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**ALFAGEN – ALUMINIUM AND AL ALLOY BILLET CASTING FACILITY**

Annex 3 of Tender Documentation – Technical Specification

AL INVEST Břidličná, a.s.

Bruntálská 167

793 51 Břidličná

An open above-threshold public contract for the supply in compliance with S. 56 of Act No. 134/2016 Coll., „Public Procurement Act“, as amended, (hereinafter also as the "**Act**" or "**ZZVZ**"

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1. General Information
   1. List of Abbreviations

AIB AL INVEST Břidličná, a.s.

MCC Motor Control Center

IPPC Integrated Pollution Prevention and Control

EU ETS EU Emissions Trading System

TiB Titan Bor

CS, CZ Czech language

UT Ultrasonic testing

PLC Programmable Logic Controller

HMI Human-Machine Interface, e.g. a touch screen

PC Personal Computer

Remote IO Remote input/output

MES Manufacturing Execution System

ERP Enterprise Resource Planning

OT Operational Technology

VPN Virtual Private Network

ICMP Internet Control Message Protocol

UAC User Account Control

LOTO Lock-out & Tag-out

MPCB Motor Protection Circuit Breaker

Y/D Y/D Starter

IGBT Insulated Gate Bipolar Transistor

LPBS Local push button stations

CPU Central Processing Unit

SAFETY PLC Safety Programmable Logic Controller

GSM Global System for Mobile Communications

LTE Long-Term Evolution

SSL Secure Sockets Layer

HW Hardware

SW Software

SNMP Simple Network Management Protocol

ICMP Internet Control Message Protocol

UAC User Account Control

SIEM Security Information and Event Management

TEFC Totally Enclosed Fan-Cooled

DCS Distributed Control System

CPU Central Processing Unit

OPC Open Platform Communications

OPC UA Open Platform Communications Unified Architecture

DHCP Dynamic Host Configuration Protocol

TOP Take over point

OEM Original equipment manufacturer

* 1. Introduction

Company AL INVEST Břidličná, a.s. (“AIB”) with its 800 local employees is a leading European producer of packaging materials and rolled semi-finished aluminium products. Its origins date back to the year 1852 when the construction of the flax processing company was launched. The company is a member of the European Aluminium Foil Association (EAFA), Packaging Institute SYBA, Southern Bohemian Chamber of Commerce and Czech Testing Laboratories Association.

AIB’s state-of-the-art research and development unit and certificates of ISO 9001:2008, ISO/TS 16 949:209, BRC/IOP, AD 2000 WO, EN 15088 guarantee the quality and reliability of its products. The company also holds various packaging and automotive certificates which are relevant for the subject of the present project.

AIB belongs to MTX Group a.s. – an industrial-business holding company based in Prague which mainly focuses on management, financing and coordination of manufacturing and trading member companies. In the Central European area, the company has its agencies in the Czech Republic, Germany, Austria and Poland. It primarily trades in metallurgical semi-finished products, production and sale of fuel coke, aluminium and copper products.

MTX Group a. s. is a joint stock company incorporated in the register of companies kept by the Municipal Court in Prague, Czech Republic, Section B, File 10649, as of 31st March 2006. The company has its registered office at Štěpánská 621/34, 110 00 Prague 1.

MTX Group a.s. was founded by Petr Otava Sr. In 2015 he was succeeded by his son – Petr Otava Jr. MTX Group expands remarkably to abroad, its activities affects a number of industrial branches. It manufactures parts for the automotive industry, and is involved in metallurgy and food processing as well.

* 1. Place of business, Project site

The project will be implemented at Bruntálská 167, 793 51 Břidličná, which is the registered office of AIB. The whole affected area is a property of AL INVEST Břidličná a.s. The project site will be a place of the overall coordination and management of the project, primarily the installation of new manufacturing facilities and constructions.

The project is planned to take place in the regions defined by the Czech government resolution No. 321/2021. The city of Břidličná lies in the Moravian-Silesian Region which is treated as economically problematic region in the resolution. The Moravian-Silesian Region is one of three coal-mining regions in the Czech Republic, as registered in the so-called “EU Coal Platform”.

* 1. Company’s approach to the environment

AIB is committed to assume a part of responsibility for the conservation and protection of the environment within the region. In 2018 a voluntary agreement was signed with the Moravian-Silesian Regional Authority which governs the obligations of individual parties. The obligations deal with e.g. reduction of dust nuisance, compilation of a power management study and a comprehensive power management conception which would reduce the power demand of production and service operations. The agreement also covers the replacement of diesel forklift trucks with electric ones.

To guarantee the continuous quality of final products and to achieve the sustainable growth of production the most important strategic investments are not only those to the technology upgrade but also those of the environmental nature which address the environmental protection and predominantly the air pollution control. That is how the company complies with the environmental management requirements as per ISO 14000 and prepares itself to acquire this certificate.

Considerable financial resources are expended every year for a comprehensive solution and improvement of the environment.

AL INVEST Břidličná a. s. is also a member of the EKO-KOM collective compliance system.

The company is a holder of the Integrated Pollution Prevention and Control (IPPC) permit the parameters of which are always complied with on an annual basis.

Machinery used in the manufacturing plant is registered in the EU ETS system. Emission assessment is compiled annually.

* 1. Project purpose and objective

The subject of the project concerns replacement of all the existing melting and casting technology. The technology encompasses both the melting and the casting furnaces for billet casting and the continuous casting technology.

The project objective is the implementation of the state-of-the-art technologies with a reduced energy demand, primarily the reduction in natural gas and electrical consumption (total energy consumption need to be reduced by min. 35 %) in the melting and casting procedure which would also lead to a considerable reduction in the environmental impact. In addition, the implementation of the state-of-the-art technology will result in reduced waste from the technology and most recent control devices used to achieve a higher level of automation.

The new technologies feature melting of primary aluminium plus aluminium scrap in melting furnaces and new casting technology with a lower power demand due to a lower natural gas / electrical consumption within the melting / casting process, namely with the newly implemented technology of regenerative burners and other state of art technology which would lead to a considerably reduced environmental impact by emissions.

The project also includes construction of new buildings within the company premises, acquisition of new machinery and construction of necessary utility lines and directly associated investments.

Contractor shall make the best effort to comply with the standards listed herein. Contractors may choose to seek deviation and obtain approval for alternatives if significant cost differential is anticipated. Under no circumstances shall the intended performance or safety aspects be compromised.

* 1. Other general requirements
     1. Standards

All equipment supplied, and related work (layout, installation, and operation) shall perfectly comply with all CE and EU-local applicable laws and regulations, including, but not limited to, those relating to environment, health and safety of workers.

All equipment designed for fabrication in the European Union (EU) shall be designed to use commonly available metric standard commodities - e.g. mm thickness aluminium sheet, plate etc.

Design must comply with standards. Documentation of compliance must be provided to customer. Any OEM components supplied, which are not a part of the overall assembly, must be CE marked. The following list of directives shall be reviewed for applicability to the equipment being produced. If the event that the contractors standards are not present the following EU directives need to be applied for their products.

* 2001/95/EC – Product Safety Directive
* 2004/108/EC – EMC Directive
* 2006/42/EC – Machinery Directive
* 2006/95/EC – Low Voltage Directive
* 2009/105/EC – Simple Pressure Vessel Directive
* 2009/125/EC – Eco-design requirements for energy related products
* 2037/2000/EC – Ozone depleting substances
* 842/2006/EC – Fluorinated Greenhouse Gases
* Guidelines for Handling Molten Aluminum (Available Online)
* 94/9/EC – ATEX directive
* 97/23/EC – Pressure Equipment Directive
* 92/58/EEC – Safety and/or Health Signs

The use of parts which are discontinued by manufactures is not allowed. Exceptions must be approved by customer.

* + 1. Accessibility and replaceability

All working parts must be designed so as to ensure the easiness of their control, inspection, monitoring, lubrication and replacement during minimum down times, with the highest possible safety and ergonomics.

* + 1. Safety

All the equipment and machines must be designed with and incorporate safety devices wherever there is potential risk for the operators, and with adequate measures for safe access to the staff and the vicinity of the machines for operation and maintenance. These items must not only include the conventional elements of the machinery but also additional covers, guards, barriers, steps, ladders, railings, coupling guards, belt covers, transmission, active scanners and chain covers etc. That are necessary for safe and ergonomic operation of the equipment. All the details of the structures that are necessary for correct operation and maintenance must be specified by the Contractor. The Contractor shall specify the safety needs which may produce compulsory blocking between functions and consequences for the operation.

* 1. Scope of the Works – Major projected parts

The purpose of this document is to specify the technical parameters of the aluminium and aluminium alloy billet horizontal casting line. The defined technical parameters are binding for the deliveries within this public procurement. The submitted bids must meet these technical parameters.

The delivery concerns the aluminium billet horizontal casting line, including supervision of the installation. The delivery includes the following envisaged parts and components:

* Metal distribution system
* Grain refining system
* Degassing
* High performance filter
* Casting line
* Casting water system
* Peeling, testing device(s) and tracking system
* Packaging line
* Furnace integration
* Mold Shop-, Test-, Auxiliary equipment and Stands
* Communication with the parent system
* Mechanical, electric, instrumentation, automation general standards
* Securing the working sites according to applicable standards
* Compliance with hygienic limits upon occurrence of all hygienic factors which may affect the employees’ health and their risk level for the personal health during particular shift (Act No. 258/2000 Coll., as amended, namely Section 37 on the Protection of Public Health and implementing provisions).
* CE declaration of conformity
* Documents, certificates, labeling of control switches, selectors, tables, tags, etc. in Czech

The Customer hereby points out that the present list is not exhaustive and may not necessarily establish a complete scope of the Works for the Contractor.

The major work of scope includes the following: Design, purchase of materials, manufacturing, assembling, inspection, painting, packaging, transportation, erection and commissioning supervision, performance tests, performance guarantee, training, and manuals.

The Contractor should carry out this project from design to the performance tests based on this purchase specification. As to possible modifications that may occur in the process of conducting the project, the contractor shall discuss with and get a written approval from customer.

The Contractor is encouraged to suggest, through a technical proposal, more advanced technologies, and design contents than those described in this purchase specification.

* 1. Technical offer contents

Following documents shall be provided with transmittal of the offer:

* Detailed technical description of the entire line (including description of individual sub-devices / equipment),
* Estimated layout indicating the overall arrangement (top and side view) and configuration - including sub-devices,
* Production calculation as per cast diameter and alloy.
* Estimated places with elevated noise level (above acoustic pressure level L82 dB - measured at a height of 1.2 m above the floor)
* Estimated consumption at take over point (TOP) of cooling water, process media (compressed air, argon, oxygen ... as required for the scope) and their quality requirements (data shall be understood as basic information – but fitting 90 % to final values confirmed during basic engineering) - minimum content:
  + Temperature (°C): Supply line and delta (between supply - / return line)
  + Pressure (MPa): Supply line and delta (between supply - / return line)
  + Flow rate (m3/h): Constant and peak
  + Quality
  + All other key requirements as per corresponding media
* Estimated HVAC requirements (electric equipment, gas, vapours, chips exhaust, etc.),
* Estimated installed electrical power and calculation of electrical energy consumption per metric ton production (kWh/t),
* Single line diagram
* Other important information (accessories or production method) not specified above which the Contractor considers to be worth mentioning to the Customer in the technical offer to ensure safe and reliable functioning of the line.
* Filled prefered equipment contractor list.
* OPEX costs per produced MT – split into:  
  - Energy costs  
  - Consumable costs  
  - Maintenance costs
* Capital spares (part of commerical offer)
* Wear parts, consumables required for the first 6 months of production
* Man power requirement per shift

1. Technical specification
   1. Current state – description

The operator will prepare the charge using the handling devices. The charge consists of three input raw materials: primary pure aluminium, internal aluminium scrap and external aluminium scrap. Using the forklift truck with a charging bucket, the operator drive the charge into the melting furnace (18 t). Two gas burners with adjustable power melt the input material. The melting furnace is connected to the parent control system which controls the movement of the ceramic partition for the correct melt level. With the metal melted, the operator draws the skims off its surface. A liquid metal with a temperature of 720 °C comes off the furnace. A sample of the liquid metal is taken and the chemical analysis of the melt is performed. The liquid metal is then processed in the refining unit where the melt is being refined (using the injected refining salts). The melting furnace is also filled with alloying elements and pre-alloys (as per the required formula). As soon as the proper chemical composition of the melt is achieved (based on the sample taken), the liquid metal is poured from the melting furnace to the casting furnace. A plugging bar is manually drawn out of the casting furnace. A liquid metal with a temperature of 720 °C comes off the casting furnace. The melt continues through meral distribution system to deggasing unit and filtration unit where it get rid of impurities. After filtration the melt ends in casting line, where billets are produced. The casted billets are then processed according to the particular customer’s requirements.

The production of billets is currently controlled by the SIEMENS control system. The line is connected to the parent system MES (SYBAS).

* 1. Requirements for the line

Apart from the delivery of the items specified above, the Contractor is also expected to provide supervision over the entire installation process. The supervisor must be present at the installation site (from 8 am to 6 pm on weekdays and from 8 am to 12 noon on Saturdays). Whenever the supervisor is absent from the installation site, he/she must be available on his/her phone for consultation (24/7). Supervision forms a part of the price quotation, at maximum possible amount. Furthermore, the Contractor is responsible for commissioning the entire working site, so that the whole line is fully functional. The contractor is present during Cold Commissioning, Start-up and Hot Commissioning, Initial Operation Tests and Performance Tests as well.

Take over points, including conversions, will be prepared by the Customer as per the project documents provided by the Contractor. Within the delivery, the Contractor will submit the technical specification for the practical completion of the Works so that the Customer is able to prepare and arrange for the necessary conversions before the delivery itself which would enable the operation and compliance with all the standards applicable to the operation. The technical specification must define all the requirements for the line, such as: take over points, layout, building foundations (loads, pits, etc.), climatic conditions and requirements set out by the relevant occupational health and safety standards, so that the line is allowed to be put into operation.

The line must comply with the noise and hygienic limits (with technological load). The limit of the acoustic pressure level LA must not exceed 82 dB in the place where the operator will move (measured at a height of 1.2 m above the floor).

The line must comply with all statutory requirements and provisions concerning the protection of the environment.

* + 1. Introduction
* It should be understood by all parties that, today’s forging producers have limitations which ensure a minimum percent prime metal input as prime is perceived as a clean input. Economics and the race for recycling will compress this minimum over time to a reasonable level in the single digits. Some traditional clean scrap melting equipment may fit well within the scope of the materials processed today and the Customer project team has been active communicating on this regard with some of the various furnace supply companies. The material Customer intends to consume in the years forward are considerably different from the traditional clean manufacturing scrap which offers no attractive recycle discount when compared to prime remelt ingot.
* Forging products are extremely fatigue sensitive to coarse intermetallic and internal inclusions and forging surface defects. Some of the coarse intermetallic and internal inclusion sensitivity originates with the incoming scrap, and this is normally overcome by traditional settling, degassing and filtration processes and procedures.
* In order to meet the strength expecaions of our customers, the molten, delivered from the furnace must go thru a series of purification steps prior to solidification. First, Hydrogen, is removed in a first order reactor where argon and sometimes minute amounts of chlorine is distributed via a stirred impeller in a heated box with molten aluminum flowing counterflow the bubbles. Finally, inclusions are separated from the molten stream via a unique tortuous path filter commonly referred to in the industry as a Ceramic Foam Filter (CFF). Our Vision, which is brought to focus in the filter section is an enhanced or high performance CFF, capable of increasing the tortuous path length, or capable of increasing the filtration efficiency via a 70 Pores Per Inch (PPI) device. Immediately after this filtration step, the molten enters the Horizontal Direct Chill (HDC) machine via the casting equipment or metal distributor prior to entering the horizontally oriented direct chill molds. After casting, the billets are cut or separated from the live casting stream into 4500-6000 mm long logs prior to downstream inspection and processing for shipment.
* Customer intends to peel the cast surface and this internally generated scrap material will be a minor portion of the material being re-charged back into the melting furnaces. After peeling, the logs are inspected for inclusions or other defects, packaged and shipped to our partner customers who produce extremely high quality forgings for the automotive, aerospace or commercial market.
  + 1. Basic technical parameters
* Product: Horizontal Cast Forging billets
* Estimated capacity of cast billets: 25 000 tons/year (330 working days)
* Range of the molten metal process temperatures: 680–790 °C
* Cast billet diameter: minimum Ø 40–125 mm
* Base configuration (cast diameter): Ø 58 Ø 68±2,5 mm/ Ø 104±2,5mm
* Estimated casting capacity: 3 - 5 tons/hour
* Alloys processed: See Annex 3\_1\_TS \_Guaranteed\_parameters\_ of\_ billets
* Output product quality: See Annex 3\_1\_TS \_Guaranteed\_parameters\_ of\_ billets
* Cast billet length (product length): 4500–6000 mm
* Shortest possible scrap cut length during casting: 3000 mm
* Cutting accuracy: +6 / -0 mm
* Packaging regulation: See Annex 3\_2\_TS \_Packing\_instruction
* Contractor to implement production calculation based on 330 days available production days (14 days year plant shut down and each week 8 hours scheduled shut down for preventive maintenance). Contractor to define down time = none production time based on machine down time (unscheduled break downs and scheduled breaks between casts).
* Contractor to deliver with the production calcuation based on 5 casting diameters ( Ø 40, 58, 68, 104, 125 mm) with corresponding with following data:  
  - Diameter, cast (mm)  
  - Diameter, final (mm)  
  - Casting rate, cast diameter (t/h)  
  - Casting rate, final diameter (t/h)  
  - Year capacity (tons/year)
  + 1. Line layout

This is the preliminary projected floor plan of the hall section, indicating the area intended for the process (*Fig. 1*)

Obsah obrázku řada/pruh, diagram, snímek obrazovky, Vykreslený graf

Popis byl vytvořen automaticky

Contractor to specify within the technical offer required space from furnace TOP up to packaging line

* + 1. Casting system control

Operation shall be performer in semi-automatic mode with main items:

