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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CONTRACTOR   |  |  | | --- | --- | | GasOil nazov | **GasOil Technology a. s.**  Nám. sv. Egídia 40/93  058 01 Poprad  Slovakia |   CUSTOMER   |  |  | | --- | --- | |  | **Conexus Baltic Grid**  Stigu street 14  Riga, LV-1021  Latvia |   CO-FINANCIER  **INOVATION AND NETWORKS**  **EXECUTIVE AGENCY**  **Connecting Europe Facility**  Project (Action) number 8.2.4-0031-LV-W-M-18 | | | | | Exemplar No.: | |
| Phase:  **tender documentation** | |
| Project Name:  Installation of Gas Compression Unit at Incukalns Underground Gas Storage | | | | | Contract No.:  **CON-2020/364**  **0173/20/52** | |
| **Document No.**: GCUI-TD-GOT-MEC-SPC-003 | | | | | Revision: **---** | |
| Document Name:  **tender documentation**  **DRAFT**  **Tender specifications for process cooler** | | | | | | |
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# GENERAL

## Scope of the Document

This Specification defines the minimum requirements for production, inspection, acceptance testing, identification and supply of Gas Coolers for “ project - Installation of Gas Compression Unit at Incukalns Underground Gas Storage” (the PROJECT) of Conexus Baltic Grid (the Employer).

Installation of Gas Compression Unit is a part of the Project of Common Interest (PCI) 8.2.4 Enhancement of Incukalns Underground Gas Storage. The aim of this project is to enhance the operations of the storage to allow the Incukalns Underground Gas Storage to maintain its functionality after pressure upgrade in Baltic transmission system and establish the compression withdrawn mode. Additional Gas Compression Unit will be installed and integrated as a part of existing gas compression station at Incukalns Underground Gas Storage and support also injection mode.

This specification covers the supplementary requirements to API 661 / EN ISO 13706, “Air-Cooled Heat Exchangers for General Refinery Service" for the design, materials, fabrication, inspection, testing, coating and supply of a Gas Cooler.

This specification describes additional requirements and clarifications to those contained in API 661 / EN ISO 13706. The Gas Cooler Supplier shall provide exceptions and clarifications to API 661 / EN ISO 13706 to the Employer for agreement prior to purchase of this equipment.

Compliance with the Employer’s requirements shall not relieve the Supplier of his responsibilities or any other obligations.

## Definitions

Table 1.1

|  |  |
| --- | --- |
| Term | Explanation |
| Project | Installation of Gas Compression Unit at Incukalns Underground Gas Storage |
| Employer | Conexus Baltic Grid |
| Consultant | GasOil Technology a. s. |
| Scope of Supply | All equipment and services which shall be delivered by the Supplier to the Employer as per requirements and conditions specified in the CONTRACT. |
| Supplier | Vendor of the Gas cooler unit sets |
| Offer | Offer for the gas cooler sets submitted to the Employer by the Supplier |

## Abbreviations

Table 1.2

| Term | Explanation |
| --- | --- |
| AC | Alternating Current |
| API | American Petroleum Institute |
| CD | Compact Disc |
| CE | European Conformity |
| DN | Diamètre Nominal (Nominal Diameter) |
| EN | European Norm |
| ISO | International Standards Organization |
| IP | Ingress Protection |
| ITP | Inspection and Test Plan |
| LVS | Low Voltage Switchgear |
| MAWP | Maximum Allowable Working Pressure |
| NPS | Nominal Pipe Size |
| PED | Pressure Equipment Directive |
| PTC | Performance Test Codes |
| QA | Quality Assurance |
| UT | Ultrasonic Testing |
| VFD | Variable-frequency drive |

## References

Table 1.3

|  |  |  |
| --- | --- | --- |
| No. | Number | Title |
| 1 | GCUI-CD-GOT-GEN-SPC-001 | Composition of Process Gas |
| 2 | GCUI-TD-GOT-MEC-DAT-003 | Gas Coolers - Datasheet |
| 3 | GCUI-CD-GOT-MEC-DIA-003 | Piping and Instrument Diagrams (P&IDs) process cooler |
| 4 | GCUI-CD-GOT-ELE-SPC-006 | Cable and Cable Laying - Specification |
| 5 | GCUI-CD-GOT-ELE-SPC-007 | Earthing and Lightning Protection - Specification |
| 6 | GCUI-CD-GOT-ELE-SPC-009 | Design and Construction of Power Supply Systems - Specification |
| 7 | GCUI-CD-GOT-ELE-SPC-001 | LV Switchgear - Specification |

## Codes and Standards

In particular, but not limited to, the following laws, codes, standards and regulations shall be observed. It shall always be checked that the latest revision of each standard is used. Manufacturer shall be responsible to design equipment’s and their components in accordance with the requirements of applicable documents.

Table 1.4

| No. | Number | Title |
| --- | --- | --- |
| 1 | 2006/42/EC | Machinery Directive |
| 2 | 2014/34/EU | ATEX Directive |
| 3 | 2016/68/EU | Pressure Equipment Directive (PED) |
| 4 | 2014/35/EU | Low Voltage Directive |
| 5 | EN 1090 | Execution of steel structures and aluminium structures |
| 6 | EN 13445 | Unfired Pressure Vessels |
| 7 | ANSI B16.5 | Pipe Flanges and Flanged Fittings |
| 8 | EN 1991-1-3 | Eurocode 1: Actions on structures - Part 1-3: General actions – Snow loads |
| 9 | EN 1991-1-4 | Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions |
| 10 | EN 60204-1 | Safety of machinery - Electrical equipment of machines |
| 11 | EN ISO 12944-1 | Paints and varnishes - Corrosion protection of steel structures by protective coating systems |
| 12 | EN ISO 12944-2 | Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 2: Classification of environments |
| 13 | EN ISO 13706 / API 661 | Petroleum, petrochemical and natural gas industries - Air-cooled heat ex-changers |
| 14 | EN ISO 1461 | Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods |
| 15 | EN ISO 17638 | Non-destructive testing of welds - Magnetic particle testing |
| 16 | EN ISO 17640 | Non-destructive testing of welds - Ultrasonic testing - Techniques, testing levels, and assessment |
| 17 | ISO 21940-11 | Mechanical vibration - Rotor balancing - Part 11: Procedures and tolerances for rotors with rigid behaviour |
| 18 | ISO 9001 | Quality management systems – Requirements |

## Conflicting Requirements, Exceptions

Supplier shall notify the Employer / Consultant of any conflict between this Specification, the related data sheets, the codes and standards and any other specifications included as part of the procurement documentation.

