



Digital Thermometer Easy to Use, Safe, and Environment-Friendly

Mercury-based instruments like conventional thermometers and blood pressure-measuring instruments will soon be phased out in accordance with the policies framed by World Health Organization (WHO). The pollution control board in India has thus been pressing all healthcare facilities, in government as well as private sectors, to phase out mercury-based equipments and replace these with aneroid-based instruments. And that's how digital thermometers – because they are mercury-free – come in the overall scheme of things.

The potential environmental hazard, human toxicity and disposal cost of mercury have led to a growing demand for non-mercury-containing devices in healthcare facilities. To quote Dr Ragini Kumari of Toxics Link, mercury inhalation as a result of spillage from an instrument could cause damage to lungs, kidney and the central nervous system. She said mercury was one of the most toxic

natural elements. It was a global contaminant and a neuro-toxin, and has an adverse effect on the human nervous system and other body parts. Besides, due to improper disposal of broken thermometers, other mercury-containing instruments as well as industrial wastes, mercury finds its way into waters in rivers and seas and poses potential health problems not only for the sea world but also by coming back into the human food chain through sea food, particularly fish.

COMPARATIVE TEST

No mercury here

Digital thermometers are mercury-free. They have sensing probes – thermistor – inside their tips which are used to measure the temperature. They are fitted with LCD displays that make it easier to read the body temperature, beep alarms and memory functions. Digital thermometers are mostly used by medics/paramedics as well as individual households these days as they are easy to use and have no risk of breakage—unlike the conventional clinical glass thermometers. Overall, they are easier to read than glass thermometers, have a quicker response time, and contain a range of specialized uses and applications.

Consumer Voice tested the digital (clinical) thermometers being sold in the market to verify their accuracy, convenience, reliability and safety. The thermometers were put through laboratory tests as per the claims and requirements and methods of tests specified in the Indian Standards for clinical thermometer (IS: 3055 Part-I, 2004). In addition, brands were tested to assess their compliance with the criteria laid down for labelling as well as based on the specifications and facilities as mentioned on their leaflets/manuals/packaging.

Brands Tested

Rank	Brand
1	Omron
2	Dr. Morepen
3	IS
3	Ishnee
3	Easy Care
4	Metro
4	Perfexea
5	RossMax
6	EZ-Life
7	Hicks
7	Extra Care
8	HSIL

Surprisingly, none of the manufacturers give any warranty for these thermometers, except for Dr. Morepen, which gives a six-month warranty. The retailer, however, did provide a one-year warranty for all the brands.

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TEST PARAMETERS

Performance/Functional Tests

Temperature measurement and accuracy: All the brands of digital thermometers are tested for various temperature measurements and accuracies during the three initial tests at different temperature ranges and also after the post-endurance and post-impact tests. All the brands are found to be accurate in the temperature measurements and within the declared error range. Omron is most accurate as no error is found in the measurement of body temperature. (Max. error (measurement range) as per IS: 3055 (Part-I) declared accuracy is

+0.1 °C/-0.15 °C (+0.2 °F/-0.3 °F).)

Impact (drop) test: As per 'The Legal Metrology (General) Rules, 2011, Part VI, for complete Digital Thermometers', the indicated temperature should not vary by more than ±0.1 °C from the reference temperature, after a fall on a hard surface, from a

Key Findings

- Based on the overall test findings, all the brands are found equally reliable. They are all found to be accurate and robust. None of them broke even after being dropped three times from a height of one metre.
- Omron (92), Dr. Morepen (88) and IS (87) are the top performers.
- The scores of Extra Care (82) and HSIL (81) are lower in terms of overall performance but they are found to be equally reliable and robust.

Best Buy
Omron

Value for Money
IS

Brand	Sample Reading (°C/°F)			Difference in Measurement (°C/°F)			Actual Temperature (°C/°F)		
Omron	37.0	39.0	41.0	0.0	0.0	0.0	37.0	39.0	41.0
Dr. Morepen	37.0	39.1	41.1	0.0	-0.1	-0.1	37.0	39.0	41.0
IS	98.6	102.3	105.9	0.0	-0.1	-0.1	98.6	102.2	105.8
Ishnee	37.1	39.1	41.1	-0.1	-0.1	-0.1	37.0	39.0	41.0
Easy Care	36.9	38.9	40.9	0.1	0.1	0.1	37.0	39.0	41.0
Metro	98.7	102.3	105.9	-0.1	-0.1	-0.1	98.6	102.2	105.8
Perfexea	98.7	102.3	105.9	-0.1	-0.1	-0.1	98.6	102.2	105.8
RossMax	98.7	102.3	106.0	-0.1	-0.1	-0.2	98.6	102.2	105.8
Ez-Life	98.7	102.3	106.0	-0.1	-0.1	-0.2	98.6	102.2	105.8
Hicks	98.8	102.4	106.0	-0.2	-0.2	-0.2	98.6	102.2	105.8
Extra Care	98.7	102.3	106.0	-0.1	-0.1	-0.2	98.6	102.2	105.8
HSIL	98.5	102.1	105.6	0.1	0.1	0.2	98.6	102.2	105.8

height of one metre, from three different orientations. Variation in temperature at the level of normal human body temperature – that is, 37.0 °C – along with the condition of the thermometer, pertaining to visual checks/damage, is reported after this test. All the brands clear the drop test, having been found to be functional and still accurate in their temperature

measurement. In particular, Omron, Dr. Morepen, IS and Metro are found with no error.

