

Employer
SAKO BRNO A.S.

Project
Modernization of WtE Plant SAKO Brno

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PART III, APPENDIX A13

PROCESS AND DESIGN

DATA



PART III, APPENDIX A13 PROCESS AND DESIGN DATA

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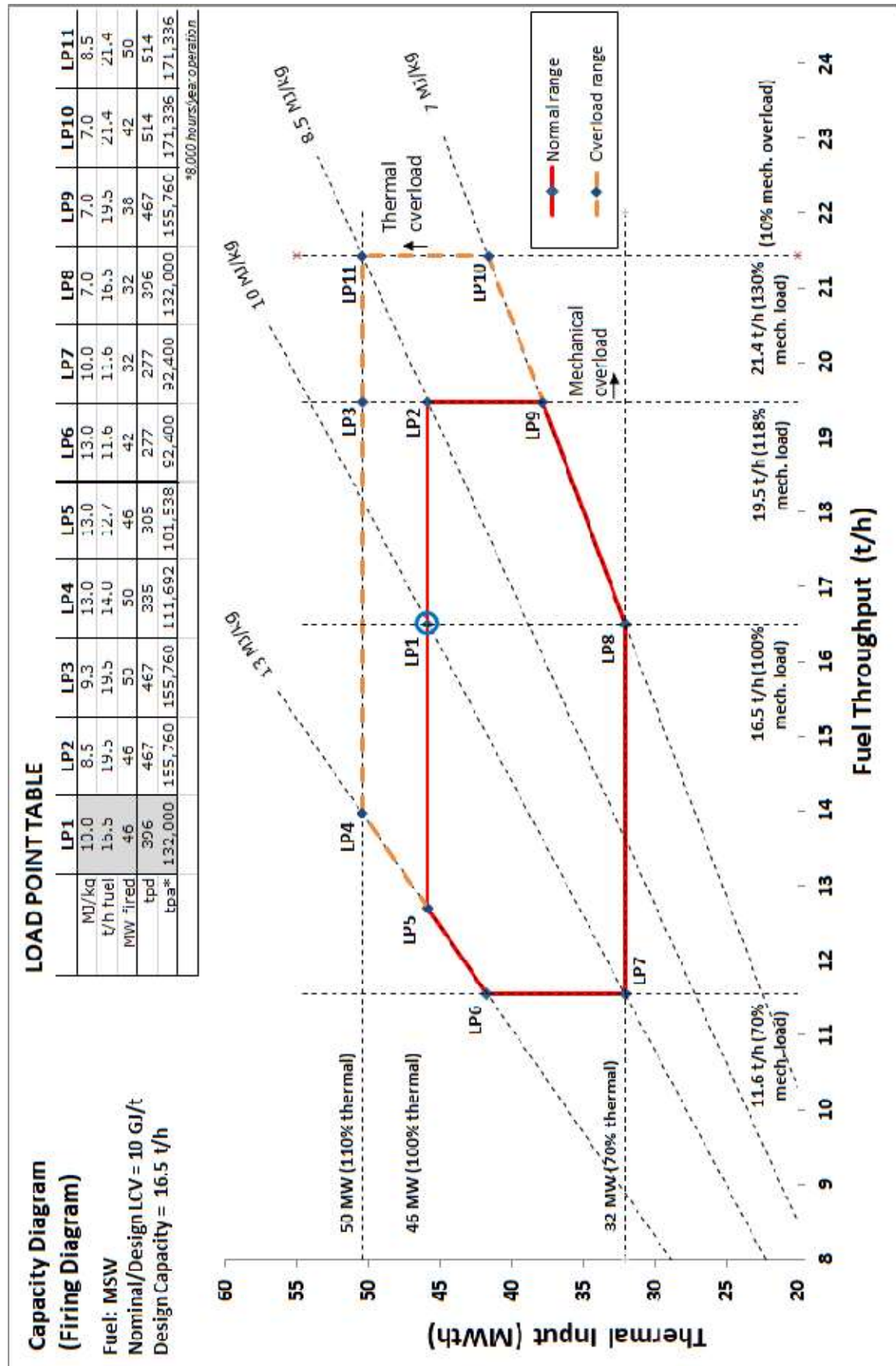
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1. CAPACITY DIAGRAM