Any exceptions to this specification and referenced documentation shall be raised by the Supplier and approved by the Employer in writing.

# GENERAL INFORMATION

## Scope of Responsibility and Addresses

Addresses

Employer Conexus Baltic Grid

Stigu street 14, Riga, LV-1021, Latvia

Site Address Incukalns Underground Gas Storage

Ragana, Krimulda parish, Sigulda district, LV-2144, Latvia

The Site location is on the territory of the Inčukalns U.G.S.F, the Krimulda parish of the Sigulda district of the Republic of Latvia, 0.25 km to the southwest from the highway of the state importance A3 Riga-Valmiera and 2.1 km to the southwest from the settlement of Ragana.

## Climatic and Environmental Conditions

The Supplier shall execute the Scope of Supply under full consideration of the site environmental conditions.

The general on-site climatic and environmental conditions to be considered are the following:

Table 2.1 - Site conditions

|  |  |  |
| --- | --- | --- |
|  | Ambient temperature | Relative humidity (%) |
| Min | -36,2°C | 66 |
| Avg | +6,4°C | 80 |
| Max | +33,2°C | 90 |

Altitude of the site is 70 m (1,005 atm).

Maximum ground freezing depth – 120 cm.

**Snow load value** to be considered for the compressor package design as applicable LVS EN 1991-1-3 «Eurocode 1 – Actions on structures – Part 1-3 : General actions – Snow loads”.

**Wind action value** to be considered for the compressor package design as applicable LVS EN 1991-1-4 “Eurocode 1: Actions on structures – Part 1-4: General actions – Wind actions”.

**Seismic zone** agR in % of g is 2. Value of the reference peak ground acceleration agr=0,20 m/s2 according LVS EN 1998-1 Eurocode 8: Design of structures for earthquake resistance Part 1: General rules, seismic actions and rules for buildings.

The control cabinets and the electrical cabinets will be installed in separate electrical and I&C rooms. These rooms will be ventilated from outside the machine hall so that the rooms are not classified as hazardous area.

The temperature in these rooms is

+ 5 °C to + 35 °C

The equipment installed in these rooms shall be designed to operate in the given temperature.

## Operating Media, Auxiliaries

### Process Gas Composition / Transport Gas

The Supplier shall consider the process gas composition listed in document “Composition of Process Gas GCUI-CD-GOT-GEN-SPC-001” during the execution of the Scope of Supply.

### Power Supply

Table 2.2 – Power supply

|  | Unit | LVS |
| --- | --- | --- |
|  |  | Power from mains |
| Voltage | V | 3x400/230 |
| Type |  | AC |
| Frequency | Hz | 50 |
| Network type |  | TN-S |
| Network type for unit |  | TN-S |
| Fuse rating |  | 3 or 4 poles for 3-phase, 2 poles for single phase consumers |
| **To be filled by CONTRACTOR:** |  |  |
| Number of fans (motors) | pcs | 1) |
| Motor power (one motor) | kW | 1) |
| Total power demand | kW | 1) |
| Number of luminaires | pcs | 1) |
| Luminaire power (one piece) | kW | 1) |
| Total lighting power demand | kW | 1) |

Table 2.3 – I&C power supply

|  | Unit | I&C | |
| --- | --- | --- | --- |
|  |  | Power from I&C panels | |
| Voltage of control system | V | 24 | |
| Type |  | DC | |
| Voltage of ESD system | V | 24 | |
| Type |  | DC | |
| **To be filled by SUPPLIER:** |  |  |  |
| Total power demand | W | 1) | 1) |

1) to be defined by the Supplier

# SCOPE OF SUPPLY

Scope of Supply is defined as:

* Detail design engineering, manufacturing, assembling work, shop testing and corrosion protection of fully assembled Gas Coolers as per the requirements of this specification and the P&ID (GCUI-CD-GOT-MEC-DIA-003)
* All expenses for 3rd Party inspection.
* Transportation to site exclusive unloading.
* Lifting and earthing lugs, anchoring equipment such as anchoring bolts and shims etc.
* Mounting plates and cable trays for lighting and lightning protection as defined / approved by others.
* LV switchgear panels (here tagged as AVO-2) for cooler fans and maintenance lighting
* Maintenance lighting 230V AC with local switch.
* Thermal and noise protection (if required).
* Complete internal cabling and earthing on the Gas Cooler including junction boxes and maintenance switches.
* Interconnecting cabling between all equipment in the Scope of Supply, including LV, I&C, telecommunication, earthing, equipotential equalization, lighting (estimated distance up to 150 m).
* All materials (cable trays, conduits, glands, gas sealed cable transitions etc.) and tools required for installation of all package and Site cabling within the Scope of Supply,
* Earthing connection points for all equipment / skids included in the Scope of Supply. The Site common earthing grid will be supplied by others (protective earth, functional earth if required).
* Service platforms and ladders for maintenance and repair works of relevant equipment.
* Parameters required for design of the foundation (forces, dimensions, anchoring system etc.)
* Process, design and manufacturing documentation incl. heat transfer and stress calculations , Data Book and As-build documentation
* ATEX certifications
* Operating, assembly and maintenance manuals
* Special Tools for installation, testing, maintenance.
* Supervising on the construction site (Option)
* Personnel training, on a daily rate basis, inclusive all training materials and trainer expenses.(Option)
* Spare parts for commissioning
  + 1 vibration switch
  + 10% plugs including gaskets
  + 1 set V-Belt
* Spare parts for three year operation
  + 1 set V-Belt
  + 1 set of pulleys (drive and fan)

## BATTERY LIMITS

The limit of supply shall comply with battery limits as shown in the P&ID (GCUI-CD-GOT-MEC-DIA-003). It shall be Supplier’s responsibility to identify and supply any other equipment or instrumentation necessary for a correct, safe and smooth operation and testing of the supply.

