**Subcategory**	**Test Pressure (kPa)**	**Minimum flow rate (L/min)**	**Maximum flow rate (L/min)**
Basin	Type 1 - single tap	300	12	
Bidet	Type 1 - single tap	300	12	
Bath	Type 1 - single tap	300	19	
Basin	Type 2 - single channel	10	7.5	
Bidet	Type 2 - single channel	10	7.5	
Bath	Type 2 - single channel	10	15	
Basin	Type 1 - Combination - Water Saving	300	4	9
Bidet	Type 1 - Combination - Water Saving	300	4	9
Sink	Type 1 - Combination - Water Saving	300	4	9
Basin	Type 2 - Combination - Water Saving	10	3	6
Bidet	Type 2 - Combination - Water Saving	10	3	6
Sink	Type 2 - Combination - Water Saving	10	3	6
Basin	Type 1 - Combination	300	12	
Bidet	Type 1 - Combination	300	12	
Sink	Type 1 - Combination	300	12	
Shower	Type 1 - Combination	300	12	

Tap type definition	Subcategory	Test Pressure (kPa)	Minimum flow rate (L/min)	Maximum flow rate (L/min)
Basin	Type 2 - Combination	10	7.5	
Bidet	Type 2 - Combination	10	7.5	
Sink	Type 2 - Combination	10	7.5	
Shower	Type 2 - Combination	10	7.5	
Bath	Type 1 - Combination (per channel)	300	19	
Bath	Type 1 - Combination (Mixed)	300	20	
Bath	Type 2 - Combination (per channel)	10	15	
Bath	Type 2 - Combination (Mixed)	10	22.5	

Table 13: EN 200 flow rate requirements

NOTE 1: Type 1 system = Pressurized system 50 kPa to 1000 kPa
NOTE 2: Type 2 system = Gravity fed system
NOTE 3: Only taps relevant to SA is reflected

This standard introduces minimum flow rates that all taps must comply with. There is a separate taps category defined as "Water Saving" taps to address water-saving taps. The minimum flow rates for these taps are lower than for non-water saving taps. A maximum flow rate is also introduced.

Each water supply channel (either hot or cold water) of a mixer tap needs to comply with these requirements. An allowance is made for an increased flow rate in cases where both water channels have been opened to their maximum settings. For type 1 taps an increase of 1 L/min is allowed which is equivalent to a 5% increase in flow. For type 2 taps an increase of 7.5 L/min is allowed which is equivalent to a 50% increase in flow.

Country	**United States of America**
Standard	ASME A112.18.1-2018/CSA B125.1-18 "Plumbing supply fittings"
Relevance:	The USA is not considered as a major direct tap exporter to South Africa. It is however considered to be a major influencer on the tap designs of first world countries which is likely to increase as products are imported into South Africa from other countries.

The flow rate requirements are summarized as follows:

Tap type definition	Subcategory	Test Pressure for Minimum Flow Rate (kPa)	Minimum Flow Rate (L/min)	Test Pressure for Maximum Flow Rate (kPa)	Maximum Flow Rate (L/min)
Bath		140	9		
Bidet		140	5.7		
Pre-rinse spray valve	Commercial			410	6
Pre-rinse spray valve	Commercial High-efficiency			410	4.8
Laundry tub		140	15		
Laundry tub	Low flow	140	3	410	15
Lavatory Tap	Domestic			410	8.3
Lavatory Tap	High-efficiency	140	3	410	5.7
Lavatory Tap	Public (other than metering)			410	1.9
Sink	Service	140	15		

Tap type definition	Subcategory	Test Pressure for Minimum Flow Rate (kPa)	Minimum Flow Rate (L/min)	Test Pressure for Maximum Flow Rate (kPa)	Maximum Flow Rate (L/min)
Sink				410	8.3
Stop valve	3/8"	140	21		
Stop valve	3/8" compression	140	15		
Shower head				550	9.5
Shower head	High-efficiency	140	4.6	550	7.6
Shower head	High-efficiency	310	5.7		
Shower head	High-efficiency	550	5.7		
Shower head	Trickle Flow		Unlimited		
Tap type definition	**Subcategory**	**Test Pressure for Minimum Volume (kPa)**	**Minimum Volume (liter)**	**Test Pressure for Maximum Volume (kPa)**	**Maximum Volume (liter)**
Metering				410	1

Table 14: ASME A112.18.1 flow rate requirements

This standard introduces the minimum and maximum flow rates for different tap types. The minimum flow rates are typically tested at a low pressure, while the maximum flow rates are tested at a higher pressure.

Water-saving taps are addressed in a separate category, defined as “high-efficiency” taps. The minimum flow rates for these taps are lower than for non- high-efficiency taps.

Country	**Japan**
Standard	JIS B 2061:2017 English Edition “Taps, ball taps and flush valves”
Relevance:	Over decades, the brand name COBRA has been a market leader in South Africa. The current owners of the brand name are Lixil, a company headquartered in Tokyo, Japan. Therefore, it is reasonable to expect the Japanese standards to influence future supply to South Africa production.

The flow rate requirements are summarized as follows:

Tap type definition	Test Pressure (kPa)	Minimum flow rate (L/min)	Maximum flow rate (L/min)
All taps	100	0.5	

Table 15: JIS B 2061 flow rate requirements

The test requirements are more focused on allowing for gradual control between the different settings of the taps operating mechanism. The minimum flow rate applies to all taps. A general requirement indicating that water supply rates must be “sufficient for the use” is included (see clause 5.9.1 a)

Country	Singapore
Standard	SS 448 – 3:1998 “Performance of draw-off taps with metal or plastic bodies for water services - Hydraulic characteristics”
Relevance:	Singapore is actively participating in the ISO committee responsible for drafting the ISO standard for water efficiency labelling systems. The relevant standard is currently under review in Singapore. The information from the current standard was considered accordingly.

The flow rate requirements are summarized as follows:

Tap type definition	Subcategory	Test Pressure (kPa)	Minimum flow rate (L/min)	Test Pressure (kPa)	Maximum flow rate (L/min)
Pillar	Single channel tap	200	6		
Bib	Single channel tap	200	6		
Basin	Combination taps	200	6		
Sink	Combination taps	200	7.8		
Shower	Combination taps	200	7.8		
Basin	Self-closing			300[#]	7.8
Shower	Self-closing			300[#]	12

Table 16: SS 448-3 flow rate requirements

This standard introduces either a minimum or a maximum flow rate for each tap type. The flow rate requirements are for a single channel. For a mixer tap, it must achieve the flow rate with water flowing through either the hot or the cold side of the tap.

Country	Australia & New Zealand
Standards	**AS/NZS 3718 “Water supply - Tap ware”** **AS/NZS 6400:2016 “Water efficient products — rating and labelling”**
Relevance:	It is known that many of the South African standards are strongly influenced by Australian and New Zealand standards. Arguably, the Australian Water Efficiency Labelling System is the world leader in water efficiency standards.

The flow rate requirements are summarized as follows:

Tap type definition	Subcategory	Test Pressure Range (kPa)	Star Rating	Minimum flow rate (L/min)	Maximum flow rate (L/min)
All Taps	High Pressure	150; 250; 350; 500	6	1.1	4.5
All Taps	High Pressure	150; 250; 350; 500	5	4.5	6
All Taps	High Pressure	150; 250; 350; 500	4	6	7.5
All Taps	High Pressure	150; 250; 350; 500	3	7.5	9
All Taps	High Pressure	150; 250; 350; 500	2	9	12
All Taps	High Pressure	150; 250; 350; 500	1	12	16

Tap type definition	Subcategory	Test Pressure Range (kPa)	Star Rating	Minimum flow rate (L/min)	Maximum flow rate (L/min)
All Taps	High Pressure	150; 250; 350; 500	0	16	not limited
All Taps	Low Pressure	35	6	1.1	4.5
All Taps	Low Pressure	35	5	4.5	6
All Taps	Low Pressure	35	4	6	7.5
All Taps	Low Pressure	35	3	7.5	9
All Taps	Low Pressure	35	2	9	12
All Taps	Low Pressure	35	1	12	16
All Taps	Low Pressure	35	0	16	not limited
Shower	High Pressure	150; 250; 350	4	4.5	7.5
Shower	High Pressure	150; 250; 350	3	7.5	9
Shower	High Pressure	150; 250; 350	2	9	12
Shower	High Pressure	150; 250; 350	1	12	16
Shower	High Pressure	150; 250; 350	0	16	not limited
Shower	Low Pressure	35	4	4.5	7.5
Shower	Low Pressure	35	3	4.5	9
Shower	Low Pressure	35	2	9	12
Shower	Low Pressure	35	1	12	16
Shower	Low Pressure	35	0	16	not limited

Table 17: AS/NZS 6400 flow rate requirements

AS/NZS 3718 is the mandated standard that taps must comply with. This standard specifies how to measure water flows, and its requirements include multiple measurements at different test pressures. The policy does not introduce any minimum or maximum flow rate limits. AS/NZS 6400 addresses water efficiency. Star rating levels are allocated based on the flow rate as determined in AS/NZS 3718.

For this report, the ZERO-star rating flow rate levels are treated as a minimum requirement as per the requirement in AS/NZS 6400 that such taps must bear a special warning labeling them as "NOT WATER EFFICIENT." The test method applied by this standard differs from the other standards evaluated in that flow rates are measured at four different pressures and the average of the combined flow rates is used as the reference to determine the star rating.

AS/NZS 6400 further requires that the flow rate at a pressure of 150 kPa may not differ by more than 2 L/min from the flow rate measures at a pressure of 350 kPa. This implies a relatively flat pressure to flow rate response curve which is typical of a tap fitted with a pressure compensating flow controller. (see "Flow rate reference test pressures" figure 7).

The use of pressure compensating flow control devices is not a requirement in South Africa and fixed orifice type taps are commonly available. In order to compare the requirements of AS/NZS 6400 with fixed orifice type taps, the formula described in section 3 under the heading *"Flow rates and pressures"* has been applied to estimate a flow rate that can be used to compare these requirements with that of the other evaluated standards.

