



# **TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR**

**Refurbishment of the Combined Heat and Power Plant  
in Mladá Boleslav**

**Business Package OB 2**

**BOILER HOUSES**

**VOLUME III**

***TECHNICAL REQUIREMENTS***

**Annex A6 Guarantee Values**

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## 1 TERMS AND CONDITIONS FOR OPERATION

The Location: The Combined Heat and Power Plant in Mladá Boleslav – ŠKO-ENERGO, s.r.o.

The altitude of the construction site is approximately 210 m.a.s.l.

The Climate data (The Meteor station in Semčice):

Average annual temperature:	9.4 °C
Average maximum temperature in the month – the warmest month	25 °C
Average air temperature in the coldest month	-1.9 °C
Lowest daily temperature	-6.0 °C
Average annual relative humidity	70percent
Dispersion of air relative humidity	35 – 90percent
Annual rainfall average	560 -620 mm
The number of ice days	24 (max. 62)
The number of arctic days	1 (max.5)
The number of tropical days	11 (max.34)
Number of days with snow cover	44 (max.94)
The extremes	
The highest measured air temperature – the extreme	38.1 °C
The highest daily average temperature – the extreme	30.9 °C
The lowest measured air temperature – the extreme	-24.6 °C
The lowest average daily temperature – the extreme	-20.5 °C

The values have been obtained from 30-year average.

Within these climatic conditions, the OB 2 CONTRACTOR designs safe, reliable, and economical operation in accordance with the applied standards.

## 2 TERMS OF REFERENCE

### 2.1 Terms of reference for GUARANTEE MEASUREMENT

The parameters always refer to the connection point.

Ambient air temperature	20 °C
Air pressure	98.8 kPa (abs)
Air relative humidity	60percent
Fuel temperature	20 °C
Cooling water temperature	22 °C
Feed water reference temperature	205°C
Feed water reference pressure	15 MPa(g)
Reference fuel	see Fuel tables (reference state values)

Note:

When pressure values are given, (g) is understood as overpressure.

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## 2.2 General conditions

The measurement of the guarantee values is based on the following general terms and conditions:

- the guarantee parameters are set in accordance with the terms specified in this document,
- the standards applied in the guarantee measurement are listed in the table below,
- the unit will be operated and maintained in accordance with the OB 2 CONTRACTOR's instructions. The CLIENT undertakes to provide to OB 2 CONTRACTOR operation and maintenance records,
- the CLIENT shall provide remote access for sharing of operating data during the entire guarantee period. The data shall be shared through the Energis platform (operated by Instar), unless agreed otherwise between the OB 2 CONTRACTOR and the CLIENT,
- the CLIENT shall provide to the CONTRACTOR in the course of the guarantee period information about qualitative and quantitative parameters of fuels and additives,
- the OB 2 CONTRACTOR will be allowed to perform during all schedule and non-scheduled shut-offs maintenance activities, particularly those relating to the securing of guaranteed availability,
- equipment and systems that do not fall within the scope of the OB 2 CONTRACTOR shall not restrict proper operation of the supplied equipment; the guarantee measurement may only be carried out in full coordination with the other contractors and the operation of the heat plant,
- only original or recommended parts may be used in cases defined by the OB 2 CONTRACTOR, some selected parts that are subject to wear must be available in the heat plant warehouse, such parts are to be supplied by the OB 2 CONTRACTOR within his scope for a period of two years beginning with the PAC.
- in the case that some facts are not sufficiently described by this document, it is possible to specify them within the documentation for the GUARANTEE MEASUREMENT PROJECT.

### 2.2.1 Noise

Legal requirements of Act No. 258/2000 Coll. on the protection of public health and on the amendment to some related laws and of Act No. 272/2011 Coll. on the protection of health from adverse effects of noise and vibrations, as amended, must be met.

### 2.2.2 Feed water

#### 2.2.2.1 Parameters of feed water at the connection point

Operating range of feed water temperature when operating with a high-pressure heater	190 -210°C
Temperature of feed water when operating without a high-pressure heater	160°C
Pressure of feed water within	14 -18 MPa(g)

#### 2.2.2.2 Quality of feed water

##### Standardized values according to ČSN 07 0403

The chemism of steam production, alkalization of demineralized (feed) water and a treatment of boiler water is governed by the standard ČSN 07 7403 from the year 1982 which is still valid and by the Local Operating Regulations for Chemical Regimes for the Treatment of All Water at the E1A No. PPT300/007.7.

Feed water must not contain any oil, mud or foam.

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The quality of feed water is defined by Czech State Standards (ČSN) also with limits applicable to the

Feed water - parameter	CC $\lambda_{25^{\circ}\text{C}}$	pH	O <sub>2</sub>	SiO <sub>2</sub>	Fe	Cu	$\Sigma$ Ca/Mg
Units	[ $\mu\text{S/cm}$ ]	[-]	[ $\mu\text{g/l}$ ]	[ $\mu\text{g/l}$ ]	[ $\mu\text{g/l}$ ]	[ $\mu\text{g/l}$ ]	[ $\mu\text{mol/l}$ ]
ČSN 07 7403	< 0.3	8.7 – 9.2	3 < 10	< 20	< 20	< 5	< 1.5

given limit states.

At the present time the Cu,  $\Sigma$  Ca/Mg values are not monitored regularly.

#### Measured values – operating averages

The measured averages from the years 2020 to 2021 are given below.

	pH	direct conductivity	silicates	ionic iron	ammonia	oxygen	CC A <sub>25°C</sub>
		$\mu\text{S/cm}$	$\mu\text{g/l}$	$\mu\text{g/l}$	$\text{mg/l}$	$\mu\text{g/l}$	$\mu\text{S/cm}$
Average value	9.34	6.14	8.56	9.72	0.8	3.4	0.089

The quality of feed water is guaranteed by the CLIENT, according to ČSN 07 74 03.

### 2.2.3 Fuel 1 – Wood chips

#### Fuel 1 – Wood chips

According to Decree No. 110/2022 Coll., as a fuel there are wood chips coming from fresh or stored broadleaf and coniferous wood in any ratio characterized as:

- As a residual material from logging, so-called the small wood, i.e. the wood up to 7 cm in diameter and residual products from its processing, including roots (tree stumps), a biomass created in the forest from thinning and pruning, wood material from maintenance of public and private greeneries, including tracks, watercourses, electricity distributions, etc., and residual products of its processing, including their modifications for transport to final consumers.
- As used wood, used products made from wood and wood materials, wooden packaging including by-products and residual products of their processing and including their treatment for transport to biomass final consumer, the wood will not contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or paint materials.
- as residual wood material resulting from the production of cellulose, including bark, including by-products from its processing, and including its modifications for transport to the final biomass consumer,
- as wood offcuts intended for material use, including by-products and residual products of their processing, and including their modifications for transport to the biomass final consumer,
- as wood chips produced during sawmilling of barked and debarked wood.

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### 2.2.3.1 Wood chip parameters

parametr		unit	value		
			min.	ref.	max.
Water content	$W^{(ar)}$	%wg.	25	<b>40</b>	55
Ash content	$A^{(ar)}$	%wg.	0.3	<b>4</b>	11
Lower heating value	$Q^{(ar)}$	MJ/kg	7.8	<b>10</b>	12
Bulk density	$\rho^{(ar)}$	kg/m <sup>3</sup>	200	<b>250</b>	380
Sulphur content	$S^{(ar)}$	%wg.	0.01	<b>0.05</b>	0.1
Chlorine content	$Cl^{(ar)}$	%wg.	0.01	<b>0.015</b>	0.02
Fluorine content	$F^{(ar)}$	%wg.	0.003	<b>0.002</b>	0.01
Nitrogen content	$N^{(ar)}$	%wg.	0.1	<b>0.3</b>	0.6
Carbon content	$C^{(ar)}$	%wg.	23	<b>30</b>	36
Hydrogen content	$H^{(ar)}$	%wg.	3	<b>3.7</b>	5

### 2.2.3.2 Trace elements in wood chips

The content of trace elements in wood chips will depend on the nature of a supply and a source of the wood material. The table below shows the values of the long-term supply of wood chips into the heating plant.

