

## ISPITNO IZVJEŠĆE Br. 06/22

### TEST REPORT No.

Objekt mjerenja: Štednjak na kruto gorivo  
*Object o measurements: Residential cooker fired by solid fuel*

Oznaka tipa: SG  
*Type designation:*

Verzije: 50, 60  
*Versions:*

Naručitelj: Senko d.o.o.  
*Customer: Vladimira Nazora 22, Štefanec  
 40000 Čakovec*

Proizvođač: Senko d.o.o.  
*Manufacturer: Vladimira Nazora 22, Štefanec  
 40000 Čakovec*

Ispitano prema: HRN EN 16510-1:2018 u vezi s dijelom 2-3  
*Tested according to: (EN 16510-1:2018 in conjunction with Part 2-3)*

Rezultati ispitivanja odnose se na navedeni objekt ispitivanja, vrijeme ispitivanja i uvjete okoliša.  
*The test results refer to the measured object, date of measurements and ambient conditions.*

Dozvoljeno je umnožavanje Ispitnog izvješća u cijelosti. Za umnožavanje pojedinih dijelova potrebno je imati pisano odobrenje  
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SVEUČILNIŠTVO U ZAGREBU  
 FAKULTET STROJARSTVA I BRODOGRADNJE  
 Zagreb, Ivana Lučića 5

Datum izdavanja  
*Issue date*

11.04.2022.

Odgovorna osoba  
*Authorized person*

dr. sc. Ivan Horvat

Voditelj laboratorija  
*Head of the laboratory*

prof. dr. sc. Damir Dović

## 1. Summary

|                 |  |
|-----------------|--|
| Customer        | Senko d.o.o., Vladimira Nazora 22, Štefanec, 40000 Čakovec   |
| Subject of test | Residential cooker fired by solid fuel according to HRN EN 16510-1:2018 (EN 16510-1:2018) in conjunction with Part 2-3 |
| Appliance       | Residential cooker fired by solid fuel   |
| Type            | <b>SG-50, SG-60</b>  |
| Manufacturer    | Senko d.o.o., Vladimira Nazora 22, Štefanec, 40000 Čakovec   |
| Intended use    | Cooking, Baking and Space heating  |
| Fuel            | Wood briquettes  |

|   | Unit   | Value | Limit according to  |                     |          |                        |                |
|---|--|-------|---------------------|---------------------|----------|------------------------|----------------|
|   |  |       | HRN EN <sup>1</sup> | HRN EN <sup>2</sup> | DIN plus | 2. Stufe der 1.BlmSchV | 2015/1185 (EU) |
| Nominal output                            | kW   | 6,0   | -                   | -                   | -        | -                      | -              |
| Efficiency                                | %  | 79,3  | > 70-80             | > 60                | -        | > 75                   | -              |
| CO – at O <sub>2</sub> = 13%              | mg/Nm <sup>3</sup>   | 707,4 | 1.500               | 12.500              | -        | 1.500                  | 1.500          |
| OGC – at O <sub>2</sub> = 13%             | mg/Nm <sup>3</sup>   | 19,9  | 120                 | -                   | 120      | -                      | 120            |
| NO <sub>x</sub> – at O <sub>2</sub> = 13% | mg/Nm <sup>3</sup>   | 91,2  | 200                 | -                   | 200      | -                      | 200            |
| Dust – at O <sub>2</sub> = 13%            | mg/Nm <sup>3</sup>   | 35,9  | 40                  | -                   | -        | 40                     | 40             |
| Distance to combustible materials         | Minimum distances at mm:<br>- rear = 100<br>- sides = 100<br>- above = 1000<br>- front = 800 |       |                     |                     |          |                        |                |

<sup>1</sup> HRN EN 16510-1:2018 (EN 16510-1:2018)

<sup>2</sup> HRN EN 12815:2014/A1:2008/Ispr.2:2008 (EN 12815:2001/A1:2004/AC:2007)

|                                   | Unit | Value | Limit according to |
|-----------------------------------|------|-------|--------------------|
|                                   |      |       | 2015/1185 (EU)     |
| Seasonal space heating efficiency | %    | 69,3  | > 65               |

Voditelj laboratorija  
 Head of the laboratory

  
 prof. dr. sc. Damir Dović

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## 2. Product specifications

Residential cookers fired by solid fuel **SG-50/60** manufactured by Senko d.o.o. is residential cooker fired by wood briquettes with grate and ash pan. Cooker is made of stainless steel sheets and castings of quality gray cast iron. The interior is coated with chamotte. Cooker is intended for cooking, baking and space heating and is designed to be used in normal environment. At the rear side, there is a connection Ø80 mm for primary. Chimney connections Ø120 mm are located at the rear and sides.