The following scope of supply will be provided by Others:

* Foundation
* Unloading and Placing on Foundation
* Connection to process gas system
* Connection to earthing grid
* Power Supply
  + 400 / 230 V AC 50Hz
* Lightning protection

## Instructions for Foundation Design

Supplier shall provide Others with the required information to design and manufacture the Gas Cooler foundation. This includes, but is not limited to, weight, forces, torques and required openings, etc. The information shall be provided in guide drawings. Additional details of the type and placement of the anchor bolts shall be provided.

# TECHNICAL REQUIREMENTS

## General

This technical specification together with all relevant documents define the minimum requirements to be complied for the design, materials, fabrication, inspection, testing, coating and supply of Gas Cooler.

The Gas Coolers and any auxiliary equipment shall be designed at the operating conditions and the following design loads shall be taken into account as a minimum:

* Equipment weight (empty, during hydraulic test, during operation at maximum capacity);
* Equipment weight during frequent pressure test (water filled)
* Static calculation;
* Wind loads acc. to EN 1991-1-4 see chapter 2.2;
* Snow loads acc. to Geographical Climatic and Environmental Conditions see chapter 2.2;
* Seismic loads acc. to Geographical Climatic and Environmental Conditions see chapter 2.2;
* Combination of loads under different operating conditions;

The following points concerning functional design and performance must be adhered to:

The calculated heat transfer rate for the Gas Cooler shall be based on the minimum sur-face, air flow and fan brake horsepower required to meet the specified duty and fouling factors.

The Supplier is responsible for the Gas Cooler, hydraulic and mechanical guarantees.

Tube inserts for turbulence promotion and heat transfer enhancement shall not be used.

The Gas Coolers must be designed to avoid problems associated with process streams cooled to a temperature below the stream critical temperatures. This requirement shall apply to all specified design cases, including reduced flow rates. The Gas Coolers must to be prepared for providing the hydraulic tests in as possible short time during the operation time (once in 8 years).

Pressure drop calculations must account for any mill tube wall thickness tolerance. The calculated pressure drop shall be the clean pressure drop.

The Supplier shall size the height of the Gas Cooler support columns to ensure that hot air recirculation will not occur. By pass sealing plates between bays shall be provided by the Supplier to minimize recirculation between bays. Supplier’s proposal shall confirm the minimum required height for proper operation.

No single tonal noise shall be present. The influence of the drivers has to be considered.

The entire Gas Cooler shall comply with the ATEX requirements for electric and non-electric ex-protection and shall be supplied with CE-marking. Components (drives, fans, junction boxes, maintenance switches, luminaires etc.) shall be supplied with EU type-examination.

## Tube Bundle Design

### General

Each tube bundle shall be rigid and self-contained so that it can be handled as one complete assembly. The width of each tube bundle shall be chosen with due regard to the transport and handling aspects. Tube-to-tube sheet joints shall be rolled and shall be strong enough to withstand the stresses caused by differential thermal expansion in case of plugged or fouled tubes. Tube bundles shall be horizontal slight slope positioned.

Tubes shall be adequately supported either by tube support boxes or proprietary stainless steel collar supports.

The tube bundles shall be designed, fabricated and tested in accordance with the applicable sections of EN 13445.

Tube bundles shall be equipped with lifting lugs. A lifting study, defining the centre of gravity and describing the mounting and un-mounting procedure, shall be provided. Required tools shall be provided by the Supplier.

### Temperature

The minimum and maximum design temperature for the pressure parts shall be as specified in the Gas Cooler data sheets.

Provision shall be made in design to prevent excessive warpage of tube sheets and/or leakage at tube joints. The analysis shall consider maximum operating temperature and maximum cooling conditions at minimum ambient air temperature as well as alternative operations such as low process flow at low ambient air temperature, loss of fans due to power failure, and cycling conditions during start-up and shut down and external loading.

### Design Pressure

The Supplier shall design the Gas Cooler for the maximum allowable working pressure (MAWP) for both the cold and un-corroded condition as well as the hot and corroded condition. The hot and corroded condition shall be stamped on the nameplate.

## Header

### General

The position of inlet and outlet shall be on same sides ( 2-way tube bundle).

The Supplier’s header design must take into consideration all start-up and operating conditions, with fans and with loss of fans, as specified in the Gas Cooler data sheet.

In addition, the lateral flow area at any point in the header shall be at least equal to the total downstream tube cross-sectional flow area.

Horizontal pass partition plates shall be provided with a hole for drainage and venting.

Header shall be plug type header.

Plugs shall be of the shoulder type with parallel threads.

Internal hexagons shall not be used.

Threads of access plugs shall be coated with a suitable thread lubricant.

### Gaskets

Plug gaskets shall be solid metal of the same general material classification as the plug. Gasket hardness values shall be less than that of the plug and header box material.

Supplier shall provide a gasket material that will not work harden and has equal or greater anti-corrosion characteristics than the plug. The choice of gasket material shall be de-scribed in the proposal for the Employer’s review.

Plug gaskets shall be of sufficient thickness to cover a minimum of one thread pitch, but not less than 1.5 mm.

### Nozzles and other connections

All nozzles and multi-purpose service connections shall be flanged with a minimum size of NPS 2”.

All nozzles shall be flanged. All flanges shall be raised face with ANSI B16.5.

A minimum of two nozzles shall be installed in header boxes that exceed a width of 2.4 meters.

Process flanges shall be in the horizontal plane.

Cast or fabricated transitions shall not be used.