Element	Unit	Wood chips		
		min.	ref.	max.
<b>As</b>	mg/kg <sup>(d)</sup>	<0.5	<0.5	0.7
<b>Al</b>	mg/kg <sup>(d)</sup>	250	540	2 250
<b>C</b>	% <sup>(d)</sup>	47	49	51
<b>Ca</b>	mg/kg <sup>(d)</sup>	2 000	2 300	4 200
<b>Cd</b>	mg/kg <sup>(d)</sup>	<0.4	<0.4	<0.4
<b>Cl</b>	% <sup>(d)</sup>	0.01	0.02	0.03
<b>Co</b>	mg/kg <sup>(d)</sup>	1.2	16	55
<b>Cr</b>	mg/kg <sup>(d)</sup>	4	12	74
<b>Cu</b>	mg/kg <sup>(d)</sup>	2.5	6.7	15
<b>F</b>	% <sup>(d)</sup>	0.002	0.005	0.01
<b>Fe</b>	mg/kg <sup>(d)</sup>	320	900	2 400
<b>H</b>	% <sup>(d)</sup>	5.6	5.9	6.3
<b>Hg</b>	mg/kg <sup>(d)</sup>	<0.02	0.03	0.05
<b>K</b>	mg/kg <sup>(d)</sup>	670	1 300	2 900
<b>Mg</b>	mg/kg <sup>(d)</sup>	280	600	1 350
<b>Mn</b>	mg/kg <sup>(d)</sup>	120	380	640
<b>N</b>	% <sup>(d)</sup>	0.1	0.27	0.7
<b>Na</b>	mg/kg <sup>(d)</sup>	17	30	60
<b>Ni</b>	mg/kg <sup>(d)</sup>	2.5	8	36
<b>P</b>	mg/kg <sup>(d)</sup>	150	250	950
<b>Pb</b>	mg/kg <sup>(d)</sup>	2.2	3.4	4.8
<b>S</b>	% <sup>(d)</sup>	0.005	0.01	0.1

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<b>Sb</b>	mg/kg <sup>(d)</sup>	<0.5	<0.5	<0.5
<b>Si</b>	mg/kg <sup>(d)</sup>	290	350	450
<b>Ti</b>	mg/kg <sup>(d)</sup>	9	13.5	23
<b>Tl</b>	mg/kg <sup>(d)</sup>	<0.5	<0.5	<0.5
<b>V</b>	mg/kg <sup>(d)</sup>	0.2	1.6	3.5
<b>Zn</b>	mg/kg <sup>(d)</sup>	20	43	80

### 2.2.3.3 Guaranteed granulometry of incoming wood chips to the UNIT OB2

Chips particles meet the following size limits and their relative fractions:

Parameter	Unit	Value
Particles smaller than 63 mm or equal to 63 mm in one direction	%	90
The largest particle can have dimensions of no more than 100x40x35 mm (height/ width/ depth)	%	10
Particles smaller than 3.15 mm in one direction	%	10
Particles smaller than 5.6 mm in one direction	%	30
Content of soil, clay, sand, etc. (max. 30 pieces of stones (e.g. gravel) the size of a cube with an edge of max. 5 cm	%	2
The maximum share of metal objects is 0.3% at the input of technologies within the scope of OB 2.		

The quantity of non-combustible particles in the fuel (with an average size of more than 2.0 mm), including ash fuel, stone, gravel, earth, supplementary sand and other non-combustible particlars shall be determined from the weight balance and the quantity of coarse material in the removed bed ashes.

### 2.2.3.1 Sampling and analysis of wood chips

The CLIENT undertakes to share in the course of the basic guarantee period information about the composition of fuel. Sampling and all other subsequent processing and analyses shall take place in accordance with applicable Czech standards listed below. The analyses shall be made by an accredited laboratory, which will be provided with a mixed sample consisting of at least 4 samples per month, with the exception of the period of scheduled and unscheduled shut-offs, when one representative sample corresponding to the fuel that has caused the failure will be required. In case of a failure of the equipment, it is possible to carry out extraordinary offtake and analysis of the fuel that has caused the failure. The required parameters and frequency of analyses are shown in the table below.

analysed variables	unit	frequency
humidity	%hm. <sup>(d)</sup>	once a month
combustion heat, calorific value	MJ/kg <sup>(d)</sup>	once a month
ash content	%hm. <sup>(d)</sup>	once a month
S	%hm. <sup>(d)</sup>	once a month
Cl	%hm. <sup>(d)</sup>	once a month
Na	mg/kg <sup>(d)</sup>	once a month
K	mg/kg <sup>(d)</sup>	once a month
C, H, N	%hm. <sup>(d)</sup>	once a month
Hg	mg/kg <sup>(d)</sup>	once a month
Pb, Zn, Sn	mg/kg <sup>(d)</sup>	once a month

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## 2.2.4 Fuel 2 – Plant pellets

The second fuel type is the pelletized plant biomass made from agricultural scraps. This fuel type is burned solely in K80 and K90 boilers. Parameters of this fuel are specified below.

parametr		unit	value		
			min.	ref.	max.
Water content	$W^{(ar)}$	%wg.	8.5	<b>12</b>	16
Ash content	$A^{(ar)}$	%	3	<b>6</b>	10
Lower heating value	$Q^{(ar)}$	MJ/kg	12	<b>15.5</b>	17.5
Bulk density	$\rho^{(ar)}$	kg/m <sup>3</sup>	300	<b>450</b>	700
Sulphur content	$S^{(ar)}$	%wg.	0.15	<b>0.2</b>	0.25
Chlorine content	$Cl^{(ar)}$	%wg.	0.07	<b>0.1</b>	0.15
Fluorine content	$F^{(ar)}$	%wg.	0.002	<b>0.005</b>	0.01
Nitrogen content	$N^{(ar)}$	%wg.	1.4	<b>1.7</b>	2.2
Carbon content	$C^{(ar)}$	%wg.	39	<b>43</b>	48
Hydrogen content	$H^{(ar)}$	%wg.	5	<b>5.5</b>	6

### 2.2.4.1 Trace elements in plant pellets

The content of trace elements in wood chips will depend on the nature of the supply and on the source of the material. The table below shows the values of the long-term supply of plant pellets into the heating plant.

Element	Unit	Plant pellets		
		min.	ref.	max.
<b>As</b>	mg/kg <sup>d</sup>	<0.5	<0.5	0.7
<b>Al</b>	mg/kg <sup>(d)</sup>	280	360	510
<b>C</b>	% <sup>(d)</sup>	44	47	50
<b>Ca</b>	mg/kg <sup>(d)</sup>	5 500	6 500	7 900
<b>Cd</b>	mg/kg <sup>(d)</sup>	<0.4	<0.4	<0.4
<b>Cl</b>	% <sup>(d)</sup>	0.08	0.13	0.15
<b>Co</b>	mg/kg <sup>(d)</sup>	0.7	3.4	10
<b>Cr</b>	mg/kg <sup>(d)</sup>	10	22	29
<b>Cu</b>	mg/kg <sup>(d)</sup>	7	11	15
<b>F</b>	% <sup>(d)</sup>	0.002	0.007	0.015
<b>Fe</b>	mg/kg <sup>(d)</sup>	400	600	810
<b>H</b>	% <sup>(d)</sup>	5.6	6	6.6
<b>Hg</b>	mg/kg <sup>(d)</sup>	<0.02	0.03	0.05
<b>K</b>	mg/kg <sup>(d)</sup>	7 400	9 200	11 000
<b>Mg</b>	mg/kg <sup>(d)</sup>	1 500	1 700	1 900
<b>Mn</b>	mg/kg <sup>(d)</sup>	75	95	120
<b>N</b>	% <sup>(d)</sup>	1.6	2	2.6
<b>Na</b>	mg/kg <sup>(d)</sup>	85	145	260
<b>Ni</b>	mg/kg <sup>(d)</sup>	2	8	16
<b>P</b>	mg/kg <sup>(d)</sup>	1 700	2 360	3 100
<b>Pb</b>	mg/kg <sup>(d)</sup>	1	3.3	5