Detailed description is provided in the instructions for installation and operation which forms integral part of the source materials.

| Type  | Main dimensions (mm) |       |       | Nominal heat output (kW) | Fuel consumption (kg/hour) | Flue gas connector diameter (mm) | Operating draught (Pa) |
|-------|----------------------|-------|-------|--------------------------|----------------------------|----------------------------------|------------------------|
|       | Height               | Width | Depth |                          |                            |                                  |                        |
| SG-50 | 850                  | 500   | 650   | 6,0                      | 1,66                       | 120                              | 13                     |

*Note:* Design of variants SG-50 and SG-60 differ only in terms of the outer cover plate.

## 3. Sample tested

The product sample indicated in the following table was used for inspection, testing and evaluation:

| Type  | Date                       | Sample Reg. No.           |
|-------|----------------------------|---------------------------|
| SG-50 | 16.03.2022.<br>24.03.2022. | prototype at the producer |

|                   |   |   |  |                                 |
|-------------------|---|---|--|---------------------------------|
| Place of testing: | at the FSB-LTTU Laboratory <input type="checkbox"/> | at the manufacturer <input checked="" type="checkbox"/> | at the customer <input type="checkbox"/> | other: <input type="checkbox"/> |
|-------------------|---|---|--|---------------------------------|

## 4. List of employed technical documentation

| Employed documentation:                        |
|--|
| 1. Instructions for installation and operation |

## 5. Detailed test results

### 5.1 Measuring and testing equipment

| No. | Name  | Manufacturer/Type   | Serial number | * Calibration certificate              |
|-----|---|---------------------|---------------|--|
| 1.  | Thermocouple*   | T/K type            |               | Calibration certificate C-4225 / 21-07 |
| 2.  | Multichannel test set up for temperature measurement* | Agilent/3491A       | MY44008250    | Calibration certificate C-4225 / 21-07 |
| 3.  | Industrial scale**                                    | Ohaus/CH30R11       | -             | 2013-219-01                            |
| 4.  | Combustion analyzer                                   | MRU/NOVA 2000       | 010277        | Calibration certificate No. E36/2020   |
| 5.  | Differential pressure sensor                          | Ahlborn FD A602-S2K | 08080490      | 2-0061/14-05                           |
| 6.  | Contact temperature sensor                            | Ahlborn ZA 9020-FS  | FPA32PH       | Calibration certificate C-4225 / 21-07 |
| 7.  | Stick meter   | -                   | -             | -                                      |

\* Calibration done according to DKD-R 5-1:2018

\*\* Calibration done according to the internal procedure

## 5.2 Thermal output, energy efficiency and emission of combustion products test

Testing method: HRN EN 16510-1:2018 in conjunction with Part 2-3

Sample tested: SG-50

Measuring equipment used: 1, 2, 3, 4, 5

### Test results – Nominal heat output

|                  |             |   |          |
|------------------|-------------|---|----------|
| Date of testing: | 16.03.2022. | $t_{ok} = 21,0 \text{ } ^\circ\text{C}$ | RH = 52% |
|------------------|-------------|---|----------|

