

Foreword

This document supports the application of [IEC 60456:2010](#) *Clothes washing machines for household use - Methods for measuring the performance* by making publicly available the expanded uncertainty of measured values for **horizontal axis washing machines** and **impeller type washing machines**. This document is also intended to complement the expanded uncertainty values included in [IEC TR 62617:2015](#) *Home laundry appliances - Uncertainty reporting of measurements*.

Background

In 2016-2017 a Round Robin test was performed by WG20 of SC59D with 20 laboratories all over the world with the following objectives:

- investigate performance & consumption values in different washing machine types: horizontal axis and vertical axis agitator and impeller types;
- compare different methods for measuring the rinsing performance and establish a reproducible test method to be later included in the next edition of IEC 60456 (Ed. 6 under preparation), applicable to all types of washing machines;
- derive and compare the uncertainty of performance values for different machine types and different water hardness: soft/hard water according to [IEC 60734:2012](#) *Household electrical appliances - Performance - Water for testing*.

For each washing machine type two different washing programmes according to IEC 60456:2010 and alternative procedures for rinsing performance were tested. For the latter the alkalinity method described in IEC 60456:2010 was compared with a new method for measuring the surfactant content at textile materials defined in [CLC/TS 50677:2019](#) *Clothes washing machines and washer-dryers for household and similar use - Method for the determination of rinsing effectiveness by measurement of the surfactant content at textile materials*.

Outcome

The results were analysed by WG 18 of SC 59D and expanded uncertainties were calculated according to IEC TR 62617:2015 for **horizontal axis washing machines** (Table 1) and **impeller type washing machines** (Table 2).

For the **agitator type washing machines**, an insufficient number of laboratories participated and calculation of expanded uncertainties was seen as inappropriate.

Table 1 – Expanded uncertainty of measured values for horizontal axis washing machines

Measured parameter	Expanded uncertainty of measured value ($k=2$)
Wash performance ratio q *	0,04 (abs)
Total energy W_{total} (in kWh) *	10 %
Total water V_{total} (in l) *	5 %
Remaining moisture RM (in %) *	4 (abs)
LAS rinsing effectiveness **	30 %
Alkalinity rinsing method *	70 %

Table 2 – Expanded uncertainty of measured values for impeller type washing machines

Measured parameter	Expanded uncertainty of measured value ($k=2$)
Wash performance ratio q *	0,06 (abs)
Total energy W_{total} (in kWh) *	10 %
Total water V_{total} (in l) *	6 %
Remaining moisture RM (in %) *	4 (abs)
LAS rinsing effectiveness**	30 %
Alkalinity rinsing method *	70 %

* according to IEC 60456:2010

** according to CLC/TS 50677:2019