



S I E Ć B A D A W C Z A Ł U K A S I E W I C Z  
**INSTYTUT TECHNOLOGII DREWNA**

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AB 088



**TESTING LABORATORY OF WOOD, WOOD-BASED MATERIALS, PACKAGING,  
FURNITURE, CONSTRUCTIONS AND WOODWORKING MACHINES**

SOLID BIOFUELS SECTION

Poznań, 08.05.2019

## TEST REPORT No.1101/2019/S.M

**Subject of the order** Quality testing of wood pellets

**Order No** A-1101-BBI/2019

**Name and address of the Customer** Control Union Poland Sp. z o.o.  
Al. Wojska Polskiego 45  
65-764 Zielona Góra

**Name and address of the Producer** Graf Sp. z o.o.  
ul. Połaniecka 19  
22-100 Chełm

**ENplus® ID number** 6mm-GRAF-1

**Performance date** 17.04 – 08.05.2019

**Operators**

| First name and surname    | Signature |
|---------------------------|-----------|
| dr inż. Magdalena Witczak |           |
| mgr Jacek Pawłowski       |           |
| mgr Monika Kubińska       |           |
| Dariusz Radoński          |           |

Laboratory stamp

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mgr inż. Małgorzata Walkowiak  
Kierownik Sekcji M

## 1. IDENTIFICATION (DESCRIPTION OF TEST SAMPLE)

The object of the assessment was the sample of solid biofuels in the form of pellets with diameter of 6 mm, produced from chemically untreated by-products and residues from the wood processing industry, described by the Customer as 6mm-GRAF-1.

Identification number: A-1101-BBI/2019

## 2. DELIVERY DATE OF TESTED SUBJECTS

The sample was taken by the Customer and delivered to Wood Technology Institute on 17.04.2019.

## 3. TEST METHODS

- EN ISO 14780:2017-07 Solid Biofuels – Sample preparation (16M Method)
- EN ISO 18134-2:2015-11 Solid biofuels – Determination of moisture content - Oven dry method - Part 2: Total moisture - Simplified method (1M Method)
- EN ISO 18134-3:2015-11 Solid biofuels – Determination of moisture content - Oven dry method - Part 3: Moisture in general analysis sample (1M Method)
- EN ISO 18122:2016-01 Solid biofuels – Determination of ash content (2M Method)
- EN ISO 17828:2016-02 Solid biofuels – Determination of bulk density (4M Method)
- EN ISO 18125:2017-07 Solid biofuels – Determination of calorific value (6M Method)
- EN ISO 16948:2015-07 Solid biofuels – Determination of total content of carbon, hydrogen and nitrogen (7M Method)
- EN ISO 16994:2015-06 Solid biofuels – Determination of total content of sulfur and chlorine (8M Method)
- EN ISO 18846:2016 Solid biofuels – Determination of fines content in quantities of pellets (9M Method)
- EN ISO 17831-1:2016-02 Solid biofuels – Determination of mechanical durability of pellets and briquettes – Part 1: Pellets (10M Method)
- EN ISO 17829:2016-02 Solid biofuels – Determination of length and diameter of pellets (11M Method)
- EN ISO 16968:2015-07 Solid biofuels – Determination of minor elements (13M Method)
- CEN/TS 15370-1:2006 Solid biofuels – Determination of ash melting behaviour – Part 1: Characteristic temperatures method (14M Method)