* Operator starts semi-automated routine (by HMI)
* Tilting of furnace as per needed melt level in the molten distribution system
* Pneumatic operatated shutters opening / closing as needed for the start and stop operation of casting
* Check of melt temperature for start of casting via software. If temperature is in correct range initiation of casting is allowed. In case temperature is out of the range casting is forbidden and flushing of melt shall be initialized. Releasing into dross bin in case too cold melt.
* Draining as consequence of melt flushing or casting stop or filter box switch.
* Recipe value (based on casting diameter and alloy) shall base content:  
  - Degasser set values  
  - Grain refining quantity (kg rod per t melt)  
  - Casting speed set points.
* Override by operator via HMI for adjusting and intervening (in case of malfunction etc.) has to be possible at any time.
* Monitoring of all measured values (temperature, melt level, medias etc.) shall be via HMI.
* Cast / cut billet tracking up to pick up and packing – including all inspection and manipulation equipment (saw etc.).
* Dynamic melt intermix model for batch change during casting sequence.
  + 1. Metal distribution system
* Intent:
* The Metal Distribution System is key to a well managed and operated recycle and remelt facility. Only the highest quality (High Alumina and low Silica) materials should be used while maintaining a healthy balance with thermal conductivity as material choices will earmark the type of inclusions generated in the metal distribution system and thermal losses in the system.
* We prefer hot air high velocity launder pre-heating for our system as the typical heated launder cover systems are an extra maintenance item and the energy consumed during heating distracts us from our goal of reduced electrical needs. We Is prefered integration of smaller CX launders, with hot air blowing as a pre-heat system when needed.
* Description of Metal Distribution System
* The proposed system shall consist of individual modules/sections that can be removed and replaced as complete units without disturbance of the remaining section.:  
  - Qty nn – Straight Sections  
  - Qty nn – Tee / Corner (90 degree) Sections  
  - Qty nn – Transitions  
  - Qty nn – Heavy Duty Stands (Under Tee, Corners and Transitions)  
  - Qty nn – Conventional Stands (Under Straight Sections)  
  nn: to be finalized during engineering phase.
* Reference Drawings, Standards & SPI’s
* The following is a list of Drawings, Standards and SPI’s having pertinent information and details for this portion of the project. The latest editions of specific codes and standards shall apply.
* Burner and Flames EN 746, EN 1539 (available online).
* Guidelines for Handling Molten Metal (available online).
* Design Requirements
* Flow Requirements:  
  - Metal Flow velocity in launder between holding furnaces and casting unit shall be less than 9.8 m/min, but greater than 7.0 m/min at any point (applicable for straight, corner or angled sections).  
  - Nominal metal level in launder shall be 50 mm from top of refractory between the holding furnace and the casting unit. Nominal metal level shall be 200 mm at casting unit.  
  - Cross section of the refractory shall be designed for easy cleaning.  
  - Minimum corner radius of any refractory section shall be 300 mm.
* Modules From Furnace to Casting Unit:  
  - Launder system shall be designed in modules. Module lengths shall be a maximum of 2 meters.  
  - Each module shall be designed to maintain a 3-dimensional compressive force on the refractory lining.  
  - Each module shall have integrated covers or covers that can be removed and stored on the module.  
  - Launder Sections shall be easily removable from overall assembly for maintenance.  
  - Transition Sections shall be minimal in length to prevent heat loss.  
  - Covers are not required on transition sections.  
  - Refractory joints between launder modules and between modules and transition sections shall be under compression.  
  - Contractor is to minimize the use of silica fiber blanket materials in the metal distribution system.  
  - Any change of launder profile shall use an angle of no more than 30 degrees.  
  - Joints between refractory shall use 9.5 to 12.5 mm Inconel woven rope for sealing.   
  - The laundering system Take Over Point (TOP) is generally within one meter length of the furnace knuckle or joint. The system generally interfaces with the degasser and the filter prior to connecting to the casting system.   
  - The system shall include 5 pneumatic or hydraulic metal control dams at the following locations:  
   - Exit of the furnace joint, generally within 2 meters of the joint.  
   - Entrance to the CFF  
   - Exit of the CFF  
   - T launder for temperature control and to be used in an upset condition  
   - Entrance of the Casting equipment  
    
  - Launder Invert Slope Angle (mm/m) of launder between respective equipment:  
   - Furnace to degasser: +2 mm/meter  
   - Degasser to filter entry: +2 mm/meter  
   - Filter exit to casting equipment: -1 mm/meter  
    
  - Metal shall flow back to furnace from the filter entry launder invert in the event of a controlled end of cast.  
  - Total launder volume shall be presented with the offer to enable Customer to interface with the furnace contractor to manage the metal flow in the event of an upset condition.  
  - Hot Air Blower (Pre Heat) for Straight modules and Joining Points - Hot air blowers, heat difficult areas in the metals distribution system without exposing the refractory to a direct flame.  
    
  - Metal Level Sensors - Steady State metal level sensors are highly accurate and generate a reliable signal which is needed to control the furnace and the processing and metal treatment equipment.  
   - One sensor at the exit of the furnace before the degasser  
   - One sensor at the entrance of the CFF  
   - One sensor at the exit of the CFF  
    
  - Low/High Level Sensors at the furnace - This special type of probe sensor, offers redundancy at the start of the cast to ensure enough metal static pressure is available to properly fill the launder to the CFF.  
  - Low/High Level Sensor at the CFF exit Invert Launder Dam - This special type of probe sensor, offers redundancy at the start of the cast to ensure enough metal static pressure is available to properly fill the casting equipment.  
  - Temperature Sensors - Steady State temperature sensors are highly accurate and generate a reliable signal which is needed to control the furnace and the processing and metal treatment equipment. At least 3 temperature sensors shall be installed:  
   - One at furnace TOP  
   - One after degasser  
   - One at casting equipment
* Refractory  
  - Refractory shall be chosen for low thermal conductivity, durability, and non – wetting characteristics.   
  - Refractory shall be pre-cast standard shapes.  
  - Launder outside shell temperature shall not exceed 150 °C with a 45 °C ambient temperature.
* Launder Stands  
  - Launder Stands shall be designed to support launder modules during use and any maintenance activities.   
  - Launder stands shall have provisions for fixing to concrete.  
  - Launder stands shall be strategically place in overall assembly for support. Each launder module does not require 2 stands.  
  - Maximum distance between stands shall be 2 m.
* Coating  
  - Launder steelwork shall be coated with high heat powder coat or equivalent. Stainless steel components need not be coated.
* System Performance and Acceptance Specifications (Metal Distribution Specific)  
  The Contractor shall guarantee the performance of the system. Acceptance by Customer shall be based on tests upon completion of the commissioning of the system.
* General standards  
  - The system shall be leak free at all joints based on proper maintenance.  
  - Launder outside shell temperature shall not exceed 150 °C with a 45 °C ambient temperature. Temperature shall be taken at the end of the cast, just prior to end of cast sequence.  
  - Freeboard measurements will be taken after standard casting practice is adopted. Freeboard in all areas of the launder shall not be less then 50 mm.  
  - Melt differential temperature measured at furnace TOP and at casting equipment shall not exeed 20 °C. Range of 12–15 °C shall be understand as normal condition.
  + 1. Grain refining system
* Intent  
  This specification shall define the minimum requirements for design, fabrication and supply of One (1) (1 x 2) Rod Feeder Systems.
* Description of System
* Rod feeder system shall consist of:  
  - Qty n – Dual Variable Speed Rod Feeders  
  - Qty n – Rod Feed Drive Stands  
  - Qty n – De-Coiling Spools  
  - Qty n – Coil Racks
* The grain refiner or alloying rod will be placed onto the De-Coiling Spool via crane or lift truck with the rotary axis of the reel in the vertical orientation. The De-Coiling Spool with the rod coil will then be positioned onto a coil rack with the rotary axis in either the vertical or horizontal orientation via crane or lift truck. The feeders will be mounted as close as feasible to the metal delivery launders to minimize the length and friction of the downstream guide tube. The de-coiling spool will be positioned to minimize length of pull between it and the feeder, while allowing suitable access to load and unload the reel.
* The feeders will receive a proportional command signal for speed control as well as digital pulse command to start and stop the feeder. These signals will come from the casting system automation PLC.
* Supports and rod guides to be designed and supplied by others; vendor to provide mounting patterns and loading diagrams.
* General
* Possible Alloys:  
  - TiBOR = 3/1; 5/1; or 5/0.2 percentage Ti/B  
  - TiCAR = 3/0.15 percentage Ti/C
* 3/8” (0.375” or 9mm) dia. rod material to be fed – aluminum-based alloys (adjustment for drive force on rod required)
* Dual Variable Speed Rod Feeder
* Rod Feed Speed range required = 0,15-3 m/minute, +/- 10 mm/min precision over complete range.
* Electrical/Controls:  
  - Digital input: start command  
  - Digital output: drive fault/status  
  - Analog input: command (speed) à 4-20 mA  
  - Analog output: rod speed feedback à 4-20 mA Drive Feed Roller should not be used.  
  OR (preferred):  
  - Bus communication with respective drive with full data exchange to PLC.
* Feeders drive capable of pulling rod from the reel up to 6 meters away and pushing the rod through a 1” stainless steel pipe 5 meters long with one (1) 45-degree x minimum 300 mm radius bend and one (1) 90-degree x minimum 300 mm radius bend.
* Adjustable feed force.
* Interconnecting Electrical Cabling for Power and Control between variable speed drive and drive motor (30 meters maximum distance).
* Connection plugs for all supplied devices.
* De-coiling Spools
* Reel with low friction bearings for holding and dispensing up to 450 kg coil of 9 mm rod.
* Bearing friction not to exceed 1kg at coil O.D. throughout life of the coil.
  + 1. Degassing
* Intent
* The degassing process is designed and operated to separate soluble Hydrogen from the melt and then encourage those separated Hydrogen bubbles to raise to atmosphere, at the oxide layer, contained in the degasser. While Hydrogen is seperating, Alkali Elements, (Li,Na and to some exten Ca) are also removed from the molten stream.
* Raising bubbles, collect or scavenge additional inclusions on the surface of the bubbles and provide a minor but important role in further inclusion removal of our entire process.
* Description Of System
* The proposed system shall consist of:  
  - Qty One (1) – Aluminum Degassing Systems
* Degasser shall consist, but not limited to, the following components:  
  - Fume Exhaust system (to be connected to furnace stack) including blower and a nominal length of duct of 8 m.  
  - Gas panel & associated controls for mixing argon / chlorine  
  - PLC & associated I/O connections – preferred bus communication in case usage of drive (regulation of rotor speed) with full data exchange to PLC.  
  - Panel to house HMI and required field wiring.  
  - Rotor Maintenance Stand  
  - Operator Maintenance and operation platform, giving access to the degasser and the cover
* Reference Drawings, Standards & SPI’s (Degasser Specific)
* The following is a list of Drawings, Standards and SPI’s having pertinent information and details for this portion of the project. The latest editions of specific codes and standards shall apply.  
  - Burner and Flames EN 746, EN 1539 (available online).  
  - Noise DIN 45635 (85 db) and DIN 45641 (8 hr 82 db) (available online).  
  - Effluents TA Luft 2002 (available online).  
  - Customer Powder and Dust Explosion Hazard Specification  
  - Guidelines for Handling Molten Metal (available online).
* Design Requirements (Degasser Specific)
* Degasser  
  - Metal flow rate range for degassing varies per cast line. The degasser should be sized accordingly.  
  - Peak Transient Metal Flow Rate (Start of the cast, during launder and filter filling) 6250 kg/min.  
  - Process temperatures: between 600 °C minimum – 740 °C maximum, depending on alloy family processed.  
  - Process gases available at site: argon, chlorine, nitrogen, and compressed air.  
  - Degasser must be capable of shutting off chlorine and argon to a broken rotor or redistributing chlorine to other rotors.
* Fume Exhaust System – Fans (Degasser Specific)
* Exhaust fans shall be direct drive. Fan blades shall be single stage. Fan housings shall be split for wheel removal and shall have a drain connection (plugged) as well as an approx. 200 mm x 200 mm removable panel to allow access for blade cleaning and fan balancing, suitable shaft seals and approved guards. The fans shall be mounted on a vibration eliminator base. The fan speeds shall be limited to 1.500 RPM maximum.  
  - Fans shall be sized to permit increases in pressure and capacity, which may be required to balance system operation at start-up.  
  - System should withstand HCl and Cl2
* Gas Consumption & Environmental (Degasser Specific)
* The system shall comply with current technical norms requirements, while operating with Stochiometric input of Chlorine for alkali metal removal, as follows:  
  - 0.003 to 0.020 kg of HCL per ton of Al processed.  
  - Maximum of 0.004 kg dust (particles emissions) per ton of Al processed.
* Specific Argon input shall be 0.3 – 0.4 liters per kg of aluminum treated.  
  The Contractor can provide an option for utilization of Salt vs. Chlorine if documentation can be provided of previous trials and results with regards to qty and type of salt used.
* At chlorine input above 0.25 %, the chlorine shall be distributed equally across all rotors except the last (downstream) rotor which maintains 0.25 % Cl2 or optionally no chlorine.  
  - If chlorine is used, a suitable external storage containment building shall be provided with an appropriate gas scrubber to process any inadvertent chlorine leaks during cylinder change out and operation.  
  - Chlorine in use shall be located on a scale or series of load cells to help alarm and notify the operator if a leak is detected.
* Temperature Control (Degasser Specific)
* System shall have the ability to raise the static metal temperature at a rate of 20 °C/hr.
* System shall be able to maintain metal temperature with ± 3 °C.
* Draining (Degasser Specific)
* Alloy changes will be frequent, potentially one per day. An economical solution shall be presented to completely drain metal to a drain pan located near unit. Minimal foundation work shall be required. Degasser must be capable of draining the metal after each cast.
* Lids (Degasser Specific)
* There shall be a sealed reactor area within the degassing launder under operating conditions. Oxygen (O2) level, within the enclosed rotor/reactor area of the degasser, when operating, shall be less than 0.2%. A cover gas shall not be used to obtain the requirements.
* The lids shall have the ability to be automatically removed from the system. Quotations shall be submitted listing two options (when applicable).  
  - Lid movement is directly above the unit for cleaning.  
  - Lid movement is up and then rotating away from the unit for cleaning and maintenance.   
  - There must be a safety lock to protect the operator from the Lid.
* Gas Mixing Panel (Degasser Specific)
* Panel must have the ability to be ventilated to location away from work environment.
* Cl2 leak detection system.
* Argon purge system.
* Gas Mass Flow Controllers – Glass mass flow controller.  
  - Chlorine Sensors – If the contractor proposes a mixed Chlorine sensor, this may be done only after approval by Customer.
* System Performance and Acceptance Specifications (Degasser Specific)

The Contractor shall guarantee the performance of the system. Acceptance by Customer shall be based on tests upon completion of the commissioning of the system. The following performance guarantee conditions shall be met for Customer to accept the system:

* Metallurgical Performance and Acceptance Specifications.  
  - Efficiency of Hydrogen removal shall be minimum of 75 %. With a target post degasser value of 0,13 cm3/100 g AL, at a temperature greater than 690 °C – but less than 705 °C.  
  - Unit shall demonstrate an inclusion removal rate of 30-35 % based on Alcan PoDFA measurements of the incoming and outgoing metal stream at steady state flow.  
  - Unit shall demonstrate removal of 50 – 70 % of Na & Ca at stoichiometric chlorine input based on OES measurements of incoming vs. outgoing metal stream at steady state flow. Li removal to be determined & agreed by Contractor and customer.  
  - Similar requirements for Na & Ca are required if Salt is utilized instead of Chlorine.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Max. inlet level | Outlet level (measured  at the outlet of the degasser) | note |
| Hydrogen | ≤ 0,50 cm3/100 g | ≤ 0,13 cm3/100 g | for alloys contain ≤ 1 % Mg |
| ≤ 0,15 cm3/100 g | for alloys contain > 1 % Mg |
| Inclusions |  | 50 % reduction of all non-wetted  inclusions greater than 15 µm |  |

* + 1. High performance filter
* Intent
* Our goal or vision with this exercise is to compare your filter inclusion reduction, furnace spout to filter exit is to realize a:  
  - 98 % reduction in 20 m inclusions  
  - 85 % reduction in 10 m inclusions with (based on the 15” upgrade)
* Other comparable technologies in the market today. It is to be understood that we intend to produce extremely high-quality finished products with chemically compatible recycle inputs.
* It is to be understood that this unit is envisioned as filter modules with a straight thru launder dividing two (2) adjacent filter bowls, known as either the right or the left-hand bowls. The straight thru launder, has adjoining entry molten metal passageways, connecting the launder to either the right or the left-hand bowl. Each entry passageway underpours molten into the respective filter bowl. Each right- and left-hand bowl being equipped with a filter tile, which is intended to collect inclusions as molten metal passes from the positive pressure or over the filter side to the negative pressure or under the filter side. Molten flows after the filter tile into a collecting basin which flows past the launder invert to fill the launder underpouring molten back into the launder which communicates with the Horizontal Direct Chill Casting Machine Casting equipment.
* Description of The System
* This specification establishes minimum requirements for a High-Performance (HP) Ceramic Foam Filter (CFF) filtration system for molten aluminum. The filtration system’s hall mark capability being an ability to prime reticulated ceramic foam materials more than 70 pores per inch (ppi), consisting of but is not limited to, the following principal components.  
  - Steel structure for casting-remelt floor mounting.  
  - All insulation and refractory.  
  - Automatic dams with manual override possibility.  
  - Metal level lasers monitoring both entrance and exit metal levels (as an option).  
  - Priming means (Electromagnetic, Permanent Magnet, Vacuum, Vibration, or even a Hydrostatic means).  
  - Insulating covers and lifting devices/hinges as necessary.  
  - Natural Gas/Hydrogen Hot Air heating system with complete combustion controls to preheat the filter bowl and filter tile. Likewise, the positive side of the filter should be equipped with two (2) immersion heaters to help maintain the incoming molten temperature. We are considering additional heaters in the post filter collecting basis to help maintain the exiting molten metal flow temperature.  
  - It is perceived that this filter unit would be serviceable at mid height on a person, so steps, handrails and operating platforms will not be needed, however if you believe these may improve the serviceability or operability of the filter unit, these will be discussed and the design may be supplied in accordance with industry and local standards.  
  - Sketches or drawings – alternate purchase points on all necessary drain pans, lifting hooks, scrap pans. Information shall include all necessary capacity/design of drain pans and scrap pans.
* Reference Drawings, Standards & SPI’s (Filter Specific).
* The following is a list of Drawings, Standards and SP’s having pertinent information and details for this portion of the project. The latest editions of specific codes and standards shall apply.  
  - Burner and Flames EN 746, EN 1539 (available online).  
  - Noise DIN 45635 (85 db) and DIN 45641 (8 hr 82 db) (available online).  
  - Effluents TA Luft 2002 (available online).  
  - Guidelines for Handling Molten Metal (available online).
* Design and Construction (Filter Specific)
* General  
  - The CFF inlet/outlet and elevation shall be designed to gravity feed metal from the filter at the end of the cast to the furnace while feeding the metal after the filter into the tap hole drain (plug and cone) at the collection basin, to a covered low profile sow mold.  
  - Quick disconnects shall be provided for all power/control/fuel supplies.  
  - CFF system shall be capable of utilizing up to a 70 ppi filter media. Contractor must provide the approximate metal level priming mechanism with an appropriate margin of safety for launder design.  
  - CFF system shall be designed to utilize one filter in each of two (2) adjacent filter bowls.  
  - The filter tile shall be sized to 381 mm (15 inch) filter tiles.   
  - Bins should be large enough to contain at least 4 unbroken filters.  
  - Gas – Hot air burner heating system shall include separate burners and separate control thermocouples for each filter bowl.  
  - Optional Automatic dam located prior to the two-filter bowls for control of initial metal flow onto the filter to ensure that is primes completely.  
   - If used, the automatic dam shall be primarily automatic from the casting PLC, with automatic opening when metal level is sensed at the dam and at an elevation dictated by the Contractor.  
   - Provision shall be made for manual override by an operator. The manual actuator for this dam shall be easily accessible by the operator without standing on top of the CFF. It shall be physically different from any other actuator on the CFF, clearly marked and guarded to prevent inadvertent actuation.  
  - Heat shields shall be supplied as necessary to maintain surface temperature below 35 °C at any location an operator must contact to operate the ceramic foam filter (kneeling or leaning points required replace filters, raise lids, etc.).  
  - At the end of the cast, the CFF system shall be capable of purging a portion of the liquid metal remaining in the CFF into the bowl as the liquid drains into the sow.