An iterative process was used to manually determine a F_{tap} value. Each star rating will allow the average of the mathematically calculated flow rates at the specified pressures (150 kPa; 250 kPa; 350 kPa; 500 kPa) to align with the maximum average flow rates specified for each star rating. The F_{tap} values were then used to calculate an equivalent pressure at which each star rating would achieve the maximum flow rate—the flow rate equated to 299 kPa, which can be rounded to 300 kPa.

High-pressure showerheads followed the same process for the specified star ratings, and the test pressures (150 kPa; 250 kPa; 350 kPa) and the equivalent pressure was equated to 243 kPa.

These values relating to the star ratings of taps are presented graphically below. The labeled “Reference” markers indicate the recommended test point at 300 kPa. The solid lines represent the estimated performance curve of a tap with an orifice-type flow control mechanism tested at the reference point.

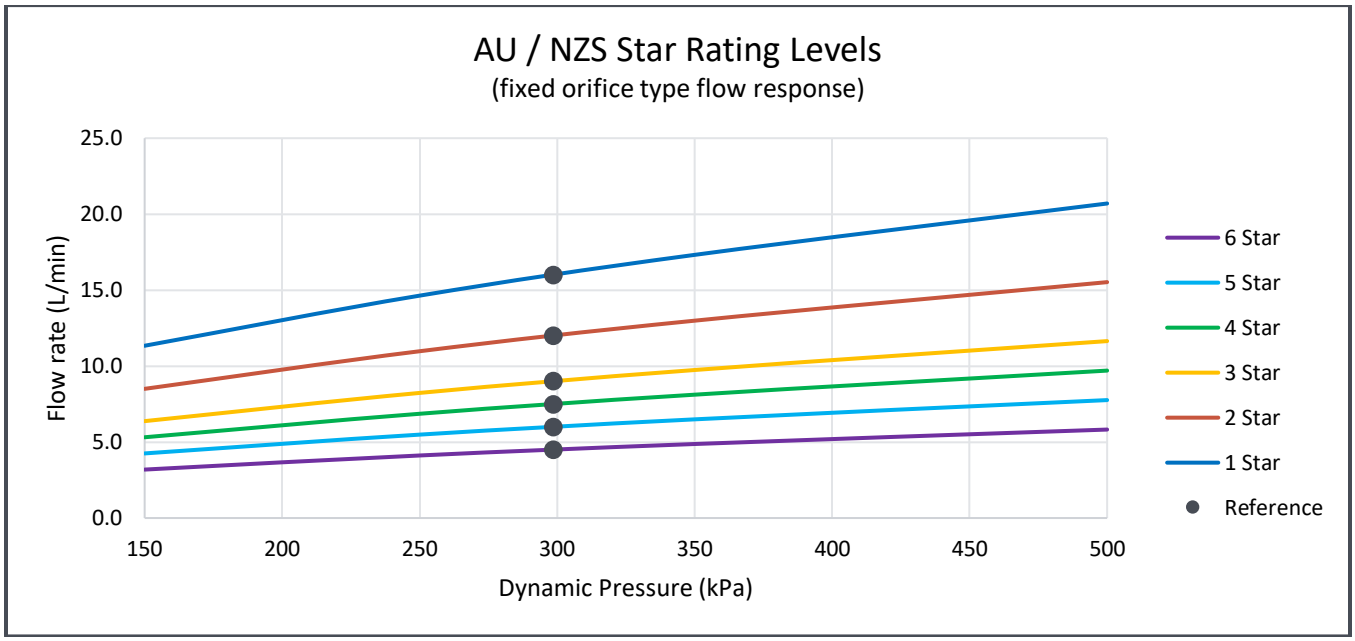

Figure 11 Estimated performance curves of AU/NZC taps

NOTE: Fixed orifice type taps might fail to comply with requirements for a flattened flow profile response

These values relating to the star ratings of showerheads are presented graphically below. The marker labeled “Reference” indicates the recommended test point at 299 kPa. The solid lines represent the estimated performance curve of a shower head with an orifice-type flow control mechanism tested at the reference point.

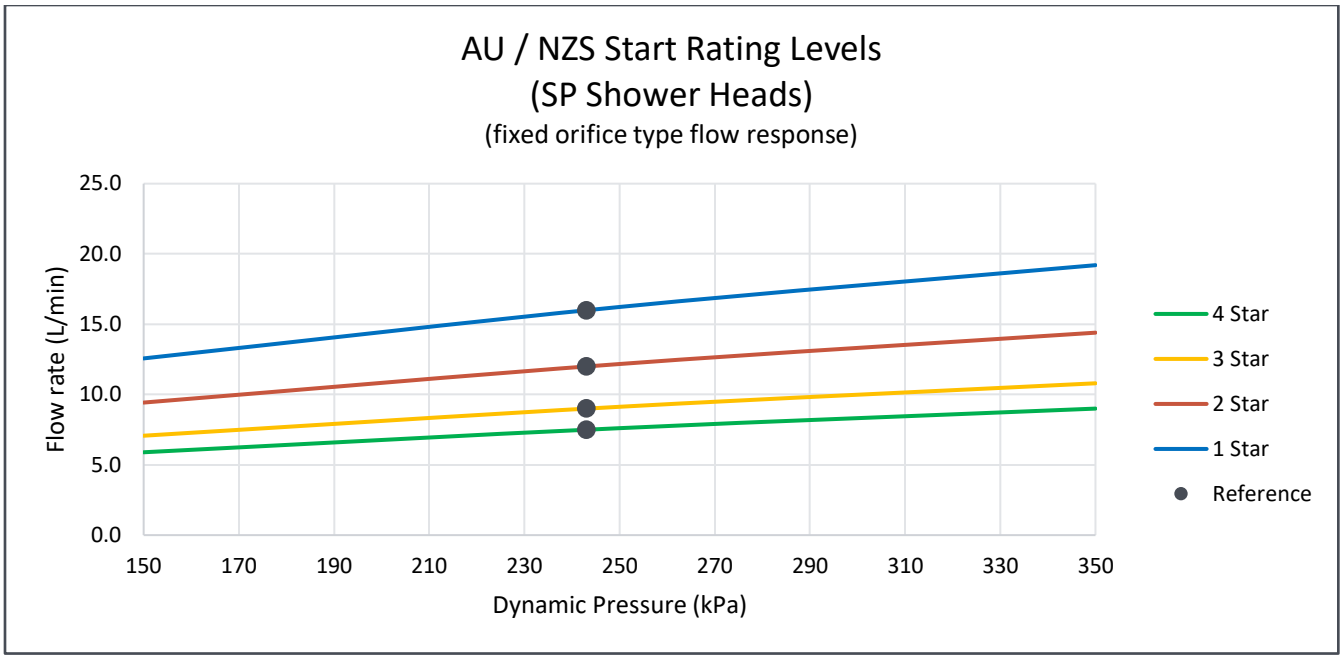

Figure 12 Estimated performance curves of AU/NZS showerheads

NOTE: Fixed orifice type showerheads might fail to comply with requirements for a flattened flow profile response

3. Alignment Between International and South Africa Tap Standards

3.1 Identifying taps across standards

The definition of taps and requirements is essential to compare related requirements between different standards. As reflected in table 18 above, SANS tap standards use a variety of terms to describe different types of taps, and apply different requirements to each, for example, “bath” or “basin”. The same applies to references to classes of taps. However, no formal definitions were introduced in the various standards to define the referred taps across various standards. The descriptions used to define the different taps refer to commonly used terms. While this allows for the general identification of taps, it leaves the definition open to user interpretation. The international standards referenced in this paper include definitions for some of the tap types referred to.

This results in the following challenges:

- Suppliers could manipulate tap descriptions or names to obtain approval they would have missed if they were named as intended in the standard. E.g., The requirements for a bathroom shampoo mixer and a kitchen prep bowl tap typically vary from each other. In contrast, it is easy to misidentify the fixtures due to similar design features.
- The lack of positive identification of taps creates ambiguity in the enforcement of requirements.
- Tap designers, importers, or other agents sourcing compliant taps for the South African market use the SANS standards to reference requirements. If the definitions are open to interpretation, it might lead to misaligned designs.

ASSE International published a Plumbing Dictionary containing plumbing definitions, including definitions that can be applied to the various tap and usage areas.

3.2 Flow rates and pressures

The product standards for taps in South Africa require flow rate measurements to be at different pressures, of between 10 kPa and 900 kPa. Similarly, the flow rate requirements of the evaluated international standards require tap testing at different flow rates of between 35 kPa and 500 kPa.

The installation standards in South Africa apply different reference pressures for determining flow rates. For example, SANS 10252-1 is silent on the reference pressure, while SANS 3088 reflects 100 kPa, 300 kPa, 600 kPa, and for some instances, it is silent on the reference pressure.

As discussed above, flow rates are dependent on the reference pressure (dynamic pressure).

This results in the following challenges:

- Enforcement of flow rate requirements can only be implemented if the flow rates and pressures are defined.
- Taps may comply with their product standards while failing to comply with installation standards.
- Duplication of test work is implied to confirm compliance of product and installation requirements.
- Taps that have been designed and verified to comply with international test requirements at a set flow rate might fail to comply with the requirements of the SANS product or installation standard where it needs to be tested at a different flow rate.

The formula below was used to estimate equivalent flow rate requirements at different dynamic test pressures for this paper. This formula, derived from the universal equations used to determine flow coefficients, is based on the principles of the Bernoulli equation. The mathematical model for deriving the equation is well published and is not the subject of this paper. For reference an explanation of the Bernoulli equation is provided by openstax.org at the following link: https://openstax.org/books/university-physics-volume-1/pages/14-6-bernoullis-equation?

$$Q = F_{tap} \sqrt{P}$$

Where:
Q = Flow rate (L/min)

F_{tap} = Factor characterizing all the design parameters determining the flow rate of the tap.
P = Dynamic pressure
The Standard's flow rate requirements were used to calculate the F_{tap} value that will allow for the tap to comply with the flow rate requirements. This was then used to calculate the equivalent flow rates at pressures across a wider pressure range.

NOTE: This formula provides **an estimate** of extrapolated flow rates. Actual flow rate extrapolation should be determined based on test data and vary from these values.

