ECMWF/RFP/2025/397

FOR

PROVISION AND INSTALLATION OF AN ADDITIONAL CHILLER UNIT

AT

ECMWF DATA CENTRE, BOLOGNA, ITALY

ANNEX 1 SPECIFICATION OF REQUIREMENTS:

Annex 1B- Specifications

Contents

1. GENERAL INFORMATION

1.1 SUBJECT OF THE CONTRACT

This report outlines the characteristics and installation procedures of the new chiller unit designated CH2n, the tenth chiller planned for the rooftop of Building L2.

The chiller was already included in the preliminary design of the technical plant and is now to be installed to increase cooling capacity and system redundancy for the ECMWF Data Centre in Bologna.

1.2 RELEVANCE

All equipment and materials must be of sufficient quality to be installed in full compliance with best industrial practices and in accordance with applicable laws and regulations.
Any defective or damaged equipment or materials during installation or testing must be replaced or repaired to the satisfaction of the Site Supervisor.

1.3 CIVIL WORKS SUPPORT

In addition to all requirements specified in the mechanical system drawings and documentation regarding foundations, trenching, minor drilling, excavation, backfilling, etc., all civil works support shall be borne by the contractor responsible for the mechanical systems.

1.4 OFFICIAL TEST CERTIFICATIONS

Where required by current regulations, particularly fire prevention standards, supplied materials must be accompanied by the necessary certifications as per Ministerial Decrees dated 6/7/1983, 26/6/1984, and 28/8/1984.
All equipment specifically required by the tender documents must bear the CE marking in compliance with Machinery Directive 89/392.

1.5 INSTRUCTIONS

The Contractor shall provide complete documentation for commissioning, operation, and maintenance, including safety instructions for each system component.
During the warranty period, the Contractor shall train the Client’s technical personnel in the use, programming, management, and maintenance of the equipment to ensure autonomous operation for routine maintenance and management.

1.6 MATERIAL AND WORK SUBMISSION PROCEDURE

Before using any material or commencing any work, the Contractor must submit a dedicated material and work approval form detailing the type and quality of materials and the proposed execution method.
Subject to approval by the Site Supervisor, the Contractor may propose valid alternatives that comply with current regulations and maintain the same cost level.
No material may be used or work carried out without prior approval from the Site Supervisor.

1.7 SHIPPING AND STORAGE

Equipment and materials must be properly stored, adequately protected, and carefully handled to prevent damage before and during installation.
Transport, storage, and protection must follow the manufacturer's recommendations.
Any damaged or defective items must be replaced.

1.8 CATALOG PRODUCTS

Unless otherwise specified in the technical documentation, materials and equipment should preferably be standard catalog products from the selected manufacturer and must be the latest compatible models.
If multiple units of the same equipment type are required, they must be from the same manufacturer.
Each main component must bear a clearly visible and securely attached nameplate indicating the manufacturer's name, address, model code, and serial number.
Nameplates showing only the representative's name will not be accepted.

1.9 ELECTRICAL SYSTEM REQUIREMENTS

Electrical materials shall be supplied together with the associated equipment and must comply with the requirements set forth in the Electrical Systems Tender Specifications attached to the contract.

1.10 ACCEPTANCE CONDITIONS

All materials, equipment, and supplies used in the works must be of the highest commercial quality, comply with current legislation, and meet the specifications of this Tender Document and other contractual documents.
To clarify the minimum acceptable quality standards, the following articles specify the main requirements for materials and equipment.

The Contractor shall ensure that all materials and equipment used during the works maintain the same characteristics as those approved by the Site Supervisor.

1.11 WORK SEQUENCE

The Contractor shall carry out the works in successive phases according to the sequence defined in the architectural specifications.
The Contractor shall maintain a daily updated copy of the system drawings, showing the actual routing of pipes and ducts and the exact positioning of equipment.
Upon completion, the final as-built status shall be transferred to digital format and delivered to the Site Supervisor, who will forward a copy to the Client and archive the originals for future reference in case of modifications or upgrades.

1.12 EXECUTION METHOD

All works must be executed in accordance with best practices and the instructions of the Site Supervisor, ensuring full compliance with the conditions set forth in this Tender Document.
Execution must be coordinated with and subordinate to any constraints arising from the simultaneous execution of other works by third-party contractors.
The Contractor shall be fully responsible and financially liable for any damage caused to the building works by its personnel or subcontractors.

1.13 SYSTEM REQUIREMENTS AND DESIGN DATA

Design data are detailed in the descriptive report and technical specifications for the mechanical systems, which form an integral part of this Tender Document.
The technical characteristics of materials and equipment, as well as installation methods, must comply with the specifications outlined in the following chapters.

1.14 WARRANTY

The Contractor is required to guarantee all systems and works for the quality of materials, equipment, installation, and proper operation for a period of one year from the approval date of the final test certificate.
During this warranty period, the Contractor shall promptly and at its own expense repair any faults or defects due to poor material quality, installation errors, or malfunctioning, excluding only those caused by improper use, poor fuel quality, or normal wear.
If the Contractor is called upon during the warranty period to correct any defects, it must repeat, at its own expense, the preliminary tests and final commissioning of the affected systems.

The Contractor shall also restore any elements removed or altered during the repair, including civil works, and the Client reserves the right to claim compensation for any damages incurred.