Refractory  
- Launder and filter bowl refractory material: Metal contact refractory shall rate 1 or 2 in CIREP immersion tests. Phosphate bonded materials can be used subject to approval but are discouraged.  
- The system shall be designed such that the filter bowls and inlet/outlet sections are identical to each other, for redundancy of spares.  
- The CFF refractory shall be heated and capable of maintaining metal temperature of 730 °C at zero flow with a launder level equivalent to that of steady state casting.   
- Direct heating of metal in the refractory is not acceptable.  
- Cold face steel temperatures shall not exceed ambient plus 30°C-at steady state molten metal flow.  
- The working lining of the launder or filter bowl shall be designed for ease of replacement. The expected operating life of the lining shall be 3 calendar years minimum; this shall be incorporated into the design criteria of the CFF. Utilization of silicon carbide is acceptable and preferred only for the filter seat.  
- Non soluble RCF shall not be any part of the CFF system lining or backup insulation.  
- Corners exposed to molten metal and atmosphere shall be fully radiused to eliminate vortex shedding at the exit of the filter and preferably at the entrance to minimize transient oxide introduction to the melt stream.  
- The system shall be designed such that refractory lining is continuously subject to 3 axis compressive force wherever possible.  
- The steel cover structure shall be designed for ease of installation with common hand tools and the jib crane. It should include covers or shields where necessary to minimize pockets where dust and debris can accumulate.  
- Lids shall be provided to cover bowl and inlet/outlet launder such that metal temperature loss and operator exposure to heat from molten metal are minimized. Lids over 20 kg must have a powered lift mechanism. Lift mechanism must always orient hot side of lid away from operator.

* Controls requirements  
  - Vendor to provide a complete combustion control system for the CFF burners. Controlling unit shall be capable of interfacing with caster control system for I/O status and interface (Temperature, fault, e-stop, sequence start, stop, etc.). The controlling unit should be capable of accepting a temperature set point from the caster control system. It is requested that all control components be provided into one control cabinet. – Preferred bus communication to PLC for full data exchange.  
  - All required safety features and devices shall be provided with the combustion control system.  
  - Control for all drain plugs and machine-assisted cover opening shall be through manual values. The manual value for drains and covers shall be physically different and clearly marked to prevent inadvertent actuation by an operator.
* Pre-Assembly, Shop Testing and Inspection (Filter Specific)
* General  
  - The Contractor shall guarantee the performance of the system. Acceptance by the Customer shall be based on tests upon completion of the commissioning of the system. The following performance guarantee conditions shall be met for Customer to accept the system:  
  - Unit(s) shall be capable of filtering molten aluminum within the stated metal flow ranges and casting duration times utilizing 70ppi filters with molten metal head differential not exceeding 25 mm. Failure to maintain this head differential as a result of the pre-heat or priming mechanism in any one of five (5) consecutive casts during the first three (3) days of commissioning shall result in a re-start of the system acceptance scheme. Failure to meet this will trigger a reset of this acceptance scheme and the contractor commissioning costs shall not be billed to the Customer.
* Unit shall demonstrate temperature control:  
  - Controlled heat up rate with a temperature difference of not greater than 75 °C between any two points of the metal side of the CFF bowl as measured with an IR thermometer. The rate should be between 50-75 °C/hour.  
  - Controlled heat up rate with a temperature difference of not greater than 25 °C between two instrumented points 2 cm in from diagonal opposite corners mid thickness. Measurements taken 15, 20, 45 and 60 minutes during preheat. The rate should be between 50-75 °C/hour. (Type K thermocouples).  
  - Heating system shall maintain temperature set point +/- 10 °C measured at the control thermocouple up to a set point of 750 °C when CFF is empty.  
  - Maximum temperature deviation measured at any point on metal side of empty refractory below typical metal level shall be no more than 5 °C when the CFF is empty.
* Unit shall demonstrate when measured by PoDFA.   
  - Demonstrate 90 % or better inclusion removal, 85 % of the time. On all PoDFA measurements when prepared with the wet method. 90 % or better inclusion removal, on 85 % of the samples taken during steady state casting (150-5000 mm in length) measurements of the incoming and outgoing metal stream.  
  - Demonstrate during steady state casting (150-5000 mm in length) a post filter metal level oscillation not more than 10 mm over a 5-minute period. Incoming metal level variances from the tilting furnace hydraulics removed-filtered.  
  - Demonstrate an average PoDFA post filter during steady state casting (150-5000 mm in length) to the casting center with a PoDFA count of less than 0.003 mm/kg. Titanium Borides excluded. This means that given the data on the table from the various incumbents, we would need to:  
   - Use oversized filter tiles which lower the Superficial Velocity to capture a greater percentage of inclusions less than 10 microns.  
  - The partner in this project will present their proposal with a common aim in this endeavor, forward in contrast to a proposal from the rear view. Doing so, releases us from the capabilities of the customary supply, that which has been used in the past to “What we want to deliver in the future”. Because we believe that the ability to deliver a truly amazing Forging Stock, from a high percentage of recycle material is in-fact out future.
  + 1. Casting system
* Intent
* Molten metal enters the machine’s casting equipment after exiting the filter via the Entry/Draining system. The purpose of the Entry/Draining portion of the system is to provide a temperature or flow relief immediately prior to releasing molten into the casting equipment. Giving the operator one last point to verify molten metal temperature and flow.
* Once the molten metal enters the casting equipment, the molten immediately flows into each mold position through a “mouse hole” passage. A few seconds after the mold adequately fills all cavities, the starting heads are retracted from their initial position as false bottom of the mold, pulling the embryonic butt from the mold onto the casting conveyor.
* Once all the molds have begun casting, and proper withdraw is underway, the starting heads are removed from the machine and the butts advance along the casting conveyor and enter the saw mechanism on the way to the exit roller conveyor.
* Finally, when the desired starting length is obtained, while the billets continue their movement along the casting conveyor, the Flying Saw begins to cut the billets from one side of the saw gap, between the casting conveyor and the exit roller conveyor. This saw is unique to the process as the saw advances with the billets, in the direction of cast to cut all the billets (length 4500 – 6000 mm) with considering respective casting speed at corresponding diameter and alloy.
* The billets, after being separated from the solidifying and moving portion of the machine are staged on the exit conveyor, for the next process = peeling, inspection, and packaging.
* Description Of System

The proposed systems shall consist of the following:

* Casting System.  
  - Casting Machine – The casting machine is a complex mechanism which receives molten metal from the distribution launder, transferring to the casting equipment, thru the thimbles and into the mold cavity where solidification takes place. At the start of the cast, a false bottom-starting head enters the mold cavity and after the initial flush of molten is solidified in the mold, the false bottom is withdrawn horizontally onto the conveyance system which is comprised of a pinch roller which captures the starting head-billet against the conveyor. After a suitable period, the starting heads are separated from the billet and the flying saw separates the butt portion of the cast billet so that the starting head support bar (bait bar) is separated from the conveyance system. Over time, as casting continues, the saw performs a cut to length function when the desired billet length is met.

- Mold Lubrication Distributor – Lubrication delivery to the mold, across the compliment of molds at a given and prescribed flow at pressure is key across the compliment of molds casting for a producer to be successful. Hydraulic line loss, given the increasing line length side to side must be uniform to deliver a uniform oil pressure behind the graphite ring. The oil must have a provision to terminate oil flow to an inoperable mold position.

- Cooling Water Distributor – Water flow, mold to mold must be uniform to deliver consistent flow and solidification conditions. Inside the mold, top to bottom, flow conditions must also vary to counteract the buoyancy effects of the liquid in the mold and sump. The water must have a provision to terminate flow to an inoperable mold position. The water must also immediately terminate in the event of a bleed out, without requiring a human to approach the mold or the backside of the casting equipment where a bubble may escape back into the molten metal.

- Flying Saw – A movable (Flying) saw must be used so that a when casting many strands, a saw may move in the direction of the cast ensuring that a common or constant cut length is attained.

- Cast Billet Exit Conveyor – Once cut, the cast billet must offload and quickly move away from the saw offload area onto an exit conveyor.

- Starting Bar (Bait Bar) Removal System – At the start of the cast, before the process is typically stabilized, the Starting Bar, with multiple starting heads must be removed. Performing this, during this portion of the cast is hazardous and should be removed, remotely without requiring human intervention.

- Scrap Conveyor – Saw chips must be quickly removed after collection in the lower half of the saw motion is key to maintaining a sharp carbide tip, and not back dragging the cut, creating an unwarranted vibration in the product which terminates at the mold with a surface defect.

- Product Withdraw Mechanism – The as cast billet surface contains water and oil which can be slippery and thus the clamping force, if used must assist with a uniform as cast billet removal velocity across the billets being cast.

- Working Platform with Stairs – The operator must be able to traverse, side to side to service the entire breadth of the cast products.

- Starting Bar for Starting Heads – Starting Bar fastens many Starting Heads, each providing the false bottom portions of each mold must penetrate each mold, a uniform distance. The Starting Heads must not allow water to escape into any mold when the water is engaged at the start of the cast.

- Pneumatic Control and Distribution – dams (automatic controlled with manual override possibility) are pneumatically operated, to ensure operation in the event of a power failure.

* Molds and Starting Heads (set as per casting diameter)  
  - Casting equipment with Lining -Casting equipment must be optimized for flow to minimize temperature loss, position to position, especially out near the terminus ends of the casting equipment.  
  - Sufficient set of casting equipment for smooth continous operation has to be secured by the Contractor (base: 1 x in operation = casting, 1 x in preparation for next casting)  
  - Molds and all necessary accessories connected to the casting equipment required to casting billets  
  - Sufficient sets as per diameter for smooth continuous operation has to be secured by the Contractor (= at less as possible time between stop and new start of casting with same diameter).  
  - Starting heads with Bait Bar – Each size must have a compliment of starting heads.  
  - Consumables for 6 months operations has to be part of base delivery of Contractor.
* Design Requirements (Casting System Specific)

Specific Requirements (Section Specific, with periodic reference to appropriate sections in the General Equipment Specification and Specific Equipment Specifications.

* Casting Machine.  
  - The structure shall be fabricated and assembled in the Contractor’s workshop, as so much reasonably practical, using full penetration welds by welders trained and certified by local authority, prior to delivery.  
  - After welding, the fabricated assembly shall be stress relieved.  
  - The molten metal spill sections shall be fabricated from structural steel grade S235J2 or equivalent.  
  - He structure shall be adequately reinforced against buckling using heavy-duty channel sections.  
  - Structural channels to be positioned with flanges facing down so as not to collect dirt.  
  - Structure shall not exceed 50 % of the material yield strength.  
  - All steel components, in the molten splash area shall be painted with an approved explosion protection paint.  
  - Mold Lubrication Distributor.  
  - All oil delivery lines shall be stainless, without any copper ferrule or fittings.  
  - Cooling Water Distributor.  
  - Water delivery lines to the mold shall have remote normally closed valves in the event of a power outage.  
  - All utilities serving the machine shall have lockable shutoff valves upstream of all operating valves and/or components to provide “zero energy state” immediately downstream.  
  - All machine assemblies shall be pre-piped to the machine boundary with single point connections.  
  - Contractor drawings shall clearly show tie-in points, connection size and type for all connections to plant piping systems (i.e. utility connections). Drawings shall also indicate tie-in points for interconnecting piping between Contractor provided components.  
  - Absolutely no hydraulic or electrical lines may be located below metal level in the proximity of the launder, casting equipment or mold.  
  - There shall be no services fastened to or attached to the concrete flooring or inside the basement wall in the proximity of the launder, casting equipment or mold.
* Flying Saw  
  - Rotating components shall be supplied in conformance with General Equipment Specifications.  
  - Saw must be able to cut:  
   - 4 500 mm – 6 000 mm billets (normal billet length)  
   - scrap billet length of 3 000 mm minimum length (during casting) and return to home position considering 5 m/min. casting speed.
* Cast Billet Exit Conveyor  
  - Conformance with General Equipment Specification.
* Starting Bar (Bait Bar) Removal System.  
  - Removal System must be able to remove he starting bar from the system without disrupting or causing a vibration at the mold.
* Scrap Conveyor  
  - Conformance with General Equipment Specification Sections
* Product Withdraw Mechanism.  
  - The cast billets must be able to advance away from the molds with or without the V Shaped pinch rolls.
* Starting Bar for Starting Head.
* Electrical Equipment and Automation.  
  - Conformance with General Equipment Specification Sections
* Pneumatic Control and Distribution.  
  - Conformance with General Equipment Specification Sections
* Molds and Starting Heads.  
  - Direct Chill Mold assemblies including,  
   - Mold body  
   - Fasteners w/ spares  
   - Ceramic ring w/ spares  
   - Ceramic clamp ring w/ spares  
   - Graphite w/ spares  
   - Refractory release agent  
   - Molds shall be manufactured from suitable 6082 or other 6xxx alloys.  
   - Water and oil passage ways shall be free of burrs.  
   - Mold-graphie casting surface shall have a suitable taper and be polished in the direction of the cast.  
   - Molds.  
   - Water holes shall be deburred at the exit of the hole to minimize any exit effects.
* Casting equipment with Lining  
  - Weep Holes shall be provided in the casting equipment shell and bottom to allow water vapor from the refractory to escape during casting equipment dry out. Weep Holes need to be threaded for M12 bolts. The Weep Holes should not be more than 1 m apart. After dryout the weep holes shall be plugged and welded closed.  
  - Contractor is to minimize the use of silica fiber materials, (Blanket or Paper) in the metal distribution system.  
  - Contractor is to provide a position specific remote molten metal terminate mechanism so that the operators must not approach the metal in the event of a bleed out.  
  - The remote molten metal termination mechanism must be able to remotely activate so that our operators do not have to lean over the casting equipment, which may burp metal into the operator’s face.
* Mold Support Plate with Molds  
  - Support plate shall be annealed after rough cut, prior to machnining.  
  - Support plate shall be machined/surface ground flat and parallel within 50 microns.
* Starting heads with Bait Bar.  
  - The starting bar, with heads attached must be able to locate the starting head in the mold cavity +/- 2mm.  
  - The starting head to mold gap must be small enough to ensure no splash back or water entering the cavity, during mold fill.  
  - It is preferred that the outer periphery of the starting head, or the portion which engages in the mold incorporates a high temperature O Ring.
* Pre-Assembly, Shop Testing and Inspection
* Oil Flow Testing. Acceptance Testing  
  - The oil system, shall be connected to the oil distribution system on one of the casting equipment-mold support plate. With the oil system active or on, a hose or clamped hose shall collect oil from each position, delivering the oil into an empty pre-weighed plastic bucket.  
  - After allowing the oil system to actively deliver oil to each plastic bucket, for two hours, the buckes shall be weighed for comparison, position to position. The oil weights shall be tabulated, and an average weight calculated. Any position which is +/- more than 1.5% of the average must be corrected and this test repeated on each casting equipment-mold plate (3 if 3 sizes are purchased).
* System Performance and Product Acceptance Testing
* Molten delta temperature in the casting equipment between middle and outer mold position shall not exceed more than 7 °C. Range between 5–7 °C shall be understood as normal condition.
* Water Flow Testing Product Acceptance Testing (PAT).  
  - The water system shall be tested for flow variability, mold to mold and the total flow variance, liters/minute shall be less than 5 % total flow, so +/- 2.5%.  
  - This test is typically conducted by attaching a flexible rubber hose to the terminating end of the water header, with the distending end allowed to hang down into the casting pit. This hose is placed inside a series of containers which hold 10-12 minutes of water, at 60 % standard casting flow. If space does not allow a full compliment of mold positions to be tested, then an adjustment to the plan may be agreed on.  
  - The test is best done with a waterproof video camera which gives visibility to all of the containers being used. The container has two holes, one 5 cm from the bottom, 2-3 mm diameter and one hole 5 cm from the top of the container. After conducting the test, time is recorded at each bucket-position starting with the lower hole and the final time, is noted when the water dribbles out of the top hole. Time is measured, averages calculated.  
  - The process must be able to produce, the number of strands of the targeted diameters at a recovery rate, off the machine, for 4 consecutive hours, within one hour of cast start of 96 % recovery measured by calculating the good material produced from each strand divided by the attempted material.  
  - Contractor is to certify that the machine is process capable for all diameters purchased, when casting EN AW 6110 with 40 ppm Boron addition rate of 5/1 grain refiner, added prior to the degasser.
  + 1. Casting water system
* Design Requirements
* General  
  - Water Tank Shall have a capacity required for at least 7 days of casting.  
  - Minimum Water Flow requirement at casting pit = 1000 L/min.  
  - Maximum Water Flow requirement at casting pit = 1500 L/min.  
  (\* calculation based on water temperature of 35 °C)
* Hot Wells / Cold Wells / Cooling Towers.  
  - Strainers required for the removal of large debris.  
  - Both Hot Wells and Cold Wells are to be covered with plate or some other material that is not transparent to prevent contamination from entering the water system.  
  - Contractor to provide typical process water speed, casting speed and water temperature increase so a cooling tower can be specified by Customer.
* Emergency Water System  
  - Emergency Water System shall have a normally closed valve which is power open which automatically shuts off when power is interrupted a 65 % of the steady state flow.
* Cooling Water Quality (to be confirmed by Contractor)  
  - Water entering the Casting Pit Shall have the following chemical make-up:  
   - Calcium Hardness (as CaCO3) = 160 – 200 ppm  
   - Alkalinity = 160 – 200 ppm  
   - Ph = 7.6 – 7.8  
   - Molybdate Corrosion Inhibitor = 3 - 5 ppm  
   - Conductivity = 800 mmhos estimated  
   - Iron Filtered = < 0.25 mm  
   - Iron Total = < 1 mm  
   - Corrosion Rates = 1.0 - 2.0 mpy mild steel / 0.2 – 0.5 mpy aluminum 6061  
   - Microbiological Count < 10,000/ml  
   - Bromine Residual = 0.3 – 0.5 ppm  
   - Turbidity (Oil Levels) = < 10 NTU  
   - Suspended Solids < 10 ppm
* Water inlet Temperature range shall be nn °C +/- 5°C. – Contractor to specify.
* Make-Up Water Supply
* The recommended water Chemistry for the make-up water supply is:  
  - Calcium (as CaCO3) = 45 ppm  
  - Alkalinity = 40 ppm  
  - Sulfate < 10 ppm  
  - Chloride < 10 ppm  
  - Conductivity <2 00 mmhos  
  - pH = 8.0 – 8.5
* Filtration
* Automatic self-cleaning Water strainer.  
  - Cooling water supply filter.  
  - Backwash valve with actuator.  
  - Differential pressure transmitter (4-20 mA signal to PLC).  
  - Pressure gauges.  
  - PLC controlled and monitored.
* Chemical Treatment
* The chemical treatment program shall consist of a scale inhibitor, a corrosion inhibitor, a polymeric dispersant, and bromine for microbiological control.
* The system shall only use non-oxidizing biocides in case of emergency. Non-oxidizing biocides negatively impact quenchibility.
* Customer will use their water treatment facility to manage their water treatment needs.
* pH to be controlled utilizing a sulfuric acid feed system.
* Water Quality Monitoring System
* System shall include:  
  - Calcium and alkalinity analyzers  
  - pH monitors and control.
* System shall automatically measure  
  - pH  
  - Conductivity  
  - Corrosion Rate  
  - Turbidity  
  - Strainer Backwash  
  - Blowdown Volume  
  - CT Makeup Volume
* All signals to be linked with caster system so alarming is activated when water quality is lost. Add contractor to supply orifice plates for emergency water flow setting.
* Water Control Systems
* Each system must provide casting water to a billet casting station consisting of following different strands and diameter combinations for a machine casting xx billets 40 - 125 mm in diameter.
* The system must maintain start water flow and run water flow within ± 5 % of the set point.
* Run water flow control is required over a range of total water flow rate 1000 – 1500 l/min, sufficient water flow for the maximum number of molds under the hottest casting conditions.
* IP-54 enclosure with cooling if required.
* Failsafe design
* RTD/transmitter with S.S. thermowell for temperature measurements
* Magnetic flow meters for flow-rate measurements (4-20 mA signal)
* Remote I/O as required.
* 24HDC power supply as required.
* Control valves to have 4-20 mA position feedback signal (4-20 mA)
* Shutoff valves to have fully open and fully closed limit switches.
* Control Loops  
  - Mold cooling water temperature measurement (4-20 mA signal)  
  - Pit Water Level
* Control valves to fail-in-last-position on power or command signal failure.
* Shutoff valves to be equipped with a brake.
* One (1) mold cooling water control system required on a common support stand. For mold cooling water, the system includes One (1) each of the following components sized to meet the flow requirements:  
  - Magnetic flow meter  
  - Flow control valve  
   - Segmented “V” style with linear flow characteristics  
  - Shutoff valve  
   - Fail in last position  
  - The above mold water control components supplied as pre-spooled assemblies with mating pipe flanges at each end.  
  - PLC I/O, PLC control logic and SCADA screens for operation of the water system.
* The emergency water system will use failsafe valves, check valves, level sensors and other components and will be sized to supply 50% of maximum required mold cooling water flow for five minutes.  
  - Emergency water supply valves  
   - 1 each normally open pneumatically operated wafer style butterfly valve with position indicating switches.  
   - 2 each check valves.
* The following are common components and only one (1) each required:  
  - Support stand for the one (1) water control spools and pit water level control valve.  
  - Pneumatically actuated emergency water valve that opens on loss of air pressure.  
  - Pit water level control valve with electrically operated actuator.  
  - Pit water level sensor – Differential pressure transducer for pit water level, 4-20 mA feedback.  
  - Pit water level monitoring with PID control.  
  - RTD/transmitter with S.S. thermowell.  
  - Casting pit evacuation pumps (includes 1 installed spare).  
  - Swing check valves.  
  - Control components pre-wired to remote I/O and tested before shipping.  
  - Mold water control components pre-wired to junction box with remote I/O.  
  - An electrically operated drain valve shall open to drain water from the table at the end of a cast.  
  - Design of all piping upstream and downstream of supplied water spools. Piping to be stainless steel.  
  - Design of conduit and wiring required for field installation of water control.
  + 1. Peeling, testing device(s) and tracking system
* Intent
* Every billet will be checked across its entire length by the inspection and monitoring device whether it complies with the required qualitative parameters. The inspection and monitoring device will be connected to the billet handling device. The billets must comply with the qualitative requirements set out in Annex\_3\_1\_ Guaranteed\_parameters\_ of\_ billets to the technical specification.
* Tracking of billets has to be ensured by Contractor up to packaging.
* Samples have to be cut after billet has passed peeling and testing. Respective equipment has to be considered by the Contractor.
* Marking of each billet as per Customer´s specification (Annex\_3\_1\_ Guaranteed\_parameters\_ of\_ billets) has to be ensured by Contractor before packaging.
* Briquetting processing line for chips (from peeling, sawing etc.) to ensure full recycling of waste material during cutting, peeling and any other kind of material usable for back charging into the melding furnace.
* The line has to be prepared to implementation of additional saw. The porpose of this additional saw is to cut unchecked ends of billets (heads/tails). The additional saw is not scope of Contractor supply.
* Description of The System
* Chain conveyor with pre-separating lever taking over the casted billets from the previous section. Buffer spaces ensuring smooth casting operation before feeding the billet into the peeling machine. In case of stoppage of the peeling machine during ongoing casting operation a by-pass of the peeling machine must be considered. Possibility of re-charge respective billets in suitable moment (casting stoppage etc.) must be ensured to process these billets accordingly.
* Full automatic peeling machine has to including also chip conveyor, emulsion plant with all required accessories to fullfill environmental norms.
* Testing equipment must be supplied by Contractor as per quality requirements specified in Annex 3\_1\_TS\_Guaranteed\_parameters\_ of\_ billets. Evidence of all testing results must be ensured by Contractor providing protocol of each tested billet after peeling. Data must be available by Customer with full access. Communication to Customer overall system has to be agreed during engineering phase. In case of stoppage of the testing equipment during ongoing casting operation a by-pass must be considered. Possibility of re-charge respective billets in suitable moment (casting stoppage etc.) must be ensured to process these billets accordingly.
* The testing equipment must check the internal defects by means of ultrasonic testing (UST). Each billet must be tested at UT comply with ASTM 2375-08, Acceptance Class AA, pulse echo method, vertical/radial acoustic radiation, phased array technology, surface quality. – parameter as specified in Annex 3\_1\_TS\_Guaranteed\_parameters\_ of\_ billets
* Billet transportation between peeling machine, testing equipment up to packaging line must ensure smooth operation with respective buffer positions to ensure stable upstream operation without immediate impact.
* Briquetting line for chips from peeling machine is fed into a shredder following directing charing into a centrifuge. Further mixing chips from flying saw or other processes collecting into a filter (oil separation) with connected hopper to final briquetting (press) machine. Size of capacity need to fit with operation parameter of the casting line.
* Electric / automation equipment  
  - As required for the process  
  - PLC/HMI system full accessible  
  - Integration into overall PLC/HMI environment  
  - Frequency converter for drives with full bus communication to PLC  
  - Following plant standard (described in following sections)
* Hydraulic equipment  
  - Following plant standard (described in following sections)
* Automatic grease lubrication
* Wear parts, Consumables for 6 months operations have to be part of base delivery of Contractor.
* The contractor will provide the list of recommended spare parts for then next two years of the production.
* System Performance and Product Acceptance Testing
* As specified under Annex\_3\_1\_TS\_Guaranteed\_parameters\_ of\_ billets
* Change of cutting tool and insert position during running operation has to be demonstrated without impacting running casting operation. Acceptable value is less than 4,5 minutes.
* Cycle for change of cutting insert position (4 positions before complete exchange of insert set) for respective diameter has to be demonstrated.  
  - minimum 250 billet peeling for a insert position  
  = 1000 billet peeling for complete exchange of peeling set.
  + 1. Packaging line
* Intent
* Peeled, tested and marked billets will be packed on wood pallets based on the specified packaging regulation. Individual layers of billets must be separated with cardboard separators. Mechanical damage of billets must be avoided. The front side of the billet package must be fitted with a label. Once the required quantity of billets is loaded on the pallets, the billets should be fastened with a strapping device. The packaging line will be connected to the billet handling device. The finished billet packages will be transferred by an overhead crane or a forklift truck. Laths (wood boards), cardboard separators and labels should be applied by the staff (one operator) at the packaging line. The operators must be secured (e.g. light barrier) during insertion of laths and separators. The laths and separators are to be inserted in full operation of the line. For a detailed description of packaged billets, see the packaging regulation (see Annex 3\_2\_TS \_Packing\_instruction). Billets do not need to be packed in a foil. A stack of packaged billets (Figure 2).
  + 1. Furnace integration