| Variables measured and calculated:                   | Unit               | Tests  |        |        |        | Limit HRN EN <sup>1</sup> |
|--|--------------------|--------|--------|--------|--------|---------------------------|
|  |                    | 1      | 2      | 3      | Avg    |                           |
| Fuel consumption                                     | kg/hour            | 1,566  | 1,721  | 1,708  | 1,665  |                           |
| Achieved input                                       | kW                 | 7,1    | 7,9    | 7,8    | 7,6    |                           |
| Combustion air temperature                           | $^\circ\text{C}$   | 22,9   | 22,4   | 20,9   | 22,0   |                           |
| Chimney draught                                      | Pa                 | 10,0   | 13,0   | 10,0   | 11,0   |                           |
| Average combustion product temperature               | $^\circ\text{C}$   | 180,0  | 187,3  | 178,0  | 181,8  |                           |
| CO <sub>2</sub>                                      | %                  | 5,62   | 5,82   | 5,70   | 5,71   |                           |
| CO – measured  | %                  | 0,0496 | 0,0365 | 0,0464 | 0,0441 |                           |
| CO – at O <sub>2</sub> = 13%                         | %                  | 0,0645 | 0,0458 | 0,0595 | 0,0566 |                           |
| CO – at O <sub>2</sub> = 13%                         | mg/Nm <sup>3</sup> | 806,0  | 572,7  | 743,5  | 707,4  | 1.500                     |
| CO – at O <sub>2</sub> = 0%                          | mg/MJ              | 520,6  | 369,9  | 480,2  | 456,9  |                           |
| OGC – at O <sub>2</sub> = 13%                        | mg/Nm <sup>3</sup> | 29,5   | 16,8   | 13,3   | 19,9   | 120                       |
| OGC – at O <sub>2</sub> = 0%                         | mg/MJ              | 19,1   | 10,9   | 8,6    | 12,8   |                           |
| NO <sub>x</sub> – measured                           | ppm                | 33,8   | 35,9   | 34,7   | 34,8   |                           |
| NO <sub>x</sub> – at O <sub>2</sub> = 13%            | mg/Nm <sup>3</sup> | 90,0   | 92,3   | 91,4   | 91,2   | 200                       |
| NO <sub>x</sub> – at O <sub>2</sub> = 0%             | mg/MJ              | 58,1   | 59,6   | 59,0   | 58,9   |                           |
| Dust – at O <sub>2</sub> = 13%                       | mg/Nm <sup>3</sup> | 29,2   | 39,1   | 39,4   | 35,9   | 40                        |
| Dust – at O <sub>2</sub> = 0%                        | mg/MJ              | 18,9   | 25,3   | 25,4   | 23,2   |                           |
| Flue gas sensible heat loss                          | %                  | 20,0   | 20,3   | 19,7   | 20,0   |                           |
| Flue gas chemical heat loss                          | %                  | 0,6    | 0,4    | 0,5    | 0,5    |                           |
| Heat loss of combustible constituents in the residue | %                  | 0,2    | 0,2    | 0,2    | 0,2    |                           |
| Efficiency   | %                  | 79,2   | 79,0   | 79,6   | 79,3   | 70-80                     |
| Uncertainty (Efficiency)                             | %                  | 1,0    |        |        |        |                           |
| Total heat output                                    | kW                 | 5,7    | 6,2    | 6,2    | 6,0    |                           |
| Rated total heat output                              | kW                 | 6,0    |        |        |        |                           |

<sup>1</sup> HRN EN 16510-1:2018 (EN 16510-1:2018)

Note: The OGC and dust results are obtained from Laboratory Medimurje ZAING d.o.o., Emission measurement report of pollutants in the air from the prototype heating device, Report number: IV-01-049-22-0514-A

CO emissions → Compliance – The measurement result is below the specification limit when the measurement uncertainty is taken into account

OGC emissions → Compliance – The measurement result is below the specification limit when the measurement uncertainty is taken into account

NO<sub>x</sub> emissions → Compliance – The measurement result is below the specification limit when the measurement uncertainty is taken into account

Dust emissions → Compliance – The measurement result is below the specification limit when the measurement uncertainty is taken into account

Efficiency → Compliance – The measurement result is above the specification limit when the measurement uncertainty is taken into account

**Evaluation:**

**Measurement uncertainty:** Specified with the measurement results

“The above-specified extended measurement uncertainties are calculated as a factor of the measurement uncertainty and the extension coefficient,  $k=2$ , corresponding to the coverage certainty of 95% for standard classification. The standard uncertainty was determined in accordance with Document EA 4/02 M.”

| Variables measured and calculated: |                      | Value | Limit<br>2015/1185 (EU) |
|------------------------------------|----------------------|-------|-------------------------|
| Seasonal space heating efficiency  | %                    | 69,3  | 65                      |
| CO                                 | [mg/m <sup>3</sup> ] | 707,4 | 1.500                   |
| OGC                                | [mg/m <sup>3</sup> ] | 13,7  | 120                     |
| NO <sub>x</sub>                    | [mg/m <sup>3</sup> ] | 91,2  | 200                     |
| Dust                               | [mg/m <sup>3</sup> ] | 35,9  | 40                      |

Seasonal space heating efficiency → Compliance – The measurement result is above the specification limit when the measurement uncertainty is taken into account

CO emissions → Compliance – The measurement result is below the specification limit when the measurement uncertainty is taken into account

OGC emissions → Compliance – The measurement result is below the specification limit when the measurement uncertainty is taken into account

NO<sub>x</sub> emissions → Compliance – The measurement result is below the specification limit when the measurement uncertainty is taken into account

Dust emissions → Compliance – The measurement result is below the specification limit when the measurement uncertainty is taken into account