3.3 Applicable pressures for South Africa

The mandatory installation standard for water supply installations, SANS 10252-1, allows for installations at controlled pressures of 600 kPa. A gravity-fed system or a pressure-reducing valve can regulate system pressures. The pressures of gravity-fed installations are directly related to the height difference between the water storage tank and the tap. The areas where such installation occurs are typically an area with no municipal water supply (e.g., a farmhouse) or high-rise buildings with a central water storage tank on a top floor. Assuming that one storey of a building is 3 meters high, it is fair to assume the water pressure from a storage tank is approximately 30 kPa per storey between the tank and the tap.

Installations where pressure reducing valves control the pressure must comply with the SANS 198 requirement. Table 19 presents the minimum and maximum controlled pressures.

The commonly used nominal pressures in South Africa were determined by evaluating the catalogs of various plumbing component suppliers. It was noted that only 400 kPa and 600 kPa pressure-reducing valves were commonly available. For a pressure reducing valve with a nominal pressure of 400 kPa, the minimum set pressure is 280 kPa, while the maximum is 340 kPa. The mean between these pressures is 310 kPa.

For a pressure-reducing valve with a nominal pressure of 600 kPa, the minimum set pressure is 420 kPa, while the maximum pressure is 510 kPa. The mean between these pressures is 465 kPa. Thus, while the installation standards allow systems designs of up to 600 kPa, it is unlikely that any system will have a dynamic pressure of more than 510 kPa.

If a single pressure reference point is used to determine the flow rate requirement, such a pressure point should be as close as possible to a commonly used pressure to allow for a realistic flow rate. Flow rates at other pressures are assumed based on extrapolations. Extrapolations become less accurate the further it is from the reference point. If the flow rate is measured at the median of pressures that can be anticipated, it will allow for the most negligible error in the assumed flow rate at the extreme pressures in the range.

The median pressure for all allowed pressure-reducing valves is calculated based on the minimum allowed set pressure of 55 kPa, and the maximum allowed set pressure of 510 kPa (see table 20). The mathematical median pressure is 282.5 kPa. **Therefore, 300 kPa** is recommended as the single reference dynamic pressure for all flow rate measurements for taps used in systems controlled by pressure-reducing valves. This is aligned with the existing pressure set point of 300 kPa used in EN200, SANS 1480 & SANS 1808-37

For gravity-fed systems, the dynamic pressure must be less than the pressures specified for systems controlled by pressure-reducing valves. The minimum gravity-fed pressure is assumed to be one story or approximately 30 kPa. In SANS 198 (the standards for pressure-reducing valves), the minimum controlled pressure is 60 kPa. The average between 60 kPa and 30 kPa is 45 kPa. Class 2 taps in SANS 226 are currently tested at 50 kPa. Therefore, **50 kPa** is recommended as the single reference dynamic pressure for all flow rate measurements for taps used in gravity-fed systems.

3.4 Determining flow rate requirements

Determination of the appropriate uniform flow rates to be used in South Africa is informed by at least four of the following factors:

- The intended application of the tap.
- The requirements for similar taps internationally.
- The recommended efficiency guidelines of international programs.

- National objectives.

The National Water and Sanitation Master Plan Version 10.1, as published by the Department of Water and Sanitation, presents various programs intended to improve the sustainability of water resources in South Africa. The program identified scheme 1.4.3, "*Establish Water Efficiency Labelling and Standards (WELS),"* as a component to improve the efficient use of water. The target date for implementation is 2025.

The master plan does not present specific performance targets for such a WELS system. Therefore, national objectives equated to a WELS system and aligned with international requirements are to be implemented and enforced. International standards and programs introduce both minimum requirements and recommended water-saving levels. However, current SANS standards introduce only minimum performance standards.

The intended application of a tap is an essential factor in determining flow rate requirements. ISO/DIS 31600(EN) *"Water efficiency labelling programs – requirements with guidance for implementation"* (Under development) by ISO PC316 confirmed the importance of product standards that set the minimum performance requirements for all taps based on its intended use. It further recommends that any WELS system must as a minimum requirement for a product to comply with its minimum performance requirement.

The level of efficiency achieved from a tap is dependent on its intended use; therefore, taps that are not perceived as functional by the user are likely not utilized. For example, if a tap fills a set volume of water, a lower flow rate will not aid water efficiency.

Tap usage can be categorized as follows:

- Taps used to fill a fixed volume of water, e.g., bath taps, sink taps, and clothes-washing taps.
- Taps used while running, e.g. Hand-wash taps in public areas, shampoo mixer taps, taps used to rinse vegetables during cooking.
- Taps used while running and fill a fixed volume. e.g., Domestic bathroom washbasin taps, garden irrigation taps.

The flow rates recommended in this paper was determined by:

1. Identifying the tap types.
2. Identifying the condition of use.
3. Comparing existing local and international requirements.
4. Estimating equivalent flow rates to account for test pressures.

4. Recommendations for alignment of South Africa Tap Standards

4.1 Align requirements across standards

It is recommended that product standards contain all flow rate requirements for showerheads and taps. Neither SANS 10252-1 nor SANS 3088 should print any flow rate requirements. Both SANS 10252-1 and SANS 3088 may identify the types of taps for different applications and recommend that the taps comply with their respective product standards

4.2 Uniformity of tap identification across standards

It is recommended that the South African National Standards should introduce uniform descriptions of tap types in relation to how the taps are intended to be used as listed below:

Tap Types:

- Bath
- Wash Basin
- Hand-held shower (including Shampoo mixers)
- Bidet
- Kitchen Sink
- Laundry
- Outdoor
- Demand taps (including mechanical as well as electronic demand and metering taps)

4.3 Definitions

It is recommended that definitions for each tap be published. The definitions published in the ASSE International Plumbing Dictionary should be the basis. In addition, it is recommended that SABS TC0138/SC02 determine the definitions and that all other technical committees referencing plumbing installations utilize these definitions.

Definitions can be introduced by amending existing standards to include definitions or publishing a new SANS standard for plumbing definitions. For example, this could be a third part of the installation standard SANS 10252.

The respective SABS Technical Committees should conclude on the appropriate definitions.

NOTE: The definition of Shampoo taps should include **all** taps with a hand shower.

4.4 Conditions of use

It is recommended that the condition of use be considered for each type of tap. The environment informs conditions and the functions of use.

It is not recommended that each standard present different requirement for different conditions. In line with normal standardization practice it is recommended that the various conditions be considered during the process of writing or amending the standards, and that only the resulting requirements be contained in the standards.

The environment of use includes:

- Domestic
- Public
- Commercial

The function of use includes:

- Continuous flow (e.g., hand wash)
- To fill a measured volume (e.g., bath tap)

It is recommended that the flow rates of taps intended to fill a measured volume of water should not have a restricted flow rate. These taps should include Bath, Laundry, and Outdoor taps of all pressures and usage conditions.

It is recommended that taps intended to be used to both fill a volume of water and to be used while running should include maximum flow rate restrictions while allowing enough flow not to frustrate the user. These taps include Kitchen Sink taps.

Further, it is recommended that the technical committee should consider introducing a uniform manner of identifying the usage conditions for all taps. For example, such identification can be labeled on the taps or showerheads or a marking on the tap. In addition, utilizing color coding is a potential method of identification.

4.5 Pressures

It is recommended that the flow rates of all taps should be measured at:

- (LP) 50 kPa for taps designed to be used with gravity fed systems
- (SP) 300 kPa for taps designed to be used with systems where the pressure is controlled with a SANS 198 type pressure control valve.

Pressure ranges:

- Pressurized, referred to as Standard Pressure (SP)
- Gravity fed, referred to as Low Pressure (LP)

To prevent LP taps from being used on SP systems, it is recommended that national standards include a requirement that taps intended to be used for LP installations must be marked on the body of the tap, indicating that. The national standards should also indicate that if a tap does not have this mark, it shall be tested as SP.

4.6 Shower Heads

The showerhead, not the shower tap, should govern the flow rate of showers. The flow control could be integrated with the showerhead, or it could be a loose component fitted to the tap, the pipework, or the showerhead. If the flow control device is not integrated, the method of installation and supporting components must be defined, and all tests performed accordingly.

The requirements and test method should be compiled to not impose a flow restriction on the tap. The showerhead should govern the flow rate, where the showerheads and taps are two separate components. Where a tap is fitted with a bypass to a hand shower, the flow rate requirements for the tap shall apply to the water flow through the spout, and the flow rate requirements for a hand shower shall apply for the flow through the bypass.

4.7 Flow rate recommendations

It is recommended that standards be amended to specify maximum flow rates for each type of tap. The maximum flow rates have been selected to be higher than the minimum flow rates specified by the evaluated international standards.

It is recommended that water flow rates should apply to a single water supply channel. i.e. for mixer taps, the flow rate should be tested by fully opening either the hot or the cold water control. A universal allowance of a 5% increase in water flow rate shall be allowed for SP mixer taps and 50% for LP mixer taps when both water supply channels are fully opened.

It is further recommended that when South Africa implements a water efficiency labeling program as per the Water and Sanitation master plan scheme 1.4.3, water flow rate targets should be set to improve water efficiency.

It is also recommended that the use of pressure compensating flow-regulating devices be used. To verify that such devices are used, additional tests can be introduced for all taps. When the flow rate of an SP tap is tested at 150 KPa, the flow rate should not be lower than 2 L/min less than the pressure measured at 300 kPa.

The recommended maximum water flow rates, as well as the recommended target flow rates for each type of tap, are presented below.

4.7.1 Bath mixers

Scope of taps:

This includes all taps intended to be used to fill a bath intended for human bathing. It applies equally to mixers taps and single water channel taps.

Intended use:

To fill a volume of water.
Limiting the flow rate is unlikely to contribute to water saving.

Conditions of use:

Bath taps are used in domestic dwellings, shared ablution facilities, and commercial accommodation facilities (e.g. hotels, guest houses, etc.)
In all anticipated conditions of use, limiting the flow rate is unlikely to contribute to water saving.