Figure 2 - Stack of packaged billets

* Intent
* The Contractor will be responsible for the integration of tilting furnace(s). The furnaces will be fitted with a PN/PN coupler for communication on the operation, process and safety level. The communication between the casting line and the furnace will take place via the Profinet line.
* The Contractor of the casting line is responsible for defining of parameters which are needed for smooth operation of whole casting process such as: Flow rate of the melt, temperature of the melt, melt level in launders…

Obsah obrázku text, diagram, snímek obrazovky, Paralelní

Popis byl vytvořen automaticky

Figure 3 - SW/HW interface block diagram

* Guaranteed parameters
* Melt from the furnace(s) with a specified chemical composition (see Annex 3\_1\_Guaranteed\_parameters\_of\_billets)
* Melt level in the launders will be maintained by means of furnace tilting within the range of ± 5 mm. The melt level in the launders will be monitored by the Contractor of the casting line.
* Melt flow rate at the furnace output 3-5 t/h
* Hydrogen content in the melt max. 0,50 cm3/100g
* PoDFA 0,45 mm2/kg
  + 1. Mold Shop-, Test-, Auxiliary equipment and Stands
* Mold Shop Equipment
* Casting equipment Stand (extra) – An extra casting equipment stand near the machine will shorten the downtime and make alloy or size change events easier.
* Miscellaneous Operator and Mold Shop Items – The mold shop, or the ease with which maintenance is performed is key to consistent operation. Records, associated with each mold, starting head and position is, second to the mold shop equipment in its importance.  
  - Any kind of special test or inspection equipment required to ensure full tested and prepared equipment for operation has to be in scope of Contractor.  
  - Other special tools shall be specified by the Contractor within detail engineering and handed over to Customer not later than 1 year before start of commissioning to ensure availability at site.
* Casting equipment Pre-Heating System – A hot air blower will help to minimize direct flame impingement refractory corrosion. – Equipment has to be in scope of Contractor.
* Test Equipment.
* Mold Assembly, Test, and Inspection Table – A table, for mold assembly, testing and cold inspection pays dividends when pre-assembling the molds on the casting equipment.
* Mold System Testing Platform – This platform is optimized for oil, testing so that oil passageways are tested prior to hot metal exposure.
* - Any kind of special test or inspection equipment required to ensure full tested and prepared equipment for operation has to be in scope of Contractor.
* Auxilliary Equipment.
* Noise protection (housing etc.) – for relevant equipment has to be in scope of Contractor. Demonstration of acceptable noise levels has to be part of acceptance tests.
* Flying Saw Chip Exhaust System – Chip briquetting will be needed given the chip generation rates with this machine. Any reduction in saw blade tooth face will reduce material loss.
* Stands
* Contractor shall provide basic engineering and where is required detail engineering drawings for any kind of equipment (for example degasser or mold or casting equipment, etc.), which enables Customer local purchase and manufacturing.
  1. Required documentation
     1. General
* The Contractor shall provide all revised or new drawings and documentation required for installation and maintaining the equipment in editable format. Where applicable, these shall include, but are not limited to, the following: Functional Description, Assembly and Disassembly Procedure Description, Process & Instrumentation Diagrams (P&I), General Arrangement & Equipment Layout Drawings, Assembly Drawings, Foundation Drawings, Structural Drawings, Piping Drawings, Plan, Section & Detail Drawings, Conduit and Cable Schedules, Single Line Drawings, Equipment Grounding Drawings, Exposed Raceway Drawings, Transition Drawings, Junction Box / Termination Panel Details, Interconnection Drawings, Control Drawings, Elementary Drawings, Communication & Interface Drawings, Level I & Level II Logic Documents, Operation & Maintenance Manuals, and Training Manuals & Visual Aids.
* Safety instructions,
* Risk analysis,
* Technical protocol (specifying name of equipment, type of equipment, serial nr., weight, main dimensions),
* Guidlines for a inspectionand checks (on daily, weekly, monthly, yearly basis),
* List of spare parts for mechanics, hydraulics, pneumatics and electrical systems with a cataloque nr., for min 2 years,
* Basic list of alarms with a help instruction,
* Initional revision, tests protocol, certificatrs for electro cabinets ets.,
* For Automation, the Contractor shall provide PLC Configuration, Hardware and Software Specifications, and technical & schematic wiring diagram. (including existing panel) PLC control software in editable and open form
* The Contractor shall provide, in one master document, a listing of all parameter settings for electrical, mechanical, and hydraulic equipment.
* The Contractor is required to notify the Customer’s Purchasing representative of any impact on cost or schedule resulting from Customer’s requested changes, whether the request was made verbally, written or in review comments on drawings. The said changes shall only be executed upon authorization by Customer’s purchasing.
* The Contractor shall provide the “As Built / As Commissioned” editable, electronic drawings and documentation, with one hard copy, no later than 3 weeks after completion of the project. The Contractor shall provide detailed fabrication drawings of all non-commercial parts utilized in the fabrication and installation of equipment within the Contractor’s scope of supply. All standard commercial parts are to be specified on respective assembly drawings, and in O & M manuals in sufficient detail to permit direct purchase from third party contractors.
* Any components currently covered by patents must be identified and appropriate patent # must be listed.
* The Contractor shall provide one editable copy of all computer-generated documents on CD or USB disk or external hard drive.
* All documentation provided to Customer shall be in Czech and English
* On the operational panel will be possible to choice a language Czech or English.
* The Contractor shall provide Customer with a limited use Right to Copy said documentation for the explicit use by Customer in maintaining, training and operating the equipment.
* The Contractor shall provide Customer with the Material Safety Data Sheets (MSDS) for any used chemical.
* Instead of CD use external hard drive.
* Technical documentation of the machine (layout of the system, sets of machining drawing, hydraulic schema, pneumatic schema, lubrication instruction),
* All documentation is delivered in 3 copies in paper format and 1 copy on CD, USB disk (pdf format). The documentation documentation must be prepared in Czech form and English.
  + 1. Drawings
* All design drawings must be done in Metric Form in the latest AutoCad version and provided in addition in \*.dwg and \*.pdf format. Other preferred formats are \*.step, \*.igs, \*.mi, \*.pkg, \*.dxf.
* The design and installation drawings shall be submitted for Customer’s review. To expedite Customer’s review, drawings shall be transmitted electronically.
* Comments on drawings by Customer do not relieve the Contractor of his responsibility for the system design, operation and safety. Drawings returned by Customer with comments, shall be resubmitted for record purposes.
* EPLAN is the preferred software for electrical documentation.
* Manuals
* Contractor shall provide a full and complete Bill of Material (BoM) for all delivered parts. Documentation in SAP Materials Management Module is preferred.
* Operation and maintenance manuals shall be submitted in editable, electronic format.
  + 1. Dokuments for construction readiness
* Machine layout and basic data output data
* Side views
* Basic information for compressed air system, cooling water, hydraulic system, other required media
* Final of load data
* Conduits/channels for media/electric dimensions - connected to civil works as needed for general designer for building engineering
* Emissions arising from the technology (if relevant) - characteristics, amount, location of the chimney (exhaust), height and diameter of the chimney (exhaust), amount of air, operating hours
* Noise - sources, amount of emissions (technical data), proposal of a possible method of limitation
  + 1. Dokuments for Basic engineering
* Machine layout with connection points and all utility output data
* Side views with connection points
* Foundation plan with load data (static and dynamic) including the Machine ground connection
* Anchor plans of the equipment
* Drawings and requirements for compressed air system – power, flow, pressure, connection dimensions, piping plans etc.
* Drawings and requirements for cooling water – power, flow, pressure, connection dimensions, piping plans etc.
* Drawings and requirements for hydraulic system – power, flow, pressure, piping plans etc.
* Drawings and requirements for air extraction (if you consider) -power, flow, connection dimensions, piping plans etc.
* Emissions arising from the technology (if relevant) - characteristics, amount, removal method - cleaning, location of the chimney (exhaust), height and diameter of the chimney (exhaust), amount of air, operating hours
* Documents for Electrical Equipment containing
* Electric switchboard dimensions
* Electric design drawings
* The required cable routes
* Drawings and requirements for other required media – power, flow, pressure, connection dimensions, piping plans, etc.
* Noise - sources, amount of emissions (technical data), proposal of a possible method of limitation
* 3D model of the device for the possibility of creating an overall model in the hall and thereby eliminating the crossing of distribution lines
* Technology requirements for other professions - lifting equipment, platforms, camera systems, special lighting, etc...
  + 1. Documents for installation of the Equipment
* engineering and design documentation containing the Detail Design documentation elaborated in details necessary for performance of the subject matter of the Contract;
* all documentation needed for proper construction, installation, erection, commissioning, operation, maintenance and repairs of the Equipment;
* detailed assembly, installation, erection, commissioning, operation and maintenance manuals for each appropriate unit of the Equipment; and
* implementation documentation to the extent necessary for the needs of the tender procedure under the Subsidy Program (including measuring technology, preparations for assembly, requirements for measurement accuracy, etc.) and assembly.
  + 1. Final Documentation
* mechanical drawing documents for parts, sub-assemblies and assemblies, in PDF and DWG format,
* electronic drawing documents in E-Plan format, version 2.9 or later and in PDF format
* pneumatic line diagram in PDF and DWG format,
* hydraulic line diagram in PDF and DWG format
* operation and maintenance manual, hard copy (3x) and digital form, in Czech and English,
* BOM for spare parts in PDF and XLS format (indicating the type identification, ordering number, manufacturer, standard, dimension, lead time, etc.),
* BOM for wear parts in PDF and XLS format (indicating the name, ordering number, manufacturer, standard, dimension, lead time, etc.),
* maintenance, inspection and revision plan in Czech – based on the government resolution No. 378/2001 Coll. Section 2
* calibration sheets and recommended calibration intervals
* leak test reports for compressed air, gas and industrial water
* safety circuit function verification report
* electrical equipment verification test report pursuant to Czech national standard ČSN EN 60204-1 ED.3 (initial inspection of electrical parts)
* certificates, CE declaration of conformity
* risk analysis according to ČSN EN ISO 12100
* data sheets and certificates for the materials used
* installation logbook
* SW backup (source codes must be supplied for the PLC control system, visualisation e.g. WinCC, control of frequency converters, hydraulics, etc.), source codes must be in English
* other documents necessary for the operation of the line
* list of necessary workshop equipment for mold preparation and cleaning
* Version of AutoCAD (DWG) and EPLAN must be confirmed by Customer at start of project.
  + 1. Others
* 3D model documents of the line, in STEP format – due date as per the Contractor’s suggestion, however not later than 8 months since the order date
* preliminary operation and maintenance manual, hard copy (3x) and digital form, in Czech – due date before the operation and maintenance operator training
* all units, dimensions and weights must be given in SI (metric) units.
  1. Mechanical
     1. General
* The equipment shall be configured for maximum availability, reliability and maintainability. Maintainability shall include, but not be limited to, the following:
* Ease of maintenance and reduction of time required to change components and parts:  
  - Duplication of components and connected spare devices where practical  
  - All valves and all components requiring lubrication or adjustment shall be serviceable from accessible positions, without endangering operating or maintenance personnel.
* All rotating equipment shall be statically balanced.
* All pipe threads (coupling nut) to be Metric ISO standard. No alternative is allowed. (Usage: Assembly of plant or equipment piping, and connections or direction changes between rigid pipe. It is not the same as port fittings into cylinders.)
* All threaded fasteners to be Metric ISO standard. No alternative is allowed. (Usage: Bolts, screws, nuts, machine assembly)
* Bearing shall be precision ball or roller type.
* Guards shall be provided for all power movable parts and rotating drive components for personnel and equipment protection. Access to moving parts may be restricted by handrail and/or mesh guards to prevent operators or maintenance technicians from accidentally reaching the moving part. Refer to ISO 13857:2008 for Safety distances to prevent hazard zones being reached by upper and lower limbs.
* Locking mechanism, manually actuated, shall be furnished to lock moving parts during maintenance. Locking mechanisms shall follow LoTo requirements.
* Lifting facilities shall be provided on all major items of equipment to allow movement by crane.
* Leveling screws shall be provided on all main bases to facilitate installation.
* Vibrating system parts shall be equipped with effective damping to avoid transmission of vibrations to buildings, steel structures, other machinery parts, and piping.
* Structural supports, platforms, stairways, handrails, floor plate, etc. required for operation and on-line maintenance shall be provided by the Contractor. Dimple plate shall be provided on other than concrete walking surfaces.
* Design shall minimize the need for foundation pits and trenches.
  + 1. Lubrication
* Customer is responsible for the first fill as par Contractror detail engeneering specification
* A means to lubricate all bearings shall be provided. All rolling contact bearings shall meet or exceed 44,000 hrs. of equipment operation.
* As far as technically possible, maintenance/lubrication free equipment shall be used, based upon a minimum design life of 44,000 hr. of operation.
* The state of lubrication upon delivery shall be documented and identified. (i.e. is it a basic lubrication or lubrication ready for operation)
* If possible, facility for lubrication while the equipment is running shall be installed, i.e. lubrication nipples, oil level gauges and fill points shall be moved outside the machine guarding for easy access and reasonably centralized and labeled.
  + 1. Pneumatics and Hydraulics
* Customer is responsible for the first fill as par Contractror detail engeneering specification
* The Hydraulic system offered with all equipment include small hydraulic power packs and are being procured along with the individual equipment as a package and the same will conform to the standard / good engineering practice adopted for Hydraulic power packages. These packages will include all necessary electrics, pipework, instrumentation and controls.
* The hydraulic systems in general will include tank units, pump motor units, filtration unit, plate type heat exchanger cooling unit, valve stands, and accumulator stands as applicable for particular system.
* All hydraulic tanks shall be of stainless steel. Pump-tank level interlocks shall have safety switches and analog for measuring/monitoring temperature shall be provided.
* Necessary test kit for proportional and servo valves will be provided as per the relevant system.
* Each hydraulic system shall be provided with electrical control panel. Audible and visible alarms shall be provided in the control panel as well as in HMI for indicating malfunctioning of any component.
* Supply of one (1) no. mobile filling pump-motor-filter unit complete with 15 m long suction and delivery hoses, electrical control cabinet, 15 m long cable and power plug. The filter will be of adequate capacity and 5 micron fineness for hydraulic systems for unloading fresh hydraulic oil from barrels/tanker to the tank of each hydraulic system.
* Supply of one (1) no. mobile nitrogen booster complete with electric motor, control cabinet, 15 m long each suction and delivery hoses, 15 m long cable and power plug for initial charging of accumulators with nitrogen.
* Hydraulic filter in any respective line (circulation, feed, pressure, return line) need to be double type (switch over between working and standby filter during operation without system stoppage is ensured) with differential pressure switch (signal to automation system with local mechanical inspection display) monitoring.
* For each type of pump (circulation, feeding, pressure pump) one hot stand by pump has to be considered.
* Pressure transducer measurement at each pump shall be provided.
* All pressure transducer measurements need to be analog type with 4-20 mA signal to automation system with local display.
* All hydraulic cylinders need to be equipped with 2 pressure transducer measurements for measuring A and B side of respective cylinder.  Analog type with 4-20 mA signal to automation system with local display.
* Any kind of servo / proportional valve need to be onboad electronic type (no external hardware card) and directly controlled by automation system with position feedback signal to automation system (preferred 4-20 mA).
* All lines feeding any kind of hydraulic drive (motor, cylinder, etc.) located close to high temperature area have to be equipped with differential pressure measurement (4-20 mA signal to automation system with local display) to detect hose or line breakage and respective line have to be equipped with shut off valve to ensure immediate stoppage of hydraulic fluid to respective hydraulic drive (motor, cylinder, etc.).
* Pneumatic equipment shall be specified for 10.5 bar maximum pressure. Actual pressure shall not exceed 6 bar (5-6 bar is the air pressure in the plant air pipelines). Contractor shall provide lockable shutoff supply valve, regulator and filter/lubricator for pneumatic devices. Contractor shall specify and supply, specify air-receiving tanks for large air volume using equipment or safety – critical equipment.
* Hydraulic piping connections on cylinders, power units and valves shall be 4-bolt SAE flanges.
* All hydraulic and pneumatic circuits shall be furnished with pad-lockable manual isolation valves and bleeders with test ports to provide and verify zero-energy state during maintenance.
* Cylinders shall be designed with an operating pressure of 100 bar and a Proof pressure of 200 bar. Cylinders shall be designed to withstand twice the operating pressure according to the relation of the cross sections. Cylinder tubing to be seamless grade 55 steel tubing, piston rod plated with minimum 0.038 mm C45 hard chromium. Guide Bushings to be RG7 Red Brass, or equivalent. Connections to be SAE O-ring Flanges.
* Hydraulic equipment shall be mill duty type. In the melting and casting area, the hydraulic fluid shall be a suitable water based Polyol Ester.
* System components and piping shall be designed for 200 bar max for cylinder systems, 500 bar for hydraulic motor drive systems.
* Hydraulic tubing, fittings and ports.
* All hydraulic tubing to be Metric ISO standard. No alternative is allowed. (Usage: Tubing which may be bent or formed with hand tools or automatic tubing bender. Used for connections between valves, cylinders, etc that are within a machine, panel, HPU. Typically heavy gauge stainless steel.)
* All hydraulic tube fittings must be approved by Customers Engineers. (Usage: Fittings used to connect SS tubing to other tubing or devices, these fittings rely on compression to form a seal between the tube and the fitting)
* All hydraulic valve & cylinder ports to be BSPP standard. Exceptions must be approved by Customers Engineers (Usage: Connection ports between pipe, tubing, or hoses and a valve, cylinder, or other hydraulic device)
* All hydraulic hose fittings to be Metric ISO 24°. Exceptions must be approved by Customer’s Engineers (Usage: Connection between tubing, pipe, or hydraulic device and a flexible hose).
* On valves stands, tables function block diagram has to be mounted by using stainless steel plate - engraved.
* At all components (pumps, valves, instruments etc.) stainless steel plate (engraved) has to be mounted displaying reference code on respective installed steel frames, table, stands etc.
* Electrical signal (LED or diode) at soleniod valve connectors or any other kind of electric powered devices indicating power or switching status.
  + 1. Pneumatic tubing, hoses, fittings and ports.
* All pneumatic tubing and hoses to be Metric ISO standard. No alternative is allowed. (Usage: Tubing, hoses which may be bent or formed with hand tools or automatic tubing bender. Used for connections between valves, cylinders, etc., that are within a machine, panel, HPU. Tubing typically lighter gauge stainless steel.)
* All pneumatic tube fittings must be approved by Customer’s Engineers. (Usage: Fittings used to connect SS tubing to other tubing or devices, these fittings rely on compression to form a seal between the tube and the fitting)
* All pneumatic valve & cylinder ports to be BSPP standard. Exceptions must be approved by Customer’s Engineers (Usage: Connection ports between pipe, tubing, or hoses and a valve, cylinder, or other pneumatic device.
* All pneumatic hose fittings to be approved by Customer’s Engineers (Usage: Connection between tubing, pipe, or pneumatic device and a flexible hose) Hydraulic directional control valves shall be 3-position valves; center position shall vent ports A & B to T with a pilot operated check valve. Pneumatic directional control valves shall be 3-position with blocked center. Loss of power will cause the valve to center in order to prevent movement when power is restored. Solenoid actuated valves shall have indicator lights and manual overrides.
  + 1. Piping
* Pipes should be sized to minimize pressure drops.
* Flow velocity shall be determined based upon an analysis between capital and operating costs. The connection of the equipment with the supply, production and waste lines should be as short as possible. If direction changes or branch offs are required, they shall be designed to allow optimal flow rates and minimize pressure drops. With limited space available optimization between routing and flow rates must be found.
* All piping shall be clearly arranged to facilitate inspection for damage/leakage. All piping shall be color-coded and labelled in compliance with ANSI 13.1.
* Pipe routing and location of valves, sensors etc. shall respect ergonomic ease for servicing and replacement.
* Hoses shall be resistant to ambient heat, commercial lubricants, hydraulic fluids and cleaning detergents. Metallic hoses shall be used in areas where molten aluminum spill hazard exists.
* Hoses shall be installed in such a way that they can neither be pinched nor worn through.
* All utilities serving the degasser shall have lockable shutoff valves upstream of all operating valves and/or components to provide “zero energy state” immediately downstream.
* All machine assemblies shall be pre-piped to the machine boundary with single point connections.
* Contractor drawings shall clearly show tie-in points, connection size and type for all connections to plant piping systems (i.e. utility connections). Drawings shall also indicate tie-in points for interconnecting piping between Contractor provided components.
  + 1. Walkways, Platforms and Ladders
* Platforms shall be installed in all locations where inspection and maintenance are required.
* Stairs shall be installed for all elevated areas that require access. Ship ladders are acceptable.
* All handrails shall be 1.2 meters high and have 100 mm high toe guards installed.
* All walkways, platforms and stairs shall be made using checkered plates, or grating as necessary for fire prevention.
  1. Electric and Instrumentation
     1. General