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<b>S</b>	% <sup>(d)</sup>	0.2	0.23	0.3
<b>Sb</b>	mg/kg <sup>(d)</sup>	<0.5	<0.5	<0.5
<b>Si</b>	mg/kg <sup>(d)</sup>	250	310	410
<b>Ti</b>	mg/kg <sup>(d)</sup>	9	11.5	15
<b>Tl</b>	mg/kg <sup>(d)</sup>	<0.5	<0.5	<0.5
<b>V</b>	mg/kg <sup>(d)</sup>	0.6	0.9	3.7
<b>Zn</b>	mg/kg <sup>(d)</sup>	30	55	80

#### 2.2.4.2 Sampling and analysis of plant pellets

The CLIENT undertakes to share in the course of the basic guarantee period information about the composition of fuel. Sampling and all other subsequent processing and analyses shall take place in accordance with applicable Czech standards listed below. The analyses shall be made by an accredited laboratory, which will be provided with a mixed sample consisting of at least 4 samples per month, with the exception of the period of scheduled and unscheduled shut-offs, when one representative sample corresponding to the fuel that has caused the failure will be required. The required parameters and frequency of analyses are shown in the table below. In case of a failure of the equipment, it is possible to carry out extraordinary offtake and analysis of the fuel that has caused the failure. The OB 2 CONTRACTOR shall be provided with information about the biological origin of the material.

analysed variables	unit	frequency
humidity	%hm. <sup>(d)</sup>	once a month
combustion heat, calorific value	MJ/kg <sup>(d)</sup>	once a month
ash content	%hm. <sup>(d)</sup>	once a month
C, H, N	%hm. <sup>(d)</sup>	once a month
S	%hm. <sup>(d)</sup>	once a month
Cl	%hm. <sup>(d)</sup>	once a month
Na	mg/kg <sup>(d)</sup>	once a month
K	mg/kg <sup>(d)</sup>	once a month
P, Ca, Mg, Si, Fe, Mn, Hg, F	mg/kg <sup>(d)</sup>	once a month

#### 2.2.5 Guaranteed parameters of the fuel mix of plant pellets (40%en.) and wood chips (60%en.)

Parameter	Units	Values	Range
Plant pellets	%en.	40	0-40
Wood chips	%en.	60	0-100
Calorific value	MJ/kg <sup>(ar)</sup>	11.64	7.8-13.7
Humidity	% <sup>(ar)</sup>	31.65	19.9-55
Ash content	% <sup>(d)</sup>	6.41	< 18.3
<b>Composition of elements</b>			
Carbon content	% <sup>(d)</sup>	49.6	
Hydrogen content	% <sup>(d)</sup>	6.2	
Oxygen content	% <sup>(d)</sup>	36.57	
Sulphur content	% <sup>(d)</sup>	0.14	0.25
Nitrogen content	% <sup>(d)</sup>	1.05	
Chlorine content	% <sup>(d)</sup>	0.058	< 0.097

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Fluorine content	mg/kg <sup>(d)</sup>	0.004	0.004
Sulphur/chlorine ratio		2.5	
Sodium content	mg/kg <sup>(d)</sup>	75	< 138
Potassium content	mg/kg <sup>(d)</sup>	4 366	< 6 043
Na + K	mg/kg <sup>(d)</sup>	4 430	< 6 170
Calcium content	mg/kg <sup>(d)</sup>	3 930	
Mercury content	mg/kg <sup>(d)</sup>	0.03	< 0.05

### 2.2.6 Natural gas – start-up fuel

Lower heating value  $Q_i$  min. 35.25 MJ/m<sup>3</sup>

Volume composition of gas:

Content of CH<sub>4</sub> 96.3 %

Content of C<sub>2</sub>H<sub>6</sub> 1.5 %

Content of C<sub>3</sub>H<sub>8</sub> 0.4 %

Content of CO<sub>2</sub> 0.4 %

Content of O<sub>2</sub> 0.5 %

Content of N<sub>2</sub> 0.9 %

Operating pressure of natural gas: 200-300 kPa

### 2.2.7 Technological fuel

It is a mixture of water and thickened oil and cutting emulsions after treatment from Škoda Auto oily water.

parametr			value		
			min.	ref.	max.
Water content	W <sup>(ar)</sup>	%wg.	8	63	80
Ash content	A <sup>(ar)</sup>	%wg.	1	1.5	5
Lower heating value	Q <sub>i</sub>	MJ/kg	8	14	25
Sulphur content	S <sup>(ar)</sup>	%wg.		0.16	
Chlorine content	Cl <sup>(ar)</sup>	%wg.		0.04	

The fuel is burned a campaign-wise in the amount of 250-650 kg/h. The burning campaign lasts approx. 5 days and occurs once a month.

### 2.2.8 DeNOx agent

The specific use of the DeNOx agent is at the Contractor's OB 2, whereby three aqueous solutions are permitted, specifically:

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- 40% urea solution,
- 30% ammonium sulphate solution,
- 25% ammonia solution.

#### 2.2.8.1 30% aqueous solution of ammonium sulphate

The ammonium sulphate solution will be made from drinking quality or demineralized water. The solution is supplied as a 30% aqueous solution.

	unit	value
residue after evaporation	mg/kg	< 2
solid particles	no solid particles	
content of (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	%	30 %

#### 2.2.8.2 25% aqueous solution of ammonium

The ammonium solution will be made from drinking quality or demineralized water. The solution is supplied as a 25% aqueous solution.

	unit	value
residue after evaporation	mg/kg	< 2
solid particles	no solid particles	
content of NH <sub>3</sub>	%	25 %

#### 2.2.8.3 40% aqueous solution of urea

The urea solution will be made from drinking quality or demineralized water. The solution is supplied as a 40% aqueous solution.

	unit	value
residue after evaporation	mg/kg	< 2
solid particles	no solid particles	
content of urea	%	40 %

### 2.2.9 Cooling water

The cooling water currently reaches the following values:

Parameter	Unit	Value
Cooling water pressure	MPa(g)	0.15
Input temperature of cooling water in the summertime - the average	°C	22
Operating temperature range	°C	10 - 30
Quality		
pH	-	8.5-8.9
KNK <sub>4,5</sub>	mmol	3 - 7
Total hardness	dH	Max.25
Conductivity	µS/cm	700 - 1200

### 2.2.10 Cooling water of the inner cooling circuit

Demi-water of inner cooling circuit currently has the following values:

Parameter	Unit	Value
Demi-water pressure	MPa(g)	0.65

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Operating temperature range	°C	10 - 25
Conductivity	µS/cm	1
Silicates	µg/l	20

### 2.2.11 Industrial water

Process currently achieves the following assigned values:

Parameter	Unit	Value
pH	-	6.7 – 7.5
KNK <sub>4,5</sub>	mmol	0.55 – 2.3
Total hardness	mmol/l	0.8 – 3.2
Conductivity	µS/cm	250 - 400
Aluminium	Mg/l	0.01 – 0.15

### 2.2.12 Transport pressure air from the Škoda Auto

Specification of pressure air from the Škoda Auto:

Nominal air pressure in the Škoda Auto distribution at the connection point	0.6 MPa(g)
Max. air pressure in the ŠKODA distribution at the connection point	0.62 MPa(g)
Pressure dew point at the dryer inlet	+3 to 7 °C from the Škoda distribution (ISO 8573-1:2001)
Maximum pressure	0.7 MPa (g)
Nominal pressure	0.6 MPa (g)
Minimal pressure	0.5 MPa (g)
Pressure dew point	+2 to +7 °C
Temperature	10–40 °C
Required air quality under ČSN ISO 8573-1: 1 – 4 - 2	

### 2.2.13 Control compressed air

Specification of the control compressed air:

- Nominal air pressure in the distribution pipes 0,75 MPa(g)
- Max. air pressure in air distribution pipes 0.83 MPa (g)
- Pressure dew point -40°C
- Required air quality under ČSN ISO 8573-1: 2 – 2 – 2

### 2.2.14 Lime hydrate

The powder form based on Ca(OH)<sub>2</sub> produced specifically for the ash cleaning purposes shall be used. Hence, it will not be the ordinary slaked lime used in the construction industry. The required properties are listed below.

