German Standard November 1989

| Hollowware for electric cookers<br>Dimensions, requirements and testing | **DIN**<br>**44 904** |
|---|---|

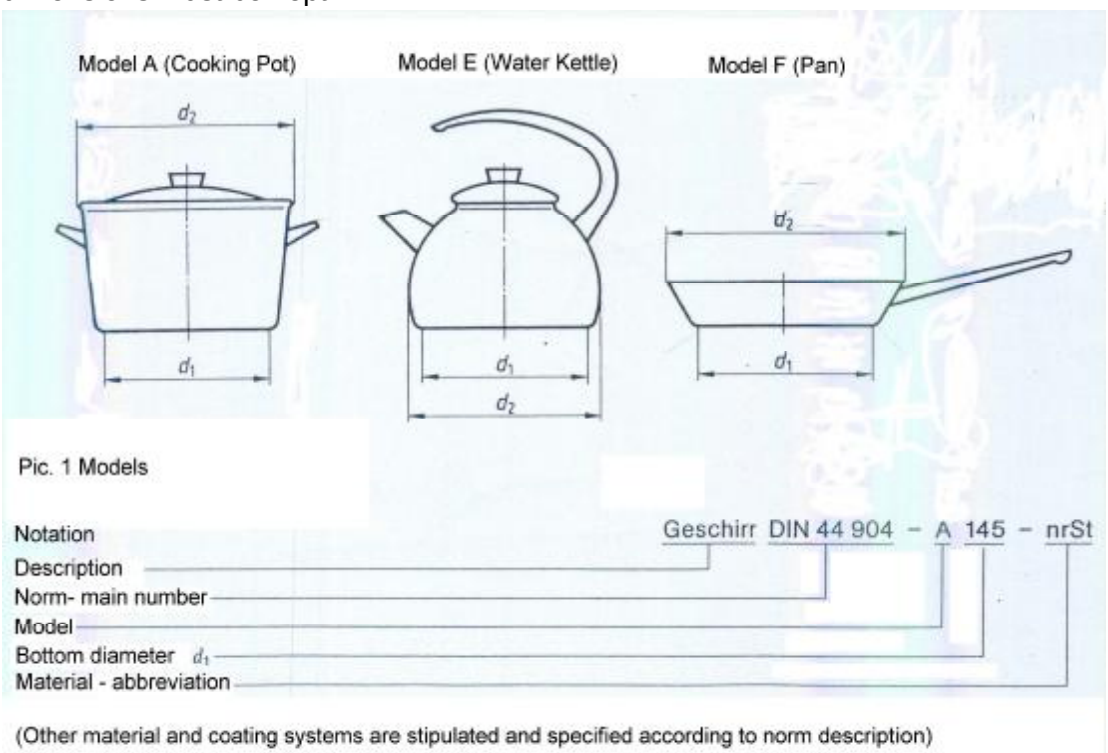
Supersedes:
DIN44 904 T 1/03.80,
DIN44 904 T 2/03.80,
DIN44 904 T 3/03.80
and DIN44 904 T 4/03.80

**1. Scope**

The standard is applied to hollowware made of enameled steel plate, aluminium and stainless steel, and used for electric cookers. It includes the main measurement and defines characteristics, requirements and test procedure. Besides, it includes requirements for safety technology to avoid any danger of end-user during operation.

**2.Dimensions, Description**

The hollowware doesn't need to be the same as the following, but the specified dimensions must be kept.




Pic. 1 Models

(Other material and coating systems are stipulated and specified according to norm description)

**Table 1. Diameter**

| $d_1$ +20 -5 | $d_2$ Models A and E max. | $d_2$ Models F max. | $d_1$ is defined as diameter of the bottom which directly on contact with the hot plate. $d_1$ is aspired as big as possible. Diameter of hot plate according to DIN 44 910 part 4. $d_2$ is defined as the biggest outer diameter (Dia. Of the cover is calculated). |
|---|---|---|---|
| 145 | 210 | 230 | |
| 180 | 245 | 265 | |
| 220 | 285 | 305 | |

**Table 2. Thickness of bottom**

| $d_1$ | Material | | | | | | |
|---|---|---|---|---|---|---|---|
| | enamelled Steel (w/t enamelling) Models | | | Aluminium Models | | Stainless Steel Models A,E,F with heat conduction coating made of: | |
| +20 -5 | A min. | E min. | F min. | A and F min. | E min. | Copper with closing plate from S/S min. | Aluminium with closing plate from S/S min. |
| 145 | 1,5 | 1 | 1,75 | 3,5 | 3 | 2 | 3,2 |
| 180 | 1,75 | 1,25 | 2 | 4,5 | 3,5 | 2,5 | |
| 220 | 2 | - | 2,25 | 5 | 4 | 3 | 4,2 |