1.15 OPERATION AND MAINTENANCE MANUAL

For each installed equipment component, an Operation and Maintenance Manual shall be provided in both Italian and English.
These manuals shall be supplied in duplicate and organized in binders.
The manual shall be delivered prior to contract completion and shall include a table of contents, with content arranged accordingly and reference indicators placed before each relevant instruction.
Instructions must be clear, legible, and easy to consult.
The manual shall include:

- Power, auxiliary, and control electrical diagrams with explanatory data for the operation and control of each component
- Control sequence detailing start-up, operation, and shutdown procedures
- Description of the function of each main component
- Start-up and operational procedures
- Shutdown instructions
- Installation instructions
- Maintenance instructions

The equipment list section shall indicate sources of supply, recommended spare parts, and service organization.
The manual shall be complete in all aspects concerning equipment, controls, accessories, and any additions necessary for proper installation.

1.16 DECLARATION OF CONFORMITY AND AS-BUILT DOCUMENTATION

Upon completion of the works, the Contractor shall deliver all as-built drawings in digital format, including general and detailed drawings with dimensions, accurately reflecting the actual execution of the works.
Additionally, the following shall be provided:

- Final test certificates
- Supplier warranties

- Declarations of conformity in accordance with former Law No. 46/90 and Ministerial Decree No. 37 dated 22/01/2008
- Technical data sheets for all installed materials and equipment

1.17 LABELLING AND IDENTIFICATION MARKINGS

All circuits and components must be clearly identifiable through labelling that references the AS-BUILT drawings, colored arrows indicating fluid flow directions, circuit nomenclature, etc.
The proposed identification system must be submitted for prior approval by the Site Supervisor.

1.18 CONTRACTOR'S RESPONSIBILITIES – CHILLER INSTALLATION

The Contractor shall carry out the installation of the new chiller unit on the rooftop of Building L2.
The Contractor is responsible for coordinating with the supplier regarding the delivery schedule to the designated location. The equipment shall arrive on site pre-tested at the factory.
The Contractor shall ensure proper installation, on-site testing, and correct operation of the equipment.

The initial start-up of the equipment shall be performed by specialized personnel from the equipment manufacturer and shall be at the expense of the supplier.
Should any installation defects be identified during initial start-up, the Contractor shall be responsible for restoring the required conditions to ensure optimal installation and operation.

The Contractor shall provide all necessary works for installation, including lifting operations (e.g., cranes), and any other requirements essential for proper installation.
The Contractor is obliged to guarantee all systems and works, including installation and proper operation, for a period of one year from the approval date of the final test certificate.

1.19 TESTING

Factory Acceptance Tests (FAT) shall be conducted for the new equipment. The following conditions apply:

- FAT includes development/approval tests and witness tests of components or pre-assembled systems performed at the manufacturer's facility

- FAT is intended to prevent non-repairable defects (especially in long-lead items such as generators) from reaching the site
- Certain component tests may not be feasible on-site
- A minimum of three tests shall be conducted, with operating conditions defined during the order confirmation phase
- Tests shall be performed by the manufacturer's personnel and repeated if any required parameters are not met

A detailed test report shall be issued on company letterhead by an internal technician, documenting the results of each test.

1.20 DOCUMENTATION, INFORMATION TRANSFER, TRAINING

1.20.1 AS-BUILT STRUCTURE DOCUMENTATION

The following documentation shall be provided:

- Owner's project requirements
- Employer's requirements – Design basis
- Technical presentation
- Construction drawings
- Installation and O&M manuals
- Commissioning report describing the process, including:
    - Startup procedures and checklists
    - Pre-functional tests
    - Functional tests
    - Integrated system tests
    - Recorded actual values (pass/fail criteria)
    - Use of automated data collection technology (permanent and temporary installations)

- System operation and maintenance manuals describing the facility and infrastructure as-built, organized by system, including:
- System descriptions, single-line and/or shop drawings
- Operation sequences
- Approved final submittals
- Factory and integrated system test reports
- Standard operating procedures (normal, maintenance, emergency, recovery)
- Installation and O&M manuals, parts lists, etc.
- Warranties and Service Level Agreements

2. REFERENCE STANDARDS

The design and execution of the systems shall comply with the applicable technical standards, laws, and regulations listed below. This list is not exhaustive.

- Fire prevention and accident safety standards, specifically related to the installed systems and materials used
- UNI standards; applicable technical specifications
- CEI standards; applicable technical specifications
- ASTM standards; applicable technical specifications
- EC Regulation No. 3093 of 15 December 1994 and Legislative Decree No. 193 of 12 April 1996
- Requirements under Article 46, paragraph 3, of Legislative Decree No. 277/91 regarding noise emission characteristics of equipment and systems
- Local Fire Brigade requirements and recommendations
- Applicable municipal regulations
- Ministerial Decree No. 37/2008 – Safety standards for systems and related implementation regulations
- Legislative Decree No. 626 of 19/09/1994 – Implementation of EU directives on worker health and safety
- Legislative Decree No. 93 of 25/02/2000 – Implementation of Directive 97/23/EC on pressure equipment
- ANSI/TIA-942-2005
- ASHRAE Standards 20/2017 and 90.1/2010
- Legislative Decree No. 192 of 19/08/2005 – Implementation of Directive 2002/91/EC on energy performance in buildings
- Legislative Decree No. 311 of 29/12/2006 – Amendments to Legislative Decree 192/2005
- Legislative Decree No. 28 of 03/03/2011 – Implementation of Directive 2009/28/EC on renewable energy

