**Annex No. 2 – Technical Specifications and Project Documentation**

The subject of the public contract is the implementation of construction work and structural modifications to the membrane walls in the combustion chamber area of boilers K2 and K3 at ZEVO Brno, including:

* Complete engineering, i.e., processing of project and production documentation for membrane wall modifications, including strength and expansion calculations at interconnection positions,
* Removal of existing membrane walls and chamber’s headers in the affected area, including appropriate protection against possible deformation and all related work (i.e., disconnecting auxiliary technology, secondary air hoses, etc.),
* Removal and dismantling of secondary air nozzles on the rear wall at both levels,
* Manufacture and delivery of new prefabricated membrane walls with Inconel cladding,
* Manufacture and delivery of new headers adapted for connection to new membrane walls in areas affected by the replacement of membrane walls (changes in connection diameters, reductions, etc.),
* Installation of new membrane walls, connection to chamber’s headers and existing membrane walls using reducers, welding of fins at connection points, creation of an Inconel cladding on assembly welds, creation of an overlap area (i.e., transition from Inconel to existing material with protection using refractory linings). Membrane walls in the overlap area must be protected with Inconel cladding material.
* Installation of new nozzles in the existing secondary air structure on both levels, including connection to the existing secondary air distribution chamber on the front and rear walls of the boilers.
* Securing approval of modifications at Technical Inspection of the Czech Republic (hereinafter referred to as “**TIČR**”) in cooperation with the Client and performing all prescribed tests in accordance with applicable legislation (Non-Destructive Testing, pressure test, etc.)
* Preparation and delivery of complete production documentation.

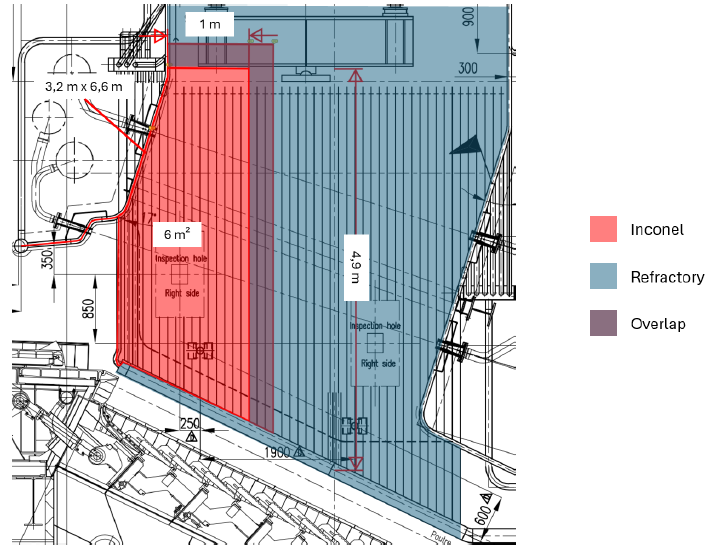
**Option – optimization of the secondary air system for both boilers K2 and K3**

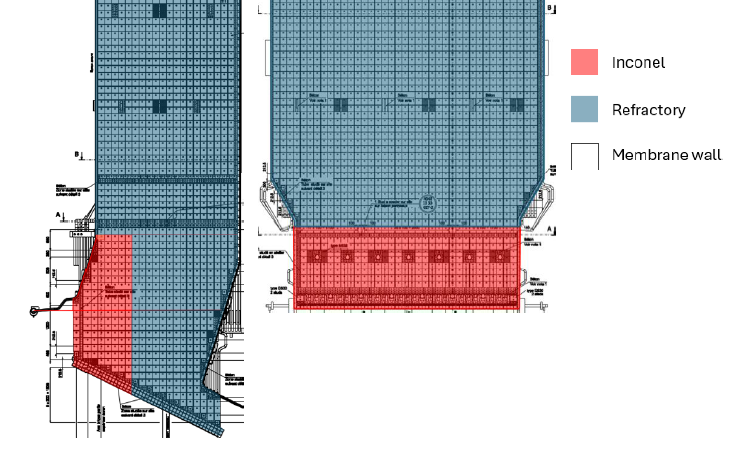
An optional part of the public contract is an offer to optimize the secondary air system, particularly its distribution within the combustion chamber, where the Client expects, for example, an increase in boiler efficiency, a reduction in emissions, a reduction in urea consumption, etc. In this case, the option offer includes:

* Complete engineering of the optimisation design of secondary air system optimization, including design of modifications to the geometry of the membrane wall, height levels, nozzle geometry, and secondary air distribution.
* Submission of a verification calculation of the secondary air flow and a calculation of T2s compliance in the event of a change in height levels,
* Manufacture, delivery, and installation of all related parts,
* Preparation and delivery of complete production documentation.