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	units	value
specific surface (BET)	m <sup>2</sup> /g	> 40
Ca(OH) <sub>2</sub> content	%wg.	> 97
particle size	< 90 µm	%wg. > 95
	< 5 µm	%wg. < 55

### 2.2.15 Sodium hydro carbonate

The powder form based on NaHCO<sub>3</sub> or Na<sub>2</sub>CO<sub>3</sub> will be used. The required properties are listed below.

	units	value
NaHCO <sub>3</sub> content	%wg.	> 98
particle size	< 20 µm	%wg. > 90

### 2.2.16 Sand for BFB boilers

Natural sand may be considered for use as an inert fluid layer material. Use of sea sand or of sand polluted or contaminated with salts is not permitted. Maximum reuse of bed ash is required as a cost saving measure. The sand is subject to the following requirements:

	units	value
humidity		dry
melting point (to be determined by the DTA method)	°C	> 1200
loose mass	kg/m <sup>3</sup>	1300 – 1500
hardness (at the MOH scale)		6,0 – 7,0

	fraction passage %wg. (the finest)	fraction passage %wg. (the coarsest)
<1.6 mm	100	100
<1.4 mm	100	95
<1.2 mm	100	80
<1.0 mm	95	50
<0.7 mm	40	0
<0.5 mm	10	0
<0.25 mm	2	0

### 2.2.17 Sand for CFB boilers

Natural sand may be considered for use as an inert fluid layer material. Use of sea sand or of sand polluted or contaminated with salts is not permitted. Maximum reuse of bed ash is required as a cost saving measure. The sand is subject to the following requirements:

	units	value
humidity		dry
melting point (to be determined by the DTA method)	°C	> 1200
loose mass	kg/m <sup>3</sup>	1200 – 1500
hardness (at the MOH scale)		6,0 – 7,0
maximum content of SiO <sub>2</sub>	%	< 60

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	<b>Fraction passage %wg. (the finest)</b>	<b>Fraction passage %wg. (the coarsest)</b>
<0,7mm	100	100
<0.5 mm	100	100
<0.355 mm	100	85
<0.25 mm	90	55
<0.125mm	40	10
<0.063 mm	15	0

### 3 CONDITIONS OF GUARANTEE MEASUREMENT

#### 3.1 General conditions

##### 3.1.1 THE TESTING COMPANY

For the method of performing all GUARANTEE TESTS of the LOT OB 2 see the *Table I 1 3.6* and conditions and requirements will be specified in the relevant GUARANTEE MEASUREMENT PROJECT approved by the CLIENT. The GUARANTEE MEASUREMENT will be performed by a mutually agreed TESTING COMPANY.

##### 3.1.2 THE PROJECT OF GUARANTEE MEASUREMENT

Before starting the GUARANTEE MEASUREMENT, the CLIENT shall approve the GUARANTEE MEASUREMENT PROJECT, according to which these tests will be directed, they will determine the expected date and program of these GUARANTEE MEASUREMENTS, their arrangement and a form, requirements for the daybook of tests, etc.

Without prior approval of the GUARANTEE MEASUREMENTS PROJECT by the CLIENT, the GUARANTEE MEASUREMENTS will not be carried out.

##### 3.1.3 The CLIENT cooperation

The CLIENT and the OB2 CONTRACTOR will provide the necessary cooperation for the performance of the GUARANTEE MEASUREMENTS.

##### 3.1.4 Further conditions

1. GUARANTEE MEASUREMENTS will take place under steady state conditions. The testing company will provide additional instrumentation with a specified accuracy that will be in accordance with the relevant standards for conducting acceptance tests for the purpose of performing GUARANTEE MEASUREMENTS. Unless specified otherwise in the standards, the results will be calculated from average values recorded during the measured period.
2. The UNIT will be operated according to operating regulations during the GUARANTEE MEASUREMENTS.
3. The guaranteed parameters will be proven by measurements at the steady state of the UNIT, or the UNIT itself will be stabilized to the initial performance level for 1 hour at least. At the same time, the OB 2 CONTRACTOR and the CLIENT will mutually agree that the UNIT is ready for the start of the testing.
4. The parameters for meeting the guaranteed values are assessed for each boiler individually.

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5. Measurement of the guaranteed parameters on the boiler will be carried out according to the ČSN EN 12952-15 standard "Water-tube boilers and auxiliary equipment - Acceptance tests". Each point will be measured for 4 hours, blasting will be carried out before new measurement, blowdown from the drum will be closed, ash release outside the unit will be limited and defined in the GUARANTEE MEASUREMENT PROJECT. Unless specified otherwise, the resulting value shall be deemed to be average value resulting from these periods. Further technical parameters will be specified and agreed in the GUARANTEE MEASUREMENT PROJECT.
6. The specified standards determine the maximum fluctuations and deviations of operating conditions, as well as the required classes of accuracy of measuring devices and the resulting average uncertainty of measurements. If it is not regulated by the standard, it will be specified by the OB 2 CONTRACTOR in the documentation for the GUARANTEE MEASUREMENT PROJECT.
7. The correction of results for different boundary conditions during measurements will be carried out in accordance with the stated standards using correction curves processed by the CONTRACTOR and approved by the CLIENT for all different boundary conditions. These corrections will be made against the reference values stated in this document. If these values are missing, they will be specified by the OB 2 CONTRACTOR in the documentation for the GUARANTEE MEASUREMENT PROJECT.
8. No repair works on the equipment are allowed during the guarantee tests.
9. If a guarantee parameter is not met in the course of the guarantee measurement, the OB 2 CONTRACTOR shall be entitled to make adjustments and/or calibration of the boiler and to repeat the guarantee test during which the deficiencies of the guaranteed performance will be retested. The OB 2 CONTRACTOR is entitled to repeat at least three times each of the guarantee tests and to make adjustments and calibrations of the equipment in the period between the tests
10. According to Article 15.5.3 of the Contract for Work, failure to fulfil certain parameters marked as "relative" in table 3.6.1 "The application of guarantee measurements and tests – the group of guaranteed values" is permitted subject to payment of the contractual fine specified in Article 18.2(c) of the Contract for Work and subject to compliance with the conditions specified in Article 6 of this document.

The properties of water / steam will be calculated according to the formulations of International Association of Properties Water and Steam –International Formulation 1997, developed by Ruhr University Bochum.

The heat input of auxiliary steam is calculated based on the steam mass flow and the difference of steam inlet and outlet enthalpies at the system border.

When evaluating the results of the Guarantee tests, the correction curves shall be applied. Supplier will provide the following correction curves in documentation of GUARANTEE TESTS PROJECT.

### **3.1.5 Performance levels for the tests**

Where the guarantee tests are ordered for the entire performance range of the UNIT OB 2, the measurements will be performed at least for the following performance levels, and always for each of the K80, K90, K20 boilers:

- a) wood chip fuel only:
  1. nominal power output of the boiler,
  2. the boiler minimum power output.

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- b) For the K80 and K90 boilers: a fuel mixture of wood chips 60percent and plant pellets 40percent share of the boiler heat input for:
1. The boiler nominal power output,
  2. The boiler minimum power output.

### 3.1.6 Regulations and standards

The following standards and laws (as amended, i.e. in their most recent wording) will be used in the GUARANTEE MEASUREMENT. In case of any conflict or collision priority will be given to Czech standards and laws. The list below may not be exhaustive.