**Evaluation:**

### Fuel analysis

| Wood briquettes                 |         |             |       |
|---------------------------------|---------|-------------|-------|
| Analytical indicator            | Symbol  | Unit        | Value |
| Calorific value                 | $Q_i$   | MJ/kg       | 16,43 |
| All water in original condition | $W_t^r$ | % by weight | 7,8   |
| Ash                             | A       | % by weight | 0,2   |
| Carbon                          | C       | % by weight | 45,3  |
| Hydrogen                        | H       | % by weight | 5,3   |
| Nitrogen                        | N       | % by weight | 0,14  |
| Sulphur                         | S       | % by weight | 0,01  |

Note: The results are obtained from Laboratory HEP - Proizvodnja d.o.o., Centralni kemijsko-tehnološki laboratorij, LABORATORIJSKI IZVJEŠTAJ br. 135/22

### Residue analysis

| Residue              |        |             |       |
|----------------------|--------|-------------|-------|
| Analytical indicator | Symbol | Unit        | Value |
| Carbon               | C      | % by weight | 25    |

Note: The results are obtained from Laboratory HEP - Proizvodnja d.o.o., Centralni kemijsko-tehnološki laboratorij, LABORATORIJSKI IZVJEŠTAJ br. 136/22

Tested by: dr. sc. Ivan Horvat

Date: 16.03.2022.

Signed: 

Reviewed by: prof. dr. sc. Damir Dović

Date: 11.04.2022.

Signed: 

### 5.3 Temperature rise of the operating components

**Testing method:** HRN EN 16510-1:2018 in conjunction with Part 2-3  
**Sample tested:** SG-50  
**Measuring equipment used:** 1, 2, 3, 6

#### Test results – Nominal heat output

|                  |             |                         |           |
|------------------|-------------|-------------------------|-----------|
| Date of testing: | 24.03.2022. | $t_{ok} = 25\text{ °C}$ | RH = 55 % |
|------------------|-------------|-------------------------|-----------|

| Measured point    | Material | Temperature rise, K | Note   |
|-------------------|----------|---------------------|--------|
| Operating knob*   | metal    | 115                 | > 35 K |
| Front door handle | metal    | 15                  | ≤ 35 K |
| Draft controller* | metal    | 41                  | > 35 K |

*Note:* The highest value is indicated in the table.  
 \*The use of protecting gloves is prescribed.

**Test evaluation:** Compliance

**Measurement uncertainty:** 0,5 K

“The above-specified extended measurement uncertainties are calculated as a factor of the measurement uncertainty and the extension coefficient,  $k=2$ , corresponding to the coverage certainty of 95% for standard classification. The standard uncertainty was determined in accordance with Document EA 4/02 M.”

Tested by: dr. sc. Ivan Horvat

Date: 16.03.2022.

Signed: 

Reviewed by: prof. dr. sc. Damir Dović

Date: 11.04.2022.

Signed: 



#### 5.4 Temperature safety test

**Testing method:** HRN EN 16510-1:2018 in conjunction with Part 2-3  
**Sample tested:** SG-50  
**Measuring equipment used:** 1, 2, 3, 5

#### Test results – Nominal heat output

|                  |             |                         |          |
|------------------|-------------|-------------------------|----------|
| Date of testing: | 24.03.2022. | $t_{ok} = 25\text{ °C}$ | RH = 55% |
|------------------|-------------|-------------------------|----------|

| Test No. | Ambient temperature | Draught in the chimney | Maximum temperature rise of adjacent combustible materials |       |         | Fuel quantity | Note   |
|----------|---------------------|------------------------|--|-------|---------|---------------|--------|
|          |                     |                        | Test corner  | Floor | Ceiling |               |        |
| -        | °C                  | Pa                     | K  |       |         | kg/hour       |        |
| 1.       | 25                  | 16                     | 27   | 15    | 5       | 3,256         | ≤ 65 K |

*Note:* During the test parameters were set for achieving maximum heat output declared by the manufacturer.  
 The appliance shows no permanent deformation or damage after the temperature safety test.  
 The highest values are indicated in the table.

**Test evaluation:** Compliance – The measurement result is below the specification limit when the measurement uncertainty is taken into account

**Measurement uncertainty:** 0,2 K

“The above-specified extended measurement uncertainties are calculated as a factor of the measurement uncertainty and the extension coefficient,  $k=2$ , corresponding to the coverage certainty of 95% for standard classification. The standard uncertainty was determined in accordance with Document EA 4/02 M.”

Tested by: dr. sc. Ivan Horvat

Date: 24.03.2022.

Signed: \_\_\_\_\_

Reviewed by: prof. dr. sc. Damir Dović

Date: 11.04.2022.

