

SkoEnerg

OB 2 Boiler Houses

Contractor's Technical Specification

Rev.1

09.09.2024

Table of Contents

1.00 COVERING LETTER, EXECUTIVE SUMMARY
2.00 DELIVERY LIMITS AND SCOPE OF SUPPLY
3.00 NA
4.00 DESING DATA
5.00 NA
6.00 PERFORMANCE INFORMATION
7.00 LIFECYCLE AND INDUSTRIAL INTERNET SERVICES
8.00 PROCESS DESCRIPTION
9.00 EQUIPMENT SPECIFICATION
10.00 INSTRUMENTATION & CONTROL
11.00 ELECTRIFICATION
12.00 CIVIL AND STRUCTURAL
13.00 HEALTH, SAFETY AND ENVIRONMENT
14.00 SPARE PARTS
15.00 ERECTION
16.00 QUALITY
17.00 TRAINING, START-UP AND COMMISSIONING
18.00 PROJECT EXECUTION
19.00 LAYOUTS
20.00 FLOWSHEETS
21.00 NA
22.00 REFERENCES



TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR

Refurbishment of the Combined Heat and Power Plant
in Mladá Boleslav

Business Package OB 2

BOILER HOUSES, BIOMASS BOILER K20

VOLUME III *TECHNICAL REQUIREMENTS*

Annex 01 Executive Summary

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 2/6
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Contents

1 EXECUTIVE SUMMARY	3
1.1 Valmet in brief	3
1.2 Proposal summary	3
1.3 Valmet BFB boiler, Bubbling Fluidized Bed technology	5
Operational Services and Valmet Industrial internet (VII)	6

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 3/6
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1 EXECUTIVE SUMMARY

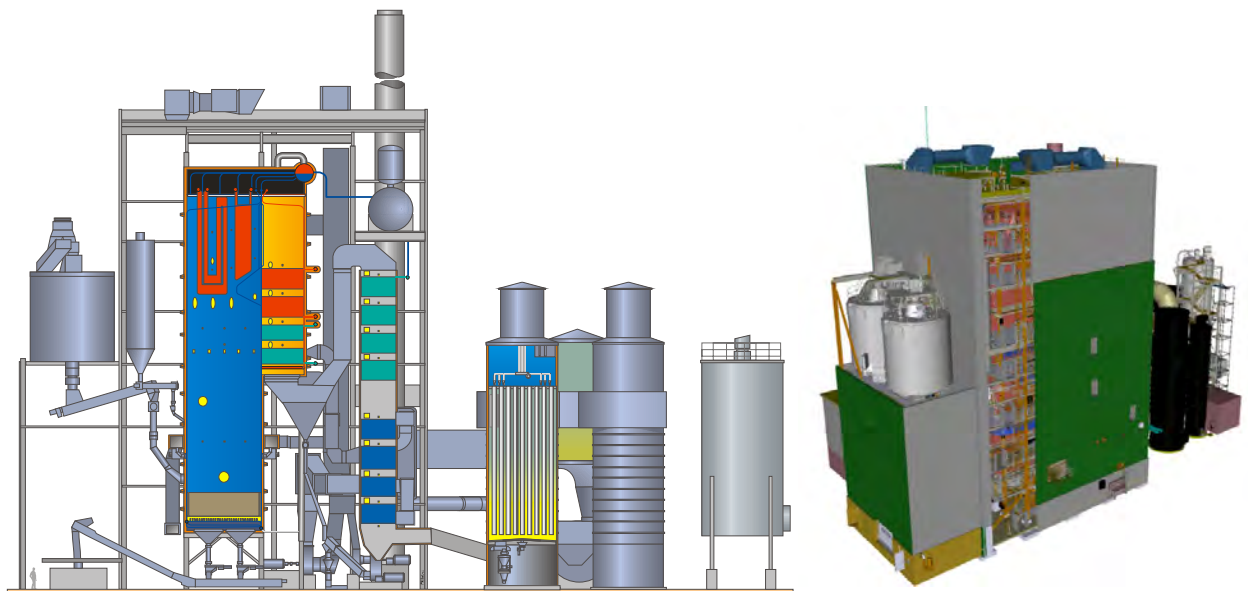
1.1 Valmet in brief

Valmet is the leading global developer and supplier of process technologies, automation and services for the pulp, paper and energy industries. Valmet's strong technology offering combined with advanced services and automation solutions improve the reliability and performance of customers' processes and enhance the effective utilization of raw materials and energy.

Valmet's 17,500 professionals around the world work close to our customers. The company has over 220 years of industrial history. Valmet's annual net sales are approximately EUR 5 billion. Valmet's head office is in Espoo, Finland and its shares are listed on the Nasdaq Helsinki

1.2 Proposal summary

Valmet proposes to provide a Valmet Bubbling Fluidized Bed boiler with dry flue gas treatment and other boiler auxiliary equipment for SkoEnergo. The boiler is fired by woodchips and it is designed to generate 80 t/h steam at 125 bar and 535°C from the feed water at 210 C (min.160 C). Flue gas treatment equipment includes a Valmet bag house filter with hydrated lime injection. The EPC based delivery includes engineering, project execution, manufacturing, freight, commissioning and training, quality control, electrification and instrumentation, boiler house including electric building, piping and installation.



Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 4/6
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Main technical benefits of Valmet BFB boiler plant:

- **Unbeatable BFB experience - Own BFB technology with +220 references**
 - ✓ In-house R&D and latest know-how utilized
 - ✓ Numerous references with similar fuels and capacity with excellent performance
 - ✓ Each Valmet boiler is tailor-made based on actual project characteristic

- **Highly reliable design features – Proven availability**
 - ✓ Water cooled HYBEX furnace - reliable discharge of impurities such as stones, gravel and other impurities from the furnace
 - ✓ Robust fuel feeding and ash handling systems, all critical equipment from proven subsuppliers
 - ✓ Low flue gas flow velocities and high alloy superheater materials – Safe superheater design against corrosion & erosion
 - ✓ No horizontal flue gas duct sections prior to bag filter – no risk of ash blockages in the flue gas duct and unscheduled shutdowns
 - ✓ Separate fly ash silo for K20 near the boiler – short lengths of pneumatic ash pipes
 - Low compressed air consumption in ash conveying
 - Low risk of ash blockages
 - Less maintenance

- **High efficiency and environmental performance**
 - ✓ High combustion efficiency and low NO_x and CO emissions
 - ✓ Valmet own Bag house filter - In-house technology in bag filter manufacturing
 - ✓ Dry sorption BHF with hydrated lime injection to reduce acidic gas emissions if necessary

- **Optimized layout for SkoEnergo**
 - ✓ Small footprint – reduced foundation costs
 - ✓ All main equipment within easy reach for service

- **Connectivity to Valmet Industrial Internet (VII)**
 - ✓ Possibility to on demand expert support by remote connection and regular performance evaluation
 - ✓ Platform for VII applications that could be upgraded in the future

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 5/6
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.3 Valmet BFB boiler, Bubbling Fluidized Bed technology

HYBEX is a trade mark for Valmet's Bubbling Fluidized Bed (BFB) boiler.

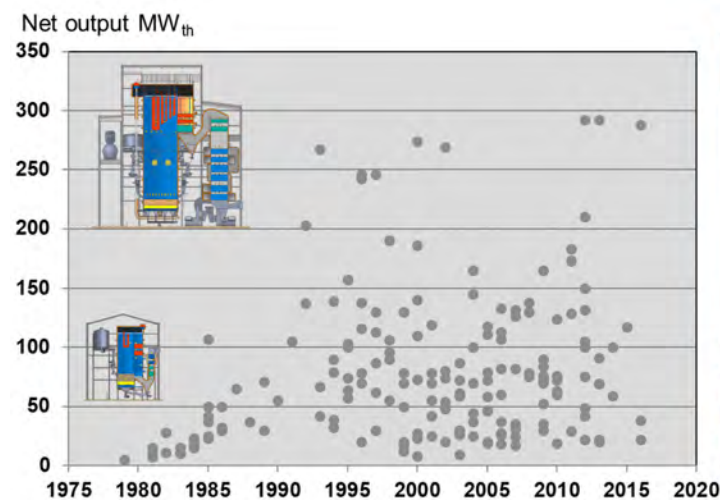
Wide range of fuels

All the available heat in the fuel can be utilized to maintain the combustion temperature in the BFB process and therefore also fuels with low heating value can be burned in the HYBEX boiler.

The HYBEX boilers are suitable for a wide range of fuels with varying heating value and moisture content, such as bark, wood chips, sawdust, forest residue, peat, rice husk, recycled fuel, rejects and sludges.

Experience

Valmet is the leading manufacturer of bubbling fluidized bed boilers with more than 220 deliveries of new BFB boilers and fluidized bed conversions to pulp and paper industry and green power producers worldwide.



BFB boiler deliveries up to 300 MW_{th} / Kymin Voima power plant, Finland

Robust design with maximized availability

Straightforward, robust design and proven technology of BFB boilers keep the unplanned shutdowns and repair costs to a minimum in industries where continuous operation is essential. A patented Hydro Beam floor was developed to counter challenges caused by increasingly demanding fuels.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 6/6
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

The totally water-cooled air beam design features efficient removal of coarse material from the furnace. In boilers with Hydro Beam floor, a total of over 30% of the furnace bottom area is open for removal of impurities, compared to only 1% in conventional designs.



Operational Services and Valmet Industrial internet (VII)

Valmet Industrial Internet provides a platform to modern data driven optimization solutions that can be extended to improve performance of the plant. Combined with our know-how in process technology, automation and services, our customers can turn their data into an asset for decision making.

Valmet Industrial Internet – Solutions for Energy

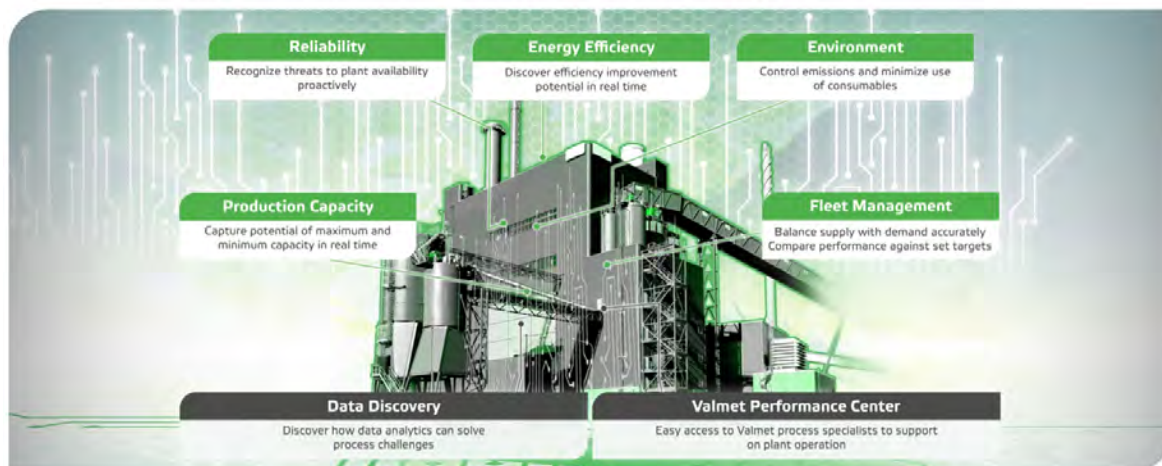


Figure 1: Overview of our offering of the applications and services



Table of Contents

1 EXECUTIVE SUMMARY	2
1.1 Valmet in brief	2
1.2 Pulp and Energy business line	2
1.3 Valmet CFB boiler, Circulating Fluidized Bed technology	3
1.4 Lifecycle and Industrial Internet services	5
1.5 Proposal summary	5



1 EXECUTIVE SUMMARY

1.1 Valmet in brief

Valmet is the leading global developer and supplier of process technologies, automation and services for the pulp, paper and energy industries. Valmet's strong technology offering combined with advanced services and automation solutions improve the reliability and performance of customers' processes and enhance the effective utilization of raw materials and energy.

Valmet's 17,500 professionals around the world work close to our customers. The company has over 220 years of industrial history. Valmet's annual net sales are approximately EUR 5 billion. Valmet's head office is in Espoo, Finland and its shares are listed on the Nasdaq Helsinki.

1.2 Pulp and Energy business line

Our pulp and energy solutions help purchasers to maximize the value of renewable raw materials while increasing production efficiency and minimizing environmental impact. For pulp production, Valmet offers entire pulping lines, from wood handling and fiber processing to chemical recovery and pulp drying. Our heat and power generation solutions focus on fluidized bed boilers or gasifiers fueled by biomass, waste or multiple fuels. We also offer environmental protection systems and new innovative biotechnology solutions.

1.3 Valmet CFB boiler, Circulating Fluidized Bed technology

Valmet CFB is a trade mark for Valmet's Circulating Fluidized Bed (CFB) boiler.

High fuel flexibility is the foremost advantage offered by the CFB boilers.



CFB boiler's combustion process

Experience

Valmet has supplied over 90 CFB boilers with steam capacities ranging from 50 to 550 MW. The supplied units have been designed to combust fuels ranging from 100% coal to 100% biomass and any combination in between.

Multi-Fuel Experience	
	Ref. units
Coal-based fuels	
Bituminous Coal	35
Brown coal (Lignite)	1
Petroleum Coke	5
Gob (Bituminous Coal Waste)	5
Culm (Anthracite Mining Waste)	1
Sub Bituminous Coal	3
Low calorific fuels	
Bark	
Peat	16
Sludge	2
Wood waste	17
Wood chips	2
Forest residue	4
Other fuels	
TDF (Tyre Derived Fuel)	8
RDF (Refuse Derived Fuel)	3



Alholmens Kraft, biofuel power plant, Finland, Steam capacity 550 MWth, start-up 2001.

High efficiency membrane cyclones

Cyclone design is the heart of the CFB process. The CFB boiler design is based on standard cyclone and loop seal components, both of which feature either water or steam cooled membrane wall design. Membrane cyclones have durable construction with very reasonable amount of refractory fixed to tube walls and small heat losses. CFB boiler cyclones feature a round shape and high separation efficiency.

Cylindrical cyclone with membrane wall

**Loop seal superheater**

In the CFB process superheater surfaces can be positioned in the loop seal in the cyclone return immersed in the bed material. A loop seal superheater is used in order to protect the superheater surface against corrosion or to provide additional heating surface in case of a high steam temperature requirement.

1.4 Lifecycle and Industrial Internet services

Lifecycle and Industrial Internet services support Customer to operate and maintain plant/mill with improved performance, reliability, and sustainability.

Valmet Industrial Internet services are a combination of data-driven solutions and expert support, which enable analyzing and optimizing the process performance and reliability. Industrial Internet services ensure easy access to Valmet's expert network providing a fast response and efficient cooperation. Regular performance evaluations will provide insights and recommended actions.

1.5 Proposal summary

Valmet proposes to provide two CFB rebuilds for Sko Energo existing Circulating Fluidized Bed boiler to allow transition to sustainable biofuels.

The boilers are rebuilt to generate 100 t/h of steam at 125 bar(g) and 535 °C with bio fuel from feed water at 205 °C. The main fuels for the boiler are wood chips and plant pellets (max 40% energy share of fuel input on all boiler loads). Boiler can occasionally fire Technological fuel from Skoda auto factory. Natural gas will be used as a start-up fuel.

The scope of supply includes the required changes in pressure part, auxiliary equipment, ducting and electrical and instrumentation according to this Technical Specification. Engineering, materials, manufacturing, freight, erection, commissioning, training and start up assistance for the supplied scope are included.



TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR

Refurbishment of the Combined Heat and Power Plant
in Mladá Boleslav

Business Package OB 2

BOILER HOUSES, BIOMASS BOILER K20

VOLUME III

TECHNICAL REQUIREMENTS

Annex 02 Scope of Supply

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 2/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Contents

.....	1
1 DELIVERY LIMITS AND SCOPE OF SUPPLY.....	3
1.1 Delivery limits	3
1.1.1 Mechanical and process	3
1.1.2 Civil and structural.....	5
1.1.3 Electrification.....	5
1.1.4 Instrumentation and automation.....	5
1.2 Scope of supply.....	5
1.2.1 HYBEX boiler	6
1.2.2 Electrification.....	11
1.2.3 Instrumentation and automation.....	12
1.2.4 Civil and structural.....	13
1.2.5 Lifecycle and Industrial Internet services	16
1.2.6 Project services.....	17

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 3/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1 DELIVERY LIMITS AND SCOPE OF SUPPLY

1.1 Delivery limits

1.1.1 Mechanical and process

The piping connections on the delivery limits are included in the scope.

1.1.1.1 Inlets

No	Media	Value
S20	Woodchips	Inlet of K20 fuel silo 1
S21	Woodchips	Inlet of K20 fuel silo 2
S3	Feedwater from K90	At the feed water line on the discharge side of the existing HP-preheater in the E1A building, elevation + 13,75 m
S4	Feedwater from K80	At the feed water line on the discharge side of the existing HP-preheater, in the E1A building, elevation + 13,75 m
S40	Natural gas	Connection at the existing natural gas pipe at the pipe bridge, located in the existing pipe bridge
	Combustion air	Inlet of suction duct
	Make-up sand	Inlet of sand silo filling pipe
S7	Cooling water	Existing cooling water line in the E1A building at level -3,75 m
	Chemical dosing (phosphate)	Inlet connection of the chemical tank
S36	Drinking water	in the E1 building
S34	Industrial water	0,5 meter above the ground level inside of the K20 boiler house
S15	Transport air	Connection at the existing transport air pipeline at the ground floor level in the E1 building
S41	Ammonia-water	Outlet of the additive dosing pump unit in the existing additive tank room
	Hydrated lime	Inlet of storage tank filling pipe

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 4/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.1.1.2 Outlets

No	Media	Description
S1	Main steam	At the main steam header in the E1A building, elevation + 13,75 m
S1a	Main steam connection for reduction station R3	Inlet of the existing reduction station in the E1A building, elevation + 13,75 m
S6	Boiler drains/reuse	Outlet blowdown tank drain pipe in the E1A building, elevation + 13,75 m
S6b	Main steam pipe drains	At the existing flash tank/expander in the E1A building
S7	Boiler drains /waste water	Outlet of the boiler blowdown tank overflow
	Superheater safety valves	Silencer outlet, above the boiler house roof
	Boiler vents	Outlet of vent steam pipe, 3 m above the boiler house roof
	Natural gas vent	Outlet of vent pipe, 3 m above boiler house roof
S8	Cooling water	Existing cooling water line in the E1A building at level -3,75 m
S11	Flue gas	Inlet opening of the existing stack
	Fly ash	Discharging equipment of the fly ash silo
	Bottom ash	Bottom ash containers (containers included)
S14a/b	Instrument air for K80/K90	Connection at the existing instrument air network at level +7,5 m in the boiler hall K80/K90
S17	Instrument air for OB1 on K80/K90	Connection at the location of the woodchip intake to silo K80/K90
S18	Instrument air for outdoor objects	Connection at the location of the woodchip intake to silo K20
S19	Instrument air for OB1	Connection at the location of the woodchip intake to silo K20
S16	Transport air (back up compressor in use)	Connection at the existing transport air pipeline at ground floor level in E1 building, same as S15

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 5/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.1.2 Civil and structural

See the Delivery limit drawing Appendix 02.01

1.1.3 Electrification

See the single line diagram Appendix 02.02

1.1.4 Instrumentation and automation

See the typical detailed drawings in Appendix 10.01

1.2 Scope of supply

Explanation for the abbreviations used in the following tables:

- V Contractor Scope
- C Client
- O Option (Contractor)
- NA Not applicable

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 6/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.2.1 HYBEX boiler

Scope of Supply	Qty	Process Design	Basic eng.	Detail eng.	Supply	Erection	Note:
BOILER							
Steam drum with internals	1	V	V	V	V	V	
Furnace		V	V	V	V	V	
2nd pass membrane walls		V	V	V	V	V	
Boiler internal piping		V	V	V	V	V	
Primary Superheater banks	3	V	V	V	V	V	
Secondary Superheater bank	1	V	V	V	V	V	
Tertiary superheater bank	1	V	V	V	V	V	
Spray water attemperators	3	V	V	V	V	V	
Spray water piping, valves	3	V	V	V	V	V	
Economizer	3	V	V	V	V	V	
MAIN STEAM							
Steam pipe up to main steam valve (main steam valve included)		V	V	V	V	V	
Steam pipe to boiler house wall		V	V	V	V	V	
Steam pipe from boiler house wall to the delivery limit in E1A building, including necessary piping supports (primary supports)		V	V	V	V	V	Piping to be supported from the existing structures
Steam piping for the connections to reduction station		V	V	V	V	V	Piping to be supported from the existing structures
BOILER ACCESSORIES							
Start-up valves	2	V	V	V	V	V	
Main steam safety valve(s)	2	V	V	V	V	V	
Exhaust piping up to silencer		V	V	V	V	V	
CBD piping		V	V	V	V	V	
Blowdown tank	1	V	V	V	V	V	
Blowdown tank drain pump	1	V	V	V	V	V	
Boiler drain and vent piping		V	V	V	V	V	
Access doors and inspection openings		V	V	V	V	V	
Manufacturer's sign plate		V	V	V	V	V	
Safety corner		V	V	V	V	V	

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 7/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Scope of Supply	Qty	Process Design	Basic eng.	Detail eng.	Supply	Erection	Note:
FEED WATER							
Feed water tank		C	C	C	C	C	
Deaerator		C	C	C	C	C	
Feedwater pumps		C	C	C	C	C	
HP feed water preheating		C	C	C	C	C	
Feed water piping from the delivery limits (K80 and K90) in the E1A building to boiler house K20, including necessary piping supports (primary supports)		V	V	V	V	V	Piping to be supported from the existing structures
Feed water valve group		V	V	V	V	V	2x 100% control valves
FUEL FEEDING							
Fuel storage and handling system (including receiving, conveying, sieving, crushing) up to the boiler fuel silos(s)		C	C	C	C	C	
Fuel feeding to the boiler							
Silo	2	V	V	V	V	V	
Silo reclaimers	2	V	V	V	V	V	
Transfer screw conveyor	2	V	V	V	V	V	
Balancing bin	1	V	V	V	V	V	
Metering screws	2	V	V	V	V	V	
Fuel feeding chutes to boiler	2	V	V	V	V	V	
Rotary valve feeders	2	V	V	V	V	V	
MAKE-UP SAND SYSTEM		V	V	V	V	V	
Sand silo	1	V	V	V	V	V	Filling pneumatically from the truck
Sand feeding screw	1	V	V	V	V	V	
Drop pipe to furnace	1	V	V	V	V	V	
AUXILIARY FIRING							
Natural gas							
Natural gas piping from the existing pipe bridge to boiler house K20		V	V	V	V	V	Piping to be supported from the existing structures
Start-up burner							
Start-up burner	1	V	V	V	V	V	
Burner valve group	1	V	V	V	V	V	

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 8/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Scope of Supply	Qty	Process Design	Basic eng.	Detail eng.	Supply	Erection	Note:
Natural gas fuel piping		V	V	V	V	V	
Ignition gas							
Ignition gas piping		V	V	V	V	V	
COMBUSTION AIR							
Suction duct with silencer	1	V	V	V	V	V	
Total air fan							
Total air fan		V	V	V	V	V	
Total air feed water preheater	1	V	V	V	V	V	
Secondary air ducting		V	V	V	V	V	
Secondary air nozzles	5+5	V	V	V	V	V	
Tertiary air nozzles	4+4	V	V	V	V	V	
Primary air							
Primary air fan	1	V	V	V	V	V	
Primary air ducting		V	V	V	V	V	
Primary air nozzles		V	V	V	V	V	
FLUE GAS							
Flue gas ducting		V	V	V	V	V	Including connection to the existing stack
Flue gas ID fan	1	V	V	V	V	V	
Recirculation gas fan	1	V	V	V	V	V	
Recirculation gas duct, dampers and accessories		V	V	V	V	V	
Flue gas dampers		V	V	V	V	V	
Stack		C	C	C	C	C	Existing stack
FLUE GAS TREATMENT							
Bag house filter		V	V	V	V	V	4 modules
Ammonia water tank		C	C	C	C	C	Existing
Ammonia water dosing pumps	2	C	C	C	C	C	Existing pumps 2x 0-80 kg/h to be used
Selective non-cathalytic reduction of NOx (SNCR) system including injection piping and nozzles, including necessary piping supports (primary supports)		V	V	V	V	V	Piping to be supported from the existing structures
Hydrated lime injection system, including storage tank and injection system into flue gas duct before bag house filter		V	V	V	V	V	silos 30m3

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 9/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Scope of Supply	Qty	Process Design	Basic eng.	Detail eng.	Supply	Erection	Note:
SOOTBLOWING							
Sootblowers	14	V	V	V	V	V	
Sootblower supports		V	V	V	V	V	
Steam and condensate piping		V	V	V	V	V	
Sealing air piping		V	V	V	V	V	
ASH HANDLING SYSTEM							
Bottom ash removal system							
Bottom ash hoppers	4	V	V	V	V	V	
Manual&pneumatic dampers	4+4	V	V	V	V	V	
Water cooled drag chain conveyor	1	V	V	V	V	V	
Bottom ash container	2	V	V	V	V	V	
Sand recycling system including. pneumatic conveyor		V	V	V	V	V	
Fly ash handling system							
Fly ash conveying system from ash hoppers		V	V	V	V	V	
Fly ash pneumatic conveyors	5	V	V	V	V	V	
Fly ash piping to fly ash silo		V	V	V	V	V	
Fly ash silo	1	V	V	V	V	V	
Dry unloading system	1	V	V	V	V	V	
AUXILIARY SYSTEMS							
Sample station with coolers	1	V	V	V	V	V	4 sampling points
Phosphate dosing unit with pumps	1	V	V	V	V	V	2x100% pumps
Cooling water supply and return piping, from E1A building to K20 building including necessary piping supports (primary supports)		V	V	V	V	V	Piping to be supported from the existing structures,
Potable water piping		V	V	V	V	V	
Safety showers with eye wash station		V	V	V	V	V	
Industrial water piping in the boiler house		V	V	V	V	V	
Compressor unit for transport air (back up compressor)		V	V	V	V	V	1x100%, or 2x50% unit
Compressor unit for instrument air		C	C	C	C	C	2x100% unit. Existing compressors to be moved to the compressor room in K20

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 10/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Scope of Supply	Qty	Process Design	Basic eng.	Detail eng.	Supply	Erection	Note:
							area and connected
Transport air piping in the K20 boiler building, including necessary piping supports (primary supports)		V	V	V	V	V	Piping to be supported from the existing structures
Transport air piping from the delivery limit to K20 boiler building		V	V	V	V	V	
Instrument air piping in the K20 boiler building		V	V	V	V	V	
Instrument air piping to E1A building including necessary piping supports (primary supports)		V	V	V	V	V	Piping to be supported from the existing structures
CASING, REFRACTORY, INSULATION & LAGGING							
Boiler refractory		V	V	V	V	V	
Boiler insulation		V	V	V	V	V	
Boiler lagging		V	V	V	V	V	
Insulation of equipment, ducts and piping		V	V	V	V	V	
Lagging of equipment, ducts and piping		V	V	V	V	V	
SPARE PARTS							
Spare parts for two years operation		-	V	V	V		Spare parts required for the availability guarantee
Consumable parts for commissioning		-	V	V	V		
Electrical spare parts		-	C	C	C		
Instrument spare parts		-	C	C	C		

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 11/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.2.2 Electrification

Scope of Supply	Process Design	Basic eng.	Detail eng.	Supply	Erection	Note:
Basic engineering		V	-	V	-	
Detail Engineering (wiring diagrams etc.)		-	V	V	-	
Integral motors	-	V	V	V	V	
Standard low voltage (LV) motors	-	V	V	V	V	
Standard medium voltage (MV) motors	-	NA	NA	NA	NA	
Variable frequency drives	-	V	V	V	V	
LV distribution switchgears	-	V	V	V	V	
LV motor control centers	-	V	V	V	V	
LV busducts or cable systems from transformers to LV switchgears or MCCs	-	V	V	V	V	
LV power distribution transformers	-	V	V	V	V	
MV distribution switchgears	-	V	V	V	V	Modifications for 2 Feeders to K20 boiler
MV motor control centers	-	C	C	C	C	
MV busducts or cable systems from transformers to MV switchgears or MCCs	-	C	C	C	C	
MV power distribution transformers	-	C	C	C	C	
UPS with batteries	-	C	C	C	C	220 VDC from customer battery system. Inverters included to the scope of supply
UPS distribution panels	-	V	V	V	V	
Power and control cables	-	V	V	V	V	Cables between K20 Electric room and existing installation excluded
Cable trays and conduits	-	V	V	V	V	
Electrical installation		V	V	V	V	
Local safety isolation switches for motors		V	V	V	V	If needed
Local switches for motors		V	V	V	V	
Lighting and maintenance power system in boiler building	-	V	V	V	V	

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 12/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Scope of Supply	Process Design	Basic eng.	Detail eng.	Supply	Erection	Note:
Lighting and maintenance power system in flue gas cleaning area	-	V	V	V	V	
Electrification for ventilation in boiler building	-	V	V	V	V	
Grounding of electrical equipment	-	V	V	V	V	
Building communication system		C	C	C	C	
Fire alarm system	-	C	C	C	C	
Trace heating		V	V	V	V	

1.2.3 Instrumentation and automation

Scope of Supply	Basic eng.	Detail eng.	Supply	Erection	Note:
Basic engineering	V	-	V	-	
Detail Engineering (wiring diagrams etc.)	-	V	V	-	
Pneumatic Control Valves	V	V	V	V	
Pneumatic ON/OFF -Valves	V	V	V	V	
Flow elements, water and steam lines	V	V	V	V	(orifice and nozzle type)
DCS (SW, HW and Configuration)	V	V	V	V	
Control room equipment, monitors and keyboards	V	V	V	V	
SIS&BMS FAT	V	V	V	-	Client to participate
DCS FAT	V	V	V	-	Client to participate
Burner management system (BMS)	V	V	V	V	
Safety Instrumented System (SIS)	V	V	V	V	
Flue gas analyzers (CEMS)	V	V	V	V	O2, CO, SO2, NOx, H2O, DUST, HCl, NH3
Furnace O2 measurement	V	V	V	V	
Temperature elements	V	V	V	V	
Standard Transmitters	V	V	V	V	PT, PDT, TT
Mass and Magnetic flow	V	V	V	V	
Radar, Ultrasonic and Radiometric levels	V	V	V	V	
Analyzers for sample station	V	V	V	V	
Local gauges	V	V	V	V	
Other Field instruments	V	V	V	V	LS, WI, FI

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 13/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Instruments included in machines which are in Valmet delivery	V	V	V	V	
Instrument installation materials	V	V	V	V	
Instrumentation erection	V	V	V	V	
Instrumentation erection supervision	V	V	V	-	Supplied by Contractor

1.2.4 Civil and structural

Scope of Supply	Basic eng.	Detail eng.	Supply	Erection	Note:
Design					
Architectural design	C	C	C	C	
Building and project permit	C	C	C	C	
Third party review of structures, if required by Client or authorities	NA	NA	C	NA	
Overall Fire safety report and engineering	C	C	C	C	
Fire safety report and engineering for Contractor Scope	V	V	V	NA	Report will be incorporated to Client's overall report
Demolition works					
Demolition of existing structures	C	C	C	C	
Earth works, Civil works					
Input data related to Contractor scope for Earth works and Civil works	NA	NA	V	NA	By Contractor
Excavation	C	C	C	C	
Earth moving	C	C	C	C	
Backfilling	C	C	C	C	
Dewatering	C	C	C	C	
Marking of basic lines and elevation at Site	NA	NA	C	NA	
Foundation Concrete Works, Civil works					
Input data related to Contractor scope for Foundation Concrete works, Civil works	V*	NA	NA	NA	*Load information for foundation design supplied by Contractor
Piling	C	C	C	C	
Pile caps	C	C	C	C	
Slab on grade	C	C	C	C	
Surface treatment of grade slab	C	C	C	C	
Moulding works and moulding parts for concrete works and recesses in concrete works	C	C	C	C	

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 14/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Scope of Supply	Basic eng.	Detail eng.	Supply	Erection	Note:
Column foundations	C	C	C	C	
Equipment foundations on grade	C	C	C	C	
Grouting of structures and equipment	C	C	C	C	
Grounding grid underground	C	C	C	C	
Underground piping	C	C	C	C	
Drainage channels with covers in grade slab	C	C	C	C	
Anchor bolts & embedded steel					
Embedded anchor bolts and parts for structures within scope	V	V	V	C*	*including receiving, unloading, storing in site warehouse, assembly and installation.
Embedded anchor bolts and parts for equipment within scope	V	V	V	C*	
Templates for anchor bolt groups within Scope	V	V	V	C*	
Survey report of anchor bolts and parts after concrete casting	NA	NA	C	NA	
Concrete works above grade/Concrete works above ground level					
Base walls of interior and exterior walls	V*	C	C	C	See Delivery limits drawing,*Outline drw by Contractor
Electrical building	V	V	V	V	Concrete walls
Structural steel					
Steel for buildings within scope	V	V	V	V	
Steel for support of equipment within scope	V	V	V	V	
Boiler furnace support beams	V	V	V	V	
Boiler furnace support columns	V	V	V	V	
Duct support steel inside building	V	V	V	V	
Flue gas duct supports from boiler to stack	V	V	V	V	
Support steel for pipe hangers	V	V	V	V	
Pipe bridge and supports for the selected process lines from the boiler K20 to E1A building	V	V	V	V	
Main stair shaft	V	V	V	V	
Emergency exit stair shaft	V	V	V	V	
Flue gas filter support structure	V	V	V	V	BHF
Platforms and stairs for buildings and structures within scope					
Steel grating platforms	V	V	V	V	
Chequered plate platforms	V	V	V	V	
Railings in boiler building	V	V	V	V	
Stairs in boiler building	V	V	V	V	
Drain piping from platforms that are watertight	V	V	V	V	

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 15/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Scope of Supply	Basic eng.	Detail eng.	Supply	Erection	Note:
Cladding					
Wall cladding	V	V	V	V	
Windows in walls within scope	NA	NA	NA	NA	
Doors in walls within scope	V	V	V	V	
Roofs for buildings within scope	V	V	V	V	
Roof drain piping	V	V	V	V	
Company logo on building	C	C	C	C	
Vacuum cleaning system					
Vacuum cleaning piping	V	V	V	V	
Mobile vacuum cleaner	C	C	C	C	
Fire protection					
Fire safety report or engineering	V*	NA	C	NA	*Contractor supplies basic information for report and analyses.
Modelling or design of fire loads on structures	C	C	C	C	if any
Passive fire protection of structures	C	C	C	C	for example, intumescent coating or cement boarding
Fire proofing of passthrough in walls and/or floors within Valmet scope	V	V	V	V	
Active fire protection for structures	C	C	C	C	for example, sprinklers or gas suppression
Fire water risers and distribution piping	V	V	V	V	Industrial water to be used
Fire water hose reels	V	V	V	V	
Handheld fire extinguishers	V	V	V	V	
Fire fighting for electrical building	C	C	C	C	
Fire extinction system in equipment by steam	V	V	V	V	fuel silos and feeding system
Hoist					
Electric hoist in boiler building above main hatchway	V	V	V	V	
Manually operated tilting platforms at hatch opening	V	V	V	V	
Elevator					
Elevator, combined for staff and goods	V	V	V	V	
Stack					
Free standing stack	C	C	C	C	existing stack. Opening and fleu gas duct connection to be made by V
HVAC					

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 16/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Scope of Supply	Basic eng.	Detail eng.	Supply	Erection	Note:
Boiler building ventilation	V	V	V	V	Natural ventilation
Equipment related to removing heat and smoke in case of fire if necessary	V	V	V	V	
Electrical building HVAC	V	V	V	V	

1.2.5 Lifecycle and Industrial Internet services

Scope of Supply	Included	Excluded	Note
Industrial Internet services	V		
Connectivity and process data to Valmet cloud	V		
Customer Portal	V		
Operations panel	V		
Performance evaluations and expert support	V		
Regular performance evaluation	V		
On-demand expert support	V		

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 17/17
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.2.6 Project services

	Included	Excluded	Notes
PROJECT SERVICES			
Project management and reporting	X		
Engineering (process, piping, layout, duct, equipment)	X		3D model
Delivery and shipping schedule	X		
Erection schedule	X		
QA/QC of supplied equipment	X		
QA/QC of erection	X		
HSE Plan	X		
Freight	X		
Dismantling and demolition work		X	Asbestos and other hazardous waste removal by others if necessary
Erection	X		Measurements for energy (water+electricity) included. Consumed energy by customer
First fill of lubricants	X		
Lubrication oil and grease		X	After the 1st fill of lubricants
Commissioning and start-up	X		
Acid cleaning, incl. materials and chemical neutralization	X		Cleaning solution shall be neutralized by the Contractor before discharging it to the mill sewerage system. Only the solid residue from the boiler cleaning process will be collected and handled by the Contractor separately.
Steam blows	X		Steam blow piping 50 meters+blow out valve +silencing container included
Utilities and consumables for commissioning and start-up of boiler		X	Valmet to specify required utilities for the customer to purchase, according to commissioning schedule
Operator and maintenance training & manuals	X		
Performance test	X		
Performance test report	X		

Table of Contents

1 DELIVERY LIMITS AND SCOPE OF SUPPLY	2
1.1 Delivery limits	2
1.1.1 Mechanical and process	2
1.1.2 Civil and structural	3
1.1.3 Electrification	3
1.1.4 Instrumentation and automation	4
1.2 Scope of supply	4
1.2.1 CYMIC boiler	4
1.2.2 Electrification	10
1.2.3 Instrumentation and automation	11
1.2.4 Civil and structural	12
1.2.5 Lifecycle and Industrial Internet services	15
1.2.6 Project services	16

1 DELIVERY LIMITS AND SCOPE OF SUPPLY

1.1 Delivery limits

1.1.1 Mechanical and process

For the in- and outgoing pipes and ducts the general delivery limit at the boiler house wall is one (1) meter outside of the boiler house wall column line at the pipe bridge elevation of four (4) meters.

For the pipes and ducts ending to the roof the delivery limit is three (3) meters above the roof.

For drains to sewers/effluent canals etc. the delivery limit is ground floor + 0.200 m in the boiler house.

1.1.1.1 Inlets and outlets of the pressure part modifications

		Value
Feedwater (economizers)	Inlets	Outlets of economizer distribution headers
	Outlets	Inlets of economizer collection headers
Boiler water	Inlets	Front wall downcomer at the height ~ +10 m from furnace bottom Side wall lower circulation pipes
	Outlets	Furnace membrane wall tubes at the height ~ +7 m from furnace bottom
Superheated steam (Hanger tubes)	Inlets	Outlets of hanger tube distribution headers
	Outlets	Inlets of hanger tube collection headers
Superheated steam (PSH)	Inlets	Outlets of PSH distribution headers
	Outlets	Inlets of PSH collection headers
Superheated steam (TSH)	Inlets	Outlets of TSH distribution headers
	Outlets	Inlets of TSH collection headers
Boiler drains (furnace)	Outlets	Connection to blowdown tank drain pipe

1.1.1.2 Inlets

	Value
Biofuel	Fuel silo inlet on top of the silo
Combustion air	Primary air ducting close to the furnace windbox Secondary air port ducts close to furnace Existing secondary air ducting, new branch to Technological fuel lance Existing burner air ducting, inlet to gas burners
Sootblowing steam	Existing sootblower line, branches to new sootblowers (separately)
Flue gas	Inlet to new flue gas fan
Make-up sand	Connection to make up sand filling pipe (at the boiler house wall)
Ammoniumsulphate solution	Existing SNCR piping in the boiler house, branch to new booster pump unit for furnace injection level
Technological fuel	Inlet to the new lance valve group
Natural gas	Inlet to the new burner valve groups
Medium pressure steam	Existing steam coil unit to be used, no changes
Cooling water	Delivery limit in the E1A building at ground floor level (Inlet piping to bottom ash cooling water booster pumps)
Hydrated lime sorbent (alternatively NaHCO ₃ sorbent)	Outlet of existing sorbent/additive silo
Nitrogen	Connections to existing piping in the coal feeding area
Instrument air	Existing instrument air ducting inside the boiler house, new branches to instrument air users close to the new equipment
Pressurized air	Existing pressurized air ducting inside the boiler house, new branches to pressurized air users close to the new equipment
Industrial water	Existing industrial water piping inside the boiler house, new branch to SNCR dilution line

1.1.1.3 Outlets

	Value
Boiler drains	Blowdown tank drain pipe, at the inlet of sewer connection
Flue gas	Outlet of new flue gas fan
Natural gas vents	Connection to existing natural gas vents close to burner valve group
Bottom ash	Inlet to removed bottom ash pneumatic ash transmitter (transportation to the bottom ash silo)
Cooling water	Delivery limit in the E1A building at floor level (Return piping from ash cooling circulation)

1.1.2 Civil and structural

See Delivery limit drawing in appendix 02.01.

1.1.3 Electrification

See the single line diagram Appendix 02.02.

1.1.4 Instrumentation and automation

See the typical detailed drawings in Appendix 10.

1.2 Scope of supply

1.2.1 CYMIC boiler

Explanation for the abbreviations used in the following table:

V= Valmet, C = Customer, O = Option (Valmet), NA= Not applicable, E=Existing, D=Demolished

Scope of Supply	Process design	Basic eng.	Detail eng.	Supply	Erection	Note:
BOILER						
Furnace, bottom part	V	V	V	V	V	New bottom part of the furnace within scope, including refractory modifications to lower furnace
Furnace, top part	E	E	E	E	E	
Cyclones and loopseals	E	E	E	E	E	
Integrated bottom ash cooler	D	D	D	D	D	
Walls of the 2 nd pass	E	E	E	E	E	Modifications based on Boiler inspection to be offered separately
Hanger tubes	V	V	V	V	V	
Primary Superheater	V	V	V	V	V	
Secondary Superheater (shot superheater in the furnace)	E	E	E	E	E	Modifications based on Boiler inspection to be offered separately
Tertiary Superheater	V	V	V	V	V	
Steam drum with internals	E	E	E	E	E	
Circulation and connection pipes	E	E	E	E	E	Needed modification to the downcomers and lower circulation piping of the furnace included
Spray water attemperators	E	E	E	E	E	

Scope of Supply	Process design	Basic eng.	Detail eng.	Supply	Erection	Note:
Spray water piping, valves	E	E	E	E	E	
Economizers	V	V	V	V	V	
MAIN STEAM	E	E	E	E	E	
BOILER ACCESSORIES	E	E	E	E	E	
FEED WATER SYSTEM	E	E	E	E	E	
FUEL FEEDING SYSTEM						
Fuel storage and handling system (including receiving, conveying, sieving, crushing) up to the boiler fuel silo(s)	C	C	C	C	C	OB1 scope
Fuel feeding system, biofuel						
Silos	V	V	V	V	V	
Silo reclaimers	V	V	V	V	V	
Transfer screws	V	V	V	V	V	
Balancing pockets	V	V	V	V	V	
Metering screws	V	V	V	V	V	
Rotary valve feeders	V	V	V	V	V	
Fuel feeding wall screws to furnace	V	V	V	V	V	
MAKE-UP SAND SYSTEM						
Sand silo	E	E	E	E	E	Existing MFV silo to be utilized as make up sand silo
Sand silo filling pipe	V	V	V	V	V	
Sand feeding conveyor	E	E	E	E	E	
Sand feeding pipes to furnace	E	E	E	E	E	
AUXILIARY FIRING						
Start-up burners						
Start-up burners	V	V	V	V	V	
Burner valve groups	V	V	V	V	V	
Aux. fuel piping	E	E	E	E	E	Modifications for scope of supply
Technological fuel firing						
Wall lance for technological fuel firing	V	V	V	V	V	
Wall lance valve group	V	V	V	V	V	
Natural gas system						
Natural gas reduction station	E	E	E	E	E	
Natural gas piping inside the delivery limits	E	E	E	E	E	
COMBUSTION AIR						
Suction duct with silencers and control dampers	E	E	E	E	E	

Scope of Supply	Process design	Basic eng.	Detail eng.	Supply	Erection	Note:
Total air						
Total air fan	E	E	E	E	E	
Total air SCAH preheater	E	E	E	E	E	
Total air FGAH	E	E	E	E	E	
Primary air	E	E	E	E	E	
Primary air fan	E	E	E	E	E	
Primary air ducting	E	E	E	E	E	
Primary air windbox	V	V	V	V	V	
Primary air nozzles	V	V	V	V	V	
Overfire air						
Secondary air ducting	E	E	E	E	E	Modifications to the scope of supply
Secondary air nozzles	V	V	V	V	V	Modifications to the scope of supply
Loopseal air	E	E	E	E	E	
Loop seal fan	E	E	E	E	E	
Sound attenuation hoods for loopseal air blowers	E	E	E	E	E	
Loopseal air ducting	E	E	E	E	E	
Loopseal air nozzles	E	E	E	E	E	
FLUE GAS						
Flue gas ducting	E	E	E	E	E	
Modifications to additive feeding and mixing to flue gas ducting	V	V	V	V	V	
Bag house filter	E	E	E	E	E	Filter bag change by Valmet
ID fan	V	V	V	V	V	
Recirculation gas fan	E	E	E	E	E	
Recirculation gas duct, dampers and accessories	E	E	E	E	E	
Recirculation gas nozzles	NA	NA	NA	NA	NA	
Stack	E	E	E	E	E	
FLUE GAS TREATMENT SYSTEM						
Ammoniumsulphate injection system	E	E	E	E	E	
Ammoniumsulphate storage tank	E	E	E	E	E	
Ammoniumsulphate unloading pump to tank	E	E	E	E	E	
Ammoniumsulphate feeding pumps	E	E	E	E	E	
Ammoniumsulphate piping with valves	E	E	E	E	E	

Scope of Supply	Process design	Basic eng.	Detail eng.	Supply	Erection	Note:
Ammoniumsulphate nozzles to cyclone inlet	E	E	E	E	E	
Ammoniumsulphate booster pumping unit to furnace injection level	V	V	V	V	V	
Ammoniumsulphate nozzles to furnace	V	V	V	V	V	Including piping within the scope of supply
Emergency showers	NA	NA	NA	NA	NA	
Additive injection to bag house filter						
Hydrated lime injection system, including feeding and dosing system into flue gas duct before bag house filter	V	V	V	V	V	
Hydrated lime injection nozzles into flue gas duct	V	V	V	V	V	
SOOTBLOWING	E	E	E	E	E	
Sootblowers, existing	E	E	E	E	E	
Sootblower supports, existing	E	E	E	E	E	
Sootblowers, additional	V	V	V	V	V	To defined areas
Sootblower supports for new sootblowers	V	V	V	V	V	
Reserve openings for sootblowers	V	V	V	V	V	
Steam and condensate piping	E	E	E	E	E	Modifications to the scope of supply
ASH HANDLING SYSTEM						
Coarse material removal system						
Bottom ash chutes	V	V	V	V	V	
Shut off gates	V	V	V	V	V	
Water cooled screw conveyors	V	V	V	V	V	
Bottom ash conveyor	V	V	V	V	V	
Bottom ash containers	V	V	V	V	V	
Bottom ash recycling system	V	V	V	V	V	
Bottom ash screen	V	V	V	V	V	
Recirculated sand pneumatic transmitter	V	V	V	V	V	
Bottom ash pneumatic transmitter (to BA silo), including piping	E	E	E	E	E	
Boiler ash handling system	E	E	E	E	E	
2nd pass ash handling system	E	E	E	E	E	
Loopseal ash handling system	E	E	E	E	E	
Fly ash handling system	E	E	E	E	E	
2 nd pass ash	E	E	E	E	E	
Fly ash pneumatic transmitters	E	E	E	E	E	
Fly ash silo	E	E	E	E	E	

Scope of Supply	Process design	Basic eng.	Detail eng.	Supply	Erection	Note:
AUXILIARY SYSTEMS						
Sampling	E	E	E	E	E	
Chemical dosing system	E	E	E	E	E	
Cooling water system for bottom ash	V	V	V	V	V	Inside boiler house, connected to existing cooling circulation
Bottom ash cooling water piping	V	V	V	V	V	
Booster pumps for bottom ash cooling water	V	V	V	V	V	
Heat exchangers for cooling water	E	E	E	E	E	
Auxiliary steam and condensate system	E	E	E	E	E	
Instrument and pressurized air system	E	E	E	E	E	
Compressor unit for instrument air	E	E	E	E	E	
Compressor unit for pressurized air	V	V	V	V	V	K20 boiler house
Pressurized air piping	E	E	E	E	E	Modification for scope of supply, branches from existing piping
Instrument air piping	E	E	E	E	E	Modification for scope of supply, branches from existing piping
Water piping						
Fire water piping	E	E	E	E	E	
Plant water piping	E	E	E	E	E	
Potable water piping	E	E	E	E	E	
CASING, REFRACTORY, INSULATION & LAGGING						
Lower furnace refractory	V	V	V	V	V	
Upper furnace refractory	E	E	E	E	E	
Cyclone and loopseal refractory	E	E	E	E	E	
Boiler insulation (lower furnace, back pass rear wall)	E	E	E	E	E	Modification for scope of supply
Boiler cladding (lower furnace, back pass rear wall)	E	E	E	E	E	Modification for scope of supply
Insulation of equipment, tanks, ducts and piping	E	E	E	E	E	Modification for scope of supply
Cladding of equipment, tanks, ducts and piping	E	E	E	E	E	Modification for scope of supply
SPARE PARTS	-	V	V	V		
Spare parts for two years operation	-	V	V	V		1 set to be utilized in both



Ško-Energo, s.r.o., Mladá Boleslav
2 x CFB rebuild
ERC21-00349

Rev. 1

9.9.2024
K. Kirvelä

Scope of Supply	Process design	Basic eng.	Detail eng.	Supply	Erection	Note:
						boilers
Consumable parts for commissioning	-	V	V	V		
Electrical spare parts	-	C	C	C		
Instrument spare parts	-	C	C	C		

1.2.2 Electrification

Explanation for the abbreviations used in the following table:

V=Valmet, C=Customer, O=Option(Valmet), NA= Not applicable, E = existing

Scope of Supply	Process design	Basic eng.	Detail eng.	Supply	Erection	Note:
Basic engineering		V	-	V	-	
Detail Engineering (wiring diagrams etc.)		-	V	V	-	
Integral motors	-	V	V	V	V	For new equipment
Standard low voltage (LV) motors	-	V	V	V	V	For new equipment
Standard medium voltage (MV) motors	-	V	V	V	V	For new equipment
Variable frequency drives	-	V	V	V	V	For new equipment
LV distribution switchgears	-	V	V	V	V	For new equipment
LV motor control centers	-	V	V	V	V	For new equipment
LV busducts or cable systems from transformers to LV switchgears or MCCs	-	C	C	C	C	
LV power distribution transformers	-	C	C	C	C	
MV distribution switchgears	-	V	V	V	V	Only needed modification to ID fan feeders
MV busducts or cable systems from transformers to MV switchgears or MCCs	-	C	C	C	C	
MV power distribution transformers	-	C	C	C	C	
Power factor compensation capacitors	-	C	C	C	C	
Harmonic filters	-	C	C	C	C	
UPS with batteries	-	C	C	C	C	
UPS distribution panels	-	V	V	V	V	
Emergency diesel generator		E	E	E	E	
Power and control cables	-	V	V	V	V	
Cable trays and conduits	-	V	V	V	V	Existing to be utilized where possible
Electrical installation		V	V	V	V	
Electrical installation supervision		V	V	V	V	
Local safety isolation switches for motors		V	V			If needed
Local control switches for motors		V	V			If needed
Lighting and maintenance power system in boiler building	-	V	V	V	V	Only where needed because of rebuild

Scope of Supply	Process design	Basic eng.	Detail eng.	Supply	Erection	Note:
Lighting and maintenance power system in flue gas cleaning area	-	V	V	V	V	Only where needed because of rebuild
Lighting in electrical rooms		C	C	C	C	
Electrification for ventilation in boiler building	-	C	C	C	C	
Electrification for HVAC in electrical rooms	-	C	C	C	C	
Grounding of electrical equipment	-	V	V	V	V	
Separate PLC for sootblowing system	-	NA	NA	NA	NA	
Separate PLC for flue gas cleaning system	-	E	E	E	E	
Building communication system		C	C	C	C	
Fire alarm system	-	C	C	C	C	

1.2.3 Instrumentation and automation

Explanation for the abbreviations used in the following table:

V=Valmet, C=Customer, O=Option(Valmet), NA= Not applicable, E = existing

Valmet scope only defined for new equipment.

Scope of Supply	Basic eng.	Detail eng.	Supply	Erection	Note:
Basic engineering	V	-	V	-	For new equipment
Detail Engineering (wiring diagrams etc.)	-	V	V	-	For new equipment
Pneumatic Control Valves	V	V	V	V	For new equipment
Pneumatic ON/OFF -Valves	V	V	V	V	For new equipment
Flow elements, water and steam lines	V	V	V	V	(orifice and nozzle type) For new equipment
DCS (SW, HW and Configuration)	V	V	V	V	For new equipment
Control room equipment, monitors and keyboards	C	C	C	C	
SIS&BMS FAT	V	V	V	-	Client to participate, only modifications to the changed scope
DCS FAT	V	V	V	-	Client to participate, only modifications to the changed scope
Burner management system (BMS)	V	V	V	V	
Safety Instrumented System (SIS)	E	E	E	E	Only modification to the changed scope by Valmet

Scope of Supply	Basic eng.	Detail eng.	Supply	Erection	Note:
Flue gas analyzers, CEMS	E	E	E	E	O ₂ , CO, SO ₂ , NO _x , DUST
Furnace O ₂ measurement	E	E	E	E	O ₂ (CO)
Temperature elements	V	V	V	V	For new equipment
Standard Transmitters	V	V	V	V	PT, PDT, TT For new equipment
Mass and Magnetic flow	V	V	V	V	For new equipment
Radar, Ultrasonic and Radiometric levels	V	V	V	V	For new equipment
Analyzers for sample station	E	E	E	E	
Local gauges	V	V	V	V	For new equipment
Other Field instruments	V	V	V	V	LS, WI, FI For new equipment
Instruments included in machines which are in Valmet delivery	V	V	V	V	
Instrument installation materials	V	V	V	V	For new equipment
Instrumentation erection	V	V	V	-	For new equipment
Instrumentation erection supervision	-	-	V	-	Supplied by Valmet

1.2.4 Civil and structural

Explanation for the abbreviations used in the following table:

V=Valmet, C=Customer, O=Option (Valmet), NA= Not applicable, , E=Existing

Scope of Supply	Basic eng.	Detail eng.	Supply	Erection	Note:
Design					
Architectural design	C	C	C	C	
Building and project permit	C	C	C	C	Valmet deliver information what needed
Third party review of structures, if required by Customer or authorities	NA	NA	C	NA	
Overall Fire safety report and engineering	C	C	C	C	
Fire safety report and engineering for Valmet Scope	C	C	C	NA	Report will be incorporated to Customers overall report
Demolition works					
Demolition of existing	V	V	V	V	What needed in scope of Valmet

Scope of Supply	Basic eng.	Detail eng.	Supply	Erection	Note:
Earth works, Civil works					
Excavation	E	E	E	E	
Earth moving	E	E	E	E	
Backfilling	E	E	E	E	
Dewatering	E	E	E	E	
Marking of basic lines and elevation at Site	NA	NA	C	NA	
Foundation Concrete Works, Civil works					
Piling	E	E	E	E	
Pile caps	E	E	E	E	
Slab on grade	C	C	C	C	
Surface treatment of grade slab	C	C	C	C	
Moulding works and moulding parts for concrete works and recesses in concrete works	C	C	C	C	
Column foundations	C	C	C	C	
Equipment foundations on grade	C	C	C	C	
Grouting of structures and equipment	V	V	V	V	For new equipment
Grounding grid underground	C	C	C	C	
Underground piping	C	C	C	C	
Drainage channels with covers in grade slab	C	C	C	C	
Anchor bolts & embedded steel					
Embedded anchor bolts and parts for structures within scope	V	V	V	C*	*including receiving, unloading, storing in site warehouse, assembly and installation.
Embedded anchor bolts and parts for equipment within scope	V	V	V	C*	
Templates for anchor bolt groups within Scope	V	V	V	C*	
Survey report of anchor bolts and parts after concrete casting	NA	NA	C	NA	
Concrete works above grade/Concrete works above ground level					
Base walls of interior and exterior walls	E	E	E	E	
Walls for feed water pump room	E	E	E	E	
Elevated concrete slabs in boiler building	E	E	E	E	
Surface treatment of elevated slabs	E	E	E	E	
Form sheets for elevated concrete slabs	E	E	E	E	
Electrical building	E	E	E	E	
Structural steel					
Steel for buildings within scope	V	V	V	V	What needed in scope of Valmet
Steel for support of equipment within scope	V	V	V	V	What needed in scope of Valmet

Scope of Supply	Basic eng.	Detail eng.	Supply	Erection	Note:
Boiler furnace support beams	NA	NA	NA	NA	
Boiler furnace support columns	NA	NA	NA	NA	
Duct support steel inside building	V	V	V	V	What needed in scope of Valmet
Flue gas duct supports from boiler to stack	E	E	E	E	
Support steel for pipe hangers	V	V	V	V	What needed in scope of Valmet
Auxiliary pipe bridges from boiler house to main pipe bridge	E	E	E	E	
Main stair with elevator shaft	E	E	E	E	
Emergency exit stair shaft	E	E	E	E	
Flue gas filter support structure	E	E	E	E	
Platforms and stairs for buildings and structures within scope					
Steel grating platforms	V	V	V	V	What needed in scope of Valmet
Chequered plate platforms	V	V	V	V	What needed in scope of Valmet
Railings in boiler building	V	V	V	V	What needed in scope of Valmet
Stairs in boiler building	V	V	V	V	What needed in scope of Valmet
Drain piping from platforms that are watertight	E	E	E	E	
Cladding					
Wall cladding above base walls	E	E	E	E	
Windows in walls within scope	E	E	E	E	
Doors in walls within scope	V	V	V	V	What needed in scope of Valmet
Roofs for buildings within scope	V	V	V	V	What needed in scope of Valmet
Roof drain piping	E	E	E	E	
Doors in walls of Customer	C	C	C	C	incl. all doors of Electrical building
Company logo on building	NA	NA	NA	NA	
Blast wall between boiler house and main staircase	E	E	E	E	
Vacuum cleaning system					
Vacuum cleaning piping	E	E	E	E	
Vacuum cleaner	E	E	E	E	
Fire protection					
Fire safety report or engineering	E	E	E	E	*Valmet supplies basic information for report and analyses.
Modelling or design of fire loads on structures	C	C	C	C	if any

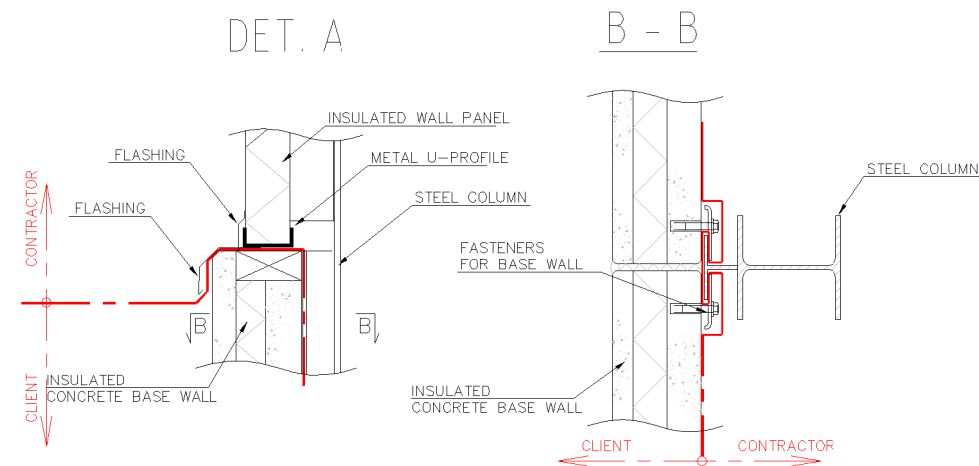
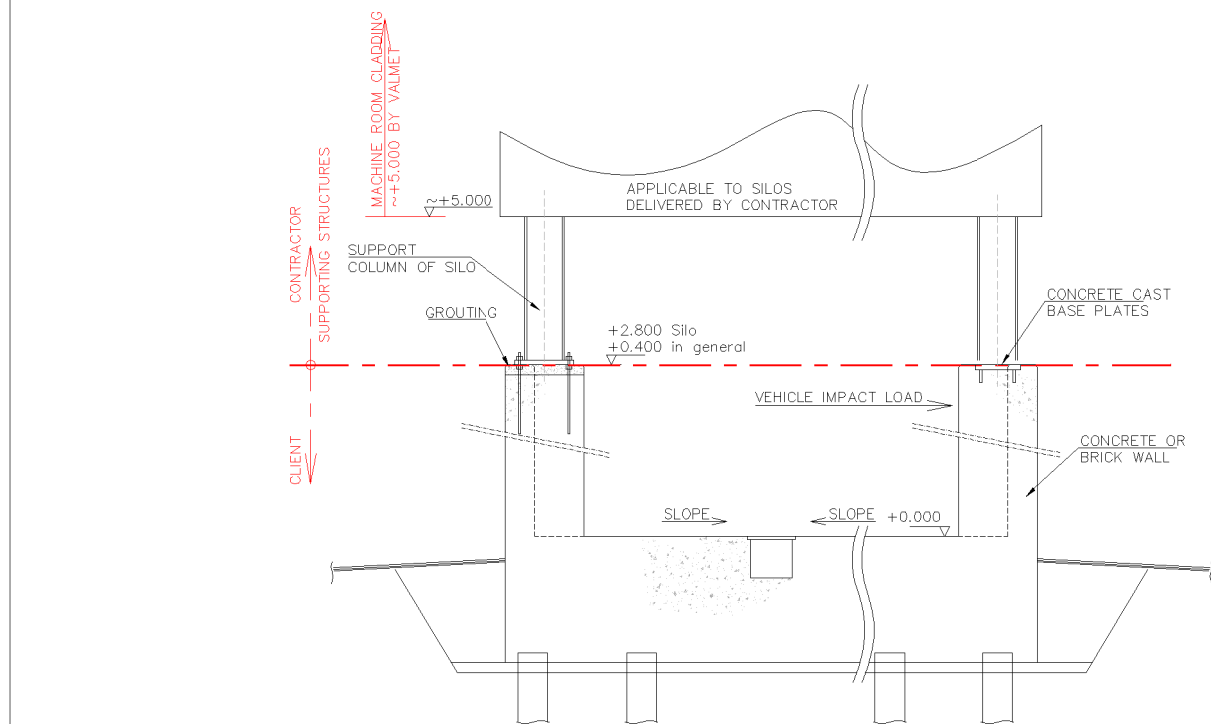
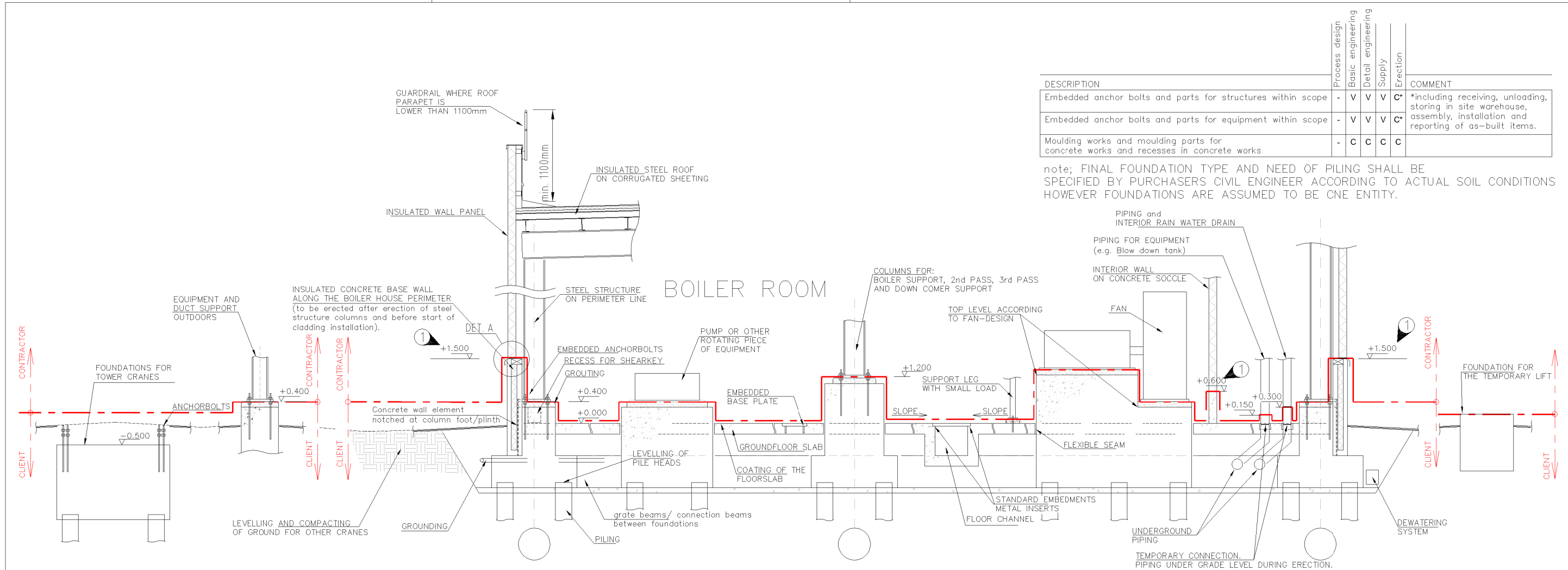
Scope of Supply	Basic eng.	Detail eng.	Supply	Erection	Note:
Fire protection of fuel silo and conveyor	V	V	V	V	
Passive fire protection of structures	C	C	C	C	for example, intumescent coating or cement boarding
Active fire protection for structures	C	C	C	C	for example, sprinklers or gas suppression
Fire proofing of passthrough in walls and/or floors within Valmet scope	E	E	E	E	
Fire proofing of passthrough in walls and/or floors in Customer scope	E	E	E	E	
Fire water risers	E	E	E	E	
Fire water hose reels	E	E	E	E	
Handheld fire extinguishers	E	E	E	E	
Fire fighting for Electrical building	E	E	E	E	
Hoist					
Electric hoist in boiler building above main hatchway	E	E	E	E	
Manually operated tilting platforms at hatch opening	E	E	E	E	
Elevator					
Freight elevator	E	E	E	E	
Staff elevator	E	E	E	E	
Stack					
Free standing double walled stack	E	E	E	E	
Aviation lights with top platform and ladder	E	E	E	E	
HVAC					
Boiler building ventilation	E	E	E	E	
Glycol system for ventilation	E	E	E	E	
Electrical building HVAC	E	E	E	E	

1.2.5 Lifecycle and Industrial Internet services

Scope of Supply	Included	Excluded	Note
Industrial Internet services			
Connectivity and process data to Valmet cloud	X		
Customer Portal	X		
Operations panel	X		
Performance evaluations and expert support			
Regular performance evaluation	x		
On-demand expert support	x		

1.2.6 Project services




	Included	Excluded	Notes
PROJECT SERVICES			
Project management and reporting	X		
Engineering (process, piping, layout, duct, equipment)	X		
Delivery and shipping schedule	X		
Erection schedule	X		
QA/QC of supplied equipment	X		
QA/QC of erection	X		
HSE Plan	X		
Freight	X		
Dismantling and demolition work		X	Asbestos and other hazardous waste removal by customer if necessary
Erection	X		
First fill of lubricants	X		
Lubrication oil and grease		X	After the 1st fill of lubricants
Commissioning and start-up	X		
Acid cleaning, incl. materials and chemical neutralization	X		Cleaning solution will be neutralized before discharging it to mill sewerage system
Steam blows	X		Steam blow piping + blow out valve+silencing container included
Utilities and consumables for commissioning and start-up of boiler		X	Valmet to specify required utilities for the customer to purchase, according to commissioning schedule
Operator and maintenance training & manuals	X		
Performance test	X		
Performance test report	X		

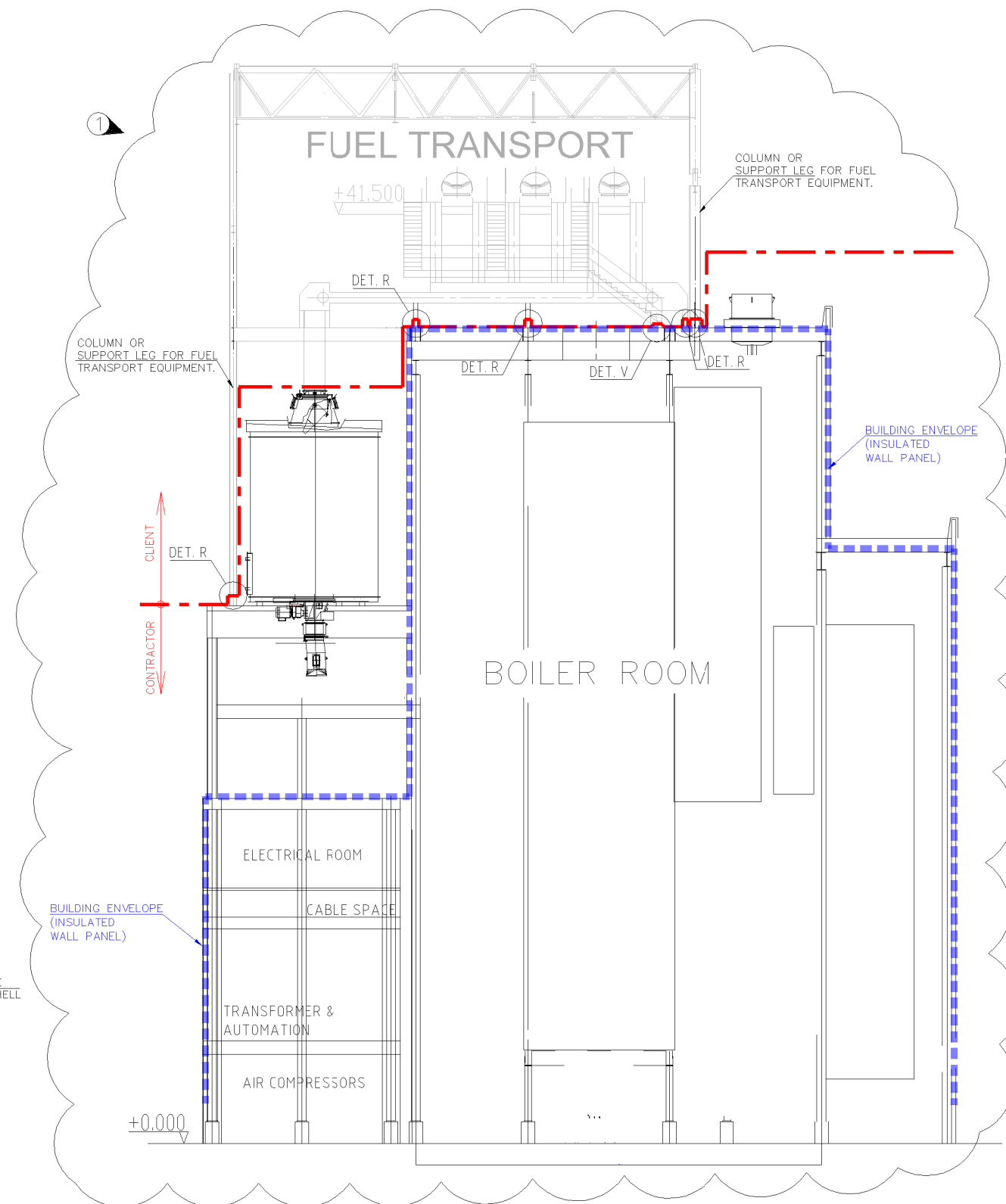
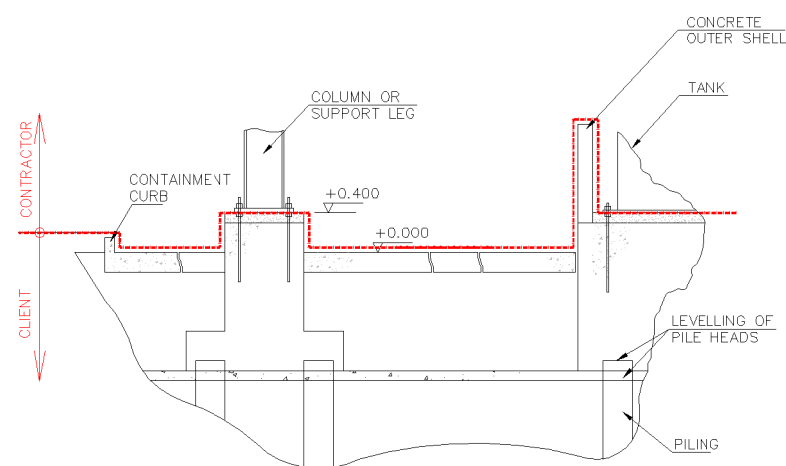
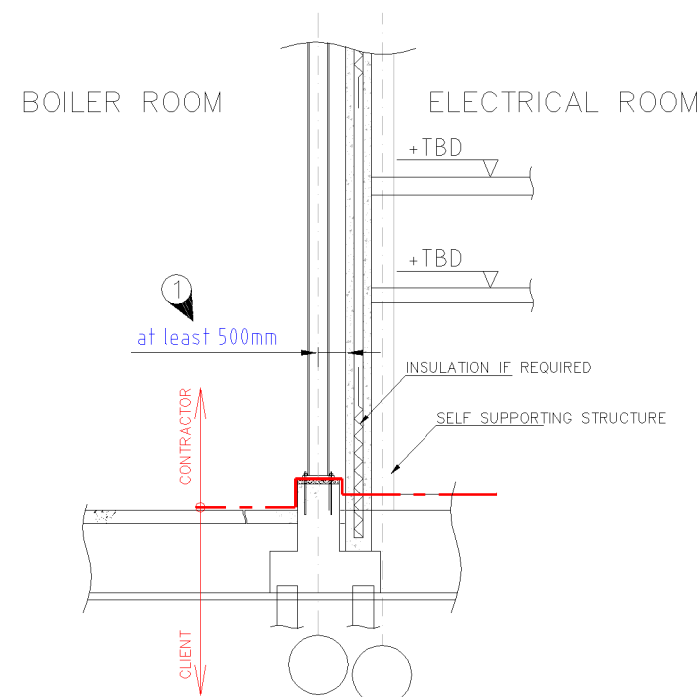
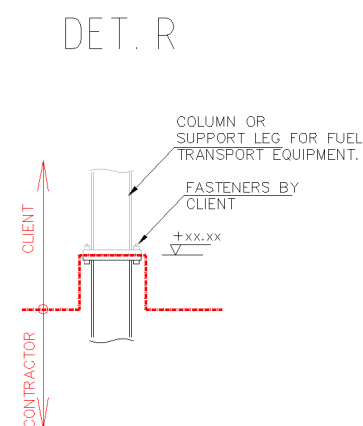
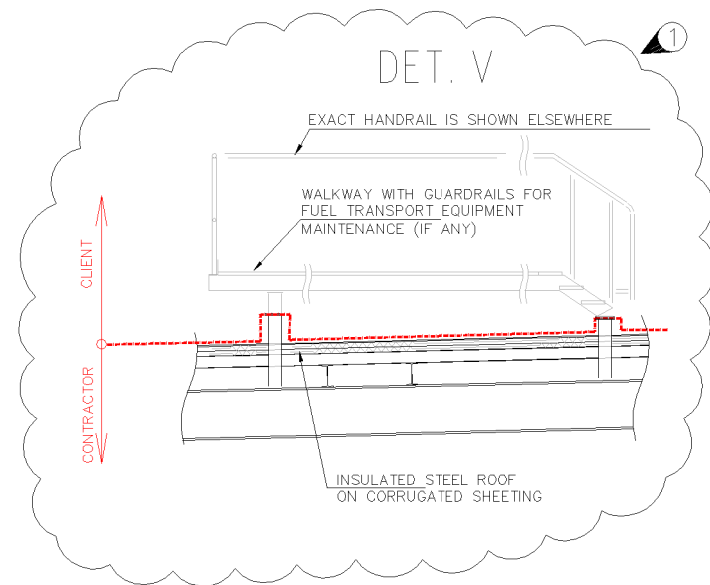


DESCRIPTION	Process design				COMMENT
	Basic engineering	Detail engineering	Supply	Erection	
Embedded anchor bolts and parts for structures within scope	-	V	V	V	C*
Embedded anchor bolts and parts for equipment within scope	-	V	V	V	C*
Moulding works and moulding parts for concrete works and recesses in concrete works	-	C	C	C	C

note; FINAL FOUNDATION TYPE AND NEED OF PILING SHALL BE SPECIFIED BY PURCHASERS CIVIL ENGINEER ACCORDING TO ACTUAL SOIL CONDITIONS HOWEVER FOUNDATIONS ARE ASSUMED TO BE ONE ENTITY.

Rev	Revision note	Created by	Checked by	Approved by	Date
1	----	G Bijmolt	P. Salo	P. Salo	----
Creation date: 5.3.2024					

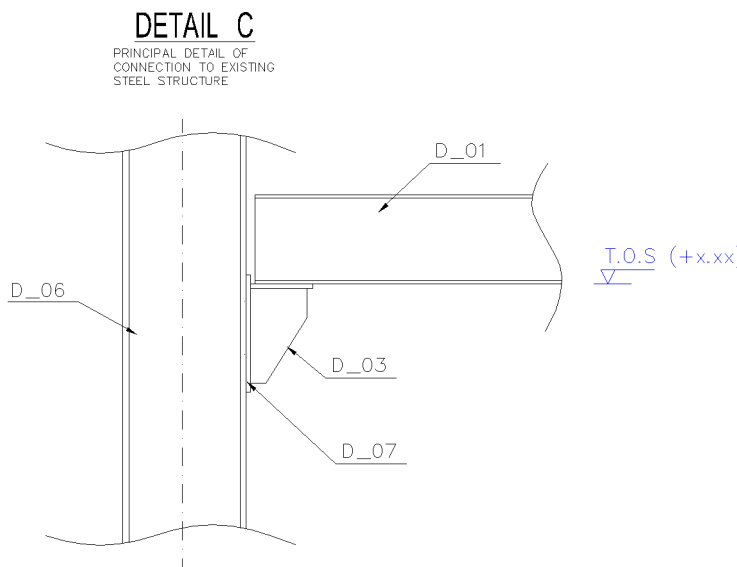
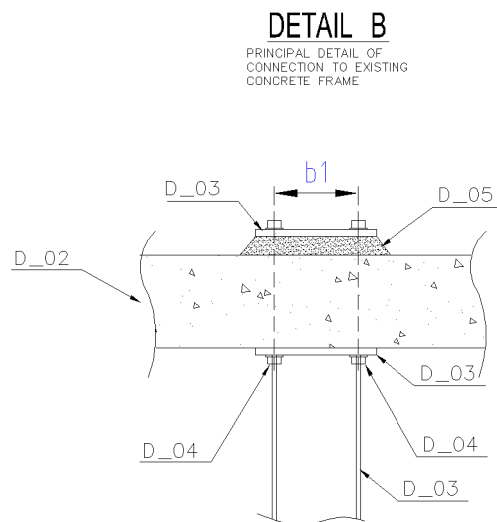
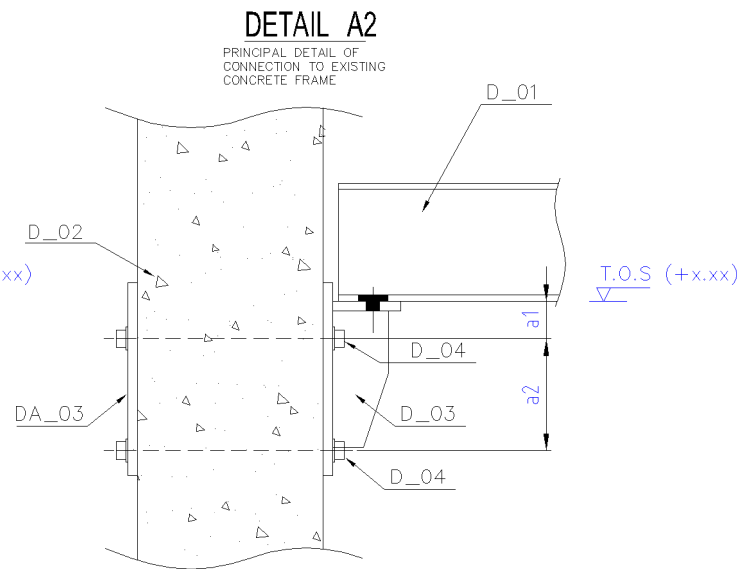
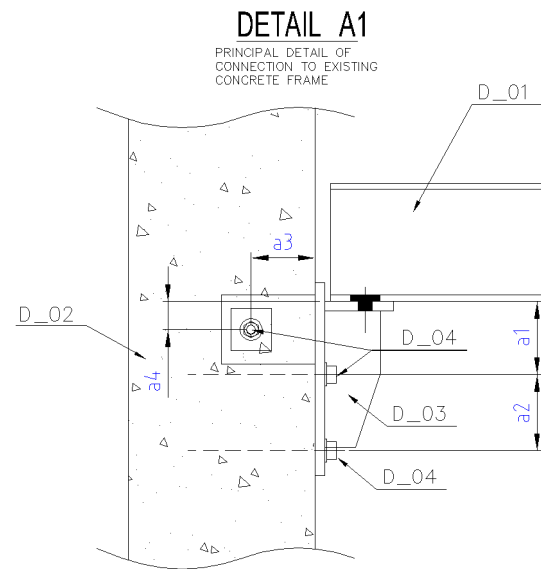
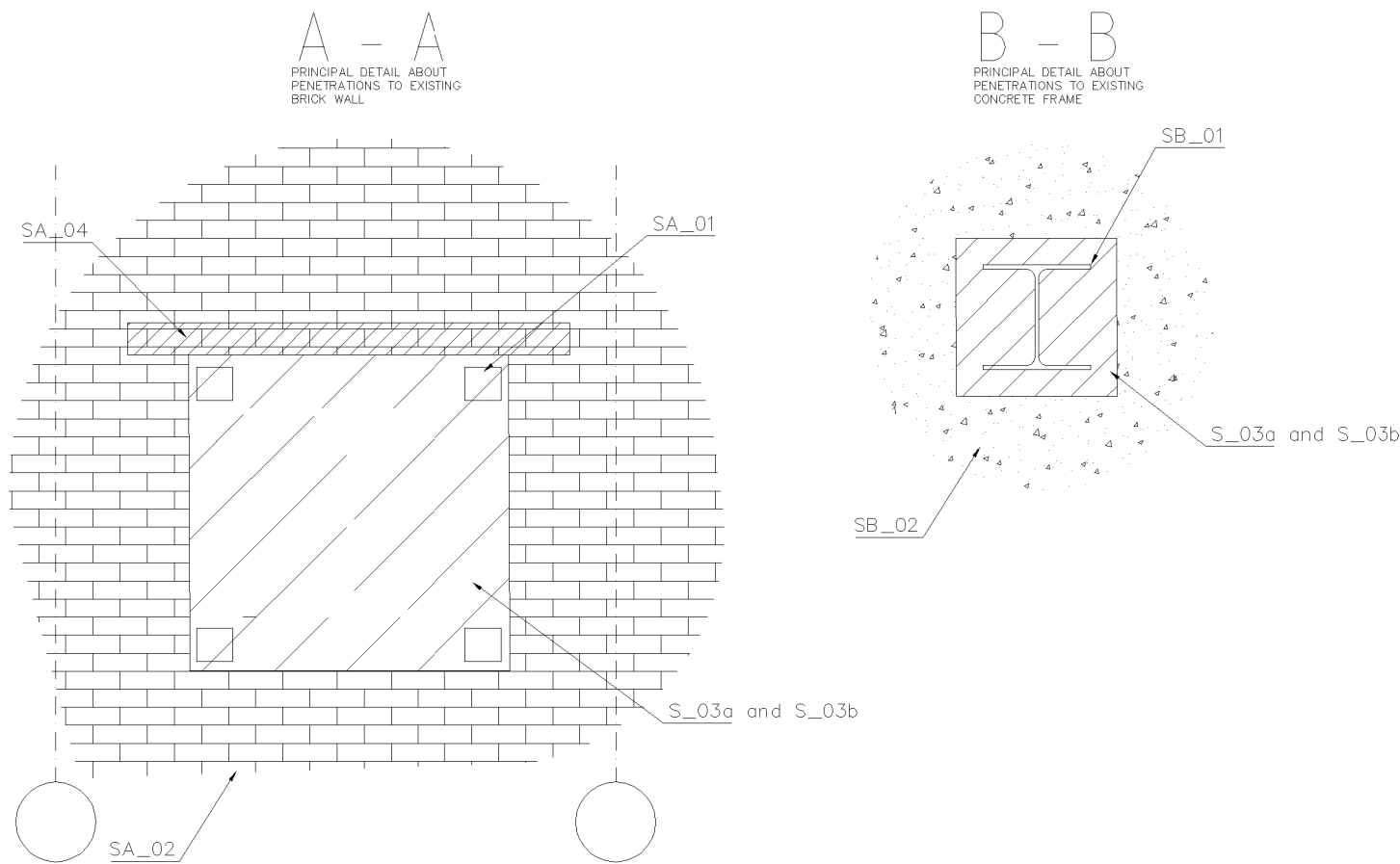
Projection method 	General tolerances 	ISO 2768- ISO 13 920-	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.				Size A 3
						Scale
Proj. no BFB21-00942 Proj. name SKO Energo BFB Czech Republic						
Title Delivery limit drawing for civil and structural For boiler K20 and for existing boilers K80/K90.						
Code ACC06		Info		Doc.id MF00683247		Revision 1
Status		PAGE 1/5				





Projection method	General tolerances	ISO 2768- ISO 13 920-	Welding symbols	Assembly Doc	Weight	Volume
			ISO 2553			
Valmet						Size A 3
This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.						Scale
Proj. no	Proj. name					Czech Republic
	BFB21-00942 SKO Energo BFB					
Title	Delivery limit drawing for civil and structural					
	For boiler K20 and for existing boilers K80/K90.					
Code	ACC06	Info	Doc.id		Revision	
Status			MF00683247		1	

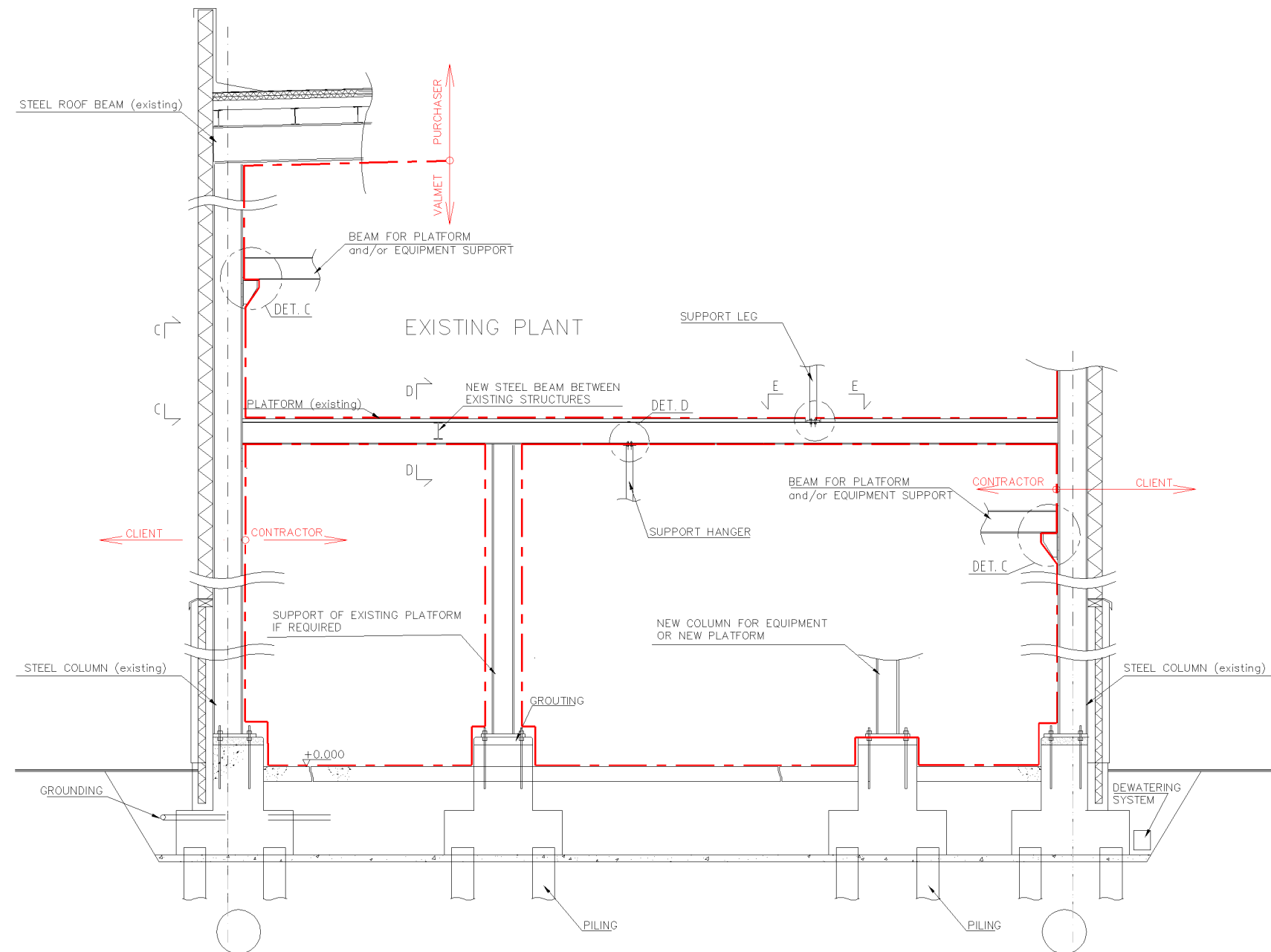
Rev	Revision note	Created by	Checked by	Approved by	Date
1	----	G Bijmolt	P. Salo	P. Salo	----
Creation date: 5.3.2024					

Publishing date: ----



ID	DESCRIPTION	Process design	Basic engineering	Detail engineering	Supply	Erection	COMMENT
D_01	STEEL BEAM FOR PLATFORM AND/OR EQUIPMENT SUPPORT	-	V	V	V	V	
D_02	EXISTING CONCRETE STRUCTURE	-	-	-	-	-	
D_03	STEEL CONSOLE <ul style="list-style-type: none"> Connection with steel structure is designed with slotted holes if possible. Where possible console has additional holes for temporary connection to concrete. 	-	V	V	V	V	
D_04	ANCHOR IN EXISTING CONCRETE <ul style="list-style-type: none"> Console design Verification of design capacity of existing structure Design of anchor bolt location Verification of anchor bolt location and verification of design capacity of connection before detail design of console. Erection drawings with anchor bolt locations and locations of consoles. 	-	V	V	V	V	<div> <div></div> <div> Anchors are typically chemical anchors, however expansion anchors can be used in smaller connections. </div> </div>
D_05	GROUTING	-	V	V	V	V	
D_06	EXISTING STEEL STRUCTURE	-	-	-	-	-	
D_07	CONNECTION TO EXISTING STEEL STRUCTURE <ul style="list-style-type: none"> Console design Verification of design capacity of existing structure in the close surrounding of the modified area. Design of connection (Site welded or Site bolted) Verification of bolt/weld location and verification of design capacity of connection before detail design of console. Erection drawings with anchor bolt locations and locations of consoles. 	-	V	V	V	V	<div> <div></div> <div> Contractor does not verify the complete existing structural frame. </div> </div>
SA_01	STEEL STRUCTURE THROUGH EXISTING STRUCTURE	-	V	V	V	V	
SA_02	EXISTING BRICK WALL STRUCTURE	-	-	-	-	-	
SA_03a	OPENINGS IN EXISTING FOR PIPING AND STEEL STRUCTURES <ul style="list-style-type: none"> Erection drawing with location and size of opening Verification of design capacity of existing structure in the close surrounding of the modified area. Verification of opening and verification of structure surrounding the opening Reinforcing of structure in close surrounding of opening (if needed) 	-	V	V	V	V	<div> <div></div> <div> Contractor does not verify the complete existing structural frame. </div> </div> <ul style="list-style-type: none"> Opening filled with metal sheet sandwich element.
SA_03b	CLOSING and/or FINISHING OF CREATED OPENING	-	V	V	V	V	<ul style="list-style-type: none"> Opening may be filled with metal sheet sandwich element. Opening may be filled with concrete Opening may be closed with grating/ tearplate Opening may remain open and edge will be made with steel profile kickplate.
SB_01	STEEL STRUCTURE THROUGH EXISTING STRUCTURE	-	V	V	V	V	
SB_02	EXISTING CONCRETE STRUCTURE	-	-	-	-	-	

Projection method 	General tolerances 	ISO 2768- ISO 13 920-	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.</p>					Size	A 3
					Scale	
Proj. no BFB21-00942 Proj. name SKO Energo BFB Czech Republic						
Title Delivery limit drawing for civil and structural For boiler K20 and for existing boilers K80/K90.						
Code ACC06	Info		Doc.id MF00683247			Revision 1
Status			PAGE 3/5			






NOTE: FINAL FOUNDATION TYPE AND NEED OF PILING SHALL BE SPECIFIED BY CLIENT'S CIVIL ENGINEER ACCORDING TO ACTUAL SOIL CONDITIONS HOWEVER FOUNDATION OF EACH BUILDING IS ASSUMED ONE ENTITY

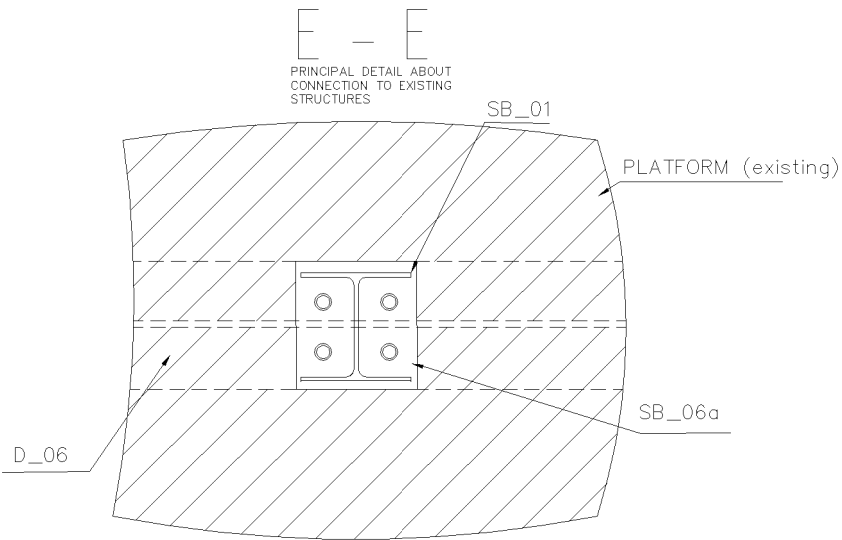
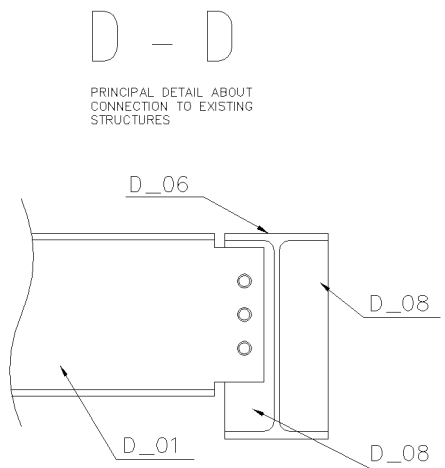
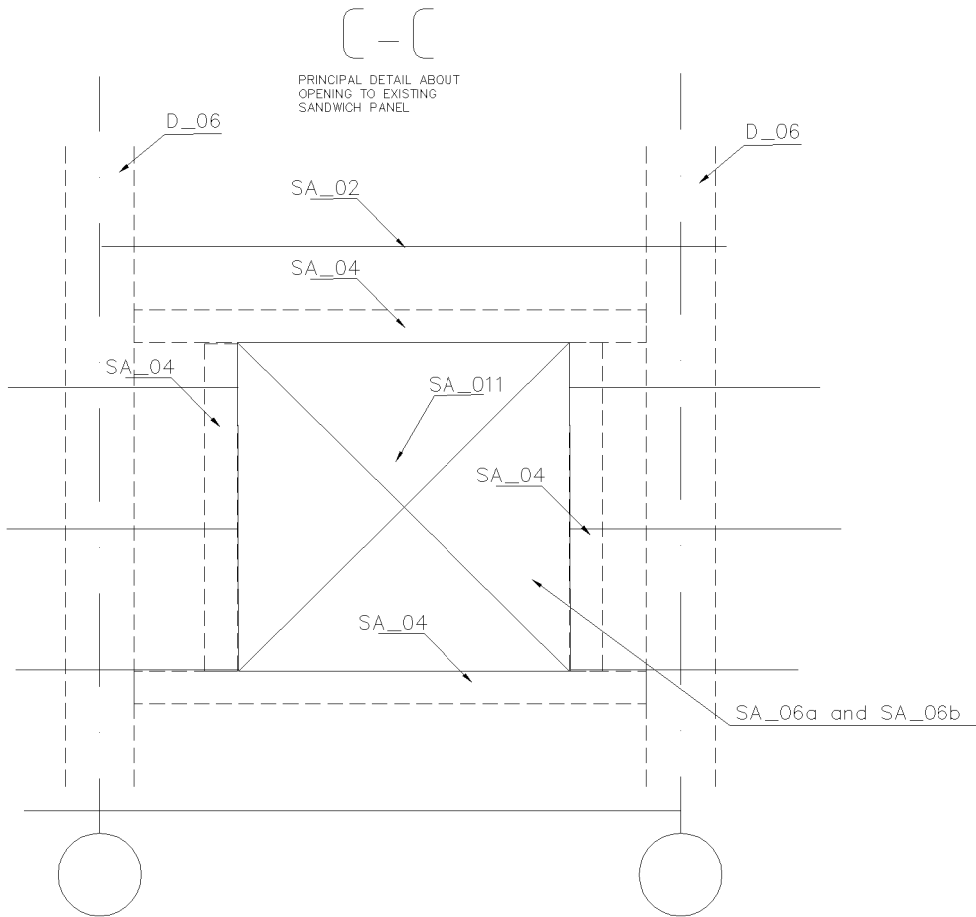
EXCLUDED FROM VALMET SCOPE:
 - SITE CLEARING, EARTH WORKS, FOUNDATIONS, GROUTING AND SOLDERING

ANCHORBOLTS AND CONCRETE CAST BASE PLATES:
 - PURCHASER; DELIVERY OF ITEMS TO SITE
 - CLIENT; UNLOADING AND STORING TO SITE WAREHOUSE, ASSEMBLY and INSTALLATION OF ITEMS, REPORT OF AS-BUILT DIMENSIONS OF ITEMS

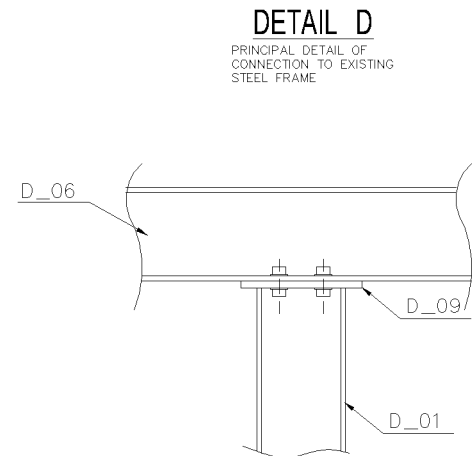
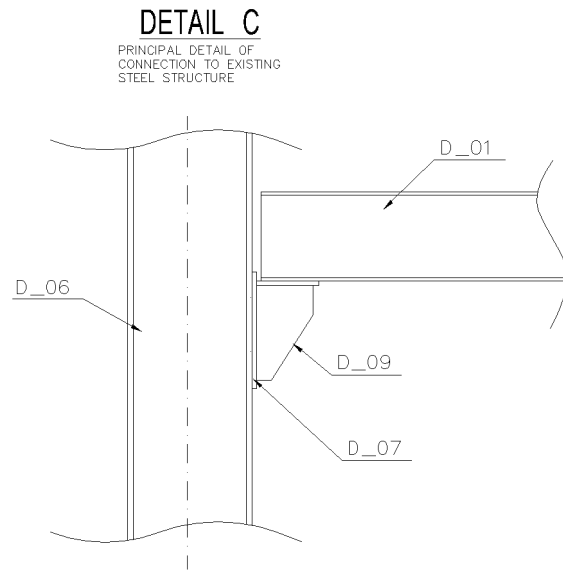
Publishing date: ----

Rev	Revision note	Created by	Checked by	Approved by	Date
1	----	T. Koivumäki	P. Salo	P. Salo	----
	Creation date: 5.3.2024				

Projection method 	General tolerances 	ISO 2768- ISO 13 920-	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.				Size A 3
						Scale
Proj. no BFB21-00942 Proj. name SKO Energo BFB Czech Republic						
Title Delivery limit drawing for civil and structural For boiler K20 and for existing boilers K80/K90.						
Code ACC06		Info		Doc.id.		Revision
Status				PAGE 4/5		1



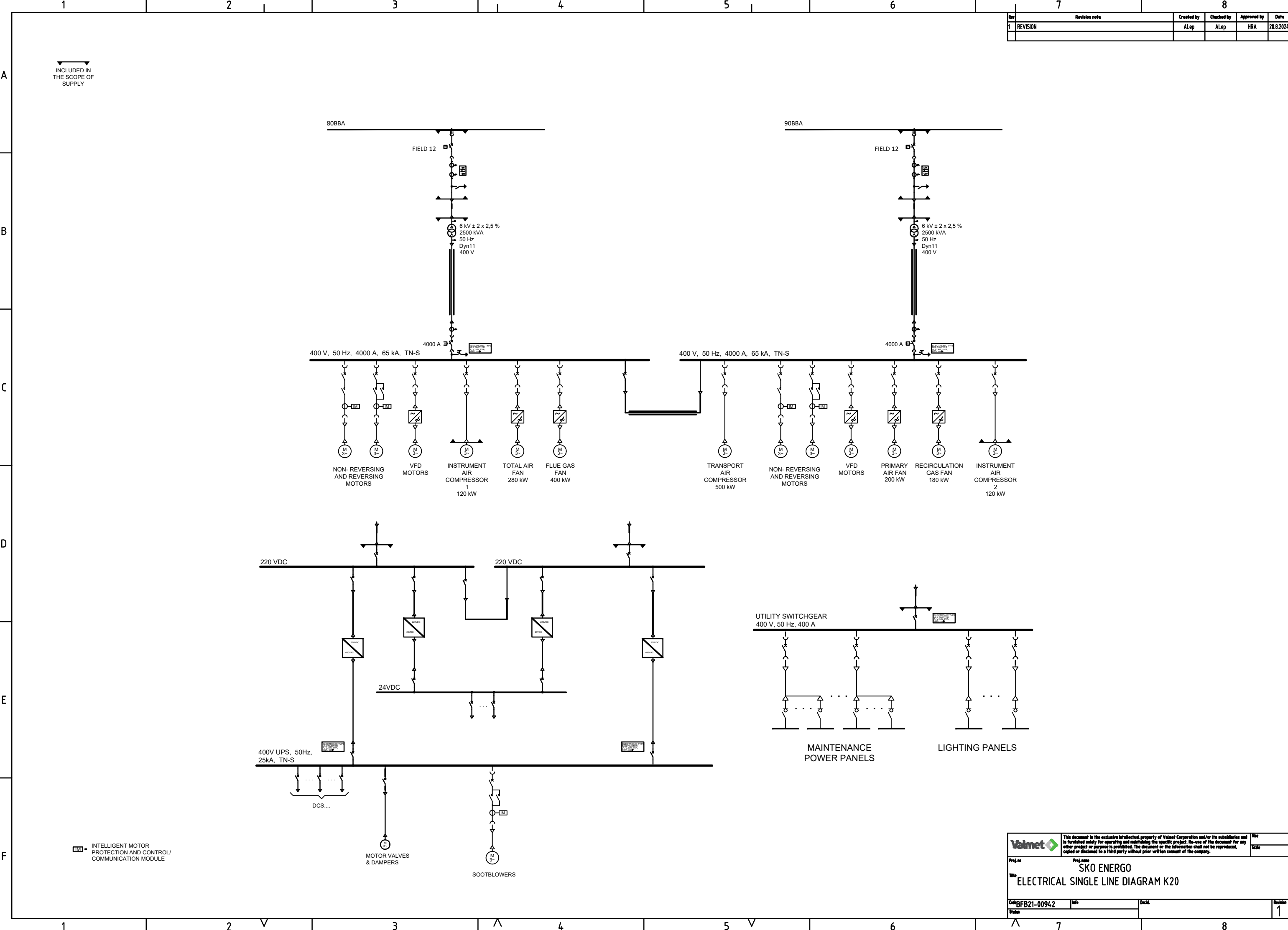
ID	DESCRIPTION	Process design	Basic engineering	Detail engineering	Supply	Erection	COMMENT
D_01	STEEL BEAM FOR PLATFORM AND/OR EQUIPMENT SUPPORT	-	V	V	V	V	
D_06	EXISTING STEEL STRUCTURE	-	V	V	V	V	Verification of the existing structure in the scope of Valmet
D_07	CONNECTION TO EXISTING STEEL STRUCTURE <ul style="list-style-type: none">- Console design- Verification of design capacity of existing structure in the close surrounding of the modified area.- Design of connection (Site welded or Site bolted)- Verification of bolt/weld location and verification of design capacity of connection before detail design of console.- Erection drawings with anchor bolt locations and locations of consoles.	-	V	V	V	V	<input checked="" type="checkbox"/> Contractor does not verify the complete existing structural frame.
D_08	CONNECTION AND STIFFENING PLATE <ul style="list-style-type: none">- Steel plate is welded by the contractor to the existing structure.	-	V	V	V	V	
D_09	STEEL CONSOLE TO STEEL STRUCTURE <ul style="list-style-type: none">- Connection with steel structure is designed with slotted holes if possible or welded at site	-	V	V	V	V	
SA_04	SUPPORT STRUCTURE FOR THE SANDWICH ELEMENTS.	-	V	V	V	V	
SA_05	EXISTING WALL STRUCTURE	-	-	-	-	-	
SA_06a	OPENING IN EXISTING <ul style="list-style-type: none">- Erection drawing with location and size of opening- Verification of design capacity of existing structure in the close surrounding of the modified area.- Design and supply of hole support structure	-	V	V	V	V	<ul style="list-style-type: none">- Opening may be closed with rockwool and sheeting- Opening may be closed with grating or tearplate- Opening may remain open and edge will be made with steel profile kickplate.<input checked="" type="checkbox"/> Valmet does not verify the complete existing structural frame.
SA_06b	CLOSING and/or FINISHING OF CREATED OPENING	-	V	V	V	V	
SA_7	OPENINGS TO THE SANDWICH PANELS	-	V	V	V	V	



Projection method	General tolerances	ISO 2768- ISO 13 920-	Welding symbols	Assembly Doc	Weight	Volume
			ISO 2553			
Valmet						This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.
Proj. no BFB21-00942						Size A 3
Proj. name SKO Energo BFB						Scale
Title Delivery limit drawing for civil and structural For boiler K20 and for existing boilers K80/K90.						
Code ACC06						Doc.id
Status						Revision 1


Rev	Revision note	Created by	Checked by	Approved by	Date
1	----	T. Koivumäki	P. Salo	P. Salo	----
Creation date: 5.3.2024					

Publishing date: ----



INCLUDED IN
THE SCOPE OF
SUPPLY

Rev	Revision note	Created by	Checked by	Approved by	Date
1	REVISION	ALep	ALep	HRA	20.8.2024

		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purposes is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.		Size
Proj.no	Proj.name		SKO ENERGO	Scale
Title				
ELECTRICAL SINGLE LINE DIAGRAM K20				
Code	BFB21-00942	Info	DocId	Revision
Status				1



TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR

Refurbishment of the Combined Heat and Power Plant
in Mladá Boleslav

Business Package OB 2

**BOILER HOUSES,
BIOMASS BOILER K20**

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 2/4
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Contents

1	DESIGN DATA.....	3
1.1.1	Boiler feedwater quality	3
1.1.2	Boiler water quality	3
1.1.3	Combustion diagram	3
1.1.4	Capacity	4
1.1.5	Explosion prevention design values	4
1.1.6	Utilities and services.....	4

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 3/4
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1 DESIGN DATA

Design data describes other parameters with ranges which form the basis for the design and dimensioning of the boiler and its auxiliary equipment.

1.1.1 Boiler feedwater quality

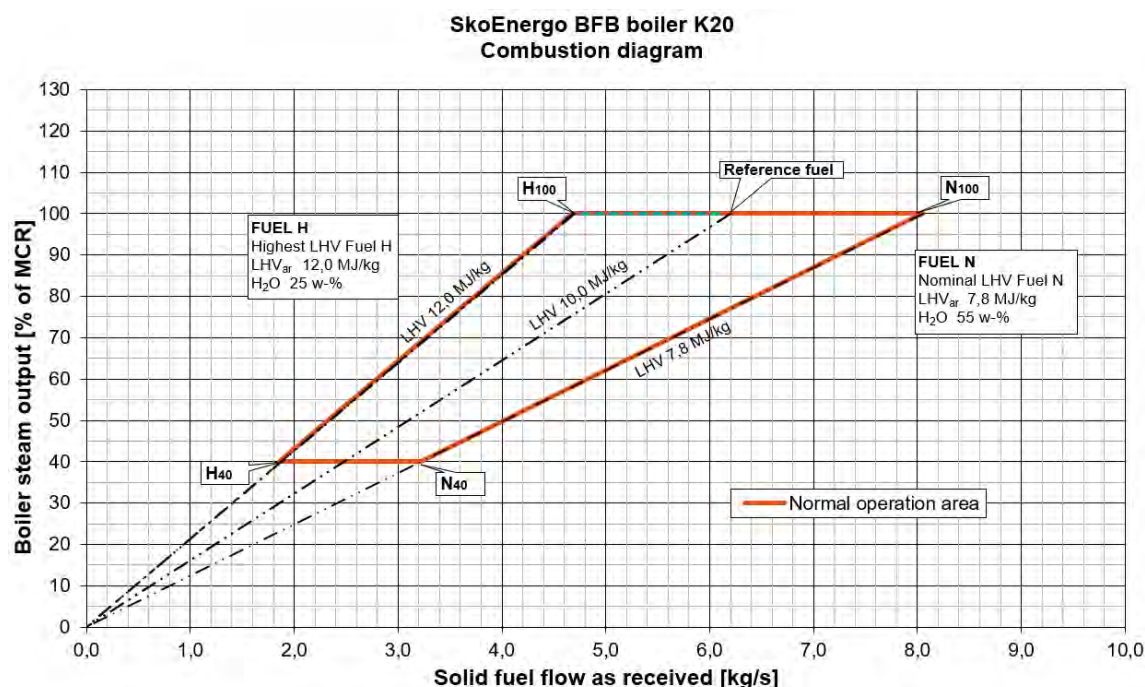
	Unit	Value
Sodium + Potassium	mg/kg	< 0,01
Organic substances (TOC, total organic carbon)	mg/kg	< 0,1

1.1.2 Boiler water quality

	Unit	Value
pH ₂₅		9,4 - 10,2
Cation conductivity and direct conductivity	μS/cm	< 50
Silica (SiO ₂)	mg/kg	20
PO ₄	mg/kg	< 6
Permanganate index	mg/l	< 15

1.1.3 Combustion diagram

Operation range of the boiler is specified by the combustion diagram.



Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 4/4
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.1.4 Capacity

Steam generating capacity of the boiler with the design fuel range:

		Design	Min
Capacity with design fuel mixtures	t/h	80	32
Operating pressure	MPa	12,5	12,5

1.1.5 Explosion prevention design values

The explosion relief equipment in the fuel feeding system is dimensioned to the following values:

Parameter	Unit	Value
Kst constant A constant numerically equal to the maximum rate of pressure increase in a volume of 1 m3 ("KST constant")	bar m/s	150
Max explosion pressure	bar	9,7

1.1.6 Utilities and services

Industrial water	Unit	Value
Operating pressure at the delivery limit	bar(g)	7
Design pressure of the pipeline	bar(g)	10
Operating temperature / range at the delivery limit	°C	25 /1-30
Design temperature	°C	60
Potable water	Unit	Value
Operating pressure at the delivery limit	bar(g)	5
Design pressure of the pipeline	bar(g)	8
Operating temperature / range at the delivery limit	°C	20 /1-30
Design temperature	°C	60
Cooling water (mill closed cooling circuit)	Unit	Value
Closed cooling water system design pressure	bar(g)	8
Closed cooling water system design temperature	°C	60

Table of Contents

1 DESIGN DATA	2
1.1.1 Guarantee fuels and range for all fuel mixtures	2
1.1.2 Boiler thermal capacity	3
1.1.3 HP-steam and feedwater	3
1.1.4 Combustion air	4
1.1.1 Boiler feedwater quality	4
1.1.5 Boiler water quality	4
1.1.6 High surface area hydrated lime	5
1.1.7 Sodium bicarbonate	5
1.2 General design data	5
1.2.1 Capacity	5
1.2.2 Combustion diagram	6
1.2.3 Kst value (basis for explosion prevention design)	6
1.2.4 Auxiliary fuels	7
1.2.5 Noise	8
1.2.6 Utilities and services	8

1 DESIGN DATA

Design parameters are of Purchaser's responsibility. Most of the design data is presented in the Annex A6, Guarantee values. In this document additional clarifications to design figures are stated.

1.1.1 Guarantee fuels and range for all fuel mixtures

Guarantee fuels are defined in Annex A6 GuaranteeValues. However, as the fuel design parameters defining min and max values cannot be combined totally freely, in the following table the clarifications for the ranges of fuel properties are presented.

Table 3.1 Guarantee fuel mixture for performance guarantees and ranges for fuel mixtures.

		Fuel 1: Wood chips		Fuel 2: Plant pellets		Guarantee fuel mix (40% wood chips, 60% pellets)	Range for All Mixtures
Parameter	Unit	Guarantee value	Design range	Guarantee value (for mix calc)	Design range	Guarantee value	
Range	% of energy		60 -100%		0-40%		
Lower heating value (LHV)	MJ/kg as received	10	7,8 - 12	15,5	12-17,5	11,64	7,8 – 13,7
Moisture	%	40		12		31,65	< 55
Ash content	% of DS	6,67		6,82	<11,9	6,41	< 18,7
Metallic Aluminium	%of DS						<0,01
Total metal	% of DS						< 0,3
Elementary analysis							
Carbon C	% of DS	50		48,86		49,6	
Hydrogen H	% of DS	6,17		5,5		6,2	
Oxygen O	% of DS	36,6		35,8		36,57	
Sulphur S	% of DS	0,08		0,23		0,14	
Nitrogen N	% of DS	0,5		1,93		1,05	
Chlorine Cl	% of DS	0,025	<0,044	0,114	< 0,179	0,058	< 0.097
Fluoride F	mg/kg DS	0,003				0,004	< 0,004
Sulphur/Chlorine ratio		3,7				2,6	

Ash major components							
Sodium Na	% of DS	30	<60	145	<260	75	< 138
Potassium K	% of DS	1300	< 2900	9200	<11000	4 366	< 6 043
Na + K	% of DS	1330	<2960	9345	<11260	4 430	< 6 170
Na ₂ O+ K ₂ O in ash	% of DS	2,4	<15	16,5	<20	8	< 15*

Note: wt = weight, DS = Dry Solids, a.r.=as received.

**The firing of high alkali content agro fuels with minimum ash content shall be limited so that the alkalioxide sum of ashes in the fuel mixture does not exceed the stated value.*

For performance tests the fuel must be close to design fuel. Small variation from design fuel will be corrected with correction curves to correspond to the design fuel.

1.1.1.1 Other fuel properties

Fuel is deemed to be clean and uncontaminated. Fuels will not contain unlisted chemicals to the extent that would be harmful for the combustion process or cause corrosion and erosion.

1.1.1.2 Design biofuel particle size

Design biofuel particle size shall be as defined in Annex A6.

1.1.2 Boiler thermal capacity

	Unit	Value
At 100% MCR -load with Guarantee fuel (Reference fuel)	MW	71

HP-steam and feedwater values according to the data in the following section (Customer Annex A6 guarantee values). For load limitations on fuel properties outside Reference fuel, see Chapter 1.2.2 Combustion diagram.

1.1.3 HP-steam and feedwater

Steam at superheater outlet on MCR load	Unit	Value
Pressure	bar(g)	125
temperature	°C	535
Feedwater before economizer		
temperature	°C	205
Temperature range	°C	160* - 210

*see Chapter 1.2.2 Combustion diagram for load restrictions for boiler operation on FW preheater bypassed.

1.1.4 Combustion air

Air temperature at the suction duct inlet		
for performance test and balance calculations	°C	20
Maximum	°C	60 (based on existing data on inlet temperatures to fan)
Minimum	°C	5
Air properties at suction duct inlet for design purposes:		
Air pressure	mbar	98,8
Air humidity	g/kg dry air	9

The combustion air shall be preheated with Clients existing steam coil air heater prior to entering flue gas air preheaters to temperature defined in Predicted performance document for each test point. The estimated amount of steam required is presented in the same document.

1.1.1 Boiler feedwater quality

	Unit	Value
pH ₂₅		> 9,2
Cation conductivity	µS/cm	< 0,2
Oxygen	mg/kg	>0,003 < 0,01
Sodium + Potassium	mg/kg	< 0,01
Silica (SiO ₂)	mg/kg	< 0,02
Organic substances (TOC, total organic carbon)	mg/kg	< 0,1
Copper, total	mg/kg	< 0,003
Iron, total	mg/kg	< 0,02

1.1.5 Boiler water quality

	Unit	Value
pH ₂₅		9.3 - 9.7
Cation conductivity and direct conductivity	µS/cm	< 40
Silica (SiO ₂)	mg/kg	0,9
PO ₄	mg/kg	1...3
Permanganate index	mg/l	< 15

1.1.6 High surface area hydrated lime

	Unit	Value
Specific area (BET)	m ² /g	> 40
Ca(OH) ₂ content	%-wt	> 94
Particle size	< 90 μm	> 95
	< 5 μm	< 55

1.1.7 Sodium bicarbonate

	Unit	Value
NaHCO ₃ content	%-wt	> 98
Particle size	< 20 μm	> 90

In the event that the guaranteed emission limits for HCl and SO₂ are not achieved using hydrated lime (Ca(OH)₂) due to an increase in the flue gas temperature, the additive is substituted with sodium bicarbonate (NaHCO₃).

Only sodium bicarbonate (NaHCO₃) may be used as a substitute for hydrated lime, not sodium carbonate (Na₂CO₃).

In order to fulfil the emission limits for fuel mixture (According to *Annex J of the tender documentation - Operating costs for the purposes of tender evaluation, Note d: The values for the combustion input of 60% wood chips and 40% plant pellets are filled in.*) using sodium bicarbonate (NaHCO₃), the guaranteed consumption is 18 kg/h.

1.2 General design data

1.2.1 Capacity

Steam generating capacity with guarantee (reference) fuel mixture:

		Design	Min
Fuel mixture			
Capacity with guarantee fuel mixtures	t/h	100	60
Operating pressure	Mpa(g)	12,5	12,5

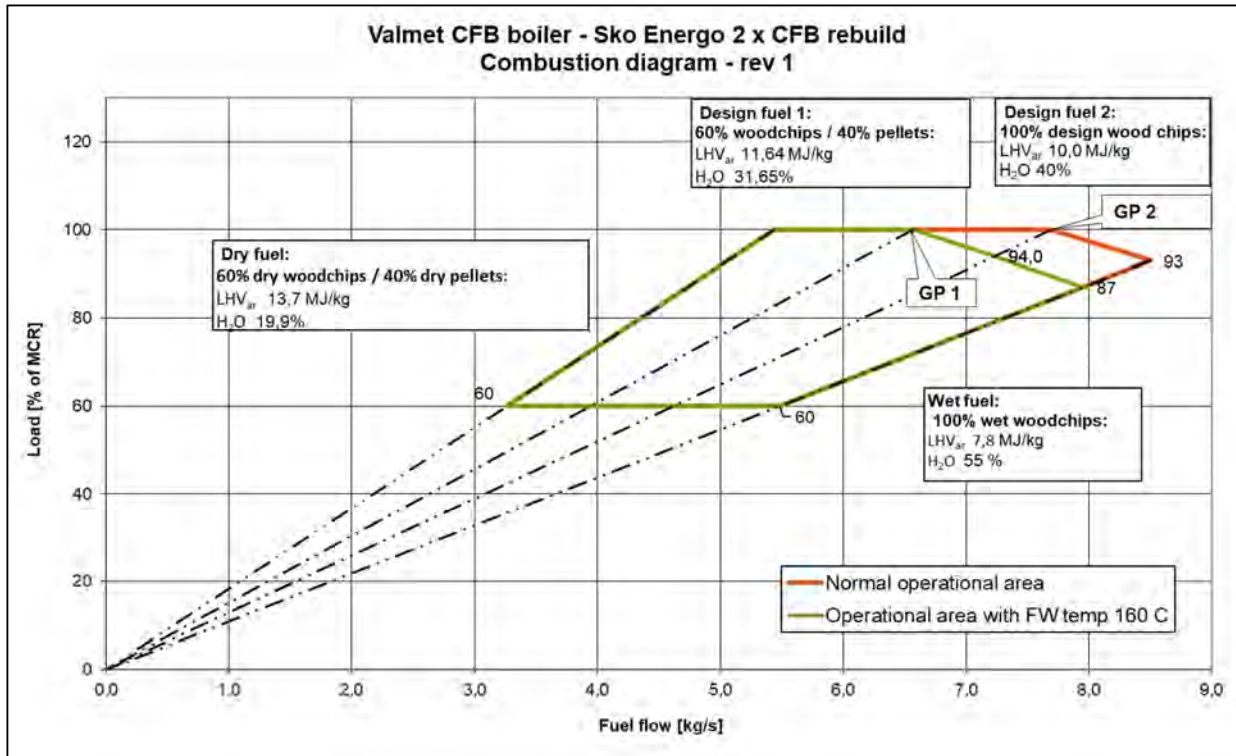
For capacity with whole fuel design range, see Combustion diagram (Chapter 1.2.2).

Steam generation with feedwater preheater bypassed, see Combustion diagram (Chapter 1.2.3)

Steam generation capacity when firing Technological fuel is lower than MCR capacity, depending on moisture content of technological fuel.

1.2.2 Combustion diagram

The operational area for the boiler with whole design range of fuels is presented in the following figure, including the operation with feedwater preheater bypassed.



In case of campaignwise combustion of Technological fuel, the max allowable boiler load with solid fuel shall be limited so that the total flue gas flow does not exceed the design flue gas flow of 100% guarantee wood chips fuel combustion. This is dependent on technological fuel moisture content and amount to be fired.

1.2.3 Kst value (basis for explosion prevention design)

The explosion relief equipment in the fuel feeding system is dimensioned to the following values (According to Client Annex L: Documentation for civil permits, folder B, file DOPV (Explosion protection documentation), chapter 3.3.):

Table 3.2 kSt values used for design

	Kst-value	P _{max}
Wood chips	150	9,7
Plant pellets*	155	8,3

*for information only, no changes to feeding system by Valmet.

1.2.4 Auxiliary fuels

Technological fuel

Technological fuel properties according to Section 4, Annex A6 Guarantee values, Chapter 2.2.7. Properties not defined in Client's documentation are based on following figures.

	Unit	Value
Type		Technological fuel
Density	kg/m ³	986*
Ignition point	°C	> 65*
Viscosity (at the burner)	cSt	10...20
Pressure at terminal point	bar(g)	10-12
Temperature at terminal point	°C	40...65
Nitrogen content, max.	wt%	0,05**

*Dimensioning figures by Valmet as no other information available.

**For emission guarantee

Natural gas

Technological fuel properties according to Section 4, Annex A6 Guarantee values, Chapter 2.2.6. Properties not defined in Client's documentation are based on following figures.

	Unit	Value
Type		Natural gas
Lower heating value (LHV)	MJ/Nm ³	35,25
Gas density	kg/Nm ³	0,829*
Pressure at the battery limit	bar(g)	2 – 3

Ultimate analysis		Unit	Design
Methane	CH ₄	mol-%	96,3
Ethane	C ₂ H ₆	mol-%	1,5
Propane	C ₃ H ₈	mol-%	0,4
Nitrogen	N ₂	mol-%	0,9
Carbon dioxide	CO ₂	mol-%	0,4
Nitrogen	N ₂	mol-%	0,9

1.2.5 Noise

For Valmet design indoor noise level of the scope of supply will be in accordance with the directive 2003/10/EC enabling worker's daily sound pressure $L_{EX, 8h}$ not exceeding 85 dB(A) in normal operation conditions.

The sound pressure level may exceed 85 dB(A) in vicinity of the following equipment:

- Sootblowers
- Fans and blowers
- Ash conveyors
- Silo reclaimers
- Control and blow down valves with high pressure drop
- Other equipment that are not in full time operation.

Customer existing equipment shall not be checked for noise level requirements.

1.2.6 Utilities and services

Medium pressure steam shall be used as heating media for combustion air in existing steam coil air heater.

Inner cooling circuit water will be used as cooling water for bottom ash equipment.

Medium Pressure Process Steam*	Unit	Value
MP steam nominal pressure at terminal point	bar(g)	18
MP steam nominal temperature at terminal point	°C	240
Industrial water	Unit	Value
Temperature normal/range	C	25
Guaranteed pressure of industrial water at terminal point	bar(g)	7
Cooling water of inner cooling circuit (Annex A6, chapter 2.2.10)	Unit	Value
Cooling water supply temperature nominal /range	°C	15/ 10 – 30
Cooling water return temperature	°C	40
Guaranteed pressure of cooling water at delivery limit	bar(g)	5
Cooling water quality (see annex A6, chapter 2.2.10, demiwater)		

Instrument Air	Unit	Value
Guaranteed pressure of instrument air at terminal point	bar(g)	6 – 8
Dew point max	°C	-40
Quality ISO 8573-1:2010		1.3.2.

Pressurized Air	Unit	Value
Guaranteed pressure of pressure air at terminal point	bar(g)	6 – 8
Dew point max	°C	-40



• Quality ISO 8573-1:2010		1.4.2.
---------------------------	--	--------



TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR

Refurbishment of the Combined Heat and Power Plant
in Mladá Boleslav

Business Package OB 2

BOILER HOUSES, BIOMASS BOILER K20

VOLUME III ***TECHNICAL REQUIREMENTS***

Annex 06 Predicted Performance

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 2/5
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Contents

PREDICTED PERFORMANCE.....	3
----------------------------	---

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 3/5
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

PREDICTED PERFORMANCE

The predicted performance data provided, is for information only and shall not be considered as part of the performance guarantees.

1: Boiler K20, 100% load woodchips

Load case		100% woodchips
Boiler load		100%
Steam and feed water		
Steam flow	t/h	80
Steam temperature	°C	535
Steam pressure	MPa(g)	12,5
Feed water temperature	°C	205
Total heat to steam generation	MWth	56,7
Feed water and steam temperatures		
At the FW valve group	°C	205
Before economizer	°C	202
After economizer	°C	313
Drum	°C	334
After Primary SH 2	°C	410
After Primary SH 3	°C	420
After Secondary SH	°C	475
After Tertiary SH	°C	535
Fuel		
Woodchips	t/h	22,3
LHV (as received)	MJ/kg	10,0
Fuel moisture content	wt-%	40,0
HHV (dry)	MJ/kg	19,63
Solid fuel input (LHV)	MWf	62
Natural gas input	MWf	0
Elementary analysis		
Carbon (C)	wt-% ar	30,0
Hydrogen (H)	wt-% ar	3,7
Oxygen (O)	wt-% ar	22,0
Sulphur (S)	wt-% ar	0,05
Nitrogen (N)	wt-% ar	0,30
Chlorine (Cl)	wt-% ar	0,015
Mercury (Hg)	wt-% ar	<0,01

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 4/5
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Load case		100% woodchips
Ash	wt-% ar	4,0
Fly ash		
Fly ash	kg/s	0,22
Fly ash	t/h	0,8
Bottom ash		
Bottom ash to container incl. impurities	t/d	6,2
Combustion air		
Excess air ratio		1,22
Total combustion air flow	Nm ³ /s	22,4
Primary Air Flow	Nm ³ /s	6,7
Fuel feeding Air Flow	Nm ³ /s	1,0
Overfire Air Flow	Nm ³ /s	14,7
Air temperatures		
Total air temperature in the suction duct	°C	25
Primary air temperature after flue gas airpreheater	°C	157
Overfire air temperature after flue gas airpreheater	°C	213
Flue gas		
Flue gas flow to stack, wet	Nm ³ /s	27,7
Flue gas flow from boiler wet	Nm ³ /s	30,9
Recirculation gas flow, wet	Nm ³ /s	3,2
Flue gas H ₂ O content (Wet)	vol-%	21,5
Flue Gas O ₂ Content (Wet)	vol-%	3,0
Flue gas temperatures		
Temperature after furnace	°C	935
Temperature before tertiary SH	°C	725
Temperature before Primary SH	°C	695
Temperature before Economizer (3 rd pass)	°C	428
Temperature after Economizer	°C	229
Temperature after Flue gas airpreheater	°C	147
Flue gas velocities		
Entering tertiary superheater	m/s	6,0
Entering primary superheater	m/s	9,4
Entering economizer (3 rd pass)	m/s	9,9
Entering flue gas airpreheater	m/s	8,4
Efficiency according to EN 12952:15		
Reference Temperature	°C	25

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 5/5
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 08/2023
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Load case		100% woodchips
Fuel Temperature	°C	25
Efficiency	%	91,2
Emissions at Stack (6% O2, dry)		
Particulates	mg/Nm ³	< 5
NOx	mg/Nm ³	< 140
SO ₂	mg/Nm ³	< 35
CO	mg/Nm ³	< 80
HCl	mg/Nm ³	< 5
HF	mg/Nm ³	< 1
NH ₃	mg/Nm ³	< 10
Hg	ug/Nm ³	< 5
CONSUMPTION OF UTILITIES K20		
Fluidized bed sand	kg/h	<70
Ammonia solution (25-% NH ₃)	kg/h	<30
Hydrated lime	kg/h	0
Auxiliary power consumption	kW	<790
Heat input to cooling water average	kW	~700
Industrial water	kg/s	< 0,1
Transport air	nm ³ /h	300
Instrument air	nm ³ /h	150



Table of Contents

1 PREDICTED PERFORMANCE	2
-------------------------	---

1 PREDICTED PERFORMANCE

The predicted performance data provided, on the following pages, is for information only and shall not be considered as part of performance guarantees.

Load case		40% plant pellets, 60 % wood chips	100% wood chips	40% plant pellets, 60 % wood chips	100% wood chips
Load case description		100%	100%	60%	60%
Steam and feed water					
Steam flow	kg/s	27,78	27,78	16,67	16,67
		100	100	60	60
Steam temperature	°C	535	535	520	520
Steam pressure	bar(g)	125	125	125	125
Feed water flow	kg/s	27,78	27,78	16,67	16,67
Feed water temperature	°C	205	205	205	205
Feed water pressure at Economizer inlet	bar(g)	150	150	150	150
Spray water flow, total	kg/s	2,5	2,7	0,78	0,94
Spray water temperature	°C	205	205	205	205
Blowdown flow	kg/s	0*	0*	0	0
Total heat to steam generation	MW	71	71	41,97	41,97
Feed water and steam temperatures					
Before economizer	°C	205	205	205	205
After economizer	°C	292	299	293	293
Drum	°C	330	330	328	328
After primary SH	°C	425	430	413	418
Before secondary SH	°C	394	411	399	410
After secondary SH	°C	480	480	473	460
Before tertiary SH	°C	476	476	473	473
After tertiary SH	°C	535	535	520	520
Fuel					
Wood chips	kg/s	4,57	7,68	2,75	4,60
Bulk density of wood chips, loose	kg/m ³	250	250	250	250
Volume flow of wood chips, design	m ³ /h	110	66	39	66
Plant pellets	kg/s	1,94	-	1,17	-
Natural gas flow	Nm ³ /s	-	-	-	-
Total solid fuel mixture	kg/s	6,51	7,68	3,92	4,58
LHV (as received)	MJ/kg	19,50	19,63	19,50	19,63

Load case		40% plant pellets, 60 % wood chips	100% wood chips	40% plant pellets, 60 % wood chips	100% wood chips
HHV (dry)	MJ/kg	75,72	76,52	45,5	46,0
Solid fuel input (LHV)	MW	-	-	-	-
Natural gas/oil input	MW	11,64	10,0	11,64	10,0
Elementary analysis					
Carbon (C), dry fuel	wt-%	49,56	50	49,56	50
Hydrogen (H), dry fuel	wt-%	6,20	6,17	6,20	6,17
Oxygen (O), dry fuel	wt-%	36,57	36,552	36,57	36,552
Sulphur (S), dry fuel	wt-%	0,14	0,08	0,14	0,08
Nitrogen (N), dry fuel	wt-%	1,05	0,5	1,05	0,5
Chlorine (Cl), dry fuel	wt-%	0,059	0,025	0,06	0,025
Ash, dry fuel	wt-%	6,41	6,67	6,41	6,67
Fuel moisture content	wt-%	31,65	40	31,65	40
Ash					
Fly ash (without additive injection)	t/h	1	0,79	0,58	0,48
Bottom ash without sand circulation	t/h	0,11	0,33	0,07	0,2
Combustion air					
Excess air ratio		1,18	1,18	1,53	1,49
Total combustion air flow	Nm ³ /s	25,7	26,80	21,0	20,0
Primary Air Flow	Nm ³ /s	11,5	12,03	8,93	8,93
Fuel feeding Air Flow	Nm ³ /s	11,5	12,03	8,47	8,64
Overfire Air Flow	Nm ³ /s	1,2	1,2	1,2	1,2
Air temperatures					
Suction air temperature	°C	22 /(60, based on data)	22 /(60, based on data)	22 /(60, based on data)	22 /(60, based on data)
Total air after steam air preheater	°C	83	81	75	75
Total air after flue gas air preheater	°C	200	204	195	198
Flue gas					
Flue gas flow, wet	Nm ³ /s	31,7	34,1	23,4	24,5
Recirculation gas flow, wet	Nm ³ /s	-	-	-	-
Flue gas H ₂ O content (Wet)	vol-%	17,8	20,5	14,5	17,1
Flue Gas O ₂ Content (Wet), before FGAH	vol-%	2,88	2,79	6,2	5,8
Flue Gas O ₂ Content (Wet), after FGAH	vol-%	3,25	3,15	6,5	6,05
Flue gas temperatures					
Temperature after furnace	°C	851	837	719	713
Temperature after Tertiary SH	°C	634	632	565	564
Temperature after Primary SH	°C	469	473	432	434
Temperature after Economizer 4	°C	380	387	364	368

Load case		40% plant pellets, 60 % wood chips	100% wood chips	40% plant pellets, 60 % wood chips	100% wood chips
Temperature after Economizer 1	°C	242	246	243	246
Temperature after FGAH	°C	151	154	147	150
Flue gas velocities					
Entering Tertiary SH	m/s	9,0	9,5	5,9	6,1
Entering Primary superheater	m/s	10,1	10,8	6,9	7,2
Entering Economizer 3	m/s	8,2	8,9	5,8	6,1
Entering Economizer 1&2	m/s	7,9	8,6	5,9	6,2
Efficiency according to EN 12952:15					
Reference Temperature	°C	25	25	25	25
Fuel Temperature	°C	22	22	22	22
Efficiency	%	91,5	90,7	89,8	89
EMISSIONS AT STACK (6 % O₂, dry)					
Particulates	mg/Nm ³	<10	<10	<10	<10
NO _x calc as NO ₂	mg/Nm ³	<160 /<200 (daily)	<160 /<200 (daily)	<160 /<200 (daily)	<160 /<200 (daily)
NH ₃	mg/Nm ³	<15	<15	<15	<15
SO ₂	mg/Nm ³	<67 /<128 (daily)	<50 /< 85 (daily)	<67 /<128 (daily)	<50 /< 85 (daily)
CO	mg/Nm ³	<80 /<275 (daily)	<80 /<275 (daily)	<80 /<275 (daily)	<80 /<275 (daily)
HCl	mg/Nm ³	<25	<25	<25	<25
HF	mg/Nm ³	<1	<1	<1	<1
Hg	µg/Nm ³	<5	<5	<5	<5
Consumption of utilities					
Ammoniasulphate solution (30-% NH ₃)'	kg/h	25	25	65	65
Hydrated lime (as 100 %Ca(OH) ₂)	kg/h	30	120	160	100
Sand	kg/h	300	150	180	90
Auxiliary steam (only SCAH's)	kg/s	0,85	0,83	0,56	0,56
Auxiliary steam (SCAHs) calc with air inlet temperature 60 °C (based on existing plant data)	kg/s	0,32	0,3	0,15	0,15

1	Industrial Internet services	2
1.1	Scope of supply	2
1.1.1	Connectivity and process data to Valmet cloud	2
1.1.2	Customer Portal	4
1.1.3	Operations panel	4
1.1.4	Performance evaluations and expert support	4
1.1.4.1	Regular performance evaluations	4
1.1.4.2	On demand expert support	5

Appendix Connectivity to Valmet Cloud 7.01
Appendix Data Access Terms 7.01

1 INDUSTRIAL INTERNET SERVICES

1.1 Scope of supply

The scope includes the following services during 2 years from the Preliminary Acceptance (PAC)e.

- Connectivity and process data to Valmet cloud
- Customer Portal
- Operations panel
- Performance evaluations and expert support

Reports and Industrial Internet applications will be provided in English language. Each service is described more in detail below.

Process data is continuously transferred to Valmet cloud for fast and efficient Client support during start-up, commissioning and operation. This gives the possibility to analyze process performance, maintenance needs of equipment and evaluate root causes.

Industrial Internet services are independent from automation system Contractor.

1.1.1 Connectivity and process data to Valmet cloud

Industrial Internet services provide set-up for remote connection to plant DCS and connectivity to Valmet cloud. The connectivity to Valmet cloud includes data push of process data from Client's DCS and IT systems to Valmet cloud.

Division of responsibility for implementation of connectivity is described in Table 1. Principal overview of Industrial Internet services is shown in Figure 1.

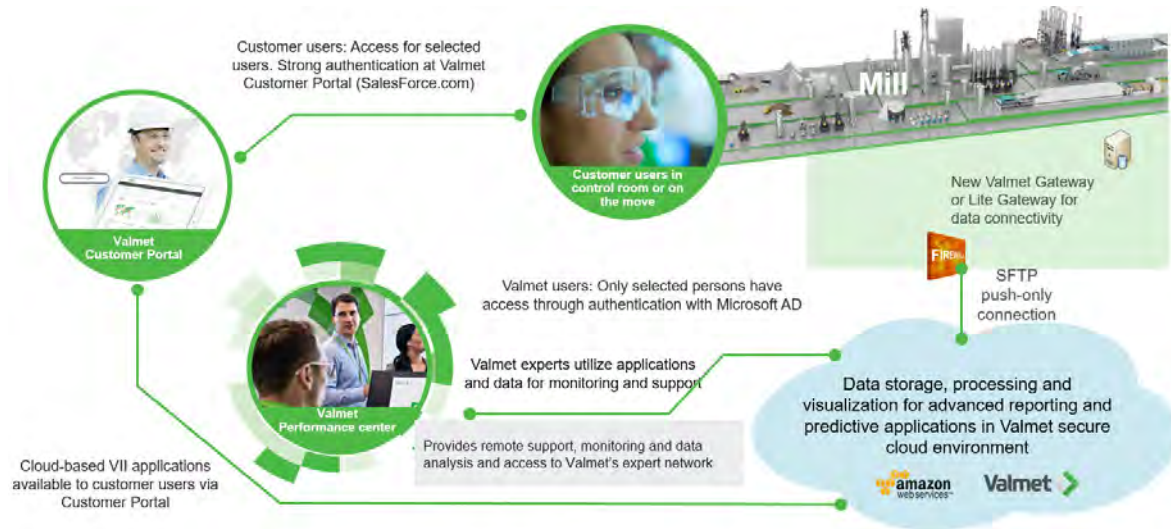
Technical specification and delivery responsibilities of the included standard connectivity solution are described in Appendix Connectivity to Valmet cloud 7.02. At the beginning of the delivery phase, the technical details of the connectivity setup will be agreed with the Client to meet IT security requirements and practices.

S

Item	Definition	Responsibility	Note
Detailed technical solution	Standard connectivity solution is included in the delivery. Adjustments and changes to meet Client's IT requirements will be discussed separately.	Contractor & Client	
Tag selection	Client and Contractor to agree on which tags are required by applications and / or services and ensure that those tags are existing / in collection.	Contractor & Client	5000 tags per boiler, 15 000 tags for all 3 boilers
Data push to Valmet cloud	Remote connection between site and Valmet cloud is needed in order to establish data pipeline for data transfer.	Contractor & Client	
Remote connection (VPN)	Remote access to operator screens (as a minimum read only capability).	Contractor & Client	
Data source availability & configuration	Client makes necessary data available for the data transfer.	Client	
Data server configuration	Client takes care of possible configuration between Client's servers and Valmet connectivity solution / server.	Client	

Table 1 Division of responsibility for implementation of connectivity.

Figure 1 Principal overview of Industrial Internet services.



1.1.2 Customer Portal

Valmet Customer Portal is a common collaboration space between Clients and Contractor. Via Portal Clients have easy access to Contractor's services and expert network. The portal content is personalized for each Client and follows their production line and equipment structure.

1.1.3 Operations panel

Operations panel is a user interface for Valmet cloud applications. Client has access to Operations panel through Customer Portal. Operations panel includes dashboards to visualize Key Performance Indicators (KPI) and a Trending tool. A predefined set of KPIs, for example Production, Consumption, Emissions and Losses, is included.

1.1.4 Performance evaluations and expert support

1.1.4.1 Regular performance evaluations

Reporting on process area performance will be done by compilation of important key performance indicators (KPIs). The process parameters will be followed up via predefined diagrams and the operation will be commented with recommended actions and insights.

Operation follow-up will be carried out on four (4) occasions per year and presented and commented at web-based meetings followed by joint discussion of approximately one hour. Follow-up will be based on provided operation- and process data, including consumption data and laboratory data by the Client. A prerequisite for the services is continuous process data transfer to Valmet cloud.

1.1.4.2 On demand expert support

Valmet Performance Center is available for operational consultations on process, operation, maintenance etc. related questions during normal office hours. Annual time bank of 60 hours is included in the scope.

Client can contact Valmet Performance Center by

- Valmet Customer Portal
- E-mail (energy.performance.center@valmet.com)

All support requests create a case, which can be monitored and collaborated through Customer Portal. Valmet Performance Center and the expert network can analyze the case using the remote connection, cloud data and delivered applications.

Remote expert support from performance centers is provided during the office hours from 8.00 a.m. to 5.00 p.m. (Eastern European Time).



1	VALMET LITE GATEWAY	2
1.1	Network requirements	2
1.2	Prerequisites	4
1.3	Implementation	4
1.4	Contractor's responsibilities in Valmet Lite Gateway delivery	6
1.5	Purchaser's responsibilities in Valmet Lite Gateway delivery	6

1 VALMET LITE GATEWAY

Valmet Lite Gateway is a connectivity product, including hardware and software for collecting and pushing data. It is used for remote connection and establishing a data pipeline from customer site to Valmet cloud.

Valmet Lite Gateway hardware is an industrial-grade PC to be installed on customer premises.

1.1 NETWORK REQUIREMENTS

- HTTPS (443) port opening towards management portal gatemanager.valmetsystem.com / 193.242.155.118
- Connection(s) to data sources in local site or automation network

When Valmet Lite Gateway is implemented, data is flowing and stored to Valmet cloud, enabling the use of data in Valmet cloud applications and analysis. Thus, data and services are in customer's disposal location-independently, authentication-based.

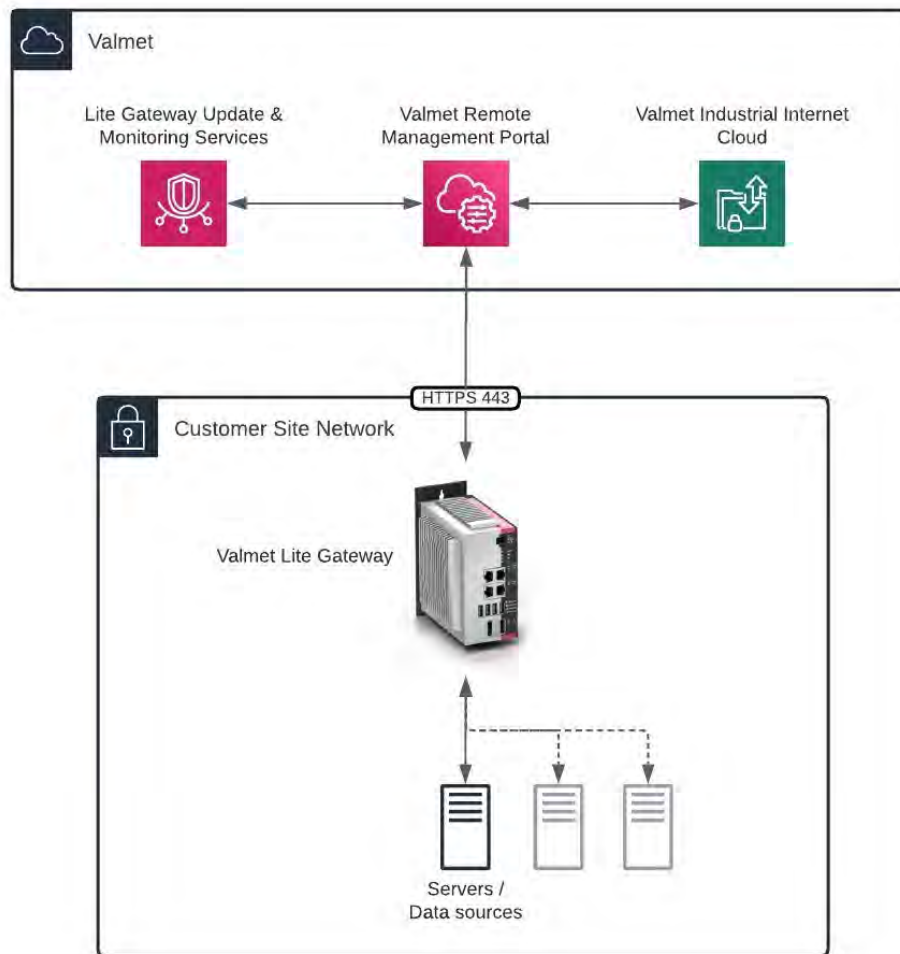


Image 1. Valmet Lite Gateway operating principle

Interfaces south bound

Systems-level interfaces

- Valmet DNA
- Valmet Info Webservice
- Valmet Tiffany Historian
- OSI PI Webservice
- Siemens S7

General data sources / protocols

- OPC UA
- OPC DA
- ODBC
- PostgreSQL / MySQL
- Flat file transfer (e.g., CSV)

Interfaces north bound

Valmet Industrial Internet -cloud

- SFTP

Notes and restrictions

Valmet Lite Gateway is designed to handle small/medium amount of tags

- If tags are collected every second → approximately 4 000 – 5 000 tags
- If tags are collected every 15 seconds → approximately 5 000 – 7 000 tags
- If tags are collected every minute → approximately 7 000 – 10 000 tags

Valmet Lite Gateway delivery does not include source data mapping and/or source data discoveries (e.g., what data is available and where).

After delivery, only hardware of Valmet Lite Gateway is customer's property. Use rights for software delivered with Valmet Lite Gateway remains with Valmet.

