ABNT NBR 15.538

BRAZILIAN STANDARD TO ASSESS WATER METER PERFORMANCE BASED ON ACTUAL OPERATIONAL CONDITIONS

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ABNT – TC 04.005.010 – Mesurement of flowrate in closed conduits
WG – potabe water meter

OBJECTIVE

Present the ABNT NBR 15.538 Standard that complement ISO 4064 adding adittional tests and procedures for evaluating the performance of cold potable water meters, based in actual working lowrate profile of the consumer, Define the MPI - Measurement Performance Index, based on meter average measurement error weighted by flow consumer profile.

WHY THIS STANDARD WAS NECESSARY ?

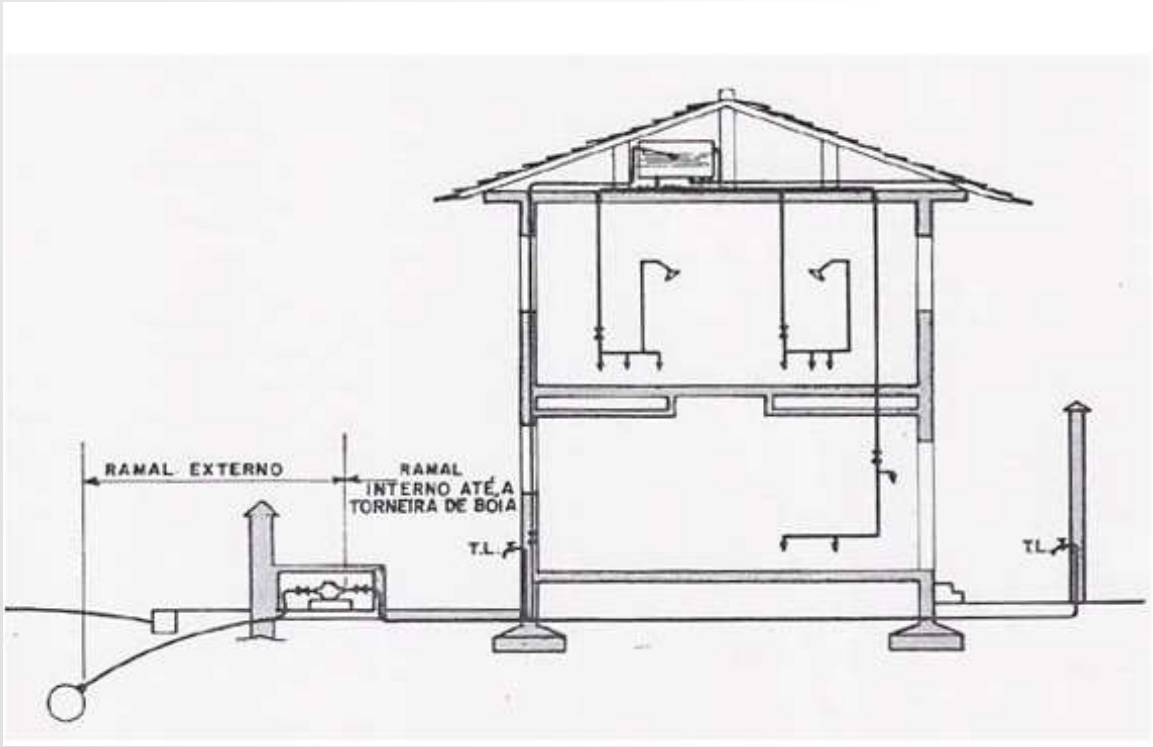
1. ISO 4064 (published in Brazil as ABNT NBR 16043) whas developped for consumer with direct water supply, and in Brazil most of installations are indirect.