2. PROCESS AND DESIGN DATA, GENERAL

Table for Process and Design Data, General		
Appendix A13		
Reference	Line Component / Parameter	Value / Description
Appendix A1	Design Basis	
A1: sec. 2/3/4	Basic Process	
	Incinerator/Boiler	<p>Furnace with grate and boiler cooled combustion chamber, SNCR and auxiliary burners.</p> <p>Steam boiler with two radiation passes and a horizontal convection pass.</p>
	Flue gas treatment	Semi-dry concept consisting of a reactor system with $\text{Ca}(\text{OH})_2/\text{CaO}$ and AC injection and a baghouse filter followed by an ID-fan, emission monitoring system, duct and installations in existing stack.
	Turbine/Generator	<p>Recovery of the energy content of the steam produced in a back-pressure turbine with a generator for power production and at least one bleed for MP steam. The exhaust shall be condensed in a condenser for district heat production.</p> <p>Under normal operations the generator will generate electrical power. Power generated will meet Employers site requirements for Complete Plant and the balance of the electrical power generated will be exported to grid.</p> <p>The Line shall be able to operate in power island mode to support waste processing i.e. where no power exports to the grid are possible due to failures etc.</p>
	Cooling	Summer coolers (dry coolers) shall be installed with sufficient capacity to off-take DH production in periods with minimal DH demand from the grid.

Table for Process and Design Data, General		
Appendix A13		
Reference	Line Component / Parameter	Value / Description
A1: sec. 10	Design Data for the Line	
A1: sec. 10.1	Estimate of the waste	
	<ul style="list-style-type: none"> • Municipal solid waste (0-100%) • Commercial and industrial waste (0-100%) • Other waste fractions (as defined in Appendix E8 <i>Approved Waste Types for Employer's Existing Plant</i>) in excess of mixed municipal solid waste and mixed commercial and industrial waste (0-30%) <p>Mixed municipal solid waste composition</p> <ul style="list-style-type: none"> - Water content: 10-40% - Ash content: 10-30% - Combustibles: 40-70% 	
	Range of calorific value of fuel mixture (lower calorific value)	7-13 MJ/kg
A1: sec. 10.2	Operating Conditions	
	Operating range	According to the Capacity Diagram
	Nominal mechanical MSW flow Nominal calorific value (lower calorific value)	16.5 tonnes/h 10 MJ/kg, LP1
	Superheating in boiler	<p>Full superheating in the entire operating range of the capacity diagram approx. 1,000 hours after manual cleaning of the boiler / clean boiler.</p> <p>0-1000 hours after manual cleaning: a slightly lower superheating temperature can be accepted.</p> <p>Turbine must be in safe operation after 100 hours after manual cleaning, without problems with erosion due to low steam temperature.</p>
	Load variation for incinerator/boiler	70-110%
	Operational range turbine/generator	Max. 110%
	Number of planned annual outages	1
	Number of annual cold starts	1-4

Table for Process and Design Data, General
Appendix A13

Reference	Line Component / Parameter	Value / Description
	Minimum hours of operation annually (availability)	
	Minimum hours of annually Line operation availability (Definition of operational availability according to part II.c Contractual penalties for non-compliance with values)	8,000 h/year
	Planned stop	560 h/year
	Unplanned stop	200 h/year
	Minimum continuous operation period	8,000 h
A1 sec. 10.2.2 + 10.3	Thermal efficiency & Ambient Air Conditions	
	Bottom ash temperature	500 °C
	Bottom ash quantity	22 % wet weight of waste load
	Feed water temperature	130 °C
	Temperature of primary intake air	25 °C
	Temperature, outdoor	Local climate However, as a minimum -10 °C to 35 °C
	Temperature, indoor (General minimum requirement)	0 °C to + 40 °C
	Radiation and convection losses indoor (boiler hall)	1.5 % of nominal thermal load i.e. thermal input into the furnace from waste fired.
	Thermal insulation	
	Process equipment surface temperature requirements	Refer to appendix A14.4 <i>Insulation and Cladding</i>
A1: sec. 10.4.5	District heating	
	Design pressure DH network	25 bara
	Operational pressure DH network downstream DH pumps (refer to DH supply limit to Plant stated in Appendix A18 Limits of Supply)	Nominal: 16 bara min.: 8 bara max.: 23.5 bara
	Design temperature DH network	130°C
	Maximum supply temperature	105°C
	District heating return temperature range	60-70°C Nominal 67°C
	District heating supply temperature range (possible operation)	80-105°C Nominal 90°C
	Typical Winter operation	67 return → 95°C supply