1.2 PREREQUISITES

Item / Prerequisite	Definition	Note
Outbound HTTPS (443)	Route to Valmet Industrial Internet cloud management	Mandatory
Data availability from data source	Customer and Valmet to agree on what data is included and ensure that data is available both network-wise and in pre-defined interfaces (south-bound)	Mandatory

1.3 IMPLEMENTATION

Name Item	Supplied by			Note
	V = Contractor Engineering	C = Client Material	Installation	
Valmet Lite Gateway - hardware		V	C	
Connection to Valmet Remote Management Portal	V		V&C	Client Network connection Contractor Connection configuration: Firewalls and network changes; Firewall opening & IP-address information for Valmet Lite Gateway

Possible firewall openings from Valmet Lite Gateway towards Valmet Remote Management Portal			C	If there are no standard Valmet connection(s), a firewall opening to Portal is required
Valmet Lite Gateway rack space	C	C	C	Client unless separate rack is purchased from Contractor
Power supply to Valmet Lite Gateway	C	C	C	
Software	Engineering		Installation	
Valmet Lite Gateway - software	V	V	V	No software installation is required on-site, after delivery
Data	Engineering		Implementation	
Data from non-DNA Valmet systems on-site	V		V	Contractor handles data transfer from possible Valmet devices on-site
Data from customer systems / non-Valmet 3 rd party systems	C		C	Good quality data from various background systems either available or delivered for/to Valmet Lite Gateway
Required data definition	V&C		V&C	Required additional data from various data sources
Documentation				
Documentation of data collection solution and implementation	V			
Handover acceptance signed	V&C			

Hardware & system

Item	Definition
Hardware	Valmet Standard Industrial PC
Software	Windows 10 LTSC
	Valmet-specific data collection and relaying software bundle
Network switches	Valmet Lite Gateway is installed to site's existing DMZ or similar network area

1.4 CONTRACTOR'S RESPONSIBILITIES IN VALMET LITE GATEWAY DELIVERY

Project Team

Supplier agrees to name a project team responsible for the delivery after the contract has been signed.

Creating specifications in cooperation with Client

Necessary meetings are held with the Client's IT Contact Person in order to agree technical details.

1.5 PURCHASER'S RESPONSIBILITIES IN VALMET LITE GATEWAY DELIVERY

IT Contact Person

The Client's responsibility is to name an IT contact person for the project when the project is being sold so that the project can be started after the delivery contract has been signed. IT Contact Person(s) should be able to define data transfer solution in cooperation with supplier considering purchaser's IT practice and guidelines.

Attachment

This Attachment is an integral part of the main transaction agreement (both individually and jointly the "Contract". The limitation of liability, choice of law and dispute resolution clauses, inter alia, stipulated in the main transaction agreement shall apply to this Attachment. Should the CLIENT order Valmet Industrial Internet (the "VII") services, Valmet VII standard terms and conditions shall apply.

Data Access Terms

1 Definition

"Data" means information, especially facts and numbers, collected to be examined and considered and used to help decision-making, or information in an electronic form that can be stored and used by a computer.

"Intellectual Property Rights" means all intellectual property rights, including (without limitation) rights in and to inventions (whether patentable or not), utility models, copyrights (including also copyrights in software), trademarks, design rights, neighboring rights, database rights and any other statutory protection of a similar kind, as well as know-how and trade secrets, whether or not such rights are registered or capable of registration and includes (where applicable) the right to apply for registration of such right in any part of the world.

"Output Data" means data which the CONTRACTOR provides to the CLIENT (by visual interface, API or any other means) based on analysis or processing of CLIENT Data as part of any remote monitoring, diagnostics, analytics or other service provided under or in connection with this Contract.

"CLIENT Data" means content and any other electronic data the CLIENT or its users enter into the solution of the CONTRACTOR (or the third party of the CONTRACTOR) or otherwise provides to CONTRACTOR in the cooperation under the Contract.

"Permitted Purpose" means the following purposes in relation to each type of data identified in the table below

Type of Data	Permitted Purpose
CLIENT Data and Output Data	Use the data to develop CONTRACTOR's product and service offering.
"Type of Data"	"Other Permitted Purpose" [Add as necessary]

"CONTRACTOR Data" means data that the CONTRACTOR has developed in accordance with the Permitted Purpose or in connection with fulfillment of the scope of the Contract, and intelligence, such as but not limited to algorithms, calculations, formulae, logic and reporting templates provided by the CONTRACTOR.

2 Status and Ownership of CLIENT Data | CLIENT Data is the CLIENT's Confidential Information (and will be deemed disclosed by the CLIENT) for the purposes of this Contract, and the CLIENT owns all Intellectual Property Rights in and to the CLIENT Data.

3 CONTRACTOR's use of CLIENT Data | CONTRACTOR may access and use CLIENT Data for providing services under the Contract. In addition, CONTRACTOR has a right to collect, analyze and use CLIENT Data for the Permitted Purpose. CLIENT grants the CONTRACTOR, its Affiliates and subcontractors a worldwide, non-exclusive, royalty-free, irrevocable and perpetual right to access and use CLIENT Data for the Permitted Purpose. CONTRACTOR shall ensure that any such third-party recipient remains subject to no less stringent confidentiality obligations than those agreed between the Parties. CONTRACTOR shall not otherwise: a) access, collect, monitor, use, store, transmit or retain any CLIENT Data; b) aggregate any CLIENT Data; or c) transfer

any CLIENT Data to any third party, except for CONTRACTOR's subcontractors and CONTRACTORS, as provided in this Attachment.

4 Status and ownership of Output Data | The CONTRACTOR transfers all Intellectual Property Rights in and to the Output Data to the CLIENT, except for the rights to decompile, disassemble, reverse engineer or make derivative works of the Output Data, which rights shall remain with the CONTRACTOR.

5 Status and Ownership of CONTRACTOR Data | CONTRACTOR Data is the CONTRACTOR's Confidential Information (and will be deemed disclosed by the CONTRACTOR), and the CONTRACTOR owns all Intellectual Property Rights in and to the CONTRACTOR Data. CLIENT may not decompile, disassemble or reverse engineer or make derivative works of the CONTRACTOR Data.

6 Data Process | The CLIENT agrees to provide CONTRACTOR with complete and correct CLIENT Data in the format requested by CONTRACTOR to the extent necessary for CONTRACTOR's performance of the work under the Contract. The CLIENT is responsible for any additional fees which may arise from an increased need for performing the work due to incomplete, incorrect or changed CLIENT Data or changes in the CLIENT's process.

7 Remote Access | CLIENT shall permit CONTRACTOR's employees and those of CONTRACTOR's subcontractors assigned or contracted by CONTRACTOR to remotely access and use software and systems installed at the CLIENT's site. CLIENT is responsible for security and monitoring of the CLIENT's systems and equipment, including any such remote access and use. CLIENT shall keep the CONTRACTOR informed of the CLIENT's security and technical requirements applicable to remote access and use by the CONTRACTOR, as well as any monitoring thereof by the CLIENT.

8 Information Security | Each Party agrees to use its reasonable efforts to ensure that the factors in its control conform to the generally applicable data security standards in their respective industries and each Party will take reasonable efforts to protect itself against commonly known data security threats (such as viruses, malware or other routines designed to permit unauthorized access to computer systems etc.). The Parties shall maintain industry standard security controls for ensuring that all the data is stored and processed in accordance with good industry standards. Each Party is responsible for all software/hardware-based security solely at their ends. The Parties shall inform each other of any breach or suspected breach of information security where such breach is suspected to jeopardize the confidentiality or integrity of data.

9 Cooperation | CONTRACTOR shall comply with any reasonable policies and instructions applicable to perform the work under the Contract at the CLIENT's site (if applicable) provided that the CLIENT has informed CONTRACTOR of such policies and instructions in good time in advance prior to the commencement of the work. The CLIENT agrees to ensure that the hardware, connections and tools which the CLIENT is responsible for are continuously up to date and meet the requirements set out in the Contract. The CLIENT agrees to install any updates necessary for its operating system and other software. The CLIENT agrees to provide CONTRACTOR with all necessary access for the



CustomerName
ProjectName
NNNyy-xxxxx

Rev.

Date
Created by

performance of the work under the Contract. The CLIENT agrees to cooperate with and assist CONTRACTOR, its personnel and subcontractors as necessary for the performance of the work.

10 Result upon termination | CONTRACTOR's responsibilities in respect of CLIENT Data in connection with termination are limited to providing access for the CLIENT to retrieval and transfer of CLIENT Data, if applicable. CONTRACTOR shall have a right to permanently destroy all CLIENT Data stored by it when thirty (30) days have lapsed from the effective date of termination. The CLIENT is responsible for taking necessary backup copies of the CLIENT Data.

11 CLIENT Data Infringement | The CLIENT shall defend and hold CONTRACTOR harmless against claims, damages and losses brought against CONTRACTOR with respect to the CLIENT Data infringing rights of a third party.

12 No Warranty | As a part of certain services, such as data optimization and monitoring, CONTRACTOR may provide recommendations, opinions or advice for the CLIENT's consideration e.g. regarding advanced process controls, improving system's or plant's operation or efficient usage of feedstocks or utilities or other matters relating to the CLIENT's business or the system or plant. It is understood that such recommendations, opinions or advice by CONTRACTOR are based on CONTRACTOR's general expertise and results of limited analysis of CLIENT Data and there may be a number of factors relating to the CLIENT, the system, the plant or other relevant circumstances of which or the consequences of which CONTRACTOR is not aware. Unless expressly otherwise agreed in the Contract, the CLIENT is solely liable for assessing suitability of such recommendations, opinions or advice to the CLIENT's operations, and assumes any risk possibly related to the implementation of the same.

13 Personal Data Processing | Parties commit to comply with the applicable laws and regulations, such as GDPR Regulation (EU 2016/679), in effect from time to time in relation to privacy and personal data protection. Please see CONTRACTOR privacy notices on https://www.valmet.com/content_folder/privacy-notice/.



TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR

Refurbishment of the Combined Heat and Power Plant
in Mladá Boleslav

Business Package OB 2

BOILER HOUSES, BIOMASS BOILER K20

VOLUME III *TECHNICAL REQUIREMENTS*

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 2/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Table of Contents

1 Process description	3
1.1 Plant operation and flexibility	3
1.1.1 Large fuel range	3
1.1.2 High availability	3
1.1.3 Operation philosophy	3
1.1.4 Plant reliability	4
1.1.5 Start-ups and shutdown	4
1.1.6 Black out	5
1.2 Fluidized bed boiler	5
1.2.1 Water steam circulation and superheaters	6
1.2.2 Sootblowing	7
1.2.3 Vents, drains	7
1.2.4 Continuous blowdown and draining	7
1.2.5 Sampling	8
1.2.6 Chemical dosing (phosphate)	8
1.2.7 Feed water system	8
1.2.8 Fuel feeding system	9
1.2.9 Sand feeding system	10
1.2.10 Combustion air system	10
1.2.11 Flue gas system	10
1.2.12 Auxiliary fuel system	11
1.2.13 Sootblowing system	11
1.2.14 Ash handling	12
1.2.15 Coarse material removal	12
1.2.16 Fly ash system	13
1.2.17 Boiler cooling water system	13
1.2.18 Compressed air system	13
1.3 Flue gas cleaning	14
1.3.1 Bag house filter	14
1.3.2 Hydrated lime feeding system	15
1.4 Noise mitigation	15

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 3/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1 Process description

The boiler K20 is designed to produce 80 t/h steam at 12,5 MPa(g) and 535 C to the steam network. Main components are bubbling fluidized bed boiler and bag house filter. The boiler K20 is controlled by high automation level providing both high plant efficiency and low stack emissions.

1.1 Plant operation and flexibility

1.1.1 Large fuel range

The bubbling fluidized bed boiler K20 is fired by woodchips with the capacity range of 40-100%. The heating value of the fuel can vary from 7,8 to 12 MJ/kg, and the moisture content from 25 to 55 w-% according to the boiler firing diagram. The properties of the individual fuel components can vary within the specified ranges of the fuel mixture.

1.1.2 High availability

In Valmet BFB boilers the fluidized bed sintering is avoided by controlling the combustion process in the fluidized bed and by efficient coarse material removal. Biomass fuel may consist of gravel, sand or stones. Those impurities are possible to be discharged efficiently through the water cooled HYBEX grate with directional air nozzles. In Valmet HYBEX grate open area for the removal of the impurities is large, which is one of the major reasons for high availability in BFB boilers.

1.1.3 Operation philosophy

In normal operation only one operator is required in the central control room for monitoring and operating the process throughout the DCS screens.

Boiler is operated according to the process steam demand from the steam network. Boiler follows the load demand and adjusts the feed water flow accordingly. The boiler operates at constant main steam pressure which is controlled by the fuel feed to the furnace. When the load demand from the process steam side increases the main steam pressure tends to sink. Then more fuel is fed to the boiler to compensate the pressure loss and keep the main steam pressure stable.

The boiler total load demand governs the main steam pressure or the main steam flow rate, as for the steam pressure or flow rate controls the total boiler fuel heat input, adjusting the rotation speed of the main fuel metering screws (rotation speed is

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 4/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

monitored online). The fuel volume flow rate into the boiler (m^3/h) is linearly dependent on the screw rotation speed. The total fuel heat input (MW) is calculated from the volume flow rate, using the so-called fuel quality factor (MWh/m^3) which is a DCS constant adjustable by the operator.

Combustion air to the furnace is further controlled automatically based on the boiler load and predefined air curves.

1.1.4 Plant reliability

Plant reliability is maximized by redundancy of the critical auxiliary equipment and supply of strategic spare parts. Redundant equipment is installed parallel in the process and they are normally in stand-by mode ready for operation. For example, cooling water pumps are doubled. Critical equipment are also possible to be isolated safely from the process and maintained during operation, if required.

Bag house filter could be used temporarily (24 hours) with one filter module out of operation and still operate the boiler at 100% boiler load. Therefore, bag filter bags could be changed during boiler operation if required.

The number of parallel instruments is considered also for the critical measurements. All the process measurements to the boiler safety system are tripled and those measurements that can affect directly the boiler availability of solid fuel firing are doubled. Unexpected shut down of the boiler due to malfunction of one single measurement in the automation system is eliminated.

1.1.5 Start-ups and shutdown

After the boiler purging sequence is completed the natural gas fired start-up burner is started-up. Cold start-up takes usually approx. 8..10 hours from the ignition of the start-up burner to maximum plant load. During plant cold start-up a few manual operations and check outs in the field are required.

The recommended drum temperature increase gradient is $0.8...1.2\text{ }^{\circ}\text{C}/\text{min}$. Higher temperature gradient is to be avoided due to thermal stress of the pressure part.

Initial solid fuel firing is started after bed temperature has reached $350\text{ }^{\circ}\text{C}$. After bed temperature has reached $800\text{ }^{\circ}\text{C}$ the boiler is operated with solid fuel only.

During the boiler start-up steam produced by the boiler is used in preheating of the main steam line and drained to the expansion tank in the turbine hall. Once boiler pressure is

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 5/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

high enough the existing reduction valve (RS 3) controls the boiler pressure during the boiler start-up and steam is taken to the steam network through the reduction valve.

1.1.6 Black out

Boiler can handle the special and abnormal situations such as, black-out fully automatically and safely.

In case of a black out electric driven equipment such as combustion air and flue gas fans and fuel feeding to the boiler furnace are stopped. Fluidized bed combustion is stopped, but the furnace is still hot generating steam, so the level in the drum starts to decrease.

When the low level in the drum is reached steam supply from the boiler is closed automatically and the boiler is bottled hot. Minimum permissible water level in the boiler is maintained during the cooling down period. Control dampers of the combustion air are opened by spring allowing ventilation of the furnace. External cooling for the boiler is not required.

Critical electric valves and other critical devices of the boiler and the flue gas treatment equipment are powered by UPS.

Other pneumatically operated actuators of the control valves operate for some time until they are mechanically switched to their safety positions.

The requirements from the boiler standard EN 12952-7 related to black out will be proven during the commissioning stage by a separate black out test which is one of the hot commissioning tests.

1.2 Fluidized bed boiler

Heat is generated by the bubbling fluidized bed boiler with a nominal load of 62 MWf. In the bubbling fluidized bed process combustion efficiency is excellent, providing negligible amount of unburned carbon and low CO and NOX emissions.

A fluid bed is a contained mass of particulate solids through which an upwardly flowing fluid is passed at a velocity sufficient to cause the particles to behave like a liquid. The fluidizing medium for the fluidized bed combustion is a mixture of primary air, combustion gases and possible recirculated flue gas.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 6/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

In the bubbling fluidized bed boiler, the combustion takes place partly in a dense fluidized bed at the bottom of the furnace and partly above the bed in so called freeboard area. Small fuel particles burn rapidly above the fluidized bed, while larger particles filter into the bed where they are dried and gasified. Residual char is burned mainly in the fluidized bed while volatile material burns both in the bed and directly above it.

Stable combustion is attained due to high heat capacity of the bed material, composed of sand, fuel and ash. The turbulent properties of the bed ensure efficient combustion process. The steam output of the boiler is adjusted by changing the fuel and air flow according to the load demand.

Fuel is fed into the furnace through four overbed fuel feeding chutes. The combustion air is staged by utilizing primary air and staging air (secondary air and tertiary air when applicable). The primary air is introduced into the furnace through the patented HYBEX® floor, consisting of water-cooled air beams. The staging air, which completes the combustion, is introduced through air openings located on the furnace walls.

The bed temperature depends on the load, fuel quality and amount of the fuel in the bed. Normally the bed temperature varies between 750°C and 900°C. The fluidized bed temperature is controlled by the recirculation gas.

1.2.1 Water steam circulation and superheaters

Boiler is a single drum unit. Furnace is constructed of gas-tight, membrane construction. The lower furnace walls are covered by refractory to protect the tubes from erosion.

Furnace walls, roof and grate are the evaporator part of the boiler. Feedwater flows through the economizers and enters the drum through a distribution pipe. Inside the drum, the feedwater mixes with the saturated, recirculated water and flows through the downcomers and supply pipes to the evaporator walls. The water is partially evaporated in these water circuits and discharges through risers back into the drum through primary steam separators. The flow through the water circuitry occurs by a natural circulation caused by density difference in the system. Steam/water mixture is returned to the steam drum through risers.

In the drum steam passes through the secondary steam separators and leaves the drum as essentially dry saturated steam. Saturated steam is taken to the the walls of 2nd pass and further to superheater banks which are located in the 2nd pass. Superheaters are divided to three stages: primary, secondary and tertiary superheating stages. Between the stages steam temperature is measured and controlled by the venturi type desuperheater.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 7/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Materials selected for the superheaters are based on the knowhow of Valmet Technologies and the experience from various fuels.

Boiler and main steam system are protected by two main steam safety valves and safety interlocks from too high pressure.

Fire fighting steam used in the silos and fuel conveyors is produced by the boiler and taken from the steam drum.

1.2.2 Sootblowing

Removal of deposits from the superheater, economizer and flue gas airpreheater tubes is performed by steam sootblowing. Sootblowing sequence is automatic including heating and dewatering of the sootblowing steam piping and actual sootblowing. Operator has a possibility to optimize sootblowing by selecting the areas to be cleaned.

Sootblowing steam pressure is reduced to blowing pressure and controlled by poppet valves at each sootblower. Sootblowing steam is superheated at each sootblowers. Drain from the sootblowing steam piping is led to blowdown tank.

1.2.3 Vents, drains

Vents are supplied for the purpose of venting the boiler during start-up and shutdown. Vent lines are taken to common vent funnel which is connected further to blowdown vent pipe. The following vents are to be piped to common collection points within the boiler house:

- Interconnecting piping
- Steam drum
- Economizer area
- Superheaters

Drains are used for the drainage of the boiler during start-up and shutdown. The drains from various locations from the boiler are collected to the blowdown tank.

All vent and drain lines connected to atmosphere are equipped with double shut off valves.

1.2.4 Continuous blowdown and draining

Proper boiler water quality is maintained by continuously blowing water with impurities from the drum to the blowdown tank.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 8/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Blowdown tank is equipped with a cooling possibility by industrial water. Maximum outlet temperature of the blowdown tank is controlled by industrial water. The drains from the blowdown tank are pumped to the existing drain collection system for the reuse of water.

1.2.5 Sampling

Properties of water-steam is monitored by continuous sampling and analyzing from various locations in the water-steam circuit:

- feedwater line
- boiler water
- saturated steam
- main steam

A complete sampling unit consists of sample coolers for each sample, valves and on-line analyzers for continuous monitoring.

1.2.6 Chemical dosing (phosphate)

Phosphate is dosed to the feed water before the economizer. Phosphate operates as a buffer solution for eliminating changes in pH of the boiler. It also reacts with impurities such as calcium and magnesium forming salts which could be blown out from the water steam circuit by continuous blowdown.

The phosphate dosing unit consist of a phosphate tank, fully redundant dosing pumps (2x100%) and necessary filters and instrumentation for automatic dosing of chemical in order to maintain boiler water quality.

1.2.7 Feed water system

Feed water is supplied by the existing feed water pumps located in the turbine hall. Feed water system consists of feed water piping with valves from the K80 and K90, feed water control valve group with 2x100% feed water control valves, economizers and pipeline to the steam drum. Feed water is taken either from K80 or K90 feed water line. The connections points are on the discharge side of the existing feed water HP-preheaters. At nominal load feed water is preheated to 210 C by the HP preheaters. In case HP-preheaters are not used the feed water temperature is 160 C for the boiler K20.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 9/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

During normal operation the drum level is controlled by a so called 3-element control method, which utilizes the feed water flow, main steam flow and the drum level. This control method enables maintaining the drum level with less fluctuation also in load change situations.

1.2.8 Fuel feeding system

Solid fuel consists of clean wood chips. Fuel is received from the fuel conveyors which feed the two boiler fuel silos. Fuel level in the boiler fuel silo is measured by three parallel radar type measurements and signal about the fuel level is transmitted to the fuel handling area. Silos are protected by necessary interlocks in case of overfilling. Boiler could be operated continuously at full load from one fuel silo. Total capacity of the fuel silos is three hours with reference fuel.

The boiler fuel feeding equipment consists of two fuel silos with screw reclaimers, screw conveyors, double metering screws with a retention bin and fuel feeding chutes equipped with rotary valve feeders.

The silo reclaimer discharge fuel to the screw conveyor. From the screw conveyor the fuel flow is taken to a balancing bin, which is used to balance the fuel feeding to the fuel chutes and ensure even fuel feed to the furnace. The fuel chutes are furnished with rotary valve feeders in order to prevent backflow from the furnace. The lower part of the fuel feed chute is air cooled.

The fuel flow into the furnace is controlled by adjusting the speed of the metering screws and other conveyors, which all are equipped with variable frequency electric motor drives. The load demand for the fuel feeding to the furnace is from the boiler water-steam circuit.

Fuel flow rate to furnace (m³/h) will be shown on the DCS screen. The flow rate calculation is based on the speed of the metering screws and measured water-steam side parameters. Fuel scales are not required.

Fire fighting in fuel feeding system

Fuel silos are located outside the boiler building wall, so the fuel inside the fuel silo does not case fire load in the boiler house. The fuel conveyors are tight construction, thus the solid fuel inside the fuel feeding conveyors is not calculated as fire load.

The fire fighting of the fuel feeding system is mainly designed to prevent fire caused by back fire from the furnace, but also general fires inside the fuel feeding equipment.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 10/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

For fire fighting the fuel silos and fuel chutes are equipped with temperature measurements and steam connections. Fire fighting steam is taken from the boiler steam drum by a motorized valve. Steam is used for fire extinguishing while it is inert gas and reduce oxygen concentration(and combustion rate) in the silo and conveyors.

The fire detection of the fuel feeding system is integrated with the plant DCS system. System includes temperature indications in main fuel feeding equipment with alarm and interlockings. High temperature in the conveyors or silo will stop the previous equipment thus preventing more fuel to enter the equipment. Based on high temperature alarm, the boiler operator can open the motorized steam valve and perform steam inertization in the fuel feeding system.

1.2.9 Sand feeding system

One sand silo is provided for make-up of sand into the furnace. Sand silo is filled pneumatically from the truck. From the silo, sand is taken to the furnace by a sand screw.

1.2.10 Combustion air system

Combustion air is supplied by the total air and primary air fan. Combustion air is taken from inside of the boiler house and the replacement air is taken from outside through separate openings located on the boiler house wall.

Primary air system consists of a primary air fan, water coil air preheater, and HYBEX air beams with fluidizing air nozzles and ductwork. Heat released the bottom ash system and other auxiliary systems is utilized in primary air preheating. Primary air flow is regulated based on boiler load and the fluidized bed temperature control.

The staging air is divided to secondary air and tertiary air levels for controlling the combustion in order to achieve low emissions. The staging air system consists of water coil air preheater, control dampers, staging air registers with nozzles located on the furnace walls and ductwork. Staging air is preheated by feed water. Total air fan controls the staging air pressure and air flow rates at each register is controlled by the control dampers.

Combustion air for the burners is supplied from the secondary air fan. Each burner air flow is measured separately and controlled with a control damper.

1.2.11 Flue gas system

Flue gas leaving the furnace passes through the empty pass where flue gas is cooled down to below 700 C before the superheater section. After the superheater section flue

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 11/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

gases flow through the plain tube economizers which are located in uncooled plate duct. Cooled flue gas enters the flue gas cleaning system where the flue gas emissions are reduced to the required level. Flue gas treatment equipment includes bag house filter of two modules.

After the bag filter remaining heat in the flue is recovered to boiler feed water by flue gas cooler which is a fin tube heat exchanger. Finally flue gases are lead to the stack which operation temperature is above dew point

Flue gases are exhausted to the atmosphere through the stack by the speed controlled flue gas induced draft fan. ID fan controls the furnace pressure.

Fluidized bed temperature is controlled by recirculating part of the flue gas back to the furnace especially when the boiler is fired by the fuel of high heating value or low moisture content. Recirculation gas is fed into the primary air and mixed with combustion air before the air registers.

Flue gas emissions to atmosphere are measured at the stack by the continuous emission measurement system.

1.2.12 Auxiliary fuel system

The auxiliary fuel system consists of natural gas piping and gas distribution to the natural gas fired start-up burner.

The boiler is equipped one 15 MW start-up burner which is located on the sidewall of the furnace. The gas burner is used in the cold start-up to heat -up the sand bed to the required temperature until the solid fuel firing is allowed by the boiler safety system.

1.2.13 Sootblowing system

The sootblowing system consists of sootblowing steam piping, sootblowers and draining system. Sootblowers will be furnished for the removal of ash deposits from the heat transfer surfaces.

The retractable sootblowers are used for cleaning of the superheaters and economizer package located in the membrane area in the 2nd pass (superheater pass). The principle of the retractable sootblower operation is cleaning of the heat transfer surfaces with high pressure steam from two nozzle openings located at the end of a rotating lance tube. The lance is normally outside of gas stream, but when operating it is gradually inserted and rotates as the steam poppet valve opens.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 12/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

The semi-retractable sootblowers are used for cleaning of the economizer packages located in the plate duct area in the 3rd pass. The principle of the semi retractable sootblower operation is cleaning of the heat transfer surfaces with high pressure steam from many nozzle openings located along a rotating lance tube and spaced between the heat exchanger tube rows. The lance material is suitable for the temperature and the flue gas conditions in which it is located. Sootblowing steam is taken from the drum and the pressure is controlled at each sootblower.

Sootblowing is an automatic sequence controlled in the DCS, which takes care of the complete sootblowing starting from the preheating and draining of the sootblowing steam piping to actual sootblowing. Operator can optimize sootblowing e.g. by defining the frequency of sootblowing and/or defining extra sootblowing to certain areas (e.g. 3rd pass sootblowers only).

1.2.14 Ash handling

1.2.15 Coarse material removal

Coarse material discharge from the furnace is based on the patented, totally water cooled grate called as HYBEX floor. This design provides an extended free removal area where coarse material including impurities such as metals can be evacuated from the bed efficiently.

The coarse material (bottom ash) is removed from the furnace through four ash hoppers and chutes. These hoppers form a construction of the furnace bottom.

Coarse material is removed periodically from the bed by sequence applied in the DCS. The removing rate is controlled by pneumatic dampers located in the chutes. Removed material is cooled by a water cooled bottom ash drag chain conveyor and conveyed to the sieving system.

The need for bottom ash removal depends on the amount of impurities coming with the fuel. The coarseness of the fluidizing material (growth in particle size) is monitored by the temperature measurements in various locations in the lower part of the furnace and by the samples from the removed material.

Because large portion of bottom ash is still acceptable fluidizing bed material, bottom ash is sieved in a rotating screen. The returnable sand fraction is pneumatically returned to the furnace and remaining coarse material is taken to the bottom ash containers. When the first bottom ash container is full ash is discharged to the second container.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 13/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.2.16 Fly ash system

The fly ash is collected by the 2nd and 3rd pass ash hoppers of the boiler and ash hoppers underneath the bag house filter. From the ash hoppers fly ash is transferred to the fly ash silo by the pneumatic conveyors.

The bends and 0,5 m straight part after each bend of the ash pipe are reinforced for the erosion mitigation.

Fly ash silo is located next to the bag house filter when the pneumatic ash pipes are short.

The fly ash silo is equipped with dry ash unloading equipment. Fly ash silo has accessible by a truck, a driver can drive through underneath the silo.

1.2.17 Boiler cooling water system

Boiler cooling water circuit is connected to the main closed cooling water system of the plant. The system includes cooling water piping to and from the existing cooling water system, 2x100% booster pumps for the supply of the cooling water to the consumers located in the K20 area and cooling water distribution piping to the various consumers.

Cooling water is supplied to the following consumers:

- Bottom ash conveyor
- Sample coolers
- Compressors

1.2.18 Compressed air system

Compressed air system consists of separate air networks with buffer air tanks for the transport air and instrument air in the K20 area.

Transport air is taken from the plant transport air system and distributed to the consumers located in K20 area. Main consumer of the transport air is pneumatic conveyors of bed material and ash. The system includes one back up transport air compressor unit with a refrigerator type dryer and necessary filters.

Instrument air system includes instrument air distribution piping in the K20 area for the consumers of the boiler K20 and supply piping for the K80/K90 boilers. Supply piping for K80/K90 is connected to the existing instrument air network with the existing buffer tanks located in the K80/K90 area.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 14/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Existing instrument air compressors and a new transport air compressor unit will be located in a separate compressor room in the K20 area.

1.3 Flue gas cleaning

Flue gas from the boiler is conveyed to a bag house filter (BHF). The purpose of the bag house filter (BHF) is to separate fly ash and other particles from the flue gas stream by filtration through fabric filter bags.

1.3.1 Bag house filter

Flue gas from the boiler is conveyed to a bag house filter. The purpose of the bag house filter is to separate fly ash and other particles from the flue gas stream by filtration through fabric filter bags. In order to reduce acid gases (SO_2 and HCl), hydrated lime is injected into the flue gas duct upstream of the filter.

The BHF consists of 4 separable compartments. Each BHF compartment is supplied with an inlet damper on the untreated flue gas side, and an outlet damper on the cleaned gas side. During operation, any filter compartment can be shut down and isolated individually for maintenance work inside the compartment. Recommended operation time with one compartment out of operation is 24 hours.

Suction pressure generated by the I.D. fan draws the flue gases from the boiler back pass into the bag house filter. The flue gas flows through the vertically installed filter bags leaving fly ash, dust, and additives on the outer surface of the bags. The cleaned gas then flows upwards inside the filter bags into the clean gas side of the filter and finally to the stack.

The layer of dust on the bags, the filter cake, consists of fly ash and solid reaction products. The chemical reactions that capture pollutants from the flue gas continue effectively in the filter cake as the flue gas passes through. The dust layer also improves mechanical separation of particles from the flue gas.

The filter bags are periodically cleaned by means of compressed air pulses. The air pulses are produced by dedicated pulse valves located on top of the header tanks in the penthouse area. The cleaning air pulse is distributed by a pulse pipe to clean one row of filter bags per pulse. A cleaning pulse is fired, when the built-up pressure difference (dp) set point over the filter is reached. If the set dp -limit is not reached within a certain time, the next bag row is cleaned based on a timer.

The cleaning pulse releases the filter cake on the filter bags into the ash hopper, located at the bottom of each compartment. From the hopper the fly ash is discharged

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 15/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

using pneumatic transmitters. The ash hoppers are equipped with electric heating elements to maintain sufficient temperature in order to avoid corrosion.

1.3.2 Hydrated lime feeding system

The additive system consists of dosing and a feeding system for hydrated lime (CaOH_2). The additive is expected to be delivered to site in tank trucks as ready-made powders. The trucks are unloaded pneumatically to the storage silo located near the bag house filter. Dosing of CaOH_2 is enabled by frequency-controlled dosing screws.

1.4 Noise mitigation

Indoor noise

General indoor noise level of the scope of supply will be in accordance with the directive 2003/10/EC and other local regulations enabling worker's daily sound pressure exposure.

In general, due to high automation level plant is operated mainly from the control room and typically there is no need to spend excess time in the boiler house during daily operation.

The following equipment are located in dedicated noise rooms:

- Compressors
- BHF pulse valves (in separate room, BHF penthouse)

Combustion air suction duct is equipped with a silencer. Critical locations of the ductwork are sound insulated. Combustion air fans and process pumps such as, cooling water pumps are provided by noise insulation or removable noise hood, if necessary.

Those equipment which are located in dedicated noise rooms, or not operated full time, such as, sootblowers or safety valves, are not equipped with special noise insulation or sound enclosure.

Outdoor noise

Boiler house cladding is made of sandwich type elements with the required noise attenuation. Openings in the walls are equipped with necessary noise dampers.

Blow off pipes of the main steam safety valves, the start-up valves and sootblowing steam safety valve are connected to the silencer located on the roof, outside of the boiler house.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 16/16
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Flue gas fan and recirculation gas fan are provided by noise insulation. Critical parts in the flue gas ductwork are noise insulated.

Table of Contents

1 PROCESS DESCRIPTION	2
1.1 General	2
1.2 Circulating Fluidized Bed Process	2
1.3 Water and Steam Systems	3
1.3.1 Boiler Water/Steam System	3
1.4 Combustion Air System	4
1.4.1 Primary (fluidizing) air system	5
1.4.2 Secondary air system	5
1.5 Flue Gas System	5
1.6 Flue gas Cleaning System	6
1.6.1 Bag house filter	6
1.6.2 Additive feeding system	6
1.7 Solid Fuel Feeding System	6
1.8 Start-up burners and technological fuel combustion	7
1.9 Ammoniumsulphate injection system for NO _x reduction and corrosion mitigation	7
1.10 Sand Handling System	8
1.11 Ash Handling System	8
1.12 Sootblowing Steam System	9

1 PROCESS DESCRIPTION

1.1 General

This section describes generally the changed process parts of the proposed plant or the effect of bioconversion on existing processes. Other processes than mentioned here are utilized as existing. The chapter is not a description of the scope of supply.

1.2 Circulating Fluidized Bed Process

A fluid bed contains a mass of particulate solids through which an upwardly flowing fluid is passed at a velocity sufficient to cause the particles to behave like a liquid. The bed material consists mainly of fine sand particles and fuel ash. The fluidizing medium consists of air and flue gas produced by the combustion of the fuel.

In the circulating fluidized bed (=CFB) boiler the velocity of fluidizing medium is so high that part of the particles is carried with the gas. There are two distinctive phases of solids in the combustion chamber, the dense phase and the dilute phase. The dense phase, or bed, consists of fuel ash, sand, a small percentage of unburned fuel and possibly of limestone. The fluidization gas elutriates fine particles into the dilute phase. The dilute phase density has a direct effect on the heat transfer rate in the furnace. Most of the solids elutriated from the combustion chamber are separated from the flue gas stream in the cyclone separator and cleaned flue gas flows to the second pass. The separated solids fall down to the bottom of the cyclone and to loop seal. The loop seal is small fluid beds, which act as a seal preventing flue gas to flow from lower part of the furnace to the cyclone. From the loop seals solid particles are returned back to the furnace.

Normally the bed temperature varies between 750 – 900 °C and due to large mass of the circulating material the temperature is almost constant throughout the furnace. The bed temperature is controlled by changing the air distribution, using flue gas recirculation and changing excess air level.

The lower part of furnace walls and other areas where risk for erosion exists are covered by refractory to minimize wearing in these sections. Due to the change to the lower heating value fuel (from coal), the bottom part refractory is extended higher up in the furnace to keep the fluidized bed temperatures on correct level. Fluidizing velocity is designed to be a moderate to ensure low erosion impact into refractory in dense bed area.

Within this rebuild the furnace, cyclones and loopseals remain as is, except for the modifications which will be done in the bottom part of the furnace for primary air nozzles, bottom ash removal and secondary air and fuel feeding openings.

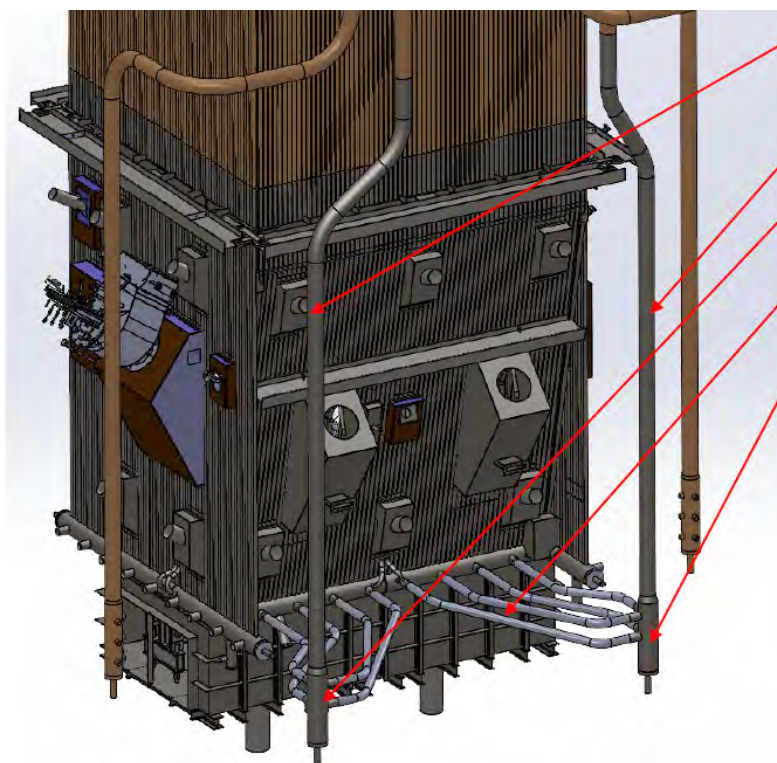
1.3 Water and Steam Systems

1.3.1 Boiler Water/Steam System

The main dimensioning and the functioning of the boiler pressure parts are kept as is.

The feedwater economizer tube bundles are replaced totally. The packages in the plate duct area are replaced by increasing heat transfer surfaces to the tube bundles to compensate the increased fouling due to fuel change (packages 1- 3). Only the heat transfer bundles are changed, the existing distribution and collection headers are utilized. Economizer in membrane wall area is replaced keeping the design as it is.

The bottom part of the furnace evaporative surface is replaced up to the height of approximately 7 meters. The lower circulation pipes are renewed. Also the front wall downcomers are modified to enable fuel feeding to be placed to the furnace front wall. Otherwise, the evaporative circulation is kept as is.



The hanger tubes forming the first part of superheating (PSH 1.1.) are replaced (existing headers are utilized). The second pass walls are not changed, but based on the boiler inspection areas with extensive wear can be repaired if needed or further protected by overlay welding or metal spraying (to be offered separately after inspection as Change order). Primary superheater tube bundles are replaced, existing headers are utilized. No changes are made to the secondary superheater in the furnace (the shot superheater) as the condition of the superheater cannot be evaluated based on the inquiry material. The condition of the secondary superheater is checked in the boiler inspection thoroughly, and if needed the possible replacement/modifications are offered separately after the inspection as Change order. The tertiary superheater tube bundles in the second pass are replaced (existing headers utilized). The TSH replacement includes the change of the material to more corrosion resistant to increase the lifetime of the heat transfer surface when firing agro/biomass fuel mix.

1.4 Combustion Air System

The combustion air is supplied for the combustion with existing total air fan. The total combustion air is heated in a tubular flue gas air preheater. The existing steam coil air preheater shall be used to heat up the combustion air prior to flue gas preheater to sufficient temperature to minimize the corrosion in the existing air preheaters.

After the tubular air preheaters, the air is divided into primary (fluidizing) air and secondary air. The existing primary air fan will be utilized to elevate the primary air pressure to the needed level for fluidization.

When replacing the bottom membrane wall section of the boiler, also the air inlets to the furnace are modified. Primary air nozzles are changed, and the secondary air inlet opening renewed.

Along with the low combustion temperatures, the combustion air is staged to obtain low NO_x -emission levels by utilizing fluidizing air and secondary air. The fluidizing air is introduced into the furnace through air nozzles penetrating the furnace floor. The secondary air, which completes the combustion, is introduced through airports located on the furnace walls at two separate levels. The fluidization results in an expanded combustion zone with high turbulence, intimate solids to-gas contact, which results in a high heat transfer rate within the bed. The bed temperature depends on the quality and amount of the fuel in the bed.

Fluidizing air for loop seals is supplied by the existing high-pressure blowers. No modifications are made to this part of air ducting.

1.4.1 Primary (fluidizing) air system

The fluidizing air is introduced into the furnace from the renewed windbox located underneath the furnace through evenly spaced fluidizing air nozzles penetrating the furnace floor. The fluidizing nozzles are multihole type.

1.4.2 Secondary air system

The heated secondary air is fed into the furnace through secondary air ports on the furnace walls. The ports are located at two elevations above the furnace floor. The first level is located directly above the dense bed and the second one is above the fuel feeding openings. Secondary air is also used as combustion air in the start-up burners.

1.5 Flue Gas System

The boiler furnace is a combustion chamber where the thermal energy bound in the fuel is released. The flue gas amount and properties generated in the combustion process depend on the fuels used. When firing biomass, the flue gas amounts are higher compared to coal firing and flue gas moisture higher.

Most of particles conveyed with flue gas from the combustion chamber are separated in the cyclone and returned back to the furnace.

The walls in the hot 2nd pass hot area are cooled by steam flowing in the wall tubes. After flue gas temperature has fallen down the walls are constructed with a plate casing.

In the second pass the flue gas cools down when it flows across superheaters, economizers and flue gas air preheaters and exits the boiler house. Then the cooled flue gas enters the bag house filter, where the particulate matter and remaining impurities are removed. The duct prior to the bag house filter is equipped with an injection point for additive feeding.

The flue gas fan is exiting the gas through a flue gas ducting into the stack and to the atmosphere. The flue gas fan is renewed to secure the sufficient flow and pressure rise capacity due to fuel change and bag house filter modifications.

If needed, part of the flue gas can be recirculated after the ID fan through existing recirculation flue gas fan to the renewed primary air windbox. The fans and the

connections are kept as is and connection to the new windbox shall be installed, although no need for RC gas is expected when operating and the boiler with new agro/biomass fuels.

1.6 Flue gas Cleaning System

1.6.1 Bag house filter

Flue gas from the boiler is conveyed to a existing bag house filter (BHF). The filter bags are renewed to more heat resistant material. To reduce acid gases (SO₂, HCl and HF), high surface area hydrated lime / sodium bicarbonate is injected into the flue gas duct upstream of the filter. The injection system is renewed to enable the feed of both hydrated lime and sodium bicarbonate. Additional mixers are installed to the flue gas ducting to enhance the reduction of acid gases with additives.

1.6.2 Additive feeding system

The additive system consists of dosing and a feeding system for hydrated lime. The additives are expected to be delivered to site in tank trucks as ready-made powders. The trucks are unloaded pneumatically to the existing storage silo located near the bag house filter. Dosing of the additives is enabled by frequency-controlled dosing screws.

1.7 Solid Fuel Feeding System

Solid fuel is provided by preparation and feed handling system to the fuel silos. The fuel is to be crushed and metals are to be separated before entering the fuel silos.

Boiler is equipped with two fuel feeding lines as well as two fuel feeding points to the furnace front wall. A line consists of a silo with a reclaimer, screw conveyor, balancing bin with two metering screws and fuel feeding chutes equipped with rotary valve feeders, manual slide gates and wall screws. The design of the lines is done so that the capacity of each line enables to reach full capacity of the boiler with only one silo line to the balancing bin (+reclaimer and screw conveyor) in operation, and maximum 70% boiler load with one fuel furnace feeding point in operation.

The silo reclaimers discharge fuel to screw conveyors. The screw conveyors feed the fuel to the common retention bin from where the fuel flow is divided to the feed chutes with the metering screws. The feeding to the furnace is performed with wall screws located on the left and right side of the boiler front wall.

All fuel chutes are furnished with rotary valve feeders to prevent any backfire from the furnace.

The fuel flow into the furnace is controlled by adjusting the speed of the conveyors and silo reclaimers, which all are equipped with variable frequency electric motor drives.

1.8 Start-up burners and technological fuel combustion

The natural gas fired start-up burners shall be renewed. The maximum capacity of burners is about 40% of boiler MCR. The start-up burners are located on both of the sidewalls of the furnace. The combustion air is supplied from the existing secondary air ducting.

The start-up burners are used to heat up the bed (sand) to the temperature required to begin the firing of solid fuel. The start-up burners are not used to support firing.

The technological fuel is fired in a separate wall lance located on the other side wall of the furnace. The wall lance has no igniter nor flame detection, and shall be used only when the furnace temperatures exceed 850 °C. The atomizing of the technological fuel is performed by pressurized air. Due to the high water content in the technological fuel, the wall lances are not allowed to be operated on full boiler load, but the load has to be lowered to keep the flue gas flow within the range of the flue gas fan.

1.9 Ammoniumsulphate injection system for NO_x reduction and corrosion mitigation

NO_x emissions are controlled by using existing SNCR (Selective Non-Catalytic NO_x Reduction) system. The additive shall be changed to ammonium sulphate. When ammonium sulphate is injected into the flue gases in the inlet of duct to the cyclones, nitrogen oxides and ammonia react by forming harmless nitrogen gas and water vapour.

The most critical parameters of the SNCR system for getting high NO_x reduction and low ammonia slip with as low ammonia consumption as possible are temperature at the injection point, residence time and mixing of the ammonia with the flue gas.

The operation temperature window is about 850 - 1100 °C and the optimum residence time is about 0,5 - 0,6 s. Hence, for the low load operation, furnace injection level shall be added to enable the optimum performance of NO_x reduction also on low loads.

Sulphate in the ammonium sulphate, in the absence of coal sulphur, is required to increase the sulphur-chlorine ratio and to reduce the chlorine corrosion of the superheaters.

The dosing of the ammonium sulphate shall be according to the either NO_x reduction need or plant pellet dosing rate, whichever requires higher dosing.

The renewed part of the ammonium sulphate system consist of piping modifications in tank area to enable feed to both K80 and K90 boilers, booster/dosing pumps for furnace injection, as well as furnace injection level injection (lances, nozzles, piping and valves). Existing tanks and most part of the piping including dosing to the cyclone inlet shall be used without modifications.

1.10 Sand Handling System

Existing MFV silo located inside the boiler house shall be utilized as fresh sand silo. The silo and the feeding system to the furnace shall be utilized as such. The filling pipe from boiler house wall shall be renewed totally. There is now longer possibility to utilize MFV silo as a storage for used bed material, but only fresh sand. Circulated bed material is fed directly to the furnace.

1.11 Ash Handling System

Bottom ash system

The purpose of the bottom ash handling system is to control the bed level and quality by extracting bottom ash from the furnace bottom and further by rejecting coarsest bottom ash particles and impurities to the bottom ash containers and recycling acceptable fine particles from sieving back to the furnace.

The bottom ash, including coarse particles, is removed from the furnace through chutes, which penetrate the primary air windbox and furnace floor. The bottom ash is extracted to three water cooled bottom ash screw conveyors. The bottom ash chutes are equipped with pneumatic and manual slide gates. The manual slide gates are used only for maintenance purposes.

The bottom ash extraction rate (and location) can be controlled in two alternative modes: either by opening and closing the pneumatic dampers or by adjusting the speed of the bottom ash screws when the pneumatic dampers are left open.

The bottom ash from screw conveyor falls into the drag chain conveyor. Water cooled drag conveyor is conveying the ash to screening. From the bottom ash screening the suitable material can be returned back to the furnace. The bed material which is not suitable size fraction to be reused in the furnace is conveyed by existing pneumatic conveyor to the existing bottom ash silo. In case of too high bed levels, the suitable bed material can also be directed to the existing pneumatic conveyor and delivered to the existing bottom ash silo. The coarsest material which cannot be pneumatically conveyed is removed via uncooled drag chain conveyor to the small coarse material container located inside the boiler house.

The needed bottom ash removal rate shall be based on bottom ash sampling and analyzing the particle size distribution, which gives information on the bed condition and the need for coarse material removal. In addition, the coarseness of the bed material (growth in particle size) can be determined based on temperature measurements in various parts of the grate. Temperature readings differentiating considerably from each other indicate that the bed material has become coarser and that the fluidizing is being disturbed, requiring bed material removal in that particular section of the grate, enhanced bed material circulation and new fresh bed material addition. The bed temperature measurement system will be renewed.

Fly ash system

No changes are performed to the fly ash system.

1.12 Sootblowing Steam System

Additional steam sootblowers according to PIDs are installed to the 2nd pass of the boiler to minimize the effect of increased fouling due to combustion of agro based biomass.

Due to high flue gas temperature and high chlorine content in the fuel the convective superheater packages are equipped with fully retractable sootblowers. The existing multi-nozzle type sootblowers with motion (partial stroke) are utilized to clean the economizer and air preheater surfaces in the second pass.

1.1 Boiler Performance and Operating Conditions with Biofuel

One of the main reasons for the boiler rebuild is to change the boiler main fuel from coal to sustainable biofuel. The boiler operational conditions with biofuel will differ significantly

from coal firing conditions. The steam parameters will remain at the same level as with coal, but steam production ability will reduce. The maximum steam generation capacity with biofuel will be lowered to 100 t/h. This is due to the increased amount of flue gas due to higher moisture content and lower heating value of the biofuel. The furnace freeboard velocity must be kept at reasonable level to ensure the hot loop circulation will not be affected and there will be no excess erosion. The velocities have been compared to the original design and checked against Valmet standards which both indicate the steam flow with biofuel should not be increased further. The higher the fuel moisture content, the lower the steam flow shall be and boiler shall be operated according to the limits defined in Valmet Design data section.

The temperature profile in the boiler will also change. Whereas with coal the bed and furnace temperatures are higher, with biofuel these temperatures will drop lower. Additional refractory will be installed to the furnace bottom part to keep the exit temperature from furnace on required level and hence to secure efficient combustion.

Fouling of the heating surfaces increases with biofuel firing compared to coal firing. The furnace and the shot heater will remain relatively clean and no major changes have been assumed in heat transfer. However, tertiary and primary superheaters as well as economiser sections will start fouling more with biofuel than with coal. This has been taken into account in the design by reducing the expected heat transfer coefficient.

The current minimum load of the boiler is determined by a certain, experience-based primary air flow required for fluidization. The fluidized air nozzles will be renewed during the rebuild and fluidization nozzles will be dimensioned to support also a low minimum load operation.



TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR

Refurbishment of the Combined Heat and Power Plant
in Mladá Boleslav

Business Package OB 2

BOILER HOUSES, BIOMASS BOILER K20

VOLUME III ***TECHNICAL REQUIREMENTS***

Annex 09 Equipment Specification

ANNEX A 1 SUBJECT AND SCOPE OF THE CONTRACT

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 2/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Contents

1.1 Pressure part	5
1.1.1 Furnace roof	6
1.1.2 Furnace screen	6
1.1.3 Walls of 2nd pass.....	7
1.1.4 Superheaters	7
1.1.5 Steam attenuation system	8
1.1.6 Steam drum	8
1.1.7 Boiler internal piping.....	9
1.1.8 Economizers	9
1.2 Accessories	10
1.2.1 Safety valves, start-up valves and silencer	10
1.2.2 Access doors	11
1.2.3 Main steam piping	11
1.3 Feedwater system	11
1.3.1 Feedwater piping.....	12
1.4 Fuel feeding system.....	12
1.4.1 Rotating spreader for silo inlet.....	12
1.4.2 Fuel silo.....	12
1.4.3 Silo screw reclaimer.....	13
1.4.4 Screw conveyor	13
1.4.1 Balance bin	14
1.4.2 Metering screws	14
1.4.3 Rotary feeders	15
1.4.4 Fuel chutes	15
1.5 Sand handling equipment	15
1.5.1 Sand silo.....	16
1.5.2 Sand screw.....	16
1.6 Combustion air	16
1.6.1 Ductwork	16
1.6.2 Combustion air fans	17
1.6.3 Feed water air preheater	18

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 3/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.6.4 Flue gas air preheaters	19
1.6.5 Air ports	19
1.7 Flue gas system.....	20
1.7.1 Ductwork	20
1.7.2 Bag house filter.....	20
1.7.3 Hydrated lime injection system.....	22
1.7.4 Flue gas fan	22
1.7.5 Recirculation gas fan	23
1.8 Natural gas system	24
1.8.1 Natural gas piping.....	24
1.8.2 Ignition gas Piping	24
1.8.3 Start-up burner.....	24
1.9 Sootblowing system	25
1.9.1 Retractable sootblowers	25
1.9.2 Short stroke multi-nozzle sootblowers	25
1.9.3 Rake sootblowers	25
1.9.4 Sootblowing steam piping	25
1.10 Bottom ash handling	26
1.10.1 Bottom ash hoppers and chutes	26
1.10.2 Bottom ash drag conveyor	26
1.10.3 Bottom ash elevator	26
1.10.4 Bottom ash sieve	27
1.10.5 Pneumatic conveyor for returnable bed material.....	27
1.10.6 Dividing Screw	27
1.10.7 Bottom ash container with equalizing screw	28
1.11 2 nd pass and 3 rd pass ash system	28
1.11.1 Rotary valve	28
1.11.2 3rd pass ash drag conveyor	28
1.11.3 Pneumatic ash conveyor 2 nd and 3 rd pass ash	29
1.11.4 Ash piping for 2 nd pass hopper ash.....	29
1.12 Fly ash system.....	29
1.12.1 Pneumatic conveyors for filter fly ash.....	29

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 4/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.12.2 Fly ash piping for filter ash	29
1.12.3 Fly Ash Silo	30
1.12.4 Fly ash dry unloading system	30
1.13 NOx reduction system (SNCR)	31
1.13.1 Aqueous ammonia dosing pumps	31
1.13.2 Aqueous ammonia dilution water booster pump	31
1.13.3 Injection of ammonia	31
1.13.4 Ammonia water piping	31
1.14 Auxiliary systems	32
1.14.1 Blowdown system	32
1.14.2 Sample station	32
1.14.3 Chemical dosing equipment	33
1.14.4 Cooling water system	33
1.14.4.1 Cooling water piping	33
1.14.5 Industrial water system	34
1.14.6 Potable water system	34
1.14.7 Auxiliary steam	35
1.14.8 Compressed air system	35
1.14.8.1 Transport air system	35
1.14.8.2 Instrument air system	36
1.15 Others	37
1.15.1 Piping and fine mountings	37
1.15.2 Thermal insulation and lagging material	38
1.15.3 Painting	38
1.15.4 Spare parts	38

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 5/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

09 EQUIPMENT SPECIFICATION

This chapter contains a detailed description of the equipment and services to be provided by Valmet as part of proposed base scope of supply.

Where reference is made to specific dimensions and/or materials, Valmet has the right to adjust these parameters as more detailed calculations and decisions of subcontracted items are executed during the project phase.

The information presented herein is provided as preliminary data until the project stage when all such dimensions and/or materials are finalized.

1.1 Pressure part

The boiler and the associating piping shall be designed, fabricated and inspected in accordance with EN code. Allowance is 1 mm calculated for straight pipe.

Pressure vessel Design code: Pressure Equipment Directive 2014/68/EU.

Main dimensions	Unit	Value
Design pressure of feed water line	bar(g)	200
Design pressure of boiler pressure part	bar(g)	154
Design pressure boiler flue gas side	kPa(g)	±5
Design pressure of main steam pipe	bar(g)	141

Furnace	Unit	Value
Width	mm	5610
Depth	mm	6290
Height from primary air nozzle top to roof	mm	23500
Cross section, free board	m ²	22,5
Grate area	m ²	35
Refractory (furnace lower part)	Unit	Value
Thickness from the tube	mm	50
Refractory height, from primary air nozzle	m	2,5
Material		LC

The lower furnace membrane wall, burner opening and other selected locations in the furnace are covered by refractory.

Refractory is attached to surface using Y-anchors/anchors welded mainly to the membrane wall fins. Material of the refractory is wear resistant low cement (LC) with low heat conductivity.

Furnace walls	Unit	Value
Type		membrane
Tube material		16Mo3
Tube OD	mm	60,3
Nominal tube wall thickness	mm	7,1
Tube spacing	mm	85
Fin material		S235JRG2

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 6/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Bottom

The furnace bottom is formed by water cooled hydrobeam grate (membrane type) which is part of the boiler natural circulation. Water is supplied from downcomers to the grate, which in turn feeds the furnace rear wall.

HYBEX grate tubes	Unit	Value
Tube material		16Mo3
Tube OD	mm	60,3
Nominal tube wall thickness	mm	7,1

Equipment of the furnace	Unit	Value
Bed temperature measurements	pcs	8
Furnace pressure measurements	pcs	3
Secondary air openings	pcs	5+5
Tertiary air openings	pcs	4+4
Fuel feeding openings	pcs	2
Make up sand feeding openings	pcs	1
Recycled bed material feeding openings	pcs	1
Start-up burner openings	pcs	1
Sight glasses	pcs	10

1.1.1 Furnace roof

	Unit	Value
Type		evaporator
Tube material		16Mo3
Tube OD	mm	60,3
Nominal tube wall thickness	mm	7,1
Tube spacing	mm	85,0

1.1.2 Furnace screen

	Unit	Value
Type		evaporator
Tube material		16Mo3
Tube OD	mm	88,9
Nominal tube wall thickness	mm	8,8
Tube spacing	mm	340

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 7/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.1.3 Walls of 2nd pass

Walls of the second pass are part of superheater, gas tight superheater 'membrane' construction.

	Unit	Value
Type		superheater
Width of the 2nd pass	mm	5622
Depth of the 2nd pass	mm	2578
Height	m	13,5
Surface area	m ²	160
Tube material		16Mo3
Tube OD	mm	48,3
Nominal tube wall thickness	mm	5,6
Tube spacing	mm	114,3

1.1.4 Superheaters

Primary superheater 1	Unit	Value
Type		convective
Tube material		16Mo3
Tube OD	mm	38,0
Tube wall thickness	mm	5,0
Number of elements	pcs	47
Number of parallel tubes/element	pcs	2
Total number of tubes/element	pcs	20
Element spacing	mm	114,3
Heat transfer surface	m ²	280

Primary superheater 2	Unit	Value
Type		convective
Tube material		16Mo3
Tube OD	mm	38,0
Tube wall thickness	mm	5,0
Number of elements	pcs	47
Number of parallel tubes/element	pcs	2
Total number of tubes/element	pcs	20
Element spacing	mm	114,3
Heat transfer surface	m ²	280

Primary superheater 3	Unit	Value
Type		convective
Tube material		13CrMo4-5
Tube OD	mm	44,5
Tube wall thickness	mm	5,0
Number of elements	pcs	24
Number of parallel tubes/element	pcs	2

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 8/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Primary superheater 3	Unit	Value
Total number of tubes/element	pcs	20
Element spacing	mm	228,6
Heat transfer surface	m ²	168

Secondary superheater	Unit	Value
Type		radiant
Tube material		X7CrMoNb18-10
Tube OD	mm	31,8
Tube wall thickness	mm	4,5
Number of elements	pcs	10
Number of parallel tubes/element	pcs	9
Total number of tubes/element	pcs	36
Element spacing	mm	510
Heat transfer surface	m ²	217

Tertiary superheater	Unit	Value
Type		convective
Tube material		X7CrMoNb18-10
Tube OD	mm	44,5
Tube wall thickness	mm	6,3
Number of elements	pcs	32
Number of parallel tubes/element	pcs	2
Total number of tubes/element	pcs	12
Element spacing	mm	170
Heat transfer surface	m ²	229

1.1.5 Steam attemperation system

Spray chamber	Unit	Value
Spray water source: feed water		
type		venturi
number		3

1.1.6 Steam drum

	Unit	Value
Drum inside diameter	mm	1400
Drum shell length	mm	8610
Corrosion allowance	mm	2
Wall thickness	mm	15NiCuMoNb5-6-4
Material		70
Design pressure	bar(g)	154

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 9/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Drum internals:

- steam separation cyclones
- steam dryers

Drum has connections for

- feed water pipe
- furnace downcomers
- riser tubes from evaporation surfaces
- saturated steam pipes
- continuous blowdown pipe
- level gauges, level transmitters and level switches
- pressure measurement

	Unit	Value
Main downcomers	pcs	2
Material of downcomers		16Mo3

1.1.7 Boiler internal piping

All the piping included in the boiler internal circulation is included.

- Feed water pipe from economizer to steam drum
- downcomers to evaporation surfaces
- supply pipes from downcomers to headers
- headers
- riser pipes from outlet headers to drum
- steam piping from the drum to superheaters
- steam piping between superheater sections

1.1.8 Economizers

Economizer (membrane area)	Unit	Value
Quantity		1
Type		plain tube
Tube material		P265GH
Tube OD	mm	38,0
Tube wall thickness	mm	5,6
Number of elements	pcs	47
Number of parallel tubes/element	pcs	1
Total number of tubes/element	pcs	20
Element spacing	mm	114,3
Tube spacing in element	mm	100
Heat transfer surface	m ²	300

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 10/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Economizer (plate duct area)	Unit	Value
Quantity		2
Type		finned tube
Tube material		P265GH
Tube OD	mm	38,0
Tube wall thickness	mm	5,6
Number of elements	pcs	36
Number of parallel tubes/element	pcs	1
Total number of tubes/element	pcs	22
Element spacing	mm	75
Tube spacing in element	mm	75
Fin (h2 type) height	mm	145
Fin width	mm	70
Fin pitch	mm	25
Heat transfer surface	m ²	2181

1.2 Accessories

1.2.1 Safety valves, start-up valves and silencer

Safety valves

The boiler is equipped with the following high pressure safety valves (EN 12952-10/2002):

	Unit	Value
Number of main steam safety valves	pcs	2
Type of main steam safety valve 1		assisted
Type of main steam safety valve 2		supplementary loaded

Signal connection from the drum according to EN 12952-10/2002

Start-up valves	Unit	Value
Motorised isolation valve	pcs	1
Motorised control valve	pcs	1

Silencer	Unit	Value
Number	pcs	1
Material, shell and head		carbon steel
Material, internals		stainless steel

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 11/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.2.2 Access doors

Location	pcs	size, mm	shape
Steam drum	1+1	350x450	Oval
Bed area	1	800	Round
Secondary superheater area	1+1	480x630	Oval
Tertiary superheater area	1+1	480x630	Oval
Primary superheater area	3+3	480x630	Oval
Membrane eco area	1+1	480x630	Oval
2nd pass pass hopper	1	500x500	Square
Economizer area	2+2	500x500	Square
Flue gas airpreheater area	4+4	500x500	Square
3rd pass hopper	1	500x500	Square

1.2.3 Main steam piping

Main steam piping	Unit	Value
Material		X10CrMoVNb9-1
Length of main steam pipe outside of boiler house K20	m	130

Main steam pipe is routed from the K20 boiler building to Machine house in E1A building. Main steam piping is provided by a connection line to the existing reduction station (by customer). Piping will be supported from the existing structures. Pipe supports (primary supports) are included.

1.3 Feedwater system

EN 12952-7 section 4.2. states that residual heat accumulated in the furnace and flue gas passes shall not cause unacceptable metal or fluid temperatures in the steam boiler during normal shutdown or lock out.

In a BFB boiler combustion stops immediately in a lock out, when fluidizing of the bed is stopped. Although theoretical heat amount stored in the bed is significant, unfluidized bed stores the heat in the bed for days. When boiler pressure is maintained, evaporation stops in couple of minutes after lock out and steam is escaping from the boiler walls while water in a drum is filling this empty space. Due to this, water level in a drum is normally dropping below the minimum water level. When majority of the heat is kept stored in the bed, boiler achieves in 20-30 minutes a balance where heat released from the refractories and bed is equal to heat losses from the boiler.

BFB boiler is fulfilling the mandatory requirement, even when the water level may drop below the furnace roof level in a lock out. No unacceptable metal or fluid temperature will occur even without secured feed water supply. Fulfillment of the requirement is verified via simulations and temperature measurements during the lock out test (EN 12952-7 ANNEX F, d)). Based on

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 12/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

EN 12952-3 section 6.3.4 Table 6.3.1 material strength value in this kind of short duration exceptional case, where pressure parts are operated in the creep range, is based on 10 000 h and with safety factor 1,25.

1.3.1 Feedwater piping

Feed water piping	Unit	Value
Material		16Mo3
Length outside of the boiler house ,total	m	179

Feed water piping is routed from the Machine house in E1A building to K20 boiler building. There are separate connection points from the feed water piping from the boiler K80 and K90. Piping will be supported from the existing structures. Pipe supports (primary supports) are included.

1.4 Fuel feeding system

Solid fuel feeding system includes all the required equipment from the fuel silo to the furnace. Zero speed switch for all conveyors and rotary feeders and plugging indicators are included in the scope where needed.

1.4.1 Rotating spreader for silo inlet

	Unit	Value
Quantity	pcs	2
Rotating speed	rpm	5
Rotating motor	kW	1,5
Material		
frame		carbon steel
parts connecting with fuel		SS 2333

Rotating spreader is equipped with expansion bellow and zero speed switch.

1.4.2 Fuel silo

Fuel silo is located outside of the boiler house.

	Unit	Value
Quantity	pcs	2
Volume each	m ³	130
Silo diameter	m	5,7
Silo height	m	7,0

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 13/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Material	Value
cover	6 mm carbon steel
side walls, upper part	6 mm carbon steel
side walls, lower part (2 m height)	6 mm Stainless steel
bottom	6 mm Stainless steel

Equipment:

- infeed opening and inspection door on the roof
- bolted service door with hinges
- railings on the roof
- fuel level indicators for control of fuel level in the silo
- level switch with automatic interlocking in the case of overfilling
- connection for inertization and temperature detection
- pressure relief panels
- manhole

1.4.3 Silo screw reclaimer

Material	Unit	Value
Quantity	pcs	2
Capacity, each	m ³ /h	10-100 (max 107)
Screw diameter	mm	500
Main motor, preliminary.	kW / rpm	37
Slewing motor, bat.	kW / rpm	2x 2,2 / 1500
Speed Control		variable frequency drive zero speed switch

	Unit	Value
Automatic lubrication unit	kW	0,1

Material	Value
screw, flight	15 mm Stainless steel, partly lined with abrasion resistant steel
shaft lining	6 mm Stainless steel, partly lined with abrasion resistant steel
fall chute	stainless steel
other parts	carbon steel

1.4.4 Screw conveyer

	Unit	Value
Quantity	pcs	2
Capacity, each	m ³ /h	10-100 (max 107)
Length	m	8

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 14/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

	Unit	Value
Diameter	mm	630
Motor	kW	15
Speed Control		variable frequency drive

Material	Value
trough	6 mm stainless steel
Screw flight	12 mm Stainless steel, partly lined with abrasion resistant steel
Shaft lining	4 mm Stainless Steel, partly lined with abrasion resistant steel
Cover	Aluminium
Other parts	Carbon steel

Equipped with blockage switch.

1.4.1 Balance bin

	Unit	Value
Quantity	pcs	1
Volume	m ³	1,5
Material		Stainless steel

The balancing bin is equipped with a continuous level indicator (radiometric type) for reliable level measurement and even fuel feed to furnace.

1.4.2 Metering screws

	Unit	Value
Quantity	pcs	1+1
Capacity, each	m ³ /h	6-60
Screw diameter	mm	500
Length	m	3,0
Motor	kW	11
Speed Control		variable frequency drive

Material	Value
through	6 mm Stainless steel, partly lined with abrasion resistant steel
Screw flights	12 mm Stainless steel, partly lined with abrasion resistant steel
shaft lining	4mm Stainless steel, partly lined with abrasion resistant steel
Cover	Aluminium
other parts	carbon steel

The conveyor is equipped with 2 pcs flameless type pressure relief devices.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 15/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.4.3 Rotary feeders

	Unit	Value
Quantity	pcs	1+1
Capacity, each	m ³ /h	60
Motor	kW	11

Material	Value
parts in contact with fuel	Stainless steel
other parts	Carbon steel
rotor wing tops	Hard welded and sharp ground

Equipped with:

- local control switch
- connection for inertization and air
- support stand with feeder pull-out possibility maintenance

1.4.4 Fuel chutes

Fuel is fed into furnace through the air-cooled chutes located at front wall side of the furnace.

	Unit	Value
Quantity	pcs	2
Material		stainless steel
Plate thickness	mm	4
Size	mm	600 x 500

Equipped with:

- expansion joint DN500, parts contact with fuel and elastic parts: stainless steel, other parts carbon steel
- pneumatically operated slide gate 600 x 600 mm, material stainless steel, cylinders D=200mm
- hand operated slide gate 600 x 600 mm, material stainless steel
- inspection door
- fuel feeding air connection

1.5 Sand handling equipment

Make-up sand silo is filled pneumatically from the truck. Bed initial sand filling is carried out directly from truck to the furnace via a separate feeding piping.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 16/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.5.1 Sand silo

	Unit	Value
Quantity	pcs	1
Volume net	m ³	40
Material walls cone and roof		carbon steel

Equipment:

- hand railing on the roof
- manhole on the silo roof
- hand operated slide gate under the silo
- silo is supported with a support ring from boiler steel structures
- silo filling pipe DN100
- vent air pipe DN100
- silo relief valve for overpressure
- level indication

1.5.2 Sand screw

	Unit	Value
Quantity	pcs	1
Capacity	m ³ /h	5
Diameter	mm	400
Length	m	6
Motor	kW	3,0

Drop pipe to the furnace and expansion bellow are included.

1.6 Combustion air

1.6.1 Ductwork

	Unit	Value
Material		carbon steel
Thickness	mm	4

Suction duct	Unit	Value
Length	m	4
Silencer		carbon steel

Air flow measuring devices	Unit	Value
Primary air	pcs	1
Secondary air	pcs	2

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 17/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Air flow measuring devices	Unit	Value
Tertiary air	pcs	2
Start-up burner air	pcs	1
Type		aerofoil
Material		carbon steel

1.6.2 Combustion air fans

Total air fan

Total air fan is radial fan type and it supplies the required air for the staging air nozzles, primary air fan and for the burners. Flow control through the fan is adjusted by variable frequency drive.

Total air fan	Unit	Value
Quantity	pcs	1
Fan type		radial
Shaft speed, max	rpm	<1700
Motor size	kW/rpm	260/1500
Control		Variable frequency drive

Load	Unit	MCR	Design
Capacity	Nm ³ /s	23,7	26,1
Inlet temperature	°C	25	40
Total pressure difference	kPa	5,0	6,2

Equipment:

- common steel base for fan and motor
- inspection door
- flexible coupling
- flanged inlet and outlet
- oil lubricated bearings
- connections for vibration measurements
- Bearing temperature measurements

Primary air fan

Primary air fan is a radial fan and it supplies fluidizing air for sand bed fluidizing and for fuel feeding. Flow control through the primary air fan is adjusted by variable frequency drive.

Primary air fan	Unit	Value
Quantity	pcs	1
Fan type		radial
Shaft speed, max	rpm	<3000
Motor size, preliminary	kW/rpm	200/
Control		Variable frequency drive

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 18/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Load	Unit	MCR	Design
Capacity	Nm3/s	10,1	11,1
Inlet temperature	°C	28	60
Total pressure difference	kPa	9,6	11,9

Equipment:

- common steel base for fan and motor
- inspection door
- flexible coupling
- flanged inlet and outlet
- oil lubricated bearings
- connections for vibration measurements
- Bearing temperature measurements

1.6.3 Feed water air preheater

	Unit	Design	MCR	MIN
air flow	Nm3/s	21,8	24,0	8,6
air inlet temperature	°C	28	28	26
air outlet temperature	°C	52	40	90
Air side pressure loss	Pa	<300	<300	<300
feed water inlet pressure	bar(g)	150	150	160
feed water inlet temperature	°C	205	205	141
heat duty	kW	750	341	715

	Unit	Value
Design pressure (water side)	bar(g)	200
Design temperature (water side)	°C	230
Design pressure (air side)	kPa(g)	10
Design temperature (air side)	°C	120

Material	Value
tubes	16Mo3
casing	carbon steel

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 19/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.6.4 Flue gas air preheaters

Primary air preheater

	Value
Type of tubes	plain tubes
Tube material	carbon steel

Section no.	Unit	I	II
Tube diameter	mm	54	54
Tube wall thickness	mm	4,0	4,0
Number of tube rows horizontal	pcs	81	81
Number of tube rows vertical	pcs	10	10
Tube spacing, horizontal / vertical	mm	80/75	80/75
Heating surface	m ²	371	371

Secondary air preheater

	Value
Type of tubes	plain tubes
Tube material	carbon steel

Section no.	Unit	I	II	III
Tube diameter	mm	54	48,3	48,3
Tube wall thickness	mm	4,0	2,9	2,9
Number of tube rows horizontal	pcs	81	81	81
Number of tube rows vertical	pcs	20	24	24
Tube spacing, horizontal / vertical	mm	80/75	80/75	80/75
Heating surface	m ²	742	796	796

1.6.5 Air ports

Primary air nozzles	Unit	Value
Number of nozzles	pcs	918
Nozzle material		AISI 304

Secondary air nozzles	Unit	Value
Number	pcs	5+5
Material		AVESTA 253 MA / carbon steel
Location		front/rear walls
Type		constant velocity and fixed nozzles

Tertiary air nozzles	Unit	Value
Number	pcs	4+4
Material		AVESTA 253 MA /carbon steel
Location		front/rear walls
Type		constant velocity and fixed nozzles

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 20/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.7 Flue gas system

1.7.1 Ductwork

	Unit	Value
Material		carbon steel
Thickness	mm	5

The ducts are of welded construction and stiffened according to design imposed.

In general, the main supports and stiffeners are located externally, thus minimizing the possibility of structural failure due to erosion. Design of the flue gas ducts allow smooth flue gas flow rate from the boiler to the stack. There are no horizontal sections in the flue gas duct prior to bag filter, which could cause ash deposition and blockages inside the duct.

Flue gas ducts are equipped with necessary access doors, instrumentation and guarantee measurement connections.

1.7.2 Bag house filter

The Valmet bag house filter includes:

Casing	Unit	Value
Number of compartments	pcs	4
Design temperature	°C	250
Design pressure	Pa	± 9 000
Material		carbon steel
Filter casing thickness	mm	5
Insulation thickness	mm	160
Baffle plates		in each compartment
Penthouse	Unit	Value
Wall cladding		profiled cladding sheet
Penthouse floor material		5 mm structural steel tear plate
Penthouse floor insulation thickness	mm	200
Maintenance hatches	pcs	for each compartment, including manual hoists for hatch lifting
Lifting beam	pcs	1
Lobby	Unit	Value
Wall structure		sandwich panel
Lobby floor material		concrete

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 21/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Bottom hoppers	Unit	Value
Number of hoppers	pcs	4
Hopper volume	m3	20
Number of heating elements per hopper	pcs	3
Heating power per element	kW	1.5
Man doors 500 x 600 mm	pcs	for each hopper, access from maintenance platform
Bag house filter dampers	Unit	Value
Damper material		carbon steel
Inlet damper type		leaf
Number of inlet dampers	pcs	4
Outlet damper type		poppet valve
Number of outlet dampers	pcs	4
Actuator type		pneumatic (safety direction; remains in position)
Manual locking for service		included

Filter bags and cages	Unit	Value (nominal operation)
Bag type		Valmet Ecostar MT
Bag material		PTFE/PI blend
Number of filter bags per compartment	pcs	348
Filter bag length	m	8
Filter bags diameter	mm	127
Filtration area	m ²	4 443
Filtration speed, all compartments in operation	m/min	0,8
N-1 operation		Yes, < 24h*
Filter cage type		2 pieces
Cage material		carbon steel with cataphoretic coating
Vertical wires/cage	pcs	16
Bag cleaning system	Unit	Value
Type of filter cleaning		Online pulse-jet cleaning
Header tank pressure	bar(g)	~3
Control unit		PLC with Valmet's Beckhoff components

Header tank	Unit	Value
Number of tanks	pcs	4
Material		carbon steel, painted
Volume	l	230
Design pressure	bar(g)	5
Pulse valves	Unit	Value
Type		Trimec piston valve
Size	"	3
Number of valves per header tank	pcs	17

*The bag house filter can operate with one section out of operation. The N-1 operation is allowed for bag replacement or plugging work.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 22/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.7.3 Hydrated lime injection system

Hydrated lime storage silo	Unit	Value
Quantity	pcs	1
Volume, gross	m ³	30
Material		carbon steel

Including:

- Support structures
- Handrails on silo top
- Ladders
- Filling pipe
- Dust filter on silo top
- Arch breaking system
- level indication
- Level switch

1.7.3.1 Hydrated lime dosing and feeding

Hydrated lime dosing screw	Unit	Value
Quantity	pcs	1
Capacity	kg/h	200
Motor size, VDF	kW	0.75

Hydrated lime rotary valve	Unit	Value
Amount	pcs	1
Capacity	kg/h	200
Motor size	kW	0,4

Feeding air fan	Unit	Value
Amount	pcs	1
Motor size	kW	11
Motor rotation speed	rpm	1500

Feeding air heater	Unit	Value
Type		Immersion heater
Installed power	kW	4,5

1.7.4 Flue gas fan

	Unit	Value
Quantity	pcs	1
Fan type		radial
Shaft speed, max	rpm	<1800
Motor size	kW/rpm	400/ 1500
Control		Variable frequency drive

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 23/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Load	Unit	MCR	Design
Capacity	Nm ³ /s	35,0	38,5
Inlet temperature	°C	150	170
Total pressure difference	kPa	3,6	4,6

Equipment:

- common steel base for fan and motor
- flexible coupling
- flanged inlet and outlet
- Inspection door
- oil lubricated bearings
- connections for vibration measurements
- Bearing temperature measurements

Flue gas flow measurements	Unit	Value
Recirculation gas flow	pcs	1
Type		IR measurement
Material		carbon steel

1.7.5 Recirculation gas fan

The flue gas recirculation gas fan is radial flow type. Flow control is arranged by variable inlet vane and variable frequency drive.

	Unit	Value
Quantity	pcs	1
Fan type		radial
Shaft speed, max	rpm	<3200
Motor size	kW/rpm	180/3000
Control		Variable frequency drive

Load	Unit	MCR	Design
Capacity	Nm ³ /s	4,6	5,0
Inlet temperature	°C	155	175
Total pressure difference	kPa	14,0	15,8

Equipment:

- common steel base for fan and motor
- inspection door
- flexible coupling
- flanged inlet and outlet
- oil lubricated bearings

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 24/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

- connections for vibration measurements
- Bearing temperature measurements

1.8 Natural gas system

Natural gas is used as start-up fuel.

1.8.1 Natural gas piping

Auxiliary fuel piping is equipped with main valve group and ignition gas valve group.

	Unit	Value
Natural gas piping material		P235GH
Length from the tie in point (existing pipe bridge to boiler house wall)	m	23

1.8.2 Ignition gas Piping

Ignition gas piping with accessories inside the boiler house is included.

	Unit	Value
Ignition gas piping material		P235GH

1.8.3 Start-up burner

	Unit	Value
Quantity	pcs	1
Fuel		natural gas
Turn-down ratio		1:4
Location		sidewall
Effect/burner	MW _{fuel}	15

Equipment:

- burner control system with flame scanner
- local control panel close to the burner
- valve rack
- gas- electrical igniter
- air windbox with associated equipment
- pressure control for combustion air

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 25/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.9 Sootblowing system

1.9.1 Retractable sootblowers

	Unit	Value
Cleaning area		Superheaters and eco 3
Quantity, total	pcs	7
Type		Fully retractable
Motor	kW	0.75
Stroke length, abt.	m	5,5

1.9.2 Short stroke multi-nozzle sootblowers

	Unit	Value
Cleaning area		Flue gas airpreheaters
Quantity	pcs	5
Stroke length	m	0,8..1,2
Motor	kW	0.55

1.9.3 Rake sootblowers

	Unit	Value
Cleaning area		Finned tube economizers
Quantity	pcs	2
Motor	kW	0.75

Equipment for sootblowers:

- carbon steel housing complete with front and rear support arrangement
- lance tube, material according to prevailing temperature
- enclosed travelling carriage/drive mechanism
- mechanically operated, carbon steel material poppet valve equipped with adjustable pressure control
- packings and gaskets
- carbon steel wall box
- limit switches

1.9.4 Sootblowing steam piping

Sootblowing steam is extracted from the primary superheater outlet to the individual sootblower including piping and valves.

	Value
Piping material	Carbon steel

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 26/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Sootblowing steam is extracted after the primary superheater and pressure is reduced to about 25 bar(g) for sootblowers.

1.10 Bottom ash handling

1.10.1 Bottom ash hoppers and chutes

	Value
Quantity of hoppers	4 pcs
• material	carbon steel
Quantity of chutes	4 pcs
• material	stainless steel
Equipment:	
• manual operated service gates	4 pcs
• pneumatically operated shut-off gates	4 pcs
• material	stainless steel
• expansion joints	
• temperature measurement	4 pcs
• clean-out doors	

1.10.2 Bottom ash drag conveyor

	Unit	Value
Type		Water cooled drag chain conveyor with double chains
Quantity	pcs	1
Length	m	18
Width	mm	600
Capacity	m ³ /h	1...6
Motor	kW/rpm	3,0 / 1500
Materials		
• Casing		6 mm carbon steel
• bottom and intermediate bottom		12 mm AR-steel
• slide bars for return chain		16 x 120 mm Hardox 400
• cover		4 mm carbon steel

1.10.3 Bottom ash elevator

	Unit	Value
Quantity	pcs	1
Capacity	m ³ /h	6,0
Width	mm	500
Height	m	7
Motor	kW/rpm	3/1500
Material		carbon steel

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 27/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.10.4 Bottom ash sieve

Bottom ash sieving system can separate partly coarse material and fine material can be returned back to the furnace.

Sieve

	Unit	Value
Quantity	pcs	1
Length	m	1,85
Diameter	mm	900
Capacity	m ³ /h	4
Mesh opening	mm	2.0
Motor size,	kW	1,5
Rotating speed, about	rpm	20
Equipment		Automatic cleaning device with solenoid valves Pneumatic gate inlet and outlet chutes

1.10.5 Pneumatic conveyor for returnable bed material

Bed material from the sieve is transferred pneumatically to furnace.

	Unit	Value
Quantity	pcs	1
Capacity, each	m ³ /h	4
Material (or equal)		carbon steel/cast iron

Equipment:

- conveying pipes with support structures to furnace
- Conveying piping is equipped with reinforced bends and 0,5 m long reinforced straight part after each bend.

1.10.6 Dividing Screw

Dividing screw conveyor	Unit	Value
Quantity	pcs	1
Diameter	mm	500
Length	m	6
Capacity	m ³ /h	6
Motor	kW	3
Material		
- Through		carbon steel
- Screw flights		carbon steel

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 28/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

- Cover		aluminium
Equipment		Outlet chutes (2 pcs) are equipped with manual winch operated fabric bellows to containers.

1.10.7 Bottom ash container with equalizing screw

Bottom ash container	Unit	Value
Quantity	piece	2
Capacity, gross	m ³	10
Material		carbon steel
Equalizing screw motor	kW	1,5
Equalizing screw material		carbon steel

1.11 2nd pass and 3rd pass ash system

Fly ash from the 2nd pass and 3rd pass is collected by the ash hoppers and further transferred into the fly ash silo.

1.11.1 Rotary valve

	Unit	Value
Quantity	pcs	1
Capacity	m ³ /h	1
Motor	kW	1,5
Inner lining of cells		Stainless steel
Other parts		Carbon steel
Knives		hard-welded and grounded

Fly ash from the 2nd pass is taken to 3rd pass ash hopper through a drop pipe.

1.11.2 3rd pass ash drag conveyor

	Unit	Value
Type		Drag conveyor with double chain
Quantity	pcs	1
Capacity	m ³ /h	3,0
Width	mm	600
Length	m	10
Motor	kW/rpm	1,5/1500
Materials		
-bottom		AR steel
-side walls		carbon steel
-cover		carbon steel
-other parts		carbon steel

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 29/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.11.3 Pneumatic ash conveyor 2nd and 3rd pass ash

Fly ash from 2nd pass and 3rd pass ash hoppers is transferred pneumatically to fly ash silo.

	Unit	Value
Quantity	pcs	1
Capacity	m ³ /h	3
Material		carbon steel/cast iron

1.11.4 Ash piping for 2nd pass hopper ash

Fly ash piping from pneumatic transmitter to the fly ash silo.

	Value
Piping material	carbon steel
Length	50 m

Ash piping is equipped with reinforced (basalt) bends and 0,5 m long reinforced straight part after each bend.

1.12 Fly ash system

1.12.1 Pneumatic conveyors for filter fly ash

Pneumatic conveyors are located below the bag filter and transfer the fly ash to the fly ash silo.

	Unit	Value
Quantity of filter hoppers	pcs	4
Quantity of pneumatic conveyors	pcs	4
Capacity/transmitter	m ³ /h	2

1.12.2 Fly ash piping for filter ash

Fly ash piping from pneumatic transmitters to the fly ash silo.

	Value
Piping material	carbon steel
Length	60 m

One common conveying piping is equipped with reinforced (basalt) bends and 0,5 m long reinforced straight part after each bend.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 30/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.12.3 Fly Ash Silo

	Unit	Value
Quantity	pcs	1
Volume	m ³	120
Diameter	m	4,4
Height	m	11
Material		carbon steel
Silo discharging	Unit	Value
Min. free height for lorries, approx	m	4-6

Silo equipment:

- legs and support steel construction
- stairs to equipment room
- ladder to silo roof
- fluidizing air piping + valve
- level indicator
- mandoor on the roof
- fenced roof
- air filter unit + fan (motor 3 kW)
- pressure relief hatch
- concrete support h = 2,8 m by others (OB 6)

1.12.4 Fly ash dry unloading system

1.12.4.1 Hand operated gate valve

	Unit	Value
Quantity	kpl	1
size	mm	400*700
Material of slide plate		Stainless steel

1.12.4.2 Rotary valve

	Unit	Value
Quantity	pcs	1
Capacity	m ³ /h	50
Motor	kW	3
Inner lining of cells		Stainless steel
Other parts		Carbon steel
Knives		hard-welded and grounded

1.12.4.3 Unloading device

	Unit	Value
Capacity	m ³ /h	50

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 31/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Motor	kW	0.55
Chute size		D= 500, loading sock with steering cones
Dust extracting system		DN150, level swith

Fly ash unloading funnel between the silo and unloading device included in the supply.

1.13 NOx reduction system (SNCR)

1.13.1 Aqueous ammonia dosing pumps

The ammonia pump station is located close to the existing ammonia tank. The existing dosing pumps (2x 80 kg/h) located inside the tank will used.

1.13.2 Aqueous ammonia dilution water booster pump

	Unit	Value
Quantity	pcs	1
Capacity	kg/h	500
Motor, preliminary	kW	2,2

1.13.3 Injection of ammonia

	Unit	Value
Number of levels	pcs	2
Number of nozzles/level	pcs	6

1.13.4 Ammoniawater piping

Ammoniawater piping from the existing dosing unit to the nozzles is included. Ammonia water piping will be supported from the existing structures. Necessary primary supports for the piping are included.

	Unit	Value
Material		AISI 316L
Length outside of boiler house	m	67

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 32/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.14 Auxiliary systems

1.14.1 Blowdown system

1.14.1.1 Blowdown tank

	Unit	Value
Volume, gross	m ³	3
Design pressure	bar(g)	5
Design temperature	°C	150
Material		Carbon steel

Vent stack is routed to roof. Drain from the blowdown tank is pumped to the reuse system of the water, or taken to the sump pit.

1.14.1.2 Blowdown tank drain pump

	Unit	Value
Quantity	pcs	1
Capacity	kg/s	6,3
Drain water in	°C	60 (range 40-120)
Pressure increase	bar	7,0
Motor	kW	10
Control		fixed speed
Material		carbon steel

Accessories:

- baseplates for pump and motor
- shaft couplings with spacer & guard
- suction and discharge pressure gauge

	Unit	Value
Material		Carbon steel
Length outside of boiler house	m	140

1.14.2 Sample station

	Unit	Value
Number of coolers	pcs	4

Sample points:

- feed water line: cation conductivity, specific conductivity, pH, O2

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 33/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

- boiler water: pH, specific conductivity
- saturated steam: cation conductivity
- superheated steam: degassed cation conductivity, pH

	Value
Sample piping material	1.4307 (high pressure class pipes; 10,2 x 2 mm)

1.14.3 Chemical dosing equipment

Phosphate

Phosphate tank	Unit	Value
Number	pcs	1
Volume	m3	0,5
Material		1.4404 or PE
Equipment		Filling / inspection hatch
		Agitator 1,5 kW
		Dosing/mixing basket for solid phosphate
		Instrumentation according to PID
Dosing pumps	Unit	Value
Number	pcs	2 x100%
Type		piston
Dosing range	l/h	0-3
Trinatrium phosphate concentration	%	1
Motor, preliminary	kW	0,25
Piping material		1.4404

	Value
phosphate piping material	1.4307 (high pressure class pipes; 10,2 x 2 mm)

1.14.4 Cooling water system

1.14.4.1 Cooling water piping

Cooling water piping	Unit	Value
Material		Carbon steel
Length outside of the boiler house; in+out	m	142+142

Cooling water piping is routed from the machine house in E1A building to K20 boiler building. Piping will be supported from the existing structures. Pipe supports (primary supports) are included.

Cooling water is used for:

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 34/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

- Compressors
- Sample coolers
- Bottom ash water cooled conveyors

1.14.4.2 Cooling water pumps

	Unit	Value
Quantity	pcs	2x 100 %
Capacity	kg/s	15
Cooling water in	°C	30
Pressure increase	bar	4,0
Motor	kW	30
Control		variable frequency drive
Material		carbon steel

Accessories for each pump:

- baseplates for pumps and motors
- shaft couplings with spacer & guard
- suction and discharge pressure gauge
- Bearing temperature measurements, 2 pcs
- connections for vibration measurements

1.14.5 Industrial water system

Industrial water is used for blowdown tank cooling (back up) and as fire fighting water

	Value
Piping material	Carbon steel

1.14.6 Potable water system

Potable water distribution piping for safety showers.

1.14.6.1 Potable water piping

	Value
Piping material	Carbon steel

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 35/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.14.6.2 Emergency showers

Emergency showers with eye wash stations	Unit	Value
Quantity	pcs	3

Locations:

- chemical dosing area
- Ammonia water injection levels

1.14.7 Auxiliary steam

Auxiliary steam is taken from the boiler saturated steam system and it is used for as fire extinction media at fuel silo and conveyors.

	Value
Piping material	P235GH

1.14.8 Compressed air system

1.14.8.1 Transport air system

1.14.8.1.1 Compressor unit for transport air system

Transport air consumptions of the consumers for compressor dimensioning:

Description	Unit	Value
Average transport air consumption K20	nm ³ /h	352
Average transport air consumption K80/K90	nm ³ /h	5 500
Average transport air consumption other OBs	nm ³ /h	630

Unit includes one compressor unit with filters and refrigerator type dryer. Unit is used as a back up supply of the transport air.

Compressor for transport air	Unit	Value
Quantity	pcs	1 x 100%
Capacity (free air, at 7 bar(g) & 20°C) each	nm ³ /min	108
Operating pressure; normal/max	MPa(g)	0,6 / 0,65
Type of compressor		screw
Lubrication		oil
Cooling system		Water cooled
Filters		Air intake filter and all necessary filters
Oil/ water separation unit		included
Electrical motor	kW	500

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 36/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Control system		vendor control system, PLC unit with DCS connection for controlling
Instrumentation		included
Dryer	Unit	Value
Quantity	pcs	1 x 100%
Type		refrigerator type
Design capacity	nm3/min	108
Dew point	C	<= +3
Instrumentation		included
Air quality (ISO 8573-1:2001)		1.4.2 (particles. water. oil)

1.14.8.1.2 Transport air piping

Transports air piping	Unit	Value
Material		Stainless steel
Length outside of boiler house	m	80

Transport air piping is routed from the E1 building to K20 boiler building. Piping will be supported from the existing structures. Pipe supports (primary supports) are included.

1.14.8.1.3 Transport air tanks

	Unit	Value
Quantity	pcs	1 + existing tanks*)
Volume	m³	5
Material		Carbon steel

*) Existing transport air tanks will be reused in E1A building for the additional buffer capacity of the network.

1.14.8.2 Instrument air system

1.14.8.2.1 Compressor unit for instrument air

Instrument air consumptions of the boilers K20, K80 and K90 and fuel handling equipment (OB1):

Description	Unit	Value
Average instrument air consumption K20	nm3/h	350
Average instrument air consumption K80/K90	nm3/h	2 x 375
Average instrument air consumption OB1	nm3/h	100

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 37/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

Existing compressor units (2x100%) and adsorption dryer will be moved to the new compressor room and connected.

1.14.8.2.2 Instrument air piping

Instrument air piping	Unit	Value
Material		1.4307
Length outside of boiler house K20	m	123

Instrument air piping include two main risers inside the K20 boiler building. Instrument air is supplied for K20/K90 and the needs of OB 1 (Fuel handling equipment).

Outside of the boiler house K20 the instrument air piping will be supported from the existing structures. Pipe supports (primary supports) are included.

1.14.8.2.3 Instrument air tanks

	Unit	Value
Quantity	pcs	1 + existing tanks*)
Volume	m ³	5,0
Material		Stainless steel

*) existing instrument air tanks will be reused in the area of K80/K90 for the additional buffer capacity in the instrument air system. in E1A building.

1.15 Others

1.15.1 Piping and fine mountings

Pipelines containing flammable substances (natural gas) will be provided by earthing.

Creep control will be done for all material which lies in Creep Range, irrespective of the pipe size.

Valves inside the delivery limits are included according to flow diagrams. All drain, blow-out and vent lines are equipped with double valves if the pressure exceeds 40 bar. Boiler vents are connected to funnel and drains to blowdown tank.

Design pressure class of the valves and other pipe auxiliaries will be according to the pipeline.

Generally CSN-EN standards will be followed unless specific deviations made.

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 38/38
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

1.15.2 Thermal insulation and lagging material

Surface temperatures higher than 50 C during normal operation will be insulated.

Boiler wall standard insulation	Unit	Value
Insulation material		mineral wool
Membrane walls, number of layers	pcs	2
Insulation thickness, total	mm	200

The lagging of the furnace, second pass and economizer will consist of smooth finished flat or box-ribbed aluminium plate. The standard lagging thickness is 0,7 mm for the box-ribbed aluminium.

Equipment, tanks, ducts and pipes insulation is according to ISO12241.

The surfaces where heat losses are not economically significant will be insulated for personnel protection only. This equipment will be insulated only for safety at the points where hot surface could be a safety hazard.

- manholes
- blow out pipes
- sample lines
- coarse material hoppers and chutes
- bottom ash conveyors
- blowdown tank

1.15.3 Painting

Following paintings are included in the scope according to manufacturers' standards and colors.

- painting for protection during sea transport
- final painting for prefabricated uninsulated parts

Equipment will be painted according to the standard colors of the manufacturers. Piping will be painted according to customer/mill standards.

1.15.4 Spare parts

Required spare parts for two years operation are included in the delivery. See the chapter 14 for the list of spare parts.

Table of Contents

1	EQUIPMENT SPECIFICATION	3
1.1	Pressure Parts	4
1.1.1	Furnace	4
1.1.2	Load carrying tubes of the 2nd Pass heat transfer surfaces	5
1.1.3	HP-superheaters	5
1.1.4	Economizers	6
1.2	Biofuel feeding systems	8
1.2.1	Biofuel silo (with rotating spreaders and silo reclaimers)	8
1.2.2	Screw conveyor	9
1.2.3	Retention bin with double metering screws	9
1.2.4	Fuel chutes (with rotary feeders and slide gates)	10
1.2.5	Wall screws	11
1.3	Sand feeding equipment	12
1.4	Combustion Air System	13
1.4.1	Ductwork and windbox	13
1.4.2	Air ports	13
1.4.3	Purge air for fuel feeding	14
1.5	Auxiliary firing	15
1.5.1	Auxiliary fuel piping	15
1.5.2	Start-up burners	15
1.5.3	Technological fuel wall lance	15
1.6	Flue gas system	16
1.6.1	Flue gas fan	16
1.6.2	Ductwork	16
1.7	Flue gas cleaning	17
1.7.1	Bag house filter	17
1.7.2	Hydrated lime injection	17
1.7.3	Ammonium sulphate injection system – SNCR and corrosion control	18
1.8	Sootblowing system	19

1.8.1	Retractable sootblowers	19
1.8.2	Short stroke multi-nozzle sootblowers	19
1.8.3	Sootblowing steam piping	19
1.9	Ash Handling System	20
1.9.1	Bottom ash handling	20
1.10	Auxiliary Systems	23
1.10.1	Low pressure piping and valves	23
1.10.2	Cooling water system	23
1.10.3	Auxiliary steam systems	23
1.10.4	Pressurised air system	24
1.11	Others	25
1.11.1	Refractories	25
1.11.2	Metal Spraying	25
1.11.3	Thermal Insulation and Lagging Material	25
1.11.4	Painting	26
1.11.5	Spare parts	26
1.12	Assessment of condition	27
1.13	Dismantling of unnecessary equipment	28

1 EQUIPMENT SPECIFICATION

This section contains a detailed description of the equipment and services to be provided by Valmet Technologies Oy as part of the proposed base scope of supply.

Where reference is made to specific dimensions and/or materials, Valmet Technologies has the right to adjust these parameters as more detailed calculations and decisions of subcontracted items are executed during the project phase.

The information presented herein is provided as preliminary data until the project stage when all such dimensions and/or materials are finalized.

This specification determines the required equipment for one boiler rebuild unless specified otherwise. The modifications for boilers K80 and K90 are identical apart from some differences in layout (incl. mirrored layout).

1.1 Pressure Parts

The boiler and the associating piping shall be designed, fabricated and inspected in accordance with EN code. Total allowances used in pressure part dimensioning are at least 1 mm for heat transfer surfaces. Allowance is calculated for straight pipe.

Pressure vessel Design code: Pressure Equipment Directive 2014/68/EU.

Main dimensions	Unit	Value
Design pressure	bar(g)	145
Design pressure (gas side)	kPa(g)	± 7000 (Existing BHF design pressure to be checked by the Client, reinforcements not included in the scope of supply)

1.1.1 Furnace

Furnace main dimensions (no changes by Valmet)

	Unit	Value
Width	mm	5 175
Depth	mm	5 145
Height (furnace bottom – roof)	mm	34 000
Cross section, free board	m ²	27
Grate area, about	m ²	15

Furnace bottom replacement

The bottom part of the furnace shall be replaced with new membrane wall, including furnace floor change.

Furnace walls	Unit	Value
Type		Membrane
Tube material (or equal)		16Mo3
Height of replacement (from bottom header centerline)	mm	Approx 6700
Tube OD	mm	57
Nominal tube wall thickness	mm	6,3
Tube spacing	mm	75

Furnace floor	Unit	Value
Tube material (or equal)		16Mo3
Tube OD	mm	88,9
Nominal tube wall thickness	mm	10
Tube spacing	mm	340

Refractory (furnace lower part)	Unit	Value
Refractory height	mm	11 000
Material		LC
Thickness from the tube	mm	50

New equipment of Furnace (for one boiler):

	Unit	Value
Bio fuel feeding openings	Pcs	2
Secondary air openings (lower and upper)	Pcs	8 + 10
Bottom ash chutes to furnace bottom	Pcs	3
Make up sand feeding openings	pcs	1
Recycled sand feeding openings	pcs	1
Start-up burner openings	pcs	2
Wall lance opening (for technological fuel)	pcs	1
Ammonia nozzle openings, lower furnace	Pcs	2+2

1.1.2 Load carrying tubes of the 2nd Pass heat transfer surfaces

The load carrying tubes in the 2nd pass, supporting the superheaters and last economizer element are replaced, forming part of the primary superheater (section 1.1). The change includes the dividing tubes to wall headers, but existing wall headers of 2nd pass walls are utilized.

Load carrying tubes	Unit	Value
Tube material		13CrMo4-5
Tube OD	mm	42,4
Nominal tube wall thickness	mm	5,6
Tube spacing	mm	170

1.1.3 HP-superheaters

The high pressure superheater elements located in the 2nd pass are replaced, composing of the primary and tertiary superheater sections. Original headers of each superheater are utilized.

Primary superheaters 1	Unit	Value
Type		Convective
Flow type		Counter flow
Tube material (or equal)		13CrMo4-5
Tube OD	mm	38,0
Tube wall thickness	mm	5,6
Number of elements	pcs	42
Number of parallel tubes/element	pcs	21
Total number of tubes/element	pcs	3
Element spacing	mm	85
Heat transfer surface, about	m ²	367

Primary superheaters 2	Unit	Value
Type		Convective
Flow type		Counter flow
Tube material (or equal)		10CrMo9-10
Tube OD	mm	38,0
Tube wall thickness	mm	7,1
Number of elements	pcs	42
Number of parallel tubes/element	pcs	21
Total number of tubes/element	pcs	3
Element spacing	mm	85
Heat transfer surface, about	m ²	367

Tertiary superheaters 1- 2	Unit	Value
Type		Convective
Flow type		Counter flow
Tube material		X7CrNiNb18-10 or equal
Tube OD	mm	38,0
Tube wall thickness	mm	6,3
Number of elements	pcs	21
Number of parallel tubes/element	pcs	24
Total number of tubes/element	pcs	6
Element spacing	mm	170
Heat transfer surface, about	m ²	285 + 285

1.1.4 Economizers

The economizer heating surfaces are manufactured from plain steel tubes. First 3 economizer banks are located inside the steel casings. Economizer 4 is located in the membrane section of the flue gas duct.

Economizer 1 – 3	Unit	Value
Type		plain tube
Tube material		16Mo3
Tube OD	mm	38,0
Tube wall thickness	mm	4,5
Number of elements	pcs	42
Number of parallel tubes/element	pcs	3
Total number of tubes/element	pcs	30
Element spacing	mm	85
Heat transfer surface /each eco package	m ²	3 * 705

Economizer 4 in membrane section	Unit	Value
Type		plain tube
Tube material		16Mo3
Tube OD	mm	38,0

Economizer 4 in membrane section	Unit	Value
Tube wall thickness	mm	4,5
Number of elements	pcs	42
Number of parallel tubes/element	pcs	3
Total number of tubes/element	pcs	30
Element spacing	mm	85
Heat transfer surface	m ²	564

1.2 Biofuel feeding systems

Solid fuels shall be in accordance with fuel data defined in Appendix 6, Guarantees and additional clarifications in Design data section 04 of Valmet tender.

This conveyor system specification determines the required equipment for one boiler rebuild (total number of equipment is specified in brackets after specified amount of equipment needed for one boiler).

Fuel feeding system for the bio fuel from boiler silo inlet to the furnace including necessary conveyors, balancing pocket, rotary feeders and fuel chutes with dampers and expansion joints. Zero speed switch for all conveyors and rotary feeders and plugging indicators are included in the scope where needed.

1.2.1 Biofuel silo (with rotating spreaders and silo reclaimers)

Fuel silos are located inside the boiler house. Fuel is fed into the silos from the top. The rotating spreader and silo reclaimer are included.

Biofuel silo	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Net volume, each, about	m ³	160
Silo diameter, prel.	m	6,3
Silo height, prel.	m	7,4
Materials:		
• cover and side walls upper parts	carbon steel	
• bottom and side walls lower part	SS 2333	

Equipment:

- infeed opening and inspection door on the roof
- bolted service door with hinges
- railings on the roof
- fuel level indicators for control of fuel level in the silo
- level switch with automatic interlocking in the case of overfilling
- extinguishing steam connection and temperature detection
- explosion doors
- manhole

Rotating spreader for silo inlet	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Rotating speed	rpm	5
Rotating motor	kW	1,5
Material (or equal)		

Rotating spreader for silo inlet	Unit	Value
frame		carbon steel
parts in contact with fuel		SS 2333
Equipments:		<ul style="list-style-type: none"> expansion bellow speed switch

Silo screw reclaimer	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Capacity	m ³ /h	14 – 70* (140)
Main motor, prel.	kW	37
Slewing motor, prel.	kW	2 x 2,2
Speed Control		variable frequency drive with zero speed switch
Materials (or equal):		
• screw, flight		Stainless steel + hard welded
• shaft lining		SS2333
• fall chute		stainless steel
• other parts		carbon steel

*maximum continuous operation capacity for reclaimers is 70 m³/h, but in cases when the other fuel silo is out of operation the reclaimer can be operated with capacity of 140 m³/h for short periods of time.

Automatic lubrication unit	Unit	Value
Motor	kW	0,1

1.2.2 Screw conveyor

	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Capacity, each	m ³ /h	14- 70* (140)
Length	m	6,6
Diameter	mm	500
Motor	kW	11
Speed Control		variable frequency drive

*maximum continuous operation capacity for reclaimers is 70 m³/h, but in cases when the other fuel silo is out of operation the reclaimer can be operated with capacity of 140 m³/h for short periods of time.

Material	Value
Screw flight	15 mm Stainless Steel
Shaft lining	6 mm Stainless Steel
Cover	Carbon steel/aluminium

Equipped with blockage switch.

1.2.3 Retention bin with double metering screws

Fuel from silo is discharged to the retention bin, where fuel to each opening on the front wall are metered.

Retention bin with double screws	Unit	Value
Retention bin:		
Quantity /boiler (total)	Pcs	1 (2)
Volume, gross	m ³	2
Material		SS2333
Metering screws:		
Quantity /boiler (total)	Pcs	1 (2)
Capacity	m ³ /h	10 - 100
Length	m	3,5
Diameter, preliminary	mm	500
Motor, each	kW	15
Speed control		Variable frequency drive

Material	Value
through	6 mm Stainless steel
Thread	10 mm Stainless steel, thread top hard welded
shaft lining	Stainless steel
other parts	carbon steel

1.2.4 Fuel chutes (with rotary feeders and slide gates)

Fuel chutes with expansion bellows	Unit	Value
Quantity	pcs	2 + 2
Capacity, each	m ³ /h	100
Materials		
• internal chute	4 mm	stainless steel
• elastic parts		stainless steel
• other parts		carbon steel

Rotary valve feeders	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Capacity / each	m ³ /h	100
Material		
• Parts in contact with fuel		Stainless steel
• Other parts		Carbon steel
Motor	kW	15
Control		Constant speed

Rotary valve feeders are equipped with air connection.

Manual operated slide gates	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Opening, preliminary	mm	500 x 600
Frame		Carbon steel
Slide gate		Stainless steel

1.2.5 Wall screws

Fuel is fed to the furnace through two wall screws at the front wall of the boiler.

Wall screws	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Capacity / each	m ³ /h	100
Length	m	4,3
Screw diameter	mm	450
Materials:		
• Trough, thread and shaft lining		Stainless steel
• End of the screw in furnace		Heat resistant steel
Motor	kW	11

The screw is equipped with air jacket for screw cooling.

1.3 Sand feeding equipment

Original MFV storage silo is utilized as fresh sand silo. Original silo filling piping shall be renewed for enable silo filling from boiler house outside wall. Original feeding screw to the furnace is utilized for fresh sand feeding to the furnace.

Separate pipelines to both K80 and K90 sand silo (about 60 meters each) with ceramic reinforced bends included,

1.4 Combustion Air System

Existing air fans, ducting, heat transfer surfaces, flow measurement devices and other equipment shall be utilized. The following connections close to the furnace bottom area shall be replaced as specied in the PI-diagrams:

- Part of primary air ducting close to the furnace windbox
- Primary air windbox
- Primary air nozzles
- Part of secondary air ducting close to the secondary air openings

1.4.1 Ductwork and windbox

	Unit	Value
Material		carbon steel
Thickness	mm	4

1.4.2 Air ports

The primary, fluidizing air will be introduced into the furnace through primary air nozzles located in bottom grate. The secondary air is introduced into the furnace above the fluidized bed through secondary air nozzles, which are at two elevations.

Primary air nozzles	Unit	Value
Number of nozzles, prel.	pcs	Approx. 500
Nozzle material (or equal)		Cast nozzle
Nozzle type		Multihole nozzle

Lower secondary air nozzles	Unit	Value
Number	pcs	8
Diameter, preliminary	mm	OD 219
Material (or equal)		AVESTA 253 MA / carbon steel
Location		front/rear and side walls
Elevation from grid	mm	Approx 1000
Type		Round nozzles directed 20-30° downwards

Upper secondary air nozzles	Unit	Value
Number	pcs	10
Diameter, preliminary	mm	OD 219
Material (or equal)		AVESTA 253 MA / carbon steel
Location		front/rear and side walls
Elevation from grid	mm	Approx 5000
Type		Round nozzles directed 20-30° downwards

1.4.3 Purge air for fuel feeding

The purge and cooling air temperature for the new rotary feeders and wall screw is maximum 130°C. Air at suitable temperature and pressure does not currently exist and therefore a new purge air blower and mixing of cold and hot primary air is needed.

1.4.3.1 Purge air blower

Purge air blower	Unit	Value
Amount	pcs	2 (4)
Type (preliminary)		Tri-lobe Rotary piston fan or equal
Capacity, preliminary	m3/h	2200
Motor size, preliminary	kW	15

1.5 Auxiliary firing

Natural gas is used as start-up fuel. Boiler is equipped with wall lance for occasionally firing diluted oily emulsion (Technological fuel from Skoda-auto).

1.5.1 Auxiliary fuel piping

Auxiliary fuel piping is equipped with main valve group and ignition gas valve group.

	Unit	Value
Auxiliary fuel piping material		P235GH

1.5.2 Start-up burners

	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Fuel		natural gas
Turn-down ratio		1:5
Location		sidewalls
Heat output / each (fuel LHV)	MW _{fuel}	15

Equipment:

- burner control system with flame scanner
- local control panel close to the burner
- valve rack
- gas- electric igniter
- air windbox with associated equipment
- pressure control for combustion air

1.5.3 Technological fuel wall lance

	Unit	Value
Quantity /boiler (total)	pcs	1 (2)
Fuel		Technological fuel
Turn-down ratio		1:3
Location		side wall
Capacity of technological fuel firing	kg/h	250 – 650

Equipment:

- local control panel close to the burner
- valve rack
- air windbox with associated equipment

- pressure control for combustion air

1.6 Flue gas system

1.6.1 Flue gas fan

The existing flue gas fan shall be replaced due to changes in 2nd pass heating surfaces, modifications to additive feeding injection point and increased flue gas amount due to moist fuels.

	Unit	Value
Quantity /boiler (total)	pcs	1 (2)
Fan type		radial
Shaft speed, max	rpm	1500
Motor size, preliminary	kW	900
Control		Variable frequency drive

Load	Unit	MCR	Design
Capacity	Nm ³ /s	36	40,3
Inlet temperature	°C	160	180
Total pressure difference	kPa	6,5	8,5

Fittings:

- steel base
- flexible coupling
- flanged inlet and outlet
- temperature (2 pcs for bearings) and connections for vibration (2 pcs) measurements

1.6.2 Ductwork

	Unit	Value
Material (or equal)		carbon steel
Thickness	mm	5

Modifications inside the ducts are required to enhance the additive mixing prior to the bag house filter, upstream of the additive injection point. The mixing plates are of welded to the existing ducting.

The ducts are of welded construction, and stiffened according to design imposed. The design allows smooth gas flow and will avoid dust deposition.

1.7 Flue gas cleaning

Flue gas cleaning system will utilize the existing baghouse filter. However, the material of the filter bags is required to be changed.

1.7.1 Bag house filter

Valmet filter bags

Filter bags	Unit	Value (nominal operation)
Bag type		Valmet Ecostar MT
Bag material		PTFE/PI blend
Number of filter bags/ boiler (total)	pcs	1344 (2688)
Filter bag length	m	5.8
Filter bags diameter	mm	150

1.7.2 Hydrated lime injection

Dosing screw	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Material		Mild steel
Capacity	kg/h	600
Motor size, VDF	kW	0,75
Motor rotation speed	rpm	1500

Rotary valve	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Material		Mild steel
Capacity	kg/h	600
Motor size	kW	0,4

Including:

Mixing device(s) inside ductwork upstream of BHF

Feeding air fan	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Motor size	kW	11
Motor rotation speed	rpm	1500

Feeding air heater	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Type		Immersion heater
Installed power	kW	6

1.7.3 Ammonium sulphate injection system – SNCR and corrosion control

The existing SNCR system is utilized for ammonium sulphate injection. The existing system is updated by adding injection level to furnace to secure low load operation. The feeding to furnace injection is performed by adding two new booster pumps for mixture of ammonium sulphate and dilution water.

1.7.3.1 Ammonia dosing pumps

	Unit	Value
Quantity /boiler (total)	pcs	2 (4)
Type		Gear pump
Capacity, preliminary	kg/h	1000
Pressure	bar	20
Motor, preliminary	kW	5,5

The pumps are located inside the existing ammonia tank next to the existing pumps.

1.7.3.2 Ammonium sulphate injection

New injection lances are added to lower furnace level for low load operation.

Lances and nozzles (furnace lower part)	Unit	Value
Quantity	pcs	4
Nozzle type (preliminary)		1/8-MEG-316SS
Material		Heat resisting steel

Ammonium sulphate piping	Value
Material	Stainless steel

1.8 Sootblowing system

New sootblowers will be added to enhance the sootblowing in the primary superheater area and below the economizer 1.

1.8.1 Retractable sootblowers

	Unit	Value
Cleaning area		Primary superheater 2
Quantity, total	pcs	1
Type		Fully retractable
Motor	kW	0.75
Stroke length, abt.	m	3.6

1.8.2 Short stroke multi-nozzle sootblowers

	Unit	Value
Cleaning area		Below economizer 1
Quantity	pcs	1
Motor	kW	0.75

1.8.3 Sootblowing steam piping

Sootblowing steam piping branches to new sootblowers shall be added, utilizing the existing main sootblowing steam line.

1.9 Ash Handling System

1.9.1 Bottom ash handling

1.9.1.1 Bottom ash discharge chutes

Furnace grid will be modified to accommodate new bottom ash chutes.

	Unit	Value
Quantity /boiler (total)	pcs	3 (6)
Diameter, preliminary	mm	250

Equipment for each chute:

- manually operated service gates
- pneumatically operated shut-off gates
- expansion joints
- temperature measurements

1.9.1.2 Water cooled screw conveyors

The casing part and the screw part in the screw conveyors are water cooled. Conveyors are also equipped with expansion joints and fall pipe.

Water cooled screw	Unit	Value
Type		Screw conveyor
Quantity /boiler (total)	pcs	3 (6)
Capacity	m ³ /h	1,5 (total 4,5 m ³ /h / boiler)
Lenght	m	3,4
Motor, preliminary	kW	1,1
Materials		
• flights		stainless steel
• water jacket		carbon steel
• casing		carbon steel

1.9.1.3 Bottom ash drag conveyor

	Unit	Value
Type		Drag conveyor
Quantity /boiler (total)	Pcs	1 (2)
Length, preliminary	m	16,7
Capacity	m ³ /h	3
Motor	kW	2,2
Materials		
• side walls		carbon steel
• cover		carbon steel

• bottom		AR steel
----------	--	----------

1.9.1.4 Bottom ash sieving equipment

Bottom ash sieving system divides the bottom ash to three streams

- coarse material ($> 6 \text{ mm}$) from bottom ash to small container located inside the boiler hall
- bottom ash ($6 \text{ mm} < x < 0,7 \text{ mm}$) pneumatically delivered to bottom ash silo
- the fine material ($< 0,7 \text{ mm}$) pneumatically returned back to the furnace or to the intermediate bed material silo

Sieve	Unit	Value
Quantity /boiler (total)	pcs	1 (2)
Capacity	m ³ /h	3
Mesh opening coarse	mm	6,0
Mesh opening fine	mm	0,7
Motor size, prel.	kW	1,5
Rotating speed, about	rpm	20

1.9.1.5 Pneumatic conveyor for returnable bed material

Bed material from the sieve is transferred pneumatically to furnace.

	Unit	Value
Quantity /boiler (total)	pcs	1 (2)
Capacity, each	m ³ /h	3
Material (or equal)		carbon steel/cast iron

Conveying piping to furnace with support structures and reinforced bendings is included.

The original pneumatic conveyor and piping for delivering bed material which is not suitable to be circulated back to the furnace to bottom ash silo shall be utilized.

1.9.1.6 Bottom ash drag conveyor

Bottom ash drag conveyor conveys the coarsest material from sieves to the containers.

	Unit	Value
Type		Drag conveyor
Quantity /boiler (total)	Pcs	1 (2)
Length, preliminary	m	7,5
Capacity	m ³ /h	1
Motor	kW	2,2
Materials		

• side walls		carbon steel
• cover		carbon steel
• bottom and intermediate bottom		AR-steel

1.9.1.7 Bottom ash containers

Bottom ash container	Unit	Value
Quantity /boiler (total)	piece	2 (4)
Capacity, gross	m ³	4
Capacity, net, about	m ³	3
Material		carbon steel

1.10 Auxiliary Systems

1.10.1 Low pressure piping and valves

The piping and valves inside the delivery limits are included as specified in the PI-diagrams.

Fluid	Material (or equal)
Boiler water (blowdown, drains, vents)	P235GH
Sootblowing steam	16Mo3
Medium pressure steam	P235GH
Low pressure steam	P235GH
Cooling water	1.4307
Instrument air	1.4307
Service air	1.4307

1.10.2 Cooling water system

Cooling water piping with valves inside the boiler house is included.

	Value
Piping material	1.4307

Cooling water is used for:

- coarse material cooling

Piping and necessary valves for this purpose inside the boiler house is included.

1.10.2.1 Circulating booster pump

	Unit	Value
Quantity per boiler /(total)	pcs	2 /(4)
Capacity, preliminary	kg/s	6,5
Pressure increase	bar	3,0
Motor, prel.	kW	4,5
Material		stainless steel

1.10.3 Auxiliary steam systems

An auxiliary steam system including valves, drains, traps, pressure and temperature gauges, etc. will be furnished.

Low pressure steam is used for:

- As fire extinction media at fuel silos and conveyors

	Value
Piping material	P235GH

1.10.4 Pressurised air system

1.10.4.1 Instrument air

Instrument air piping for new equipment with fittings is included within the scope.

	Value
Piping material	1.4307

1.10.4.2 Service air

Pressurized air piping for new equipment with valves inside the scope of supply is included.

	Value
Piping material	1.4307

1.10.4.3 Vacuum cleaner piping

Vacuum cleaner piping for new equipment with valves inside the scope of supply is included.

	Value
Piping material	P235GH

1.11 Others

1.11.1 Refractories

Refractory is used in areas where erosion can occur to protect the pressure parts, such as furnace walls in bottom area, furnace roof, burner openings, cyclone inlet areas, cyclones inside totally, loopseals and the ducts from cyclones to the 2nd pass.

Refractory material is mainly wear resistant low cement or silica carbide. The type of the refractory used as well as refractory material thickness depend on the location of refractory. For the areas of extreme erosion, like the target areas in the cyclones, harder refractory material is used. Refractory material is included in the delivery.

Refractory is attached to the surfaces using Y-anchors welded mainly to the membrane wall fins, or studs, welded to the membrane wall. The selection between Y-anchors and studs depends on type and thickness of the refractory used.

1.11.2 Metal Spraying

The area above the edge of the refractory in the furnace is protected using metal spraying. The height of the spraying is approximately 500 mm.

The area around each furnace ammonia nozzle opening is protected using metal spraying.

1.11.3 Thermal Insulation and Lagging Material

The surfaces within scope of supply, which will be at a temperature in excess of 60 °C during normal operation, will be insulated. The surfaces where heat losses are not economically significant will be insulated for personnel protection only.

	Unit	Value
Insulation material		mineral wool
Membrane walls, number of layers	pcs	2
Insulation thickness in membrane wall, total	mm	200

Equipments, tanks, ducts and pipes insulation according to SFS3977 TblB3.

The following items are not insulated:

- manholes
- blow out pipes
- sample lines
- coarse material chutes
- bottom ash conveyors

These equipments are safety protected at the points where hot surface could be a safety hazard.

The lagging of the furnace bottom part will consist of smooth finished flat or box-ribbed aluminium plate. The standard lagging thickness is 0.7 mm for the box-ribbed aluminium.

1.11.4 Painting

Following paintings are included in the scope according to manufacturers' standards and colors.

- painting for protection during sea transport
- final painting for prefabricated uninsulated parts

1.11.5 Spare parts

Spare parts for commissioning and for 2 years operation are included in the basic scope of supply. See the chapter 12 for the lists of spare parts.

1.12 Assessment of condition

The condition of boiler equipment will be assessed during the arranged outage of the boiler. Based on this condition assessment the necessary changes to the boiler equipment may be needed. The parts/equipment listed below are the main focus of the inspection and the need of their modification is decided based on inspection. The price of modifications of this equipment is not included in the tender price, but will be offered separately.

Based on the condition evaluation Valmet will not mechanically guarantee the lifetime of the existing equipment due to possibility to hidden defects in the existing equipment.

The main equipment included, but not limited to in the assessment are:

- Convective pass membrane walls
- Flue gas air heater, bundles 3 - 4 in the air flow directions which have not yet been replaced
- Upper furnace walls
- Secondary superheater in the furnace
- Cyclone vortex finders
- Cyclone refractories
- Baghouse filter (other than filter bags)
- Sootblowers

Detailed description of the boiler inspection scope is attached as an annex to this equipment specification.

1.13 Dismantling of unnecessary equipment

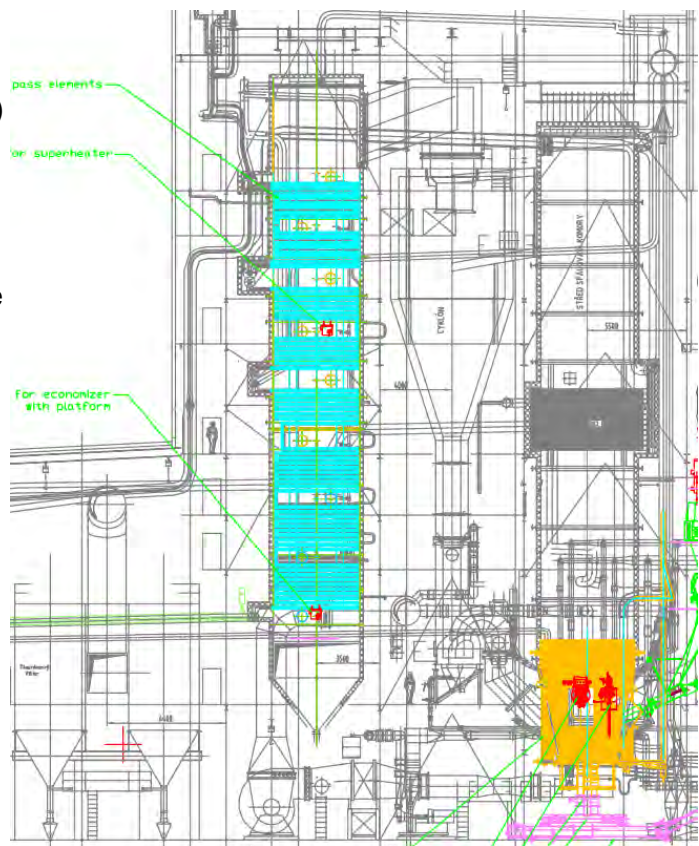
As part of the contract work, all the equipment preventing the installation of the new equipment shall be dismantled from parts preventing the installation of the new equipment. The dismantled equipment consists of following equipment, but is not limited to:

- Coal feeding equipment in the boiler house
- Bed ash cooler equipment
- Existing burners
- Replaced pressure parts

1 Visual inspection scope for CFB boiler

Following boiler parts and equipment are included in the mechanical visual inspection scope as far as they are accessible. The part of the CFB boilers that will be rebuilt (such as furnace lower part, 2nd pass heat elements and fuel and ash handling systems) are not inspected. Spot-wise tube thickness measurement (UT) of pressure parts will be made based on visual findings.

1. Furnace upper part
 - a. Furnace walls and roof
 - b. Secondary superheater
 - c. Penthouse
 - d. Refractory (if applicable)
2. Cyclone
 - a. Cyclone inlet duct
 - b. Cyclone refractory
 - c. Vortex finder
 - d. Loop seal under cyclone
3. 2nd pass
 - a. Grid tubes
 - b. Membrane walls
 - c. Economizers
 - d. Flue gas air preheaters
 - e. Sootblowers + openings (visually from inside the boiler)
 - f. Ash hopper
4. Air and flue gas ducts
5. BHF
 - a. Construction for corrosion/erosion
 - b. Bag condition
 - c. Inlet and outlet ducts
 - d. Dirty and clean gas chambers
6. Tanks
 - a. Steam drum
 - b. Feed water tank
 - c. Blow down tank
 - d. Continuous blow down tank
7. Steam air preheaters
8. Fans inspected from service hatch
9. Pneum. transm. of fly ash system



2 Excluded from inspection scope

Following equipment and systems are excluded from the inspection scope:

1. Pumps
2. Conveying equipment (except fly ash pneumatic transmitters)
3. Fuel, ash and sand silos
4. Valves
5. BHF additive feeding system
6. Equipment and systems not specifically mentioned in Chapter 1.

3 Inspection resources and schedule

Inspection will be carried out by three inspectors in dayshift during weekdays for a maximum of 12 hours/day.

Inspection schedule to be agreed separately to make sure Valmet has resources.

4 Reporting

The written inspection report will be delivered latest 8 weeks after the inspection in English language. The report includes:

- Visual findings supported with photographs
- Measurement results of tube thickness spot checks
- Evaluation of the current technical condition
- Recommendations of repairs and replacement

Based on collected information, recommendations for future replacements, modifications, repairs and overhauls will be made. The implementation of such recommended actions are not covered by this proposal, but will be separately offered.

5 Customer's responsibility

Following works are not included in the scope of supply and should be provided by Customer:

- Boiler shutdown and cleaning
- Opening and closing of manddoors and inspection hatches
- Hatch guard
- Removal of sand from boiler (bed, cyclone duct, loop seal)
- Cleaning/grinding of tubes for tube thickness measurement
- Scaffolding
- Lock-out tag-out and de-energizing of equipment
- Basic lightning inside furnace
- Site huts / changing rooms

TABLE OF CONTENTS

1 AUTOMATION	2
1.1 General	2
1.2 Control Philosophy and Automation System.....	2
1.3 Field instruments	3
1.4 Local Instruments	4
1.4.1 CEMS system	4
1.5 Burner management and boiler safety system	4
1.6 Cabling and Installation	5
1.7 Engineering and Documentation	6
1.7.1 General.....	6
1.7.2 Basic Engineering.....	6
1.7.3 Detail Engineering	6
1.7.4 DCS Engineering	6
1.7.5 Start-up and Commissioning	6
1.8 Spare parts	7
1.9 Training	7
1.10 Options	7

Attachment: *E&I 3D Modelling scope of supply_rev1.docx*
Example-control diagrams.pdf
Examples_Model CNT.pdf
Examples_Model INT.pdf
Examples_Model SEQ.pdf
FunctionDescription Example.pdf
Hook-ups_Typicals.pdf

1 AUTOMATION

1.1 General

The delivery of instrumentation includes basic and detail engineering, demolition / Installation work Boiler K80/K90, Boiler K20 new installation of all process instruments, control valves and other accessories delivered by Valmet Technologies.

The automation system equipment with application engineering, software, installation and commissioning is included in the scope of delivery. Boiler K80/K90 ABB procontrol P19 software cleaning of coal boiler items and update K80/K90 as new Bio Boiler needs. New Boiler K20 will be controlled by ABB 800xA.

The Employer provides manpower for training purposes during installation, start-up and commissioning.

1.2 Control Philosophy and Automation System

The Boiler control is based on a centralized control room with a distributed control system (DCS).

The following functions are performed by the DCS:

- Plant supervision and control
- Analog measurements and controls
- Reporting
- Motor controls
- Sootblowing controls

The following separate packaged control systems are included to Valmet delivery K20:

- Safety Instrumented System (SIS) for Boiler and Burners.
-

These packaged systems will be connected to DCS, preferably with communication busses.

1.3 Field instruments

The field instruments for the Boiler include:

- Orifice plates and flow nozzles
- Venturi tubes or aerofoils
- Flow switches and rotameters
- Level measurements and switches
- Thermoelements
- Pt-100- elements
- TT, PT and PDT transmitters
- Mass and magnetic flow meters
- Pneumatic Control and On-off valves, solenoids located to top of valve.
- Flue gas analyzers for boiler control, O₂.
- Control and On-off actuators for vanes and dampers
- Limit-, temperature-, pressure-, flow- or other switches, which are closely connected to the delivered machinery.

The actuators are pneumatic equipped with digital “HART™” positioners. The actuators and control valves will be chosen so that a safe position is obtained in case of power and/or air supply failure (No Handwheel included in pneumatically controlled valves!).

Signal types:

Analog signal ranges	4-20 mA DC + HART
Instrument air pressure	5-7 bar (g)
Digital signals	24 V DC or 230 VAC 50 Hz
Solenoid valves	24 V DC < 3 VA

1.4 Local Instruments

The instrumentation scope of supply includes the following local equipment:

- All local instruments such as pressure gauges, thermometers, thermowells, level indicators and flow meters.
- Instrument connections on the Boiler and auxiliary equipment included in the supply.
- Indicators and local control devices required for seal water and lubrication of delivered equipment.
- One (1) bi-colour steam drum water level indicator of which is suitable for TV-monitoring in Control Room.

Process connections for the test measurements – as shown in the P&ID's.

1.4.1 CEMS system

CEMS delivery includes:

FTIR and FID Hardware

- analyzers for flue gas component specified in PID
- Dust measurement device
- Pressure measurement
- Temperature measurement
- Flow measurement
- Heated sample line
- Air conditioned Container if needed
- Process connections locations in the stack
- Stack platform designed as supplier normal delivery

Softwares and documentation

- QAL1 equipment specification documents according to EN 15267

Installation, start-up and inspections of the system

- Regular automatic on-line calibration
- functional checks prior QAL2 included
- QAL2 partly, only installation inspection
- System check, connections to the DCS

Commissioning and Reference measurements

- First calibration of the system with factory setting
- QAL2 "third party" reference measurement are included

Reference gases and pressure regulators are not included to the delivery (customer delivery)

Reporting included to the delivery

Standard reporting package (annual, monthly and daily).

Reporting in now done in supplier standard system.

System maintenance

QAL3 not included to the delivery

Service agreement during warranty period

1.5 Burner management and boiler safety system

The burner management system (BMS) and boiler safety instrumented system (SIS) are included in the delivery.

Boiler K80/90 will be updated. Boiler K20 will have new system.

The safety related system will be carried out in fail-safe type PLC.

Safety system will fulfil the requirements in IEC 61508.

The delivery includes operational logic diagrams and operation descriptions for the BMS and SIS as well as all detailed engineering and software programming.

The delivery includes local control equipment for the burners consisting of the following:

- Local control panels for the burners located at burner level including necessary pushbuttons, signal lamps and flame intensity meters
- Solenoid valves for the pneumatic control of burner valves
- Flame detectors for the burners

Emergency shutdown panel to be located in the control room is included.

1.6 Cabling and Installation

Cabling and installation work is included to scope of supply according Valmet process delivery limits.

1.7 Engineering and Documentation

1.7.1 General

The instrumentation design is based on ISO and IEC standards. Documentation will be in English. On measurement units the SI-standard will be followed. The use of special design tools and database systems shall be discussed separately. (The normally used tools are: MS Excel, -Word and AutoCAD)

1.7.2 Basic Engineering

The basic engineering includes the following activities and/or documents:

- PI - diagrams showing field instruments and the basic control concept
- Instrument loop lists
- Instrument and control valve process data lists.
- Control loop diagrams
- Interlocking diagrams
- Process connection drawings
- Piping arrangement drawings showing connection points for instrument.
- Recommendations for DCS displays
- Alarm and interlocking lists.
- Necessary project meetings

1.7.3 Detail Engineering

The detail engineering will be done using Valmet's standard documentation.

1.7.4 DCS Engineering

The process supplier will take part in the Factory Acceptance Test of the Automation system for verifying and approving application software programs.

1.7.5 Start-up and Commissioning

The start-up and commissioning of the instrumentation comprise the coordination,

instructions and supervision activities, which are needed for testing and commissioning of the equipment and systems delivered by the Valmet Technologies Oy.

1.8 Spare parts

Start-up spares are included to the scope of supply according the delivery limits.

1.9 Training

Training includes training on troubleshooting, calibration and maintenance of the field instruments and analyzers for the operating and maintenance personnel of the plant.

For SIS, BMS and other packaged systems at site will be arranged hands-on training for maintenance personnel.

One day (6h) / sub-system, in English language, class room training for packaged system, equipment maintenance, software training and failure finding maintenance.

1.10 Options

N/A

1. E&I 3D modelling scope of supply

Only the objects which are mentioned in this chapter will be modelled to 3D model if they are included in the Valmet scope of supply. Other objects (e.g., transmitters and impulse pipes) which are not mentioned in this chapter, are excluded from modelling scope. Generally, the objects will be modelled as space reservations, based on dimensions by manufacturer. In most cases the object's space reservation is shown as a box element where the volume shows the equipment outer dimensions without any detail information about e.g., inside components. Objects are named in E3D model according to standard label coding rules. Customer labeling can be utilized if it is agreed in the Contract

Modelling work will be done by using Aveva E3D software.

1.1 Instrumentation

- Field boxes and local control panels
- Automatic valves, flow elements and inline instruments
- Process connections (in piping, ducting, tanks and process equipment) for instruments to be connected to automation system.
- Local control- /emergency switches, misalignment guards, speed switches, blockage switches

1.2 Electrical equipment's at field

- Motors
- Safety switches >250A

1.3 Electrical / automation room

- Transformers
- Busducts / cable connection route from transformer to MCC
- Frequency converters
- MCC's
- UPS and batteries
- Other electrical panels
- Automation cabinets
- Cable trays for cable room

1.4 Cable trays

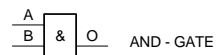
- Main cable trays
- Secondary cable trays for process and lighting
- Dropouts to motors $\geq 630\text{kW}$
- Primary supports

Cable tray engineering based on MEKA type of cable trays.

1.5 Building Electrification

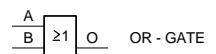
- Maintenance panel outlets
- Lighting boards

DIGITAL LOGIC



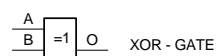
AND - GATE

A	0	1	0	1
B	0	0	1	1
O	0	0	0	1



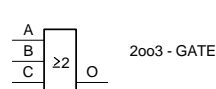
OR - GATE

A	0	1	0	1
B	0	0	1	1
O	0	1	1	1



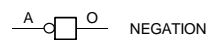
XOR - GATE

A	0	1	0	1
B	0	0	1	1
O	0	1	1	0



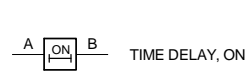
2oo3 - GATE

A	0	1	0	0	1	1	0	1
B	0	0	1	0	1	0	1	1
C	0	0	0	1	0	1	1	1
O	0	0	0	0	1	1	1	1

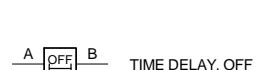
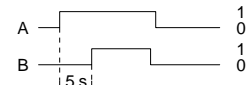


NEGATION

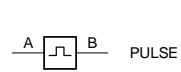
A	0	1
O	1	0



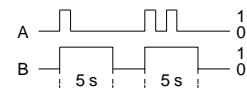
TIME DELAY, ON




TIME DELAY, OFF



PULSE



SETTING BY RAISING EDGE



A schematic diagram of an SR latch. It consists of two rectangular blocks, one labeled 'S' on top and one labeled 'R' on the bottom. Each block has two input lines on its left side and one output line on its right side. The output line of the 'S' block is labeled 'O'.

		SR			
		00	01	10	11
O	0	0	0	1	0
	1	1	0	1	0

INDICATION AND ALARMS

INDICATION ON DISPLAY

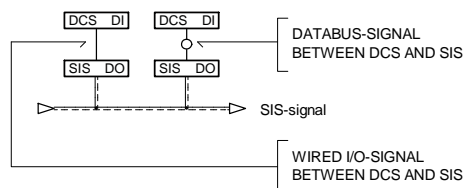
ALARM ON "1" STATE

ALARM ON "0" STATE

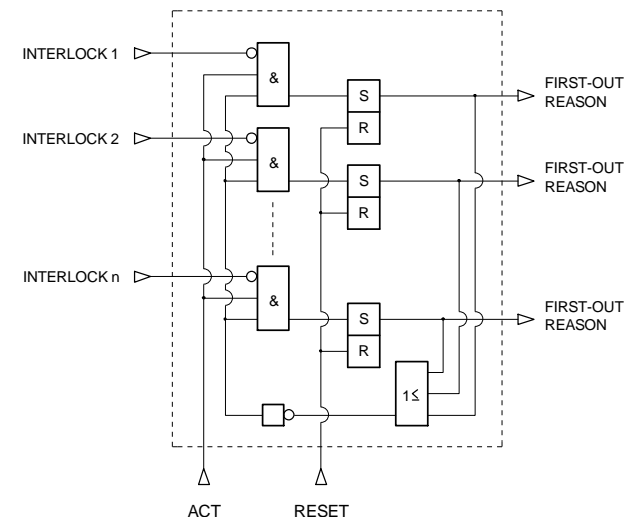
INDICATION ON DISPLAY,
ALARM ON "1" STATE

INDICATION ON DISPLAY,
ALARM ON "0" STATE

SIGNALS:



FIRST-OUT




Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31
0	Revision	FTAMSKU	FTAMSKU	FTAMSKU	2013-06-19
Customer		Product			
Project		Comos ID	Published Model	Area	



LEGEND SHEET

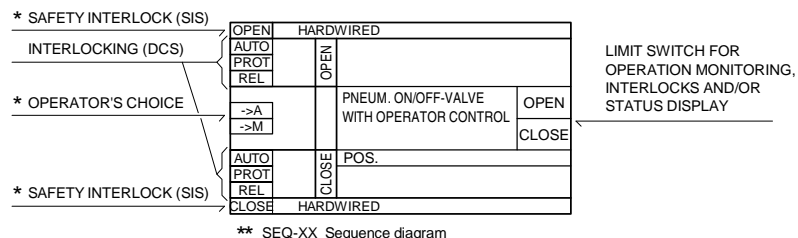
Project Number	-	Status	Rev
Doc Class	INTERLOCKING DIAGRAM	Doc ID/ Collection ID	DCC EFA05
		Customer Doc ID	Sheet 1 / 1
		Position	Label INT-00.01

Rev	Description	Created by	Checked by	Approved by	Date	yyyy-MM-dd		Project Number	-	Status	Rev	-			
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31			Doc Class	INTERLOCKING DIAGRAM	Doc ID/Collection ID	/	DCC	EFA05		
0	Revision	FTAMSKU	FTAMSKU	FTAMSKU	2013-06-19										
Customer			Product					Title			Customer Doc ID			Sheet	1 / 1
Project			Comos ID			Published Model	Area	LEGEND SHEET , MOTORS			Position			Label	INT-00.02

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.

ON-OFF VALVES

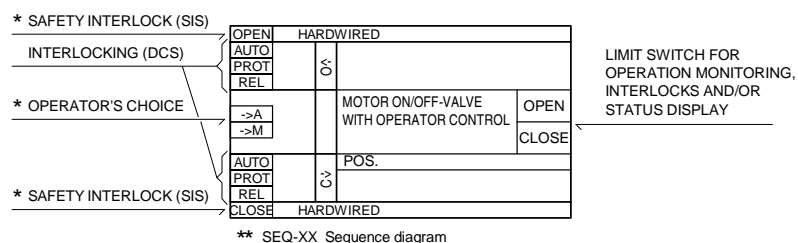
*** WHEN SAME ACTION BOTH AUTO AND PROT ACTIVATES
AT SAME TIME FUNCTIONS ARE ACCORDING AUTO
(NO CHANGE TO MANUAL, NO FORCING ALARM),



* WHEN USED

** WHEN CONTROLLED BY SEQUENCE

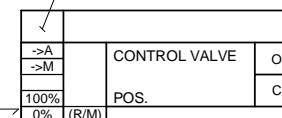
AUTO	AUTOMATIC OPEN/CLOSE
PROT	PROTECTION (FORCED) OPEN/CLOSE. CHANGE TO MANUAL MODE, IF STATUS CHANGES. (ALWAYS ON AUTO IF MAN DISABLED)
REL	RELEASED TO OPEN/CLOSE
->A	SETTING TO AUTO MODE IF SHOWN, AUTO MODE IS POSSIBLE
->M	SETTING TO MANUAL MODE ALWAYS ON AUTO, IF NOT SHOWN



CONTROL VALVES

OPERATOR CONTROL
E.g. FIC, HIC, etc.

INTERLOCKING (DCS)
100% = OPEN
0% = CLOSE

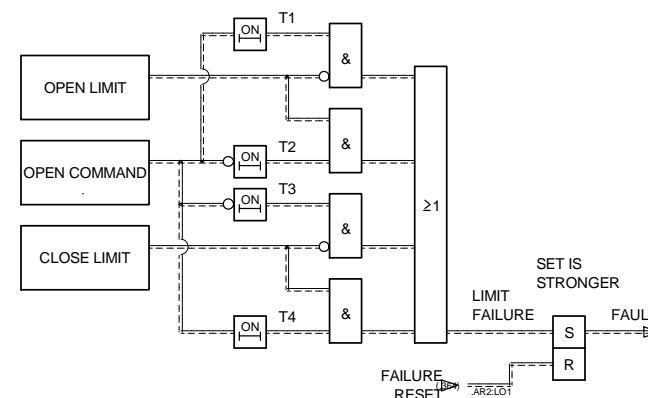


LIMIT SWITCH FOR
OPERATION MONITORING,
INTERLOCKS AND/OR
STATUS DISPLAY

O = OPEN
C = CLOSE

** CNT-XX Control diagram
SEQ-XX Sequence diagram

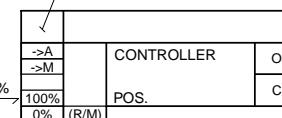
VALVE WATCHDOG CIRCUIT (SIS)



CONTROLLER

OPERATOR CONTROL
E.g. FIC, HIC, etc.

INTERLOCKING (DCS)
CONTROL TO 0% OR 100%



CONTROL MODE AFTER INTERLOCK
SEE CONTROL DIAGRAM LEGEND SHEET

** CNT-XX Control diagram
SEQ-XX Sequence diagram


Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31
0	Revision	FTAMSKU	FTAMSKU	FTAMSKU	2013-06-19
Customer		Product			
Project		Comos ID	Published Model	Area	



LEGEND SHEET, VALVES AND CONTROLLER

Project Number	-	Status	Rev	-
Doc Class	INTERLOCKING DIAGRAM	Doc ID/Collection ID	DCC EFA05	
Title		Customer Doc ID	Sheet	1 / 1
		Position	Label	INT-00.03

0		1		2		3		4		5		6		7
								<div>BINARY LIMIT SIGNALS DERIVED FROM ANALOG MEASUREMENT SIGNALS</div>						
								<div>TRIGGER LIMIT VALUES</div>						
								<div>ANALOG MEASUREMENT</div> <div>POS.</div> <div>H < MAX4 XH67</div> <div>H < MAX3 XH65</div> <div>H < MAX2 XH63</div> <div>H < MAX1 XH61</div> <div>H < MAX4 XH59</div> <div>H < MAX3 XH57</div> <div>H < MAX2 XH55</div> <div>H < MAX1 XH53</div> <div>Fixed high alarm XH01</div> <div>Fixed low alarm XH52</div> <div>H > MIN1 XH04</div> <div>H > MIN2 XH06</div> <div>H > MIN3 XH08</div> <div>H > MIN4 XH10</div> <div>H > MIN1 XH12</div> <div>H > MIN2 XH14</div> <div>H > MIN3 XH16</div> <div>H > MIN4 XH18</div>						
								<div>DCS LIMIT</div> <div>MEASUREMENT (Eg. T, P, L, F etc.) COMPARED TO SETPOINT</div> <div>ANALOG MEASUREMENT</div> <div>POS.</div> <div>T < MAX XX °C</div>						
								<div>SIS LIMIT</div> <div>ANALOG MEASUREMENT</div> <div>POS.</div> <div>T > MIN XX °C</div>						

Description	Created by	Checked by	Approved by	Date	yyyy-MM-dd		Project Number	-	Status	Rev	-
For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31			Doc Class	INTERLOCKING DIAGRAM	Doc ID/ Collection ID	/	DCC
Revision	FTAMSKU	FTAMSKU	FTAMSKU	2013-06-19		<div><div>Title</div><div>LEGEND SHEET, TRIGGER LIMITS</div></div>			Customer Doc ID	Sheet	1 / 1
Order		Product							Position	Label	INT-00.04
		Compos ID	Published Model	Area							

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.

TYPICAL MOTOR CONTROL

OPERATION MONITORING;
FAILURE ALARM IF:

- MOTOR DOES NOT START WITHIN 3s MONITORING TIME (*1)
- MOTOR DOES NOT STOP WITHIN 3s MONITORING TIME
- MOTOR STARTS/STOPS WITHOUT ANY COMMAND

-> CONTROL MODE CHANGES TO MAN

DEVICE INTERLOCK (MCC)

- START IS PREVENTED, MOTOR STOPPED AND ALARM GENERATED
- CONTROL MODE CHANGES TO MAN

PROCESS INTERLOCK

- START IS PREVENTED AND IF MOTOR IS STOPPED ALARM IS GENERATED
- WHEN MOTOR IN AUTO-MODE STOPS BY PROCESS INTERLOCK: CONTROL MODE CHANGES TO MAN

AUTO -> MAN

- WHEN CONTROL IS IN AUTO-MODE AND IT IS CHANGED TO MAN-MODE BY OPERATOR:

MOTOR STAYS RUNNING AND CAN BE STOPPED BY OPERATOR

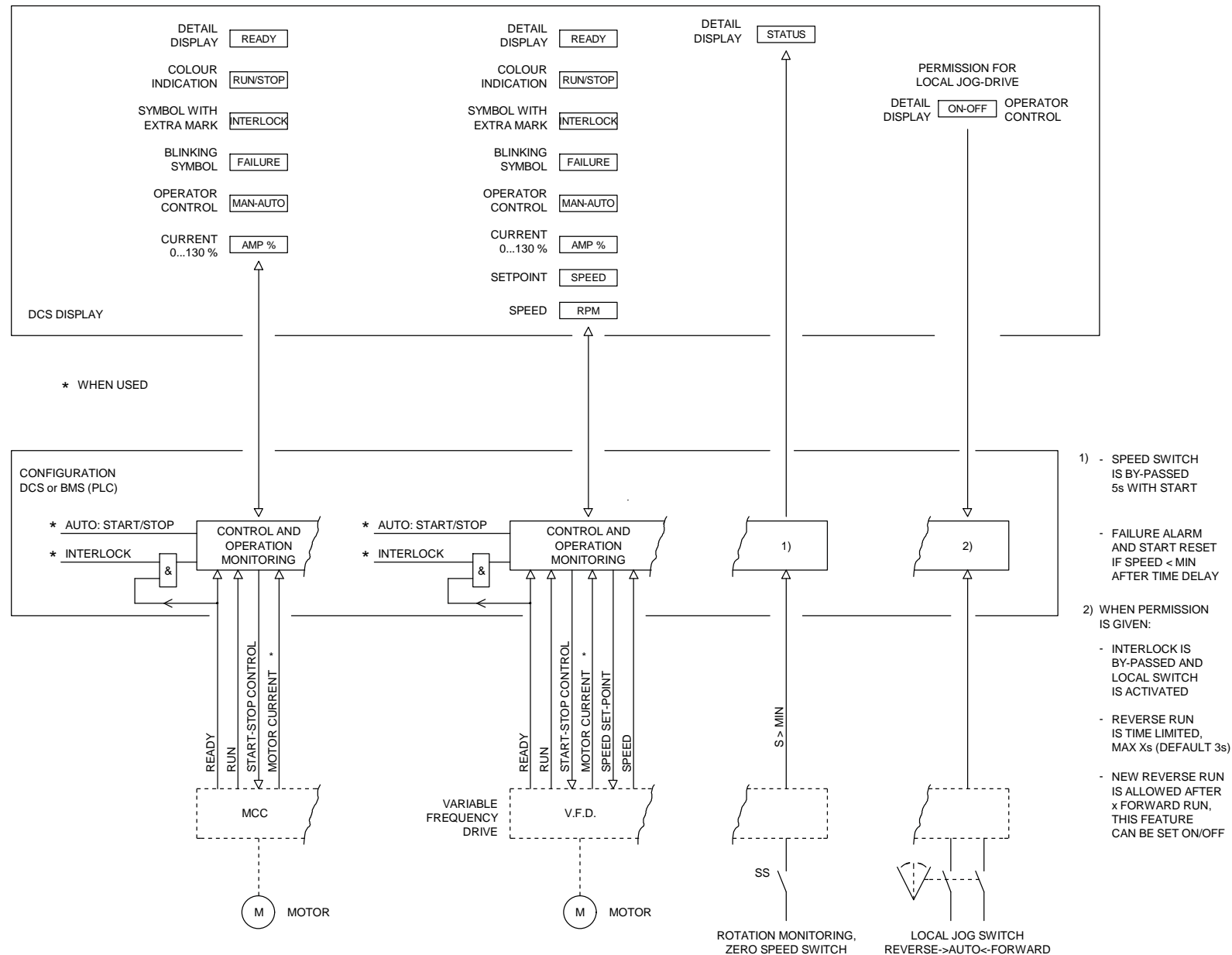
START CONTROL RESET

- RESET ALWAYS WITH FAILURE FUNCTION

OVERLOAD ALARM

- MOTORS WITH CURRENT MEASUREMENT, OVERLOAD ALARM AFTER 10s WHEN CURRENT > PREFIXED MAX LOAD
- ALARM AND BLINKING AMP % - DISPLAY

(*1) EACH MOTOR CAN HAVE ITS OWN MONITORING TIME ACCORDING TO LIST



Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31
0	Revision	FTAMSKU	FTAMSKU	FTAMSKU	2013-06-19
Customer		Product			Title
Project		Comos ID	Published Model	Area	

		Project Number	-	Status		Rev	-
		Doc Class	INTERLOCKING DIAGRAM	Doc ID/Collection ID	/	DCC	EFA05
OPERATION PRINCIPLE FOR MOTORS				Customer Doc ID		Sheet	1 / 1
				Position		Label	INT-00.05

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.