## 3. Requirements

### 3.1 Material

Enamelled Steel: Steel according to DIN 1623 Part3 (Kind chose by producer)
Enamel according to RAL 529 A2
Al.: Aluminum according to DIN 1725 Part1&2 (Kind chose by producer)
Stainless Steel: Stainless steel according to DIN 17 441(Kind chose by producer, e.g. material no. 1.4301)

All material must be with the characteristic, that there is no deleterious matter, which could do harm to health, olfaction & gestation, will be produced during normal use, and get to the food.

### 3.2 Standard capacity

The standard capacity of the hollowware is defined based on full to the top edge, and can not deviate about ±7% from the specification of the producer.

Test according to article 4.2.

### 3.3 Bottom of hollowware

The surface of the bottom must be flat and without burrs which could result in splits between the hollowware and the hot plate.

Test according to article 4.3.

**3.3.1 Bending**

Protruding of the hollowware's bottom is not acceptable. For bending:

- cold condition (room temperature) max. 6‰
- warm condition (200±5) $^{o}$C max. 3.5‰ from respective diameter of bottom $d_1$

If an inwrought impression appears in the middle of the outside of bottom, it must be taken into consideration accordingly.

Test according to article 4.3.1 & 4.3.2.

**3.4 Edge of hollowware**

Concerning edge of model A (cooking pot) and cover edge of model E (water kettle), they must be formed upon that, no water drains to the outside during testing according to article 4.4 (Individual drops at the end of test will not be taken into consideration).

**3.5 Cover**

The cover of the model A (cooking pot) must be formed upon that, it's splash-proof and no water drains to the outside of the hollowware during testing according to article 4.5.

**3.5.1 Design**

For model A (cooking pot), height of the fittings (handle) can't be over that of pot's edge.

Inspect according to article 4.6.1.

**3.5.2 Fixing**

The fittings (handle, stick, etc.) can't be unscrewed or deformed after all tests required in the standard.

Test according to article 4.6.2.

**3.5.3 Protection against combustion by heat insulated fittings**

The heat insulated fittings must be designed, so that the handle of the hollowware will not contact with the metal parts, whose temperature can be possible to exceed 50$^{o}$C. The test lamp should not be lighted up during testing according to article 4.6.3.

**3.5.4 Temperature rise of the heat insulated fittings**

The temperature rise of the position, which is planned for handhold can't exceed 40 K

by heat insulated fittings during testing according to article 4.6.4.

**3.5.5 Baking oven resistance of the heat insulated fittings**

The insulated fittings of the hollowware, which planned to be used in baking oven, must be marked with admissible baking oven temperature. (e.g. “Baking oven resistance to 250 $^{o}$C” .)

No blister & fissure is allowed after testing according to article 4.6.5.

**3.6 Enameling**

Enameled surface must conform to specifications of DIN51 031 & DIN51 032.

**3.6.1 Resistance to temperature change**

The hollowware must have a medium resistance to temperature change of min. 280 $^{o}$ C.

Test according to article 4.7.1.

**3.6.2 Resistance to shock**

The enamel inside of the bottoms must be able to pass impact test – can stand min. 30N spring and no damage. (Striker marks on the enamel will not be considered as damage.)

Test according to article 4.5.2.

**3.6.3 Acid resistance**

Enamel’s weight loss per unit area inside of the bottoms - model A & F (cooking pot & pan) is max. 10g/m$^{2}$.

Test according to article 4.7.3.

**3.7 Non-stick Coating**

(In Preparation)

**3.8 User Manual**

Each hollowware must be provided with a user manual in German language. It must include intelligibly instructions for handling, using and caring, especially must contain below information:

- Diameter of the hot plate where the hollowware used (Standard diameter of the hot plate or glass ceramic kitchen area according to DIN 44 910 Part 4 and DIN 44 546).
- Standard capacity in liter.
- Instruction for proper using, starting, caring and cleaning.
- Instruction for dangers caused by warming in empty condition (overheating) and complete evaporation of the moisture in cooking food (combustion).