Table for Process and Design Data, General
Appendix A13

Reference	Line Component / Parameter	Value / Description
	Typical Summer operation	67 return → 85°C supply
	Design Flow Velocity for DH pipes	3.5 m/s (@ maximum heat output, bypass operation, with winter DH temperatures)
	Maximum total pressure loss (@ maximum heat output, bypass operation, with winter DH temperatures): - DH pipe outlet to DH pipe inlet through outer walls of existing DH building (including condensers, exterior and interior pipework, valves, etc., refer to DH supply limits in Appendix A18 <i>Limits of Supply</i>)	1.5 bar
	Maximum pressure difference between cold and hot connection to summer cooler at main DH pipe (connection located between existing DH building and Line).	2 bar
A1: sec. 10.4.1	Water Supply	
	Velocity in water pipes	Max. 1 m/s
	Fresh water - Water pressure - Water temperature, winter - Water temperature, summer	4-5 bara 5-15°C 16-21°C
A1: sec. 10.4.8	Electrical Supply	
	Medium voltage power supply	22/6,3 kV AC
	Low voltage power supply	400/230 V AC alternatively another
	Safe Supply (UPS)	2 UPS units for safe power 400/230 V AC
	Emergency power supply	400/230 V AC
	Control Voltage	230V AC /220 V DC/24V DC
	CMS Control Voltage	24 DC

3. PROCESS AND DESIGN DATA, INCINERATOR/BOILER

Table for Process and Design Data, Incinerator/boiler		
Appendix A13		
Reference	Line Component / Parameter	Value / Description
Appendix A2	Incinerator / Boiler	
A2: sec. 2.1	Feed Hopper	
	Hopper opening area	<p>The length of the slant opening of the hopper shall minimum be equivalent to the width of the waste grab in open position. The grab may thus not drop waste directly into the chute but shall drop all waste onto the slanted part without spillage.</p> <p>Minimum three sides of the hopper shall have angled sides.</p> <p>The width of the hopper should be 2 meter wider (minimum 0.8 m) than the width of the grate.</p> <p>The front of the hopper shall have an angle of approximately 55-60 degrees.</p>
	Volume	Min. 1 hour capacity
	Material thickness, steel plates	Min. 8 mm (preferably 12 mm), depending on the structural reinforcement
	Blockage detection	Min. 2 radar sensors
A2: sec. 2.2/2.3	Waste Chute	
	Height of chute	Min. 4-5 m
	Minimum depth of refuse chute	Min. 1 m (preferably 1.5 m)
	Cut-off gate drive	Hydraulic
	Material thickness, steel plates	> 8 mm
	Level measuring equipment	Micro-wave or gamma ray
A2: sec. 2.4	Waste Feeder	
	Pusher drive	Hydraulic
A2: sec. 3	Grate	
	Grate drive	Hydraulic
	Min. number of access doors to grate	2
	Access door to grate, minimum dimension (W x H)	1.50 m x 1.80 m
A2: sec. 4.2	Primary Air	
	Ducts for combustion air:	
	Material thickness	Min. 4 mm
	Air velocity	Max. 15 m/sec

Table for Process and Design Data, Incinerator/boiler
Appendix A13

Reference	Line Component / Parameter	Value / Description
A2: sec. 4.3	Secondary Air	
	Ducts for combustion air:	
	Material thickness	min. 4 mm
	Air velocity	Max. 15 m/sec
A2: sec. 4.4	Primary and Secondary Air Fan	
	Design specifications for Primary and Secondary Air Fans	Fan and motor shall be designed for 15 % excess capacity relative to the nominal load point (LP1) with $\lambda = 1.8$. Pressure head shall be increased with respect to the 15 % excess capacity.
	Primary Air Fan:	
	Primary air fan speed at nominal load point with $\lambda = 1.8$	Max. 1500 rpm
	Minimum wall thickness of the housing	Min. 6 mm
	Secondary Air Fan:	
	Secondary air fan speed at nominal load point with $\lambda = 1.8$	Max. 1500 rpm
A2: sec. 4.5	Air Pre-heater	
	Air temperature increase at nominal load point with $\lambda = 1.8$	-10 °C to design temperature
	Driving steam condensate return temperature	60-110°C
	Construction	Bare tube structure / unfinned
	Free distance between tubes	min. 15 mm
	Cleaning system	Water spray
	Drains	Yes
A2: sec. 6-7	Primary and Secondary Combustion Chambers	
	Excess air ratio To be calculated as $21/(21-O_2)$, where O_2 specifies the oxygen content in flue gas on dry basis (% vol.) for the purposes of calculating chamber dimensions	$\lambda=1.8$
	Variation of CO-content at outlet of secondary combustion chamber	Max. factor 2 across a cross section
A2: sec. 8	Refractory/Ceramic lining/Inconel Cladding	
	Minimum SiC (Silicon Carbide) - content in areas with $t \geq 900$ °C	$\geq 90\%$
	Minimum Al_2O_3 (Aluminium Oxide) - content in areas with $t < 900$ °C	$\geq 60\%$
	Inconel cladding until temperature level in flue gas	≤ 850 °C