The maximum allowable nozzle load shall be 3 times the value specified in EN ISO 13706.

### Tubes

Elliptical tubes shall not be used.

All tubes shall be properly supported in order to prevent deformation of fins and vibrations.

Circumferential welds in the tubes are allowed only at the U-tube bends and with serpentine bundle designs. All circumferential welds shall be 100% radiographed.

Circumferential welds in straight tubes are strictly prohibited.

## Air Side Design

### General

Gas Cooler shall be designed to accommodate the load, lowering and removal of fan motors for maintenance. The heat exchange surface area must be calculated based on the design flow rate plus.

In no case shall the minimum design exposure temperature be less than the design dry bulb temperature.

All drivers, fans, bearings, etc. shall be weatherproof and suitable for outdoor use in environmental conditions as specified in Geographical Climatic and Environmental Conditions (chapter 2.2).

The Gas Cooler shall employ forced draft fans.

### Drivers and Transmissions

The Supplier shall furnish all drive equipment. Fans and driving equipment shall be arranged and mounted so as to provide easy and complete accessibility for service. All drive equipment shall be located below the tube bundle.

Fan motor components shall be lifetime lubricated. Power transmission shall be accomplished via V-belt drives. V-belts shall be of antistatic type with ATEX certification. An easily removable protective housing shall be provided around V-belts for mechanical / personnel protection.

Electric motor drivers shall be designed for 110% of design air quantity (within specified noise limits). Each E-motor shall be equipped with a lockable maintenance switch providing all-pole disconnection of the drive, including leading off-contacts. The maintenance switch shall provide independent cable entries (2x power cable U > 60V AC and 1 control cable U < 60V AC).

The e-drives of the fans shall be ATEX certified to the hazardous area zone 1 protection type EEx de, category II 2G at least IIB T3,IP 65, with PTC. The electric drives can also be equipped with a standstill heater (power supply 230V AC), whereby the Supplier assures that the use of the standstill heating is not required for the protection of a certified explosion protection group. The corresponding ATEX certificates are to be submitted to the Employer.

The motors used shall be suitable for vertical installation in order to prevent the penetration of water / foreign substances into the bearing / housing . Possibly additionally necessary technical activities are to be agreed with the Employer. One of the motors the fans is to implement with VFD for speed regulation.

Motors must be equipped with suitable metric cable glands for each cable. It means, separate gland for:

* power supply cable,
* anticondensation heater
* thermal protection devices (PTC).

Fans, transmissions and motors are subject to the EU Machinery Directive and shall be provided with ATEX certification.

### Drive Cabinets

The drive cabinet (motor control switchgear) shall be delivered by Supplier and installed by third party. In addition to the motor starters, the drive cabinet will be used also as an electrical interface for the vibration switches, PTC sensors, auxiliary contacts of the maintenance switches. The scope of the Supplier also includes all interface information and clarifications to the motor control switchgears manufacturer with regards to the integration of monitoring and control of the fans in the station control system. The required information and documents are to be provided by the Supplier.

### Fans and Fan Hubs

The fan characteristic performance curves for both, design and maximum, air side pressure drop fouling case, and throughout the full range of blade angles, shall be supplied with the data sheet. Fan blade angle shall be set manually.

One extra fan shall be incorporated for redundancy (n + 1 sparing philosophy).

Fans shall be ‘low-noise’ type, equipped as necessary with tip seals and hub seal discs.

Rotors shall be dynamically balanced according to ISO 21940-11.

### Vibration Cut-out Switches

Vibration switches are required on each fan drive, enclosed in IP 65 housing. The vibration switches shall be ATEX certified to the hazardous area zone 1 protection type Ex-d, category II 2G at least IIB T3.

Vibro-switches shall be provided with coil for reset, requiring power supply  230 V AC. Local reset button shall be also available.

## Structural Design

### Structural Design Code

The supporting structure shall be designed in accordance with EN 1090-2 EXC 2. Supplier shall be qualified according to EN 1090-1.

The supporting structure shall be designed considering the load conditions specified as per EN ISO 13706. The applied loads shall be specified by the Gas Cooler Supplier during the development engineering.

### Vibration Test

A shop test is required to verify compliance with the vibration limits. Fan blades shall be set at the design operating pitch for the test.

### Plenums

Plenums shall be continuous seal welded.

Each fan shall have its own plenum chamber effectively sealed off from adjacent plenum chambers.

### Mechanical Access Facilities

Suitable walkways, platforms, and ladders must be included for easy access during maintenance and repair activities.

All structural steel required to support platforms must be provided by the Supplier.

The Supplier shall furnish the necessary support legs / columns to provide a minimum vertical clear distance of 2.20 meters between the bottom of induced draft bundles or the fan guard of forced draft bundles including motors and accessories and the ground surface.

The Supplier shall provide safety screens for personnel protection devices at locations where operating or maintenance personnel might come in contact with high air-outlet temperatures or hot surfaces during normal operation.

The tube bundles shall be removable without removing the platform.

## Electrical Equipment and Instrumentation

The electrical part of the scope of supply includes the delivery, installation and final commissioning of all electrically controlled and supplied equipment necessary to operate the gas coolers in a specified manner.

### Electrical part scope of supply

The scope of electrical equipment supply consists mainly of:

* Motor control switchgear for gas coolers (shall be tagged as AVO-2),
* Control, instrumentation and low voltage power cabling interconnecting electrical components included in the scope of supply with the specified terminals for connection to equipment provided by others,
* Local lighting within the gas cooler structures,
* Terminal boxes, local control stations, maintenance switches,
* Potential equalization of all components in the scope of supply.

All electrical interfaces are shown schematically in document No. GCUI-TD-GOT-GEN-DWG-002 Electrical and I&C Interfaces for GCU - Schematics.

### Electric Power Supply

As battery limit the power connection terminals of the existing low voltage power distribution board (LVDB – at Inčukalns UGS it is tagged as TA-1) is defined.