TYPICAL PNEUM. VALVE CONTROL

OPERATION MONITORING AND FAILURE ALARM IF:

- VALVE IS NOT OPEN OR CLOSE WITHIN 10s MONITORING TIME (*1)
- VALVE OPENS OR CLOSES WITHOUT ANY COMMAND

-> CONTROL MODE CHANGES TO MAN

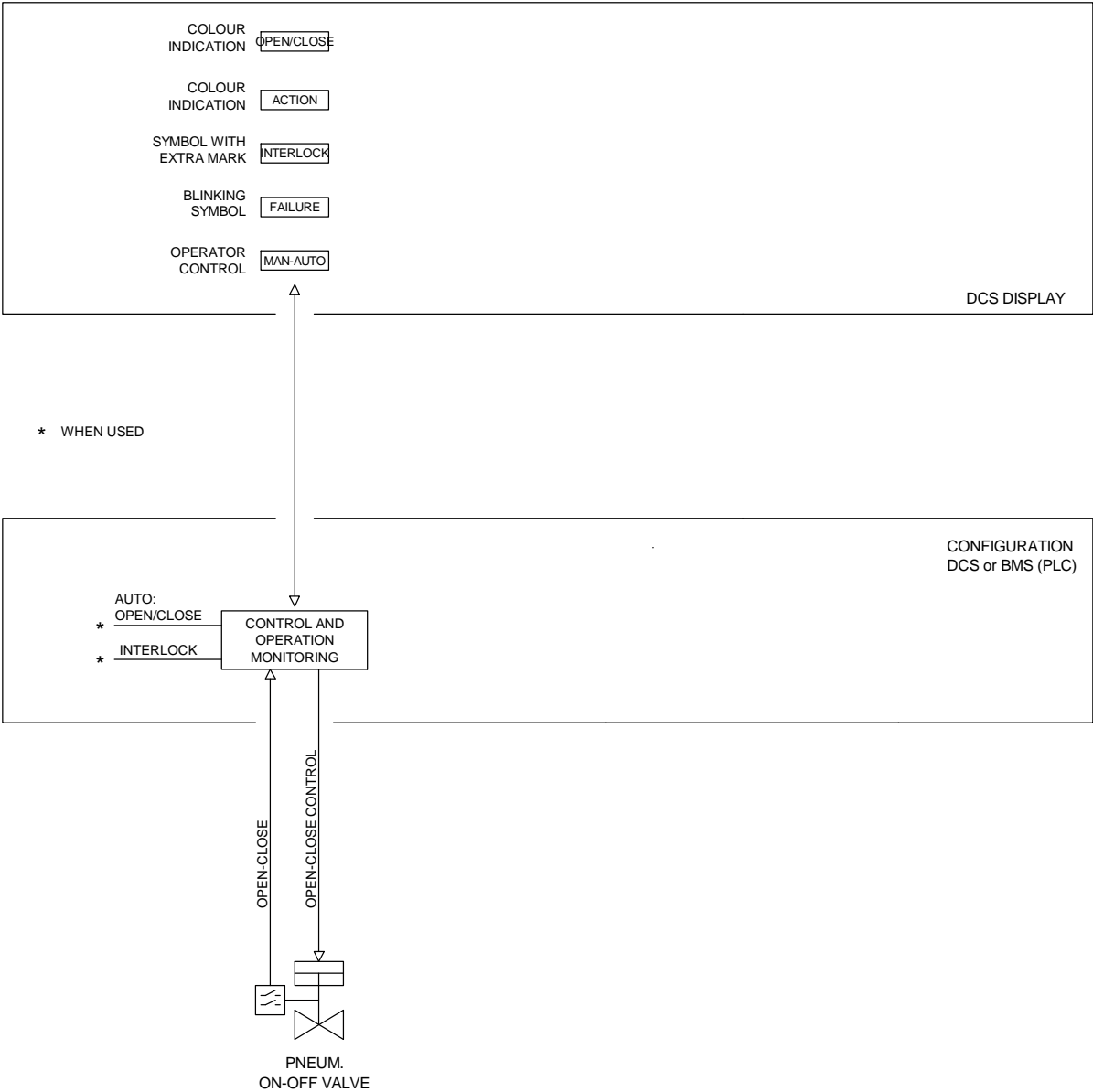
PROCESS INTERLOCK


- VALVE OPENS/CLOSES ALWAYS ACCORDING TO INTERLOCK
- IF STATUS CHANGES DUE TO INTERL., ALARM IS GENERATED AND CONTROL MODE CHANGES TO MAN

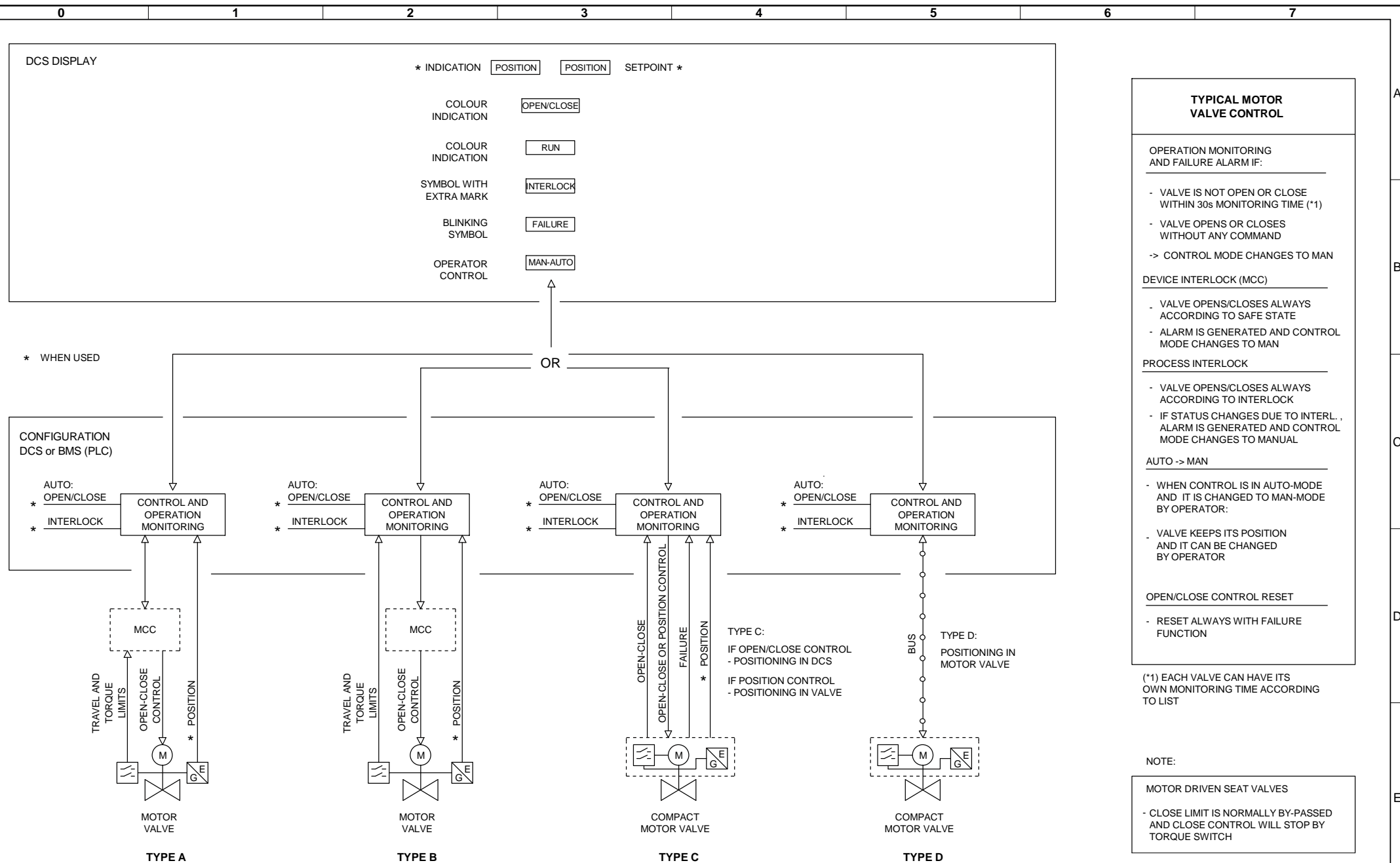
AUTO -> MAN


- WHEN CONTROL IS IN AUTO-MODE AND IT IS CHANGED TO MAN-MODE BY OPERATOR:
- VALVE KEEPS ITS POSITION AND IT CAN BE CHANGED BY OPERATOR

(*1) EACH VALVE CAN HAVE ITS OWN MONITORING TIME ACCORDING TO LIST



Rev	Description		Created by	Checked by	Approved by	Date	yyyy-MM-dd			Project Number	-	Status	Rev	-		
-	For Model		ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31				Doc Class	INTERLOCKING DIAGRAM		Doc ID/Collection ID	/	DCC	EFA05
0	Revision		FTAMSKU	FTAMSKU	FTAMSKU	2013-06-19										
Customer				Product				Title				Customer Doc ID		Sheet	1 / 1	
Project				Comos ID		Published Model	Area					OPERATION PRINCIPLE FOR ON-OFF VALVES (PNEUM.)		Position	Label	INT-00.06



Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd			Project Number -	Status	Rev -
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31			Doc Class INTERLOCKING DIAGRAM	Doc ID/Collection ID /	DCC EFA05
0	Revision	FTAMSKU	FTAMSKU	FTAMSKU	2013-06-19					
Customer			Product			Title			Customer Doc ID	Sheet 1 / 1
Project			Comos ID Published Model Area						Position	Label INT-00.07

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.

FEEDWATER TANK
PRESSURE
M1-FW-FST-PIC0017
P< MAX1 bar(g)
CNT-01.02 Feedwater tank pressure

PIC	
->A	FEEDWATER TANK PRESSURE
->M	M1-FW-FST-PIC0017
0%	(M) [FW-FST-PV0017]

PRESSURE < MAX1
M1-FW-FST-PIC0017
Feedwater tank pressure
INT-01.05 Emergency pump
INT-02.01 Feedwater preheating
INT-02.02 Feedwater HP-preheater condensate
INT-07.04 LP-Steam condensate pumps
INT-18.01 Main condensate tank

HIGH LEVEL
FW-FST-L0007
ALARM^L

HIGH LEVEL
FW-FST-L0008
ALARM^L

HIGH LEVEL
FW-FST-L0009
ALARM^L

DCS DI

SIS DO

DCS DI

SIS DO

DCS DI

SIS DO

≥2

HIGH LEVEL INTERLOCK
FW-FST-X0047
ALARM^L

DCS DI

SIS DO

FW TANK LEVEL < MAX2
M1-FW-FST-LIC0011
Feedwater tank level, calculated
INT-07.04 LP-Steam condensate pumps
INT-18.02 Condensate pump

AUTO		OPEN	
PROT			
REL			
->A		TOTAL CONDENSATE VALVE TO FEEDWATER TANK	OPEN
->M			CLOSE
AUTO		M1-WT-MCS-HS0020	
PROT			
REL			
CLOSE			
CLOSE		HARDWIRED	

FEEDWATER TANK
LEVEL 1
M1-FW-FST-LI0007
L< MAX1 %
L< MAX1 90.0 %
L> MIN1 10.0 %
CNT-01.01 Feedwater tank level

LEVEL < MAX1
M1-FW-FST-LIC0011
Feedwater tank level, calculated
INT-02.01 Feedwater preheating
INT-02.02 Feedwater HP-preheater condensate
INT-18.01 Main condensate tank

≥2

FEEDWATER TANK
LEVEL 2
M1-FW-FST-LI0008
L< MAX1 %
L< MAX1 90.0 %
L> MIN1 10.0 %
CNT-01.01 Feedwater tank level

DEMIWATER
PUMP RUN

LIC	
->A	FEEDWATER TANK LEVEL, CALCULATED
->M	M1-FW-FST-LIC0011
0%	(R) [FW-FST-LV0011]

HI	
->A	CONDENSATE VALVE TO FEEDWATER TANK
->M	M1-WT-MCS-HI0005
0%	(R) [WT-MCS-HV0005]

CONDENSATE
PUMP RUN

FEEDWATER TANK
LEVEL 3
M1-FW-FST-LI0009
L< MAX1 %
L< MAX1 90.0 %
L> MIN1 10.0 %
CNT-01.01 Feedwater tank level

≥2

FW TANK LEVEL > MIN
M1-FW-FST-LIC0011
Feedwater tank level, calculated
INT-01.03 Feedwater pump 1
INT-01.04 Feedwater pump 2
INT-01.05 Emergency pump
INT-01.05 Turbine pump, common interlocks
INT-01.05 Feedwater pump 3

Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd
-	For Model	ADMVILGRON	ADMVILGRON	ADMVILGRON	2022-01-31
2	Revision	FTAMTMUT	FTAMTMUT	FTAMTMUT	2014-10-15
Customer		Product			
Project		Comos ID	Published Model	Area	

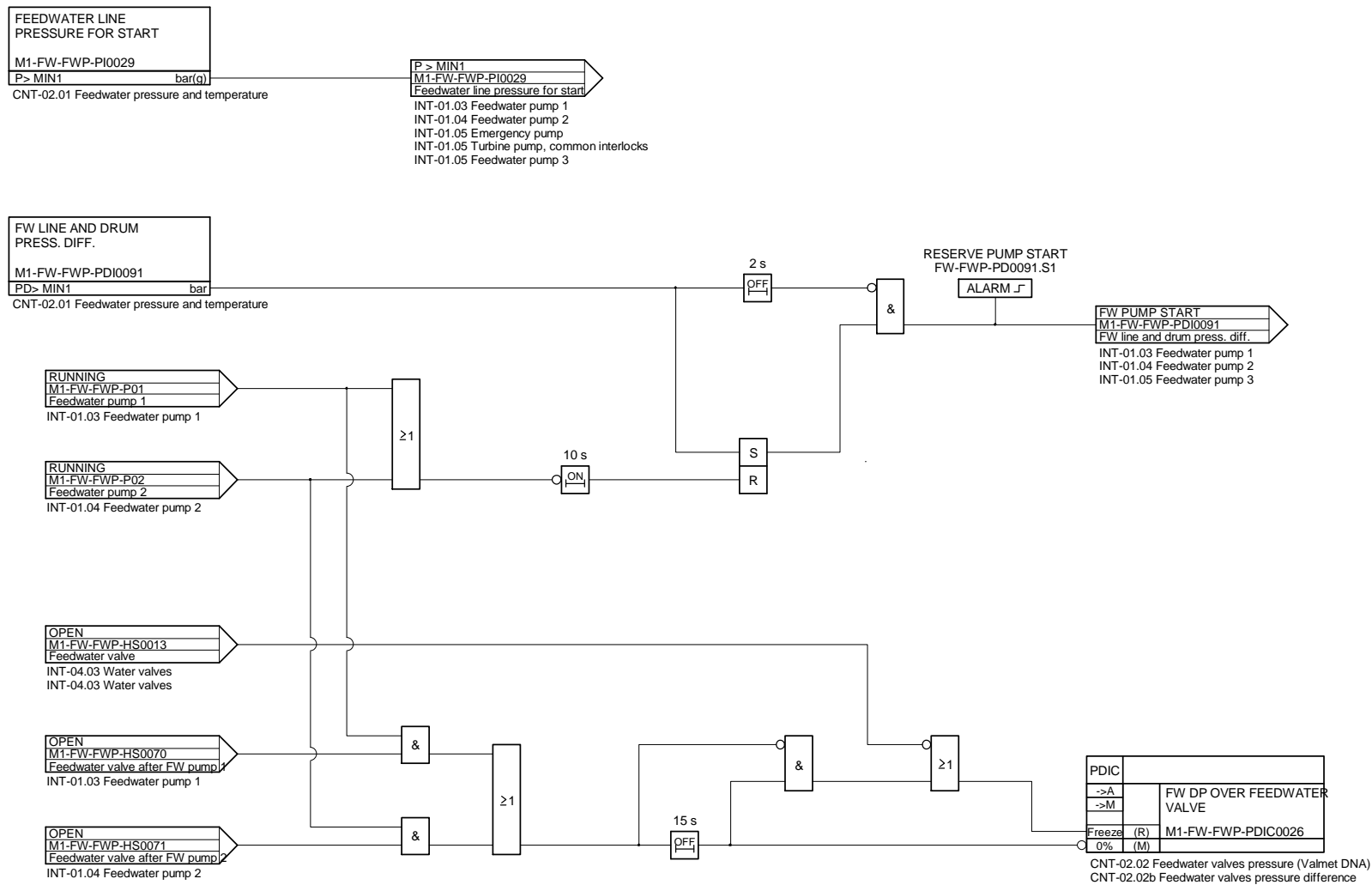



Title
FEEDWATER TANK

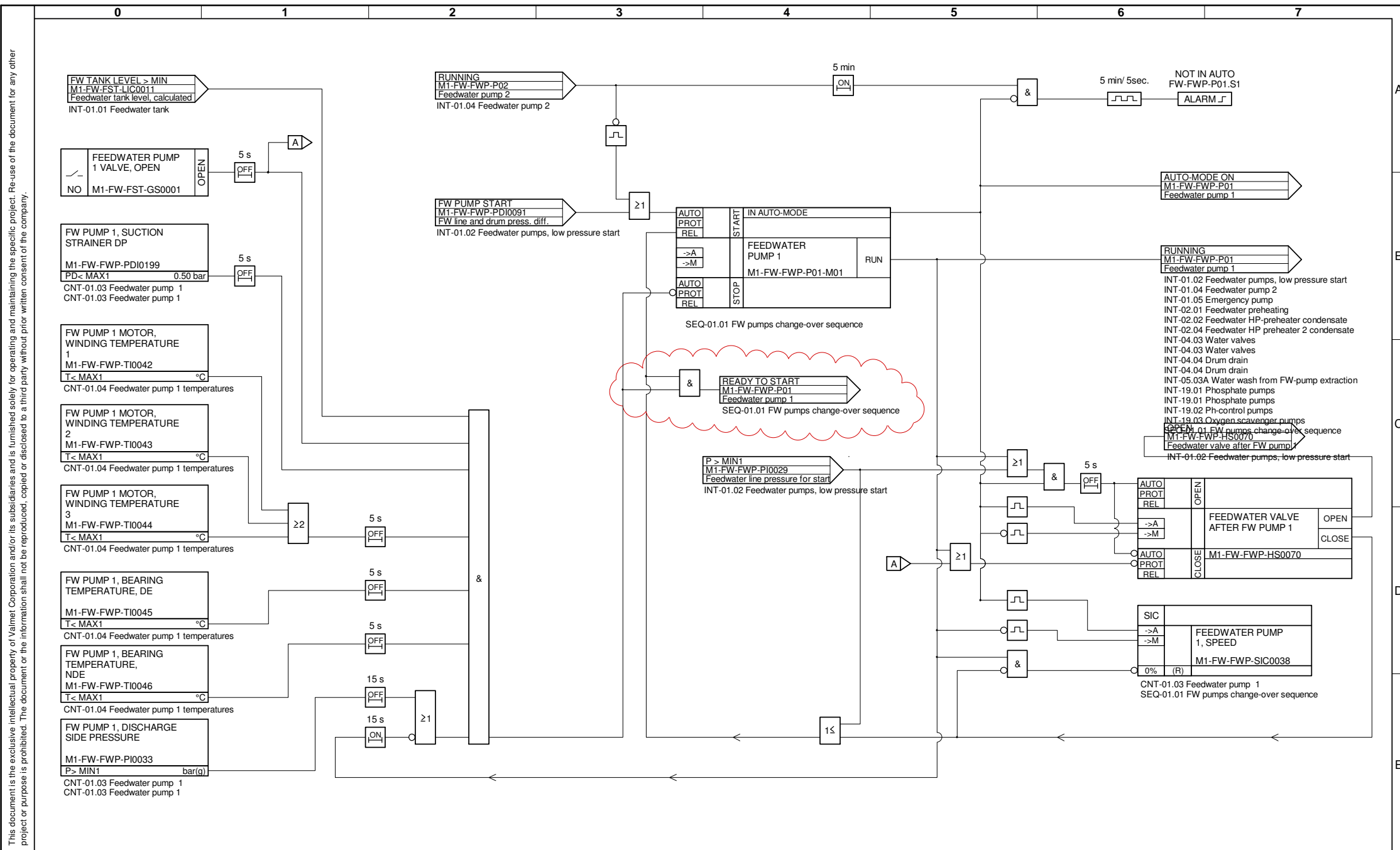
Project
Number -
Doc
Class INTERLOCKING DIAGRAM

Status	Rev -
Doc ID/ Collection ID /	DCC EFA05
Customer Doc ID	Sheet 1 / 1
Position	Label INT-01.01

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.



Rev	Description		Created by	Checked by	Approved by	Date	yyyy-MM-dd			Project Number	-	Status	Rev	-
-	For Model		ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31				Doc Class	INTERLOCKING DIAGRAM			Doc ID/Collection ID
1	Revision		FTAMSKU	FTAMSKU	FTAMSKU	2013-06-19		Title	FEEDWATER PUMPS, LOW PRESSURE START			Customer Doc ID	Sheet	1 / 1
Customer			Product				Position					Label	INT-01.02	
Project			Comos ID	Published Model	Area									



Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd	Project Number		Status	Rev
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31	-		Doc ID/ Collection ID	-
6	Revision	FTAMJJA	FTAMJJA	FTAMJJA	2015-05-28	INTERLOCKING DIAGRAM		Doc ID/ Collection ID	DCC EFA05
Customer		Product		Title		Customer Doc ID		Sheet 1 / 1	
Project		Comos ID Published Model		Area		Position		Label INT-01.03	

Valmet

FEEDWATER PUMP 1

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.

SIGNAL HANDLING



SQUARE ROOT



SUMMING



DIVIDING



MULTIPLICATION



MIN/MAX LIMITING



HYSTERESIS



INTEGRATOR



CURVE



FUNCTION (FORMULA)



LOW-PASS FILTER (DAMPING)



DERIVATION



SWITCH



MULTI SELECTION SWITCH



MINIMUM SELECTION



MAXIMUM SELECTION



CHANGE RATE LIMITER
(e.g. MW/ min)



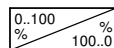
ADJUSTMENT SETPOINT



FIXED SETPOINT



RAMP



SIGNAL CONVERSION



AVERAGE

Average is formed from signals without fault.
In case of two or more values, the average value is used.



MEDIAN

Median is formed from signals without fault.
In case of three or more signals, the middle value is used.
If the number of values is even, then average value of
the two middle ones is used



DEVIATION

If max - min > xx % the alarm is given.
1 % hysteresis shall be used.
Only signals without fault are observed



PRESSURE AND/OR
TEMPERATURE
COMPENSATION
WITH NOMINAL VALUES

In case of measurement fault,
the nominal value to be used

T-compensation: Gas

$$F = F_o * \text{SQRT} [(T_d + 273.16) / (T_o + 273.16)]$$

P&T-compensation: Gas

$$F = F_o * \text{SQRT} [((T_d + 273.16) * (P_o + 1)) / ((T_o + 273.16) * (P_d + 1))]$$

P&T-compensation: Steam

$$F = F_o * \text{SQRT} [f(T_d, P_d) / f(T_o, P_o)]$$

$$f(T_d, P_d) = [((T_d + 273.16)/(P_d + 1)) - (B/(T_d + 273.16)^2)]$$

$$f(T_o, P_o) = [((T_o + 273.16)/(P_o + 1)) - (B/(T_o + 273.16)^2)]$$

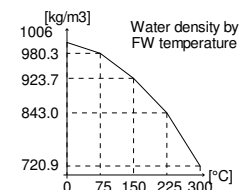
- where Fo, To, Po are measured values and Td, Pd
design values and B = 400371.8

- the pressures Po and Pd are relative pressures (bar(g))

T-compensation: Water

$$F = F_o * \text{SQRT} [\text{density_calc} / \text{density_design}]$$

- where Fo is measured value and density_calc is
density calculated by temperature (see curve on right)
and density_design is density by design values.



TRANSMITTERS

MIN or MAX
to output signal when
self-diagnostic detects sensor
or microprocessor failure
Also same function is made
in I/O-channel of DCS
if fault is detected.
In case MIN/MAX not defined,
signal should freeze to last
right value.



D = DENSITY
E = ELECTRICAL VARIABLE
F = FLOW
G = POSITION
L = LEVEL
P = PRESSURE
PD = PRESSURE DIFFERENCE
T = TEMPERATURE
Q = ANALYSIS
C, pH, O2, CO, SO2, dust, TRS, etc.

CONTROLLERS



PI - FUNCTION CONTROLLER
DIR = DIRECT
REV = REVERSE

DIRECT = Controller with increasing
input signal (measurement), is
giving increasing output signal



CONTROLLER WITH P - OR I - TERM
PARAMETER SETTING
(GAIN SCHEDULING)

I/O- CHANNELS

DATABUS SIGNAL
(between control systems,
eg. DCS-SIS)



ANALOG INPUT






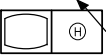
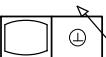
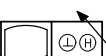

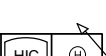

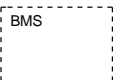















ANALOG OUTPUT



MOTOR CONTROLLED ACTUATOR

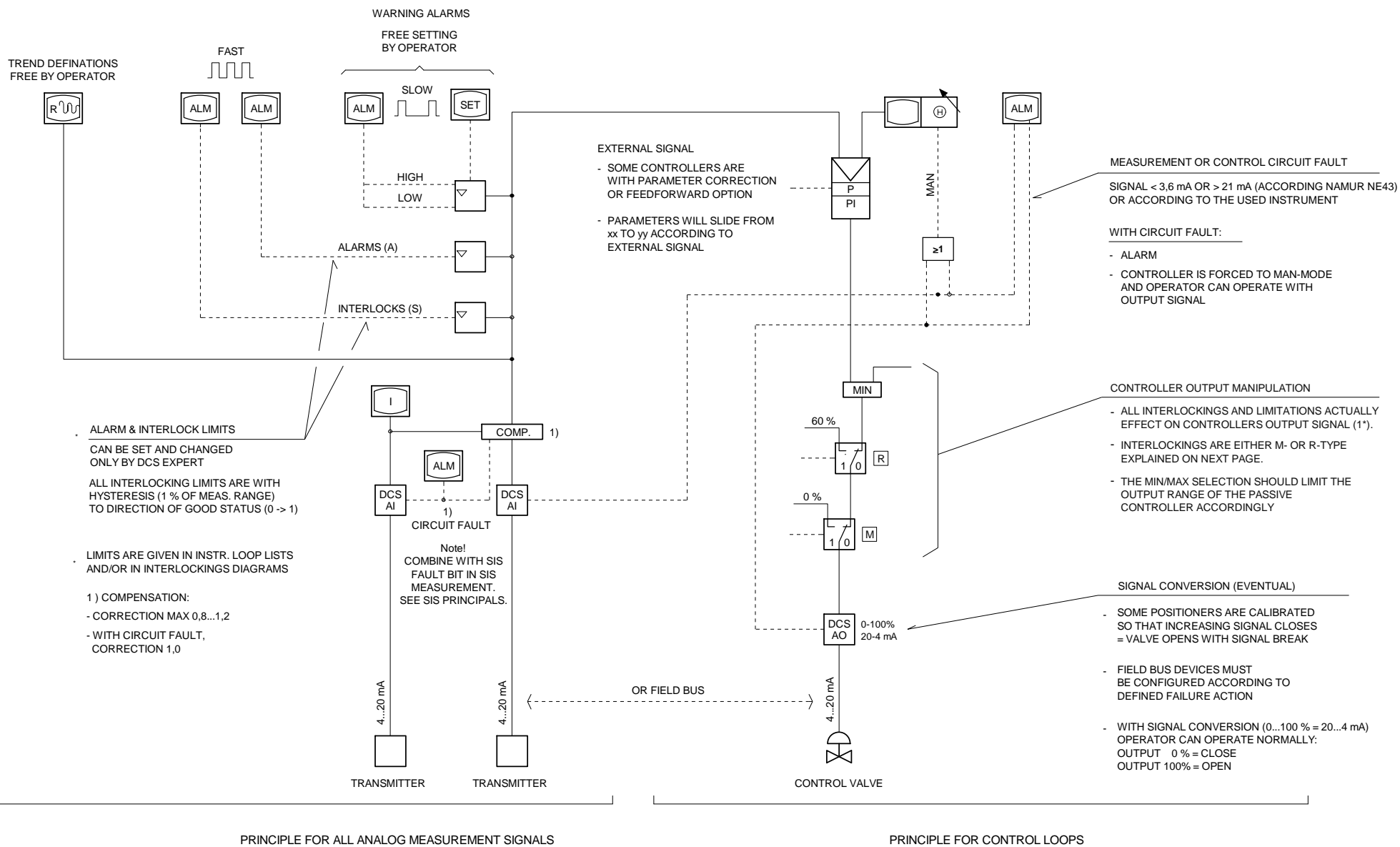
Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd	Valmet		Project Number	Status	Rev
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31			-		-
1	Revision	FTAMSKU	FTAMSKU	FTAMSKU	2013-05-02					
Customer		Product		Title		Project Class		Doc ID/Collection ID		Customer Doc ID
Project		Comos ID Published Model		Area		CONTROL DIAGRAM		/		Sheet 1 / 1
				LEGEND SHEET				Position		Label CNT-00.01

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.

0	1	2	3	4	5	6	7	
<div>DISPLAYS</div> <div><div>INDICATION</div><div>ALARM</div><div>COUNTER</div><div>OPERATION FACEPLATE WITH M/A-CHANGE</div><div>OPERATION FACEPLATE WITH R/L-CHANGE</div><div>OPERATION FACEPLATE WITH M/A-CHANGE AND R/L-CHANGE</div><div>SELECTION FACEPLATE</div><div>MANUAL STATION</div><div><div>SAFETY INSTRUMENTED SYSTEM</div><div>BURNER MANAGEMENT SYSTEM</div></div></div>		<div>VALVES</div> <div><div>MEMBRANE ACTUATOR</div><div>MOTOR ACTUATOR</div><div>VALVES, ACTUATOR PISTON</div></div> <div><div>FAILURE FUNCTIONS</div><div>with air supply or signal failure</div><div>CLOSES (F.C.)</div><div>OPENS (F.O.)</div><div>LOCKED (F.L.)</div><div>FREE (F.F.)</div></div>		<div>DIGITAL LOGIC</div> <div><div>AND-GATE</div><div>OR-GATE</div><div>NEGATION</div><div>TIME DELAY, ON</div><div>TIME DELAY, OFF</div><div>PULSE</div><div>SETTING BY RAISING EDGE</div><div><div>SR - FLIP FLOP</div></div></div>				

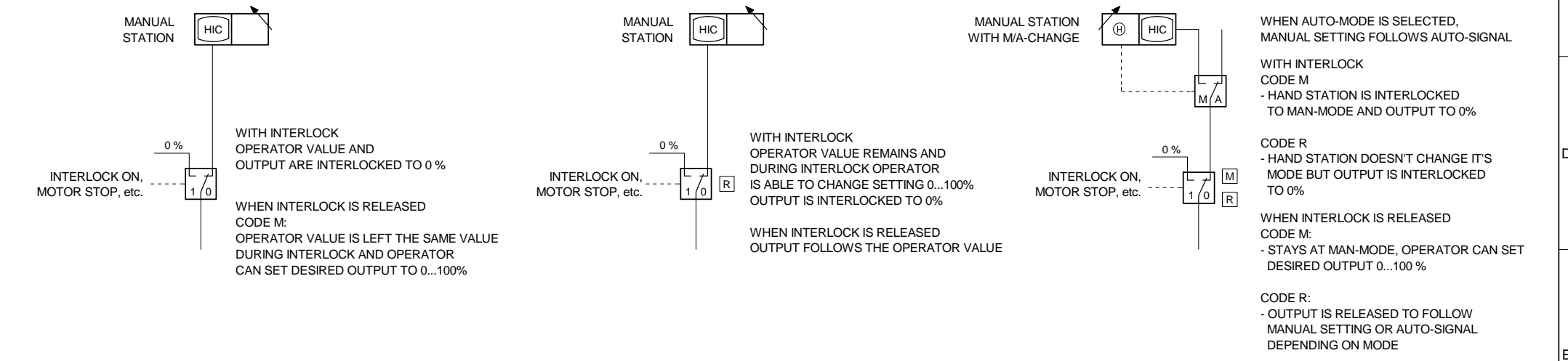
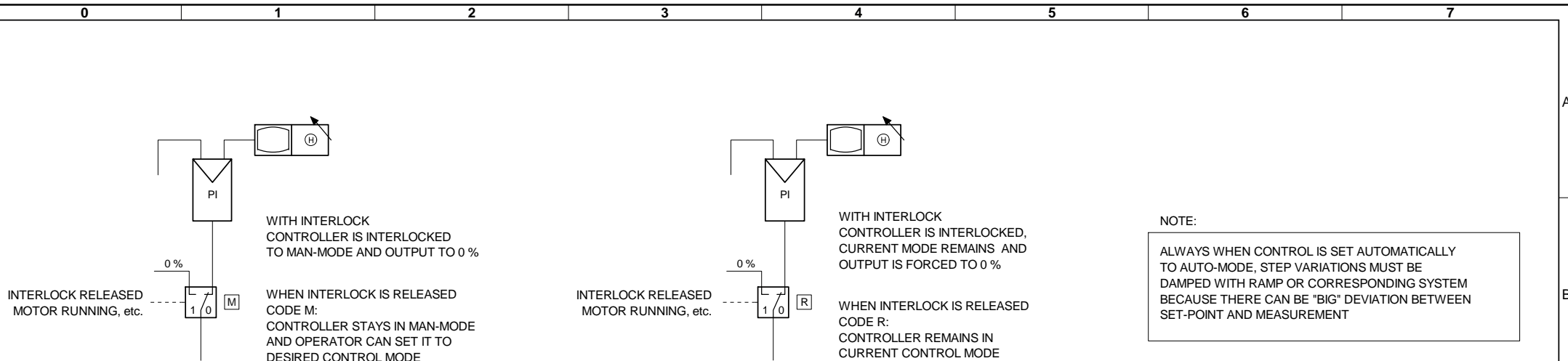
Rev	Description	Created by	Checked by	Approved by	Date	yyyy-MM-dd	Project Number		Status	Rev
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31		-			-
1	Revision	FTAMJJA	FTAMJJA	FTAMJJA	2013-04-25		Doc Class		Doc ID/ Collection ID	DCC EFA02
Customer		Product		Title		Customer Doc ID		Position		Sheet 1 / 1
Project		Comos ID Published Model		Area		LEGEND SHEET				Label CNT-00.02

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.



Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd	Project Number		Status	Rev
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31	-		Doc ID/Collection ID	DCC EFA02
1	Revision	FTAMLNK	FTAMLNK	TREPENTTJO	2013-02-27	CONTROL DIAGRAM		Customer Doc ID	Sheet 1 / 1
Customer		Product		Title		Position		Label	
Project		Comos ID	Published Model	Area	DCS CONFIGURATION PRINCIPLES				CNT-00.03

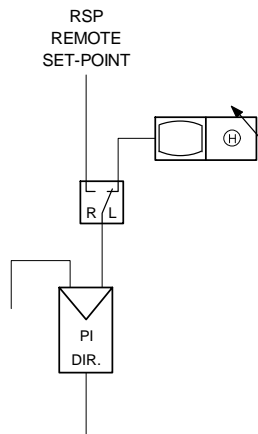
This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.



Rev	Description	Created by	Checked by	Approved by	Date	yyyy-MM-dd	Project Number	Status	Rev
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31		-		-
2	Revision	FTAMJJA	FTAMJJA	FTAMJJA	2013-04-25				
Customer		Product		Title		Doc Class		Customer Doc ID	
Project		Comos ID Published Model		Area		CONTROL DIAGRAM		Position	
				DCS CONFIGURATION DETAILS				DCC EFA02	
								Sheet 1 / 1	
								Label CNT-00.04	

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.

REMOTE SET-POINT



WHEN LOCAL CONTROL IS SELECTED (LSP):

- NORMAL OPERATOR CONTROL

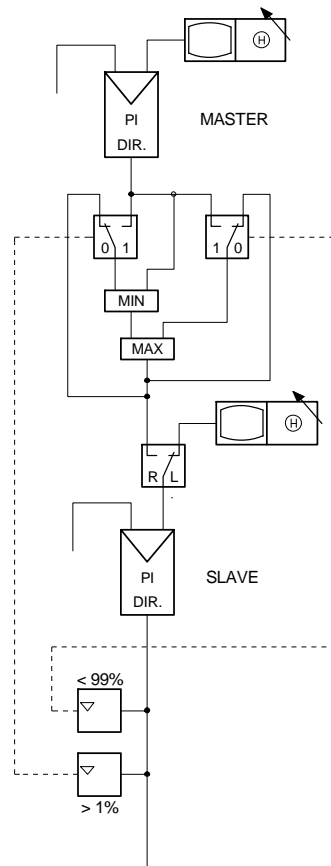
WHEN REMOTE CONTROL IS SELECTED (RSP):

- POSSIBLE +/- DEVIATION BETWEEN LSP AND RSP IS DAMPED.
- DAMPING e.g. 0...100 % / 100 s.
- LOCL SET-POINT FOLLOWS REMOTE SET-POINT

NOTE

DETAIL DISPLAYS:
OPERATOR MUST SEE THE REMOTE SET-POINT
ALL THE TIME, ESPECIALLY BEFORE CHANGE TO REMOTE.

CASCADE LOOP



SLAVE:

WHEN LOCAL CONTROL IS SELECTED (LSP):

- NORMAL OPERATOR CONTROL
- MASTER IS INTERLOCKED TO MAN-MODE
- MASTER OUTPUT IS UPDATED WITH SLAVE'S LSP

SLAVE:

WHEN REMOTE CONTROL IS SELECTED (RSP)

- MASTER IS SET TO AUTO
- SLAVE'S LOCAL SET-POINT IS UPDATED WITH REMOTE SET-POINT

SLAVE CONTROL DIRECTION IS DIRECT:

- WHEN SLAVE OUTPUT IS > 99%,
MASTER OUTPUT IS LIMITED TO CURRENT VALUE DOWNWARDS
- WHEN SLAVE OUTPUT IS < 1%,
MASTER OUTPUT IS LIMITED TO CURRENT VALUE UPWARDS

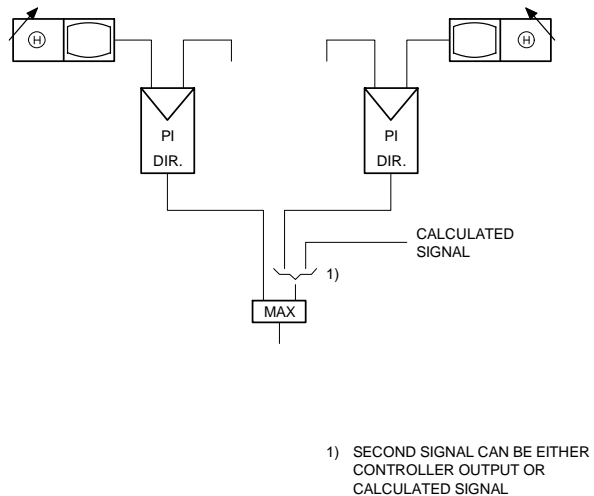
SLAVE CONTROL DIRECTION IS REVERSE:

- WHEN SLAVE OUTPUT IS > 99%,
MASTER OUTPUT IS LIMITED TO CURRENT VALUE UPWARDS
- WHEN SLAVE CONTROL IS < 1%,
MASTER OUTPUT IS LIMITED TO CURRENT VALUE DOWNWARDS

Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd	Project Number		Status	Rev
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31	-		Doc ID/ Collection ID	DCC EFA02
1	Revision	FTAMLNK	FTAMLNK	TREPENTTJO	2013-02-27	Doc Class		Customer Doc ID	Sheet 1 / 1
Customer		Product				Title		Position	Label
Project		Comos ID	Published Model	Area		DCS CONFIGURATION DETAILS			CNT-00.05

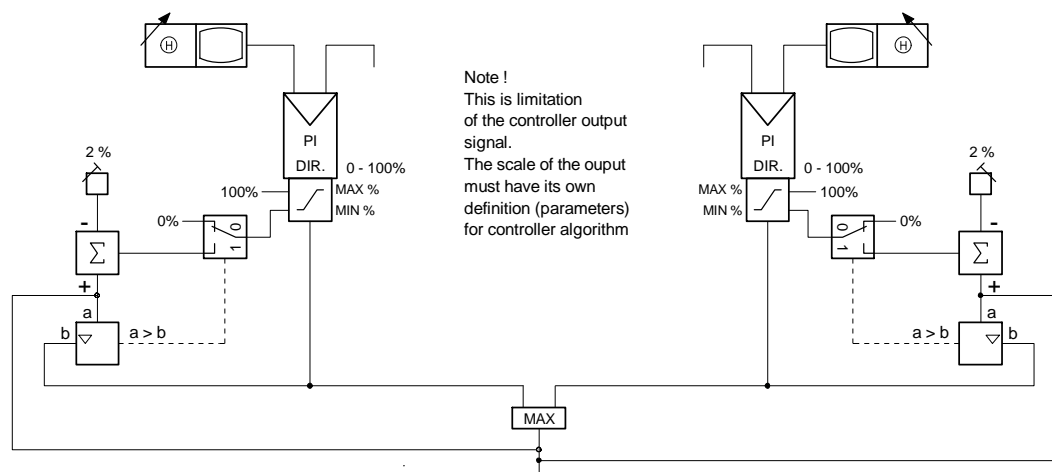
This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.

PRESENTATION IN CONTROL DIAGRAM

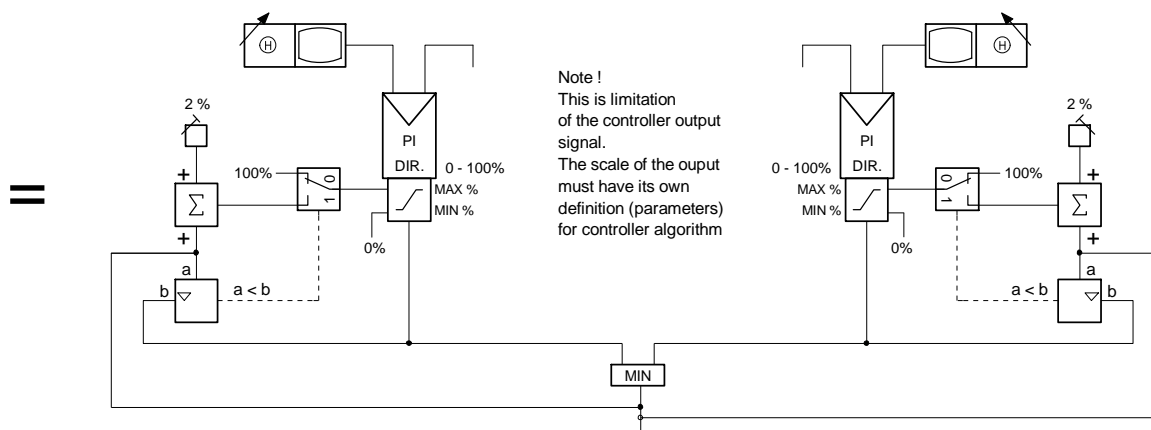
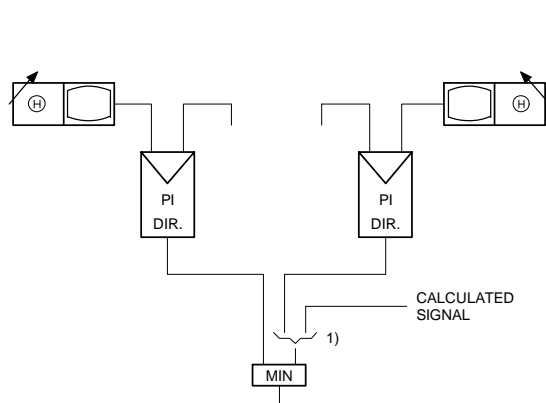


TRUE FUNCTIONALITY WITH OVERRIDE

OVERRIDE CONTROL (MAX)



OVERRIDE CONTROL (MIN)




Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31
2	Revision	FTAMJJA	FTAMJJA	FTAMJJA	2013-04-25
Customer		Product			
Project		Comos ID	Published Model	Area	




Title
DCS CONFIGURATION DETAILS, OVERRIDE CONTROL

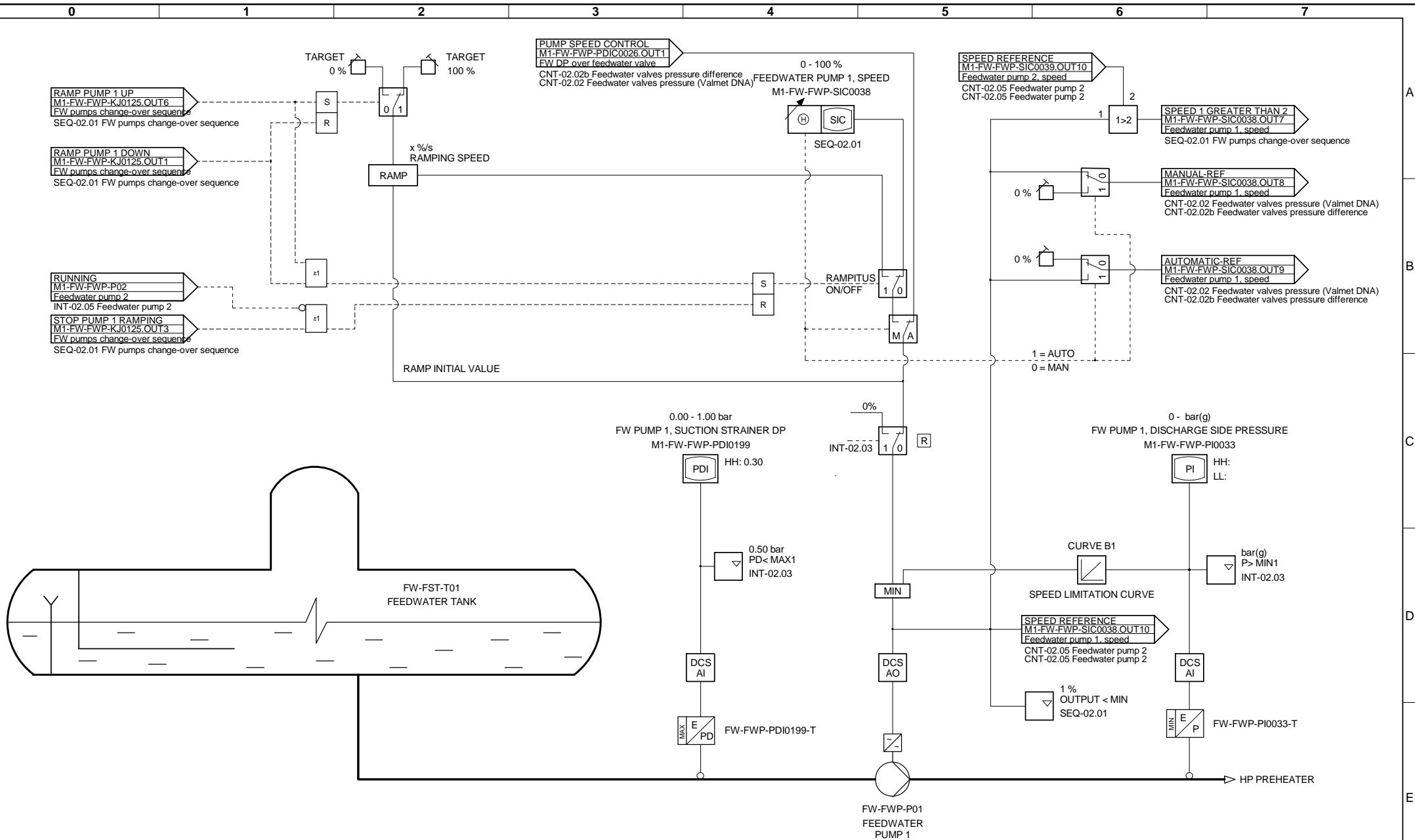
Project Number
-
Doc Class
CONTROL DIAGRAM

Status	Rev -
Doc ID/ Collection ID	DCC EFA02
Customer Doc ID	Sheet 1 / 1
Position	Label CNT-00.06

Rev	Description		Created by	Checked by	Approved by	Date		Project Number	-	Status	Rev	-	
*	Revision		FTAMSKU			2022-02-24		Doc ID/Collection ID	/		DCC	EFA02	
-	For Model		ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31		Doc Class	CONTROL DIAGRAM		Customer Doc ID	Sheet	1 / 1
Customer			Product			Title			Position		Label	CNT-02.01	
Project			Comos ID	Published Model	Area	FEEDWATER TANK LEVEL							

[illegible]

Description	Created by	Checked by	Approved by	Date	yyyy-MM-dd		Project Number	-	Status	Rev	-	
For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31			Doc Class	CONTROL DIAGRAM	Doc ID/ Collection ID	/	DCC	EFA02
Revision	FTAMJJA	FTAMJJA	FTAMJJA	2015-05-28					Customer Doc ID		Sheet	1 / 1
Author		Product				Title	FEEDWATER TANK PRESSURE				Label	CNT-02.02
		Comos ID	Published Model	Area								



Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd
*	Revision	FTAMSKU			2022-02-24
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31
Customer		Product			
Project		Comos ID	Published Model	Area	

Valmet		Project Number	-	Status		Rev	-
		Doc Class	CONTROL DIAGRAM	Doc ID/Collection ID	/	DCC	EFA02
Title				Customer Doc ID		Sheet	1 / 1
FEEDWATER PUMP 1				Position		Label	CNT-02.03

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.

0	1	2	3	4	5	6	7

Page	Document	Description	Rev	SIS
1	CNT-00.00	Table of Contents		
2	CNT-09.31	Hydrated lime dosing feeder	*	

Page	Document	Description	Rev	SIS
------	----------	-------------	-----	-----

Page	Document	Description	Rev	SIS
------	----------	-------------	-----	-----

[illegible]

Rev	Description	Created by	Checked by	Approved by	Date			Project Number	H1016AEW1 - Anjalankoski BFB Rebuild 94 MW/th	Status	PRELIMINARY	Rev			
*	Revision	FTAMSKU			2021-10-19			Doc Class	CONTROL DIAGRAM	Doc ID/Collection ID	MFXXXXXXXXX / MFXXXXXXXXX	DCC	EFA02		
Customer	Anjala Paper Mill, SE Anjala		Product	Valmet BFB Boiler		Title	Control diagrams HYDRATED LIME DOSING FEEDER					Customer Doc ID	XXXXXX	Sheet	2 / 2
Project	H1016A - SE Anjala Boiler 2 Upgrade FIN		Comos ID	151880	Area										



Project name
Boiler Type
xx-vvvvv

Rev. 0

September 12, 2023
Simo Tella

Function description

Project

Prepared by

Reason for issue

Checked by

Approved by

© Valmet 2023

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.

RECOX Function Description

2/12

Revision

Internal

Project name

Doc. ID

8 June 2018

Ext. doc. ID

1	GENERAL.....	3
1.1	Abbreviations.....	3
1.2	Safety defined analog measurements (SIL-2)	4
2	FEEDWATER SYSTEM	5
2.1	Instrumentation and controls	5
2.1.1	Measurements.....	5
2.1.2	Controls	6
2.2	Interlockings	7
2.2.1	Safety functions	7
2.2.2	Equipment interlockings	7
2.2.3	Automatics and sequences	8

RECOX Function Description

3/12

Revision

Internal

Project name

Doc. ID

8 June 2018

Ext. doc. ID

1 GENERAL

1.1 Abbreviations

BA	Bottom ash
BB	Boiler bank
BDT	Blowdown tank
BFB	Bubbling fluidized bed
BL	Black liquor
BMS	Burner management system
CBDT	Continuous blowdown tank
CNCG	Concentrated non-condensable gas
CNCGB	CNCG burner
DCS	Distributed control system
DNCG	Diluted non-condensable gas
dP	Differential pressure
ECO	Economizer
ES	Emergency stop
ESP	Electrostatic precipitator
FA	Fly ash
FG	Flue gas
FGC	Flue gas cooler
FW	Feedwater
FWP	Feedwater pump
GL	Green liquor
HART	Highway Addressable Remote Transducer
HFO	Heavy fuel oil
HSA	High secondary air
HSAF	High secondary air fan
ID fan	Induced draft fan
INA	Instrument air
LB	Load burner
LFO	Light fuel oil (diesel)
LK	Lime kiln
LP-steam	Low pressure steam
LPG	Liquid propane gas
MCR	Maximum capacity rate
MeOH	Methanol
MPST	Middle pressure steam
NG	Natural gas
PAF	Primary air fan
PB	Power boiler

RECOX Function Description

4/12

Revision

Internal

Project name

Doc. ID

8 June 2018

Ext. doc. ID

PSH	Primary superheater
QSH	Quartenary superheater
RB	Recovery boiler
RW	Reserve water
SAF	Secondary air fan
SB	Sootblower/sootblowing
SEW	Service water
SIS	Safety instrumented system
SRW	Service water
SSH	Secondary superheater
SSO	Safety shut-off
SUB	Start-up burner
TAF	Tertiary air fan
TRS	Total reduced sulphur
TSH	Tertiary superheater
VFD	Variable frequency drive
VG	Vent gas
ZSS	Zero speed switch
LSP	local setpoint value

1.2 Safety defined analog measurements (SIL-2)

All the safety defined analog measurement in this project are purchased with a HART capable i/i converter installed inside the SIS/BMS cabinet. Milliampere signal from the transmitter is wired to SIL-2 certified AI-card for safety functions and transferred into DCS via single communication bus.

Milliampere signal is decoupled by i/i converter and wired to DCS AI-card by HART cable. HART signal is used for measurement failure diagnostics and process control due to its more extensive information content and faster response compared to bus.

RECOX Function Description

5/12

Revision

Internal

Project name

Doc. ID

8 June 2018

Ext. doc. ID

2 FEEDWATER SYSTEM

2.1 Instrumentation and controls

2.1.1 Measurements

2.1.1.1 Feedwater tank temperature

Tags:

3108TI6004 Feedwater tank temperature

Purpose:

Water temperature in feedwater tank is measured for operational monitoring purposes.

Function:

Temperature is measured by a resistance temperature sensor located in thermowell at the bottom of the tank.

2.1.1.2 Feedwater pump suction strainer dP

Tags:

3108PDI6040 Feedwater pump 1 suction strainer dP

3108PDI6028 Feedwater pump 2 suction strainer dP

3108PDI6016 Feedwater pump 3 suction strainer dP

Purpose:

Pressure difference (dP) over feedwater pump suction strainer is measured for following condition of strainer and for feedwater pump interlocks. Pressure difference indicates filter blockage.

Function:

dP is measured by pressure difference transmitter connected to inlet and outlet strainer which is located on feedwater line before pumps 3108P0008, 3108P0006 and 3108P0004.

Transmitter failure direction is MAX, when in case of signal failure, the measurement value is substituted by the measurement range maximum. Measurement high limit signals are used to interlockings of feedwater pumps.

2.1.1.3 FW pumps 1-3, bearing temperatures

Tags:

3108TI6045 FW pump 1, bearing temp., motor side

3108TI6046 FW pump 1, bearing temp., pump side

RECOX Function Description

6/12

Revision

Internal

Project name

Doc. ID

8 June 2018

Ext. doc. ID

3108TI6033 FW pump 2, bearing temp., motor side
 3108TI6034 FW pump 2, bearing temp., pump side
 3108TI6021 FW pump 3, bearing temp., motor side
 3108TI6022 FW pump 3, bearing temp., pump side

Purpose:

Bearings temperatures of feedwater pumps are measured for monitoring bearing condition and for pump protection against severe bearing damages.

Function:

Bearing temperature is measured by a resistance temperature sensor located on bearing housing. One measurement is located on pump's drive end bearing, one on pump's non-drive end bearing.

Transmitter failure direction is MIN when in case of signal failure, the measurement value is substituted by the measurement range minimum. Measurement high limit signals are used to feedwater pumps interlocks.

2.1.2 Controls

2.1.2.1 Feedwater tank level control

Tags:

3108LIC6010 Feedwater tank level, calculated
 3108LI6007 Feedwater tank level 1
 3108LI6008 Feedwater tank level 2
 3108LI6009 Feedwater tank level 3
 3108LIC6010-LV01 Demi water valve to FW tank

Purpose:

Feedwater tank water level is measured for operation monitoring purposes, for level control and for protection against feedwater pumps running dry or overfilling the tank.

Measurement:

The level is measured by three pressure difference transmitters connected to separate measuring column. Transmitter failure direction is MIN, when in case of signal failure, the measurement value is substituted by the measurement range minimum.

For the level control, operator can select with 3108LIC6010.S11 a single signal from each separate transmitter or a middle value (median) of all transmitters. Normally the middle value should be selected for control.

If a signal fault occurs, the faulty signal is ignored in median selector and average of two remaining signals is used. If a single transmitter is selected and becomes faulty,

RECOX Function Description

7/12

Revision

Internal

Project name

Doc. ID

8 June 2018

Ext. doc. ID

selector will be changed automatically to the middle value mode. Alarm is generated if a difference between minimum and maximum of non-faulty measurements is greater than 5 % of measuring range.

Setpoint:

The setpoint for the level is given at controller's auto & local-mode by the operator.

Control:

The level is controlled by control valve 3108LIC6010-LV01 controlling demineralised water flow to feedwater tank. Valve position has maximum of 5%/s upward ramp of valve control range.

2.2 Interlockings

2.2.1 Safety functions

2.2.1.1 Total condensate valve to feedwater tank

Tags:

3108HS6001 Total condensate valve to feedwater tank

SIS-interlocking:

Valve can be open or opened, when **all** following conditions are fulfilled:

- Feedwater tank level is under MAX2 with 2oo3 principle
 - Feedwater tank level 1 3108LI6007 $L < MAX2$
 - Feedwater tank level 2 3108LI6008 $L < MAX2$
 - Feedwater tank level 3 3108LI6009 $L < MAX2$

2.2.2 Equipment interlockings

2.2.2.1 FW valves after FW pumps 1-3

Tags:

3108HS6050 Feedwater valve after FW pump 1

3108HS6038 Feedwater valve after FW pump 2

3108HS6026 Feedwater valve after FW pump 3

Interlocking principles and automatic functions of FW valves after pumps are identical so only FW valve after pump 1 is described.

RECOX Function Description

8/12

Revision

Internal

Project name

Doc. ID

8 June 2018

Ext. doc. ID

DCS-interlocking:

Valve opening is allowed when one of the following conditions is valid:

- FWP 1 valve, open limit switch 3108GS6039 is active (off-delay 5 s)
- Feedwater pump 1 3108P0008 is running

If none of the above conditions are valid, valve is force closed.

Automatic functions:

Mode change:

- Valve follow the (A/M) mode of FW pump 1 pulse-wisely.

Auto-open, when FW pump 1 is in auto-mode and **one** of the following conditions is valid:

- FW pump 1 is running
- Feedwater line pressure for start 3108PI6054 P>MIN1

Auto-close, when:

- Above auto-open conditions are not valid

2.2.3 Automatics and sequences

2.2.3.1 Feedwater pumps change-over sequence

Sequence interlockings and start conditions

Sequence is released to start when **all** the following conditions are valid:

- One running feedwater pump must be selected to stop
- One stand-by feedwater pump must be selected to start
- Change-over sequence is not already running
- The speed controller of the running feedwater pump must be in auto mode

Sequence is started in man-mode by operator from the display screen.

RECOX Function Description

9/12

Revision

Internal

Project name

Doc. ID

8 June 2018

Ext. doc. ID

Sequence:

Step 1: Devices to auto mode

If Feedwater pump 1 is selected to stop or to start, then:

- Feedwater pump 1 3108P0008 auto-mode on

If Feedwater pump 2 is selected to stop or to start, then:

- Feedwater pump 2 3108P0006 auto-mode on

If Feedwater pump 3 is selected to stop or to start, then:

- Feedwater pump 3 3108P0004 auto-mode on

Step transition conditions

If Feedwater pump 1 is selected to stop or to start, then:

- Feedwater pump 1 3108P0008 is in auto-mode

If Feedwater pump 2 is selected to stop or to start, then:

- Feedwater pump 2 3108P0006 is in auto-mode

If Feedwater pump 3 is selected to stop or to start, then:

- Feedwater pump 3 3108P0004 is in auto-mode

Step 2: Starting pump to zero speed

If Feedwater pump 1 is selected to start, then:

- Feedwater pump 1 3108SIC6041 controller to man mode and output to 0 %

If Feedwater pump 2 is selected to start, then:

- Feedwater pump 2 3108SIC6029 controller to man mode and output to 0 %

If Feedwater pump 3 is selected to start, then:

- Feedwater pump 3 3108SIC6017 controller to man mode and output to 0 %

Step transition conditions

If Feedwater pump 1 is selected to start, then:

- Feedwater pump 1 3108SIC6041 controller in man mode and output < 1 %

RECOX Function Description

10/12

Revision

Internal

Project name

Doc. ID

8 June 2018

Ext. doc. ID

If Feedwater pump 2 is selected to start, then:

- Feedwater pump 2 3108SIC6029 controller in man mode and output < 1 %

If Feedwater pump 3 is selected to start, then:

- Feedwater pump 3 3108SIC6017 controller in man mode and output < 1 %

Step 3: Starting pump start

If Feedwater pump 1 is selected to start, then:

- Feedwater pump 1 3108P0008 auto start

If Feedwater pump 2 is selected to start, then:

- Feedwater pump 2 3108P0006 auto start

If Feedwater pump 3 is selected to start, then:

- Feedwater pump 3 3108P0004 auto start

Step transition conditions

If Feedwater pump 1 is selected to start, then:

- Feedwater pump 1 3108P0008 running and pressure after pump P > MIN1

If Feedwater pump 2 is selected to start, then:

- Feedwater pump 2 3108P0006 running and pressure after pump P > MIN1

If Feedwater pump 3 is selected to start, then:

- Feedwater pump 3 3108P0004 running and pressure after pump P > MIN1

Step 4: Starting pump ramp speed up

If Feedwater pump 1 is selected to start, then:

- Feedwater pump 1 3108SIC6041 speed controller to auto-mode and output upwards

If Feedwater pump 2 is selected to start, then:

- Feedwater pump 2 3108SIC6029 speed controller to auto-mode and output upwards

If Feedwater pump 3 is selected to start, then:

RECOX Function Description

11/12

Revision

Internal

Project name

Doc. ID

8 June 2018

Ext. doc. ID

- Feedwater pump 3 3108SIC6017 speed controller to auto-mode and output upwards

Step transition conditions

If Feedwater pump 1 is selected to start, then:

- Feedwater pump 1 3108SIC6041 speed diff. between setpoint and control value $SD < MIN2$ (Percentual value from SIC output)

If Feedwater pump 2 is selected to start, then:

- Feedwater pump 2 3108SIC6029 speed diff. between setpoint and control value $SD < MIN2$ (Percentual value from SIC output)

If Feedwater pump 3 is selected to start, then:

- Feedwater pump 3 3108SIC6017 speed diff. between setpoint and control value $SD < MIN2$ (Percentual value from SIC output)

Step 5: Pump speed balanced

- N/A

Step transition conditions

- Waiting time has elapsed

Step 6: Stopping pump ramp speed down

If Feedwater pump 1 is selected to stop, then:

- Feedwater pump 1 3108SIC6041 speed controller auto-mode on and 0 %

If Feedwater pump 2 is selected to stop, then:

- Feedwater pump 2 3108SIC6029 speed controller auto-mode on and 0 %

If Feedwater pump 3 is selected to stop, then:

- Feedwater pump 3 3108SIC6017 speed controller auto-mode on and 0 %

Step transition conditions

If Feedwater pump 1 is selected to stop, then:

- Feedwater pump 1 3108SIC6041 controller in auto-mode and output $< 1 \%$

RECOX Function Description

12/12

Revision

Internal

Project name

Doc. ID

8 June 2018

Ext. doc. ID

If Feedwater pump 2 is selected to stop, then:

- Feedwater pump 2 3108SIC6029 controller in auto-mode and output < 1 %

If Feedwater pump 3 is selected to stop, then:

- Feedwater pump 3 3108SIC6017 controller in auto-mode and output < 1 %

Step 7: Stopping pump stop

If Feedwater pump 1 is selected to stop, then:

- Feedwater pump 1 3108P0008 auto stop

If Feedwater pump 2 is selected to stop, then:

- Feedwater pump 2 3108P0006 auto stop

If Feedwater pump 3 is selected to stop, then:

- Feedwater pump 3 3108P0004 auto stop

Step transition conditions

If Feedwater pump 1 is selected to stop, then:

- Feedwater pump 1 3108P0008 is not running

If Feedwater pump 2 is selected to stop, then:

- Feedwater pump 2 3108P0006 is not running

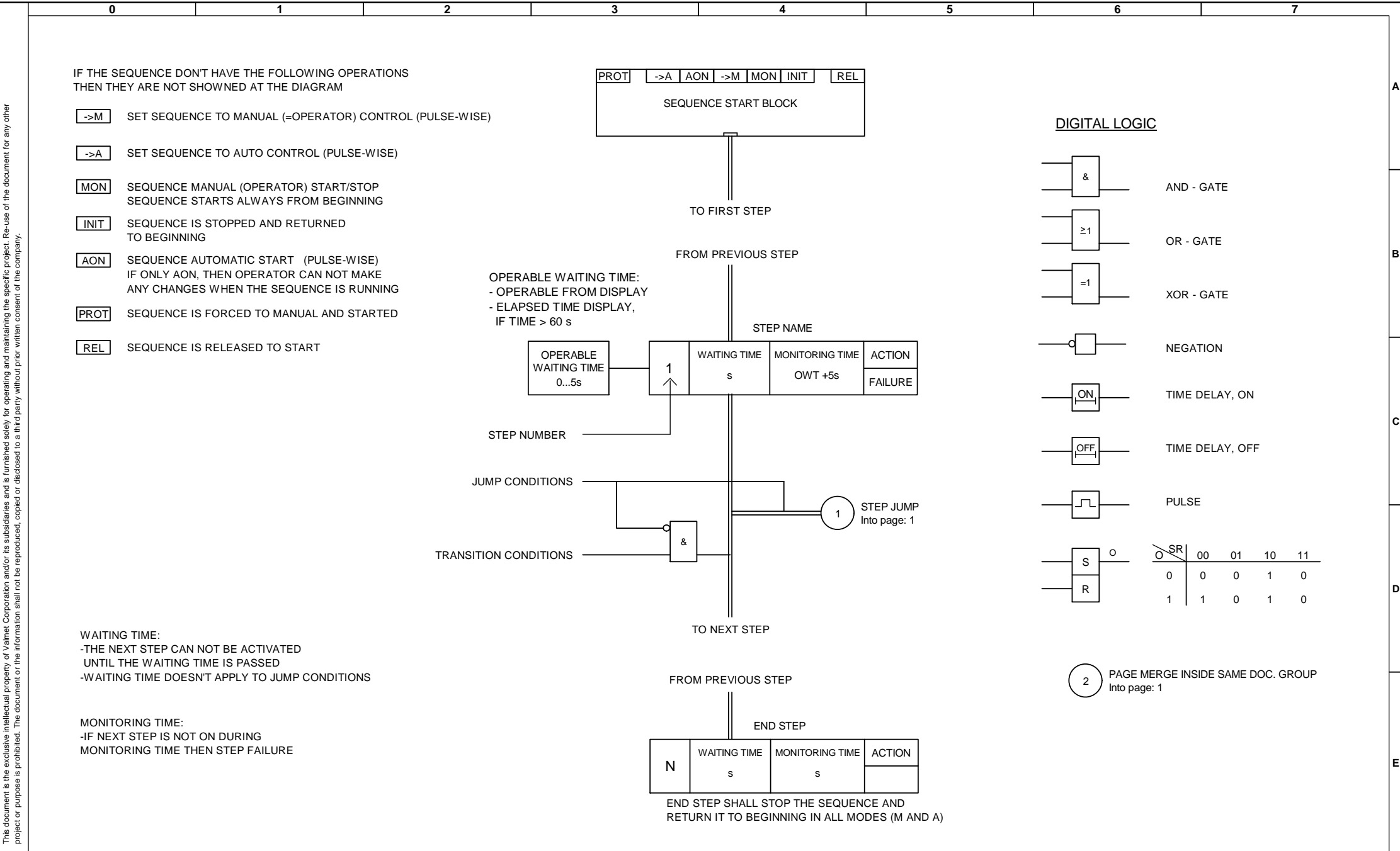
If Feedwater pump 3 is selected to stop, then:

- Feedwater pump 3 3108P0004 is not running

Step 8: Sequence end

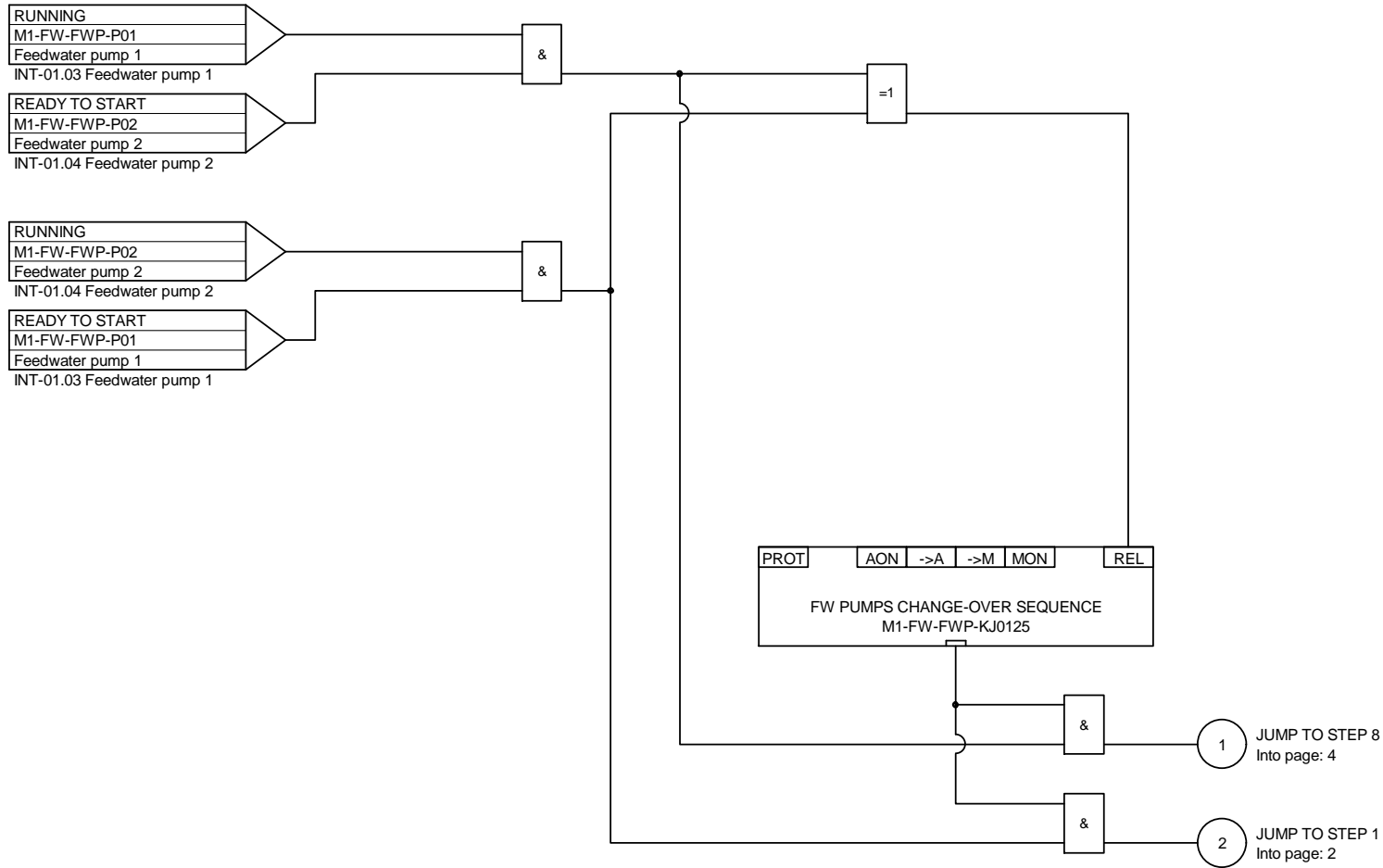
- Sequence completed

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.



Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd	Project		Status	Rev
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31	-			-
0	first revision	FTAMTMUT	FTAMTMUT	FTAMTMUT	2016-03-22	SEQUENCE DIAGRAM		Doc ID/ Collection ID	DCC EFA03
Customer		Product		Title		Customer Doc ID		Sheet 1 / 1	
Project		Comos ID Published Model		Area		Position		Seq. Page 1	Label SEQ-00.01

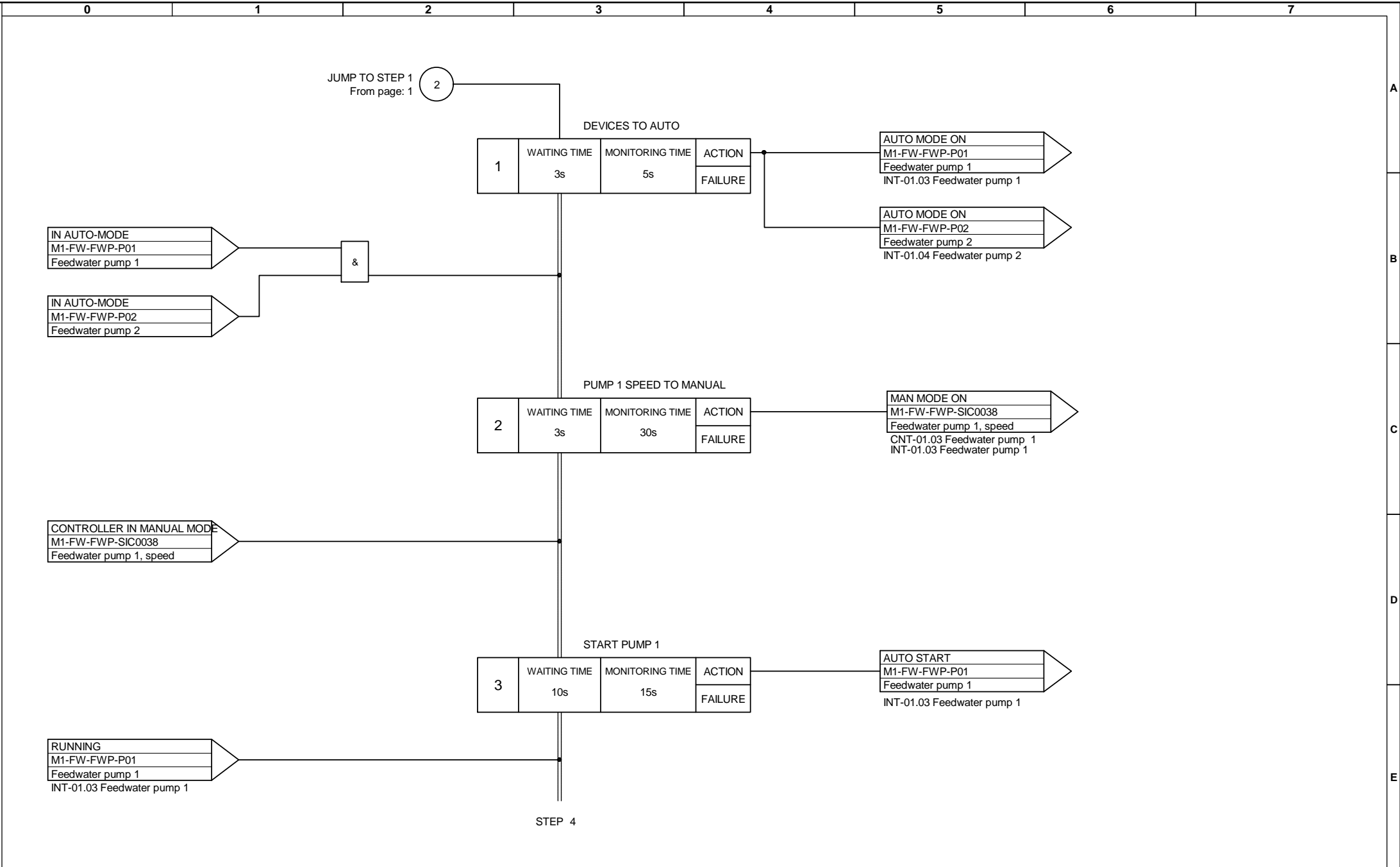
This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.



Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31
1	Revision	FTAMJJA	FTAMJJA	FTAMJJA	2015-05-28
Customer		Product			
Project		Comos ID	Published Model	Area	

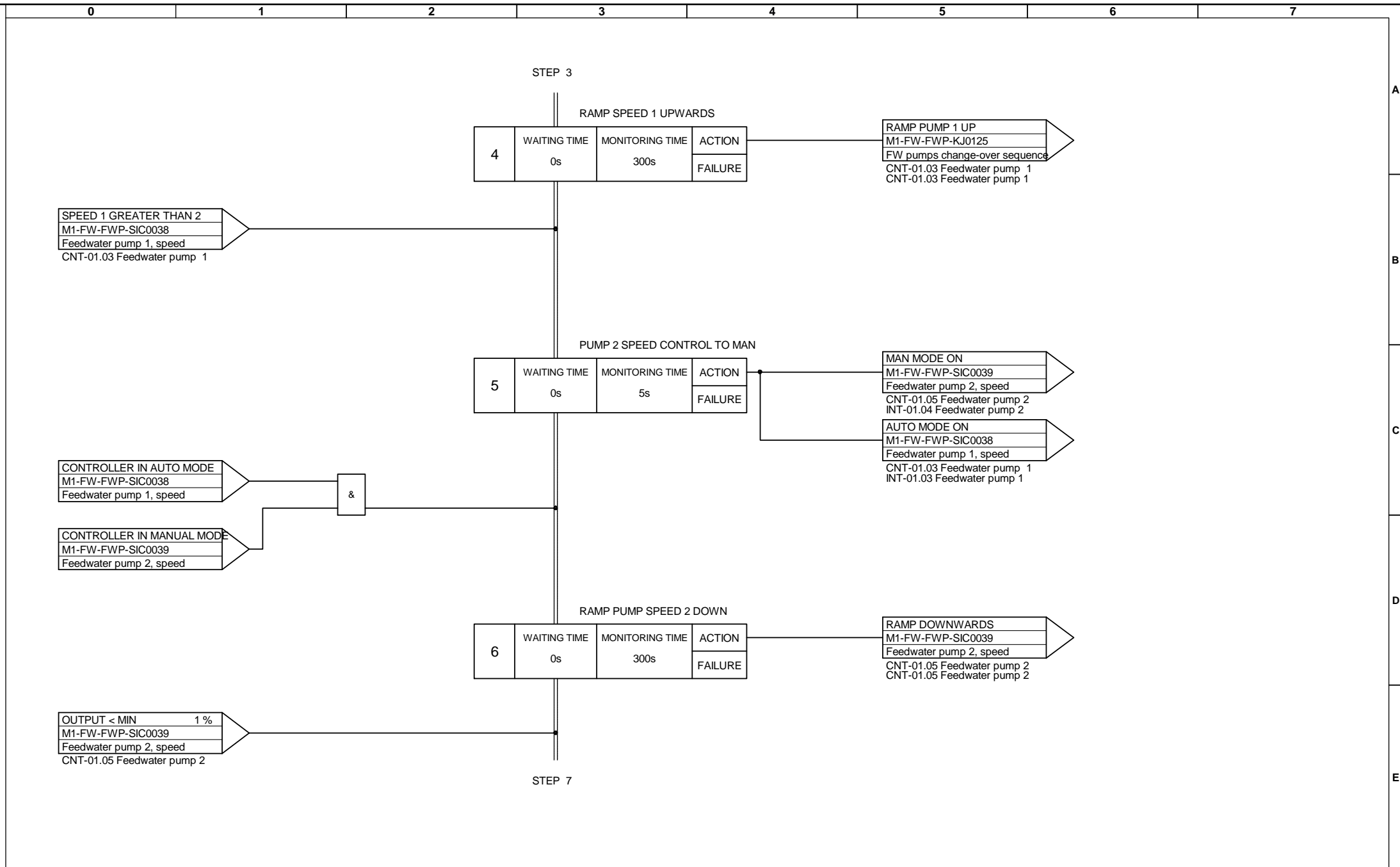
		Project Number	-	Status		Rev	-
		Doc Class	SEQUENCE DIAGRAM	Doc ID/Collection ID	/	DCC	EFA03
Title		Customer Doc ID		Sheet		1 / 1	
FW PUMPS CHANGE-OVER SEQUENCE		Position		Seq. Page	1	Label	SEQ-01.01


This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.



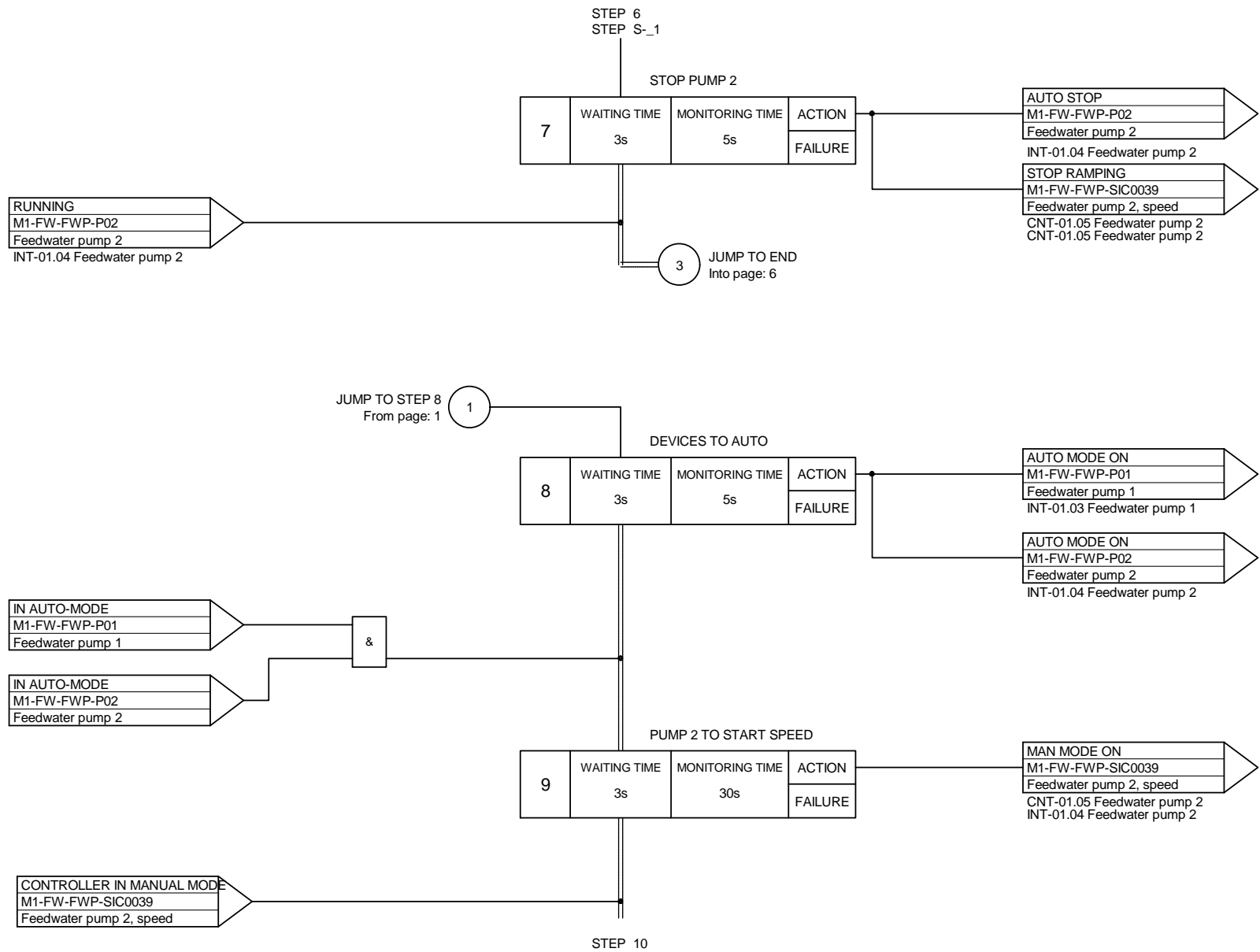
Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd	Project Number		Status	Rev
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31	-		Doc ID/Collection ID	-
1	Revision	FTAMJJA	FTAMJJA	FTAMJJA	2015-05-28	Doc Class		Customer Doc ID	DCC EFA03
Customer			Product			Title			Sheet 2 / 1
Project			Comos ID	Published Model	Area	FW PUMPS CHANGE-OVER SEQUENCE			Seq. Page 2
									Label SEQ-01.01

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.



Rev	Description		Created by	Checked by	Approved by	Date yyyy-MM-dd			Project Number	-	Status		Rev	-		
-	For Model		ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31			Doc Class	SEQUENCE DIAGRAM		Doc ID/ Collection ID		/	DCC	EFA03
1	Revision		FTAMJJA	FTAMJJA	FTAMJJA	2015-05-28					Customer Doc ID		Sheet		3	/ 1
Customer			Product			Title			FW PUMPS CHANGE-OVER SEQUENCE		Position		Seq. Page	3	Label	SEQ-01.01
Project			Comos ID		Published Model	Area										

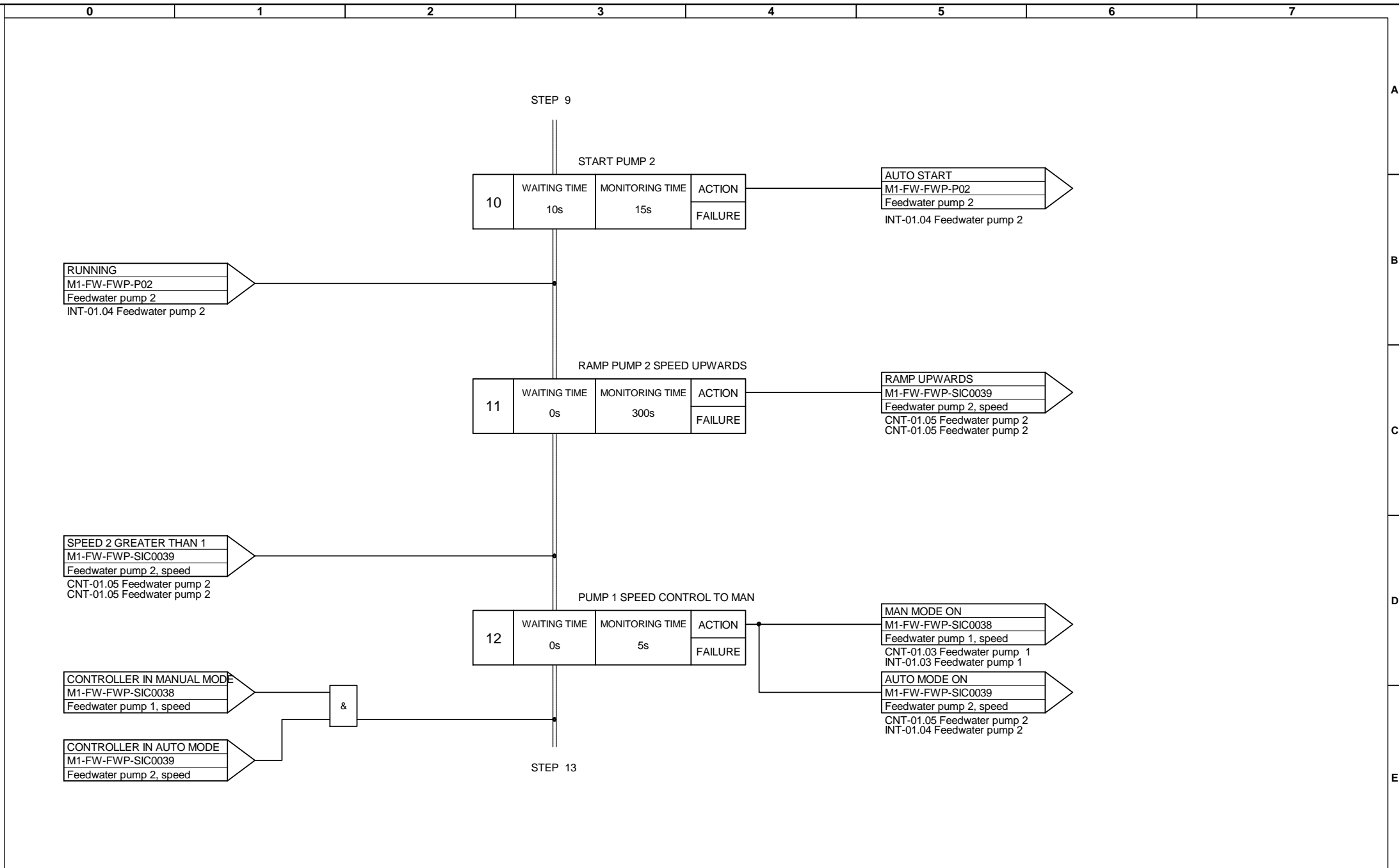
This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.




Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31
1	Revision	FTAMJJA	FTAMJJA	FTAMJJA	2015-05-28
Customer		Product			
Project		Comos ID	Published Model	Area	

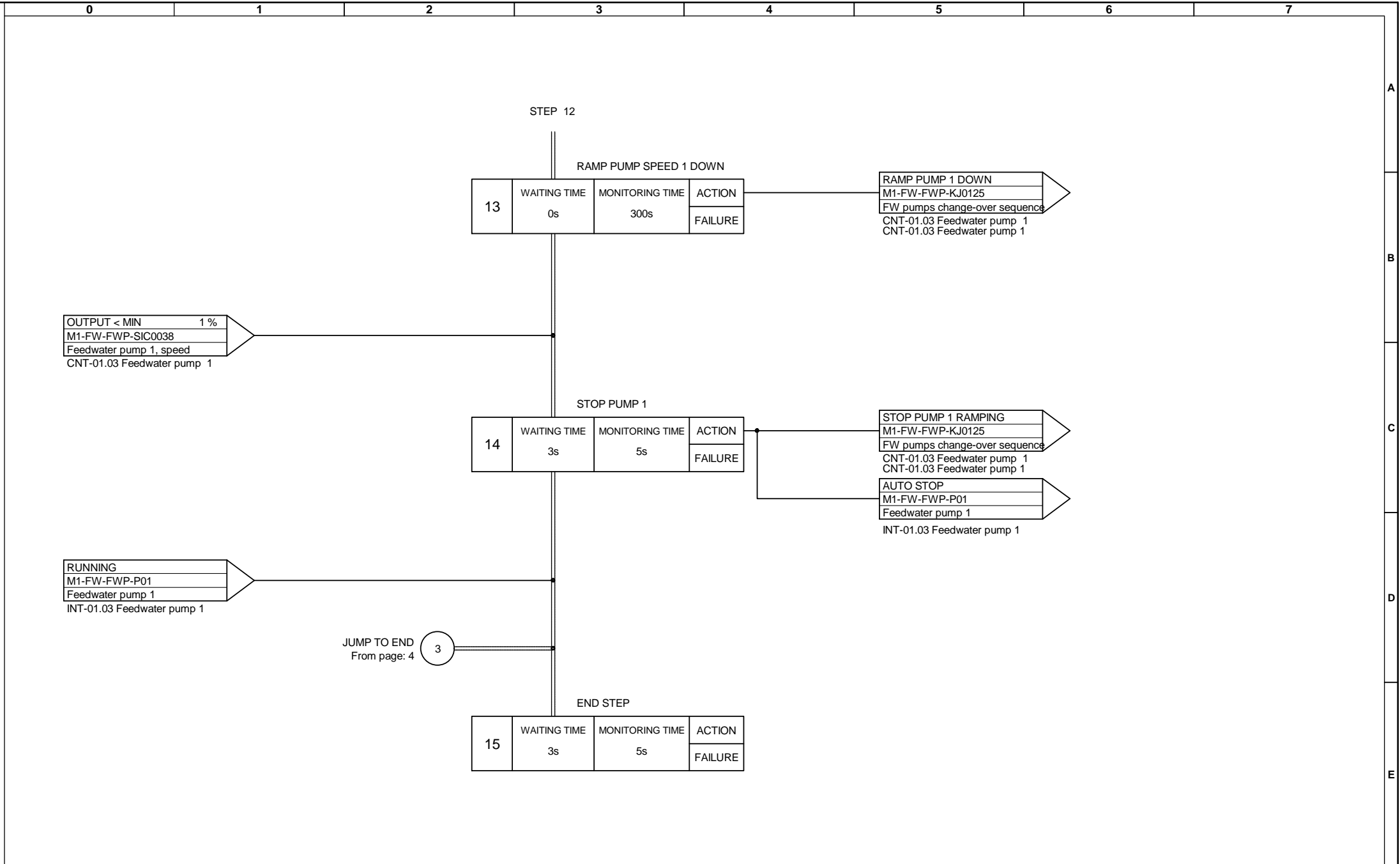
Valmet		Project Number	-	Status		Rev	-
		Doc Class	SEQUENCE DIAGRAM	Doc ID/Collection ID	/	DCC	EFA03
Title		Customer Doc ID		Sheet		4 / 1	
FW PUMPS CHANGE-OVER SEQUENCE		Position		Seq. Page	4	Label	SEQ-01.01


This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.



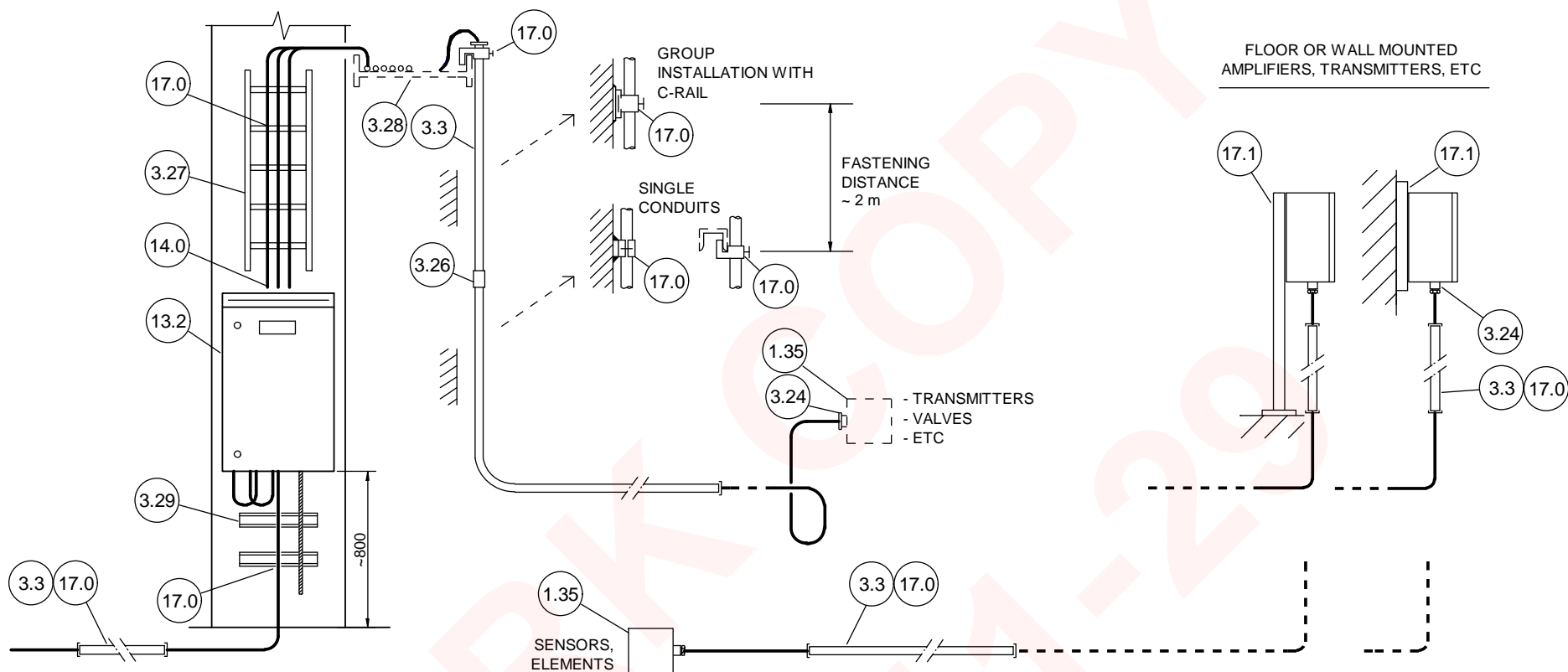
Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd		Project Number	-	Status	Rev	-			
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31		Doc Class	SEQUENCE DIAGRAM		Doc ID/ Collection ID	/			
1	Revision	FTAMJJA	FTAMJJA	FTAMJJA	2015-05-28				DCC	EFA03				
Customer			Product			Title			Customer Doc ID			Sheet	5 / 1	
Project			Comos ID Published Model Area						Position			Seq. Page	5	Label
						FW PUMPS CHANGE-OVER SEQUENCE								

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.



Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd		Project Number	-	Status	Rev	
-	For Model	ADMVILGRON	ADMVILGRON	TREILONETA	2022-01-31		Doc Class	SEQUENCE DIAGRAM	Doc ID/ Collection ID	/	DCC EFA03
1	Revision	FTAMJJA	FTAMJJA	FTAMJJA	2015-05-28						
Customer			Product			Title			Customer Doc ID		Sheet 6 / 1
Project			Comos ID Published Model Area						Position		Seq. Page 6
						FW PUMPS CHANGE-OVER SEQUENCE					

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.




17.1	Mounting bracket	1	I	I				
17.0	Fastening accessories	1	I	I				
14.0	Signal cable	m	I	I		Copper		
13.2	Junction box	1	O	I				
3.8	Fixing and marking material	1	I	I				
3.3	Protection tube	m	I	I		Aluminium		
3.29	C-rail	1	I	I				
3.28	Main cable ladder	1	L	L				
3.27	Cable ladder	1	O	I				
3.26	Extension piece	1	I	I				
3.24	Cable gland	1	I	I		Plastic		
3.0	Pos. plate	1	I	I		Plastic		
1.35	Instrument	1	O	I				

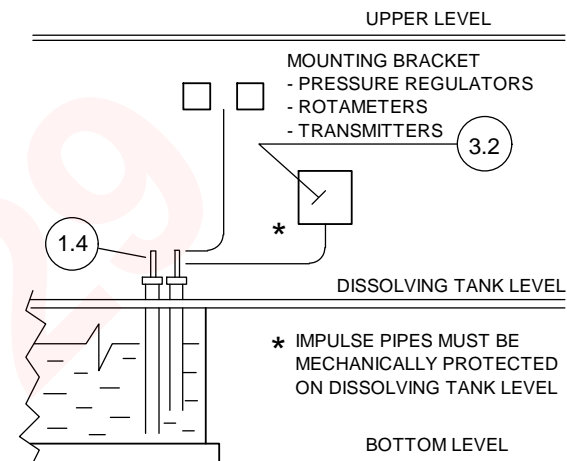
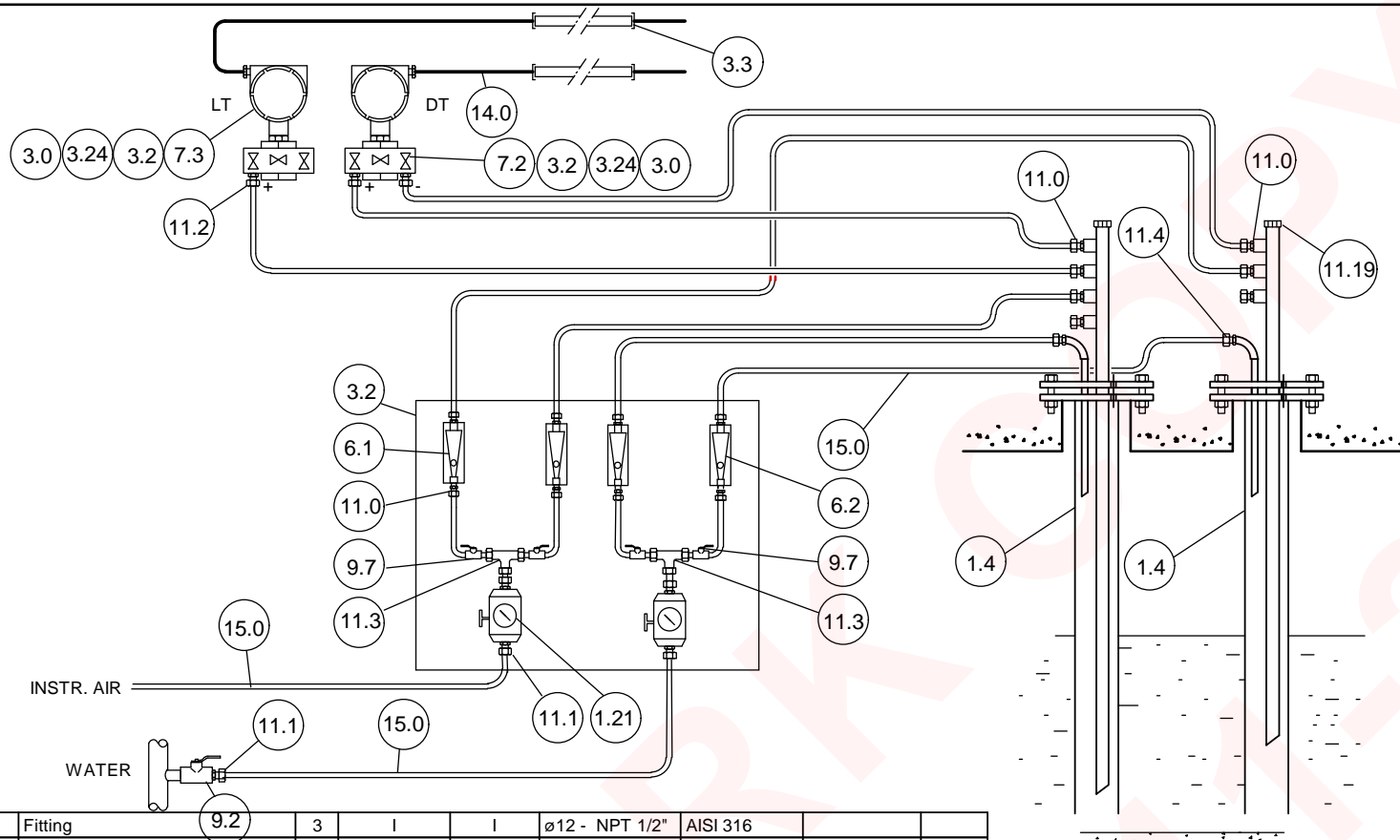
Part	Description	Qty	Supplied By	Mounted By	Size	Material	Note	REV	Part	Description	Qty	Supplied By	Mounted By	Size	Material	Note	REV
------	-------------	-----	-------------	------------	------	----------	------	-----	------	-------------	-----	-------------	------------	------	----------	------	-----

C = Customer L = Electric Contractor I = Instrument Contractor O = Others

NOTES

Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd		Valmet Project -	Status	Rev 0
0	updates & colors	FTAMSKU	FTAMSKU	FTAMSKU	2013-12-18		Doc Class INSTRUMENTATION HOOK-UP DRAWING	Doc ID/Collection ID /	DCC EEC09
Customer			Product			Title	Customer Doc ID		Sheet 1 / 1
Project			Comos ID	Published Model	Design Area		Position		Label AA01
						INSTALLATION PRINCIPLE FOR SIGNAL CABLES			

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.




11.1	Fitting	3	I	I	ø12 - NPT 1/2"	AISI 316		
11.0	Fitting	15	I	I	ø12 - NPT 1/4"			
9.7	Shut-off valve	4	I	I				
9.2	Shut-off valve	1	O	I	NPT 1/2"			
7.3	Transmitter & valve block	1	O	I				
7.2	DP-Transmitter & valve block	1	O	I				
6.2	Purge rotameter	2	O	I	1/4" / 0...2 l/min	For water		
6.1	Purge rotameter	2	O	I	1/4" / 0...5 l/min	For air		
3.3	Protection tube	m	I	I		Aluminium		
3.24	Cable gland	2	I	I		Plastic		
3.2	Mounting plate	2	I	I		eg.2mm zinked		
3.0	Pos. plate	2	I	I		Plastic		
1.4	Bubbling tube system	2	O	I				
1.21	Pressure regulator	2	I	I		For air		
11.0_1	T-fitting	15	I	I	ø12 - NPT 1/4"	AISI 316		

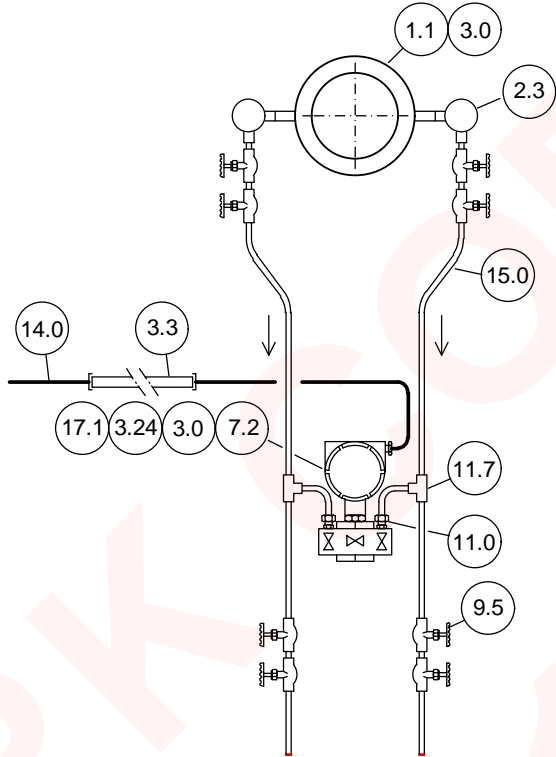
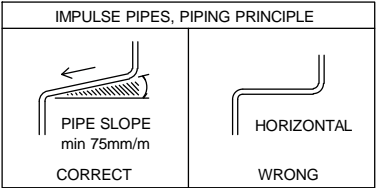
Part	Description	Qty	Supplied By	Mounted By	Size	Material	Note	REV	Part	Description	Qty	Supplied By	Mounted By	Size	Material	Note	REV
------	-------------	-----	-------------	------------	------	----------	------	-----	------	-------------	-----	-------------	------------	------	----------	------	-----

C = Customer L = Electric Contractor I = Instrument Contractor O = Others

NOTES

Rev	Description		Created by		Checked by		Approved by		Date yyyy-MM-dd			Valmet Project -		Status		Rev 0			
0	updates & colors		FTAMSKU		FTAMSKU		FTAMSKU		2013-12-18			Doc Class INSTRUMENTATION HOOK-UP DRAWING		Doc ID/ Collection ID /		DCC EEC09			
Customer						Product						Title		Customer Doc ID		Sheet 1 / 1			
Project						Comos ID		Published Model		Design Area				Position		Label AD01			
												DENSITY AND LEVEL MEASUREMENT WITH BUBBLING TUBE, DISSOLVING TANK							

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.



17.1	Mounting bracket	1	I	I				
15.0	Impulse pipe	m	I	I	ø12x2			
14.0	Signal cable	m	I	I		Copper		
11.7	T-connection	2	I	I	3 x ø12	AISI 316	welded	
11.0	Fitting	2	I	I	ø12	AISI 316	welded	
9.5	Needle valve	4	I	I	DN 15	AISI 316	1) 3)	
7.2	DP-Transmitter & valve block	1	O	I				
3.8	Fixing and marking material	1	I	I				
3.3	Protection tube	m	I	I		Aluminium		
3.24	Cable gland	1	I	I		Plastic		
3.0	Pos. plate	2	I	I		Plastic		
2.3	Condensate chamber	2						
1.1	Flow nozzle	1	O	P			2)	

Part	Description	Qty	Supplied By	Mounted By	Size	Material	Note	REV	Part	Description	Qty	Supplied By	Mounted By	Size	Material	Note	REV
------	-------------	-----	-------------	------------	------	----------	------	-----	------	-------------	-----	-------------	------------	------	----------	------	-----

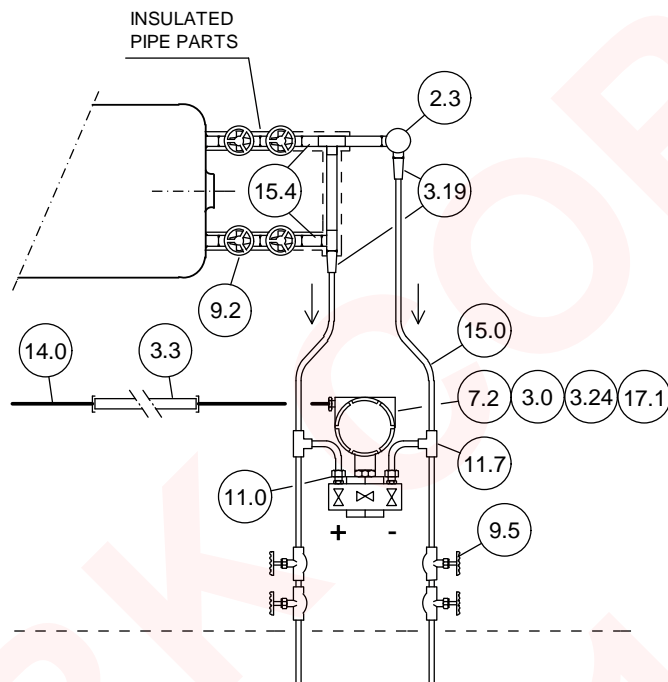
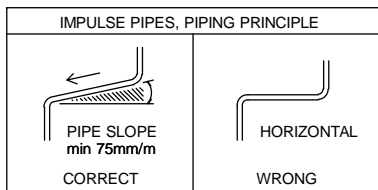
C = Customer L = Electric Contractor I = Instrument Contractor O = Others

NOTES 1) SOCKET WELD TYPE 2) SEE CONNECTION DWG FE01. COMPLETE WITH SHUT-OFF VALVES AND CONDENSATE CHAMBERS

Rev	Description	Created by	Checked by	Approved by	Date yyyy-MM-dd	Valmet Project		Status	Rev
1	updates & colors	FTAMSKU	FTAMSKU	FTAMSKU	2013-12-18			-	1
0	Revision	FTAMVSU	FTAMVSU	FTAMVSU	2007-01-11	Doc Class INSTRUMENTATION HOOK-UP DRAWING		Doc ID/Collection ID /	DCC EEC09
Customer		Product		Title		Customer Doc ID		Sheet 1 / 1	
Project		Comos ID Published Model		Design Area		Position		Label AF01	

FLOW MEASUREMENT WITH NOZZLE, HP-STEAM, WELDED IMPULSE PIPES

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.




15.4	Piping	m	P	P	DN25			
15.0	Impulse pipe	m	I	I	ø12x2			
14.0	Signal cable	m	I	I		Copper		
11.7	T-connection	2	I	I	3 x ø12	AISI 316	welded	
11.0	Fitting	2	I	I	ø12	AISI 316		
9.5	Needle valve	4	I	I	DN8	AISI 316	1)	
9.2	Shut-off valve	4	O	P	DN25		See dwg LE01.1	
7.2	DP-Transmitter & valve block	1	O	I				
3.8	Fixing and marking material	1	I	I				
3.3	Protection tube	m	I	I		Aluminium		
3.24	Cable gland	1	I	I		Plastic		
3.19	Reducing piece	2	O	P	DN25 - ø12			
3.0	Pos. plate	1	I	I		Plastic		
2.3	Condensate chamber	1	O	P				

Part	Description	Qty	Supplied By	Mounted By	Size	Material	Note	REV	Part	Description	Qty	Supplied By	Mounted By	Size	Material	Note	REV
------	-------------	-----	-------------	------------	------	----------	------	-----	------	-------------	-----	-------------	------------	------	----------	------	-----

C = Customer L = Electric Contractor I = Instrument Contractor O = Others

NOTES 1) WELDED, SOCKET WELD TYPE

Rev	Description		Created by	Checked by	Approved by	Date yyyy-MM-dd		Valmet Project	-	Status	Rev	1	
1	updates & colors		FTAMSKU	FTAMSKU	FTAMSKU	2013-12-18		Doc Class	INSTRUMENTATION HOOK-UP DRAWING		Doc ID/ Collection ID	/	DCC EEC09
0	Revision		FTAMVSU	FTAMVSU	FTAMVSU	2007-01-11	Title				Customer Doc ID	Sheet	1 / 1
Customer			Product			LEVEL MEASUREMENT, STEAM DRUM & HP-TANKS, WELDED IMPULSE PIPES				Position	Label	AL01.1	
Project			Comos ID	Published Model	Design Area								



List

Instrument index (Sales)

Status Draft

Issue Status

Project Name: SKO Energo BFB

Project Key:

Project Number: BFB21-00942

Document ID:

Customer Document ID:

Revision:

Instructions

Don't delete or reorder columns

You can delete row if it is not relevant

Revision markup

Deleted rows option: Don't show deleted rows

Revision monitoring: Show changes from last revision

Font styles

Strikeout removed text: Yes

Use italic font for new/changed cells: Yes

Text & Cell colors

New text

Modified text

Removed text color

Editable cell backgroud

Read only cell backgroud

Rev	Revision Note	Created by	Checked by	Approved by	Date
*	Revision	FTAMSTE			2024-09-04

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.

No.	Loop TAG	Loop description	Instrument TAG	Instrument Description	BUS	DCS AI	DCS AO	DCS DO	SIS AI	SIS AO	SIS DI	SIS DO	BMS AI	BMS AO	BMS DI	BMS DO	PLC AI	PLC AO	PLC DI	PLC DO	HW	PIflow	Remarks	Rev
329	FG-FLG-10127	RECIRCULATION FG TEMPERATURE AFTER FAN	FG-FLG-10127-E	THERMOCOUPLE TEMPERATURE																		81PFB01-09010 Primary Air	0	
330	FG-FLG-10127	RECIRCULATION FG TEMPERATURE AFTER FAN	FG-FLG-10127-T	TEMPERATURE TRANSMITTER																		81PFB01-09010 Primary Air	0	
331	AF-S01-F0020	SUB COMBUSTION AIR FLOW	AF-S01-F0020-E	AEROFIL						1												81PFB01-09040 Overfire Air	0	
332	AF-S01-F0020	SUB COMBUSTION AIR FLOW	AF-S01-F0020-T	PRESSURE DIFFERENCE TRANSMITTER						1												81PFB01-09040 Overfire Air	0	
333	AF-S01-FW019	SUB COMBUSTION AIR FLOW, TEST	AF-S01-FW019-E	POINT CONNECTION, FLOW																		81PFB01-09040 Overfire Air	0	
334	CA-SEA-F0017	SA FLOW TO REAR WALL	CA-SEA-F0017-FG-V-Z-Y	POSITIONER											1							81PFB01-09040 Overfire Air	0	
335	CA-SEA-F0017	SA FLOW TO REAR WALL	CA-SEA-F0017	CONTROL FLAP																		81PFB01-09040 Overfire Air	0	
336	CA-SEA-F0019	SA FLOW TO FRONT WALL	CA-SEA-F0019-FG-V-Z-Y	POSITIONER											1							81PFB01-09040 Overfire Air	0	
337	CA-SEA-F0019	SA FLOW TO FRONT WALL	CA-SEA-F0019	CONTROL FLAP																		81PFB01-09040 Overfire Air	0	
338	CA-SEA-F0017	SA FLOW TO REAR WALL	CA-SEA-F0017-E	AEROFIL																		81PFB01-09040 Overfire Air	0	
339	CA-SEA-F0017	SA FLOW TO REAR WALL	CA-SEA-F0017-T	PRESSURE DIFFERENCE TRANSMITTER						1												81PFB01-09040 Overfire Air	0	
340	CA-SEA-F0019	SA FLOW TO FRONT WALL	CA-SEA-F0019-E	AEROFIL																		81PFB01-09040 Overfire Air	0	
341	CA-SEA-F0019	SA FLOW TO FRONT WALL	CA-SEA-F0019-T	PRESSURE DIFFERENCE TRANSMITTER						1												81PFB01-09040 Overfire Air	0	
342	CA-SEA-FW0036	SA FLOW TO REAR WALL, TEST	CA-SEA-FW0036-E	POINT CONNECTION, FLOW																		81PFB01-09040 Overfire Air	0	
343	CA-SEA-FW0037	SA FLOW TO FRONT WALL, TEST	CA-SEA-FW0037-E	POINT CONNECTION, FLOW																		81PFB01-09040 Overfire Air	0	
344	CA-SEA-P0058	SEALING AIR PRESS. TO SOOTBLOWERS, LOCAL	CA-SEA-P0058-E	PRESSURE GAUGE																		81PFB01-09040 Overfire Air	0	
345	CA-SEA-P0058	SEALING AIR PRESS. TO SOOTBLOWERS, LOCAL	CA-SEA-P0058-IA	POINT CONNECTION, PRESSURE																		81PFB01-09040 Overfire Air	0	
346	CA-SEA-P0073	SECONDARY AIR PRESSURE	CA-SEA-P0073-E	PRESSURE MEASUREMENT CONTROLLER																		81PFB01-09040 Overfire Air	0	
347	CA-SEA-P0073	SECONDARY AIR PRESSURE	CA-SEA-P0073-T	PRESSURE TRANSMITTER																		81PFB01-09040 Overfire Air	0	
348	CA-SEA-T0088	SEALING AIR TEMP. TO SOOTBLOWERS, LOCAL	CA-SEA-T0088-I	THERMOMETER																		81PFB01-09040 Overfire Air	0	
349	CA-SEA-T0089	SECONDARY AIR TEMPERATURE	CA-SEA-T0089-E	RESISTANCE TEMPERATURE SENSOR																		81PFB01-09040 Overfire Air	0	
350	CA-SEA-T0089	SECONDARY AIR TEMPERATURE	CA-SEA-T0089-T	TEMPERATURE TRANSMITTER																		81PFB01-09040 Overfire Air	0	
351	CA-TEA-F0027	TA FLOW TO RIGHT WALL	CA-TEA-F0027-FG-V-Z-Y	POSITIONER											1							81PFB01-09040 Overfire Air	0	
352	CA-TEA-F0027	TA FLOW TO RIGHT WALL	CA-TEA-F0027	CONTROL FLAP																		81PFB01-09040 Overfire Air	0	
353	CA-TEA-F0030	TA FLOW TO LEFT WALL	CA-TEA-F0030-FG-V-Z-Y	POSITIONER											1							81PFB01-09040 Overfire Air	0	
354	CA-TEA-F0030	TA FLOW TO LEFT WALL	CA-TEA-F0030	CONTROL FLAP																		81PFB01-09040 Overfire Air	0	
355	CA-TEA-F0027	TA FLOW TO RIGHT WALL	CA-TEA-F0027-E	AEROFIL																		81PFB01-09040 Overfire Air	0	
356	CA-TEA-F0027	TA FLOW TO RIGHT WALL	CA-TEA-F0027-T	PRESSURE DIFFERENCE TRANSMITTER						1												81PFB01-09040 Overfire Air	0	
357	CA-TEA-F0030	TA FLOW TO LEFT WALL	CA-TEA-F0030-E	AEROFIL																		81PFB01-09040 Overfire Air	0	
358	CA-TEA-F0030	TA FLOW TO LEFT WALL	CA-TEA-F0030-T	PRESSURE DIFFERENCE TRANSMITTER						1												81PFB01-09040 Overfire Air	0	
359	CA-TEA-FW0026	TA FLOW TO RIGHT WALL, TEST	CA-TEA-FW0026-E	POINT CONNECTION, FLOW																		81PFB01-09040 Overfire Air	0	
360	CA-TEA-FW0029	TA FLOW TO LEFT WALL, TEST	CA-TEA-FW0029-E	POINT CONNECTION, FLOW																		81PFB01-09040 Overfire Air	0	
361	BR-FUR-P0005	FURNACE TOP PRESSURE, CALC	BR-FUR-P0005S	SOFTWARE LOOP																		81PFB01-10020 Flue Gas A	0	
362	BR-FUR-P0007	FURNACE TOP PRESSURE, 1, RIGHT	BR-FUR-P0007-E	PRESSURE MEASUREMENT CONTROLLER																		81PFB01-10020 Flue Gas A	0	
363	BR-FUR-P0007	FURNACE TOP PRESSURE, 1, RIGHT	BR-FUR-P0007-T	PRESSURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
364	BR-FUR-P0008	FURNACE TOP PRESSURE, 2, MIDDLE	BR-FUR-P0008-E	PRESSURE MEASUREMENT CONTROLLER																		81PFB01-10020 Flue Gas A	0	
365	BR-FUR-P0008	FURNACE TOP PRESSURE, 2, MIDDLE	BR-FUR-P0008-T	PRESSURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
366	BR-FUR-P0009	FURNACE TOP PRESSURE, 3, LEFT	BR-FUR-P0009-E	PRESSURE MEASUREMENT CONTROLLER																		81PFB01-10020 Flue Gas A	0	
367	BR-FUR-P0009	FURNACE TOP PRESSURE, 3, LEFT	BR-FUR-P0009-T	PRESSURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
368	CA-PRA-T0110	PRIM. AIR PREHEATER MATERIAL TEMP. 1	CA-PRA-T0110-E	THERMOCOUPLE TEMPERATURE																		81PFB01-10020 Flue Gas A	0	
369	CA-PRA-T0110	PRIM. AIR PREHEATER MATERIAL TEMP. 1	CA-PRA-T0110-T	TEMPERATURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
370	CA-PRA-T0111	PRIM. AIR PREHEATER MATERIAL TEMP. 2	CA-PRA-T0111-E	THERMOCOUPLE TEMPERATURE																		81PFB01-10020 Flue Gas A	0	
371	CA-PRA-T0111	PRIM. AIR PREHEATER MATERIAL TEMP. 2	CA-PRA-T0111-T	TEMPERATURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
372	CA-PRA-T0112	PRIM. AIR PREHEATER MATERIAL TEMP. 3	CA-PRA-T0112-E	THERMOCOUPLE TEMPERATURE																		81PFB01-10020 Flue Gas A	0	
373	CA-PRA-T0112	PRIM. AIR PREHEATER MATERIAL TEMP. 3	CA-PRA-T0112-T	TEMPERATURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
374	CA-PRA-T0113	PRIM. AIR PREHEATER MATERIAL TEMP. 4	CA-PRA-T0113-E	THERMOCOUPLE TEMPERATURE																		81PFB01-10020 Flue Gas A	0	
375	CA-PRA-T0113	PRIM. AIR PREHEATER MATERIAL TEMP. 4	CA-PRA-T0113-T	TEMPERATURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
376	CA-SEA-T0159	SEC. AIR PREHEATER MATERIAL TEMP. 1	CA-SEA-T0159-E	THERMOCOUPLE TEMPERATURE																		81PFB01-10020 Flue Gas A	0	
377	CA-SEA-T0159	SEC. AIR PREHEATER MATERIAL TEMP. 1	CA-SEA-T0159-T	TEMPERATURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
378	CA-SEA-T0160	SEC. AIR PREHEATER MATERIAL TEMP. 2	CA-SEA-T0160-E	THERMOCOUPLE TEMPERATURE																		81PFB01-10020 Flue Gas A	0	
379	CA-SEA-T0160	SEC. AIR PREHEATER MATERIAL TEMP. 2	CA-SEA-T0160-T	TEMPERATURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
380	CA-SEA-T0161	SEC. AIR PREHEATER MATERIAL TEMP. 3	CA-SEA-T0161-E	THERMOCOUPLE TEMPERATURE																		81PFB01-10020 Flue Gas A	0	
381	CA-SEA-T0161	SEC. AIR PREHEATER MATERIAL TEMP. 3	CA-SEA-T0161-T	TEMPERATURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
382	CA-SEA-T0162	SEC. AIR PREHEATER MATERIAL TEMP. 4	CA-SEA-T0162-E	THERMOCOUPLE TEMPERATURE																		81PFB01-10020 Flue Gas A	0	
383	CA-SEA-T0162	SEC. AIR PREHEATER MATERIAL TEMP. 4	CA-SEA-T0162-T	TEMPERATURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
384	FG-FLG-P00039	FG DP OVER SUPERHEATERS, CALC	FG-FLG-PDSW0039	SOFTWARE LOOP																		81PFB01-10020 Flue Gas A	0	
385	FG-FLG-P00040	FG DP OVER ECONOMIZERS, CALC	FG-FLG-PDSW0040	SOFTWARE LOOP																		81PFB01-10020 Flue Gas A	0	
386	FG-FLG-P00044	FG DP OVER AIR FG PREHEATERS, CALC	FG-FLG-PDSW0044	SOFTWARE LOOP																		81PFB01-10020 Flue Gas A	0	
387	FG-FLG-P00093	FLUE GAS PRESSURE AFTER SUPERHEATERS	FG-FLG-P00093-E	PRESSURE MEASUREMENT CONTROLLER																		81PFB01-10020 Flue Gas A	0	
388	FG-FLG-P00093	FLUE GAS PRESSURE AFTER SUPERHEATERS	FG-FLG-P00093-T	PRESSURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
389	FG-FLG-P00271	FLUE GAS PRESSURE AFTER ECOS	FG-FLG-P00271-E	PRESSURE MEASUREMENT CONTROLLER																		81PFB01-10020 Flue Gas A	0	
390	FG-FLG-P00271	FLUE GAS PRESSURE AFTER ECOS	FG-FLG-P00271-T	PRESSURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
391	FG-FLG-P00272	FLUE GAS PRESSURE AFTER AIR FG PREHEATERS	FG-FLG-P00272-E	PRESSURE MEASUREMENT CONTROLLER																		81PFB01-10020 Flue Gas A	0	
392	FG-FLG-P00272	FLUE GAS PRESSURE AFTER AIR FG PREHEATERS	FG-FLG-P00272-T	PRESSURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
393	FG-FLG-Q00094	FLUE GAS O2 CONTENT, LEFT	FG-FLG-Q00094-E	MEASUREMENT PROBE																		81PFB01-10020 Flue Gas A	0	
394	FG-FLG-Q00094	FLUE GAS O2 CONTENT, LEFT	FG-FLG-Q00094-T	O2 TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
395	FG-FLG-Q00095	FLUE GAS O2 CONTENT, RIGHT	FG-FLG-Q00095-E	MEASUREMENT PROBE																		81PFB01-10020 Flue Gas A	0	
396	FG-FLG-Q00095	FLUE GAS O2 CONTENT, RIGHT	FG-FLG-Q00095-T	O2 TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
397	FG-FLG-Q0108	FLUE GAS O2 CONTENT, MIDDLE	FG-FLG-Q0108-E	MEASUREMENT PROBE																		81PFB01-10020 Flue Gas A	0	
398	FG-FLG-Q0108	FLUE GAS O2 CONTENT, MIDDLE	FG-FLG-Q0108-T	O2 TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
399	FG-FLG-Q00112	FLUE GAS O2 CONTENT, CALC	FG-FLG-QS00112	SOFTWARE LOOP																		81PFB01-10020 Flue Gas A	0	
400	FG-FLG-T01050	FLUE GAS TEMP. AFTER SUPERHEATERS, LEFT	FG-FLG-T01050-E	THERMOCOUPLE TEMPERATURE																		81PFB01-10020 Flue Gas A	0	
401	FG-FLG-T01050	FLUE GAS TEMP. AFTER SUPERHEATERS, LEFT	FG-FLG-T01050-T	TEMPERATURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
402	FG-FLG-T01051	FLUE GAS TEMP. AFTER SUPERHEATERS, RIGHT	FG-FLG-T01051-E	THERMOCOUPLE TEMPERATURE																		81PFB01-10020 Flue Gas A	0	
403	FG-FLG-T01051	FLUE GAS TEMP. AFTER SUPERHEATERS, RIGHT	FG-FLG-T01051-T	TEMPERATURE TRANSMITTER																		81PFB01-10020 Flue Gas A	0	
404	FG-FLG-T01052	FLUE GAS TEMPERATURE AFTER ECO, LEFT	FG-FL																					

Loop TAG	Loop description	Instrument TAG	Instrument Description	BUS	DCS AI	DCS AO	DCS DI	DCS DO	SIS AI	SIS AO	SIS DI	SIS DO	BMS AI	BMS AO	BMS DI	BMS DO	PLC AI	PLC AO	PLC DI	PLC DO	HW	PI-flow	Remarks	Rev
493FG-BF2-HS0026	BHF COMP 2 FGO OUTLET DAMPER	FG-BF2-HV0026	POPPET DAMPER																			81PFB01-11040 Bag House Filter Main Duct	0	
494FG-BF3-GS0002	BHF COMP 3 FGO INLET DAMPER, OPEN	FG-BF3-GS0002-S	LIMIT SWITCH																			81PFB01-11040 Bag House Filter Main Duct	0	
495FG-BF3-GS0003	BHF COMP 3 FGO INLET DAMPER, CLOSED	FG-BF3-GS0003-S	LIMIT SWITCH					1														81PFB01-11040 Bag House Filter Main Duct	0	
496FG-BF3-GS0027	BHF COMP 3 FGO OUTLET DAMPER, OPEN	FG-BF3-GS0027-S	LIMIT SWITCH									1										81PFB01-11040 Bag House Filter Main Duct	0	
497FG-BF3-GS0029	BHF COMP 3 FGO OUTLET DAMPER, CLOSED	FG-BF3-GS0029-S	LIMIT SWITCH																			81PFB01-11040 Bag House Filter Main Duct	0	
498FG-BF3-HS0001	BHF COMP 3 FGO INLET DAMPER	FG-BF3-0001-HS-V-Z-EV	SOLENOID VALVE						1													81PFB01-11040 Bag House Filter Main Duct	0	
499FG-BF3-HS0001	BHF COMP 3 FGO INLET DAMPER	FG-BF3-HV0001	ON-OFF FLAP									2										81PFB01-11040 Bag House Filter Main Duct	0	
500FG-BF3-HS0026	BHF COMP 3 FGO OUTLET DAMPER	FG-BF3-0026-HS-V-Z-EV	SOLENOID VALVE										2									81PFB01-11040 Bag House Filter Main Duct	0	
501FG-BF3-HS0026	BHF COMP 3 FGO OUTLET DAMPER	FG-BF3-HV0026	POPPET DAMPER																			81PFB01-11040 Bag House Filter Main Duct	0	
502FG-BF4-GS0002	BHF COMP 4 FGO INLET DAMPER, OPEN	FG-BF4-GS0002-S	LIMIT SWITCH										1									81PFB01-11040 Bag House Filter Main Duct	0	
503FG-BF4-GS0003	BHF COMP 4 FGO INLET DAMPER, CLOSED	FG-BF4-GS0003-S	LIMIT SWITCH																			81PFB01-11040 Bag House Filter Main Duct	0	
504FG-BF4-GS0027	BHF COMP 4 FGO OUTLET DAMPER, OPEN	FG-BF4-GS0027-S	LIMIT SWITCH																			81PFB01-11040 Bag House Filter Main Duct	0	
505FG-BF4-GS0029	BHF COMP 4 FGO OUTLET DAMPER, CLOSED	FG-BF4-GS0029-S	LIMIT SWITCH										1									81PFB01-11040 Bag House Filter Main Duct	0	
506FG-BF4-HS0001	BHF COMP 4 FGO INLET DAMPER	FG-BF4-0001-HS-V-Z-EV	SOLENOID VALVE											2								81PFB01-11040 Bag House Filter Main Duct	0	
507FG-BF4-HS0001	BHF COMP 4 FGO INLET DAMPER	FG-BF4-HV0001	ON-OFF FLAP																			81PFB01-11040 Bag House Filter Main Duct	0	
508FG-BF4-HS0026	BHF COMP 4 FGO OUTLET DAMPER	FG-BF4-0026-HS-V-Z-EV	SOLENOID VALVE											2								81PFB01-11040 Bag House Filter Main Duct	0	
509FG-BF4-HS0026	BHF COMP 4 FGO OUTLET DAMPER	FG-BF4-HV0026	POPPET DAMPER																			81PFB01-11040 Bag House Filter Main Duct	0	
510FG-BHF-HS0085	BHF ALARM TEST BUTTON	FG-BHF-HS0085-S01	PUSH-BUTTON																			81PFB01-11040 Bag House Filter Main Duct	0	
511FG-BHF-HS0084	BHF ALARM HORN AND LAMP	FG-BHF-HS0084-H01	SIREN INDICATOR LIGHT										1									81PFB01-11040 Bag House Filter Main Duct	0	
512FG-FLG-PD0155	FG DPI OVER BAG HOUSE FILTER	FG-FLG-PD0155-E 1	PRESSURE MEASUREMENT CONT																			81PFB01-11040 Bag House Filter Main Duct	0	
513FG-FLG-PD0155	FG DPI OVER BAG HOUSE FILTER	FG-FLG-PD0155-E 2	PRESSURE MEASUREMENT CONT																			81PFB01-11040 Bag House Filter Main Duct	0	
514FG-FLG-PD0155	FG DPI OVER BAG HOUSE FILTER	FG-FLG-PD0155-T	PRESSURE DIFFERENCE TRANSM																1			81PFB01-11040 Bag House Filter Main Duct	0	
515FG-FLG-Q0157	BHF DUST LEAK MEASUREMENT	FG-FLG-Q0157-E	ANALYZER, GENERAL																			81PFB01-11040 Bag House Filter Main Duct	0	
516FG-FLG-Q0157	BHF DUST LEAK MEASUREMENT	FG-FLG-Q0157-T	DUST TRANSMITTER																			81PFB01-11040 Bag House Filter Main Duct	0	
517FG-FLG-T0154	FG TEMPERATURE BEFORE BHF MAIN DUCT	FG-FLG-T0154-E	RESISTANCE TEMPERATURE SEN																			81PFB01-11040 Bag House Filter Main Duct	0	
518FG-FLG-T0154	FG TEMPERATURE BEFORE BHF MAIN DUCT	FG-FLG-T0154-T	TEMPERATURE TRANSMITTER																			81PFB01-11040 Bag House Filter Main Duct	0	
519FG-FLG-TS0483	EXHAUST AIR FAN TEMPERATURE SWITCH, PENTHOUSE	FG-FLG-TS0483-S	THERMO SWITCH																			81PFB01-11040 Bag House Filter Main Duct	0	
520FG-FLG-TS0484	EXHAUST AIR FAN TEMPERATURE SWITCH, LOBBY	FG-FLG-TS0484-S	THERMO SWITCH																			81PFB01-11040 Bag House Filter Main Duct	0	
521AY-SER-P0005	TRANSF. AIR PRESSURE REGULATOR TO BHF. LOCAL	AY-SER-P0005-I	PRESSURE GAUGE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
522AY-SER-P0040	CLEANING AIR PRESSURE	AY-SER-P0040-E	PRESSURE MEASUREMENT CONT																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
523AY-SER-P0040	CLEANING AIR PRESSURE	AY-SER-P0040-T	PRESSURE TRANSMITTER																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
524FG-BF1-HS0004	BHF COMP 1 HEADER TANK VALVE	FG-BF1-HV0004	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
525FG-BF1-HS0007	BHF COMP 1 PULSE VALVE 1	FG-BF1-HV0007	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
526FG-BF1-HS0008	BHF COMP 1 PULSE VALVE 2	FG-BF1-HV0008	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
527FG-BF1-HS0009	BHF COMP 1 PULSE VALVE 3	FG-BF1-HV0009	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
528FG-BF1-HS0010	BHF COMP 1 PULSE VALVE 4	FG-BF1-HV0010	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
529FG-BF1-HS0011	BHF COMP 1 PULSE VALVE 5	FG-BF1-HV0011	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
530FG-BF1-HS0012	BHF COMP 1 PULSE VALVE 6	FG-BF1-HV0012	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
531FG-BF1-HS0013	BHF COMP 1 PULSE VALVE 7	FG-BF1-HV0013	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
532FG-BF1-HS0014	BHF COMP 1 PULSE VALVE 8	FG-BF1-HV0014	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
533FG-BF1-HS0015	BHF COMP 1 PULSE VALVE 9	FG-BF1-HV0015	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
534FG-BF1-HS0016	BHF COMP 1 PULSE VALVE 10	FG-BF1-HV0016	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
535FG-BF1-HS0017	BHF COMP 1 PULSE VALVE 11	FG-BF1-HV0017	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
536FG-BF1-HS0018	BHF COMP 1 PULSE VALVE 12	FG-BF1-HV0018	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
537FG-BF1-HS0019	BHF COMP 1 PULSE VALVE 13	FG-BF1-HV0019	SOLENOID VALVE																			81PFB01-11040.1 BHF Compartments 1 & 2	0	
538FG-BF1-HS0020	BHF COMP 1 PULSE VALVE 14	FG-BF1-HV0020	SOLENOID VALVE													</								

Loop TAG	Loop description	Instrument TAG	Instrument Description	BUS	DCS AI	DCS AO	DCS DI	DCS DO	SIS AI	SIS AO	SIS DI	SIS DO	BMS AI	BMS AO	BMS DI	BMS DO	PLC AI	PLC AO	PLC DI	PLC DO	HW	PI-flow	Remarks	Rev
821AH-COR-HS0073	BA DRAG CONVEYOR SLIDE GATE	AH-COR-0073-HS-V-Z-Y-S	CLOSE LIMIT SWITCH																			81PFB01-16001 Bottom Ash Handling	0	
822AH-COR-HS0073	BA DRAG CONVEYOR SLIDE GATE	AH-COR-0073-HS-V-Z-Y-S	OPEN LIMIT SWITCH					1														81PFB01-16001 Bottom Ash Handling	0	
823AH-COR-HS0073	BA DRAG CONVEYOR SLIDE GATE	AH-COR-HV0073	SLIDE GATE																			81PFB01-16001 Bottom Ash Handling	0	
824AH-COR-HS0081	BOTTOM ASH DRAG CONVEYOR, JOG SWITCH	AH-COR-HS0081-S10	JOG SWITCH, REV-AUTO-FOR					2														81PFB01-16001 Bottom Ash Handling	0	
825AH-COR-HS0082	BOTTOM ASH DISCHARGE CONVEYOR, JOG SWITCH	AH-COR-HS0082-S10	JOG SWITCH, REV-AUTO-FOR					2														81PFB01-16001 Bottom Ash Handling	0	
826AH-COR-HS0083	ASH CONTAINER 1 SCREW, JOG SWITCH	AH-COR-HS0083-S10	JOG SWITCH, REV-AUTO-FOR					2														81PFB01-16001 Bottom Ash Handling	0	
827AH-COR-HS0084	ASH CONTAINER 2 SCREW, JOG SWITCH	AH-COR-HS0084-S10	JOG SWITCH, REV-AUTO-FOR					2														81PFB01-16001 Bottom Ash Handling	0	
828AH-COR-HS0107	BOTTOM ASH ELEVATOR, JOG SWITCH	AH-COR-HS0107-S10	JOG SWITCH, AUTO-FOR					1														81PFB01-16001 Bottom Ash Handling	0	
829AH-COR-S0016	ASH CONTAINER 1 LEVEL SWITCH	AH-COR-S0016-S	LEVEL LIMIT SWITCH					1														81PFB01-16001 Bottom Ash Handling	0	
830AH-COR-S0017	ASH CONTAINER 2 LEVEL SWITCH	AH-COR-S0017-S	LEVEL LIMIT SWITCH					1														81PFB01-16001 Bottom Ash Handling	0	
831AH-COR-S00075	BOTTOM ASH DRAG CONVEYOR, SPEED	AH-COR-SSW0075	SOFTWARE LOOP					1														81PFB01-16001 Bottom Ash Handling	0	
832AH-COR-S00112	BOTTOM ASH ELEVATOR, SPEED CTRL	AH-COR-SSW0112	SOFTWARE LOOP					1														81PFB01-16001 Bottom Ash Handling	0	
833AH-COR-SS00031	BA DRAG CONVEYOR, SPEED SWITCH	AH-COR-SS00031-S	SPEED SWITCH					1														81PFB01-16001 Bottom Ash Handling	0	
834AH-COR-SS0032	ASH CONTAINER 1 SCREW, SPEED SWITCH	AH-COR-SS0032-S	SPEED SWITCH					1														81PFB01-16001 Bottom Ash Handling	0	
835AH-COR-SS0034	ASH CONTAINER 2 SCREW, SPEED SWITCH	AH-COR-SS0034-S	SPEED SWITCH					1														81PFB01-16001 Bottom Ash Handling	0	
836AH-COR-SS0035	BA DISCHARGE CONVEYOR, SPEED SWITCH	AH-COR-SS0035-S	SPEED SWITCH					1														81PFB01-16001 Bottom Ash Handling	0	
837AH-COR-SS0108	BOTTOM ASH ELEVATOR, SPEED SWITCH	AH-COR-SS0108-S	SPEED SWITCH					1														81PFB01-16001 Bottom Ash Handling	0	
838AH-COR-T00036	BOTTOM ASH CHUTE 1 TEMPERATURE	AH-COR-T00036-E	THERMOCOUPLE TEMPERATURE					1														81PFB01-16001 Bottom Ash Handling	0	
839AH-COR-T00037	BOTTOM ASH CHUTE 2 TEMPERATURE	AH-COR-T00037-E	THERMOCOUPLE TEMPERATURE					1														81PFB01-16001 Bottom Ash Handling	0	
840AH-COR-T00037	BOTTOM ASH CHUTE 2 TEMPERATURE	AH-COR-T00037-T	TEMPERATURE TRANSMITTER					1														81PFB01-16001 Bottom Ash Handling	0	
841AH-COR-T00037	BOTTOM ASH CHUTE 2 TEMPERATURE	AH-COR-T00037-E	THERMOCOUPLE TEMPERATURE					1														81PFB01-16001 Bottom Ash Handling	0	
842AH-COR-T00038	BOTTOM ASH CHUTE 3 TEMPERATURE	AH-COR-T00038-E	THERMOCOUPLE TEMPERATURE					1														81PFB01-16001 Bottom Ash Handling	0	
843AH-COR-T00038	BOTTOM ASH CHUTE 3 TEMPERATURE	AH-COR-T00038-T	TEMPERATURE TRANSMITTER					1														81PFB01-16001 Bottom Ash Handling	0	
844AH-COR-T00039	BOTTOM ASH CHUTE 4 TEMPERATURE	AH-COR-T00039-E	THERMOCOUPLE TEMPERATURE					1														81PFB01-16001 Bottom Ash Handling	0	
845AH-COR-T00039	BOTTOM ASH CHUTE 4 TEMPERATURE	AH-COR-T00039-T	TEMPERATURE TRANSMITTER					1														81PFB01-16001 Bottom Ash Handling	0	
846AW-CWA-FS0018	CW RETURN FLOW FROM BA DRAG CONVEYOR	AW-CWA-FS0018-I	ROTAMETER WITH LIMIT SWITCH																			81PFB01-16001 Bottom Ash Handling	0	
847AW-CWA-FS0018	CW RETURN FLOW FROM BA DRAG CONVEYOR	AW-CWA-FS0018-GS	ROTAMETER LIMIT SWITCH					1														81PFB01-16001 Bottom Ash Handling	0	
848AW-CWA-HS00025	CW VALVE TO BA DRAG CONVEYOR	AW-CWA-0025-HS-V-Z-EV	SOLENOID VALVE						1													81PFB01-16001 Bottom Ash Handling	0	
849AW-CWA-HS00025	CW VALVE TO BA DRAG CONVEYOR	AW-CWA-0025-HS-V-Z-Y	CLOSE LIMIT SWITCH					1														81PFB01-16001 Bottom Ash Handling	0	
850AW-CWA-HS00025	CW VALVE TO BA DRAG CONVEYOR	AW-CWA-0025-HS-V-Z-Y	OPEN LIMIT SWITCH					1														81PFB01-16001 Bottom Ash Handling	0	
851AW-CWA-HS00025	CW VALVE TO BA DRAG CONVEYOR	AW-CWA-HV0025	ON-OFF VALVE																			81PFB01-16001 Bottom Ash Handling	0	
852AH-COR-HS0094	BOTTOM ASH SIEVE, JOG SWITCH	AH-COR-HS0094-S10	JOG SWITCH, REV-AUTO-FOR					2														81PFB01-16003 Bottom Ash Sieving	0	
853AH-COR-HS0211	SIEVE CLEANING AIR VALVE 1	AH-COR-HV0211	SOLENOID VALVE					1														81PFB01-16003 Bottom Ash Sieving	0	
854AH-COR-HS0212	SIEVE CLEANING AIR VALVE 2	AH-COR-HV0212	SOLENOID VALVE					1														81PFB01-16003 Bottom Ash Sieving	0	
855AH-COR-HS0213	SIEVE CLEANING AIR VALVE 3	AH-COR-HV0213	SOLENOID VALVE					1														81PFB01-16003 Bottom Ash Sieving	0	
856AH-COR-SS00095	BOTTOM ASH SIEVE, SPEED SWITCH	AH-COR-SS00095-S	SPEED SWITCH					1														81PFB01-16003 Bottom Ash Sieving	0	
857FH-SNF-HI0140	RECIRC MATERIAL PNEUM. TRANSM. CONVEYING	FH-SNF-HI0140-H01	PILOT LAMP					1														81PFB01-16003 Bottom Ash Sieving	0	
858FH-SNF-HI0140	RECIRC MATERIAL PNEUM. TRANSM. FAILURE	FH-SNF-HI0140-H01	PILOT LAMP					1														81PFB01-16003 Bottom Ash Sieving	0	
859FH-SNF-HS0034	RECIRC MATERIAL PNEUM. TRANSM. FILL UP VALVE	FH-SNF-0034-HS-V-Z-EV	SOLENOID VALVE					1														81PFB01-16003 Bottom Ash Sieving	0	
860FH-SNF-HS0034	RECIRC MATERIAL PNEUM. TRANSM. FILL UP VALVE	FH-SNF-HV0034	ON-OFF VALVE					1														81PFB01-16003 Bottom Ash Sieving	0	
861FH-SNF-HS0036	RECIRC MATERIAL PNEUM. TRANSM. SEALING VALVE	FH-SNF-HV0036	SOLENOID VALVE					1														81PFB01-16003 Bottom Ash Sieving	0	
862FH-SNF-HS0037	RECIRC MATERIAL PNEUM. TRANSM. FLUIDIZATION VALVE	FH-SNF-0037-HS-V-Z-EV	SOLENOID VALVE					1														81PFB01-16003 Bottom Ash Sieving	0	
863FH-SNF-HS0037	RECIRC MATERIAL PNEUM. TRANSM. FLUIDIZATION VALVE	FH-SNF-HV0037	ON-OFF VALVE					1														81PFB01-16003 Bottom Ash Sieving	0	
864FH-SNF-HS0038	RECIRC MATERIAL PNEUM. TRANSM. BLOW VALVE	FH-SNF-0038-HS-V-Z-EV	SOLENOID VALVE					1														81PFB01-16003 Bottom Ash Sieving	0	
865FH-SNF-HS0038	RECIRC MATERIAL PNEUM. TRANSM. BLOW VALVE	FH-SNF-HV0038	ON-OFF VALVE					1														81PFB01-16003 Bottom Ash Sieving	0	
866FH-SNF-HS0039	RECIRC MATERIAL PNEUM. TRANSM. EXTRA BLOW VALVE	FH-SNF-0039-HS-V-Z-EV	SOLENOID VALVE					1														81PFB01-16003 Bottom Ash Sieving	0	
867FH-SNF-HS0039	RECIRC MATERIAL PNEUM. TRANSM. EXTRA BLOW VALVE	FH-SNF-HV0039	ON-OFF VALVE					1																

No. 1	Loop TAG	Loop description	Instrument TAG	Instrument Description	IBUS	DCS AI	DCS AO	DCS DI	DCS DO	SIS AI	SIS AO	SIS DI	SIS DO	BMS AI	BMS AO	BMS DI	BMS DO	PLC AI	PLC AO	PLC DI	PLC DO	HW	Pi-flow	Remarks	Rev
985	AH-FSD-P10089	FA PNEUM. TRANSMITTER 3 INA PRESSURE	AH-FSD-P10089-E	PRESSURE MEASUREMENT COM																				B1PFB01-16070 Fly Ash Transportation	0
986	AH-FSD-P10089	FA PNEUM. TRANSMITTER 3 INA PRESSURE	AH-FSD-P10089-T	PRESSURE TRANSMITTER																				B1PFB01-16070 Fly Ash Transportation	0
987	AH-FSD-P10090	FA PNEUM. TRANSMITTER 4 PRESSURE	AH-FSD-P10090-E	PRESSURE MEASUREMENT COM																				B1PFB01-16070 Fly Ash Transportation	0
988	AH-FSD-P10090	FA PNEUM. TRANSMITTER 4 PRESSURE	AH-FSD-P10090-T	PRESSURE TRANSMITTER																				B1PFB01-16070 Fly Ash Transportation	0
989	AH-FSD-P10091	FA PNEUM. TRANSMITTER 4 INA PRESSURE	AH-FSD-P10091-E	PRESSURE MEASUREMENT COM																				B1PFB01-16070 Fly Ash Transportation	0
990	AH-FSD-P10091	FA PNEUM. TRANSMITTER 4 INA PRESSURE	AH-FSD-P10091-T	PRESSURE TRANSMITTER																				B1PFB01-16070 Fly Ash Transportation	0
991	AH-FCO-GS0001	FLY ASH DRY UNLOADING, POSITION UP	AH-FCO-0001-GS-SO	OPEN LIMIT																				B1PFB01-16082 Fly Ash Storage & Discharging	0
992	AH-FCO-GS0002	FLY ASH DRY UNLOADING, POSITION DOWN	AH-FCO-0002-GS-SC	CLOSE LIMIT																				B1PFB01-16082 Fly Ash Storage & Discharging	0
993	AH-FCO-GS0002	FLY ASH DRY UNLOADING, POSITION DOWN	AH-FCO-GS0002-DO	DISTANCE LENGTH																				B1PFB01-16082 Fly Ash Storage & Discharging	0
994	AH-FCO-GS0310	FLY ASH DRY UNLOADING, SLACK WIRE	AH-FCO-0310-GS-SO	OPEN LIMIT																				B1PFB01-16082 Fly Ash Storage & Discharging	0
995	AH-FCO-GS0310	FLY ASH DRY UNLOADING, SLACK WIRE	AH-FCO-GS0310-E	POINT CONNECTION, DISTANCE																				B1PFB01-16082 Fly Ash Storage & Discharging	0
996	AH-FCO-HS0016	FLY ASH SILO DUST REMOVAL VALVE	AH-FCO-0016-HS-V-Z	PISTON																				B1PFB01-16082 Fly Ash Storage & Discharging	0
997	AH-FCO-HS0016	FLY ASH SILO DUST REMOVAL VALVE	AH-FCO-0016-HS-V-Z-EV	SOLENOID VALVE																				B1PFB01-16082 Fly Ash Storage & Discharging	0
998	AH-FCO-HS0016	FLY ASH SILO DUST REMOVAL VALVE	AH-FCO-0016-HS-V-Z-S	CLOSE LIMIT SWITCH																				B1PFB01-16082 Fly Ash Storage & Discharging	0
999	AH-FCO-HS0016	FLY ASH SILO DUST REMOVAL VALVE	AH-FCO-0016-HS-V-Z-S	OPEN LIMIT SWITCH																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1000	AH-FCO-HS0016	FLY ASH SILO DUST REMOVAL VALVE	AH-FCO-HV0016	ON-OFF VALVE																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1001	AH-FCO-HS0043	FA DRY UNLOADING ROTARY FEEDER, JOG SWITCH	AH-FCO-HS0043-S10	JOG SWITCH, REV-AUTO-FOR																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1002	AH-FCO-HS0049	FA DRY UNLOADING UP	AH-FCO-HS0049-S01	PUSH-BUTTON																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1003	AH-FCO-HS0079	FA DRY UNLOADING FAST STOP	AH-FCO-HS0079-S01	PUSH-BUTTON																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1004	AH-FCO-HS0080	FA DRY UNLOADING START	AH-FCO-HS0080-S01	PUSH-BUTTON																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1005	AH-FCO-HS0081	FA DRY UNLOADING STOP	AH-FCO-HS0081-S01	PUSH-BUTTON																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1006	AH-FCO-HS0082	FA DRY UNLOADING DOWN	AH-FCO-HS0082-S01	PUSH-BUTTON																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1007	AH-FCO-HS0085	FA DRY UNLOADING FLUIDIZING AIR VALVE	AH-FCO-HV0085	SOLENOID VALVE																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1008	AH-FCO-LI0017	FLY ASH SILO LEVEL	AH-FCO-LI0017-E	LEVEL MEASUREMENT CONNECT																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1009	AH-FCO-LI0017	FLY ASH SILO LEVEL	AH-FCO-LI0017-T	RADAR TRANSMITTER																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1010	AH-FCO-LS0018	FLY ASH SILO LEVEL	AH-FCO-LS0018-S	LEVEL SWITCH, VIBRATION																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1011	AH-FCO-LS0107	FLY ASH DRY UNLOADING LEVEL	AH-FCO-LS0107-S	LEVEL																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1012	AH-FCO-P10128	TRANSPORT AIR PRESSURE REGULATOR, LOCAL	AH-FCO-P10128-I	PRESSURE GAUGE																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1013	AH-FCO-P10129	FA DRY UNLOADING PRESSURE REGULATOR, LOCAL	AH-FCO-P10129-I	PRESSURE GAUGE																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1014	AH-FCO-SS0030-S	FA DRY UNLOADING ROTARY FEEDER, SPEED SWITCH	AH-FCO-SS0030-S	SPEED SWITCH																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1015	AH-FCO-XS0086	FLY ASH SILO FILTER CLEANING UNIT	AH-FCO-XS0086-S	SWITCH																				B1PFB01-16082 Fly Ash Storage & Discharging	0
1016	AF-NGS-HS0005	NATURAL GAS VENT VALVE	AF-NGS-0005-HS-V-Z-EV	SOLENOID VALVE																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1017	AF-NGS-HS0005	NATURAL GAS VENT VALVE	AF-NGS-0005-HS-V-Z-S	CLOSE LIMIT SWITCH																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1018	AF-NGS-HS0005	NATURAL GAS VENT VALVE	AF-NGS-0005-HS-V-Z-S	OPEN LIMIT SWITCH																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1019	AF-NGS-HS0005	NATURAL GAS VENT VALVE	AF-NGS-HV0005	ON-OFF VALVE																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1020	AF-NGS-P10026	NATURAL GAS FILTER DP	AF-NGS-P10026-EA	PRESSURE MEASUREMENT COM																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1021	AF-NGS-P10026	NATURAL GAS FILTER DP	AF-NGS-P10026-S	PRESSURE MEASUREMENT COM																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1022	AF-NGS-P10026	NATURAL GAS FILTER DP	AF-NGS-P10026-T	PRESSURE DIFFERENCE TRANSM																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1023	AF-NGS-P10027	NATURAL GAS PRESSURE, LOCAL	AF-NGS-P10027-I	PRESSURE GAUGE																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1024	AF-NGS-P10027	NATURAL GAS PRESSURE, LOCAL	AF-NGS-P10027-A	POINT CONNECTION, PRESSURE																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1025	AF-NGS-P10028	NATURAL GAS PRESSURE	AF-NGS-P10028-E	PRESSURE MEASUREMENT COM																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1026	AF-NGS-P10028	NATURAL GAS PRESSURE	AF-NGS-P10028-T	PRESSURE TRANSMITTER																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1027	AF-NGS-P10029	IGNITION GAS PRESSURE REDUCER, LOCAL	AF-NGS-P10029-I	PRESSURE GAUGE																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1028	AF-NGS-P10030	IGNITION GAS PRESSURE TO BURNER	AF-NGS-P10030-E	PRESSURE MEASUREMENT COM																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1029	AF-NGS-P10030	IGNITION GAS PRESSURE TO BURNER	AF-NGS-P10030-T	PRESSURE TRANSMITTER																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1030	AF-NGS-P10031	IGNITION GAS PRESSURE TO BURNER, LOCAL	AF-NGS-P10031-I	PRESSURE GAUGE																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1031	AF-NGS-P10031	IGNITION GAS PRESSURE TO BURNER, LOCAL	AF-NGS-P10031-A	POINT CONNECTION, PRESSURE																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1032	AF-NGS-QS0062	NATURAL GAS FILTER GAS DETECTOR	AF-NGS-QS0062-T	NATURAL GAS DETECTOR																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1033	AF-NGS-T10047	NATURAL GAS TEMPERATURE	AF-NGS-T10047-E	RESISTANCE TEMPERATURE SEN																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1034	AF-NGS-T10047	NATURAL GAS TEMPERATURE	AF-NGS-T10047-T	TEMPERATURE TRANSMITTER																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1035	AF-NGS-T10047	NATURAL GAS TEMPERATURE	AF-NGS-T10047-W	THERMOWELL																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1036	AY-INA-P10007	INA PRESSURE TO START-UP BURNER	AY-INA-P10007-E	PRESSURE MEASUREMENT COM																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1037	AY-INA-P10007	INA PRESSURE TO START-UP BURNER	AY-INA-P10007-T	PRESSURE TRANSMITTER																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1038	AY-INA-P10008	INA PRESSURE TO START-UP BURNER, LOCAL	AY-INA-P10008-E	PRESSURE MEASUREMENT COM																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1039	AY-INA-P10008	INA PRESSURE TO START-UP BURNER, LOCAL	AY-INA-P10008-T	PRESSURE TRANSMITTER																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1040	BU-BBU-HS0003	AUXILIARY FUEL EMERGENCY STOP, START-UP BURNER LEVEL	BU-BBU-HS0003-S01	EMERGENCY SWITCH																				B1PFB01-19010 Natural Gas to Start-up Burner	0
1041	AF-S01-B10001	SUB FLAME SCANNER	AF-S01-B10001-E	FLAME SCANNER																				B1PFB01-19015 Start-up Burner	0
1042	AF-S01-B10001	SUB FLAME SCANNER	AF-S01-B10001-T	FLAME SCANNER CONTROL UNIT																				B1PFB01-19015 Start-up Burner	0
1043	AF-S01-BS0002	SUB IGNITER	AF-S01-BS0002-S	IGNITER																				B1PFB01-19015 Start-up Burner	0
1044	AF-S01-BS0002	SUB IGNITER	AF-S01-BS0002-T	IGNITER CONTROL UNIT																				B1PFB01-19015 Start-up Burner	0
1045	AF-S01-FC0008	SUB NATURAL GAS FLOW	AF-S01-0008-FC-V-Z-Y	POSITIONER																				B1PFB01-19015 Start-up Burner	0
1046	AF-S01-FC0008	SUB NATURAL GAS FLOW	AF-S01-FV0008	CONTROL VALVE																				B1PFB01-19015 Start-up Burner	0
1047	AF-S01-FC0020	SUB COMBUSTION AIR FLOW	AF-S01-0020-FC-V-Z-Y	POSITIONER																				B1PFB01-19015 Start-up Burner	0
1048	AF-S01-FC0020	SUB COMBUSTION AIR FLOW	AF-S01-FV0020	CONTROL FLAP																				B1PFB01-19015 Start-up Burner	0
1049	AF-S01-FV0008	SUB NATURAL GAS FLOW	AF-S01-FV0008-E	STANDARD ORIFICE, GEN																				B1PFB01-19015 Start-up Burner	0
1050	AF-S01-FV0008	SUB NATURAL GAS FLOW	AF-S01-FV0008-T	PRESSURE DIFFERENCE TRANSM																				B1PFB01-19015 Start-up Burner	0
1051	AF-S01-F10015	SUB INA FLOW TO FLAME SCANNER, LOCAL	AF-S01-F10015-I	ROTAMETER																				B1PFB01-19015 Start-up Burner	0
1052	AF-S01-F10017	SUB INA FLOW TO IGNITER, LOCAL	AF-S01-F10017-I	ROTAMETER																				B1PFB01-19015 Start-up Burner	0
1053	AF-S01-GS0005	SUB GAS LANCE INSERTED	AF-S01-GS0005-S	LIMIT SWITCH																				B1PFB01-19015 Start-up Burner	0
1054	AF-S01-HS0006	SUB IGNITION GAS VALVE 1	AF-S01-0006-HS-V-Z-06	SOLENOID VALVE																				B1PFB01-19015 Start-up Burner	0
1055	AF-S01-HS0																								

© Valmet

Valmet

Instrument Index (Sales)

SKG Energy BFB

BFB21-00942

Sum:

0

184

21

306

95

41

0

43

15

0

0

10

6

9

0

4

0

0

Draft

No.	1	Loop TAG	Loop description	Instrument TAG	Instrument Description	BUS	DCS AI	DCS AO	DCS DI	DCS DO	SIS AI	SIS AO	SIS DI	SIS DO	BMS AI	BMS AO	BMS DI	BMS DO	PLC AI	PLC AO	PLC DI	PLC DO	HW	Pl-flow	Remarks	Rev
1313	FG-BF3-HS0043		BHF COMP 3 PULSE VALVES MODE	FG-BF3-HSW0043	SOFTWARE LOOP																			Not in document		0
1314	FG-BF3-XS0038		BHF COMP 3 CLEANING PULSE	FG-BF3-XSW0038	SOFTWARE LOOP																			Not in document		0
1315	FG-BF3-XS0039		BHF COMP 3 FLUE GAS ROUTE	FG-BF3-XSW0039	SOFTWARE LOOP																			Not in document		0
1316	FG-BF4-HS0035		BHF COMP 4 PULSE COUNT RESET PW PROTECTED	FG-BF4-HSW0035	SOFTWARE LOOP																			Not in document		0
1317	FG-BF4-HS0037		BHF COMP 4 VALVE ALARM RESET	FG-BF4-HSW0037	SOFTWARE LOOP																			Not in document		0
1318	FG-BF4-HS0042		BHF COMP 4 DAMPERS CONTROL	FG-BF4-HSW0042	SOFTWARE LOOP																			Not in document		0
1319	FG-BF4-HS0043		BHF COMP 4 PULSE VALVES MODE	FG-BF4-HSW0043	SOFTWARE LOOP																			Not in document		0
1320	FG-BF4-XS0038		BHF COMP 4 CLEANING PULSE	FG-BF4-XSW0038	SOFTWARE LOOP																			Not in document		0
1321	FG-BF4-XS0039		BHF COMP 4 FLUE GAS ROUTE	FG-BF4-XSW0039	SOFTWARE LOOP																			Not in document		0



List
Instrument index (Sales)

Status Draft
Issue Status

Project Name: SKo Energo 2 X CFB Rebuild FGT
Project Key:
Project Number: ERC21-00349

Document ID:
Customer Document ID:
Revision:

Instructions

Don't delete or reorder columns

You can delete row if it is not relevant

Revision markup

Deleted rows option: Don't show deleted rows

Revision monitoring: Show changes from last revision

Font styles

Strikeout removed text: Yes

Use italic font for new/changed cells: Yes

Text & Cell colors

New text

Modified text

Removed text color

Editable cell backgroud

Read only cell backgroud

Rev	Revision Note	Created by	Checked by	Approved by	Date
*	Revision	FTAMSTE			2024-09-06

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.