Table for Process and Design Data, Incinerator/boiler
Appendix A13

Reference	Line Component / Parameter	Value / Description
	Inconel requirements must meet VGB standard	VGB-S-013-00-2017-04-EN
	Degree of dilution	The iron content in the surface must not exceed 5%
A2: sec. 9	Boiler	
	Access doors	Min. 800x800 mm
	Boiler drum, no. of doors	2 (one at each end of drum)
	Superheater and evaporators in convection pass	
	First section: Transverse tube pitching	Min. 160 mm
	Subsequent sections: Transverse tube pitching	Min. 120 mm
	All sections: Longitudinal tube pitching	Min. 120 mm
	Economizer	
	Transverse tube pitching	Min. 100 mm
	Longitudinal tube pitching	Min. 100 mm
	Minimum distance between evaporator-, superheater- and economizer sections:	Min. 800 mm
	Pressure in furnace chamber	
	Lowest permissible pressure in furnace chamber	Max. -5,000 Pa
	Membrane tube walls	
	Tube Pitching	Max. 80 mm
A2: sec. 10.1	Blow down and drainage system	
	Maximum temperature to IBA wastewater pit	65 °C
A2: sec. 10.5	Water and Steam data	
	Steam quality	In accordance with VGB guideline no. 450 L ("Normalstufe")
	Steam pressure at inlet to turbine stop valve - Nominal	40 bara

Table for Process and Design Data, Incinerator/boiler
Appendix A13

Reference	Line Component / Parameter	Value / Description
	- Variation	Acc. to IEC ¹ 60045-1
	Steam temperature - Nominal - Variation	400 °C Acc. to IEC 60045-1
	Steam flow Max. steam flow variation	Max. steam flow variation: - 92% of all 1 minute values within a 14 days period are within 5% of the relative setpoint. - 3% of all 1 minute values within a 14 days period are within 5-8% of the relative setpoint. - 3% of all 1 minute values within a 14 days period are within 8-10% of the relative setpoint. - 2% of all 1 minute values within a 14 days period are +10% of the relative setpoint.
A2: sec. 10.6	Flue gas Temperature Conditions*	
	Flue gas temperature downstream first pass at the end of the guaranteed minimum continuous operation period	Max. 900°C
	Flue gas temperature upstream the surface of a possible evaporator "cooling trap" at the end of the guaranteed minimum continuous operation period	Max. 650°C
	Flue gas temperature upstream the first superheater surface at the end of the guaranteed minimum continuous operation period	Max. 625°C
	Flue gas temperature at boiler outlet	Min. 170°C Nominal 170°C Maximum 190°C
	*(Maximum temperature limits shall be valid also after 8,760 hours operation, without manual boiler cleaning. Online cleaning frequency during Guarantee period: a) Water spray cleaning max one cleaning sequence per 24 h b) Mechanical rapping max one cycle per shift (8 h)	
A2: sec. 10.7	Flue Gas Velocity Conditions	
	First pass, secondary combustion chamber	Max. 3.5 m/s
	Second pass	Max. 6 m/s
	Third pass	Max. 4 m/s
	Horizontal convection part	Max. 6 m/s

¹ The International Electrotechnical Commission (IEC) prepares and publishes International Standards for all electrical, electronic and related technologies.

Table for Process and Design Data, Incinerator/boiler
Appendix A13

Reference	Line Component / Parameter	Value / Description
	Velocity in the flue gas ducts	Max. 15 m/s
A2: sec. 10.8	Auxiliary and Start-up Burners	
	Fuel	Natural gas
	Capacity, percentage of rated thermal boiler input	60%
	Number of burners	Min. 2
	Burner modulation, each burner	Min. 1:10
A2: sec. 10.9	Make-up Water System	
	Make-up water quality	Boiler make-up water Acc. to industry standard EN 12952-12
	Capacity of make-up water plant	Complete filling of the boiler within 24 hours
	Volume of make-up water tank	min. 120% of ordinary water content of boiler
A2: sec. 11	Feed water system	
	Net volume of de-aerator/feed water tank	Minimum 30 min. x nominal steam production
	Temperature in feed water tank	130 ± 3 °C
A2: sec. 12	Feed Pump System	
	Electrically driven pumps	Two pumps, each with 100% capacity, frequency-controlled and emergency power supplied by emergency generator(s).
	Diesel driven pump	One additional direct diesel engine driven pump, alternatively fed from emergency generator system with 100% capacity
	Maximum rate of pressure rise during boiler start-up (inlet of boiler economizer)	2 bar/minute
	Flow Velocity	
	Maximum values at maximum flow (at 100 % load)	
	Saturated steam	25 m/s
	Superheated steam	50 m/s
	Feed water and condensate (pressure pipe)	5 m/s
	Feed water and condensate (suction pipe)	2 m/s
A2: sec. 13	Component cooling system	
	Content of propylene glycol (in water/glycol mixture)	41 %