**-** Instruction for energy-saving cooking (e.g. with cover…)

**4. Testing**

All tests will be done with the same test sample, except the test for enameling (pls see article 4.7) and unless otherwise noted, in room temperature of (20±5) $^{o}$C. The test is carried out for opening mould before start of series production, when tools or precondition of production changes, and will be recorded in test report.

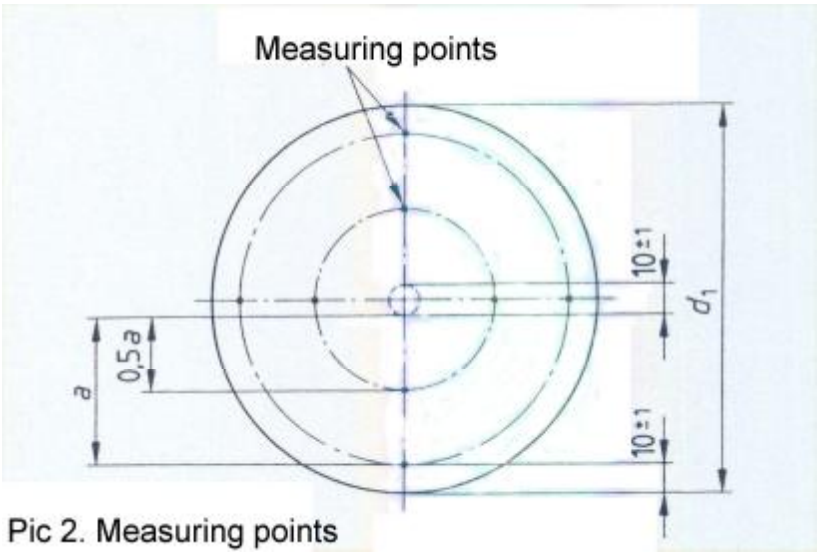
**4.1 Dimensions**

Diameter mentioned in table 1 will be measured.

Thickness of the bottom mentioned in table 2 will be measured as below:

-For hollowware made of enameled steel plate without enamelling, will be measured on any point. An existent impression can't be agreed. Thickness of the enameling will be measured with a measuring instrument for stratum thickness.

-For hollowware made of aluminium and stainless steel, will be measured on all measuring points marked in Pic.2. The smallest and biggest measuring value is given.



Pic 2. Measuring points

**4.2 Standard capacity**

The standard capacity is measured with a graduated cylinder according to DIN 12 680 part 1. Fill the hollowware with water in temperature of (20±5) $^{o}$C to the top edge.

**4.3 Bottom of hollowware**

It's tested obey a rule, for example, according to DIN874 part 1, that whether the bottom of hollowware is free from burrs.

**4.3.1 Bending in cold condition**

Use the midpoint of the bottom as the centre of a circle, and diameter of 10mm. Bending of the hollowware bottom will be measured with a dial gauge in any place within the circle. Test is carried out when:

a). In condition of delivery.
b). After implementation of test according to article 4.3.3.

### 4.3.2 Bending in warm condition

Fill the hollowware with oil (e.g. silicone oil or edible oil) to a height of 30mm. Place the hollowware on the hot plate with respective diameter according to Table 3 in room temperature of (20±5) $^{o}$C and heat up.

**Table 3. Cooking place**

| Hot plate according to DIN44 910 Part 4 | |
|---|---|
| Standard Diameter<br>mm | Standard Power<br>W |
| 145 | 1000 |
| 180 | 1500 |
| 220 | 2000 |

The measuring device (for example, according to Pic3 and Pic4) stands on 3 equidistant quartz rods, which are fit to each other and designed as tripod legs. A wider quartz rod in the middle of the measuring device conduces to data transmission.