Any upstream power switch(es) for the gas coolers equipment in the LVDB distribution board will be delivered by the Employer while the engineering data (also settings of thermal and instantaneous releases) of these switches will be under responsibility of the Supplier. Any necessary engineering data for switch (-es) must be handed over to the Employer at least 6 weeks after contractual agreement.

Electric power supply for all electrical consumers of the new gas coolers shall be provided from new AVO-2 switchgear, which shall be also Supplier’s scope of supply. The switchgear shall be placed in existing Power building. AVO-2 shall be fed from existing LVDB main switchgear (TA-1) by two independent incomers.

Available voltage system is 3x400/230 V, 50 Hz, TN-S. Any auxiliary necessary voltage levels for gas coolers equipment shall be generated by Supplier’s converters.

Electric power for main LVDB switchgear is provided from two transformers 20/0,4 kV, 1,6 MVA.

As a connection point (or points) of the new gas coolers power supply the spare outputs in mentioned existing main LVDB switchgear shall be utilized.

The power requirements have to be provided to the Employer as part of the offer.

Necessary uninterruptible power sources for the gas coolers shall be Supplier’s scope of supply (batteries, converters, inverters etc.).

### General Requirements

All scales and displays must adopt the metric system based on SI units.

#### Equipment

Supplier must ensure that selection of all equipment and components is based on simple maintenance, trouble-free fault detection and long maintenance intervals.

Equipment and utilities have to be designed for continuous operation with nominal power and in due consideration of the ambient conditions. Only components of proven industrial standard and high technical availability shall be used. They shall as far as possible be part of the Supplier’s standard supply program.

Equipment and components of identical kind and type must be used for equal or similar functions. In any case exchangeability must be guaranteed.

Depending on the installation and application, an ingress protection (IP) rating for enclosures in line with EN 60529 is required for the various electrical equipment. IP rating of devices shall be chosen according to their location.

All electrical equipment and components, including their installation peripherals, located in hazardous areas shall be in compliance with the requirements of the applicable IEC Ex-standards and the European product directive 2014/34/EU. The ATEX certificates are part of the documentation. Ex-certified equipment shall meet classifications of Zones (0,1,2), of temperature class (T1÷T6) and gas group (A,B or C) that shall be determined in document No. GCUI-CD-GOT-GEN-PRO-001 “Environment assessment protocol”.

Maintenance switches, vibration switches and junction boxes shall be placed together on Gas Cooler frame. For maintenance-switches and junction boxes access for operator inspection shall be from ground level. The electric motor shall be visible from the maintenance switch.

#### Tagging

All equipment, components and installations must be tagged with suitable nameplates of corrosion free material with long-lasting, light and weather proof labelling. Plates on cabinet front sides or other housings must be fastened by bolts. The Supplier shall apply his tagging procedures.

#### Design Basis

The complete electric installation has to be designed in a way that there is a spare power margin of 10% with respect to the maximum required power of the supplied system under worst case conditions.

#### Harmonic Distortions

It is Supplier’s obligation and part of the scope of supply that the gas coolers electric installation can be connected to the electric grid in such a way that no existing installation will be negatively influenced. Moreover, the Supplier has to ensure that the electric system itself can be operated failure-free when connected to the electrical grid.

The points of common coupling (PCC) are defined at feeding terminals in LVDB main switchgear.

The principles for the evaluation of the harmonic distortions can be found in the standards. Moreover, Supplier has to ensure that the power quality for all consumers connected to the energy supply still complies with the limits required by EN 50160 after connecting the gas coolers electrical installation to the grid.

The reference value for the short-circuit power at PCC shall be provided by the Employer.

To proof the conformity to the requirements of grid operator and standards, a network analysis must be carried out prior and after commissioning of the drive systems, especially concentrated on harmonics measurement at PCC (0,4 kV level) during VSD run (if VSD are present).

The two harmonics measurements should be performed as far as possible at identical conditions:

This means:

* Identical measurement device
* Identical or similar seasonal conditions.

Measurement process and procedure for data storage has to be elaborated by the Supplier and submitted to the Employer for review and approval.

A report, confirming the conformity to the specifications shall be issued.

#### Emergency electric shut down

The complete package has to be equipped with an emergency electric shut down system according to the requirements of this specification (EN 60204-1, category 0) as well as HAZOP/SIL requirements.

The shutdown philosophy will include the de-energization of the low voltage electrical installation of gas coolers.

As isolating switches the main incoming circuit breakers or disconnectors in AVO-2 can be used. Tripping must be ensured by undervoltage coils and normally closed push-buttons (or other safety contacts) connected in series.

#### Electromagnetic compatibility (EMC)

The essential requirement of the EMC is to prevent any current flow within the earthing or equipotential system. For this the whole power distribution system of the gas coolers package must follow the TN-S net characteristic acc. IEC 60364-1.

All electrical equipment supplied under this contract shall comply with the following requirements in regard to EMC:

* the harmonic content of the power supply is in accordance with IEC 61000-2-4, Class 3,
* the harmonic content caused by the equipment may not exceed the requirements of IEC 61000-2-2 for LV Variable Speed Drives.

#### Noise Emission and Noise Protection

All auxiliary drives and equipment noise shall be well below the EN 60034-9 sound power level limit value. The achievable values shall be given for the complete operating range.

A type-testing protocol must be provided as a proof.

### Earthing and equipotential bonding

The Employer provides an equipotential meshed grounding networks on the site.

Following groundings are available:

* Power earth (PE)
* Instrument earth (IE)
* Intrinsically safe earth (IS)
* Frame ground (FG).

All exposed conductive parts or elements of the gas coolers systems shall be connected to these networks by Supplier, according to its requirements.

### Motor control switchboard

The LV power distribution and feeding power towards the electrical consumers delivered with the gas coolers package shall be realized by a motor control switchgear tagged as AVO-2. The basic construction shall be realized by use of type tested switchboards in withdrawable design and possible exceptions in fixed-mounting design. Manufacturer shall follow the standard regulation according to EN 61439 and EN 60947, the equipment shall be suitable for operation and utilization according to EN 50110.