Table for Process and Design Data, Incinerator/boiler
Appendix A13

Reference	Line Component / Parameter	Value / Description
	Cooling glycol supply temperature	max. 35 °C
	Cooling glycol return temperature	min. 39 °C
	Design pressure of cooling glycol circuit	6 barg
	Operating pressure at interfaces to existing cooling glycol supply	1.8 barg
	Employer's Existing Component cooling system	
	Content of propylene glycol (in water/glycol mixture)	41 %
	Design outdoor temperature (@ glycol temperature 35/41,2 °C)	30.6 °C
	Cooling glycol supply temperature	nom. 33 °C
	Cooling glycol return temperature	nom. 39 °C
	Maximum permissible glycol temperature	45 °C
	Design pressure of cooling glycol circuit	10 barg
	Static operating pressure	1.8 barg
	Volume of existing glycol tank	16 m ³
	Maximum permissible pressure of existing glycol tank	6 barg
	Cooling capacity of existing component cooling system available for the Line	500 kW
A2: sec. 14	Boiler ash transport system	
	Collection boiler	Mechanical
	Transport from boiler to end product silo 1 and 2	Mechanical or pneumatic
	Sampling (pneumatic part)	Inspection ports for sampling
A2: sec. 15	IBA Handling System	
	Ash content in waste	Max. 30%
	Water content in bottom ash downstream extractor	Max. 20% wt. basis
A2: sec 16.1	Technical water tank	
	Quantity	1
	Net capacity of pit/tank	25 m ³
A2: sec 16.2	Wastewater pit	
	Quantity	1
	Net capacity of pit	50 m ³
A2: sec 18.4	Hydraulic System	
	Capacity of hydraulic system	110%

4. PROCESS AND DESIGN DATA, FLUE GAS TREATMENT

Table for Process and Design Data, Flue gas treatment		
Appendix A13		
Reference	Line Component / Parameter	Value / Description
Appendix A3	Flue gas treatment	
A3	Raw Flue Gas	
	Referring to flue gas downstream boiler	
	Nominal load data (100%) ¹⁾	
	Flue gas flow rate, wet, actual O ₂ ²⁾	85,800 Nm ³ /h
	Flue gas flow rate, dry at 11% O ₂	91,400 Nm ³ /h
	Temperature	170 °C
	Pressure	– 1,000 Pa
	H ₂ O	14.9 % vol.
	O ₂	8.5 % vol., dry
	Dust	2,200 mg/Nm ³ , 11 % O ₂ , dry
	Σ Cd + Tl	1 mg/Nm ³ , 11 % O ₂ , dry
	Σ Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V	50 mg/Nm ³ , 11 % O ₂ , dry
	HCl	840 mg/Nm ³ , 11% O ₂ , dry
	SO ₂ and SO ₃ (as SO ₂)	360 mg/Nm ³ , 11 % O ₂ , dry
	HF	20 mg/Nm ³ , 11 % O ₂ , dry
	NO _x as NO ₂ ³⁾	120 mg/Nm ³ , 11 % O ₂ , dry
	NH ₃ ³⁾	10 mg/Nm ³ , 11 % O ₂ , dry
	Hg	0.2 mg/Nm ³ , 11 % O ₂ , dry
	Dioxins and furans (tox. equivalent 2,3,7,8 TCDD)	2 ng/Nm ³ , 11 % O ₂ , dry
	¹⁾ Nominal values to be used as reference for guarantee values (at nominal) of consumables, residues, and energy production and consumption etc. Values apply at boiler exit ²⁾ Wet flue gas at actual O ₂ content ³⁾ after SNCR-deNO _x	
	Dimensioning data, process ¹⁾	
	Min. Flue gas flow rate, wet flue gas at actual O ₂ -content	No higher than 60,100 Nm ³ /h
	Max. flue gas flow rate, wet flue gas at actual O ₂ -content	No less than 101,100 Nm ³ /h
	Flue gas flow rate, dry at 11% O ₂ , dry	63,900-100,500 Nm ³ /h
	Temperature ²⁾	160 – 200 °C
	Pressure ²⁾	– 2,500 Pa
	H ₂ O	10 – 24 % vol.
	O ₂ ²⁾	6 – 10 % vol., dry
	Dust ²⁾	500-5,000 mg/Nm ³ , 11% O ₂ , dry
	Σ Cd + Tl ²⁾	Max. 5 mg/Nm ³ , 11% O ₂ , dry
	Σ Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V ²⁾	Max. 200 mg/Nm ³ , 11% O ₂ , dry
	HCl	50 – 2,500 mg/Nm ³ , 11% O ₂ , dry