## 4. EQUIPMENT OF THE TEST STANDS (elementary)

| No. | Name                                                                             | Type          | Producer                    | Lab.No. |
|-----|----------------------------------------------------------------------------------|---------------|-----------------------------|---------|
| 1.  | Analitical balance                                                               | LE26P-0CE     | SARTORIUS                   | M7/2    |
| 2.  | Analitical balance                                                               | CPA225D-0CE   | SARTORIUS                   | M8/57   |
| 3.  | Laboratory drier                                                                 | Redline RF115 | BINDER                      | M1/47   |
| 4.  | Calorimeter                                                                      | C6000         | IKA POL                     | M6/83   |
| 5.  | Elemental analyzer                                                               | Flash EA 1112 | THERMO ELECTRON CORPORATION | M7/8    |
| 6.  | Furnace                                                                          | FCF 7SM/pl    | CZYLOK                      | M2/4    |
| 7.  | Ionic chromatograph                                                              | ICS-1100      | THERMO SCIENTIFIC           | M8/54   |
| 8.  | Laboratory balance                                                               | PS 6000/C/2   | RADWAG                      | M9/46   |
| 9.  | Pellets durability tester                                                        | TUMBLER 3000  | BIONERGY ANLAGENPLANUNG     | M10/42  |
| 10. | Sieve 3,15mm                                                                     | -             | RETSCH                      | M9/34   |
| 11. | Caliper                                                                          | SD-10         | BAKER                       | M3/14   |
| 12. | Microwave oven                                                                   | MARS 6        | CEM CORPORATION             | M13/80  |
| 13. | Atomic Absorption Spectrometer                                                   | 280FS AA      | AGILENT TECHNOLOGIES        | M13/66  |
| 14. | Atomic Absorption Spectrometer                                                   | 280Ze AA      | AGILENT TECHNOLOGIES        | M13/67  |
| 15. | System for determination of characteristic temperatures of ash melting behaviour | PR-37/1600    | Radio Research Institute    | M14/88  |
| 16. | Sieve 0.075 mm                                                                   | -             | ATEST                       | M14/91  |

## 5. TESTS RESULTS

Tests results are presented in record No. 1/1101/2019.

## 6. DECLARATION

The test results refer only to the sample and do not necessarily mean that similar products or seemingly identical they have the same properties.

The Test Report cannot be copied in parts, only in its entirety.

# Record No. 1/1101/2019

**Sample name:** Wood pellets  
**Name of Producer:** Graf Sp. z o.o.  
 ul. Połaniecka 19, 22-100 Chełm  
**ENplus® ID:** 6mm-GRAF-1

| Origin:                                         |                                 | 1. Woody biomass                                                                      |                                 |                                                              |        |        |
|-------------------------------------------------|---------------------------------|---------------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------------|--------|--------|
| Traded form:                                    |                                 | Wood pellets                                                                          |                                 |                                                              |        |        |
| Classification according to EN ISO 17225-1:2014 |                                 | 1.2.1 Chemically untreated by-products and residues from the wood processing industry |                                 |                                                              |        |        |
| Parameter                                       | Unit                            | Value                                                                                 | Uncertainty<br>[±] <sup>1</sup> | Threshold value acc. to ENplus® Handbook, Part 3 version 3.0 |        |        |
|                                                 |                                 |                                                                                       |                                 | A1                                                           | A2     | B      |
| Diameter                                        | mm                              | 6,1                                                                                   | 0,1                             | 6 ± 1 or 8 ± 1                                               |        |        |
| Length                                          | mm                              | 20,2                                                                                  | 8,0                             | 3,15 < L ≤ 40                                                |        |        |
| Moisture                                        | w-% <sub>ar</sub>               | 5,35                                                                                  | 0,19                            | ≤ 10                                                         |        |        |
| Ash                                             | w-% <sub>d</sub>                | 0,53                                                                                  | 0,05                            | ≤ 0,7                                                        | ≤ 1,2  | ≤ 2,0  |
| Mechanical durability                           | w-% <sub>ar</sub>               | 99,0                                                                                  | 0,1                             | ≥ 98,0                                                       | ≥ 97,5 |        |
| Fines (<3.15 mm)                                | w-% <sub>ar</sub>               | 0,16                                                                                  | 0,02                            | ≤ 1,0 (< 0,5%) <sup>4</sup>                                  |        |        |
| Gross calorific value                           | MJ/kg <sub>d</sub>              | 20,55                                                                                 | 0,02                            | -                                                            |        |        |
| Net calorific value                             | MJ/kg <sub>ar</sub>             | 18,00                                                                                 | 0,05                            | ≥ 16,5                                                       |        |        |
|                                                 | kWh/kg <sub>ar</sub>            | 5,00                                                                                  | 0,01                            | ≥ 4,6                                                        |        |        |
| Bulk density                                    | kg/m <sup>3</sup> <sub>ar</sub> | 687                                                                                   | 9                               | 600 ≤ BD ≤ 750                                               |        |        |
| Carbon                                          | w-% <sub>d</sub>                | 51,06                                                                                 | 0,69                            | -                                                            |        |        |
| Hydrogen                                        | w-% <sub>d</sub>                | 6,41                                                                                  | 0,02                            | -                                                            |        |        |
| Nitrogen                                        | w-% <sub>d</sub>                | 0,082                                                                                 | 0,004                           | ≤ 0,3                                                        | ≤ 0,5  | ≤ 1,0  |
| Sulfur                                          | % <sub>d</sub>                  | 0,010                                                                                 | 0,001                           | ≤ 0,04                                                       | ≤ 0,05 |        |
| Chlorine                                        | % <sub>d</sub>                  | 0,012                                                                                 | 0,002                           | ≤ 0,02                                                       |        | ≤ 0,03 |