The AVO-2 shall be an industrial standard system, with interface to UCS.

To protect the equipment against lightning strikes, overvoltage arresters Class I+II shall be installed near the main power supply terminals of AVO-2 cabinet.

The AVO-2 will contain two independent feeders from existing outputs of upstream main LV switchgear. Each feeder shall supply its own bus-bar inside the AVO-2. Both bus-bars shall be interconnected through a coupling switch. Incoming disconnectors (or circuit breakers) and coupling switch in the AVO-2 shall be operated by an automatic power transfer device.

In case of short power failure of the common power supply (time to be defined by the Employer) and after its restoration, the UCS shall automatically restore the operation status of the whole equipment as it had before power outage. That means that no resets or pushing of buttons shall be required in order to return to normal operation.

For other requirement and specifications see doc. No. GCUI-CD-GOT-ELE-SPC-001.

### Cables and cable ways

Supplier shall use only cable types in accordance to the doc. No. GCUI-CD-GOT-ELE-SPC-006 “Cable and Cable Laying – Specification” .

The selection of the cross section is the responsibility of Supplier. Supplier shall consider the cable load, cable operation, environmental conditions, installation conditions and requirements of protective multiple earthing.

The maximum allowed voltage drops under full load conditions are the following:

* At motors during nominal load -5 %
* At heaters during nominal load -3 %
* At motor terminals during start up -15 %
* At lighting fixtures -2 %
* At switchgear bus-bars during start-up of the biggest motors -10 %

of the nominal voltage.

The cross section of power cables must be calculated on the basis for the following specified maximum conductor temperature:

* PVC – insulated cable 70 °C
* XLPE – insulated cable 90 °C

All cables shall comply with the core colour rules acc. EN 60445.

Cables have to be designed considering that the cable between the buildings will be routed in buried conduits.The cable laying will be performed based on the cable plot plans prepared and reviewed in close coordination with the Employer.

The Supplier installs the power, control and instrumentation cables interconnecting electrical cabinets and all consumers and other installations within the scope. In the power building the cables will be laid in indoor cable trays and ducts provided and installed by the Employer. The detailed engineering of these cables and the individual cable routing is part of the Supplier’s scope as well as the timely provision of the related engineering results to the Employer.

The cableway construction within the gas coolers structures is carried out by the Supplier in accordance with its needs.

The cables between a Power building and gas coolers shall be laid in ground in protective ducts or multi-ducts. Excavation works, cable duct supply and backfilling of cable trenches have to be provided by Employer.

The power cables from the LVDB distribution board towards Supplier’s electrical cabinets will be installed in indoor cable tray systems, provided and installed by the Employer. The detailed engineering of these cables considering the individual cable routing is part of the Supplier’s scope as well as the timely provision of the related engineering results to the Employer. The Employer himself will separately organize cable installation work for the commissioning phase of the plant to aim a concentrated cable installation works for all cabling between buildings for any discipline on site. In this issue, the outer structures of the gas coolers are the boundaries of responsibility between the Employer and Supplier, regarding cable route preparation.

Any installation and deliverables on gas coolers structures are under Supplier’s scope.

Cables for power systems and signal systems shall be routed as far as possible separate from each other. Above grade power cables and signal cables must be laid in separate cable trays and protecting tubes.

For intrinsically safe cables separate routes are to be planned as well. Intrinsically safe cables can be laid together with other signal cables in the same cable trays on the condition that proper separation is ensured.

Separation of underground cables shall be achieved by placing individual types of cables according to the voltage level in separate pipes or compartments of multi-ducts.

Supplier’s cable tray system shall be made of hot dipped galvanized material. Cable trays must be connected to the earthing system at every distance of 20 m, also at the route ends.

Cable laying and testing must met requirements described in the aforementioned doc. No. GCUI-CD-GOT-ELE-SPC-006 “Cable and Cable Laying – Specification”.

### Local lighting

The whole site is already equipped by outdoor floodlights installed on 23 m high masts. The average illuminance is claimed to be 10 lx.

For a rare servicing of switches, valves etc. a local lighting of gas coolers is proposed. Illuminance of outdoor local devices for such purposes shall be necessary to provide by local lighting fixtures. The average illuminance of such objects shall be at least 20 lx at a height of 1 m (for service of valves, motors starting etc.). Ratio between minimum and average illuminance shall be min. 0,25.

Fixtures installed in hazardous areas shall be ATEX certified. As light sources LED modules shall be used preferably.

Switching of local lighting shall be done by means of local 2-pole switches located nearby illuminated areas. Luminaires power supply shall be 230 V AC.

## Materials

All Tubes shall be seamless and cold drawn and shall be subjected to non-destructive testing at mill.

All carbon steel and low alloy steel material including forgings used for pressure parts shall be procured in normalized condition.

Plates having thickness of 16 mm to 50 mm shall be examined ultrasonically as per EN 13445, both on surfaces and on edges. Ultrasonic examination shall be done after heat treatment.

Use of cast iron is not permitted.

All materials for pressure containing parts shall be charpy-tested to at least 27J at the lowest design temperature of -40°C, according to PED.

Yield strength for all materials for pressure containing parts shall be confirmed at the maximum design temperature of 110°C.[[1]](#footnote-1)

## Fabrication

### Welding

Welding procedures and welders shall be qualified to the requirements of EN 13445 and welding shall be performed in accordance with the PED.

### Tube to Tubesheet Joints

Supplier shall guarantee that the yield strength of the tube material does not critically exceed the yield strength of the tubesheet material in order to insure that quality rolling, expanding and sealing of tubes to tubesheet is attained. When necessary, the Supplier shall upgrade the tubesheet material and/or strength weld the tube to tubesheet joints.

All welded tube to tubesheet joints, whether seal welded or strength welded, shall be fully expanded.

## Earthing

Permanent conductive bonding of all metallic parts of the Gas Cooler shall be ensured. The requirements of the Earthing and Lightning Protection – Specification (GCUI-CD-GOT-ELE-SPC-007) shall be considered.