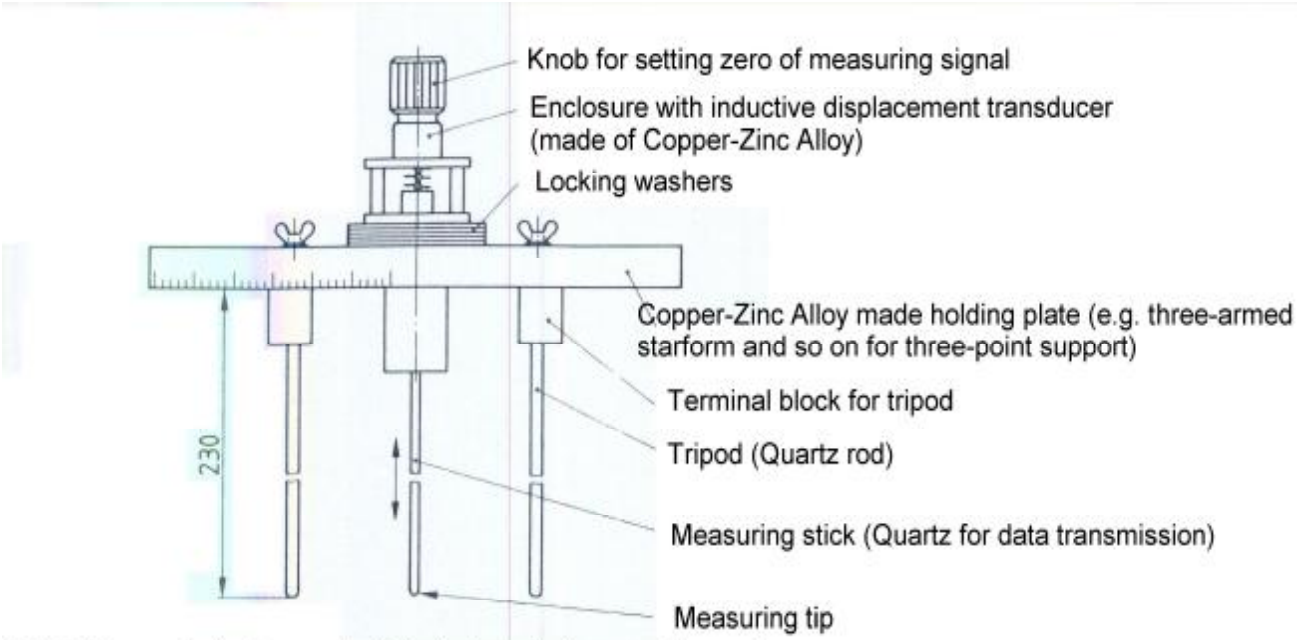
The measuring device (of producer's choice according to Pic3 or Pic4) should be placed in hollowware in this way, that the base of the 3 quartz rods put in a circle which diameter max.$d_1$, but not smaller than 5mm and under inner diameter of the bottom. The diameter, which is directly connected to the inside radius of curvature, is regarded as inner diameter of the bottom. Fluctuation of bottom will be measured with the measuring stick in the middle of the bottom and within a circle, centre of which is the midpoint of the bottom, and diameter of 10mm.

Bending measured in cold condition (20±5) $^{o}$C is adjusted to original value.

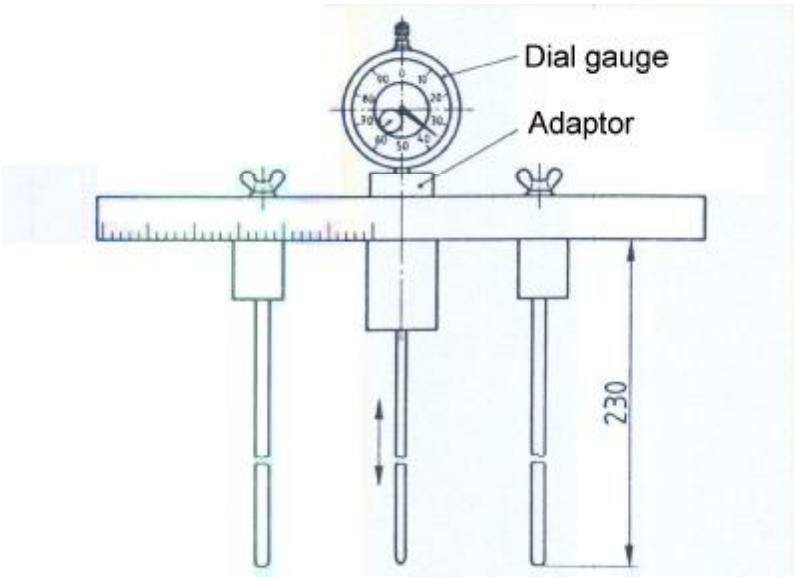
Heat up hollowware on the hot plate by standard power, till temperature of oil rose to (200±5) $^{o}$C. A thermocouple (wire dia. 0.3mm) will be fastened 5-10mm distance from measuring stick (not on itself) to measure the temperature of oil.

Bending of the bottom will be measured in this condition.

The inspection is taken up in condition of delivery and after implementation of test according to article 4.3.3.