- Presidential Decree No. 59 of 02/04/2009 – Implementation of Legislative Decree 192/2005
- UNI 7939-1 – Terminology for automatic regulation of comfort systems – Heating systems
- UNI 8011 – Refrigeration systems – Safety requirements
- UNI EN 378-1 to 378-4/2012 – Refrigeration and heat pump systems – Safety and environmental requirements
- UNI EN 14511-1 to 14511-4/2022 – Air conditioners, liquid chillers, and heat pumps with electrically driven compressors – Definitions, test conditions, methods, and requirements
- UNI 8199 – Acoustics – Acoustic testing of HVAC systems – Contractual guidelines and measurement methods
- UNI 9432 – Acoustics – Determination of personal noise exposure in the workplace
- D.P.C.M. 01/03/1991 – Maximum noise exposure limits in residential and external environments
- Law of 26/10/1995 – Framework law on noise pollution
- D.P.C.M. 14/11/1997 – Determination of noise source limits
- D.P.C.M. 05/12/1997 – Determination of passive acoustic requirements of buildings
- Ministerial Decree 16/03/1998 – Techniques for detecting and measuring noise pollution
- ASHRAE 90.1-2010 – Energy Standard for Buildings Except Low-Rise Residential Buildings

3. VERIFICATIONS, TESTS, COMMISSIONING, DECLARATIONS, AS-BUILT

Upon completion of the system, the following commissioning verifications shall be carried out:

- Compliance with legal requirements
- Compliance with specific conditions agreed during the tender phase

Commissioning procedures shall follow, in addition to the standard ones listed below, the guidelines of TIA STANDARD 942/2015.

3.1 VISUAL INSPECTION

A visual inspection shall be performed to verify that the systems have been installed in accordance with general and specific standards applicable to the installed system.
This inspection shall confirm that materials and equipment comply with relevant standards and show no visible damage that could compromise safety.
These inspections shall begin during the execution phase.

3.2 COMPONENT VERIFICATION

All installed components shall be verified to ensure they are suitable for the installation conditions and environmental characteristics.

3.3 COMMISSIONING

3.3.1 TECHNICAL COMMISSIONING STANDARDS

The system shall undergo a series of tests over time to verify full compliance with the technical specifications and its actual functionality.
All fluids and energy required for testing shall be provided by the Contractor.
For each test described below, the Contractor shall prepare an official report to be submitted to the Site Supervisor and filed in dedicated binders.
The commissioning test schedule must be communicated in advance to the Site Supervisor, who reserves the right to attend.

3.3.2 VERIFICATIONS AND TESTS

The specified tests shall be performed during the execution phase and in any case within one month of installation and adjustment of each system component.
Preliminary verifications and tests shall be conducted jointly by the Site Supervisor and the Contractor.

If the Site Supervisor finds any non-compliance with the specifications, the final acceptance report shall only be issued after confirming that all necessary modifications, additions, repairs, and replacements have been made to ensure proper system operation. Successful preliminary tests shall not exempt the Contractor from fulfilling warranty obligations after commissioning.

4. MATERIAL TECHNICAL SPECIFICATIONS

4.1 PIPING

4.1.1 STEEL PIPING

Steel piping for the connection of the new chiller unit shall be made of black drawn steel in accordance with UNI EN 10255 (medium series) for diameters up to 4", and UNI EN 10216-1:2014 for larger diameters.

a) For diameters from DN 125 (5”) to DN 400

Seamless commercial black steel pipes, Fe 330 grade, in accordance with UNI EN 10216:2014 (with various temperature ratings), using only the nominal diameters listed below. Alternatively, Fe 320 grade pipes per UNI EN 10216-1:2014 may be used for the same nominal diameters:

NOMINAL DIAMETER	OUTER DIAMETER (MM)	WALL THICKNESS (MM)	WEIGHT (KG/M)
DN 125 (5”)	139.7	4.0	13.5
DN 150 (6”)	168.3	4.5	18.1
DN 200 (8”)	219.1	5.9	31.0
DN 250 (10”)	273.0	6.3	41.6
DN 300 (12”)	323.9	7.1	55.6
DN 350 (14”)	355.6	8.0	68.3
DN 400 (16”)	406.4	8.8	85.9

Flanges shall be butt-weld type in accordance with UNI EN 1092:2013 and subsequent revisions, based on nominal operating pressure. Blind flanges shall comply with UNI EN 1092:2013.
All flanges shall feature sealing face per UNI 2229-67 and collar outer diameter matching pipe outer diameter (ISO standard).
Gaskets shall be Klingerite type, 2 mm thick.
Bolts shall be hex-head with hex nuts per UNI 5737 or UNI 5739, strength class 8.8, and nuts per UNI 5588, strength class 8G. For outdoor applications, bolts shall be cadmium-

plated or stainless steel.
Elbows shall be seamless, short-radius, stamped steel per UNI 7929-79 and subsequent standards for diameters above DN 20.
Fittings and branches shall be black steel per UNI ISO 3419.
Cold-bent elbows may be used up to a maximum diameter of 1¼".
Segmented or pinched elbows shall not be permitted under any circumstances.

For piping with Victaulic-type joints, refer to section 4.2.

Pipe sizing and pressure drop calculations shall be based on the following parameters:

- Maximum water velocity: 2 m/s
- Total pressure drop (continuous and localized): between 100 and 300 Pa/m

Use of pipes, even stainless steel, that are visibly oxidized due to prolonged exposure on site shall not be permitted if oxidation exceeds 1/100 of the pipe wall thickness.
Likewise, galvanized pipes with compromised coating integrity due to site handling shall be rejected, even if damage is minor.

Steel piping joints shall be made using reinforced malleable cast iron threaded fittings up to 1½" diameter.
For larger diameters, joints shall be made by autogenous welding or Victaulic system.
Welding shall be performed using arc or oxy-acetylene methods, free of slag, and executed by certified welders.

Indoor piping and equipment shall be installed away from lighting fixtures, doors, windows, and other openings.
Overhead piping shall be as inconspicuous as possible.
Adequate clearance shall be maintained from walls, ceilings, and floors to allow for joint welding.
Piping shall be allowed to expand and contract freely.