**Sample name:** Wood pellets  
**Name of Producer:** Graf Sp. z o.o.  
 ul. Połaniecka 19, 22-100 Chelm  
**ENplus® ID:** 6mm-GRAF-1

| Origin:                                         |                    | 1. Woody biomass                                                                      |                                 |                                                              |        |   |
|-------------------------------------------------|--------------------|---------------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------------|--------|---|
| Traded form:                                    |                    | Wood pellets                                                                          |                                 |                                                              |        |   |
| Classification according to EN ISO 17225-1:2014 |                    | 1.2.1 Chemically untreated by-products and residues from the wood processing industry |                                 |                                                              |        |   |
| Parameter                                       | Unit               | Value                                                                                 | Uncertainty<br>[±] <sup>1</sup> | Threshold value acc. to ENplus® Handbook, Part 3 version 3.0 |        |   |
|                                                 |                    |                                                                                       |                                 | A1                                                           | A2     | B |
| Ash shrinkage temperature SST <sup>2, 3</sup>   | °C                 | 1200                                                                                  | 24                              | Should be stated                                             |        |   |
| Ash deformation temperature DT <sup>2, 3</sup>  | °C                 | 1250                                                                                  | 51                              | ≥ 1200                                                       | ≥ 1100 |   |
| Ash hemisphere temperature HT <sup>2, 3</sup>   | °C                 | 1260                                                                                  | 20                              | Should be stated                                             |        |   |
| Ash flow temperature FT <sup>2, 3</sup>         | °C                 | 1272                                                                                  | 12                              | Should be stated                                             |        |   |
| Arsenic                                         | mg/kg <sub>d</sub> | < 0,1                                                                                 | -                               | ≤ 1                                                          |        |   |
| Cadmium                                         | mg/kg <sub>d</sub> | 0,09                                                                                  | 0,01                            | ≤ 0,5                                                        |        |   |
| Chromium                                        | mg/kg <sub>d</sub> | < 0,5                                                                                 | -                               | ≤ 10                                                         |        |   |
| Copper                                          | mg/kg <sub>d</sub> | 1,46                                                                                  | 0,07                            | ≤ 10                                                         |        |   |
| Lead                                            | mg/kg <sub>d</sub> | 1,81                                                                                  | 0,16                            | ≤ 10                                                         |        |   |
| Mercury                                         | mg/kg <sub>d</sub> | < 0,05                                                                                | -                               | ≤ 0,1                                                        |        |   |
| Nickel                                          | mg/kg <sub>d</sub> | < 0,5                                                                                 | -                               | ≤ 10                                                         |        |   |
| Zinc                                            | mg/kg <sub>d</sub> | 7,80                                                                                  | 0,41                            | ≤ 100                                                        |        |   |

<sub>d</sub> dry <sub>ar</sub> as received

1. the expanded uncertainty was determined for coverage factor  $k = 2$  and 95% confidence level
2. characteristic ash melting temperature determined in an oxidizing atmosphere
3. ash received at 815°C
4. at the end of production or when loading truck for deliveries to end-users (< 0,5% at the end of production, when filling pellet bags or big bags)



End of report