Pic 3. Measuring instrument with inductive displacement transducer




(Other data, please see Pic 3)
Pic 4. Measuring instrument with dial gauge

**4.3.3 Bottom stable**

Heat up the empty hollowware on the hot plate with respective diameter according to Table 3 by standard power, till temperature rose to (200±5) $^{o}$C (measured in the hottest place). Then pour water in temperature of 15-20 $^{o}$C into the hollowware to quench it. The amount of water poured in model A and F is ca. 1/5 of the full capacity, while in model E is ca. 1/5 of the capacity measured to under edge of the cover.

Then take the hollowware away from the hot plate and pour into cold water in

temperature of (20±5) $^{o}$C to cool down it.

The test will be done for 50 times continuously. The hot plate in temperature of max.50 $^{o}$C. must be cooled down before each heating-up process.

It won't be evaluated if enameling peels off. Test for bending of bottom according to article 4.3.2 & 4.3.3 will be done again after this test.

**4.4 Edge of hollowware**

The hollowware will be cleaned in hot water with commercial detergent before testing. Fill the cooking pot (Model A) with cold water to 3/4 of its full capacity, and water kettle (Model E) to 3/4 of the capacity measured to under edge of the cover.

Then pour out the amount of water uniformly within the given pouring time according to Table 4 from hollowware.

It can be inspected by observing, that whether water drains to the outside of the hollowware.

**Table 4. Amount of water and pouring time**

| $d_1$ | Amount of water poured out<br>$cm^3$ | Pouring time<br>s |
|---|---|---|
| 145 | 200 | 4 to 5 |
| 180 | 500 | 6 to 7 |
| 220 | 1000 | 8 to 10 |

**4.5 Cover**

Fill the model A (cooking pot) with cold water to 2/3 of its full capacity, and put on the cover. Then heat it up on the proper hot plate with the highest regulating notch in standard power (pls see Table 3) in a windtight room in room temperature of (20 ± 5) $^{o}$ C till the water is boiling. At the beginning of ebullition, i.e. when plumes of steam appear, switch to next cooking notch [1]).

It will be confirmed during the following farther cooking operation for 20 minutes, whether the cover is splash-proof and no water drains to the outside of the hollowware.

**4.6 Fittings**

**4.6.1 Design**

It can be confirmed by observing, that whether the height of fittings (handle) of Model A is over that of pot's edge.

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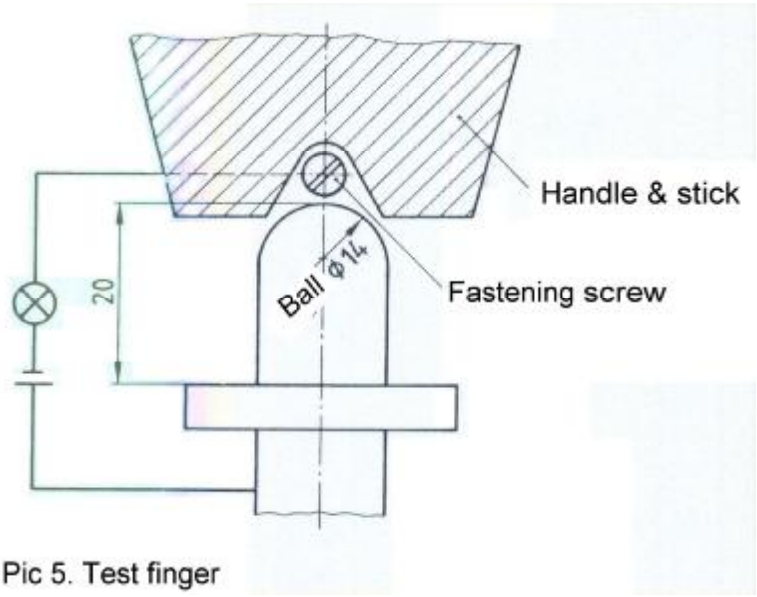
[1]). According to DIN 44 910 Part 4, regulating notch 2, for boil timing adjustment.

**4.6.2 Fixing**

After all tests required in the standard finished, it can be confirmed by observing, that whether the fittings is unscrewed/deformed or not.