The Gas Cooler shall be provided with at least two earthing lugs, one each on opposing sides.

## Painting and Protective Coating

Steel Structure, Ladders, Handrails etc. shall be hot-dip galvanized according to EN ISO 1461.

Header shall be painted as per Supplier standard.

Painting and coating shall provide durability M according to EN 12944-1 at atmospheric corrosivity category C3 according to EN 12944-2. A dry-film-thickness of at least 200μm shall be provided.

Supplier shall forward the applicable painting and coating specification for Employer’s approval.

The topcoat colour will be specified by Employer latest 1 month after contract award.

## Inspection and Testing

### General

The Scope of Supply shall include the cost for EN 13445 / PED (Module G) inspection and stamping.

The Supplier shall be responsible for testing of the equipment to ensure that the operational performance complies with the requirements specified within this document and associated referenced documents.

### Quality Control

The inspection requirements, as well as the witness and hold points, shall be defined in an Inspection and Test Plan (ITP). The ITP shall be sent to the Employer for approval.

### Hydrostatic Testing

Gas Cooler bundles shall be hydrostatic tested in accordance with EN 13445 and PED.

Joints taken apart after hydrotest shall be retested, except when joints are taken apart to replace test gaskets.

Tube seal welded joints shall be air and soap tested prior to and after final rolling.

Gasket coatings other than graphite in combination with oil or grease are prohibited.

For the hydrostatic pressure test, water with corrosion inhibitor shall be used.

After the hydrostatic test, the bundles shall be dried (dewpoint 0 °C at atmospheric pressure) and the process shall be documented in a written record. The Employer reserves the right to inspect the bundles after drying.

### Examination

The equipment and its components shall be inspected by Employer or its authorized representative based on approved ITP and quality assurance procedures at all stages of manufacturing, starting from raw material to completion. The inspection made by Employer or its authorized representative shall not absolve the Supplier from his responsibility to exercise such quality assurance procedures so as to assure that the requirements and intent of the specification are satisfied. The Employer’s Representative shall be per-mitted access to the works during all phases of fabrication and testing.

All welding of pressure parts shall be 100% radiographed, if not feasible the same shall be UT tested as per EN ISO 17640. All nozzles of header welds shall be 100% ultrasonically tested. All fillet welds on pressure parts and attachment welds over pressure parts shall be 100 % Magnetic Particle tested to EN ISO 17638.

### Shop Inspection

At the time of the shop inspection a, at least preliminary, certificate of conformity according to PED is required.

The shop assembled Gas Cooler shall be given a shop run-in test for the driver, drive assembly and fan. Fan blades shall be set at the design operating pitch.

The shop run-in test shall be performed with the Gas Cooler completely assembled. During this test the fan(s) shall be run for a period of 1 hour at full speed. The vibration shut down system shall also be tested and compliance with the vibration limits verified. Sound pressures shall be determined at a variety of locations covering a 360 degree sample, at 1 m radius around the Gas Cooler.

After shop run-in test is completed, all structural supports shall be matchmarked and then disassembled. Matchmarking shall be stamped into the structural components in clearly visible and uniquely distinguishable manner.

The Supplier shall conduct inspection and tests on materials, components, equipment and assembled unit according to the requirements specified in section 7 of EN ISO 13706, to the instructions specified in the actual specification and all other applicable standards.

Test results shall be filled as test declarations, records, and certificates and shall be submitted to the Employer.

The Employer reserves the rights to witness all tests by his own personnel or it’s Representative. The Employer shall be informed, in writing, two weeks before the shop inspection.

## Preparation for Shipment

### General

Successful shop test is required prior to shipment of the Gas Cooler.

The Gas Cooler shall be cleaned and thoroughly drained after the hydrostatic test. All surfaces shall be thoroughly cleaned of grease, scale rust and weld splatter. All scale and debris shall be removed from the internal surfaces of the Gas Cooler and the external surfaces of all welded joints.

Temporary bracing provided for transportation and/or installation shall be bolted in place (not welded). Temporary bracing shall be painted yellow and marked with large lettering “REMOVE BEFORE OPERATING” or similar warning.

The Supplier may check / measure the Gas Cooler foundation provided by Others prior shipment.

### Surface and Finishes

Flanged connections shall be protected against corrosion by the application of an easily removable rust preventative coating, and be provided with cover plates.

### Supplementary Requirements

Supplemental requirements shall apply when the conditions listed in EN ISO 13706 sub clause 12.1 occur.

## Site Acceptance Test

The Gas Cooler shall be subjected to a site acceptance test after it has been erected at the site. The site acceptance test shall include, but is not limited to the following:

* Visual examination
* Successful operation of the fans, vibration switches and other auxilliary devices.
* Proven ability to meet the cooling duty without exceeding the maximum specified pressure drop and noise emissions at the operating conditions stated on the data sheet.
* Check of complete as-built documentation

The compressor station, including the Gas Cooler, will be leak tested prior commissioning. The Supplier is required to provide immediate measures should any leaks be detected at the Gas Cooler. The Supplier may be present for the leakage test.

## Guarantees

The Gas Cooler shall be guaranteed to perform within the design constraints as specified in the data sheet. The following performances as indicated in the gas cooler datasheet shall be guaranteed at design conditions:

* + 1. The maximum outlet gas temperature at design condition is equal to 40 °C. Higher outlet gas temperature is not accepted. This case refers to +33,5 °C ambient temperature. For lower ambient temperatures the guaranteed cooler duty has to be proven accordingly.
    2. The maximum total pressure drop from inlet nozzles to outlet nozzles at design conditions is < 300 mbar.
    3. The maximum consumed electric power per electric motor shall be as specified in the electric load list.
    4. Noise limit: The sound pressure level generated by the Gas Cooler in operation at the rated conditions shall be ≤ 80 dB(A) in a distance of 1 m. The value is applied to the whole system: motor, transmission, fan-bundle, header, nozzle, and associated piping and will be verified at site by third party. No notable tone shall be present.