Signed: \_\_\_\_\_



## 5.5 Hot plate boiling test

**Testing method:** HRN EN 16510-1:2018 in conjunction with Part 2-3  
**Sample tested:** SG-50  
**Measuring equipment used:** 1, 2, 3

### Test results – Nominal heat output

|                  |             |                         |           |
|------------------|-------------|-------------------------|-----------|
| Date of testing: | 24.03.2022. | $t_{ok} = 25\text{ °C}$ | RH = 55 % |
|------------------|-------------|-------------------------|-----------|

| Variables measured                                 | Unit | Test 1 | Test 2 | Avg  | Note     |
|--|------|--------|--------|------|----------|
| Mass of the water                                  | g    | 2040   | 2020   | 2030 |          |
| Water temperature at the start of the boiling test | °C   | 19,2   | 19,6   | 19,4 |          |
| Time when the temperature is increased by 75 K     | min  | 10     | 9,5    | 9,7  | <20      |
| Average oven temperature                           | °C   | 235    |        |      | 230 ± 30 |

**Test evaluation:** Compliance – The measurement result is below the specification limit when the measurement uncertainty is taken into account

**Measurement uncertainty:** 10 g / 0,2 K / 0,5 min

“The above-specified extended measurement uncertainties are calculated as a factor of the measurement uncertainty and the extension coefficient,  $k=2$ , corresponding to the coverage certainty of 95% for standard classification. The standard uncertainty was determined in accordance with Document EA 4/02 M.”

Tested by: dr. sc. Ivan Horvat

Date: 24.03.2022.

Signed: 

Reviewed by: prof. dr. sc. Damir Dović

Date: 11.04.2022.

Signed: 

## 5.6 Oven heating test

**Testing method:** HRN EN 16510-1:2018 in conjunction with Part 2-3  
**Sample tested:** SG-50  
**Measuring equipment used:** 1, 2

### Test results

|                  |             |                               |          |
|------------------|-------------|-------------------------------|----------|
| Date of testing: | 24.03.2022. | $t_{ok} = 25^{\circ}\text{C}$ | RH = 55% |
|------------------|-------------|-------------------------------|----------|

| Variables measured        | Unit  | Test                   |
|---------------------------|-------|------------------------|
| Achieved oven temperature | 228°C | Browning chart index 2 |



**Test evaluation:** Compliance

**Measurement uncertainty:** 0,2 K

“The above-specified extended measurement uncertainties are calculated as a factor of the measurement uncertainty and the extension coefficient,  $k=2$ , corresponding to the coverage certainty of 95% for standard classification. The standard uncertainty was determined in accordance with Document EA 4/02 M.”

Tested by: dr. sc. Ivan Horvat

Date: 16.03.2022.

Signed: 

Reviewed by: prof. dr. sc. Damir Dović

Date: 11.04.2022.

Signed: 

## 5.7 Oven shelf test

**Testing method:** HRN EN 16510-1:2018 in conjunction with Part 2-3  
**Sample tested:** SG-50  
**Measuring equipment used:** 3, 7

### Test results

|                  |             |                                       |           |
|------------------|-------------|---------------------------------------|-----------|
| Date of testing: | 24.03.2022. | $t_{ok} = 25\text{ }^{\circ}\text{C}$ | RH = 55 % |
|------------------|-------------|---------------------------------------|-----------|

| Oven shelf | Total added mass | Shelf sagging from horizontal | Note              |
|------------|------------------|-------------------------------|-------------------|
| -          | kg               | °                             |                   |
| 1          | 9                | 8                             | $\leq 10^{\circ}$ |

**Test evaluation:** Compliance – The measurement result is below the specification limit when the measurement uncertainty is taken into account

**Measurement uncertainty:**  $1^{\circ}$

“The above-specified extended measurement uncertainties are calculated as a factor of the measurement uncertainty and the extension coefficient,  $k=2$ , corresponding to the coverage certainty of 95% for standard classification. The standard uncertainty was determined in accordance with Document EA 4/02 M.”

Tested by: dr. sc. Ivan Horvat

Date: 24.03.2022.

Signed: 

Reviewed by: prof. dr. sc. Damir Dović

Date: 11.04.2022.

Signed: 

### List of referenced documents

- HRN EN 16510-1:2018 (EN 16510-1:2018)
- Emission measurement report of pollutants in the air from the prototype heating device, Report number: IV-01-049-22-0514-A, Međimurje ZAING d.o.o.
- LABORATORIJSKI IZVJEŠTAJ br. 135/22, Centralni kemijsko-tehnološku laboratorij, HEP Proizvodnja
- LABORATORIJSKI IZVJEŠTAJ br. 136/22, Centralni kemijsko-tehnološku laboratorij, HEP Proizvodnja

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**End of test report**