Pipes shall not be embedded, covered, or insulated until they have been inspected, tested, and approved.
Materials and equipment shall be protected from weather conditions.

Branch connections to main headers shall be made using directional fittings aligned with fluid flow.
Transitions between different pipe diameters shall be made using appropriate conical reducers.
Direct insertion of smaller diameter pipes into larger ones shall not be permitted.

Use of sharp elbows or bends with a radius less than 1.5 times the pipe diameter shall also be prohibited.

ADDITIONAL REQUIREMENTS FOR STEEL PIPING INSTALLATION

- Beveling of fittings at 37° and 50°
- Removal of slag using hammering, chiseling, etc., to ensure clean and burr-free surfaces
- Use of shielded conductors for arc welding machines to eliminate the risk of induced currents
- Complete fusion of filler metal with base metal in a homogeneous manner

Welds shall be free of slag and executed by certified welders qualified for this type of work.
Steel galvanized piping networks shall be equipped with reinforced malleable cast iron fittings and branches, flanged and heavily galvanized.
As previously stated, elbows with a bending radius less than 1.5 times the pipe diameter shall not be permitted, except for small diameters (3/8", 1/2", 3/4").
The use of right/left threaded couplings shall not be allowed; where necessary, sliding threaded fittings with locking nuts shall be used.

Threading for special fittings must be proportioned to ensure continuity of the galvanized coating.
Only high-quality sealing materials shall be used for threaded connections, and they must be non-putrescible and resistant to degradation over time.

Fluid distribution networks with horizontal runs shall be installed level, avoiding reverse slopes against the direction of flow.
Special attention shall be paid to HVAC piping to avoid high points that cannot be vented, which may hinder fluid circulation.

Pipe and equipment supports shall be made of steel profiles, both static and seismic-rated, free of visible oxidation, and hot-dip galvanized.
Anchors, prefabricated special profiles, and related bolts shall be made of galvanized or cadmium-plated steel.

Pipe and support installation shall allow for continuous insulation coverage, even at support points, and permit free thermal expansion.
All black steel pipes under installation shall be sealed at open ends with appropriate caps to prevent ingress of dust or debris. Nylon, plastic, or cloth closures shall not be permitted.

Steel pipes stored on-site shall be protected from weathering to prevent oxidation (for black steel) and chemical degradation (for galvanized steel).

The routing of horizontal and vertical piping as shown in the construction drawings must be strictly followed.
Any deviations due to force majeure or system changes must be submitted for prior approval by the Site Supervisor.

All piping shall undergo pressure testing after installation.
Test pressure shall be 1.5 times the maximum operating pressure.
The system shall be maintained under pressure for 24 hours using recording manometers and photographic documentation.
During this period, inspections shall be carried out to identify and eliminate any leaks.
The Site Supervisor reserves the right to request repeat testing.

After hydraulic testing and before commissioning, all piping shall be thoroughly flushed.
Flushing shall be performed by draining water through appropriate outlets until it runs clear.
Final cleanliness shall be verified in the presence of the Site Supervisor.

4.2 VICTAULIC-TYPE GROOVED JOINT SYSTEM

4.2.1 GENERAL REQUIREMENTS

Mandatory Conditions

- Grooved joints must be accompanied by a Declaration of Performance (DoP) in accordance with EU Regulation No. 305/2011 (Construction Products Regulation), and comply with harmonized standard EN 10311:2005 – “Joints for the connection of steel tubes and fittings for the conveyance of water and other aqueous liquids.”
- Grooved joints must meet a safety factor of 3:1 relative to nominal operating pressure.
- Grooved products must be documented with manufacturer’s drawings and technical data sheets, and clearly identified by type or serial number.
- The manufacturer of grooved-end products must be ISO 9001 certified.

- Products must originate preferably from the EU; North American origin (US/CA/MEX) is also acceptable. Products from other regions are not permitted.

Quality Certification

- All certifications and declarations must be issued directly by the manufacturer of the grooved system; documentation from resellers or intermediaries will not be accepted.
- To ensure component compatibility and uniformity, all grooved products must be supplied by the same manufacturer.
- Roll grooving machines used for pipe preparation must be from the same manufacturer as the grooved components.
- A qualified representative from the manufacturer must train site personnel on the use of grooving machines and installation of grooved products.
- The same representative, in coordination with the installer and/or Site Supervisor, must conduct periodic site inspections to verify correct installation.
- The Contractor must remove and replace any improperly installed or non-compliant products.
- Vibration Attenuation. The grooved system must allow vibration attenuation for pumps and other equipment without the use of rubber anti-vibration joints.
- The following must be provided:
- Manufacturer’s engineering sheet detailing the technical solution and grooved products to be used (series/code)
- Independent test results demonstrating effectiveness, including test conditions (pipe diameters, vibration frequencies)
- Thermal Expansion Compensation. Expansion must be compensated using maintenance-free grooved components, without deformable metal parts.
- Solutions must follow the manufacturer’s engineering documentation:
- Angular compensation via flexible grooved joints (OGS/AGS system)
- Axial compensation via grooved expansion joints, maintenance-free and without deformable metal elements (e.g., bellows)

- Seismic Risk. The joint manufacturer must provide independent test results demonstrating mechanical resistance under seismic conditions, with measured accelerations not less than 6g and water pressure not less than 10 bar.
- The grooved system manufacturer must provide engineering documentation for seismic configurations (e.g., pipe crossings at structural/seismic joints).