	Standard
proposed parameters - legislation	Directive 2014/68/EU of the European Parliament and of the Council of 15 May 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment
water-tube boilers– output parameters	ČSN EN 12952
non-heated pressure containers	ČSN EN 13445
metal industrial popes	ČSN EN 13480
materials	ČSN EN 12952-2
control	ČSN EN 12952-6
Measurement of emissions - legislation	Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) Act No. 201/2012 Cool. on the protection of atmosphere Decree No. 415/2012 Coll. on the admissible pollution level and its identification and on the implementation of some other provisions of Act No. 201/2012 Cool. on the protection of atmosphere
Solid pollutants	ČSN EN 13284-1 ČSN ISO 9096
Sulphur dioxide SO <sub>2</sub>	ČSN EN 14791
Nitrogen oxides NO <sub>x</sub>	ČSN EN 14792
Carbon oxide CO	ČSN EN 15058
Water H <sub>2</sub> O	ČSN EN 14790
Oxygen O <sub>2</sub>	ČSN EN 14789
Hydrogen chloride HCl	ČSN EN 1911
Hydrogen fluoride HF	ČSN P CEN/TS 17640
Total mercury Hg	ČSN EN 13211
Heavy metals	ČSN EN 14385
Total organic carbon (TOC)	ČSN EN 12619
PCDD/F	ČSN EN 1948
Ammonium NH <sub>3</sub>	ČSN 834728
Nitrous oxide N <sub>2</sub> O	ČSN EN ISO 21258
Steam output	ČSN EN 12952-15

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Radiation	ČSN EN 12952-15
Total organic carbon (TOC) in ash	ČSN EN 13137
Sampling	ČSN EN 18135
Sample preparation	ČSN EN 14780
Humidity content	ČSN EN 18134
Combustion heat	ČSN EN 18125
Ash content	ČSN EN 18122
Sulphur content	ČSN EN 16994
Chlorine content	ČSN EN 16994
Fluorine and bromine content	ČSN EN 16994
Nitrogen, oxygen and hydrogen content	ČSN EN 16948
Content of minority materials in ash (Cd, Ti, Hg, Sb, As, Cr, Co, Cu, Mn, Ni, V, Pb, Sn, Zn)	ČSN EN 16968 ČSN EN 1483
Content of majority materials in ash (Na, K, Ca, Mg, Si, P, Fe, Al, Ti, Mn)	ČSN EN 16967
Bulk density	ČSN EN 17828
Size and distribution of particles	ČSN EN 17827-1
Volatile substances (VOC)	ČSN EN 18123
Ash melting temperature	ČSN ISO 540
Fuel sieving	ČSN ISO 3310-2
Vibration	ČSN ISO 10816-1+3
Determination of internal acoustic level	ČSN ISO 3744
Determination of external acoustic level	ČSN ISO 8297
Scope of load change	VDI/VDE 3501-3508
Classification of hazardous premises (ATEX)	Directive 94/9/EC a 1999/92/EC of the European Parliament and f the Council, ČSN EN 60079-10, ČSN EN 50281-3
Oils viscosity	ČSN EN ISO 3104
Oil viscosity at 15°C	ČSN EN ISO 12185

### 3.2 Preliminary measurements of some guaranteed values during COMPREHENSIVE EXAMINATIONS AND A TRIAL RUN

The UNIT is operated in the manner and for the period as specified in Annex A1 for a relevant test, or in Annex A5.

#### 3.2.1 Measurement of guaranteed emission values

The preliminary measurements of continuously measured emissions will be carried out during the entire COMPLEX TEST and the entire TRIAL RUN in accordance with Decree No. 415/2012 Coll., in accordance with Methodological Instruction MZP 2019/710/462 and in accordance with BAT 2017/1442.

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### 3.2.2 Emission measuring device

As for the measurement is considered, the measured values will be applied by continuous measurement of the emissions of the boilers K20, K80, K90 before entering the stack.

### 3.2.3 Measurements of other guaranteed parameters

The preliminary measurements of guaranteed values will be performed for parameters that will be measurable by installed operational measurements, see the table and the table - 1 3.63.6 2 - the Group of guaranteed values II.

## 3.3 GUARANTEE MEASUREMENTS A

After a successful COMPREHENSIVE TEST, the GUARANTEE MEASUREMENTS A will be performed. The Testing company will perform the GUARANTEE MEASUREMENTS A proving to the CLIENT that the LOT OB 2 meets the guaranteed parameters prescribed for the GUARANTEE MEASUREMENTS A in this Appendix and the requirements set forth in the technical appendices in accordance with the GUARANTEE MEASUREMENT PROJECT.

The GUARANTEE MEASUREMENTS A shall be carried out during the TRIAL RUN,

## 3.4 Guarantee Measurements during the GUARANTEE PERIOD

The results of pollutants measurements conducting within continuous measurements will be evaluated according to Decree 415/2012 Coll., in accordance with BAT 2017/1442 and the relevant methodological instructions for the entire BASIC GUARANTEE PERIOD.

The results of one-time measurements, carried out during the GUARANTEE period in the frequency and method of evaluation according to Decree 415/2012 Coll. and the relevant methodological instruction and in accordance with BAT 2017/1442.

The measurement of the availability of the UNIT OB 2 will be carried out within the period being evaluated.

## 3.5 GUARANTEE MEASUREMENTS B

In accordance with the GUARANTEE MEASUREMENT PROJECT, the GUARANTEE MEASUREMENTS B will be performed before the BASIC GUARANTEE PERIOD within the range of guaranteed parameters defined in the Table 3.6-1. The GUARANTEE MEASUREMENTS B will be performed in the course of the BASIC GUARANTEE PERIOD but not earlier than 12 months after the PAC and not later than 2 months before the expiration of the BASIC GUARANTEE PERIOD.

## 3.6 The application of guaranteed measurements of guaranteed values

Table 3.6-1 The application of guarantee measurements and tests – the group of guaranteed values I

Number	Parameter	The preliminary measurements of guaranteed values by operational measurements during the COMPLEX TEST and the TRIAL RUN	GUARANTEE MEASUREMENTS A	GUARANTEE MEASUREMENTS B	absolute /relative
G1	SP	Yes	Yes	Yes	absolute
G2	NO <sub>x</sub>	Yes	Yes	Yes	absolute

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Number	Parameter	The preliminary measurements of guaranteed values by operational measurements during the <b>COMPLEX TEST</b> and the <b>TRIAL RUN</b>	<b>GUARANTEE MEASUREMENTS A</b>	<b>GUARANTEE MEASUREMENTS B</b>	absolute /relative
G3	CO	Yes	Yes	Yes	absolute
G4	SO <sub>2</sub>	Yes	Yes	Yes	absolute
G5	HF	Yes	Yes	Yes	absolute
G6	NH <sub>3</sub>	Yes	Yes	Yes	absolute
G7	HCl	Yes	Yes	Yes	absolute
G8	Hg	No	Yes	Yes	absolute
G9	K20 output, steam temperature and pressure - fuel 1	Yes	Yes	Yes	absolute
G10	K80 and K90 outputs, steam temperature and pressure – fuel 1	Yes	Yes	Yes	absolute
G11	K80 and K90 outputs, steam temperature and pressure – mixture of the fuel 1 and the fuel 2	Yes	Yes	Yes	absolute
G12	Steam quality	No	Yes	Yes	absolute
G13	Availability *)	No	No	Yes	relative
G14	Boiler output – fuel 1 and 2	No	Yes	No	relative
G15	Minimum steam output of the boiler	No	Yes	No	relative
G16	Self- consumption of electricity by K20	No	Yes	No	relative
G17	Limestone consumption	No	Yes	No	relative
G18	Hydrated lime consumption	No	Yes	No	relative
G19	Soda bicarbonate consumption	No	Yes	No	relative
G20	Sand consumption	No	Yes	No	relative
G21	Consumption of aqueous solution of urea	No	Yes	No	relative
G22	Consumption of aqueous solution of ammonium sulphate	No	Yes	No	relative
G23	Consumption of aqueous solution of ammonium	No	Yes	No	relative

\*) The availability will be measured as a guaranteed value after a period preliminary handover of the LOT OB 2 to the CLIENT in the course of the BASIC GUARANTEE PERIOD.

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## 4 GUARANTEED PARAMETERS

Unless specified otherwise, the following parameters listed below are guaranteed for terms of reference defined in this document:

- *chapter 2.1: Terms of Reference for GUARANTEE MEASUREMENT, and*
- *reference values are considered for guarantee measurement,*
- *reference values for each medium and fuel or fuel mix stated in chapter 2.2 General conditions.*

### 4.1 Emissions

#### 4.1.1 Emissions - General conditions

The CONTRACTOR guarantees for the LOT OB 2, that the guaranteed values of emissions into the atmosphere specified in this Annex will not be exceeded.