Table for Process and Design Data, Flue gas treatment
Appendix A13

Reference	Line Component / Parameter	Value / Description
	SO ₂ and SO ₃	0 - 1,500 mg/Nm ³ , 11% O ₂ , dry
	HF	0 - 50 mg/Nm ³ , 11% O ₂ , dry
	NH ₃ ²⁾	0 - 20 mg/Nm ³ , 11% O ₂ , dry
	Hg	Max. 0.5 mg/Nm ³ , 11% O ₂ , dry
	Dioxins and furans (tox. equivalent 2,3,7,8 TCDD) ²⁾	Max. 10 ng/Nm ³ , 11% O ₂ , dry
	¹⁾ Minimum and maximum dimensioning values refer to continuous load based on half hour average. i.e. there may be short term peaks exceeding stated values. Values in general apply at boiler exit. When raw gas values are outside range, environmental guarantees and guarantees of consumption do not apply, but no damage or corrosion may be ascribed to exceeding raw gas values. ²⁾ preliminary values, subject to Contractor responsibility.	

Table for Process and Design Data, Flue gas treatment
Appendix A13

Reference	Line Component / Parameter	Value / Description
A3: sec. 2	Reactor	
	Gas outlet temperature	min. 135°C
A3: sec. 2	Baghouse Filter	
	Dust content downstream filter (dry flue gas at 11% O ₂) - 12 hours average	Max. 5 mg/Nm ³
	Specific filter area load at maximum flue gas flow all n chambers in operation	<0.8 am ³ /min/m ²
	Specific filter area load at maximum flue gas flow with n-1 chambers in operation	<1.0 am ³ /min/m ²
	Maximal preheating time from cold conditions	8 hours
	Flue gas temperature in bag house filter in any given point.	Min 120 °C
	Minimum design temperature	220 °C
	Gas velocity through filter bags at nominal load (LP1)	max. 0.8 m/min
A3: sec. 3	Low-Temperature Economizer and Flue Gas Condensation (Option 1)	
	Low temperature Economizer (LT-ECO)	
	Flue gas temperature out, nominal	90°C
	District heating temperature in / out nominal	Refer to nominal DH temperatures.
	District heating max outlet	105°C
	Corrosion protection, tubes	Enamel+PFA or similar
	Flue Gas Condenser	
	Net heat recovery from flue gas condensation at LP1 and with nominal DH temperatures	min. 6 MW
	Heat pump system	
	MP steam available from Existing facility as driving heat source at interface - Nominal temperature - Maximum temperature - Nominal pressure - Pressure variation	215 °C 250 °C 11.0 bara 8-11.5 bara
	Condensate return from heat pump to condensate tank for Existing facility - Temperature - Pressure	Max 95°C Atmospheric pressure
	Flue Gas Condensate System	
	Minimum condensate tank capacity ref. max. flow of produced condensate	15 min
	Reheater	
	Minimum temperature increase capability Flue gas reheater	10 °C

Table for Process and Design Data, Flue gas treatment
Appendix A13

Reference	Line Component / Parameter	Value / Description
A3 sec. 4	Induced Draught Fan	
	Revolutions	Max. 1,100 rpm. at nominal flow rate.
	Fan capacity (pressure increase corresponding to the inclusion of option LT ECO and Flue Gas Condensation.)	The fan(s) shall be selected for a flow rate of 1.3 times the nominal flow rate and the corresponding pressure increase, as a minimum.
	Number of motors	1 or 2
	Motor power	The motor(s) shall have a total operational capacity of 110% of the power needed at the dimensioning capacity.
	Maximum ramping down time from max power load to 20% of speed in situ	60 sec
A3: sec. 6.1	Ducts	
	Max. flue gas velocity	15 m/s, actual conditions
	Construction materials	Min. 6 mm steel plates or where the conditions so require, glass fibre re-enforced plastic materials. Choice of materials shall reflect operational condensation temperatures and acid dew points.
A3: sec. 6.2	Stack	
	Height above ground level to be defined as a part of the EIA	125 m
	Existing stack pipe cavity, diameter	1.6 m
	Flue gas exit velocity at nominal load	Max. 22 m/s, actual condition
	Materials, flue gas pipe and inner liner	Choice of materials shall reflect temperatures at normal and abnormal operation.