Loop TAG	Loop description	Instrument TAG	Instrument Description	BUS	DCS AI	DCS AO	DCS DI	DCS DO	SIS AI	SIS AO	SIS DI	SIS DO	BMS AI	BMS AO	BMS DI	BMS DO	IPLC AI	IPLC AO	IPLC DI	IPLC DO	HW	Pt-flow	Remarks	Rev
1AF-L19-F0011	OIL LANCE COMBUSTION AIR FLOW	AF-L19-F0011-E	AEROFOL																			C1PFB01-09050 Secondary Air		0
2AF-L19-F0011	OIL LANCE COMBUSTION AIR FLOW	AF-L19-F0011-T	PRESSURE DIFFERENCE TRANSN																			C1PFB01-09050 Secondary Air		0
3AF-S01-F0020	SUB 1 COMBUSTION AIR FLOW	AF-S01-F0020-E	AEROFOL																			C1PFB01-09050 Secondary Air		0
4AF-S01-F0020	SUB 1 COMBUSTION AIR FLOW	AF-S01-F0020-T	PRESSURE DIFFERENCE TRANSN																			C1PFB01-09050 Secondary Air		0
5AF-S02-F0025	SUB 2 COMBUSTION AIR FLOW	AF-S02-F0025-E	AEROFOL																			C1PFB01-09050 Secondary Air		0
6AF-S02-F0025	SUB 2 COMBUSTION AIR FLOW	AF-S02-F0025-T	PRESSURE DIFFERENCE TRANSN																			C1PFB01-09050 Secondary Air		0
7CA-SEA-I0003	LOWER SECONDARY AIR FLOW	CA-SEA-I0003-E	AEROFOL																			C1PFB01-09050 Secondary Air		0
8CA-SEA-I0003	LOWER SECONDARY AIR FLOW	CA-SEA-I0003-T	PRESSURE DIFFERENCE TRANSN																			C1PFB01-09050 Secondary Air		0
9CA-SEA-H0060	UPPER SECONDARY AIR FLOW	CA-SEA-H0060-E	AEROFOL																			C1PFB01-09050 Secondary Air		0
10CA-SEA-H0060	UPPER SECONDARY AIR FLOW	CA-SEA-H0060-T	PRESSURE DIFFERENCE TRANSN																			C1PFB01-09050 Secondary Air		0
11CA-SEA-HS5001	LOWER SECONDARY AIR DAMPER	CA-SEA-HV5001	ON-OFF FLAP																			C1PFB01-09050 Secondary Air		0
12CA-SEA-HS5002	UPPER SECONDARY AIR DAMPER	CA-SEA-HV5002	ON-OFF FLAP																			C1PFB01-09050 Secondary Air		0
13BR-FUR-P0108	FURNACE TOP PRESSURE, CALC.	BR-FUR-PSW0108	SOFTWARE LOOP																			C1PFB01-10030 Fuel Gas		0
14BR-FUR-P0109	PRESSURE, FURNACE, TOP LEFT	BR-FUR-P0109-A	PRESSURE MEASUREMENT CONT																			C1PFB01-10030 Fuel Gas		0
15BR-FUR-P0109	PRESSURE, FURNACE TOP, LEFT	BR-FUR-P0109-T	PRESSURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
16BR-FUR-P0110	PRESSURE, FURNACE TOP, MIDDLE	BR-FUR-P0110-E	PRESSURE MEASUREMENT CONT																			C1PFB01-10030 Fuel Gas		0
17BR-FUR-P0110	PRESSURE, FURNACE TOP, MIDDLE	BR-FUR-P0110-T	PRESSURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
18BR-FUR-P0111	PRESSURE, FURNACE TOP, RIGHT	BR-FUR-P0111-E	PRESSURE MEASUREMENT CONT																			C1PFB01-10030 Fuel Gas		0
19BR-FUR-P0111	PRESSURE, FURNACE TOP, RIGHT	BR-FUR-P0111-T	PRESSURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
20BR-FUR-T0015	FLUIDIZED BED MATERIAL TEMPERATURE 1	BR-FUR-T0015-E	THERMOCOUPLE TEMPERATURE																			C1PFB01-10030 Fuel Gas		0
21BR-FUR-T0015	FLUIDIZED BED MATERIAL TEMPERATURE 1	BR-FUR-T0015-T	TEMPERATURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
22BR-FUR-T0016	FLUIDIZED BED MATERIAL TEMPERATURE 2	BR-FUR-T0016-E	THERMOCOUPLE TEMPERATURE																			C1PFB01-10030 Fuel Gas		0
23BR-FUR-T0016	FLUIDIZED BED MATERIAL TEMPERATURE 2	BR-FUR-T0016-T	TEMPERATURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
24BR-FUR-T0017	FLUIDIZED BED MATERIAL TEMPERATURE 3	BR-FUR-T0017-E	THERMOCOUPLE TEMPERATURE																			C1PFB01-10030 Fuel Gas		0
25BR-FUR-T0017	FLUIDIZED BED MATERIAL TEMPERATURE 3	BR-FUR-T0017-T	TEMPERATURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
26BR-FUR-T0018	FLUIDIZED BED MATERIAL TEMPERATURE 4	BR-FUR-T0018-E	THERMOCOUPLE TEMPERATURE																			C1PFB01-10030 Fuel Gas		0
27BR-FUR-T0018	FLUIDIZED BED MATERIAL TEMPERATURE 4	BR-FUR-T0018-T	TEMPERATURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
28BR-FUR-T0019	FLUIDIZED BED MATERIAL TEMPERATURE, CALC.	BR-FUR-T-SW0019	SOFTWARE LOOP																			C1PFB01-10030 Fuel Gas		0
29CA-PRA-F0004	PRIMARY AIR FLOW TO FURNACE	CA-PRA-F0004-E	AEROFOL																			C1PFB01-10030 Fuel Gas		0
30CA-PRA-F0004	PRIMARY AIR FLOW TO FURNACE	CA-PRA-F0004-T	PRESSURE DIFFERENCE TRANSN																			C1PFB01-10030 Fuel Gas		0
31FG-FLG-PD0508	FG DIFFERENTIAL PRESSURE OVER BHF	FG-FLG-PD0508-E	PRESSURE MEASUREMENT CONT																			C1PFB01-10030 Fuel Gas		0
32FG-FLG-PD0508	FG DIFFERENTIAL PRESSURE OVER BHF	FG-FLG-PD0508-T	PRESSURE DIFFERENCE TRANSN																			C1PFB01-10030 Fuel Gas		0
33FG-FLG-PD0508	FG DIFFERENTIAL PRESSURE OVER BHF	FG-FLG-PD0508-E	PRESSURE MEASUREMENT CONT																			C1PFB01-10030 Fuel Gas		0
34FG-FLG-P5004	FG PRESSURE 1 AFTER CYCLONE	FG-FLG-P5004-E	PRESSURE MEASUREMENT CONT																			C1PFB01-10030 Fuel Gas		0
35FG-FLG-P5004	FG PRESSURE 1 AFTER CYCLONE	FG-FLG-P5004-T	TEMPERATURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
36FG-FLG-P5005	FG PRESSURE 2 AFTER CYCLONE	FG-FLG-P5005-E	PRESSURE MEASUREMENT CONT																			C1PFB01-10030 Fuel Gas		0
37FG-FLG-P5005	FG PRESSURE 2 AFTER CYCLONE	FG-FLG-P5005-T	PRESSURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
38FG-FLG-P5006	FG PRESSURE 3 AFTER CYCLONE	FG-FLG-P5006-E	PRESSURE MEASUREMENT CONT																			C1PFB01-10030 Fuel Gas		0
39FG-FLG-P5006	FG PRESSURE 3 AFTER CYCLONE	FG-FLG-P5006-T	TEMPERATURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
40FG-FLG-P5007	FG PRESSURE AFTER CYCLONE, CALC.	FG-FLG-PSW5007	SOFTWARE LOOP																			C1PFB01-10030 Fuel Gas		0
41FG-FLG-T0125	FLUE GAS TEMPERATURE AFTER TSH, LEFT	FG-FLG-T0125-E	THERMOCOUPLE TEMPERATURE																			C1PFB01-10030 Fuel Gas		0
42FG-FLG-T0125	FLUE GAS TEMPERATURE AFTER TSH, LEFT	FG-FLG-T0125-T	TEMPERATURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
43FG-FLG-T0126	FLUE GAS TEMPERATURE AFTER TSH, RIGHT	FG-FLG-T0126-E	THERMOCOUPLE TEMPERATURE																			C1PFB01-10030 Fuel Gas		0
44FG-FLG-T0126	FLUE GAS TEMPERATURE AFTER TSH, RIGHT	FG-FLG-T0126-T	TEMPERATURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
45FG-FLG-T5001	FLUE GAS TEMPERATURE AFTER PSB, LEFT	FG-FLG-T5001-E	THERMOCOUPLE TEMPERATURE																			C1PFB01-10030 Fuel Gas		0
46FG-FLG-T5001	FLUE GAS TEMPERATURE AFTER PSB, LEFT	FG-FLG-T5001-T	TEMPERATURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
47FG-FLG-T5002	FLUE GAS TEMPERATURE AFTER PSB, RIGHT	FG-FLG-T5002-E	THERMOCOUPLE TEMPERATURE																			C1PFB01-10030 Fuel Gas		0
48FG-FLG-T5002	FLUE GAS TEMPERATURE AFTER PSB, RIGHT	FG-FLG-T5002-T	TEMPERATURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
49FG-FLG-T5003	FLUE GAS TEMPERATURE BEFORE TSH, RIGHT	FG-FLG-T5003-E	THERMOCOUPLE TEMPERATURE																			C1PFB01-10030 Fuel Gas		0
50FG-FLG-T5003	FLUE GAS TEMPERATURE BEFORE TSH, RIGHT	FG-FLG-T5003-T	TEMPERATURE TRANSMITTER																			C1PFB01-10030 Fuel Gas		0
51SB-SBL-GS0140	SOOTBLOWER XX	SB-SBL-GS0140-SA	LIMIT SWITCH RETRACTED																			C1PFB01-10030 Fuel Gas		0
52SB-SBL-GS0140	SOOTBLOWER XX	SB-SBL-GS0140-SB	LIMIT SWITCH INSERTED																			C1PFB01-10030 Fuel Gas		0
53SB-SBL-GS0140	SOOTBLOWER XX	SB-SBL-GS0140-SC	LIMIT SWITCH APPROACH																			C1PFB01-10030 Fuel Gas		0
54SB-SBL-GS0141	SOOTBLOWER XX	SB-SBL-GS0141-SA	LIMIT SWITCH RETRACTED																			C1PFB01-10030 Fuel Gas		0
55SB-SBL-GS0141	SOOTBLOWER XX	SB-SBL-GS0141-SB	LIMIT SWITCH INSERTED																			C1PFB01-10030 Fuel Gas		0
56SB-SBL-GS0141	SOOTBL OWER XX	SB-SBL-GS0141-SC	LIMIT SWITCH APPROACH																			C1PFB01-10030 Fuel Gas		0
57CB-BAS-F0406	NA2SO3 FEEDING AIR FLOW	FG-BAS-F0406-E	STANDARD ORIFICE, GEN.																			C1PFB01-11080 Bicarbonate		0
58FG-BAS-F0406	NA2SO3 FEEDING AIR FLOW	FG-BAS-F0406-T	FLOW TRANSMITTER																			C1PFB01-11080 Bicarbonate		0
59FG-BAS-F5017	NA2SO3 FEEDING AIR FLOW	FG-BAS-F5017-E	STANDARD ORIFICE, GEN.																			C1PFB01-11080 Bicarbonate		0
60FG-BAS-F5017	NA2SO3 FEEDING AIR FLOW	FG-BAS-F5017-T	FLOW TRANSMITTER																			C1PFB01-11080 Bicarbonate		0
61FG-BAS-HS0226	NAHCO3 DOSING SCREW 1, JOG SWITCH	FG-BAS-HS0226-S10	JOG SWITCH, REV-AUTO-FOR																			C1PFB01-11080 Bicarbonate		0
62FG-BAS-HS5001	NAHCO3 ROTARY VALVE 1, JOG SWITCH	FG-BAS-HS5001-S10	JOG SWITCH, REV-AUTO-FOR																			C1PFB01-11080 Bicarbonate		0
63FG-BAS-HS5003	PRESSURE AIR TO ROTARY FEEDER	FG-BAS-HV5003	SOLENOID VALVE																			C1PFB01-11080 Bicarbonate		0
64FG-BAS-HS5009	NAHCO3 DOSING SCREW 2, JOG SWITCH	FG-BAS-HS5009-S10	JOG SWITCH, REV-AUTO-FOR																			C1PFB01-11080 Bicarbonate		0
65FG-BAS-HS5010	NAHCO3 ROTARY VALVE 2, JOG SWITCH	FG-BAS-HS5010-S10	JOG SWITCH, REV-AUTO-FOR																			C1PFB01-11080 Bicarbonate		0
66FG-BAS-HS5012	PRESSURE AIR TO ROTARY FEEDER	FG-BAS-HV5012	SOLENOID VALVE																			C1PFB01-11080 Bicarbonate		0
67FG-BAS-S5002	NAHCO3 SILO ARCHEMPT1 Y	FG-BAS-S5002-S	LEVEL LIMIT SWITCH																			C1PFB01-11080 Bicarbonate		0
68FG-BAS-S5007	NAHCO3 SILO ARCHEMPT2 Y	FG-BAS-S5007-S	LEVEL LIMIT SWITCH																			C1PFB01-11080 Bicarbonate		0
69FG-BAS-P0066	NAHCO3 FEEDING PRESSURE, LOCAL	FG-BAS-P0066-E	PRESSURE MEASUREMENT CONT																			C1PFB01-11080 Bicarbonate		0
70FG-BAS-P0066	NAHCO3 FEEDING PRESSURE, LOCAL	FG-BAS-P0066-T	PRESSURE GAUGE																			C1PFB01-11080 Bicarbonate		0
71FG-BAS-P0068	NAHCO3 FEEDING AIR PRESSURE, LOCAL	FG-BAS-P0068-E	PRESSURE MEASUREMENT CONT																			C1PFB01-11080 Bicarbonate		0
72FG-BAS-P0068	NAHCO3 FEEDING AIR PRESSURE, LOCAL	FG-BAS-P0068-T	PRESSURE GAUGE																			C1PFB01-11080 Bicarbonate		0
73FG-BAS-P0070	NAHCO3 FEEDING AIR PRESSURE	FG-BAS-P0070-E	PRESSURE MEASUREMENT CONT																			C1PFB01-11080 Bicarbonate		0
74FG-BAS-P0070	NAHCO3 FEEDING AIR PRESSURE	FG-BAS-P0070-T	TEMPERATURE TRANSMITTER																			C1PFB01-11080 Bicarbonate		0
75FG-BAS-P5002	AIR PRESSURE TO ROTARY FEEDER	FG-BAS-P5002-T	PRESSURE GAUGE																			C1PFB01-11080 Bicarbonate		0
76FG-BAS-P5008	NAHCO3 FEEDING PRESSURE, LOCAL	FG-BAS-P5008-E	PRESSURE MEASUREMENT CONT																			C1PFB01-11080 Bicarbonate		0
77FG-BAS-P5008	NAHCO3 FEEDING PRESSURE, LOCAL	FG-BAS-P5008-T	PRESSURE GAUGE																			C1PFB01-110		

No.	Loop TAG	Loop description	Instrument TAG	Instrument Description	BUS	DCS AI	DCS AO	DCS DI	DCS DO	SIS AI	SIS AO	SIS DI	SIS DO	BMS AI	BMS AO	BMS DI	BMS DO	PLC AI	PLC AO	PLC DI	PLC DO	HW	PLC low	Remarks	Rev
166	FH-FSB-HS0230	SILO 2 ROTATING SPREADER, JOG SWITCH	FH-FSB-HS0230-S10	JOG SWITCH, REV-AUTO-FOR	2																		C1PFB01-14030 Fuel Feeding		0
167	FH-FSB-HS0231	SILO 2 RECLAIMER 1, JOG SWITCH	FH-FSB-HS0231-S10	JOG SWITCH, REV-AUTO-FOR	2																		C1PFB01-14030 Fuel Feeding		0
168	FH-FSB-HS0232	SILO 2 REC. TURNING DEVICE, JOG SWITCH	FH-FSB-HS0232-S10	JOG SWITCH, REV-AUTO-FOR	2																		C1PFB01-14030 Fuel Feeding		0
169	FH-FSB-HS0244	FUEL CONVEYOR 1, JOG SWITCH	FH-FSB-HS0244-S10	JOG SWITCH, REV-AUTO-FOR	2																		C1PFB01-14030 Fuel Feeding		0
170	FH-FSB-HS0243	METERING SCREW 1, JOG SWITCH	FH-FSB-HS0243-S10	JOG SWITCH, REV-AUTO-FOR	2																		C1PFB01-14030 Fuel Feeding		0
171	FH-FSB-HS0244	METERING SCREW 2, JOG SWITCH	FH-FSB-HS0244-S10	JOG SWITCH, REV-AUTO-FOR	2																		C1PFB01-14030 Fuel Feeding		0
172	FH-FSB-HS0245	ROTARY FEEDER 1, JOG SWITCH	FH-FSB-HS0245-S10	JOG SWITCH, REV-AUTO-FOR	2																		C1PFB01-14030 Fuel Feeding		0
173	FH-FSB-HS0246	ROTARY FEEDER 2, JOG SWITCH	FH-FSB-HS0246-S10	JOG SWITCH, REV-AUTO-FOR	2																		C1PFB01-14030 Fuel Feeding		0
174	FH-FSB-HS0265	WALL SCREW 1, JOG SWITCH	FH-FSB-HS0265-S	JOG SWITCH, REV-AUTO-FOR	2																		C1PFB01-14030 Fuel Feeding		0
175	FH-FSB-HS0266	WALL SCREW 2, JOG SWITCH	FH-FSB-HS0266-S	JOG SWITCH, REV-AUTO-FOR	2																		C1PFB01-14030 Fuel Feeding		0
176	FH-FSB-HS0264	FUEL SCREW CONVEYOR 2, JOG SWITCH	FH-FSB-HS0264-S10	JOG SWITCH, REV-AUTO-FOR	2																		C1PFB01-14030 Fuel Feeding		0
177	FH-FSB-L00025	FUEL SILO 1 LEVEL 1	FH-FSB-L00025-E	LEVEL MEASUREMENT CONNECT	1																		C1PFB01-14030 Fuel Feeding		0
178	FH-FSB-L00025	FUEL SILO 1 LEVEL 1	FH-FSB-L00025-T	MICRO WAVE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
179	FH-FSB-L00026	FUEL SILO 2 LEVEL 1	FH-FSB-L00026-E	LEVEL MEASUREMENT CONNECT	1																		C1PFB01-14030 Fuel Feeding		0
180	FH-FSB-L00026	FUEL SILO 2 LEVEL 1	FH-FSB-L00026-T	MICRO WAVE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
181	FH-FSB-L00033	RETENTION BIN 1 LEVEL	FH-FSB-L00033-T	NUCLEAR TRANSMITTER/DETECT	1																		C1PFB01-14030 Fuel Feeding		0
182	FH-FSB-L00033	RETENTION BIN 1 LEVEL	FH-FSB-L00033-XA	NUCLEAR SOURCE	1																		C1PFB01-14030 Fuel Feeding		0
183	FH-FSB-L00033	RETENTION BIN 1 LEVEL	FH-FSB-L00033-XB	NUCLEAR SOURCE	1																		C1PFB01-14030 Fuel Feeding		0
184	FH-FSB-L00220	FUEL SILO 1 LEVEL 2	FH-FSB-L00220-E	LEVEL MEASUREMENT CONNECT	1																		C1PFB01-14030 Fuel Feeding		0
185	FH-FSB-L00220	FUEL SILO 1 LEVEL 2	FH-FSB-L00220-T	MICRO WAVE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
186	FH-FSB-L00221	FUEL SILO 1 LEVEL 3	FH-FSB-L00221-E	LEVEL MEASUREMENT CONNECT	1																		C1PFB01-14030 Fuel Feeding		0
187	FH-FSB-L00221	FUEL SILO 1 LEVEL 3	FH-FSB-L00221-T	MICRO WAVE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
188	FH-FSB-L00222	FUEL SILO 2 LEVEL 2	FH-FSB-L00222-E	LEVEL MEASUREMENT CONNECT	1																		C1PFB01-14030 Fuel Feeding		0
189	FH-FSB-L00222	FUEL SILO 2 LEVEL 2	FH-FSB-L00222-T	MICRO WAVE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
190	FH-FSB-L00223	FUEL SILO 2 LEVEL 3	FH-FSB-L00223-E	LEVEL MEASUREMENT CONNECT	1																		C1PFB01-14030 Fuel Feeding		0
191	FH-FSB-L00223	FUEL SILO 2 LEVEL 3	FH-FSB-L00223-T	MICRO WAVE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
192	FH-FSB-L00040	SILO 1 RECLAIMER, BLOCKAGE SWITCH	FH-FSB-L00040-S	LEVEL LIMIT SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
193	FH-FSB-L00042	FUEL CONVEYOR 1, BLOCKAGE SWITCH	FH-FSB-L00042-S	LEVEL LIMIT SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
194	FH-FSB-L00043	METERING SCREW 2, BLOCKAGE SWITCH	FH-FSB-L00043-S	LEVEL LIMIT SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
195	FH-FSB-L00044	METERING SCREW 1, BLOCKAGE SWITCH	FH-FSB-L00044-S	LEVEL LIMIT SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
196	FH-FSB-L00046	SILO 2 RECLAIMER, BLOCKAGE SWITCH	FH-FSB-L00046-S	LEVEL LIMIT SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
197	FH-FSB-S0001	FUEL SCREW CONVEYOR 2, BLOCKAGE SWITCH	FH-FSB-S0001-S	LEVEL LIMIT SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
198	FH-FSB-S0008	SILO 1 RECLAIMER, SPEED	FH-FSB-S0008	SOFTWARE LOOP	1																		C1PFB01-14030 Fuel Feeding		0
199	FH-FSB-S0009	FUEL CONVEYOR 1, SPEED	FH-FSB-S0009	SOFTWARE LOOP	1																		C1PFB01-14030 Fuel Feeding		0
200	FH-FSB-S0009	METERING SCREW 1, SPEED	FH-FSB-S0009	SOFTWARE LOOP	1																		C1PFB01-14030 Fuel Feeding		0
201	FH-FSB-S0009	METERING SCREW 2, SPEED	FH-FSB-S0009	SOFTWARE LOOP	1																		C1PFB01-14030 Fuel Feeding		0
202	FH-FSB-S0009	SILO 2 RECLAIMER, SPEED	FH-FSB-S0009	SOFTWARE LOOP	1																		C1PFB01-14030 Fuel Feeding		0
203	FH-FSB-S0027	SILO 1 RECLAIMER TURNING DEVICE 1, SPEED	FH-FSB-S0027	SOFTWARE LOOP	1																		C1PFB01-14030 Fuel Feeding		0
204	FH-FSB-S0028	SILO 2 RECLAIMER TURNING DEVICE 1, SPEED	FH-FSB-S0028	SOFTWARE LOOP	1																		C1PFB01-14030 Fuel Feeding		0
205	FH-FSB-S0028	SILO 1 RECLAIMER TURNING DEVICE 2, SPEED	FH-FSB-S0028	SOFTWARE LOOP	1																		C1PFB01-14030 Fuel Feeding		0
206	FH-FSB-S0028	SILO 2 RECLAIMER TURNING DEVICE 2, SPEED	FH-FSB-S0028	SOFTWARE LOOP	1																		C1PFB01-14030 Fuel Feeding		0
207	FH-FSB-S0002	FUEL SCREW CONVEYOR 2, SPEED	FH-FSB-S0002	SOFTWARE LOOP	1																		C1PFB01-14030 Fuel Feeding		0
208	FH-FSB-S00115	SILO 1 RECLAIMER, SPEED SWITCH	FH-FSB-S00115-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
209	FH-FSB-S00116	FUEL CONVEYOR 1, SPEED SWITCH	FH-FSB-S00116-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
210	FH-FSB-S00117	METERING SCREW 1, SPEED SWITCH	FH-FSB-S00117-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
211	FH-FSB-S00118	METERING SCREW 2, SPEED SWITCH	FH-FSB-S00118-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
212	FH-FSB-S00119	ROTARY FEEDER 2, SPEED SWITCH	FH-FSB-S00119-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
213	FH-FSB-S00120	ROTARY FEEDER 1, SPEED SWITCH	FH-FSB-S00120-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
214	FH-FSB-S00122	SILO 2 RECLAIMER 1, SPEED SWITCH	FH-FSB-S00122-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
215	FH-FSB-S00137	WALL SCREW 1, SPEED SWITCH	FH-FSB-S00137-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
216	FH-FSB-S00138	WALL SCREW 2, SPEED SWITCH	FH-FSB-S00138-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
217	FH-FSB-S00390	SILO 1 ROTATING SPREADER, SPEED SWITCH	FH-FSB-S00390-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
218	FH-FSB-S00391	SILO 2 ROTATING SPREADER, SPEED SWITCH	FH-FSB-S00391-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
219	FH-FSB-S00003	FUEL SCREW CONVEYOR 2, SPEED SWITCH	FH-FSB-S00003-S	ZERO SPEED SWITCH	1																		C1PFB01-14030 Fuel Feeding		0
220	FH-FSB-T01067	FUEL SILO 1 FIRE DETECTING TEMPERATURE	FH-FSB-T01067-E	RESISTANCE TEMPERATURE SEN	1																		C1PFB01-14030 Fuel Feeding		0
221	FH-FSB-T01068	ROTARY FEEDER 2 FIRE DETECTING TEMP	FH-FSB-T01067-T	TEMPERATURE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
222	FH-FSB-T01068	ROTARY FEEDER 2 FIRE DETECTING TEMP	FH-FSB-T01068-E	RESISTANCE TEMPERATURE SEN	1																		C1PFB01-14030 Fuel Feeding		0
223	FH-FSB-T01068	ROTARY FEEDER 2 FIRE DETECTING TEMP	FH-FSB-T01068-T	TEMPERATURE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
224	FH-FSB-T01069	ROTARY FEEDER 1 FIRE DETECTING TEMP	FH-FSB-T01069-E	RESISTANCE TEMPERATURE SEN	1																		C1PFB01-14030 Fuel Feeding		0
225	FH-FSB-T01069	ROTARY FEEDER 1 FIRE DETECTING TEMP	FH-FSB-T01069-T	TEMPERATURE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
226	FH-FSB-T01070	FUEL SILO 2 FIRE DETECTING TEMP	FH-FSB-T01070-E	RESISTANCE TEMPERATURE SEN	1																		C1PFB01-14030 Fuel Feeding		0
227	FH-FSB-T01070	FUEL SILO 2 FIRE DETECTING TEMP	FH-FSB-T01070-T	TEMPERATURE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
228	FH-FSB-T01074	FUEL CONVEYOR 1 FIRE DETECTING TEMP	FH-FSB-T01074-E	RESISTANCE TEMPERATURE SEN	1																		C1PFB01-14030 Fuel Feeding		0
229	FH-FSB-T01074	FUEL CONVEYOR 1 FIRE DETECTING TEMP	FH-FSB-T01074-T	TEMPERATURE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
230	FH-FSB-T05005	FUEL SCREW CONVEYOR 2 FIRE DETECTING TEMP	FH-FSB-T05005-E	THERMOCOUPLE TEMPERATURE	1																		C1PFB01-14030 Fuel Feeding		0
231	FH-FSB-T05005	FUEL SCREW CONVEYOR 2 FIRE DETECTING TEMP	FH-FSB-T05005-T	TEMPERATURE TRANSMITTER	1																		C1PFB01-14030 Fuel Feeding		0
232	FH-SNF-H00025	BED MATERIAL SILO FILLING, NOT ALLOWED	FH-SNF-H00025-H01	PILOT LAMP	1																		C1PFB01-14301 Sand Feeding		0
233	FH-SNF-H00027	BED MATERIAL SILO FILLING, ALLOWED	FH-SNF-H00027-H01	PILOT LAMP	1																		C1PFB01-14301 Sand Feeding		0
234	AH-COR-F0136J	SEALING AIR FLOW TO BA SCREW 1	AH-COR-F0136J	ROTAMETER	1																		C1PFB01-16001 Bottom Ash Handling		0
235	AH-COR-F0137	SEALING AIR FLOW TO BA SCREW 1	AH-COR-F0137J	ROTAMETER	1																		C1PFB01-16001 Bottom Ash Handling		0
236	AH-COR-F0138	SEALING AIR FLOW TO BA SCREW 2	AH-COR-F0138J	ROTAMETER	1																		C1PFB01-16001 Bottom Ash Handling		0
237	AH-COR-F0139	SEALING AIR FLOW TO BA SCREW 2	AH-COR-F0139J																						

TABLE OF CONTENTS

1.	ELECTRIFICATION	2
1.1	General	
1.2	Scope of supply	2
1.3	Basic and detailed engineering, documentation and customer training	3
1.4	Controls and interlockings	4
1.4.1	Motor controls	4
1.5	Medium voltage switchgear	4
1.6	Power distribution transformers	4
1.7	Compensation and filtering for the harmonics	5
1.8	Low voltage switchgears and motor control centers	5
1.9	Electrical motors	7
1.10	Frequency converters	8
1.11	Emergency power supply equipment.....	9
1.12	Electric heat tracing	9
1.13	Cables, installation materials and installation work for electrification.....	9
1.13.1	6 kV power cables	10
1.13.2	500 V and 400 V power cables	10
1.13.3	230 V control cables	11
1.13.4	Cable trays/ladders.....	11
1.13.5	Check-out and start-up	11
1.14	Spare parts	11
Appendix 11.1	Motor and consumer list	
Appendix 02.02	Single line diagram	

1. ELECTRIFICATION

1.1 General

The delivery includes electrical equipment, engineering and documentation, training, installation materials and installation work and installation supervision and commissioning for the power boiler plant and areas, in the scope according to this specification.

All electrical equipment included in the delivery meet the requirements of appropriate IEC standards and harmonized EN standards.

Equipment located in electrical rooms are designed for a maximum +35 °C average temperature, during 24 hours.

Electrical rooms for boiler plant will be located as shown in the layout drawings in Annex 19. Lighting, electrification for HVAC, fire detection/alarm system and raised floors for the new electrical rooms (for K20) are included. Those are excluded from the existing electrical rooms (K80 and K90).

Dimensioning for the cables in the boiler building and other process areas is based on a maximum +40 °C ambient temperature. Maximum allowed conductor temperature for the cables is based on the used cable types.

IP classes for equipment in electrical rooms min IP21, process areas min IP54. Outdoors min IP class is IP55.

The following voltage levels will be utilised:

6 kV, 50 Hz, 3 phase, isolated neutral	Medium voltage distribution, new flue gas fans for K80 and K90.
400 V, 50 Hz, 3 phase, TN-S	Constant speed and variable speed motors
220 VDC	MCC control voltage
24 VDC	Instrumentation and control system inputs
220 VDC	Battery secured power
230 V, 50 Hz, 1 phase	Power outlets
400 V, 50 Hz, 3 phase	Power outlets
230 V, 50 Hz, 1 phase	Lighting system

1.2 Scope of supply

The delivery includes electrification according to Section 02 Scope of Supply and Appendix 02.02 Single Line Diagram.

Delivery limits K20:

- Electrical equipment and power cables:
 - Incoming terminals of the new distribution transformers in K20 electrical rooms.
 - For secured power the delivery limit is at incoming terminals of new 220VDC panels in K20 electrical rooms.
 - For lighting and maintenance the delivery limit is at incoming terminals of new utility panel in K20 electrical rooms.
 - Modifications to the existing switchgears included for the feeders needed to supply the new switchgears.
- Earthing: Main earthing busbar (MEB) in main electrical rooms, MEB included in the scope of supply, connection to earthing grid underground by Others. Underground earthing electrode by Others.
- Lightning protection: Connection to the earthing grid.
- Cable trays: According to the delivery limit for cables (cable ladders only for cables included in the scope will be supplied).

Delivery limits K80 and K90:

- Electrical equipment and power cables:
 - Flue gas fans: Outgoing terminals of medium voltage switchgear (existing flue gas fan feeder)
 - Outgoing terminals of existing LV switchgears
- Earthing: Connection to existing earthing system (existing MEB or earthing wire)
- Lightning protection: Excluded from the scope of supply
- Cable trays: Existing cable trays to be used as much as possible. New trays to be done if needed for new equipment.
- Disconnecting the old cables from the dismantled equipment. Cables top be cut and left to the trays.
- Modifications to the existing switchgears included for the feeders needed to supply the new switchgears.

1.3 Basic and detailed engineering, documentation and customer training

The delivery includes basic and detailed engineering and documentation for the electrification.

All documentation will be carried out according to IEC standards and Employer requirements.

The documentation will be delivered according to documentation schedule.

All engineering documentation will be delivered in English, all safety related in Czech.

Final documentation will be delivered in following formats:

© Valmet 2024

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.

Drawings: Autocad/pdf
Tables: MS Excel/pdf
Texts: MS Word/pdf

Operation and maintenance documentation will be in Czech if available, otherwise in English, all safety related in Czech.

1.4 Controls and interlockings

1.4.1 Motor controls

All motor controls except for the separately specified PLC controls (if any) will be carried out in the DCS.

1.5 Medium voltage switchgear

Modifications for existing spare feeders for new K20 feeders are included as well as modifications for K80 and K90 flue gas fan feeders.

1.6 Power distribution transformers

Power distribution transformers for the new K20 boiler plant are included in the scope of supply.

Transformers will be dry type cast resin insulated transformers.

Primary voltage level will be 6 kV.

The transformers will comply with EN/IEC 60076.

The transformer ratings are calculated according to continuous use with natural cooling.

Preliminary technical data for distribution transformers (400 V):

Quantity (preliminary)	2 pc
Duty	Continuous/converter load
Rated power (preliminary)	2500 kVA
Rated frequency	50 Hz
Primary voltage	6 kV, three-phase
Secondary voltage	400 V
Voltage regulation	off-load tap changer, $\pm 2 \times 2.5 \%$
Winding material	Al

Winding connections	Dyn11
Type of insulation, primary	cast resin
Type of insulation, secondary	vacuum pressure impregnated (VPI)
Cooling method	AN
Impedance voltage (preliminary)	6-7 %
No-load losses	*)
Load losses	*)
Short circuit duration	1 second
Insulation class for winding insulation	F/F
Winding temperature rise, °C	100/100 (class F)
Protection class for the enclosure	≥ IP 00
Insulation level, 10 kV windings and bushings	according to standards
Insulation level, secondary windings and bushings	according to standards
Environmental class/Climate class/Fire behaviour class	E2/C2/F1

*) No-load and load losses and efficiencies must fulfil the requirements in the European Commission Regulation (EU) n° 2019/1783 Eco design TIER 2.

The distribution transformers will contain accessories as follows:

- Local temperature monitoring
- Thermal protection and remote indication signal equipment
- Terminal box for the signals
- Lifting lugs
- Transport rollers
- Handle for off-load tap changer
- Earthing terminals, earthing balls
- Electrostatic earthing screen between HV and LV terminals
- Enclosure (at least IP 2X)

1.7 Compensation and filtering for the harmonics

Power factor compensation or harmonic filters is not included in the scope of supply.

1.8 Low voltage switchgears and motor control centers

400 V distribution switchgears (normal power, UPS power) for the K20 boiler plant are included in the delivery. For K80 and K90 needed distribution boards for new equipment are included.

Distribution switchgears and motor control centers are factory-assembled metal-enclosed indoor switchgears.

They are equipped with withdrawable motor starters (up to size 200 kW). Power feeders are also of withdrawable structure. Small MCB feeders are fixed.

For withdrawable type of structure the separation between functional units is form 3b. For fixed type of structure the separation between functional units (between compartments for groups of MCB feeders) is form 4a.

Switchgears fulfil the safety regulations specified in IEC 60439-1.

Rated duration of the short-circuit withstand for the switchgears is 1 second.

Internal arc withstand for the switchgears has been tested for 0.3 seconds according to applicable European standards.

Main LV switchgears are furnished with arc detection/protection system.

Switchgears are equipped with circuit breakers or switch fuse as main device for the outgoing feeders.

Motor starters include a circuit-breaker, contactor and intelligent motor protection and control unit of the latest type (Siemens Simocode or equal).

Incoming cubicles of the 400 V main switchgears are equipped with withdrawable air circuit-breaker. There is an earthing switch after the incoming circuit breaker.

Incoming cubicles of the 400 V main switchgears include a multifunction measurement device (at least A-, V-, P-, - and THD-level measurements available) connected to the DCS by bus connection (Profibus or equal).

Busbar material is bare copper or aluminium.

All motors except frequency converter drives have direct-on-line starters. Frequency converters have only circuit-breaker or fuse feeders in the LV switchgears.

The control voltage of the switchgear will be 230VAC (UPS).

There is a separate dedicated distribution board connected to the UPS power supply. Redundant Inverters 220VDC/400VAC for K20 are included in the scope.

400 V switchgears include after start-up about 10 % installed spare motor starters (at least 1 pc of each installed physical size), and 20 % empty spare space.

Technical data for the K20 power boiler plant 400V main switchgears (2 pc):

Rated voltage	400 V, 50 Hz, TN-S
Rated current	4000 A

Short-circuit withstand	65 kA, 1 sec
Degree of protection	IEC 60529 IP31

Technical data for the K20 power boiler plant utility switchgear (1 pc):

Rated voltage	400 V, 50 Hz, TN-S
Rated current	400 A
Short-circuit withstand	35 kA, 1 sec
Degree of protection	IEC 60529 IP31

Technical data for the K20 power boiler plant 220VDC distribution boards (2 pc):

Rated voltage	220 VDC
Rated current	250 A
Short-circuit withstand	35 kA, 1 sec
Degree of protection	IEC 60529 IP31

Technical data for the K80 power boiler plant 400 V switchgear (1 pc):

Rated voltage	400 V, 50 Hz, TN-S
Rated current	250 A
Short-circuit withstand	20 kA, 1 sec
Degree of protection	IEC 60529 IP31

Technical data for the K90 power boiler plant 400 V switchgear (1 pc):

Rated voltage	400 V, 50 Hz, TN-S
Rated current	250 A
Short-circuit withstand	20 kA, 1 sec
Degree of protection	IEC 60529 IP31

1.9 Electrical motors

All electrical motors are included in the delivery.

Motors are totally enclosed fan cooled three phase squirrel cage motors complying with IEC standards. Big motors can also be supplied with separate air-to-air or air-to-water heat exchanger.

Degree of protection for the motors is better or equal to IP 55 and IP 55 for motor terminal boxes.

Motors will be supplied as standard air-cooled 3-phase asynchronous motors in accordance with EN 50347 and IEC publications 60034, 60072-1/60072-2.

Motor voltages will be according to chapter 1.1.

Continuously running DOL motors and frequency converter controlled motors 0.75 kW-1000 kW will be supplied as a minimum according to IE3 efficiency class. 75 kW – 200 kW motors will be supplied as a minimum according to IE4 efficiency class.

Designed insulation class for all motors is class F, max. temperature rise with normal continuous running load is according to class B.

Motors > 160 kW are equipped with 6 pcs Pt 100 thermoelements for the temperature protection of stator winding and 2 pcs for the bearings (1 pc/bearing).

Smaller frequency converter controlled motors are equipped with 2x3 pcs thermistors for the temperature protection of stator winding.

Anti-condensation heaters are provided for motors > 160 kW.

Supplied motors will as a minimum fulfill grade A vibration level.

Noise level for supplied motors will be max. 85 dBA (higher levels allowed for motors located in separate noise rooms)..

400 V frequency converter controlled motors are equipped with reinforced insulation if required by manufacturer.

Motors \geq 100 kW are equipped with insulated N- (non-drive-end-) bearing.

SPM nipples for checking the bearing condition by the shock-impulse-measurement method are included for the motors approximately \geq 10 kW (from the smallest as a standard available size from the selected motor vendor).

1.10 Frequency converters

All frequency converters are included in the delivery.

Generally voltage level for the frequency converters is 400 V. For K80 and K90 new flue gas fans voltage level is 6kV.

Frequency converters are PWM type with direct torque control (DTC) or other latest technology.

Variable frequency drives will be controlled from the DCS by means of databus connection (Profibus or Profinet).

All frequency converters will be air-cooled.

Power supply from LV switchgears to floor-mounted LV frequency converters will be done by cables.

Frequency converters \geq 160 kW will be supplied as floor-mounted single drive units. Smaller frequency converters are to be built in VFD switchgears.

Degree of protection for the frequency converters is as a minimum IP21.

Low voltage frequency converters are equipped with du/dt and/or common-mode filters according to motor manufacturer's requirements.

Low voltage frequency converters will be standard 6-pulse type equipment.

MV frequency converters will be air cooled version with integrated transformer.

Mechanical installation and commissioning and start-up for the delivered frequency converters are included.

1.11 Emergency power supply equipment

At least following equipment will be powered by the UPS emergency power system:

- DCS
- Boiler safety system
- Critical boiler instrumentation
- Motor starter control voltage
- Critical boiler motors, sootblowers etc.
- Critical motor valves
- Safety evacuation lighting

Inverters and distribution board for the power boiler plant are included in the delivery. Preliminary size for the inverters will be 50 kVA.

UPS dimensioning will be based on real power need for boiler safe shutdown.

1.12 Electric heat tracing

Needed electric heat tracing for the pipes etc. is included in the delivery.

Detailed engineering and heat tracing cables are included in the delivery.

Power supply cables for the heat tracing cables are included, control panels are also included.

1.13 Cables, installation materials and installation work for electrification

The delivery includes the following cables and installation materials and installation work for the process and building electrification for the power boiler plant within the delivery limits:

- 6 kV cables for new flue gas fans.
- 400 V power cables for the process motors and other electrical equipment of the power boiler plant
- All control cables from the motors and electrical equipment in the delivery to the motor control centers and frequency converters
- All control cables from field equipment and from frequency converters to the DCS
- All power and control cables for sootblowing
- All heat tracing cables
- Earthing and lightning protection material in the limits specified in the scope of supply
- Cable trays and conduits for power and control cables inside delivery limits
- Needed local control switches for motors
- Local safety switches if needed
- Local control switches for motors according to process requirements
- Lighting fixtures (normal lighting, exit lighting) for K20 and needed (because of process changes) additional lights for K80 and K90.
- Maintenance power outlet panels for K20 and additional maintenance power outlet panels for K80 and K90 if needed because of process changes.
- Electrical installation and materials for process ventilation inside delivery limits
- Necessary installation materials for the electrification
- All installation and cabling work for the above mentioned equipment, panels, cables, cable trays, local safety switches etc.

The design of the cable systems will be based on the requirements of EN 50399/EN 60332-1-2.

CPR class for the cables will be at least Dca.

Design value for lighting system is as a 100 lux for K20 boiler house.

1.13.1 6 kV power cables

6 kV power cables have copper or aluminium conductors.

Cables are multi-core, multi-strand cables.

Insulation class for the 6 kV cables is 6/10 kV.

1.13.2 400 V power cables

Low voltage power cables have copper conductors.

Different cross sections will be used according to actual loads.

Cables will be non-armoured.

Cables with separate EMC screening will generally not be used for the frequency converter drive cabling (only used if required according to FC manufacturer's instructions). Cable types with concentric PE-wire/shield around the phase conductors will be used.

Generally cables are multicore, multistrand cables.
Insulation class for the cables is 0.6/1 kV.

Minimum cross section for the power cables is 2.5 mm².

1.13.3 230 V control cables

Control cables are screened and have copper conductors.
Cables will be non-armoured.

Number of conductors in the cable will be determined according to functional requirements.

Cross section of the 230 V control cables is 1.5 mm².

1.13.4 Cable trays/ladders

Cable ladders/trays are made of galvanized steel. Tray covers will be delivered where needed for mechanical protection.

Power and signal cables will be installed on separate trays.

Motor cable from the main cable tray/ladder to the motor will be installed on a smaller branch tray or in aluminium tube.

1.13.5 Check-out and start-up

The following items are included as a normal part of the check-out and start-up procedure:

- Low voltage cable testing before energization
- Motor rotation testing
- Control wiring continuity and function testing
- Inspection of electrical apparatus for damage, missing components and loose connections

1.14 Spare parts

Spare parts for electrical equipment are excluded from the delivery.



List

Motor and Electrical Equipment (sales)

Status Draft

Issue Status

Project Name: SKO Energo BFB

Project Key:

Project Number: BFB21-00942

Document ID:

Customer Document ID:

Revision:

Instructions

Don't delete or reorder columns

You can delete row if it is not relevant

Revision markup

Deleted rows option: Don't show deleted rows

Revision monitoring: Show all changes

Font styles

Strikeout removed text: Yes

Use italic font for new/changed cells: Yes

Text & Cell colors

New text

Modified text

Removed text color

Editable cell backgroud

Read only cell backgroud

Rev	Revision Note	Created by	Checked by	Approved by	Date
*	Revision	FTAMALEP			2024-09-02

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.

No.	Label	Main Equipment Description	Sub Equipment Description	Voltage [V]	Power [kW]	RPM [1/min]	Frequency [Hz]	Current [A]	Switchgear	VFD	Emergency power	Remarks	Scope of supply	PIDs	Rev.
1	B1-FW-FWP-HV5001	Feedwater from K80 valve	Motor actuator	400	0,3						UPS		Valmet	B1PFB01-00010 Media Distribution	0
2	B1-FW-FWP-HV5002	Feedwater from K90 valve	Motor actuator	400	0,3						UPS		Valmet	B1PFB01-00010 Media Distribution	0
3	B1-TU-MST-HV5003	Main steam valve for turbine	Motor actuator	400	0,3						UPS	Customer	Valmet	B1PFB01-00010 Media Distribution	0
4	B1-TU-MST-HV5006	Main steam valve for start-up expander	Motor actuator	400	0,2						UPS		Valmet	B1PFB01-00010 Media Distribution	0
5	B1-FW-FWP-HV0001	Spray water valve to attemperators	Motor actuator	400	0,1								Valmet	B1PFB01-02010 Feedwater Preheating	0
6	B1-FW-FWP-HV0012	Boiler filling valve	Motor actuator	400	0,1								Valmet	B1PFB01-02010 Feedwater Preheating	0
7	B1-FW-FWP-HV0013	Feedwater valve	Motor actuator	400	0,3						UPS		Valmet	B1PFB01-02010 Feedwater Preheating	0
8	B1-AP-LPS-HV0162	Fire steam valve to fuel feeding	Motor actuator	400	0,15						UPS		Valmet	B1PFB01-05011 Superheated Steam A	0
9	B1-TU-MST-HV0022	Start-up steam valve	Motor actuator	400	0,3						UPS		Valmet	B1PFB01-05030 Main Steam	0
10	B1-TU-MST-HV0023	Start-up steam valve	Motor actuator	400	0,3						UPS		Valmet	B1PFB01-05030 Main Steam	0
11	B1-TU-MST-HV0024	Main steam valve	Motor actuator	400	0,3								Valmet	B1PFB01-05030 Main Steam	0
12	B1-TU-MST-HV0025	Main steam valve by-pass valve	Motor actuator	400	0,2						UPS		Valmet	B1PFB01-05030 Main Steam	0
13	B1-SB-SBL-E001	Sootblower 1	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
14	B1-SB-SBL-E002	Sootblower 2	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
15	B1-SB-SBL-E003	Sootblower 3	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
16	B1-SB-SBL-E004	Sootblower 4	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
17	B1-SB-SBL-E005	Sootblower 5	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
18	B1-SB-SBL-E006	Sootblower 6	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
19	B1-SB-SBL-E007	Sootblower 7	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
20	B1-SB-SBL-E008	Sootblower 8	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
21	B1-SB-SBL-E009	Sootblower 9	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
22	B1-SB-SBL-E010	Sootblower 10	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
23	B1-SB-SBL-E011	Sootblower 11	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
24	B1-SB-SBL-E012	Sootblower 12	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
25	B1-SB-SBL-E013	Sootblower 13	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
26	B1-SB-SBL-E014	Sootblower 14	Motor	400	0,55								Valmet	B1PFB01-06020 Sootblowing Steam	0
27	B1-SB-SBL-HV0312	Sootblowing steam valve	Motor actuator	400	0,2						UPS		Valmet	B1PFB01-06020 Sootblowing Steam	0
28	B1-AP-CND-P04	Blowdown tank drain pump	Motor	400	10								Valmet	B1PFB01-07020 Draining & Venting	0
29	B1-BR-DRU-HV0007	Drum continuous blowdown valve	Motor actuator	400	0,1						UPS		Valmet	B1PFB01-07020 Draining & Venting	0
30	B1-BR-DRU-HV0008	Drum drain valve	Motor actuator	400	0,15						UPS		Valmet	B1PFB01-07020 Draining & Venting	0
31	B1-CA-PRA-F01	Primary air fan	VFD Motor	400	200					X			Valmet	B1PFB01-09001 Air Preheating & Fans	0
32	B1-CA-TOA-F01	Total air fan	VFD Motor	400	260					X			Valmet	B1PFB01-09001 Air Preheating & Fans	0
33	B1-FG-FLG-F01	Induced draft fan	VFD Motor	400	400					X			Valmet	B1PFB01-10040 Flue Gas B	0
34	B1-FG-FLG-F05	Flue gas recirculation fan	VFD Motor	400	180					X			Valmet	B1PFB01-10040 Flue Gas B	0
35	B1-FG-FLG-HV0023	Recirculation gas damper	Motor actuator	400	0,4								Valmet	B1PFB01-10040 Flue Gas B	0
36	B1-FG-FLG-HV0025	Flue gas damper after ID fan	Motor actuator	400	0,5								Valmet	B1PFB01-10040 Flue Gas B	0
37	B1-FG-FLG-F13	Exhaust air fan, BHF penthouse	Motor	400	0,85								Valmet	B1PFB01-11040 Bag House Filter Main Duct	0
38	B1-FG-FLG-F14	Exhaust air fan, BHF lobby	Motor	400	0,5								Valmet	B1PFB01-11040 Bag House Filter Main Duct	0
39	B1-FG-FLG-F15	Cooling air fan, inlet dampers	Motor	400	0,5								Valmet	B1PFB01-11040 Bag House Filter Main Duct	0
40	B1-FG-BF1-E04	BHF comp 1 hopper heaters group	Hopper heater 1	400	1,5								Valmet	B1PFB01-11040.1 BHF Compartments 1 & 2	0
41	B1-FG-BF1-E04	BHF comp 1 hopper heaters group	Hopper heater 2	400	1,5								Valmet	B1PFB01-11040.1 BHF Compartments 1 & 2	0
42	B1-FG-BF1-E04	BHF comp 1 hopper heaters group	Hopper heater 3	400	1,5								Valmet	B1PFB01-11040.1 BHF Compartments 1 & 2	0
43	B1-FG-BF2-E04	BHF comp 2 hopper heaters group	Hopper heater 1	400	1,5								Valmet	B1PFB01-11040.1 BHF Compartments 1 & 2	0
44	B1-FG-BF2-E04	BHF comp 2 hopper heaters group	Hopper heater 2	400	1,5								Valmet	B1PFB01-11040.1 BHF Compartments 1 & 2	0
45	B1-FG-BF2-E04	BHF comp 2 hopper heaters group	Hopper heater 3	400	1,5								Valmet	B1PFB01-11040.1 BHF Compartments 1 & 2	0
46	B1-FG-BF3-E04	BHF comp 3 hopper heaters group	Hopper heater 1	400	1,5								Valmet	B1PFB01-11040.2 BHF Compartments 3 & 4	0

No.	Label	Main Equipment Description	Sub Equipment Description	Voltage [V]	Power [kW]	RPM [1/min]	Frequency [Hz]	Current [A]	Switchgear	VFD	Emergency power	Remarks	Scope of supply	PIDs	Rev.
47	B1-FG-BF3-E04	BHF comp 3 hopper heaters group	Hopper heater 2	400	1,5								Valmet	B1PFB01-11040.2 BHF Compartments 3 & 4	0
48	B1-FG-BF3-E04	BHF comp 3 hopper heaters group	Hopper heater 3	400	1,5								Valmet	B1PFB01-11040.2 BHF Compartments 3 & 4	0
49	B1-FG-BF4-E04	BHF comp 4 hopper heaters group	Hopper heater 1	400	1,5								Valmet	B1PFB01-11040.2 BHF Compartments 3 & 4	0
50	B1-FG-BF4-E04	BHF comp 4 hopper heaters group	Hopper heater 2	400	1,5								Valmet	B1PFB01-11040.2 BHF Compartments 3 & 4	0
51	B1-FG-BF4-E04	BHF comp 4 hopper heaters group	Hopper heater 3	400	1,5								Valmet	B1PFB01-11040.2 BHF Compartments 3 & 4	0
52	B1-FG-BAS-C01	HL dosing screw	VFD Motor	400	0,75					X			Valmet	B1PFB01-11070 Hydrated Lime	0
53	B1-FG-BAS-C02	HL rotary valve	Motor	400	0,37								Valmet	B1PFB01-11070 Hydrated Lime	0
54	B1-FG-BAS-F01	HL dosing screw, cooling fan	Motor	400	0,1								Valmet	B1PFB01-11070 Hydrated Lime	0
55	B1-FG-BAS-F02	HL feeding air fan	Motor	400	11					X			Valmet	B1PFB01-11070 Hydrated Lime	0
56	B1-FH-FSB-C01	Silo 1 rotating spreader	Motor	400	1,5								Valmet	B1PFB01-14010 Fuel Feeding	0
57	B1-FH-FSB-C01	Silo 2 rotating spreader	Motor	400	1,5								Valmet	B1PFB01-14010 Fuel Feeding	0
58	B1-FH-FSB-C02	Silo 1 reclaimer	VFD Motor	400	45					X			Valmet	B1PFB01-14010 Fuel Feeding	0
59	B1-FH-FSB-C02	Silo 2 reclaimer	VFD Motor	400	45					X			Valmet	B1PFB01-14010 Fuel Feeding	0
60	B1-FH-FSB-C03	Silo 1 reclaimer turning device 1	VFD Motor	400	2,2					X			Valmet	B1PFB01-14010 Fuel Feeding	0
61	B1-FH-FSB-C03	Silo 2 reclaimer turning device 1	VFD Motor	400	2,2					X			Valmet	B1PFB01-14010 Fuel Feeding	0
62	B1-FH-FSB-C04	Silo 1 reclaimer turning device 2	VFD Motor	400	2,2					X			Valmet	B1PFB01-14010 Fuel Feeding	0
63	B1-FH-FSB-C04	Silo 2 reclaimer turning device 2	VFD Motor	400	2,2					X			Valmet	B1PFB01-14010 Fuel Feeding	0
64	B1-FH-FSB-C06	Fuel screw conveyor 1	VFD Motor	400	15					X			Valmet	B1PFB01-14010 Fuel Feeding	0
65	B1-FH-FSB-C25	Metering screw 1	VFD Motor	400	15					X			Valmet	B1PFB01-14010 Fuel Feeding	0
66	B1-FH-FSB-C26	Metering screw 2	VFD Motor	400	15					X			Valmet	B1PFB01-14010 Fuel Feeding	0
67	B1-FH-FSB-C48	Rotary feeder 1	Motor	400	11								Valmet	B1PFB01-14010 Fuel Feeding	0
68	B1-FH-FSB-C49	Rotary feeder 2	Motor	400	11								Valmet	B1PFB01-14010 Fuel Feeding	0
69	B1-FH-FSB-C51	Fuel screw conveyor 2	VFD Motor	400	15					X			Valmet	B1PFB01-14010 Fuel Feeding	0
70	B1-FH-FSB-P01	Screws lubrication oil unit	Motor	400	0,1								Valmet	B1PFB01-14010 Fuel Feeding	0
71	B1-FH-FSB-P02	Screws lubrication oil unit	Motor	400	0,1								Valmet	B1PFB01-14010 Fuel Feeding	0
72	B1-FH-SNF-C03	Sand feeding screw	Motor	400	2,2								Valmet	B1PFB01-14301 Sand Feeding	0
73	B1-AH-COR-C01	Ash container 1 screw	Motor	400	1,5								Valmet	B1PFB01-16001 Bottom Ash Handling	0
74	B1-AH-COR-C01	Ash container 2 screw	Motor	400	1,5								Valmet	B1PFB01-16001 Bottom Ash Handling	0
75	B1-AH-COR-C05	Bottom ash drag conveyor	VFD Motor	400	4					X			Valmet	B1PFB01-16001 Bottom Ash Handling	0
76	B1-AH-COR-C07	Bottom ash discharge conveyor	Motor	400	1,5								Valmet	B1PFB01-16001 Bottom Ash Handling	0
77	B1-AH-COR-C12	Bottom ash elevator	VFD Motor	400	3					X			Valmet	B1PFB01-16001 Bottom Ash Handling	0
78	B1-AH-COR-S02	Bottom ash sieve	Motor	400	1,5								Valmet	B1PFB01-16003 Bottom Ash Sieving	0
79	B1-AH-FSD-C08	2nd pass ash rotary feeder	Motor	400	2,2								Valmet	B1PFB01-16040 2nd & 3rd Pass Ash Handling	0
80	B1-AH-FSD-C15	2nd & 3rd pass ash pneum. transmitter	2nd & 3rd pass ash pneum. transm. heater	400	0,2								Valmet	B1PFB01-16040 2nd & 3rd Pass Ash Handling	0
81	B1-AH-FSD-C41	3rd pass ash drag conveyor	Motor	400	3								Valmet	B1PFB01-16040 2nd & 3rd Pass Ash Handling	0
82	B1-AH-FSD-C01	Fly ash pneum. transmitter 1	FA pneum. transmitter 1 heater	400	0,2								Valmet	B1PFB01-16070 Fly Ash Transportation	0
83	B1-AH-FSD-C02	Fly ash pneum. transmitter 2	FA pneum. transmitter 2 heater	400	0,2								Valmet	B1PFB01-16070 Fly Ash Transportation	0
84	B1-AH-FSD-C03	Fly ash pneum. transmitter 3	FA pneum. transmitter 3 heater	400	0,2								Valmet	B1PFB01-16070 Fly Ash Transportation	0
85	B1-AH-FSD-C04	Fly ash pneum. transmitter 4	FA pneum. transmitter 4 heater	400	0,2								Valmet	B1PFB01-16070 Fly Ash Transportation	0
86	B1-AH-FCO-C11	FA dry unloading rotary feeder	Motor	400	1								Valmet	B1PFB01-16082 Fly Ash Storage & Discharging	0
87	B1-AH-FCO-C14	Fly ash dry unloading	Motor	400	0,5								Valmet	B1PFB01-16082 Fly Ash Storage & Discharging	0
88	B1-AH-FCO-F01	Fly ash silo fan	Motor	400	3								Valmet	B1PFB01-16082 Fly Ash Storage & Discharging	0
89	B1-AW-CWA-P01	Cooling water pump 1	Motor	400	15					X			Valmet	B1PFB01-20001 Cooling Water	0
90	B1-AW-CWA-P02	Cooling water pump 2	Motor	400	15					X			Valmet	B1PFB01-20001 Cooling Water	0
91	B1-AY-CAR-F01	Instrument air compressor	Motor	400	120							Customer compressor	Existing	B1PFB01-21001 Compressed Air System	0
92	B1-AY-CAR-F02	Instrument air compressor	Motor	400	120							Customer compressor	Existing	B1PFB01-21001 Compressed Air System	0



No.	Label	Main Equipment Description	Sub Equipment Description	Voltage [V]	Power [kW]	RPM [1/min]	Frequency [Hz]	Current [A]	Switchgear	VFD	Emergency power	Remarks	Scope of supply	PIDs	Rev.
93	B1-AY-CAR-F51	Transport air compressor (back-up)	Motor	400	500								Valmet	B1PFB01-21001 Compressed Air System	0
94	B1-WT-CFS-P03	Phosphate pump 1	Motor	400	0,5								Valmet	B1PFB01-25001 Chemical Dosing	0
95	B1-WT-CFS-P04	Phosphate pump 2	Motor	400	0,5								Valmet	B1PFB01-25001 Chemical Dosing	0
96	B1-WT-CFS-T02-A01	Phosphate tank agitator	Motor	400	1,5								Valmet	B1PFB01-25001 Chemical Dosing	0
97	B1-AC-O02-HV0001	Roof exhaust heatmover 1	Motor actuator	230	0,01		50						Valmet	B1PFB05-3001A Boiler House Roof Ventilation	0
98	B1-AC-O02-HV0005	Roof exhaust heatmover 5	Motor actuator	230	0,01		50				UPS		Valmet	B1PFB05-3001A Boiler House Roof Ventilation	0
99	B1-AC-O02-HVA0002	Roof exhaust heatmover 2	Motor actuator	230	0,01		50						Valmet	B1PFB05-3001A Boiler House Roof Ventilation	0
100	B1-AC-O02-HVB0003	Roof exhaust heatmover 3	Motor actuator	230	0,01		50						Valmet	B1PFB05-3001A Boiler House Roof Ventilation	0
101	B1-AC-O02-HVC0004	Roof exhaust heatmover 4	Motor actuator	230	0,01		50				UPS		Valmet	B1PFB05-3001A Boiler House Roof Ventilation	0
102	B1-AC-R01-F01	Recirculation air fan	Motor	400	15								Valmet	B1PFB05-3001A Boiler House Roof Ventilation	0
103	B1-AC-X01-HV0019	Boiler house wall damper 1	Motor actuator	230									Valmet	B1PFB05-3001D Boiler Room Wall Dampers	0
104	B1-AC-X01-HV0020	Boiler house wall damper 2	Motor actuator	230									Valmet	B1PFB05-3001D Boiler Room Wall Dampers	0
105	B1-AC-X01-HV0021	Boiler house wall damper 3	Motor actuator	230									Valmet	B1PFB05-3001D Boiler Room Wall Dampers	0
106	B1-AC-X01-HV0022	Boiler house wall damper 4	Motor actuator	230									Valmet	B1PFB05-3001D Boiler Room Wall Dampers	0
107	B1-AC-X01-HV0023	Boiler house wall damper 5	Motor actuator	230									Valmet	B1PFB05-3001D Boiler Room Wall Dampers	0
108	B1-AC-I31-F01	Main staircase supply air fan	VFD Motor	400	1,1					X			Valmet	B1PFB05-3001F Boiler House Staircases	0
109	B1-AC-I31-F51	Elevator shaft exhaust air fan	Motor	230	0,25								Valmet	B1PFB05-3001F Boiler House Staircases	0
110	B1-AC-T01-F01	Pressurization unit fan	VFD Motor	400	2,2					X			Valmet	B1PFB05-3003A Pressurization air unit	0
111	B1-AC-T01-HV0001	Pressurization unit damper	Motor actuator	230									Valmet	B1PFB05-3003A Pressurization air unit	0
112	B1-AC-T01-HV0014	DCS room pressurization air fire damper	Motor	230									Valmet	B1PFB05-3003B Electric Equipment Room 1	0
113	B1-AC-T01-HV5007	LV room pressurization air fire damper	Motor	230									Valmet	B1PFB05-3003C Electric Equipment Room 2	0
114	B1-AC-I33-F01	Compressor room supply air fan	Motor	400	3								Valmet	B1PFB05-3003D Compressor room	0



List

Motor and Electrical Equipment (sales)

Status Draft

Issue Status

Project Name: SKo Energo 2 X CFB Rebuild FGT

Project Key:

Project Number: ERC21-00349

Document ID:

Customer Document ID:

Revision:

Instructions

Don't delete or reorder columns

You can delete row if it is not relevant

Revision markup

Deleted rows option: Don't show deleted rows

Revision monitoring: Show all changes

Font styles

Strikeout removed text: Yes

Use italic font for new/changed cells: Yes

Text & Cell colors

New text

Modified text

Removed text color

Editable cell backgroud

Read only cell backgroud

Rev	Revision Note	Created by	Checked by	Approved by	Date
*	Revision	FTAMALEP			2024-09-02

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.



No.	Label	Main Equipment Description	Sub Equipment Description	Voltage [V]	Power [kW]	RPM [1/min]	Frequency [Hz]	Current [A]	Switchgear	VFD	Emergency power	Remarks	Scope of supply	PIDs	Rev.
1	C1-CA-SEA-HV5001	Lower secondary air damper	Motor actuator										Existing	C1PFB01-09050 Secondary Air	0
2	C1-CA-SEA-HV5002	Upper secondary air damper	Motor actuator										Existing	C1PFB01-09050 Secondary Air	0
3	C1-FG-FLG-F01	Induced draft fan	VFD Motor		850					X			Valmet	C1PFB01-10030 Flue Gas	0
4	C1-SB-SBL-E001	Sootblower 1	Motor		0,55								Valmet	C1PFB01-10030 Flue Gas	0
5	C1-SB-SBL-E002	Sootblower 2	Motor		0,55								Valmet	C1PFB01-10030 Flue Gas	0
6	C1-FG-BAS-C05	NaHCO3 rotary valve 1	Motor		0,37								Valmet	C1PFB01-11080 Bicarbonate	0
7	C1-FG-BAS-C06	NaHCO3 dosing screw 1	VFD Motor		0,75					X			Valmet	C1PFB01-11080 Bicarbonate	0
8	C1-FG-BAS-C51	NaHCO3 rotary valve 2	Motor		0,37								Valmet	C1PFB01-11080 Bicarbonate	0
9	C1-FG-BAS-C52	NaHCO3 dosing screw 2	VFD Motor		0,75					X			Valmet	C1PFB01-11080 Bicarbonate	0
10	C1-FG-BAS-F09	NaHCO3 dosing screw 1, cooling air fan	Motor		0,1								Valmet	C1PFB01-11080 Bicarbonate	0
11	C1-FG-BAS-F11	NaHCO3 feeding air fan 1	VFD Motor		11					X			Valmet	C1PFB01-11080 Bicarbonate	0
12	C1-FG-BAS-F51	NaHCO3 dosing screw 2, cooling air fan	Motor		0,1								Valmet	C1PFB01-11080 Bicarbonate	0
13	C1-FG-BAS-F52	NaHCO3 feeding air fan 2	VFD Motor		11					X			Valmet	C1PFB01-11080 Bicarbonate	0
14	C1-FG-AIN-P03	Ammonia booster pump 1	VFD Motor							X			Valmet	C1PFB01-12040 Ammonia Injection to Furnace	0
15	C1-FG-AIN-P04	Ammonia booster pump 2	VFD Motor							X			Valmet	C1PFB01-12040 Ammonia Injection to Furnace	0
16	C1-FG-ASP-P01	Ammonia pump 1	VFD Motor										Existing	C1PFB01-12040 Ammonia Injection to Furnace	0
17	C1-FG-ASP-P02	Ammonia pump 2	VFD Motor										Existing	C1PFB01-12040 Ammonia Injection to Furnace	0
18	C1-CA-PRA-F51	Purge air blower 1	VFD Motor							X			Valmet	C1PFB01-14030 Fuel Feeding	0
19	C1-CA-PRA-F52	Purge air blower 2	VFD Motor							X			Valmet	C1PFB01-14030 Fuel Feeding	0
20	C1-FH-FSB-C01	Silo 1 rotating spreader	Motor		1,5								Valmet	C1PFB01-14030 Fuel Feeding	0
21	C1-FH-FSB-C01	Silo 2 rotating spreader	Motor		1,5								Valmet	C1PFB01-14030 Fuel Feeding	0
22	C1-FH-FSB-C02	Silo 1 reclaimers	VFD Motor		37					X			Valmet	C1PFB01-14030 Fuel Feeding	0
23	C1-FH-FSB-C02	Silo 2 reclaimers	VFD Motor		37					X			Valmet	C1PFB01-14030 Fuel Feeding	0
24	C1-FH-FSB-C03	Silo 1 reclaimers turning device 1	VFD Motor		2,2					X			Valmet	C1PFB01-14030 Fuel Feeding	0
25	C1-FH-FSB-C03	Silo 2 reclaimers turning device 1	VFD Motor		2,2					X			Valmet	C1PFB01-14030 Fuel Feeding	0
26	C1-FH-FSB-C04	Silo 1 reclaimers turning device 2	VFD Motor		2,2					X			Valmet	C1PFB01-14030 Fuel Feeding	0
27	C1-FH-FSB-C04	Silo 2 reclaimers turning device 2	VFD Motor		2,2					X			Valmet	C1PFB01-14030 Fuel Feeding	0
28	C1-FH-FSB-C06	Fuel screw conveyor 1	VFD Motor		15					X			Valmet	C1PFB01-14030 Fuel Feeding	0
29	C1-FH-FSB-C25	Metering screw 1	VFD Motor		15					X			Valmet	C1PFB01-14030 Fuel Feeding	0
30	C1-FH-FSB-C26	Metering screw 2	VFD Motor		15					X			Valmet	C1PFB01-14030 Fuel Feeding	0
31	C1-FH-FSB-C48	Rotary feeder 1	Motor		15								Valmet	C1PFB01-14030 Fuel Feeding	0
32	C1-FH-FSB-C49	Rotary feeder 2	Motor		15								Valmet	C1PFB01-14030 Fuel Feeding	0
33	C1-FH-FSB-C51	Fuel screw conveyor 2	VFD Motor		15					X			Valmet	C1PFB01-14030 Fuel Feeding	0
34	C1-FH-FSB-C63	Wall screw 1	Motor		11								Valmet	C1PFB01-14030 Fuel Feeding	0
35	C1-FH-FSB-C64	Wall screw 2	Motor		11								Valmet	C1PFB01-14030 Fuel Feeding	0
36	C1-FH-FSB-P01	Screws lubrication oil unit	Motor		0,1								Valmet	C1PFB01-14030 Fuel Feeding	0
37	C1-FH-FSB-P02	Screws lubrication oil unit	Motor		0,1								Valmet	C1PFB01-14030 Fuel Feeding	0
38	C1-FH-SNF-C03	Sand feeding screw	Motor										Existing	C1PFB01-14301 Sand Feeding	0
39	C1-AH-COR-C01	Bottom ash screw conveyor 1	VFD Motor		1,1					X			Valmet	C1PFB01-16001 Bottom Ash Handling	0
40	C1-AH-COR-C02	Bottom ash screw conveyor 2	VFD Motor		1,1					X			Valmet	C1PFB01-16001 Bottom Ash Handling	0
41	C1-AH-COR-C03	Bottom ash screw conveyor 3	VFD Motor		1,1					X			Valmet	C1PFB01-16001 Bottom Ash Handling	0
42	C1-AW-CCW-P01	Ash CW booster pump 1	Motor										Valmet	C1PFB01-16001 Bottom Ash Handling	0
43	C1-AW-CCW-P02	Ash CW booster pump 2	Motor										Valmet	C1PFB01-16001 Bottom Ash Handling	0
44	C1-AH-COR-C05	Bottom ash drag conveyor	VFD Motor		2,2					X			Valmet	C1PFB01-16001 Bottom Ash Handling C1PFB01-16003 Bottom Ash Sieving	0
45	C1-AH-COR-C13	Bottom ash transfer conveyor	VFD Motor		2,2					X			Valmet	C1PFB01-16003 Bottom Ash Sieving	0
46	C1-AH-COR-S02	Bottom ash sieve	Motor		1,5								Valmet	C1PFB01-16003 Bottom Ash Sieving	0
47	C1-AH-COR-S02	Bottom ash sieve	Motor		1,5								Valmet	C1PFB01-16003 Bottom Ash Sieving	0



Table of Contents

12 CIVIL AND STRUCTURAL	3
12.1 General	3
12.2 Scope of Supply	3
12.3 Delivery limits	3
12.4 Design data	4
12.4.1 Codes and standards	4
12.4.2 Third party review	6
12.4.3 Material standards (in general):	6
12.4.4 Fire safety	7
12.4.5 Architectural design	8
12.4.6 Foundations	8
12.5 Fabrication	9
Workshop	9
12.5.1 Surface treatment of steel structures	9
12.6 Building structures	10
12.6.1 Platforms	11
12.6.2 Handrails	14
12.6.3 Stairs	15
12.6.4 Ladders	16
12.6.5 Drainage system	17
12.7 Wall and roof structures	17
12.7.1 Roof decking	18
12.7.2 External walls	19
12.7.3 Internal walls	20
12.7.4 Cladding colour scheme	20
12.7.5 Doors and Windows	21
12.7.6 Drainage system	23
12.8 Equipment	23



12.8.1 Elevator	23
12.8.2 Hoist	24
12.8.3 Central vacuum cleaning piping	24
12.9 Stack (existing)	25

Appendices:

02.01	Delivery limits for civil and structural, drawing (later)
-------	---

12 CIVIL AND STRUCTURAL

12.1 General

The Client will obtain a construction licence and other necessary permits for the project.

12.2 Scope of Supply

Scope of supply is presented in Appendix 02 Scope of supply and battery limits.

The scope list contains also works by others, in order to give an overview of the items that may be required, but the list should not be considered all inclusive.

12.3 Delivery limits

Delivery limits are shown in Appendix 02.01 "Delivery limits for civil and structural".

Electrical room concrete

Concrete structured electrical building for boiler island is self- supporting building separated from main boiler building.

Delivery limit of the concrete structured electrical rooms: Floors walls and ceilings are designed, supplied and finished by Contractor. The electrical building will support equipment, piping and ducting exact locations will be defined during the project.

Size of rooms included in boiler island delivery as per layout drawings.

Loading and dimensional information for the concrete structure engineering shall be given by Valmet:

- Loads for foundations and the slab at grade
- Loads and locations of equipment supported by the concrete structures
- Machinery frame details
- Information for the concrete base and concrete structures (openings and loads)

Loads for concrete structure engineering will be given in characteristic load values not in load combinations.

Sizing of pedestals for columns and equipment is in the scope of the Client.

12.4 Design data

12.4.1 Codes and standards

Design standards:

EN (Eurocode) for the structural design.

Consequence class for buildings is CC2 (EN1990)

Execution class for steel structures is EXC2 (EN 1090-2).

Loading standards:

Natural loads:

Natural loads in accordance with Eurocode and National annex.

- Wind load: terrain factor II, v_{bo} 22,5 m/s
- Snow load: $s_k = 0,70$ kN/m² according to Eurocode 1 and NAD
- Seismic loads:

The site is not located in an undermined area or in an area threatened by seismicity.

Dead loads:

- All structures shall be designed for the actual dead load due to the weight of all permanent structural and non-structural components such as framing, walls, floors, platforms, roof and permanently installed equipment.

Live loads:

On the platforms, as listed below:

• Steel platforms in general	uniform load	5.0	kN/m ²
	or point load	1.5	kN (200x200mm)
• Stairs and landings	uniform load	2.0	kN/m ²
		1.5	kN (200x200mm)
• Live load on the roofs	uniform load	1.0	kN/m ²

Small piping and cable loads (0,5 kN/m²) are included in the uniform loads above.

Where Eurocode and NAD allow, above mentioned live load on floors will not be accumulated for design of columns.

Dynamic loads:

- The dynamic effect of rotating or oscillating equipment on the supporting structure or foundation shall be considered as applicable.

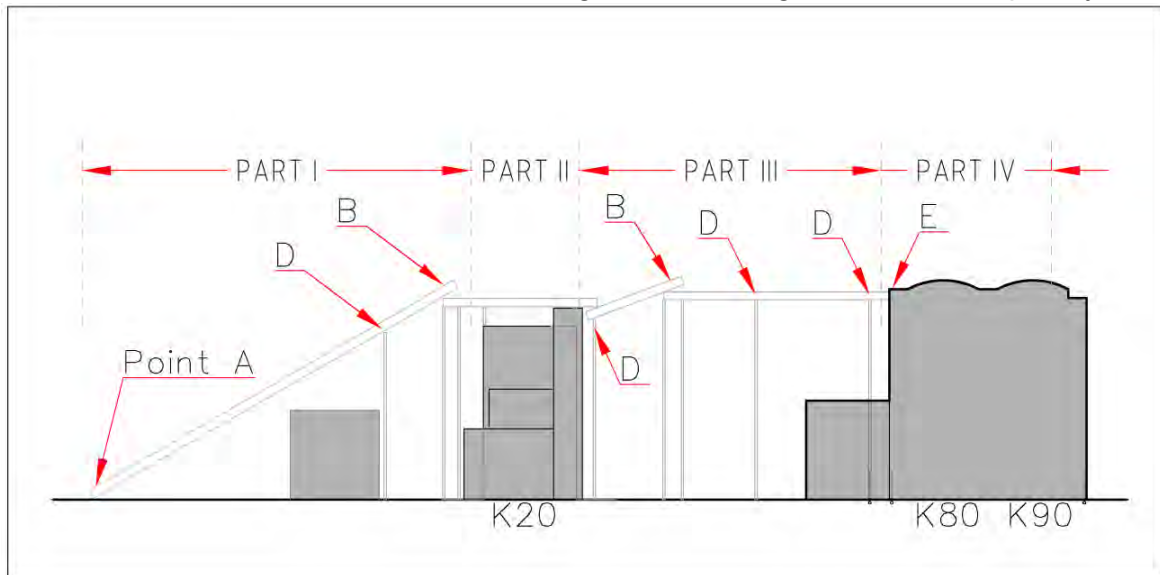
Equipment loads:

- Structures shall be specially designed to support the operating loads of equipment supplied by Valmet when the operating load exceeds the total floor live load on the area the equipment occupies.

Live, Dead and Equipment loads caused by equipment outside of the Delivery will be handled as a Change Order Request during the Project Phase.

Incoming conveyor (by Client) and fuel transport system (by Client)

Incoming conveyor will be supported by the boiler house or boiler house annex steel structure. The offer is based on the following understanding of the fuel transport system.



In Part I of the fuel transport system will rise to the height above the boiler house K20. All loads from the fuel transport system are supported by steel structure in customer scope. Horizontal loads in Conveyor direction are directed to the foundation in point A. Point D is supporting vertical loads and horizontal loads perpendicular to the conveyor. Point B support the area where the conveyor continues to the next conveyor. A tower with stair cases is assumed (by Client)

In Part II the fuel transport system and incoming conveyor are supported by the boiler house K20. The Incoming conveyor runs perpendicular to the fuel transport system and transports fuel from the incoming conveyor to the day-silos. The offer is based on the assumption that the fuel transport system and the incoming conveyor are supported as one large system to the boiler building K20. The smaller maintenance platforms are

supported separately. The following loads are considered if not timely mentioned otherwise according to the time schedule:

	horizontal	horizontal (conveyor direction)	Vertical
leg 1	+/-100kN	+50kN	-240kN
leg 2	+/-15kN	+50kN	-240kN
leg 3	+/-100kN	+50kN	-240kN
leg 4	+/-15kN	+50kN	-240kN

In Part III the fuel transport system will rise to the height above the boiler house K80 and K90. All loads from the fuel transport system are supported by steel structure in customer scope. Horizontal loads in Conveyor direction are directed to the foundation in point B. Point D is supporting vertical loads and horizontal loads perpendicular to the conveyor. Point B supports the area where the conveyor continues to the next conveyor. A tower with stair cases is assumed (by Client)

In Part IV the fuel transport system is supported by the existing boiler buildings of boilers K80 and K90. Point E is at the wall line and the first support point of part IV. See document annex 12.02 for more information.

12.4.2 Third party review

Third party review (Prüfingenieure für Baustatik or similar) will be limited to the basic design of the steel structure within the scope of Valmet and according the local norms and regulations.

12.4.3 Material standards (in general):

Eurocode (EN) for the structural steel. Handrails gratings, stairs, chequered plates and cladding material standards based on origin of the fabricator.

Embedded anchorbolts for steel structures are Peikko HPM Rebar anchor bolts and/or Peikko PPM High Strength anchor bolts or similar. Anchorbolts will be delivered as loose parts. Assembly of loose parts and templates is done at Site by Client.

Templates for anchor bolt groups are Peikko standard Templates or steel plates thickness 5mm. Templates will be marked and delivered as loose parts.

Anchorbolts and templates need to be assembled at Site before installation, see scope of supply.

Fasteners for steel structure connections:

- Bolts are to be of grade 8.8 , hot-dip galvanized
- Nuts are to be of grade 8, hot-dip galvanized
- Washers are hot-dip galvanized

12.4.4 Fire safety

The boiler's fire protection measures adhere to rational fire safety principles. As part of the project, the Client will compile a comprehensive fire safety report. Valmet, responsible for the boiler room and fan room, will provide a separate fire safety report.

The Valmet fire safety report will be integral to the Client's overall fire safety assessment. It will demonstrate that the steel structure in the boiler room does not require additional fire protection measures like sprinklers or intumescent coating. Fireload analysis indicates no significant risk to the steel structure's integrity.

Incorporating the Valmet report ensures a thorough evaluation of fire safety measures for the entire project. The boiler room and fan room, along with other aspects, will be adequately addressed based on expert analysis.

The size of the steel structure in the boiler building and within the specified limits will not be made larger to meet requirements in prescriptive fire design. No fire protective painting is included, considering prior experience and fire technical analysis. The main stair shaft is separated from the boiler room by a Paroc-type wall without air locks. Electrical and control rooms are in separate buildings, not impacting boiler building fire safety.

A risk assessment will determine protection methods for each process component. The draft of the Fire Safety Report will be provided later. Additional requirements from third parties, authorities, or insurers post-contract will be handled as Change Order Requests.

Main cable trays may require water sprinkler protection as per local authorities and will be handled as a Change Order Request.

12.4.4.1 Smoke exhaust

Smoke exhaust in boiler room building shall be managed with ventilation fans or hatches. In staircases smoke exhaust is managed with smoke hatches at the top of

each shaft. More detailed description of the smoke exhaust system can be found in Ventilation specification (12.01).

12.4.4.2 Fire water piping, hose reels and fire hydrants

The design is based on the following, all equipment and systems related to fire safety are in the scope of OB7 (see contract).

Boiler room

In the boiler room are located two permanent hose reels without cabinets at each main level. One is located beside the door to the main staircase and one beside the door to the secondary staircase. Wet riser continues as dry riser to hose reel on exterior on roof level. See appendix 20 Flowsheets.

One (1) hand held extinguisher will be located near each hose reel.

In addition one (1) dry riser (DN80) is provided. It will be equipped with local type landing valves for fire brigade located inside the main staircase.

Flue Gas Treatment area

One (1) hand held extinguisher will be located in each room.

12.4.5 Architectural design

Architectural design for permit application purposes is excluded from the delivery of Valmet. The quotation is based upon the common industrial appearance: all colors shall be mutually selected from standard charts of manufacturer. Mouldings are simple and only in the corners of building.

12.4.6 Foundations

Foundations are excluded from the delivery of Valmet.

Settlements of the foundations due to the column loads are limited to the following:

- Differential settlement between two adjacent boiler columns at side line is limited to 5 mm.
- Differential settlement between two adjacent boiler columns cross the boiler is limited to 10 mm.
- Differential settlement between boiler column and exterior wall column is limited to 20 mm.
- Differential settlement between two adjacent exterior wall columns is limited to 10 mm.

- Differential settlement between two exterior wall columns cross the boiler house is limited to 20 mm.
- If using mat foundation, the maximum inclination of foundation mat is limited to 1:2000

Assumed for structural calculation of column base plates

Concrete cubic strength (in general) min. C35/40 (40 MN/m²)

Non-shrinkable grouting is used under the steel column base plates having minimum cubic strength min. C50/60 (60 MN/m²).

Steel structure columns will transfer horizontal and vertical loads to the foundation as well as pending moment. Columns have rigid connection with foundation. Loads and bending moment will be in all directions.

12.5 Fabrication

Fabrication and Erection will be carried out according to the EN 1090 "Execution of steel structures. General rules and rules for buildings".

EN 1090 includes also procedure of QC, e.g. material certificate of structural steel is according to EN 10204 and "Quality Assurance Plan".

Workshop

A special program for the fabrication will be established to meet the quality determined in applicable standards and codes.

12.5.1 Surface treatment of steel structures

Painting will be carried out according to European standard EN ISO 12944- "Paints and varnishes - Corrosion protection of steel structures by protective paint systems".

Hot dip galvanizing will be carried out according to the EN ISO 1461, where minimum coating is related to the material thickness.

	Painting system 1	Hot-dip Galvanized
Category	C3	
Durability	H	
ISO 12944-5 system number	C3.09	
Binder types	EP Zn(R)PUR	
NDFT in μm / no. of coats	160/2	
Preparation	P2	

<i>Blast cleaning</i>	<i>Sa 2½</i>	
<i>Prime coat (binder type)</i>	<i>60-80 Zn(R)</i>	
<i>Additional edge protection by stripe coat</i>	<i>No</i>	
<i>Intermediate coat (binder type)</i>	<i>No</i>	
<i>Finnish coat (binder type)</i>	<i>80-100 PUR</i>	
Structure or part		
Steel structures inside and out side	✓	
Fasteners for steel structures		✓
Handrails		✓ ¹
Handrails outside cladding		✓
Gratings		✓
Toeplates		✓ ¹
Steps		✓
Stringers		✓ ¹
Ladders		✓
Gates for ladders		✓
Tear/chequered plates 6mm (watertight)	✓ ²	
Tear/chequered plates 3mm (dust tight)		✓
All connection parts for steels structures (cleat angles, gussets, splice plates, suspension rods etc.)		✓ ¹
Roof purlins		✓ ¹

Note 1: These part may be painted by the choice of the contractor.

Note 2: Top of the tearplate will be mechanically cleaned by brushes followed with a new primer paint layer and above mentioned paint system.

Hot-dip galvanized parts will not be painted.

Colours shall be mutually selected from standard charts (such as RAL) of manufacturer. Metal shade colours shall not be used.

12.6 Building structures

Main frame of the boiler building, stair cases and auxiliary rooms such as ID fan room are made of structural steel. The skeleton of the boiler house will be designed to be a structural entity.

Steel structure of the boiler house will be divided into vertical erection sections (or tiers). There is a horizontal truss at the top of each section. These trusses as well as the horizontal truss placed on the upper surface of boiler supporting level will transfer horizontal loads to the perimeter column lines. These horizontal stiffening systems will also give a lateral support for the columns in order to decrease the buckling lengths. There are vertical braces in the perimeter column lines.

Frame of electric building is assumed to be independent concrete structure. Elevated floor slabs are made of pre-cast concrete elements (hollow sections).

External main stair shaft will be made of structural steel and will not be laterally supported by the boiler building frame.

External secondary stair shaft will be made of structural steel and laterally supported by the boiler building frame. With horizontal bracing outside the building walls.

Structural steel

Perimeter columns are rolled or welded H- / I – sections.

Internal main (boiler) columns are welded I- or box -sections.

Diagonal and lateral braces are of I- or tube sections.

Boiler main supporting beams are of welded plate girders and/or truss structures.

Main supporting beams are of welded plate girders or rolled sections.

Platform secondary beams and stair stringers are of hot rolled sections.

Horizontal bracing system is consisting of lateral trusses, which is formed by platform beams and diagonal trusses.

Stair shaft is made of hot rolled profiles.

Roof girders and purlins are of hot or cold rolled sections.

Connections:

- Field connections are mainly bolted
- In some cases welded connections will also be used for specific structural members (e.g. boiler tertiary beams)

12.6.1 Platforms

Delivery includes platforms shown in the Contract layouts.

Contract price is fixed to these platform areas and can be adjusted in accordance with the unit prices after total quantities have been calculated. All platforms are included in the delivery where platforms are necessary for regular maintenance or operation of equipment within the scope of supply.

Walkways and platforms for convenient access to all areas requiring regular access during operations fulfill the following requirements according to the EN ISO 14122 (Safety of machinery. Permanent means of access to machines and industrial Plants):

- The minimum width of walkway is 1.2 m in main stair tower
- The minimum width of walkway is 1.0 m in emergency staircase
- The minimum width of walkway is 1.0 m in service staircase in Flue Gas Area
- The minimum width of walkways is 1.0 m in main service areas, this may be locally reduced to 0,8m.
- The minimum width of walkway is 0.8 m for maintenance with hand tools
- The minimum width of walkway is 0.6 m for only inspection and testing
- The minimum headroom clearance is 2.1 m, this may be locally reduced to 1.8m e.g. under silos or ducts and piping.

Steel Platforms:

INDOOR

Service platforms will be covered with hot-dip galvanized grating. Bearing bar of the grating is min. **2 mm x 30 mm** and have a maximum opening of **30 mm** maximum length of the opening is **30 mm**. Cross bar is a twisted square bar of min. **5 x 5 mm**. Grating panels shall be securely fastened to the supporting steel beams by special saddle type clip fasteners. Minimum of four fasteners provided at each section of grating. Fasteners will be self-tapping bolts M8, bolt holes will be drilled at Site. Alternatively, the gratings may be fixed with shooting fasteners directly to steel (e.g. Hilti DX).



OUTDOOR

Service platforms will be covered with hot-dip galvanized grating. Bearing bar of the grating is min. **3 mm x 30 mm** and have a maximum opening of **30 mm** and have a maximum length of **30 mm**. Bearing bar is **serrated (slip resistant)** Cross bar is a twisted square bar of min. **5 x 5 mm**. Grating panels will be securely fastened to the supporting steel beams by special saddle type clip fasteners. Minimum of four fasteners provided at each section of grating. Fasteners will be self-tapping bolts M8, bolt holes will be drilled at Site. Alternatively, the gratings may be fixed with shooting fasteners directly to steel (e.g. Hilti DX).

Where dry material may drop on to platform (e.g. by maintenance openings of fuel conveyors), tear plate of 3 mm will be installed above grating. Grating platform of certain routes for hauling shall be covered with 3 mm tear plate. Plate is connected with screws and splices are not welded. Alternatively, tear plates may be part of the grating panel premanufactured at the workshop.

Where water or oil may drop on to platform, tear plate of 6 mm will be installed directly on beams. Plate is welded at Site to be watertight, plates will be painted at Site.

Below the pattern of the tearplate (or similar)



Toe plates and handrails will be arranged around all platforms. The toe plates will be made of 5 x 150 mm steel bar or equal L-bar.

Concrete platforms:

Platforms in electric rooms are assumed to be made of concrete.

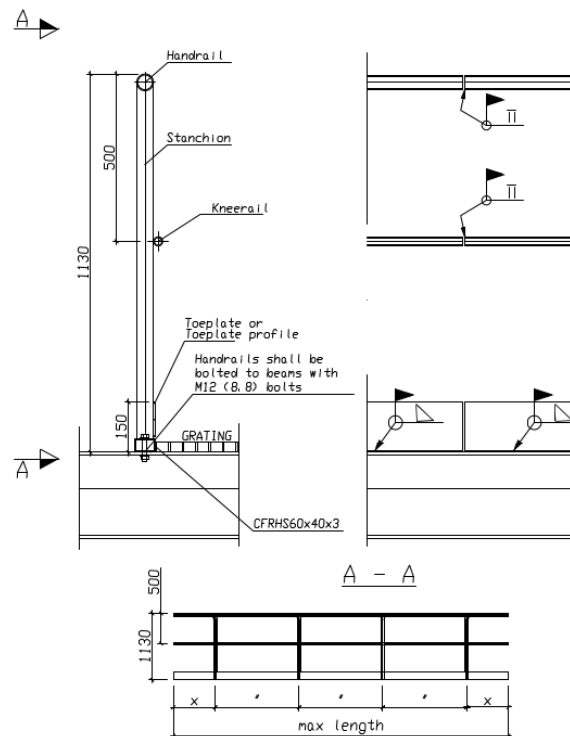
Coating of electric and control rooms is static dissipative plastic flooring on walking areas. Otherwise dust suppression varnish or painting.

12.6.2 Handrails

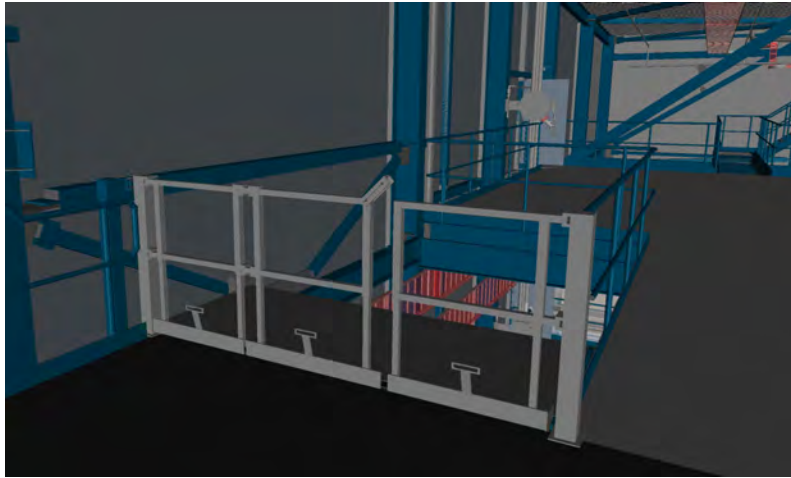
Guardrails will be made of mild steel S185 or S235 pipes and will be constructed in accordance with the EN 14 122. Guardrails shall be constructed using approximately 6 m long prefabricated elements including kick plate or designed as single elements by the choice of Valmet.

	profile
Handrail	CFCHS 48.3 x 2.6
Stanchion	CFCHS 48.3 x 2.6
Kneerail	CFCHS 26.9 x 2.6
Toeplate / profile	PL5x100 or L-profile
Connection to platform	Bolted with holes drilled at Site or welded at Site

GUARDRAIL ELEMENT ON PLATFORMS



Removable handrails or gates shall be provided beside (one side) the hatchway.



A turnable platform for safer hauling at the gate is included.

12.6.3 Stairs

There is one main stair shaft and one emergency stair shaft for access between operating platforms of the boiler house.

Stairs will be constructed in accordance with the EN 14122.

In the main stair shaft:

- Stair slope, constant value between 32°... 38°
- Stair width: See 12.6.1

In the other stairs:


- Stair slope 36°... 45°
- Stair width: See 12.6.1

Stair treads are of hot-dip galvanized grating type with non-slip nosing.

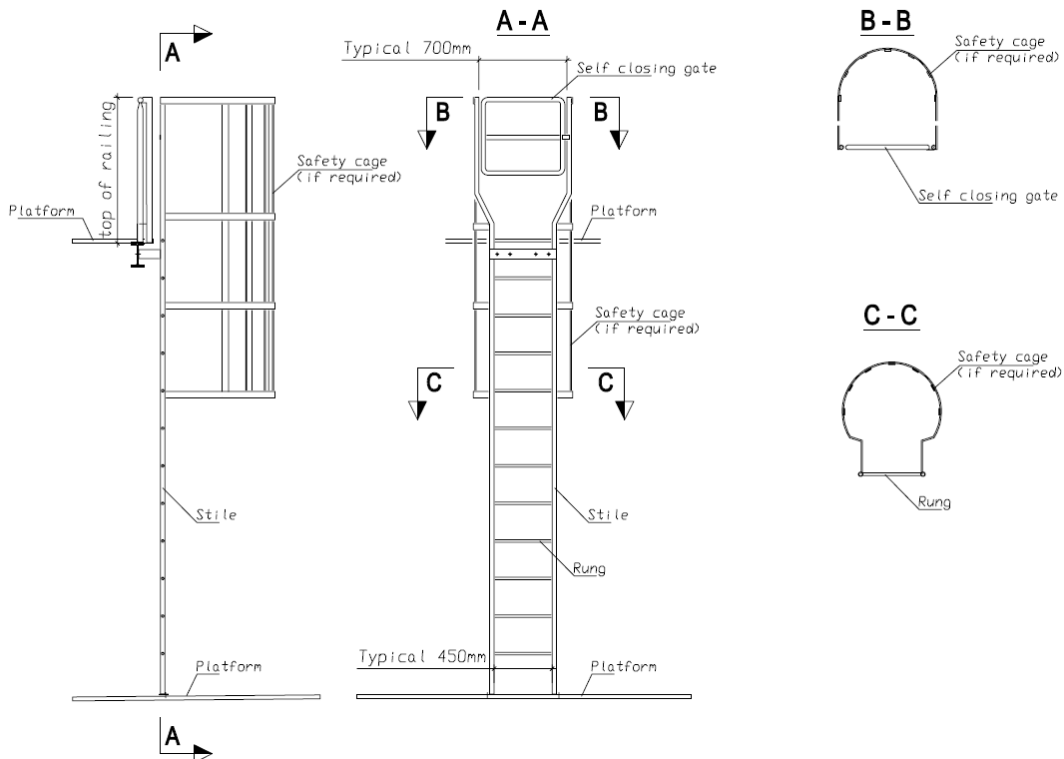
Guardrails will be as per item 12.6.2 Handrails but without toe plates. On stair cases the inner handrail is continuous and the perimeter handrail is interrupted with spaces in the corners of landings.

12.6.4 Ladders

Ladders to be provided to areas requiring service where stair access is impossible or impractical. Safety cages will be provided to the ladders where necessary according to safety regulations EN ISO 14122.

	profile
Stile	CFCHS 42.4 x 3.2
Rung	 (or similar)
Self-closing gate	CFCHS 42.4 x 3.2 or Contractor's standard
Safety cage (if required by ISO 14122)	PL6x40
Connection to platform	Bolted

LADDER



12.6.5 Drainage system

Rain water piping from the roof to ground level will be designed. Waste water from water tight platforms will be led to ground floor with piping. See appendix 02.01 for the delivery limit.

12.7 Wall and roof structures

See Appendix 02 "Delivery limits and scope of supply" and 02.01 "Delivery limits for civil and structural" for scope of supply and delivery limits.

In the delivery can be three different type of structures;
Closed-insulated structures,
Closed structures and
Open-structures.

Below a table with the different rooms and the type of structure. Also a description of the different types.

	Closed-Insulated Closed Open-structure	comment
Boiler room	Closed- Insulated	
Main staircase	Closed-Insulated	
I.D. fan room	Open-structure	
HVAC area	Open-structure	
Fuel silo and reclaiming area	Open-structure	
Ash container room	Open-structure	
Secondary staircase	Open-structure	
Other areas	Open-structure	

Fasteners for roofing and walls will be made of stainless steel AISI 410 (corresponding EN 1.4301 or AISI 304) or equal.

12.7.1 Roof decking

Roofs are sloped roofs, unless otherwise mentioned roofs have no parapet and no handrail. Handrail to roof parapet is installed on boiler building roof, where height of parapet is smaller than 1.1 m.

Boiler room has two roof fields with a ridge. The field of a roof is sloping in one direction, draining of roof by internal drainage or gutters on the exterior (see 12.7.6 Drainage system).

12.7.1.1 Closed-Insulated structure

Weather tight insulated roofs

Roof construction will be built on lightweight purlins or secondary beams, supported by roof beams.

Roof construction is:

- Galvanized corrugated metal sheet decking, roof slope 1:40 (approx. 1,43 degree)
 - Sheet thickness at least 0.7mm
 - Coating:
 - top side: No coating
 - bottom side: PE or acrylic (manufactures standard colour)
- Vapour barrier
- Hard mineral wool min. 100 mm
- Top layer of roofing type two layer asphalt roofing or single layer PVC
- Service walkways on the roof of impregnated wood. Alternatively rubber tiles can be used.
- Roof slope of other rooms than boiler room 1:23 (approx. 2,5 degree)
- Counter slopes or cricket are made by hard mineral wool or expanded clay pearls.

Suspended ceiling (if applicable):

Ceiling construction is made of:

- Mineral wool insulated steel sandwich element: sheet - wool – sheet
- Thickness at least 100mm
- Sheet thickness 0.5 / 0.6mm
- Coating:
 - side on exterior: PVDF (PVF2) Pural (colour),
 - side on interior: PE or acrylic (manufactures standard colour).

12.7.1.2 Closed structure

Weather tight roofs.

Simple weather tight roof decking built on purlins, which are supported by roof beams. Field of roof is sloping in one direction, draining of roof by gutters are on the exterior (see 12.7.6 Drainage system). Boiler room has two roof fields with a ridge.

Roof construction is:

- Galvanized corrugated metal sheet decking, roof slope 1:16
 - Sheet thickness at least 0.6mm
 - Profile height 40-50mm
 - Coating:
 - side on exterior: PVDF (PVF2) Pural (colour),
 - side on interior: PE or acrylic (no colour)

Roof construction of Closed structures may also be as a Insulated structure, by choice of Valmet.

12.7.2 External walls

12.7.2.1 Closed-Insulated structure

Wall construction is made of:

- Mineral wool insulated steel sandwich element: sheet - wool – sheet
- Thickness at least 150mm
- Sheet thickness 0.5 / 0.6mm
- Coating:
 - side on exterior: PVDF (PVF2) Pural (colour),
 - side on interior: PE or acrylic (manufactures standard colour)
- The panels are installed horizontally
- Thickness of necessary flashing at least 0.5mm.

12.7.2.2 Closed structure

Wall construction is made of:

- Galvanized trapezoidal sheeting (installed vertical)
- supported by horizontal light weight purlins.
- Sheet thickness at least 0.5mm
- Profile height 15-30mm
- Coating:
 - side on exterior: PVDF (PVF2) Pural (colour),

- side on interior: PE or acrylic (manufactures standard colour) Thickness of necessary flashing at least 0.5mm.

12.7.3 Internal walls

Wall construction is made of:

- Mineral wool insulated steel sandwich element: sheet - wool – sheet
- Thickness at least 100mm
- Sheet thickness 0.5 / 0.6mm
- Coating: PE or acrylic (manufactures standard colour)

The panels are installed horizontally

Wall of elevator shaft is made of:

- Galvanized trapezoidal sheeting (installed vertical)
- supported by horizontal light weight purlins.
- Sheet thickness at least 0.5mm
- Profile height 15-30mm
- Coating:
 - outside: PE or acrylic (colour),
 - inside: PE or acrylic (manufactures standard colour)

Other walls:

In electric rooms internal walls shall be either brick, concrete or mineral wool insulated steel sandwich elements, see scope of supply (Appendix 02 and 10.01).

The feed water pump room internal walls shall be either brick, concrete or mineral wool insulated steel sandwich elements, see scope of supply (Appendix 02 and 02.01).

12.7.4 Cladding colour scheme

Colours of surfaces shall be mutually agreed form the standard colours of cladding material Contractors. Metal shade colours shall not be used.

The delivery does not include any logo or provisions for a logo. Logo and/or preparations for the support or connection of a logo will be handled as a Change Order Request (COR).

12.7.5 Doors and Windows

See Appendix 02 "Delivery limits and scope of supply" and 10.01 "Delivery limits for civil and structural" for scope of supply and delivery limits.

Locking system excluded in delivery.

Personnel doors

Type	Size[M]	Steel structured	Insulated	Window	Closer	Handle and lock body	Lock	Panic bar	Fire resistance (min)	Comment
Weather door	11x21	X	X	-	X	X	-	-	-	building → out door
Fire door	(10+3)x21	X	-	-	X	X	- ¹	-	30	Boiler building → main staircase
Weather door	(10+3)x21	X	X	-	X	X	- ¹	-	-	Main staircase → out door
Fire door	11x21	X	-	-	X	X	-	-	30	Boiler building → sec staircase
Other doors	11x21	X	-	-	X	X	-	-	-	If any

Note 1: Slave door is designed with a lock bolt.

Maintenance gates

Type	Size [M]	Overhead door	Electrically operated	Insulated	Window	Handle	Lock body	Lock, Panic bar, closer [L/P/C]	Fire resistance	Personnel door	Comment
Service door	(15+15)x30	-	-	X	-	X	X	- ¹	-	-	
Service door	(10+10)x25	-	-	X	-	X	X	- ¹	-	-	Boiler room → out
Service door	35x40	X	X ⁴	X	X ²	X	X	-	-	-	At hatch way in Boiler room → out

Other service doors	(10+10)x25	-	-	-	-	X	X	- ¹	- ³	-	In interior walls
---------------------	------------	---	---	---	---	---	---	----------------	----------------	---	-------------------

Note 1. Slave door is designed with a lock bolt

Note 2. Window is at eye level in door leaf.

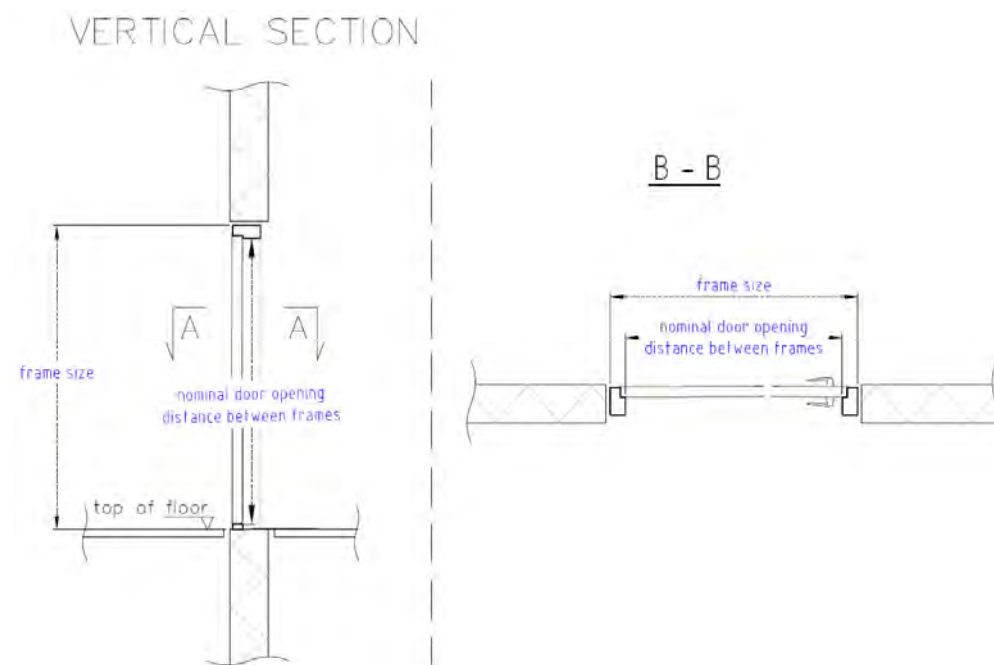
Note 3. Fire resistance where required.

Note 4. The motor maybe installed on the exterior.

Service doors according to the general lay out drawings.

Sizes (for example 11x21M) are modular sizes (M) of the frame, the nominal door opening is smaller than the frame size. 1M equals 10cm.

The final frame size and nominal door opening is manufacturers standard.



Windows

Standard industrial type double glazed glass windows with aluminium frame. Scope includes no window area.

12.7.6 Drainage system

12.7.6.1 Internal roof water drainage

Internal down pipes are used in boiler building.

Rainwater piping is $\varnothing 100 \dots 150$ mm of stainless steel pipes from the roof to the ground level.

Overflow drains are installed in addition to the roof drains.

12.7.6.2 External roof water drainage

External down pipes are used in bottom ash container room, stair shafts, flue gas filter, ash silo and flue gas fan room. Boiler stair cases shall have external piping leading rainwater to boiler building roof.

Gutters and down pipes are $\varnothing 100 \dots 150$ mm of hot dip galvanized sheet with coating per Contractor standard.

12.7.6.3 Internal drainage from elevated platforms

Platforms which may collect large amount of water will have drainage, internal down pipes are used in boiler building.

Piping is $\varnothing 100 \dots 150$ mm of stainless steel pipes from the roof to the ground level.

Piping to be connected to the designated sewage system.

12.8 Equipment

12.8.1 Elevator

Technical data of elevator:

- | | |
|--------------------|--|
| • Type | Passenger, standard type, single entry |
| • Capacity | 1600 kg |
| • Location | In main staircase (1pcs) |
| • Speed | 1,0 m/s |
| • Protection class | IP 21 |
| • Power supply | 400 / 230 V, 50 Hz |
| • Stops | To main service platforms (including ground level) |
| • Travel | From ground level to the topmost service platform |

- Control Full collective
- Intercom Voice link with alarm system, no telephone
- Fire alarm Return to ground floor
- configuration No fire man function nor evacuation use
- Car enclosure Stainless steel panels, walls & ceiling brushed, aluminium floor tear plate
- Doors Automatic, side opening, brushed stainless steel panels
- Machine In shaft, no machine room
- Service Local service available

12.8.2 Hoist

Typical technical data / hoist as follows:

- Capacity 5 tons, FEM 1Am
- Location Above main hatchway (1pcs)
- Service Indoors
- Type Wire rope – close headroom
- Lifting height From ground floor to the highest service platform
- Lifting speed standard m/min
- Monorail Standard I-beam
- Control Radio

12.8.3 Central vacuum cleaning piping

The piping will consist of one main vertical riser pipe and branch pipes where necessary. The system will be designed for two simultaneous users. The connection to the mobile equipment will be at one location at the ground floor.

Piping:

- Galvanized steel with rubber hose bends and connections
- Main riser diameter is 108, 127 or 152 mm,
- Branch pipes having dia 127 mm, 108 mm, 76 mm and 50 mm
- 50/76 mm suction socket at every main platform
- 3 pcs Ø 76 hose sets, length 15m, locations to be mutually agreed
- See flow sheets in appendix 20 Flowsheets



12.9 Stack (existing)

A flue gas duct will lead to the existing free standing general concrete stack.

- Necessary measuring points max. 12 pcs dia NS 80
- Service/ measurement platform One unsheltered platform along side the duct, depth max 1500 mm, supporting steel and grating hot dip galvanized, access from boiler building or open staircase.

12.01

VENTILATION, HEATING AND COOLING OF A NEW BFB BIOMASS POWER PLANT (K20) AND ELECTRICAL ROOM COOLING FOR 2 EXISTING BOILERS (K80 AND K90)



Table of Contents

12.01.01 DESIGN DATA	3
12.01.01.01 Utility and ambient air design data	3
12.01.01.02 Internal sound attenuation, ventilation	3
12.01.02 VENTILATION, HEATING AND COOLING EQUIPMENT	4
12.01.02.01 Boiler room ventilation, natural ventilation concept	4
12.01.02.02 Ventilation of the main stair case	5
12.01.02.03 Ventilation of the compressor room	6
12.01.02.04 Cooling and ventilation of electrical rooms BFB	6
12.01.02.05 Additional cooling of electrical rooms in the existing boiler plant	7
12.01.03 DELIVERY STANDARDS	9
12.01.03.01 Standard materials and components	9

12.01.01 DESIGN DATA

12.01.01.01 Utility and ambient air design data

Outdoor design temperature	
- summer	+30,9 °C
- winter	-6 °C
Outdoor design humidity	
- summer	16 g H ₂ O/kg d.a.
- winter	2 g H ₂ O/kg d.a.

12.01.01.02 Internal sound attenuation, ventilation

Internal noise caused by the ventilation equipment is maximum according to the following list:

Internal noise, L _p (1 m):	
- boiler room	85 dB(A)
- main stair case	75 dB(A)
- fan rooms	85 dB(A)
- other process rooms	85 dB(A)
- electrical rooms	80 dB(A)

The measurement is carried out according to ISO 3746 standard. The noise caused by the ventilation equipment is measured at a height of 1.55 m above the floors or walkways in the building and at a distance of not less than 1 m from the equipment.

12.01.02 VENTILATION, HEATING AND COOLING EQUIPMENT

12.01.02.01 Boiler room ventilation, natural ventilation concept

TECHNICAL DESCRIPTION

Main design goals and principles:

- to ventilate excess heat generated by process systems out from boiler house and keep indoor temperature within design values
- to compensate for the combustion air taken from the boiler house

The excess heat from process machinery and the boiler, is utilized for boiler room and combustion air heating as much as possible.

Exhaust air is flowing out through a number of heatmovers on the roof.

A number of direct air intake dampers are placed to the boiler house walls for supply air.

One recirculation air unit is located into boiler house. The recirculation air unit moves warm air from the upper part of the building to the lower part wintertime.

A number of shutdown heaters are located at the ground floor near door openings.

Dimensioning criteria	
Maximum temperature at the upper part of the building	+60 °C
Minimum temperature at the ground level	+5 °C
Minimum temperature during shutdown	+5 °C
Supply air filtering	No
Maximum differential pressure over building	100 Pa

DESCRIPTION OF OPERATION

The inside air temperature is controlled with the supply and exhaust air dampers.

The recirculation air unit circulate warm air from the upper part of the boiler house to the ground level in order to minimize the need of separate heating wintertime. Summertime it is closed.

Boiler house ventilation operation in shutdown

In summer all dampers can be used for ventilation.

In winter all ventilation openings and doors have to be closed.

Ground floor unit heaters are in operation when needed.

12.01.02.02 Ventilation of the main stair case

TECHNICAL DESCRIPTION

Main design goals and principles (main staircase):

- to ventilate the staircase and keep the temperature within the design values
- to keep the main staircase in overpressure compared to the boiler house

The supply air is taken from outside.

The exhaust air is flowing out in the upper part of the staircase.

The main staircase is heated with an air heater.

The lift shaft is underpressurized with an exhaust air fan.

Dimensioning criteria - main staircase	
Maximum temperature	+46 °C
Minimum temperature	+5 °C
Minimum temperature during shutdown	+5 °C
Supply air filtering	No

DESCRIPTION OF OPERATION

The temperature and overpressurizing of the main staircase is controlled with the speed of the fan and the air heater.

12.01.02.03 Ventilation of the compressor room

TECHNICAL DESCRIPTION

Main design goals and principles:

- to ventilate excess heat generated by process systems out from the room and keep indoor temperature within design values

The supply air is taken from the boiler house ground floor. The supply air equipment is located on the compressor room wall.

The exhaust air is flowing back to the boiler house.

Dimensioning criteria	
Maximum temperature	+46 °C
Minimum temperature	+5 °C
Minimum temperature during shutdown	+5 °C
Supply air filtering	No

DESCRIPTION OF OPERATION

The fan is running all the time.

12.01.02.04 Cooling and ventilation of electrical rooms BFB

TECHNICAL DESCRIPTION

Main design goals and principles:

- to cool the electrical rooms and keep the temperature within design values
- to keep the electrical rooms in overpressure compared to the boiler house, outside and other rooms.

The cooling units are roof or floor mounted compressor cooled units located inside the electrical rooms.

The pressurization air is calculated to be 2.5 changes/h, for the electrical rooms.

Overpressurizing unit is common for all electrical rooms and located outside on the roof above the electrical rooms. The overpressurization unit is equipped with humidity reduction (humidification is not included), and fine filtration F8.

Dimensioning criteria - electrical rooms	
Average target temperature and humidity 1.5 m above floor in the middle of the electrical rooms	+23 °C 55 % RH
Minimum temperature during shutdown	+ 10 °C
Supply air filtering	F8

DESCRIPTION OF OPERATION

The temperature inside the electrical rooms is controlled with the compressor cooling units.

The temperature of the pressurization air is controlled with the heating and cooling coils. The humidity of the pressurization air is controlled summertime with the cooling coil. No humidification is possible.

Pressure meters is included for all overpressurized rooms.

12.01.02.05 Additional cooling of electrical rooms in the existing boiler plant

TECHNICAL DESCRIPTION

Additional coolers are installed in the existing medium voltage electrical rooms to compensate for the additional heat load from the new flue gas fan frequency converters.

The cooling units are roof or floor mounted compressor cooled units located inside the electrical rooms.

The additional heat load in the low voltage rooms is small, and possible to handle with the existing cooling system.

The pressurization air for the electrical rooms is existing.



DESCRIPTION OF OPERATION

The temperature inside the electrical rooms is controlled with the compressor cooling units.

12.01.03 DELIVERY STANDARDS

12.01.03.01 Standard materials and components

STANDARD MATERIALS

Main material specification for the delivery is as the following table. Minor deviations can exist.

Equipment	Material
Fans	galvanized steel sheet
Ventilation units	galvanized steel sheet
Air ducts	galvanized steel sheet
Silencers, regulation dampers, etc.	galvanized steel sheet
Air intake or exhaust louvers	galvanized steel sheet
Heating and cooling coils	Cu/Al
Refrigerant piping	copper
Heating piping	stainless steel
Cooling piping	stainless steel

The following or equivalent materials are used for the manufacturing of the equipment.

Ventilation equipment	Material standards, EU
Surface sheets of insulated ducts	EN AW-1050A (Al 99,5)
Cold-rolled steel sheets	DC01 (CR 2-11) (St12)
Hot-rolled steel sheets	S235JRG2 (Fe37B) or S355 (Fe52)
Steel profiles	S235JRG2 or S355 (Fe52)
Aluzink steel sheet	ALZ B500A
Galvanized steel sheet	DX51D+Z200
Stainless steel sheet	EN 1.4301
Stainless steel piping	EN 1.4307

STANDARD COMPONENTS

All instruments are HVAC standard components, protection class IP54. Standard electrical motors are according to IEC

standard, efficiency class IE2/IE3 according to the EN standard, protection class IP55. Special motors according to the suppliers standard. All other components are of good HVAC standard.

Standard HVAC equipment, are complete shop fabricated units with motors, possible integrated frequency converters, instruments, paintings, etc. They are selected by the unit manufacturers, when they have issued the CE marking. Changes to these units can be done only in special cases, and the Purchaser bear all the costs.

Component	Manufacturer
Actuators - on/off, fire or smoke, electrical - regulation, electrical	Siemens, 230 VAC Belimo, 24 VDC, 230 VAC Siemens, 24 VDC, 0-10 V Belimo, 24 VDC, 230 VAC, 0-10 V
Water regulation valves, regulation or on/off, electrical	HORA
Water/steam regulation valves, pneumatic (steam or district heating)	Neles
Balancing valves	Vexve, Naval
Manual valves	Vexve, KSB, Armatec, AVS, Haitima
Sensors/gauges - temperature sensor - temperature gauge - pressure sensors - pressure gauge - pressure switches - filter guards - humidity	Endress + Hauser Wika Endress + Hauser Wika Kromschröder Kytölä, ALRE, Stig Wahlström Siemens
Standard motors	Siemens, ABB, VEM, WEG
Ventilation units	VBW, Wolf, Euroclima, IV Product, Tecnaïr, Emerson, Cetra, Fläkt
Electrical room cabinet coolers	Tecnaïr, Emerson, Carrier, Keyvent, Mitsubishi
Air coolers, air heat pumps	Carrier, Toshiba, Daikin, Mitsubishi
Axial flow fans	Stiavelli, Novenco, Sodeca, AT Air, Systemair, Ziehl-Abegg, Ferrari, Koja, Fläkt
Centrifugal fans	Howden, Ziehl-Abegg, EBM Papst, Gebhard-Nicotra, Fläkt
Regulation dampers, air intake louvers	Lindab, Fläkt, Halton, ETS Nord, Klimat-Solec
Air distributors and exhaust diffusers	Lindab, Halton, Fläkt, ETS Nord, Klimat-Solec
Smoke exhaust fans	Fläkt, Ferrari, Novenco, Systemair, Sodeca
Smoke evacuation hatches	Harikko, Keraplast, Fläkt, ETS Nord, Sodeca, Tikli, Mercor
Fire dampers	Fläkt, Halton, Lindab, Trox
Water pumps (integrated motor and pump)	Kolmeks, Grundfos
Fan air heaters	Fläkt, Frico, GEA, Galletti
Cooling units (Cylinder or Scroll	Galletti, Carrier, KojaCool, Chiller,



compressors)	Trane,
Expansion tanks	Reflex, A-Flex, Armatex, Flamco
Water heating heat exchangers (district heating water, steam)	Alfa Laval, Vahterus
Air heating coils (water, steam)	GEA, FACO, Ecocoil, Salpahitsaus, Modine, BTN
Electrical heaters	Meyer-vastus
Sound attenuators	Fläkt, Lindab, Klimat-Solec
Exhaust heatmovers	Zefyr
Chemical filters	Climecon, Camfil, Purafil
Air ducts	Various subsuppliers, not specified

STANDARD VENTILATION COMPONENTS

Corrosivity categories for the air systems.

Equipment	Atmospheric - corrosivity category according to ISO 12944
Equipment located outside	C3
Equipment inside the building	C2

Table of Contents

1 CIVIL AND STRUCTURAL	2
1.1 Delivery limits	2
1.2 Scope of supply	4
1.2.1 List of civil objects in scope of supply	4
1.3 Design data	9
1.3.1 Codes and standards	9
Loading standards:	9
Material standards (in general):	10
1.3.2 Fire safety	10
1.4 Fabrication	10
1.4.1 Workshop	10
1.4.2 Surface treatment of steel structures	10
1.5 Frame structures	11
1.5.1 Platforms	11
1.5.2 Handrails model similar as existing	13
1.5.3 Stairs	13
1.5.4 Ladders	14
1.6 Wall and roof structures	14
1.6.1 Roof decking	14
1.7 OH&S and fire prevention	14

1 CIVIL AND STRUCTURAL

1.1 Delivery limits

These general delivery limits are valid if not otherwise specified later.

Delivery limit for the new steel structures supported on the foundations is ground floor level +0.00:

- Stairs and other equipment will start above concrete pads with top of concrete approximately +0.200 above nominal level of ground (slab).
- others according to equipment drawings

Loading and dimensional information for the concrete structure engineering shall be given by Valmet:

- Loads for foundations and the slab at grade
- Loads and locations of equipment supported by the concrete structures
- Information for the concrete base and concrete structures (openings and loads)

Loads for concrete structure engineering will be given in characteristic load values not in load combinations. Sizing of pedestals for columns and equipment is in the scope of the Purchaser.

Steel structures

New steel structures will come only area where Valmet need new structures for new fuel feeding system and silos as well as for new sootblowers.

Valmet do not make any modifications or new structures to the building for fuel feeding systems which are in purchaser's scope. In this case new conveyors to the building and into the old coal gallery.

Delivery limit for the new steel structures supported from the existing frame is the touch up painting for connection points of existing frame. Points where existing structures must be sand to erect new structures.

Valmet do the structural calculations only for area where modifications are needed. Valmet do not make statical calculation for old steel frame of the boiler house.

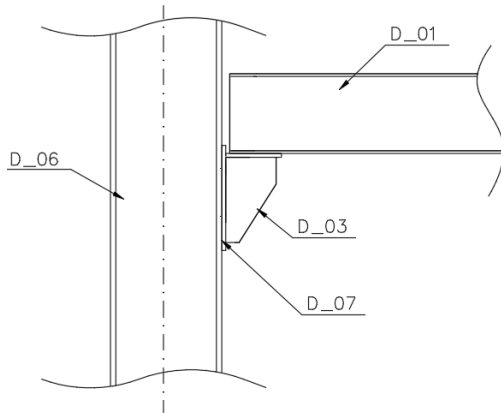


Figure 1 PRINCIPAL DETAIL OF CONNECTION TO EXISTING STEEL STRUCTURE

V – Valmet, C – Customer

		Basic engineering	Detail engineering	Supply	Erection
D_01	Steel beam for platform and/or equipment support	V	V	V	V
D_03	Steel Console - Connection with steel structure is designed with slotted holes if possible	V	V	V	V
D_06	Existing steel structure	-	-	-	-
D_07	Connection to existing structure - Console design (V) - Verification of existing structure (C) - Design of connection (site welded or site bolted) (V) - Verification of bolt/weld location and verification of design capacity of connection before detail design of console (V) - Erection Drawings with anchor bolt locations (if concrete) and locations of consoles (V)	V	V	V	V

Cladding and roof

Delivery limit for insulation and cladding modifications and rebuild. Cladding and roof structures are to be rebuild as the old after modifications needed within scope of supply.

Building permit and third-party inspection

The Purchaser shall obtain a construction license and other necessary permits for the project. Valmet will provide structural calculations for the new steel structures within scope of supply. Excluding structural calculations for the old existing structures. Written description of the possible impacts on the existing steel structures from the new steel structures provided, if required.

1.2 Scope of supply

The delivery includes the following list of civil objects related to the supply of Valmet as well as engineering, procurement and supply according to the delivery terms for the structures, which are specified in Valmet's delivery table in Appendix 02 "Scope of supply"

The scope list contains also works by others, in order to give an overview of the items that may be required, but the list should not be considered all inclusive. Supporting structures and foundations for the new delivered equipment are included in the scope of supply.

1.2.1 List of civil objects in scope of supply

New fuel silos and their vicinity

New platforms indicated with yellow color below the new fuel silos. The top existing platform to be modified to answer the same as old after modifications required by the fuel silo instruments. Modifications to the existing platforms vicinity of the fuel conveyors. Supporting steel structures for the fuel silos and their instruments. Structural changes and new equipment may require additional bars for structural entity and stability, the existing frame is strengthened where it is needed.

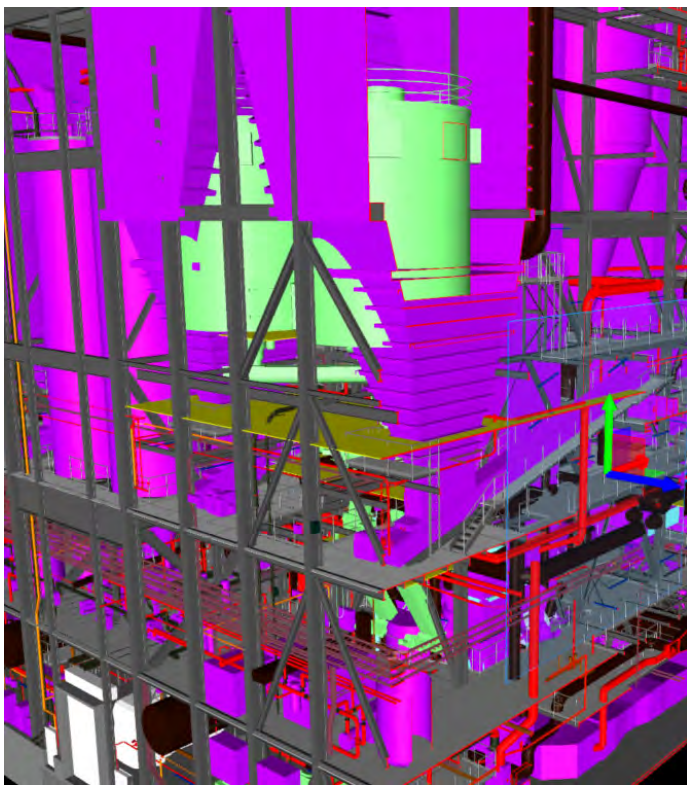


Figure 2 New platforms indicated with yellow color below the new fuel silos. –

New platforms around the boiler building

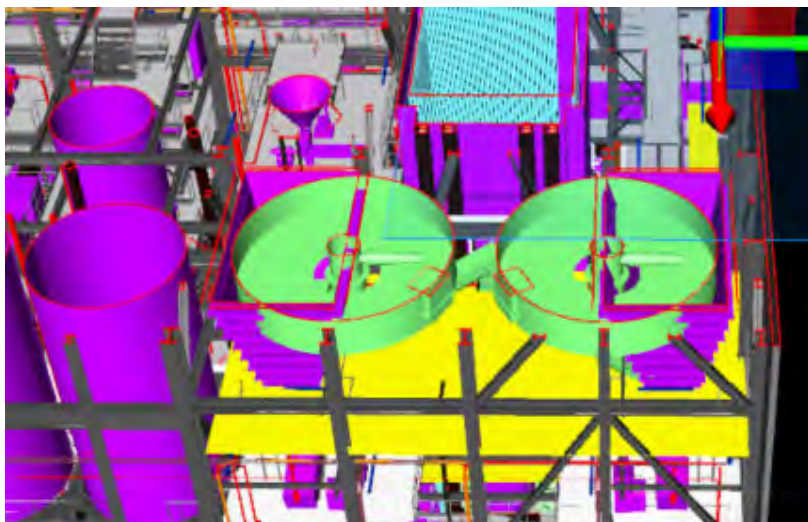


Figure 3 New platform under the silos.

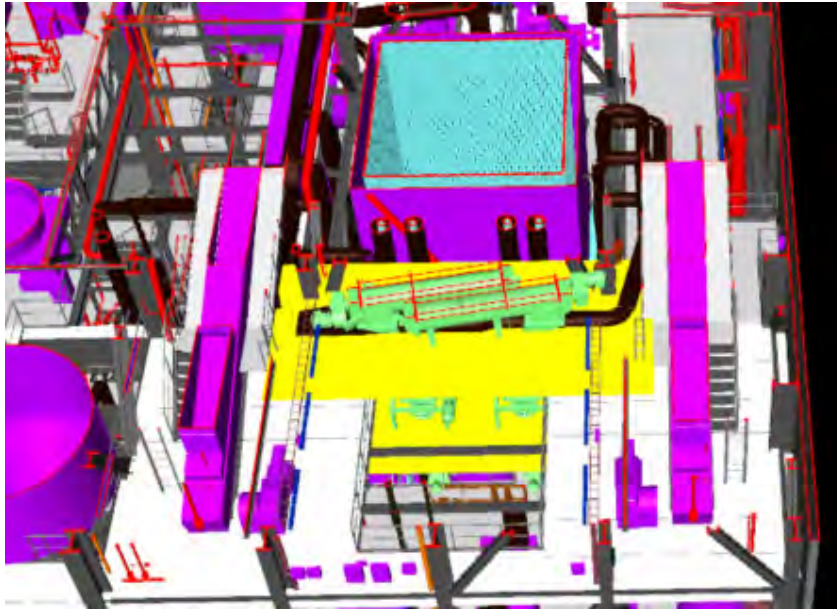


Figure 4 New platforms for fuel feeding system.

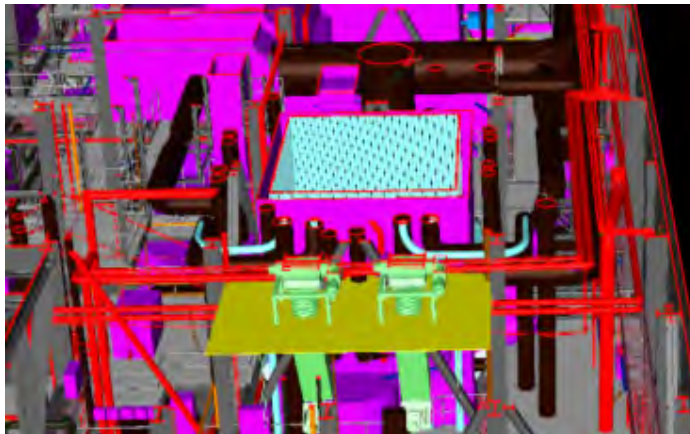


Figure 5 Second new platform for fuel system.

The existing steel structure will be utilized if possible to support the silo. Valmet will provide new steel structures to support the silo. The Purchaser will reinforce and verify the old structures if they are utilized.

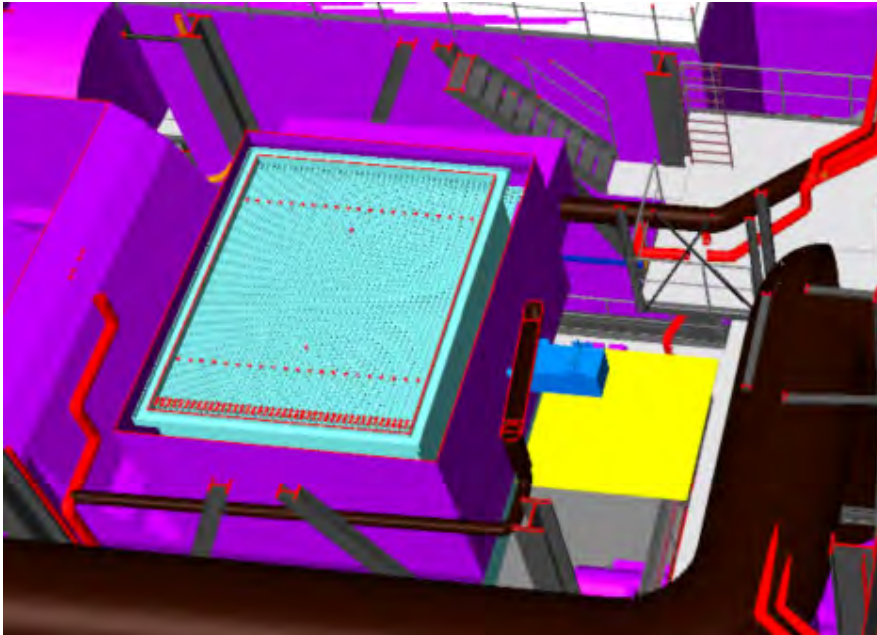


Figure 6 New platform for sootblower.

Insulation and claddings

Insulation and cladding modifications will be done for explosion ducts from silos

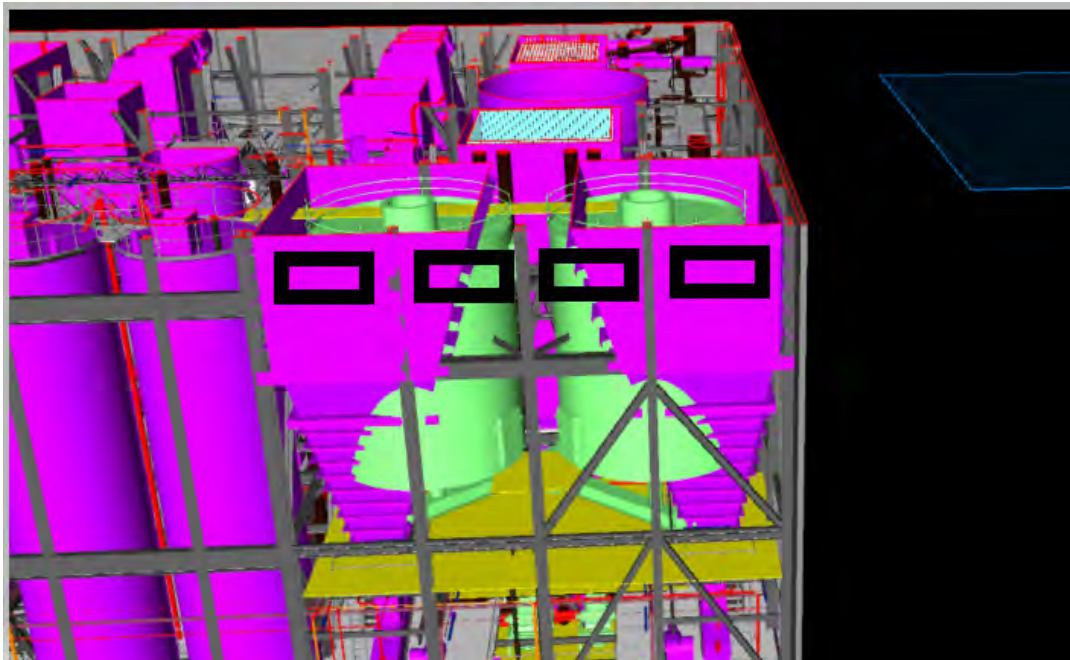


Figure 7 Cladding modifications

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.