Permanent Join

- The gasket must be made of synthetic elastomer, compatible with the outer diameter of the steel pipe and the groove housing, as specified in ASTM D-2000, and must be manufactured by the joint producer (commercial or untraceable materials are not permitted).
- Independent certifications must be provided confirming that the grooved joint is permanent. Minimum/maximum operating temperature of the gasket alone is not sufficient to guarantee its durability.
- Gasket replacement during the system's lifetime is neither allowed nor foreseen.
- Gasket material must have undergone performance testing according to the following standards:
    - Durometer/Hardness – ASTM D2240
    - Tensile Strength and Elongation – ASTM D412
    - Compression Set – ASTM D395
    - Stress Relaxation – ISO 3384
    - Volume Swell – ASTM D471
    - Accelerated Aging – ASTM D573
- Performance and durability reports from real installations must be provided, along with a declaration of suitability for systems with a 50-year expected service life.

References

- EN 10311:2005 – Joints for the connection of steel tubes and fittings for the conveyance of water and other aqueous liquids
- Regulation (EU) No. 305/2011 – Construction Products Regulation (CPR)
- Pressure Equipment Directive (PED 97/23/EC)

- ASTM Standards:
    - ASTM A-53 – Steel pipe, black and hot-dipped, welded and seamless
    - ASTM A-183 – Carbon steel bolts and nuts
    - ASTM A-234 – Forged carbon steel and alloy steel pipe fittings
    - ASTM A-449 – Quenched and tempered steel bolts and studs
    - ASTM A-536 – Ductile iron castings
    - ASTM F-1476 – Performance of mechanical joints with gaskets for piping applications
- ASME Standards:
- ASME B16.9 – Factory-made wrought steel fittings
- ASME B31.1 – Power piping for chemical plants and refineries
- ASME B31.9 – Building services piping

Prefabrication

- Components of the technical plant shall be supplied as prefabricated assemblies, ensuring proper pipe preparation and grooved joint installation.
- Prefabrication aims to minimize on-site joints and provide manufacturer warranty for most connections.
- Assemblies shall include pipe, fittings, grooved joints, valves (butterfly, check, balancing), filters, and other accessories from the same manufacturer.
- Maximum dimensions of assemblies shall be defined during the construction phase to facilitate installation.

All hot and chilled water distribution networks within the plant rooms shall use Victaulic-type grooved joint systems.

Grooved mechanical components such as couplings, fittings, expansion joints, branch outlets, etc., shall be used for mechanical pipe joining and construction of chiller plants and distribution lines, as an alternative to welded, flanged, or threaded systems.

Operating conditions shall not exceed temperatures from –34°C to +110°C.

4.2.2 GROOVED PIPE

Grooved pipe shall be made of carbon steel, A-53B/A-106B, compliant with EN 10255, EN 10216, ASTM, or other recognized standards.
Pipe may be black, painted, or galvanized.
Grooved ends shall be cut or roll-grooved depending on material, wall thickness, pressure, dimensions, and joining method.
Pipe ends shall comply with Victaulic standards per OGS and AGS specifications.

4.2.3 MECHANICAL JOINT FOR GROOVED CARBON STEEL PIPE

Standard OGS mechanical couplings from 2"/DN50 to 12"/DN300 shall be made of two segments of ductile iron alloy, conforming to ASTM A-536, grade 65-45-12.
Gaskets shall be made of synthetic rubber, pressure-responsive, suitable for the intended service, and compliant with ASTM D-2000.
Gaskets for potable water applications must be UL-classified and compliant with ANSI/NSF-61, DVGW, and ARPA.
Certification must clearly identify the gasket manufacturer and be issued in the manufacturer's name (certifications from resellers or intermediaries are not accepted).
Bolts shall be zinc-plated (ASTM B-633), carbon steel, heat-treated, conforming to ASTM A-449 and ASTM A-183, with minimum tensile strength of 110,000 psi (758,450 kPa), as specified by Victaulic or equivalent.

4.2.4 RIGID COUPLING

Two types of rigid couplings may be used:

- **Quick Vic Coupling**:
  Ready-to-install rigid coupling without field disassembly.
  Ductile iron housing per ASTM A-536 grade 65-45-12, sizes 2"–8", with 45° angled stops.
  Pre-lubricated EPDM Grade "EHP" gasket with central positioning lip.
  Operating temperature: –34°C to +121°C.
  Pressure rating: up to 51 bar (2"–5"), 48 bar (6"), 41 bar (8").
  No torque wrench required.
  Finish: painted or hot-dip galvanized.
  Bolts and nuts: hot-dip galvanized steel per ASTM A-449 and ASTM A-183.
- **AGS Coupling**:
  Ductile iron housing per ASTM A-536 grade 65-45-12.
  EPDM FlushSeal gasket for temperatures –34°C to +110°C.

Pressure rating: up to 25 bar (14”–24”).
Two-segment design.
Finish: painted or hot-dip galvanized.
Bolts and nuts: hot-dip galvanized steel per ASTM A-449 and ASTM A-183.

4.2.5 FLEXIBLE COUPLING

Flexible couplings shall be used where vibration attenuation, stress reduction, or misalignment compensation is required.
They may replace rubber anti-vibration joints at equipment connections.
Three couplings shall be installed near the vibration source.

Two types of flexible couplings:

- **2" (DN50) to 8" (DN200)**:
  Ready-to-install flexible coupling, direct application without field disassembly.
  EPDM Grade “EHP” gasket, red-green color code.
  Operating temperature: –34°C to +120°C.
  Victaulic Style 177N Quick-Vic™
- **10" (DN250) to 12" (DN300)**:
  Flexible coupling with EPDM Grade “E” gasket, green color code.
  Operating temperature: –34°C to +110°C.
  Victaulic Style 77

4.2.6 REDUCING COUPLING

Reducing coupling made of ductile iron conforming to ASTM A-536 grade 65-45-12, with EPDM gasket suitable for temperatures from –34°C to +110°C and pressure up to 24 bar. Designed for line transitions from 2” DN50 to 8” DN200, with grooved ends on both inlet and outlet.