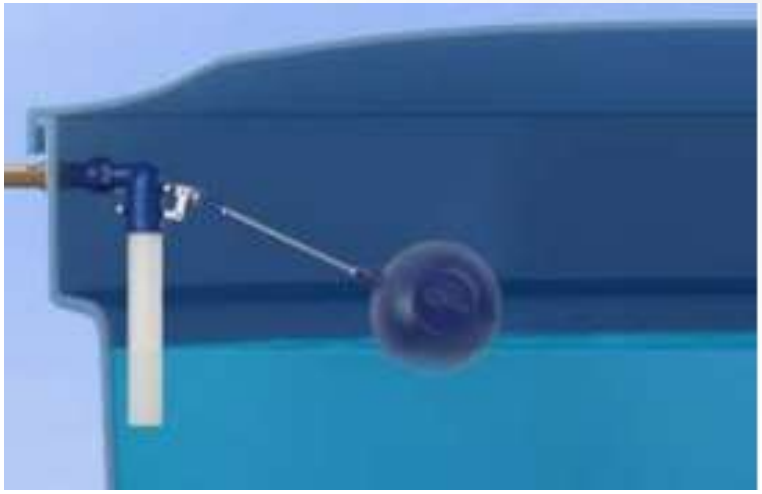
2. Consumer flowrate profile is diferent in Brazil due to diferent habits and equipments that reduce flowrate (eletric showers).

3. It was noticed that some manufacturers develop water meter to pass in ISO 4064 endurance test, not to have the best meter performance.

4. Considering that Brazil is a country that have tropical climate in the north and temperate climate in the South, a single criterium for sizing and evalutate meter performance could be not necessarelly adequate.

TYPICAL RESIDENTIAL INSTALATION





Indirect supply allow the reduction of pessre in the pipes, reducing loss (leakages) and misuse of water (cleaning floor using water jet)

HISTORIC

- **2007 – 1st. Editon**
  - Introduce ccuracy test based on 10 flowrates calibration, average error and MPI (Meter Performance Idex) wheighted by flow rate consumption profile. The tested flowrates were considered differentlly for each meter size (Qn) do not allowing evauation the best meter size for each condition.
- **2011 - 2nd. edition**
  - Change the procedure: calibration flowrates were choosen based on the actual consumption profile independent of the meter model and size.
- **2021 – Proposed de revision**
  - Include methods for determination residential flow profile surveys and inscentivate companies to determinate the actua profile of their consumers, allowing best decision on sizing and evaluating watermeters.

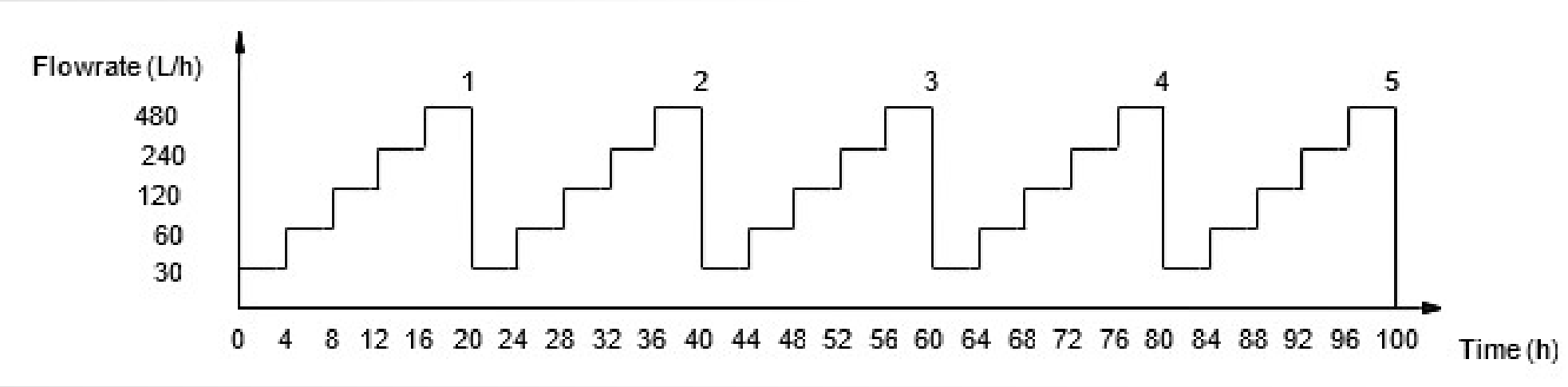
TESTS PREVIEWED IN ABNT NBR 15.538

- **Determination of MPI - Meter performance Index**
  - Determination of erros in 10 flowrates (before endurance)
  - Endurance test in Qmax and in lowerflowrates
  - Determination of erros in 10 flowrates (after endurance)
- **Magnetic Shield**
- **Sealed display tightness**
- **Dome resistance**
- **Dome compression resistance**
- **Torsion test (body deformation) – composite meters**