Support structure modification in coal gallery

Valmet assume that old structure at level +36.000 can support new conveyors. Valmet will modify level +36.000 for new conveyors.

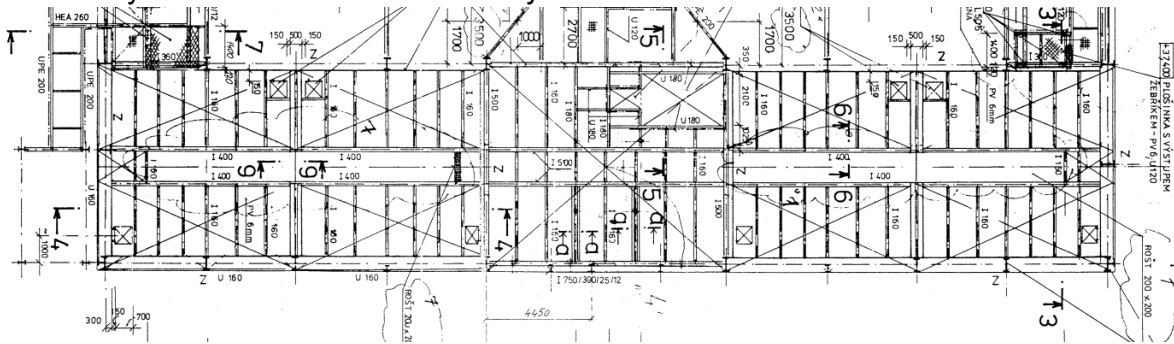


Figure 8 Coal gallery at level +36.000

Valmet will make new platforms and supports for new conveyors inside the building. Also small extensions for new conveyors as in our drawing has proposed. According to our analysis old building cannot handle forces (horizontal and vertical) which are coming from new bridge. For those loads need to build support outside the building. New support for conveyor bridge is not in Valmet's scope.

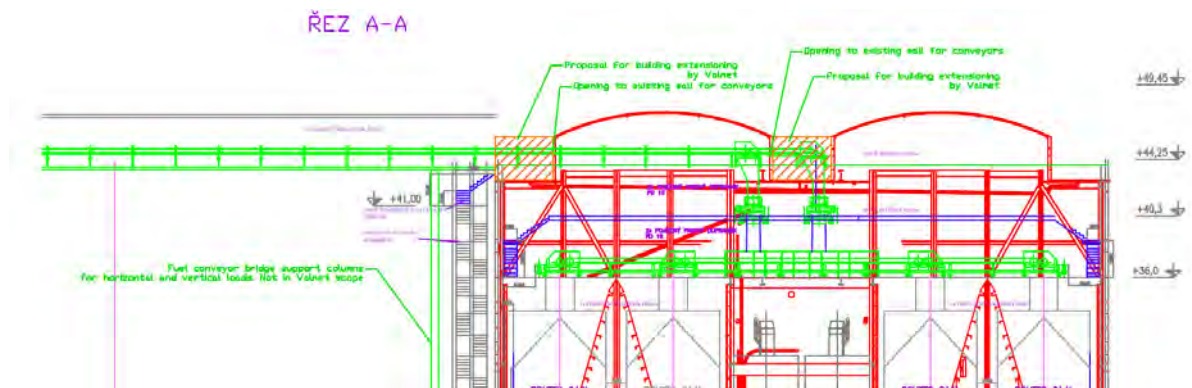


Figure 10 Coal gallery above at level +36.000

1.3 Design data

1.3.1 Codes and standards

Design standards:

EN (Eurocode) for the structural design.

Consequence class for buildings is CC2 (EN1990)

Execution class for steel structures is EXC2 (EN 1090-2).

Loading standards:

Natural loads in accordance with Eurocode 1991 series and National annex.

Dead loads:

All structures shall be designed for the actual dead load due to the weight of all permanent structural and non-structural components such as framing, walls, floors, platforms, roof and permanently installed equipment.

Live loads on the platforms, as listed below:

New steel platforms around the fuel feeding systems and silos	uniform load	5.0	kN/m ²
	or point load	2.5	kN (200x200mm)
Stairs and landings	uniform load	2.5	kN/m ²

Small piping and cable loads (0,5 kN/m²) are included in the uniform loads above.

Where Eurocode and NAD allow, above mentioned live load on floors will not be accumulated for design of columns.

Dynamic loads:

- The dynamic effect of rotating or oscillating equipment on the supporting structure or foundation shall be considered as applicable.

Equipment loads:

- Structures shall be specially designed to support the operating loads of equipment supplied by Valmet when the operating load exceeds the total floor live load on the area the equipment occupies.

Live, Dead and Equipment loads caused by equipment outside of the Delivery will be handled as a Change Order Request during the Project Phase.

Material standards (in general):

Eurocode (EN) for the structural steel. Handrails gratings, stairs, chequered plates and cladding material standards based on origin of the fabricator.

Fasteners:

- Bolts are to be of grade 8.8 (or ASTM A325), hot-dip galvanized
- Nuts are to be of grade 8 (or ASTM A325), hot-dip galvanized
- Washers are hot-dip galvanized

1.3.2 Fire safety

In boiler building and in other rooms within delivery limits and within scope of supply steel dimensions will not be increased due to fire loads. No fire protective painting or coverage is included, based on earlier experience of fire technical and risk analysis of similar plants.

Valmet will not do any modification to existing fire safety systems

Architectural design

Architectural design is excluded from the delivery of Valmet. The quotation is based upon the common industrial appearance: all colors shall be mutually selected from standard charts of manufacturer.

1.4 Fabrication

Fabrication and Erection will be carried out according to the EN 1090 "Execution of steel structures. General rules and rules for buildings".

EN 1090 includes also procedure of QC, e.g. material certificate of structural steel is according to EN 10204 and "Quality Assurance Plan".

1.4.1 Workshop

A special program for the fabrication will be established to meet the quality determined in applicable standards and codes.

1.4.2 Surface treatment of steel structures

Painting will be carried out according to European standard EN ISO 12944- "Paints and varnishes - Corrosion protection of steel structures by protective paint systems".

Hot dip galvanizing will be carried out according to the EN ISO 1461, where minimum coating is related to the material thickness.

Steel structures inside cladding shall be painted,
category C4 high (ISO 12944-5/ C4.10), EP Zn(R)PUR 200/3:

- Preparation grade P3 (thorough preparation)
- Blast cleaning Sa 2½
- Prime coat zinc-rich epoxy primer, 60 - 80 µm
No additional edge protection

- Intermediate coat (one layer) epoxy paint, 60 - 80 µm
- Finish coat (one layer) Polyurethane paint 60 - 80 µm

Surface coating of floor gratings, steps and fasteners is hot-dip galvanizing.

Colours shall be mutually selected from standard charts (such as RAL) of manufacturer. Metal shade colours shall not be used.

1.5 Frame structures

In general, primary and secondary structures, are made of standard steel profiles, HEA, HEB, IPE, UNP, UPE, SHS, RHS and CHS profiles (or corresponding Polish open and hollow sections, as well as other manufactured profiles and factory welded profiles as shall be specified in the detail design documents and as it is most beneficial from static and economical point of view. The steel grade, which normally shall be used, is S235J(H) (or corresponding). If required higher grade of steel shall be used, for instance S355J(H) (or corresponding).

Generally, the structural elements are connected with shear or tension, hot dip galvanized bolts, according to the normal practice. Site welding shall be carried out according to detail design documents exceptionally in the places, which cannot be implemented with bolted connections or otherwise there is a special reason for site welding.

1.5.1 Platforms

Delivery includes platforms and walkways for the new equipment's and old modifications. Walkways and platforms for convenient access to all areas requiring regular access during operations, inspection, testing or maintenance fulfil the following

requirements according to the EN ISO 14122 are followed as a guideline. (Safety of machinery. Permanent means of access to machines and industrial Plants):

Safety of machinery. Permanent means of access to machines and industrial Plants):

- The minimum width of walkway is 1.2 m including escape routes
- The minimum width of walkways is 1.0 m in main service areas, this may be locally reduced to 0,8m.
- The minimum width of walkway is 0.8 m for maintenance with hand tools
- The minimum width of walkway is 0.6 m for only inspection and testing
- The minimum headroom clearance is 2.1 m, this may be locally reduced to 1.8m e.g. under silos or ducts and piping.

However, in this kind of modification of the old plant these dimensions cannot be met in all locations.

INDOOR steel platforms: Service platforms will be covered with hot-dip galvanized grating size **30*30** as existing grating. Bearing bar of the grating is min. **2 mm x 35 mm**. Cross bar is a twisted square bar of min. **5 x 5 mm**. Grating panels will be securely fastened to the supporting steel beams by special saddle type clip fasteners. Minimum of four fasteners provided at each section of grating. Gratings will be clamped on profiles (e.g. Hilti X-MGR) at Site.



Platforms general: Where dry material may drop on to platform (e.g. by maintenance openings of fuel conveyors), tear plate of 3 mm will be installed above grating. Grating platform of certain routes for hauling shall be covered with 3 mm tear plate. Plate is connected with screws and splices are not welded. Alternatively, tear plates may be part of the grating panel premanufactured at the workshop.

Below the pattern of the tearplate (or similar)



Toe plates and handrails will be arranged around all platforms. The toe plates will be made of 5 x 150 mm steel bar or equal L-bar.

1.5.2 Handrails model similar as existing

Guardrails will be made of mild steel S185 or S235 pipes and will be constructed in accordance with the EN 14122. Connections between (approximately 6 m long prefabricated elements including kick plate) elements to be welded or bolted by choice of Valmet.

	profile
Handrail	CFCHS 48.4 x 2.6
Stanchion	CFCHS 48.4 x 2.6
Kneerail	CFCHS 26.9 x 2.6
Toeplate / profile	PL5x120 or L-profile
Connection to platform	Bolted with holes drilled at Site or welded at Site

1.5.3 Stairs

There will be stairs inside boiler building, provided between service platforms. Stairs will be constructed in accordance with the EN 14122.

In the stairs:

- Stair slope 36°... 45°
- Stair width: See 1.5.1

Stair treads are of hot-dip galvanized grating type.

Guardrails will be as per item 1.5.2 Handrails. On staircases the inner handrail is continuous and the is interrupted with spaces in the corners of landings. First and last stair steps are marked according to Koehler specification.

1.5.4 Ladders

Ladders to be provided to areas requiring service where stair access is impossible or impractical. Safety cages will be provided to the ladders where necessary according to safety regulations EN ISO 14122.

1.6 Wall and roof structures

See Appendix 02 "Scope of supply" for scope of supply and delivery limits. Wall and roof structures are rebuilt to answer old wall and roof properties.

1.6.1 Roof decking

Temporary opening will done for erection works and re-done after erection works as existing structure.

1.7 OH&S and fire prevention

Main principle is to ensure both occupational health, safety and fire prevention during project implementation in respect of both newly constructed and dismantled facilities and devices. Existing system will be maintained. Protection actions needed for newly constructed and dismantled facilities, devices and rooms will be built.

Project HSE Plan for EPC deliveries

1. DEFINITIONS

“Customer” is Valmet’s End-customer.

“Subcontractor” is Valmet’s sub-supplier.

2. INTRODUCTION

Purpose

The purpose of this document is to ensure that all necessary actions are taken to accomplish an acceptable safety level for the product and all the project activities by controlling Health, Safety and Environment (HSE) issues in all phases of the project.

Valmet’s global management system

Valmet’s Global Management System (GMS) integrates all our policies, processes, procedures, guidelines, instructions and templates to ensure that we fulfill all requirements to achieve our objectives and serve our stakeholders.

Valmet’s GMS is certified globally according to ISO 9001:2015 (Quality), ISO 14001:2015 (Environment) and ISO 45001:2018 (Health and Safety) management system standards in a multi-site certificate. The multi-site certification secures a process-oriented and standardized global way of working. Valmet’s GMS is followed in all phases of the project.

HSE objectives

As stated in Valmet’s HSE policy, we are committed to protecting the health, safety and environment (HSE) of our people, partners and customers, as well as the communities where we operate. Our goal is zero harm to people and environment. To achieve this goal, our aim is to ensure that consideration of HSE receives the highest priority during the project.

3. HSE REQUIREMENTS

Legislation

National legislation in the country of destination shall be complied with.

Customer HSE requirements

The Customer’s HSE requirements as specified in the Contract shall be complied with.

It is the Customer’s responsibility to inform Valmet (before signing the Contract) and to specify and request corresponding compliance if local legislation or requirements at the Customer establishment require that additional regulations or procedures must be complied with.

Valmet HSE requirements

Valmet's HSE Policy, Site HSE specification and Global Management System shall be complied with.

4. HSE ORGANIZATION AND RESPONSIBILITIES

The scope of the responsibilities between Valmet and the Customer shall be described in the Contract and its appendices.

Valmet Project Manager is responsible for managing the project to meet the customer contract objectives and to fulfil Valmet's HSE goals in Valmet scope of delivery.

Valmet Project HSE coordinator is responsible for coordination of HSE issues in the project in Valmet scope of delivery.

Valmet Site Manager is responsible for meeting contract requirements and Valmet's HSE goals by planning and managing the site operations, ensuring cost effectiveness, quality and correct timing.

HSE actions are carried out by Valmet and its Subcontractors. Where tasks are transferred to Subcontractors, Valmet requires project HSE requirements to be fulfilled by the Subcontractor. Valmet shall monitor the fulfilment of Subcontractors' duties.

The Customer Site Manager is responsible for HSE activities on site. Site Manager shall ensure that all persons on site comply with HSE requirements and instructions.

5. HSE MANAGEMENT IN PROJECTS**Target**

The Project's HSE target is zero harm and an injury-free worksite. HSE is actively promoted and followed in the project through HSE event reporting practices, HSE walks, inspections, conversations, and toolbox talk activity rates and the use of Think About.

Project Management

Project management consists of ensuring the following HSE activities are executed:

1. Requirements of legislation and standards, and Customer's requirements as specified in the Contract are acknowledged and fulfilled.
2. Valmet HSE practices, HSE Policy and Management System are followed.
3. Risk assessments for products in Valmet's scope is completed.
4. HSE risk assessments for construction and commissioning are completed.

Risk management

Identified HSE risks in all stages of the project shall be reduced to an acceptable level by applying the following principles, in order of importance:

1. Avoiding risks by safe design.
2. Using safety devices or other protective measures and a safe way of working.
3. Informing users of the residual risks.

Minimizing risks to health, safety and environment is an integral part of engineering in Valmet. Hazards which may lead to human, material or environmental damages, are identified and analyzed in risk assessments in engineering phase. Risk assessment is done for the whole delivery and for the whole life cycle of the products in the delivery.

Engineering

Engineering HSE activities will follow Valmet's HSE practices, and the requirements of the Customer as specified in the Contract. When carrying out engineering work, designers shall avoid foreseeable risks to those involved in the construction and future use of the product. All hazards must be eliminated and risks, derived from those hazards which remain, reduced to a level which is as low as reasonably practicable.

Design reviews are done regularly at set points in the engineering phase. In standard product solutions experiences from earlier projects are reviewed and well-known practices are used to minimize risks for health, safety and environment. Special attention is paid to new solutions and their operability and safety.

Risks deriving from the products in Valmet's scope are assessed in Hazard and risk analysis, using principles of HAZOP (Hazard and Operability study), in engineering phase. Analysis includes Hazard identification, SIL (Safety integrity level) assessment and Residual risk assessment. Explosion and fire risks are analyzed as a part of Hazard and risk analysis and further documented in Hazardous area classification plan and Fire safety plan.

In hazard and risk analyses potential hazards are identified and elimination and mitigation actions are noted. Residual risks are assessed and communicated to the project team and end user as required. References to Valmet Operation and Maintenance manual are made and training materials updated.

Supply management

Only Subcontractors accepted by Valmet in accordance with the Valmet Global Management System shall be used.

The Customer's HSE requirements as specified in the Contract and Valmet's HSE requirements are included in the purchasing contracts with Subcontractors.

HSE risk assessments shall be required from all Subcontractors performing construction or erection work and the actions to reduce risks shall be supervised.

Production

In production at Valmet Workshops, the health and safety of employees is taken care of and environmental management organized according to Valmet's GMS and HSE Policy. At Valmet Workshops Valmet Minimum Safety Standards are complied with.

Valmet is responsible that all changes during production are to be reviewed for their HSE impact. HSE risks are assessed before approval of a change in design.

Construction, Commissioning and Take-over

This document is the exclusive intellectual property of Valmet Oyj and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.

Valmet's global management system and Site HSE instructions shall be complied with.

A Site HSE Plan is prepared for the site phase. The Site HSE plan outlines the HSE management practices at the Valmet worksite and only covers Valmet's scope of supply.

Site HSE risk assessments shall be performed for the site works. The purpose of the risk assessments are to identify all foreseeable hazards related to work at the site and to ensure that all necessary protected measures are effectively implemented for the health and safety of employees and environment. Potential environmental hazards shall be assessed either individually or as a part of the risk assessment.

Table of Contents

1 SCOPE AND DEFINITIONS	2
1.1 Scope	2
1.2 Definitions	2
2 ATEX directives and explosion protection	2
2.1 ATEX directives	2
2.2 Explosion protection document	2
3 Classification of hazardous places	3
3.1 Explosive substances	3
3.2 Hazardous area classification	3
4 Equipment in explosive atmospheres	4
4.1 Equipment and systems delivered by Client	4
4.2 Changes to hazardous area classification by Client	4

1 Scope and definitions

1.1 Scope

The project consists of a delivery as described in the contract.

Purpose of this document is to specify requirements related to potentially explosive atmospheres (ATEX) and to clarify the documentation issued by Valmet.

1.2 Definitions

“Client” is Valmet’s customer.

“Subcontractor” is Valmet’s sub-supplier.

“Employer” is as described in the EU Directive 89/391/EEC

“Explosive atmosphere” means a mixture with air, under atmospheric conditions, of flammable substances in the form of gases, vapors, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture. (EU Directive 1999/92/EC)

"Hazardous place" is a place where explosive atmosphere may occur.

2 ATEX directives and explosion protection

2.1 ATEX directives

The EU Directive 1999/92/EC (ATEX Workplace Directive) gives the minimum requirements for improving the safety and health of workers at a risk from potentially explosive atmospheres.

The EU Directive 2014/34/EU (ATEX Equipment Directive) gives the requirements for equipment and protective systems intended for use in potentially explosive atmospheres.

2.2 Explosion protection document

According to ATEX Workplace Directive 1999/92/EC Employer shall assess the specific risks arising from explosive atmospheres. To carry out these requirements Employer must produce an explosion protection document, where explosion risk assessments and technical and organizational measures shall be shown. The document shall include classification of the places where explosive atmospheres may occur. The explosion protection document must be drawn up prior to the commencement of work.

Valmet’s scope of delivery includes the following documents that can be used as a part of the explosion protection document:

This document is the exclusive intellectual property of Valmet Oyj and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.

- Hazardous area classification plan
 - Identification and classification of explosive substances and potential ignition sources
 - Classification of hazardous places
- Hazard and risk analysis (assessment of explosion risks)

3 Classification of hazardous places

3.1 Explosive substances

Flammable substances that can form explosive atmospheres:

- Natural gas
- Ammonia water
- Combustible dusts from solid fuel

3.2 Hazardous area classification

Classification of hazardous areas will be made in accordance with rules given in the ATEX Workplace Directive 1999/92/EC and with standards:

- IEC 60079-10-1:2015 Explosive atmospheres - Part 10-1: Classification of areas - Explosive gas atmospheres
- IEC 60079-10-2:2015 Explosive atmospheres - Part 10-2: Classification of areas - Explosive dust atmospheres

According to ATEX Workplace Directive 1999/92/EC Employer shall classify places where explosive atmospheres may occur into zones in accordance with Annex I of the Directive.

The following classification of hazardous areas is used as the basis for engineering of the process and the equipment in Valmet's scope. Classification is not valid during shutdowns or maintenance.

System	Item	Zone	Zone extent	Notes
Natural gas / ignition gas system	Burners & valve groups	n/a	-	
	Natural gas line, MOP < 4 bar(g)	n/a	-	
	Vent pipe outlets	2	r = 1,5 m	
	Ignition gas lines, MOP < 4 bar(g)	n/a	-	
Ammonia water system	Ammonia lines and equipment	n/a	-	
Solid fuel system	Solid fuel silos	21	inside	above fuel level
	Solid fuel conveyors	22	inside	
	Fuel chutes	22	inside	
Vacuum cleaning unit	Vacuum cleaning piping	n/a		

This document is the exclusive intellectual property of Valmet Oyj and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.

4 Equipment in explosive atmospheres

ATEX Workplace Directive 1999/92/EC requires that equipment used in the classified zones must be in accordance with the categories set out in ATEX Equipment Directive 2014/34/EU regarding the zone in question. Equipment delivered by Subcontractors must meet the same requirements.

4.1 Equipment and systems delivered by Client

Contractor is not responsible for classifying of any systems or equipment which are delivered by the Client.

The Client is responsible for all the extra costs which an area classification of any system or equipment in Client's scope causes to Valmet.

4.2 Changes to hazardous area classification by Client

Contractor is not responsible for any extra costs caused by changes in the hazardous area classification made by the Client after signing of the contract.

Site HSE Responsibility Matrix for EPC

Site Health, Safety and Environment (HSE) Responsibility Matrix

Both the Supplier (Valmet) and the Customer have to operate and provide a work environment at the Site within the scope of supply in a way that will not cause any additional safety risks to other parties at the Site or vicinity of the Site. The Supplier and the Customer shall arrange and pay for the facilities, services and works within the scope of supply as shown in the following table. The Supplier means the Supplier and/or its subcontractors. The Supplier will provide, and pay for, if so indicated, the items if they are applicable and deemed necessary by the Supplier to carry out the works of the scope of supply. Site infrastructure (roads, prefabrication areas, storage areas, etc.) and site utilities (power, compressed air, water, etc.), which are on Customer's responsibility, shall be ready and available before the Supplier will mobilize its resources to the Site.

Item of responsibility	Arranged by		Paid by		Notes
	Supplier	Customer	Supplier	Customer	
1 OVERALL HSE RESPONSIBILITY ON SITE		X		X	
2 HSE PERSONNEL ON SITE					
2.1 Site Health and Safety Coordinator		X		X	
2.2 Site HSE officers/supervisors	X	X	X	X	
3 HSE ARRANGEMENTS					
3.1 Access control to site		X		X	
3.2 Site security arrangements		X		X	
3.3 Supplier area surrounding fences		X		X	
3.4 Pedestrian and traffic routes maintenance		X		X	
3.5 Site-specific HSE instructions and rules	X	X	X	X	
3.6 Site-specific HSE plan	X	X	X	X	
3.7 Hazard identification and risk assessments	X	X	X	X	
3.8 Site HSE inductions and training	X	X	X	X	
3.9 General and access lighting		X		X	
3.10 Working area lighting	X		X		
3.11 Warning / emergency alarm arrangements		X		X	
3.12 Emergency exits, lighting and signs		X		X	
3.13 Safety and warning signs	X	X	X	X	
3.14 On-site work permit procedures		X		X	
3.15 Personal protective equipment, PPE	X		X		
3.16 Working at heights and fall prevention	X		X		
3.17 Lockout / Tagout procedure	X		X		
3.18 Hot Work fire guarding	X		X		
3.19 Confined space work hatch guarding	X		X		
3.20 Explosion protection (ATEX) practices	X		X		
3.21 Occupational hygiene measurements	X	X	X	X	

Item of responsibility	Arranged by		Paid by		Notes
	Supplier	Customer	Supplier	Customer	
3.22 Asbestos survey		X		X	
3.23 Asbestos works		X		X	
4 FIRST AID ARRANGEMENTS ON SITE					
4.1 First Aid services at the site		X		X	
4.2 First Aid equipment	X		X		
5 ENVIRONMENTAL ISSUES					
5.1 Waste management arrangements	X		X		
5.2 Hazardous waste collecting and sorting	X		X		
5.3 Hazardous waste storage and disposal					
5.4 Oil spill/chemical leak response equipment, absorbent materials	X		X		
5.5 Collecting and sorting scrap, waste and rubbish and transporting them into waste containers	X		X		
5.6 Main waste containers and emptying them.	X		X		

Site Health, Safety and Environment (HSE) Specifications

These specifications are not extensive or comprehensive and they define only the minimum required level or scope of the specifications. HSE-specifications obligate both Contract Parties within the limits of the prescribed agreements and responsibilities (for example in the main Contract document or in its other appendices). This document does not overrule statutory requirements, for example based on the local legislation or any mandatory requirements from the local authorities. In case of interpretation disagreements or inconsistency, mandatory legislation will apply and prevail.

Item of responsibility	Specification
1 OVERALL HSE RESPONSIBILITY ON SITE	<p>The party with the primary responsibility for overall HSE management and coordination on site.</p> <p>Ensures that all HSE activities on site are adequate and in compliance with the local legislation.</p>
2 HSE PERSONNEL ON SITE	
2.1 Site Health and Safety Coordinator	As defined in EU Directive 92/57/EEC and local legislation implementing the Directive or other national legislation.
2.2 Site HSE officers/supervisors	Resources that shall be pointed for Site HSE officer/supervisor duties.
3 HSE ARRANGEMENTS	
3.1 Access control to site	Access control arrangement to the site.
3.2 Site security arrangements	<p>For example;</p> <ul style="list-style-type: none"> Security patrol/ guarding on site Recordable video monitoring system.

3.3	Supplier area surrounding fences	Mountings and fences shall be designed to withstand the foreseeable stresses caused by environmental conditions and the nature of operations at the site.
3.4	Pedestrian and traffic routes maintenance	<p>Pedestrian and traffic routes maintenance includes;</p> <ul style="list-style-type: none"> • Maintaining the routes load bearing capacity • Ensuring that the conditions of the routes allow the safe use of routes • Keeping the routes clear and free of obstacles • Maintaining the route markings and traffic signs • Arranging the de-icing by chemical or inert surface treatment and snow/ water/ mud removal activities when needed.
3.5	Site-specific HSE instructions and rules	Written instructions, rules and routines at the site that makes the safe working possible for everyone.
3.6	Site-specific HSE plan	<p>Site-specific HSE plan outlines the HSE activities at the common worksite. It describes how HSE activities are managed during the project.</p> <p>The plan describes the rules of order and health and safety to be applied on the site; a description of how safety and health work shall be organized; and a description of special measures to be taken for hazardous work.</p>
3.7	Hazard identification and risk assessments	<p>The documented process that combines;</p> <ol style="list-style-type: none"> 1. Specification of the limits of the object 2. Specification of the project phases/work tasks 3. Hazard identification 4. Risk estimation 5. Judgment, whether the risk reduction objectives have been achieved or not 6. Additional protective measures to achieve the risk reduction, if needed 7. Judgment, whether the residual risks are in an acceptable level
3.8	Site HSE inductions and training	Site HSE induction for Supplier's scope of delivery.
3.9	General and access lighting	<p>General area and access lighting;</p> <p>Minimum requirement: 100 lx.</p>
3.10	Working area lighting	<p>Working area lighting;</p> <ul style="list-style-type: none"> • Minimum requirement: 200 lx.
3.11	Warning/ emergency alarm arrangements	General acoustic alarm system at the site area in case of fire, chemical accident, earthquake or similar serious emergency situations.
3.12	Emergency exits, lighting and signs	<p>Emergency routes and exits must remain clear and lead as directly as possible to a safe area.</p> <p>Doors shall be easily accessible and should open in the direction of escape.</p>

	<p>Emergency exit routes shall be clearly marked. An escape lighting shall be sited near each exit door and at positions where it is necessary to point out potential danger or safety equipment.</p> <p>Emergency exit signs: see 3.13 Safety and warning signs.</p>
3.13 Safety and warning signs	<p>Signs should include descriptions both by symbol and text.</p> <p>Symbols, colours and size of the signs shall be clear, commonly recognizable and well observable.</p> <p>Fasteners and signs shall be designed to withstand the foreseeable stresses.</p>
3.14 On-site work permit procedures	<p>Works that may contain significant safety risks shall be determined as These works shall not be executed without a valid work permit.</p> <p>The procedure defines the scope, time limits, responsibilities, prerequisites, work arrangements, qualifications, protective measures, co-operation, communication and other HSE requirements which shall be implemented and fulfilled during the work tasks.</p> <p>The procedure shall also clarify the method; how, when and where the work permits can be applied and who is the responsible party managing the permits.</p> <p>On-site works which are determined as a permit-based include, but may not be limited to the following;</p> <ul style="list-style-type: none"> • hot works • roof hot works • works in confined spaces • asbestos works • lifting operations • electrical works • equipment testing • excavation works • works related to radiation
3.15 Personal protective equipment, PPE	<p>Individual protective measures that are used to reduce employee exposure to hazards after engineering and collective protective measures are not mitigated the risks to acceptable level.</p> <p>PPE that everyone working on site shall have at the minimum;</p> <ul style="list-style-type: none"> • Safety glasses • Hearing protectors • Workwear / High visibility workwear • Protective footwear • Safety helmet <p>Other area or work specific PPE shall be used as defined in risk assessments, instructions, operating procedures or safety signs.</p>

	<p>If the customer or location has higher requirements than Valmet, then those stricter standards apply.</p> <p>All PPE shall meet the requirements of the local legislation and product safety standards.</p>
3.16 Working at heights and falling prevention	<p>Falling prevention arrangements shall be implemented, when the work contains a significant risk of falling.</p> <p><u>Guardrailing</u></p> <ul style="list-style-type: none"> The guardrailing shall be adequate and compliance with the local legislation. <p><u>Falling prevention systems</u></p> <ul style="list-style-type: none"> When the use of individual falling prevention systems are required, the sufficient amount of safety anchor points shall be provided. The resistance of anchor points shall be adequate and compliance with the local legislation. All personal protective equipment against falls from a height shall be valid and in good condition. <p><u>Openings</u></p> <ul style="list-style-type: none"> All openings, which can cause the risk of falling, stepping into or falling objects shall be covered. Hole covers shall be clearly marked and stationary.
3.17 Lockout / Tagout procedure	<p>Procedure;</p> <ul style="list-style-type: none"> Shall provide the information, which isolations and de-energizations shall be made, locked and tagged out before work can be started in each specific work task. Shall be used always, when there is a risk of accidental startup of equipment/ machinery/ process and/ or accidental release of energy during work activities. <p>Every employee must have their own individual locks and tags (lock out --cards). The lock out -card shall include the name of the employee and his/ her mobile phone number.</p>
3.18 Hot Work fire guarding	<p>Non-stop fire guarding during the hot works. Minimum one hour non-stop fire guarding after the hot works.</p>
3.19 Confined space work hatch guarding	<p>Non-stop safety guarding during the confined space work.</p>
3.20 Explosion protection (ATEX) practices	<p>Information and routines while working near/ in explosive atmospheres (ATEX area).</p>
3.21 Occupational hygiene measurements	<p>Includes the measurements, analysis of the measurements and monitoring, corrective actions and follow up, when necessary.</p> <p>Occupational hygiene measurement services include, but may not be limited to following;</p> <ul style="list-style-type: none"> Air contaminants <ul style="list-style-type: none"> Dust Gases

	<ul style="list-style-type: none"> • Oxygen content in the air • Harmful chemical compounds • Physical conditions <ul style="list-style-type: none"> ○ Illumination ○ Noise ○ Vibration ○ Temperature ○ Ionizing and nonionizing electromagnetic radiation • Biological hazards <ul style="list-style-type: none"> ○ Bacteria ○ Viruses ○ Other living organism, that can cause infections • The Supplier has the right to remove its own employees and contracted staff Including also those of its subcontractors from the Site and re-schedule work without delay penalty consequences if limiting values (hazardous concentrations of impurities in workplace) of Occupational Hygiene measurements are exceeded or if these employees or staff suffer from severe health symptoms. The Supplier shall take in good cooperation with the Customer reasonable alternative measures to mitigate impact of such removal.
3.22 Asbestos survey	The party responsible for possible asbestos survey before work is started by Valmet.
3.23 Asbestos works	The party performing any asbestos related works such as working on, removing or disposing asbestos.
4 FIRST AID ARRANGEMENTS ON SITE	
4.1 First Aid services at the site	<p>First-aid rooms must be fitted with essential first-aid installations and equipment and be easily accessible with stretchers.</p> <p>First-aid rooms must be signposted.</p> <p>Services available throughout the working period.</p>
4.2 First-Aid equipment	<p>Each workplace shall have a sufficient amount of first-aid supplies at appropriate locations to deal with injuries and medical emergencies, taking into account the number of employees, the nature of their work, and the prevailing circumstances.</p> <p>First-aid cabinets must be easy to find and clearly marked.</p> <p>The first-aid cabinet's supplies shall be regularly checked and maintained.</p>
5 ENVIRONMENTAL ISSUES	
5.1 Waste management	Purchasing waste and recycling bins and containers, implementation of waste and recycling collection points, arranging and organizing the emptying, handling and transportation of waste and recycled material, disposal of waste and recycled material.

		Taking care of all permits, licenses, authoritative issues and costs related to waste management at the site.
5.2	Hazardous waste collecting and sorting.	Hazardous waste collecting, sorting, marking and transportation to the hazardous waste storage.
5.3	Hazardous waste storage, transportation and disposal	<p>Purchasing bins and containers for hazardous material, implementation of hazardous material collection points, arranging and organizing the emptying, handling and transportation of hazardous material, disposal of hazardous material.</p> <p>The hazardous material collection points shall be located nearby the supplier's work place.</p>
5.4	Oil spill / chemical leak response equipment, absorbent materials	Oil spill / chemical leak response equipment, absorbent materials and trip trays.
5.5	Removal and sorting of scrapped materials, waste and rubbish	<p>Removal and sorting of scrapped materials, waste and rubbish and taking them to waste containers.</p> <p>The waste collection points shall be located nearby the supplier's workplace.</p>
5.6	Main waste containers and emptying them.	Arranging the waste containers and organizing the emptying, handling and transportation of waste and recycled material, disposal of waste and recycled material.

Valmet Site HSE Specification

Contents

1 INTRODUCTION	2
2 DEFINITIONS	2
3 PURCHASER RESPONSIBILITIES	3
3.1 Ensuring the Site is safe	3
3.2 Compliance with applicable legislation	3
3.3 Communication to Valmet about Site HSE requirements and risks	4
3.4 Compliance with Valmet's HSE requirements	4
4 VALMET RIGHTS AND RESPONSIBILITIES	4
4.1 Ensuring the Site is safe	4
4.2 Valmet's right to suspend performance, remove personnel, terminate the contract	5
5 VALMET'S HSE REQUIREMENTS	5
5.1 HSE communication	5
5.2 Zero tolerance of drugs and alcohol	5
5.3 Access control and Site security arrangements	6
5.4 Site HSE induction	6
5.5 Site work permit procedures	6
5.6 Emergency response and rescue plans and services	6
5.7 Safety and warning signage and signals	6
5.8 Traffic and pedestrian management at Site	7
5.9 Safe access and emergency exits	7
5.10 Storage of materials and equipment	7
5.11 Lighting	7
5.12 Risk assessment and communication	7
5.13 Asbestos	8
5.14 Chemicals and gases from the running processes	8
5.15 Chemical accident and explosion protection	8
5.16 Process safety	9
5.17 Working around radiation	9
5.18 Lockout / tagout procedure	9
5.19 Hot work	9
5.20 Working at height	9
5.21 Lifting	10
5.22 Person lifts	10
5.23 Confined spaces	10
5.24 Hazardous materials	10
5.25 Maintaining good order	11
5.26 Electrical safety	11
5.27 Operating machines, tools and equipment	11
5.28 General Site HSE inspections	11
5.29 Waste management	11
5.30 Dust	11
5.31 Occupational hygiene measurements and limits	11
5.32 Extreme events	12

1 INTRODUCTION

Valmet is committed to protecting the health, safety and environment (HSE) of our employees, partners, customers, suppliers and other business contacts. **The purpose of this Valmet HSE Specification is to define Valmet's requirements to ensure** that all necessary actions are taken to accomplish an acceptable safety level for Site activities in all phases of our customer project deliveries, such as preparation of works, lifting, assembly, installation, commissioning, start-up and testing activities.

This Specification does not overrule or replace the Purchaser's HSE requirements, instructions and plan. The Purchaser's HSE requirements and instructions, arising from the contract or from the Customer's HSE plan shall be followed.

2 DEFINITIONS

Purchaser means the end-customer (owner or operator of the Site) who is responsible for general Site safety and overall investment at the Site. However such Purchaser may alternatively be for example an EPC contractor in cases where Valmet acts as subcontractor to it.

For the avoidance of doubt, in cases where Valmet has a contract with the Purchaser (like EPC contractor) and not with the final Customer, then the obligations of the Purchaser in this Specification will also mean the obligations of the purchasing company and such Purchasing company shall be directly responsible for such obligations, as applicable to it.

For the avoidance of doubt, this Specification does not change expressly in the relevant contract agreed responsibility matrix or expressly agreed parties' rights and obligations.

For the avoidance of doubt, each party (each legal entity) shall be responsible for its own employees and workers and for its own supply chain companies as for its own acts and omissions.

Valmet means the Valmet group company, who acts as supplier / seller (either as main contractor or subcontractor position towards the Purchaser) on Site.

Suppliers or **subcontractors** are Valmet's supply chain partners in the Project on Site (for example equipment, systems, parts or services suppliers or installation work subcontractors). Later in this document these suppliers and subcontractors are called as the Subcontractors.

Employees and **workers** are individual people who work at the Site under the employment contract, or leased workforce contract, or freelance contract or other contract with Valmet, with Valmet's Subcontractors, with the Purchaser, with the Purchaser or with other companies.

Site is the installation location, existing production facility, or other workplace of the Customer where Valmet provides project related activities as specified in the contract in question.

Valmet's scope of work at the Site may be called either as Works or Supply, and it is part of the Purchaser's production Plant (production facility, production line or process system).

Hot work is any work that involves burning, welding, using fire- or spark-producing tools, or that produces a source of ignition.

Work at height means work in any place where, if there were no precautions in place, a person could fall a distance liable to cause personal injury.

Confined space is a place that has restricted means of entry, is not designated for continuous occupancy, is large enough and configured so that a person can partially or fully enter the space to perform tasks and has the potential to contain hazardous substances or other dangerous conditions that could cause serious injury, illness, or death. Confined spaces are for example, excavations, pits, sewers, tunnels, barges, pipes, furnaces, boilers, tanks, silos and ducts.

3 PURCHASER RESPONSIBILITIES

3.1 Ensuring the Site is safe

Unless otherwise agreed in the contract the Purchaser is responsible for the overall HSE management and co-ordination of the Site, provision of adequate HSE resourcing to fulfil this responsibility, and for ensuring that the Site is a safe place to work during all phases of the delivery project.

Purchaser and Valmet, for their own scope of works, are responsible for ensuring that everyone involved in the Site activities follows safe work practices, communicates and co-ordinates on HSE related issues, and fulfills all applicable requirements and codes regarding HSE protection.

3.2 Compliance with applicable legislation

The Purchaser shall always comply with any applicable local, regional, national and international laws, regulations and other requirements with respect to quality assurance procedures on the Site, workplace safety, environmental issues and workers' health issues. This includes, among other things, compliance with mandatory applicable safety requirements imposed by the relevant authorities (either from Site location and/or country or from a country of workers), irrespective of which company has employed them.

The Purchaser shall, as requested by Valmet, provide Valmet and its Subcontractors safe and unlimited access to the Site and a working environment that complies with the applicable laws, regulations and other requirements for a safe and sound working environment.

To the extent not expressly otherwise specified in the contract: The Purchaser shall provide and pay for all licenses, permits, information and authorizations necessary for the installation and operation of the Plant at the Site. Safety and other consequences of the absence of any above referenced licenses, permits, information or authorization, or

civil works and other Purchaser's scope of supply and related requirements shall exclusively be on account of the Purchaser.

This document does not overrule the mandatory legislation or any other mandatory requirements from the authorities. They shall be complied with in all Site activities.

3.3 Communication to Valmet about Site HSE requirements and risks

The Purchaser shall provide Valmet with all relevant information about their safety standards, as well as about the Site and Works-related HSE requirements, also including non-existence of hazardous and toxic materials. The Purchaser shall inform Valmet in a timely manner of potential risks at the Site, including for example infectious disease situation, hazardous chemicals, gases, liquids, asbestos and radiation. The Purchaser shall also inform Valmet in a timely manner of relevant HSE events that occur at the Site, including for example unexpected gas releases, serious injuries and near misses, fires and explosions. The Purchaser shall also inform Valmet about HSE related issues arising from the work of their other Contractors and Subcontractors. The Purchaser is responsible for maintaining Site specific safety rules up-to-date with all applicable laws and other requirements.

3.4 Compliance with Valmet's HSE requirements

In addition to requirements and obligations set forth above, the Purchaser shall comply with all of Valmet HSE requirements as specified in this document and in relevant contract appendices.

Valmet shall have the right, at any time at its sole option, to propose and implement additional Works-related safety requirements based for example on recent industry development, experiences from other job Sites, recent international or local safety guidance and best practice. Such new requirements shall be incorporated into this Specification at Valmet's sole option. Where applicable, the parties to the contract shall promptly upon Valmet's request enter into a contract amendment or a change order or otherwise agree to effectively implement such new requirements.

4 VALMET RIGHTS AND RESPONSIBILITIES

4.1 Ensuring the Site is safe

Valmet shall assure that its employees and Subcontractors follow safe work practices, Valmet's own and Purchaser's HSE rules and instructions as well as applicable laws and requirements.

Each Valmet and its Subcontractors' employee and worker has the responsibility to work in compliance with Valmet safety rules and instructions and to commit to the correct and safe way of working. Employees and workers must, in addition to one's own safety, take into account both the safety of the other personnel and visitors on Site and impact on environment.

Each Valmet employee and worker has the right and duty to refuse to expose themselves to a situation which may cause danger to the life or health of the employee themselves or others. Such events, and all other observed safety deficiencies at the

Site, shall be immediately reported to the Valmet Responsible person at the Site or the Valmet Project Manager.

If Valmet determines that the Site is not a safe place to work, the Valmet Project Manager shall notify the Purchaser of any discovered shortfalls. In such cases Valmet shall have the right to refrain from entering the workplace until the found safety defects have been rectified by the Purchaser.

4.2 Valmet's right to suspend performance, remove personnel, terminate the contract

If Valmet discovers that the Site is not a safe place to work, Valmet shall notify the Purchaser (and the Purchaser, as applicable) of any discovered HSE shortfalls in writing. In cases of either (a) Purchaser's breach, default or other failure to comply with any of the above obligations even after Valmet's notice and non-cure of situation, or (b) if it is evident that the Site conditions have exposed or may expose the employees or workers to risks which may have an impact on health and safety (such as asbestos, chemicals or other hazardous substance exposures exceeding European Union binding and indicative occupational exposure limit values, or infection risks, or failure to observe Valmet HSE requirements), then Valmet shall have the right, at its sole option and without liability, to immediately suspend its performance of the contract and to remove its own and its Subcontractors' personnel from the Site until such failures and risks have been removed by and at the cost of the Purchaser. Any costs of Valmet and its Subcontractors waiting time shall be borne by the Purchaser. Valmet shall have the right, at its sole option and without liability, to terminate the contract with immediate effect and the provisions in the article about termination shall apply.

The Purchaser agrees to indemnify, defend and hold Valmet (including also its directors, officers, employees, affiliated entities, insurers, subcontractors and agents) harmless from all loss, cost, damage, legal fees, expense, cost and other liability whatsoever arising out of or otherwise resulting from any Purchaser's obligation, breach, default, negligence or other failure described above in this Specification.

Valmet shall have no liability for pollution damage or environmental liability, except arising out of his operations during the Works. Valmet shall have no liability for ground, soil or reservoir conditions, or for conducting soil surveys or soil improvements.

5 VALMET'S HSE REQUIREMENTS

5.1 HSE communication

The Purchaser shall regularly provide all necessary HSE information relevant for the safe conduct of work on the Site to Valmet and Valmet Subcontractors in the project's official language.

5.2 Zero tolerance of drugs and alcohol

The Purchaser and Valmet are together responsible for providing a workplace that is free of alcohol and drugs.

If the Purchaser does not have a non-smoking policy, then Purchaser and Valmet together they shall provide dedicated smoking areas that are isolated from work areas and flammable good storage areas.

5.3 Access control and Site security arrangements

Unless otherwise agreed, the Purchaser is responsible for providing (i) access control arrangements for the Site to prevent unauthorized access to work areas and storage areas; and (ii) Site security arrangements including security patrol/guarding 24 hours a day, seven days a week.

5.4 Site HSE induction

The Purchaser and Valmet shall provide together relevant Site HSE induction training to all Contractors and Subcontractors before entering the Site the first time and when re-entering after a longer absence.

5.5 Site work permit procedures

Unless otherwise agreed, the Purchaser shall provide and implement robust work permit procedures for high-risk work including, but not limited to;

- hot work
- roof hot work
- work in confined spaces
- asbestos work
- lifting operations
- electrical work
- equipment testing
- excavation work
- pressure testing
- work related to radiation

Valmet employees and Subcontractor employees shall not perform high-risk work without a valid permit that defines the scope, time limits, responsibilities, prerequisites, work arrangements, qualifications, protective measures, co-operation, communication and other HSE requirements which shall be implemented and fulfilled during the work task.

5.6 Emergency response and rescue plans and services

The Purchaser and Valmet shall together prepare and keep up-to-date the emergency response and rescue plan for the Site. Plan is informed to all people entering the Site through Site induction procedures. Purchaser shall provide a general acoustic alarm system at the Site area in case of fire, chemical accident, earthquake or similar serious emergency situations.

5.7 Safety and warning signage and signals

The Purchaser and Valmet arrange at the Site adequate and appropriate safety and warning signage with both symbols and text to ensure everyone is well informed about all Site risks – Valmet in his own construction area and Purchaser elsewhere. Signage

is designed to be durable and are clear, commonly recognizable and well observable considering the environment. Hand, light and sound signals are used where necessary to pass on information.

5.8 Traffic and pedestrian management at Site

The Purchaser is responsible for (i) providing adequate and safe parking space, (ii) keeping the roads in the Site in good condition with regards to load bearing capacity, drainage, route markings and signage and being obstacle-free, for both movement of goods and emergency vehicle access, (iii) securing separation of pedestrians and vehicles and providing safe pedestrian access across the Site; and (iv) arranging de-icing by chemical or inert surface treatment and snow/ water/ mud removal activities when needed.

5.9 Safe access and emergency exits

Unless otherwise agreed in the contract, the Purchaser is responsible for ensuring that emergency exits, rescue routes and re-assembly areas are clearly marked and are accessible and maintained in all Site areas.

The Purchaser shall make sure that passage routes, steps, floors, corridors, loading areas and ramps are properly designed, easily accessible, safe and appropriate to use, and kept in such condition free from waste, debris, cables and other materials that the risk of slipping, tripping over and falling is as low as possible.

If there is a risk that any object or material may fall on working locations or passage routes, the Purchaser shall make sure appropriate controls such as protective coverings, guard rails, fencing, safety nets and/or exclusion zones are implemented.

5.10 Storage of materials and equipment

The Purchaser and their Contractors and Subcontractors are responsible for (i) the reception, loading, unloading and organizing of storage of own goods in suitable locations away from Valmet work areas, unless otherwise agreed with Valmet; (ii) the immediate removal of unnecessary and idle material and equipment from Valmet work areas; and (iii) arranging unloading, loading and storage so that no goods, material or building equipment are lifted over any people and that nobody is in danger zone.

5.11 Lighting

The Purchaser is responsible for providing (i) sufficient and appropriate general area and access lighting in workplaces, personnel facilities, passage routes and at night is at least 100 lux illumination; and (ii) backup / emergency lighting so that all people on the Site have enough light to stop work safely and egress, with extra attention paid to locations where employees and workers are particularly vulnerable to risks if general lighting fails.

5.12 Risk assessment and communication

The Purchaser and their Contractors and Subcontractors are responsible for (i) preparing risk assessments for their own scope of work, including the potential HSE

impacts of such work to Valmet and others working on the Site; (ii) implementing necessary protective measures to achieve risk reduction objectives as specified in the assessments; (ii) updating risk assessments and protective measures both before any relevant changes in original plans, schedules, scope of work or work methods and also after HSE incidents, severe near misses or other shortcomings have realised either in own works or works by other Contractors at the Site; and (iv) communicating to Valmet and others working on the Site about potential HSE impacts and concerns related to their activities.

5.13 Asbestos

Valmet employees, workers and Subcontractors shall never perform asbestos-related work.

The Purchaser is responsible for (i) performing all needed asbestos surveys in good time before the work is planned to be started by Valmet; (ii) informing Valmet before arrival at the Site about the existence of asbestos; (iii) either removing asbestos or sealing it, then cleaning the Site properly, and finally measuring the effectiveness of taken measures before Valmet will start any work.

Valmet will visually and/or by measuring verify that surfaces are cleaned and if needed take air samples and dust samples from surfaces before starting work.

5.14 Chemicals and gases from the running processes

The Purchaser is responsible for (i) ensuring that all workplaces have enough good breathing air and that ventilation is sufficiently effective and appropriate; (ii) informing all workers about emergency actions in the case of a leak or accidental release of hazardous chemicals and gases (iii) providing area monitoring and alarm systems for detecting and warning about possible hazardous leaks and discharges and implementing evacuations of unsafe areas (iv) making air oxygen and impurity measurements in case of any concerns raised by Valmet; and (v) immediately informing Valmet about discharges of toxic or dangerous gases such as but not limited to:

- hydrogen sulfide
- sulphur dioxide
- chlorine dioxide
- chlorine
- ozone
- methanol
- carbon monoxide
- oxygen
- ammonia

5.15 Chemical accident and explosion protection

The Purchaser is responsible for (i) providing information and routines for working near/in existing explosive atmospheres (ATEX areas); and (ii) ensuring that the pipes, tanks and equipment are empty of chemicals and non-pressurized before opening them is allowed.

5.16 Process safety

The Purchaser is responsible for (i) ensuring all open processes are kept clean and protected against unwanted and foreign objects; (ii) reporting and taking mitigation action if foreign objects are detected or suspected in the process.

5.17 Working around radiation

Purchaser and Valmet, for their own scope of works, are responsible for ensuring that (i) the maximum allowed radiation level at the Site and nearby where employees and workers may be exposed never exceeds 0.4 uSv/h; (ii) all persons working with x-ray or radioactive materials are fully competent for the work in question; (iii) all parties working at the site are informed in a timely manner prior to any work with radioactive materials is planned to start; (iv) during any work with x-ray or radioactive materials the affected area is emptied of people and black and yellow warning tape and signs are used to block entrance to radiation areas and alert people of the presence of radiation.

5.18 Lockout / tagout procedure

Unless otherwise agreed in the contract, the Purchaser is responsible for (i) implementing a robust lockout / tagout procedure to prevent accidental activation of machines, equipment and processes during commissioning, operation, servicing, and maintenance; (ii) ensuring that all workers have their own individual locks and tags (lock out-cards) that include the name of the employee, his/ her mobile phone number and the company name.

5.19 Hot work

Unless otherwise agreed in the contract, the customer is responsible for (i) defining permanent non-permit hot work areas and permit required temporary hot-work areas; (ii) implementing permit-to-work routines (ii) providing non-stop fire guarding during hot work activities and a minimum of one-hour non-stop fire guarding after the hot works are completed; (iii) providing adequate fire protection equipment in the hot-work area.

5.20 Working at height

Purchaser and Valmet, for their own scope of works, are responsible for implementing protection against falling when work takes place on platforms or above openings where the fall distance is one meter or more by ensuring:

- Collective protective measures such as guardrails, hole covers and working platforms are used as the primary protection option for working at height risks.
- Guardrails are used along the open sides of work platforms, walkways, steps and step platforms and they are constructed at a minimum of a top rail, intermediate rail, toe board and are at least one meter high.
- All holes and openings are covered and/or protected to prevent a trip and/or fall hazard for tools, equipment and people. Hole covers are marked, fixed in position and strong enough to withstand the foreseeable load. All openings larger than 1 m² and other gaps where persons or any item can fall into, are surrounded by guardrails and toe boards.
- Protection from falling objects is always provided, for example by using safety nets, protective canopies, toe boards, tool buckets and isolating access to danger zones.

- If removal of a protective structure, such as guardrail, piece of platform, stairs or hatch cover, is necessary at some work stage, then the danger area shall be protected or isolated and clearly signed.
- Ladders are not used as a working platform.
- Scaffolding is safe and (i) suitable for the work in question; (ii) erected, disassembled and adjusted/modified only by competent scaffolding erectors under the supervision of a qualified person; (iii) built by using only standard and approved scaffolding materials; (iv) inspected and approved before use and provided with a green scaffolding tag indicating that the scaffolding is safe for use; (v) re-inspected after significant strain or weather conditions; (vi) provided with a red scaffolding tag prohibiting their use when erecting, disassembling or adjusting a scaffolding or its part. In addition, access to the hazardous area must be blocked by appropriate means. (vii) equipped with sufficiently strong and well dimensioned guard rails at all open edges. The height of the top rail shall be at least one meter. The intermediate guard rail shall be placed so that any gap between it and other means of protection does not exceed 0.5 meter. (viii) equipped with toe boards. (ix) kept free of all materials and never used for storage.

5.21 Lifting

Purchaser and Valmet, for their own scope of works, are responsible for ensuring (i) lifting plans exist for all lifting work; (ii) lifting areas are isolated and access to danger zones are restricted either by barricading, or a person guarding the area and warning others from entering (ii) that loads are never lifted over people; and (iii) lifting equipment and tools are approved, inspected and in proper condition; (iv) damaged lifting equipment is taken out of service immediately

5.22 Person lifts

Purchaser and Valmet, for their own scope of works, are responsible for ensuring that (i) a lifting plan is available before lifting people; (ii) the platform and supports are stable; and (iii) only lifting equipment designed, approved, inspected and in proper condition for lifting people are used.

5.23 Confined spaces

Purchaser and Valmet, for their own scope of works, are responsible for (i) implementing permit-to-work routines (ii) providing non-stop safety guarding by a competent guard (ii) providing continuous ventilation (iii) testing / monitoring the atmosphere for gases and contaminants (iv) safe access and egress (v) providing rescue services.

5.24 Hazardous materials

Purchaser and Valmet, for their own scope of works, shall ensure that (i) all chemicals containers or vessels are marked with user and safety instructions (ii) unmarked containers or vessels containing unknown chemicals are not used; (iii) safety data sheets are available for all chemicals stored and used on the Site; (iii) required safety and protective equipment are used when handling chemicals; (iv) when using hazardous chemicals, other workers must be warned, when necessary, and, if needed, the work Site must be isolated from the rest of the work environment.

5.25 Maintaining good order

Good order and tidiness are the most important preconditions for fire prevention and for health and safety at work. Particularly passages and walkways must be free from waste, debris, cables and other material and things which may cause a risk of tripping. Waste and other unnecessary objects in working areas must be regularly removed into shown places or to trash pallets.

5.26 Electrical safety

Purchaser and Valmet, for their own scope of works, shall ensure that (i) only authorized and qualified people perform electrical work; (ii) running electrical cables across roads, walkways, floor, through doorways and over sharp edges is avoided; (iii) protections are in place to prevent electrical injury if non-insulated cables which cannot be moved or made voltage-free exist on the work Site or near it.

5.27 Operating machines, tools and equipment

Purchaser and Valmet, for their own scope of works, shall ensure that all the structures, devices, machinery, work equipment and tools used on Site fulfill legal safety requirements, are approved, inspected and in proper condition, are suitable for the work environment, have all guards, safety devices, safety related control systems and warnings in place before the use, do not cause any significant additional risks and are maintained in a safe condition.

5.28 General Site HSE inspections

The Purchaser has overall responsibility of regular monitoring the safety of the Site through regular and documented Site HSE inspections and action follow-up.. Any risks and hazards related to the safety of people will always be given high priority and addressed without delay.

Valmet shall arrange regular HSE inspections within its own work area and Purchaser is invited to join the regular reviews.

5.29 Waste management

Unless otherwise agreed in the contract the Purchaser is responsible for (i) providing hazardous and non-hazardous waste and recycling bins and collection points near Valmet's workplaces (ii) collecting and removing such waste regularly (iii) arranging waste treatment and disposal according to local regulations (iii) taking care of all permits, licenses, regulatory issues, and costs related to waste management at the Site.

5.30 Dust

The Purchaser is responsible for ensuring adequate dust control so that the dust does not harm people's health and does not interfere with the safe execution of work.

5.31 Occupational hygiene measurements and limits

The Purchaser shall arrange occupational hygiene measurements, analysis, monitoring, required mitigating actions and situation follow up when there is a risk that occupational

exposure limit of harmful agents, substances or working conditions are exceeded during Purchaser controlled activities and it can affect the health and safety of Valmet's or Valmet's subcontractor employees. Occupational hygiene measurements shall be conducted by qualified and competent specialists and the results analyzed at accredited laboratories according to international exposure standards.

Valmet strictly adheres to the European Union's lists of binding and indicative occupational exposure and biological limits values.

Occupational hygiene measurements can include:

Air contaminants	<ul style="list-style-type: none"> • Asbestos • Fibers • Dust or small particles • Fumes • Mist • Vapors • Gases • Aerosols
Oxygen concentration in the air	
Chemical compounds	
Physical conditions	<ul style="list-style-type: none"> • Illumination • Noise • Vibration • Temperature • Ionizing and nonionizing radiation
Biological hazards	<ul style="list-style-type: none"> • Bacteria • Viruses • Fungi • Other living organism that can cause infections

5.32 Extreme events

In the event of a natural disaster such as an earthquake, tsunami or a security threat such as a terrorist attack or infectious disease outbreak such as COVID-19, Valmet will make arrangements to secure the health and safety of their employees including work modifications (for example, remote working from hotel) or temporary evacuation.



All spare parts in the list below are required for Availability guarantee.

W= Wear and tear part are parts, which do not belong to mechanical warranty, but are considered to be normal maintenance items of the plant.

St = Strategic spare part are parts, which are necessary for the operation of the plant and/or have long delivery time.

St & W = Strategic wear and tear parts which are not subject to mechanical warranty

As some items are vendor specific, Valmet reserves the right to modify the list to meet each vendor's recommendations.

Device		Spare part					
Part ID	Device	Spare part name	Strategic part (St)	Wear part (W)	Required quantity / 2 years	Unit	Comment for red markings
1	<u>BOILER PRESSURE PARTS</u>						
1.1	<u>Tubes</u>						
		Tube of furnace walls	St		20	m	
		Tube of primary superheater 1 & 2	St		20	m	
		Tube of primary superheater 3	St		20	m	
		Tube of secondary superheater	St		20	m	
		Tube of tertiary superheater	St		20	m	
		Tube of economizers	St		20	m	
1.2	<u>Tube bends</u>						
		Primary superheater 1 & 2 bend	St		2	pcs/type	
		Primary superheater 3 bend	St		2	pcs/type	
		Secondary superheater bend	St		2	pcs/type	
		Tertiary superheater bend	St		2	pcs/type	
		Primary air opening panels	St		2	pcs/type	
1.3	<u>Steam drum</u>						
		Manhole gasket	St	W	8	pcs	
		Sight glass spare repair set	St	W	1	set	
		Bolts and nuts for manhole	St	W	1	set	
1.4	<u>Refractory</u>						
		Refractory material	St	W			5% of total area / year are considered as wear part, not under warranty
2	<u>BOILER ACCESSORIES</u> (According to Manufacturer's recommendations)						
2.1	<u>Main steam valve</u>						
		Set of gaskets		W	1	set	
2.2	<u>Start-up valves</u>						
		Set of gaskets		W	1	set	
2.3	<u>Main steam safety valves</u>						
		Manufacturer's standard spare part kit		W	1	set	
2.4	<u>Access doors</u>						
		Access door, D=800	St		1	pcs	
		Access door, 480x630	St		1	pcs	
		Access door, 500x500	St		1	pcs	
3	<u>FUEL FEEDING SYSTEM</u>						

	According to manufacturer's recommendations					
3.1	<u>Common spare parts for fuel feeding & ash handling system</u>					
	Zero speed limit switch	St		1	pcs	
	Rotation guard	St		1	pcs	
	Sealing rope 5x10, 10m		W	1	set	
	Sealing rope 10x10, 20m		W	1	set	
	Hard welding rod		W	3	set	
3.2	<u>Rotating spreader for fuel silos inlet</u>					
	V-sealing		W	1	pcs	
3.3	<u>Fuel silo</u>					
	Explosion disc	St	W	4	pcs	
3.4	<u>Silo screw reclaimer</u>					
	Bearings for screw shaft		W	1	pair	
	Shaft sealing set		W	1	pcs	
	Roller chain		W	1	pcs	
	Roller chain sprocket (smaller)		W	1	pcs	
	Chain tightener	St		2	pcs	
3.4.1	Slip ring unit					
	Signal brush		W	5	pcs	
	Holder for signal brush		W	2	pcs	
	Power brush		W	2	pcs	
	Holder for power brush		W	2	pcs	
	Sealing		W	1	pcs	
3.5	<u>Rotary feeders</u>					
	Bearing	St	W	2	pcs	
	Shaft sealing set	St	W	2	pcs	
	Overload coupling	St	W	1	pcs	
	Counter blade		W	2	pcs	
3.6	<u>Expansion joint</u>					
	Steel bellow	St		1	pcs	
4.	<u>AUXILIARY FUEL SYSTEM</u>					
4.1	<u>Start-up burner</u>					
	Lance tube	St		1	pcs	
	Impeller	St		1	pcs	
	Natural gas nozzle		W	1	pcs	
	Gas hose	St		1	pcs	
	Cooling air hose for flame scanner	St		1	pcs	
	Gas hose for igniter	St		1		
	Air hose for igniter	St		1		
	Instrument air hose for cylinder	St		1		
	Limit switch for lance	St		1		
	Limit switch for cylinder	St		1		
	Sight glass		W	2		
	Flame scanner unit	St		1	pcs	
	Gas-electric igniter	St		1	pcs	
5	<u>COMBUSTION AIR SYSTEM</u>					
	According to manufacturer's recommendations					
5.1	<u>Total air fan</u>					
	Flexible parts set for coupling		W	1	set	
	Bearing set with seals	St		1	set	
	Shaft seals		W	1	set	
	Inlet flexible part for connection		W	1	pcs	
	Outlet flexible part for connection		W	1	pcs	
5.2	<u>Primary air fan</u>					

		Flexible parts set for coupling		W	1	set	
		Bearing set with seals	St		1	set	
		Shaft seals		W	1	set	
		Inlet flexible part for connection		W	1	pcs	
		Outlet flexible part for connection		W	1	pcs	
5.3	<u>Air port nozzle castings or sleeves</u>						
		Secondary nozzle		W	2	pcs	
		Secondary nozzle refractory box sleeve		W	2	pcs	
		Tertiary nozzle		W	2	pcs	
		Tertiary nozzle refractory box sleeve		W	2	pcs	
6	<u>FLUE GAS SYSTEM</u>						
	According to manufacturer's recommendations						
6.1	<u>Flue gas fan</u>						
		Flexible parts set for coupling		W	1	set	
		Bearing set with seals	St		1	set	
		Shaft seals		W	1	set	
		Inlet flexible part for connection		W	1	pcs	
		Outlet flexible part for connection		W	1	pcs	
6.2	<u>Recirculation gas fan</u>						
		Flexible parts set for coupling		W	1	set	
		Bearing set with seals	St		1	set	
		Shaft seals		W	1	set	
		Inlet flexible part for connection		W	1	pcs	
		Outlet flexible part for connection		W	1	pcs	
7	<u>FLUE GAS CLEANING</u>						
7.1	<u>Bag house filter</u>						
7.1.1	General	3" pulse valve	St		4	pcs	
		Pulse valve kit (piston, spring, diaphragm)	St		4	pcs	
		Pilot valve	St		6	pcs	
		Tank refilling valve	St		1	pcs	
		Filter bag (5% of total amount)	St	W	70	pcs	5% of filter bags/year are considered normal wear part, not under warranty. Supplier has the right to collect filter bags for laboratory analysis every 6 months to follow up the condition of bags. Purchaser will receive a report from such analysis
		Blinding plates (5%)	St		70	pcs	
		Filter cages (1%)	St		14	pcs	1% of filter cages/year are considered normal wear part, not under warranty
		Outer roof hatch gasket 1	St	W	2	pcs	
		Outer roof hatch gasket 2	St	W	2	pcs	
		Bottom hopper heater	St		2	pcs	
7.1.2	Dampers	Limit switch, inlet damper	St		2	pcs	
		Limit switch, outlet damper	St		2	pcs	
		Solenoid valve, inlet damper	St		1	pcs	
		Solenoid valve, outlet damper	St		2	pcs	
		Ball bearing unit	St		1	pcs	
		Graphite box packing	St	W	4	set	
		Inlet damper sealing kit	St	W	1	set	
		Outlet damper sealing kit	St	W	1	set	
		Inlet damper actuator	St		1	pcs	
		Outlet damper actuator	St		1	pcs	
7.1.3	Instrumentation & control	Interface module	St		1	pcs	
		Analog input module	St		1	pcs	
		Digital input module	St		1	pcs	
		Digital output module	St		1	set	
		Stabilized power supply	St		1	pcs	
		Industrial Ethernet switch	St		1	pcs	
		Level switch	St		1	pcs	
		Temperature sensor	St		1	pcs	

		Pressure sensor	St		1	pcs	
		Delta P sensor	St		1	pcs	
7.2	<u>Hydrated lime injection system</u>						
7.2.1	Hydrated lime feeder						
		Feeder screws	St		1	set	
		Bearing	St	W	5	pcs	
		Chain wheel, drive unit	St		1	pcs	
		Chain wheel, shaft	St		1	pcs	
		Chain	St	W	1	pcs	
		Chain lock	St	W	1	pcs	
		Gear wheel	St	W	5	pcs	
		Motor (excl. cooling fan)	St		1	pcs	
		Lamella sealing	St		5	pcs	
7.2.2	Rotary valve						
		Rotorblade	St	W	1	pcs	
		Glander, sealing	St		1	pcs	
7.2.3	Hydrated lime silo						
		Silo filter cartridge		W	1	set	
		Silo filter solenoid valve	St		1	pcs	
		Silo filter membrane valve	St		1	pcs	
		Coil, solenoid valve, arch breaking system	St		1	pcs	
7.2.4	Feeding air fan						
		Suction filter	St	W	1	pcs	
7.2.5	Common						
		Rotation switch	St		1	pcs	
		Level switch	St		1	pcs	
		Hose	St		1	pcs	
7.3	<u>SNCR-system</u>						
		Ammonia nozzles		W	1	set	
		Ammonia lance assembly		W	1	pcs	
7.3.1	Aqueous ammonia dilution water booster pump						
		Spare part set for pumps		W	1	set	
8	<u>SOOTBLOWING SYSTEM</u>						
	According to manufacturer's recommendations						
8.1	<u>Retracable Sootblowers</u>						
		Poppet valve	St		1	pcs	
		Feed tube packing		W	4	pcs	
		Feed tube gasket		W	4	pcs	
		Lance tube gasket		W	4	pcs	
		Companion flange gasket		W	4	pcs	
		Valve stem packing		W	4	pcs	
		Air relief valve		W	1	pcs	
		Limit switch	St		1	pcs	
8.2	<u>Short stroke multi-nozzle sootblowers</u>						
		Poppet valve	St		1	pcs	
		Feed tube packing		W	2	pcs	
		Feed tube gasket		W	2	pcs	
		Lance tube gasket		W	2	pcs	
		Companion flange gasket		W	2	pcs	
		Valve stem packing		W	2	pcs	
		Air relief valve		W	1	pcs	
		Limit switch	St		1	pcs	
8.3	<u>Rake sootblowers</u>						
		Poppet valve	St		1	pcs	
		Feed tube packing		W	2	pcs	
		Feed tube gasket		W	2	pcs	
		Lance tube gasket		W	2	pcs	
		Companion flange gasket		W	2	pcs	
		Valve stem packing		W	2	pcs	
		Air relief valve		W	1	pcs	
		Limit switch	St		1	pcs	

9	ASH HANDLING SYSTEM According to manufacturer's recommendations					
9.1	<u>Pneumatic slide gate</u>					
	Sealing set for cylinder		W	1	pcs	
	Control valve	St		1	pcs	
9.2	<u>Drop chute with expansion bellow</u>					
	Steel bellow	St		1	pcs	
9.3	<u>Bottom ash chain conveyor</u>					
	Conveyor chain with flights		W	5	m	
	Conveyor chain without flights		W	5	m	
	Inner link		W	6	pcs	
	Outer link		W	12	pcs	
	Conveyor flight		W	10	pcs	
	Drive wheel		W	1	pcs	
	Tail Wheel		W	1	pcs	
	Wheel with bearing for middle section		W	1	pcs	
9.4	<u>Pneumatic slide gate</u>					
	Sealing set for cylinder		W	1	pcs	
	Control valve	St		1	pcs	
9.5	<u>Bottom ash sieve</u>					
	Screen mesh		W	2	pcs	
9.6	<u>Drag chain conveyor for 2nd and 3rd pass ash handling</u>					
	Drag Chain with flights		W	3	m	
	Tooth rim for drive sprocket		W	2	pcs	
	Tail wheel		W	1	pcs	
9.7	<u>Pneumatic operated slide gate</u>					
	Sealing set for cylinder		W	1	pcs	
	Control valve	St		1	pcs	
9.8	<u>Pneumatic transmitters for bottom, 2nd / 3rd pass & fly ash</u>					
	Spare parts, varies between conveyors, including:	St	W	1	set	
	Dome sealing		W	6	pcs	
	Cover seal		W	6	pcs	
	Upper flange sealing		W	6	pcs	
	Dome		W	1	pcs	
	Dome shaft sealing set		W	3	pcs	
	Dome shaft bearing set		W	3	pcs	
	Filter w/p 1/4"	St		3	pcs	
	Filter w/p 1/2"	St		3	pcs	
	Dome valve pneumatic actuator	St		1	pcs	
	Manometer 10 bar	St		1	pcs	
	3/2 limit valve	St		1	pcs	
	Solenoid valve	St		1	pcs	
	Pressure regulator	St		1	pcs	
	Level switch	St		1	pcs	
	Ball valve DN25 with actuator	St		1	pcs	
	One-way valve DN15	St		1	pcs	
9.9	<u>Conveying pipelines for bottom, 2nd / 3rd pass & fly ash</u>					
	Spare set, varies between pipelines, including:		W	1	set	
	Conveying pipe		W	2	pcs	
	Conveying pipe bend		W	2	pcs	
10	<u>FLUIDIZED BED GRATE AND FURNACE</u>					

		Fluidizing nozzles	St	W	40	pcs	2% of nozzles / year are considered wear parts, not under warranty
		Thermocouple protection tube+pocket, one level		W	1	pcs	
		Thermocouple protection tube+pocket, multilevel		W	1	pcs	
11	<u>OTHER SYSTEMS</u>						
	According to manufacturer's recommendations						
11.1	<u>Blowdown system</u>						
		Spare part set for blowdown tank drain pump		W	1	set	
11.2	<u>Sample station</u>						
		Set of spares		W	1	set	
11.3	<u>Chemical dosing system</u>						
		Spare part set for Phosphate pumps		W	1	set	
11.4	<u>Cooling water system</u>						
		Spare part set for pumps		W	1	set	
11.5	<u>Closed cooling water system</u>						
		Spare part set for pumps		W	1	set	
11.6	<u>Compressed air system</u>						
11.6.1	Transport air system	Set of spares	St	W	1	set	
11.7	<u>Instruments</u>						
		Temperature transmitter	St		3	pcs	
		Temperature sensor		W	6	pcs	
		Pressure and pressure difference transmitters	St		3	pcs	



All spare parts in the list below are required for Availability guarantee.

W= Wear and tear part are parts, which do not belong to mechanical warranty, but are considered to be normal maintenance items of the plant.

St = Strategic spare part are parts, which are necessary for the operation of the plant and/or have long delivery time.

St & W = Strategic wear and tear parts which are not subject to mechanical warranty

As some items are vendor specific, Valmet reserves the right to modify the list to meet each vendor's recommendations.

Device		Spare part					
Part ID	Device	Spare part name	Strategic part (St)	Wear part (W)	Required quantity / 2 years	Unit	Comment for red markings
1	<u>BOILER PRESSURE PARTS</u>						
1.1	<u>Tubes</u>						
		Tube of furnace walls	St		20	m	
		Tube of primary superheater	St		20	m	
		Tube of tertiary superheater	St		20	m	
		Tube of economizers	St		20	m	
1.2	<u>Tube bends</u>						
		Primary superheater bend	St		2	pcs/type	
		Tertiary superheater bend	St		2	pcs/type	
1.3	<u>Refractory</u>						
		Refractory material	St	W			5% of total area / year are considered as wear part, not under warranty
2	<u>BIOFUEL FEEDING SYSTEM</u>						
	According to manufacturer's recommendations						
2.1	<u>Common spare parts for fuel feeding & ash handling system</u>						
		Zero speed limit switch	St		2	pcs	
		Rotation guard	St		2	pcs	
		Sealing rope 5x10, 10m		W	2	set	
		Sealing rope 10x10, 20m		W	2	set	
		Hard welding rod		W	4	set	
2.2	<u>Fuel silo</u>						
		Explosion disc	St	W	8	pcs	
2.3	<u>Rotating spreader for fuel silos inlet</u>						
		V-sealing		W	2	pcs	
2.4	<u>Silo screw reclaimer</u>						
		Spare screw sleeve		W	1	pcs	
		Bearings for screw shaft		W	1	pair	
		Shaft sealing set		W	2	pcs	
		Roller chain		W	2	pcs	
		Roller chain sprocket (smaller)		W	2	pcs	
		Chain tightener	St		4	pcs	
2.4.1	<u>Slip ring unit</u>						
		Signal brush		W	10	pcs	
		Holder for signal brush		W	4	pcs	
		Power brush		W	4	pcs	

		Holder for power brush		W	4	pcs	
		Sealing		W	2	pcs	
2.5	<u>Rotary feeders</u>						
		Bearing	St	W	2	pcs	
		Shaft sealing set	St	W	2	pcs	
		Overload coupling	St	W	1	pcs	
		Counter blade		W	4	pcs	
2.6	<u>Expansion joint</u>						
		Steel bellow	St		1	pcs	
2.7	<u>Wall screws</u>						
		Rotating union		W	2	pcs	
		Hose with connector		W	2	pcs	
3	<u>MAKE-UP SAND SYSTEM</u> According to manufacturer's recommendations						
3.1	<u>Sand silo equipment</u>						
		Bend AL203, DN100		W	1	pcs	
		Pipe AL203, DN100 L=500		W	1	pcs	
		Fill-up coupling		W	1	pcs	
4	<u>COMBUSTION AIR SYSTEM</u> According to manufacturer's recommendations						
4.1	<u>Air port nozzle castings or sleeves</u>						
		Secondary nozzle (lower)		W	2	pcs	
		Secondary nozzle refractory box sleeve (lower)		W	2	pcs	
		Secondary nozzle (upper)		W	2	pcs	
		Secondary nozzle refractory box sleeve (upper)		W	2	pcs	
5	<u>AUXILIARY FUEL SYSTEM</u>						
5.1	<u>Start-up burner</u>						
		Lance tube	St		1	pcs	
		Impeller	St		1	pcs	
		Gas nozzle		W	2	pcs	
		Sight glass		W	4	pcs	
		Limit switch for cylinder (for gas lance)	St		1	pcs	
		Limit switch for lance	St		1	pcs	
		Flame scanner unit	St		1	pcs	
		Gas-electric igniter	St		1	pcs	
		Flexible hoses for start-up burner	St		1	set	
5.2	<u>Technological fuel wall lance</u>						
		Oil nozzle		W	4	pcs	
		Limit switch for cylinder	St		2	pcs	
		Limit switch for lance	St		1	pcs	
		Flexible hose for oil	St		1	pcs	
		Flexible hose for atomizing air	St		1	pcs	
		Flexible hose for cylinder	St		2	pcs	
		Flexible hose for cooling air	St		1	pcs	
6	<u>FLUE GAS SYSTEM</u> According to manufacturer's recommendations						
6.1	<u>Flue gas fan</u>						
		Flexible parts set for coupling		W	1	set	
		Bearing set with seals	St		1	set	

		Shaft seals		W	1	set	
		Inlet flexible part for connection		W	1	pcs	
		Outlet flexible part for connection		W	1	pcs	
7	<u>FLUE GAS CLEANING</u>						
7.1	<u>Bag house filter</u>						
		Filter bag (5% of total amount)	St	W	134	pcs	5% of filter bags/year are considered normal wear part, not under warranty. Supplier has the right to collect filter bags for laboratory analysis every 6 months to follow up the condition of bags. Purchaser will receive a report from such analysis
7.2	<u>Sodium bicarbonate injection</u>						
7.2.1	Dosing screw	Feeder screws	St	W	2	set	
		Bearing	St	W	10	pcs	
		Chain wheel, drive unit	St		2	pcs	
		Chain wheel, shaft	St		2	pcs	
		Chain	St	W	2	pcs	
		Chain lock	St		2	pcs	
		Gear wheels	St		10	pcs	
		Lamella sealing	St	W	10	pcs	
7.2.2	Rotary valve	Rotor blade	St	W	2	set	
		Glander, sealing	St		2	pcs	
7.2.3	Feeding air fan	Suction filter	St	W	2	pcs	
7.2.4	Common parts	Rotation switch	St		1	pcs	
		Level switch	St		1	pcs	
7.3	<u>Ammonium sulphate injection</u>						
7.3.1	Ammonia dosing pumps	Spare part set	St	W	2	set	
7.3.2	Ammonium sulphate injection	Ammonia lance assembly, furnace	St	W	1	pcs	
		Ammonia nozzles, furnace	St	W	2	set	
8	<u>SOOTBLOWING SYSTEM</u>						
	According to manufacturer's recommendations						
8.1	<u>Retractable Sootblowers</u>						
		Poppet valve	St		1	pcs	
		Feed tube packing		W	1	pcs	
		Feed tube gasket		W	1	pcs	
		Lance tube gasket		W	1	pcs	
		Companion flange gasket		W	1	pcs	
		Valve stem packing		W	1	pcs	
		Air relief valve		W	1	pcs	
		Limit switch	St		1	pcs	
8.2	<u>Short stroke multi-nozzle sootblowers</u>						
		Poppet valve	St		1	pcs	
		Feed tube packing		W	1	pcs	
		Feed tube gasket		W	1	pcs	
		Lance tube gasket		W	1	pcs	
		Companion flange gasket		W	1	pcs	
		Valve stem packing		W	1	pcs	
		Air relief valve		W	1	pcs	
		Limit switch	St		1	pcs	
9	<u>ASH HANDLING SYSTEM</u>						
	According to manufacturer's recommendations						

9.1	<u>Pneumatic slide gate</u>					
		Cylinder	St		1	pcs
		Sealing set for cylinder		W	2	pcs
		Control valve	St		1	pcs
9.2	<u>Drop chute with expansion bellow</u>					
		Steel bellow	St		1	pcs
9.3	<u>Water cooled screw conveyors</u>					
		Rotating union		W	2	pcs
		Hose with connector		W	2	pcs
9.4	<u>Bottom ash drag conveyor</u>					
		Conveyor chain without flights		W	20	m
		Inner link		W	12	pcs
		Outer link		W	24	pcs
		Conveyor flight		W	20	pcs
		Drive wheel		W	4	pcs
		Tail Wheel		W	4	pcs
		Wheel with bearing for middle section		W	4	pcs
9.5	<u>Pneumatic slide gate</u>					
		Cylinder	St		1	pcs
		Sealing set for cylinder		W	2	pcs
		Control valve	St		1	pcs
9.6	<u>Bottom ash sieve</u>					
		Screen drum (1 + 1 pc)		W	1	pcs
		Screen mesh for outer drum		W	4	pcs
9.7	<u>Bottom ash drag conveyor</u>					
		Conveyor chain without flights		W	14	m
		Inner link		W	12	pcs
		Outer link		W	24	pcs
		Conveyor flight		W	14	pcs
		Drive wheel		W	4	pcs
		Tail Wheel		W	4	pcs
		Wheel with bearing for middle section		W	4	pcs
9.8	<u>Pneumatic transmitter</u>					
		Cover DN200		W	1	pcs
		Dome DN200		W	1	pcs
		Sealing DN200, Silicone		W	4	pcs
		Cover seal DN200	St		4	pcs
		Axle sealing set	St		1	set
		Axle bearing set	St		1	set
		Mechanical valve	St		1	pcs
		Double acting actuator for dome valve	St		1	pcs
		Filter 1/4 in		W	4	pcs
		Pressure indicator	St		1	pcs
		Actuator Ball Valve DN25	St		1	pcs
		Actuator Ball Valve D15	St		1	pcs
		Back-pressure valve DN25 PN40	St		1	pcs
		Pressure regulator		W	1	pcs
		Back-pressure valve DN15	St		1	pcs
		Sealing ø450/ø400	St		1	pcs
		Sealing ø343/ø210	St		4	pcs
		Solenoid valve	St		1	pcs
		Level switch	St		1	pcs
9.9	<u>Conveying pipeline DN100</u>					
		Bend AL203, DN100		W	1	pcs
		Pipe AL203, DN100 L=500		W	1	pcs

		Ball curve DN100		W	1	pcs	
		Bellows assembly DN100		W	1	pcs	
		Last bend AL203, DN100		W	1	pcs	
		Reinfroced pipe after last bend, L=1m		W	1	pcs	
		Wear pipe to boiler inlet		W	1	pcs	
						pcs	
10	FLUIDIZED BED GRATE AND FURNACE						
		Fluidizing nozzles, nozzle only (bed)	St	W	30	pcs	2% of nozzles / year are considered wear parts, not under warranty
		Fluidizing nozzles, nozzle only (loop seal)	St	W	30	pcs	2% of nozzles / year are considered wear parts, not under warranty
		Thermocouple protection tube+pocket, furnace bottom		W	2	set	
		Thermocouple protection tube+pocket, loop seal		W	2	set	
11	OTHER SYSTEMS						
	According to manufacturer's recommendations						
11.1	Cooling water system						
		Spare part set for pumps		W	2	set	



DOR for main contract

Table of Contents

15 ERECTION	2
Erection supervision	2
Erection of the delivered materials and equipment	2
Site health, safety and environment, HSE	3
Site arrangements	3

DOR for main contract

15 ERECTION

The delivery includes erection planning, erection and installation work and site management and erection supervision of the equipment and materials within the scope of delivery.

Erection supervision

The site will be resourced with suitable management manpower to perform management and supervision. Key roles are the site manager and the erection supervisors.

- The site manager and the erection supervisors reporting to him are responsible for the site operations. The site manager reports to the project manager.
- The site manager acts as Contractor's representative and contact person on site in matters concerning site events between the Client and Contractor.
- The site manager controls and takes care of the contractual testing, inspections and quality control.
- The site manager is responsible of the HSE operations within the contractual scope.

Contractor's site management team performs planning and administration of erection and installation, including:

- Site establishment.
- Providing the erection subcontractors with erection and installation directions and technical documents required for erection work.
- Prepare and maintain erection schedules.
- Preparing reports on the progress of the work at agreed intervals to the Client and Contractor.

Erection of the delivered materials and equipment

The materials and equipment to be erected by Contractor are listed in the scope of supply.

DOR for main contract

Site health, safety and environment, HSE

The Client shall assure that he and the selected contractor(s) and the employees of the Client and of the contractor(s), follow safe work practices and Client HSE policy, instructions and rules as well as applicable laws and requirements

Contractor shall assure that his employees and subcontractors follow safe work practices, Contractor and Client HSE policy, instructions and rules as well as applicable laws and requirements.

The Client is responsible for assuring that the erection site is a safe place to work.

The Client shall inform Contractor of potential risks at the workplace, including for example hazardous chemicals, gases, liquids, asbestos and radiation. An inspection report or other reliable evidence concerning the aforesaid risks at the workplace shall be presented to Contractor before commencing the advisory services at site.

If Contractor determines that the erection site is not safe place to work, he shall without delay notify the Client of any discovered shortfalls. In such cases Contractor shall have the right to refrain entering the workplace until found safety defects have been rectified by the Client and/or the contractor(s), and any costs of Contractor or its contractors' relating to waiting time shall be borne by the Client. Contractor also reserves the right to extension of time due to delays caused by unsafe workplace of the Client.

Site arrangements

Contractor and the Client shall provide and pay for the facilities, services and works as shown in the following table and notes. Contractor will provide for, and pay, if so indicated, the items if they are applicable and deemed necessary by Contractor to carry out the erection works of the scope of supply. Site infra structure (roads, prefabrication areas, storage areas etc.), which is on Client's responsibility, shall be ready before Contractor mobilization to the site.

Site arrangements and responsibilities – V = Contractor, P = Client					
Item of responsibility	Provided by		Paid by		Note
	V	P	V	P	
1 SITE LEGAL RESPONSIBILITIES					
1.1 Site Principal Contractor		X		X	
1.2 Site HSE Coordinator		X		X	
2 PERSONNEL					
2.1 Contractor salaries, wages, expenses	X		X		

DOR for main contract

Site arrangements and responsibilities – V = Contractor, P = Client					
Item of responsibility	Provided by		Paid by		Note
	V	P	V	P	
2.2 Contractor travel and accommodation	X		X		
2.3 Contractor salaries, wages, expenses	X		X		
2.4 Contractor travel and accommodation	X		X		
3 PERSONNEL AND SITE FACILITIES					
3.1 Canteen facilities	X		X		
3.2 Changing rooms	X		X		Two lockers per person.
3.3 Shower rooms	X		X		One shower per 15 persons.
3.4 Toilet facilities	X		X		One toilet per 15 persons.
3.5 Portable toilets	X		X		On ground level within 50 meters of the boiler area.
3.6 Personnel huts (rest period huts)	X		X		
3.7 Site office	X		X		
3.8 Furniture for site office	X		X		
3.9 Water, sewage, electricity for site offices and huts.		X	X		For items 3.1-3.4 and 3.6-3.7.
3.10 Internet installation	X		X		
3.11 Phone charges	X		X		
3.12 Internet charges	X		X		
3.13 Parking area		X		X	Sufficient size area at one location within 200 meters of the site facilities.
3.14 Construction signs	X		X		
4 PERMITS AND PERMISSION(S)					
4.1 Access to the site		X		X	
4.2 Building/construction permit		X		X	
4.3 Workers work permits	X		X		
4.4 Hot work permits		X		X	
5 INSPECTION, TESTING					
5.1 Quality Control / Quality Assurance and NDT testing	X		X		As specified in Contractor's QA/QC documentation
5.2 Receiving inspection at site	X		X		
5.3 Marking of materials at site	X		X		
5.4 As-built drawings	X		X		
5.5 Concrete testing		X		X	If applicable

DOR for main contract

Site arrangements and responsibilities – V = Contractor, P = Client					
Item of responsibility	Provided by		Paid by		Note
	V	P	V	P	
6 FREIGHT AND SITE LOGISTICS					
6.1 Customs clearance and duties	X		X		
6.2 Preparation of storage lay-down areas		X		X	
6.3 Maintenance and snow removal at site roads and storage areas		X		X	
6.4 Transport of the goods to the site	X		X		
6.5 Reception of the goods at site	X		X		
6.6 Unloading of the goods at site	X		X		
6.7 Create and maintain inventory of goods	X		X		
6.8 Packing of the goods for the storage before and during the works when needed	X		X		
6.9 Materials used for covering and protection	X		X		
6.10 Transport, incl. loading and unloading of the goods within the site	X		X		
6.11 Storage, including directly associated handling of the goods at site	X		X		
6.12 Packing of the goods for transport from site (e.g. for prefabrication)	X		X		
7 ERECTION EQUIPMENT AND FACILITIES					
7.1 Lifting and transport equipment	X		X		
7.2 Temporary personnel lift	X		X		For K20
7.3 Electrical main supply panels for erection work, prefabrication and lay-down areas	X		X		
7.4 Electrical distribution equipment for tools	X		X		
7.5 Welding equipment and materials	X		X		
7.6 Construction tools	X		X		
7.7 Scaffolding material	X		X		
7.8 Erection trestles, support materials	X		X		
7.9 Heated stores	X		X		If needed
7.10 Unheated stores, covered	X		X		
7.11 Lay down and pre-assembly area		X			
7.12 Tool stores	X		X		
7.13 Workshop premises at site	X		X		
7.14 Site work area fencing	X		X		
8 SUPPLIES AND SERVICES					

DOR for main contract

Site arrangements and responsibilities – V = Contractor, P = Client					
Item of responsibility	Provided by		Paid by		Note
	V	P	V	P	
8.1 General lighting at lay-down and storage areas and site roads		X		X	
8.2 General lighting, boiler house and work areas	X		X		
8.3 Spot lighting	X		X		
8.4 General ventilation	X		X		
8.5 Spot ventilation	X		X		
8.6 Acetylene, oxygen, welding gases	X		X		
8.7 Electrodes, consumables, grinding material etc.	X		X		
8.8 Electrical power 230/400 V, 50 Hz		X		X	
8.9 Oil, lubricants for construction equipment	X		X		
8.10 Compressed air		X		X	At K80 & 90
8.11 Construction water		X		X	At one location on ground level
8.12 Demineralised water for hydrostatic pressure tests, 50-80 deg C		X		X	At one location on ground level.
8.13 Sewage connections		X		X	In the boiler area and for facilities
8.14 Steam for line purging and refractory drying		X		X	If needed
8.15 Temporary heating of erection areas (equipment)	X		X		
8.16 Temporary heating of erection areas (energy, steam, electricity)		X	X		
9 CIVIL WORKS					
9.1 Excavation and site levelling		X		X	
9.2 Site levelling on boiler slab level for boiler house and other structures surroundings within 25 meters distance before Contractor's site mobilization		X		X	
9.3 Cleaning and disposal of excavation waste material		X		X	
9.4 Piling and mass change		X		X	
9.5 Levelling and reinforcement of storage, prefabrication and erection areas, and lifting areas		X		X	
9.6 Preparation and clearance for oversize loads inside site boundary.	X		X		

DOR for main contract

Site arrangements and responsibilities – V = Contractor, P = Client					
Item of responsibility	Provided by		Paid by		Note
	V	P	V	P	
9.7 Reinforcement of adjacent buildings and structures to accommodate loads and vibrations caused by erection works		X		X	
9.8 Underground piping and sewage		X		X	
9.9 Rain water removal during construction		X		X	
9.10 Foundations and concrete floors (slabs)		X		X	
9.11 Foundations for tower crane(s) and other temporary structures		X		X	If applicable
9.12 Cleaning and disposal of foundation works waste material	X		X		
9.13 Geodetic measurements and line markings	X	X	X	X	Reference point and main coordinates by the Client
9.14 Anchor bolt and other embedment design and manufacturing	X		X		
9.15 Anchor bolt and other embedment unloading and installation		X		X	
9.16 Anchor bolt and other embedment inspections	X	X	X	X	
9.17 Grouting and finishing		X		X	
9.18 Marking of holes (to be drilled)	X		X		
9.19 Drilling and breaking-up of holes to concrete structures	X	X	X	X	Up to 30 mm by Contractor
9.20 Holes for wedge bolts	X		X		
9.21 Installation openings and their covers	X		X		
9.22 Temporary brackets for lifting equipment	X		X		
10 WORKS ON EXISTING PLANT PARTS					
10.1 Works on existing steel and concrete structures	X		X		
10.2 Works on existing wall and roof structures	X		X		
10.3 Works on existing insulation and cladding works	X		X		
10.4 Works on existing underground canals, piping and cables	X		X		
10.5 Works on existing electrical systems	X		X		
10.6 Works on existing control and instrument systems	X		X		
10.7 Landscaping		X		X	

DOR for main contract

Site arrangements and responsibilities – V = Contractor, P = Client					
Item of responsibility	Provided by		Paid by		Note
	V	P	V	P	
11 MECHANICAL WORKS					
11.1 Installation works	X		X		
11.2 Scaffolding works	X		X		
11.3 Touch-up paint	X		X		
11.4 Touch-up painting work	X		X		
11.5 Pressure tests	X		X		
11.6 Temporary piping and equipment for pressure tests	X		X		
11.7 Heat treatment	X		X		
11.8 Preheating	X		X		
11.9 Mechanical check-out	X		X		
11.10 Temporary piping installation for steam blow	X		X		
12 HSE ISSUES					
12.1 HSE plan and risk analysis	X	X	X	X	
12.2 Inspection and removal of potential risks at the workplace relating to Client's facilities, including for example hazardous chemicals, gases, liquids, asbestos and radiation.		X		X	
12.3 Construction area fencing, notices and signs (Contractor works)	X		X		
12.4 Construction area fencing, notices and signs (Client works)		X		X	
12.5 First aid supplies	X	X	X	X	Each for own staff
12.6 Medical room	X		X		Local health services will be used
12.7 Doctor / Nurse	X		X		Local health services will be used
12.8 Mill area security guarding		X		X	
12.9 Boiler site safety supervising	X		X		
12.10 Entrance guarding		X		X	
12.11 Temporary firefighting equipment and protection	X		X		
12.12 Fire guard service at site		X		X	Mill fire department, if available
12.13 Fire watch during and after working hours	X		X		
13 CLEANING					
13.1 Cleaning of working areas	X		X		



SkoEnergio
OB2 Boiler Houses
BFB21-00942

Rev. 1

9.9.2024
Pekka Kulju

DOR for main contract

Site arrangements and responsibilities – V = Contractor, P = Client					
Item of responsibility	Provided by		Paid by		Note
	V	P	V	P	
13.2 Cleaning of offices, changing rooms, personnel and sanitary facilities	X		X		
13.3 Cleaning of plant before erection inspection	X		X		
13.4 Removal and sorting of scrapped materials, waste, rubbish etc. to waste containers	X		X		
13.5 Waste containers and emptying	X		X		

Site electrical supply

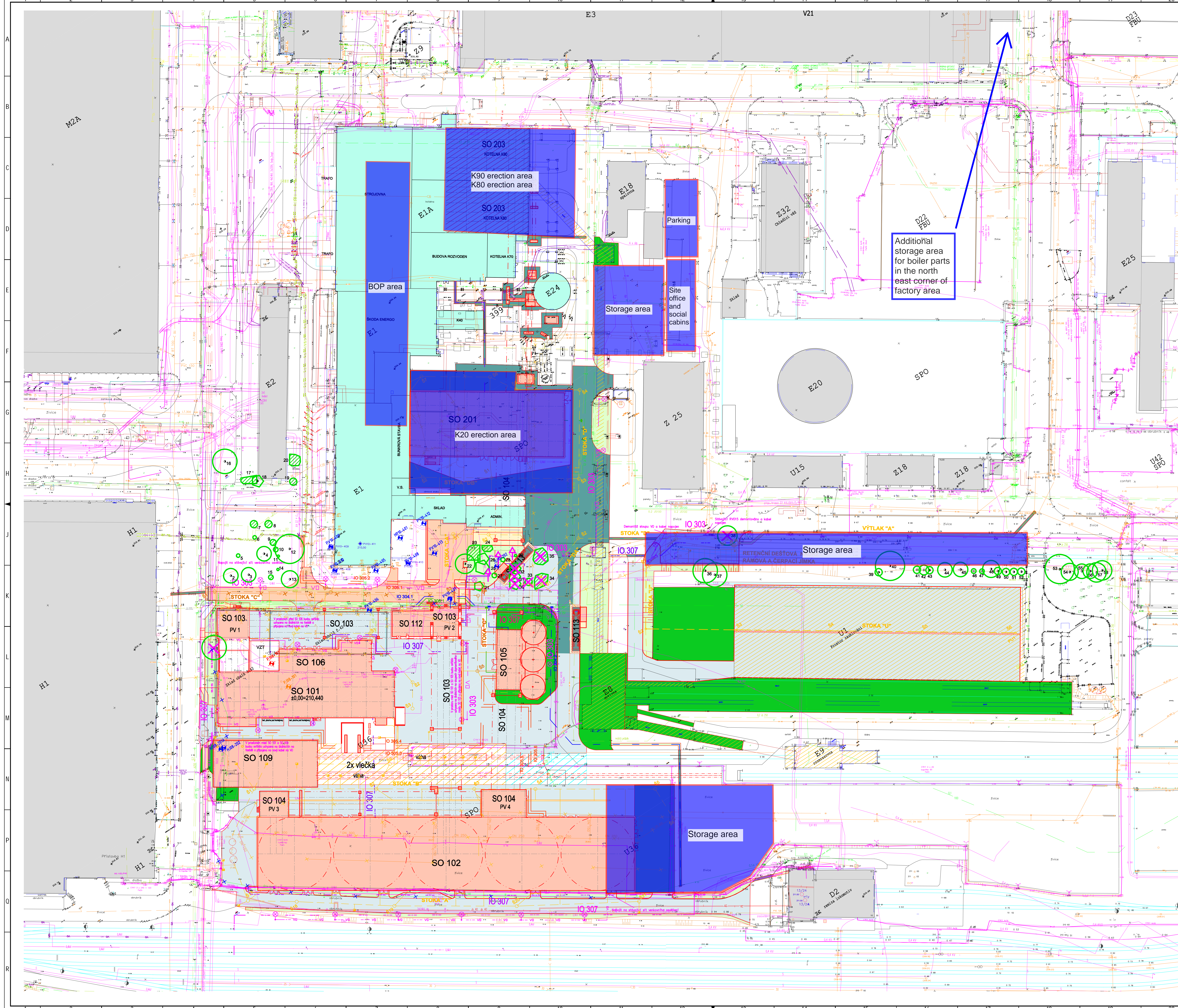
1. Boiler K20

Following construction power supplies are needed for boiler K20 construction:

- 400V/160A for tower crane
- 400V/400A for boiler house
- 400V/125A for bag house filter area
- 400V/250A for social facilities and site offices
- 400V/125A for tool containers and storage tent

2. Boiler K80 and K90

- Existing power supply cabinets inside the boilerhouse shall be used if available
- If existing power supply cabinets are not available a main supply of 400V/250A is needed for construction power main board



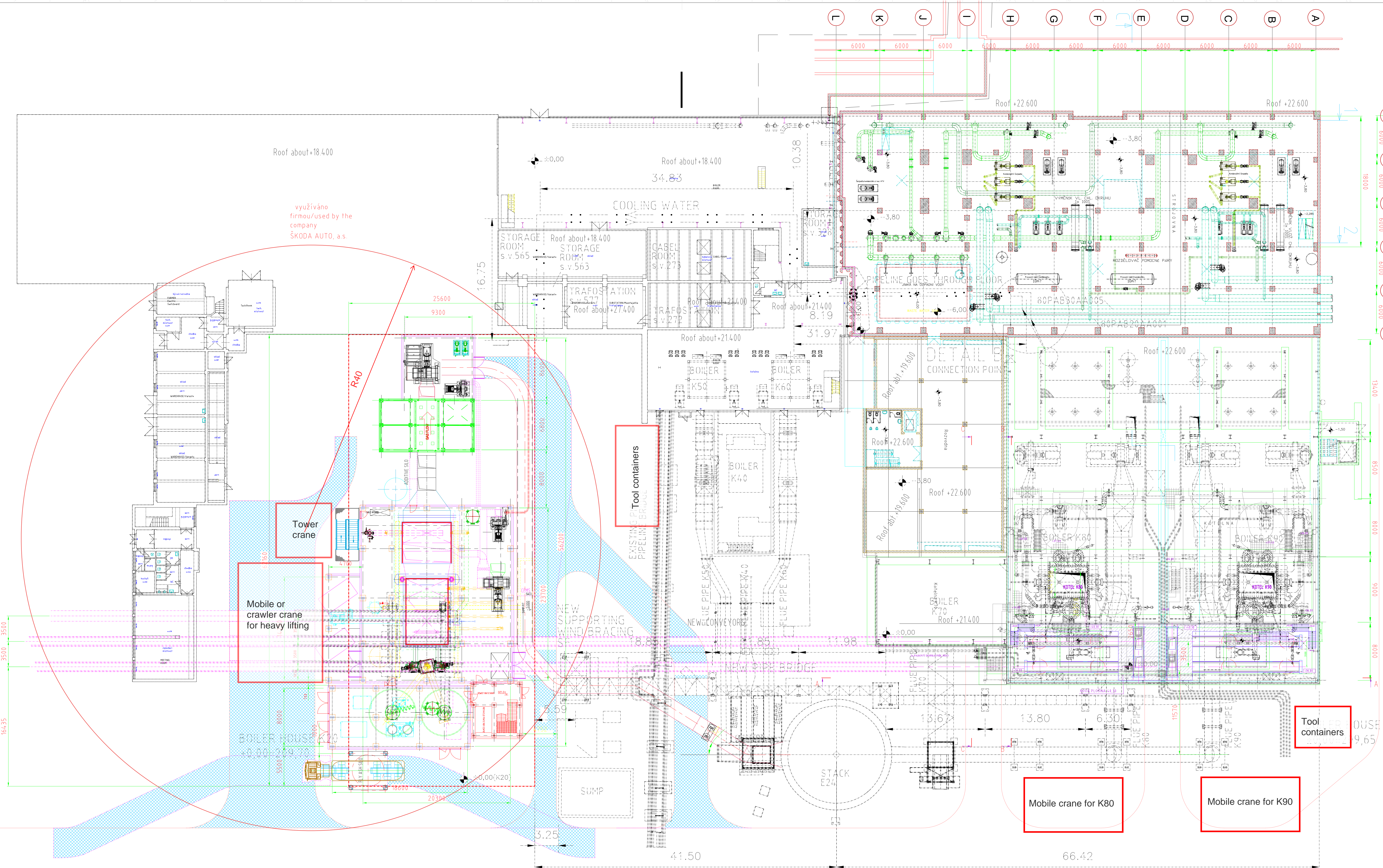
- LEGENDA**
- NOVÉ STAVEBNÍ OBJEKTY
NEW CONSTRUCTION BUILDINGS
 - STÁVAJÍCÍ DOTČENÉ STAVEBNÍ OBJEKTY
EXISTING BUILDINGS CONCERNED
 - ROZSAH STAVEBNÍCH OPRAV VE STÁVAJÍCÍCH OBJEKTECH
SCOPE OF CONSTRUCTION MODIFICATIONS IN EXISTING BUILDINGS
 - OBJEKTY ÚPŘENÉ K DEMOLICI - 2. ETAPA
BUILDINGS FOR DEMOLITION - 2nd STAGE
 - STÁVAJÍCÍ OBJEKTY
EXISTING FACILITIES
 - STÁVAJÍCÍ KOMUNIKACE, TERÉN, KONSTRUKCE
EXISTING COMMUNICATIONS, TERRAIN, STRUCTURES
 - IO 301 - NOVÁ ASFALTOVÁ VOZOVKA
NEW ASPHALT ROADWAY
 - IO 301 - OPRAVA STÁVAJÍCÍ ASFALTOVÉ VOZOVKY
REPAIR OF THE EXISTING ASPHALT ROADWAY
 - IO 301 - OPRAVA STÁVAJÍCÍ VOZOVKY ZE ŽÁKOVÉ DLAŽBY
REPAIR OF EXISTING ROAD FROM LOCK PAVEMENT
 - IO 301 - NOVÝ CHODNÍK
NEW SIDEWALK
 - IO 301 - NOVÝ OCHRANNÝ CHODNÍK U STÁVAJÍCÍCH STAVEBNÍCH OBJEKTŮ
NEW PROTECTIVE SIDEWALK AT EXISTING BUILDINGS
 - SO 111 - NOVÉ ZATRAVNĚNÉ PLOCHY
NEWLY GRASSED AREAS
 - SO 111 - STÁVAJÍCÍ ZNOVU ZATRAVNĚNÉ PLOCHY PO STAVEBNÍCH OPRAVÁCH
EXISTING RE-GRASSED AREAS AFTER CONSTRUCTION ADJUST
 - STÁVAJÍCÍ ZATRAVNĚNÉ PLOCHY
EXISTING GRASS AREAS
 - STÁVAJÍCÍ MONITOROVACÍ VRT
EXISTING MONITORING WELL
 - RUŠENÉ STÁVAJÍCÍ MONITOROVACÍ VRT
DISRUPTED EXISTING MONITORING WELL
 - NOVÝ MONITOROVACÍ VRT
NEW MONITORING WIRE

- NOVÉ INŽENÝRSKÉ SÍTĚ
NEW ENGINEERING NETWORKS**
- IO 302 - DEŠŤOVÁ KANALIZACE
STORM SEWAGE
 - IO 302 - JEDNOTNÁ KANALIZACE
UNIFORM SEWERAGE
 - IO 302 - SPLAŠKOVÁ KANALIZACE
SEWAGE SEWAGE
 - IO 303 - VNĚJŠÍ OSVĚTLENÍ
EXTERIOR LIGHTING
 - IO 304 - PITNÝ VODOVOD
DRINKING WATER SUPPLY
 - IO 305 - VODA SHZ
WATER SHZ
 - IO 306 - PRŮMYSLOVÝ VODOVOD
INDUSTRIAL PLUMBING
 - IO 307 - PŘÍPOJKA NN KABELU
HV CABLE CONNECTION
 - IO 307 - PŘÍPOJKA NN KABELU
LV CABLE LAYER
 - IO 307 - PŘÍPOJKY NN
LV CONNECTIONS
 - IO 307 - PŘÍPOJKA SLP KABELU
SLP CABLE LAYER

- RUŠENÉ STÁVAJÍCÍ INŽENÝRSKÉ SÍTĚ
DISRUPTED EXISTING ENGINEERING NETWORKS**
- DEŠŤOVÁ KANALIZACE
STORM SEWAGE
 - JEDNOTNÁ KANALIZACE
UNIFORM SEWERAGE
 - PITNÝ VODOVOD
DRINKING WATER SUPPLY
 - PRŮMYSLOVÝ VODOVOD
INDUSTRIAL PLUMBING
 - ELEKTRO - SILNOPROUD
ELECTRICITY - STRONG CURRENT
 - ELEKTRO - SLABOPROUD
ELECTRIC - WEAK CURRENT

- STÁVAJÍCÍ INŽENÝRSKÉ SÍTĚ
EXISTING ENGINEERING NETWORKS**
- DEŠŤOVÁ KANALIZACE
STORM SEWAGE
 - SPLAŠKOVÁ KANALIZACE
SEWAGE SEWAGE
 - JEDNOTNÁ KANALIZACE
UNIFORM SEWERAGE
 - CHEMICKÁ KANALIZACE
CHEMICAL SEWAGE
 - PITNÝ VODOVOD
DRINKING WATER SUPPLY
 - PRŮMYSLOVÝ VODOVOD
INDUSTRIAL PLUMBING
 - TEPLOVOD
HEAT PIPE
 - ELEKTRO - SILNOPROUD
ELECTRICITY - STRONG CURRENT
 - ELEKTRO - SLABOPROUD
ELECTRIC - WEAK CURRENT

- Stavební objekty**
- SO 101 - Přijem a úprava dřevní štěpky
 - SO 102 - Sklad dřevní štěpky
 - SO 103 - Oprava dřevní štěpky do skladu
 - SO 104 - Oprava dřevní štěpky do kotelny
 - SO 105 - SHZ - strojovna a základní nádrží
 - SO 106 - Elektrozvodna hospodářství dřevní štěpky
 - SO 108 - Kabelové kanály
 - SO 109 - Přesuvna vagonů
 - SO 111 - Sadové úpravy a zatravněné plochy
 - SO 112 - Vzorokovna dřevní štěpky - laboratoř
 - SO 113 - Silniční vlny
 - SO 201 - Kotelna K20
 - SO 202 - Páry ze kotelny K20 - čističe spalin
 - SO 203 - Úprava kotelny K80, K90
 - SO 204 - Vnější kotelny - konstrukce a základy
 - SO 205 - Odpovídání - potrubní most a základy
- Inženýrské objekty**
- IO 301 - Komunikace a zpevněné manipulační plochy
 - IO 302 - Kanalizace
 - IO 303 - Vnější osvětlení
 - IO 304 - Pitný vodozvod
 - IO 305 - Voda SHZ
 - IO 306 - Průmyslový vodozvod
 - IO 307 - Přípojky a přeložky elektro



Měřítko 1:200



0

100 m

Project name	SKO-ENERGY s.r.o. - Mladá Boleslav	Project number	11.000-001	Scale	1:200
Client	SKO-ENERGY s.r.o.	Design	11.000-001	Sheet	A-1
Project location	BFB21-00942 SKO-Energy s.r.o. Mladá Boleslav, Czech Republic New Valmet BFB Boiler Location at site				
Project description	This document is the exclusive intellectual property of Valmet Corporation and its subsidiaries and is intended solely for the specific project and purpose for which it was created. It is not to be reproduced, copied, or distributed in whole or in part without prior written consent of the company.				

Workers manpower estimate - VALMET and Subcontractors

WORKERS	YEAR/WEEK																									
Task	Company	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Steel structures and cladding	Subcontractor										25					5	15	15	15	15	25	25	25	25	25	25
Boiler, Piping, Equipment, Duct	Subcontractor	5	15	15							90						5	12	12	12	12	20	20	20	30	30
Electrification	Subcontractor	2	2	2							20															
Instrumentation	Subcontractor										20															
Refractory	Subcontractor										8															
Insulation	Subcontractor	4		4							50															
Scaffolding	Subcontractor	5	5	5							20						5	5	5	5	5	10	10	10	10	10
Others	Subcontractor										5															
TOTAL		16	22	26	0	0	0	0	0	0	238	0	0	0	0	5	25	32	32	32	42	55	55	55	65	65

Tie-ins during shutdown

Start of erection K20

Office manpower estimate - VALMET and Subcontractors

MANAGEMENT	YEAR/WEEK																									
Task	Company	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Site management	Valmet	4	4	4												3	6	6	7	7	7	7	7	7	7	7
Commissioning	Valmet																									
CSA	Subcontractor															2	3	3	3	3	3	3	3	3	3	3
Mechanical erection	Subcontractor	4	4	4												3	4	4	4	4	4	6	6	6	6	6
E&I	Subcontractor																									
Refractory	Subcontractor																									
Insulation	Subcontractor	1	1	1													1	1	1	1	2	2	2	2	2	2
Scaffolding	Subcontractor	1	1	1												1	2	2	2	2	2	2	2	2	2	2
TOTAL		10	10	10	0	0	0	0	0	0	0	0	0	0	0	9	16	16	17	17	18	20	20	20	20	20

		2026																															
51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
25		25	25	25	25	20	20	20	20	20	20	15	15	15	15	15	8	8	8	8	8	8	8	8	5	5	5	5	5				
30		50	50	50	50	60	60	60	60	90	90	110	110	110	100	100	90	90	70	70	60	60	60	50	50	50	50	50	40	40	40	30	30
			5	5	5	5	5	5	5	12	12	12	12	12	12	12	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
									5	5	5	10	10	10	10	10	10	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
															8	8	8	8															
												10	10	10	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	20	20
10		10	10	15	15	15	15	15	15	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	15	15	15	15	10
			2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
65	0	85	92	97	97	102	104	104	109	151	151	181	181	181	199	199	190	190	172	172	162	162	162	152	149	149	149	149	134	129	129	109	94

Start of demolition K80

Hydro test K20

Hydro test K80

		2026																															
51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
7		8	8	8	8	8	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	8	8	7	7	
															2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	1	1	1				
6	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	7	7	6	6	6	6	6	6	6	5	5	5	5	3
			2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
															1	1	1	1															
2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	11	23	25	25	25	25	25	26	28	28	28	28	28	28	31	31	30	30	28	28	28	29	29	29	29	29	28	28	27	25	25	24	21

33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14
																											10	10	10	10	10	10	
30	20	20	10	10	2	2	2																				30	30	30	30	40	40	
20	15	15	10	10	2																						3						
10	10	10	4	4	2																												
10	10	10	5	5																													
10	10	10	4	4	4																						10	10	10	10	10	10	
4	4	4	4	4																													
84	69	69	37	37	10	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53	50	50	50	60	60

Initial solid fuel firing K20

Initial solid fuel firing K80

Start of demolition K90

33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14
7	5	5	3	3	3	3	3																				3	5	5	5	5	5	5
5	5	5	5	5	5	5	5	5	4	4	4	4	4	4	4																		
																											2	2	2	2	2	2	2
3	3	2	2	2	2																						2	4	4	4	4	4	4
4	4	4	3	2	2																												
1	1	1	1	1																													
2	2	2	2	2	1																						1	2	2	2	2	2	2
22	20	19	16	15	13	8	8	5	4	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	6	13	13	13	13	13	13

2027																																	
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
10	10	10	10	10	10	10																											
40	40	50	50	50	50	50	50	50	50	50	50	30	30	30	20	20	20	20	20	10	10	2	2	2	2								
								5	5	5	5	5	10	10	10	10	10	10	5	5	5												
										5	5	5	5	8	8	8	8	8	8	8	2	2											
											8	8																					
											10	20	20	20	20	20	20	10	10	5	5	5											
10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	6	6	6	6	6	6	6	6											
										2	2	2	2	2	2	2	2	2	2	2	2	2											
60	60	70	70	70	70	70	60	65	65	72	90	80	77	80	66	66	66	56	51	36	30	17	2	2	2	0	0	0	0	0	0	0	0

Hydro test K90

Initial solid fuel firing K90

2027																																	
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
5	5	5	5	5	5	5	5	6	6	6	6	6	6	5	5	5	5	5	5	5	5	3	3	3	3								
											2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
2	2	2	2	2	2	2	2	2	2																								
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3												
								2	2	4	4	4	4	4	4	4	4	4	4	4	2	2											
											1	1																					
										2	2	2	2	2	2	2	2	2	1	1	1	1											
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1											
13	13	13	13	13	13	13	13	16	16	18	21	21	20	19	21	21	20	20	18	18	16	11	7	7	7	4	4	4	4	4	4	4	4

49	50	51	52
0	0	0	0

49	50	51	52
0	0	0	0



Quality plan

16.01 Quality plan, new BFB

Issue Status:

Project Name: SKO Energo BFB
Project Key:
Project Number: BFB21-00942
Document ID: MF00685728
Customer Document ID:
Revision: 1

Rev
1

Rev note

Created by
Holmström Elina
(absent)

Checked by

Approved by

Date

Contents

1 Scope	1
2 Terms and definitions	1
3 Valmet management system	1
4 Applicable laws, codes and standards	2
5 Project management	4
6 Contract review	4
7 Change management and non- conformities	4
8 Design	4
9 Purchasing	5
10 Third party and authority inspections and inspections done under National legislation	6
11 Mechanical installation	6
12 Electrification and Instrumentation	6
13 Automation	6
14 Supervision of commissioning	7
15 Conformity assessment and CE marking	7
16 Take over the delivery	8
17 Documentation	8
18 Servicing	8

1 Scope

This Quality Plan will be applied to the Valmet delivery scope of the project and defines minimum quality-related requirements and procedures to ensure that the delivered equipment and systems fulfill all the requirements of the Contract.

2 Terms and definitions

- "Purchaser" is Valmet's Customer
- "Subcontractor" is Valmet's Subcontractor

3 Valmet management system

The Management System of Valmet corporation Pulp & Energy Business Line (later Valmet) is certified to conform to the requirements of the international standards ISO 9001, ISO 14001 and ISO 45001.

The certificates of the management system cover the development and supply of services and technologies for the pulp, paper and energy industries. Valmet's management system shall be followed in the project.

Valmet's own workshops and subcontractor workshops in Europe have been certified in accordance with the ISO 3834-2 and have certificates of authorization of the American

Society of Mechanical Engineers (ASME) for manufacture and assembly of the power boilers.

4 Applicable laws, codes and standards

The applicable codes, standards and regulations mentioned in Table 1 shall be followed as product standards with the edition valid at the time of signing the contract.

Machines or assemblies of machines, pressure parts and assemblies, electrical devices, lifts, etc. shall be purchased CE marked according to the applicable EU Directives and national implementing legislation.

Table 1

ITEM	APPLICABLE CODE, STANDARD OR NORM
Foundations	Eurocode 2, (EN 1992-1-1)
Steel construction	Regulation (EU) No 305/2011 on laying down harmonized conditions for the marketing of construction products
- Design, materials, manufacturing, installation and inspections	EN 1990, EN 1993 (Eurocode 3), EN 1991 (Eurocode 1), EN 1090-1, -2
- Platforms, handrails	EN ISO 14122
- Surface treatment	EN ISO 12944-5, EN ISO 1461
Boiler assembly	Pressure Equipment Directive 2014/68/EU
- Materials	EN 12952-2:2021
- Design	EN 12952-3:2011
- Manufacturing and installation	EN 12952-5:2021
- Inspections	EN 12952-6:2021
Piping with PS > 0,5 bar	Pressure Equipment Directive 2014/68/EU
- Design, materials, manufacturing, installation and inspections	<p>PED categories I-III: EN 13480:2017</p> <p>PED Article 4, item 3 (sound engineering practice): EN 13480:2017, piping class 0, with the exceptions:</p> <ul style="list-style-type: none"> instead of proof test according to EN 13480 a leakage test in operation pressure shall can be performed during assembly or commissioning for bolts, screws and nuts EN ISO 898 8.8 and 5.6 grades can be used piping with hazardous chemical content acc. to CLP Regulation

	<p>1272/2008: EN 13480 piping class I is followed (without CE marking)</p> <ul style="list-style-type: none"> if cold bending of longitudinally welded tubes is used welds can be located outside bend neutral zone Compression fittings in accordance with EN 13480-4 can be used in piping when specified in isometric drawings
Piping with PS ≤ 0,5 bar	
- Design, materials, manufacturing, installation and inspections	Sound engineering practice
Pressure vessels	Pressure Equipment Directive 2014/68/EU Simple Pressure Vessel Directive 2014/29/EU
- Design, materials, manufacturing, installation and inspections	<p>PED categories I-IV: Standard EN 13445:2021 with the following exceptions:</p> <ul style="list-style-type: none"> For serially produced pressure equipment also other recognized, not harmonized standards can be accepted depending on manufacturer's decision, e.g. for plate heat exchangers and compressed air vessels standard AD2000. <p>PED Article 4, item 3 (sound engineering practice): Standard EN 13445:2021 or other recognized, not harmonized standard or manufacturer's proven practice</p>
Tanks with PS ≤ 0,5 bar	
- Design, materials, manufacturing, installation and inspections	<p>Steel tanks according to EN 14015 or other applicable standard or sound engineering practice.</p> <p>Plastic tanks according to standard chosen by manufacturer</p> <p>Scrubbers according to Sound engineering practice</p>
Machines	Machinery Directive 2006/42/EC ATEX Directive 2014/34/EU and other applicable Directives
Lift	Lifts Directive 2014/33/EU
Insulations	SFS standards
Refractory	SFS standards

Automation, electrification and instrumentation	Applicable Directives (e.g. EMC, LVD, ATEX, RoHS) and IEC standards
--	---

5 Project management

A separate project organization, including the Quality Assurance Engineer of the project, will be named at the beginning of the project. If no separate QAE is appointed to support the project work, the Project Manager shall be responsible for the QA tasks.

The Project Manager and the persons responsible for different project functions, in cooperation with the Project Manager, have authorizations and are responsible for requesting, communicating, reviewing and approving drawings, plans and other project documents.

Project execution and its control will be done in accordance with the Valmet Project Execution Model (PEM). As an integrated part of the PEM, a lean project management method called Pulse shall be used for running the project.

6 Contract review

Valmet shall review the Contract to ensure that requirements are adequately defined, and Valmet has the capability to meet the Contract requirements.

7 Change management and non- conformities

All changes which lead to a change in the conditions (cost, schedule, scope or technical solution) established from the project start, shall be handled in accordance with the change management processes described in the Valmet management system.

Product nonconformity (NCR) is any condition in a product or its performance which does not comply with the applicable law or code or deviates from the requirements of a contract, drawing, procedure, specification or material purchase order.

A nonconforming work shall be put on hold until a nonconformity report has been prepared, handled and filed according to the Valmet management system and either a re-work, scrap, repair or 'use as is' decision has been made.

NCR's which decision is "use as is", and the completed product deviates from requirements of the Contract and mandatory product standard will be issued for Purchaser approval.

8 Design

8.1 Design carried out by Valmet

All design for civil work, steel structures, machinery, pressure equipment and for electrification, instrumentation and automation, will be performed in accordance with the

Valmet management system. Subcontracted design shall be purchased in accordance with the Valmet management system.

After each major design phase, a design review meeting shall be arranged.

8.2 Hazard and risk analysis

At the design stage, a hazard and risk analysis is arranged to ensure the safety of the delivery.

Hazards which may cause damage to human, property or environment shall be identified and assessed. Necessary actions to minimize hazards shall be implemented. The results of the hazard and risk analysis meetings shall be documented.

Hazard and risk analysis at the delivery limits are under responsibility of Purchaser.

For rebuild or modification works, updating hazard and risk analysis of the existing equipment's are on the responsibility of Purchaser

9 Purchasing

9.1 Approval of Subcontractors

All subcontractors used in project shall be approved in accordance with the Valmet management system. Supplier assessments are done when required in the Management system. Supplier list in contract applies for purchases in projects.

9.2 Supply plan

Supply Plan listing main deliveries and used suppliers, will be prepared for project. Purchases will be done according to Valmet management system.

9.3 Supply quality specification

Supply Quality Specification or technical specification defining quality related requirements, will be issued for purchasing of selected equipment, manufacturing and installation.

9.4 Supplier supervision

Supplier Supervision Plan showing the main items to be inspected during project will be issued. The supervision degrees (remote, spot wise or permanent supervision) for each item is defined by Valmet depending on the selected supplier and product.

Suppliers are supervised by Valmet supplier quality engineers, by representative of the purchasing and/or quality assurance department or by the project manager.

If the Purchaser wishes to be involved in the supervision it shall be marked this in the Supplier Supervision plan. Also ITP's will be delivered for customer review on these items.

Manufacturing and quality control at Valmet's own workshops will be performed in accordance with the workshops Quality Control Manual.

10 Third party and authority inspections and inspections done under National legislation

When required in the applicable laws and standards or Contract, the Third Party organization shall be involved in the inspection of delivered equipment and assemblies. Valmet or its Subcontractor selects the Third Party organization for the works.

All permitting and inspections which belong under national legislations in the country of destination (e.g. first in-service inspection and registration of pressure equipment) are in the area of responsibility of the Purchaser but Valmet shall perform contractually agreed works included under national legislation and deliver needed documentation for permitting and for first in-service inspections of equipment.

11 Mechanical installation

Construction, erection and assembly mentioned in this Quality plan are considered as installation works of agreed scope.

All installation work shall, as a minimum, fulfill the requirements of Valmet and equipment manufacturers specifications and installation instructions. The work shall be controlled by applicable ITP's and Installation checklists. Inspection and Test Plans (ITP) for main installation works can be submitted to customer on request.

The traceability of welding, heat treatment and NDT of pressurized equipment and piping shall be ensured by Welding log.

Qualifications of persons and procedures for welding and NDT shall be verified before installation work start.

12 Electrification and Instrumentation

Installation and electrification shall be done according to adequate engineering documents and taking into account National legislation for electrical installation. Field circuits shall be tested and verified in commissioning inspection of electrical installation.

Valmet supervisors shall sign of tested circuits on the checklists.

13 Automation

Functions for automation and safety automation shall be implemented as specified in functional engineering documents and as described in in safety function requirements specification.

Automation functions are verified during FAT (Factory acceptance test) and SAT (Site acceptance test) and validated in functional tests at site during commissioning. Safety automation shall be validated according to safety automation standards. Pressure vessel automation shall be assessed by third party when required by legislation.

The Purchaser's representatives may also attend the FAT and SAT.

14 Supervision of commissioning

All commissioning work shall, as a minimum, fulfill the requirements of Valmet and equipment manufacturers specifications and commissioning instructions. The work shall be controlled by applicable commissioning checklists for equipment and commissioning systems.

The commissioning of the plant will be performed as a test that cover all functions, controls and interlocks of the installation using appropriate methods and raw materials. Each systems of the plant will be tested according to beforehand-agreed protocols for commissioning including also all necessary actions during different phases.

15 Conformity assessment and CE marking

A manufacturer, as defined in European Commission's Guide to the implementation of directives based on the New Approach and the Global Approach, has sole and ultimate responsibility for the conformity of the product to the applicable Directives.

Valmet shall take necessary actions (e.g. Hazard and risk analysis, conformity assessment procedures) to make sure that the whole contractual scope and the interfaces between the equipment and assemblies of the supply meets the requirements of the applicable EU directives.

Valmet or Valmet's subcontractor is the responsible Manufacturer of the single equipment and/or Assemblies acc. to Directives and issues EU Declarations of Conformity and CE-markings accordingly. To ensure assemblies CE-marking, following conditions shall be met:

- Design, manufacturing, installation, supervision and Notified Body for the assemblies and main equipment is in Valmet's contractual scope and Valmet or Valmet's subcontractor has possibility to conduct full conformity assessment of the assemblies.
- Automation and safety automation components and functions are defined, verified and approved by Valmet
- Documentation and verification protocols on components or installations which are not included to Valmet delivery scope (e.g. electrification) is delivered to Valmet to be included to Valmet technical file

Valmet delivery consists of number of pressure equipment assemblies, machine assemblies and/or single machines or equipment as identified by the Directives and defined by Valmet. Whole delivery cannot be handled as just one Pressure equipment assembly or as one Machine assembly acc. to Directives (ref. Guide to application of the Machinery Directive 2006/42/EC §38). One EU Declaration of Conformity for the

whole delivery scope cannot be issued as it is not recognized or required by the Directives.

Individual pressure equipment, machines and electrical devices in the Valmet contractual scope are purchased and delivered as CE marked and include in the assemblies as applicable.

If, in Valmet's delivery scope, there are machines which are intended to be incorporated into machinery or assembled with other machinery by Purchaser, Declaration of Incorporation, as described in the Machinery Directive 2006/42/EC Article 6.2 and Annex II.1.B, will can be delivered.

CE Markings as required by Directives is not applicable to repair or modification works of existing equipment.

16 Take over the delivery

After fulfilment of the contractual requirements for taking over, the customer takes over the responsibility of the plant. This is confirmed by issuing and signing by both parties a Take over certificate.

Valmet EU Declarations of Conformity for the assemblies shall be delivered and CE-plates attached latest at the take over.

17 Documentation

17.1 Final documentation

The documentation as required by the applicable laws and codes and the Operating instructions will be submitted to the Purchaser on completion of the contract.

For pressure equipment the documentation required by the product standards and manufacturing designs, will be delivered in .pdf format. For example, the Design and Manufacturing Data Dossier as required by the standard EN 12952-6, EN 13480 and EN 13445 will be submitted.

Valmet will store the technical documentation required by the applied directives and standards for 10 years from the date of delivery.

Final quality documentation shall be delivered in English.

17.2 Instruction manuals

Instruction manuals shall always be delivered in the language of the country of destination or they shall be bilingual (language of the country of destination / English).

18 Servicing

The project organization is involved in the project throughout the warranty period.



Quality plan
16.01 Quality plan, CFB rebuilds

Issue Status:

Project Name: SKo Energo 2 x CFB rebuild
Project Key:
Project Number: ERC21-00349

Document ID: MF00685730
Customer Document ID:
Revision: 1

Rev	Rev note	Created by	Checked by	Approved by	Date
1		Paakkunainen Mika			

Contents

1 Scope	1
2 Terms and definitions	1
3 Valmet management system	1
4 Applicable laws, codes and standards	2
5 Project management	4
6 Contract review	5
7 Change management and non- conformities	5
8 Design	5
9 Purchasing	6
10 Third party and authority inspections	6
11 Mechanical installation	6
12 Electrification and Instrumentation	7
13 Automation	7
14 Supervision of commissioning	7
15 Conformity assessment	8
16 Take over the delivery	8
17 Documentation	8
18 Servicing	9

1 Scope

This Quality Plan will be applied to the Valmet delivery scope of the project and defines minimum quality-related requirements and procedures to ensure that the delivered equipment and systems fulfill all the requirements of the Contract.

2 Terms and definitions

- "Purchaser" is Valmet's Customer
- "Subcontractor" is Valmet's Subcontractor

3 Valmet management system

The Management System of Valmet corporation Pulp & Energy Business Line (later Valmet) is certified to conform to the requirements of the international standards ISO 9001, ISO 14001 and ISO 45001.

The certificates of the management system cover the development and supply of services and technologies for the pulp, paper and energy industries. Valmet's management system shall be followed in the project.

Valmet's own workshops and subcontractor workshops in Europe have been certified in accordance with the ISO 3834-2.

4 Applicable laws, codes and standards

The applicable codes, standards and regulations mentioned in Table 1 shall be followed as product standards with the edition valid at the time of signing the contract.

ITEM	APPLICABLE CODE, STANDARD OR NORM
New parts of steel construction	Regulation (EU) No 305/2011 on laying down harmonised conditions for the marketing of construction products
- Design, materials, manufacturing, installation and inspections	EN 1990, EN 1993 (Eurocode 3), EN 1991 (Eurocode 1), EN 1090-1,-2
-Platforms, handrails	EN ISO 14122
- Surface treatment	EN ISO 12944-5, EN ISO 1461
New boiler pressure parts, modification of existing boiler parts and internal piping	<p>National implementing legislation of Pressure Equipment Directive 2014/68/EU in CZ</p> <p>with the exception that test pressure for boiler assembly is as specified by CZ national legislation and boiler owner. Single boiler parts are not pressure tested during manufacturing.</p> <p>Materials EN 12952-2:2021 Design EN 12952-3:2011 Manufacturing and installation EN 12952-5:2021 Inspections EN 12952-6:2021</p>
Piping and modification of existing piping with PS > 0,5 bar	National implementing legislation of Pressure Equipment Directive 2014/68/EU in CZ

ITEM	APPLICABLE CODE, STANDARD OR NORM
- Design, materials, manufacturing, installation and inspections	<p>Piping class I-III: EN 13480 with exception: -in modification works of existing piping, proof test can be replaced with NDT-testing when agreed between Purchaser and Valmet beforehand.</p> <p>Sound engineering practice): EN 13480:2017, piping class 0, with the exceptions:</p> <ul style="list-style-type: none"> • instead of proof test according to EN 13480 a leakage test in operation pressure shall can be performed during assembly or commissioning • for bolts, screws and nuts EN ISO 898 8.8 and 5.6 grades can be used • piping with hazardous chemical content acc. to CLP Regulation 1272/2008: EN 13480 piping class I is followed (without CE marking) • if cold bending of longitudinally welded tubes is used welds can be located outside bend neutral zone • Compression fittings in accordance with EN 13480-4 can be used in piping when specified in isometric drawings
Piping with PS ≤ 0,5 bar	
- Design, materials, manufacturing, installation and inspections	Sound engineering practice
New pressure vessels and heat exchangers	<p>Pressure Equipment Directive 2014/68/EU</p> <p>Simple Pressure Vessel Directive 2014/29/EU</p>
- Design, materials, manufacturing , installation and inspections	<p>PED categories I-IV: Standard EN 13445:2021 with the following exceptions:</p> <ul style="list-style-type: none"> • For serially produced pressure equipment also other recognized, not harmonized standards can be accepted depending on manufacturer's decision, e.g. for plate heat

ITEM	APPLICABLE CODE, STANDARD OR NORM
	<p>exchangers and compressed air vessels standard AD2000.</p> <p>PED Article 4, item 3 (sound engineering practice): Standard EN 13445:2021 or other recognized, not harmonized standard or manufacturer's proven practice</p>
Tanks with PS ≤ 0,5 bar	
- Design, materials, manufacturing , installation and inspections	<p>Steel tanks according to EN 14015 or other applicable standard or sound engineering practice.</p> <p>Plastic tanks according to standard chosen by manufacturer</p> <p>Scrubbers according to Sound engineering practice</p>
Machines	Machinery Directive 2006/42/EC and other applicable directives, EN standards
Insulations	SFS standards
Refractory	SFS standards
Automation, electrification and instrumentation *	Applicable directives (e.g. EMC, LVD, ATEX, RoHS) and IEC standards

*) ATEX classification of existing equipment in the plant is not covered

5 Project management

A separate project organization, including the Quality Assurance Engineer of the project, will be named at the beginning of the project. If no separate QAE is appointed to support the project work, the Project Manager shall be responsible for the QA tasks.

The Project Manager and the persons responsible for different project functions, in cooperation with the Project Manager, have authorizations and are responsible for requesting, communicating, reviewing and approving drawings, plans and other project documents.

Project execution and its control will be done in accordance with the Valmet Project Execution Model (PEM). As an integrated part of the PEM, a lean project management method called Pulse shall be used for running the project.

6 Contract review

Valmet shall review the Contract to ensure that requirements are adequately defined and Valmet has the capability to meet the Contract requirements.

7 Change management and non- conformities

All changes which lead to a change in the conditions (cost, schedule, scope or technical solution) established from the project start, shall be handled in accordance with the change management processes described in the Valmet management system.

Product nonconformity (NCR) is any condition in a product or its performance which does not comply with the applicable law or code or deviates from the requirements of a contract, drawing, procedure, specification or material purchase order.

A nonconforming work shall be put on hold until a nonconformity report has been prepared, handled and filed according to the Valmet management system and either a re-work, scrap, repair or 'use as is' decision has been made.

NCR's which decision is "use as is", and the completed product deviates from requirements of the Contract and mandatory product standard will be issued for Purchaser approval.

8 Design

8.1 Design carried out by Valmet

All design for civil work, steel structures, machinery, pressure equipment and for electrification, instrumentation and automation, will be performed in accordance with the Valmet management system. Subcontracted design shall be purchased in accordance with the Valmet management system.

After each major design phase, a design review meeting shall be arranged.

8.2 Hazard and risk analysis

At the design stage, a hazard and risk analysis is arranged to ensure the safety of the delivery.

Hazards which may cause damage to human, property or environment shall be identified and assessed. Necessary actions to minimize hazards shall be implemented. The results of the hazard and risk analysis meetings shall be documented.

Hazard and risk analysis at the delivery limits are under responsibility of Purchaser. For rebuild or modification works, updating hazard and risk analysis of the existing equipment's are on the responsibility of Purchaser

9 Purchasing

9.1 Approval of Subcontractors

All subcontractors used in project shall be approved in accordance with the Valmet management system. Supplier assessments are done when required in the management system. Supplier list in contract applies for purchases in projects.

9.2 Supply plan

Supply Plan listing main deliveries and used suppliers, will be prepared for project. Purchases will be done according to Valmet management system.

9.3 Supply quality specification

Supply Quality Specification or technical specification defining quality related requirements, will be issued for purchasing of selected equipment, manufacturing and installation.

9.4 Supplier supervision

Supplier Supervision Plan showing the main items to be inspected during project will be issued. The supervision degrees (remote, spot wise or permanent supervision) for each item is defined by Valmet depending on the selected supplier and product.

Suppliers are supervised by Valmet supplier quality engineers, by representative of the purchasing and/or quality assurance department or by the project manager.

If the Purchaser wishes to be involved in the supervision it shall be marked this in the Supplier Supervision plan. Also ITP's will be delivered for customer review on these items.

Manufacturing and quality control at Valmet's own workshops will be performed in accordance with the workshops Quality Control Manual.

10 Third party and authority inspections and inspections done under National legislation

When required in the applicable laws and standards or Contract, the Third Party organization shall be involved in the inspection of delivered equipment and assemblies. Valmet or its Subcontractor selects the Third Party organization for the works.

All permitting and inspections which belong under national legislations in the country of destination (e.g. first in-service inspection and registration of pressure equipment) are in the area of responsibility of the Purchaser but Valmet shall perform contractually agreed works included under national legislation and deliver needed documentation for permitting and for first in-service inspections of equipment.

11 Mechanical installation

Construction, erection and assembly mentioned in this Quality plan are considered as installation works of agreed scope.

All installation work shall, as a minimum, fulfill the requirements of Valmet and equipment manufacturers specifications and installation instructions. The work shall be controlled by applicable ITP's and Installation checklists. The traceability of welding, heat treatment and NDT of pressurized equipment shall be ensured by Welding log. Qualifications of persons and procedures for welding and NDT shall be verified before installation work start.

Inspection and Test Plans (ITP) for main installation works can be submitted to customer.

12 Electrification and Instrumentation

Installation and electrification shall be done according to adequate engineering documents and taking into account National legislation for electrical installation. Field circuits shall be tested and verified in commissioning inspection of electrical installation.

In case electrification of equipment which installed by Valmet is not in Valmet delivery scope, a documentation and verification protocols on electrification components or installations shall be delivered to Valmet to be included to Valmet technical file.

13 Automation

Functions for automation and safety automation shall be implemented as specified in functional engineering documents and as described in in safety function requirements specification.

Automation functions are verified during FAT (Factory acceptance test) and SAT (Site acceptance test) and validated in functional tests at site during commissioning. Safety automation shall be validated according to safety automation standards. Pressure vessel automation shall be assessed by third party when required by legislation.

The Purchaser's representatives may also attend the FAT and SAT.

14 Supervision of commissioning

All commissioning work shall, as a minimum, fulfill the requirements of Valmet and equipment manufacturers specifications and commissioning instructions. The work shall be controlled by applicable commissioning checklists for equipment and commissioning systems.

The commissioning of the plant will be performed as a test that cover all functions, controls and interlocks of the installation using appropriate methods and raw materials.

Each systems of the plant will be tested according to beforehand-agreed protocols for commissioning including also all necessary actions during different phases.

15 Conformity assessment

In modification works of existing boiler or external piping, CE-marking requirement according to PED 2014/68/EU is not applicable. Same shall apply to delivered new boiler pressure parts or parts of external piping and modifications of Machines. Conformity of the modification of existing pressure equipment shall be evaluated under National legislation in country of destination.

Individual new pressure equipment (in this project e.g. pneumatic conveyors, heat exchangers) shall be purchased and delivered CE marked acc. to PED 2014/68/EU. Valmet or Valmet subcontractor shall choose the Conformity assessment module and notified body used.

Individual new machines and electrical devices in the Valmet's contractual scope shall be purchased and delivered as CE marked. If, in Valmet's delivery scope, there are machines which are intended to be incorporated in to machinery or assembled with other machinery by Purchaser, Declaration of Incorporation, as described in the Machinery Directive 2006/42/EC Article 6.2 and Annex II.1.B, will be delivered.

16 Take over the delivery

After fulfilment of the contractual requirements for taking over, the customer takes over the responsibility of the plant. This is confirmed by issuing and signing by both parties a Take over certificate.

17 Documentation

17.1 Final documentation

The documentation as required by the applicable laws and codes and the Operating instructions will be submitted to the Purchaser on completion of the contract.

For pressure equipment the documentation required by the product standards and manufacturing designs, excluding welding procedure specifications (WPS), will be delivered in .pdf format. For example, the Design and Manufacturing Data Dossier as required by the standard EN 12952-6, EN 13480 and EN 13445 will be submitted.

Valmet will store the technical documentation required by the applied directives and standards for 10 years from the date of delivery.
Final quality documentation shall be delivered in English.

17.2 Instruction manuals

Instruction manuals shall always be delivered in the language of the country of destination or they shall be bilingual (Czech/English).



18 Servicing

The project organization is involved in the project throughout the warranty period.



IS - Inspection Specification

16.02 IS Boiler, new BFB rev0

Issue Status:

Project Name: SKO Energo BFB
Project Key:
Project Number: BFB21-00942
Document ID: MF00751660
Customer Document ID:
Revision: 0

Rev	Rev note	Created by	Checked by	Approved by	Date
0	No content change	Paakkunainen Mika			

Contents

1. Scope	2
2. Stipulations and standards to be followed	2
3. Non-destructive testing of welds	2
3.1 Method standards and acceptance criteria	2
3.2 Qualification of NDT personnel	3
3.3 Type and extent of non-destructive testing	3
3.4 General notes	4
3.4.1 Extend of NDT	4
3.4.2 Visual inspection	4
3.4.3 Testing on random basis	4
3.4.4 Testing before or after PWHT	4
3.4.5 Load carrying welds	4
3.4.6 Overlay welding of single tubes and raw panels	4
3.4.7 Connecting weld of pipeline and header	4
3.4.8 Requirements for non-pressure part welds	4
3.4.9 Hydrostatic pressure test	5
3.4.10 Abbreviations	5
Appendix 1: Material groups	11

1. Scope

This inspection specification is applied for pressure bearing parts in Bubbling Fluidized Bed (BFB) boiler assembly.

The minimum extend of a boiler assembly is as described in PED guideline C-04 and in EN 12952-1 chapter 1.2. Boiler assembly shall comprise all pressure parts from the feed water inlet (including the inlet valve) up to the main steam outlet (including the outlet valve) as well as all the necessary parts for drainage, blow down, vent and other minor boiler piping up to the first or second close valves.

More detailed extent of the boiler assembly is be described in the project specific PI-diagrams.

The non-destructive tests for boiler external piping are given in a separate Inspection Specification for piping.

2. Stipulations and standards to be followed

The Pressure Equipment Directive 2014/68/EU (later PED) and national implementing legislation in the country of destination shall be followed for pressurized components included in new boiler assemblies.

The water tube boiler standard EN 12952-6:2021 "Water-tube boilers and auxiliary installations" shall be followed in inspections boiler parts.

Also the requirements set in this inspection specification shall be followed.

3. Non-destructive testing of welds

3.1 Method standards and acceptance criteria

Method standards and acceptance criteria for non-destructive testing of the boiler assembly shall be in accordance with the standard EN 12952-6:2021. Method standards and acceptance criteria are given in Table 1.

Table 1

NDT method	Method standard	Acceptance criteria
RT	EN ISO 17636-1:2013 EN ISO 17636-2:2013 Testing level B	Table 6 in standard EN 12952-6:2021
UT	EN ISO 17640:2018 and item 7.4.2.1 in standard EN 12952-6	EN ISO 11666:2018, acceptance level 3
PAUT *)	EN ISO 13588:2019 (>6mm) EN ISO 20601:2019 (3.2-8mm)	EN ISO 19285:2017, acceptance level 2 EN ISO 4761:2022, acceptance level 1
MT	EN ISO 17638:2016	EN ISO 23278:2015, acceptance level 2X
PT	EN ISO 3452-1:2021	EN ISO 23277:2015, acceptance level 2X
VT	EN ISO 17637:2016	Table 5 in standard EN 12952-6:2021 Table C.1 in annex C of standard EN 12952-5:2021

*) The use of Phased array UT (PAUT) is accepted only with approval from Valmet. A separate written procedure and demonstration with preparation and inspection of a test piece is required.

3.2 Qualification of NDT personnel

The personnel performing non-destructive testing (MT, PT, UT) and the personnel evaluating the radiographs shall be qualified to level 2 of the EN ISO 9712:2012.

The personnel performing radiographic testing shall be qualified to level 1 of the EN ISO 9712 and the testing shall be performed under the direct supervision of personnel qualified as a minimum to level 2 of the EN ISO 9712, who shall also be responsible for the evaluation of the films.

Visual testing shall be carried out by experienced personnel having sufficient knowledge in welding techniques and a full comprehension of the standard EN 12952.

The NDT personnel performing the testing of the boiler assembly shall be approved by a third party organization recognized by a Member State, as required in item 3 in annex 1 of the PED.

3.3 Type and extent of non-destructive testing

The type and extent of non-destructive testing for tubes, headers and drum of the boiler are given in the Table 3.

The testing methods and the extent of testing for manufacturing and installations of tubes, headers and drums are based on the standard EN 12952-6:2021 and Valmet proven practice.

Material groups are given in **appendix 1** of this specification.

3.4 General notes

3.4.1 Extend of NDT

For all components, the extent in percent (%) in table 3 is calculated from the number of welded joints. For the selected joints, the entire length of the joints shall be tested unless otherwise agreed.

3.4.2 Visual inspection

All welds shall be 100% visually tested even though other type of NDT is specified.

3.4.3 Testing on random basis

When the extend of testing is less than 100%, the selected welds for testing shall include a sample of each welder and welding operator's work for each welding procedure specification on the component concerned. The testing shall be spread over whole duration of the work and include first weld of each welder.

3.4.4 Testing before or after PWHT

Generally all non-destructive testing shall be performed after post-weld heat treatment.

Non-destructive testing can be performed before post-weld heat treatment when following conditions applies:

- Material belongs to the material group 1.1 or 1.2; or
- The weld to be tested is circumferential butt weld in tube and the material belongs to the material group 5.1 or 5.2 and $d_0 \leq 114,3$ mm and tube nominal thickness $e \leq 7,1$ mm or the testing is required by Valmet (B) or customer (C)

3.4.5 Load carrying welds

Load carrying attachment welds (see Table 3) are marked with letters "LC" to weld markings of drawings by the designer.

3.4.6 Overlay welding of single tubes and raw panels

Mechanized overlay welding and inspections of single tubes and raw panels shall be made according to Valmet specifications.

3.4.7 Connecting weld of pipeline and header

First butt weld between outlet header and connecting pipeline shall be treated and inspected as internal piping weld as shown in point 5 of table 3.

3.4.8 Requirements for non-pressure part welds

Non-pressure part welds are considered to be fin to fin welds in furnace walls which make furnace gas tight.

Table 2

	Weld area	Weld penetration requirements	Type and extend of NDT	Acceptance criteria
1	Longitudinal fin to fin butt welds in tube walls	Partial penetration welds with min. 70% penetration welded from single or both sides	VT A100% PT A10% Note 1	EN 12952-6 table 5
2	Transversal fin to fin butt welds in tube walls and Window pieces	Full penetration welds, with the exceptions as stated in Note 3	VT A100% RT A5% PT A10% Note 2	EN 12952-6 table 5 and 6
3	Other non-pressure part welds in boiler assembly	Acc. to drawings	VT B100%	EN ISO 5817 weld class C

Note 1: PT inspection is done for longitudinal fin to fin site assembly welds from inside of the furnace in case fin material is other than material group 1 or 5

Note 2: PT inspection is done for transversal fin to fin welds in panels from inside of the furnace in case fin material is other than material group 1 or 5. In case of window pieces, Inspection can be done for finished window piece.

Note 3: Transversal Fin to fin butt welds shall be full penetration welds with the exception that transversal fin to fin butt welds in "window pieces" can have maximum 2mm unpenetrated weld in both butt weld end corner points. Middle part of the fin to fin transversal weld shall be fully penetrated to ensure adequate and uniform heat transfer between the fin ends in the membrane structure. RT inspection for butt weld shall be done before welding the fillet welds.

3.4.9 Hydrostatic pressure test

The hydrostatic pressure test for new boiler assembly shall be carried out after installation according to the PED 2014/68/EU and EN 12952. A separate instruction for hydrostatic pressure test shall be prepared.