Facilities, features and functions: Facilities for self-check, last recorded reading, high and low temperature functions as well as auto shut-off (time) are verified as available or not, and compared against declaration. Auto shut-off time of 10 minutes is provided by all the



Internal Components of a Digital Thermometer

A typical layout of a digital thermometer is shown in the accompanying image. It is made up of a microcontroller, memory that is embedded in the form of COB IC, along with some passive components like a capacitor, resistors, sensors, a buzzer and a switch. The analog value of temperature measured is converted to the digital form by the microcontroller and then displayed on the LCD. If the value of temperature exceeds the highest value, then the buzzer makes a sound.



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brands except Omron – it has a thirty-minute auto shut-off time, which results in extra consumption of its battery.

Error displays: All thermometers display an error message when they are not properly in contact with the body. All the tested brands of digital thermometers

have provided this facility, though varying in the time of beep, which ranges from three seconds to ten seconds. Omron has provided the lowest time of 3 seconds, followed by IS with 4 seconds and Easy Care with 5 seconds. Interestingly, the beep time of eight brands is up to 10 seconds.

Post-endurance and post-impact temperature accuracy tests: Temperature accuracy test is done after the impact test and the endurance test to check if it is still accurate or not.

Brand	Post-Endurance Test			Post-Impact Test		
	Sample Reading	Correction to Reading	Actual Temp.	Sample Reading	Correction to Reading	Actual Temp.
Omron	37.0	0.0	37.0	37.0	0.0	37.0
Dr. Morepen	37.1	-0.1	37.0	37.0	0.0	37.0
IS	98.6	0.0	98.6	98.6	0.0	98.6
Ishnee	37.0	0.0	37.0	37.1	-0.1	37.0
Easy Care	36.9	0.1	37.0	36.9	0.1	37.0
Metro	98.7	-0.1	98.6	98.6	0.0	98.6
Perfexea	98.8	-0.2	98.6	98.7	-0.1	98.6
RossMax	98.8	-0.2	98.6	98.7	-0.1	98.6
Ez-Life	98.7	-0.1	98.6	98.7	-0.1	98.6
Hicks	98.8	-0.2	98.6	98.8	-0.2	98.6
Extra Care	98.8	-0.2	98.6	98.8	-0.2	98.6
HSIL	98.5	0.1	98.6	98.5	0.1	98.6



The indicated temperature should not vary by more than ± 0.1 °C from the reference temperature, after a fall on a hard surface from a height of one metre]

Temperature change over facility (°C to °F and vice versa): Since different parts of the world follow different temperature-measuring units, four brands – namely Dr. Morepen, Easy Care, Ishnee and Omron – have provided the change over facility from °C to °F and vice versa.

Time duration accuracy: Three readings each were taken to check for the time duration of all the thermometer brands for oral as well as underarm modes. The variation observed in maximum time and minimum time, reported in seconds as time duration accuracy, is tabulated as shown here:

Brand	Oral (in sec)	Underarm (in sec)
Omron	03	05
Dr. Morepen	04	11
IS	03	09
Ishnee	04	06
Easy Care	08	15
Metro	04	12
Perfexea	09	12
RossMax	08	10
Ez-Life	07	11
Hicks	06	10
Extra Care	03	06
HSIL	08	14

Omron, Extra Care and IS are found with the minimum variation for oral time measurement, whereas HSIL, Easy Care, Perfexea and RossMax have the highest variation in time duration accuracy. In underarm measurement, Omron, Extra Care and Ishnee have the minimum time variation, and HSIL and Easy Care have the maximum time variation.

Display of previous reading: This test is done by visual inspection. All the tested thermometer brands are found to have the facility of displaying the previously recorded temperature reading.

Care, maintenance, convenience and ease of use: These aspects are checked and reported after the complete usage of the thermometer. Ease of use also includes error display, display of previous reading, facility and functions including default, accessories

provided as well as display size. Operating manuals are verified for instructions pertaining to care and maintenance, and reported as very good/good/average/poor/very poor. Brands have been rated also based on whether they have given complete information.