1. The K20 boiler is classified as a new combustion unit.
2. The boilers K80 and K90 are considered as an existing combustion unit.
3. The resource has been included in the category of input power higher than 300 MW.
4. All emission values are understood at the entrance to the stack, unless defined otherwise.
5. The emission values of the boiler relate to reference conditions which are given by valid legislation, in the time of publishing tender documentation it was: dry gas 6 percent, O<sub>2</sub> in flue gases, pressure 101.325 kPa and temperature 273.15 K.
6. Concentrations of pollutants will be documented by the installed legal measurement device separately for each boiler in accordance with the standards listed above.

#### 4.1.2 The assessment of emission limits measurement

##### 4.1.2.1 Pre-PAC Evaluation Period

The evaluation of fulfilment of the guaranteed values of continuously measured emissions will be carried out for the entire period of preliminary measurements of the guaranteed values during the COMPREHENSIVE TEST and the TRIAL RUN, as well as the guarantee measurements during the GUARANTEE TEST A.

##### 4.1.2.2 Pre-FAC Evaluation within the GUARANTEE PERIOD

The evaluation of the fulfilment of the guaranteed emission values will be carried out in accordance with Chapter 4.1.2.3.

##### 4.1.2.3 Method of Evaluation

The measurement will be carried out in accordance with Act No. 201/2012 Coll.

The evaluation of emission limits will be carried out in accordance with Decree No. 415/2012 on the permissible level of pollution and its detection and the methodological instruction of the Ministry of the Environment No. MZP/2019/710/462 – the minimum emission requirements according to the emission levels associated with the best techniques for large combustion plants based on the implementation decision of the European Commission BAT 2017/1442.

The measured values for pollutants for which a monthly or annual limit are indicated will be for the period specified in the chapter 4.1.2.1 *The evaluated period before the PAC* and will be compared additionally with the annual and monthly limits.

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#### 4.1.3 Guaranteed emissions of the boilers K20, K80, K90

The parameters are guaranteed for the full operating range of a boiler, from the minimum to maximum boiler output, for the entire range of defined fuel quality and for entire ranges of media:

- in the case of K80 and K90 boilers also for the entire range of the co-combustion of fuel 1: wood chips and the fuel 2: plant pellets in the range of fuel 2 co-combustion; 0-40percent of heat input,
- 

	Emissions from the boiler	Limits	
	Particulate matter Continuous measurement	Annual limit Value (mg/Nm <sup>3</sup> )	Daily limit Value (mg/Nm <sup>3</sup> )
G 1.1	The boiler K20 fuel 1: wood chips	5	10
G1.2.1	The boilers K80 and K90 Fuel 1: wood chips	10	16
G1.2.2	The boilers K80 and K90 – a mixture Fuel 1: wood chips and the fuel 2 – plant pellets	10	16
	NO <sub>x</sub> Continuous measurement	Annual limit Value (mg/Nm <sup>3</sup> )	Daily limit Value (mg/Nm <sup>3</sup> )
G2.11	The boiler K20, the fuel 1: wood chips	140	150
G2.2.1	The boilers K80 and K90 Fuel 1: wood chips	160	200
G2.2.2	The boilers K80 and K90 – a mixture Fuel 1: wood chips and the fuel 2 – plant pellets	160	200
	CO Continuous measurement	Annual limit Value (mg/Nm <sup>3</sup> )	
G3.1	The boiler K20 – the fuel 1: wood chips	80	275
G3.2.1	The boilers K80 and K90 Fuel 1: wood chips	80	275
G3.2.2	The boilers K80 and K90 – a mixture Fuel 1: wood chips and the fuel 2 – plant pellets	80	275
	SO <sub>2</sub> Continuous measurement	Annual limit Value (mg/Nm <sup>3</sup> )	Daily limit Value (mg/Nm <sup>3</sup> )
G4.1	The boiler K20, the fuel 1: wood chips	35	70
G4.2.1	The boilers K80 and K90	50	85

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	Fuel 1: wood chips		
G4.2.2	The boilers K80 and K90 – a mixture Fuel 1: wood chips and the fuel 2 – plant pellets	67	128
	<b>HF</b>	Average value (mg/Nm <sup>3</sup> )	Daily limit Value (mg/Nm <sup>3</sup> )
G5.1	The boiler K20, the fuel 1: wood chips - <b>One-time measurement</b>	1	1
G5.2.1	The boilers K80 and K90 - <b>Continuous measurement</b> Fuel 1: wood chips	1	1
G5.2.2	The boilers K80 and K90 – a mixture - <b>Continuous measurement</b> Fuel 1: wood chips and the fuel 2 – plant pellets	1	1
	<b>NH<sub>3</sub></b> <b>Continuous measurement</b>	Annual limit Value (mg/Nm <sup>3</sup> )	
G6.1	The boiler K20, the fuel 1: wood chips	15	
G5.2.1	The boilers K80 and K90 Fuel 1: wood chips	15	
G6.2.2	The boilers K80 and K90 – a mixture Fuel 1: wood chips and the fuel 2 – plant pellets	15	
	<b>HCl</b> <b>Continuous measurement</b>	Annual limit Value (mg/Nm <sup>3</sup> )	Daily limit Value (mg/Nm <sup>3</sup> )
G7.1	The boiler K20, the fuel 1: wood chips	5*	12***
G7.2.1	The boilers K80 and K90 Fuel 1: wood chips	5**	12***
G7.2.2	The boilers K80 and K90 – a mixture Fuel 1: wood chips and the fuel 2 – plant pellets	5**	12***
<p>*an exception for 15mg/Nm<sup>3</sup> in case of use of the aqueous solution ammonium sulphur in the SNCR technology may be applied</p> <p>**an exception for 25mg/Nm<sup>3</sup> in case of use of the aqueous solution ammonium sulphur in the SNCR technology may be applied</p> <p>***it is possible to apply an exception in case of use of the aqueous solution ammonium sulphur in the SNCR technology where this value will not be required</p>			
	<b>Annual limit Hg</b>	Annual limit	

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	<b>One-time measurement</b>	<b>Value (<math>\mu\text{g}/\text{Nm}^3</math>)</b>	
G8.1	The boiler K20, the fuel 1: wood chips	5	
G8.2.1	The boilers K80 and K90 Fuel 1: wood chips	5	
G8.2.2	The boilers K80 and K90 – a mixture Fuel 1: wood chips and the fuel 2 – plant pellets	5	

## 4.2 Nominal parameters of the boiler

Meters certified by ČMI (Czech Institute of Metrology) will be used for steam measurements at the output from the boiler before the joint steam busbar in the machine room. Average value from max. 5 minutes intervals will be used for the evaluation.

	<b>Parameters at connection points</b>	<b>Units</b>	<b>Value</b>
	<b>The boiler K20- the fuel 1</b>		
G9.1	The nominal output of the boiler K20 at the nominal steam parameters at the connection point for fuel 1: wood chips	t/h	80
G9.3	The nominal steam temperatures of the boiler K20 for fuel 1: wood chips	°C	535±5
A 9.1.3	The nominal steam pressure of the boiler K20 in fuel 1: wood chips	MPa(g)	12.5±0.3
	<b>The boilers K80 and K90 – the fuel 1</b>		
G10.1	The nominal steam pressure for each of the K80 and K90 boilers K20 at the output for t fuel 1: wood chips	t/h	100
G10.2	The steam rated temperatures of each of the K80 and K90 boilers for fuel 1: wood chips	°C	535±5
G10.3	The nominal steam pressure of each of the K80 and K90 boilers for fuel 1: wood chips	MPa(g)	12.5±0.3
	<b>The boilers K80 and K90 for a mixture of fuels based on heat input</b>		
G11.1	The nominal output of each of the K80 and K90 boilers for fuel 1: wood chips 60percent and fuel 2: plant pellets – 40percent	t/h	100
G11.2	The nominal steam temperatures of each of the K80 and K90 boilers for the operating range from 70 to 100percent for fuel 1: wood chips 60percent and fuel 2: plant pellets – 40percent	°C	535±5
G11.3	The nominal steam pressure of each of the K80 and K90 boilers fuel 2: plant pellets – 40percent	MPa(g)	12.5±0.3

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#### 4.3 The guaranteed quality of superheated steam at the connection point

Superheated steam	Cathexis conductivity CC $\lambda_{25^{\circ}\text{C}}$	Fe	SiO <sub>2</sub>	Sodium and Potassium (Na <sup>+</sup> + K <sup>+</sup> )
G12	( $\mu\text{S/cm}$ )	( $\mu\text{g/l}$ )	( $\mu\text{g/l}$ )	( $\mu\text{g/l}$ )
ČSN 07 74 03	<0.3	<20	<20	<10

#### 4.4 Availability

The measurement of availability will be carried out in the course of the BASIC GUARANTEE PERIOD for a period of one year. The measurement will start not later than 3 months after PAC upon written notice of the OB 2 CONTRACTOR.