Considerations:

Limiting flow rates is unlikely to result in water saving.
Low flow rates might lead to user dissatisfaction in which case users might decline to use, or tamper with these taps.
None of the considered standards imposed maximum flow rates. However, most impose minimum flow rates.
The AS/NZS standard does not differentiate between this type of tap and any other type of tap. It awards higher star ratings to taps with lower flow rates which include this type of tap.

It is fair to assume that in some cases users might fill a bath with more water if the tap delivers a higher flow than anticipated. As such it is recommended that bath taps with restricted flow rates be acknowledged as a better option than such taps with unlimited flow rates.

Recommended maximum flow rate: **Unlimited**
Recommended water-saving target flow rate: **20 L/min**

See figure 13 for a visual illustration of the compared flow requirements for high pressure bath mixers.

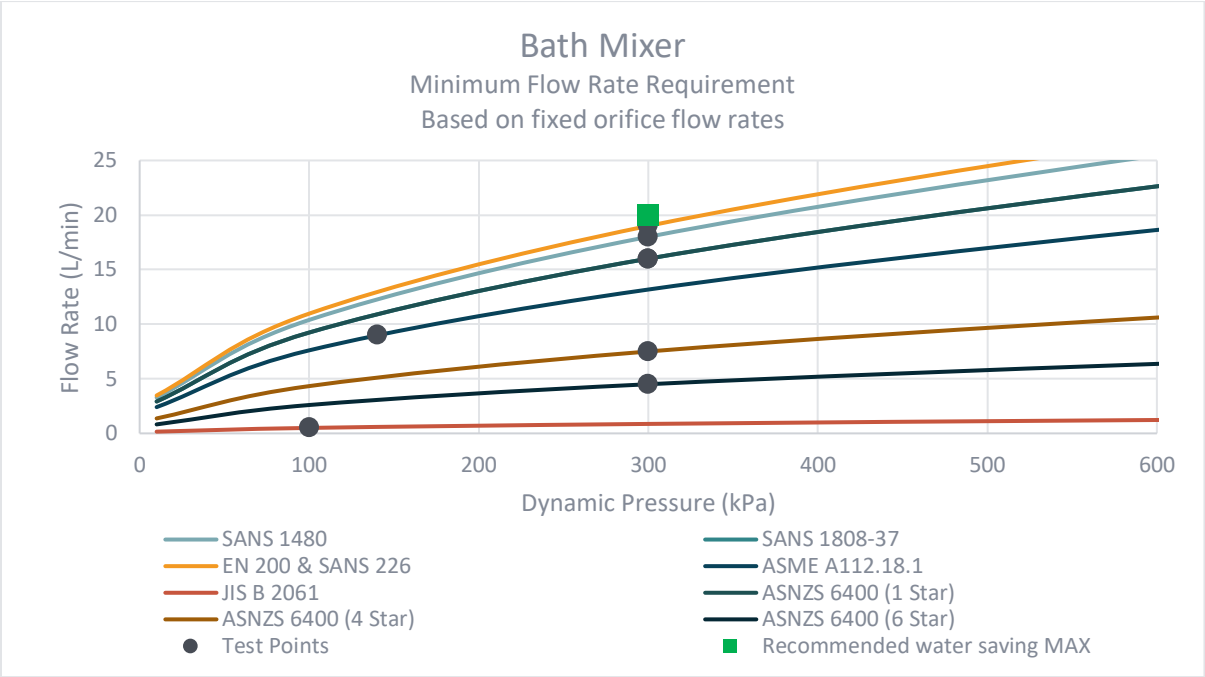

Figure 14 Bath Tap (SP) comparison

4.7.2 Wash basin

Scope of taps:

This includes all taps intended to be used with a hand washbasin. It includes taps intended for domestic use as well as tap intended for use in public restrooms. Additionally, it applies equally to mixers taps and single water channel taps.

Intended use:

Predominantly for use with running water, typically for washing of hands.
Usage also includes filling a volume of water in a washbasin.
Addressing the use with running water takes precedence over filling a volume.

Conditions of use:

Wash Basin taps are used in domestic dwellings, shared ablution facilities (e.g. ablution facilities in public buildings), and commercial accommodation facilities (e.g. hotels, guest houses, etc.)

In all anticipated conditions of use, the water flow rate should be adequate to rinse body parts (e.g. hands) without wasting water.

Considerations:

Limiting flow rates is likely to result in water saving.

Too low flow rates might lead to user dissatisfaction in which case users might decline to use, or tamper with these taps.

The ASME standard imposes a 15 L/min (@410 kPa) flow rate for **domestic use**. If such a tap is restricted based on the orifice size only, then it is likely to deliver a flow rate of approximately 12.8 L/min when tested at 300 kPa. If such a tap is restricted using a pressure compensated flow restrictor the flow rate is anticipated to only be slightly lower than 15 L/min.

The ASME standard imposes an 8.3 L/min (@410 kPa) flow rate for **"high-efficiency" taps**. If such a tap is restricted based on the orifice size only, then it is likely to deliver a flow rate of approximately 7.1 L/min when tested at 300 kPa. If such a tap is restricted using a pressure compensated flow restrictor the flow rate is anticipated to only be slightly lower than 8.3 L/min.

The ASME standard imposes an 8.3 L/min (@410 kPa) flow rate for **"public" taps**. If such a tap is restricted based on the orifice size only, then it is likely to deliver a flow rate of approximately 7.1 L/min when tested at 300 kPa. If such a tap is restricted using a pressure compensated flow restrictor the flow rate is anticipated to only be slightly lower than 8.3 L/min.

Thus, if the SANS standard imposes a maximum flow limit of less than 15 L/min, some taps compliant with the ASME standard would not be allowed for sale in South Africa.

The AS/NZS standard does not differentiate between this type of tap and any other type of tap. It awards higher star ratings to taps with lower flow rates which include this type of tap.

The EN standard imposes a 12 L/min (@300 kPa) **minimum** flow rate requirement for these taps. It makes allowance for a tap to be sold as a "water-saving" tap, in which case a 4 L/min (@300 kPa) **minimum** flow rate maximum is imposed. The EN standard does not impose a maximum flow rate.

If the SANS standard imposes a maximum flow rate restriction of 16 L/min it will be approximately equivalent to the maximum flow rate allowed by the AS/NZS standard. It will allow a practical tolerance of approximately 3 L/min (12.8 L/min to 16 L/min) for ASME taps to comply with and
approximately 4 L/min (12 L/min to 16 L/min) for EN taps to comply with.

A recommended water-saving flow rate of 8 L/min will be approximately aligned with a AS/NZS 4-star rating. It will allow a practical tolerance of approximately 2 L/min (8.3 L/min to 10 L/min) for ASME high-efficiency taps to comply with and approximately 6 L/min (4 L/min to 10 L/min) for EN taps to comply with.

Recommended maximum flow rate: **16 L/min**
Recommended water-saving target flow rate: **10 L/min**

See figures 15 and 16 for a visual illustration of the compared flow requirements.