Endurance: To judge reliability of operation as well as the battery life for a fixed period/cycles of operation, endurance as well as battery life tests are carried out for about 200 measurements at ambient temperature in a water bath, within the maximum permissible measurement range. All the brands have worked satisfactorily and quite reliably.

Post-endurance: This test is to check the temperature accuracy at normal human body temperature – that is, 37.0 °C/98.6 °F. All the brands pass the test within the permissible limits. Omron, IS and Ishnee are found with no error and given equal scores.

Measurement of sound level (in dB): Sound level of beep audibility is measured on new thermometer and after post-endurance test (200 measurements). It is primarily to examine whether it is reasonably audible when measured from a close distance.

Easy Care, Ez-Life and Ishnee have the maximum audible sound when measured on the new/fresh thermometers; HSIL and Omron have the lowest sound level. The relative difference in sound level after the endurance test is minimum in Metro, RossMax and Extra Care.

Physical Observations

Marking/Labelling: Omron has given maximum information on product, packing and leaflet. HSIL, Easy Care, Ez-Life, Ishnee and RossMax have not mentioned batch no./lot no., while Dr. Morepen, HSIL, Hicks and RossMax are deficient in providing technical specification.

Weight: Most brands weigh approximately 10gm, except Extra Care, IS and Omron, which weigh almost 12gm.

Overall Test Ratings

All the brands are almost neck and neck, being technically reliable as well as durable. Omron (92) is ranked No. 1 and followed by Dr. Morepen (88) and IS (87); they are the top performers. The scores of Extra Care (82) and HSIL (81) are lower in terms of overall performance but they are found to be equally reliable and robust.

COMPARATIVE TEST

COMPARATIVE PERFORMANCE RATING OF DIGITAL THERMOMETERS

Test Parameters ↓	Brands →		% Weightage	Omron	Dr. Morepen	IS	Ishnee	EasyCare	Metro	Perfexea	RossMax	Ez-Life	Hicks	Extra Care	HSIL
	Model	Model													
Retail Price/MRP (Rs)	150/155	160/190	120/275	MC-246	MT-101	-	IN101A	EC-508	CE-0197	MT-502	TB-100	MT-101,111	DT10IN	CE-0197	DIGITAL
1. Measurement Tests	44	40.51	38.04	41.81	40.51	38.04	39.69	39.39	36.68	36	35.93	36.87	33.82	36.39	35.02
1.1 Accuracy in measurement (initial)	15	14	14	15	14	14	13.5	13.5	13.5	13.5	13	13	12	13	13
1.2 Accuracy in measurement after endurance & impact tests	10	9.5	10	10	9.5	10	9.5	9.0	9.5	8.5	8.5	9.0	8.0	8.0	9.0
1.3 Beep sound level	8	6.45	6.25	6.45	7.21	6.25	6.49	7.73	6.21	6.53	7.12	7.56	6.35	7.36	6.03
1.4 Temp. change over facility	3	3.00	0.75	3.00	3.00	0.75	3.00	3.00	0.75	0.75	0.75	0.75	0.75	0.75	0.75
1.5 Time duration accuracy	8	7.36	7.04	7.36	6.8	7.04	7.20	6.16	6.72	6.72	6.56	6.56	6.72	7.28	6.24
2. Care, Maintenance, Convenience, Ease Of Use	23	17.6	19.51	19	17.6	19.51	17.5	19.44	18.46	18.16	17.2	17.2	17.76	16.96	17.48
3. Durability	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
3.1 Endurance	8	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
3.2 Impact test	7	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
4. General Tests	18	16.03	14.55	16.03	15.05	14.55	14.53	12.88	15.18	15.92	15.64	13.84	15.65	13.36	13.82
4.1 Manual/Leaflet	4	3.8	3.4	3.8	3.4	3.4	3.4	2.6	3.4	3.2	3.6	3.2	3.6	3.2	3.2
4.2 Net weight	3	2.27	2.88	2.27	2.88	2.83	2.86	2.41	2.79	2.85	2.87	2.87	2.66	2.26	2.93
4.3 Dimensions	3	2.16	2.77	2.16	2.77	2.52	2.77	2.77	2.89	2.77	2.77	2.77	2.89	1.5	2.89
4.4 Packing quality	4	3.80	3.6	3.80	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.4	3.6	3.2	3.2
4.5 Marking/labeling	4	4	2.4	4	2.4	2.2	1.9	1.5	2.5	3.5	2.8	1.6	2.9	3.2	1.6
Overall Score (Rounded off)	100	92	87	92	88	87	87	87	85	85	84	83	82	82	81

Rating: >91: very good ***; 71-90: good *****, 51-70: average ***, 31-50: poor **, up to 30: very poor ***

Note: Care, maintenance, convenience and ease of use includes scoring of facilities and functions including default, error display and display of previous reading, display size and additional accessories provided.

****HSIL:** Hemant Surgical Industries Limited