During the availability measurement period, the OB 2 CONTRACTOR will be entitled to planned shut-off for an agreed period allowing to perform all checks and maintenance works. This shut-off period, all necessary preparatory works preceding the shut-off and all necessary works performed during the shut-off period shall be agreed and planned between the CLIENT and the OB 2 CONTRACTOR in a way permitting effective preventive maintenance and repairs of the equipment with the aim of ensuring maximum availability.

Availability means the relative period during which the unit is operated in a **regulated scope** and is capable of operation at the nominal value and nominal parameters.

Annual availability is represented by the following relation:

$$D_K = \frac{100 \cdot t_p}{t_c} [\%]$$

where:

$D_K$  is the availability of the relevant boiler (K20, K80, K90),

$t_p$  is the total length of the evaluated period during which the boiler is ready for operation. In case of any impediments or of the CLIENT's decision (e.g. due to human errors on the CLIENT's side), the above period will not include hours during which the hourly availability will be less than 100% due to such reasons. Neither will the calculated period include any interruptions caused outside the equipment falling within the scope of the OB 2 CONTRACTOR.

$t_c$  means the maximum possible fond of the operating period of the boiler or the measured period (8760 hours.)

Conditions of gathering evidence (testing conditions):

- the availability will be evaluated by the CLIENT with the CONTRACTOR's participation on the basis of the operating records of the equipment,
- $t_p$  will not include the period from the moment of shut-off of the equipment due to its malfunction or failure,
- $t_p$  will include periods required for start-up from idle time and the idle time caused by external factors, force majeure, incorrect operation (failure to comply with operating regulations), by a failure of equipment outside the scope of the OB 2 LOT, by a decision or reasons on the CLIENT's side.

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The OB 2 CONTRACTOR is obliged to ensure that the availability of all boilers will not be less than 91%  
The minimum availability of the boilers is defined as follows:

G13.1            **K20 availability: 91 %**

G13.2            **K80 availability: 91 %**

G13.3            **K920 availability: 91 %**

#### 4.5 The Boiler Efficiencies

The indirect method according to ČSN EN 12 952 will be used to determine the guaranteed efficiency.

	Parameter	Units	The value of the guaranteed parameter	LIMIT VALUE OF THE GUARANTEED PARAMETER
	<b>The boiler K20 - Fuel 1</b>			
G14.1	The average boiler efficiency at nominal boiler output for fuel 1: wood chips	%	<b>TO BE ADDED</b>	min. 91
	<b>The boilers K80 and K90 - Fuel 1</b>			
G14.2.1	The average boiler efficiency at the boiler nominal output for the fuel 1: wood chips - for the duration of 24 hours	%	<b>TO BE ADDED</b>	min. 89
	<b>The boilers K80 and K90 for any mixture of fuel 1: wood chips – 60percent and the fuel 2: plant pellets – 40percent</b>			
G14.2.2	The average boiler efficiency at the boiler nominal output for the fuel mixture	%	<b>TO BE ADDED</b>	min. 89

#### 4.6 Minimum Steam Output of the Boiler

It is applied to reference fuels, reference feed water temperature and reference conditions.

	Parameters at the connecting points	Units	Value
	<b>Boiler K20, fuel 1</b>		
G15.1.1	Minimum steam output of the boiler K20 at the connecting point	%	40
G15.1.2	the K20 boiler at the minimum steam output of the boiler	°C	520
G15.1.3	K20 steam pressure at the minimum steam output of the boiler	MPa(g)	12
	<b>Boilers K80 and K90, fuel 1</b>		
G15.2.1	Steam output of each of the K80 and K90 boilers at the boiler outlet for fuel 1: wood chips	%	60
G15.2.2	Steam temperature of each of the K80 and K90 boilers at the minimum steam output for fuel 1: wood chips	°C	520
G15.2.3	Steam pressure of each of the K80 and K90 boilers at the minimum steam output for fuel 1: wood chips	MPa(g)	12

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	<b>Boilers K80 and K90 fuel mix based on heat input</b>		
G15.3.1	Steam output of each of the K80 and K90 boilers at the boiler outlet for fuel 1: wood chips - 60% and fuel 2: plant pellets – 40%	%	60
G15.3.2	Steam temperature of each of the K80 and K90 boilers at the minimum steam output for fuel 1: wood chips - 60% and fuel 2: plant pellets – 40%	°C	520
G15.3.3	Steam pressure of each of the K80 and K90 boilers at the minimum steam output for fuel 1: wood chips- 60% and fuel 2: plant pellets – 40%	MPa(g)	12

#### 4.7 Self-consumption of electricity of K20

This is the self-consumption of the UNIT OB 2 defined part of the K20 boiler part, from the fuel input to the operating silo to the output from the boiler smoke exhaust fan and the ash output on the filter hoppers.

The BIDDER will list the appliances in their offer.

	<b>Parameter</b>	<b>Units</b>	<b>The value of the guaranteed parameter</b>	<b>Note</b>
G16	Self- consumption of electricity at the nominal output of the K20 boiler as an hourly average over 4 hours of operation.	kWh/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation

Self- consumption includes all appliances located within the K20 boiler house, including air conditioning, heating, lighting, including the flue gas and air system of the K20 boiler, flue gas cleaning, ash removal, small cooling circuit.

The air compressor station, a supply of belt conveyors within the OB 1 and the fuel management ventilation systems within the OB 1 are excluded from this evaluated group.

#### 4.8 Specific consumption of lime

	<b>Parameter</b>	<b>Units</b>	<b>The value of the guaranteed parameter</b>	<b>Note</b>
	<b>The boiler K20 – fuel 1: wood chips</b>			
G17.1	Specific consumption of limestone as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 - Fuel 1: wood chips</b>			
G17.2	Specific consumption of limestone as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the

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				tender documentation
	<b>The boilers K80 and K90 for any mixtures of the fuel 1 – 60percent and the fuel 2 – 40percent</b>			
G17.3	Specific consumption of limestone as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation

#### 4.9 Specific consumption of hydrated lime

	Parameter	Units	The value of the guaranteed parameter	Note
	<b>The boiler K20 – fuel 1: wood chips</b>			
G18.1	Specific consumption of lime hydrate as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 - Fuel 1: wood chips</b>			
G18.2	Specific consumption of hydrated lime as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 for any mixtures of the fuel 1 – 60percent and the fuel 2 – 40percent</b>			
G18.3	Specific consumption of hydrated lime as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation

#### 4.10 Specific consumption of sodium bicarbonate

	Parameter	Units	The value of the guaranteed parameter	Note
	<b>The boiler K20 – fuel 1: wood chips</b>			

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G19.1	Specific consumption of sodium bicarbonate as a one hour average over 4 hours at the boiler nominal output	kg/h	TO BE ADDED	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 - Fuel 1: wood chips</b>			
G19.2	Specific consumption of sodium bicarbonate as a one hour average over 4 hours at the boiler nominal output	kg/h	TO BE ADDED	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 for any mixtures of the fuel 1 – 60percent and the fuel 2 – 40percent</b>			
G19.3	Specific consumption of sodium bicarbonate as a one hour average over 4 hours at the boiler nominal output	kg/h	TO BE ADDED	according to the value entered in Annex J of the tender documentation