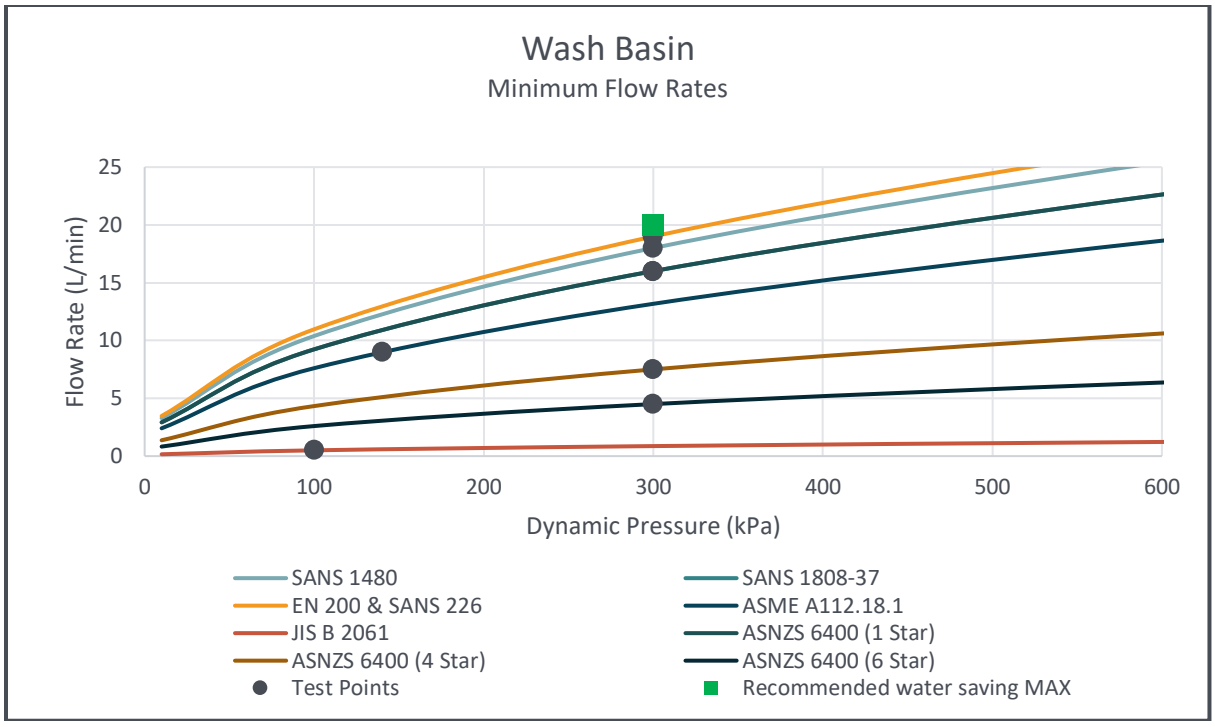

Figure 17 Wash Basin (SP) minimum requirements comparison

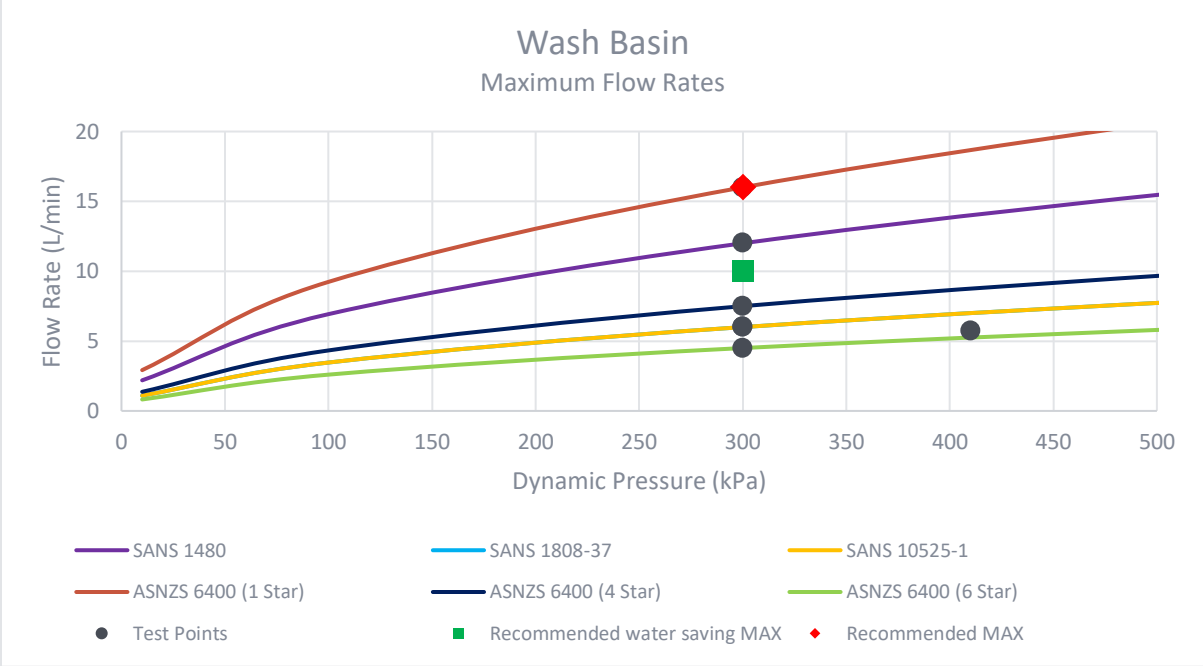

Figure 18 Wash Basin(sp) maximum requirements comparison

4.7.3 Handheld shower

Scope of taps:

Taps with handheld shower attachments.

This will include a hand shower attachment to a bath tap, as well as to a wash basin tap.

A handheld shower attachment is identified by the fact that a flexible connector or hose is fitted between the shower attachment and the tap.

This applies equally to mixers taps and single water channel taps but excludes spray attachments on kitchen sink taps.

Intended use:

Predominantly for use with running water, typically for rinsing body parts and washing of hair.

Conditions of use:

Taps with a handheld shower attachment are used in domestic dwellings, shared ablution facilities (e.g. ablution facilities in hostels), and commercial accommodation facilities (e.g. hotels, guest houses etc.)

In all anticipated conditions of use, the water flow rate should be adequate to rinse body parts (e.g. hands) without wasting water.

Considerations:

Limiting flow rates is likely to result in water saving.

The EN standards does not explicitly address the flow rate of a hand shower attachments as a separate item. The requirements for shower taps are considered to be relevant for cases where a bath mixer is fitted with a shower attachment that can be used for bathing.

The EN standard imposes a 12 L/min (@300 kPa) **minimum** flow rate requirement for these taps. It makes no allowance for "water-saving" shower taps. However, it does not impose a maximum flow rate.

The ASME standard requires handheld shower attachments to be tested to the same requirements as showerheads.

The ASME standard imposes a 9.5 L/min (@550 kPa) **maximum** flow rate for **showerheads** and **handheld shower attachments**. If such a showerhead is restricted based on the orifice size only, then it is likely to deliver a flow rate of approximately 7 L/min when tested at 300 kPa. If restricted using a pressure compensated flow restrictor, the flow rate is anticipated to only be slightly lower than 9.5 L/min

The ASME standard imposes a 7.6 L/min (@550 kPa) **maximum** flow rate for **"high-efficiency" showerheads** and **handheld shower attachments**. If such a showerhead is restricted based on the orifice size only, it is likely to deliver a flow rate of approximately 5.6 L/min when tested at 300 kPa. If restricted using a pressure compensated flow restrictor, the flow rate is anticipated to only be slightly lower than 7.6 L/min

The ASME standard imposes a 4.6 L/min (@140 kPa) **minimum** flow rate for **"high-efficiency" showerheads** and **handheld shower attachments**. If such a showerhead is restricted based on the orifice size only, then it is likely to deliver a flow rate of approximately 6.7 L/min when tested at 300 kPa. If restricted using a pressure compensated flow restrictor, the flow rate is anticipated to only be slightly above 6.7 L/min.

In this case, it is not possible to identify a single minimum requirement that will allow both an EN and ASME taps to comply. To aid water efficiency, it is recommended that the ASME requirements be prioritized above the EN standard.

If the SANS standard imposes a maximum flow rate restriction of 10 L/min it will be approximately aligned with the requirements of the ASTM standard.
It will be approximately aligned with a 1 Star rating for showers as allowed for by the AS/NZS standard.

A recommended water-saving flow rate of 8 L/min maximum will be approximately aligned with the requirements of the ASTM standard for high-efficiency showerheads.
It will be approximately aligned with a 2 Star rating for showers as allowed for by the AS/NZS standard.

Recommended maximum flow rate: **10 L/min**
Recommended water-saving target flow rate: **8 L/min**

See Figures 19 and 20 for a visual illustration of the compared flow requirements for high-pressure taps.