4.2.7 FITTINGS

Fittings (elbows, tees, crosses, nipples, end caps, reducers, etc.) shall be full-flow type, made of ductile iron or segmentally welded steel, with grooved ends for connection to couplings, valves, and accessories.
Standard ductile iron fittings shall comply with ASTM A-395 grade 65-45-15 and ASTM A-536 grade 65-45-12.
Segmentally welded steel fittings shall comply with ASTM A-53, type F, E or S, grade B.
Standard fittings shall be finished with red enamel or hot-dip galvanization in accordance with ASTM A-153.

4.2.8 ADAPTERS

Two types of flange adapters may be used:

- **Flange Adapter for ANSI125/ANSI150 and PN10/PN16 connections**, from 2" DN50 to 24" DN600, made of ductile iron conforming to ASTM A-395 grade 65-45-15 and ASTM A-536 grade 65-45-12.
  Finish: black enamel or hot-dip galvanized per ASTM A-153.
- **Flange Adapter for ANSI300 connections**, from 2" DN50 to 12" DN300, made of ductile iron conforming to ASTM A-395 grade 65-45-15 and ASTM A-536 grade 65-45-12.
  Finish: black enamel or hot-dip galvanized per ASTM A-153.

4.2.9 BRANCH OUTLETS

Secondary lines branching from main risers shall be made by drilling the pipe and installing Victaulic branch outlets.
Secondary lines from ½" DN15 to 4" DN100 may be derived from main risers ranging from 2" DN50 to 8" DN200.
Branch outlets shall be made of ductile iron, rated for 500 PSI (34 bar), with zinc-plated steel clamping bolts per ASTM B-633 and finished with red enamel or hot-dip galvanization per ASTM A-153.

4.2.10 EXPANSION JOINTS

To accommodate pipe expansion and contraction, Victaulic expansion joints shall be used for diameters from 2" DN50 to 6" DN150, or Style 155 for diameters from ¾" DN20 to 24" DN600.

4.2.11 EXECUTION AND INSTALLATION

General Guidelines

- Pipe ends must be clean and free from indentations, extrusions, and roll marks in the area between the pipe end and the groove to ensure proper gasket sealing.
- Verify that the gasket style and elastomer grade are suitable for the intended service.
- AGS products must not be installed with standard grooved-end (OGS) pipes or components. Mixing AGS and OGS products may result in joint separation and/or leakage.

- Proper installation of OGS couplings (DN50–DN300) is achieved when metal-to-metal visual contact between housings is confirmed; torque wrench is not required. For rigid couplings, housings must show positive offset (refer to manual I-100 for details).
- Proper installation of AGS couplings (DN350–DN1500) is achieved when metal-to-metal visual contact is confirmed and tightening requirements from manual I-100 are met.
- Always consult the latest version of the field installation and instruction manual (I-100).
- The system is guaranteed for a 50-year expected service life.

Pipe Grooving: Tolerances and Traceability

- **Prefabrication**: Grooving of prefabricated assemblies shall be performed in factory and guaranteed by the manufacturer.
- **On-site or external grooving**: Must be performed using the Victaulic RG5200i automatic machine, capable of numerically controlling groove tolerances and generating a report for each operation, ensuring quality and traceability. The automatically generated report must be provided.
- Pipe preparation (cutting and grooving) for plant rooms shall be performed in factory.
- 100% of grooves not part of prefabricated assemblies must be executed using the RG5200i computer-assisted grooving tool. Each groove must be numbered and printed as suitable for use.

Joint Inspection

- Prefabricated assembly joints are executed and verified in factory by Victaulic and do not require on-site inspection.
- The installer must follow the guidelines outlined above.
- The installer shall provide an internal inspector to verify grooved joints installed on-site, ensuring metal-to-metal contact of housings, with timing and procedures to be agreed upon.

- The installer shall provide a report mapping installed joints and their verification.
- All pipe and joint operations shall be subject to inspection:
- The installer shall verify and guarantee the prefabricated assemblies and joint installation therein.
- Pipes not included in prefabricated assemblies (e.g., distribution lines) and grooved using the RG5200i machine shall be verified and deemed compliant with the required standard.
- Installed joints shall be verified and guaranteed.

4.3 ACOUSTIC REQUIREMENTS

General Notes

All mechanical systems shall comply with the following general acoustic requirements:

- Avoid rigid contact between piping and slabs; fill slots with fibrous material or seal with concrete after wrapping pipes with elastic material.
- Wrap all vertical pipe sections.
- In service shafts with multiple water pipes, cavities should be filled with fibrous material or pipes wrapped with fibrous shells.
- For sanitary fixtures, insert a resilient sheet (e.g., Isolmant, Isolgomma or equivalent) between the fixture and horizontal/vertical masonry.
- The drainage network shall be constructed using pipes with high acoustic performance, both in terms of materials and fittings.
- In electrical installations, avoid placing boxes directly opposite each other in partition walls; deep holes must be insulated with lead/polyurethane sheets, heavy rubber, or similar materials, including in drywall partitions.
- Water velocity in pipes must be less than 2 m/s.
- Pipe sizing must be designed for this maximum velocity.
- Minimize the number of pipe distribution elements (elbows, T or Y connections).
- Pipes must be sound-insulated (e.g., multilayered pipes).