#### 4.11 Specific consumption of sand

	Parameter	Units	The value of the guaranteed parameter	Note
	<b>The boiler K20 – fuel 1: wood chips</b>			
G20.1	Specific consumption of sand as a one hour average over 4 hours at the boiler nominal output	kg/h	TO BE ADDED	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 - Fuel 1: wood chips</b>			
G20.2	Specific consumption of sand as a one hour average over 4 hours at the boiler nominal output	kg/h	TO BE ADDED	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 for any mixtures of the fuel 1 – 60percent and the fuel 2 – 40percent</b>			
G20.3	Specific consumption of sand as a one hour average over 4	kg/h	TO BE ADDED	according to the value entered in Annex J of the

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	hours at the boiler nominal output			tender documentation
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#### 4.12 Specific consumption of the aqueous solution of urea

	Parameter	Units	The value of the guaranteed parameter	Note
	<b>The boiler K20 – fuel 1: wood chips</b>			
G21.1	Specific consumption of the aqueous solution of urea as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 - Fuel 1: wood chips</b>			
G21.2	Specific consumption of the aqueous solution of urea as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 for any mixtures of the fuel 1 – 60percent and the fuel 2 – 40percent</b>			
G21.3	Specific consumption of the aqueous solution of urea as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation

#### 4.13 . Specific consumption of the aqueous solution of ammonium sulphate

	Parameter	Units	The value of the guaranteed parameter	Note
	<b>The boiler K20 – fuel 1: wood chips</b>			
G22.1	Specific consumption of the aqueous solution of ammonium sulphate as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 - Fuel 1: wood chips</b>			

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G22.2	Specific consumption of the aqueous solution of ammonium sulphate as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 for any mixtures of the fuel 1 – 60percent and the fuel 2 – 40percent</b>			
G22.3	Specific consumption of the aqueous solution of ammonium sulphate as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation

#### 4.14 Specific consumption of the aqueous solution of ammonium

	Parameter	Units	The value of the guaranteed parameter	Note
	<b>The boiler K20 – fuel 1: wood chips</b>			
G23.1	Specific consumption of the aqueous solution of ammonium as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 - Fuel 1: wood chips</b>			
G23.2	Specific consumption of the aqueous solution of ammonium as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation
	<b>The boilers K80 and K90 for any mixtures of the fuel 1 – 60percent and the fuel 2 – 40percent</b>			
G23.3	Specific consumption of the aqueous solution of ammonium as a one hour average over 4 hours at the boiler nominal output	kg/h	<b>TO BE ADDED</b>	according to the value entered in Annex J of the tender documentation

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## 5 GUARANTEE AND GUARANTEE CONDITIONS

The guarantees provided in the contract for work apply subject to the following:

- The equipment is operated, checked and maintained (including preventive maintenance) in accordance with standard international industrial procedures and with procedures defined by the OB 2 CONTRACTOR.
- The input materials (fuel, air, water, additives, etc.) used in the course of the guarantee period comply with the parameters defined by this document.
- No changes of the equipment supplied by the OB 2 CONTRACTOR are made without his consent.
- The CLIENT shall notify the OB 2 CONTRACTOR without undue delay of any circumstances indicating possible failures of the equipment that forms part of the OB LOT (such as minor leaks of tubes), which may result in major damage or in the shut-off of the boiler. Thereafter, the CLIENT shall begin implementing remedial and preventive measures in coordination with the CONTRACTOR.
- The CLIENT possesses and proceeds in accordance with an internal fuel quality control system (fuel sampling and testing is carried out in accordance with applicable operating regulations or with the standards listed above) or ensure that the fuel burned in the boilers corresponds to the definitions set forth in this document.
- The CLIENT keeps records of all failures, records, quantity and quality of fuel and additives, as well as all operating data as required by the OB 2 CONTRACTOR. The CLIENT shall allow to OB 2 CONTRACTOR access to such data or such data shall be sent to the OB 2 CONTRACTOR in agreed intervals.

The guarantee does not apply to:

- any equipment that did not fall within the scope of the OB 2 LOT,
- defects and shortcomings:
  - of the equipment that did not fall within the scope of the OB 2 LOT, or
  - caused by incorrect operation, handling or storage by the CLIENT in conflict with common industrial practice or OB 2 CONTRACTOR's instructions,
  - defects resulting from any modifications or repairs carried out by the CLIENT or a third party without an express consent of the OB 2 CONTRACTOR,
- defects that could be caused by fuel deviating from the above specification,
- parts subject to wears and tear – replacement of those parts is considered routine maintenance not covered by the guarantee,
- goods qualified as consumables,
- **ordinary** wear and tear, damage, corrosion or erosion of the equipment; if, however the thickness of the tube wall in the pressure parts of the boiler is less at the end of the BASIC GUARANTEE PERIOD than the thickness defined in accordance with harmonized standards, the supplier shall repair or replace such defective parts.

## 6 CONTRACTUAL FINE FOR GUARANTEED VALUES

If the OB 2 CONTRACTOR fails to achieve some of the valued guaranteed below which are designated as “relative” in the Application of guarantee measurements and tests – guaranteed values group, the

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OB 2 CONTRACTOR may repeat at his own discretion the guarantee measurement or pay the contractual fine specified in the following table:

	Guaranteed value	Unit	Value	EUR for each whole unit value	Limit on compensation with contractual fine
G14.1	Boiler effectiveness - K20	%	0,1	<b>60 000</b>	min 91 %
G14.2	Boiler effectiveness - K80/90	%	0,1	<b>75 000</b>	min 89 %
G15	Minimum steam output of the boiler	%	1	<b>15 000</b>	
G13.1	Availability of K20	%	1	<b>110 000</b>	
G13.2+G13.3	Availability of K80/90	%	1	<b>140 000</b>	
G16	Self-consumption of electricity by K20	kW	10	<b>30 000</b>	
G17	Lime consumption	kg/h	10	<b>14 000</b>	
G18	Lime hydrate consumption	kg/h	10	<b>95 000</b>	
G19	Sodium bicarbonate consumption	kg/h	10	<b>155 000</b>	
G20	Sand consumption	kg/h	10	<b>6 500</b>	
G21	Consumption of aqueous solution of urea	kg/h	5	<b>52 000</b>	
G22	Consumption of aqueous solution of ammonium sulphate	kg/h	5	<b>50 000</b>	
G23	Consumption of aqueous solution of ammonium	kg/h	5	<b>32 500</b>	

The OB 2 CONTRACTOR acknowledges that the minimum limits defined for values of effectiveness and availability must always be complied with (the columns "Limit on compensation with contractual fine"), i.e. the failure to comply with them during the GUARANTEE MEASUREMENT cannot be compensated by payment of the contractual fine and if the OB 2 CONTRACTOR fails to comply with them, he will be obliged to repeat the GUARANTEE MEASUREMENT. All other parameters that are not presented, i.e. the values marked as "absolute" in the table "Application of guarantee measurements and tests – guaranteed values group" must be met under any circumstances and their achievement during the GUARANTEE MEASUREMENT cannot be replaced by payment of the contractual fine. The best resulting value will be counted in case of a repetition of the GUARANTEE MEASUREMENT, but only from one measurement. All these parameters must be achieved in one test and results of different tests cannot be combined.

If the required value is not achieved in the GUARANTEE MEASUREMENTS A and the LD is paid, the basic value for the Guarantee Measurement B shall be the value achieved in the Guarantee Measurement A.

In case of the achievement of a better value of the guaranteed parameter by the whole unit value, the amount specified in the above table shall be ascribed to the CONTRACTOR, who can set it off with fees imposed for his failure to comply with other guaranteed values. This applies, however, solely to the guaranteed parameters designated as "relative" and this amount cannot be used in compensation of fees between GUARANTEE MEASUREMENTS A and B. If, after the evolution of the measurement, the CONTRACTOR still possesses an amount to his credit, such amount will not be paid out. This means that such amount may only be used to compensate deficiencies caused by the failure to achieve other guaranteed values designated as "relative".