This chapter specifies the documentation of electrical and instrumentation systems that is necessary to meet the requirements of a new industrial facility.

The documentation level requirements for each part are set out in the scope of work.

The intention is to design modern equipment in accordance with the needs of the entire project, including electrical and instrumentation systems.

When selecting the size and type of electrical cabinets, transformers, motors, drives, etc., standardized types and ratings must be preferred to maximize interchangeability and minimize maintenance needs.

TOP (Take over point):  
- 400 V power supply for low voltage equipment – TOP is input terminal in MCC or, respective electric cabinet.  
- Contractor shall provide the preliminary SLD and automation configuration diagram with his offer document.

* + 1. Ambient conditions

The proposed instrumentation will be suitable for operation in the following ambient conditions:

* Outdoor temperature max. 40 °C

min. -30 °C

* Indoor temperature max. 50 °C

min. 10 °C

* level above sea to 1000 m

The Contractor acknowledges that the above information is a guide to the general design. However, the maximum temperatures to be considered will depend on the location of the equipment, which is the responsibility of the Contractor.

* MCC / distribution room 15-35 °C

Relative humidity 70 % (air-conditioned)

* Control room / PLC room 15-25 °C

Relative humidity 55 ± 5 % (air- conditioned)

* Cable tunnel / cable cellar Ventilated

Relative humidity 95 %

* + 1. Voltage and power supply conditions
* Voltage system

Medium voltage: nn kV (will be defined during engineering)

Low voltage: 0.4 kV TN-C 3+PEN, TN-C 3+PE+N

* Frequency 50 Hz
* Voltage fluctuations ± 10%
* Frequency fluctuations ± 0.5%
* Operation of air circuit breakers, AC contactor coils

auxiliary relays etc. 230 VAC, 1 phase, 50 Hz

* Digital input and output card,

Auxiliary relays, control voltage, solenoid / control (magnetic) valves

LED indication lights 24 V DC

* Analogue input and output card 4-20 mA (prefered) or 0 - 10 V
  + 1. Other conditions

The casting line shall be designed in accordance with the latest technological developments. It shall also be designed to allow easy interconnection with other systems. It must ensure that all parts of the process are equipped with all necessary safety features such as emergency stop buttons, limit switches, etc.

The motors and controls must conform with the main mechanical equipment and process control requirements. Drives requiring speed control, positioning and coordinated operation shall be equipped with AC motors powered by a variable speed drive system. In the case of AC motor control by a frequency converter, insulated bearings shall be used. All other drives not requiring speed control, such as pumps, blowers, etc., shall be equipped with constant speed AC motors and controlled from motor control centres. The control features shall be designed for easy interfacing with other control systems that are separately supplied by other contractors.

All LEDs must be the clustered LED type indicator lights.

Identification numbers shall be provided for all devices in the circuit breaker panels, control panel, motor control center, drive panel, control panel/column, etc., and all terminals on the various control devices shall be interlocked terminals with engraved numbers.

A non-magnetic gland shall be provided in the electrical cabinet for termination of single core power cables.

Power for all Level 1 and Level 2 automation equipment, process AC drives and all communication/electronic/microprocessor equipment and field devices (instruments, sensors, etc.) for whole Contractor and its Sub-Contractor scope (= it is not allowed to install several UPS as per Contractors scope split) shall be provided from an uninterruptible power supply (UPS) system with a minimum 30 minute battery backup provided by the Contractor.

The basic level automation system (Level 1) required for interlocking, sequencing, switching, safety, etc., shall be designed using programmable logic controllers (PLCs) and PCs as specified in the section for the Level 1 automation system.

The degree of protection by the enclosure for equipment located internally and externally shall be as follows:

* Electrical cabinet/MCC IP4X (indicative, according to the required standard)
* Control panel/pulpit IP3X (indicative, according to the required standard)
* Motors (internal) IP54 (indicative, according to the required standard)
* Motors (external and pump motor) IP55 (indicative, according to the required standard)
* Local push-button station IP65 (indicative, according to the required standard)
* Junction box etc. IP65 (indicative, according to the required standard)

The design of mechanical equipment shall take into account and provide features to facilitate the maintenance of electrical equipment including motors, brakes, circuit breakers, switches, junction boxes, etc.

The following must be ensured:

* Sufficient space around each machine
* Easy access (maintenance) to each machine

Layout of electrical equipment

* Location of Low voltage panels, MCC(s), frequency converters, PLC panels, UPS for steel shop shall be as per SELLER disposition of the equipment. Locations for the above need to be indicated in the layout.
* As mentioned earlier, one central control room for centralized operation is envisaged in the shop control room building.

During engineering Risk assessment study shall be elaborated according to requirements of norm ČSN EN ISO 12100. Study shall define requirements to ‘Safety Integrity Level’ (ČSN EN ISO 13849-1) and ‘Performance Levels’ (ČSN EN 62061).

Salient technical features of equipment and system

* SELLER in his design shall include the technical features of equipment and system as mentioned in the following section.
  + 1. Main technical features of the casting line and the system

In their proposal the Contractor must include the following technical features of the casting line and the system as they are listed below.

* Medium voltage electrical cabinets

1. Medium voltage electrical cabinets are within the scope of the Customer. Monitoring and remote control of this electrical cabinet to the indoor substation will be the responsibility of the Customer.
2. The Contractor will only be responsible for monitoring (status of disconnector, circuit breaker, consumption, etc.) of this electrical cabinet for local maintenance purposes. The Customer shall provide the Contractor with the bus interface. Monitoring will be designed using a simple schematic in a level 1 system accessible on the control panel (HMI)

* Medium/low voltage transformers (or, potentially, another transformer)

1. Transformers must be the dry-type tranformers
2. Transformers will be naturally ventilated
3. IP rating IP2X

* Low voltage electrical cabinet

The scope of engineering work under this tender will include basic data for the low voltage electrical cabinet, but detailed engineering is required for integration into the control system.

Below are the technical properties of the 400 V electrical cabinets (or, potentially, other low voltage cabinets):

1. The preferred type is the standard fixed cabinet type.
2. Each transformer MV/0,42kV or shall be connected to the independent power distribution switchboards.
3. For back up purpose will be incoming section of power distribution switchboards interlocked with another power distribution switchboard (with automatic coupling section). The switchboard shall be provided with automatic incoming feeder transfer in case of breakout of main feeder from transformer.
4. Each medium/low voltage transformer must be connected to independent electrical cabinets.
5. The short circuit current level is 50 kA for 1 second.
6. IP rating to be IP4X (indicative, must comply with the required standard). The design must take into account the external influence assessment.
7. Electrical cabinets shall include one spare section for future needs.
8. The input and output status of all power supplies must be monitored. It is necessary to provide a Remote IO connection to the PLC (using auxiliary contacts for the power supplies) and to indicate it on level 1 of the HMI.
9. A device measuring voltage, current, power consumption etc. is installed on the input part - connected via a bus system to the PLC and indicated on level 1 of the HMI.
10. All feeders will be equipped with a pull-out circuit breaker and motor charging and will also have remote control (PLC) capability from a Level 1 HMI.
11. Busbar material shall be made of copper.
12. The internal wiring of the electrical cabinet will be marked and all electrical cabinet equipment will be tagged.
13. The Contractor must bear in mind that it is not possible to connect several auxiliary contacts for power supplies, contactors and similar items in series to the respective PLC/Remote IO digital inputs. Each auxiliary contact must have a separate PLC/Remote IO digital input.
14. Number of outgoing feeders shall be as per requirement.
15. All feeders shall ensure safety and galvanic outage with possibilities lock in outage status for example by fuse disconnector or lock on circuit breaker. Equipment has to meet safety norm of Customer.

* AC motors and control units

1. The asynchronous motor with cage shall be designed, manufactured and tested according to IEC 60034.
2. A motor with an output of less than 350 kW must be supplied from a low-voltage grid and a motor with an output of 350 kW or more must be supplied from a medium-voltage grid. The motors shall be continuous duty, totally enclosed, fan cooled (TEFC), IP54 rated (IP55 for a pump motor), Class F insulated with temperature rise limited to Class B at 100% load.
3. If necessary, an electro-hydraulic brake with low-voltage three-phase motors and a limit switch to release the brake to be used, e.g. for tilting furnace drives, etc.
4. All accessories, such as digital tacho/pulse encoder, brakes, etc., as required, shall be supplied. Adequate motor ventilation with air-to-air heat exchanger shall be provided along with the required monitoring equipment. Motor cooling at low speed and rated power shall be provided. Motor cooling in the IC number shall be clearly indicated. The number of motor frame sizes shall be standardised and kept to a minimum as far as possible.
5. Built-in Pt100 temperature sensors are considered for all motors with an output of 20 kW and above that require speed control, and the signals shall be interfaced to the automation system for central parameter monitoring in addition to the standard alarm and shutdown functions implemented in the drive system.
6. Motor shall be energy efficient type. The motors must comply with EU Regulation 640/2009 as amended by EU Regulation 4/2014, EU Directive 2009/125/EC and EN (IEC) 60034 or later applicable standards. All motors shall comply with IE4 efficiency, but at least IE3 according to EN60034-30.
7. Anti-condensation heaters shall be provided for motors located outdoor.
8. Medium voltage motors and other motors where applicable shall be equipped with a bearing temperature and vibration monitoring system at the end of the drive and beyond, anti-condensation heaters, in addition to duplicate resistive temperature detectors (PTC) for each phase winding. This also applies to all fan IDs (primary/secondary) regardless of voltage level.
9. Also phase segregated power terminal box and separate control terminal box with brass cable glands for termination of anti-condensation heaters and winding RTDs.
10. For variable speed applications the motors must be inverter type.
11. Any additional motor mounted equipment required for the process must be available.

* Motor Control Centers (MCC)

The MCCs shall be equipped for the control of low voltage motors as well as for the supply and control of feeders for downstream equipment with all necessary arrangements for interfacing via Remote IO with PLCs and Level 1 controllers. Technical properties of the low voltage MCCs are specified below:

1. A standard fixed (preferred smart type with bus communication to PLC to ensure full diagnostic and data exchange) MCC type is preferred.
2. The short circuit current level is 50 kA for 1 second.
3. IP rating: IP4X (indicative, must comply with the required standard). The design must take into account the external influence assessment.
4. A contactor and electronic overload relay must be provided for motors rated 7.5 kW and above, and a motor protection circuit breaker (MPCB) must be provided for motors rated less than 7.5 kW. For motors rated 90 kW and above up to 350 kW, a YD (star-delta) starter shall be provided.
5. One section shall remain free as a spare for future needs.
6. All feeders shall provide safety and galvanic failure with the possibility of interlocking in a fault condition, for example by a fuse disconnector or circuit breaker interlock.
7. The status of all input and output feeders must be monitored. The necessary connection to the Remote IO with the PLC (auxiliary contacts for the power supplies) must be provided and indicated on level 1 - HMI.
8. A device measuring voltage, current, power consumption etc. shall be installed on the input part - connected via a bus system to the PLC and indicated on the HMI level 1.
9. All feeders will be equipped with a pull-out circuit breaker and motor charging and will also have remote control (PLC) capability from a Level 1 HMI.
10. Motor output feeders of 15 kW and above must have an ammeter.
11. Output feeders with directly controlled switching elements/contacts must be controlled and connected via the bus system to the PLC and indicated on the level 1 HMI.
12. Busbar material shall be made of copper.
13. The internal wiring of the electrical cabinet will be marked (tagged) and all electrical cabinet equipment will be tagged.
14. The Contractor must bear in mind that it is not possible to connect several auxiliary contacts for power supplies, contactors and similar items in series to the respective PLC/Remote IO digital inputs. Each auxiliary contact must have a separate PLC/Remote IO digital input.