3.4.10 Abbreviations

Following abbreviations are used in this specification:

Testing requirements:

A = Requirement of the EN 12952-6

B = Requirement of Valmet

C = Requirement of the customer

NDT methods:

RT = Radiographic Testing

UT = Ultrasonic Testing

MT = Magnetic Particle Testing

PT = Liquid Penetrant Testing

VT = Visual Testing

Other abbreviations:

e = material weld joint thickness

e_b = wall thickness of the pressure connection or branch joint

e_s or e_h = thickness of the end plate weld joint. End plate types are given in Figure 10.3-1 of the 12952-3

d₀ = outside diameter of the tube

DN = nominal size of the tube or pipe

Weld types (Valmet internal abbreviations):

BW = Butt Weld
 TBW = T-Butt Joint
 BCWO = Branch Connection Weld Set On
 BCWI = Branch Connection Weld Set In
 FW = Fillet Weld

Table 3

1.	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING						
		RT	UT	RT/ UT	MT 5)	PT	MT/ PT	NOTES
a)	Longitudinal butt welds (BW)		A100		A100			
b)	Circumferential butt welds (BW)		A100		A100			
c)	Pressure connection welds, $d_0 \geq 142$ mm (BCWO, BCWI) <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm 		A100 A10		A100 A100 A10			
d)	Pressure connection welds, $d_0 < 142$ mm (BCWO, BCWI) <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm 				A100 A100 A10			
e)	Attachments welds (TBW, FW) <ul style="list-style-type: none"> Load carrying Non load carrying 		B100				A100 A10	2)
f)	Other accessories <ul style="list-style-type: none"> Inspection of straightness of cyclone flanges 							3)

2.	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING						
		RT	UT	RT/ UT	MT 5)	PT	MT/P T	NOTES
2.1	Distribution and collection headers and headers of downcomers							4)
a)	Circumferential butt welds and Flat end welds EN12952-3 types a,b,e (BW) Material group 1: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} \leq e \leq 25$ mm $e < 15$ mm Material group 4: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} < e \leq 25$ mm $e < 15$ mm 	A100 A100	A100 A100 A100 A100		A100 A10 A10 A100 A100 A100			6) 1)
b)	Pressure connection welds, $d_0 \geq 142$ mm (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm Material group 3: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm Material group 4: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm 		A100 A100 A100	A10 A10 A10			A100 A10 A10 A100 A100 A10	

c)	Pressure connection welds, $d_0 < 142$ mm (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm Material groups 3 and 4: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm 						A10 A10 A10 A100 A100 A10	
d)	Flat end welds, EN12952-3 types c,d,f,g (TBW, BW) <ul style="list-style-type: none"> $d_0 > 70$ mm and e_s or $e_h \geq 8$ mm $d_0 \leq 70$ mm or e_s or $e_h < 8$ mm 		A100		A100 A100			
e)	Attachments welds (TBW, FW) <ul style="list-style-type: none"> Load carrying Non load carrying 		B10				A100 A10	7) 2)
2.2	Tube walls of furnace and back pass							
a)	Circumferential butt welds (BW) Material group 1: <ul style="list-style-type: none"> $e / d_0 < 0,12$ $e / d_0 \geq 0,12$ 	A20 A30						1) 9) 10) 11) 14)
b)	Pressure connection welds and tube to header welds $e_b < 15$ mm (BCWO, BCWI)						A10	
c)	Fin to tube welds (FW)							8)
d)	Transversal fin to fin welds (BW)							See table 2
e)	Longitudinal fin to fin welds (BW)							See table 2
g)	Attachments welds (TBW, FW) <ul style="list-style-type: none"> Load Carrying Non load carrying $d_0 \leq 76,1$ Non load carrying $d_0 > 76,1$ 						A100 A10 B10	7)

3.	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING						NOTES
		RT	UT	RT/ UT	MT 5)	PT	MT/ PT	
3.1	ECONOMIZER AND BOILER BANK							
3.1	Distribution and collection headers							4) 1)
a)	Circumferential butt welds (BW) Material group 1: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} \leq e \leq 25$ mm 		A100 A100		A100 A10			
	<ul style="list-style-type: none"> $e < 15$ mm 	A100			A10			
b)	Pressure connection welds, $d_0 \geq 142$ mm (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm 		A100	A10			A100 A10 A10	
c)	Pressure connection welds, $d_0 < 142$ mm (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm 						A10 A10 A10	
d)	Flat end welds, EN12952-3 types c,d,f,g (TBW, BW) <ul style="list-style-type: none"> $d_0 > 70$ mm and e_s or $e_h > 8$ mm $d_0 \leq 70$ mm or e_s or $e_h \leq 8$ mm 		A100		A100 A100			
e)	Attachments welds (TBW, FW) <ul style="list-style-type: none"> Load carrying Non load carrying 		B10				A100 A10	7) 2)
3.2	Economizer and boiler bank tubes							

a)	Circumferential butt welds (BW)	A10			A10		1) 9) 10) 11) 14)
b)	Tube to header welds (BCWO, BCWI)					A10	
c)	Attachments welds (TBW, FW) <ul style="list-style-type: none"> Load Carrying Non load carrying $d_0 \leq 76,1$ Non load carrying $d_0 > 76,1$ 					A100 B10 A10	
d)	Fin to tube welds in finned tube economizer						15)

ITEM OR SUBJECT		TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING						
4.	SUPERHEATERS	RT	UT	RT/ UT	MT 5)	PT	MT/ PT	NOTES
4.1	Distribution and collection headers and spray attemperators							4)
a)	Circumferential butt welds Flat end welds, EN12952-3 types a,b,e (BW) Material group 1: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} \leq e \leq 25$ mm $e < 15$ mm Other material groups: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} < e \leq 25$ mm $e < 15$ mm 	A100	A100 A100		A100 A10 A10			6) 1)
b)	Pressure connection welds, $d_0 \geq 142$ mm (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm Other material groups: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm 		A100	A10			A100 A10 A10	
c)	Pressure connection welds, $d_0 < 142$ mm (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm Other material groups: <ul style="list-style-type: none"> $e_b \geq 25$ mm $15 \text{ mm} \leq e_b < 25$ mm $e_b \leq 15$ mm 						A100 A10 A10	
d)	Flat end welds, EN12952-3 types c,d,f,g (TBW, BW) <ul style="list-style-type: none"> $d_0 > 70$ mm and e_s or $e_h \geq 8$ mm $d_0 \leq 70$ mm or e_s or $e_h < 8$ mm 		A100		A100 A100			
f)	Attachment welds (TBW, FW) <ul style="list-style-type: none"> Load carrying Non load carrying 		B10				A100 A10	2)
4.2	Superheater tubes							
a)	Circumferential butt welds (BW) Material groups 1 and 5 Material group 6, 8.1 and 8.2 Dissimilar welds between material groups 5.1, 5.2, 6.2 and 8.1, 8.2 Dissimilar welds between material groups 6.4 and 8 <ul style="list-style-type: none"> manually welded machine welded 	A10 A25 A25 A100 A10			A10	A25 A25		1) 9) 10) 11) 14)

b)	Fin to tube welds							8)
c)	Attachment welds (TBW, FW) <ul style="list-style-type: none"> Load Carrying Non load carrying $d_0 \leq 76,1$ Non load carrying $d_0 > 76,1$ 						A100 B10 A10	12)

5.	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING						NOTES
		RT	UT	RT/ UT	MT 5)	PT	MT/ PT	
a)	Headers of downcomers in accordance with item 2.1							
b)	Circumferential butt welds, $d_0 \geq 142$ mm (BW) Material group 1: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} \leq e \leq 25 \text{ mm}$ $e < 15$ mm Material groups 2, 3, 4 and 5: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} \leq e \leq 25 \text{ mm}$ $e < 15$ mm Material group 6: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} \leq e \leq 25 \text{ mm}$ $e < 15$ mm 	A10	A100 A10		A100 A100 A100			1)
c)	Circumferential butt welds, $76.1 < d_0 \leq 142$ mm (BW) Material group 1: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} \leq e \leq 25 \text{ mm}$ $e < 15$ mm Material groups 2, 3, 4 and 5: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} \leq e \leq 25 \text{ mm}$ $e < 15$ mm Material group 6: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} \leq e \leq 25 \text{ mm}$ $e < 15$ mm 	A10	A10 A10		A100 A10 A10			1)
d)	Circumferential butt welds, $d_0 \leq 76.1$ mm (BW) Material group 1: <ul style="list-style-type: none"> $15 \text{ mm} \leq e \leq 25 \text{ mm}$ $e < 15$ mm Material groups 2, 3, 4 and 5: <ul style="list-style-type: none"> $15 \text{ mm} \leq e \leq 25 \text{ mm}$ $e < 15$ mm Material group 6 and 8: <ul style="list-style-type: none"> $15 \text{ mm} \leq e \leq 25 \text{ mm}$ $e < 15$ mm 	A10	A10		A10 A10			1)
e)	Pressure connection welds, $d_0 > 142$ mm (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25 \text{ mm}$ $e_b \leq 15$ mm Material group 2, 3, 4 and 5: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} \leq e_b \leq 25 \text{ mm}$ $e_b \leq 15$ mm Material group 6: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} \leq e_b \leq 25 \text{ mm}$ $e_b \leq 15$ mm 			A100 A10			A100 A10 A10	13)

f)	Pressure connection welds, d ₀ ≤ 142 mm (BCWO, BCWI) Material group 1: • e _b > 25 mm • 15 mm < e _b ≤ 25 mm • e _b ≤ 15 mm Material group 2, 3, 4 and 5: • e _b > 25 mm • 15 mm ≤ e _b ≤ 25 mm • e _b ≤ 15 mm Material group 6 • e _b > 25 mm • 15 mm ≤ e _b ≤ 25 mm • e _b ≤ 15 mm						A100 A10 A10 A100 A100 A10 A100 A10 A10		
g)	Attachments welds (TBW, FW)								
	• Load Carrying • Non load carrying d ₀ ≤ 76,1 • Non load carrying d ₀ > 76,1		B10					A100 B10 A10	2)

- 1) UT inspection instead of RT can be used for material weld thicknesses $8 \text{ mm} \leq e < 15$ mm and PAUT inspection for material weld thicknesses $3.2 \text{ mm} \leq e < 15$ mm in accordance with separately accepted procedure. For PAUT inspection a demonstration with preparation and inspection of a test piece is required.
- 2) UT inspection is applied only to load carrying full penetrated welds in hanger lugs
- 3) Tightness of the drum cyclone flange connection shall be assured by machining the sealing surfaces between cyclone flange and attachment plate flange. In addition, pairs shall be fitted together and the cyclone/attachment plate pairs shall be numbered. If the cyclone attachment plates have been heat treated with the drum, the flatness of the attachment plate shall be verified after heat treatment. The upper and lower surfaces of the cyclone and attachment plate flanges shall make a tight contact and the maximum deviation from the flatness on the longitudinal edge of the attachment plate is < 0.15 mm. After mounting the cyclones, the gap between the sealing surfaces of attachment plate flange and cyclone flange shall be checked and the gap shall be < 0.2 mm on the upper edge of the flange and < 0.3 mm on the other edges.
- 4) If holes or openings are machined over or near the circumferential butt welds of the headers (distance < 50 mm), the butt welds shall be locally (minimum the distance of the diameter) grinded and inspected by using non-destructive testing (PT or MT).
- 5) PT testing instead of MT is acceptable in the case of test restrictions and for steel group 8 or when using nickel-based or austenitic welding filler metals.
- 6) For EN 12952-3 type e) flat ends additional UT inspection of the flat end edge area is required to ensure that no lamellar tearing occurs.
- 7) When refractory anchors are welded manually to pressure carrying parts, VT A100% + PT A100% inspection shall be done. When anchors, studs or attaching pins are welded to non-pressure carrying parts (e.g. fins), visual testing VT B100 % shall be performed. Surface quality of the weld shall fulfil the requirements of the EN 5817 class C. When refractory anchors or studs are welded by arc-stud welding, EN ISO 14555 with comprehensive quality requirements of 3834-2 shall be followed.
- 8) The requirements of the standard EN 12952-5, annex C shall be followed for fin to tube welding. Production test shall be done for mechanized fin to tube welds at the workshop. VT A100% inspection shall be done for mechanized and manual fin to tube welds and manually welded "window pieces" in panels.
- 9) Production weld test shall be done for butt welds in overlay welded tubes and panels in accordance with separate procedure. The penetration of the cladding weld into base material shall be examined.
- 10) In case RT inspection for tube butt weld is required, it shall be done before overlay welding except when overlay weld is calculated as a part of pressure bearing part of tube butt weld, RT inspection shall be done after overlay welding.
- 11) PT B10% is required for overlay welded tube and panel butt welds if RT is done before applying overlay welding
- 12) Studs for superheater ties shall be tested with the same method and extent than given for non-load-carrying attachment welds. Welding of superheater ties shall be done in accordance with the Valmet procedure FS3-020. In case nickel based filler metal is used, 10 first welds shall be PT-inspected
- 13) If ultrasonic examination is not possible, radiographic testing is permitted instead.
- 14) For circumferential welds at boiler tubes with $d_0 < 76,1$ mm tested by using elliptical radiographic technique it is sufficient to have 1 partial image per weld, provided that the other requirements of EN ISO 17636-1:2013 are met. The elliptical technique in accordance with EN ISO 17636-1 Figure 11

should not be used when external diameter $De > 100$ mm or wall thickness $t > 8$ mm or weld width $> De/4$. Exceptions to this are tube wall, load carrying tube and superheater tube butt welds at installation site for which RT with elliptical images can be accepted independent of the tube wall thickness and weld width in case suitability of technic is demonstrated.

- 15) Production test for fin to tube weld in finned tube economizer shall be done according to manufacturer's specification

Appendix 1: Material groups

Grouping of most typical boiler and piping materials in accordance with standards CEN ISO/TR 15608, ISO/TR 20172, ISO/TR 20173, EN 12952-2 and EN 13480-2

Material Designation	Material No.	Material standard	Material group
P235GH	1.0345	EN 10216-2 EN 10028-2	1.1
P265GH	1.0425	EN 10216-2 EN 10028-2 EN 10273	1.1 1.1 1.1
P245GH	1.0352	EN 10222-2	1.1
P280GH	1.0426	EN 10222-2	1.2
16Mo3	1.5415	EN 10216-2 EN 10028-2 EN 10273 EN 10222-2	EN 12952-2: 1.1 EN 13480-2: 1.2
P420NH	1.8932	EN 10222-4	1.3
P460NH	1.8935	EN 10028-3	1.3
15NiCuMoNb5-6-4 (15NiCuMoNb5)	1.6368	EN 10216-2 EN 10028-2 Vd.TÜV Wbl. 377/1 Vd.TÜV Wbl. 377/2 Vd.TÜV Wbl. 377/3	EN 12952-2: 4.2 EN 13480-2: 3.1
13CrMo4-5	1.7335	EN 10216-2 EN 10028-2 EN 10273 EN 10222-2	5.1
10CrMo9-10	1.7380	EN 10216-2 EN 10028-2 EN 10273	5.2
11CrMo9-10	1.7383	EN 10222-2	5.2
7CrMoVTiB 10-10	1.7378	EN 10216-2	6.2
X10CrMoVNb9-1	1.4903	EN 10216-2 EN 10028-2 EN 10222-2 Vd.TÜV Wbl. 511/2 Vd.TÜV Wbl. 511/3	6.4
X20CrMoV11-1	1.4922	EN 10216-2	6.4
X2CrNi18-9	1.4306	EN 10217-7, EN 10216-5	8.1
X2CrNi19-11	1.4307	EN 10217-7, EN 10216-5	8.1
X2CrNiMo17-12-2	1.4404	EN 10217-7, EN 10216-5	8.1
X5CrNiMo 17-12-2	1.4401	EN 10217-7, EN 10216-5	8.1
X3CrNiMo17-13-3	1.4436	EN 10217-7, EN 10216-5	8.1
X7CrNiNb18-10	1.4912	EN 10216-5	8.1
X8CrNi19-11	1.4908	Vd.TÜV Wbl 547	8.1

Material Designation	Material No.	Material standard	Material group
TP310HCbN	-	SA-213	8.2
X6CrNiNbN25-20	1.4952	Vd.TÜV Wbl 546	8.2
X2CrNiMoN 22-5-3	1.4462	EN 10217-7, EN 10216-5	10.1
X2CrNiN 23-4	1.4362	EN 10217-7, EN 10216-5	10.1
X2CrNiMoN25-7-4	1.4410	EN 10217-7, EN 10216-5	10.2

Grouping of most typical composite and overlay welded tube cladding materials:

Material Designation	Material group
304L	8.1
309L	8.2
Sanicro 28, Alloy 28	8.2
Sanicro 67	43
Alloy 625	43
Sanicro 38, Alloy 825	45



IS - Inspection Specification

16.02 IS Boiler, CFB rebuilt x 2 rev0

Issue Status:

Project Name: SKo Energo 2 x CFB rebuild

Project Key:

Project Number: ERC21-00349

Document ID: MF00751665

Customer Document ID:

Revision: 0

Rev
0

Rev note

Created by
Paakkunainen Mika

Checked by

Approved by

Date

Contents

1. Scope	2
2. Stipulations and standards to be followed	2
3. Non-destructive testing of welds	2
3.1 Method standards and acceptance criteria	2
3.2 Qualification of NDT personnel	3
3.3 Type and extent of non-destructive testing	3
3.4 General notes	4
3.4.1 Extend of NDT	4
3.4.2 Visual inspection	4
3.4.3 Testing on random basis	4
3.4.4 Testing before or after PWHT	4
3.4.5 Load carrying welds	4
3.4.6 Discontinuities in CFB furnace walls	4
3.4.7 Overlay welding of single tubes and raw panels	4
3.4.8 Connecting weld of pipeline and header	4
3.4.9 Requirements for non-pressure part welds in tube walls	5
3.4.10 Hydrostatic pressure test	5
3.4.11 Abbreviations	5
Appendix 1: Material groups	12

1. Scope

This inspection specification is applied for pressure bearing parts in Circulating Fluidized Bed (CFB) boiler assembly.

The minimum extend of a boiler assembly is as described in PED guideline C-04 and in EN 12952-1 chapter 1.2. Boiler assembly shall comprise all pressure parts from the feed water inlet (including the inlet valve) up to the main steam outlet (including the outlet valve) as well as all the necessary parts for drainage, blow down, vent and other minor boiler piping up to the first or second close valves.

More detailed extent of the boiler assembly is be described in the project specific PI-diagrams.

The non-destructive tests for boiler external piping are given in a separate Inspection Specification for piping.

2. Stipulations and standards to be followed

The Pressure Equipment Directive 2014/68/EU (later PED) and national implementing legislation in the country of destination shall be followed for pressurized components included in new boiler assemblies.

The water tube boiler standard EN 12952-6:2021 "Water-tube boilers and auxiliary installations" shall be followed in inspections boiler parts.

Also the requirements set in this inspection specification shall be followed.

3. Non-destructive testing of welds

3.1 Method standards and acceptance criteria

Method standards and acceptance criteria for non-destructive testing of the boiler assembly shall be in accordance with the standard EN 12952-6:2021. Method standards and acceptance criteria are given in Table 1.

Table 1

NDT method	Method standard	Acceptance criteria
RT	EN ISO 17636-1:2013 EN ISO 17636-2:2013 Testing level B	Table 6 in standard EN 12952-6:2021
UT	EN ISO 17640:2018 and item 7.4.2.1 in standard EN 12952-6	EN ISO 11666:2018, acceptance level 2
PAUT *)	EN ISO 13588:2019 (>6mm) EN ISO 20601:2019 (3.2-8mm)	EN ISO 19285:2017, acceptance level 2 EN ISO 4761:2022, acceptance level 1
MT	EN ISO 17638:2016	EN ISO 23278:2015, acceptance level 2X
PT	EN ISO 3452-1:2021	EN ISO 23277:2015, acceptance level 2X
VT	EN ISO 17637:2016	Table 5 in standard EN 12952-6:2021 Table C.1 in annex C of standard EN 12952-5:2021

*) The use of Phased array UT (PAUT) is accepted only with approval from Valmet. A separate written procedure and demonstration with preparation and inspection of a test piece is required.

3.2 Qualification of NDT personnel

The personnel performing non-destructive testing (MT, PT, UT) and the personnel evaluating the radiographs shall be qualified to level 2 of the EN ISO 9712:2012.

The personnel performing radiographic testing shall be qualified to level 1 of the EN ISO 9712 and the testing shall be performed under the direct supervision of personnel qualified as a minimum to level 2 of the EN ISO 9712, who shall also be responsible for the evaluation of the films.

Visual testing shall be carried out by experienced personnel having sufficient knowledge in welding techniques and a full comprehension of the standard EN 12952.

The NDT personnel performing the testing of the boiler assembly shall be approved by a third party organization recognized by a Member State, as required in item 3 in annex 1 of the PED.

3.3 Type and extent of non-destructive testing

The type and extent of non-destructive testing for tubes, headers and drum of the boiler are given in the Table 3.

The testing methods and the extent of testing for manufacturing and installations of tubes, headers and drums are based on the standard EN 12952-6:2021 and Valmet proven practice.

Material groups are given in **appendix 1** of this specification.

3.4 General notes

3.4.1 Extend of NDT

For all components, the extent in percent (%) in table 3 is calculated from the number of welded joints. For the selected joints, the entire length of the joints shall be tested unless otherwise agreed.

3.4.2 Visual inspection

All welds shall be 100% visually tested even though other type of NDT is specified.

3.4.3 Testing on random basis

When the extend of testing is less than 100%, the selected welds for testing shall include a sample of each welder and welding operator's work for each welding procedure specification on the component concerned. The testing shall be spread over whole duration of the work and include first weld of each welder.

3.4.4 Testing before or after PWHT

Generally all non-destructive testing shall be performed after post-weld heat treatment.

Non-destructive testing can be performed before post-weld heat treatment when following conditions applies:

- Material belongs to the material group 1.1 or 1.2; or
- The weld to be tested is circumferential butt weld in tube and the material belongs to the material group 5.1 or 5.2 and $d_0 \leq 114,3$ mm and tube nominal thickness $e \leq 7,1$ mm or the testing is required by Valmet (B) or customer (C)

3.4.5 Load carrying welds

Load carrying attachment welds (see Table 3) are marked with letters "LC" to weld markings of drawings by the designer.

3.4.6 Discontinuities in CFB furnace walls

Abrupt discontinuities are not allowed at the entire non-refractory areas of the furnace walls and roof. Discontinuities of the welds shall be ground smooth at these areas (slope max. 1:5).

3.4.7 Overlay welding of single tubes and raw panels

Mechanized overlay welding and inspections of single tubes and raw panels shall be made according to Valmet specifications.

3.4.8 Connecting weld of pipeline and header

First butt weld between outlet header and connecting pipeline shall be treated and inspected as internal piping weld as shown in point 5 of table 3.

3.4.9 Requirements for non-pressure part welds in tube walls

Non-pressure part welds are considered to be fin to fin welds in furnace walls which make furnace gas tight.

Table 2

	Weld area	Weld penetration requirements	Type and extend of NDT	Acceptance criteria
1	Longitudinal fin to fin butt welds in tube walls	Partial penetration welds with min. 70% penetration welded from single or both sides	VT A100% PT A10% see Note 1	EN 12952-6 table 5
2	Transversal fin to fin butt welds in tube walls and Window pieces	Full penetration welds, with the exceptions as stated in Note 3	VT A100% RT A5% PT A10% see Note 2	EN 12952-6 table 5 and 6
3	Other non-pressure part welds in boiler assembly	Acc. to drawings	VT B100%	EN ISO 5817 weld class C

Note 1: PT inspection is done for longitudinal fin to fin site assembly welds from inside of the furnace in case fin material is other than material group 1 or 5

Note 2: PT inspection is done for transversal fin to fin welds in panels from inside of the furnace in case fin material is other than material group 1 or 5. In case of window pieces, Inspection can be done for finished window piece.

Note 3: Transversal Fin to fin butt welds shall be full penetration welds with the exception that transversal fin to fin butt welds in "window pieces" can have maximum 2mm unpenetrated weld in both butt weld end corner points. Middle part of the fin to fin transversal weld shall be fully penetrated to ensure adequate and uniform heat transfer between the fin ends in the membrane structure. RT inspection for butt weld shall be done before welding the fillet welds.

3.4.10 Hydrostatic pressure test

The hydrostatic pressure test for new boiler assembly shall be carried out after installation according to the PED 2014/68/EU and EN 12952. A separate instruction for hydrostatic pressure test shall be prepared.

3.4.11 Abbreviations

Following abbreviations are used in this specification:

Testing requirements:

A = Requirement of the EN 12952-6

B = Requirement of Valmet

C = Requirement of the customer

NDT methods:

RT = Radiographic Testing

UT = Ultrasonic Testing

MT = Magnetic Particle Testing

PT = Liquid Penetrant Testing

VT = Visual Testing

Other abbreviations:

e = material weld joint thickness

e_b = wall thickness of the pressure connection or branch joint

e_s or e_h = thickness of the end plate weld joint. End plate types are given in Figure 10.3-1 of the 12952-3

d_0 = outside diameter of the tube

DN = nominal size of the tube or pipe

Weld types (Valmet internal abbreviations):

BW = Butt Weld

TBW = T-Butt Joint

BCWO = Branch Connection Weld Set On

BCWI = Branch Connection Weld Set In

FW = Fillet Weld

Table 3

	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING						
1.	DRUM	RT	UT	RT/ UT	MT 5)	PT	MT/ PT	NOTES
a)	Longitudinal butt welds (BW)		A100		A100			
b)	Circumferential butt welds (BW)		A100		A100			
c)	Pressure connection welds, d ₀ ≥ 142 mm (BCWO, BCWI) • e _b > 25 mm • 15 mm < e _b ≤ 25 mm • e _b ≤ 15 mm		A100 A10		A100 A100 A10			
d)	Pressure connection welds, d ₀ < 142 mm (BCWO, BCWI) • e _b > 25 mm • 15 mm < e _b ≤ 25 mm • e _b ≤ 15 mm				A100 A100 A10			
e)	Attachments welds (TBW, FW) • Load carrying • Non load carrying		B100				A100 A10	2)
f)	Other accessories • Inspection of straightness of cyclone flanges							3)

	ITEM OR SUBJECT		TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING					
2.	FURNACE, CYCLONE, BACK PASS AND LOOP SEAL	RT	UT	RT /UT	MT 5)	PT	MT/ PT	NOTES
2.1	Distribution and collection headers and headers of downcomers							4)
a)	Circumferential butt welds and Flat end welds EN12952-3 types a,b,e (BW) Material group 1: • e > 25 mm • 15 mm ≤ e ≤ 25 mm • e < 15 mm Material group 4: • e > 25 mm • 15 mm < e ≤ 25 mm • e < 15 mm	A100 A100	A100 A100 A100 A100		A100 A10 A10 A100 A100 A100			6) 1)
b)	Pressure connection welds, d ₀ ≥ 142 mm (BCWO, BCWI) Material group 1: • e _b > 25 mm • 15 mm < e _b ≤ 25 mm • e _b ≤ 15 mm Material group 3: • e _b > 25 mm • 15 mm < e _b ≤ 25 mm		A100 A100	A10 A10			A100 A10 A10 A100 A100	

	<ul style="list-style-type: none"> $e_b \leq 15 \text{ mm}$ Material group 4: <ul style="list-style-type: none"> $e_b > 25 \text{ mm}$ $15 \text{ mm} < e_b \leq 25 \text{ mm}$ $e_b \leq 15 \text{ mm}$ 		A100	A10			A10 A100 A100 A10	
c)	Pressure connection welds, $d_0 < 142 \text{ mm}$ (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25 \text{ mm}$ $15 \text{ mm} < e_b \leq 25 \text{ mm}$ $e_b \leq 15 \text{ mm}$ Material groups 3 and 4: <ul style="list-style-type: none"> $e_b > 25 \text{ mm}$ $15 \text{ mm} < e_b \leq 25 \text{ mm}$ $e_b \leq 15 \text{ mm}$ 						A10 A10 A10 A100 A100 A10	
d)	Flat end welds, EN12952-3 types c,d,f,g (TBW, BW) <ul style="list-style-type: none"> $d_0 > 70 \text{ mm}$ and e_s or $e_h \geq 8 \text{ mm}$ $d_0 \leq 70 \text{ mm}$ or e_s or $e_h < 8 \text{ mm}$ 		A100		A100 A100			
e)	Attachments welds (TBW, FW) <ul style="list-style-type: none"> Load carrying Non load carrying 		B10				A100 A10	7) 2)
2.2	Tube walls of furnace, cyclone, back pass and loopseal							
a)	Circumferential butt welds (BW) Material group 1: <ul style="list-style-type: none"> $e / d_0 < 0,12$ $e / d_0 \geq 0,12$ 	A20 A30						1) 9) 10) 11) 14)
b)	Pressure connection welds and tube to header welds $e_b < 15 \text{ mm}$ (BCWO, BCWI)						A10	
c)	Fin to tube welds (FW)							8)
d)	Transversal fin to fin welds (BW)							See table 2
e)	Longitudinal fin to fin welds (BW)							See table 2
g)	Attachments welds (TBW, FW) <ul style="list-style-type: none"> Load carrying Non load carrying $d_0 \leq 76,1$ Non load carrying $d_0 > 76,1$ 						A100 A10 B10	7)

	ITEM OR SUBJECT		TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING					
3.	ECONOMIZER AND BOILER BANK	RT	UT	RT/ UT	MT 5)	PT	MT/ PT	NOTES
3.1	Distribution and collection headers							4) 1)
a)	Circumferential butt welds (BW) Material group 1: <ul style="list-style-type: none"> $e > 25 \text{ mm}$ $15 \text{ mm} \leq e \leq 25 \text{ mm}$ 		A100 A100		A100 A10			
	<ul style="list-style-type: none"> $e < 15 \text{ mm}$ 	A100			A10			
b)	Pressure connection welds, $d_0 \geq 142 \text{ mm}$ (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25 \text{ mm}$ $15 \text{ mm} < e_b \leq 25 \text{ mm}$ $e_b \leq 15 \text{ mm}$ 		A100	A10			A100 A10 A10	
c)	Pressure connection welds, $d_0 < 142 \text{ mm}$ (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25 \text{ mm}$ $15 \text{ mm} < e_b \leq 25 \text{ mm}$ $e_b \leq 15 \text{ mm}$ 						A10 A10 A10	
d)	Flat end welds, EN12952-3 types c,d,f,g (TBW, BW)							

	<ul style="list-style-type: none"> $d_0 > 70$ mm and e_s or $e_h > 8$ mm $d_0 \leq 70$ mm or e_s or $e_h \leq 8$ mm 		A100		A100 A100			
e)	Attachments welds (TBW, FW) <ul style="list-style-type: none"> Load carrying Non load carrying 		B10				A100 A10	7) 2)
3.2	Economizer and boiler bank tubes							
a)	Circumferential butt welds (BW)	A10			A10			1) 9) 10) 11) 14)
b)	Tube to header welds (BCWO, BCWI)						A10	
g)	Attachments welds (TBW, FW) <ul style="list-style-type: none"> Load carrying Non load carrying $d_0 \leq 76,1$ Non load carrying $d_0 > 76,1$ 						A100 A10 B10	
d)	Fin to tube welds in finned tube economizer							15)

	ITEM OR SUBJECT		TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING					
4.	SUPERHEATERS	RT	UT	RT/ UT	MT 5)	PT	MT/P T	NOTES
4.1	Distribution and collection headers and spray attemperators							4)
a)	Circumferential butt welds Flat end welds, EN12952-3 types a,b,e (BW) Material group 1: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} \leq e \leq 25$ mm $e < 15$ mm Other material groups: <ul style="list-style-type: none"> $e > 25$ mm $15 \text{ mm} < e \leq 25$ mm $e < 15$ mm 	A100 A100	A100 A100 A100 A100		A100 A10 A10 A100 A100 A100			6) 1)
b)	Pressure connection welds, $d_0 \geq 142$ mm (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm Other material groups: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm 		A100 A100	A10 A10			A100 A10 A10 A100 A100 A10	
c)	Pressure connection welds, $d_0 < 142$ mm (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25$ mm $15 \text{ mm} < e_b \leq 25$ mm $e_b \leq 15$ mm Other material groups: <ul style="list-style-type: none"> $e_b \geq 25$ mm $15 \text{ mm} \leq e_b < 25$ mm $e_b \leq 15$ mm 						A100 A10 A10 A100 A100 A10	
d)	Flat end welds, EN12952-3 types c,d,f,g (TBW, BW) <ul style="list-style-type: none"> $d_0 > 70$ mm and e_s or $e_h \geq 8$ mm $d_0 \leq 70$ mm or e_s or $e_h < 8$ mm 		A100		A100 A100			
f)	Attachment welds (TBW, FW) <ul style="list-style-type: none"> Load carrying Non load carrying 		B10				A100 A10	2)
4.2	Superheater tubes							
a)	Circumferential butt welds (BW) Material groups 1 and 5	A10			A10			1) 9) 10) 11) 14)

	Material group 6, 8.1 and 8.2 Dissimilar welds between material groups 5.1, 5.2, 6.2 and 8.1, 8.2 Dissimilar welds between material groups 6.4 and 8	A25				A25		
	• manually welded	A25				A25		
	• machine welded	A100					A100	
		A10					A10	
b)	Fin to tube welds							8)
c)	Attachment welds (TBW, FW)							12)
	• Load carrying						A100	
	• Non load carrying $d_0 \leq 76,1$						A10	
	• Non load carrying $d_0 > 76,1$						B10	

ITEM OR SUBJECT		TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING						
5.	INTERNAL PIPING (pipes inside the boiler assembly)	RT	UT	RT/UT	MT 5)	PT	MT/PT	NOTES
a)	Headers of downcomers in accordance with item 2.1							
b)	Circumferential butt welds, $d_0 \geq 142$ mm (BW) Material group 1: • $e > 25$ mm • $15 \text{ mm} \leq e \leq 25 \text{ mm}$ • $e < 15$ mm Material groups 2, 3, 4 and 5: • $e > 25$ mm • $15 \text{ mm} \leq e \leq 25 \text{ mm}$ • $e < 15$ mm Material group 6: • $e > 25$ mm • $15 \text{ mm} \leq e \leq 25 \text{ mm}$ • $e < 15$ mm	A10	A100 A10		A100 A100 A100			1)
		A100	A100 A100		A100 A100 A100			
		A100	A100 A100		A100 A100 A100			
c)	Circumferential butt welds, $76.1 < d_0 \leq 142$ mm (BW) Material group 1: • $e > 25$ mm • $15 \text{ mm} \leq e \leq 25 \text{ mm}$ • $e < 15$ mm Material groups 2, 3, 4 and 5: • $e > 25$ mm • $15 \text{ mm} \leq e \leq 25 \text{ mm}$ • $e < 15$ mm Material group 6: • $e > 25$ mm • $15 \text{ mm} \leq e \leq 25 \text{ mm}$ • $e < 15$ mm	A10	A10 A10		A100 A10 A10			1)
		A10	A100 A10		A100 A10 A10			
		A25	A100 A25		A100 A25 A25			
d)	Circumferential butt welds, $d_0 \leq 76.1$ mm (BW) Material group 1: • $15 \text{ mm} \leq e \leq 25 \text{ mm}$ • $e < 15$ mm Material groups 2, 3, 4 and 5: • $15 \text{ mm} \leq e \leq 25 \text{ mm}$ • $e < 15$ mm Material group 6 and 8: • $15 \text{ mm} \leq e \leq 25 \text{ mm}$ • $e < 15$ mm	A10	A10		A10 A10			1)
		A10	A10		A10 A10			
		A25	A25		A25 A25			
e)	Pressure connection welds, $d_0 > 142$ mm (BCWO, BCWI) Material group 1: • $e_b > 25$ mm • $15 \text{ mm} < e_b \leq 25 \text{ mm}$ • $e_b \leq 15$ mm Material group 2, 3, 4 and 5:			A100 A10			A100 A10 A10	13)

	<ul style="list-style-type: none"> $e_b > 25 \text{ mm}$ $15 \text{ mm} \leq e_b \leq 25 \text{ mm}$ $e_b \leq 15 \text{ mm}$ Material group 6 <ul style="list-style-type: none"> $e_b > 25 \text{ mm}$ $15 \text{ mm} \leq e_b \leq 25 \text{ mm}$ $e_b \leq 15 \text{ mm}$ 			A100 A10			A100 A100 A10	
	<ul style="list-style-type: none"> $e_b > 25 \text{ mm}$ $15 \text{ mm} \leq e_b \leq 25 \text{ mm}$ $e_b \leq 15 \text{ mm}$ 			A100 A25 A25			A100 A10 A10	
f)	Pressure connection welds, $d_0 \leq 142 \text{ mm}$ (BCWO, BCWI) Material group 1: <ul style="list-style-type: none"> $e_b > 25 \text{ mm}$ $15 \text{ mm} < e_b \leq 25 \text{ mm}$ $e_b \leq 15 \text{ mm}$ Material group 2, 3, 4 and 5: <ul style="list-style-type: none"> $e_b > 25 \text{ mm}$ $15 \text{ mm} \leq e_b \leq 25 \text{ mm}$ $e_b \leq 15 \text{ mm}$ Material group 6 <ul style="list-style-type: none"> $e_b > 25 \text{ mm}$ $15 \text{ mm} \leq e_b \leq 25 \text{ mm}$ $e_b \leq 15 \text{ mm}$ 						A100 A10 A10 A100 A100 A10 A100 A10 A10	
g)	Attachments welds (TBW, FW)							
	<ul style="list-style-type: none"> Load Carrying Non load carrying $d_0 \leq 76,1$ Non load carrying $d_0 > 76,1$ 		B10				A100 B10 A10	2)

- 1) UT inspection instead of RT can be used for material weld thicknesses $8 \text{ mm} \leq e < 15 \text{ mm}$ and PAUT inspection for material weld thicknesses $3.2 \text{ mm} \leq e < 15 \text{ mm}$ in accordance with separately accepted procedure. For PAUT inspection a demonstration with preparation and inspection of a test piece is required.
- 2) UT inspection is applied only to load carrying full penetrated welds in hanger lugs
- 3) Tightness of the drum cyclone flange connection shall be assured by machining the sealing surfaces between cyclone flange and attachment plate flange. In addition, pairs shall be fitted together and the cyclone/attachment plate pairs shall be numbered. If the cyclone attachment plates have been heat treated with the drum, the flatness of the attachment plate shall be verified after heat treatment. The upper and lower surfaces of the cyclone and attachment plate flanges shall make a tight contact and the maximum deviation from the flatness on the longitudinal edge of the attachment plate is $< 0.15 \text{ mm}$. After mounting the cyclones, the gap between the sealing surfaces of attachment plate flange and cyclone flange shall be checked and the gap shall be $< 0.2 \text{ mm}$ on the upper edge of the flange and $< 0.3 \text{ mm}$ on the other edges.
- 4) If holes or openings are machined over or near the circumferential butt welds of the headers (distance $< 50 \text{ mm}$), the butt welds shall be locally (minimum the distance of the diameter) grinded and inspected by using non-destructive testing (PT or MT).
- 5) PT testing instead of MT is acceptable in the case of test restrictions and for steel group 8 or when using nickel-based or austenitic welding filler metals.
- 6) For EN 12952-3 type e) flat ends additional UT inspection of the flat end edge area is required to ensure that no lamellar tearing occurs.
- 7) When refractory anchors are welded manually to pressure carrying parts, VT A100% + PT A100% inspection shall be done. When anchors, studs or attaching pins are welded to non-pressure carrying parts (e.g. fins), visual testing VT B100 % shall be performed. Surface quality of the weld shall fulfil the requirements of the EN 5817 class C. When refractory anchors or studs are welded by arc-stud welding, EN ISO 14555 with comprehensive quality requirements of 3834-2 shall be followed.
- 8) The requirements of the standard EN 12952-5, annex C shall be followed for fin to tube welding. Production test shall be done for mechanized fin to tube welds at the workshop. VT A100% inspection shall be done for mechanized and manual fin to tube welds and manually welded "window pieces" in panels.
- 9) Production weld test shall be done for butt welds in overlay welded tubes and panels in accordance with separate procedure. The penetration of the cladding weld into base material shall be examined.
- 10) In case RT inspection for tube butt weld is required, it shall be done before overlay welding except when overlay weld is calculated as a part of pressure bearing part of tube butt weld, RT inspection shall be done after overlay welding.

- 11) PT B10% is required for overlay welded tube and panel butt welds if RT is done before applying overlay welding
- 12) Studs for superheater ties shall be tested with the same method and extent than given for non-load-carrying attachment welds. Welding of superheater ties shall be done in accordance with the Valmet procedure FS3-020. In case nickel based filler metal is used, 10 first welds shall be PT-inspected
- 13) If ultrasonic examination is not possible, radiographic testing is permitted instead.
- 14) For circumferential welds at boiler tubes with $d_o < 76,1$ mm tested by using elliptical radiographic technique it is sufficient to have 1 partial image per weld, provided that the other requirements of EN ISO 17636-1:2013 are met. The elliptical technique in accordance with EN ISO 17636-1 Figure 11 should not be used when external diameter $D_e > 100$ mm or wall thickness $t > 8$ mm or weld width $> D_e/4$. Exceptions to this are tube wall, load carrying tube and superheater tube butt welds at installation site for which RT with elliptical images can be accepted independent of the tube wall thickness and weld width in case suitability of technique is demonstrated.
- 15) Production test for fin to tube weld in finned tube economizer shall be done according to manufacturer's specification

Appendix 1: Material groups

Grouping of most typical boiler and piping materials in accordance with standards CEN ISO/TR 15608, ISO/TR 20172, ISO/TR 20173, EN 12952-2 and EN 13480-2

Material Designation	Material No.	Material standard	Material group
P235GH	1.0345	EN 10216-2 EN 10028-2	1.1
P265GH	1.0425	EN 10216-2 EN 10028-2 EN 10273	1.1 1.1 1.1
P245GH	1.0352	EN 10222-2	1.1
P280GH	1.0426	EN 10222-2	1.2
16Mo3	1.5415	EN 10216-2 EN 10028-2 EN 10273 EN 10222-2	EN 12952-2: 1.1 EN 13480-2: 1.2
P420NH	1.8932	EN 10222-4	1.3
P460NH	1.8935	EN 10028-3	1.3
15NiCuMoNb5-6-4 (15NiCuMoNb5)	1.6368	EN 10216-2 EN 10028-2 Vd.TÜV Wbl. 377/1 Vd.TÜV Wbl. 377/2 Vd.TÜV Wbl. 377/3	EN 12952-2: 4.2 EN 13480-2: 3.1
13CrMo4-5	1.7335	EN 10216-2 EN 10028-2 EN 10273 EN 10222-2	5.1
10CrMo9-10	1.7380	EN 10216-2 EN 10028-2 EN 10273	5.2
11CrMo9-10	1.7383	EN 10222-2	5.2
7CrMoVTiB 10-10	1.7378	EN 10216-2	6.2
X10CrMoVNb9-1	1.4903	EN 10216-2 EN 10028-2 EN 10222-2 Vd.TÜV Wbl. 511/2 Vd.TÜV Wbl. 511/3	6.4
X20CrMoV11-1	1.4922	EN 10216-2	6.4
X2CrNi18-9	1.4306	EN 10217-7, EN 10216-5	8.1
X2CrNi19-11	1.4307	EN 10217-7, EN 10216-5	8.1
X2CrNiMo17-12-2	1.4404	EN 10217-7, EN 10216-5	8.1
X5CrNiMo 17-12-2	1.4401	EN 10217-7, EN 10216-5	8.1
X3CrNiMo17-13-3	1.4436	EN 10217-7, EN 10216-5	8.1
X7CrNiNb18-10	1.4912	EN 10216-5	8.1
X8CrNi19-11	1.4908	Vd.TÜV Wbl 547	8.1
TP310HCbN	-	SA-213	8.2
X6CrNiNbN25-20	1.4952	Vd.TÜV Wbl 546	8.2
X2CrNiMoN 22-5-3	1.4462	EN 10217-7, EN 10216-5	10.1
X2CrNiN 23-4	1.4362	EN 10217-7, EN 10216-5	10.1
X2CrNiMoN25-7-4	1.4410	EN 10217-7, EN 10216-5	10.2



Grouping of most typical composite and overlay welded tube cladding materials:

Material Designation	Material group
304L	8.1
309L	8.2
Sanicro 28, Alloy 28	8.2
Sanicro 67	43
Alloy 625	43
Sanicro 38, Alloy 825	45



IS - Inspection Specification

16.03 IS Piping, new BFB rev0

Issue Status:

Project Name: SKO Energo BFB
Project Key:
Project Number: BFB21-00942
Document ID: MF00751661
Customer Document ID:
Revision: 0

Rev	Rev note	Created by	Checked by	Approved by	Date
0	minor changes	Paakkunainen Mika			



Table of Contents

1.	Stipulations and standards to be followed	2
2.	Non-destructive testing (NDT) of welds	2
2.1	Method standards and acceptance criteria	2
2.2	Qualification of NDT personnel	3
2.3	Type and extent of non-destructive testing	3
2.4	General notes	3
3.	Non-destructive testing of formed parts	9
4.	Notes for manufacturing piping	9
4.1	Bending and other forming	9
5.	Hydrostatic pressure test	Error! Bookmark not defined.
6.	Abbreviations and material groups	10

1. Stipulations and standards to be followed

This inspection specification covers the non-destructive testing of metallic industrial piping, e.g. process piping and boiler external piping.

The Pressure Equipment Directive 2014/68/EU (later called PED) and standard EN 13480 Metallic industrial piping, shall be followed in design, manufacturing, installation and inspections. Also requirements set in this inspection specification shall be followed.

The editions which are valid at the time of signing contract shall be followed if not otherwise agreed in contract.

For piping in accordance with PED Article 4, paragraph 3, EN 13480 piping category 0 will be applied with the following exceptions:

- Instead of proof test according to EN 13480 a leakage test shall be performed during assembly or commissioning
- NDT method and extent shall be according to this Inspection Specification (IS)
- For bolts, screws and nuts standard ISO 898 8.8 and 5.6 grades are used
- Piping with hazardous chemical content according to CLP Regulation 1272/2008 shall be manufactured minimum to EN 13480 piping category I.
- longitudinal welds of tubes can be located outside the neutral zone in case cold bending is used and piping has no hazardous chemical content

2. Non-destructive testing (NDT) of welds

2.1 Method standards and acceptance criteria

Method standards and acceptance criteria for non-destructive testing of external piping shall be in accordance with the Table 1.

Table 1

NDT method	Method standard	Acceptance criteria
VT	EN ISO 17637	EN ISO 5817 quality level C [B]
PT	EN ISO 3452-1	EN ISO 23277, acceptance level 2X
MT	EN ISO 17638	EN ISO 23278, acceptance level 2X
RT-F (film)	EN ISO 17636-1 level B	EN ISO 10675-1 level 2 [1]
RT-D, RT-CR, DDA (digital)	EN ISO 17636-2 level B	EN ISO 10675-1 level 2 [1]
UT (pulse echo)	EN ISO 17640, class A [B]	EN ISO 11666, acceptance level 3 [2]
UT -- TOFD	EN ISO 10863 level B [C]	EN ISO 15626 level 2 [1]
UT -- PAUT	EN ISO 13588 level A [B]	EN ISO 19285 level 3 [2]

Note: the level marked in square brackets [] shall be used where creep or fatigue is controlling factor in design

2.2 Qualification of NDT personnel

The personnel performing non-destructive testing (MT, PT, UT) and the personnel viewing the radiographs shall be qualified to level 2 of EN ISO 9712.

The personnel performing radiographic testing shall be qualified to level 1 of EN ISO 9712 and the testing shall be performed under the control of personnel qualified as a minimum to level 2 of EN ISO 9712, who shall also be responsible for the evaluation of the films.

Visual testing shall be carried out by experienced personnel having sufficient knowledge in welding techniques, and a full comprehension of standard EN 13480.

The requirements set in paragraph 3 in annex 1 of the PED shall be met. In addition, for piping in PED category III, the personnel must be approved by a third party organization.

2.3 Type and extent of non-destructive testing

The type and extent of non-destructive testing for piping in different pressure equipment categories are given in the Table 2.

The testing methods and the extent of testing for fabrication and installations of piping are based on the standard EN 13480, "Metallic industrial piping", Part 5, "Inspection and testing", and in addition to Valmet proven practice.

Pressure equipment category for different piping is given in a project-wise pipe line list (PED category). Categories are in accordance with the standard EN 13480-1, table 4.1-1.

The additional customer requirements are given in a separate attachment, if any.

The terms, abbreviations and material groups are given in paragraph 6 of this specification.

Table 2 also gives Valmet's requirement for testing of piping belonging to PED Article 4, paragraph 3.

Only visual testing VT 100% will be performed for piping which maximum allowable pressure (PS) is 0.5 bar or less.

See also paragraph 5, Proof test.

2.4 General notes

2.4.1.1

For all components, the extent in percent (%) is calculated from the number of welded joints distributed evenly among pre-manufactured welds and installation welds. For the selected joints, the entire length of the joints shall be tested.

2.4.1.2

Base material grouping given in Tables 2 and 4 is based on the standard CEN ISO/TR 15608, see Paragraph 6.

2.4.1.3

All welds shall be visually tested even though other type of NDT is specified.

2.4.1.4

If the result of non-destructive testing is rejected, the principle for the extension of the rate of that NDT shall be in accordance with the standard EN 13480-5, Paragraph 8.1.3.

2.4.1.5

When the extent of testing is less than 100%, the selected welds for testing shall include a sample of each welder's work for each welding procedure specification on the component concerned. The testing shall be spread over the whole duration of the work.

2.4.1.6

Non-destructive testing shall be done after forming and after post-weld heat treatment when the testing is required by the standard (A).

2.4.1.1

Final connecting welds in pipelines, which need to be done after pressure test ("golden welds") shall be inspected with 100%VT + 100%RT/UT + 100%MT/PT.

Table 2

	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING					
		RT	UT	RT or UT	MT	MT or PT	NOTES
1.	PED Article 4, paragraph 3 EN 13480 pipe category 0						1)
1.1	Material groups 1.1 and 1.2						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $e \geq 8\text{ mm}$	B2		B2			
b)	Branch welds (BCWO)						
c)	Socket/fillet welds (FW)						
1.2	Material group 3.1, 6.4						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $8\text{ mm} \leq e \leq 30\text{ mm}$ • $e > 30\text{ mm}$	B5		B5 B5			
b)	Branch welds (BCWO)			B5		B5	
c)	Socket/fillet welds (FW)					B5	
1.3	Material group 8.1						
a)	Circumferential welds (BW) • $e < 15\text{ mm}$ • $e \geq 15\text{ mm}$	B2		B2			
b)	Branch welds (BCWO)						
c)	Socket/fillet welds (FW)						
1.4	Material groups 5.1, 5.2 and 10.1						
a)	Circumferential welds (BW) • $e \leq 30\text{ mm}$ • $e > 30\text{ mm}$			B5 B5			
b)	Branch welds (BCWO)						
c)	Socket/fillet welds (FW)						

- 1) For piping where creep or fatigue is the controlling factor in design, the whole piping line shall be tested in accordance with standard EN 13480-5, table 8.2-1. NDT extent for pipelines in creep or fatigue range or when pneumatic pressure test is applied instead of hydro test, is also given in Table 2 in brackets (). In that case, the tests are given in the fabrication and assembly drawings.

	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING					
		RT	UT	RT or UT	MT	MT or PT	NOTES
2.	PED category I EN 13480 pipe category I						1)
2.1	Material groups 1.1 and 1.2						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $e \geq 8\text{ mm}$	A5 (A10)		A5 (A10)		(A5) (A5)	
b)	Branch welds (BCWO)					(A5)	
c)	Socket/fillet welds (FW)						
2.2	Material group 3.1, 6.4						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $8\text{ mm} \leq e \leq 30\text{ mm}$ • $e > 30\text{ mm}$	A25		A25 A25		A10 A10 A25	
b)	Branch welds (BCWO)			A25		A25	
c)	Socket/fillet welds (FW)					A25	
2.3	Material group 8.1						
a)	Circumferential welds (BW) • $e < 15\text{ mm}$ • $e \geq 15\text{ mm}$	A5 (A10)		A5 (A10)		(A5) (A5)	
b)	Branch welds (BCWO)					(A5)	
c)	Socket/fillet welds (FW)						
2.4	Material groups 5.1, 5.2 and 10.1						
a)	Circumferential welds (BW) • $e \leq 30\text{ mm}$ • $e > 30\text{ mm}$			A10 A10		A5 A10	
b)	Branch welds (BCWO)					A10 (A25)	
c)	Socket/fillet welds (FW)					A10	

	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING					
		RT	UT	RT or UT	MT	MT or PT	NOTES
3.	PED category II EN 13480 pipe category II						1) 2)
3.1	Material groups 1.1 and 1.2						
a)	Circumferential welds (BW) • $e < 8\text{mm}$ • $e \geq 8\text{ mm}$	A5 (A10)		A5 (A10)		(A5) (A5)	
b)	Branch welds (BCWO)					(A5)	
c)	Socket/fillet welds (FW)						
3.2	Material group 3.1, 6.4						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $8\text{ mm} \leq e \leq 30\text{mm}$ • $e > 30\text{ mm}$	A25		A25 A25		A25 A25	
b)	Branch welds (BCWO)			A25		A25	
c)	Socket/fillet welds (FW)					A25	
3.3	Material group 8.1						
a)	Circumferential welds (BW) • $e < 15\text{mm}$ • $e \geq 15\text{ mm}$	A5 (A10)		A5 (A10)		(A5) (A5)	
b)	Branch welds (BCWO)					(A5)	
c)	Socket/fillet welds (FW)						
3.4	Material groups 5.1, 5.2 and 10.1						
a)	Circumferential welds (BW) • $e \leq 30\text{ mm}$ • $e > 30\text{ mm}$			A10 A10		A5 A10	
b)	Branch welds (BCWO)					A10 (A25)	
c)	Socket/fillet welds (FW)					A10	

2) EN 13480 table 8.2-1 note d: Additional testing for transverse defects from weld surface (see EN ISO 17640:2010, testing level C) is done only for welds which $e > 30\text{ mm}$.

	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING					
		RT	UT	RT or UT	MT	MT or PT	NOTES
4.	PED category III EN 13480 pipe category III						1) 2)
4.1	Material groups 1.1 and 1.2						
a)	Circumferential welds (BW) • $e < 8\text{mm}$ • $e \geq 8\text{ mm}$	A10		A10		(A5) (A5)	
b)	Branch welds (BCWO) • all • nozzle DN > 100, $e_b > 15\text{mm}$			A10		A10 A10	
c)	Socket/fillet welds (FW)					A10	
4.2	Material group 3.1, 6.4						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $8\text{ mm} \leq e \leq 30\text{mm}$ • $e > 30\text{ mm}$	A25 (A100)		A25 (A100) A25 (A100)		A100 A100 A100	
b)	Branch welds (BCWO)			A100		A100	
c)	Socket/fillet welds (FW)					A100	
4.3	Material group 8.1						
a)	Circumferential welds (BW) • $e < 15\text{mm}$ • $e \geq 15\text{ mm}$	A10		A10		(A5) (A5)	
b)	Branch welds (BCWO) • all • nozzle DN > 100, $e_b > 15\text{mm}$			A10		A10 A10	
c)	Socket/fillet welds (FW)					A10	
4.4	Material groups 5.1, 5.2 and 10.1						
a)	Circumferential welds (BW) • $e \leq 30\text{ mm}$ • $e > 30\text{ mm}$			A10 (A25) A10 (A25)		A5 A10	
b)	Branch welds (BCWO) • all • nozzle DN > 100, $e_b > 15\text{ mm}$			A10		A10 (A25) A10 (A25)	
c)	Socket/fillet welds (FW)					A25	

3. Non-destructive testing of formed parts

Hot formed parts (bent tubes, hemispherical ends and reducers) shall be non-destructive tested as required in table 4 below and as specified in standard EN 13480 paragraph 7.2.4.

The method standards and acceptance criteria for testing are given in Table 1 of this specification.

Table 4

Formed part	Type and extent of testing of component forming area
<u>Hot formed reducers:</u> <ul style="list-style-type: none"> Material groups 1.1, 1.2, 3.1, 5.1, 5.2 Material group 6.4 	<ul style="list-style-type: none"> MT/PT B10%. MT/PT B100%
<u>Hot formed ends:</u> <ul style="list-style-type: none"> Material groups 1.1, 1.2, 3.1, 5.1, 5.2 Material group 6.4 	<ul style="list-style-type: none"> MT/PT B10%. MT/PT B100%
<u>Hot formed bends:</u> <ul style="list-style-type: none"> Material groups 1.1, 1.2, 5.1, 5.2 Material group 3.1, 6.4, 8.1, 10.1 	<ul style="list-style-type: none"> MT/PT B10%. MT/PT B100%

After forming the surface of base material shall comply with the requirements of the delivery conditions of the base metal. Cracks are not permitted at all.

For formed parts, the extent in percent (%) given in Table 4 is calculated from the number of tested parts.

Cold formed parts shall be tested as specified in standard EN 13480 paragraph 7.2.4.3.

For the selected parts, the entire formed area shall be tested.

Grouping of materials is given in Paragraph 6.

4. Notes for manufacturing piping

4.1 Bending and other forming

Bending and other forming of external piping shall fulfil the requirements of standard EN 13480-4, paragraph 7:

- Pipe shall be post weld heat treated after cold forming in accordance with the standard EN 13480-4, table 7.2.2-1.
- Pipe shall be post weld heat treated after hot forming in accordance with the standard EN 13480-4, paragraph 7.3.
- The tolerances for out-of-roundness of bends and the wrinkles at bends shall meet the requirements given in the standard EN 13480-4, paragraph 7.4.

5. Proof test

The proof test of piping shall be performed at site in accordance with the requirements of the standard EN 13480 with the exceptions as stated in paragraph 1 of this specification.

For piping which maximum allowable pressure (PS) is 0.5 bar or less no pressure test or tightness test is required.

6. Abbreviations and material groups

NDT methods:

RT = Radiographic Testing (methods as per Table 1)

UT = Ultrasonic Testing (methods as per Table 1)

MT = Magnetic Particle Testing

PT = Liquid Penetrant Testing

VT = Visual Testing

Testing requirements:

A = Requirement of EN 13480-5

B = Requirement of Valmet

C = Requirement of the Customer

Other abbreviations:

e = material joint thickness

DN = nominal size of the tube or pipe

PS = maximum allowable pressure

Weld types (Valmet internal abbreviations):

BW = Butt Weld

TBW = T-Butt Joint

BCWO = Branch Connection Weld Set On

FW = Fillet Weld

Material groups and standards

Grouping of most typical piping materials in accordance with standard
CEN ISO/TR 15608, EN 12952-2, EN 13480-2, ISO/TR 20172 and ISO/TR 20173.

Material Designation	Material No.	Material standard	Material group
P235GH	1.0345	EN 10216-2 EN 10028-2	1.1
P265GH	1.0425	EN 10216-2 EN 10028-2 EN 10273	1.1 1.1 1.1
P245GH	1.0352	EN 10222-2	1.1
P280GH	1.0426	EN 10222-2	1.2
16Mo3	1.5415	EN 10216-2 EN 10028-2 EN 10273 EN 10222-2	EN 12952-2: 1.1 EN 13480-2: 1.2
P420NH	1.8932	EN 10222-4	1.3
P460NH	1.8935	EN 10028-3	1.3
15NiCuMoNb5-6-4 (15NiCuMoNb5)	1.6368	EN 10216-2 EN 10028-2 Vd.TÜV Wbl. 377/1 Vd.TÜV Wbl. 377/2 Vd.TÜV Wbl. 377/3	EN 12952-2: 4.2 EN 13480-2: 3.1
13CrMo4-5	1.7335	EN 10216-2 EN 10028-2 EN 10273 EN 10222-2	5.1
10CrMo9-10	1.7380	EN 10216-2 EN 10028-2 EN 10273	5.2
11CrMo9-10	1.7383	EN 10222-2	5.2
7CrMoVTiB 10-10	1.7378	EN 10216-2	6.2
X10CrMoVNb9-1	1.4903	EN 10216-2 EN 10028-2 EN 10222-2 Vd.TÜV Wbl. 511/2 Vd.TÜV Wbl. 511/3	6.4
X20CrMoV11-1	1.4922	EN 10216-2	6.4
X2CrNi18-9	1.4306	EN 10217-7, EN 10216-5	8.1
X2CrNi19-11	1.4307	EN 10217-7, EN 10216-5	8.1
X2CrNiMo17-12-2	1.4404	EN 10217-7, EN 10216-5	8.1
X5CrNiMo 17-12-2	1.4401	EN 10217-7, EN 10216-5	8.1
X3CrNiMo17-13-3	1.4436	EN 10217-7, EN 10216-5	8.1
X7CrNiNb18-10	1.4912	EN 10216-5	8.1
X8CrNi19-11	1.4908	Vd.TÜV Wbl 547	8.1
TP310HCbN	-	SA-213	8.2
X6CrNiNbN25-20	1.4952	Vd.TÜV Wbl 546	8.2
X2CrNiMoN 22-5-3	1.4462	EN 10217-7, EN 10216-5	10.1
X2CrNiN 23-4	1.4362	EN 10217-7, EN 10216-5	10.1
X2CrNiMoN25-7-4	1.4410	EN 10217-7, EN 10216-5	10.2



IS - Inspection Specification

16.03 IS Piping, CFB rebuilt x 2 rev0

Issue Status:

Project Name: SKo Energo 2 x CFB rebuild
Project Key:
Project Number: ERC21-00349
Document ID: MF00751663
Customer Document ID:
Revision: 0

Rev
0

Rev note

Created by
Paakkunainen Mika

Checked by

Approved by

Date



Table of Contents

1. Stipulations and standards to be followed	2
2. Non-destructive testing (NDT) of welds	2
2.1 Method standards and acceptance criteria	2
2.2 Qualification of NDT personnel	3
2.3 Type and extent of non-destructive testing	3
2.4 General notes	3
3. Non-destructive testing of formed parts	9
4. Notes for manufacturing piping	9
4.1 Bending and other forming	9
5. Hydrostatic pressure test	Error! Bookmark not defined.
6. Abbreviations and material groups	10

1. Stipulations and standards to be followed

This inspection specification covers the non-destructive testing of metallic industrial piping, e.g. process piping and boiler external piping.

The Pressure Equipment Directive 2014/68/EU (later called PED) and standard EN 13480 Metallic industrial piping, shall be followed in design, manufacturing, installation and inspections. Also requirements set in this inspection specification shall be followed.

The editions which are valid at the time of signing contract shall be followed if not otherwise agreed in contract.

For piping in accordance with PED Article 4, paragraph 3, EN 13480 piping category 0 will be applied with the following exceptions:

- Instead of proof test according to EN 13480 a leakage test shall be performed during assembly or commissioning
- NDT method and extent shall be according to this Inspection Specification (IS)
- For bolts, screws and nuts standard ISO 898 8.8 and 5.6 grades are used
- Piping with hazardous chemical content according to CLP Regulation 1272/2008 shall be manufactured minimum to EN 13480 piping category I.
- longitudinal welds of tubes can be located outside the neutral zone in case cold bending is used and piping has no hazardous chemical content

2. Non-destructive testing (NDT) of welds

2.1 Method standards and acceptance criteria

Method standards and acceptance criteria for non-destructive testing of external piping shall be in accordance with the Table 1.

Table 1

NDT method	Method standard	Acceptance criteria
VT	EN ISO 17637	EN ISO 5817 quality level C [B]
PT	EN ISO 3452-1	EN ISO 23277, acceptance level 2X
MT	EN ISO 17638	EN ISO 23278, acceptance level 2X
RT-F (film)	EN ISO 17636-1 level B	EN ISO 10675-1 level 2 [1]
RT-D, RT-CR, DDA (digital)	EN ISO 17636-2 level B	EN ISO 10675-1 level 2 [1]
UT (pulse echo)	EN ISO 17640, class A [B]	EN ISO 11666, acceptance level 3 [2]
UT -- TOFD	EN ISO 10863 level B [C]	EN ISO 15626 level 2 [1]
UT -- PAUT	EN ISO 13588 level A [B]	EN ISO 19285 level 3 [2]

Note: the level marked in square brackets [] shall be used where creep or fatigue is controlling factor in design

2.2 Qualification of NDT personnel

The personnel performing non-destructive testing (MT, PT, UT) and the personnel viewing the radiographs shall be qualified to level 2 of EN ISO 9712.

The personnel performing radiographic testing shall be qualified to level 1 of EN ISO 9712 and the testing shall be performed under the control of personnel qualified as a minimum to level 2 of EN ISO 9712, who shall also be responsible for the evaluation of the films.

Visual testing shall be carried out by experienced personnel having sufficient knowledge in welding techniques, and a full comprehension of standard EN 13480.

The requirements set in paragraph 3 in annex 1 of the PED shall be met. In addition, for piping in PED category III, the personnel must be approved by a third party organization.

2.3 Type and extent of non-destructive testing

The type and extent of non-destructive testing for piping in different pressure equipment categories are given in the Table 2.

The testing methods and the extent of testing for fabrication and installations of piping are based on the standard EN 13480, "Metallic industrial piping", Part 5, "Inspection and testing", and in addition to Valmet proven practice.

Pressure equipment category for different piping is given in a project-wise pipe line list (PED category). Categories are in accordance with the standard EN 13480-1, table 4.1-1.

The additional customer requirements are given in a separate attachment, if any.

The terms, abbreviations and material groups are given in paragraph 6 of this specification.

Table 2 also gives Valmet's requirement for testing of piping belonging to PED Article 4, paragraph 3.

Only visual testing VT 100% will be performed for piping which maximum allowable pressure (PS) is 0.5 bar or less.

See also paragraph 5, Proof test.

2.4 General notes

2.4.1.1

For all components, the extent in percent (%) is calculated from the number of welded joints distributed evenly among pre-manufactured welds and installation welds. For the selected joints, the entire length of the joints shall be tested.

2.4.1.2

Base material grouping given in Tables 2 and 4 is based on the standard CEN ISO/TR 15608, see Paragraph 6.

2.4.1.3

All welds shall be visually tested even though other type of NDT is specified.

2.4.1.4

If the result of non-destructive testing is rejected, the principle for the extension of the rate of that NDT shall be in accordance with the standard EN 13480-5, Paragraph 8.1.3.

2.4.1.5

When the extent of testing is less than 100%, the selected welds for testing shall include a sample of each welder's work for each welding procedure specification on the component concerned. The testing shall be spread over the whole duration of the work.

2.4.1.6

Non-destructive testing shall be done after forming and after post-weld heat treatment when the testing is required by the standard (A).

2.4.1.1

Final connecting welds in pipelines, which need to be done after pressure test ("golden welds") shall be inspected with 100%VT + 100%RT/UT + 100%MT/PT.

Table 2

	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING					
		RT	UT	RT or UT	MT	MT or PT	NOTES
1.	PED Article 4, paragraph 3 EN 13480 pipe category 0						1)
1.1	Material groups 1.1 and 1.2						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $e \geq 8\text{ mm}$	B2		B2			
b)	Branch welds (BCWO)						
c)	Socket/fillet welds (FW)						
1.2	Material group 3.1, 6.4						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $8\text{ mm} \leq e \leq 30\text{ mm}$ • $e > 30\text{ mm}$	B5		B5 B5			
b)	Branch welds (BCWO)			B5		B5	
c)	Socket/fillet welds (FW)					B5	
1.3	Material group 8.1						
a)	Circumferential welds (BW) • $e < 15\text{ mm}$ • $e \geq 15\text{ mm}$	B2		B2			
b)	Branch welds (BCWO)						
c)	Socket/fillet welds (FW)						
1.4	Material groups 5.1, 5.2 and 10.1						
a)	Circumferential welds (BW) • $e \leq 30\text{ mm}$ • $e > 30\text{ mm}$			B5 B5			
b)	Branch welds (BCWO)						
c)	Socket/fillet welds (FW)						

- 1) For piping where creep or fatigue is the controlling factor in design, the whole piping line shall be tested in accordance with standard EN 13480-5, table 8.2-1. NDT extent for pipelines in creep or fatigue range or when pneumatic pressure test is applied instead of hydro test, is also given in Table 2 in brackets (). In that case, the tests are given in the fabrication and assembly drawings.

	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING					
		RT	UT	RT or UT	MT	MT or PT	NOTES
2.	PED category I EN 13480 pipe category I						1)
2.1	Material groups 1.1 and 1.2						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $e \geq 8\text{ mm}$	A5 (A10)		A5 (A10)		(A5) (A5)	
b)	Branch welds (BCWO)					(A5)	
c)	Socket/fillet welds (FW)						
2.2	Material group 3.1, 6.4						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $8\text{ mm} \leq e \leq 30\text{ mm}$ • $e > 30\text{ mm}$	A25		A25 A25		A10 A10 A25	
b)	Branch welds (BCWO)			A25		A25	
c)	Socket/fillet welds (FW)					A25	
2.3	Material group 8.1						
a)	Circumferential welds (BW) • $e < 15\text{ mm}$ • $e \geq 15\text{ mm}$	A5 (A10)		A5 (A10)		(A5) (A5)	
b)	Branch welds (BCWO)					(A5)	
c)	Socket/fillet welds (FW)						
2.4	Material groups 5.1, 5.2 and 10.1						
a)	Circumferential welds (BW) • $e \leq 30\text{ mm}$ • $e > 30\text{ mm}$			A10 A10		A5 A10	
b)	Branch welds (BCWO)					A10 (A25)	
c)	Socket/fillet welds (FW)					A10	

	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING					
		RT	UT	RT or UT	MT	MT or PT	NOTES
3.	PED category II EN 13480 pipe category II						1) 2)
3.1	Material groups 1.1 and 1.2						
a)	Circumferential welds (BW) • $e < 8\text{mm}$ • $e \geq 8\text{ mm}$	A5 (A10)		A5 (A10)		(A5) (A5)	
b)	Branch welds (BCWO)					(A5)	
c)	Socket/fillet welds (FW)						
3.2	Material group 3.1, 6.4						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $8\text{ mm} \leq e \leq 30\text{mm}$ • $e > 30\text{ mm}$	A25		A25 A25		A25 A25	
b)	Branch welds (BCWO)			A25		A25	
c)	Socket/fillet welds (FW)					A25	
3.3	Material group 8.1						
a)	Circumferential welds (BW) • $e < 15\text{mm}$ • $e \geq 15\text{ mm}$	A5 (A10)		A5 (A10)		(A5) (A5)	
b)	Branch welds (BCWO)					(A5)	
c)	Socket/fillet welds (FW)						
3.4	Material groups 5.1, 5.2 and 10.1						
a)	Circumferential welds (BW) • $e \leq 30\text{ mm}$ • $e > 30\text{ mm}$			A10 A10		A5 A10	
b)	Branch welds (BCWO)					A10 (A25)	
c)	Socket/fillet welds (FW)					A10	

2) EN 13480 table 8.2-1 note d: Additional testing for transverse defects from weld surface (see EN ISO 17640:2010, testing level C) is done only for welds which $e > 30\text{ mm}$.

	ITEM OR SUBJECT	TYPE AND EXTENT (%) OF NON-DESTRUCTIVE TESTING					
		RT	UT	RT or UT	MT	MT or PT	NOTES
4.	PED category III EN 13480 pipe category III						1) 2)
4.1	Material groups 1.1 and 1.2						
a)	Circumferential welds (BW) • $e < 8\text{mm}$ • $e \geq 8\text{ mm}$	A10		A10		(A5) (A5)	
b)	Branch welds (BCWO) • all • nozzle DN > 100, $e_b > 15\text{mm}$			A10		A10 A10	
c)	Socket/fillet welds (FW)					A10	
4.2	Material group 3.1, 6.4						
a)	Circumferential welds (BW) • $e < 8\text{ mm}$ • $8\text{ mm} \leq e \leq 30\text{mm}$ • $e > 30\text{ mm}$	A25 (A100)		A25 (A100) A25 (A100)		A100 A100 A100	
b)	Branch welds (BCWO)			A100		A100	
c)	Socket/fillet welds (FW)					A100	
4.3	Material group 8.1						
a)	Circumferential welds (BW) • $e < 15\text{mm}$ • $e \geq 15\text{ mm}$	A10		A10		(A5) (A5)	
b)	Branch welds (BCWO) • all • nozzle DN > 100, $e_b > 15\text{mm}$			A10		A10 A10	
c)	Socket/fillet welds (FW)					A10	
4.4	Material groups 5.1, 5.2 and 10.1						
a)	Circumferential welds (BW) • $e \leq 30\text{ mm}$ • $e > 30\text{ mm}$			A10 (A25) A10 (A25)		A5 A10	
b)	Branch welds (BCWO) • all • nozzle DN > 100, $e_b > 15\text{ mm}$			A10		A10 (A25) A10 (A25)	
c)	Socket/fillet welds (FW)					A25	

3. Non-destructive testing of formed parts

Hot formed parts (bent tubes, hemispherical ends and reducers) shall be non-destructive tested as required in table 4 below and as specified in standard EN 13480 paragraph 7.2.4.

The method standards and acceptance criteria for testing are given in Table 1 of this specification.

Table 4

Formed part	Type and extent of testing of component forming area
<u>Hot formed reducers:</u> <ul style="list-style-type: none"> Material groups 1.1, 1.2, 3.1, 5.1, 5.2 Material group 6.4 	<ul style="list-style-type: none"> MT/PT B10%. MT/PT B100%
<u>Hot formed ends:</u> <ul style="list-style-type: none"> Material groups 1.1, 1.2, 3.1, 5.1, 5.2 Material group 6.4 	<ul style="list-style-type: none"> MT/PT B10%. MT/PT B100%
<u>Hot formed bends:</u> <ul style="list-style-type: none"> Material groups 1.1, 1.2, 5.1, 5.2 Material group 3.1, 6.4, 8.1, 10.1 	<ul style="list-style-type: none"> MT/PT B10%. MT/PT B100%

After forming the surface of base material shall comply with the requirements of the delivery conditions of the base metal. Cracks are not permitted at all.

For formed parts, the extent in percent (%) given in Table 4 is calculated from the number of tested parts.

Cold formed parts shall be tested as specified in standard EN 13480 paragraph 7.2.4.3.

For the selected parts, the entire formed area shall be tested.

Grouping of materials is given in Paragraph 6.

4. Notes for manufacturing piping

4.1 Bending and other forming

Bending and other forming of external piping shall fulfil the requirements of standard EN 13480-4, paragraph 7:

- Pipe shall be post weld heat treated after cold forming in accordance with the standard EN 13480-4, table 7.2.2-1.
- Pipe shall be post weld heat treated after hot forming in accordance with the standard EN 13480-4, paragraph 7.3.
- The tolerances for out-of-roundness of bends and the wrinkles at bends shall meet the requirements given in the standard EN 13480-4, paragraph 7.4.

5. Proof test

The proof test of piping shall be performed at site in accordance with the requirements of the standard EN 13480 with the exceptions as stated in paragraph 1 of this specification.

For piping which maximum allowable pressure (PS) is 0.5 bar or less no pressure test or tightness test is required.

6. Abbreviations and material groups

NDT methods:

RT = Radiographic Testing (methods as per Table 1)

UT = Ultrasonic Testing (methods as per Table 1)

MT = Magnetic Particle Testing

PT = Liquid Penetrant Testing

VT = Visual Testing

Testing requirements:

A = Requirement of EN 13480-5

B = Requirement of Valmet

C = Requirement of the Customer

Other abbreviations:

e = material joint thickness

DN = nominal size of the tube or pipe

PS = maximum allowable pressure

Weld types (Valmet internal abbreviations):

BW = Butt Weld

TBW = T-Butt Joint

BCWO = Branch Connection Weld Set On

FW = Fillet Weld

Material groups and standards

Grouping of most typical piping materials in accordance with standard
CEN ISO/TR 15608, EN 12952-2, EN 13480-2, ISO/TR 20172 and ISO/TR 20173.

Material Designation	Material No.	Material standard	Material group
P235GH	1.0345	EN 10216-2 EN 10028-2	1.1
P265GH	1.0425	EN 10216-2 EN 10028-2 EN 10273	1.1 1.1 1.1
P245GH	1.0352	EN 10222-2	1.1
P280GH	1.0426	EN 10222-2	1.2
16Mo3	1.5415	EN 10216-2 EN 10028-2 EN 10273 EN 10222-2	EN 12952-2: 1.1 EN 13480-2: 1.2
P420NH	1.8932	EN 10222-4	1.3
P460NH	1.8935	EN 10028-3	1.3
15NiCuMoNb5-6-4 (15NiCuMoNb5)	1.6368	EN 10216-2 EN 10028-2 Vd.TÜV Wbl. 377/1 Vd.TÜV Wbl. 377/2 Vd.TÜV Wbl. 377/3	EN 12952-2: 4.2 EN 13480-2: 3.1
13CrMo4-5	1.7335	EN 10216-2 EN 10028-2 EN 10273 EN 10222-2	5.1
10CrMo9-10	1.7380	EN 10216-2 EN 10028-2 EN 10273	5.2
11CrMo9-10	1.7383	EN 10222-2	5.2
7CrMoVTiB 10-10	1.7378	EN 10216-2	6.2
X10CrMoVNb9-1	1.4903	EN 10216-2 EN 10028-2 EN 10222-2 Vd.TÜV Wbl. 511/2 Vd.TÜV Wbl. 511/3	6.4
X20CrMoV11-1	1.4922	EN 10216-2	6.4
X2CrNi18-9	1.4306	EN 10217-7, EN 10216-5	8.1
X2CrNi19-11	1.4307	EN 10217-7, EN 10216-5	8.1
X2CrNiMo17-12-2	1.4404	EN 10217-7, EN 10216-5	8.1
X5CrNiMo 17-12-2	1.4401	EN 10217-7, EN 10216-5	8.1
X3CrNiMo17-13-3	1.4436	EN 10217-7, EN 10216-5	8.1
X7CrNiNb18-10	1.4912	EN 10216-5	8.1
X8CrNi19-11	1.4908	Vd.TÜV Wbl 547	8.1
TP310HCbN	-	SA-213	8.2
X6CrNiNbN25-20	1.4952	Vd.TÜV Wbl 546	8.2
X2CrNiMoN 22-5-3	1.4462	EN 10217-7, EN 10216-5	10.1
X2CrNiN 23-4	1.4362	EN 10217-7, EN 10216-5	10.1
X2CrNiMoN25-7-4	1.4410	EN 10217-7, EN 10216-5	10.2

Table of Contents

1 TRAINING AND OPERATION AND MAINTENANCE MANUALS	2
1.1 Training program	2
1.1.1 Theoretical training	3
1.1.2 Maintenance training for chosen sub-suppliers' equipment	3
1.1.3 Practical Training at Client's Site	3
1.1.4 Specification of training courses	4
1.1.5 Assumptions for training planning	4
1.2 Operation and maintenance manuals	5
2 COMMISSIONING AND START-UP	5
2.1 Scope	5
2.2 Commissioning Team	6
2.3 General Descriptions of Commissioning Period	7
2.3.1 Cold commissioning	7
2.3.2 Hot commissioning	8
2.3.3 On-line tuning	11
2.3.4 Start-up	11
2.3.5 Trial run	12
2.3.6 Guarantee test A	12
2.3.7 Take Over	12

1 TRAINING AND OPERATION AND MAINTENANCE MANUALS

Valmet provides an extensive training program combined with training tools, which together with the participation in the check-out and start-up procedures will ensure the provisions for a successful operation of the Valmet BFB boiler and CFB rebuilds.



Figure 1 A training system that ensures efficient knowledge transfer.

The general objectives of the training courses are to:

- Provide a good understanding of the processes involved, the system functions and the operation and maintenance of the equipment.
- Ensure safe operation and maintenance procedures.
- Provide uniform operating procedures, "all shifts operating the same way".
- Protect the environment by minimizing emissions.
- Improve process controlling techniques for better efficiency and economy.

1.1 Training program

The training program includes the following courses:

- Theoretical training
- Maintenance training for chosen sub-suppliers' equipment
 - Mechanical
 - Electrical
 - Instrumentation
- Practical training at Client's site

On-site training takes place immediately before and during the commissioning period.

Electrical and instrumentation training is arranged by E/I department and it is not included in the specification of training courses described later in this document.

1.1.1 Theoretical training

The theoretical training is based on our plant-specific documentation. The courses are a classroom training, led by instructors from Valmet.

Training takes place at the Client's site or / and remotely. The training concerns the supplied equipment and systems and includes:

- Design data
- Process, systems and equipment knowledge
- Safety hazards
- Review of flowsheets
- Start-up, normal operation and shutdown procedures
- Troubleshooting and corrective measures for disturbances
- Maintenance

1.1.2 Maintenance training for chosen sub-suppliers' equipment

Valmet's main sub-suppliers' provide training for operators and maintenance personnel in operation and maintenance of their equipment. The training is carried out at the Client's site during erection and/or commissioning, when the sub-suppliers' personnel are on site.

1.1.3 Practical Training at Client's Site

- Personnel shall be involved and engaged in the cold commissioning of the equipment and systems.
- During the start-up period the trained operators will be supported by experienced engineers. During this period the operators will involve themselves in trimming the plant and prepare for a complete take-over after the completed test run.

Practical training will be performed daily during commissioning and trial run period.

1.1.4 Specification of training courses

BFB (K20) new build training

Management, Production and Maintenance personnel	Number of courses	Number of participants /course	Course length (days)	Total amount (days)
Theoretical training	5	20	3	15
Practical training during commissioning and start-up	included	included	Included	*
Training on sub-suppliers' equipment **)	**	**	**	**
Total theoretical training days				15

CFB (K80 and K90) rebuild training

Management, Production and Maintenance personnel	Number of courses	Number of participants /course	Course length (days)	Total amount (days)
Theoretical training	5	20	1	5
Practical training during commissioning and start-up	included	included	Included	*
Training on sub-suppliers' equipment **)	**	**	**	**
Total theoretical training days				5

(* Depending on how many operators / electricians and/or automation specialists from Client wants to take part in commissioning phase of the plant.

(** For the chosen main equipment. Included in total training days

1.1.5 Assumptions for training planning

The operation manager and foremen are experienced in boiler operations. Participants of training are assumed to have basic knowledge of boiler process. It is also assumed that participants have been trained in the Plant's safety rules and country's applicable rules and regulations for workers

Schedule in general

- 7* 50 min lessons per day, 5 days/week
- To be arranged consecutive days from Monday to Friday so that trainer's travel costs are minimized. Any additional costs to be discussed separately
- Hands-on training along daily work, 8 h/day, 5 days/week

The Client will be responsible to provide the classroom and audio-visual facilities.

The Client pays all his personnel costs, including travelling and accommodation. Valmet pays all their personnel costs.

1.2 Operation and maintenance manuals

Boiler operation manuals are made according to Valmet's standards. Maintenance and operation manuals of auxiliary equipment are collected according to each sub supplier's standards. Operation manuals can be used as training material.

Boiler operation manuals and auxiliary equipment manuals will be delivered mainly in Czech and partly in English language.

2 COMMISSIONING AND START-UP

2.1 Scope

The delivery includes a start-up and commissioning period including uninterrupted operation for each boiler separately. A more detailed commissioning program will be agreed with the Client later on, but the commissioning period is basically divided as follows:

- Cold commissioning / Individual tests
- Hot commissioning and on-line tuning / preparation for Trial Run
- Start-up / Comprehensive test
- Trial run
- Guarantee test A
- Take Over / Preliminary Acceptance (PAC)

During the commissioning, start-up and trial runs

Valmet shall be responsible for:

- Commissioning, testing and start-up in accordance with Prudent Industry Practices
- Providing commissioning spare parts
- An economical use of the materials provided by Client.
- Act according to environmental and safety considerations; however the guarantee values and emission standards could be momentarily exceeded during a commissioning and startup periods.

The Client shall be responsible for:

- The provision of fuel, utilities such as treated feed water, start-up steam, electric power, consumables, lubricants, chemicals, filters, cooling liquids necessary for the operation of the Supply free of charge to Valmet as specified in commissioning plan and schedule.
- Qualified operation and maintenance staff. For the operation of the Supply, free of charge to Valmet.
- Take steam to network during boiler tuning period as specified in commissioning plan and schedule.

2.2 Commissioning Team

Valmet personnel will take the leading role in the Commissioning Management of delivered equipment. They will be assisted by its Sub-suppliers' and Consultant's personnel.

The Commissioning Manager has the responsibility of overall coordination, availability of Valmet own manpower and need of consumables.

Valmet will define the commissioning team

The functional responsibilities and terms of internal and external communication for Management and execution of Commissioning will be clearly established.

The personnel will be competent, well trained and will have a good cooperation.

The Commissioning team will be responsible of the Functional Tests and the Trial Run.

The Client's Boiler Operations Team will assist the Valmet Commissioning Team and make themselves familiar with the process and location of the Plant equipment.

It is pointed out that Commissioning of the process systems is very useful and important to operating personnel. They will get to know the equipment and the operation before the start of the production.

BFB (K20) new build supervision

Table 1: Estimated quantity of BFB (K20) commissioning supervisory services

Commissioning Supervisory	Months at site
Chief commissioning engineer	Common with K80
Assistant commissioning engineer I	
Assistant commissioning engineer II	
Assistant commissioning engineer III	
Assistant commissioning engineer IV	
Assistant commissioning engineer E&I	
Total	30

CFB (K80, K90) rebuilds Supervision

CFB (K80) manning plan is based on the assumption that K20 and K80 have individual schedule for commissioning and acceptance, but they are carried out within the same time span. Commissioning teams will have a common Chief Commissioning Manager.

Table 2: Estimated quantity of CFB (K80) commissioning supervisory services

Commissioning Supervisory	Months at site
Chief commissioning engineer	Common with K20
Assistant commissioning engineer I	
Assistant commissioning engineer II	
Assistant commissioning engineer E&I	
Total	12

Table 3: Estimated quantity of CFB (K90) commissioning supervisory services

Commissioning Supervisory	Months at site
Chief commissioning engineer	
Assistant commissioning engineer I	
Assistant commissioning engineer II	
Assistant commissioning engineer E&I	
Total	15

There will also be local commissioning engineers addition to the manning described in the tables above. Valmet Chief commissioning engineer will define their site days according to the project needs.

2.3 General Descriptions of Commissioning Period

2.3.1 Cold commissioning

Also described as individual tests.

Prior to the cold commissioning, (ECC) Erection Completion Certificate procedure to be completed for the process system in question.

Piping and tank inspections

Preconditions:

- Installation of the equipment completed according to the construction schedule

Inspections:

- Pipelines are in accordance with the flowsheets and valve and fittings lists
- Fittings are properly located and marked
- Piping supports, expansion joints, drains, vents, condensate removal
- Location of measuring sensors and controllers
- Safety valves

Testing:

- Process system flushing

Equipment inspections and tests

Preconditions:

- Equipment, duct and piping installations completed according to construction schedule
- Electrification (motor) installation completed
- Control system (DCS) available for testing

Inspections:

- Alignments in order

Testing:

- Checking of the motors direction of rotation
- Equipment safety interlocks

Off-line testing of measurements, controls and interlocking

Preconditions:

- Electrification and instrumentation installation ready for off-line testing system by system

Testing:

- Operation of measurements, control loops etc. is tested by electric simulation
- The actuators and motors direction of rotation
- Alarm, interlock and control parameters
- Actuator limits

2.3.2 Hot commissioning

Also described as preparation for Trial Run.

Chemical cleaning

The boiler piping and equipment will be properly cleaned and protected with plastic caps at the manufacturing workshop.

Prior to commissioning, the following parts of the boiler will be acid cleaned:

- feedwater piping inside delivery limits
- economizers
- natural circulation loop
- internal circulation pipes

Hanging superheaters will not be acid cleaned.

Chemical cleaning of main steam pipe is to be reviewed to shorten the time needed for steam blows.

The Client shall provide the following

- demineralized water supply capacity sufficient for filling up the boiler twice in 24 hours
- electric power for circulation pumps
- hot water or steam for heating the acid cleaning solutions
- compressed air
- discharge point for neutralized waste.

Acid cleaning waste will be disposed by Contractor to the sewerage system after reaching parameters suitable for discharge. Contractor will also prepare a necessary facility for storing neutralized water. The Client is responsible for the application for waste disposal permission, if required by local authority.

Preconditions:

- Burner(s) readiness for magnetite film formation

Measures:

- Chemical treatment to be carried out for the boiler according to a separate program

Final situation:

- After the acid cleaning the boiler is ready for magnetite film formation and complete the burner tests

Refractory Drying

- The internals of the boiler are secured by the refractory material. The equilibrium water content of the refractory material must be removed and the surface of the refractory must be hardened to be wear-proof before boiler is allowed to operate continuously in main fuel mode.
- Refractory drying starts immediately after refractory is done. After that the refractory drying continues according to the separate instructions provided by the refractory supplier.

Development of magnetite film

Preconditions:

- Needed amount of burner capacity available
- All interlocking tests for starting the boiler with auxiliary fuel have been carried out.

Measures:

- During what is called the forty-eight (48) hour operation the boiler to be operated at a pressure of 2.5-3.5 MPa(g)
- Water analyses to be done
- Supply of dosing chemicals to be started
- Steam blows through continuous blowdown and start-up valves
- Separate instructions to be followed

Final situation:

- After the development of the magnetite film the boiler is ready for steam generation and steam blows

Steam blows

Steam blowing is performed to remove oxide scales, rust etc. impurities from the superheater and the main steam piping.

Scope

Valmet's cleaning responsibility covers only the delivery scope. If some non-scope piping is included in the cleaning, it must be internally sandblasted to remove scales originating from the pipe fabrication.

Steam blowing arrangement

The temporary steam blow piping with a necessary target plate connection, reducers and a valve are installed near turbine shut-off valve. Silencer (if needed) for blowing system is included in the delivery.

Steam blowing execution time

The steam blowing is to be executed right after the chemical cleaning of the boiler. A sufficient fuel burning capacity must be available. The boiler is to be set into continuous operation after the steam blows are completed.

Preconditions:

- Magnetite film has been developed
- Temporary Blowdown line has been built
- Permits and advance notices of blowdowns are in order
- A sufficient steam load can be generated
- A sufficient amount of make-up water available

The boiler and piping are allowed to cool down between the blows for a sufficient time to create a thermal shock high enough to intensify the removal of impurities.

The duration of steam blows is to be a minimum of 2 minutes. During the steam blow the drum temperature is not allowed to fall more than 50°C.

Steam blowing is carried out by the principles of the norm VGB-S-513-00-2014-07-EN.

2.3.3 On-line tuning

Also described as preparation for Trial Run.

Preconditions:

- Necessary permits from authorities are in order
- Hydrostatic test, chemical cleaning, steam blows and necessary inspections have been carried out
- Measurements, controls and interlocks have been found to be electrically in order

Testing and tuning:

- Operational testing of interlocks, controls and sequences
- Operational testing of safety valves by raising drum pressure
- Checking of reliability of measurements
- On-line tuning of controls

2.3.4 Start-up

Also described as comprehensive test.

Preconditions:

- On-line tuning has been carried out fulfilling safety requirements

Measures:

- The readiness of the equipment for the trial run is determined by 72 hour (K20) and 36+36 hour (K80, K90) uninterrupted boiler run.

2.3.5 Trial run**Preconditions:**

- The permits if required are valid
- The commissioning has been carried out according to the contract and the matter has been confirmed in writing

Measures:

- Boiler operation according to a boiler capacity program is prepared together with the Client in order to check the validity of the design data at different loads and to carry out tuning of equipment and controls
- Control of steam and water parameters

Trial Run acceptance will be based on functional properties of steam parameters and emissions which are possible to be measured online by plant measurements. Trial Run will be extended by only unsuccessful days which will be repeated.

2.3.6 Guarantee test A

Guarantee test A to be carried out as described in the Appendix 5.

2.3.7 Take Over

Also described as Preliminary Acceptance.

Preconditions:

- Trial Run completed and (PAC) certificate signed by both Parties
- Valmet in agreement with Client prepares list of remaining works and schedule to complete.

Measures:

- As in main contract



ID	Status	Task Name	Start	Finish	Duration	Task Calendar																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
							2025							2026							2027																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
							Qtr 4, 2024		Qtr 1, 2025		Qtr 2, 2025		Qtr 3, 2025		Qtr 4, 2025		Qtr 1, 2026		Qtr 2, 2026		Qtr 3, 2026		Qtr 4, 2026		Qtr 1, 2027		Qtr 2, 2027		Qtr 3, 2027		Qtr 4, 2027																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
			Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
0		Project name	Thu 03/10/24	Fri 31/12/27	849 days	None																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															</



ID	Status	Task Name	Start	Finish	Duration	Task Calendar																								
							2025												2026											
							Qtr 4, 2024				Qtr 1, 2025				Qtr 2, 2025				Qtr 3, 2025				Qtr 4, 2025				Qtr 1, 2026			
			Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
65		Demolition works K80, Steel structure	Mon 02/03/26				Sat 11/04/26																							
66		Equipment, ducting & piping	Mon 13/04/26				Sat 22/08/26																							
67		Pressure parts	Sat 11/04/26				Wed 01/07/26																							
68		Hydro test boiler assembly	Fri 03/07/26				Fri 03/07/26																							
69		Insulation and cladding	Mon 01/06/26				Sat 26/09/26																							
70		Electrification, instrumentation & automation	Mon 04/05/26				Fri 25/09/26																							
71		K90	Mon 01/03/27				Tue 24/08/27																							
72		Demolition works K90, Steel structure	Mon 01/03/27				Sat 10/04/27																							
73		Equipment, ducting & piping	Mon 12/04/27				Tue 27/07/27																							
74		Pressure parts	Mon 12/04/27				Tue 29/06/27																							
75		Hydro test boiler assembly	Wed 30/06/27				Wed 30/06/27																							
76		Insulation and cladding	Mon 31/05/27				Tue 24/08/27																							
77		Electrification, instrumentation & automation	Mon 10/05/27				Tue 24/08/27																							
78		COMMISSIONING AND TRIAL RUN (Including all the activities for preparation for start-up)	Mon 04/05/26				Fri 31/12/27																							
79		Electrification & instrumentation (MCC, DCS, SIS) ready for equipment and loop tests (by Purchaser or Valmet)	Mon 04/05/26				Mon 04/05/26																							
80		Consumables (water, chemicals, air, steam) available for use at delivery limits (by Purchaser)	Mon 04/05/26				Mon 04/05/26																							
81		Auxiliary fuel available for use at delivery limit (by Purchaser)	Mon 06/07/26				Mon 06/07/26																							
82		Steam net / reduction station ready to receive steam (by Purchaser)	Mon 06/07/26				Mon 06/07/26																							
83		K20	Sat 23/05/26				Mon 30/11/26																							
84		Cold commissioning, testing and tuning	Sat 23/05/26				Sun 30/08/26																							
85		Initial auxiliary fuel firing (boiler first start-up on auxiliary fuel)	Fri 24/07/26				Fri 24/07/26																							
86		Acid cleaning and steam blow-outs	Mon 03/08/26				Tue 25/08/26																							
87		Hot commissioning and tuning with auxiliary fuel	Thu 27/08/26				Mon 07/09/26																							
88		Solid fuel available for use at delivery limit (by Purchaser)	Tue 04/08/26				Tue 04/08/26																							
89		Initial solid fuel firing	Tue 18/08/26				Tue 18/08/26																							
90		Boiler operational on auxiliary fuel (ready for continuous steam production)	Wed 09/09/26				Wed 09/09/26																							
91		First steam to turbine	Fri 18/09/26				Fri 18/09/26																							
92		Hot commissioning and tuning with solid fuel (Including Comprehensive testing)	Thu 10/09/26				Wed 21/10/26																							
93		Tuning for Trailrun	Thu 22/10/26				Mon 26/10/26																							
94		Readiness for Trial Run	Mon 26/10/26				Mon 26/10/26																							
95		Trial Run Period (30 days)	Tue 27/10/26				Wed 25/11/26																							
96		Guarantee test A - K20	Thu 26/11/26				Sun 29/11/26																							
97		PAC (Take Over), K20	Mon 30/11/26				Mon 30/11/26																							
98		K80	Wed 01/07/26				Mon 30/11/26																							
99		Cold commissioning, testing and tuning	Wed 01/07/26				Thu 27/08/26																							
100		Initial auxiliary fuel firing (boiler first start-up on auxiliary fuel)	Thu 20/08/26				Thu 20/08/26																							
101		Acid cleaning and steam blow-outs	Fri 28/08/26				Tue 08/09/26																							
102		Hot commissioning and tuning with auxiliary fuel	Wed 09/09/26				Thu 24/09/26																							
103		Solid fuel available for use at delivery limit (by Purchaser)	Fri 28/08/26				Fri 28/08/26																							
104		Initial solid fuel firing	Thu 10/09/26				Thu 10/09/26																							
105		Boiler operational on auxiliary fuel (ready for continuous steam production)	Thu 24/09/26				Thu 24/09/26																							
106		First steam to turbine	Fri 25/09/26				Fri 25/09/26																							
107		Hot commissioning and tuning with solid fuel (Including Comprehensive testing)	Fri 25/09/26				Tue 20/10/26																							
108		Comprehensive test (72 hours)	Sun 18/10/26				Tue 20/10/26																							
109		Readiness for Trial Run	Wed 21/10/26				Wed 21/10/26																							
110		Trial Run Period (30 days)	Thu 22/10/26				Fri 20/11/26																							
111		Guarantee test A	Mon 23/11/26				Fri 27/11/26																							
112		PAC (Take Over), K80	Mon 30/11/26				Mon 30/11/26																							
113		K90	Thu 01/07/27				Fri 31/12/27																							
114		Cold commissioning, testing and tuning	Thu 01/07/27				Fri 27/08/27																							
115		Initial auxiliary fuel firing (boiler first start-up on auxiliary fuel)	Fri 20/08/27				Fri 20/08/27																							
116		Acid cleaning and steam blow-outs	Sat 28/08/27				Wed 08/09/27																							
117		Hot commissioning and tuning with auxiliary fuel	Thu 09/09/27				Mon 20/09/27																							
118		Solid fuel available for use at delivery limit (by Purchaser)	Fri 03/09/27				Fri 03/09/27																							
119		Initial solid fuel firing	Fri 10/09/27				Fri 10/09/27																							
120		Boiler operational on auxiliary fuel (ready for continuous steam production)	Fri 24/09/27				Fri 24/09/27																							
121		First steam to turbine	Sat 25/09/27				Sat 25/09/27																							
122		Hot commissioning and tuning with solid fuel (Including Comprehensive testing)	Sat 25/09/27				Wed 20/10/27																							
123		Comprehensive test (72 hours)	Mon 18/10/27				Wed 20/10/27																							
124		Readiness for Trial Run	Thu 21/10/27				Thu 21/10/27																							
125		Trial Run Period (30 days)	Fri 22/10/27				Sat 20/11/27																							
126		Guarantee test A	Mon 22/11/27				Fri 26/11/27																							
127		PAC (Take Over), K90	Tue 30/11/27				Tue 30/11/27																							
128		Site Cleared & Demobilised (Pending Punch items)	Fri 31/12/27				Fri 31/12/27																							

Document Exchange Schedule

Project name SKOENERGO OB 2 BOILER HOUSES

Doc. ID
Project ID

CONFIDENTIAL
[Author]
6.9.2024

Resp = PUR = Client, SUP= Contractor (Valmet)
C* = Included in contract
ED = Contract effective date (ED+wk = weeks after effective date)
P = Preliminary
C = Certified
ASB = As Built (2 months after PAC (taking over))

Doc. Class	Item	Document	Use of Document	Resp	Delivery package	1	2	3	4	5	6	7	8	9	10	As Built (ASB)		Remarks
					C*	ED+5	ED+8	ED+12	ED+18	ED+27	ED+38	ED+47	ED+54	ED+65	ED+75			
A		OVERALL MANAGEMENT																
ABB	01	Project progress report	Information	SUP														Periodically acc. to agreement
ABE	01	Project milestone schedule	Information	PUR	C													Agreed before signing of contract
ABE	02	Overall project schedule	Information	PUR/SUP	P			C										Updated when needed
ABE	03	Erection schedule	Information	PUR/SUP						P	C							Updated when needed
ABE	04	Commissioning schedule	Information	SUP						P	C							Updated when needed
ABE	05	Project organisation chart	Information	PUR/SUP		C												
ABE	06	Site organisation chart	Information	PUR/SUP						P	C							
ABE	07	Site manpower diagram	Information	SUP						P	C							
ABE	08	Site conditions	Engineering, erection, procurement	PUR	C													Agreed before signing of contract
AEB	01	Standards, regulations and purchaser's specifications	Engineering, manufacturing, procurement	PUR	C													Agreed before signing of contract Incl. label and marking specifications Incl. surface treatment specification and colour guide
AQA	01	Quality plan for project	Information	SUP		P		C										
AQA	02	Final quality documentation	Information	SUP														2 months after taking over (acc. to separate list)
AQA	03	EC declarations of conformity	Information	SUP														Take over. For boiler assembly and other pressure equipment assemblies
AQB	01	Purchaser's HSE requirements	Procurement, erection	PUR	C													Agreed before signing of contract
AQB	02	Supplier's HSE plan for construction phase	Information	SUP														4 weeks before start of erection (live documents)
B		OVERALL TECHNOLOGY																
BBG	01	Plan for commissioning and test runs	Commissioning, test runs	SUP								P		C				Certified agreed before cold commissioning start
BBG	02	Plan for performance guarantee test	Performance test	PUR/SUP														Certified agreed before performance test
BBT	01	Training plan	Training	SUP								P	C					
BBT	02	Training material	Training	SUP														Certified 3 weeks before training
BDC	01	Operation and maintenance manuals	Information	SUP										P		ASB		Preliminary for training and commissioning
BEB	01	Insulation specification	Insulation	SUP	C													Agreed before signing of contract
BEC	01	Process, design, etc. information of purchaser supplied equipment	Engineering	PUR		P		C										
BQB	01	Hazard and risk analysis	Information	SUP						P	C							
BQB	02	Hazardous area classification plan	Engineering	SUP					P		C							Certified incl. drawings
BQB	03	Fire safety plan for fire safety solution	Information	SUP				P			C							
BTL	01	Site layout drawings	Engineering, erection	PUR ¹⁾ / SUP ²⁾	C ¹⁾				P ²⁾		C ²⁾							¹⁾ Certified with coordinate system and elevations before signing of contract ²⁾ Incl. crane locations, storage areas, utilities etc. in detail
C		CONSTRUCTION ENGINEERING																
CLB	02	Foundation loads of columns	Foundation design	SUP			P		C \$									Preliminary not to exceed loads for piling design
CLB	03	Foundation loads of equipment	Foundation design	SUP			P		C \$									Certified for foundation detail design
CLB	04	Foundation loads of cranes and erection areas	Foundation design	SUP				P		C								Preliminary not to exceed loads for piling design
CLB	05	Anchor bolts location drawing of columns	Foundation design, erection	SUP					C									Certified for equipment foundation detail design
CTA	01	Architectural design: Facade and roof drawings	Information	PUR/SUP	C													Agreed before signing of contract
E		ELECTROTECHNOLOGY														AS-built documents according the separate list in project execution phase		
		Automation																
EDB	01	Automation concept	Engineering, manufacturing, supply	SUP	P		C											Agreed before signing of contract
EEC	02	DCS FAT plan	Engineering	SUP					P			C						
EFA	01	Interlocking, control and sequence diagrams	Engineering	SUP					P			C						
		Instrumentation																
EEC	03	Instrument index	Engineering	SUP					P					C				Instrument and I/O list
EEC	04	Hook-up drawings	Engineering	SUP					P					C				
EEC	01	Instrumentation circuit diagrams	Engineering, erection	SUP					P					C				
EEC	08	Field junction box drawings	Engineering, erection	SUP					P					C				
		Electrification																
EDB	02	Electrification concept	Engineering, manufacturing, supply	SUP	P		C											Agreed before signing of contract
EEC	12	Motor and consumer list	Engineering						P					C				
EED	01	Short circuit calculations and selectivity plan	Engineering, erection	SUP					P					C				
EED	02	Power distribution specifications from purchaser	Engineering, erection	PUR		P	C											
EED	02	Cable dimensioning and selection tables	Engineering, erection	SUP					P					C				
EFA	02	Electrical overview diagram	Engineering, erection	SUP					P							Single line diagram		
EFS	01	MCC circuit diagrams	Engineering, erection	SUP					P					C				Preliminary is "typical circuit diagrams".
ELD	01	Earthing diagram	Engineering, erection	SUP					P					C				

Document Exchange Schedule

Project name SKOENERGO OB 2 BOILER HOUSES

Doc. ID
Project ID

CONFIDENTIAL
[Author]
6.9.2024

Resp = PUR = Client, SUP= Contractor (Valmet)
C* = Included in contract
ED = Contract effective date (ED+wk = weeks after effective date)
P = Preliminary
C = Certified
ASB = As Built (2 months after PAC (taking over))

Doc. Class	Item	Document	Use of Document	Resp	Delivery package											As Built (ASB)	Remarks
						1 ED+5	2 ED+8	3 ED+12	4 ED+18	5 ED+27	6 ED+38	7 ED+47	8 ED+54	9 ED+65	10 ED+75		
ELD	02	Earthing arrangement drawing	Engineering, erection	SUP			P		C								Connection points to underground grid
ELU	04	Cable tray arrangement drawing	Engineering, erection	SUP					P								
EDA	03	Dimensions of electrical equipment in electrical rooms	Engineering	SUP			P		C1				C2				C1 Not exceed dimensions and C2 final information
		Building Electrification															
EEC	14	Lighting fixture list	Engineering, erection						P					C			
ELU	05	Lighting fixture and maintenance power outlet arrangement drawings	Engineering, erection	SUP					P					C			
EQB	01	Lightning protection plan	Engineering, erection	SUP					P					C			
M		MECHANICAL ENGINEERING															
MLH	01	General arrangement drawings	Information	SUP	P						C						ASB
MLU	01	Equipment drawings of purchaser equipment	Layout design	PUR		C											Incl. loads of incoming fuel conveyor of OB1
MLU	02	Loads and moments at main tie-in points	Engineering, Foundation design	PUR	P	C											Items with high loads, for instance Fuel conveyor, Stack, Connected buildings, Platforms, Pipe bridges, etc.
MMA	01	Tie-in drawings	Layout design	PUR/SUP			P		C								
MTA	02	Foundation drawings for machinery and equipment: Ground floor	Foundation design	SUP						C (\$)							Incl. dimensions, embedded steel, loads
MTA	03	Foundation drawings for machinery and equipment: Elevated floors	Engineering	SUP						C							If elevated floors in purchaser's scope
MTB	01	3D plant review model	Information	SUP													Incl. dimensions, embedded steel, loads
																	Regular 3D model update to be agreed
P		PROCESS ENGINEERING															
PDA	01	Mass and heat balance	Engineering	SUP			P			C							
PDA	02	Consumption data	Engineering	SUP				P		C							
PEC	01	Purchaser's positioning instructions	Engineering	PUR	C												Agreed before signing of contract
PEC	02	Tie-in list	Engineering	PUR ¹⁾ /SUP ²⁾	P1 ¹⁾		P2 ¹⁾		C								ASB
PEC	03	Design data for purchaser equipment	Engineering	PUR		C											Preliminary incl. main items affecting process dimensioning
PFB	01	Process and instrument diagrams (P&ID)	Engineering	SUP			P			C							Existing equipment and pressure parts
PPD	01	Equipment list	Information	SUP						C							ASB
																	Incl. tag no. and name of equipment, P&ID no.



TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR

Refurbishment of the Combined Heat and Power Plant
in Mladá Boleslav

Business Package OB 2

BOILER HOUSES, BIOMASS BOILER K20

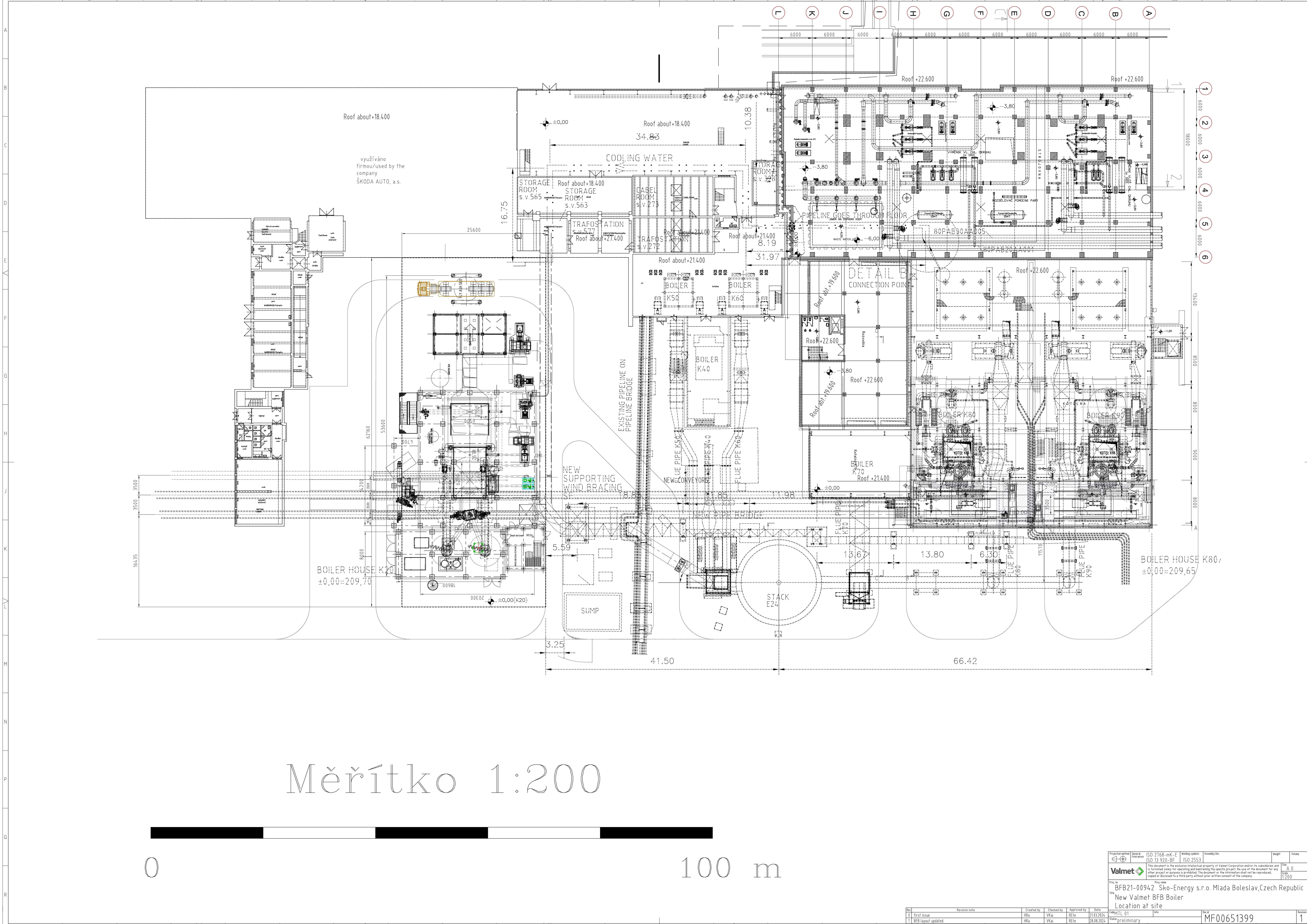
VOLUME III ***TECHNICAL REQUIREMENTS***

Annex 19 Layouts

Refurbishment of the combined heat and power plant in Mladá Boleslav	Pages 2/2
TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR Technical requirements	Date: 09/09/2024
OB 2 BOILER HOUSES, BIOMASS BOILER K20	Revision 0

LAYOUTS BOILER K20

Title	Number	Rev.
Boiler K20 Area layout	MF00651399	1
Side view K20	MF00651297	1
Plan view K20	MF00651398	1
Ground Floor (+0.00)	MF00749228	0
Floor +4.100 and +4.900	MF00749229	0
Floor +7.900	MF00749230	0
Floor +12.900	MF00749231	0
Floor +16.400	MF00749232	0
Floor +19.900	MF00749233	0
Floor +24.000	MF00749234	0
Floor +27.000	MF00749235	0
Floor +29.800	MF00749236	0
Floor Roof +35.600	MF00749237	0

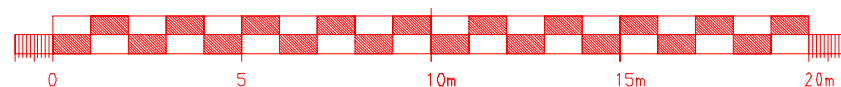
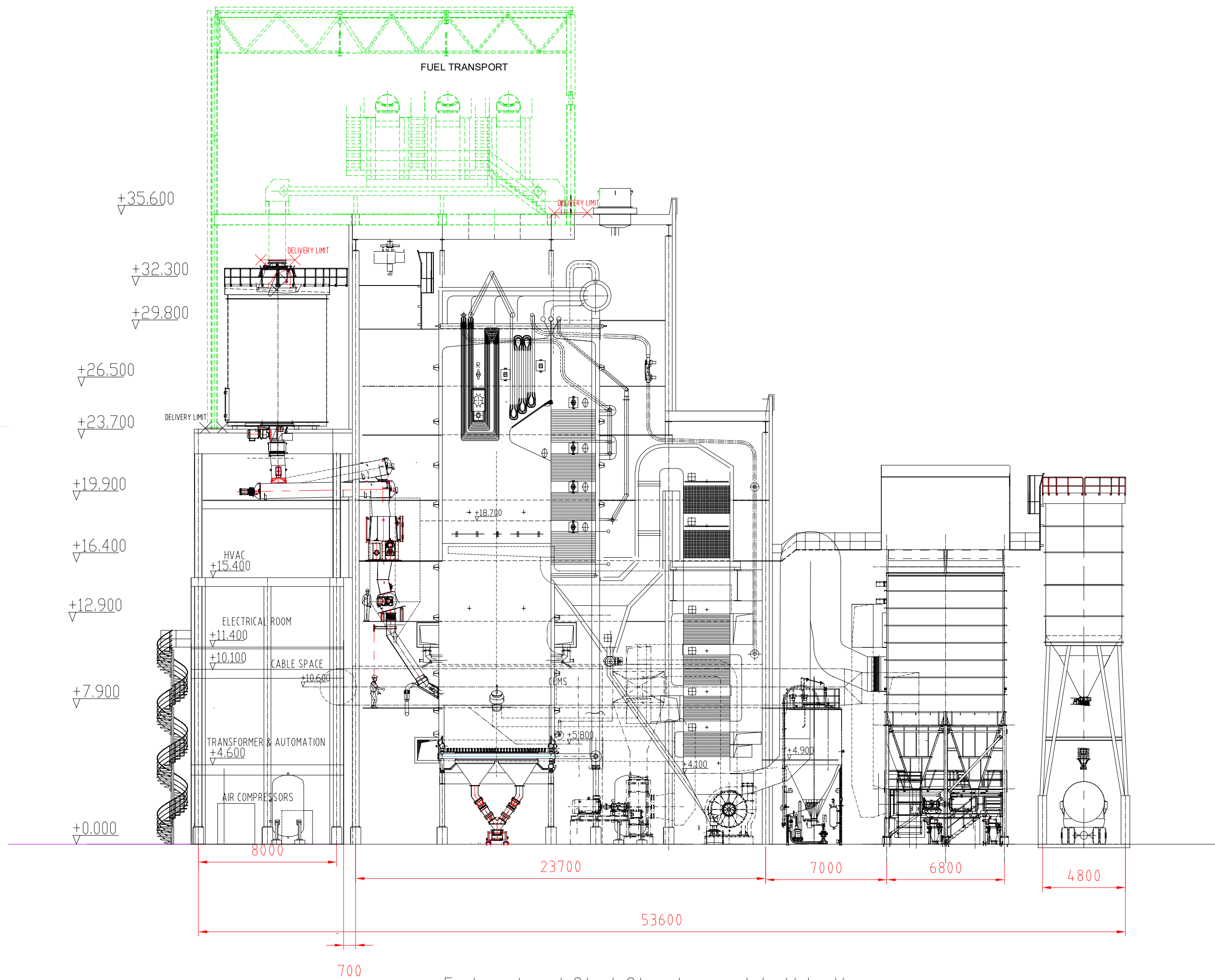


Měřítko 1:200



100 m

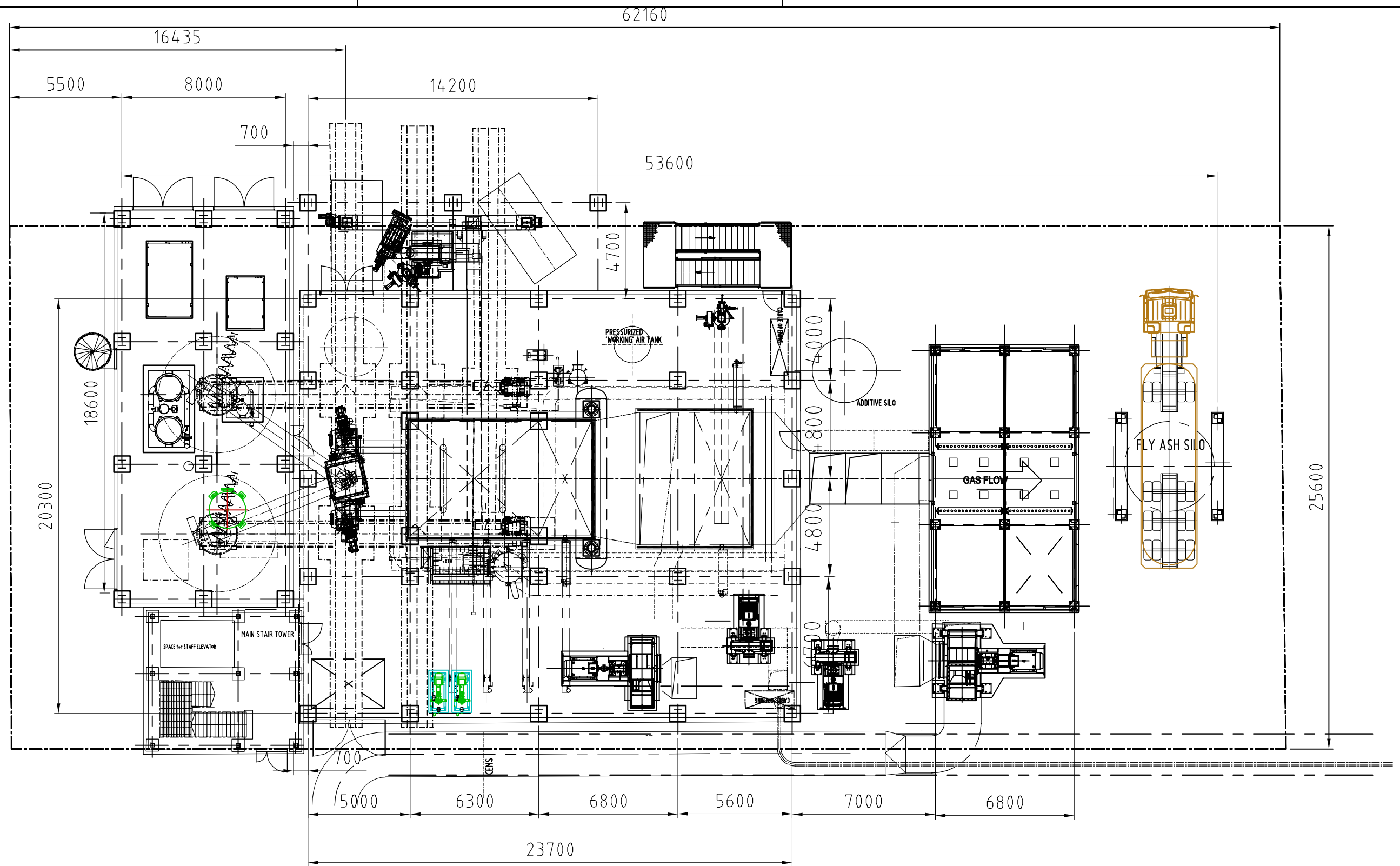
Projection method	ISO 2768-mK-E	General tolerances	ISO 13 920-BF	Welding symbols	ISO 2553	Assemble	Doc	Scale	Value
Valmet									A 0
Proj. name									1:200
BFB21-00942 Sko-Energy s.r.o. Mlada Boleslav, Czech Republic									
New Valmet BFB Boiler									
Location at site									
Rev	Revision name	Created by	Checked by	Approved by	Date	Comp. 01	Iss	Draw	Revision
0	First issue	HRa	VRa	REte	21.03.2024				1
1	BFB layout updated	HRa	VRa	REte	28.08.2024				

INCOMING FUEL CONVEYORS AND FUEL TRANSPORT SYSTEM
(DELIVERED BY OTHER SUPPLIER) ARE SUPPORTED BY THE STEEL STRUCTURE OF THE BOILERHOUSE K20



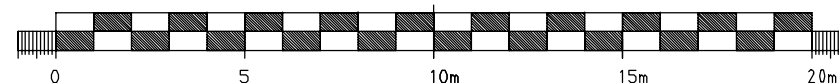
Rev	Revision note	Created by	Checked by	Approved by	Date
0	first issue	HRa	VKa	REte	16.02.2024
1		HRa	VKa	REte	28.08.2024

Projection method 		General tolerances ISO 2768-mK-E ISO 13 920-BF		Welding symbols ISO 2553		Assembly Doc		Weight		Volume											
						This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.						Size A 2									
												Scale 1:200									
Proj. no		Proj. name																			
BFB21-00942												Sko-Energy s.r.o. Mlada Boleslav, Czech Republic									
Title		Valmet BFB Boiler																			
Layout, Side view																					
Code		MTL 01				Info		Doc. id.				Revision									
Status		preliminary				MF00651397				1											





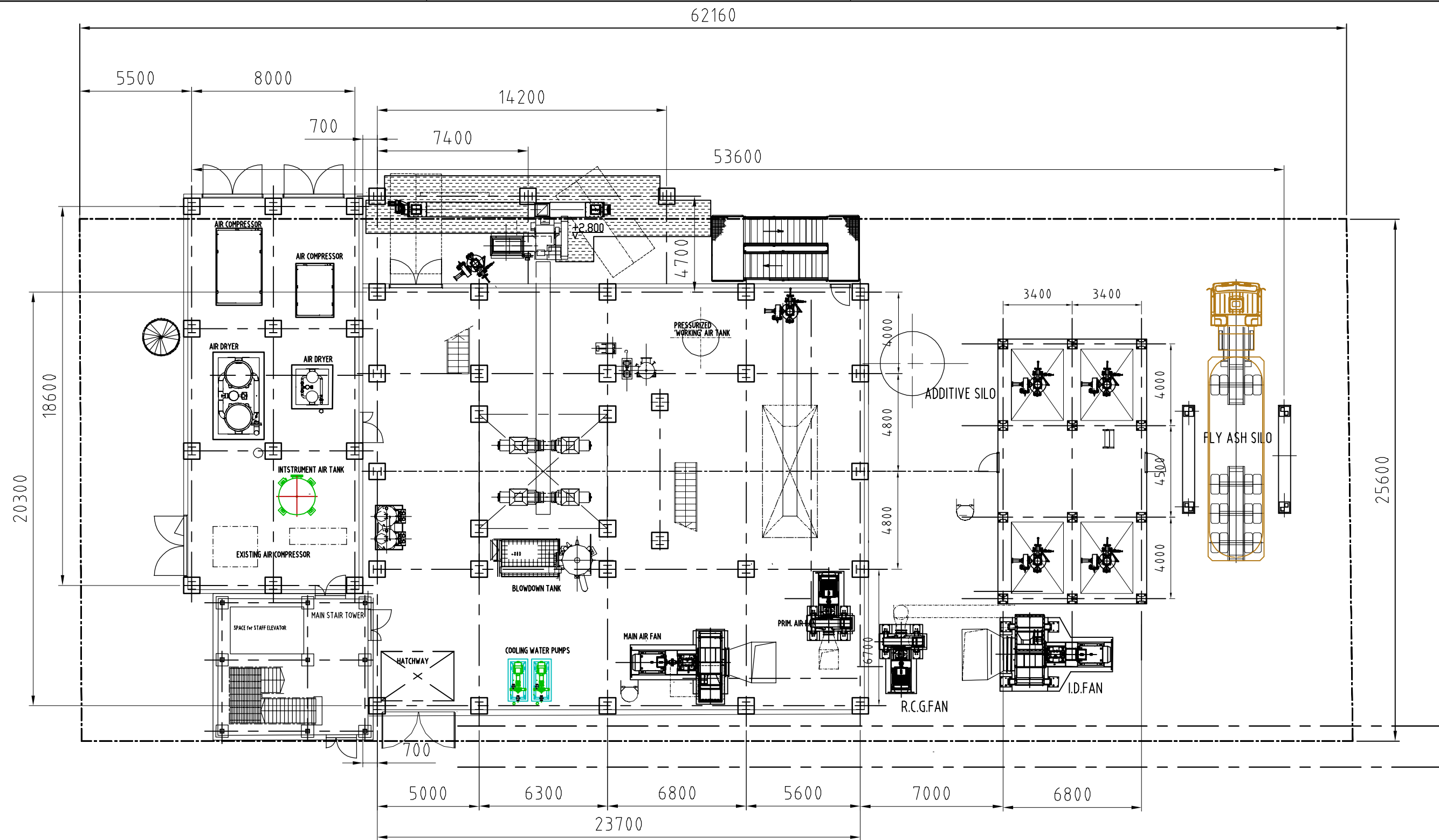
TOTAL PLATFORM AREA :

	Concrete platform area	m ²
	Grating area	1284 m ²
	Checkered plate area	150 m ²

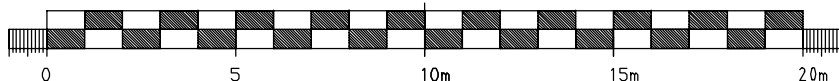


Rev	Revision note	Created by	Checked by	Approved by	Date
0	first issue	HRa	VKai	REte	14.02.2024
1		HRa	VKai	REte	28.08.2024



Projection method 	General tolerances ISO 2768-mK-E ISO 13 920-BF	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
 This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.				Size A 1	
				Scale 1:200	
Proj. no BFB21-00942					
Proj. name Sko-Energy s.r.o. Mlada Boleslav, Czech Republic					
Title Valmet BFB Boiler					
Layout, plan view					
Code MTL 01		Info		Doc.id. MF00651398	
Status preliminary				Revision 1	

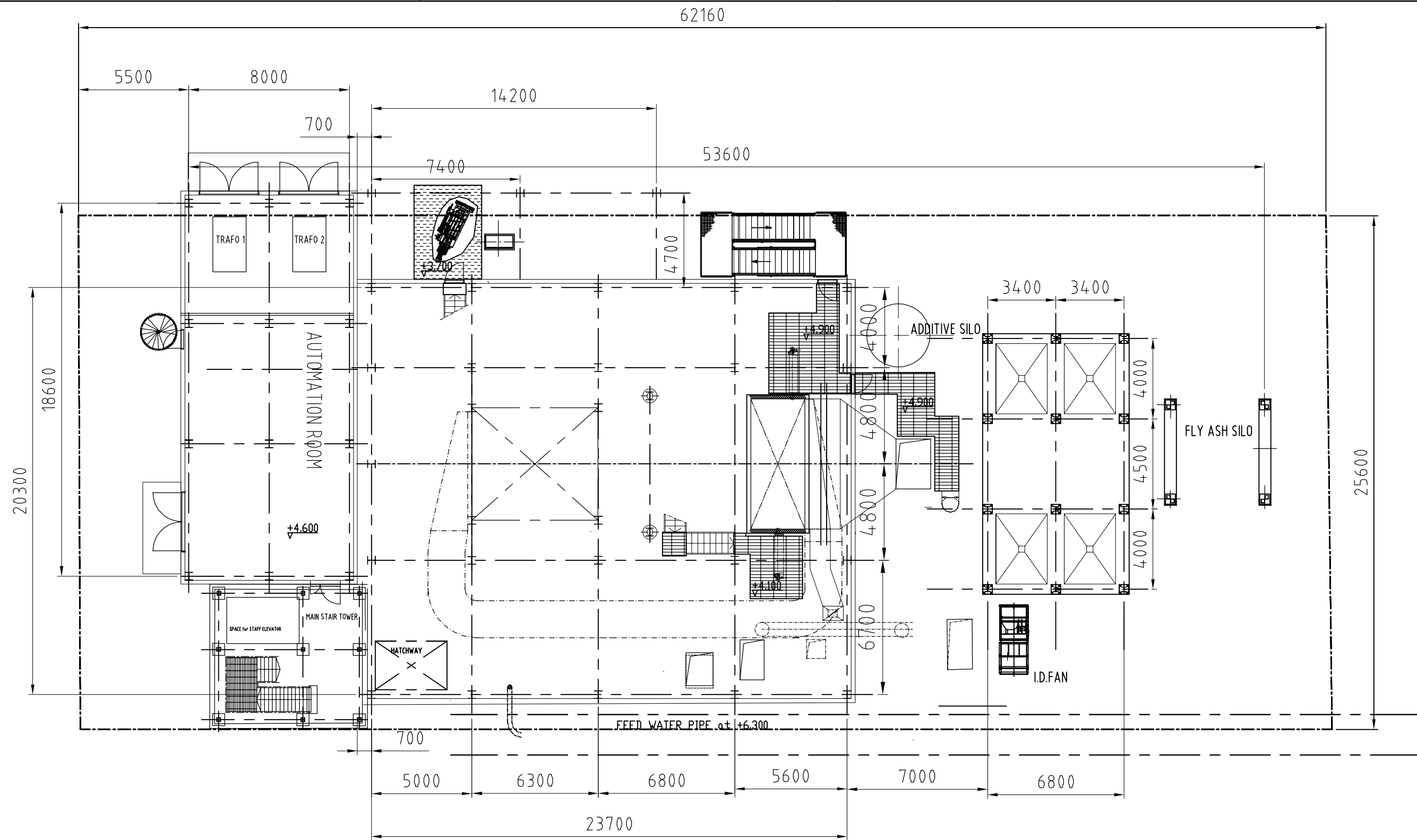


	Concrete platform area	m ²
	Grating area	0 m ²
	Checkered plate area	47 m ²

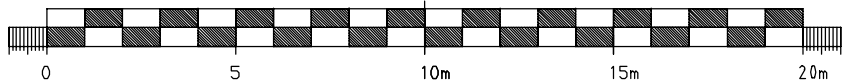


Rev	Revision note	Created by	Checked by	Approved by	Date
0	first issue	HRa	VKai	REte	28.08.2024

Projection method 	General tolerances ISO 2768-mK-E ISO 13 920-BF	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.			Size A 1
					Scale 1:200
Proj. no BFB21-00942					
Proj. name Sko-Energy s.r.o. Mlada Boleslav, Czech Republic					
Title Valmet BFB Boiler Layout Ground Floor					
Code MTL 01		Info		Doc.id. MF00749228	
Status preliminary				Revision 0	

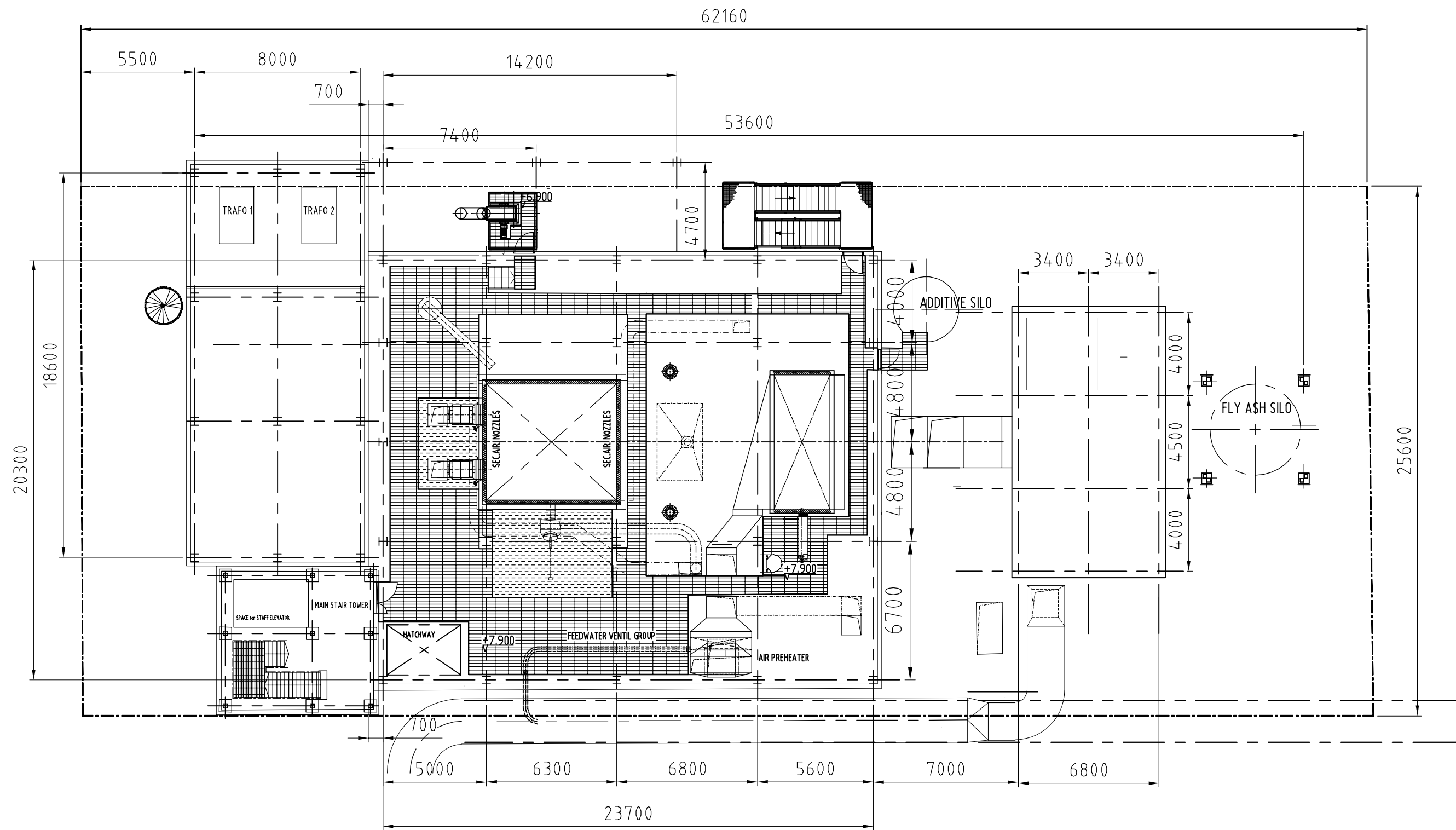


	Concrete platform area	m ²
	Grating area	55 m ²
	Checkered plate area	16 m ²

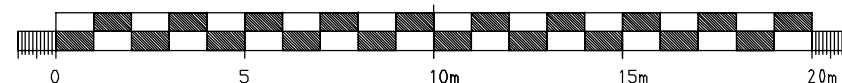


Rev	Revision note	Created by	Checked by	Approved by	Date
0	first issue	HRa	VKai	REte	28.08.2024

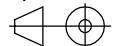

Projection method 	General tolerances ISO 2768-mK-E ISO 13 920-BF	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.				Size A 1	
				Scale 1:200	
Proj. no BFB21-00942					
Proj. name Sko-Energy s.r.o. Mlada Boleslav, Czech Republic					
Title Valmet BFB Boiler Layout +4.100 and +4.900					
Code MTL 01		Info		Doc.id. MF00749229	
Status preliminary				Revision 0	

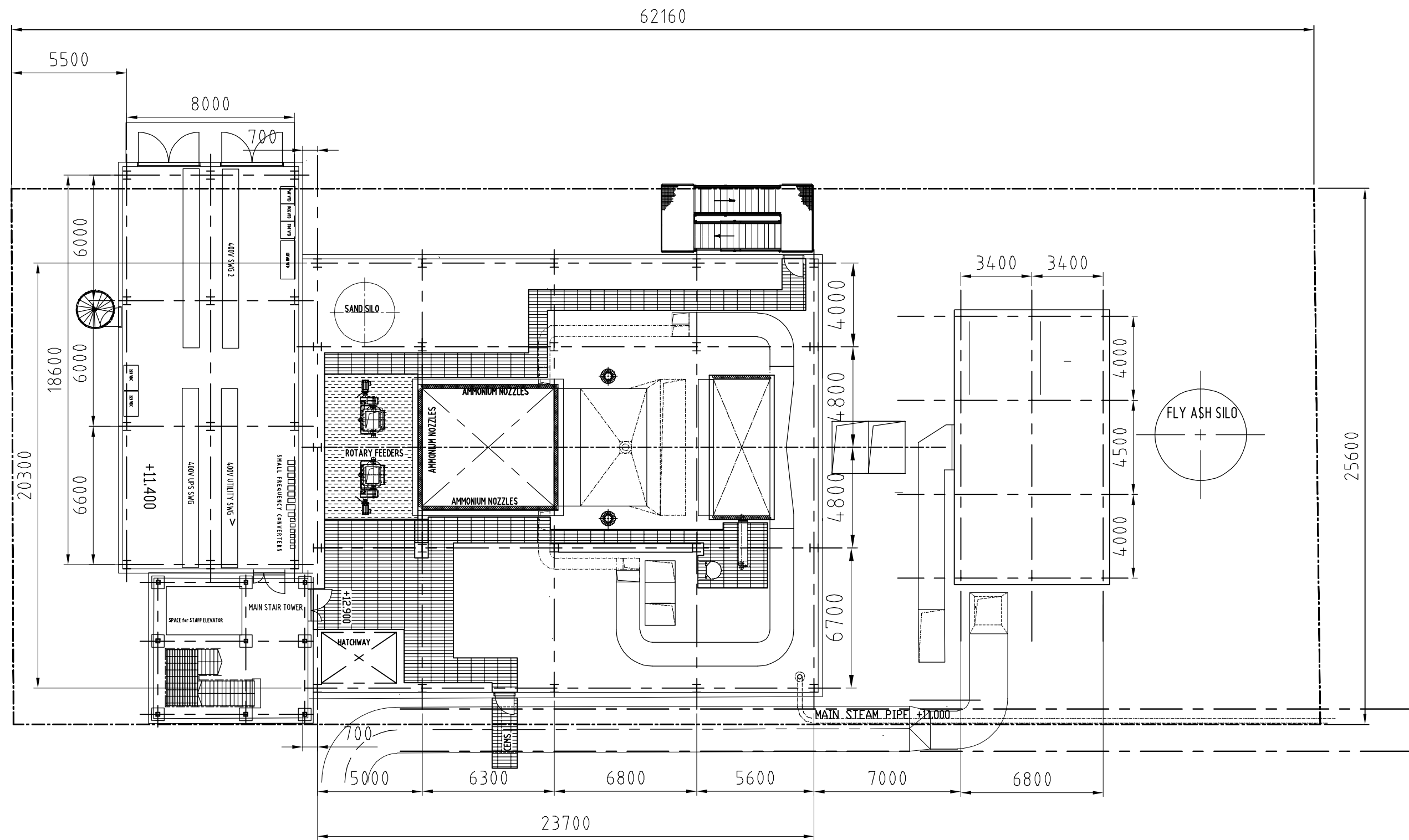


	Concrete platform area	m ²
	Grating area	223 m ²
	Checkered plate area	34 m ²

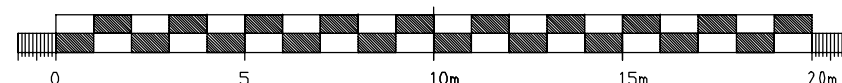


Rev	Revision note	Created by	Checked by	Approved by	Date
0	first issue	HRa	VKai	REte	28.08.2024



Projection method 	General tolerances ISO 2768-mK-E ISO 13 920-BF	Welding symbols ISO 2553	Assembly Doc	Weight	Volume	
 This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.				Size A 1	Revision 0	
				Scale 1:200		
Proj. no BFB21-00942 Proj. name Sko-Energy s.r.o. Mlada Boleslav, Czech Republic						
Title Valmet BFB Boiler						
Layout +7.900						
Code MTL 01		Info		Doc.id. MF00749230		
Status preliminary						

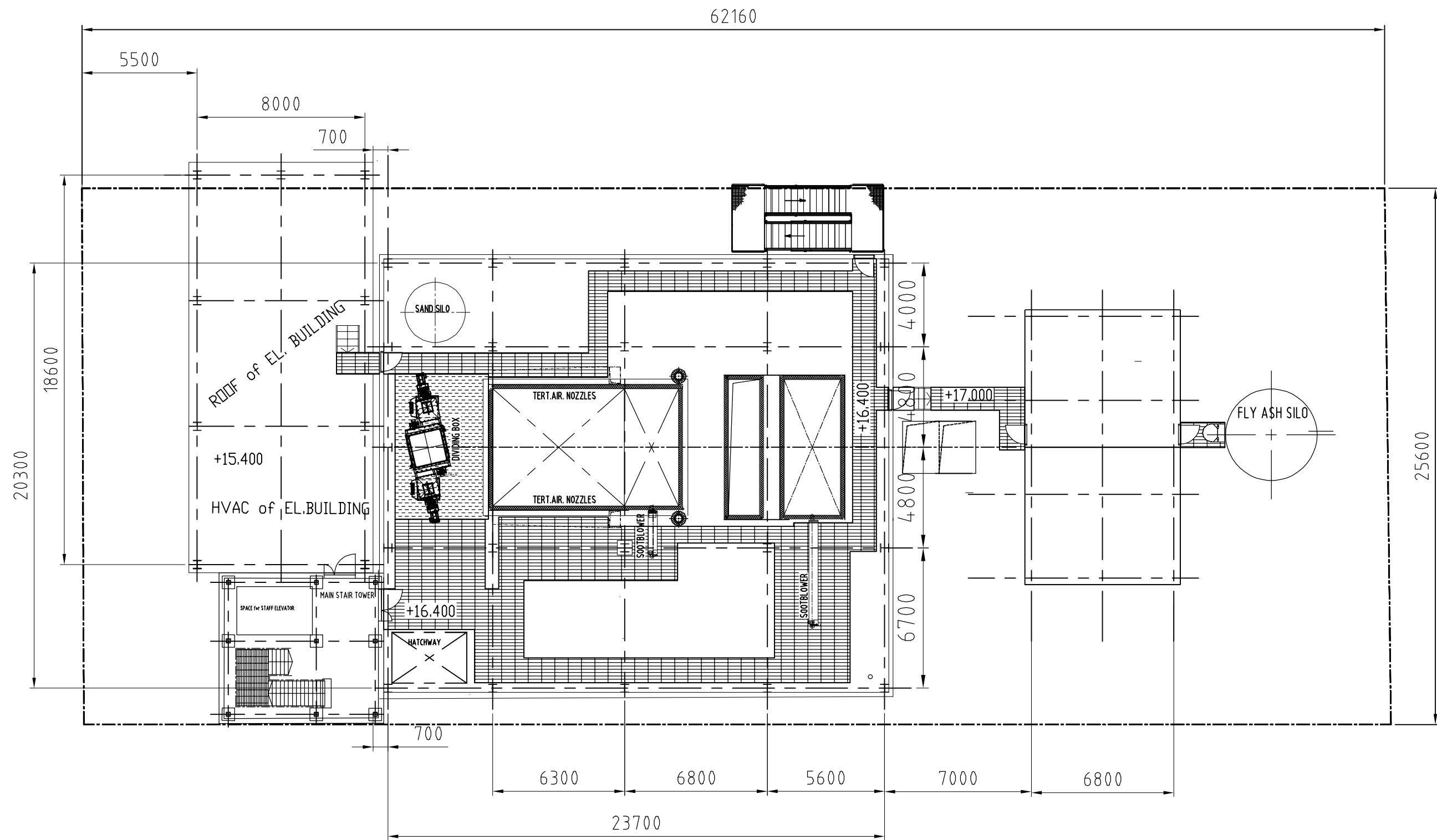


	Concrete platform area	m ²
	Grating area	95 m ²
	Checked plate area	31 m ²

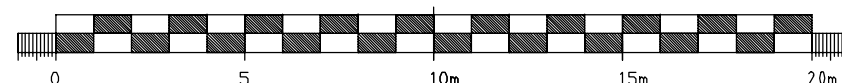


Rev	Revision note	Created by	Checked by	Approved by	Date
0	first issue	HRa	VKai	REte	28.08.2024



Projection method 	General tolerances ISO 2768-mK-E ISO 13 920-BF	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
 <p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.</p>				Size A 1	
				Scale 1:200	
Proj. no BFB21-00942					
Proj. name Sko-Energy s.r.o. Mlada Boleslav, Czech Republic					
Title Valmet BFB Boiler Layout +12.900					
Code MTL 01		Info		Doc.id. MF00749231	
Status preliminary				Revision 0	

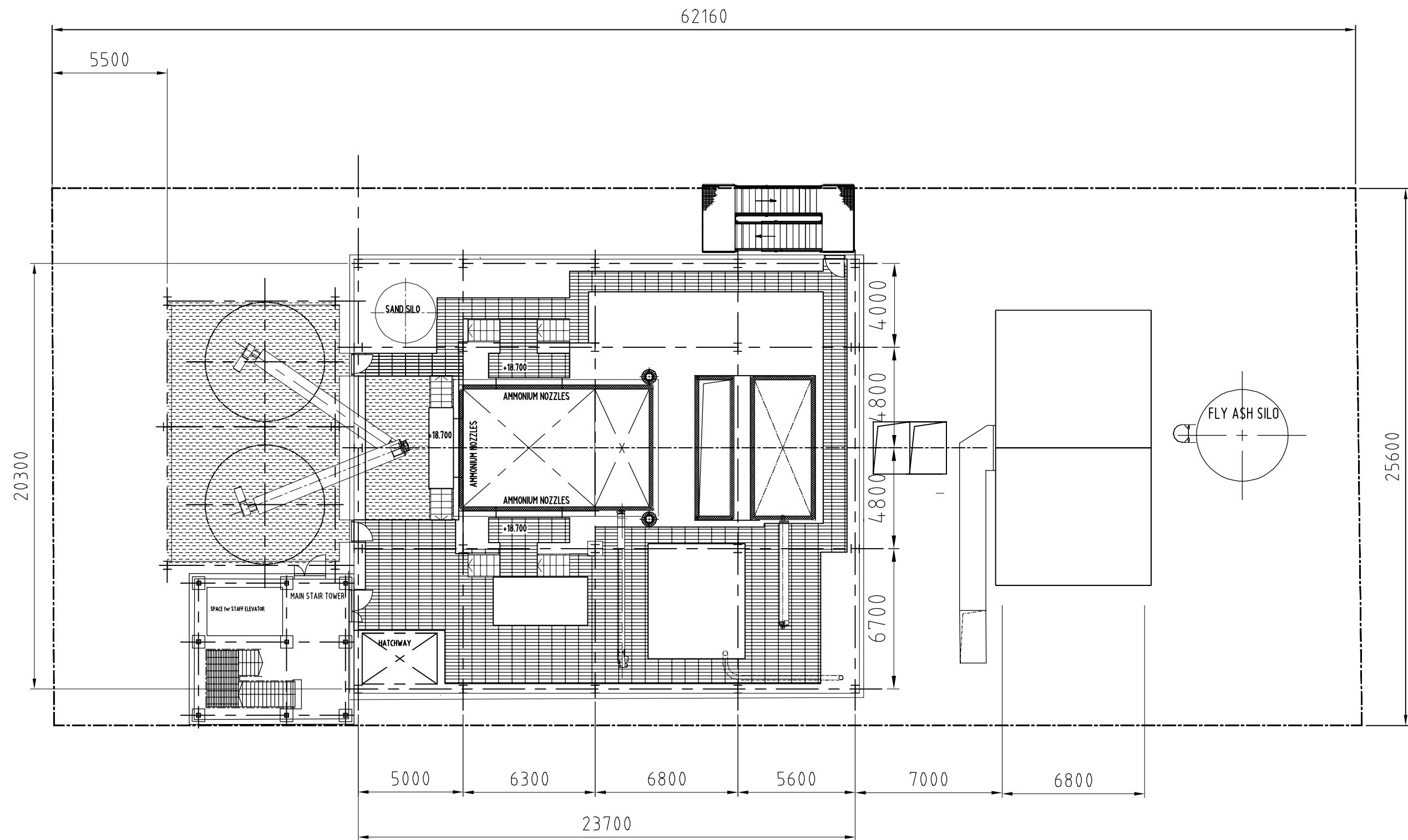


	Concrete platform area	m ²
	Grating area	159 m ²
	Checkered plate area	31 m ²

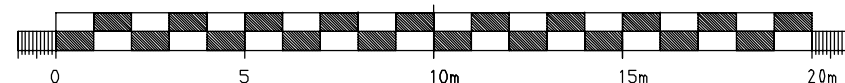


Rev	Revision note	Created by	Checked by	Approved by	Date
0	first issue	HRa	VKai	REte	28.08.2024

Projection method 	General tolerances ISO 2768-mK-E ISO 13 920-BF	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
 This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.				Size A 1	
				Scale 1:200	
Proj. no					