ENDURANCE TESTS

1. Constant flow rate, 100h @ Qmax
2. Cyclick test:

Cyclick	1				
Flowrates (L/h)	30	60	120	240	480
Time/cycle for each flowrate (h)	4	4	4	4	4
time for each Cycke (h)	20				
Total time for 5 Cycles	100				



DETERMINATION OF METER PERFORMANCE INDEX

I. Test of accuraccy (calibration in 10 flowrates) - initial

flowrates (L/h)	2,5	10	22,5	40	100	250	450	700	1000	1325

II. Endurance

- 100 h flow at Qmax or Q4
- 100 h in 5 cycles fo lower flowrates (30; 60; 120; 240; 480 L/h)

I. Test of accuraccy (calibration in 10 flowrates) - final

II. PMI calculation based on wheighted average error

"wheighted average error : Performance eavluation parameter obtained from the association of the meter mesurement calibration error to the actual water flowrate consumption profile:"

$$\text{Wheighted Average Error WAE (\%)} = \frac{\sum[(\boldsymbol{Error\ Qx})\boldsymbol{x}\ (\boldsymbol{wheight\ Qx})]}{\mathbf{100}}$$

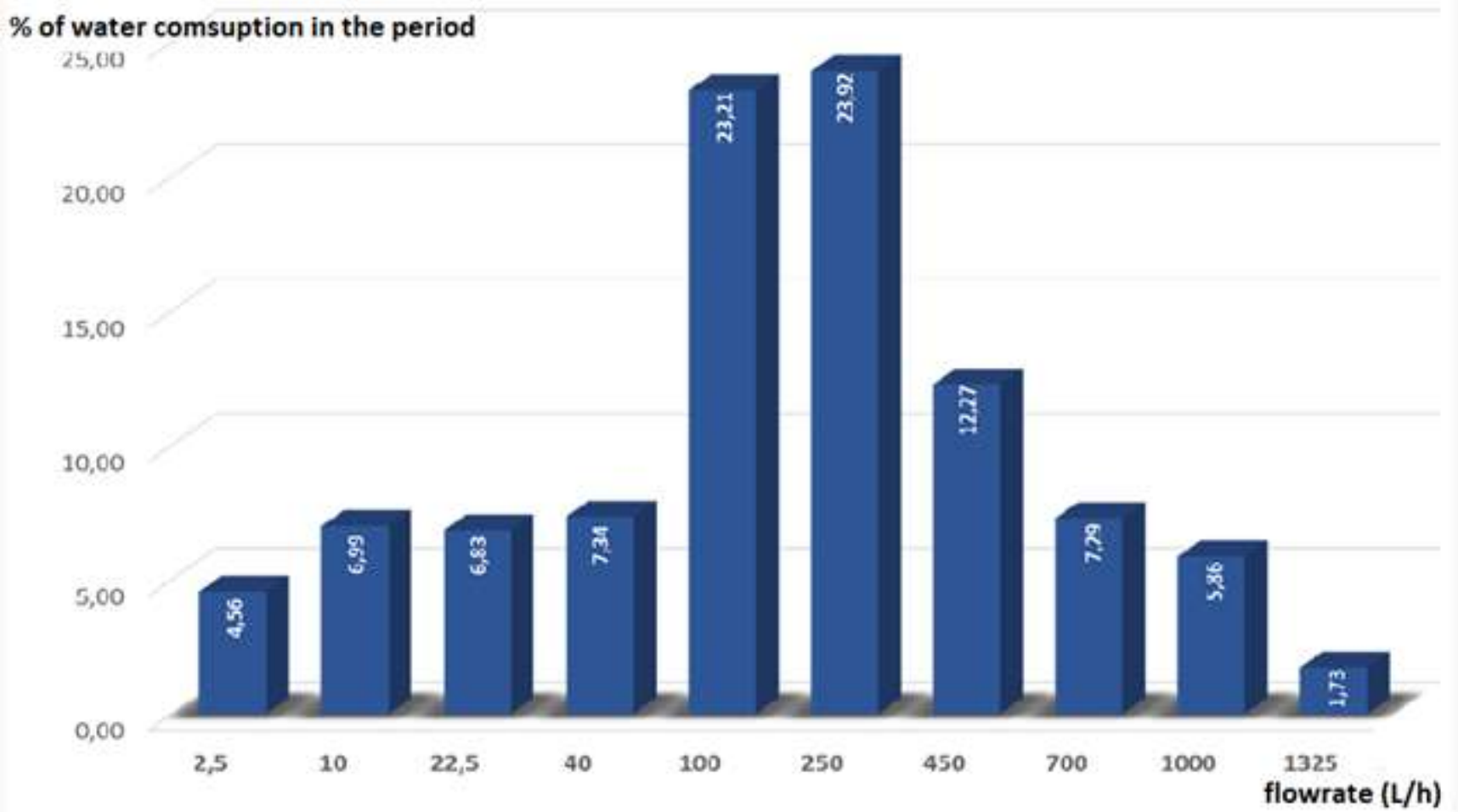
Wheight = consumed volume in each flow rate band, for a month consumprion in %