* Variable speed drive

1. For a variable speed drive, the AC induction motor must be powered by an IGBT (insulated gate bipolar transistor) type inverter with a fully digital microprocessor based control system. Individual variable speed drives shall be provided for individual motors requiring speed and torque control.
2. The enclosure of the drive must have a minimum IP31 rating.
3. If necessary, the active front end must be mains regenerative (no braking resistance).
4. The VVVF drives shall generally be sensor less vector controlled and shall have provision for hardwired as well as bus interface with PLC of level-1 automation system.
5. Cast resin insulated converter transformer shall be provided for VVVF drive where is necessary.
6. VVVF will have necessary input and output filters or reactor for prevention against influence to the electric net.

* Control station

1. The main control console in the control room must accommodate HMI terminals. The control console to be equipped with all necessary control switches, buttons, signal lamps, joysticks, etc. As required for control of the entire line, it must be of the fully enclosed floor mounted type, dust and pest proof, with vertical sides and sloped tops. The top of the control console shall be stainless steel plate.
2. The controls and instruments to be located on the various control consoles shall be grouped for convenient operation and shall include those items necessary to meet the ultimately established control and operating philosophy.
3. Local control pulpits shall be provided for convenient operation and maintenance, in addition to remote control from the control room.
4. Wherever more than one control console is provided to control a common machine, the necessary control switches will be provided, along with indicator lamps for switching control from one console to another, with a confirmation function.
5. For all drives, a local control/pushbutton station (LPBS) shall be provided and shall be located in the vicinity of the relevant equipment. LPBSs for non-reversible drives that are controlled via a Level 1 automation system shall be equipped with 'Start', 'Stop' and 'Emergency Stop' buttons along with an indicator light showing 'Locally Selected', while LPBSs for reversible drives shall additionally be equipped with 'Forward/Open/Up' and Backward/Close/Down' buttons and a 'Start' button is not required. However, for drives not controlled by a Level 1 automation system, a "Local/Remote" switch shall be provided on the appropriate LPBS instead of the "Locally Selected" indicator. The 'Emergency Stop' buttons shall have a mushroom-shaped head and be of the 'press to lock and key to release' type.
6. The IP rating of the control console shall be IP4X and the local control pulpits IP65 (indicative, must comply with the required standard). The enclosure for the local control pulpits must be stainless steel. The top of the control console shall also be made of stainless steel. The design must take into account the external influence assessment.

* Junction box

The required number of local junction boxes shall be provided. The junction box rating will be IP65. The enclosure for the local junction box to be made of sheet steel. The design must take into account the external influence assessment.

* Uninterruptable power supply (UPS)

Power for all Level 1 and Level 2 automation equipment, process AC drives and all communication/electronic/microprocessor equipment and field devices (instruments, sensors, etc.) for whole Contractor and its Sub-Contractor scope (= it is not allowed to install several UPS as per Contractors scope split) shall be provided from an uninterruptible power supply (UPS) system with a minimum 30 minute battery backup provided by the Contractor.

* UPS shall be fed from 400 V switch board
* The UPS unit shall comprise but not be limited to the following,
  + - * + Incoming circuit breaker
        + Isolation transformer
        + UPS modules considering parallel redundant load sharing arrangement
        + Ni-cd battery for 30 min.
        + 230 V distribution for power distribution to various loads
* Technical parameters

|  |  |  |
| --- | --- | --- |
| Rating | **:** | To suit requirement and + 30 % spare capacity for future loads (to be supported with calculation) |
| Input voltage | **:** | 400 VAC ± 10 %, 3phase, TN-C 3+PEN, TN-C 3+PE+N |
| Output voltage | **:** | 230 VAC± 1 %, single phase |
| Output frequency | **:** | 50 Hz ± 0.1 % |

* Each UPS distribution circuit breaker need to be monitored (auxiliary contact as PLC input / Remote IO). SELLER to note that no serial connection of several auxiliary contacts for feeders, contactors and similar items to respective PLC / Remote IO digital inputs are to be considered. Each auxiliary contact needs to have separate PLC / Remote IO digital input.
* UPS unit shall be connected via bus communication for monitoring to respective PLC.
* Power and control cables and installation material

#### All electrical devices must be designed to withstand the environment in which they are to be used. Temperature is of particular concern, especially for those devices which are mounted above or near molten metal or near furnaces.

Cable sizes shall be designed and standardized during the design phase, taking into account the following properties:

1. Single or multi-core armoured cables with PVC insulation, dimensions 500, 400, 300, 240, 150 and 95 mm2.
2. Class 1.1 kV, single or multi-core, PVC insulated and PVC sheathed copper cables with dimensions ranging from 1.5 to 500 mm2 and to be standardised during the design phase.
3. Class 1.1 kV, multi-core, PVC insulated and PVC sheathed copper control cables with the following dimensions and core numbers:

Core number Dimensions, mm2

2, 4, 7, 10, 16, 24, 48 1.5 (for control, indication

PLC input/output)

1. When there are three or four cores in a cable, one core must be spare and when more than four cores are used, there must be 20 % of spare cores.
2. Special signal cables including shielded twisted pairs and shielded control cables required for signal transmission shall be provided. A fibre optic cable shall be provided for data transmission.
3. The hot zone (for example around furnace(s), launders, casting area) must have heat resistant power and control cables according to the ambient conditions at the workplace.
4. Different cable trays/ducts must be used for different voltage levels.
5. Mixing voltage levels on the cable is not allowed.
6. Any cables used for data transmission (regardless of the system) must be installed in isolation from other cable types.
7. All bus and network cables are to be measured and an inspection protocol is to be provided.
8. Exposed conduit shall be rigid zinc conduit.
9. Common equipment ground to be provided for all electrical components via conduit or separate conductor.
10. Low level signal instrumentation wiring shall be Teflon insulated (150 °C to 200°C).
11. Thermocouple extension wire shall be type PLTC, PVC / PVC with overall shield, type KX.
12. Thermocouple extension wire for high temperature areas shall be type FEP / TEP insulated cable.
13. Fiber Optics Cable:  
    - Multimode fiber optic cable (50/125) for general short haul application internal to any single infrastructure – cable color: Orange.  
    - Single-mode fiber optic cable (9/125) for long haul fiber optic runs, typically by carriers that have implementations over several miles providing connectivity between two facilities – cable color: Yellow.
14. All communication or networking cable, if utilized near or around high temperatures shall be plenum rated.
15. If Contractor is responsible for equipment installation, then the Contractor shall be responsible for purchasing and installing all equipment grounds and ensuring that all equipment is properly grounded. Contractor shall be responsible for tying in equipment grounds to the existing plant ground grid. Connection to grid shall be via Exothermic Weld using 4/0 copper cable (or equivalent), green & yellow colored jacket required were exposed.
16. Identification:
    * + All cables shall be identified by cable tagging at both ends, identifying the cable and the individual wires by color and wire number. The tagging shall indicate the purpose, source and destination of the cable.
      + Each wire shall be identified by wire number on both ends. Wire labels shall be pre-labeled tubular type.
      + Devices located in electrical panels, terminal boxes, or mounted on stands, shall be labeled with a device tag identifying the device. The tag shall be permanently attached to the component. If the component is mounted on a mounting plate, the plate shall also include the identity of the device.

* Grounding

1. Complete earthing system design shall be provided for the total earth resistance value for the new buildings must be within respective norm (Information for BD purpose)
2. The dimensions of the grounding conductors and their installation must be in accordance with the applicable standards.
3. A separate electronic grounding system shall be provided for the various units covered by this specification for AC drives, PLC, Level 1 and Level 2 automation system, instrumentation system etc. The total electronic grounding resistance values per device shall not exceed 0.5 to 1 Ohm
4. All non-current-carrying metal parts of various electrical equipment as well as cable fittings, trays etc. must be properly grounded.

* Protection against lightning (section for BD purpose)

Lightning protection must be provided wherever necessary. The separate grounding system for lightning protection shall be complete with grounding electrodes, grounding conductors and accessories as required by the standard.

* Illumination system (section for BD purpose)

Illumination system shall be in SELLER scope for all building which in scope of turnkey. It means especially:  
- Indoor lighting  
- Outdoor lighting   
- Emergency lighting

Number of lamp and intensity of lighting shall be according norm for concrete space. LED type of lamp will be preferably used.

* Maintenance socket distribution (section for BD purpose)

For new buildings and equipment will be installed socket box 400 VAC with one socket 63 A, one socked 32 A and four socked 16 A.

Number of sockets will such that it can be without problem make maintenance and repair of all installed equipment, piping, building, infrastructure etc.

* Fire signalization (section for BD purpose)

To the new building with dispatch center will be installed new central exchange. Number and location of fire signalization sensors will be implemented according norm and fire brigade.

* Telecommunication and data distribution (section for BD purpose)

For new buildings and equipment will be installed new IP telecommunications and data distribution systems, especially to the pulpits, dispatch centers, maintenance rooms, operation rooms, electrics rooms, social building, and offices.

* Intercommunication System (section for BD purpose)

An intercommunication system will be provided for the whole plant with a sufficient number of communication units in the production areas, electric rooms, hydraulic stations, civil rooms/buildings, at each gate, at local control boxes etc.

* Painting of Equipment

For all electrical, instrumentation and automation equipment necessary steps shall be taken in treating all enclosures, plates, frames, fixtures etc. to prevent any rusting, corrosion or any other physical damage to the equipment or the components thereof.

Shade agreed during finalization of tender for finish coat to be applied for equipment installed indoor. All equipment to be installed in the control room shall generally have paint shade RAL 7032.

* Electrical cabinet base requirements

1. Self-Standing floor mounted type, Front/Rear access door (  
   rear door if required).
2. Protections: IP 20 without doors by standing in separate PLC room / IP54 or better as standalone by standing in production hall or other non-electrical rooms.
3. Dimensions
4. Height: 2000 mm
5. Width: 800 mm (minimuim, as per final design)
6. Depth: 600 mm
7. Socket: 200 mm (no socket required in rooms with raised floor)
8. Cooling units if necessary
9. Color: RAL7032
10. Cable entry: Bottom
11. Cabinet lighting
12. Power outlet for computer etc.
13. Power supply for low-voltage main distribution board
14. 400 VAC 3 Phase UPS power supply.
15. Separate 230 VAC for socket, lightning without UPS power supply.
16. Over voltage protection

* Electrical cabinet door locks

All supplied electrical cabinets, control pulpits, junction boxes etc. shall have the same door lock design.

Door lock type for "2bit 5 mm key" - Select which one

Obsah obrázku skica, diagram, kresba, Technický výkres

Popis byl vytvořen automaticky Obsah obrázku kovové předměty, Železářské zboží pro domácnosti, klíč

Popis byl vytvořen automaticky

Door lock type for "8 mm triangle key" - Select which one

* Type of electric devices (frequency converter, MCC, PLC / Remote IO, circuit breakers, etc.) to be standardized – including sub-contractor packages / package units!
* Drawings to be handed over in editable form (DWG for layout drawings, EPLAN for circuit diagram drawings) and as PDF.
* Emergency power back up

As mentioned in one of the earlier emergency power back up shall be provided for ‘black out’ type of situation. Contractor is requested to include this into respective Contractor’s low voltage distribution and automatic switching elements.

* 1. Automation Instrumentation Equipment
* For general, standards, battery limit, scope of work, installation, testing and commissioning, design basis, voltage and power supply conditions, layout of equipment, painting shall follow the guidelines mentioned in the electrical part.
  + 1. Equipment specification
* The design of the instrumentation system must be based on the latest technology and spare parts and service support must be available. Contractor provided instrumentation shall be calibrated prior to shipment to meet contractor’s published accuracy.
* Each motion device shall be equipped with two digital absolute encoders with data communication. The system shall have automatic calibration and automatic position-based correction.
* All transmitter output signals shall be isolated 4-20 mA DC. Transmitters shall be suitable for the environment in which they are to be located and shall meet all applicable codes.
* Flow measurement elements shall be differential pressure devices (orifice plate, pilot tube, etc.) or integrated mass flow control. A vortex-shedding meter may be used subject to purchaser approval.
* Gas and Electric energy metering shall be accurate to 0.5 % unless otherwise specified in the specific equipment specification.
* For any fan, continuous vibration measurement at minimum four points using acceleration type sensors with locally mounted transmitters for 4-20 mA DC signal outputs for PLC based system.
* Signals having different voltage levels shall not be mixed-up in same cable or same tray.
* Fan speed measurement shall use encoders.
* Noncontact type proximity switches shall be considered to suit the process requirement.
* Control valves shall generally be of the electric type, but for the gas handling area the control valve shall be of the pneumatic type with smart positioner.
* The body of the control and shut-off valves shall be stainless steel.
* An electro-pneumatic actuator shall be used to open and close the valves. Open and close limit switches shall be included to monitor valve position.
* Field mounted gauges shall be phenolic or stainless steel construction and have 100 mm diameter dial. Remote seal gauges shall include stainless steel diaphragm and suitable fill fluid for the application. Fluorocarbons or flammable fill fluids will not be permitted.
* All impulse lines, instrument air lines and fittings and accessories shall be of stainless steel. Impulse lines/instrument air lines shall have 2 mm thickness
* All control valves (pneumatic, hydraulic, …) need to send back actual position for movement / position monitoring.
* Local gauges like those for temperature, pressure, differential pressure etc. shall be provided.
* All local temperature gauges shall be bi-metallic type.
* All transmitters must have an integrated type divider.
* The leakage class of all safety shut-off valves shall be Class VI.
* All control and shut-off valves shall have a handwheel for emergency operation.
* All impulse lines and fittings and accessories shall be of stainless steel. Impulse lines/instrument air lines shall have 2 mm thickness.
* Hydraulic tank level interlocks shall have safety switches as per norm needed and analog level / temperature measurement (4-20 mA) for monitoring and respective alarm level adjustment via L1-HMI.
* Hydraulic pressure measurement shall be analogue (4-20 mA) with local display.
* Hydraulic filter (differential pressure) monitoring shall be analogue (4-20 mA) with local display.
* Lubrication tanks shall be equipped with minimum following level switches and option shall be provided for analog type (4-20 mA) level monitoring:  
  - Max  
  - Min  
  - Min min (shall be mandatorily safety switch)
* Lubrication line pressure switches and pressure switches for other systems shall be analogue (4-20 mA) with local display.
* Water or any kind of media (compressed air etc.) filter (differential pressure) monitoring shall be analogue (4-20 mA) with local display.
* Control, proportional, servo valves (for any kind of media and) to have 4-20 mA position feedback signal
* Control, proportional, servo valves (for any kind of media and) to have 4-20 mA position command signal – Except special type valve with different command signal (bus communication).
* Mounting hardware for measurement and control devices, actuators etc. must be designed to minimize vibration. Necessary modifications to mounting hardware due to vibration are at the expense of the Contractor.
  1. Control System and Automation
     1. General

This chapter specifies the documentation of control and automation systems that is necessary to meet the requirements of a new industrial facility.

The documentation level requirements for each part are set out in the scope of work.

The intention is to design modern equipment in accordance with the needs of the entire project, including control and automation systems.

The control system used to manage the individual processes will be designed to ensure that all processes operate and communicate reliably. The system will control and monitor all processes and measured variables. The status of the process units and the measured quantities will be displayed on the control console and on the PC monitor in the control room. Inputs and permissions to the individual program levels will be accessible according to the rights defined by the Customer.

The casting line will be ready for communication with the melting furnace and other processes upstream of the actual casting process.

The system will be equipped with acoustic and light fault signalling. The system will store all technical-technological data and this data can be recalled, printed and further processed at any time. The control system will allow:

* ongoing monitoring of blocking conditions
* monitoring and control of the whole process
* monitoring and automatic testing of the control automaton, including sensors and actuators
* signalling of deviation of operating parameters from the set values
* back check of set limits
* continuous monitoring of instantaneous power consumption
* controlled process visualization
* the control system will allow and be equipped for remote connection
* the casting line will be ready for connection to the data collection system

The delivery includes the supply of cables and cable routes to individual machine units.

* + 1. Level 1 automation system

The Level 1 automation system shall monitor and control all significant variables in accordance with process requirements, providing all operational requirements and necessary sequencing, interlocking and safety functions including alarms for abnormal conditions. The Level 1 automation system shall be designed as an integrated system for drives, controllers and automation of the entire line.

* The casting line and software specifications for the Level 1 automation system include, but are not limited to, the following:

1. All PLC systems shall be of the same make and the same series.
2. Each PLC must have a power supply module and a CPU communication module.
3. Safety circuits shall be designed using the SAFETY PLC.
4. Each bus system must be designed as "circular" (circular closed topology). A bus system within a single electrical box does not need to have a closed topology.
5. Active online bus diagnostics must be maintained. Each station/device connected to the relevant bus system must be visible with the maximum possible online diagnostic information (status/fault message or warning code).
6. At frequency converters full bus communication data (commands, set points, actual values, status/fault or warning code) has to be visible on HMI.
7. Remote input/output units connecting inputs/outputs in different areas of the casting line.
8. Input/output modules must have active online diagnostics.
9. For signals from field devices (sensors, instruments etc.) online hardware diagnostic (wire breakage detection, etc.) has to be installed (usage of respektive DI/DO/AI/AO card).
10. Data bus connecting the PLC and HMI units and remote I/O units to the PLC.
11. Two (2) Nos. portable laptop type programming terminal for the PLCs mentioned above, with all required system software packages and accessories (cables etc.).
12. Monitor for servers, HMI operator stations, etc. must have a 27" widescreen (state-of-the-art); minimum screen resolution of 1920 x 1200.
13. The Web Remote HMI client system will be accessible from the "Customer's" network. The Customer will hand over the user access list to the Contractor during the project processing.
14. Production views, diagnostic views, maintenance views, trend views and historical data must be accessible on Web Remote clients.
15. The operating system for PC-based HMI units must be Windows-based. The system shall be equipped with standard software packages such as multi-program executive routines, protocol formats, compilers, assemblers, editors and utility packages. The required application software licences shall be included.
16. Additional software, e.g. antivirus, communication, MS office etc., necessary for the implementation of the functions and completeness of the system must be included.
17. The HMI screen for operators must be in Czech and English.
18. The programming language must be in English.
19. Separate grounding of electronic devices and grounding of the electrical cabinet.
20. Online diagnostics of field devices (measurement, valves etc.), where is applicable (bus communication etc.).
21. The Ethernet switch must be of the manageable type and the required number of optical ports must be taken into account. Type to be agreed with Customer during basic engineering.
22. Each network component must have a fixed IP address (without DHCP).
23. Establishment of links / communications including supply of communication cable and required integration into L1 automation system as well as necessary hardware and software amongst the following systems:

- BUYER’s automation system (where is required) and Incoming material handling system (ferro-alloy and lime transportation system). Control of the belt system from the respective dumping station(s) up to bunkers shall be full within automation system. Respective bus communication / signal interface to dumping station(s) to be considered.  
- BUYER’s Substation Automation system.