- Pipes must be joined using gradual section fittings; if not possible, isolate the most acoustically disturbing sections using flexible connectors.
- Both black and grey water pipes must be acoustically isolated from building structures at contact points using resilient sleeves or damping elements.
- Where pipes pass through walls, the hole size must be minimal; under no circumstances should the pipe touch the wall. The gap must be filled with resilient material to prevent acoustic bridging.
- External rainwater downpipes must be isolated from the structure using felt or neoprene collars between pipes and wall connection rings.
- Connections between pumps and system piping must be made using flexible elements.
- Wastewater pipes in noise-sensitive areas must be wrapped in lead bilaminate and finished with aluminium sheeting (avoid foams that create rigid transmission bridges).
- All pumps must be isolated from horizontal partitions using vibration isolators with a minimum static deflection of 1.2 mm.
- Acoustic insulation must ensure that pipes, ducts, and machinery do not transmit noise or vibrations to the structure or trigger resonance phenomena.

Pipe Insulation

All ceiling-mounted and suspended pipes shall be anchored to the building structure using brackets equipped with tensioners.
Brackets shall be connected to suspension or support elements via anti-vibration mounts such as "Vibrostop" or equivalent, with flexibility appropriate to the static load.
All pipes directly connected to machines with moving parts (e.g., pumps, chillers) must be fitted with rubber anti-vibration joints at the connections to eliminate direct metal transmission.

Equipment Isolation

All machines and equipment with rotating components shall be installed on rigid bases acting as inertial masses to reduce oscillation frequency.
These bases shall rest on the building structure via floating systems consisting of rubber anti-vibration joints with a minimum thickness of 20 mm (see technical datasheet) or spring systems.

Duct Isolation

As with piping, ducts shall be anchored with neoprene strips interposed.
Connections to air handling units shall be made using removable anti-vibration joints, constructed with double-layer canvas (olona), with a minimum length of 20 cm.

Duct Acoustic Absorption

Where specified, suitable silencers shall be installed to reduce noise transmission within supply and return ducts.

4.4 INSULATION

All piping shall comply with the technical datasheets provided below.

4.4.1 PIPE AND VALVE INSULATION

General Requirements
Insulation of pipes serving the summer and winter HVAC systems shall be installed with thicknesses in accordance with current regulations, specifically DPR 412/93 Annex B, as follows:

- **Class 1**: 100% thickness for pipes located in boiler rooms, basements, external ducts, unheated rooms, roof passages, etc.
  The validity of the adopted insulation thicknesses must be documented prior to installation, based on the type of insulation proposed.

d) Pipes Installed on Roof of Plant Room L2
Insulation of pipes carrying chilled fluids installed outdoors shall be made using flexible sleeves and/or closed-cell elastomeric sheets.
Minimum insulation thickness shall comply with Annex B of DPR 412/93, without applying correction/reduction coefficients for passage through heated environments.
The insulating sleeve material shall have a closed-cell structure, with water vapor diffusion resistance greater than 7000 per DIN 52615 – UNI 9233.
Fire behaviour shall be Class 1 per UNI 9174 and UNI 8457.
Thermal conductivity of the insulation shall be no greater than 0.040 W/m°C at 40°C.
The insulation shall be covered with 6/10 mm-thick aluminium sheeting, fully removable to allow routine maintenance, with longitudinal and transverse joints secured using hot-dip galvanised self-tapping steel screws.

ISOLAMENTO DELLE RETI DI DISTRIBUZIONE DEL CALORE NEGLI IMPIANTI TERMICI

LA TABELLA RIPORTA LO SPESSORE MINIMO DELL' ISOLANTE IN FUNZIONE DEL DIAMETRO DELLA TUBAZIONE E DEL LAMBDA DELL'ISOLANTE STESSO (ALLEGATO B DPR nr. 412 DEL 26–08–1993)

tenendo conto che:

- Per valori di Lambda diversi da quelli in tabella lo spessore minimo dell'isolante sara' da calcolare per interpolazione.
- I montanti verticali delle tubazioni devono essere posti all'interno dell'isolamento termico dell'edificio ed i relativi spessori minimi vanno moltiplicati per 0,5.
- Per tubazioni correnti entro strutture non affacciate ne' all'esterno ne' su locali non riscaldati gli spessori vanno moltiplicati per 0,3.

Conduttivita' Termica isolante Lambda (W/m°C)	Diametro esterno della tubazione (mm)					
	<20	da 20 a 39	da 40 a 59	da 60 a 79	da 80 a 99	> 100
0.030	13	19	26	33	37	40
0.032	14	21	29	36	40	44
0.034	15	23	31	39	44	48
0.036	17	25	34	43	47	52
0.038	18	28	37	46	51	56
0.040	20	30	40	50	55	60
0.042	22	32	43	54	59	64
0.044	24	35	46	58	63	69
0.046	26	38	50	62	68	74
0.048	28	41	54	66	72	79
0.050	30	44	58	71	77	84

4.5 SEISMIC RESISTANCE CRITERIA

4.5.1 INTRODUCTION

The Technical Standards for Construction (NTC) of the Ministerial Decree dated January 14, 2008, include a series of requirements for the design and implementation of seismic anchoring systems for building service installations.
The selection of the anchoring system for mechanical systems depends on the following parameters:

- Importance and function of the building post-earthquake
- Seismic zone in which the building is located
- Seismic vulnerability of the system components

Minimum seismic safety requirements are defined with reference to specific objectives, which for mechanical systems include:

- Maintaining operational continuity of critical systems
- Preventing collapse or detachment of components
- Ensuring safety for occupants during seismic events

The sizing of support and anchoring systems for mechanical installations shall be defined in the dedicated structural engineering report.