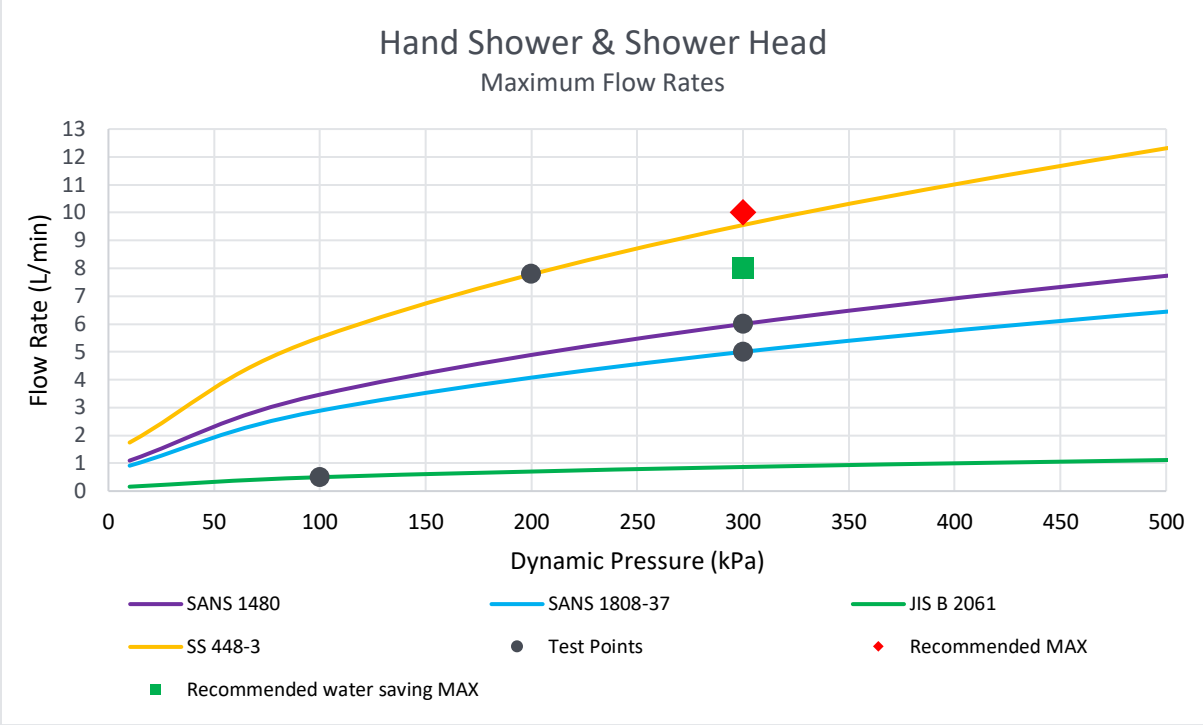

Figure 14 Shower and Shower Head flow rates comparison

Figure 21 Hand

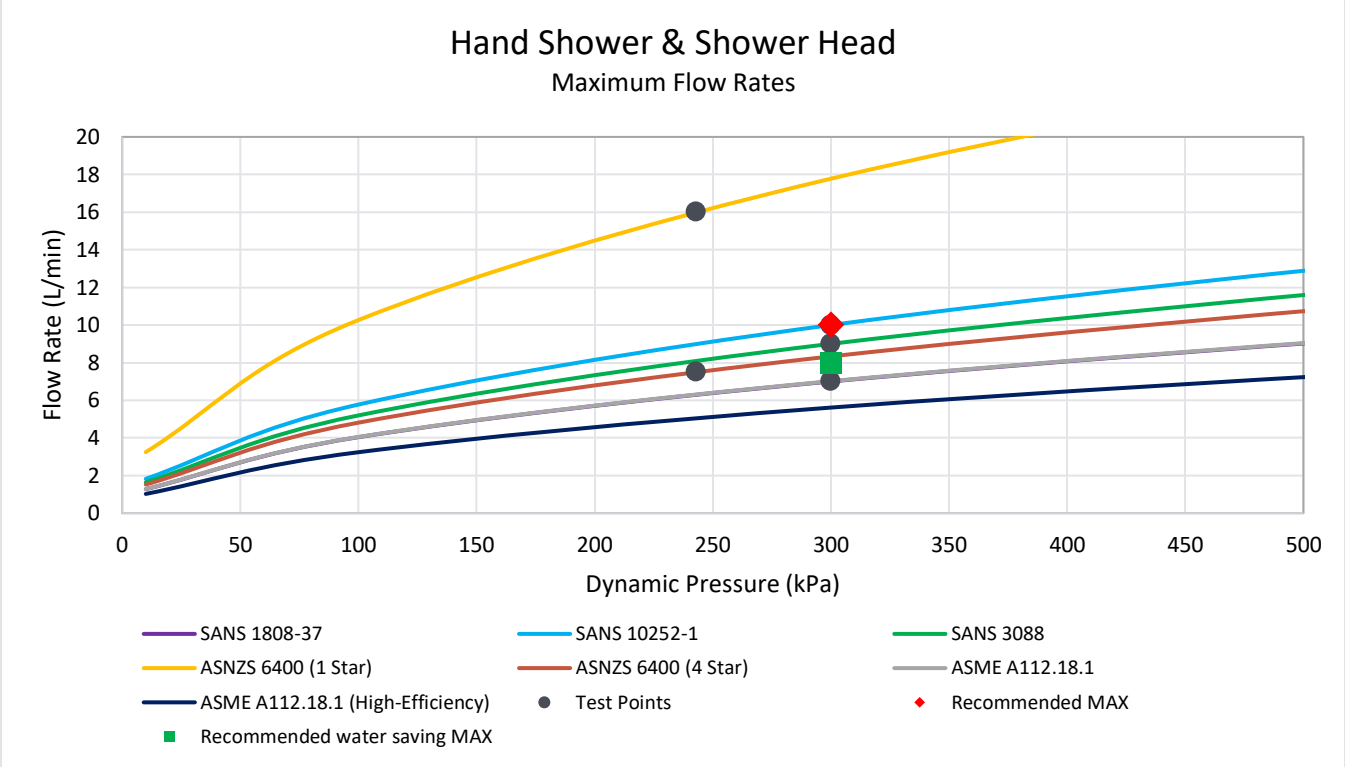

Figure 22: Shower components (SP) comparison

4.7.4 Bidet

Scope of taps:

Taps intended to be used as a bidet. It applies equally to mixer taps and single water channel taps.

Intended use:

Predominantly for use with running water, typically for rinsing body parts such as genitals and anus.

Conditions of use:

Bidet taps are used in domestic dwellings, shared ablution facilities, and commercial accommodation facilities.
In all anticipated conditions of use, the water flow rate should be adequate to rinse body parts, without wasting water.

Considerations:

Limiting flow rates is likely to result in water saving.

The ASME standard impose a 5.7 L/min (@140 kPa) **minimum** flow rate for **bidet taps**. If such a tap is restricted based on the orifice size only, it is likely to deliver a flow rate of approximately 8.3 L/min when tested at 300 kPa, while if it's restricted using a pressure compensated flow restrictor, the flow rate is anticipated to only be slightly higher than 5.7 L/min

The EN standard impose a 12 L/min (@300 kPa) **minimum** flow rate for **bidet taps.** The same standard allows a restricted range of flow rates for **water saving bidet taps**. The allowed range is between a minimum of 4 L/min (@300 kPa) and a maximum of 9 L/min (@300 kPa)

No SANS tap standard currently addresses the specific requirements of bidet taps. Such taps can fall within the scopes of SANS 1480, 1808-37, 226, 1021 and under 1808-35 as well. SANS 3088 requires a maximum flow rate of 5 L/min while none of these standards allows such a flow rate.

If the SANS standards impose a maximum flow rate restriction of 14 L/min It will allow a practical tolerance of approximately 2 L/min (12 L/min to 14 L/min) for EN taps to comply with and a practical tolerance of approximately 6 L/min (8.3 L/min to 14 L/min) for ASME taps to comply with.
It will be approximately aligned with a 2 Star rating for taps as allowed for by the AS/NZS standard.

A recommended water saving follow rate of 8 L/min maximum will be approximately aligned with the requirements of the EN standard for water saving bidet taps.
It will be approximately aligned with a 3 Star rating for bidet taps as allowed for by the AS/NZS standard.

Recommended maximum flow rate: **14 L/min**
Recommended water saving target flow rate: **8 L/min**

See Figure 23 for a visual illustration of the compared flow requirements for high pressure taps.

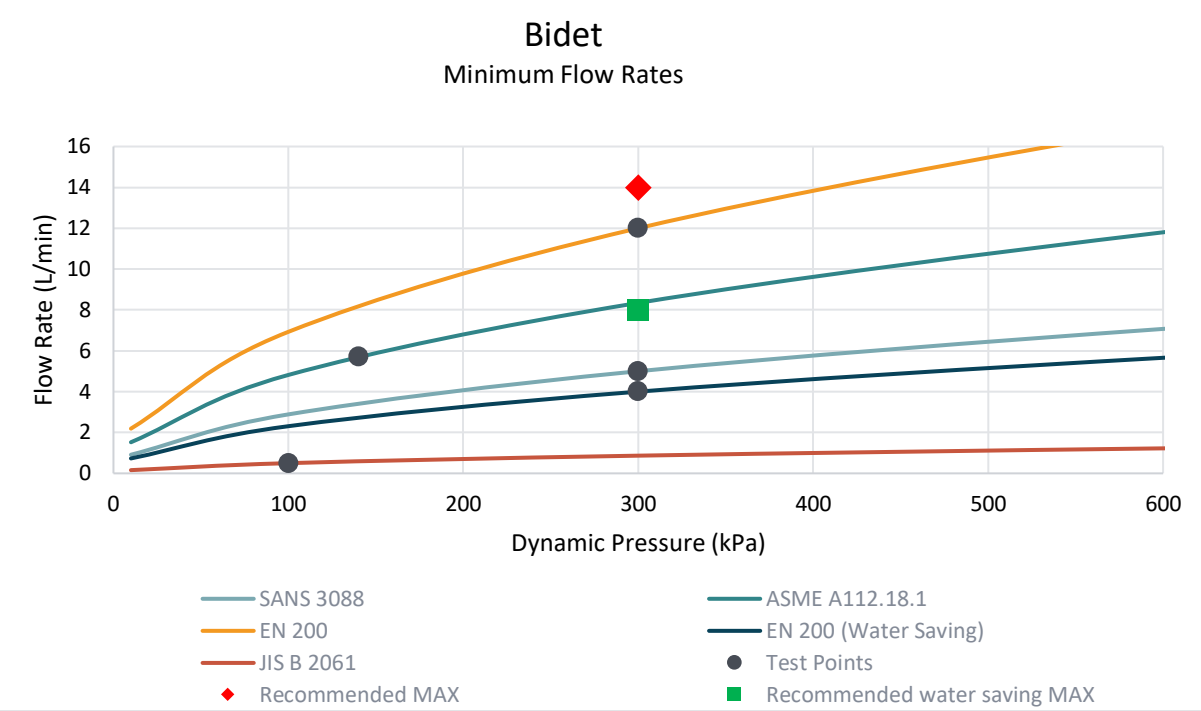

Figure 24: Bidet comparison

4.7.5 Kitchen sink

Scope of taps:

This include all taps intended to be mounted at a kitchen sink where dishes are washed, and at a prep bowl where foods are washed. This includes taps intended for domestic use as well as tap intended for use in restaurant kitchens.
This applies equally to mixers taps and single water channel taps.

Intended use:

These taps are intended to be used for both filling of a fixed volume, or with running water.
Taps will be used to fill a sink for washing of dishes.
Taps will be used for rinsing of vegetables and other food stuff during food preparation.
Taps will be used for washing of hands.

Addressing the use with running water takes precedence over filling a volume.

Conditions of use:

Wash Basin taps are used in domestic dwellings and commercial kitchens (e.g. Restaurants, cafeterias etc.)

In all anticipated conditions of use, the water flow rate should be adequate to rinse food stuff without wasting of water, and to prevent an unreasonable time to fill a sink.

Considerations:

Limiting flow rates is likely to result in water saving.

Too low flow rates might lead to user dissatisfaction in which case users might decline to use, or tamper with these taps.

The ASME standard imposes a 15 L/min (@140 kPa) **minimum** flow rate for **service kitchen sink taps**. This refers to taps installed in commercial kitchens. If such a tap is restricted based on the orifice size only, then it is likely to deliver

a flow rate of approximately 22 L/min when tested at 300 kPa while if it's restricted using a pressure compensated flow restrictor, the rate is anticipated to only be slightly higher than 15 L/min.

The ASME standard imposes an 8.3 L/min (@410 kPa) **maximum** flow rate for **kitchen sink taps**. This refers to taps installed in commercial kitchens. If such a tap is restricted based on the orifice size only, then it is likely to deliver a flow rate of approximately 7.1 L/min when tested at 300 kPa while if it's restricted using a pressure compensated flow restrictor, the flow rate is anticipated to only be slightly lower than 8.3 L/min.

The EN standard imposes a 7.5 L/min (@300 kPa) **minimum** flow rate for **kitchen sink taps**. The same standard imposes a 4 L/min (@300 kPa) **minimum** flow rate and a 9 L/min (@300 kPa) **maximum** for **water saving kitchen sink taps**.

In this case, it is not feasible to identify a single minimum requirement what will allow both an EN and ASME taps to comply. To aid water efficiency it is recommended that the EN requirements be prioritized above the ASME standard.

This type of tap has similar use as a hand wash basin tap and the maximum flow rate should be aligned.
If the SANS standard/s imposes a maximum flow rate restriction of 16 L/min, it will allow a practical tolerance of approximately 8 L/min (7.5 L/min to 16 L/min) for EN taps to comply with.
Taps that comply with the ASME maximum flow rate of 8.3 L/min will also comply with the SANS requirement.
It is unlikely that an ASME **service kitchen sink tap** will comply with this requirement. It will be approximately aligned with a 1 Star rating for taps as allowed for by the AS/NZS standard.

A recommended water-saving follow rate of 8 L/min maximum will be approximately aligned with the requirements of the EN standard for water-saving kitchen sink taps.
It will be approximately aligned with a 3 Star rating for bidet taps as allowed for by the AS/NZS standard.

Recommended maximum flow rate: **16 L/min**
Recommended water-saving target flow rate: **8 L/min**

See figure 25 and 26 for a visual illustration of the compared flow requirements for high-pressure tap.