5. PROCESS AND DESIGN DATA, TURBINE/GENERATOR

Table for Process and Design Data, Turbine/generator		
Appendix A13		
Reference	Line Component / Parameter	Value / Description
Appendix A4	Turbine/generator set	
A4: sec. 1	Availability of the steam turbine and Line synchronous generator	a minimum of 8,700 h /year while keeping the requirements as per Appendix II.g Guarantees
	Preliminary steam data	
	Nominal load (100%) Steam flow	Maximum continuous flowrate (MCR) set point (LP2) in boiler capacity diagram
	Expected MCR steam flow	15.5 kg/s
	110% load steam flow	17.1 kg/s
	70% load steam flow	10.9 kg/s
	Steam flow rates possible	Low: Island mode High: 110% of boiler MCR
	Steam pressure (inlet of Emergency shut-off valve, controlled by turbine inlet nozzle group)	40 bara
	Steam temperature during start-up (maximum up to 500 hrs after boiler cleaning)	320°C
	Steam temperature nominal at turbine inlet	400 °C
	Max. steam temperature variation	ACC. to IEC 60045-1
	Swallowing capacity for turbine	Corresponding to live steam flow at 110% MCR
	Swallowing capacity for bypass system	Corresponding to live steam flow at 110% MCR with no auxiliary steam reduction
	Max. steam flow variation	At least 90% of all 1 minute mean values from a 14 days period within +/-5% relative to set point
	Steam Pressure variation normal operation (continuous waste fired boiler operation)	+/- 0.2 bara
	Steam quality (chemical)	VGB-S-010-T-00;2011-12.EN
	Steam quality (mechanical)	VGB R 513-00-2014-07-EN
	Maximum temperature of condensate to feed water tank/deaerator	110 °C
	Island mode	

Table for Process and Design Data, Turbine/generator
Appendix A13

Reference	Line Component / Parameter	Value / Description
	Electricity demand, Island Mode	Contractor to determine during detailed engineering
A4: sec. 3	Turbine bleeds (design)	
		Approx. 5 bara to supply steam to: - air preheater - de-aerator
A4: sec. 11	Turbine bypass station	
	Steam downstream turbine bypass station Temperature	Lower limit: Saturation + 5-10 °C
	Steam capacity	10-110% nominal steam from boiler. Zero auxiliary steam use to be assumed.
A4: sec. 13	District Heating condensers	
	Hydraulic capacity of district heating condensers / DH system	-Live steam flow of 110% of MCR -Bypass operation (no turbine) -DH temperature difference of 11°C over DH condenser.
	Maximum capacity at DH export connection interface	-Live steam flow of 110% of MCR -Bypass operation (no turbine) -LT-ECO in operation -Flue gas condensation in operation -DH temperature difference of 17°C over the Line producers.
	Tolerance on DH forward temperature	±2 °C from set point
	District heating water quality	Refer to Appendix E2, <i>Quality of Water Flows</i> .
	Pressure vessel design code in general	EN 13345
	Type	Shell and U-tube heat exchangers with district heat water in the tubes
	Materials: • Shell and water boxes • Tubes • Tube sheets	Mild steel Stainless steel Solid stainless or stainless steel plated
A19: sec. 2.9	Summer coolers	
	Capacity of summer coolers @ - 100/70°C forward/return DH temp.	30 MW

Table for Process and Design Data, Turbine/generator
Appendix A13

Reference	Line Component / Parameter	Value / Description			
	- 30°C ambient air temperature & 25% relative humidity				
	Nominal DH temperature, in	82°C			
	Nominal DH temperature, out	Max. 67°C			
	Hydraulic capacity:	To match the cooling capacity at the Contractor’s design DH temperature out			
	Load points				
	The Tenderer shall supply energy and mass balances the following load points both with and without Option 1 included and in operation:				
	Load point	Name	Live Steam turbine (% MCR)	Live steam bypass (% MCR)	DH return/supply*
	1	Nominal	100%	0%	69/83°C
	2	High forward	100%	0%	69/90°C
	3	Very high forward	100%	0%	69/95°C
	4	Low dT	100%	0%	69/80°C
	5	70% load	70%	0%	69/83°C
	6	Max forward	100%	0%	69/105°C
	7	Low DH return T	100%	0%	60/83°C
	8	110% steam load	110%	0%	69/90°C
	9	110% turbine bypass + high DH flow	0%	110%**	69/83°C
	10	70 % turbine load + low DH flow	70%	0%	69/105°C
	11	Power island mode	To sustain estimated 1 MWe generated power	Supplier design	0 MJ/s
	* DH temperatures are at DH supply limits of the Line, refer to Appendix A18 <i>Limits of Supply</i> . I.e the connection points for the Line to the Employer’s existing DH system. ** Based on 110% live steam supply to be split between de-aeration steam (reduction station outside scope) and the live steam bypass.				