The execution of the works is planned to be carried out during the regular autumn technological shutdown in 2026 and 2027 (from the end of September to October), which places emphasis on a high level of organization of individual activities due to the parallel multiple works ongoing on site. During the implementation period, working hours are envisaged in the form of day and night shifts (24/7).

Schematic representation of the required scope of modifications of the combustion chamber:





Detailed drawings of the existing membrane walls and combustion chamber area are attached to this document. Specifically, drawings of the existing design of:

* membrane walls,
* secondary air ducts,
* waste chute,
* steel structures,
* other indicated common auxiliaries.

## **Technical requirements**

1. **Project and production documentation**

* Preparation of complete project and production documentation,
* Providing strength and expansion calculations at the interconnection positions of the modifications,
* Calculation and verification of the impact of the planned modifications on the natural circulation of the boiler in terms of flow characteristics and possible impacts on heat flows,
* Providing a control calculation of secondary air flow and a calculation of T2s compliance **– applies to the Option part of the performance (the Work).**

1. **Construction modifications to the combustion chamber**

* Preparation of the workplace, including disconnection of the affected peripherals (this refers to a temporary removal and return of all technology and piping around the boiler and in transport routes that prevent the work from being carried out, including electrical and I&C parts). Coordination of scaffolding assembly. Scaffolding is provided by the Client.
* Identification of the affected area for the purpose of removing the refractory lining, which will be carried out in cooperation with the Client.
* Removal of existing membrane walls with a diameter of 57 mm and a spacing of 100 mm made of P265GH material.
* Removal/cutting of existing headers at the place of new membrane walls.
* Manufacture, delivery, and installation of a new headers and membrane walls, including connection to existing membrane walls using reducers.
* All related handling work.
* Reconnection of all affected peripherals of the pressure unit, sealing of the boiler and handover of the Work into operation.

1. **Membrane wall**

* The pipes for the new membrane wall will be made of tubes with a diameter Ø76.1 mm, maintaining a tube pitch of 100 mm.
* The wall thickness of the existing pipes in straight sections is 4.5 mm. In bends, it is at least 6.3 mm. The wall thickness of the new pipes must be based on a new strength calculation for the maximum operating parameters of the boiler with a total addition of at least 2.5 mm.
* The quality of the new pipes will also be determined by calculation. The pipes will be made of verified material that meets all standards and is confirmed by verified certificates. The existing pipes are made of P265GH material.
* The existing fins between the pipes is 6 mm thick and made of P235GH material. The Client requires that at least this thickness and quality of the base material be maintained.
* Connection to the existing pipes of the membrane wall will be solved by inserting new headers in the lower part and suitable reducers in the upper part.
* In the case of a bid without an option:
  + The locations of the secondary air nozzles must be constructed in accordance with the geometry of the existing front and rear membrane walls. At the rear wall, only the secondary nozzles in the existing location will be replaced.
  + Installation of new secondary air nozzles on the front wall at both levels, simultaneously with a replacement of the membrane wall,
  + The replacement of secondary nozzles includes the removal of existing ones, the manufacture, delivery, and installation of new ones. This includes metal cladding, refractory linings and insulation.
* If an option is offered:
  + The locations of the secondary air nozzles must be designed in accordance with the geometry of the existing front and rear membrane walls. The solution must optimize combustion in terms of demonstrable improvement in combustion. At the same time, a functional solution must be maintained, whereby the nozzles mix the flue gas with air and simultaneously provide a covering function of the combustion chamber with a stream of air. The individual nozzles are not placed directly opposite each other but are positioned alternately.
  + The replacement of secondary nozzles includes the removal of existing ones, the manufacture, delivery, and installation of new ones. This includes metal cladding, refractory linings, and insulation.