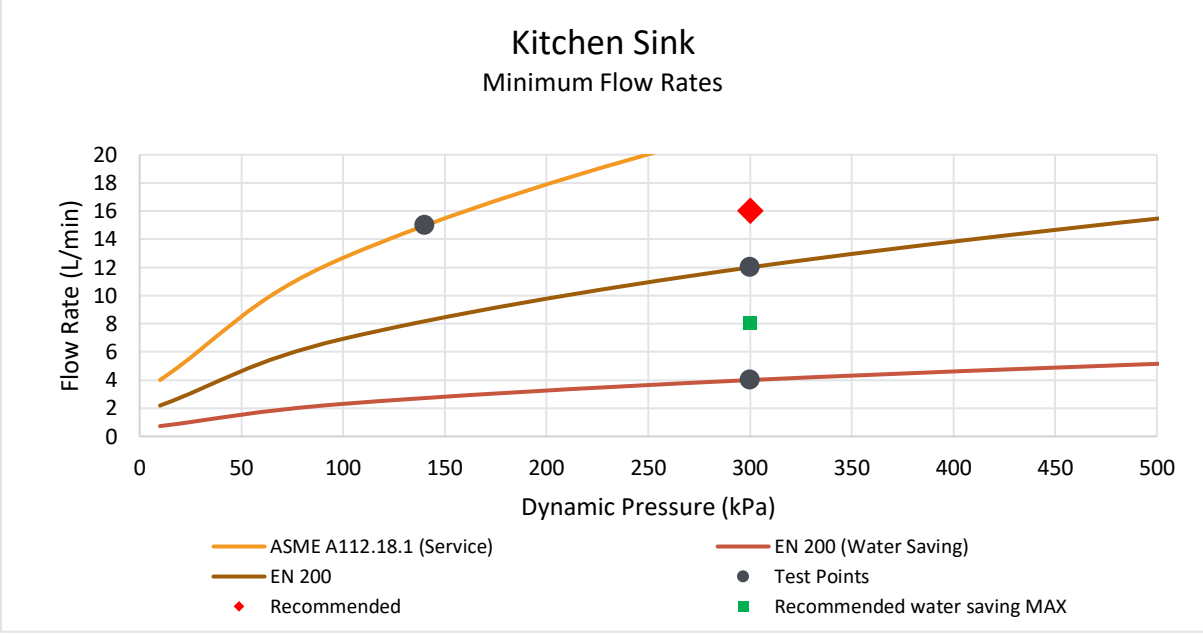

Figure 27 Kitchen sink minimum flow rate comparison

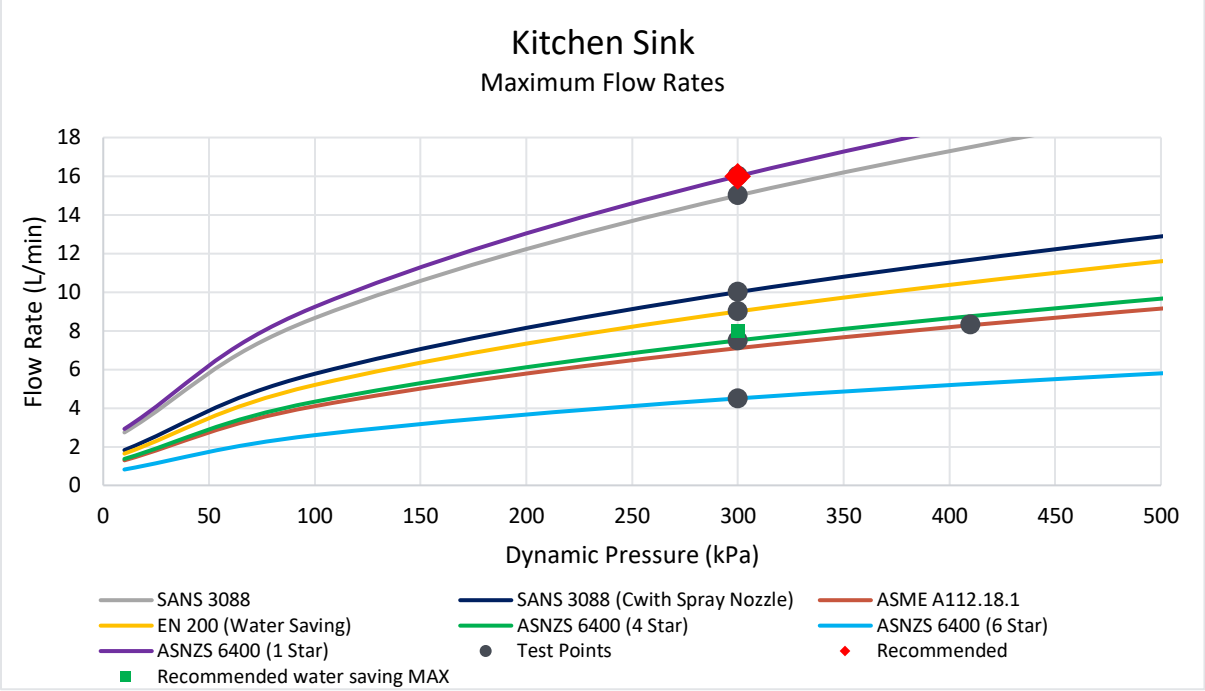

Figure 28: Kitchen Sink comparison

4.7.6 Laundry

Scope of taps:

This includes all taps intended to be mounted at a laundry washbasin, or for laundry appliances to be connected to the tap. They include taps intended for domestic and commercial use.

This type of tap is typically taps with single water supply channels. However, mixer taps can also be included in the scope of these taps.

Intended use:

These taps are intended to be used for both filling of a fixed volume, or with running water.

Taps will be used to fill a larger washbasin for washing dishes.

It will be used for automatic washing machines to be connected to. In this case, it will be used for filling a fixed volume as controlled by the washing machine.

Taps are likely to be used for limited rinsing of clothes under running water.

Conditions of use:

Wash Basin taps are used in domestic dwellings and commercial laundromats (e.g. Restaurants, cafeterias, etc.).

In all anticipated conditions of use, the water flow rate should be adequate to prevent an unreasonable delay in the time it takes to fill a volume of water in a larger washbasin.

Flow rates should not be unrestricted to allow for water-saving while such taps are used for rinsing.

Considerations:

Limiting flow rates is likely to result in water saving.

The ASME standard imposes a 15 L/min (@140 kPa) **minimum** flow rate for **laundry tub taps.** If such a tap is restricted based on the orifice size only, then it is likely to deliver a flow rate of approximately 22 L/min when tested at 300 kPa, while if it's restricted using a pressure compensated flow restrictor, the flow rate is anticipated to only be slightly lower than 15 L/min

The same standard allows a restricted range of flow rates for low-flow **laundry tub taps**. The allowed range is between a minimum of 3 L/min (@140 kPa) and a maximum of 15 L/min (@410 kPa). If such a tap is restricted based on the orifice size only, then it is likely to deliver a flow rate of approximately 4.4 L/min at the minimum level and 12.8 L/min at the maximum level, when tested at 300 kPa. If such a tap is restricted using a pressure compensated flow restrictor, the flow rate is anticipated to only be slightly above 3 L/min levels and slightly below the 15 L/min levels.

No SANS tap standard currently addresses the specific requirements of laundry taps. Such taps can fall within the scopes of SANS 1480, 1808-37, 226, 1021, and under 1808-35 as well. Between the different tap types and classes detailed in this standard, it could allow for minimum flow rates of 25 L/min and unrestricted maximum flow rates.

SANS 226 & 1021, specifies an allowed flow range of 20 L/min to 30 L/min for taps used on standard pressure and that has a 20mm inlet connection. Such taps are commonly used as laundry taps.

If the SANS standards impose a maximum flow rate restriction of 30 L/min, it will maintain the current maximum flow rate limit of the standards. It will also allow a practical tolerance of approximately 8 L/min (22 L/min to 30 L/min) for ASME taps to comply with.
Taps that comply with the ASME maximum flow rate of approximately 12.8 L/min (@300kPa) will also comply with the SANS requirement.

A recommended water-saving follow rate of 13 L/min maximum will be approximately aligned with the requirements of the ASTM standard for high-efficiency laundry taps.
It will be approximately aligned with a 1 Star rating for bidet taps as allowed for by the AS/NZS standard.

Recommended maximum flow rate: **30 L/min**
Recommended water-saving target flow rate: **13 L/min**

See figures 29 and 30 for a visual illustration of the compared flow requirements for high-pressure taps.