Any special instructions or procedures regarding handling, storage, preservation or pre-commissioning work which are pre-conditions for the validation of the Guarantee on the goods by the Supplier shall be listed in the relevant certificate of conformity provided by the Supplier.

Any approval of documents shall not relieve the Supplier of his overall responsibilities and obligations.

## Nameplates

The nameplate shall be Stainless Steel and shall include at least the following information:

* Design Code and CE marking
* Tag number
* Purchase order number
* Maximum allowable working pressure and temperature
* Manufacturer name and year fabricated
* Manufacturer serial number
* Hydrostatic test pressure
* Header minimum thickness

# DOCUMENTATION

## General

This section covers the documentation required for the design, fabrication and testing for the equipment, components and services to be provided according this specification.

All correspondence, drawings, instructions, data sheets, design calculations and any other written information shall be in English language, except the Operation and Maintenance manuals which shall be in English and Latvian.

Documents which are mandatory for a Third-Party approval have to be in Latvian language. The translating and any other additional costs for this procedure are in scope of the Supplier.

Units of measurement within the Supplier documentation will be in accordance with the International System of Units (SI units). Use of non-SI units is permitted for certain nominal dimensions for reference only (i.e. pipe diameter).

## Documents for Quotation

The Supplier shall submit at least the following documents with the quotation:

* QA certification (ISO 9001)
* Time schedule including delivery
* Filled-in Gas Cooler Datasheet (GCUI-TD-GOT-MEC-DAT-003)
* Preliminary arrangement drawing with key dimensions and location of junction boxes
* Design data and basic thermal calculation (with and without 10% margin on sur-face area and fan air supply)
* Electrical consumer list with all loads
* MCC and Control Cabinet preliminary design
* List of recommended spare parts for commissioning and three years operation (including prices)
* List of special tools (including prices) if any
* Detailed Technical Description
* List of Sub-Suppliers
* Deviation List (stating “no deviations” if none)

## Documents after contract award

All documents are subject to review / approval.

Delivery times start with contract notification.

Table 5.1 - Documents after contract award

| Document | Delivery Time |
| --- | --- |
| List of Deliverables (LOD) | 2 weeks |
| Detailed time schedule for planning, fabrication, testing and delivery | 2 weeks |
| Final Gas Cooler Datasheet GCUI-TD-GOT-MEC-DAT-003 | 4 weeks |
| General Arrangement Drawings | 4 weeks |
| Inspection and Test Plan (ITP) | 4 weeks |
| Foundation guide drawing and static and dynamic loads for detail engineering of civil work by Others | 6 weeks |
| Foundation detail drawings of anchoring | 6 weeks |
| Electrical consumer list | 6 weeks |
| Equipment datasheets | 8 weeks |
| Wiring Diagrams | 8 weeks |
| ATEX certifications | 8 weeks |
| Balance certificate for fans | 10 weeks |
| Static calculation of steel structure | 10 weeks |
| Spare part list for 2 years operation | 10 weeks |
| Operation and maintenance manuals | At delivery of Gas Cooler |
| Final documentation including inspection reports and material certificates | At delivery of Gas Cooler |
| CE-Declaration of Conformity / Certificate of Conformity | At delivery of Gas Cooler |
| Welding and NDE procedures / qualifications | At delivery of Gas Cooler |
| Testing procedure for shop and site | 10 weeks prior test |
| Packing list | 8 weeks before delivery |
| Progress reports | monthly |

All documents shall be issued in “as-built” revision before end of contract (prior last payment). The as-built documentation shall be handed over to the Employer two times as hardcopy and once digital in PDF and native file on CD.

## Progress Report

The Supplier shall supply a schedule showing the documents for review and approval, material procurement and a production / installation progress.

The schedule shall be updated on a monthly basis.

## Drawings

General arrangement drawings shall be submitted to the Employer / Contractor for review and approval. "Approved" status drawings shall be issued after final approval. Documents prepared by the Supplier must be submitted also in an editable form (\*.docx, \*.xlsx, \*.dwg etc.).

The components and process to produce the ordered Equipment shall be shown in sufficient detail to be fully appraised, e.g. plating drawings, shall as a minimum, show the position of all through thickness welds, together with material thicknesses and specifications, clearly indicating the welding procedure specification which is applicable to each weld.

General arrangement drawings shall be to scale and show the relative location and main dimensions of all components including elevations and orientations of bars, nameplates and nameplate details.

# Detail drawings which may be included on the general arrangement shall include thicknesses and dimensions of all components, weld details, machining and surface finish requirements and nameplate details.QUALITY ASSURANCE

Supplier shall operate an effective QA System which, as a minimum, shall comply with the requirements of ISO 9001, a copy of their ISO 9001 Certificate shall be provided.

A project specific Quality Plan specifying quality controls for the product shall be provided. The Plan shall address all applicable parts of the Scope of Supply including Sub-Supplier activities. Where Sub-Supplier Quality Plans are submitted such plans shall be approved by Supplier prior to submission.

## Inspections

Examination or tests may be reviewed or witnessed by Employer or its authorized representative at the Supplier’s facility. A general inspection of the facility for quality control procedures may be made as selected by the representative.

Repairs shall also be inspected as selected by the Employer’s representative after the repairs have been completed.

## Refurbishments

Refurbishment is not permitted unless specifically authorized and if the requirements of this specification are satisfied.

## Major Repairs

Major repairs shall not be performed without authorization by Employer.

# SHIPPING AND LOADING

After testing, painting and preservation the coolers shall be adequately protected for shipping such that handling damage during shipping is prevented. The packaging must be such that the equipment can be stored outdoors for up to one year. The Supplier shall notify Employer / Engineer of the shipping date at least forty-eight (48) hours prior to shipment. All documentation in accordance to chapter 5 shall be sent to Employer / Engineer for approval before shipping of coolers.

1. To be confirmed by the compressor manufacturer [↑](#footnote-ref-1)