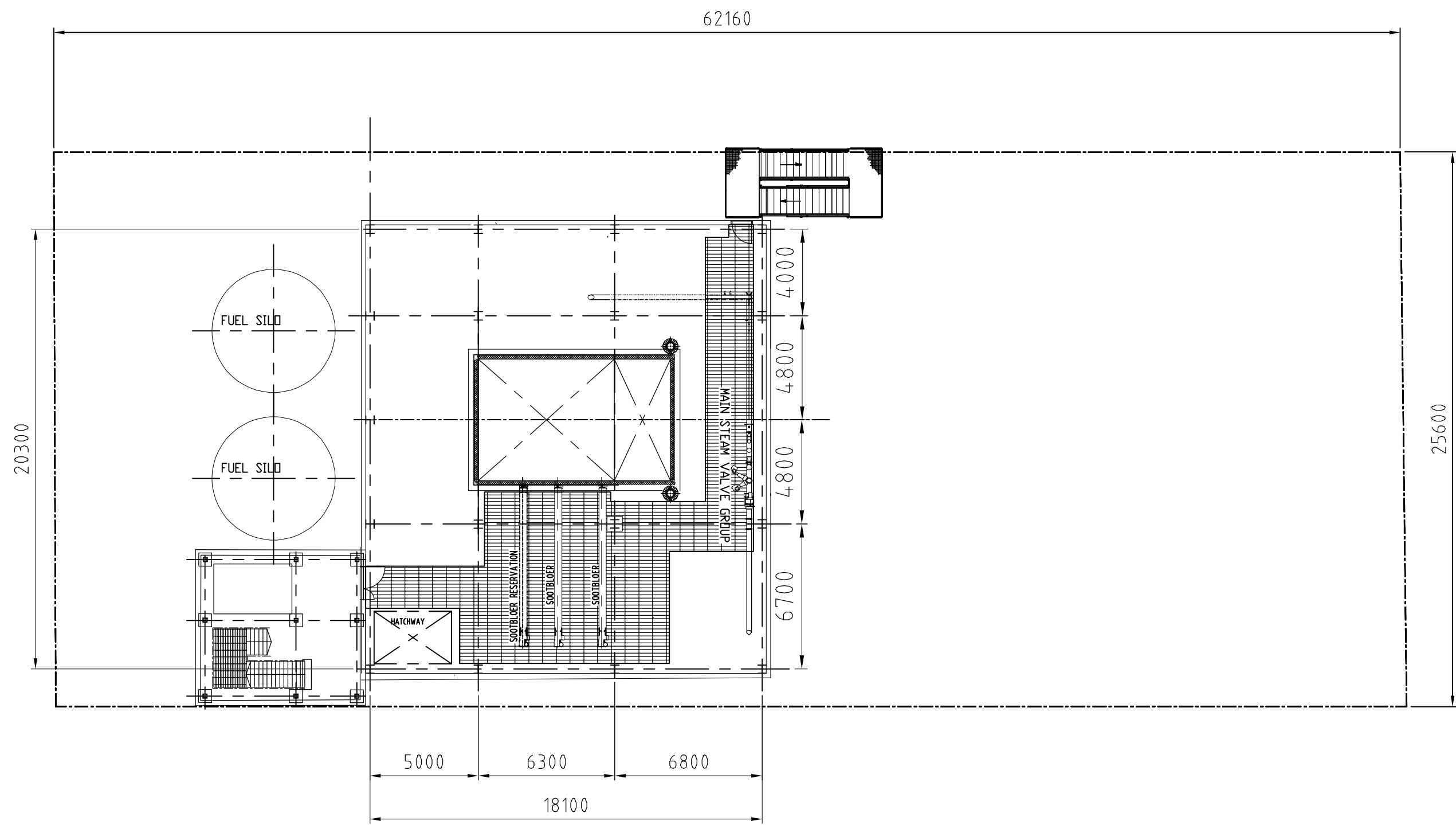


	Concrete platform area	m ²
	Grating area	224 m ²
	Checkered plate area	128 m ²

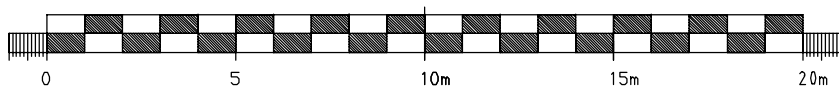


Rev	Revision note	Created by	Checked by	Approved by	Date
0	first issue	HRa	VKai	REte	28.08.2024

Projection method 	General tolerances ISO 2768-mK-E ISO 13 920-BF	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.				Size A 1	
				Scale 1:200	
Proj. no BFB21-00942					
Proj. name Sko-Energy s.r.o. Mlada Boleslav, Czech Republic					
Title Valmet BFB Boiler Layout +19.900					
Code MTL 01		Info		Doc.id. MF00749233	Revision 0
Status preliminary					

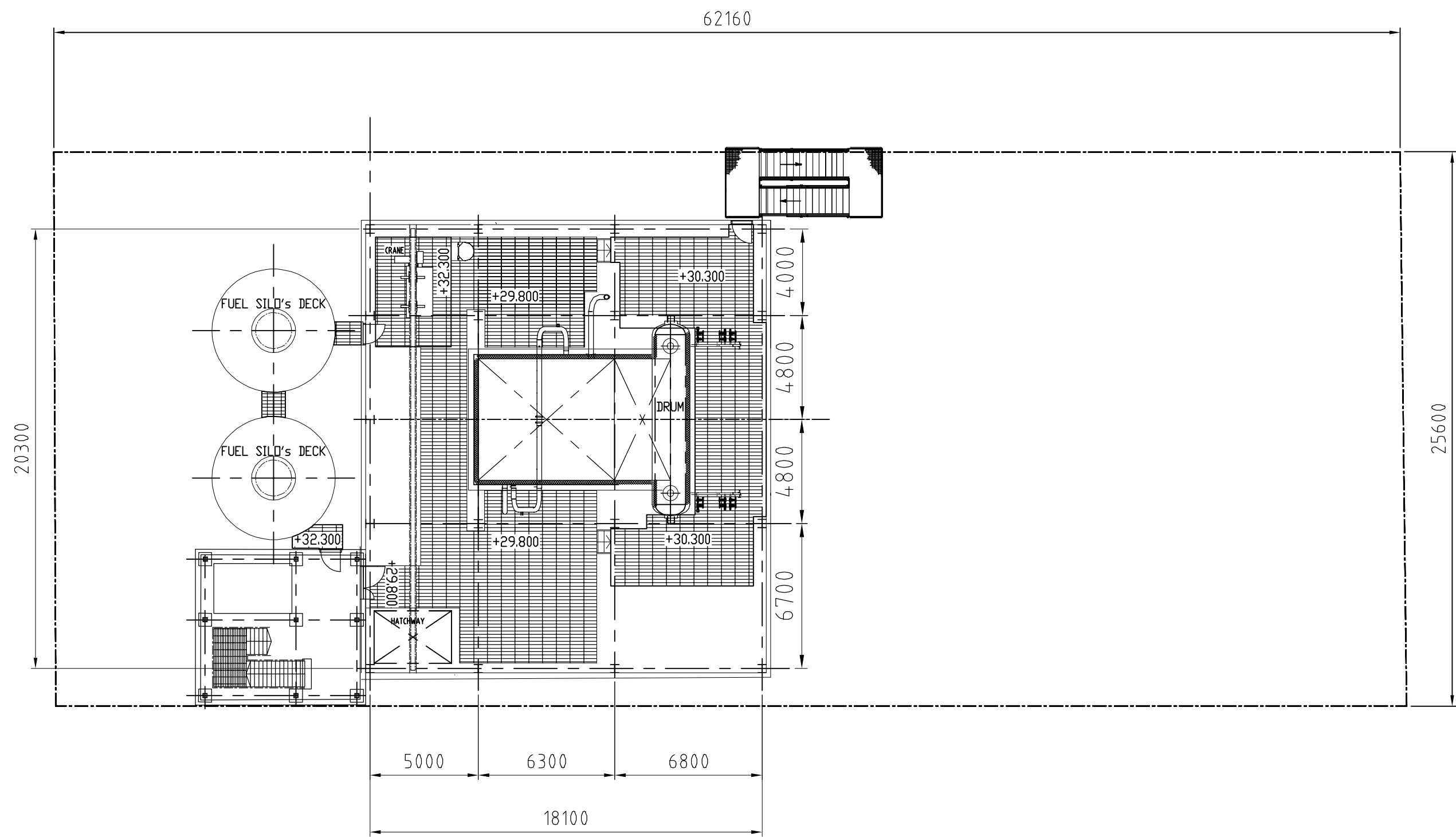


	Concrete platform area	m ²
	Grating area	117 m ²
	Checkered plate area	m ²

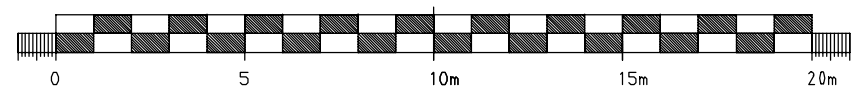


Rev	Revision note	Created by	Checked by	Approved by	Date
0	first issue	HRa	VKai	REte	28.08.2024

Projection method 	General tolerances ISO 2768-mK-E ISO 13 920-BF	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.			Size A 1 Scale 1:200
Proj. no BFB21-00942		Proj. name Sko-Energy s.r.o. Mlada Boleslav, Czech Republic			
Title Valmet BFB Boiler Layout +26.500					
Code MTL 01		Info		Doc.id. MF00749235	Revision 0
Status preliminary					

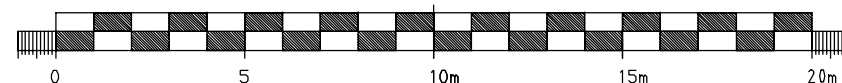
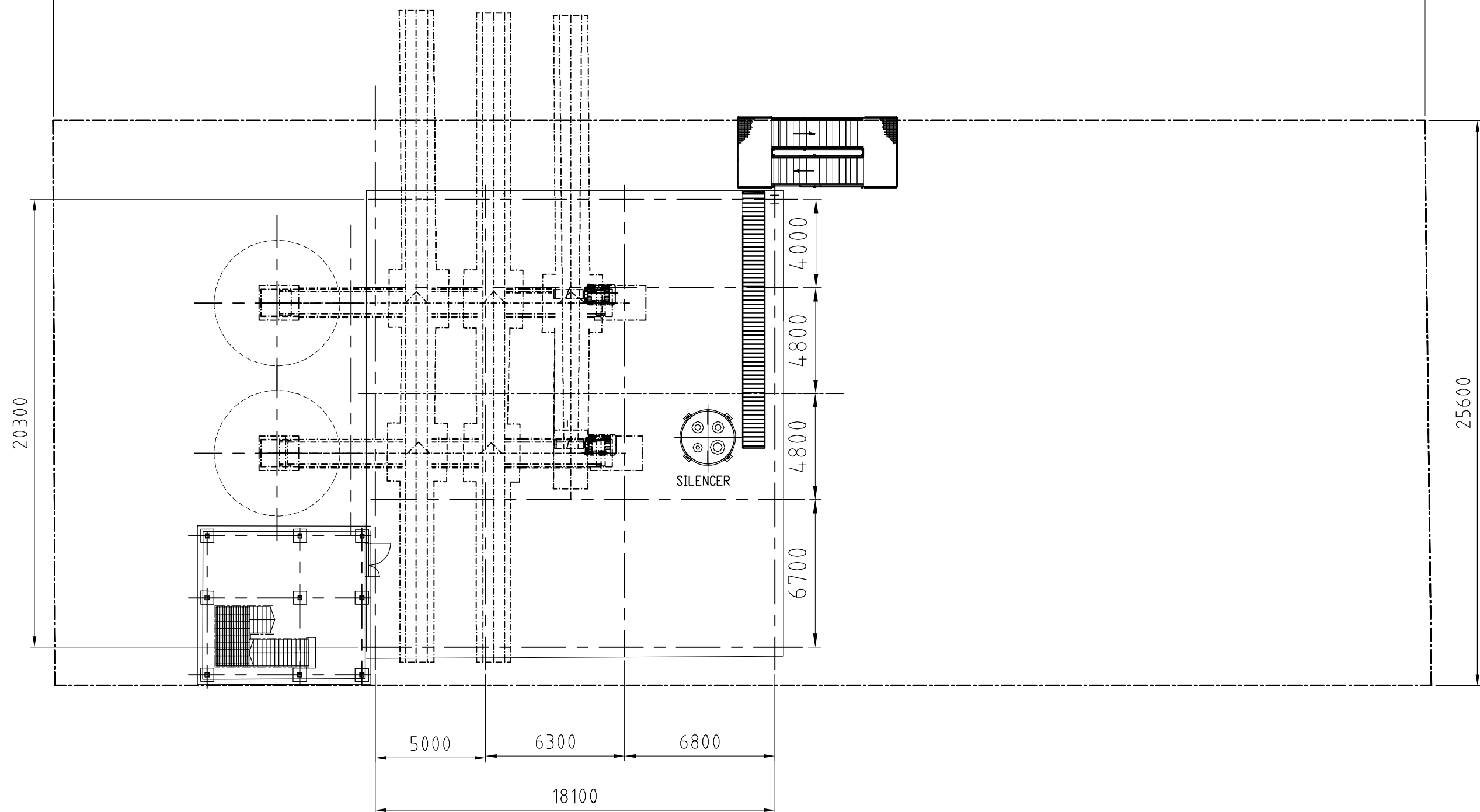


	Concrete platform area	m ²
	Grating area	213 m ²
	Checkered plate area	m ²





Rev	Revision note	Created by	Checked by	Approved by	Date
0	first issue	HRa	VKai	REte	28.08.2024

Projection method 	General tolerances ISO 2768-mK-E ISO 13 920-BF	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.			Size A 1
					Scale 1:200
Proj. no BFB21-00942					
Proj. name Sko-Energy s.r.o. Mlada Boleslav, Czech Republic					
Title Valmet BFB Boiler Layout +29.800					
Code MTL 01		Info		Doc.id. MF00749236	
Status preliminary					Revision 0



Rev	Revision note	Created by	Checked by	Approved by	Date
0	first issue	HRa	VKai	REte	28.08.2024

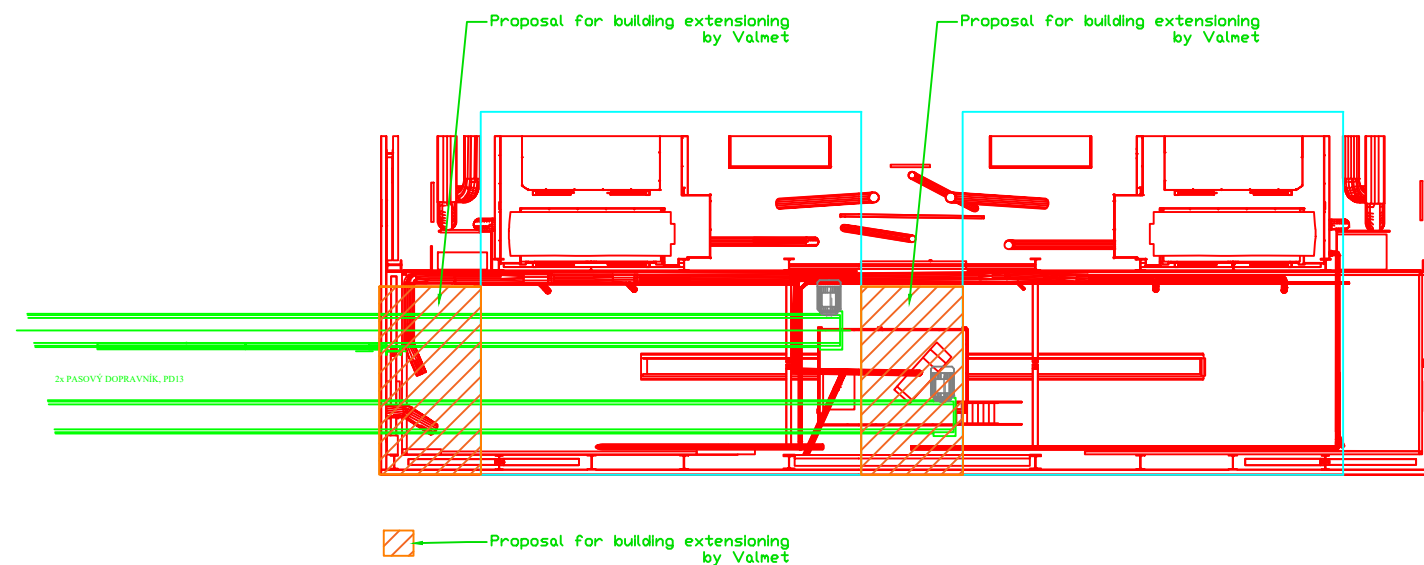
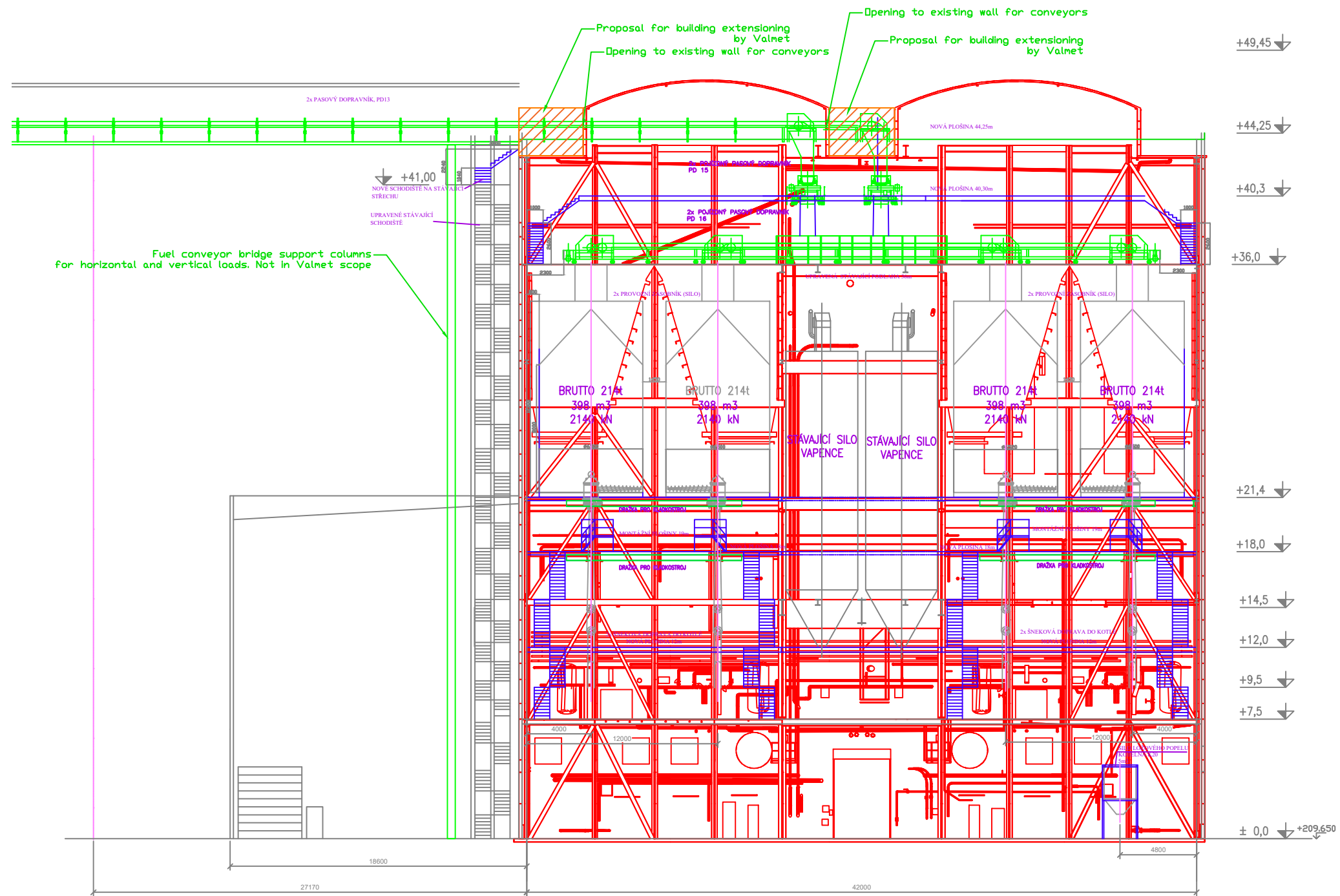
Projection method 	General tolerances ISO 2768-mK-E ISO 13 920-BF	Welding symbols ISO 2553	Assembly Doc	Weight	Volume
				Size A 1	
				Scale 1:200	
This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries and is furnished solely for operating and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to a third party without prior written consent of the company.					
Proj. no BFB21-00942		Proj. name Sko-Energy s.r.o. Mlada Boleslav, Czech Republic			
Title Valmet BFB Boiler Layout Roof +35.600					
Code MTL 01		Info			Doc.id. MF00749237
Status preliminary					Revision 0

Layouts

Title	Number	Rev.
Sideview + Building extension	MF00688744	1
+0,0	MF00688745	0
+7,5	MF00688746	0
+15,0	MF00688748	0

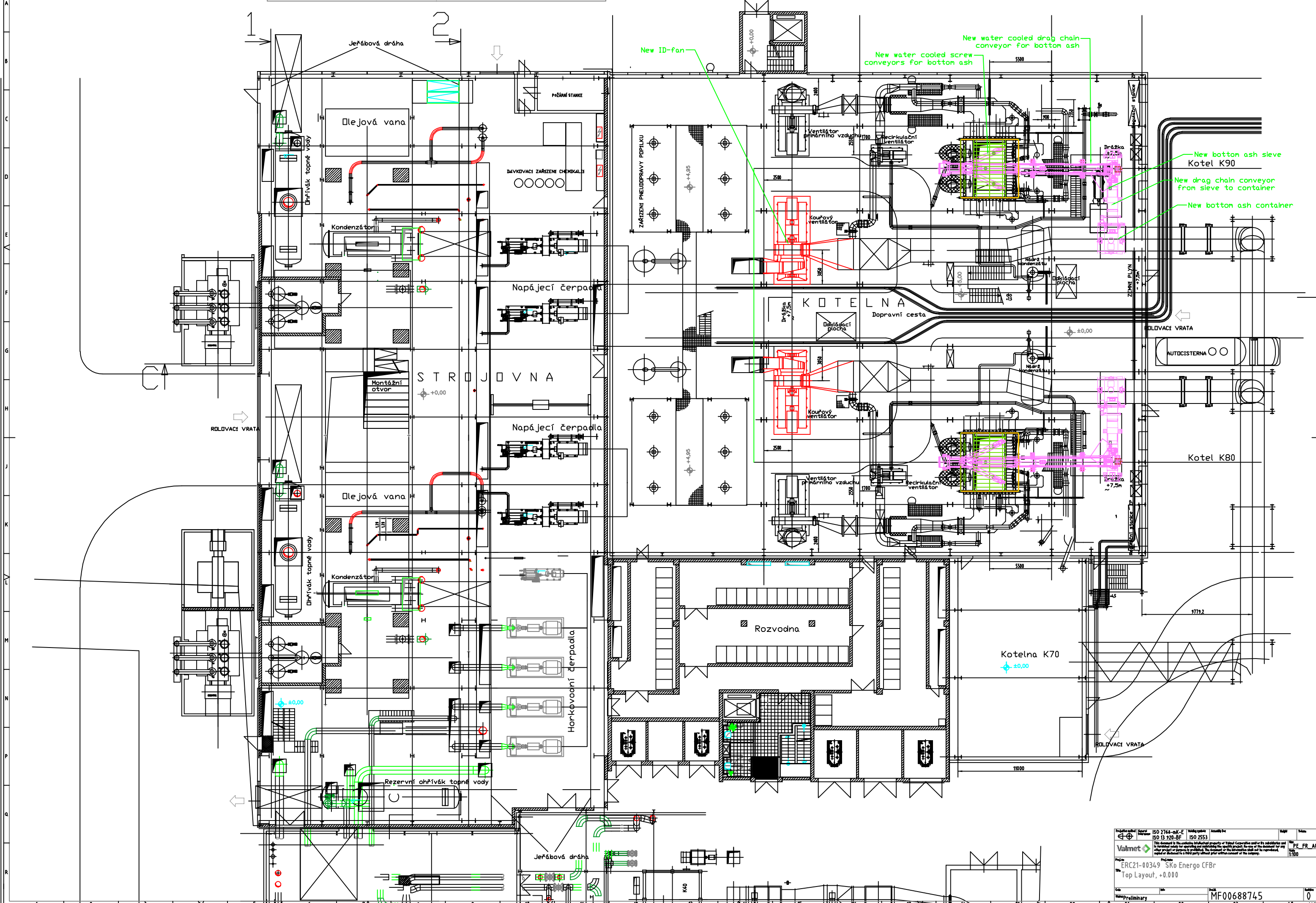
Appendix 19.02 Layouts

ŘEZ A-A



KOTELNA - PODLAŽÍ + 0,000

Rev.	Revizní info	Created by	Checked by	Approved by	Date
I	First issue	TMI			12.03.2024

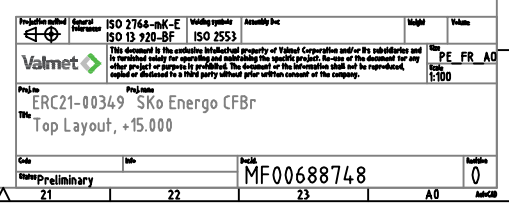


Production code: ISO 2768-MK-E Valmet logo Project: ERC21-00349 SKo Energo CFBr Title: Top Layout, +0.000 Status: Preliminary	Assembly code: ISO 13 920-BF Valmet logo Project: SKo Energo CFBr Title: Top Layout, +0.000 Status: Preliminary	Sheet: PE_FR_A0 Scale: 1:100 Drawing number: MF00688745 Version: 0
---	---	---

KOTELNA - PODLAŽÍ + 7,500



21		22		23		24	
Rev	Revision note	Created by	Created by	Approved by	Date		
1	First Issue	THB			12.03.2024		





TENDER DOCUMENTATION FOR SELECTION OF THE CONTRACTOR

Refurbishment of the Combined Heat and Power Plant
in Mladá Boleslav

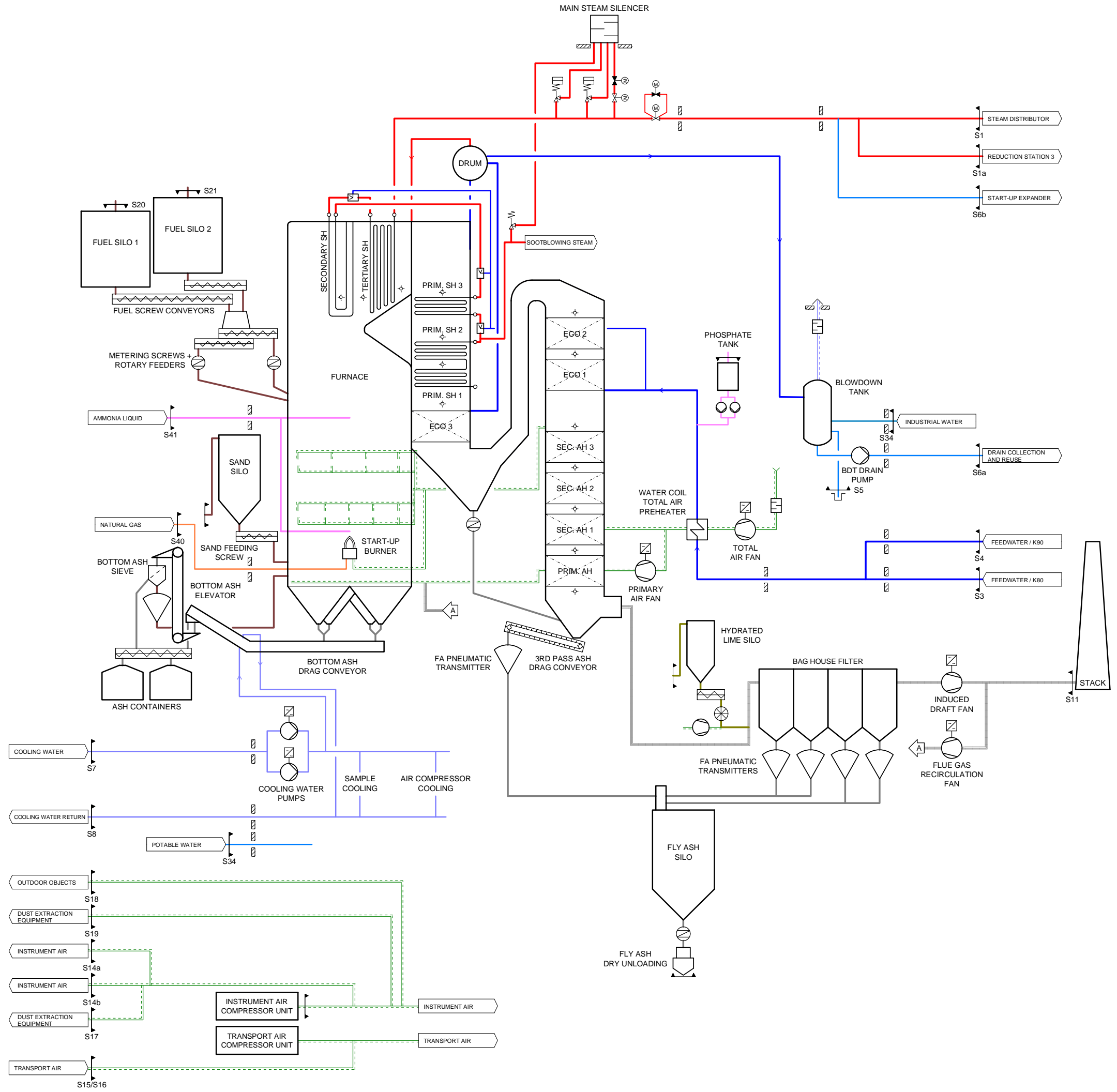
Business Package OB 2

BOILER HOUSES, BIOMASS BOILER K20

VOLUME III ***TECHNICAL REQUIREMENTS***

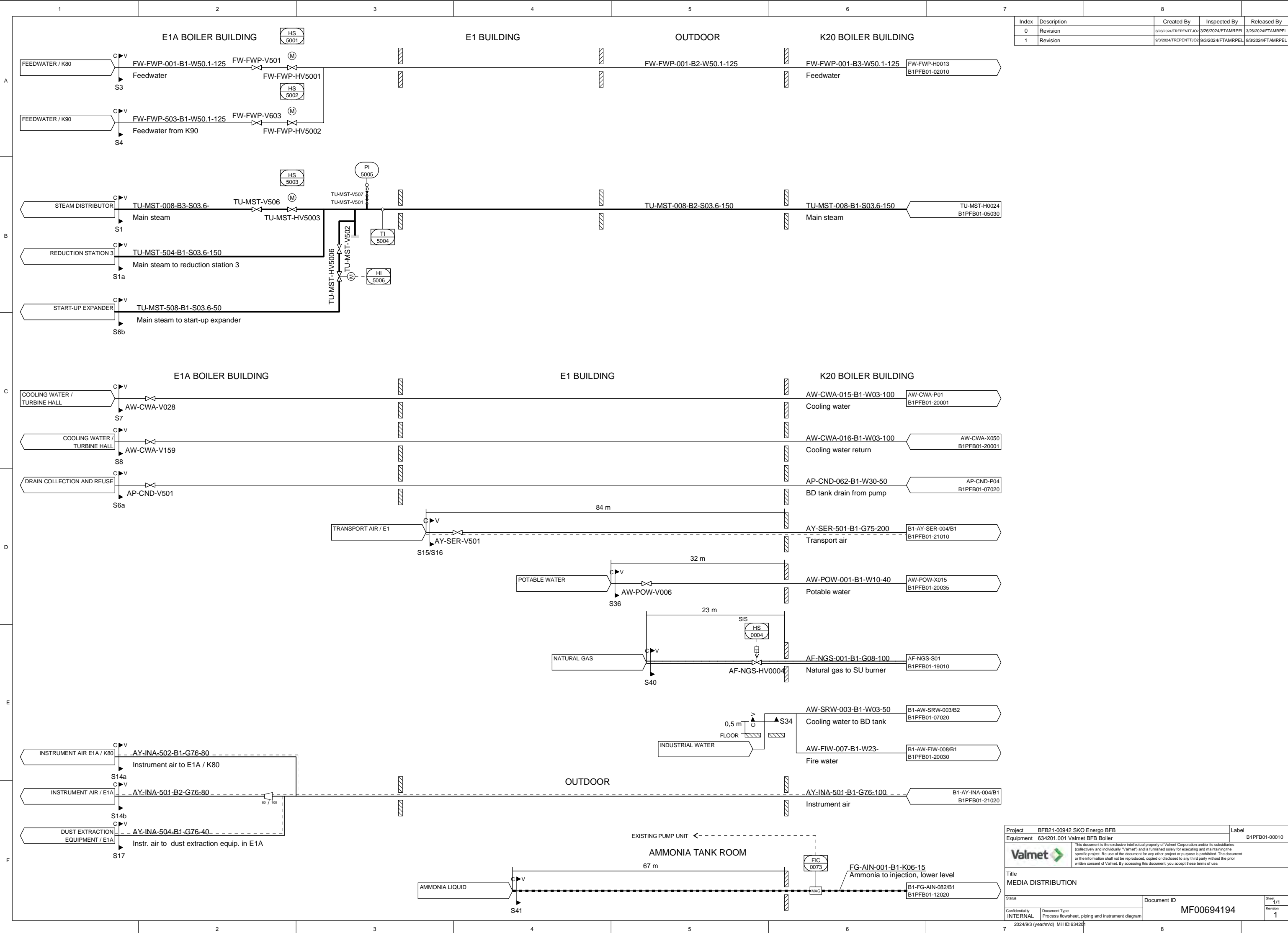
Annex 20 Flowsheets

Index	Description	Created By	Inspected By	Released By
0	Revision	09/20/24/TRE PENTTJL00	03/20/24/T TAMPEL	09/20/24/T TAMPEL
1	Revision	03/20/24/TRE PENTTJL00	03/20/24/T TAMPEL	03/20/24/T TAMPEL

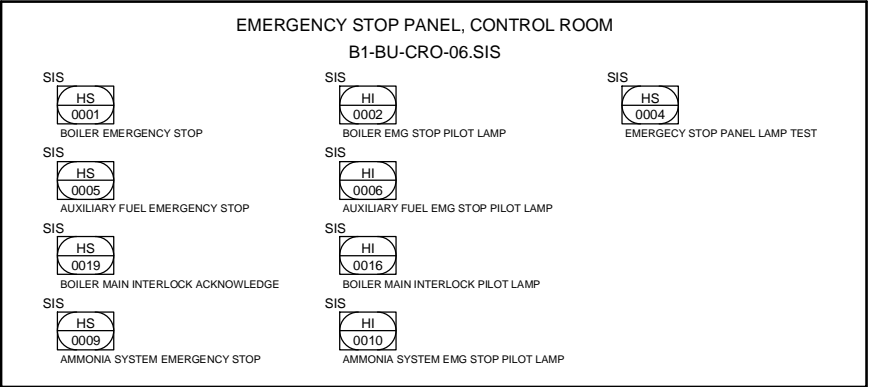
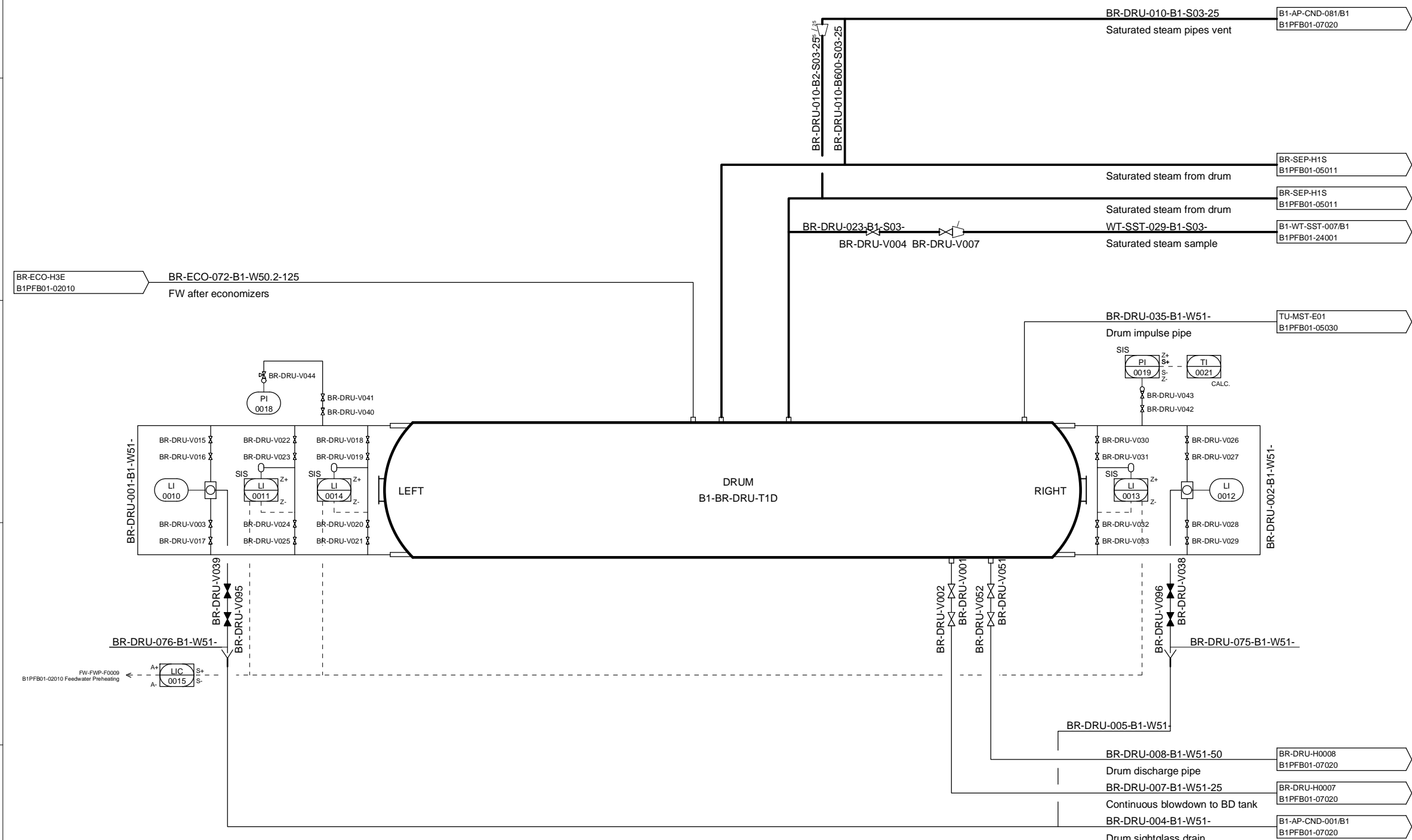



Project	BFB21-00942 SKO Energo BFB	Label	B1PFB03-0401
Equipment	634201.001 Valmet BFB Boiler		
This document is the exclusive intellectual property of Valmet Corporation and its subsidiaries (collectively and individually, "Valmet") and is furnished solely for executing and maintaining the specific project. The use of this document for other project or purposes is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.			
Title BFB BOILER MAIN PROCESS DIAGRAM			
Status	Document Type	Document ID	Page 1 of 1
INTERNAL	Block and process flow diagram	MF00694191	Revision 1
2024/9/3 (year:month) M8 ID:634201			

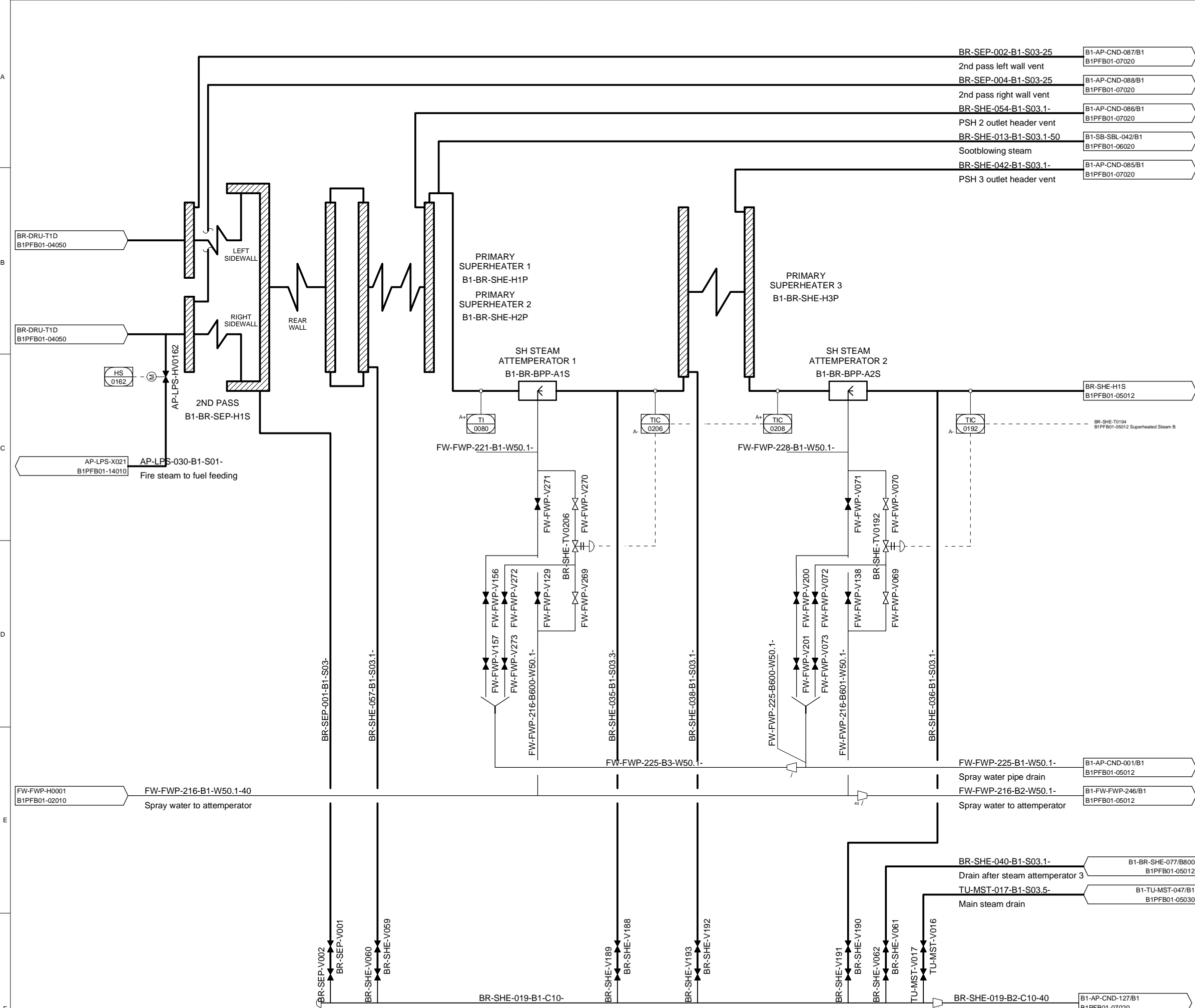
CUSTOMER VALMET



Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPTTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPTTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL



Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-04050	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
SATURATED STEAM					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00694197			Revision 1



Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPTTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPTTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

ProjectBFB21-00942 SKO Energo BFB

Equipment634201.001 Valmet BFB Boiler

LabelB1PFB01-05011

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.

TitleSUPERHEATED STEAM A

Status

Document IDMF00694198

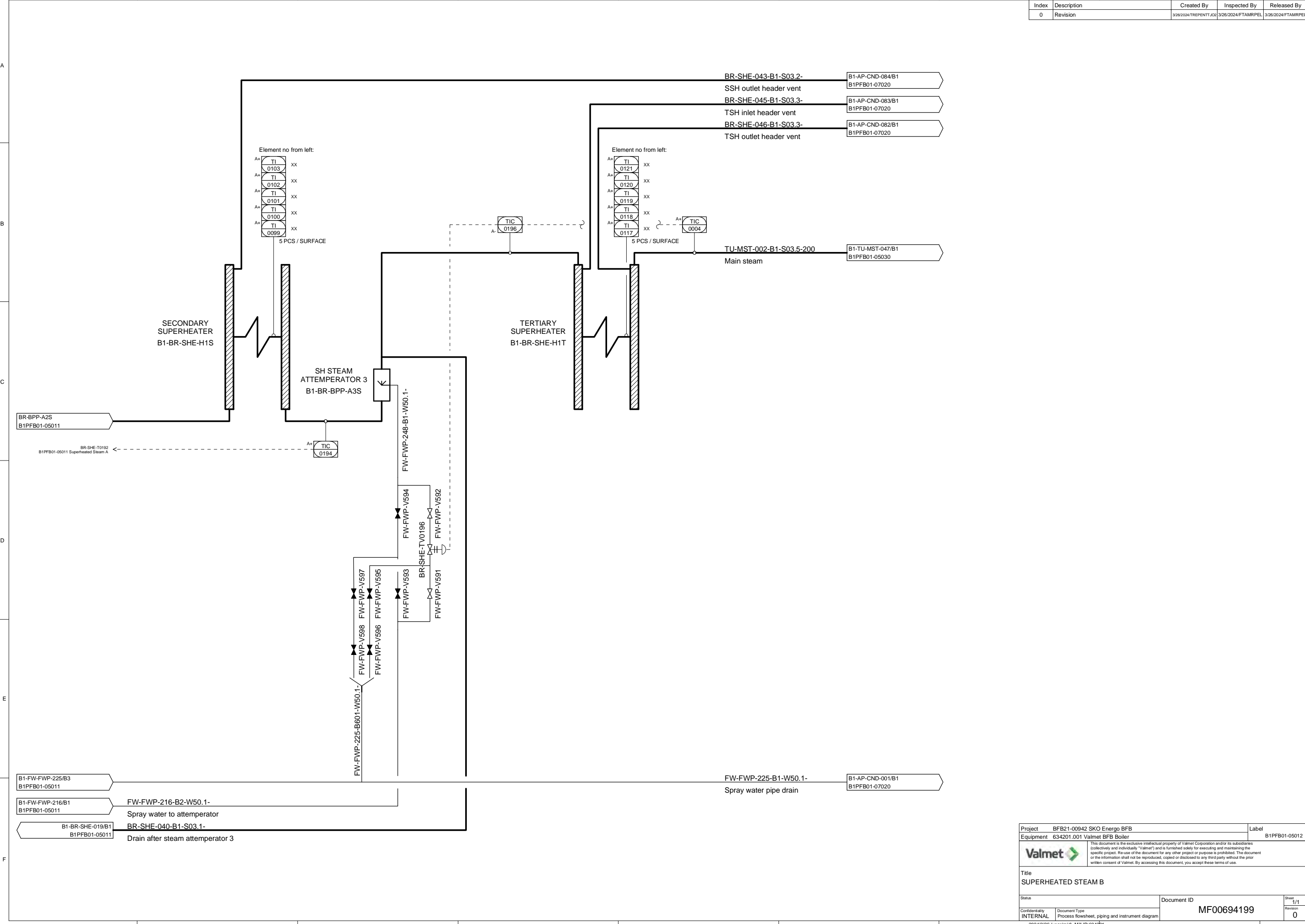
ConfidentialityINTERNAL

Document TypeProcess flowsheet, piping and instrument diagram


Sheet1/1

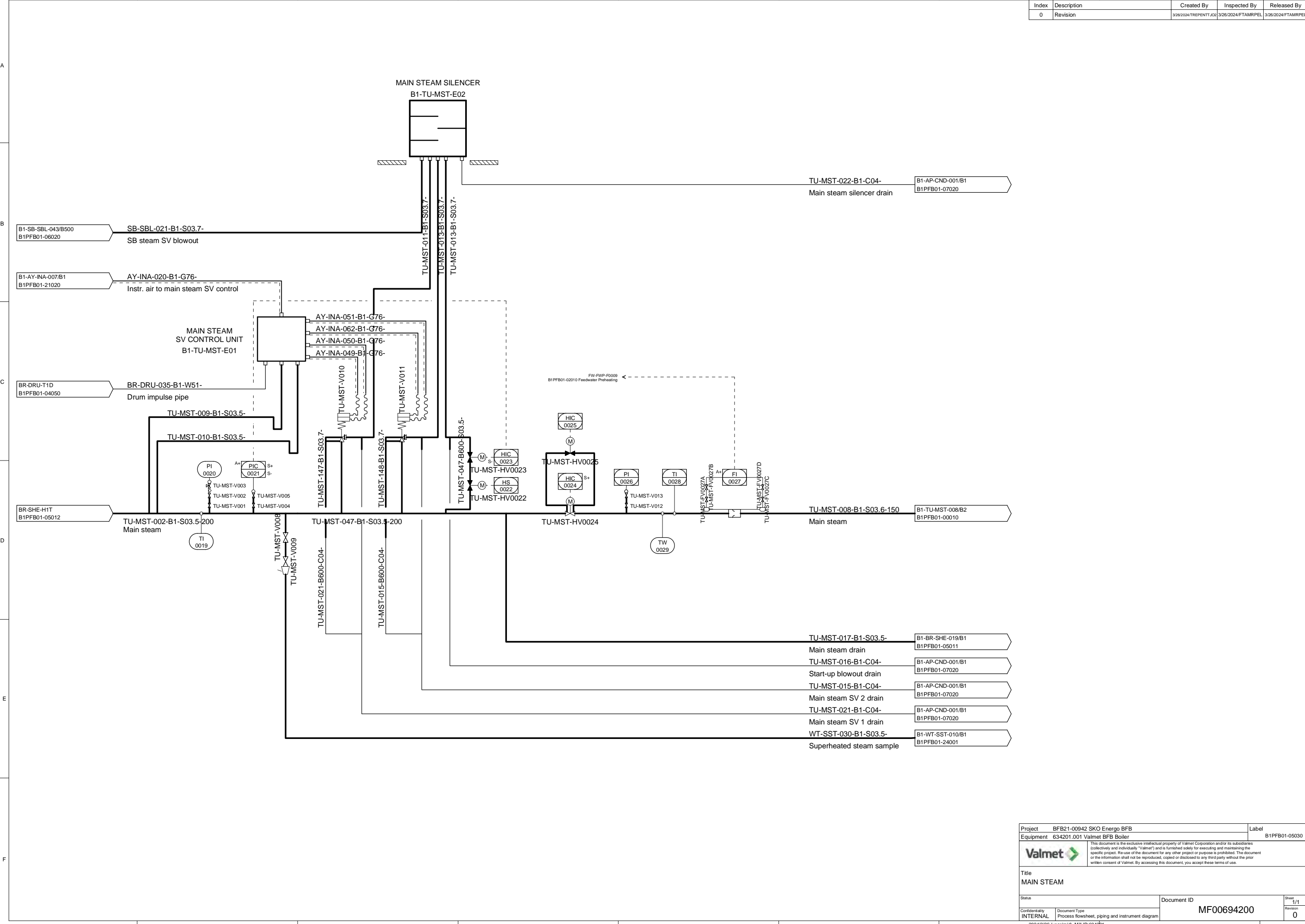
Revision1

2024/9/3 (year/m/d) Mill ID:634201




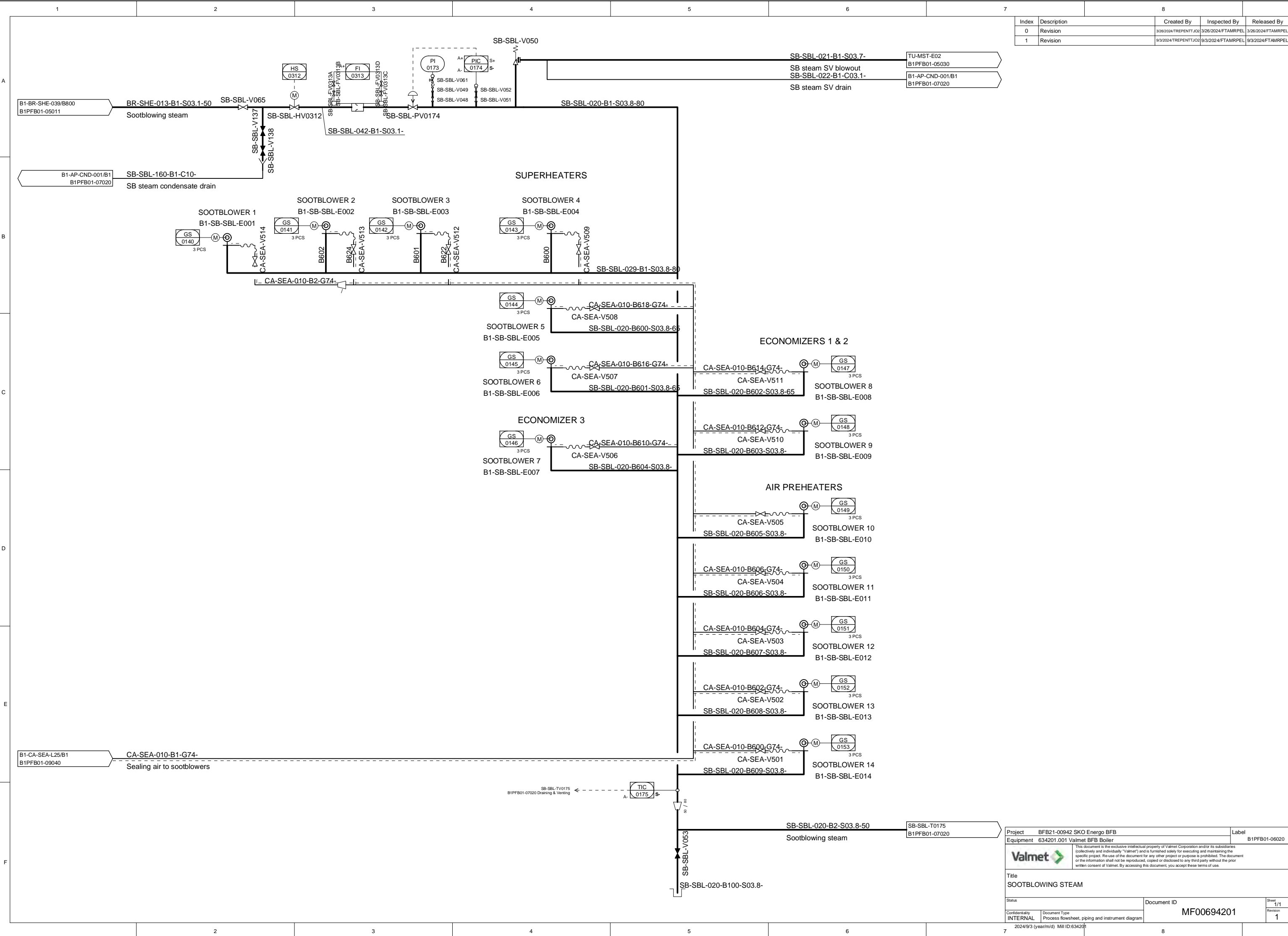
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TRENTT.J02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL

Project		BFB21-00942 SKO Energo BFB	Label	B1PFB01-05012
Equipment		634201.001 Valmet BFB Boiler		
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>		
Title				
SUPERHEATED STEAM B				
Status		Document ID		Sheet 1/1
Confidentiality	Document Type	MF00694199		Revision
INTERNAL	Process flowsheet, piping and instrument diagram			0




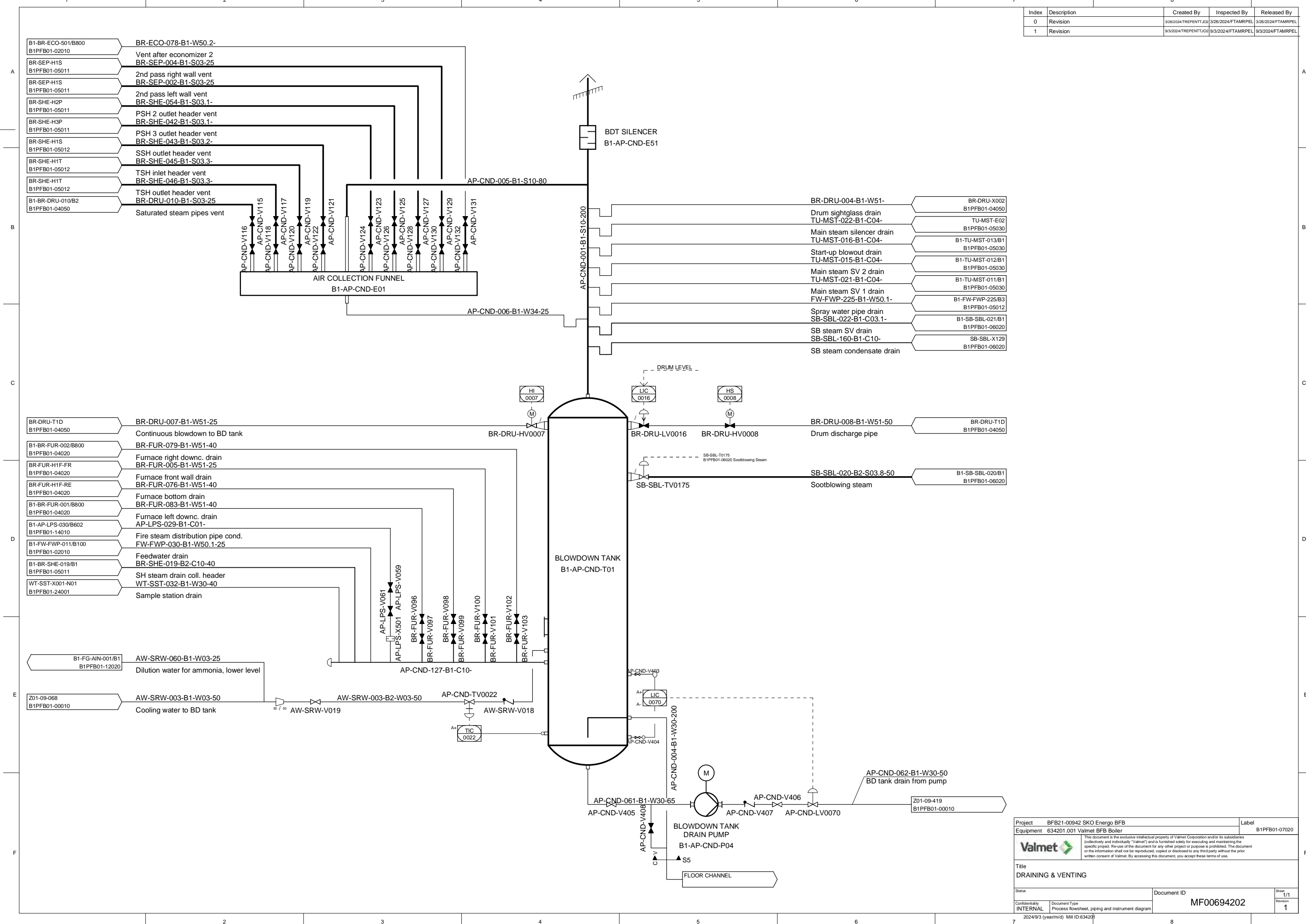
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTYJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL

Project BFB21-00942 SKO Energo BFB		Label B1PFB01-05030	
Equipment 634201.001 Valmet BFB Boiler			
		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.	
Title MAIN STEAM			
Status	Document ID		Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00694200	
2024/3/26 (year/m/d) M&I ID:634201		Revision 0	




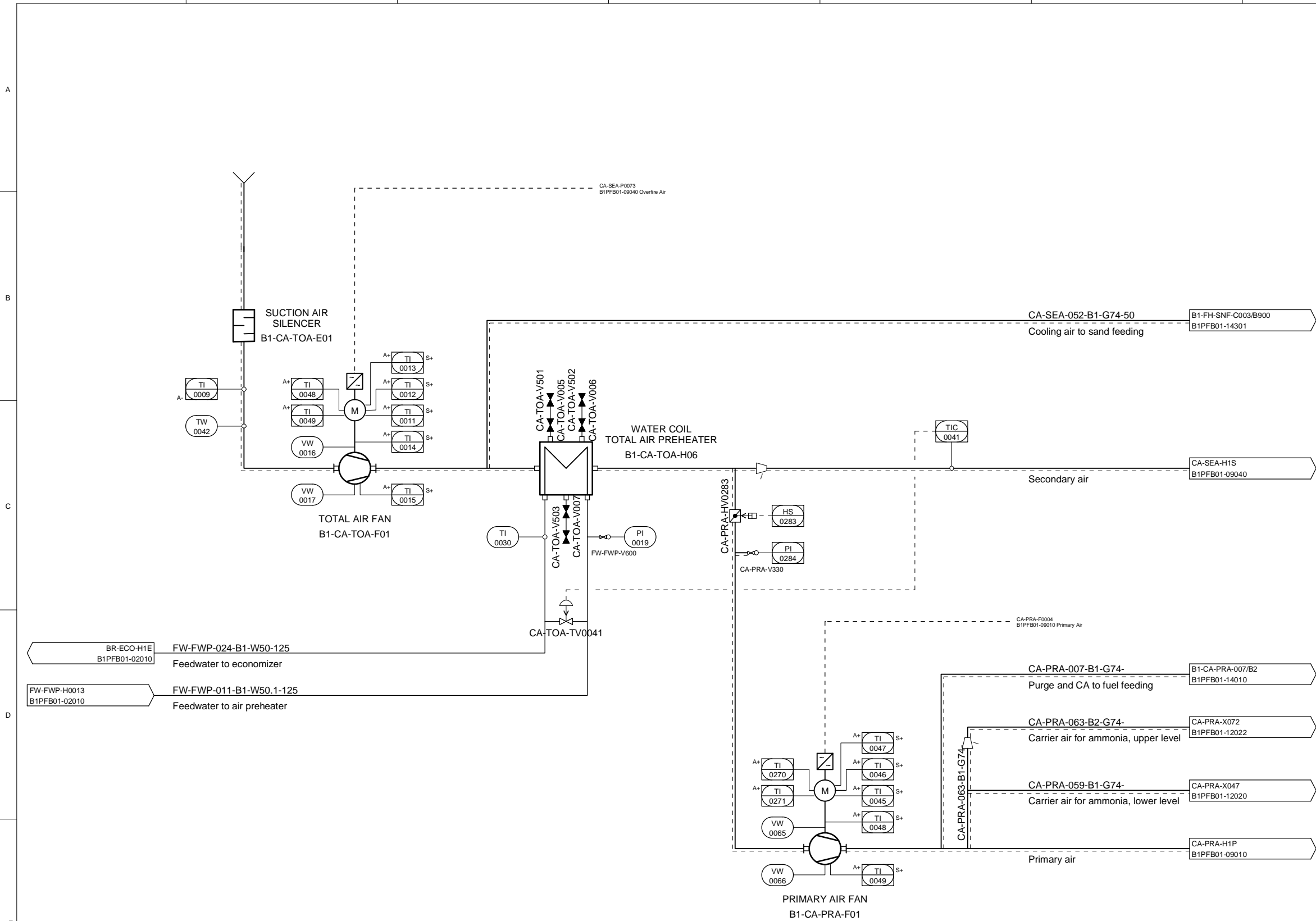
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPTTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPTTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

Project BFB21-00942 SKO Energo BFB		Label
Equipment 634201.001 Valmet BFB Boiler		B1PFB01-06020
<div><div></div><div>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</div></div>		
Title		
SOOTBLOWING STEAM		
Status		Document ID
		Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00694201
		Revision 1




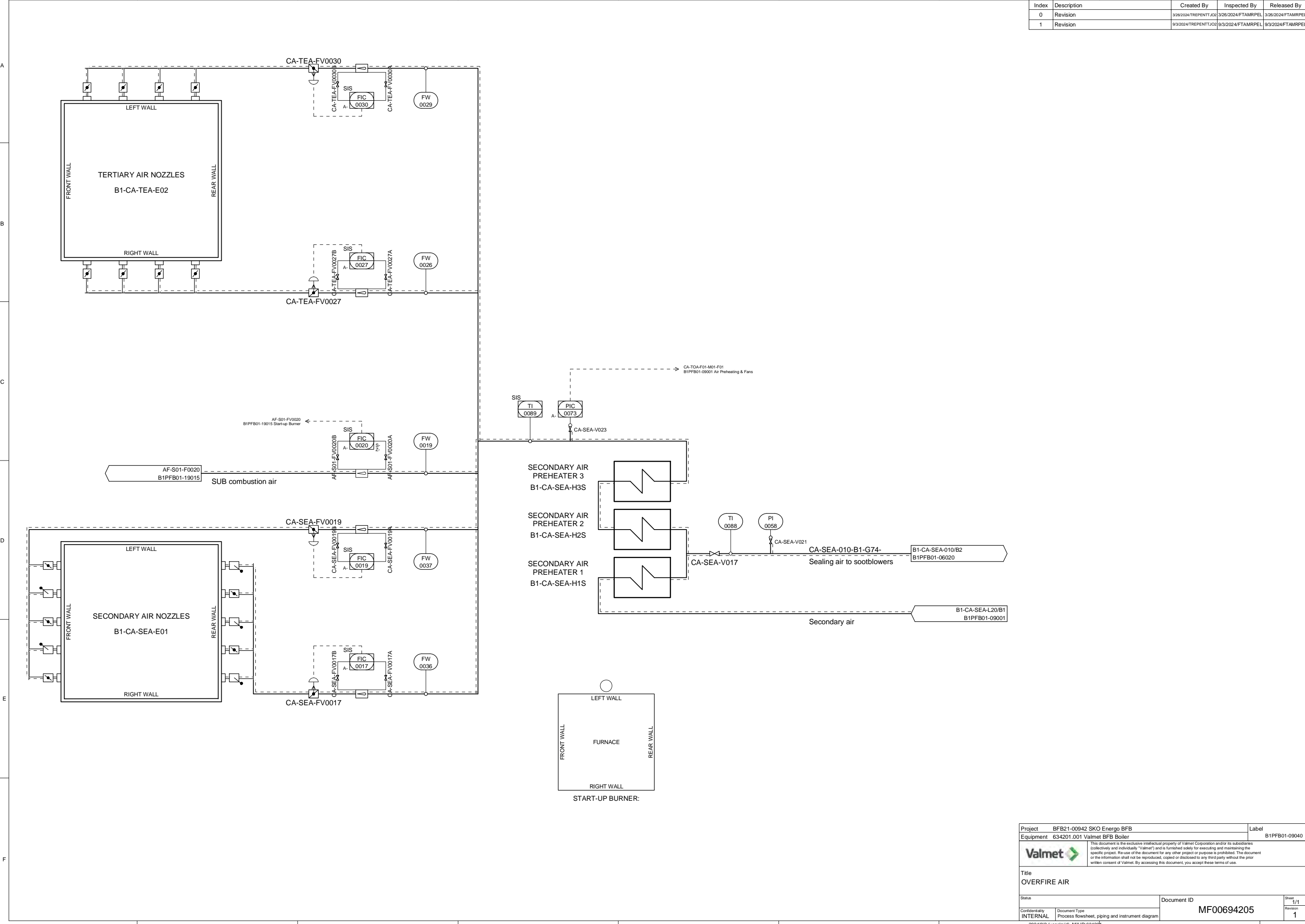
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-07020	
		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.			
Title					
DRAINING & VENTING					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00694202			Revision 1




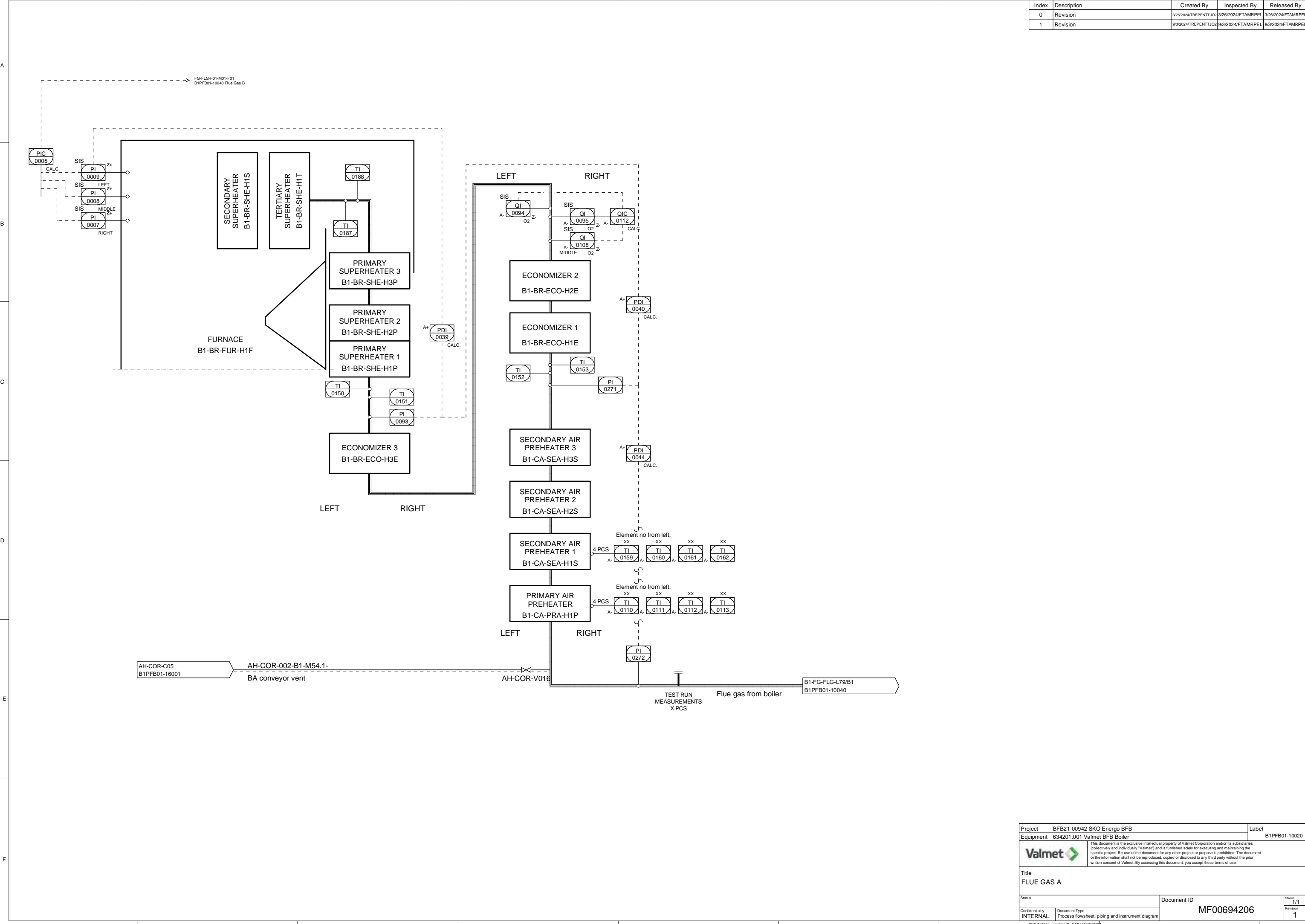
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-09001	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
AIR PREHEATING & FANS					
Status		Document ID		Sheet	
				1/1	
Confidentiality		MF00694203		Revision	
INTERNAL				1	
Document Type					
Process flowsheet, piping and instrument diagram					
2024/9/3 (year/m/d) Mill ID:634201					




Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

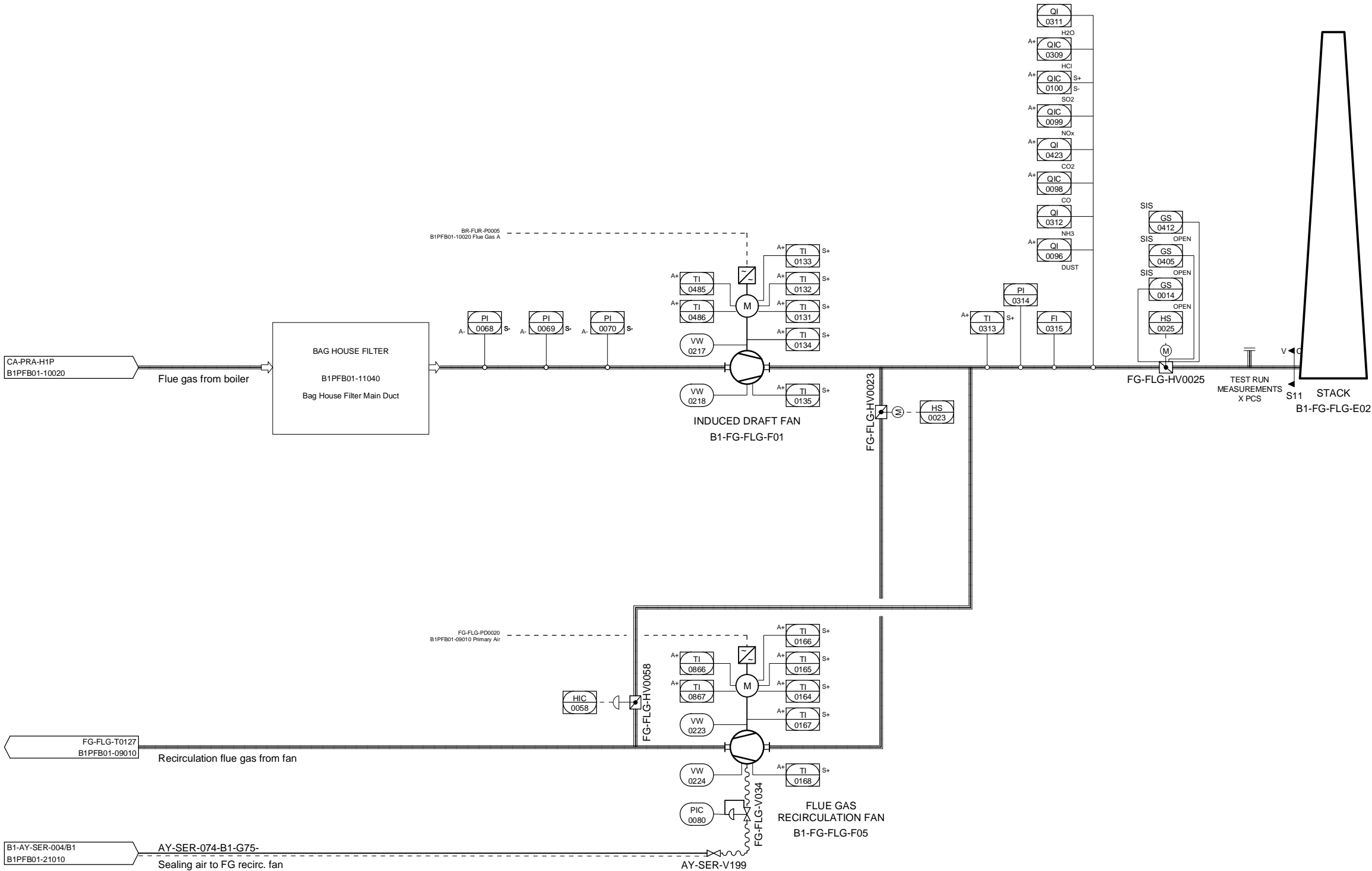
Project		BFB21-00942 SKO Energo BFB	Label	
Equipment		634201.001 Valmet BFB Boiler	B1PFB01-09040	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>		
Title				
OVERFIRE AIR				
Status		Document ID		Sheet 1/1
Confidentiality	Document Type	MF00694205		Revision 1
INTERNAL	Process flowsheet, piping and instrument diagram			




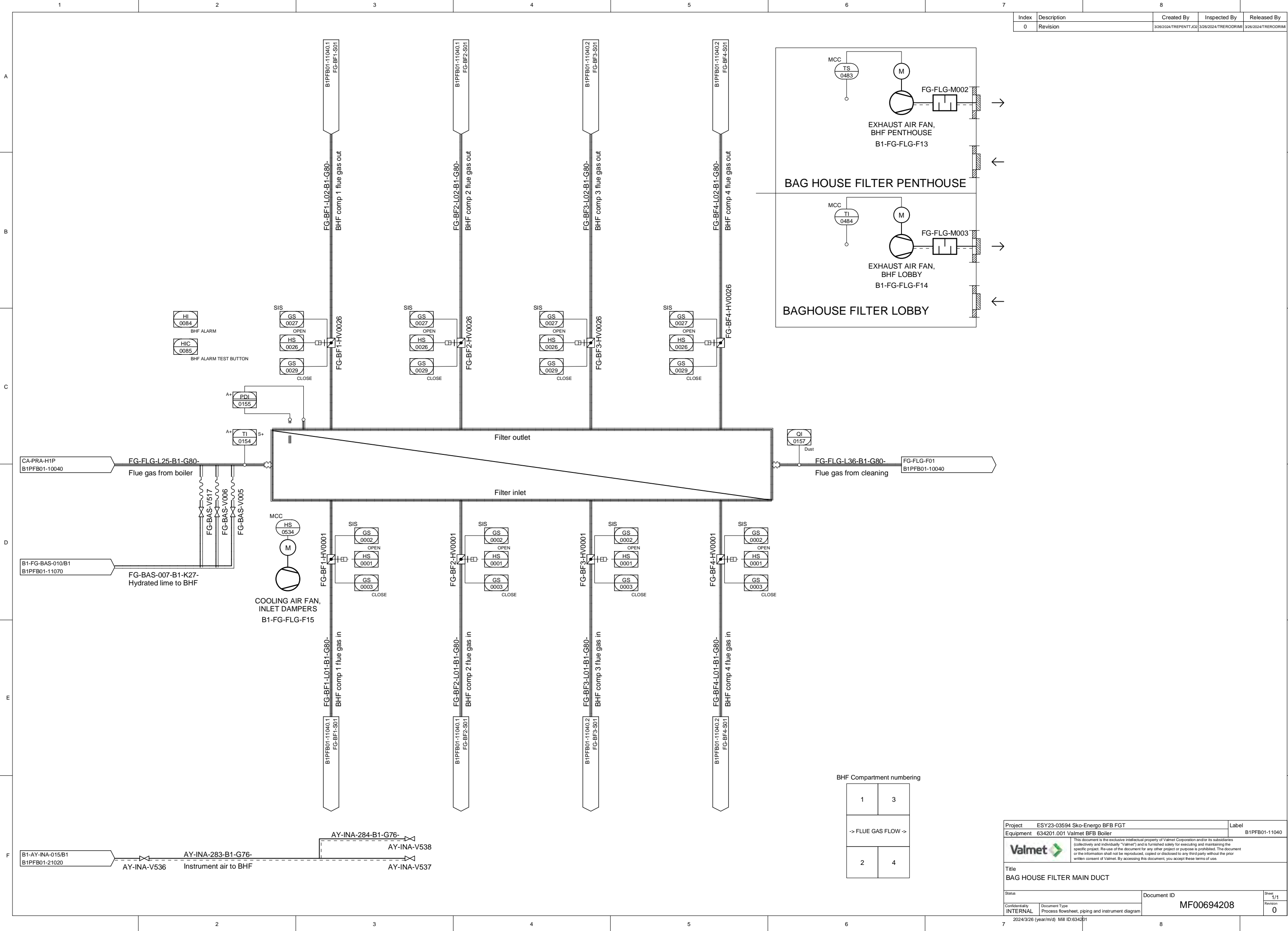
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ.O2	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ.O2	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-10020	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
FLUE GAS A					
Status		Document ID		Sheet 1/1	
Confidentiality INTERNAL		Document Type Process flowsheet, piping and instrument diagram		Revision 1	
		MF00694206			

Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL



Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-10040	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
FLUE GAS B					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL		MF00694207			Revision 1
Document Type Process flowsheet, piping and instrument diagram					

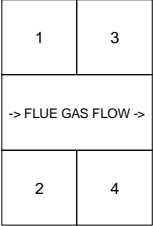



Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTY.J02	3/26/2024/TREODRIM	3/26/2024/TREODRIM

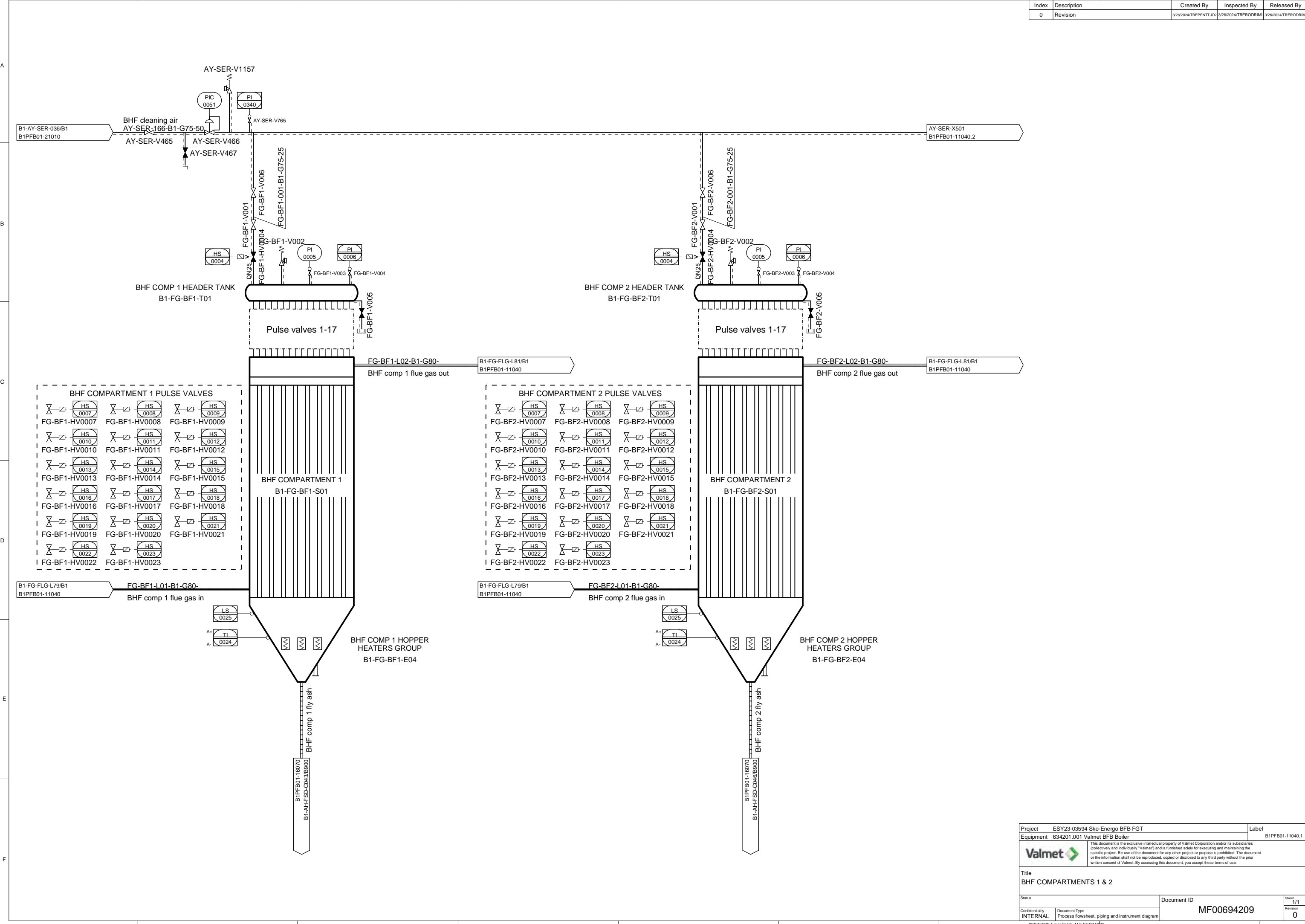
BAG HOUSE FILTER PENTHOUSE

BAGHOUSE FILTER LOBBY

BHF Compartment numbering



Project ESY23-03594 Sko-Energo BFB FGT		Label	
Equipment 634201.001 Valmet BFB Boiler		B1PFB01-11040	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>	
Title			
BAG HOUSE FILTER MAIN DUCT			
Status		Document ID	Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00694208	Revision 0



Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TRENTT.J02	3/26/2024/TREODRIM	3/26/2024/TREODRIM

Project

ESY23-03594 Sko-Energo BFB FGT

Label

B1PFB01-11040.1

Equipment

634201.001 Valmet BFB Boiler

Valmet

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.

Title

BHF COMPARTMENTS 1 & 2

Status

INTERNAL

Document ID

MF00694209

Sheet

1/1

Revision

0

Confidentiality

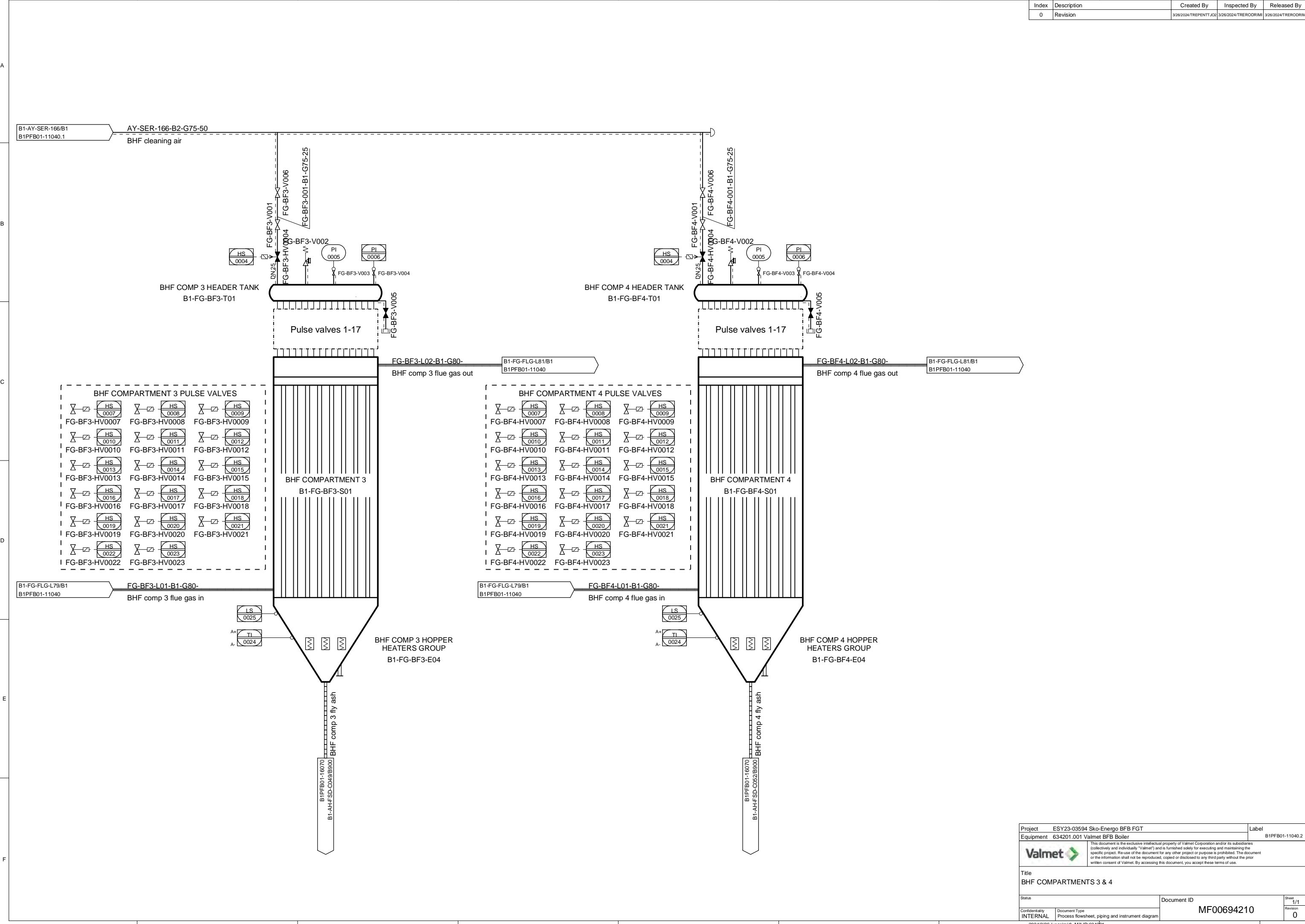
INTERNAL

Document Type


Process flowsheet, piping and instrument diagram

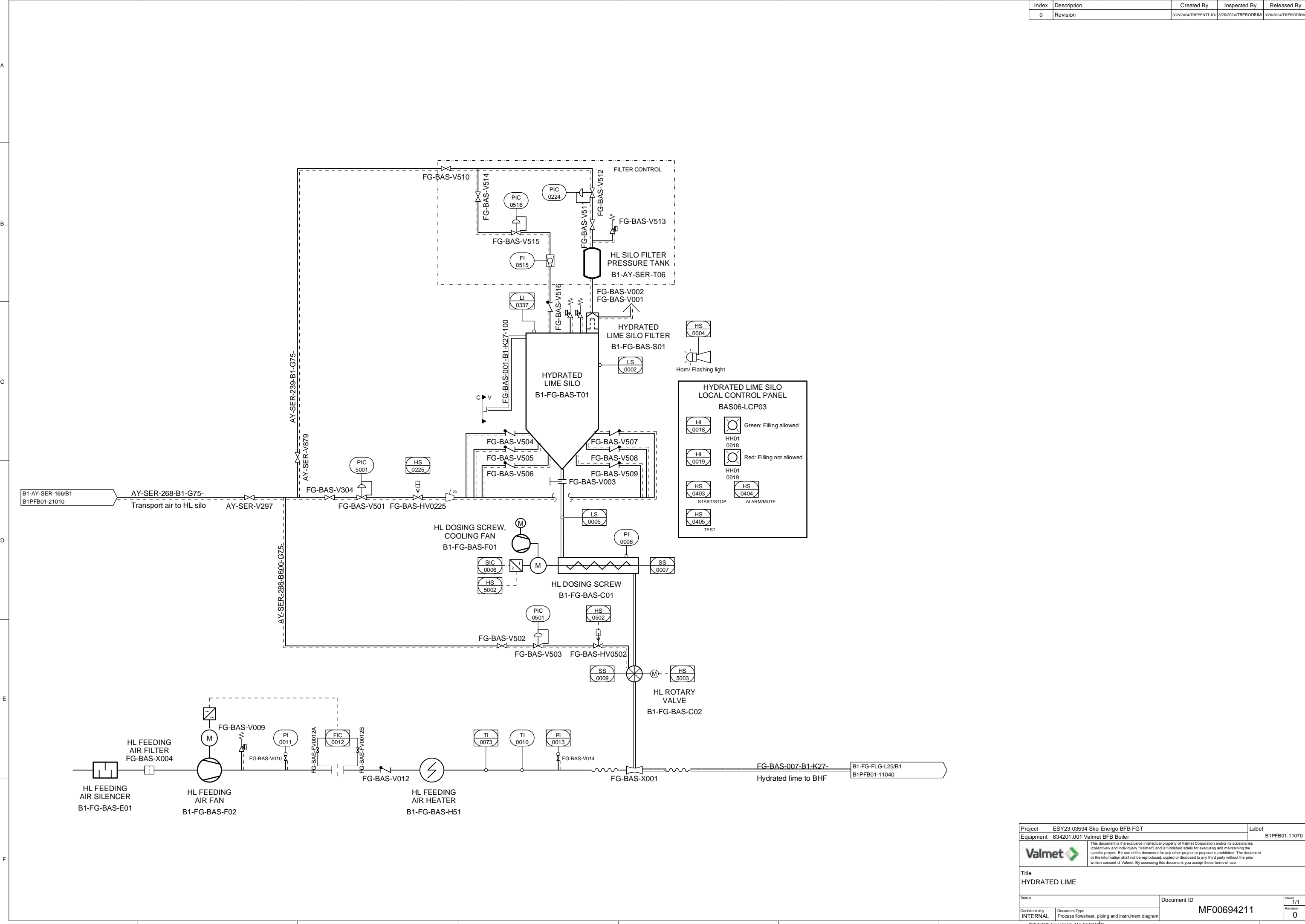
2024/3/26 (year/m/d)

MIL ID:634201



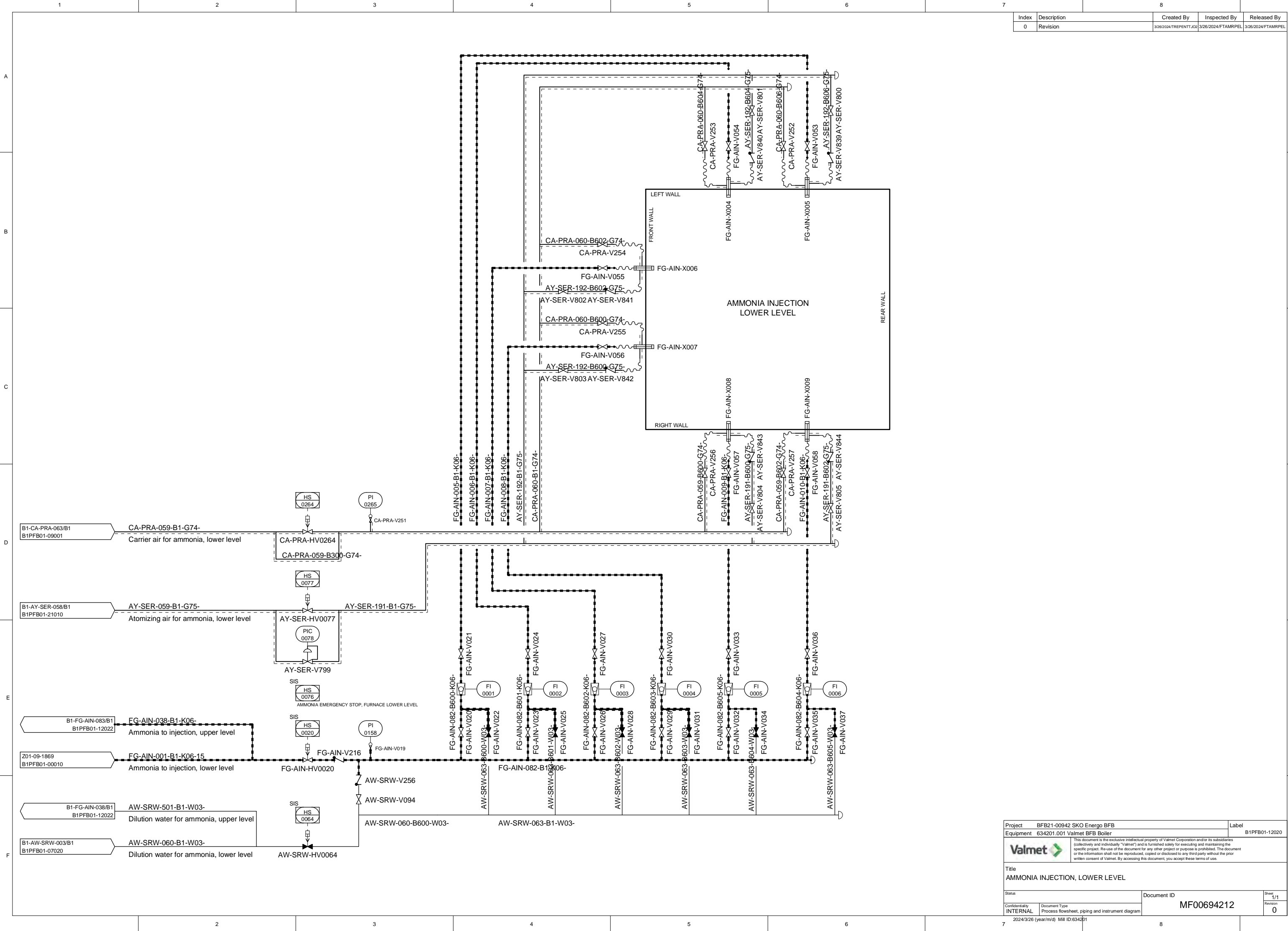
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TRENTT.J02	3/26/2024/TREODRIM	3/26/2024/TREODRIM

Project ESY23-03594 Sko-Energo BFB FGT		Label	
Equipment 634201.001 Valmet BFB Boiler		B1PFB01-11040.2	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>	
Title			
BHF COMPARTMENTS 3 & 4			
Status		Document ID	
Confidentiality INTERNAL		MF00694210	
Document Type Process flowsheet, piping and instrument diagram		Sheet 1/1 Revision 0	




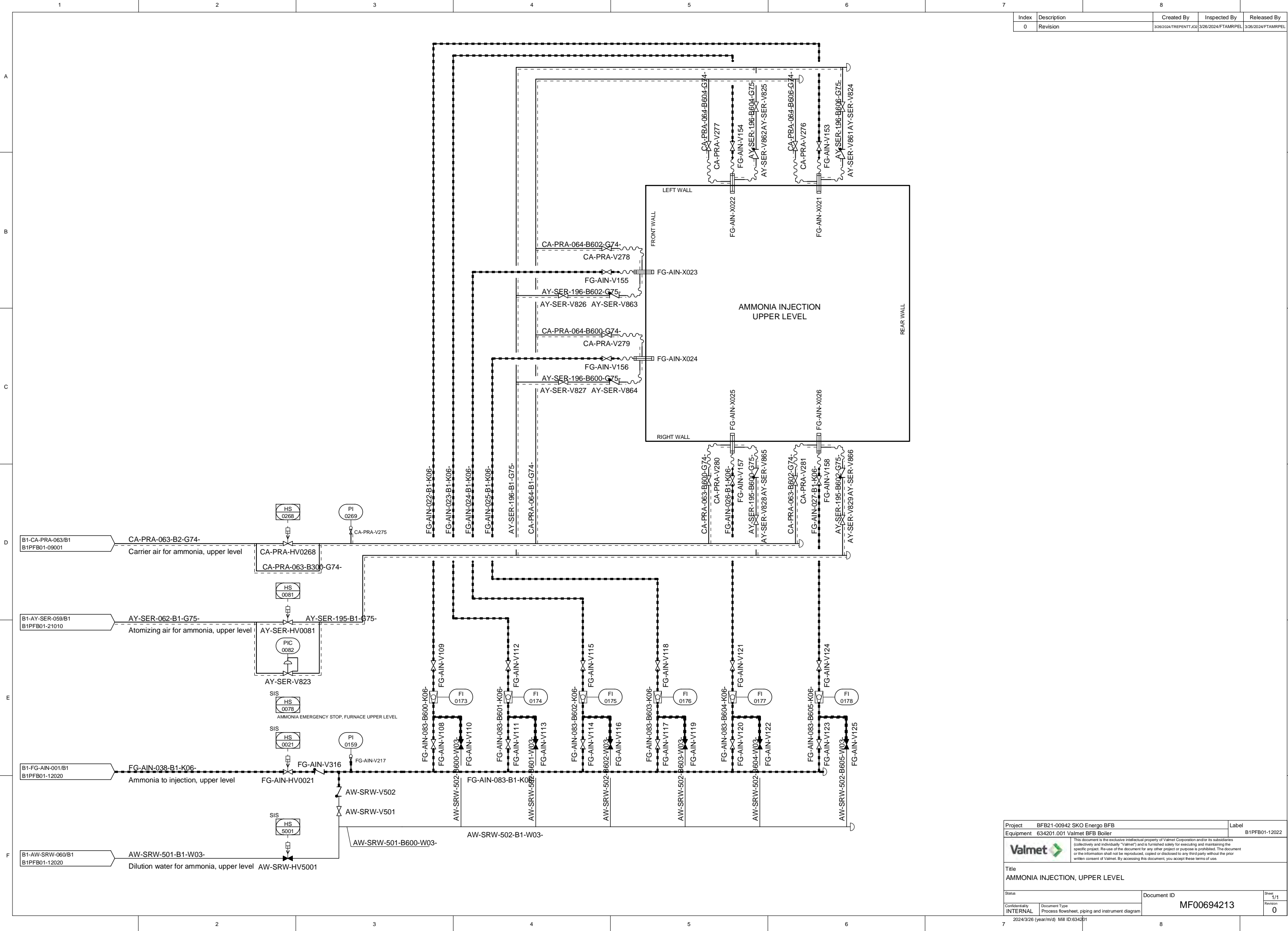
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTYJ02	3/26/2024/TREODRIM	3/26/2024/TREODRIM

Project ESY23-03594 Sko-Energo BFB FGT		Label B1PFB01-11070
Equipment 634201.001 Valmet BFB Boiler		
<div>Valmet</div>		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>
Title HYDRATED LIME		
Status	Document ID MF00694211	Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	Revision 0




Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTYJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL

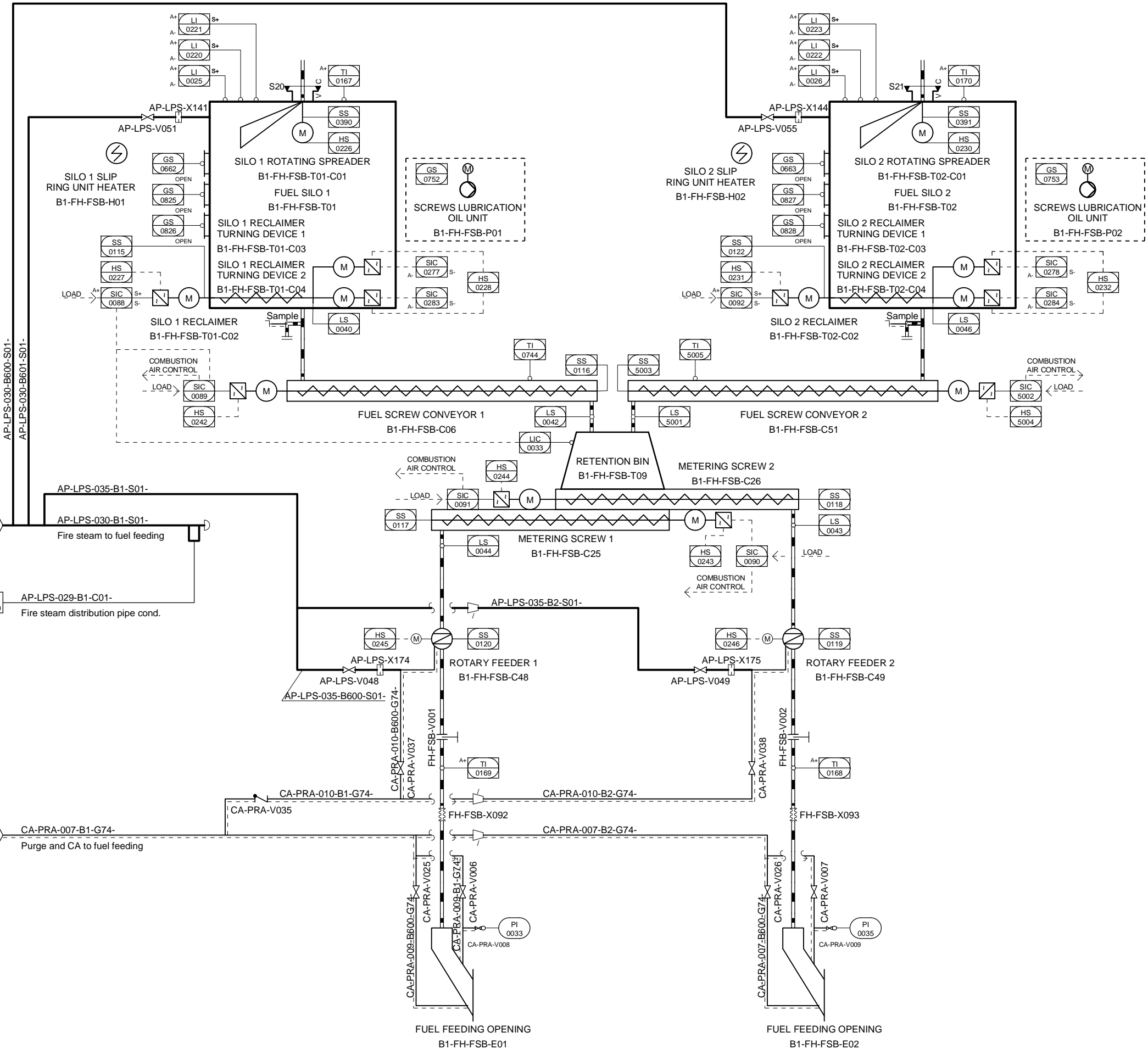
Project BFB21-00942 SKO Energo BFB		Label B1PFB01-12020
Equipment 634201.001 Valmet BFB Boiler		
<div></div>		<div>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</div>
Title AMMONIA INJECTION, LOWER LEVEL		
Status		Document ID MF00694212
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	Sheet 1/1 Revision 0




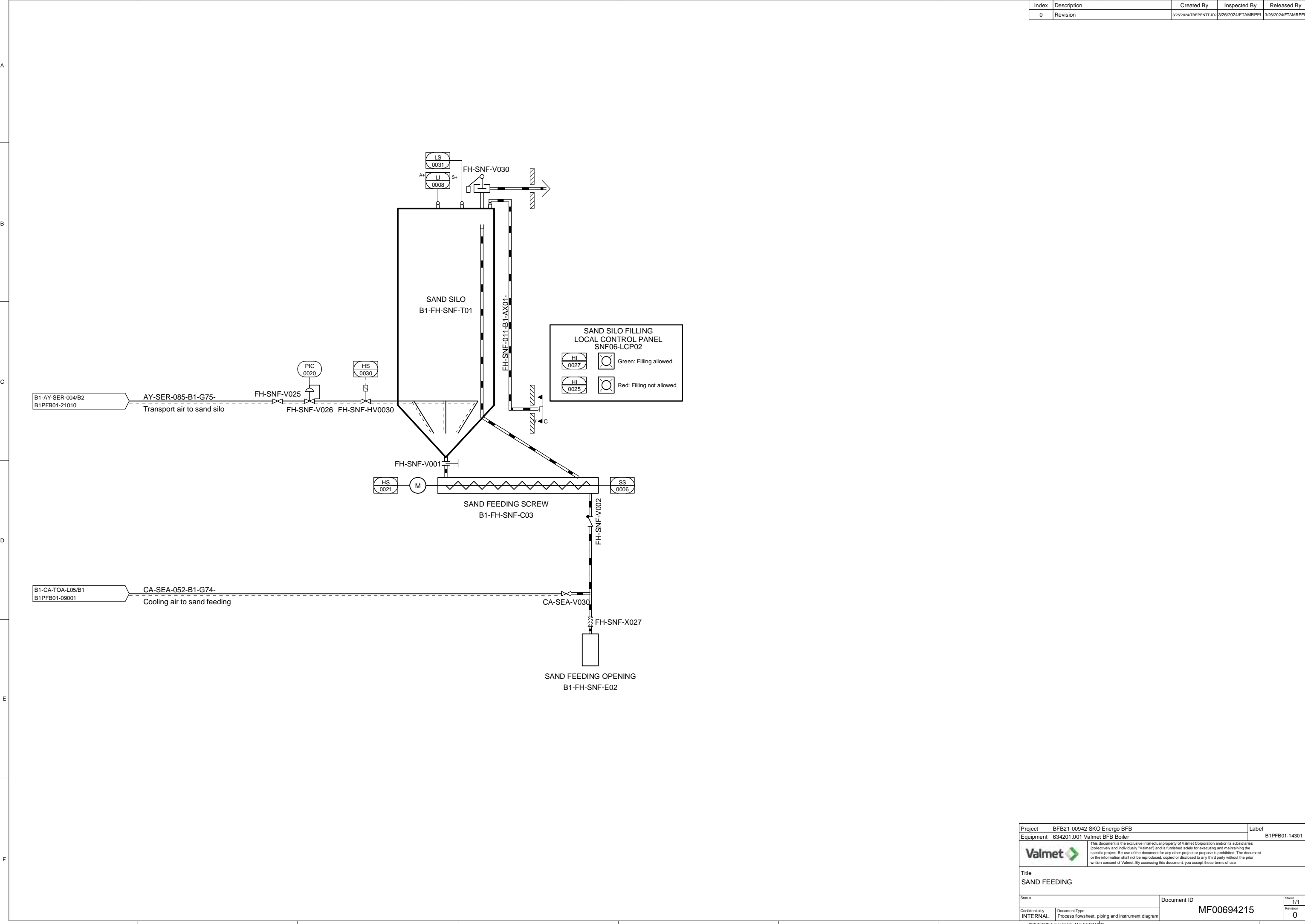
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TRENTTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-12022	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
AMMONIA INJECTION, UPPER LEVEL					
Status		Document ID			Sheet
					1/1
Confidentiality		MF00694213			Revision
INTERNAL					0


Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL



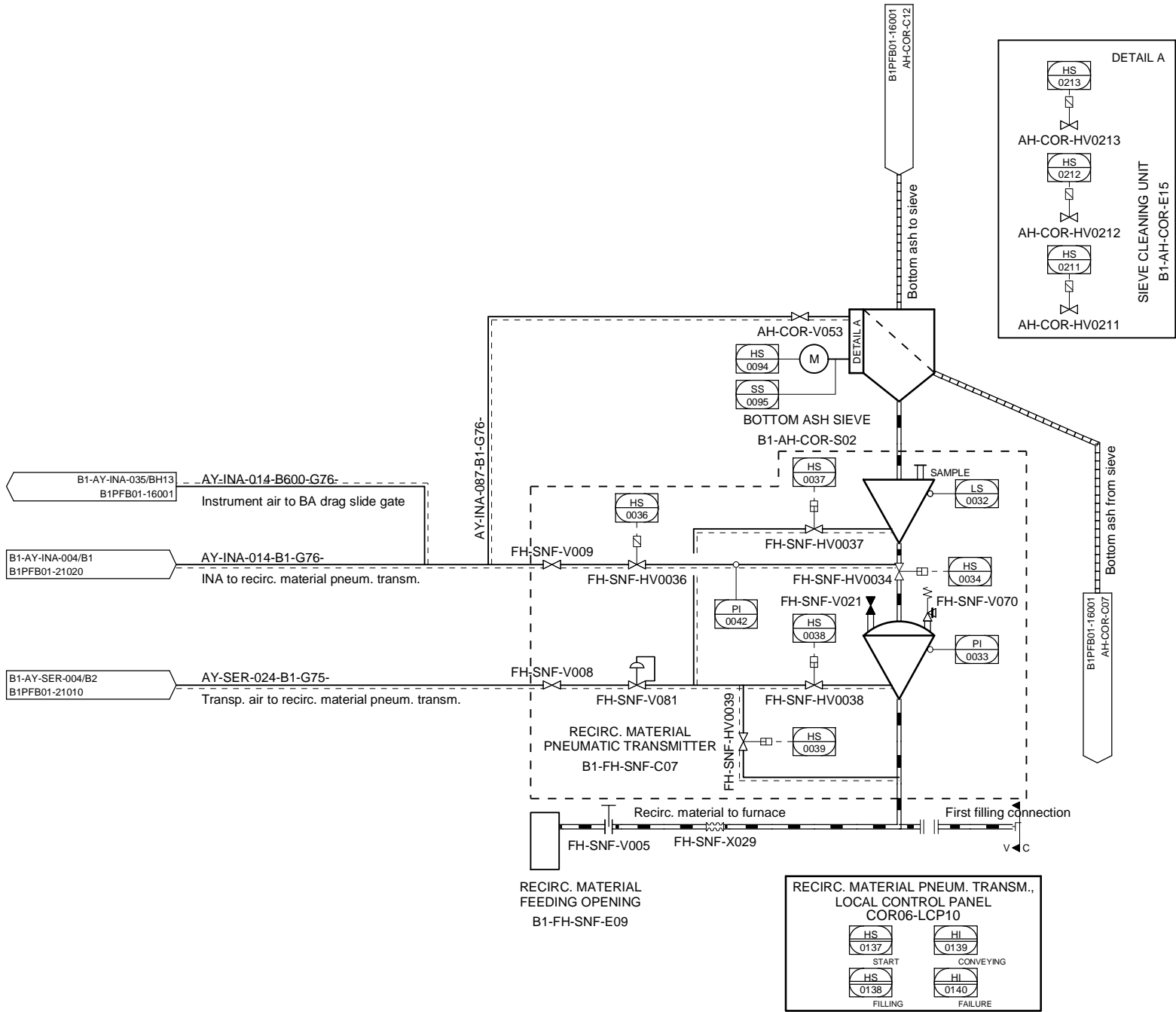
Project BFB21-00942 SKO Energo BFB		Label
Equipment 634201.001 Valmet BFB Boiler		B1PFB01-14010
<div><div></div><div><p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p></div></div>		
Title		
FUEL FEEDING		
Status		Document ID
		Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	Revision 1
		MF00694214




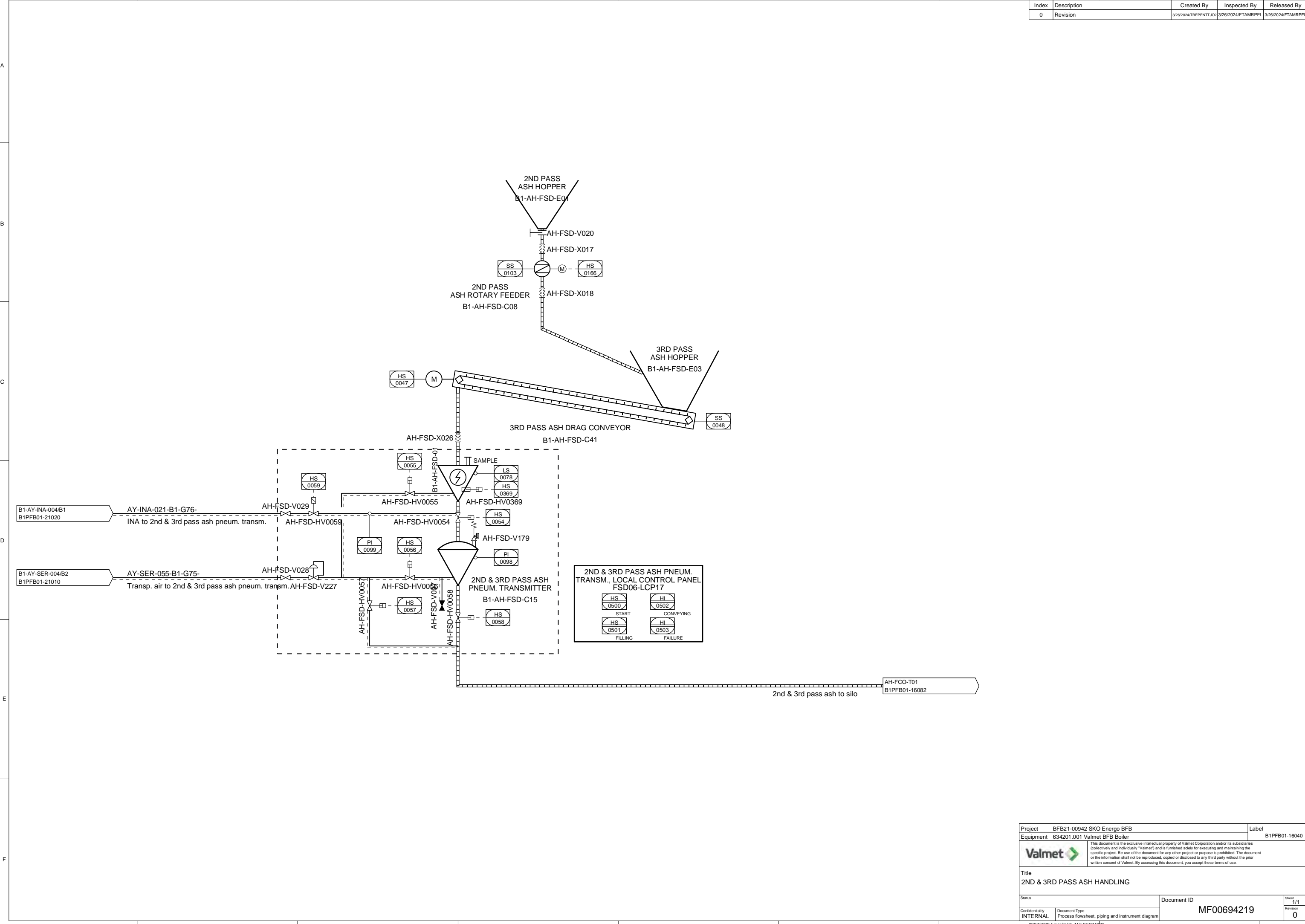
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTT.J02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL

Project		BFB21-00942 SKO Energo BFB	Label	
Equipment		634201.001 Valmet BFB Boiler	B1PFB01-14301	
<div><div></div><div><p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p></div></div>				
Title				
SAND FEEDING				
Status			Document ID	Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram		MF00694215	Revision 0


Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

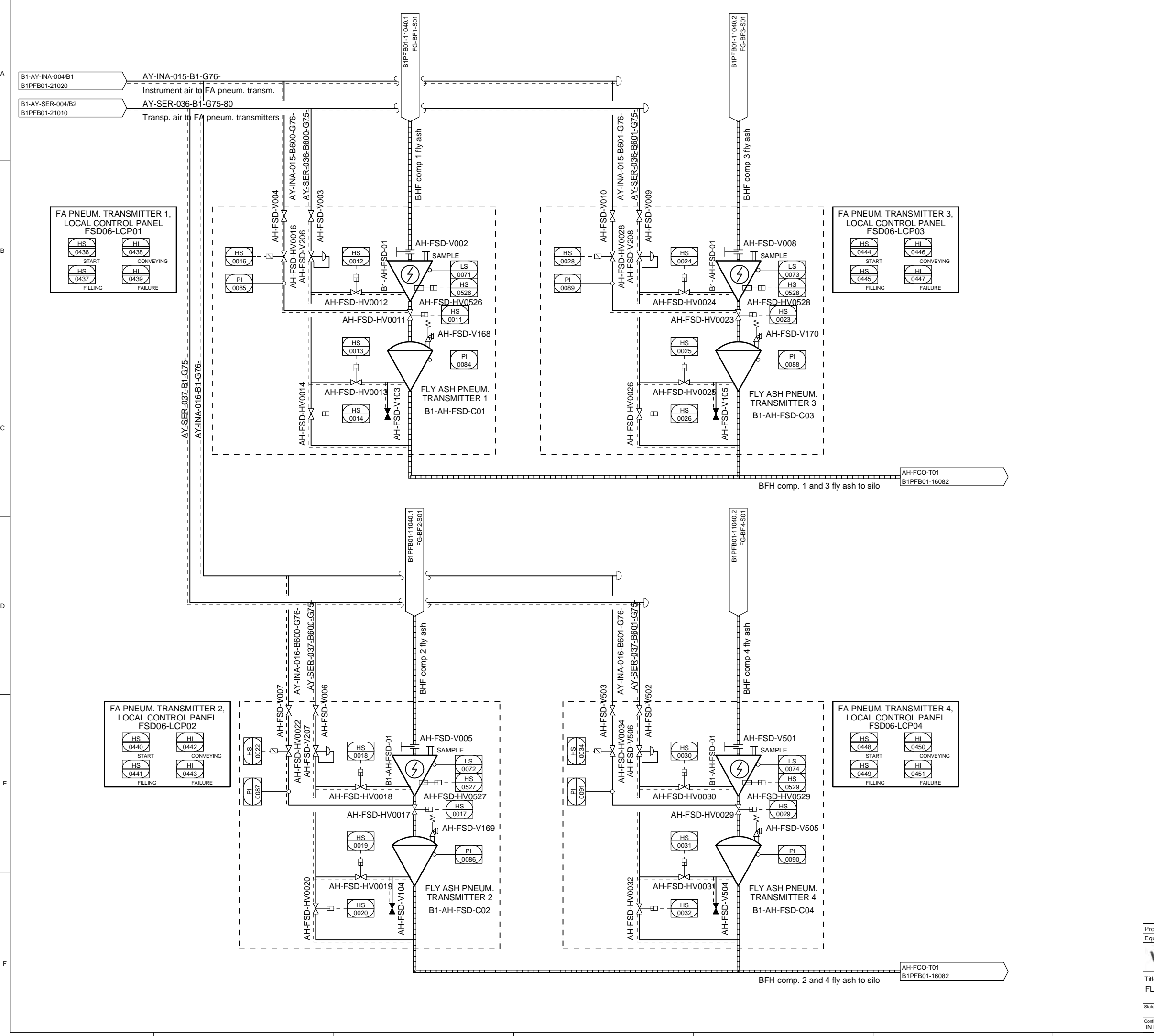


Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-16003	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
BOTTOM ASH SIEVING					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL		MF00694217			Revision 1
Document Type Process flowsheet, piping and instrument diagram					



Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TRENTT.J02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-16040	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
2ND & 3RD PASS ASH HANDLING					
Status		Document ID		Sheet	
Confidentiality		Document Type		1/1	
INTERNAL		Process flowsheet, piping and instrument diagram		Revision	
		MF00694219		0	



Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TRENTT.J02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL

ProjectBFB21-00942 SKO Energo BFB

Equipment634201.001 Valmet BFB Boiler

LabelB1PFB01-16070

This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.

TitleFLY ASH TRANSPORTATION

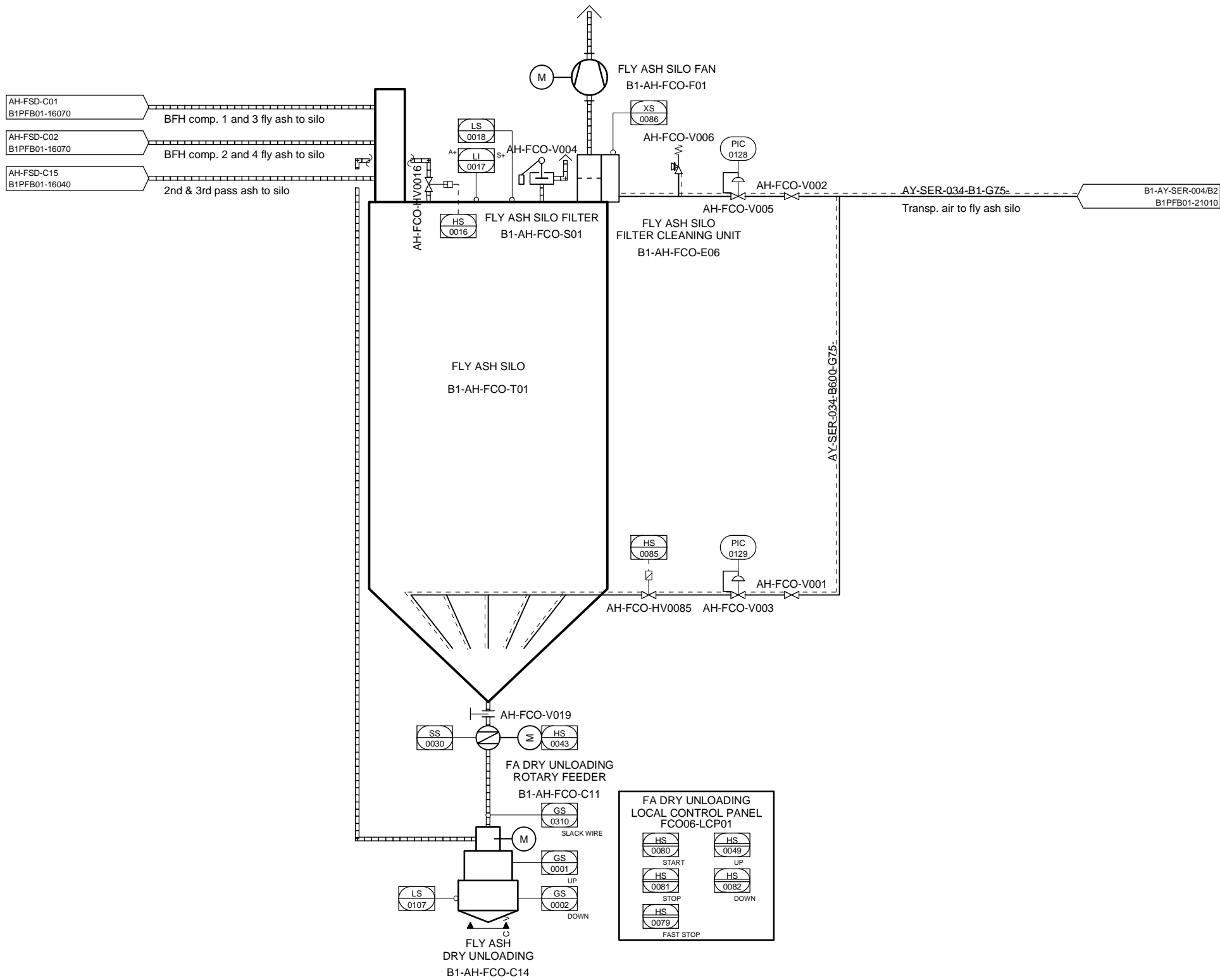
StatusINTERNAL


Document TypeProcess flowsheet, piping and instrument diagram

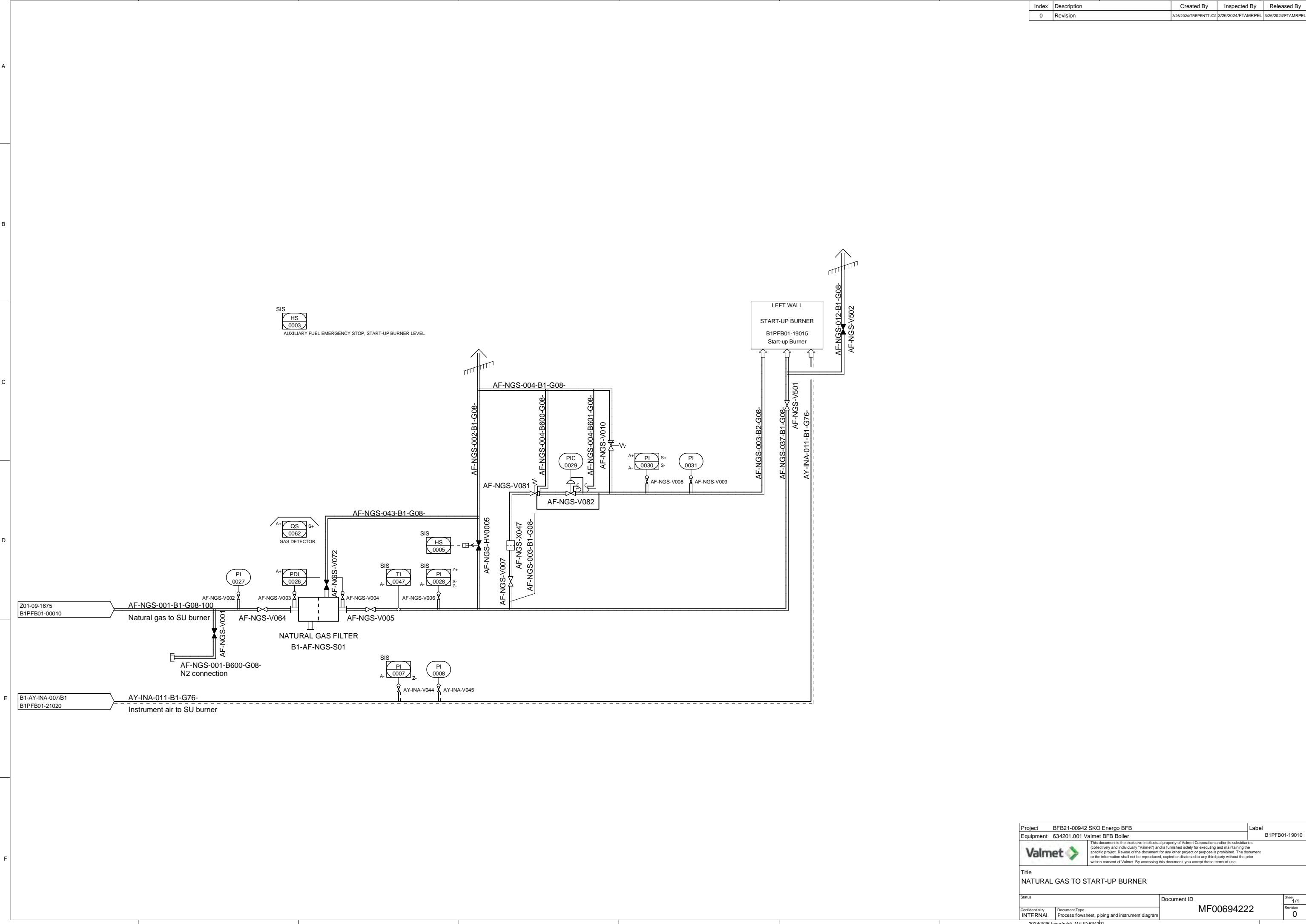
Document IDMF00694220

Sheet1/1
Revision0


Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTT.J02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL

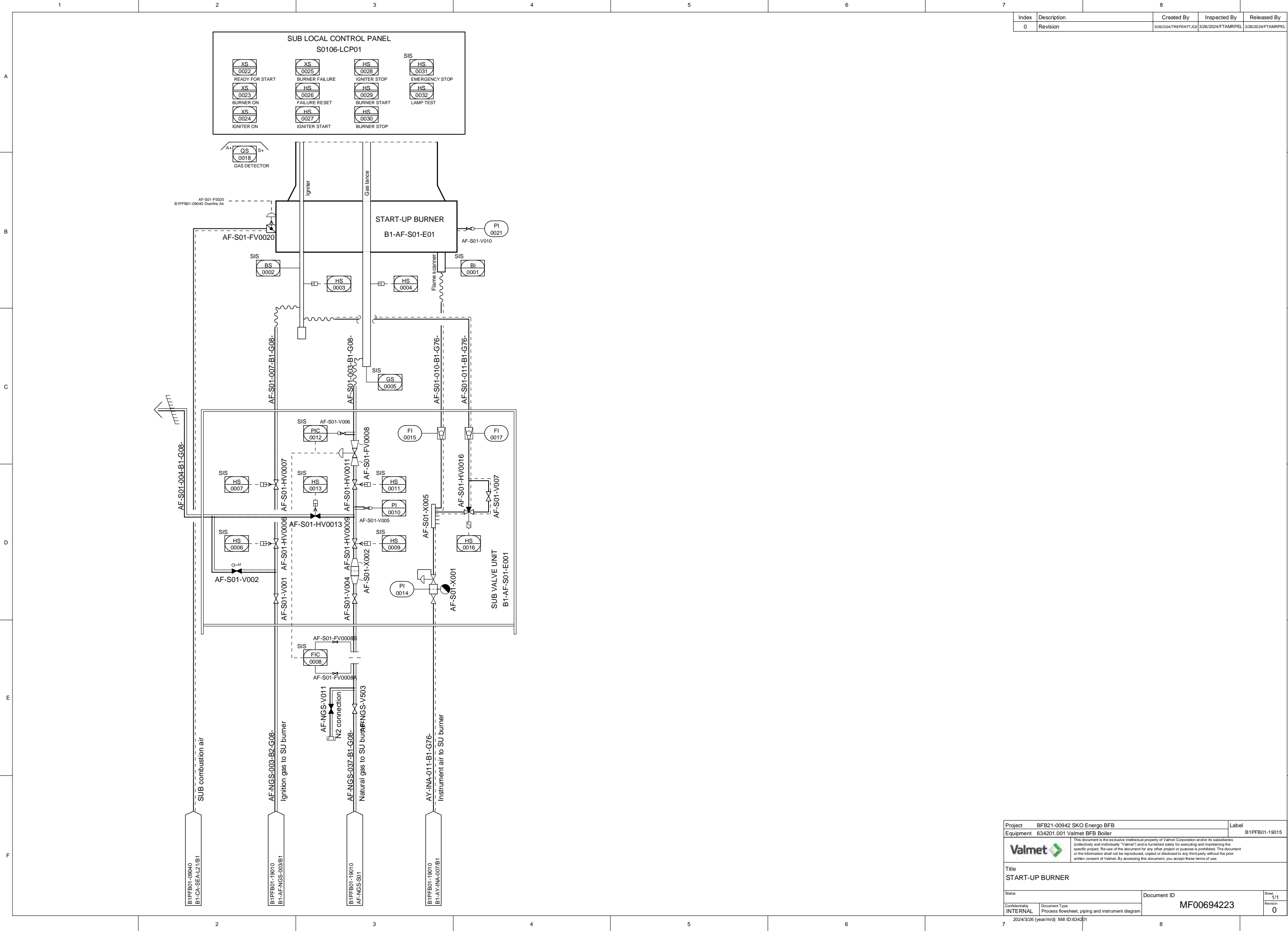


Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-16082	
		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.			
Title					
FLY ASH STORAGE & DISCHARGING					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00694221			Revision 0




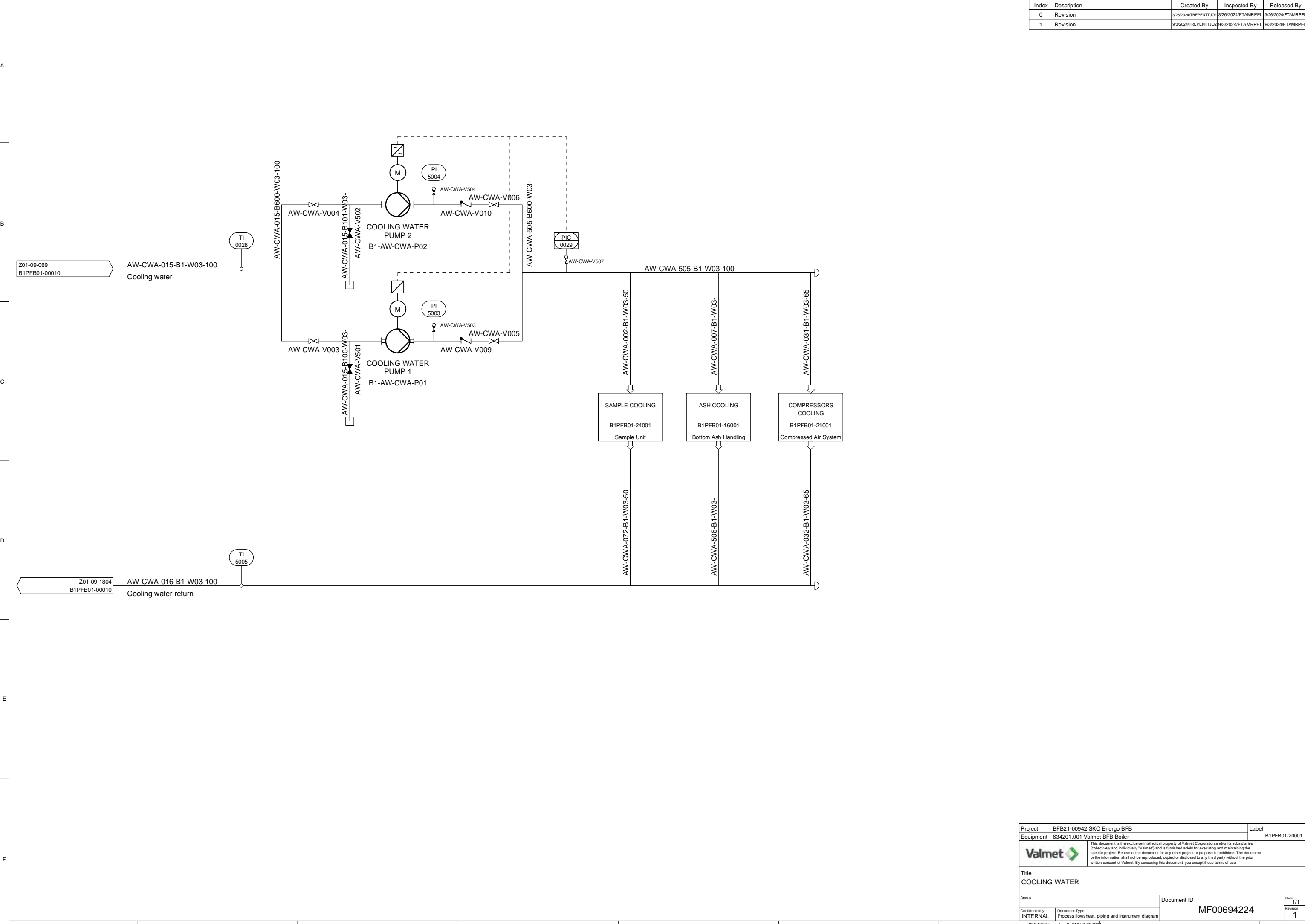
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTYJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL

Project BFB21-00942 SKO Energo BFB		Label
Equipment 634201.001 Valmet BFB Boiler		B1PFB01-19010
<div><div></div><div>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</div></div>		
Title		
NATURAL GAS TO START-UP BURNER		
Status		Document ID
		Sheet 1/1
Confidentiality	Document Type	Revision
INTERNAL	Process flowsheet, piping and instrument diagram	0
		MF00694222




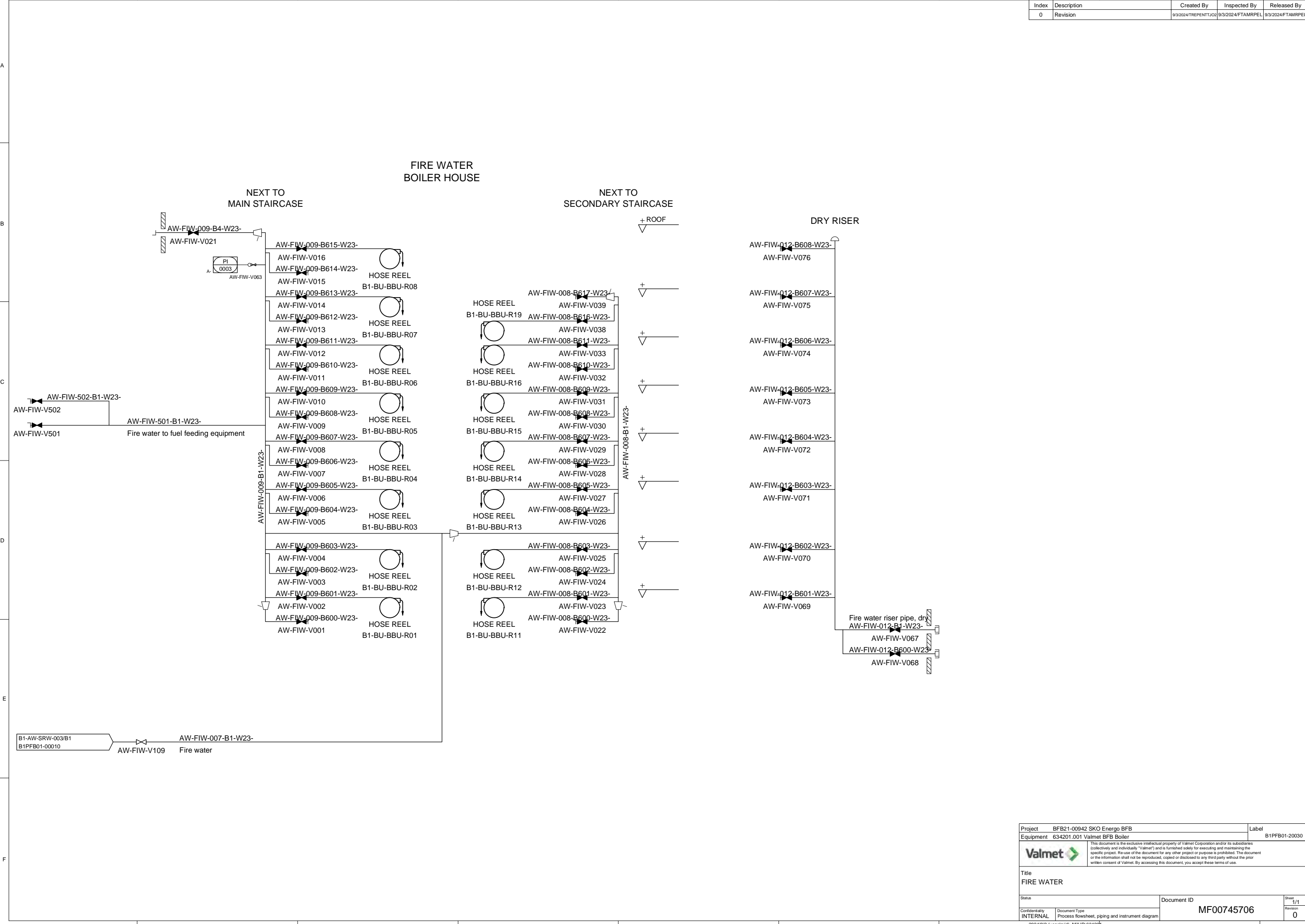
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTYJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-19015	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
START-UP BURNER					
Status		Document ID			Sheet
					1/1
Confidentiality		MF00694223			Revision
INTERNAL					Document Type
		Process flowsheet, piping and instrument diagram			




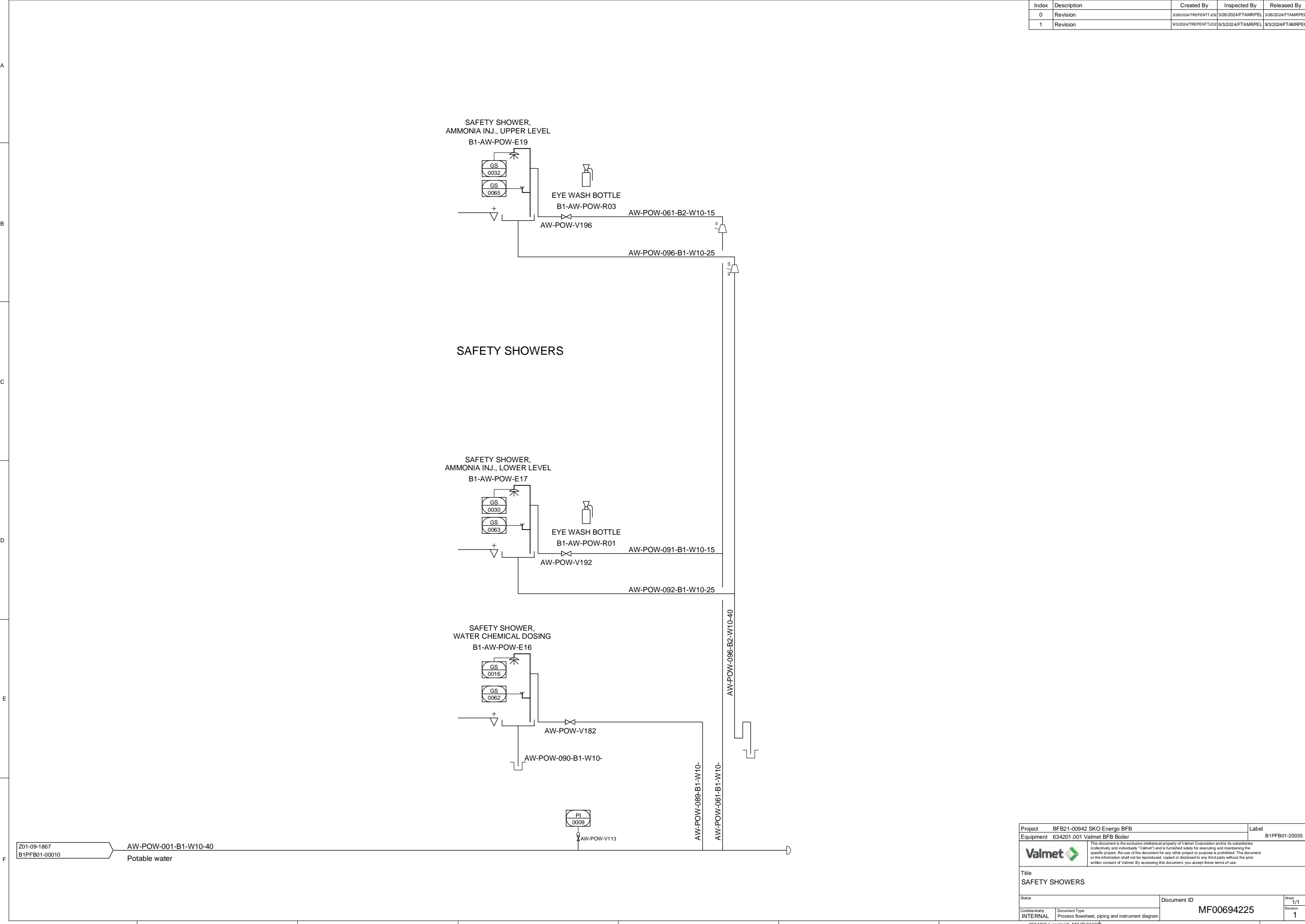
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ.O2	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ.O2	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

Project		BFB21-00942 SKO Energo BFB	Label	
Equipment		634201.001 Valmet BFB Boiler	B1PFB01-20001	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>		
Title				
COOLING WATER				
Status		Document ID		Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00694224		Revision 1




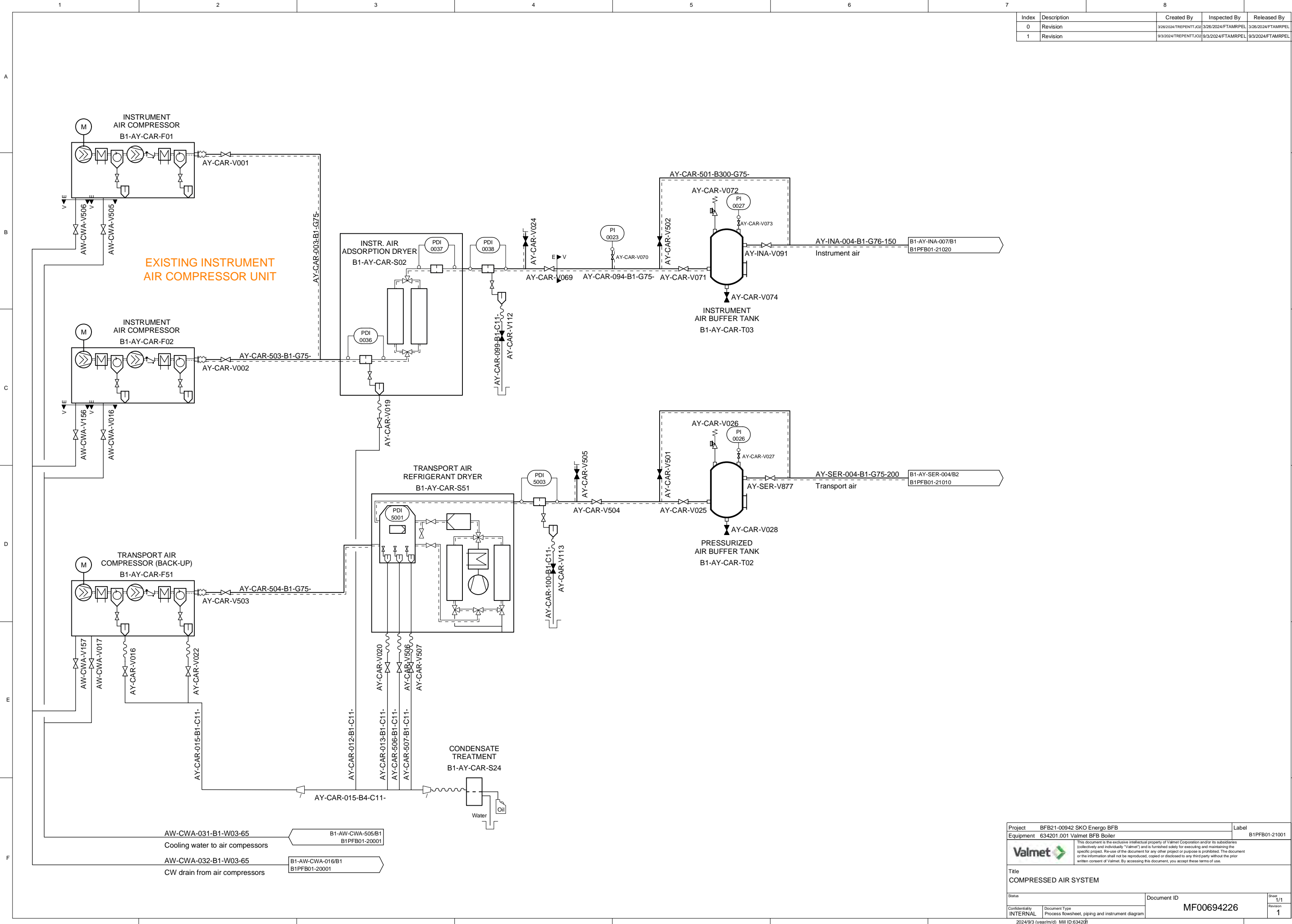
Index	Description	Created By	Inspected By	Released By
0	Revision	9/3/2024/TREPTTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-20030	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
FIRE WATER					
Status		Document ID		Sheet	
Confidentiality		Document Type		1/1	
INTERNAL		Process flowsheet, piping and instrument diagram		Revision	
				0	




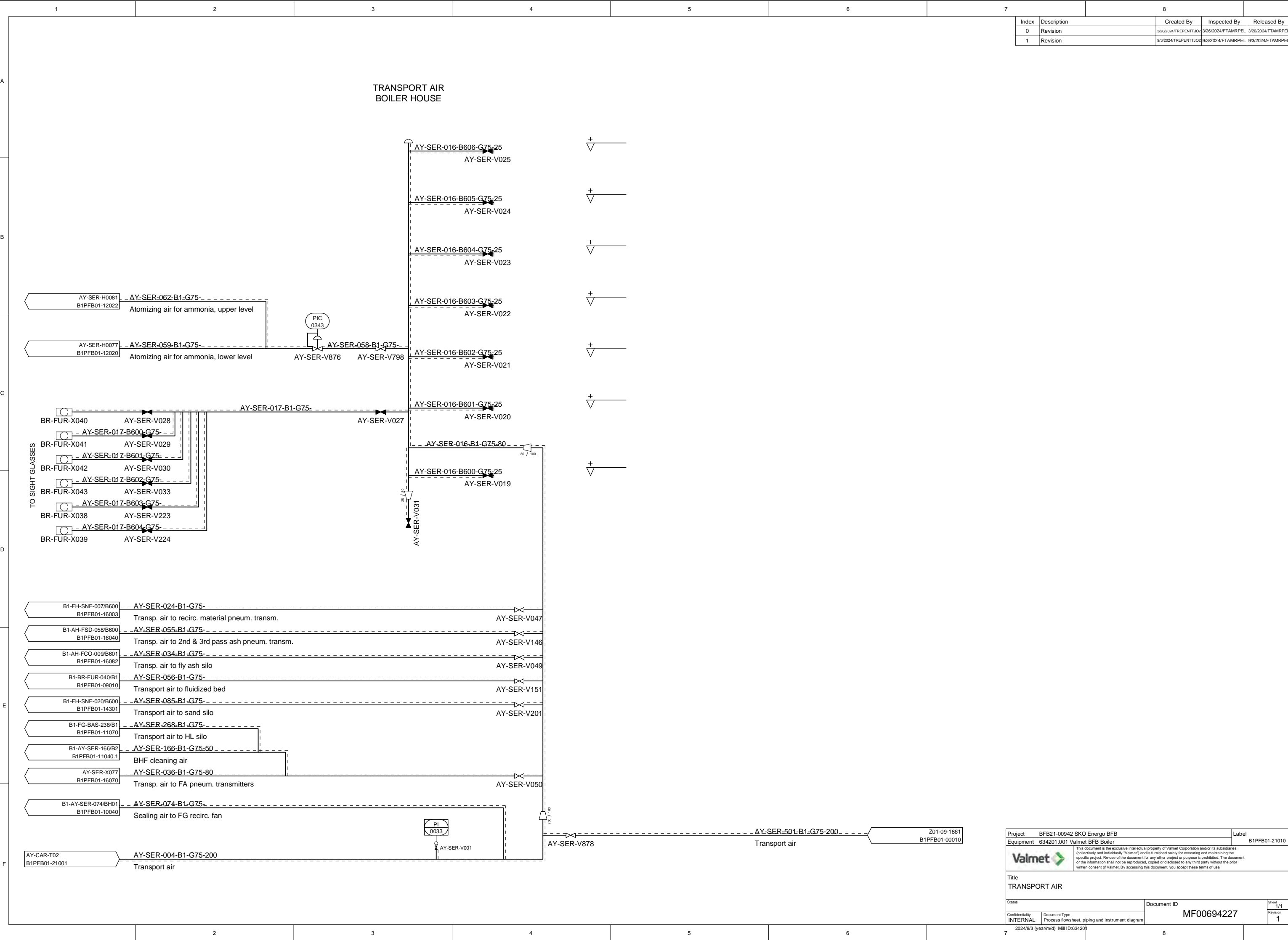
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTT.J02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTT.J02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