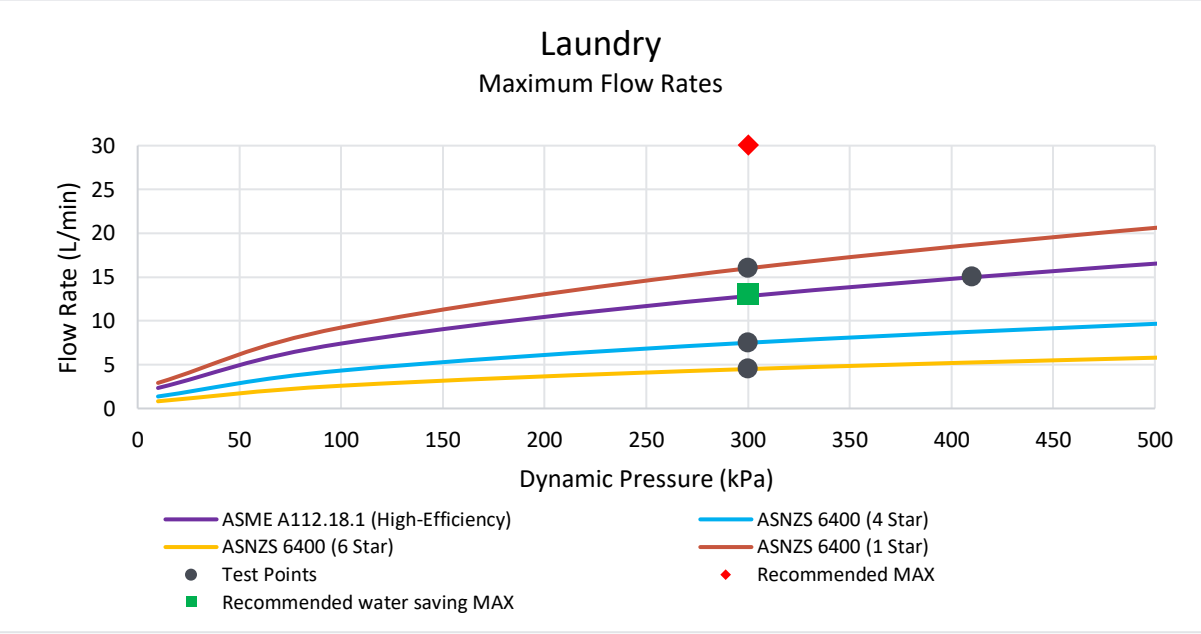

Figure 31 Laundry taps maximum flow rates comparison

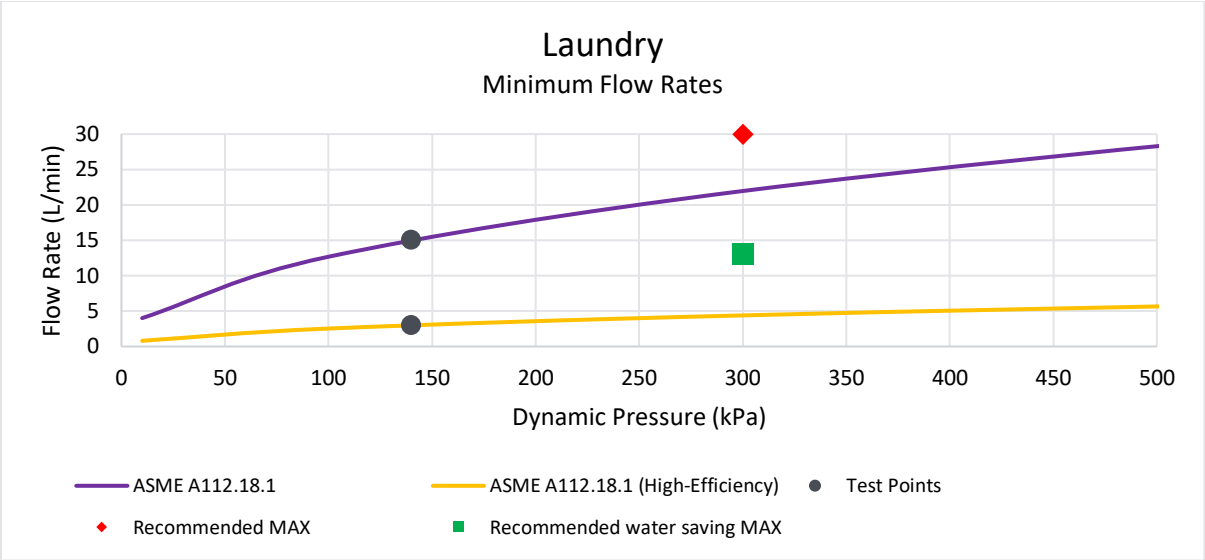

Figure 32: Laundry Tap comparison

4.7.7 Outdoor

Scope of taps:

This includes all taps intended to be mounted outdoors with the intended use for gardening and to provide some means of fire protection. Such taps are typically fitted with a screwed thread to allow for the connection of a gardening hose or other item.
This is applicable to taps with a single water supply channel only.
This is intended for taps used with cold water only. It excludes all other taps described in this report.
The recommended requirements for any tap that is predominantly intended for indoor use should not be relaxed if it is installed in an outdoor setting.

Intended use:

These taps are intended to be used for continuous flow as well as for filling large volumes.
Typical applications will be watering of gardens, washing of outdoor areas or objects (e.g. washing of a car, or paving, etc.)
Filling large volumes of water could include filling or topping up a swimming pool.
SANS 10252-1 requires that such a tap be installed on a pressure line before water pressures are reduced for plumbing installations so that it could be used to aid fire protection.

Conditions of use:

Wash Basin taps are used outside of domestic dwellings and commercial buildings.
Such taps could be used as irrigation connection points for communal gardens and parks.

Considerations:

Limiting flow rates might result in water-saving during some forms of use. Limiting flow rates might on the other hand limit the functionality of the taps. E.g. restricted flow could prevent the ability of the tap to aid fire protection. A low flow rate might cause a user not to supervise the water flow, with a potential that water overflowed the required volume by the time the user returns, etc.

The ASME standard imposes a 15 L/min (@140 kPa) **minimum** flow rate for **outdoor taps.** If such a tap is restricted based on the orifice size only, it is likely to deliver a flow rate of approximately 22 L/min when tested at 300 kPa while if it's restricted using a pressure compensated flow restrictor, the flow rate is anticipated to only be slightly lower than 15 L/min.

The same standard allows a restricted range of flow rates for **High-Efficiency outdoor taps**. The allowed range is between a minimum of 3 L/min (@140 kPa) and a maximum of 15 L/min (@410 kPa). If such a tap is restricted based on the orifice size only, it is likely to deliver a flow rate of approximately 4.4 L/min at the minimum level and 12.8 L/min at the maximum level, when tested at 300 kPa. If restricted using a pressure compensated flow restrictor, the flow rate is anticipated to only be slightly above than 3 L/min levels and slightly below the 15 L/min levels.

SANS 226 & 1021, specifies an allowed flow range of 20 L/min to 30 L/min for taps used on standard pressure and that has a 20mm inlet connection. Such taps are commonly used as outdoor taps.

If the SANS standard imposes a maximum flow rate restriction of 30 L/min, it will maintain the current maximum flow rate limit in terms of the SANS standards. It will also allow a practical tolerance of approximately 8 L/min (22 L/min to 30 L/min) for ASME taps to comply with.
Taps that comply with the ASME maximum flow rate of approximately 12.8 L/min (@300kPa) will also comply with the SANS requirement.

Due to the health and safety risks associated with fire protection, it is recommended that no water-saving target flow rate should be introduced.

Recommended maximum flow rate: **30 L/min**
Recommended water-saving target flow rate: **30 L/min**

4.8 Recommendations for consideration by SABS Technical Committees.

While this project focused on the alignment of flow rate requirements, additional factors were identified through the study and industry engagements. The following recommendations should be considered by the relevant SABS Technical Committees to advance the overall effectiveness of the various standards and programs.

4.8.1 Drainage infrastructure

It was identified that sewage infrastructure has been designed and installed based on traditional high flow rates. Higher water volumes aid the effective and hygienic removal of sewage. Inadequate water volumes in drainage pipes will lead to blockages of pipes. This is likely to worsen over time.

One such example is taps used for washing vegetables. Taps with low flow rates could effectively clean vegetables, resulting in the dirt not being washed down the drainage pipe, leaving residue and biofilm build up over time.

The minimum flow rates required to ensure effective sewage for different applications are unknown. The minimum flow rates specified for selected taps cannot be defined conclusively. Further study is recommended to determine the minimum flow allowed and ensure effective sewerage removal allowed flow volumes.

4.8.2 Functionality of taps and shower heads

As referenced in this report, the functionality of taps and showerheads must be considered. For example, showerheads that leave the user to perceive an unsatisfactory shower experience are likely to shower for long periods or remove the flow control components. In either scenario, this will undermine the purpose of reduced water flow components.

It is recommended that the technical committees evaluate the functional requirements for each tap and showerhead and include, where necessary, such requirements to ensure that the tap or showerhead will be functional and will provide an adequate user experience.

In particular:

- Specific attention should be given to the performance requirements of demand type and metering type taps.
- Showerhead coverage area and spray force should be considered.

4.8.3 Standard references in installation standards

It was identified that all requirements for taps and showerheads should be included in the relevant product standard only. If installation standards introduce additional requirements or restrictions that are not contained in the product standard, it is highly likely that the manufacturers will overlook such requirements and inadvertently supply products that might not be legally installed.

In addition, taps and showerheads should only be required to undergo one set of tests. All test methods relating to minimum flow rates, water efficiency labeling, functionality, flow rates for selected conditions etc. must be contained in the product standard.
Installation or water efficiency labeling standards may refer to the test results obtained during the test but should not require additional testing.

It is recommended that SANS 10252-1 and SANS 3088 only refer to compliance with the tap product standards, and that neither of these standards should include additional flow rate restrictions.

References

SANS 226:2016 “Water taps (metallic bodies)”
SANS 1480:2005 “Single control mixer taps”
SANS 1021:2007 “Water taps (plastic bodies)”
SANS 1808-9:2017 “Water supply and distribution system components Part 9: Metering taps and valves (metallic bodies)”
SANS 1808-16:2017 “Water supply and distribution system components Part 16: Drinking fountain taps”
SANS 1808-30:2004 “Water supply and distribution system components Part 30: Laboratory water taps”
SANS 1808-35:2010 “Water supply and distribution system components Part 35: Electronically operated taps and valves”
SANS 1808-37:2005 “Water supply and distribution system components Part 37: Single-control mixer taps (plastics)”
CLASP: https://www.clasp.ngo/
“In-depth Assessment of Water Efficiency Opportunities in South Africa” Published by CLASP in January 2021
Bernoulli equation: Openstax https://openstax.org/books/university-physics-volume-1/pages/14-6-bernoullis-equation?
LIXIL corporate information: https://www.lixil.com/en/about/information.html

Standards act: Act no. 8 of 2008, as published in the Government Gazette number 31253 on 18 July 2008.

SANEDI: South African National Energy Development Institute. https://www.sanedi.org.za/

ASSE International Plumbing Dictionary: ASSE International, 18927 Hickory Creek Drive, Suite 220
Mokena, Illinois 60448

ISO/DIS 31600(en) “Water efficiency labelling programmes – requirements with guidance for implementation” (Under development): https://www.iso.org/obp/ui/#iso:std:iso:31600:dis:ed-1:v1:en

National Water and Sanitation Master Plan Version 10.1. Published by the Department of Water and Sanitation of the Republic of South Africa: https://www.gov.za/documents/national-water-and-sanitation-master-plan-28-nov-2019-0000

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