Error = measurement error for each flowrate Qx, express im %.

$$\mathbf{PMI} = 100 + \boldsymbol{WAE}$$

"PMI = numeric value tha characterize the performance of a watermeter, in specific test conditions."

FLOWRATE WHEIGHTS – FLOW PROFILE



EXAMPLES OF PMI CALCULATIONS

Ordem	Flowrate bands L/h	Calibration flowrates L/h	Error after endurance%	Whight %	EWAE %	PMI %
1	0 a 5	2,5	- 100,00	4,56	- 6,66	93,34
	5 a 15	10	- 27,33	6,99		
	15 a 30	22,5	- 1,30	6,83		
	30 a 50	40	0,80	7,34		
	50 a 150	100	0,40	23,21		
	150 a 350	250	- 0,25	23,92		
	350 a 550	450	- 0,66	12,27		
	550 a 850	700	- 0,72	7,29		
	850 a 1 150	1 000	- 0,80	5,86		
	1 150 a 1 500	1 325	- 0,76	1,73		
2	0 a 5	2,5	- 70,00	4,56	- 2,75	97,25
	5 a 15	10	- 0,40	6,99		
	15 a 30	22,5	- 0,40	6,83		
	30 a 50	40	0,50	7,34		
	50 a 150	100	1,00	23,21		
	150 a 350	250	1,00	23,92		
	350 a 550	450	0,60	12,27		
	550 a 850	700	0,60	7,29		
	850 a 1 150	1 000	0,43	5,86		
	1 150 a 1 500	1 325	0,43	1,73		

REVISION PROPOSAL – 2021

- **Procedure for consption profile surveys and get a new average profiles**
  - Survey campains , regional na national
  - Population: Redidential consumers up yo 2 families and indirect water supply;
  - Three average Monthly consumption cathegories: 0 to 10 and 11 to 20 and 20 to 50 m^3/month
- **Include new tests for medidores eletrônicos (tampering)**
- **Review overall procedures**
- **Definition of test sequence for a Model evaluation and qualification of na adquired meter lot**

CONCLUSIONS

- **1st experience with ABNT NBR 15538:2007 was successful and increase the interess of companyes to survey their own consumption profile and better segment meter mode and size by consumer cathegory**
- **New test for meter resistance to tampering are necessary specially for electronic meters.**
- **Revision of procedures increase the efficiency of the test**
- **Quality of meter manufactured in Brazil was observed, and reduction of volume nor measured.**
- **Surveys generate key information for planning water distribuition system growing.**

QUESTIONS ?