6. PROCESS AND DESIGN DATA, AUXILIARY EQUIPMENT

Table for Process and Design Data, Auxiliary Equipment		
Appendix A13		
Reference	Line Component / Parameter	Value / Description
A5: sec. 4	Waste cranes	
	Number of cranes	2 fully automated cranes for the new Line and Existing facility.
	Grab size	Min. 8 m ³
	Crane lifting capacity	Min. 12 t
	Precision of weighing system	+/- 2% of actual weight in the complete scale range
	Crane rail	DIN 536
	Crane rails, clamps and base material	VDI 3576
	Tolerances for crane rails	VDI 3576 Tolerance Class 1
	Crane capacity (pr. crane in automatic mode)	
	Charging hopper (nominal)	45 t/h
	Mixing	75 t/h
	Maximum hourly supply of delivered waste to be removed from the unloading bays and redistributed	200 t/h
A5: sec. 4	Hoppers of existing Lines K2 and K3	
	Dimensions	Refer to Appendix E7 <i>Waste hopper drawings for Existing Plant</i>
A5: sec. 4	Waste crane availability	
	Operational availability of crane system (common system for Line K1, Line K2 and Line K3)	8760 hours/year
	Operational availability of each of the two individual crane systems (cranes are not considered available while performing service and maintenance)	8700 hours/year
	Availability of crane system in unmanned full automatic mode (common system for Line K1, Line K2 and Line K3)	8700 hours/year
	Maximum number of required interventions in evening, night and weekends, due to malfunctions of unmanned full automatic operation system.	Within any period of 2 months the crane system shall operate for at least 30 evenings/nights of 16 consecutive hours and 5 whole weekends (weekend of 48 consecutive hours) without it is required that the operating staff intervenes.
	Maximum number of required interventions in working days due to malfunctions of unmanned full automatic operation system	Within any period of 5 consecutive working days the crane system shall be able to operate with a maximum of:
	Interventions due to unnormal operation due	

Table for Process and Design Data, Auxiliary Equipment
Appendix A13

Reference	Line Component / Parameter	Value / Description
	to nonconforming waste shall not be taken into account.	a) 4 required interventions per day in connection with change of tasks. b) 1 required intervention not due to change of tasks.
A5: sec. 4	Waste composition	
	Waste density in grab to be used for calculation of waste crane capacity.	600 kg/m ³
	Waste density in grab to be used for calculation of design load.	min. 850 kg/m ³
A5: sec. 4	Construction for Waste cranes	
	Load- carrying structure safety factor	Normal
	FEM Crane 1.001 class	A8
	FEM Mechanisms classification as per ISO norm:	
	- Hoist	M8
	- Crane travelling drive	M7
	- Trolley traversing drive	M7
	DIN Crane classes	H4, B6
	DIN Mechanism Groups	
	- Hoist	5m
	- Crane travelling drive	4m
	- Trolley traversing drive	4m
	Lifting speed, lifting gear with full grab	70 m/min
	Driving speed, trolley	80 m/min
	Driving speed, bridge	80-100 m/min
	Safety class	Normal
	Design lifetime	25 years
	Length of runways (approx.)	To be designed to achieve full coverage of new and existing bunkers and crane maintenance decks with both cranes.
	Span of crane bridge	To be designed according to building dimensions.
	Lifting height	To be designed according to building dimensions.

Table for Process and Design Data, Auxiliary Equipment
Appendix A13

Reference	Line Component / Parameter	Value / Description
A5: sec. 2.3.1	Firefighting equipment in waste bunker (existing and new bunker)	
	Number of water spraying cannons	Minimum 3 large water cannons to cover the entire bunker. 3 smaller water cannons or powerful sprinklers to cover hoppers
A5: sec. 5.2	Turbine hall service crane	
	Number of cranes	1 overhead crane
	Length of runways	To be designed according to building dimensions.
	Span of crane bridge	To be designed according to building dimensions.
	Hoisting height	To be designed according to building dimensions.
	Lifting capacity for maintenance works (not installation).	Heaviest item for maintenance, however min. 10 t. Supplier to guarantee lifting capacity is sufficient for all maintenance works on turbine, including lifting upper turbine casing parts, control valve bodies, turbine rotor, generator parts etc. Excepted are parts as bottom of casing and generator stator which normally are not removed for maintenance. Parts shall be removable out of the turbine hall without removing façade elements (i.e. shall be moved from turbine hall through suitable service opening in the turbine hall floor or doors)
A5: sec. 7	Compressed Air (Available from existing compressed air station)	
	General	Compressed air quality according to ISO 8573-1:2010.
	Process air	
	ISO 8573-1 Quality class	[1:-:1] No drying is applied.
	Pressure at the output pressure measurement at the compressors	8 bar(g)
	Instrument air	
	ISO 8573-1 Quality class	[1:2:1]
	Pressure at the output pressure measurement at the compressors	8 bara

Table for Process and Design Data, Auxiliary Equipment		
Appendix A13		
Reference	Line Component / Parameter	Value / Description
A7: sec. 7	Camera monitoring system (CCTV)	
	Total number of new cameras to be included in the process and building surveillance of the Line (positioning of cameras shall be coordinated with the Employer)	20

7. CIVIL WORKS

The Contractors filled-in Room Data Sheet (see part 0.h Room Data Sheet) are to be completed and handed over before Contract signing.