1. There must be 3 independent Ethernet levels.

* PLC network (communication between PLC and Level 1 + 2 "warm backup" servers)
* Level 1 network (communication between level 1 server and level 1 clients = workstations)
* Level 2 network (communication between level 2 server and level 2 clients = workstations)

1. All computers, servers, client stations must be equipped with the maximum state-of-the-art RAM and hard drives available at the time of project implementation/delivery.
2. All monitors must be of the same type/manufacturer to ensure interchangeability between different clients and different levels (level 1 or 2).
3. All software licenses shall have unlimited validity. In special cases where unlimited validity is not possible, the maximum validity by mutual agreement will be taken into account.
4. Sub contractor packages need to be connected via respektive bus communication system (= stand alone system with just status OK / Not OK communication is allowed). Sub contractor package can have its own HMI system, but full integration to overall plant HMI system has to be considered = full communication and integration of status / alarm / values to overall PLC / HMI to ensure central monitoring.
5. Level 1 automation shall have features to enable and predict proactive preventive maintenance requirements. Such as the view of operating hours of engines, pumps, fatigue cycles (e.g. for cylinder movement, valve operation, ...) etc., coupled with warning messages (e.g. for preventive inspection, seal replacement, lubrication, oil check, ...).
6. The Contractor must bear in mind that it is unacceptable to connect several auxiliary contacts for power supplies, contactors and similar items in series to the respective PLC/Remote IO digital inputs. Each auxiliary contact must have a separate PLC/Remote IO digital input.
7. There must be full access to the source code. The know-how protection area must be specified in detail in the tender.
8. Ethernet switches must be supplied by a reputable manufacturer (e.g. CISCO, HP, etc.).
9. Ethernet network panels for Servers / client stations with related required equipment like network switch / FO patch panels / other required network accessories / UPS circuit breakers with front and back side doors to be placed in respective rooms. Connection from network panels to respective working place / desk shall be done with respective cable connection (for example KVM or similar). Inside of each network panel has to be space reserve for minimum 2 additional computers for Customer purpose. At control room one complete empty network panel shall be available with respective power sockets and network accessories.
10. Working place / desk shall be “cable-free”.
11. Each individual control desk shall be equipped with CCTV, Intercom, telephone.
12. Keyboard in Czech and English layout for all computers (level 1 / 2 and maintenance).
13. IP address and password/user access definition to be fixed in cooperation with Customers IT-department during basic engineering stage.

* The Level 1 automation system shall provide both process control and drive control/interlock functions for the complete casting line (from furnace TOP up to packing equipment), including operation and status monitoring of all drives, pumps, fans, valves, etc.
* PLC programming: Instruction List (IL) programming shall be avoided. Ladder programming is the preferred language, but programming may be done in CFC (Continuous Function Chart) or in FBD (Function Block Diagram). If Instruction List programming is necessary due to system requirements, then it shall be commented in detail (each line). The IL code shall be separated into networks according to functionality and the networks shall be commented in detail.
* The configuration of the automation system must be designed to achieve the following operating modes:

1. Computer control mode
2. Automatic control mode
3. Remote-manual mode
4. Local mode

* Failure/unavailability of the Level 2 system shall not impede the operation of the Level 1 system or affect normal production.
* For critical parameters, an audio-visual message with "CONFIRMATION" and "RESET" function should be considered.
* Various alarm levels on Level 1 - HMI

1. Critical (= process stopping alarm)
2. Alarm (= immediate operator's intervention required)
3. Warning (= advance warning for an impending alarm situation)
4. Event, information (= any kind of motion monitoring, process run/stop status, any kind of operator intervention from local panel or remote screen or level 1 HMI screen).

Everything must be recorded in the level 1 historical archive - HMI.

* A Level 1 HMI system shall provide the following functions and features:

1. Casting line operation (from furnace TOP up to packing line) and monitoring.
2. List up of all preconditions/interlocks for any kind of control (automatic, semi-automatic sequence etc.) or operation etc. to ensure easy and fast (without necessary checking of PLC program) respective condition.
3. Recipe management (read only by operation team, write/read by technology engineers).
4. System configuration and PLC programming.
5. Dynamic interactive graphic displays group displays loop (PI) displays.
6. PI drawing of all related medias (water, compressed air, argon, hydraulic, etc.) as per project scope with all PLC connected devices.
7. Real-time trends and historical trends.
8. Process alarm and event monitoring.
9. Diagnostic alarms and event monitoring.
10. Real-time alarms / events and historical alarm archive.
11. Ability to filter alarms by device / alarm level / area.
12. Data logging and online configurable report generation.
13. Multilevel password.
14. Real-time server database.
15. Possibility of remote Internet access for troubleshooting, software upgrade, data analysis.

* Diagnostic screens for level 1 maintenance diagnostics - The HMI must display, among other things:

1. Frequency converter / MCC (status/control expression/required values/actual values according to bus communication with online mode).
2. Safety logic (E-Stop, E-Limit switches etc. - blocking a particular function/process etc.).
3. Hardware configuration with complete network diagnostics (Ethernet/any installed bus system).
4. Active online bus diagnostics must be maintained. Each station/device connected to the relevant bus system must be visible with the maximum possible online diagnostic information (status/fault message or warning code). Respective alarming information to be available as alarm message in alarm system / archive.
5. IOs (Digital / Analogue / Counters / etc. modules) arranged as per PLC / remote IO configuration (arranged as per PLC Hardware configuration; status of respective DI / DO (0 or 1) or AI / AO (analogue rough value) or Counter module (counter value) to be available on respective IO point.
6. Analog measurement with alarm level setting (HH-very high, H-high, L-low, LL-very low), gross value display, simulation option (for testing software functions), alarm enable function, different colors for different alarm levels.
7. Alarm level setting.
8. All feeders to the control cabinets are monitored (analogue voltage value), all 24 VDC power supplies are monitored (analogue voltage value).
9. Operating hour counters for motors, pumps etc. (with counter reset function).
10. Preventive maintenance information system (equipment status, preventive inspection information, ...).
11. Full data model scope for realizing full access of SCADA system for process control, process and system diagnosis, parameter settings, regulator / quality analysis.

* Various password levels for:

1. Administrator
2. Maintenance
3. Process Engineer
4. Operator

* All metering and control of utilities, gases and energy systems must be implemented in the PLC system of the respective area.
* Large displays (if required) for displaying temperature etc. shall be seven-segment LED type, 100 mm in size for each area, with suitable IP rating (IP54).
* All digital displays on the control panels must be suitably connected to the PLC via a bus connection.
* Automation system acceptance criteria:

|  |  |  |
| --- | --- | --- |
| a) | Level 1 automation system availability | ≥ 99.9 % |
| b) | HMI screen refresh time | ≤ 1 s |
| c) | I/O scanning time, data update time | ≤ 20 ms for analogue signals  ≤ 20 ms for digital signals  *Data requiring higher scanning speeds are processed as a priority.* |
| d) | Network bandwidth usage (average 5 minutes)  *Measured continuously for 8 hours* | < 10 % |
| e) | Available free memory capacity  (for system, server and PC, DCS/PLC controller) | ≥ 50 % (after commissioning) |
| f) | Spare I/O capacity of each type at each location, spare base bus modules | ≥ 20 % (after commissioning) |
| g) | CPU load (average) | ≤ 50 % (after commissioning) |
| h) | CPU cycle time | Max. up to 50 ms for a normal cycle  Average 30 ms for a normal cycle |
| i) | Data backup | i. Historical data shall be available at the HMI operator station for at least 180 working days  ii. Availability of historical data for a minimum of 2 years on an external storage device |
| j) | Maximum response time for full screen update (background and foreground) | ≤ 2 s. (the 2 s refer to the time from the function request to the end of the display) |
| k) | Ethernet switch | Minimum of 40 % free (unused) ports per Ethernet switch (after commissioning) |
| l. | L1-HMI tag licenses | Minimum 50 % free available tag license (after commissioning). |
| m. | L1-HMI historical data base tag licenses | Minimum 50 % free available tag license (after commissioning). |
| n. | IBA for fast data recording with | £ 5 ms scanning rate |

* + 1. Level 2 automation system

The complete Level 2 automation system is the responsibility of the Customer. The Customer will hand over the system parameters - SW/HW configuration to the Contractor during the project.

The Contractor must equip the level 1 control system with an OPC interface to enable communication with the OPC server and the "Customer's" MES system.

The standard is the OPC UA variant, which must be used by the Contractor.

* + 1. Others
* Requirement for the network address range

Before implementing the industrial systems, it is necessary to compile and approve the draft network address range and its individual features which will be used by the Contractor for communication with the control system, MES, ERP and other communication layers. The approval of the draft network address range must be made by the Customer before the implementation of the industrial systems.

* Requirement for the network isolation

To ensure safe and continuous operation, it is necessary to strictly isolate parts of the production network from the administrative network and from other networks of individual processes. This isolation is aimed at restricting the risk of attack or malfunction propagation to one individual part of the network while keeping the other parts safe and maintaining the continuity of the operation.

In the event that the production network needs to be interconnected with other surrounding networks, the individual destinations, including the IPv4 source, IPv4 target and ports, must be clearly defined in accordance with the safety standards and the Customer’s requirements.

The network interconnection with other networks must be approved by the Customer and secured so as not to endanger the production network safety.

* Remote access

For the purpose of remote administration and service interventions the remote connection is subject to the prior approval and discretion of the Customer via the pre-arranged HW and SW features.

If the Contractor uses his own HW devices for remote connection, the Customer’s approval must be sought. The final technical design of this access must be properly documented, including the identification of the network connection point.

The Contractor is required to arrange for the following:

1. Update and maximum possible securing of all the devices within the Customer’s network that are used for remote access.
2. Default passwords preset by the device manufacturers must not be used. Passwords must have at least 12 characters.
3. Adherence to the current safety standards, including regular update of the operation system, functional and updated antivirus software and/or use of two-factor authentication.
4. Ensuring that the users connected to the Customer’s network have no administrative rights in their local computers.
5. Every use of the remote access must be properly documented and must comply with the pre-arranged conditions and safety requirements.

* OT (Operational technology) documentation

Detailed documentation for the OT area will be developed during the project implementation. This documentation should include:

1. Control system communication diagrams
2. Allocated addresses of features
3. Methods of communication among individual features
4. Feature configuration back up method, including a description of their creation and restoring
5. Inventory of HW/SW computer equipment, such as servers and stations
6. Authorisation information for each purpose of the system

* Change management

Change management must be maintained during implementation and operation. Any change in the configuration or topology of the system must be recorded at least to the extent of:

1. The person who made the change
2. Time of the change
3. Extent of the change
4. Reason for the change
5. Responsible person

* Support and service

The level of support and service, including response time and availability of technical support, must be specified for each feature. It shall be determined how system updates and repairs will be provided. It should be clear in advance how long the company wants to support the systems and to what extent = taking into account costs and consequences.

* Monitoring a logging

If the Contractor does not implement his own monitoring and logging system, it is necessary to ensure that all the active elements are monitored at least by ICMP to secure the elementary availability from a particular address within the OT network supplied by the Customer. The Contractor should make available the diagnostics information through the SNMP protocol if present on the particular device, feature or system.

If the system cannot arrange for logging itself, it is necessary that the systems where authentication/verification of users take place are able to send the SYSLOG messages to the address designated by the operator, with the following information:

1. Person performing the action.
2. Time of the action.
3. System where the action takes place.
4. Description of the change or event.

* Disaster recovery a continuity plan

As part of the implementation, plans will be developed to restore the operation of the given device in the event of an attack/damage to the system. This plan should include the following:

1. Definition of the individual recovery steps, including:
2. Identification of critical processes and systems for recovery
3. Procedures for data and application recovery
4. Procedures for hardware and software feature recovery
5. Plans for communication with the internal and external stakeholders during the recovery
6. Matrix of responsibilities, including:
7. Identification of persons responsible for individual recovery steps.
8. Clearly defined roles and responsibilities within the disaster recovery

The Contractor is required to ensure that the disaster recovery plan complies with the latest procedures and best practices in the field of disaster planning and recovery.

* Requirement for endpoint and server security

As part of the protection against the introduction of malicious code, security of end stations and servers must be secured by the following means:

1. Periodic update of the system, at least in the area of critical vulnerabilities
2. Physical security of active features and network distribution
3. Operation of basic antivirus protection
4. UAC activation
5. Not using administrator accounts for regular user operation.
6. Adherence to generally applicable rules for the security of operation systems and accounts with a view to Mitre ATT&CK, SIEM Security Configuration Assessment.
7. Disabled use of USB flash disks, cameras and other portable media.

All essential control and operation systems for the operation of the production facility / set shall have an available backup in accordance with 3-2-1 Rule, which means a backup on at least three different media, with at least two locations and one backup outside the operation site. This conception must be designed and implemented in cooperation with the Customer.

The Contractor should ensure that all the safety measures are implemented and observed in accordance with the latest safety standards and the Customer’s requirements.

* Disaster recovery plan

As part of the implementation, plans will be developed to restore the operation of the given process in the event of an attack/damage to the system. This should include the definition of the individual recovery steps, the matrix of responsibilities and their contacts, the location of backups, the recovery process (method and procedure) of the system.

* 1. Standardization

Components of all the devices must be designed, assembled and tested in accordance with the applicable Czech and EU standards, as appropriate, to reflect all the specific aspects in the environment of the Czech Republic.

All the items of the equipment must comply with the regulations and provisions of the relevant statutory bodies of the Czech government as long as applicable. If required by the regulations, the Contractor must obtain the necessary permits from the statutory bodies and other relevant authorities.

All products delivered from the non-EU countries must be furnished with the CE certificate (Conformité Européenne) / Conformance to European Norms).

Electrical equipment must also correspond to the latest Czech electro-technical regulations in terms of safety, grounding and other basic provisions set out for the installation and operation of electrical devices and facilities.

1. Scope of work

The Contractor’s activities include: design, engineering, delivery and supervision over the installation, testing, commissioning within the limits and tolerances defined herein. The scope of the Contractor’s work must generally comply with the following:

* 1. Structures – mechanical, electrical, instrumentation and automation
* Engineering includes designing the devices, technological structures, electrical installation, instrumentation and automation, water supply system, utility lines, hydraulic, lubrication and pneumatic systems, auxiliary and ancillary equipment. Drawings and documents must include the general arrangement, assembly, arrangement drawings, pipeline arrangement drawings with supporting details, technological diagrams, pipeline and instrumentation diagrams, one-line power-management diagram, block diagrams, list of motors with calculated power, management philosophy, functional description, test certificates, technical and installation drawings etc. Designs of all the devices/systems/items, as mentioned in this specification and set out for proper functioning/operation of the system.
* The Contractor shall be responsible for supplying the necessary data relating to the scope of work which will be used by the Customer as a background material for acquiring all statutory permits such as the zoning plan, building permit etc., on request by the Customer by an agreed date.
* Providing the basic data / technical data for all the units/items not stated in this document however necessary for the completeness of the system is the basic responsibility of the Contractor.
* In the course of designing the machinery within the competence of the Contractor, it is necessary to take account of the interface with the devices of other Contractors (such as furnace systems, power supply etc.) which are not within the scope of this specification.
* Designing the pipeline/lines, fittings, valves and other accessories for the utility lines and water supply system within the faucets, including the pipe supports.
  1. Designing – constructional and structural
* Load data for all the machines and accessories designed by the Contractor for the necessary construction project of the Customer. This includes the data concerning the load of the necessary foundations, supports, structures, buildings, rooms, local stations which are required by the Contractor’s machines/system.
* Format and parts of the load data must be agreed on between the Customer and the Contractor at the designing stage, based on the applicable European regulations and standards.
* Structural design of the entire line/system supplied by the winning Contractor, as stated in various parts of this specification. This includes the structural design, necessary supports and anchors for the line/system as required by the line/system of the Contractor.
  1. Delivery

The scope of the delivery includes: delivery of the entire line, technological structures, electrical installation, instrumentation and automation, water supply system, utility lines, hydraulic, lubrication and pneumatic systems, auxiliary and ancillary equipment within the premises of the Contractor.

* 1. Spare parts
* Contractor to submit a list of Preliminary Recommended Spare Parts based on historical Mean Time Between Failures (MTBF) data along with ABC ranking and criticality ranking. The quote proposal shall include:  
  - List of individual Operational Spare Parts (Normal Wear items) for two years of operation with most favorable pricing, quantity and standard delivery time;  
  - List of Capital Spare Parts (Longer durability items) with most favorable pricing, quantity and standard delivery time.
* If – during the commissioning – the Contractor uses the spare parts delivered under the delivery contract, the Contractor will be obliged to replenish these spare parts / to deliver them to the Customer free of charge.
* The Contractor will provide technical specification of the spare parts for their purchase in the future. Where applicable, detailed and production drawings must be prepared so that the Customer may produce/order from several sources/markets as needed.
* The Contractor will clearly specify the list of spare parts where detailed technical drawings / production drawings cannot be shared. The main idea is to be informed beforehand about the spare parts where the Customer is “dependent on” the Contractor.
  1. Supervision over installation, testing and commissioning
* The Contractor’s area of competence includes: supervision and necessary technical assistance during installation, testing, commissioning of the line and putting into operation, including performance tests of all the devices, machines and equipment, i.e. cables, pipes etc., which the Contractor has delivered, as well as those acquired/produced by any other parties based on the Contractor’s drawings and specifications.
* The Contractor’s area of competence includes but is not limited to:
* Supervision over the assembly staff, assistance and instructions given to the same for proper interpretation and use of project specifications, drawings, specific technical documents for the installation company within the competences of the Contractor.
* Preparation of project specifications, procedures and supervision of the performance of dimensional checks, adjustment checks, welding procedures, non-destructive tests, pressure tests, leakage tests, corrosion-proof treatment etc.
* Planning, supervision and technical assistance for cold and hot tests, commissioning and testing of guaranteed power parameters.
* Within its bid, the Contractor is obliged to mention the following information concerning the equipment delivered.
* Size of roofed area necessary for storage (in m2)
* Size of free area necessary for storage (in m2)
* Size of free area necessary for installation/production, outside the area intended for the machinery itself (in m2).
  1. Work progress report

The Contractor is responsible for preparation of weekly and monthly work progress reports during the engineering activity.

* 1. Drawings and documents – General
* The Contractor is responsible for providing and submitting the drawings and documents, including BOM’s and technical catalogues, standard operation and maintenance procedures, calculations of productivity and dimensioning.
* The Contractor is responsible for providing a detailed time schedule for the engineering stage, indicating the deadlines for drawings and documents to be submitted.
* Delivery of detailed technical drawings/documents for spare parts and wear parts is included in the scope of the Contractor’s delivery.
* 3D model documents must be submitted for the line, depicting the as-built status in which it was handed over to the Customer. In its bid, the Contractor should state which kind of 3D software is planned to be used for this project. This information is important for the Contracting Authority so that it is able to obtain compatible software which it will use for loading the 3D models submitted by the Contractor.
* Isometric drawings of pipelines, with indicated dimensions, must be submitted.
* The Contractor’s scope of activities must include preparation and submission of drawings of the line depicting the as-built status in which it was handed over to the Contracting Authority.
* Contractor to submit recommended spares list based on mean time between failure information from Contractor’s database.
* All spare parts to be quoted individually at system design prices, stating delivery time and quantity in use.
* Spares will be ordered separately at Customer’s discretion, after receipt of complete recommended spare parts list. Recommended spare parts lists, with prices, shall be submitted no later than 6 weeks after the completion of engineering. All parts shall be identified by original manufacturer’s part number and full description.
* Contractor shall be responsible for providing and staging all spare parts required for system start-up and commissioning. These parts are to be provided at no expense to Customer.
  1. Specification of public procurement for installation work

The Contractor’s scope of activities includes preparation of tender documentation concerning the installation of the line as designed by the Contractor.