1. **Inconel cladding**

* Material: Inconel 625,
* Material requirements: VGB-S-013-00-2017-04-EN standard, iron content in the surface must not exceed 3% (degree of mixing). Must be documented by a test report,
* Cladding thickness: min. 3 mm,
* Application: robotic welding in the production plant, with 100% quality control according to standards. Manual welding is only permitted at the connection point to the existing boiler pressure unit. The entire surface must then be subjected to 100% inspection for the presence of Ferrous on the surface (degree of mixing) with a satisfactory result.
* Surface: complete inner surface of new membrane walls.
* Material lifetime guarantee: min. 24,000 hours until the first repair welding, which occurs when the cladding thickness falls below 0.5 mm at any point.

1. **Refractory concrete lining**

* The original design documentation for refractory linings is not fully applicable due to the new membrane wall construction. This is particularly true in the area of secondary air nozzle penetrations. The Contractor is therefore obliged to check the existing solution and, as part of the project, propose and document a new solution in the affected areas regarding the functionality of the refractory linings in the boiler as a whole.
* The installation of lining bricks will be part of the Client's scope. The Contractor will only ensure the welding of pins according to the Client's instructions at the point where Inconel transitions to the existing material.
* Installation of all refractory concrete (e.g., at secondary nozzles) will be part of the scope of work of the Client. However, the Contractor will provide an updated plan for the placement of refractory to reflect the modifications made.

1. **Quality control**

* Cooperation with the Client in the matter of approval of the procedure by the TIČR inspection body based on the project prior to the start of production,
* Submission of an inspection and testing plan and performance of quality control in accordance with applicable standards. The Client additionally requires 100% x-ray testing (RT) of installed headers,
* Delivery of complete documentation, including confirmation from the Notified Body (NOBO) for the purpose of performing a pressure test in cooperation with the Client.

1. **Others**

* Delivery of technological procedures and analysis of main risks for the purposes of preparing an HSE plan and movement on the construction site,
* Provision of necessary mechanization and handling equipment,
* Cleaning of the workplace at the site of the work, construction waste and material packaging will be disposed of in accordance with the Waste Management Act No. 185/2001 Coll. or Implementing Decree No. 383/2001 Coll. as amended. The Work will be carried out in accordance with EMS rules.
* Tests and inspections
  + The contractor is obliged to perform all tests, inspections, and pressure tests in accordance with the applicable legislation for designated pressure equipment, in particular according to:
  + Act No. 250/2021 Coll. on occupational safety.
  + Decree No. 219/2021 Coll. on designated pressure equipment.
  + Relevant ČSN EN standards and TIČR technical rules.
  + Test results must be documented in reports and approved by an authorized person.
* Cleanliness of assembly
  + The Contractor is obliged to ensure maximum cleanliness during assembly:
  + Elimination of contamination, especially of Inconel hand-welded joints, with grinding dust, grease, or material residues.
  + Use of protective films, continuous cleaning of work surfaces.

## **Battery limits**

Mechanical:

* Expansion gap between the waste chute and the front header. The Contractor is responsible for maintaining the expansion gap for the boiler at this location and connecting it to the compensator. The delivery and installation of a new compensator is in the scope of the Client. Any dismantling is within the scope of the Contractor's performance.
* Existing headers in the side walls at the connection point to the new headers. The connection point is determined by the Contractor as part of the project preparation.
* Connection to the existing grate compensator at the side headers. The delivery and installation of the new compensator is in the scope of the Client. Any dismantling is within the scope of the Contractor's performance.
* Existing membrane walls at the cut-out position.
* Existing rear membrane wall at the locations of the secondary air nozzles.
* insulation and sheet metal cladding at the location according to the scope of work,
* steel structures to the extent necessary for dismantling work,
* refractory lining (concrete, bricks) at the installation site according to the scope of work, welding of pins/spikes, etc. is within the scope of the Contractor's performance,
* Secondary air distribution pipes and hoses in front of and rear membrane wall, depending on the scope of dismantling work.

Electrical:

* connection point for the electrical cabinet (portable cabinet is within the scope of the Contractor),

I&C:

* not considered