**4.6.3 Protection against combustion**

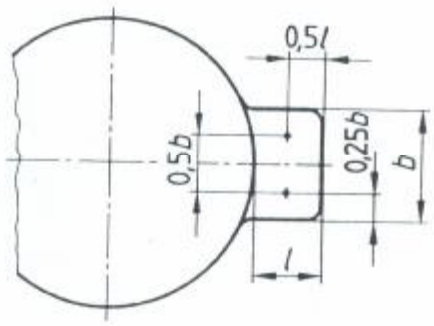
The test for fasteners of the insulated fittings, which give protection against combustion, will be carried out when the hollowware is in cold condition. The test-finger will be used as test equipment according to Pic5, which is combined with a test lamp and a pole for source of low-voltage current. Lay the other pole by the metal parts of the hollowware. It will be tested, whether the test-finger contacts the fasteners.



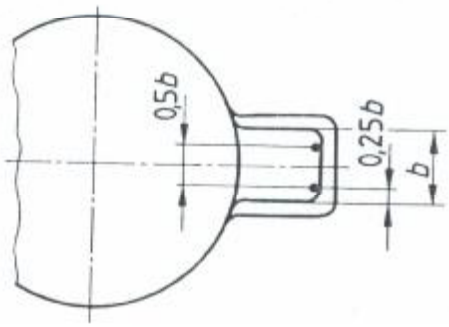

Pic 5. Test finger

**4.6.4 Temperature rise of the heat insulated fittings**

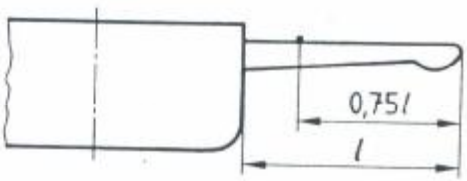
To measure the temperature of the insulated fittings, fill the hollowware with water to 2/3 of its full capacity. And heat it up on the related hot plate till boiling. Keep the working condition for 30 minutes. Temperature rise of the handle & stick will be measured on the measuring points according to Pic6, 7, 8, 9 and specified in Kelvin (K) with a limiting deviation of ± 3K. The measuring will be carried out on the top and under side of the full handle, and only on the under side of the embowed handle of water kettle. Measure the temperature rise with a temperature sensor or a thermocouple directly fixed to the test point.



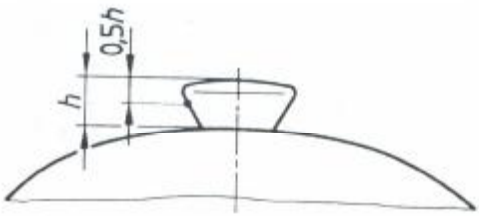

Pic 6. Full handle on cooking pot and cover




Pic 7. Embowed handle on cooking pot and cover




Pic 8. Handle on cooking pot and cover




Pic 9. Knob on top of cover

**4.6.5 Baking oven resistance of the heat insulated fittings**

The hollowware will be heated-up in an incubator with air swirl according to DIN 50 011 part 12, in a temperature of which is 20K higher than that of the specified fittings (the heat insulated fittings) and will be kept in this temperature for 2 hours. Then the

hollowware will be cooled on an insulated plate in a temperature of $(20 \pm 5)^{o}C$ after taking out from the incubator.

The test will be repeated for 5 times continuously.

It can be confirmed by observing (reference visual range 250mm) after the last test, whether there is blister or fissure.

**4.7 Enameling**

**4.7.1 Resistance to temperature change**

Test according to DIN ISO 2747.

**4.7.2 Resistance to shock**

Test according to DIN 51 155. The test point is the midpoint of the bottom, and the hollowware is taken in hand during testing.

**4.7.3 Acid resistance**

Test according to DIN ISO 2742. The testing duration is total 2.5 hours.

**4.8 User Manual**

Inspect that whether the specifications is available according to article 4.7.

**5 Inspection Report**

The following information is given in the inspection report based on the standard:

a). Description of the tested item

b). Quantity of the tested item

c). Deviation from the standard

d). Inspection date

**6. Mark**

The hollowware must be marked with the name/symbol of the producer/supplier, and the marks must be long - lasting & readable.

The producer/supplier has responsibility for marking on the hollowware to indicate that it measures up with the standard according to details in DIN 44 904, and the marks must be in conjunction with the name/symbol of the producer/supplier. And the method of marking, e.g. stamping, sticking and so on, will be decided by producer/supplier. Hollowware for electrical cookers according to the standard must be liable to the Hollowware Security Law (GSG), and must be marked with “GS” (certificated security) as confirmation, that it accords with the security requirements on the basis of a test done by the test centre, which is designated by Federal Minister for Labor and Social Affairs.