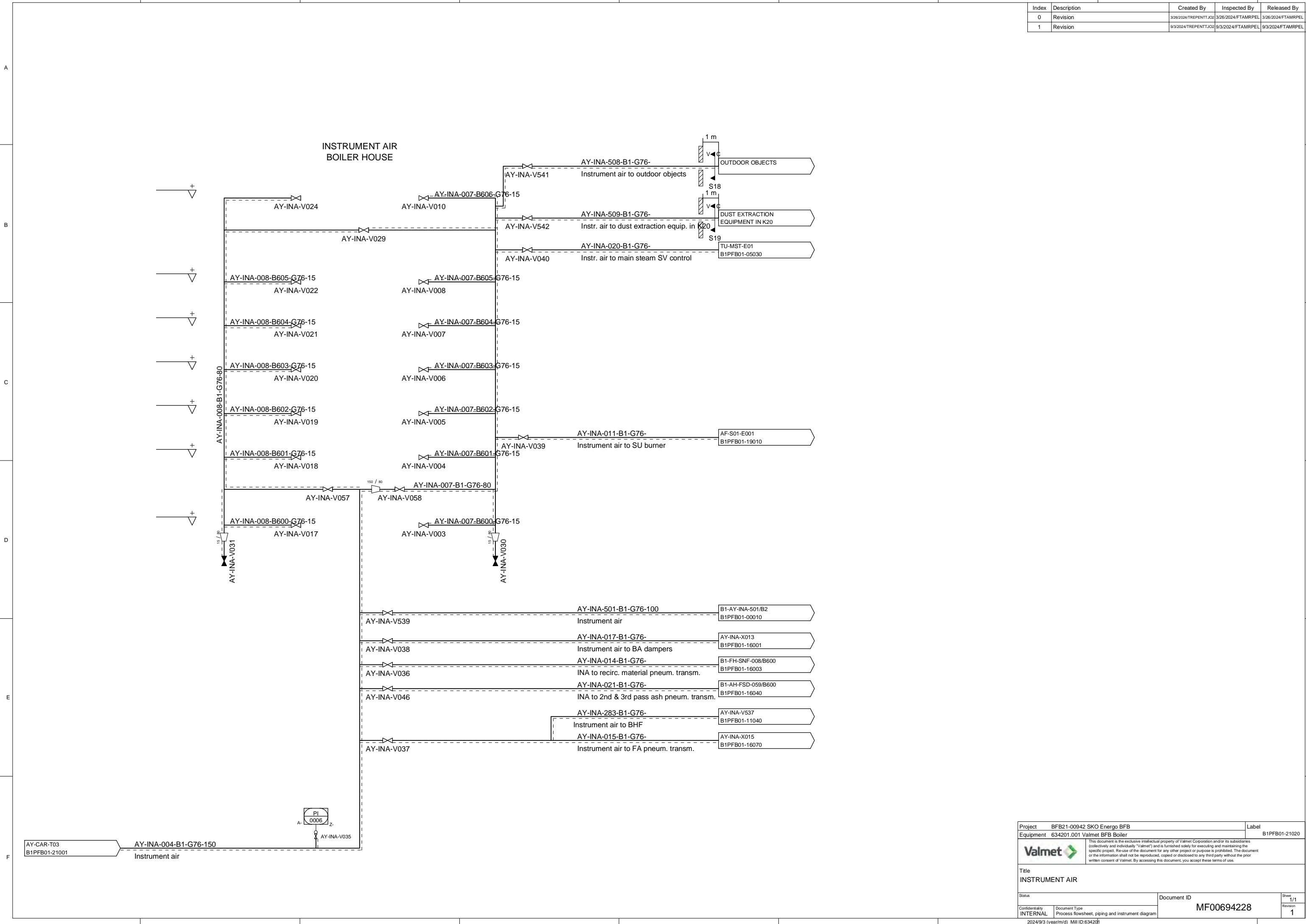
Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-20035	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
SAFETY SHOWERS					
Status		Document ID		Sheet 1/1	
Confidentiality INTERNAL		Document Type Process flowsheet, piping and instrument diagram		Revision 1	
		MF00694225			




Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

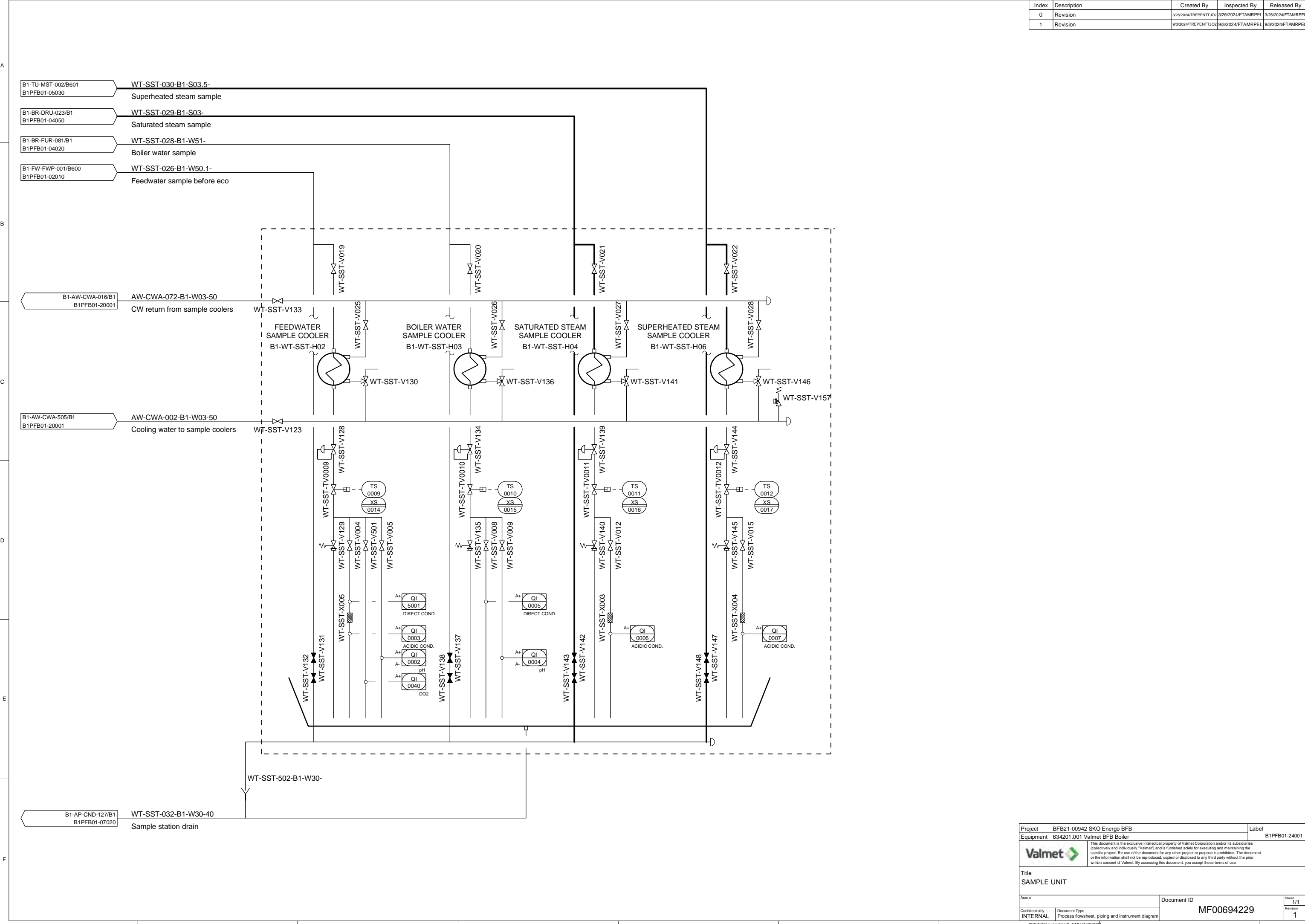
Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-21001	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
COMPRESSED AIR SYSTEM					
Status		Document ID			Sheet
					1/1
Confidentiality	Document Type	MF00694226			Revision
INTERNAL	Process flowsheet, piping and instrument diagram				1






Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

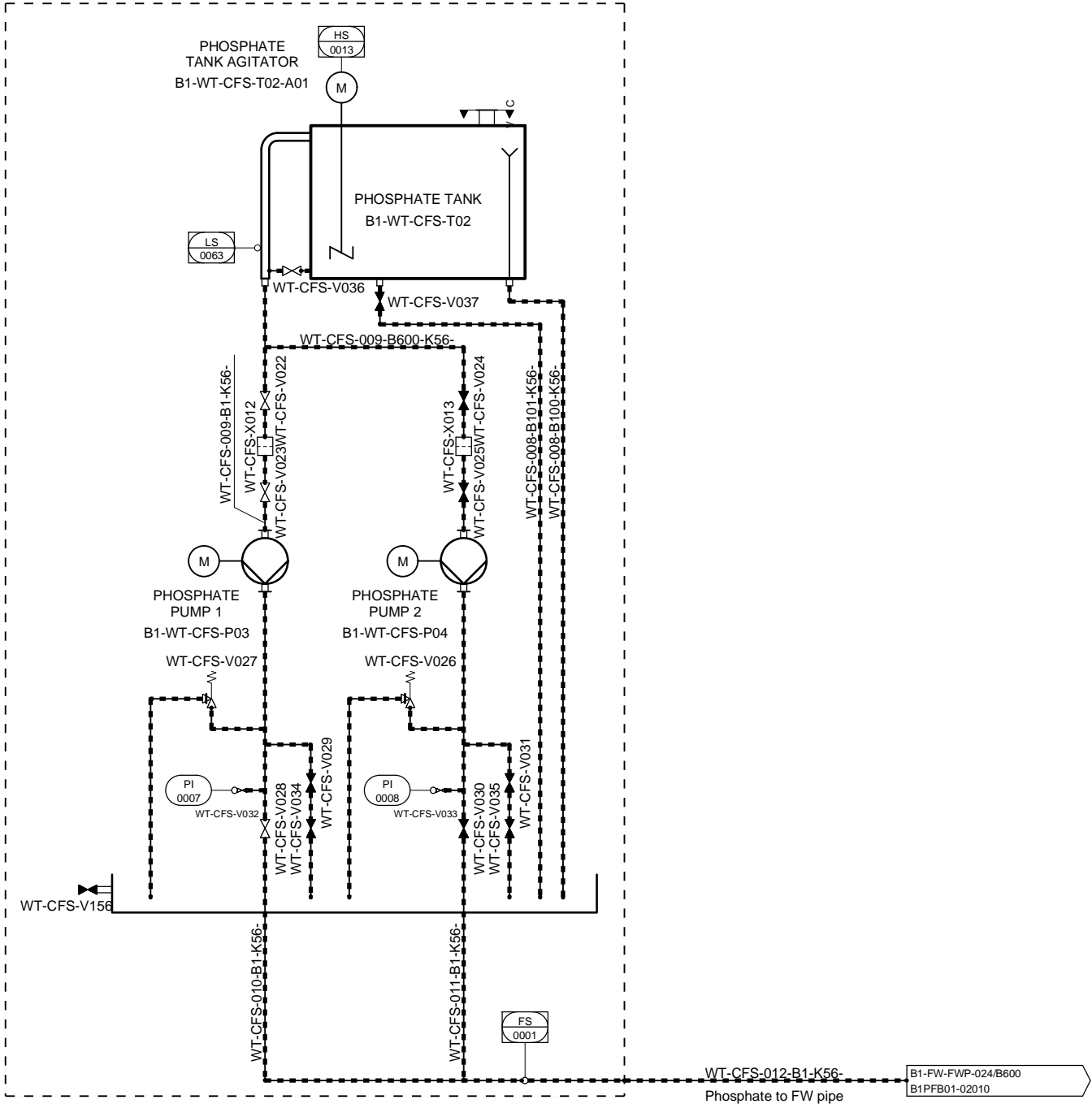
Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-21020	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
INSTRUMENT AIR					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram		MF00694228		Revision 1




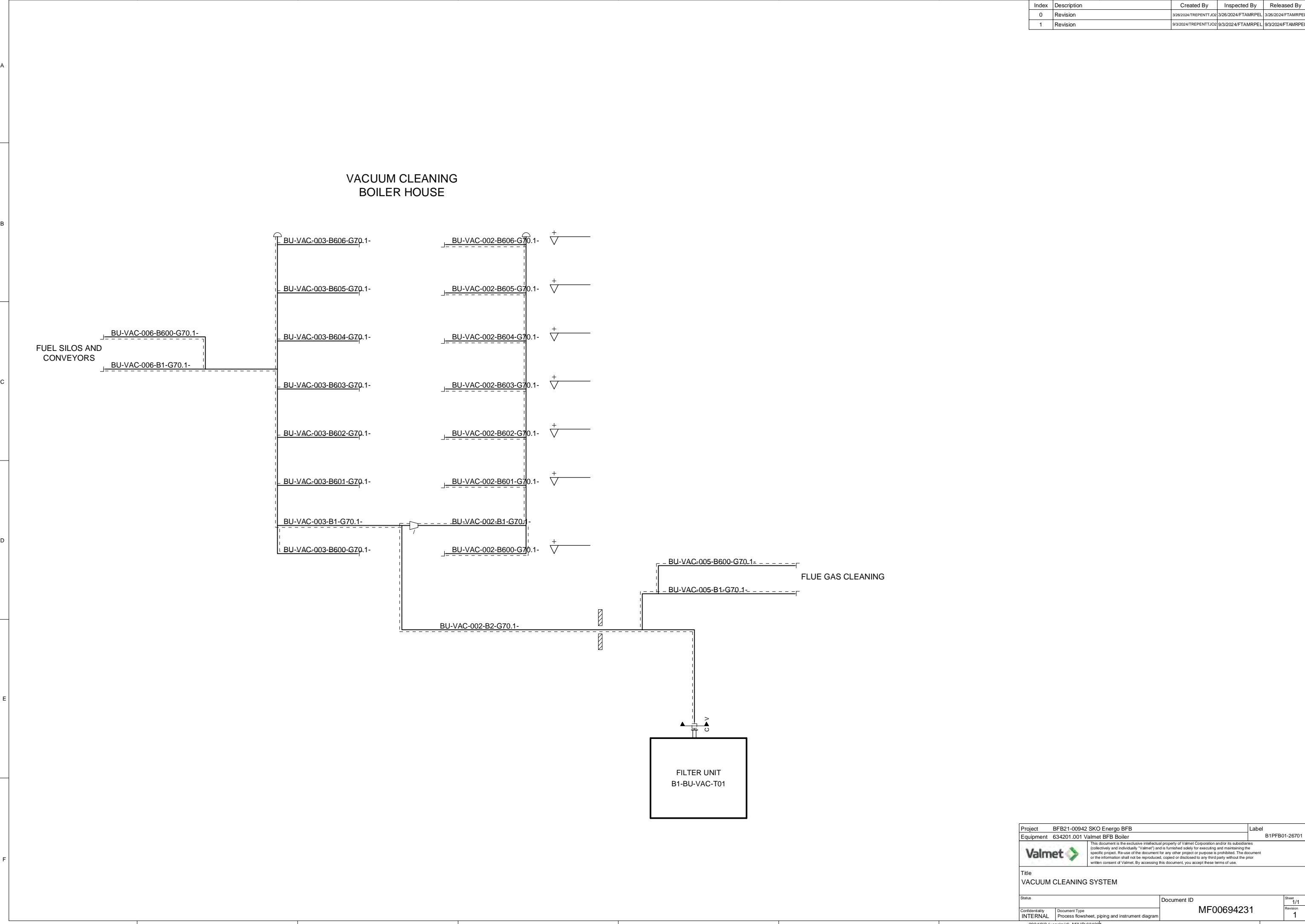
Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

Project		BFB21-00942 SKO Energo BFB	Label	B1PFB01-24001
Equipment		634201.001 Valmet BFB Boiler		
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>		
Title				
SAMPLE UNIT				
Status		Document ID		Sheet 1/1
Confidentiality	Document Type	MF00694229		Revision
INTERNAL	Process flowsheet, piping and instrument diagram			1


Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTT.J02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL



Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-25001	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
CHEMICAL DOSING					
Status		Document ID			Sheet
					1/1
Confidentiality	Document Type	MF00694230			Revision
INTERNAL	Process flowsheet, piping and instrument diagram				0



Index	Description	Created By	Inspected By	Released By
0	Revision	3/26/2024/TREPENTJ.02	3/26/2024/FTAMRPEL	3/26/2024/FTAMRPEL
1	Revision	9/3/2024/TREPENTJ.02	9/3/2024/FTAMRPEL	9/3/2024/FTAMRPEL

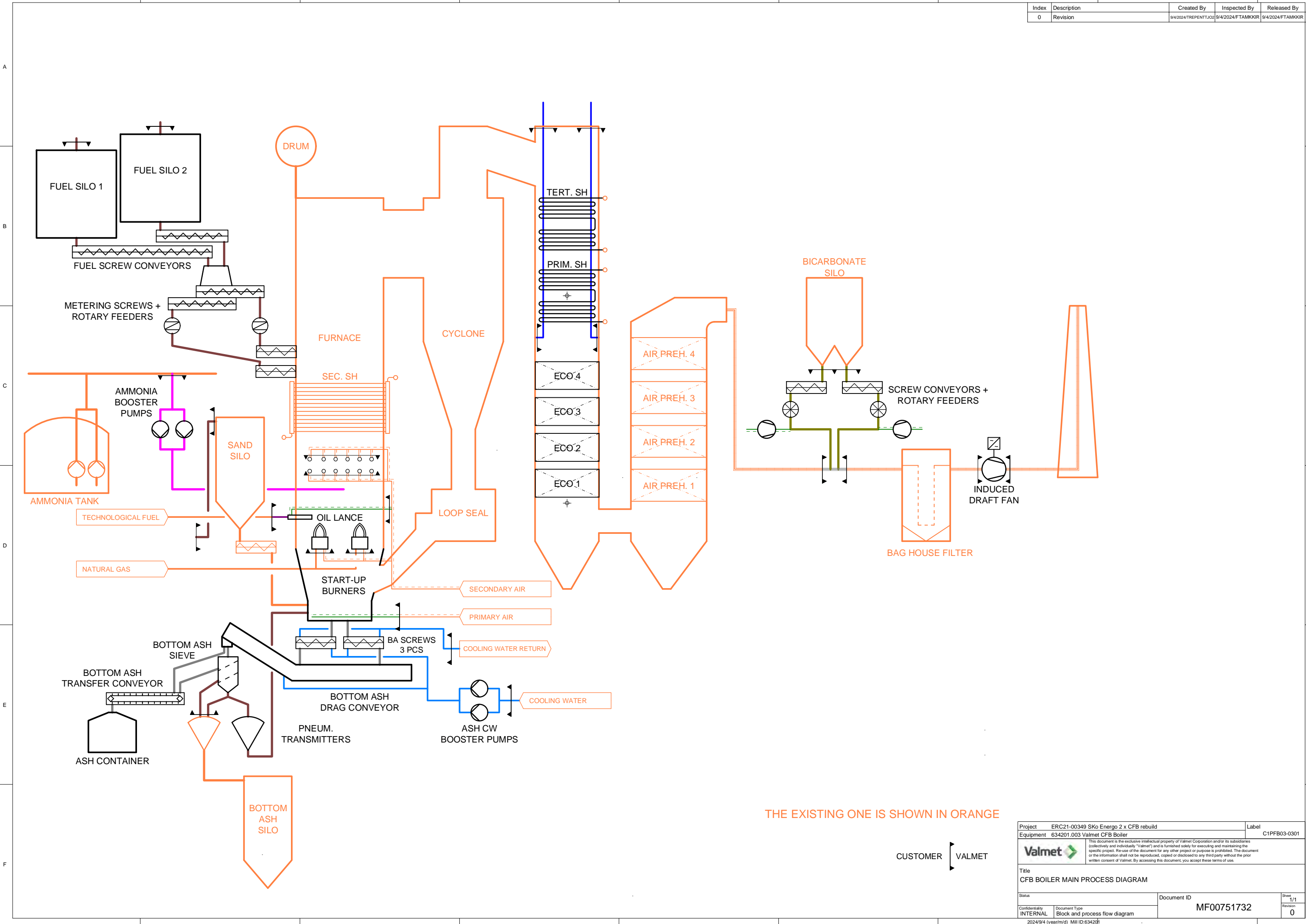
Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB01-26701	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
VACUUM CLEANING SYSTEM					
Status		Document ID		Sheet	
Confidentiality		Document Type		1/1	
INTERNAL		Process flowsheet, piping and instrument diagram		Revision	
				1	



Flowsheets, 2 * CFB Rebuild

Title	Rev.
Main process diagram, CFB rebuild	0
Flowsheets, CFB rebuild	0


Appendix 20.02 Flowsheets



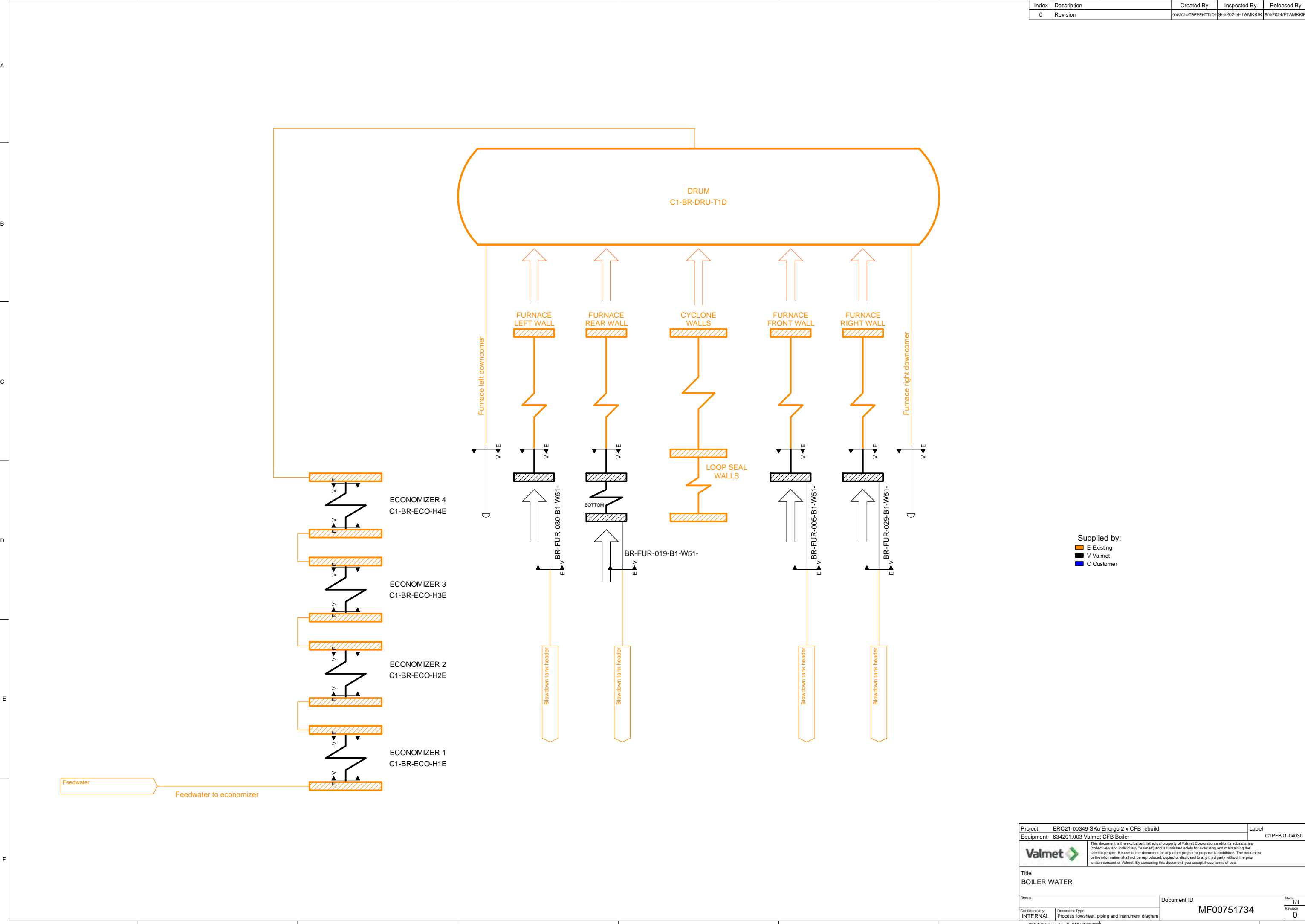
Index	Description	Created By	Inspected By	Released By
0	Revision	9/4/2024/TREPTTJ02	9/4/2024/FTAMKKIR	9/4/2024/FTAMKKIR

THE EXISTING ONE IS SHOWN IN ORANGE

CUSTOMER VALMET


Project		ERC21-00349 SKo Energo 2 x CFB rebuild		Label	
Equipment		634201.003 Valmet CFB Boiler		C1PFB03-0301	
<div><div></div><div><p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p></div></div>					
Title					
CFB BOILER MAIN PROCESS DIAGRAM					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL	Document Type Block and process flow diagram	MF00751732			Revision 0

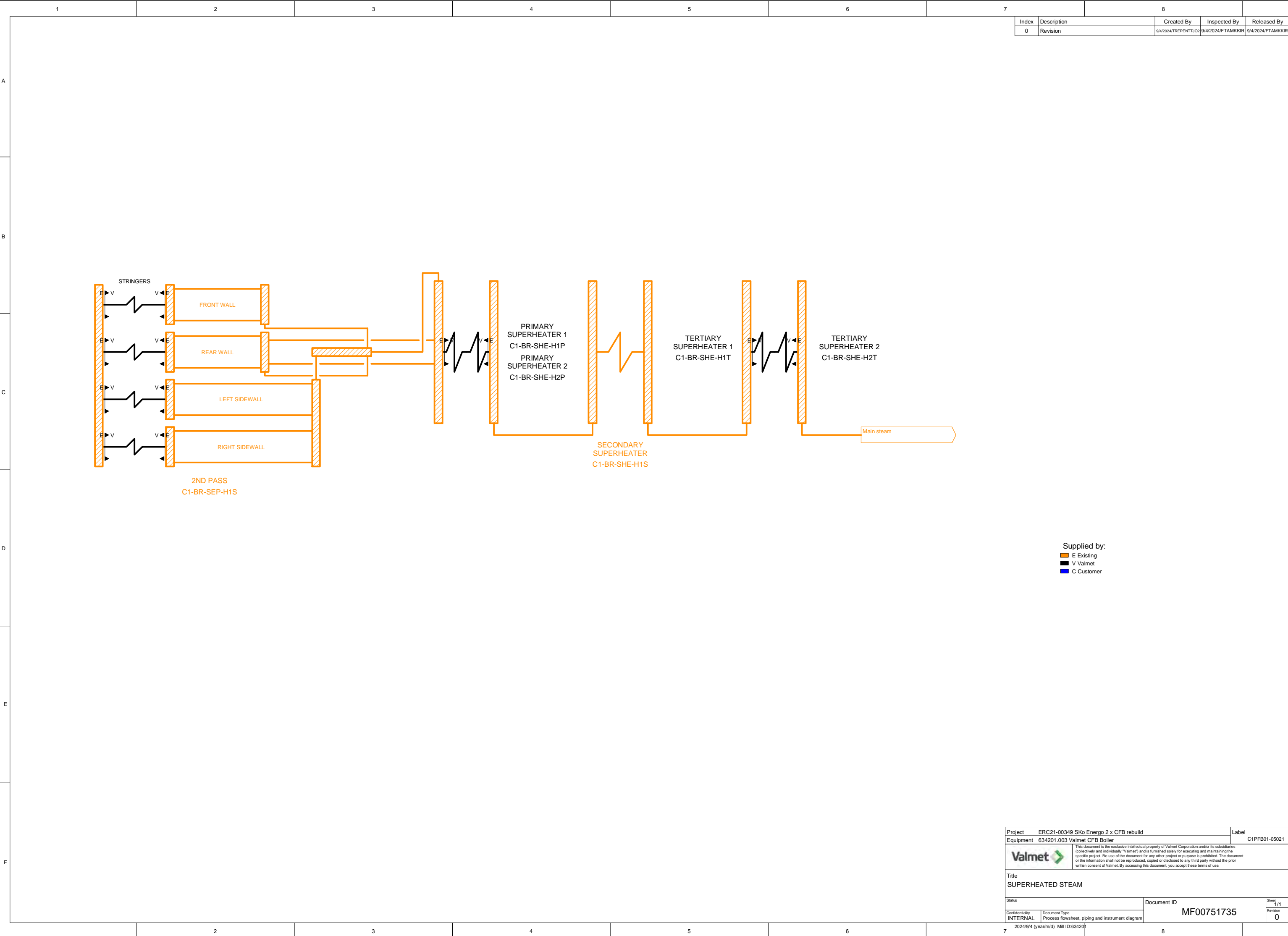
1		2		3		4		5		6		7		8	
EQUIPMENT SYMBOLS		PIPE / DUCT FITTINGS ETC.				INSTRUMENT SYMBOLS				ELECTRIC SYMBOLS				PROCESS LINES	
<div><div><div><div><div></div><div></div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div></div></div>															

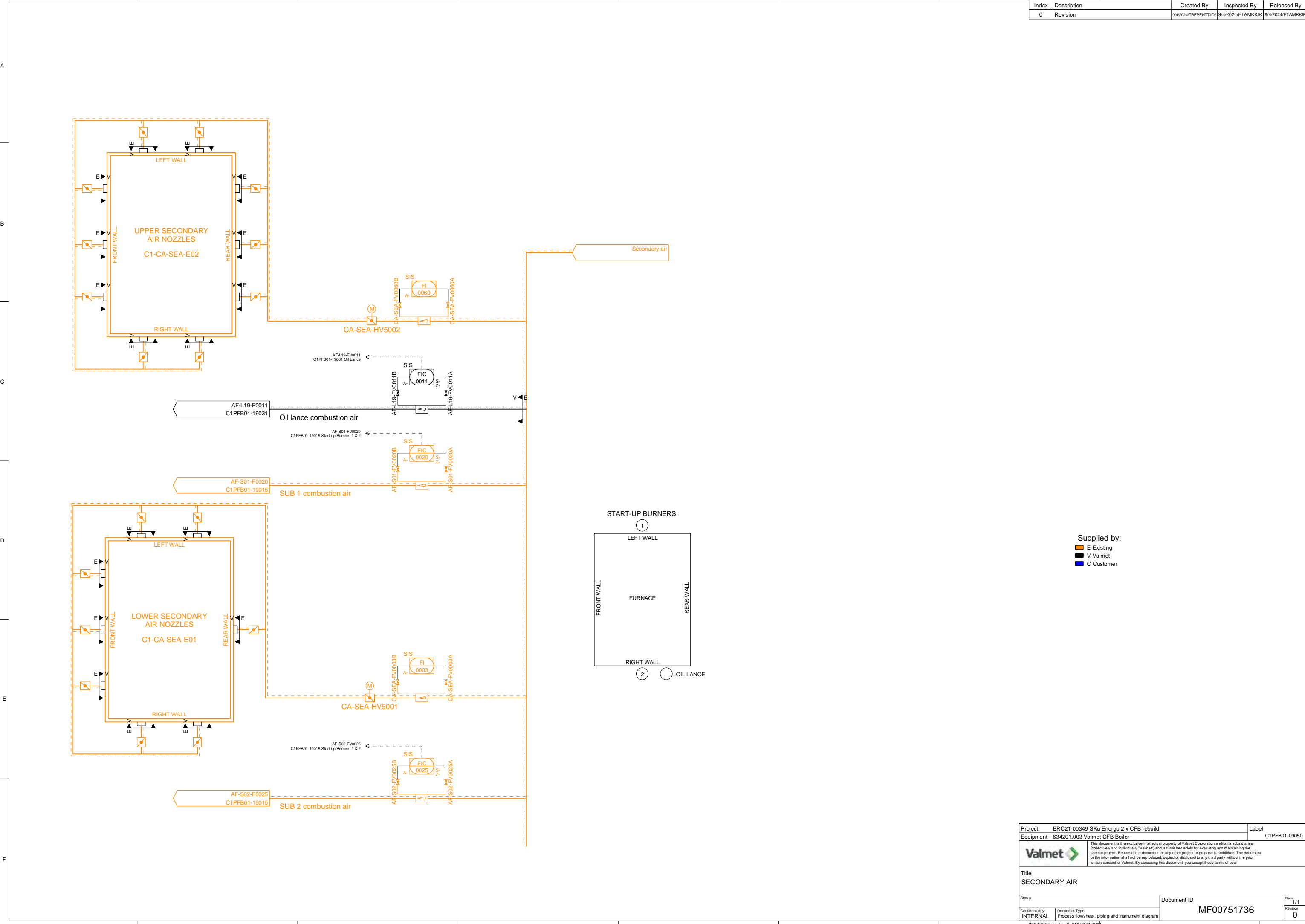


Index	Description	Created By	Inspected By	Released By
0	Revision	9/4/2024/TREPTJJO2	9/4/2024/FTAMKKR	9/4/2024/FTAMKKR


Supplied by:
E Existing
V Valmet
C Customer

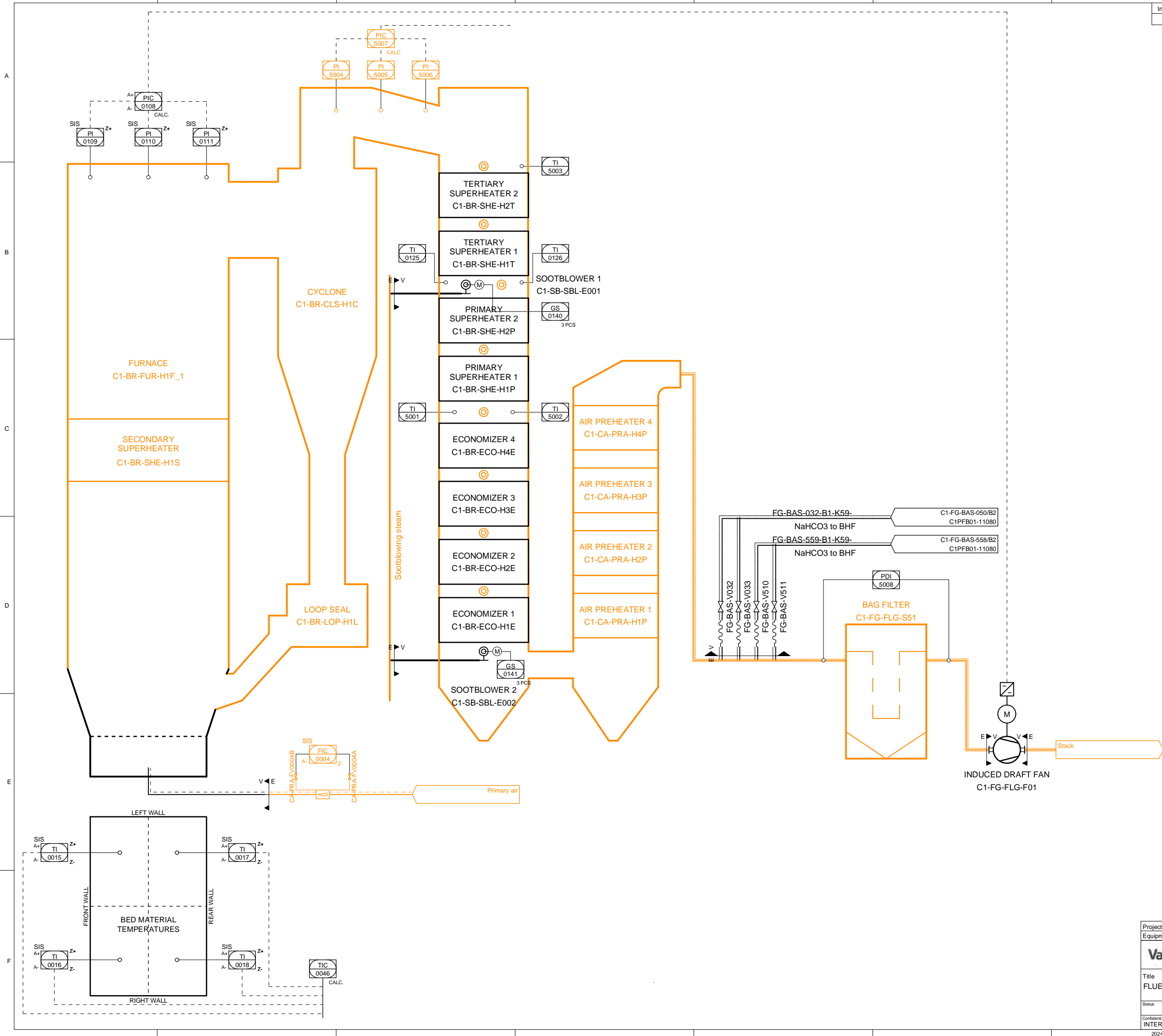
Project		ERC21-00349 SKo Energo 2 x CFB rebuild		Label	
Equipment		634201.003 Valmet CFB Boiler		C1PFB01-04030	
		<div>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</div>			
Title					
BOILER WATER					
Status		Document ID		Sheet	
Confidentiality		Document Type		1/1	
INTERNAL		Process flowsheet, piping and instrument diagram		Revision	
				0	





Index	Description	Created By	Inspected By	Released By
0	Revision	9/4/2024/TREPTTJ02	9/4/2024/FTAMKKIR	9/4/2024/FTAMKKIR

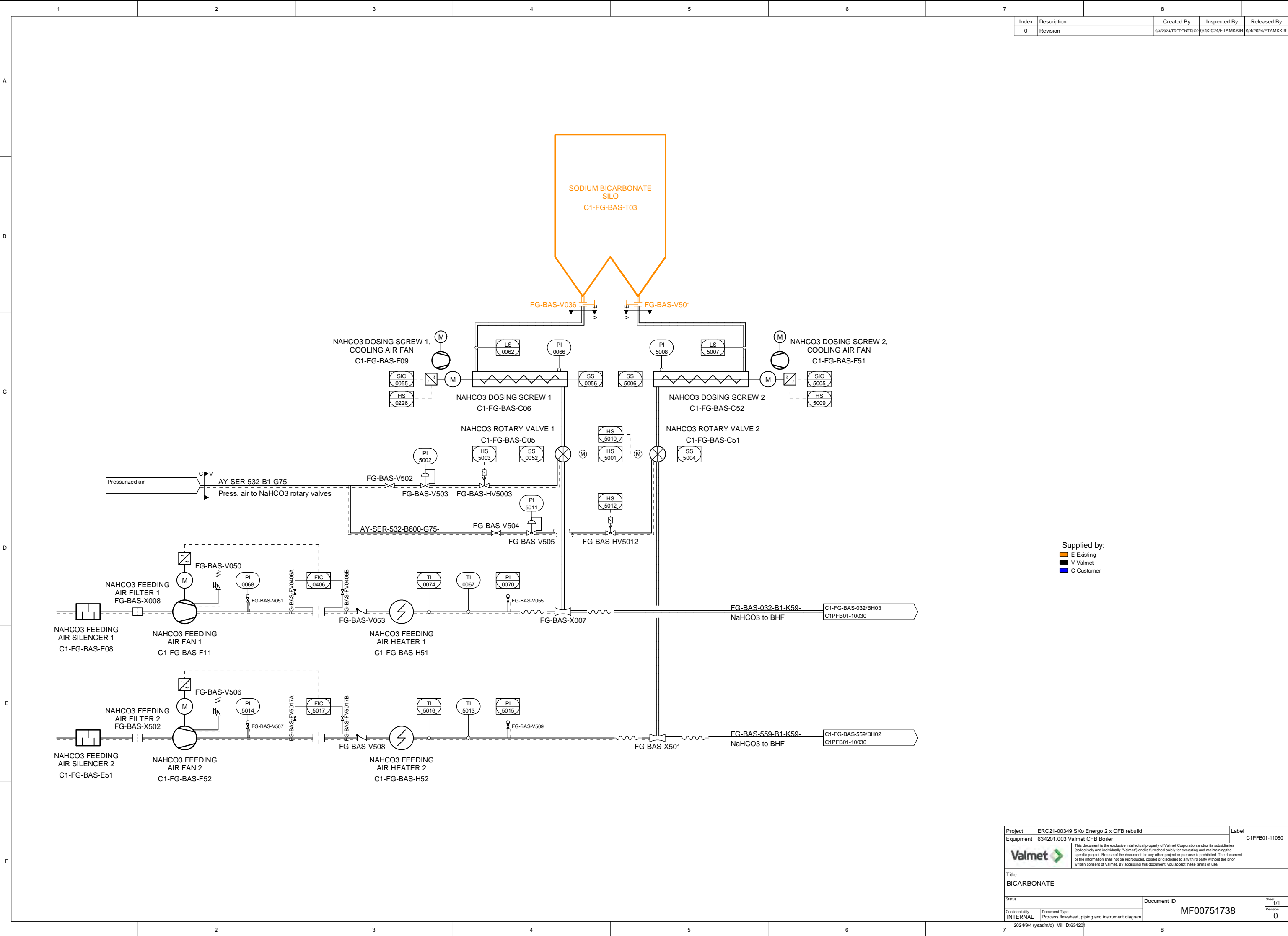
Project		ERC21-00349 SKo Energo 2 x CFB rebuild		Label	
Equipment		634201.003 Valmet CFB Boiler		C1PFB01-09050	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
SECONDARY AIR					
Status		Document ID		Sheet	
Confidentiality		Document Type		1/1	
INTERNAL		Process flowsheet, piping and instrument diagram		Revision	
		MF00751736		0	

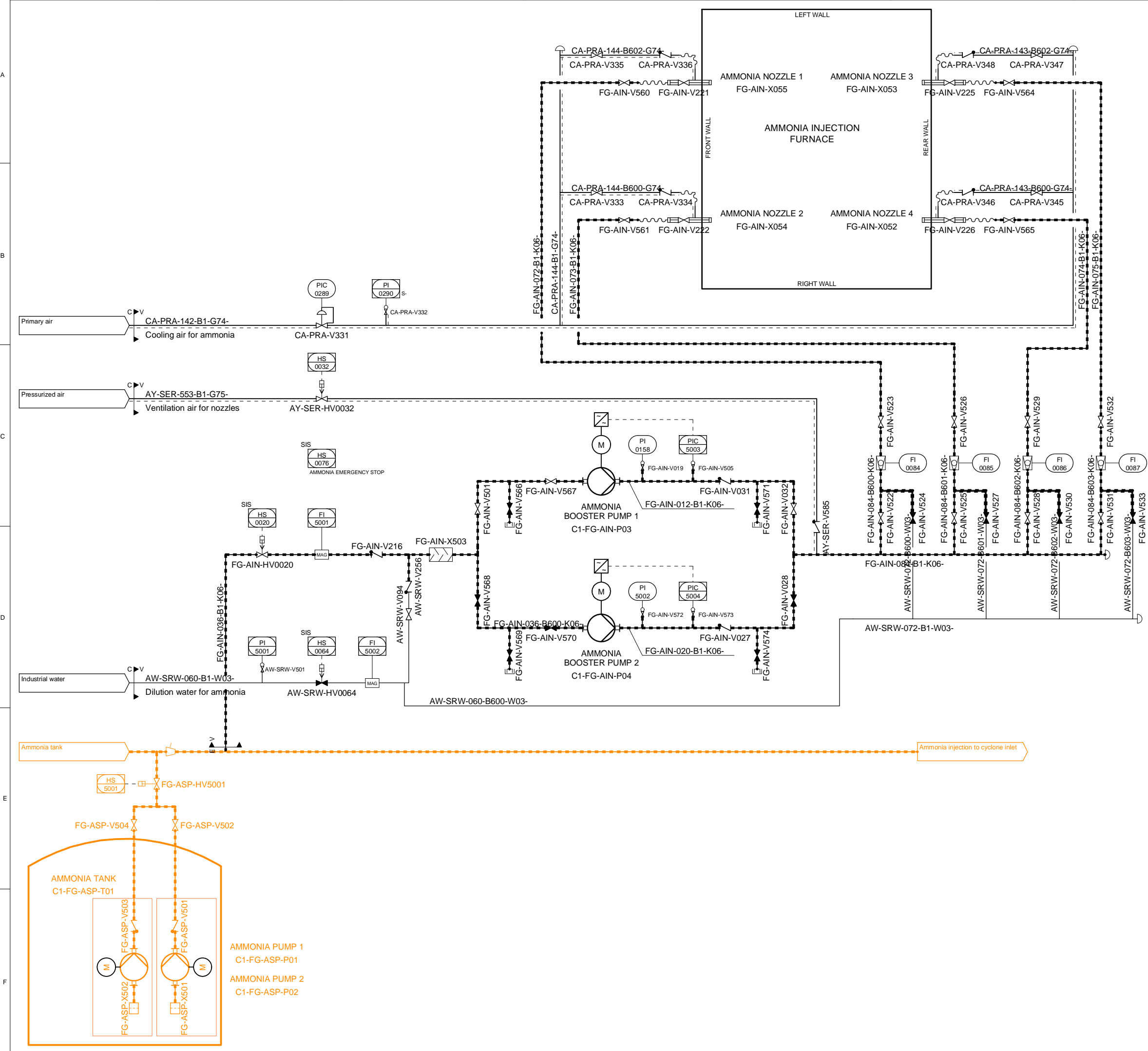


Index	Description	Created By	Inspected By	Released By
0	Revision	9/4/2024/TREPTTJ02	9/4/2024/FTAMKKR	9/4/2024/FTAMKKR

Supplied by:
E Existing
V Valmet
C Customer

Project ERC21-00349 SKo Energo 2 x CFB rebuild		Label C1PFB01-10030	
Equipment 634201.003 Valmet CFB Boiler			
		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.	
Title FLUE GAS			
Status	Document ID	Sheet 1/1	
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	Revision 0	
2024/9/4 (year/m/d) Mill ID:634201		MF00751737	




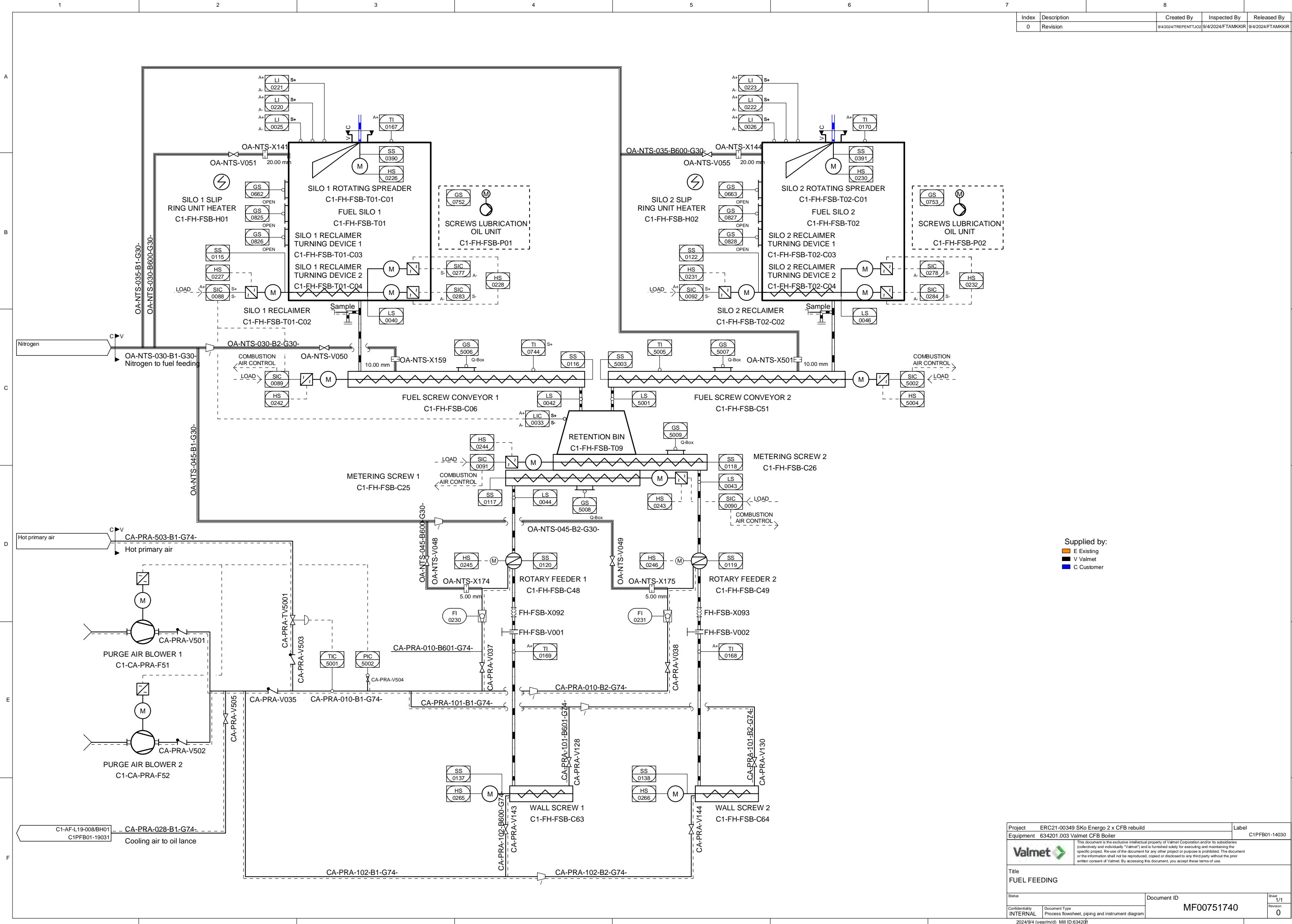


Index	Description	Created By	Inspected By	Released By
0	Revision	9/4/2024/TREPTTJ02	9/4/2024/FTAMKKGR	9/4/2024/FTAMKKGR

Supplied by:


- E Existing
- V Valmet
- C Customer

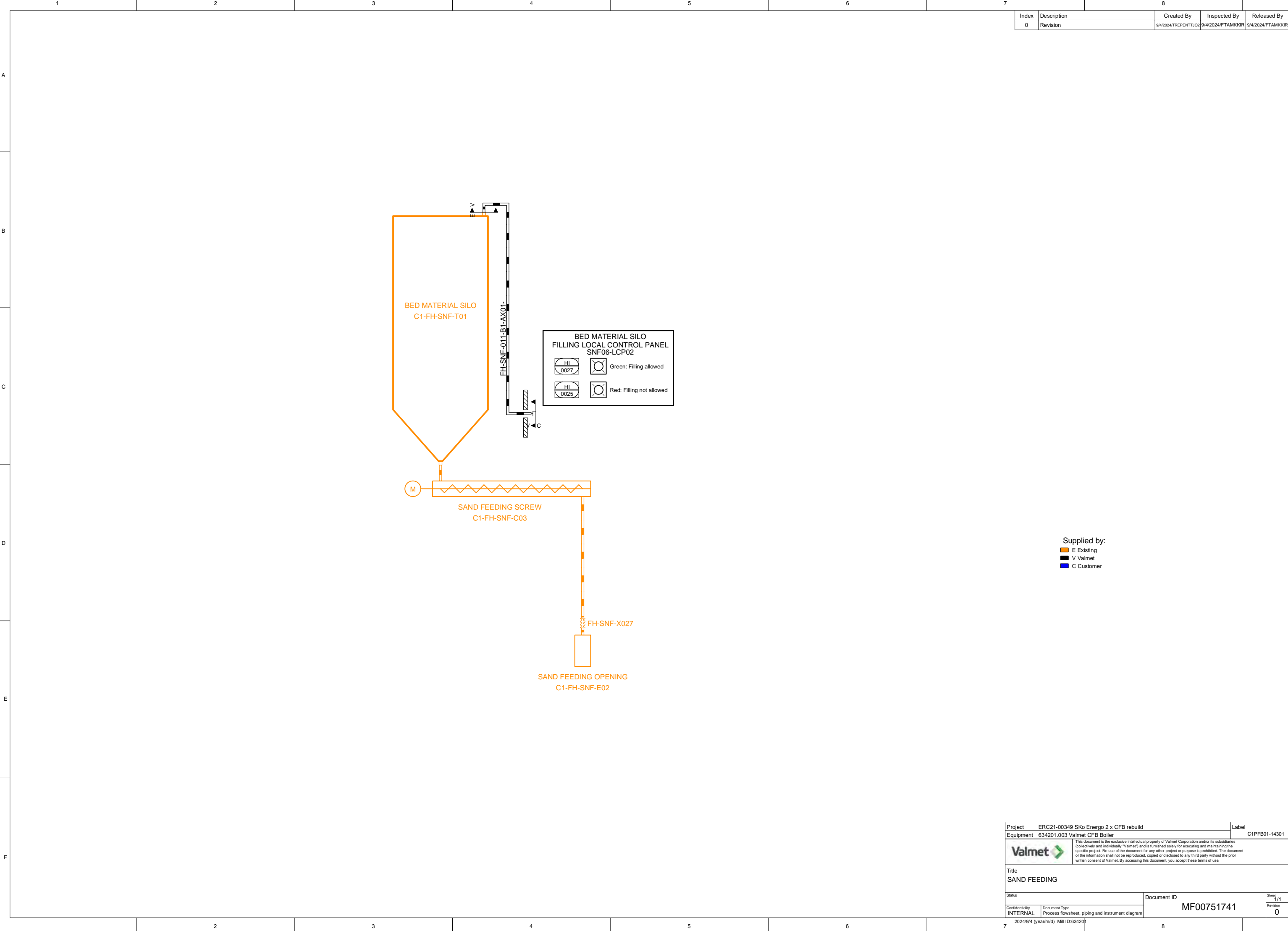
Project		ERC21-00349 SKo Energo 2 x CFB rebuild		Label	
Equipment		634201.003 Valmet CFB Boiler		C1PFB01-12040	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
AMMONIA INJECTION TO FURNACE					
Status		Document ID		Sheet	1/1
Confidentiality	Document Type	MF00751739		Revision	0
INTERNAL	Process flowsheet, piping and instrument diagram				

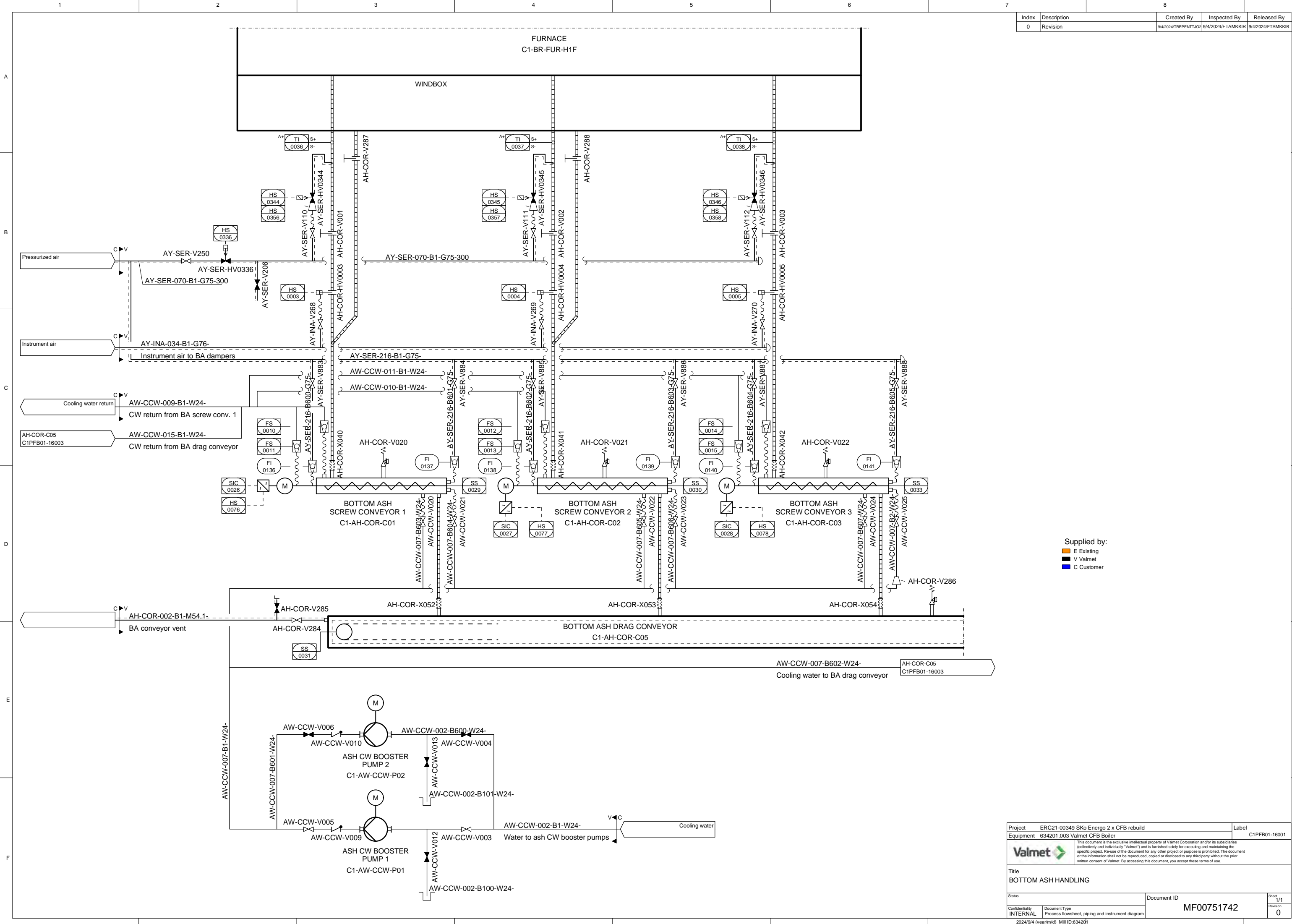


Index	Description	Created By	Inspected By	Released By
0	Revision	9/4/2024/TREPTJ02	9/4/2024/FTAMKKIR	9/4/2024/FTAMKKIR

Supplied by:
E Existing
V Valmet
C Customer


Project		ERC21-00349 SKo Energo 2 x CFB rebuild		Label	
Equipment		634201.003 Valmet CFB Boiler		C1PFB01-14030	
<div><div></div><div><p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p></div></div>					
Title					
FUEL FEEDING					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00751740			Revision 0

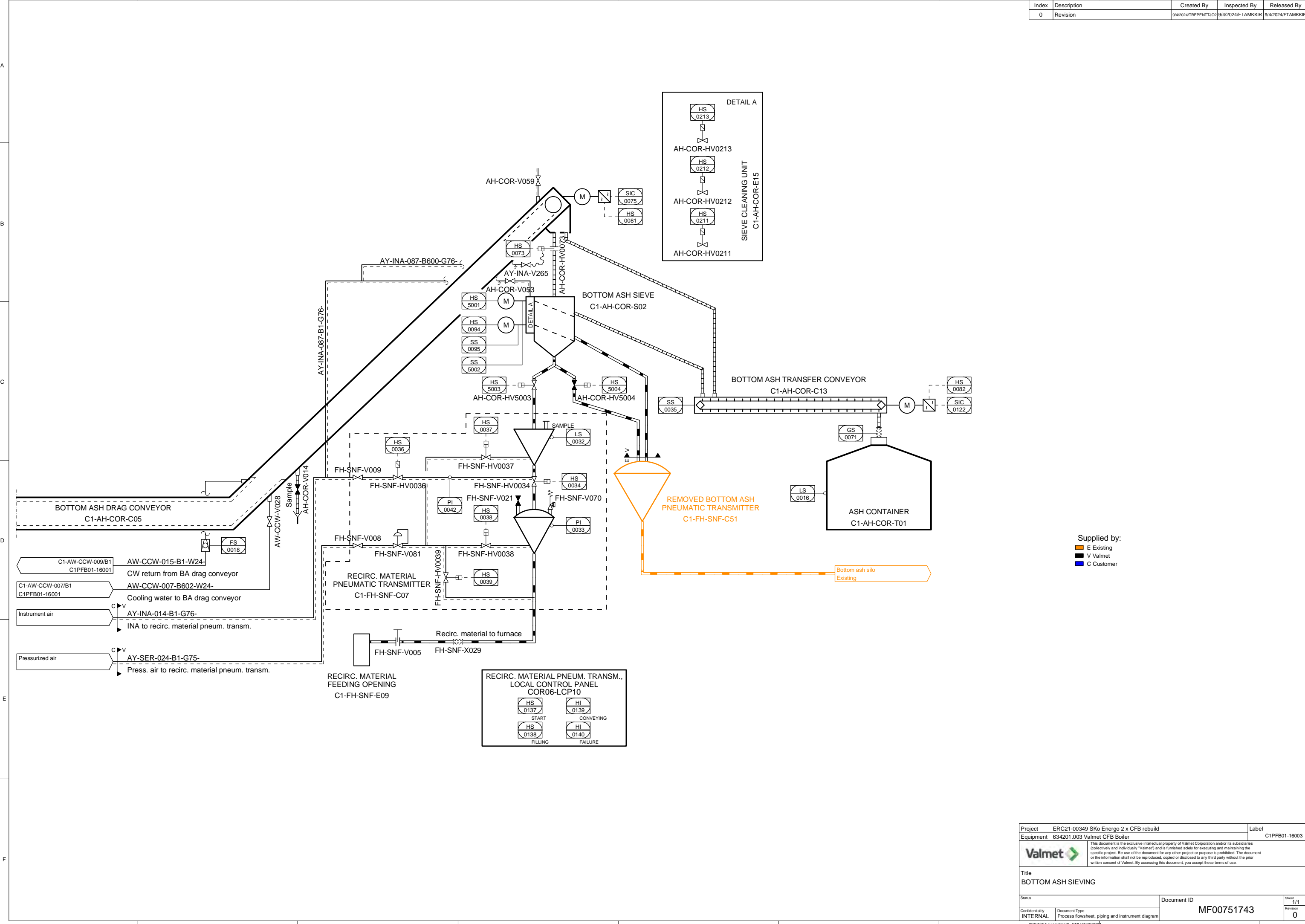




Index	Description	Created By	Inspected By	Released By
0	Revision	9/4/2024/TREPTJJO2	9/4/2024/FTAMKKIR	9/4/2024/FTAMKKIR


Supplied by:
E Existing
V Valmet
C Customer

Project		ERC21-00349 SKo Energo 2 x CFB rebuild		Label	
Equipment		634201.003 Valmet CFB Boiler		C1PFB01-16001	
<div><div></div><div><p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p></div></div>					
Title					
BOTTOM ASH HANDLING					
Status		Document ID			Sheet 1/1
Confidentiality	Document Type	MF00751742			Revision
INTERNAL	Process flowsheet, piping and instrument diagram				0

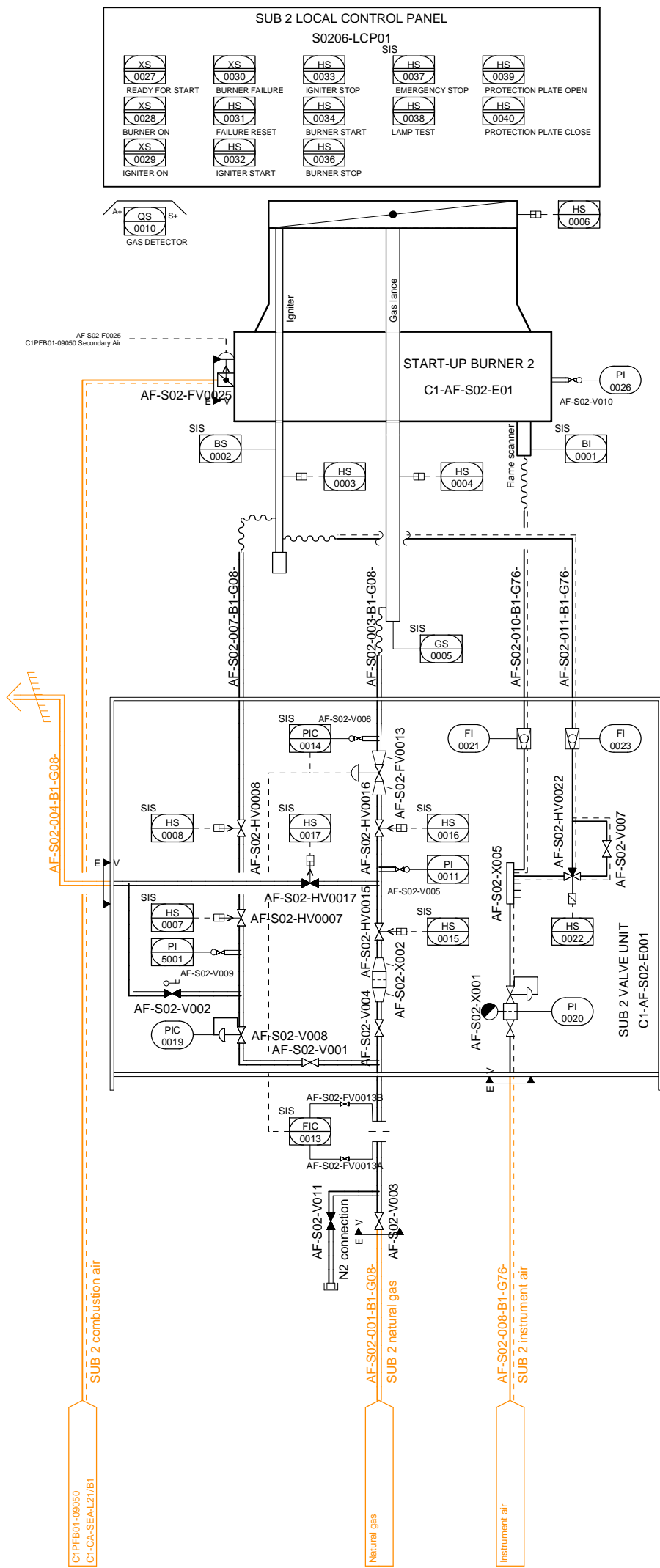
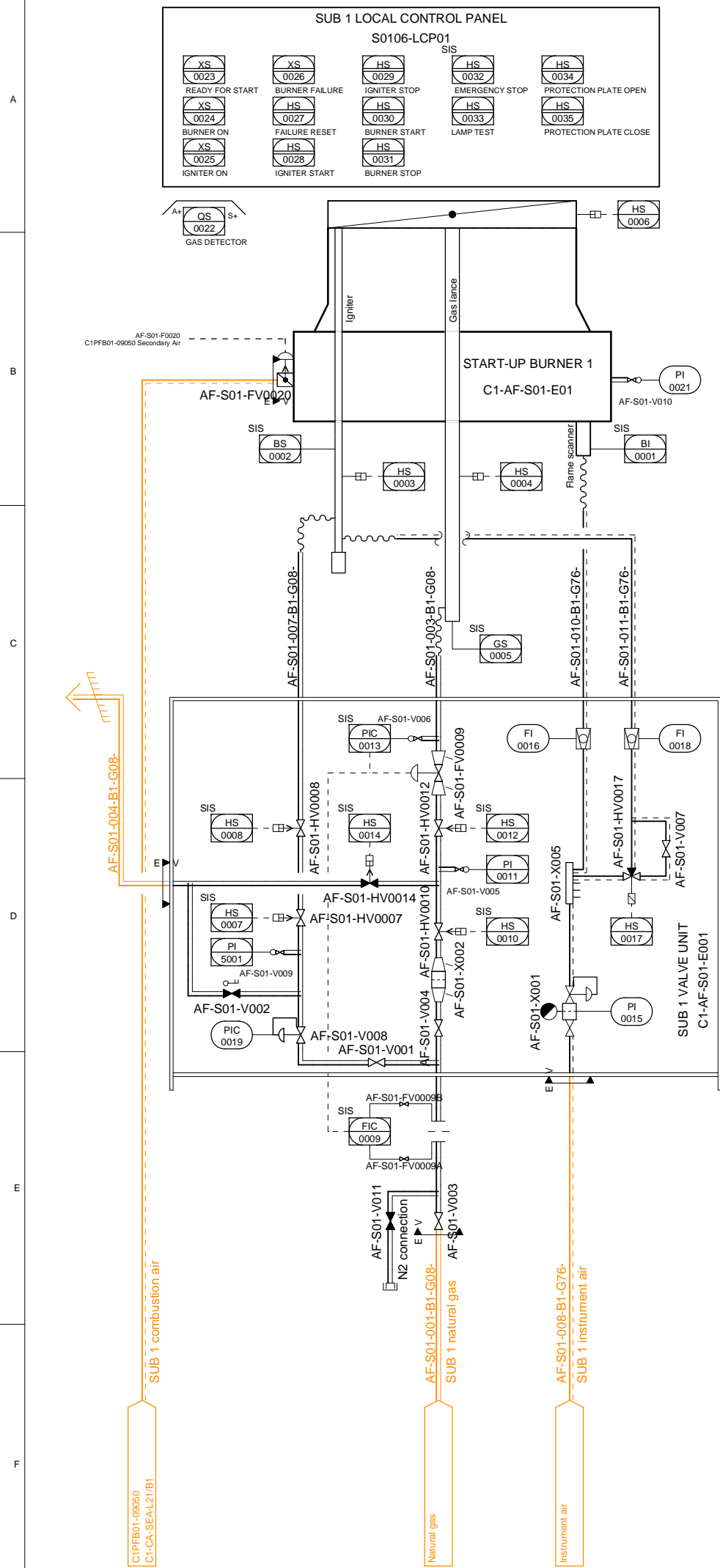


Index	Description	Created By	Inspected By	Released By
0	Revision	9/4/2024/TREPTTJ02	9/4/2024/FTAMKKR	9/4/2024/FTAMKKR

Supplied by:
E Existing
V Valmet
C Customer


Project		ERC21-00349 SKo Energo 2 x CFB rebuild		Label	
Equipment		634201.003 Valmet CFB Boiler		C1PFB01-16003	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
BOTTOM ASH SIEVING					
Status		Document ID		Sheet	
				1/1	
Confidentiality		Document Type		Revision	
INTERNAL		Process flowsheet, piping and instrument diagram		0	

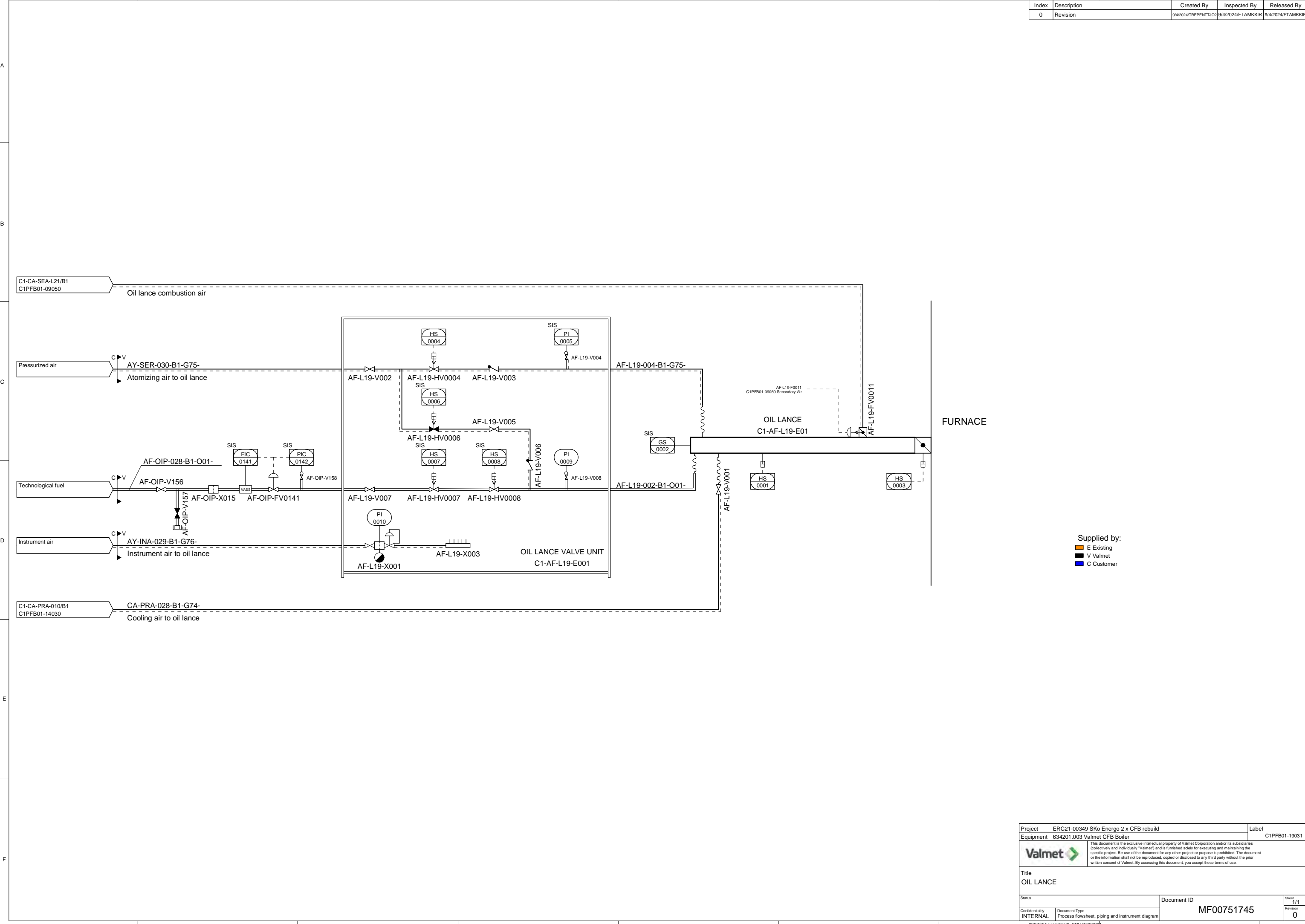
Index	Description	Created By	Inspected By	Released By
0	Revision	9/4/2024/TREPENTJ02	9/4/2024/FTAMKKJR	9/4/2024/FTAMKKJR



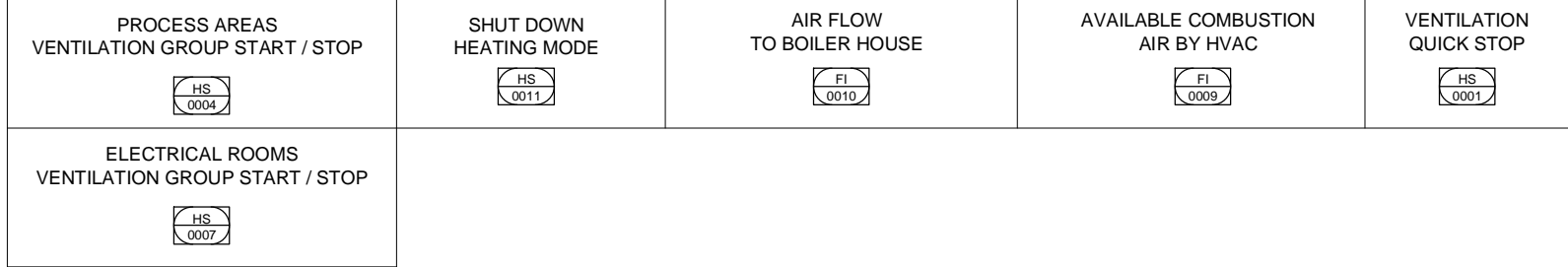
Supplied by:

- E Existing
- V Valmet
-  C Customer

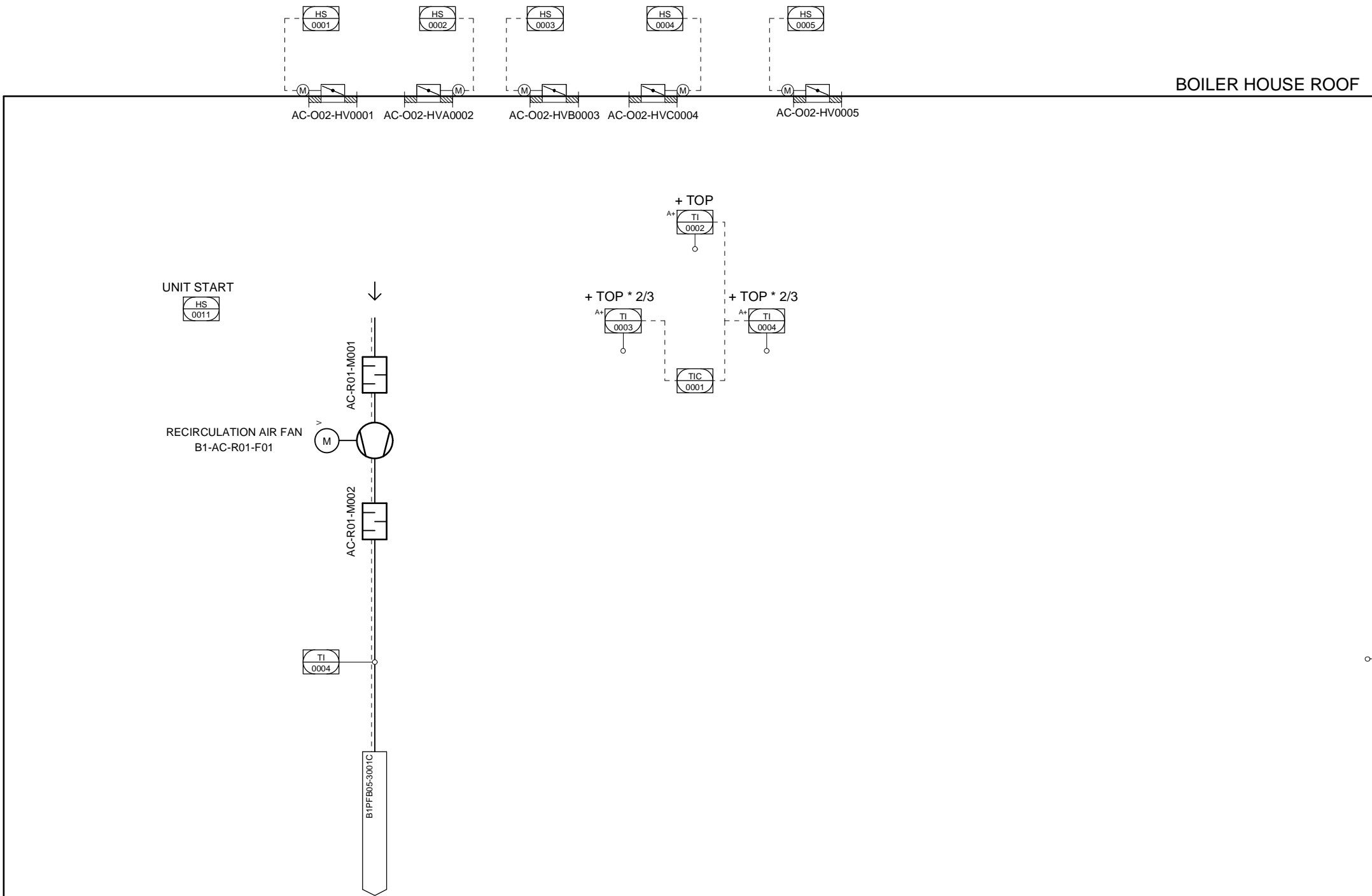
Project	ERC21-00349 SKo Energo 2 x CFB rebuild	Label	
Equipment	634201.003 Valmet CFB Boiler		C1PFB01-19015
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>	
<p>Title</p> <p>START-UP BURNERS 1 & 2</p>			
Status:		Document ID	Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00751744	Revision 0



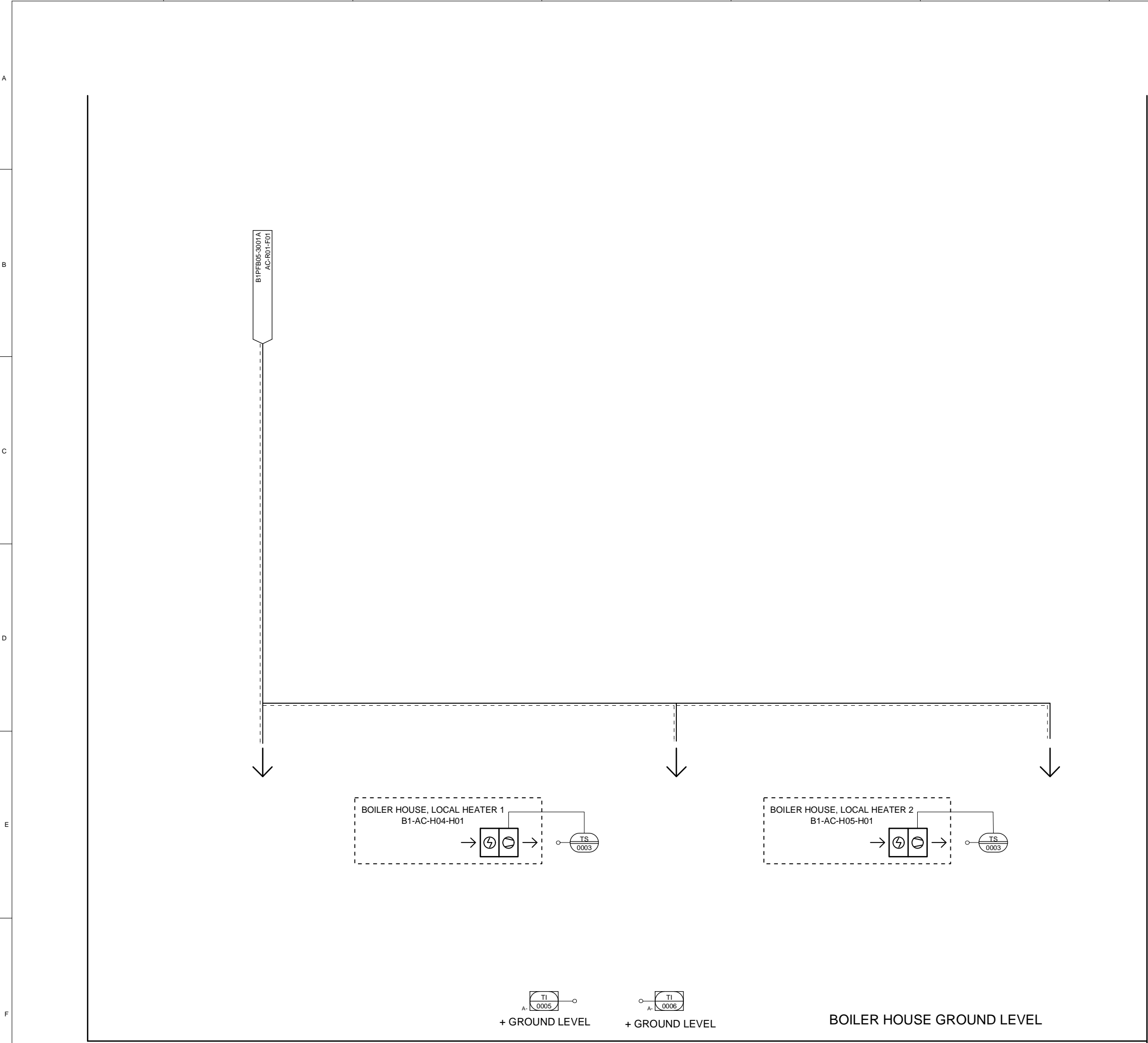
1		2		3		4		5		6		7		8	
PROCESS LINES								INSTRUMENTS							




Index	Description	Created By	Inspected By	Released By
0	Revision	06/03/2024/TKUKALLITE	06/03/2024/TKUHANNH	06/03/2024/TKUHANNH
1	Revision	06/03/2024/TKUKALLITE	06/03/2024/TKUHANNH	06/03/2024/TKUHANNH
2	Revision	14/03/2024/TKUKALLITE	14/03/2024/TKUHANNH	14/03/2024/TKUHANNH
3	Revision	20/06/2024/PORHARJUAL	20/06/2024/TKUHANNH	20/06/2024/TKUHANNH

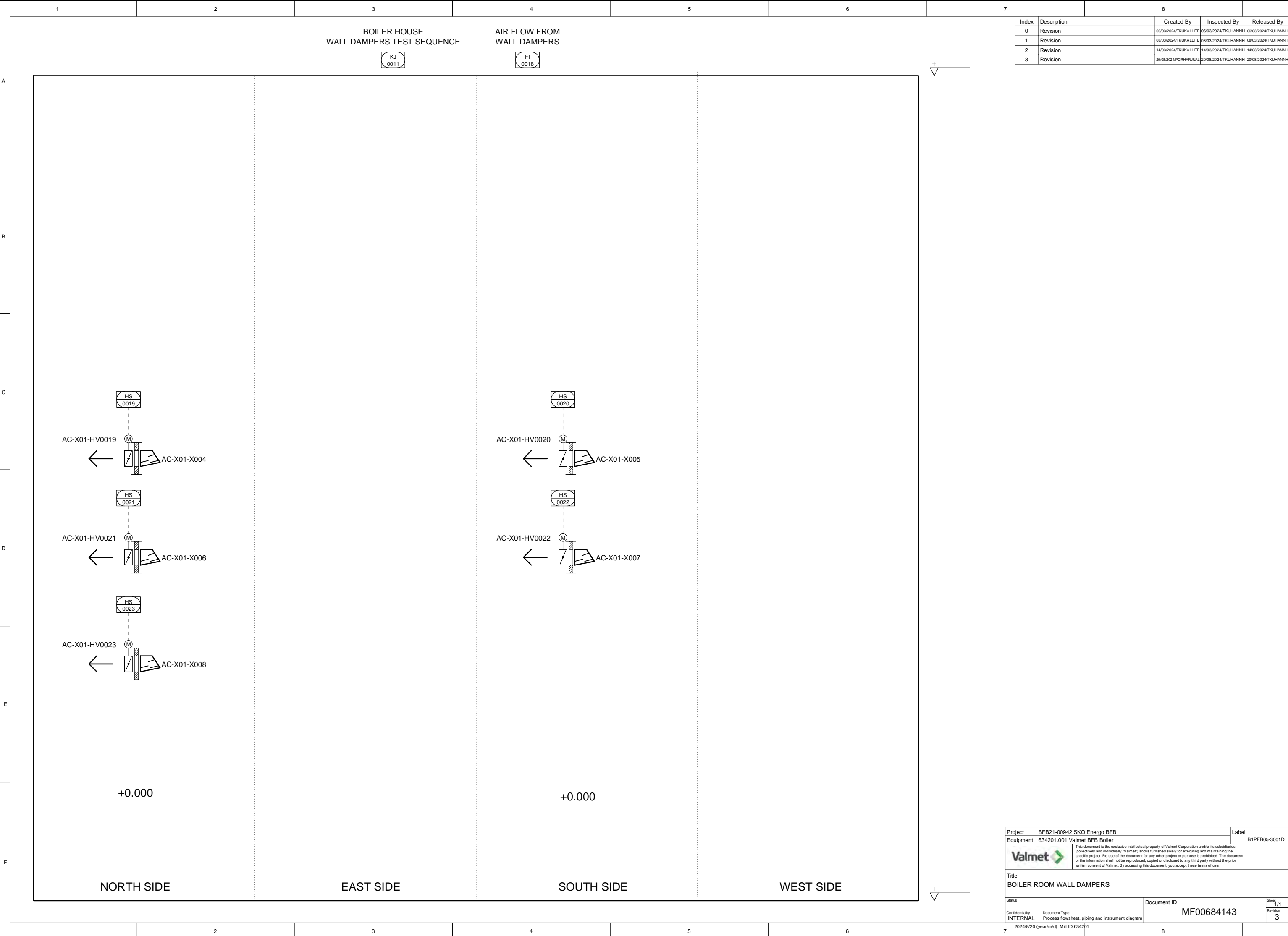


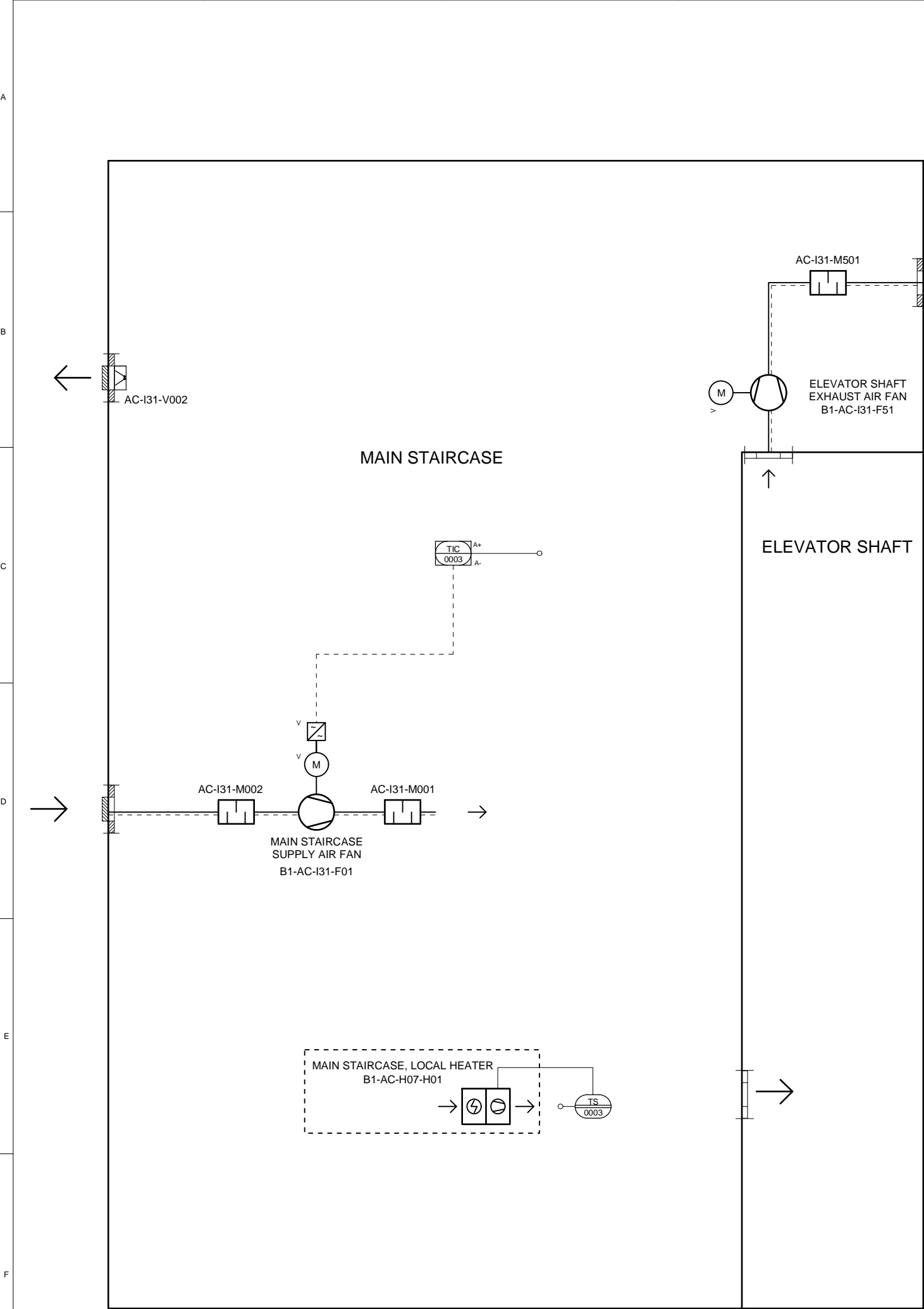
Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB05-3001A	
<div><div>Valmet</div><div></div></div>		<div>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</div>			
Title					
BOILER HOUSE ROOF VENTILATION					
Status		Document ID			Sheet
Confidentiality		INTERNAL			1/1
Document Type		Process flowsheet, piping and instrument diagram			Revision
		MF00684141			3




Index	Description	Created By	Inspected By	Released By
0	Revision	06/03/2024/TKUKALLITE	06/03/2024/TKUHANNH	06/03/2024/TKUHANNH
1	Revision	06/03/2024/TKUKALLITE	06/03/2024/TKUHANNH	06/03/2024/TKUHANNH
2	Revision	14/03/2024/TKUKALLITE	14/03/2024/TKUHANNH	14/03/2024/TKUHANNH
3	Revision	20/06/2024/PORHARJUAL	20/06/2024/TKUHANNH	20/06/2024/TKUHANNH

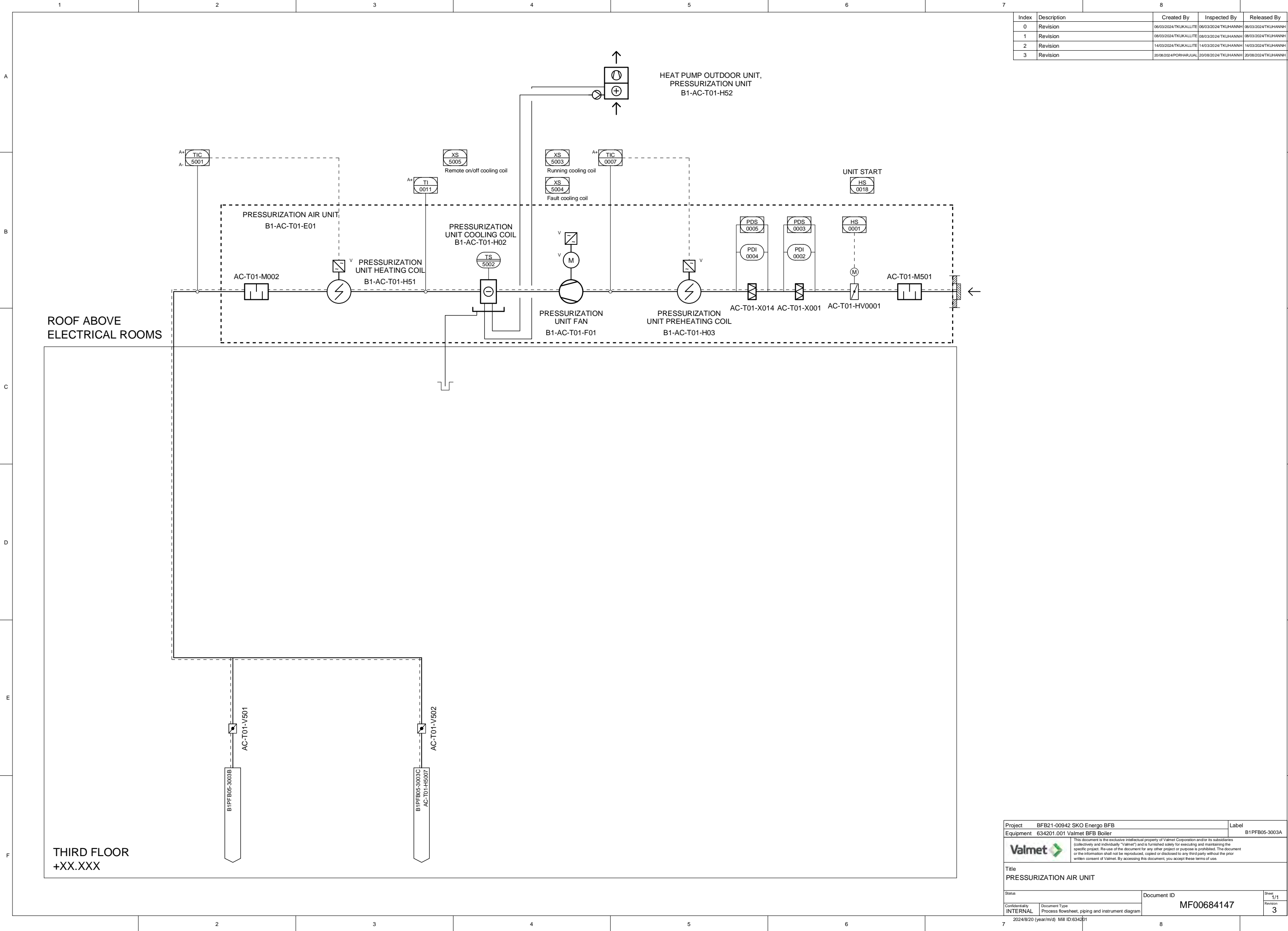
Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB05-3001C	
		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.			
Title					
BOILER ROOM GROUND LEVEL					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00684142			Revision 3






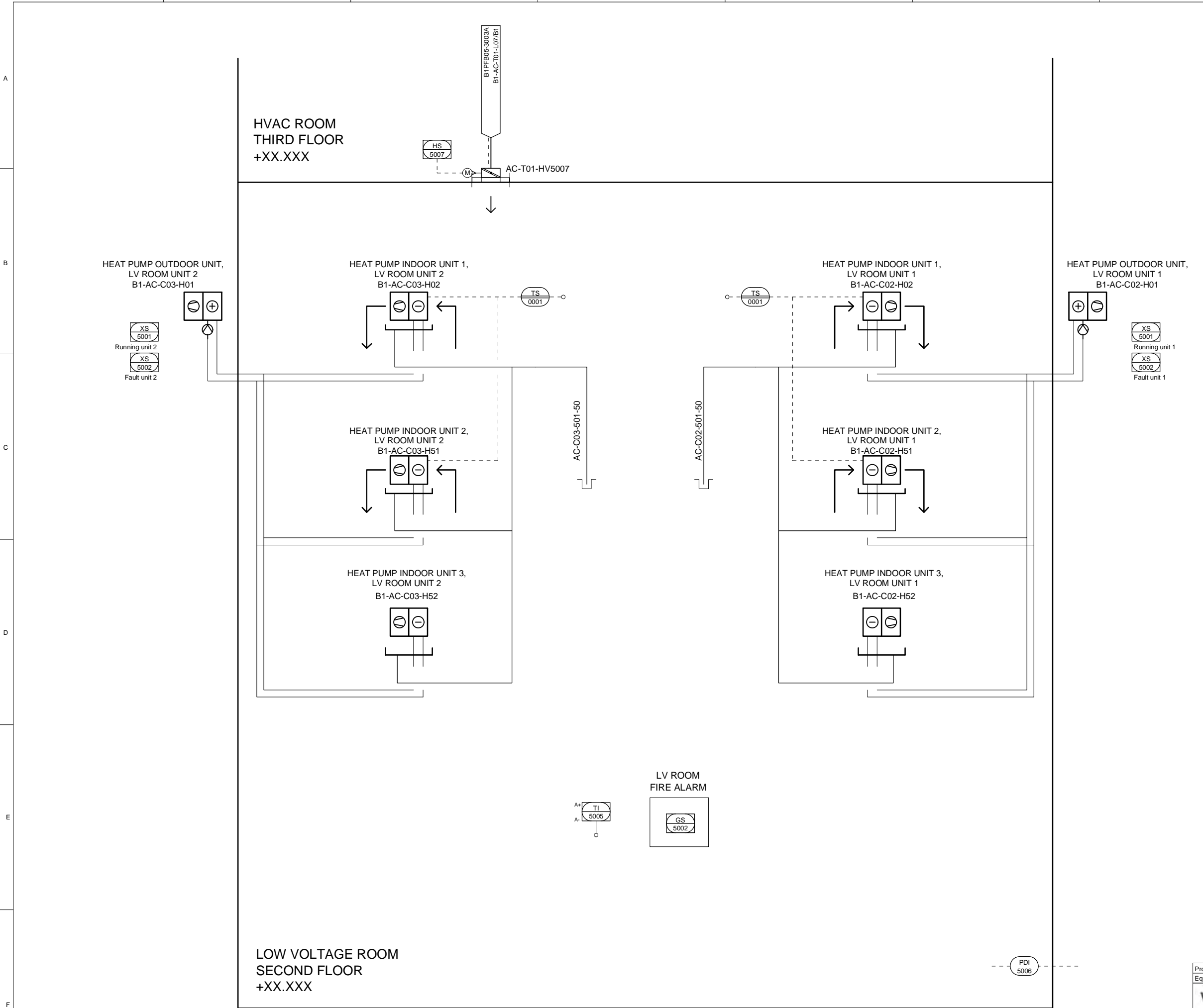
Index	Description	Created By	Inspected By	Released By
0	Revision	06/03/2024/TKUKALLITE	06/03/2024/TKUHANNH	06/03/2024/TKUHANNH
1	Revision	06/03/2024/TKUKALLITE	06/03/2024/TKUHANNH	06/03/2024/TKUHANNH
2	Revision	14/03/2024/TKUKALLITE	14/03/2024/TKUHANNH	14/03/2024/TKUHANNH
3	Revision	20/06/2024/PORHARJUAL	20/06/2024/TKUHANNH	20/06/2024/TKUHANNH

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB05-3001F	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
BOILER HOUSE STAIRCASES					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00684144			Revision 3




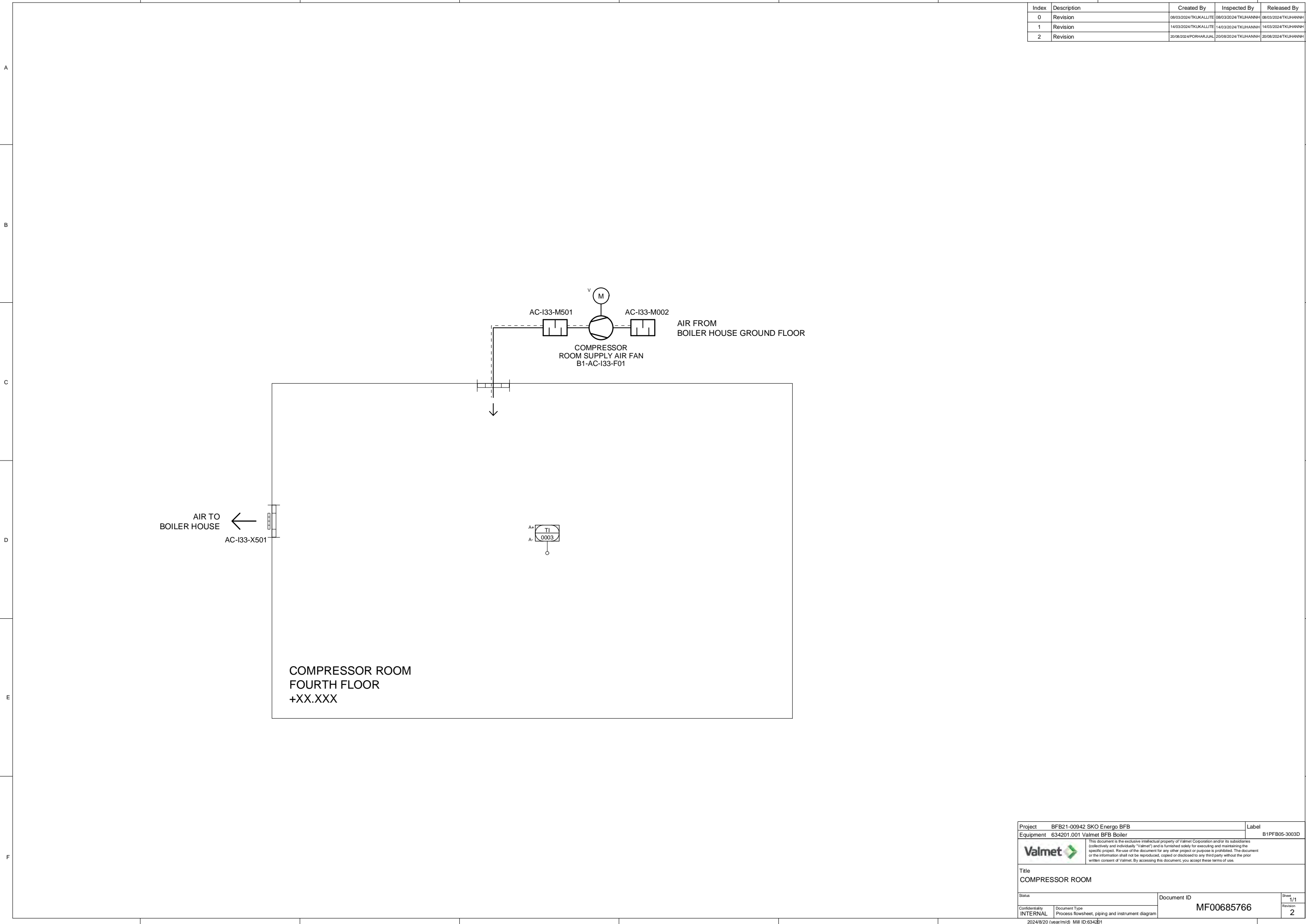
Index	Description	Created By	Inspected By	Released By
0	Revision	06/03/2024/TKUKALLITE	06/03/2024/TKUHANNH	06/03/2024/TKUHANNH
1	Revision	06/03/2024/TKUKALLITE	06/03/2024/TKUHANNH	06/03/2024/TKUHANNH
2	Revision	14/03/2024/TKUKALLITE	14/03/2024/TKUHANNH	14/03/2024/TKUHANNH
3	Revision	20/06/2024/PORHARJUAL	20/06/2024/TKUHANNH	20/06/2024/TKUHANNH

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB05-3003A	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
PRESSURIZATION AIR UNIT					
Status		Document ID			Sheet
					1/1
Confidentiality	Document Type	MF00684147			Revision
INTERNAL	Process flowsheet, piping and instrument diagram				3




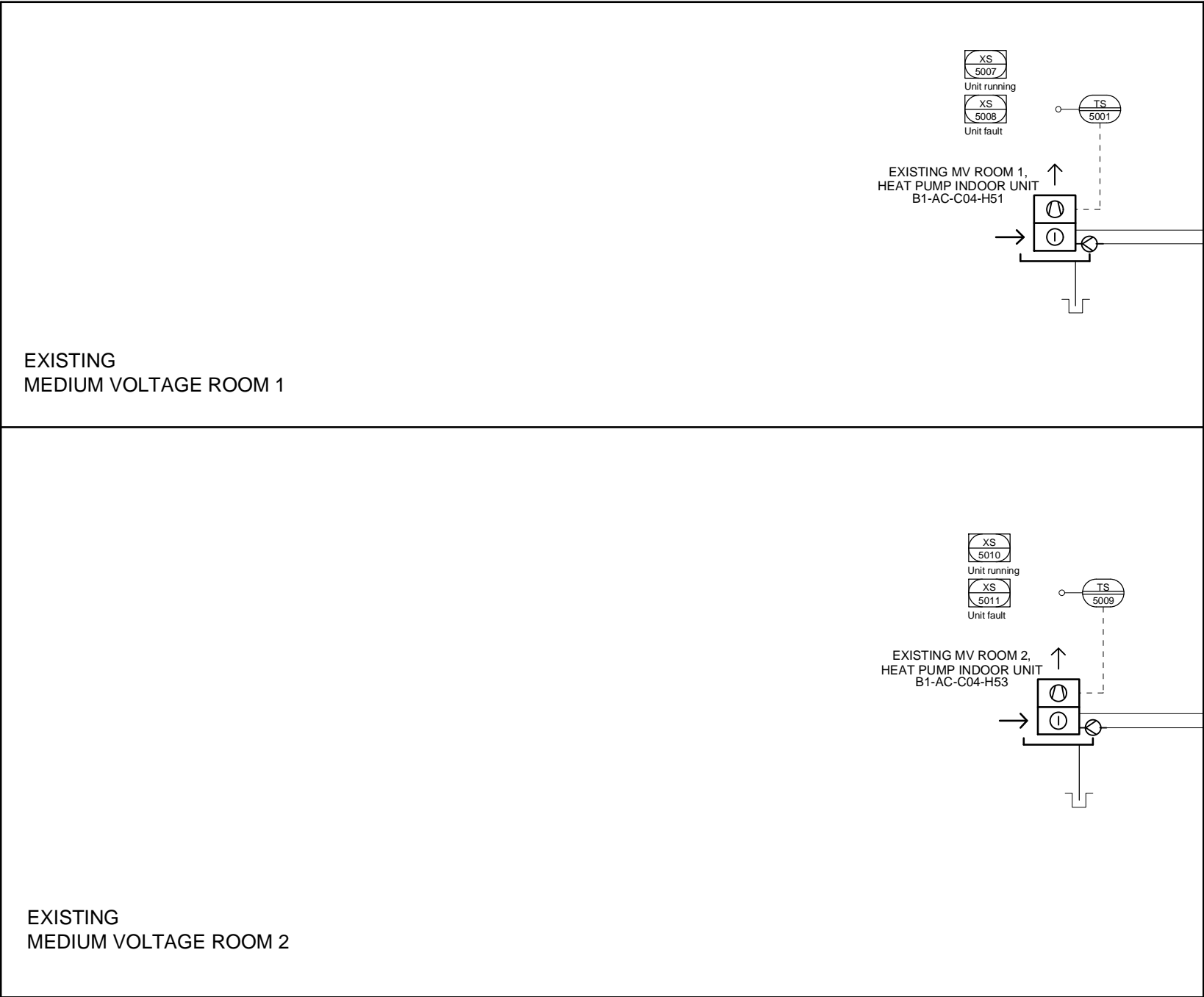
Index	Description	Created By	Inspected By	Released By
0	Revision	06/03/2024/TKUKALLITE	06/03/2024/TKUHANNH	06/03/2024/TKUHANNH
1	Revision	06/03/2024/TKUKALLITE	06/03/2024/TKUHANNH	06/03/2024/TKUHANNH
2	Revision	14/03/2024/TKUKALLITE	14/03/2024/TKUHANNH	14/03/2024/TKUHANNH
3	Revision	20/06/2024/PORHARJUAL	20/06/2024/TKUHANNH	20/06/2024/TKUHANNH

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB05-3003C	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
ELECTRIC EQUIPMENT ROOM 2					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL		MF00684149			Revision 3
Document Type Process flowsheet, piping and instrument diagram					




Index	Description	Created By	Inspected By	Released By
0	Revision	08/03/2024/TKUKALLITE	08/03/2024/TKUHANNH	08/03/2024/TKUHANNH
1	Revision	14/03/2024/TKUKALLITE	14/03/2024/TKUHANNH	14/03/2024/TKUHANNH
2	Revision	20/08/2024/PORHARJUAL	20/08/2024/TKUHANNH	20/08/2024/TKUHANNH

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB05-3003D	
		<p>This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.</p>			
Title					
COMPRESSOR ROOM					
Status		Document ID			Sheet 1/1
Confidentiality INTERNAL	Document Type Process flowsheet, piping and instrument diagram	MF00685766			Revision 2



Index	Description	Created By	Inspected By	Released By
0	Revision	14/03/2024/TKUKALLITE	14/03/2024/TKUHANNH	14/03/2024/TKUHANNH
1	Revision	20/08/2024/PORHARJUAL	20/08/2024/TKUHANNH	20/08/2024/TKUHANNH

Project		BFB21-00942 SKO Energo BFB		Label	
Equipment		634201.001 Valmet BFB Boiler		B1PFB05-3004A	
		This document is the exclusive intellectual property of Valmet Corporation and/or its subsidiaries (collectively and individually "Valmet") and is furnished solely for executing and maintaining the specific project. Re-use of the document for any other project or purpose is prohibited. The document or the information shall not be reproduced, copied or disclosed to any third party without the prior written consent of Valmet. By accessing this document, you accept these terms of use.			
Title					
EXISTING ELECTRIC EQUIPMENT ROOMS					
Status		Document ID		Sheet	
Confidentiality		INTERNAL		1/1	
Document Type		Process flowsheet, piping and instrument diagram		Revision	
		MF00689606		1	

Reference List Valmet BFB Boiler

Start Up	Customer Site	Country/Region	Fuels	Steam Capacity 1 (kg/s)	Steam Capacity 2 (MWth)	Steam Pressure (bar)	Steam Temperature (C)	Technology Sub Type
2026	Göteborg Energi AB, Gothenburg	Sweden	Recycled wood, Biomass	49.8	140	100	510	
2025	Suzano S.A., Aracruz	Brazil	Eucalyptus bark	30.55	84.9	66	455	
2025	Progroup Power 2 GmbH, Burg	Germany	Biogas, Natural gas, De-inking rejects, Paper processing reject, RDF	40.75	116	65	460	
2025	GREENVOLT - Energias Renováveis S.A., Mortágua Biomass Power Plant	Portugal	Eucalyptus bark	15	44	90	480	
2025	DS Smith Paper Rouen S.A.S, Rouen Paper Mill	France	Sludge, Recycled wood, De-inking rejects	19.6	70.6	81	440	
2024	Condat SAS, Condat	France	RDF	11.4	31.5	67	415	EFW
2024	PT. Oki Pulp & Paper Mills, Ogan Komering Ilir	Indonesia	Bark, Wood chips, Coal, Sludge	117	111.4	110	515	
2024	PT. Oki Pulp & Paper Mills, Ogan Komering Ilir	Indonesia	Sludge, Coal, Wood chips, Bark	117	111.4	110	515	
2024	ORLEN Poludnie S.A., Zakad Jedlicze	Poland	Wood chips, Lignin, Biogas	16	49.5	80	480	
2023	Caima - Indústria de Celulose SA, Constancia	Portugal	Eucalyptus bark	25	75	90	480	Water tube
2022	Norske Skog Bruck GmbH, Bruck	Austria	Paper processing reject, Sewage sludge, Natural gas, Sludge, RDF	17	50	40	490	EFW
2022	Veolia Energie R, a.s. , Prerov	Czech Republic	Wood chips, RDF	15.8	40	42	420	
2022	Seinäjoen Energia Oy, Seinäjoki	Finland	Biomass	152	44	13	192	
2021	Göteborg Energi AB, Rya HVC	Sweden	Wood pellets		20	40	360	ACZ
2021	Lidköping Energi AB, Lidköping	Sweden	RDF, Recycled fuel, Recycled wood					
2021	CELULOSA ARAUCO Y CONSTITUCION S A, Arauco Mill L3 (MAPA)	Chile	Eucalyptus bark, Willow chips	65	160	106	495	
2020	Moritz J. Weig GmbH & Co. KG, Weig Mayen	Germany	Biogas, Sludge, Paper processing reject	15.3	44	82	530	EFW
2020	Loimua Oy, Hämeenlinna	Finland	Peat, Biomass		35			
2019	Imasa, Ingenieria Y Proyectos, Oviedo-Asturias	Spain	Biomass	52	128	90	485	
2019	Borås Energi och Miljö AB, Sobacken	Sweden	Bark, Forest residue, Wood chips	48	120	139	540	
2019	Georgia-Pacific LLC, Pennington	United States	Bark, Wood chips	69	171	92	482	Water tube
2019	Ørsted Bioenergy & Thermal Power A/S, Kalundborg	Denmark	Stump chips, Wood chips, Bark	50	130	100	540	
2019	Sociedade Bioelectrica do Mondego S.A., Celbi Pulp Mill	Portugal	Forest residue, Wood, Eucalyptus bark	43	109	89	480	Water tube
2016	Nokianvirran Energia Oy, Nokia	Finland	Forest residue, Peat, Sludge, Wood chips	24	68	86	485	
2016	WestRock CP LLC , Demopolis AL	United States	Bark, Sludge, Natural gas, Non-condensable gas	44	117	41	399	
2016	Nybro Värmecentral AB, Transtorp	Sweden	RDF		22	65	410	ACZ
2016	PT. Oki Pulp & Paper Mills, Ogan Komering Ilir	Indonesia	Coal, Bark, Sludge	117	302	110	515	Water tube
2016	PT. Oki Pulp & Paper Mills, Ogan Komering Ilir	Indonesia	Sludge, Bark, Coal	117	302	110	515	Water tube
2016	Skövde Energi AB, Skövde	Sweden	Sawdust, Wood chips, Bark, Forest residue, Peat	14	38	90	480	
2015	Uni Viridas d.o.o, Zagreb	Croatia (Hrvatska)	Bark, Forest residue, Wood chips	10.6	28	90	500	Water tube

Reference List Valmet BFB Boiler

Start Up	Customer Site	Country/Region	Fuels	Steam Capacity 1 (kg/s)	Steam Capacity 2 (MWth)	Steam Pressure (bar)	Steam Temperature (C)	Technology Sub Type
2014	Jönköping Energi AB, Jönköping	Sweden	Bark, Forest residue, Peat, Wood chips	39.5	100	139	540	
2013	Helme Energia OÜ, Patkõla	Estonia	Biomass	8	22	90	500	
2013	SIA Gren Latvija, Jelgava	Latvia	Peat, Biomass	26	69	117	527	Water tube
2013	Vantaan Energia Oy, Järvenpää	Finland	Milled peat, Biomass	26	69	117	527	Water tube
2013	Gainesville Regional Utility, GRU Deerhaven Gainesville FL	United States	Forest residue, Wood chips	117	292	112	540	Water tube
2013	Suzano S.A., Imperatriz	Brazil	Sewage sludge, Debarking wood loss, Bark, Biomass, Eucalyptus bark	33	91	94	480	Water tube
2013	Västervik Miljö & Energi AB, Västervik	Sweden	RDF	7	20	60	410	ACZ
2012	Bomhus Energi AB, Gävle	Sweden	Biomass, Recycled wood, Forest residue, Bark, Bio oil, Sludge, Wood chips, Sawdust	57	150	120	520	
2012	SIA Graanul Invest Energy, Launkalne	Latvia	Bark, Milled peat, Wood chips	8	22	90	500	
2012	Nacogdoches Power, LLC, Sacul	United States	Sawdust, Forest residue	117	292	112	540	
2012	NAES Corporation, Cushing	United States	Sawdust, Forest residue	117	292	112	540	
2012	CMPC PULP SPA, Santa Fe	Chile		59	210	94	485	
2012	Affärsverken Karlskrona AB, Karlskrona	Sweden	Biomass	17.3	42	91	485	
2012	Valio Oy, Lapinlahti	Finland	Biomass	9	20	30	245	
2012	Tauron Ciepło SP. z o.o., Tychy	Poland	Coal	38	105	100	540	
2011	PGE Energia Ciepła S.A., Szczecin CHP	Poland	Forest residue, Willow chips, Straw pellets	64	183	70	535	
2010	Vattenfall AB, Haninge	Sweden	Demolition wood	25	63	80	470	Water tube
2010	Dalkia SA, Facture	France	Sawdust, Forest residue, Stump chips, Recycled wood, Sludge, Bark	47	124	119	520	
2009	Möln dal Energi AB, Möln dal	Sweden	Sawdust, Recycled wood, Wood chips, Bark, Peat, Stump chips, Forest residue	27	70	123	520	Water tube
2009	UPM-Kymmene (UK) Ltd, Caledonian	United Kingdom	Sawdust, Forest residue, Demolition wood, Sludge, Bark	34	90	90	510	
2009	Keravan Lämpövoima OY, Helsinki	Finland	Milled peat, Forest residue	28	73	77	480	
2009	GREENVOLT - Energias Renováveis S.A., Constância	Portugal	Sawdust, Olive bagasse, Pine bark, Eucalyptus bark	13	35	64	450	Water tube
2009	Gren Tartu AS, Ropka Boiler House	Estonia	Milled peat, Wood chips, Natural gas	29	76	115	525	
2009	Kalmar Energi Värme AB, Kalmar	Sweden	Forest residue, Bark, Wood chips, Peat	36	90	143	540	
2009	CELULOSA ARAUCO Y CONSTITUCION S A, Arauco Mill L2 (Horcones)	Chile	Plywood residue, Sawdust, Bark	58	165	85	485	
2009	Loimua Oy, Hämeenlinna	Finland	Natural gas, Biomass, Peat, Coal	18	52	27	400	
2009	Suzano S.A., Tres Lagoas	Brazil	Biomass	33	138	84	485	Water tube
2008	Övik Energi AB, Örnsköldsvik	Sweden	Sawdust, Bark, Forest residue	53	130	141	540	
2007	Smurfit Kappa Kraftliner, Piteå	Sweden	Bark, Forest residue, Peat, Sludge, Sawdust	50	132	120	520	

Reference List Valmet BFB Boiler

Start Up	Customer Site	Country/Region	Fuels	Steam Capacity 1 (kg/s)	Steam Capacity 2 (MWth)	Steam Pressure (bar)	Steam Temperature (C)	Technology Sub Type
2007	Fibre Excellence France, Fibre Excellence SNDP	France	Wood fuel, De-inking rejects, Gas	32	82	83	485	
2007	E.ON UK PLC, Lockerbie	United Kingdom	Sawdust, Wood chips, Recycled wood, Bark	48	126	137	537	
2007	Falu Energi & Vatten AB, Falun	Sweden	Bark, Recycled wood, Sawdust, Wood chips	11	31	70	500	ACZ
2007	Shotton Mill Ltd, Shotton Paper Mill	United Kingdom	Wood fuel, Sludge, De-inking rejects, Gas	32	82	83	485	
2007	Rodao Power, Vila Velha de Ródão	Portugal	Pine bark, Olive bagasse, Sawdust, Eucalyptus bark	13	35	64	450	Water tube
2006	Norske Skog Golbey SA, Golbey	France	RDF, Bark, Gas, Sludge	40	90	25	224	Water tube
2006	CMPC PULP SPA, Pacifico	Chile	Plywood residue, Wood chips, Grinding dust, Bark, Sawdust	42	113	61	450	
2006	Rauman Biovoima Oy, Rauma	Finland	Forest residue, Sludge, Peat, Bark, Recycled fuel	40	107	118	535	
2006	Öresundskraft Kraft & Värme AB, Åkerslundsverket	Sweden	Biomass		23			ACZ
2005	Fibre Excellence Saint-Gaudens, Saint-Gaudens	France	Sawdust, Sludge, Bark	17	46	61	450	
2005	Veracel Celulose S.A., Eunápolis	Brazil	Oil, Debarking wood loss, Bark, Biomass, Eucalyptus bark	25	72	92	490	Water tube
2005	Öresundskraft Kraft & Värme AB, Åkerslundsverket	Sweden	Biomass		23			ACZ
2005	Nevel Oy, Haapavesi	Finland	Milled peat, Sludge	10	27	63	510	
2004	Biomasseheizkraftwerk Herbrechtingen GmbH, Herbrechtingen	Germany	Forest residue	15	44	90	520	Water tube
2004	CELULOSA ARAUCO Y CONSTITUCION S A, Nueva Aldea Mill	Chile	Sawdust, Sludge, Non-condensable gas, Bark, Oil	58	165	85	485	
2004	CELULOSA ARAUCO Y CONSTITUCION S A, Valdivia Mill	Chile	Non-condensable gas, Bark, Sludge, Sawdust	25	70	85	485	
2004	Smurfit Kappa Parenco B.V., Renkum	Netherlands	De-inking rejects, Water treatment sludge, Gas	13	37	65	475	
2004	Termomeccanica S.P.A., La spezia	Italy	RDF	10	30	42	405	ACZ
2004	Termomeccanica S.P.A., La spezia	Italy	RDF	10	30	42	405	ACZ
2003	Essity Hygiene and Health AB, Lilla Edet	Sweden	De-inking rejects, Wood chips	9	23	62	420	
2003	Järvi-Suomen Voima OY, Savonlinna	Finland	Plywood residue, Forest residue, Peat, Wood fuel, Bark, Grinding dust	28	72	92	523	Water tube
2003	Kotkan Energia Oy, Kotka	Finland	Peat, Bark, Wood	21	61	62	480	
2003	A2A Ambiente S.p.A, Corteolona (pv)	Italy	RDF	10	30	40	402	ACZ
2003	Ecologia Oggi S.p.A., Lamezia terme (cz)	Italy	RDF	10	29	41	405	ACZ
2003	Ecologia Oggi S.p.A., Lamezia terme (cz)	Italy	RDF	10	29	41	405	ACZ
2002	Kymin Voima Oy, Kuusankoski	Finland	Forest residue, Sludge, Peat, Bark	107	269	114	541	
2002	Järvi-Suomen Voima OY, Pello/niemi	Finland	Peat, Grinding dust, Forest residue, Bark, Plywood residue	30	74	84	482	
2002	Lidköping Energi AB, Lidköping	Sweden	Demolition wood, MSW, RDF, Wood fuel	9	20	40		ACZ
2002	Sandviken Energi AB, Björksåtra Kraftvärmeverk	Sweden	Peat		20	20		ACZ
2002	Sandviken Energi AB, Björksåtra Kraftvärmeverk	Sweden	Peat, Coal		20	20		ACZ

Reference List Valmet BFB Boiler

Start Up	Customer Site	Country/Region	Fuels	Steam Capacity 1 (kg/s)	Steam Capacity 2 (MWth)	Steam Pressure (bar)	Steam Temperature (C)	Technology Sub Type
2001	Kokkolan Energia Oy, Kokkola	Finland	Peat, Wood	27	70	80	482	Water tube
2001	Visy Pulp & Paper Pty., Ltd., Tumut	Australia	Bark, Gas, Wood	19	55	64	460	
2001	Härnösand Energi & Miljö Aktiebolag, Härnösand	Sweden	Bark, Forest residue, Peat, Sawdust, Wood chips	14	42	90	510	Fire tube
2000	Eskilstuna Energi och Miljö AB, Eskilstuna	Sweden	Biomass	41	110	139	540	Water tube
2000	Caima - Indústria de Celulose SA, Constancia	Portugal	Eucalyptus bark	8	23	40	425	Water tube
2000	Halmstads Energi & Miljö AB, Halmstad	Sweden	Biomass		27	16		Water tube
2000	Edenderry Power Operations Ltd, Edenderry	Ireland	Peat	100	274	160	540	Water tube
1999	Asia Honour Paper Industries (M) SDN. BHD, Mentakab	Malaysia	Sludge, Oil	8	20	99		Water tube
1999	MVV Environment Baldovie Limited, Dundee	United Kingdom	MSW	7	17	40	400	ACZ
1999	Gävle Energi AB, Gävle	Sweden	Demolition wood, Oil, Peat	29	77	90	480	Water tube
1999	MVV Environment Baldovie Limited, Dundee	United Kingdom	MSW	7	17	40	400	ACZ
1999	Bio Energie Centrale Cuijk B.V., Cuijk	Netherlands	Wood	27	78	100	525	Water tube
1996	UPM Specialty Papers Oy, Tervasaari	Finland	Sludge, Paper processing reject, Peat, Gas, Bark	28	78	85	485	Water tube
1996	Norske Skog Saugbrugs AS, Saugbrugs	Norway	Sludge, Gas, Bark, Wood	24	70	65	480	Water tube
1996	National Power Plant 3 Co.,Ltd, Khao Hin Son	Thailand	Wood	55	157	84	480	Water tube
1996	Stora Enso Veitsiluoto Oy, Veitsiluoto	Finland	Wood, Sludge, Peat	95	246	90	525	Water tube
1996	Vattenfall AB, Motala	Sweden	Bark, Wood		20	16		ACZ
1994	Model Sachsen Papier GmbH, Eilenburg	Germany	Sludge, Gas	11	32	84	490	Water tube
1986	Fibre Excellence France, Fibre Excellence SNBP	France	Sludge, Gas, Bark	11	32	49	460	Water tube
1986	Mineracao Rio Do Norte S/A, Oriximina	Brazil		12	30	64	480	Water tube
1985	Västervik Miljö & Energi AB, Västervik	Sweden	RDF		10	16		ACZ
1985	Skellefteå Kraft AB, Skellefteå	Sweden	Coal, Oil, Peat, Wood		25	16	185	Water tube
1984	Tekniska Verken i Linköping AB, Katrineholm	Sweden	Coal		20	16		Water tube
1983	Bollnäs Energi AB, Säverstaverket Bollnäs	Sweden	MSW, Peat, Wood		10	16		EFW
1983	Västervik Miljö & Energi AB, Västervik	Sweden	Wood chips		20	16		Water tube
1983	Västervik Miljö & Energi AB, Västervik	Sweden	RDF		10	16		ACZ
1983	Bollnäs Energi AB, Säverstaverket Bollnäs	Sweden	Wood, RDF, Bark		10	16		EFW
1983	Landskrona Energi Kraft AB, Landskrona	Sweden	Coal, RDF, Wood		10	16		Water tube
1983	Landskrona Energi Kraft AB, Landskrona	Sweden	Wood, RDF, Coal		10	16		Water tube
1981	Chalmers tekniska högskola AB, Gothenburg	Sweden	Coal	6	16	32	425	Water tube
1981	Eksjö Energi AB, Eksjö	Sweden			10	16		Water tube
1981	Sunbury Generation LLC, Shamokin dam	United States		3	7	14		Water tube

Reference List Valmet BFB Boiler

Start Up	Customer Site	Country/Region	Fuels	Steam Capacity 1 (kg/s)	Steam Capacity 2 (MWth)	Steam Pressure (bar)	Steam Temperature (C)	Technology Sub Type
1979	Eksjö Energi AB, Eksjö	Sweden	MSW, RDF		5	16		Water tube

VALMET TECHNOLOGIES OY
POWER BOILER REBUILDS AND CONVERSIONS
REFERENCE LIST

BFBc = BFB conversion
BFBu = BFB upgrade or capacity increase
CFBu = CFB upgrade or capacity increase
Other = Other kind of rebuild

DELIVERY YEAR	CUSTOMER	COUNTRY	STEAM DATA					TYPE OF PROJECT		FUELS
			BFB CAPACITY kg/s	TOTAL CAPACITY kg/s	PRESSURE bar(g)	TEMP °C	CAPACITY MW _{th}			
2025	PT Cikarang Litrindo, Jakarta	Indonesia		134,0	130	543	339	Unit 2 CFB fuel upgrade (woods chips) and flue gas recirculation system	CFBu	Coal, wood chips
2024	HELEN Oy, Salmisaari, Helsinki	Finland	Hot water		16	120	163	Pulverized Coal fired hot water boiler conversion to BFB	BFBc	Wood pellets, light fuel oil
2024	Veolia/Ujpalotai Energia Kft., Oroszlany	Hungary	52,8		99	540	136	PC boiler conversion to BFB	BFBc	Biomass, SRF, light fuel oil
2024	Veolia/CHP-Invest Kft., Oroszlany	Hungary	52,8		99	540	136	PC boiler conversion to BFB	BFBc	Biomass, SRF, light fuel oil
2024	Koehler Oberkirch GmbH, Oberkirch	Germany		25,0	94	515	64	CFB fuel upgrade from coal to biomass	CFBu	Wood chips, landscaping waste wood chips and sieve over flow from compost processing
2023	BEB Bioenergie Baden GmbH, Kehl	Germany		16,4	90	500	44	CFB fuel upgrade (adding sludges to fuel mix) and SH modification	CFBu	Waste wood, woodchips, sewage sludge, paper fiber sludge
2023	JSC Vilniaus Kogeneracinė Jėgainė, Vilnius	Lithuania		2 x 37,5	131	540	2 x 95	Completion of 2 biomass fired CFB boilers (original contractor was unable to complete the works)	Other	Wood chips, forestry residues, bark, willow and other energy crops, straw, lignin
2022	Stora Enso Oy, Anjala	Finland	38,5		70	480	110	BFB boiler modernization and upgrade suitable for SRF combustion	BFBu	SRF, bark, clean recycled wood, sludge
2021	Zespół Elektrowni Pątnów-Adamów-Konin SA	Poland	61,1		97	540	157	PC boiler conversion to BFB firing	BFBc	Wood chips, willow chips, light fuel oil
2021	PT Cikarang Litrindo, Jakarta	Indonesia		134,0	130	543	339	Unit 1 CFB fuel upgrade (Palm Kernel Shell) and flue gas recirculation system	CFBu	Coal, PKS
2020	Biomass Energie Alizay, Alizay	France	58,0		62	460	163	Recovery boiler (RB) conversion to BFB boiler	BFBc	Wood chips, bark, recycled wood
2019	Sala-Heby, Silververket	Sweden	14,4		80	480	32	BFB boiler rebuild to use also recycled wood	BFBu	Wood chips, recycled wood, bio-oil
2019	Turun Seudun Energia, Naantali	Finland		144,0	164	555	390	CFB fuel upgrade (adding asphaltene to fuel mix)	CFBu	Wood biomass, agro biomass, peat, coal, SRF (solid recovered fuel), asphaltene

VALMET TECHNOLOGIES OY
POWER BOILER REBUILDS AND CONVERSIONS
REFERENCE LIST

BFBc = BFB conversion
BFBu = BFB upgrade or capacity increase
CFBu = CFB upgrade or capacity increase
Other = Other kind of rebuild

DELIVERY YEAR	CUSTOMER	COUNTRY	STEAM DATA					TYPE OF PROJECT		FUELS
			BFB CAPACITY kg/s	TOTAL CAPACITY kg/s	PRESSURE bar(g)	TEMP °C	CAPACITY MW _{th}			
2019	Hamburger Hungaria Erömlü, Dunaujvaros	Hungary		62,0	113	520	158	CFB fuel upgrade (insreasing RDF portion)	CFBu	Biomass, coal, rejects, sludge, RDF
2019	Sociedade Bioelectrica do Montego S.A., Celbi	Portugal	43,0		91	480	109	New BFB to old RB boiler building	Other	Euca bark, wood waste, forest residues
2017	Mäntän Energia Oy, Mänttä	Finland	25,0		75	510	71	Rebuild/modernization of BFB boiler	BFBu	Bark, wood residues, deinking and water treatment sludge, oil
2017	Fibria, Três Lagoas	Brazil	42,0		86	487	111	BFB boiler capacity increase	BFBu	Biomass, sludge, oil
2016	Energotekhnomash / Ilim Group, Bratsk	Russia	20,8		39	440	71	BFB combustion equipment and technology delivery, boiler no. 16	Other	Bark, wood residues
2016	Sappi Paper and Packaging, Ngodwana	South Africa		147,0	89	496	404	PC boiler single drum conversion and SH & eco replacement	Other	Coal, bark, oil
2014	Celulosa Arauco y Constitución S.A., Constitución	Chile	11,0	20,0	62	450	31	BFB boiler single drum conversion, repair and upgrade	BFBu	Pine bark and lodging residuals, stumps, sawdust, sludge, oil
2013	Kuopion Energia Oy, Kuopio	Finland	88,0		114	535	220	Pulverized peat fired boiler conversion to BFB	BFBc	Peat, wood residues, oil
2012	OJSC Mondi, Syktyvkar	Russia	35,0		40	440	80	RB conversion to BFB	BFBc	Bark, wood, residues, sludge, oil
2012	CMPC Celulosa S.A., Laja	Chile	42,0	49,0	46	440	114	RB conversion to BFB firing	BFBc	Eucalyptus and pine bark, wood residues, fuel oil
2012	Elektrociepłownia Tychy S.A., Tychy	Poland	38,0		100	540	105	Coal fired CFB boiler conversion to BFB firing	BFBc	Wood chips, non-forest biomass
2012	Elektrociepłownia Białystok S.A., Białystok	Poland	29,0		138	540	75	PC boiler conversion to BFB firing	BFBc	Wood chips, forest residue, willow, grain waste, coal

VALMET TECHNOLOGIES OY
POWER BOILER REBUILDS AND CONVERSIONS
REFERENCE LIST

BFBc = BFB conversion
BFBu = BFB upgrade or capacity increase
CFBu = CFB upgrade or capacity increase
Other = Other kind of rebuild

DELIVERY YEAR	CUSTOMER	COUNTRY	STEAM DATA					TYPE OF PROJECT		FUELS
			BFB CAPACITY kg/s	TOTAL CAPACITY kg/s	PRESSURE bar(g)	TEMP °C	CAPACITY MW _{th}			
2011	Howe Sound Pulp and Paper Ltd Port Mellon, BC	Canada	67,0		85	480	173	Hydrograte Stoker conversion to BFB	BFBc	Wood residues, sludge, natural gas
2011	Dalkia Łódź S.A., Łódź	Poland	50,0		130	540	129	PC boiler conversion to BFB	BFBc	Wood chips, non-forest biomass
2010	Kogeneracja S.A., Wrocław	Poland	28,0		80	500	76	PC boiler conversion to BFB	BFBc	Wood chips, non-forest biomass
2010	Martinská Teplárenská a.s., Martin	Slovakia	21,0		57	450	60	PC conversion to BFB	BFBc	Wood chips
2010	OJSC Ilim Group, Bratsk, Irkutsk Oblast	Russia	25,0		40	440	72	BFB firing equipment to new boiler	Other	Bark, wood, residues, sludge
2009	Portucel Cacia, Cacia	Portugal	25,0	35,0	63	425	67	Travelling grate conversion to BFB	BFBc	Eucalyptus bark, wood residues, oil, gas
2009	E.on Värme Händelöverket, Norrköping	Sweden		45,0	110	540	135	CFB fuel ugrade (wood waste, recycled wood) and capacity increase	CFBu	Coal, wood waste, recycled wood
2009	Elektrociepłownia Saturn, Swiecie	Poland	28,0		96	510	71	New BFB into the existing boiler building	Other	Wood residues, saw dust
2008	Elektrociepłowni Białystok S.A., Białystok	Poland	29,0		138	540	75	PC boiler conversion to BFB	BFBc	Wood chips, forest residue, willow, grain waste, coal
2008	Stora Enso Oy, Anjalankoski	Finland	47,0	74,0	87	500	133	BFB boiler capacity increase	BFBu	PDF (package derived fuel), peat, bark, sludge, oil, gas
2007	Grupo Empresarial ENCE, S.A., Huelva	Spain	28,0		64	460	78	BFB boiler capacity increase	BFBu	Eucalyptus bark, wood residues, sludge, oil
2006	Stora Enso AB, Skoghall	Sweden	49,0	78,0	100	500	133	Oil fired (PC) boiler conversion to BFB	BFBc	Bark, wood, residues, sludge, oil

VALMET TECHNOLOGIES OY
POWER BOILER REBUILDS AND CONVERSIONS
REFERENCE LIST

BFBc = BFB conversion
BFBu = BFB upgrade or capacity increase
CFBu = CFB upgrade or capacity increase
Other = Other kind of rebuild

DELIVERY YEAR	CUSTOMER	COUNTRY	STEAM DATA					TYPE OF PROJECT		FUELS
			BFB CAPACITY kg/s	TOTAL CAPACITY kg/s	PRESSURE bar(g)	TEMP °C	CAPACITY MW _{th}			
2006	Vilniaus Energija UAB, Vilnius	Lithuania	22,0		40	440	60	PC boiler conversion to BFB	BFBc	Peat, wood chips
2005	Billerud Gruvön AB, Gruvön	Sweden	42,0		65	480	118	Grate (Inclined) boiler conversion to BFB	BFBc	Bark, wood residues, sludge, oil
2005	Enel Produzione SpA, Laino Borgo	Italy	35,0		82	460	111	PC boiler conversion to BFB	BFBc	Wood fuel
2005	Billerud Skärblacka AB, Skärblacka	Sweden	28,0	39,0	60	470	79	RB / Grate fired boiler conversion to BFB	BFBc	Bark, wood residues, sludge, oil
2005	Billerud Karlsborg AB, Karlsborg	Sweden	21,0	36,0	63	450	58	Grate (Kablitz) boiler conversion to BFB	BFBc	Bark, sludge, oil
2005	CMPC Celulosa S.A., Santa Fe	Chile	17,0	22,0	65	455	47	BFB boiler upgrade	BFBu	Eucalyptus and pine bark, saw dust, sludge, oil
2005	Stora Enso Sachsen, Eilenburg	Germany	9,0		75	484	26	BFB upgrade	BFBu	Deinking sludge, biogas, natural gas
2004	Pannonpower Rt., Pécs	Hungary	56,0		99	540	145	PC boiler conversion to BFB	BFBc	Wood chips
2004	Göteborg Energi AB, Sävenäs	Sweden	Hot water				100	BFB Conversion of hot water grate boiler	BFBc	Bark, wood residues, demolition wood chips
2004	JSC Arkhangelsk PPM, Arkhangelsk	Russia	20,8		39	440	67	BFB combustion equipment and technology delivery	Other	Bark, wood residues, sludge, oil
2003	Portucel SA, Setubal	Portugal	31,0		65	470	87	RB/Travelling grate conversion to BFB	BFBc	Eucalyptus bark, wood residues,
2003	Soporcel SA, Figueira da Foz	Portugal	21,0	28,0	65	470	59	Travelling grate conversion to BFB	BFBc	Eucalyptus bark, wood residues

VALMET TECHNOLOGIES OY
POWER BOILER REBUILDS AND CONVERSIONS
REFERENCE LIST

BFBc = BFB conversion
 BFBu = BFB upgrade or capacity increase
 CFBu = CFB upgrade or capacity increase
 Other = Other kind of rebuild

DELIVERY YEAR	CUSTOMER	COUNTRY	STEAM DATA					TYPE OF PROJECT		FUELS
			BFB CAPACITY kg/s	TOTAL CAPACITY kg/s	PRESSURE bar(g)	TEMP °C	CAPACITY MW _{th}			
2002	Södra Cell AB, Mörum	Sweden	29,0	36,0	58	450	80	RB conversion to BFB	BFBc	Bark, sludge, oil
2002	Porvoon Energia Oy, Tolkkinen	Finland	17,0		65	475	48	Grate fired boiler conversion to BFB	BFBc	Bark
2002	Fortum Enertec GmbH, Afferde	Germany	19,0		100	490	54	Conversion of coal fired BFB to biomass	BFBu	Demolition wood
2001	SCA Graphics Sundsvall AB, Östrand	Sweden	28,0	56,0	58	450	78	BFB conversion of the multifuel boiler with Axon owens	BFBc	Bark, wood waste, sludge, oil
2001	Stora Enso, Imatra	Finland	79,0		84	530	235	BFB boiler capacity increase	BFBu	Bark, sludge, natural gas, oil
2000	Fortum Power & Heat, Joensuu	Finland	75,0		110	535	186	PF peat boiler conversion to BFB	BFBc	Peat, wood chip, wood residues
2000	Weyerhaeuser Prince Albert Mill, Saskatchewan	Canada	53,0		42	400	140	RB conversion to BFB	BFBc	Bark, wood waste, gas
2000	International Paper Kwidzyn S.A	Poland	28,0		65	440	73	Travelling grate conversion to BFB	BFBc	Bark, wood waste sludge, oil
1998	Tampereen kaupungin sähkölaitos, Tampere, Naistenlahti	Finland	75,0	83,0	113	535	190	Pulverized peat fired boiler conversion to BFB	BFBc	Peat, wood residues, oil, gas
1998	SES Tlmace/ SCP, Ruzomberok	Slovakia	38,0		41	400	96	Grate boiler conversion to BFB	BFBc	Wood waste, gas, oil, sludge, non condensable gases
1998	Fortum Power & Heat, Hämeenlinna	Finland	19,0		27	400	55	Travelling grate boiler conversion to BFB	BFBc	Peat, bark, wood, coal
1997	Alliance Inc. Dolbeau, Quebec	Canada	47,0		43	468	130	Pin hole grate conversion to BFB	BFBc	Wood waste, oil, gas

VALMET TECHNOLOGIES OY
POWER BOILER REBUILDS AND CONVERSIONS
REFERENCE LIST

BFBc = BFB conversion
BFBu = BFB upgrade or capacity increase
CFBu = CFB upgrade or capacity increase
Other = Other kind of rebuild

DELIVERY YEAR	CUSTOMER	COUNTRY	STEAM DATA					TYPE OF PROJECT		FUELS
			BFB CAPACITY kg/s	TOTAL CAPACITY kg/s	PRESSURE bar(g)	TEMP °C	CAPACITY MW _{th}			
1997	Mac Millan Bloedel, Port Alberni, B.C.	Canada	44,0	57,0	43	400	113	Travelling grate conversion to BFB	BFBc	Wood waste, sludge, oil
1997	AssiDomän Carton, Frövi	Sweden	31,0		64	480	87	Grate boiler conversion to BFB	BFBc	Bark, wood waste, sludge, oil
1996	Oulun kaupungin energialaitos, Oulu, Toppila	Finland	100,0		118	540	242	PF peat boiler conversion to BFB	BFBc	Peat, wood chips, oil
1996	Wisaforest Oy, Pietarsaari	Finland	50,0		82	500	138	Grate (inclined) boiler conversion to BFB	BFBc	Wood waste, coal, oil
1996	Porin Lämpövoima Oy, Pori	Finland	44,0		112	525	116	Grate boiler conversion to BFB	BFBc	Peat, bark, oil
1995	Kaukas Oy, Voikkaan Paperitehdas	Finland	33.3		65	500	100	Grate boiler conversion to BFB	BFBc	Wood waste, peat, natural gas, oil
1995	Enso-Gutzeit Oy, Anjalankoski Mills	Finland	32.9	73.6	87	525	74	Grate (inclined) boiler conversion to BFB	BFBc	Peat, bark, sludge
1995	Stora Nymölla AB, Bromölla	Sweden	22,2		60	485	64	Oil boiler conversion to BFB	BFBc	Bark, sludge, oil
1995	ENCE Pontevedra S.A., Pontevedra	Spain	20,8		64	450	57	RB conversion to BFB	BFBc	Eucalyptus bark, oil
1994	Aracruz Celulose SA, Aracruz	Brazil	50,0		65	455	139	Grate boiler conversion to BFB	BFBc	Eucalyptus bark, oil
1994	Porin Lämpövoima Oy, Pori	Finland	32,0		112	525	90	Grate boiler conversion to BFB	BFBc	Peat, wood waste, oil
1994	SCA Ortviken AB, Sundsvall	Sweden	14,0		60	475	39	Grate (inclined) boiler conversion to BFB	BFBc	Bark, sludge, wood waste, oil

VALMET TECHNOLOGIES OY
POWER BOILER REBUILDS AND CONVERSIONS
REFERENCE LIST

BFBc = BFB conversion
BFBu = BFB upgrade or capacity increase
CFBu = CFB upgrade or capacity increase
Other = Other kind of rebuild

DELIVERY YEAR	CUSTOMER	COUNTRY	STEAM DATA					TYPE OF PROJECT		FUELS
			BFB CAPACITY kg/s	TOTAL CAPACITY kg/s	PRESSURE bar(g)	TEMP °C	CAPACITY MW _{th}			
1993	Imatran Voima Oy, Rauhalahhti Power Plant, Jyväskylä	Finland	110,0		135	533	267	PF peat boiler conversion to BFB	BFBc	Peat, wood waste, coal, oil
1993	Champion International Corp., Sheldon, TX	USA	25,0		60	440	67	Travelling grate boiler conversion to BFB	BFBc	Bark, sludge, oil
1993	Kemira Chemicals Oy, Oulu	Finland	14,8		87	515	42	Oil boiler conversion to BFB	BFBc	Peat, wood waste, oil, process gas
1990	ENCE S.A., Huelva	Spain	20,0		65	460	55	Grate (inclined) boiler conversion to BFB	BFBc	Eucalyptus bark, sludge, oil
1989	Kymmene Oy, Kuusankoski	Finland	28,0		130	525	71	Grate (inclined) boiler conversion to BFB	BFBc	Bark, wood waste, peat, sludge, coal, gas, oil
1988	V/O Prommashimport, Baikalsk	Russia	13,9		38	440	37	Grate boiler conversion to BFB	BFBc	Bark, wood waste, sludge
1987	Enso-Gutzeit Oy, Summa Paper Mills, Kotka	Finland	25,0		115	525	65	Grate boiler conversion to BFB	BFBc	Bark, wood waste, peat, sludge, coal, gas, oil
1986	Enso-Gutzeit Oy, Imatra Mills, Tainionkoski	Finland	16,7		84	480	50	Grate (inclined) boiler conversion to BFB	BFBc	Bark, wood waste, peat, sludge, gas, oil
1985	United Paper Mills, Jämsänkoski Paper Mills, Jämsä	Finland	18,0		103	520	50	Grate (inclined) boiler conversion to BFB, unit 1	BFBc	Peat, bark, sludge, coal, oil
1985	United Paper Mills, Jämsänkoski Paper Mills, Jämsä	Finland	18,0		103	520	50	Grate boiler (inclined) conversion to BFB, unit 2	BFBc	Peat, bark, sludge, coal, oil
1985	Metsäliiton Teollisuus Oy, Kirkniemi Paper Mills, Lohja	Finland	13,8		85	520	37	Oil boiler conversion to BFB	BFBc	Coal, bark, sludge, oil
1981	Oy Kyro Ab, Kyröskoski	Finland	6,5		62	500	15	BFB combustor connected to grate boiler	Other	Bark