The specification applies to all mechanical, electrical, instrumentation and automation equipment. The specification must reasonably describe the use of special tools and instruments, preventive measures, binding and fixing equipment for transfer and positioning of the line sub-assemblies.

* 1. Governing language
* All drawings and documents must be submitted in the Czech and English language.
* All HMI’s must be submitted in the Czech and English language.
* During engineering, the Contractor must have at least one member of the team who is able to speak and write in English or Czech.
  1. Others

The Contractor’s activities include provision of training for various operation and maintenance works.

Design of special tools and instruments that are necessary for effective operation and maintenance of the line/system projected by the Contractor falls in the competence of the Contractor.

1. Specific provisions
   1. Assembly and testing at the Contractor’s site

The Customer will be authorized to check the quality and quantity of mechanical and electrical parts of the specified line at the Contractor’s site or at the sites of the latter’s subcontractors.

Prior to sending the line and machines to the Customer’s site, they must be completely assembled to the maximum extent and tested by the Contractor at its site. The Customer’s representatives must be given access to the assembly and testing. None of the machines delivered by the Contractor according to this specification may be sent to the Customer’s site until the tests are fully approved by the Customer’s representatives. The Customer requests the tests be announced at least fourteen (14) days in advance.

* 1. Preparation for transport

The line may only be disassembled to the minimum necessary extent for the transport, all parts must be carefully packed and labelled. All conductors should be left in their channels, bare wires should be wound and packed so as to be protected during the transport. All conductors and cables must be properly labelled for the ease of identification.

* 1. Lock-out & Tag-out (LOTO)

The Contractor must compile a Lock-out & Tag-out procedure for its line.

The system must ensure that all dangerous parts of the machine are properly switched off and cannot be switched on before the maintenance or service is finished.

The Contractor will prepare the task lists for four (4) points of Lock-out and Tag-out. These points are as follows: identification of power source, disconnection of power source, securing and identifying the power source and proof of the disconnection effectiveness.

The procedure for disconnection and identification (lock-out and tag-out) must be discussed with and approved by the Customer.

* 1. Delivery to the Customer’s site

The Contractor will take into account the width and height of the production hall gate. Gate dimensions are as follows: 4.5 x 4.5 m, 5 x 5 m a 7 x 7 m.

The delivery of the line, machines and other related consumables to the Customer’s site must be coordinated with and approved by the Customer in advance.

* 1. Technical media interface

The Customer will arrange for and provide the following technical media in the place of installation.

* + 1. Natural gas
* Pressure in supply line: 25 or 100 kPa
* Temperature: Ambient temperature
* Heating value 30,4 – 38,4 MJ/m3
  + 1. Cooling water (plant wide open circuit with cooling towers)
* Temperature in supply line: 10 - 25 °C
* Delta temperature (between supply and return line): 5 – 8 °C
* Pressure in supply line: 0,59 – 0,70 MPa
* Flow rate: 250 m3/h (at 0,6 MPa)
* Chemical composition will be communicated during engineering
* pH value 7,6 – 8,0
  + 1. Compressed air
* Pressure in supply line: 0,5 - 0,6 MPa
* Temperature: 15 - 25 °C
* Quality class: 1 according to ISO 8573-1
* Relative humidity: 0 %
  + 1. Argon
* Pressure in supply line: 1,1 MPa, max. 1.6 MPa
* Temperature: Ambient temperature
* Quality class: 5.0 / 99,999

Contractor to define with transmittal of offer all required media (water, technical gases) with base definition (temperature, pressure, flow rate etc. and acceptable range).

1. Safety requirements
   1. General

The Contractor is obliged to address and/or implement the criteria for the safety device design.

The Contractor is obliged to reasonably reduce the risks, propose the necessary protective measures for those who may be exposed to risks due to dangerous situations.

Dangerous situations may be caused by the following:

* Failures or failure statuses in electrical devices which may result in electric shock or fire of electric origin.
* Failures or failure statuses in control circuits (or components and devices connected to these circuits) which result in malfunctioning of the line/machine.
* Failures or power outages as well as failures and failure statuses in power circuits which result in malfunctioning of the line/machine.
* Loss of integrity in circuits dependent on the sliding or rolling contacts, which results in impaired safety function.
* Electrical interference, e.g. electromagnetic, electrostatic generated either outside or inside the electrical devices, which results in malfunctioning of the line/machine as a whole.
* Release of accumulated power (electric or mechanic) which results in electric shock or unexpected motion which may cause injury.
* Surface temperatures which may cause injury.

Safety measures must combine the measures introduced at the design stage (this is the Contractor’s responsibility; whereas the measures which are to be introduced by the user are the responsibility of the Customer).

Safety shall be a primary consideration in the design of this equipment. Guards, protective devices and Lockout and Tag-out and Zero Energy procedures shall conform to applicable Customers standards and shall minimize potential hazards to operating and maintenance personnel. Contractor shall obtain all approvals of equipment and components prior to delivery and commissioning.

As part of the CE certification the Contractor shall collaborate with Customers Personnel in executing a risk analysis. The machinery and equipment must be designed and built by taking into account the results of the risk analysis. Risks from hazardous substances, biological hazards, fire and explosion hazards, thermal, physical, physical risks are incorporated into the risk analysis.

The Contractor shall design and furnish all necessary machine guarding and fall protection incorporated within machine assemblies.

All elevated platforms > 1.0 m (with regard to an adjacent floor, ground or other working/walking surface) shall be equipped with a hand rail and a mid rail (local regulations that require railings be installed at a lower height shall be met). A toe board is required when there is the potential for tools and/or materials to be kicked off the elevated work platform and onto personnel below.

The Contractor shall provide a zoned LOTO (Lock Out Tag Out) according to maintenance requirements on the equipment.

The Contractor shall design equipment such that cleaning, adjustments, threading and/or maintenance of such equipment shall minimize “Confined Space” entry by operating or maintenance personnel. If entry is unavoidable, design of the confined space shall permit rescue and provide means of extraction of an unconscious individual, weighing up to 130 kg.

The equipment shall be designed with a noise level having an upper exposure action value equal to 85 dB and a lower exposure action value equal to 80 dB.

The Contractor shall provide periodic safety reviews with Customer’s representatives during equipment design, installation, commissioning and start-up.

The Contractor shall calculate the distributed load of platforms etc. (kg/m²) and show the sufficiency of the support.

Equipment shall be designed such as minimizing / controlling the risk of spills and emissions in compliance with local regulations.

Special attention should be placed on the inherent explosion hazards associated with molten aluminium, the best reference being the “Guidelines for Handling Molten Aluminum.

* 1. Requirements for mechanical safety

Mechanical safety covers the protection of users against risks related to moving parts, mechanical forces, falling objects or any other mechanical risks.

* + 1. Protective covers and guards

The line must be equipped with fixed protective covers which protect the users against access to moving parts of the line or any other risks. The covers must be designed so that they are difficult to circumvent or removed without tools.

* + 1. Protective fencing

Protective fencing is another form of protection which prevents access to dangerous parts of the line and the line must be fitted with the same. This fencing should be reasonably rigid and resistant to withstand external influences and to enable clear view of the machine interior for the purpose of inspection and maintenance.

* + 1. Safety switches and sensors

The use of safety switches and sensors may prevent the operation of the line if the protective elements have been removed or in case of a dangerous situation. These elements may include: emergency switches which stop the line in case of touching or vicinity switches.

* + 1. Protective brakes and emergency stop

The machines should be equipped with safety brakes or emergency stop systems which can quickly stop the movement of the machine in case of danger or whenever instant stop is required.

* + 1. Distance from dangerous parts

The design of the line must minimize the risk of injury by keeping the safe distance between the user and dangerous parts of the machine, such as rotating or moving parts.

* + 1. Protection against falling objects

The machinery should be designed so as to minimize the risk of fall of dangerous objects from the working platform which could lead to personal injury of the user.

* + 1. Rigidity and stabilization

The machinery must be stable and firmly fixed on the floor in order to minimize the risk of tilting or any other accidents related to the machinery instability.

* + 1. Appropriate marking and indication

Dangerous parts of machines should be marked in accordance with the applicable standards so that the users are informed of potential risks.

* 1. Requirements for electrical safety
     1. Electric shock protection

The machinery must be designed so as to minimize the risk of electric shock. This includes the use of insulation materials, grounding, protective elements such as fuses, circuit breakers and protective switches.

* + 1. Protection against electric discharge

Electrical components of the machinery must be placed and insulated so as to minimize the risk of occurrence of electric discharge which would endanger the user or damage the line/machine.

* + 1. Safety insulation

The machinery must be fitted with sufficient insulation to protect the user against touching or approaching dangerous electrical parts.

* + 1. Ensuring safe voltage

The voltage used in the machinery must comply with the applicable standards and must be designed to minimize the risk of injury.

* + 1. Protection against overload and short-circuit

The machinery must be fitted with protective elements, such as fuses, circuit breakers etc. which protect against overload and short-circuit that may lead to fire or injuries.

* + 1. Safety grounding

Electrical devices must be grounded in order to minimize the risk of electric discharge and to ensure safe excess current drainage.

* + 1. Protection against humidity and dust

The line must be designed so that it is resistant against ingress of moisture and dust which could lead to damage of electrical components and increased risk of injury.

* + 1. Protection against electromagnetic interference

Electrical devices must be designed so that they minimize the interference from electromagnetic fields which may influence the functioning of the machine or any other machinery in its vicinity.

* + 1. Safety marking and indication

Dangerous electrical parts of the machinery must be marked in accordance with the applicable standards so that the users are informed of potential risks.

* + 1. Regular inspection and maintenance

Electrical devices must be regularly checked and maintained in order to detect potential problems which may endanger safety.

1. Service and maintenance

The bid will include a draft service level agreement covering the machinery. The Customer wishes the agreement to include annual service checks. If a higher frequency of these checks is necessary, the agreement should set out their interval.

**Troubleshooting**

* Failure condition addressed via remote connection: response time within 4 hours of the announcement.
* Failure condition addressed personally by a technician: response time within 24 hours of the announcement.

The draft service level agreement should also incorporate a price quotation for regular service and urgent service, with price validity of 5 years. Price for regular service means 1 on-site service check.

* 1. Reliability

Customer’sprefers items that would lead to reliable physical assets and reliable processes to be implemented as early as in the design phase. Some of these items are listed below:

* An asset care / maintenance program shall be provided. The preferable asset care strategy shall be condition based maintenance rather than time based maintenance.
* The Contractor shall consider maintainability in the design (e.g. lifting devices, quick releases) operability, (i.e. layout and location of control pulpits, analysis of operator movements, visual management for inspection and recognition of equipment condition), testability, (e.g. sample points for oil), accessibility, (e.g. room for maintenance workers and tools, platforms etc.), time saving methods, standardization, and mistake proofing in the design.
* The Contractor shall base equipment selection decisions on Life Cycle Cost, incl. energy cost, maintenance costs, operating costs, buying cost, material cost.
* The Contractor shall deliver standard procedures for installation, start-up, commissioning, (incl. detailed plans, required times & resources, tolerances, alignment, start-up sequencing, check of performance indicators).
* Any special tools required for removal, assembly and maintenance of any system or component shall be included with the equipment.
* Where practical and cost effective, the Contractor shall implement redundancy of critical components, for instance so that maintenance work can be performed without causing downtime.
* The Contractor shall be willing to participate with at least one representative in a risk analysis event if asked to. They shall also provide a limited amount of reliability reviews with Customer’s representatives during equipment design, installation, commissioning and start-up.

1. Energy
   1. General

* The equipment and components shall be selected to ensure the lowest life cycle cost and meet all energy efficiency requirements in the Břidličná facility.
* The Contractor will provide means to meter and to monitor each energy source (electricity, gas) and fluids (compressed air, nitrogen, argon, etc. ) at each process unit and also for each significant single user (est. yearly cost > $100K ) with an accuracy of 0.5%.
* The following data shall be provided for the equipment: Power installed (all in kW), energy efficiency class /standard, and power used for nominal output and 50% nominal output, specific energy consumption (in kWh - using upper calorific value) per output unit (e.g. Tons) and energy consumption for the key process steps (e.g. consumption during holding time).
* The electrical equipment and components shall follow the state of art energy efficiency rules.
* All AC motors shall meet the “IE3 “ or “NEMA Premium ” efficiency standards. IE2 motors are only acceptable if the yearly use is less than 2000 h.
* Direct coupling with “state of the art” alignment. If a belt must be used, the selection of the belt will target the highest friction.
* The selection of distribution transformers will target the lowest life cycle cost (class I efficiency transformers or NEMA premium, efficiency > 98 %).
* All electrical appliances shall meet the A or B or “EU Eco Label” (Directive 2009/125/EC) or “Energy Star” efficiency ratings.
* The lighting provided with the equipment should be of high energy efficiency and a good color rendering (>70) (fluorescent T5 with electronic ballast are preferred).
* The selection of compressed air energy source for driving / moving / cleaning / cooling is only allowed only if no alternative with a lower life cycle cost is available or it is required for specific safety, regulation, or process reasons. The compressed air equipment design and working pressure set point should target the minimum life cycle cost.
* Energy conservation will be fully integrated in the design and control of the equipment by providing systems which automatically switch off the energy consumers or reduce their energy consumption in a controlled and safe way according to the standards and regulations during idle time or downtimes. The MMI systems will allow an easy manual switch off of the equipment.
* Adapt the energy use to the real demand: The equipment shall be designed and sized to optimize the real energy use according to the real demand. In the case of a fixed demand, the equipment should be designed to target the optimal equipment efficiency. In case of a variable demand, the equipment should be equipped with variable output systems. (number of motors running by a cascade control, variable speed drives, variable flow pumps, heating control, level control etc.)
  1. Heat management:
* State of art high efficiency burners shall be selected based on a life cycle cost analysis. The combustion air temperature and furnace door opening time shall be monitored. The oxygen content in flue gas and furnace pressure control will be optimized to ensure the highest energy efficiency.
* The insulation (piping, tanks, furnaces, boilers etc.) will be designed to minimize the energy losses and will target the lowest life cycle cost.
* Natural convective cooling is preferred, where applicable.
* Simultaneous cooling and heating shall be avoided.
* The heat recovery solutions are preferred over solutions that require any additional energy use.
  1. Hydraulics:
* The use of variable flow pumps with an integrated proportional valve for pressure control combined with a variable speed drive on the motor (main pump and filtration pump) is recommended. The pressure set point will be adjusted to the purpose for each cycle step. The use of low friction oil is also recommended.

1. Training

Staff training will be provided by the Contractor FREE OF CHARGE within the delivery of the line.

The training will be divided into three levels, based on the proficiency and complexity of the line/machine:

* Operators
* Maintenance
* Technologist

The training will take place in a minimum of four blocks, at the Customer’s site, in English. The blocks are necessary due to various working shifts of the operators and expert staff.

Theoretical training will take place in the Contractor’s classroom, duration: 3 (three) days. The purpose of the theoretical training is to give general information of the line technology.

On site training (duration: 5 (five) days) as per during cold and hot commissioning.

All training documents to be provided in PDF format and hand over in electronic form (USB or CD).

Detailed training schedule will be agreed on at the appropriate time during the project implementation.

To this end, the Customer will arrange for an adequate number of interpreters at the appropriate time.

Each training will be documented; an attendance list will be made according to the Customer’s internal regulations.

* 1. Operators

The Contractor will compile the training documents (in Czech and English) for the operators, and will train the staff in safety measures and simple maintenance interventions.

The training will cover the following topics:

* Process and procedure
* Tools and changeover
* Maintenance (daily maintenance within the operators’ competence)
  1. Maintenance

This training applies to expert staff, such as electricians, mechanics, tool makers, PLC programmers, process engineers, metallurgists and management.

The Contractor will provide general and specialized expertise of the operation as well as experience through this training which will also include recommendations concerning the process technology, working procedures with special oral/written operation and testing specifications, as well as information about specific performance data based on the practice.

The Contractor will prepare the training documents (in Czech and English) for the expert staff.

The training will cover at least the following topics:

* Safety systems at the machinery
* Functional description of electric, pneumatic, hydraulic control (flow chart)
* Maintenance planning and performance
* Troubleshooting, breakdowns. Basic structure of the programmed management process To this end, practical hardware and software training must be provided.
* Setting the technological parameters and effect of their changes.
* Review of available documentation including drawings, instruction manuals, bill of material and spare parts.
* Review of system operation, control, interlocks, sequencing, maintenance and safety via operation and maintenance manuals and drawings.
* Provide suggestions of other pertinent topics related to operating and maintaining the new equipment.

1. Painting
   1. General

* The Contractor shall comply with the Customer Plant Appearance Standards, which shall be final confirmed and agreed during engineering.
* The Contractor shall comply with DIN 2403 (Identification of pipelines according to fluid conveyed) and DIN 12792 (Ventilation for buildings – symbols, terminology and graphical symbols) in regard to the identification of pipelines according to the fluid conveyed. The below table is a quick reference for the information within DIN 2403 and is specific to the Customer facility.

|  |  |  |
| --- | --- | --- |
| **Pipe/Media/**  **Machine parts** | **Color Code** | **Color** |
| Stacionary machine parts | RAL 5022 night blue | Blue |
| Movable machine parts | RAL 1021 | Yellow |
| Machine parts above 80 °C | RAL 9007 | Grey |
| Natural Gas | RAL 1003 | Yellow |
| Hydraulic | RAL 8023 | Orange Brown |
| Cooling Water | RAL 6032 with shield / insulation | Yellow Green |
| Fresh Water | RAL 6032 with shield / insulation | Yellow Green |
| De-ionized Water | Stainless steel Grade 1.4571 [316Ti] with shield |  |
| Hot Water | RAL 6032 with shield / insulation |  |
| Compressed Air | RAL 5015 | Blue |
| Acid | RAL 2003 with shield | Pastel Orange |
| Thermal Oil | RAL 8023 with shield / insulation | Orange Brown |
| Argon | Stainless steel Grade 1.4571 [316Ti] with shield / insulation |  |
| Chlorine | Stainless steel Grade 1.4571 [316Ti] with shield / insulation |  |

* Primer and finish coats of a suitable aluminum explosion prevention coating shall be applied to all equipment near the casting pit exposed to molten metal, per manufactures instructions.
* Area’s not to be painted include:  
  - Machined surfaces  
  - Electrical connection points  
  - Bearings, liners, gears, wheel contact surfaces
* All chemical solvents and paints shall be used in accordance with manufacturer’s instructions and Customer standard practices.
* All chemicals and paints shall be approved by submission of a Material Safety Data Sheet as well as any manufacturers supplied information and or instructions to the Customer project manager prior to delivery onto Customer site.
* A Material Safety Data Sheet shall be in the immediate vicinity of all chemical and paints when located on Customers site.
* At end of installation, the Contractor shall touch-up / paint to cover unpainted, field-welded or scratched / damaged surfaces. Any paint waste products shall be removed and disposed of properly and legally by the Contractor at no additional cost to Customer.

1. Annexes

Annex No. 3\_1\_TS\_Guaranteed\_parameters\_of\_billets

Annex No. 3\_2\_TS\_Packing\_instruction