4.5.2 EXECUTION CONDITIONS FOR SEISMIC PROTECTION OF SYSTEMS

Seismic protection measures aim to maintain the highest possible level of efficiency of the entire mechanical system, ensuring a high degree of safety for occupants during seismic events.
Based on the building classification and its geographic location, the following minimum requirements must be met.
During the construction design phase, anchoring details—including bolt dimensions and types—shall be defined in accordance with applicable regulations and based on the characteristics of the selected equipment.

4.5.3 GENERAL SEISMIC PRECAUTIONS

Installation of mechanical equipment shall include at least the following general precautions:

- Anchor systems to the building's load-bearing structures to prevent significant relative displacement during seismic events
- Allow relative movement between system components and structural elements without causing connection failure
- Avoid crossing structural joints wherever possible
- Absolutely avoid placing components, equipment, or machinery across structural joints

4.5.4 SPECIFIC SEISMIC PRECAUTIONS FOR EQUIPMENT

For equipment with vibration isolation devices, mounting shall include brackets and plates designed to limit movement and transfer seismic forces directly to the slab.

For equipment without vibration isolation devices, the following measures shall be implemented:

- Supports and bases for containers and equipment must withstand design-level seismic forces
- All floor-mounted equipment and containers must be bolted to the slab or otherwise secured to the building structure
- Equipment taller than 2 meters must be properly braced and anchored to slabs and structural walls

4.5.5 SEISMIC SUPPORTS FOR CHILLER UNIT

Seismic supports for the chiller unit shall be constructed according to the type illustrated in the referenced photo.

4.6 VALVES AND ACCESSORIES

4.6.1 BUTTERFLY VALVES WITH VICTAULIC CONNECTIONS

Double-offset grooved butterfly valve DN50–DN300, rated for 300 psi (20 bar), suitable for bidirectional service and full-pressure shut-off.
Double-offset disc: off-center disc design ensures 360° sealing on the gasket seat; when open, the disc does not compress or deform the gasket.
EPDM seat suitable for temperatures from –34°C to +121°C, with pressure-responsive sealing.
Victaulic Series 761 Vic300 or equivalent.

4.6.2 DIAPHRAGM EXPANSION VESSEL

Closed-type diaphragm expansion vessels with air cushion, manufactured in accordance with current I.S.P.E.S.L. regulations for pressure equipment.
Units up to 35 liters must be certified; larger capacities must be tested and supplied with appropriate certifications.
Vessels shall be sized based on the system's hydrostatic head and the safety valve set pressure, with a tolerance of ±10% from the calculated value.
Pre-charged at ambient temperature with a pressure at least 0.3 Ate above the highest point in the system.

Operating conditions:

- Pmax = 10 kg/cm^2
- Tmax = 99°C

4.7 MEASUREMENT AND CONTROL INSTRUMENTATION

4.7.1 DIAL THERMOMETERS

Thermometers shall use bimetallic sensing elements and have scales appropriate to the fluid being monitored.
Dial thermometers shall feature:

- DN100 AISI 304 stainless steel case

- White aluminum dial with black graduations and numbering
- Black lacquered aluminum pointer
- AISI 316 stainless steel bulb, 8 mm diameter
- White natural rubber gasket
- AISI 304 stainless steel bayonet ring

Installation shall be via threaded wells welded to the pipe.
Thermometers must be dry-mounted, with the bulb immersed in oil within the well.
Air duct thermometers shall be mercury-filled dial type with vertical stem and mounting flange.
Dial thermometers for ducts shall have chrome-plated brass cases, 80 mm diameter, rigid stems long enough to reach duct center, and calibration devices.

Temperature scales must be selected according to the monitored range.
Contact thermometers are not permitted.

Default scales (in absence of specific design instructions):

- Cold circuits: 0–50°C
- Hot circuits: 0–120°C

4.7.2 PRESSURE GAUGES

Pressure gauges shall feature:

- White aluminum dial with black graduations and numbering
- Aluminum pointer
- AISI 316 stainless steel connection pin and Bourdon tube
- Reinforced stainless steel movement
- White natural rubber gasket
- AISI 304 stainless steel bayonet ring

Graduation shall be in kPa or meters of water column.
Full scale shall match circuit pressure requirements; in absence of specific instructions, use gauges with full scale approximately 1.5× the maximum expected pressure.

Gauges shall include:

- Shut-off valve with test gauge flange per ISPESL standards
- Copper siphon loop with 3/8" threaded connection on welded pipe sleeve
- Accuracy class: 1

4.7.3 FLOW METER

A 6” flanged electromagnetic flow meter shall be installed.

5. COMPONENT SPECIFICATIONS

5.1 AIR-COOLED CHILLER WITH SCREW COMPRESSORS

Outdoor liquid chiller for chilled water production, equipped with inverter-driven semi-hermetic screw compressors designed for R134a refrigerant.
Includes axial fans, microchannel aluminum condenser coil, single-pass shell-and-tube evaporator, and electronic expansion valve.
Base frame, structure, and panels made of polyester powder-coated galvanized steel.
Eurovent certified.
Flexible and reliable unit designed to adapt to varying load conditions through precise thermal regulation and optimized internal component design.

Compressors feature:

- Innovative lubrication system
- Advanced internal geometry
- Enhanced capacity control system

These innovations ensure improved performance, especially under partial load conditions.

Installation Note

Unit is supplied pre-charged with refrigerant, factory-tested and commissioned.
On-site installation requires only hydraulic and electrical connections.

Structure

Outdoor-rated structure with base and frame made of hot-dip galvanized steel profiles of adequate thickness.
All components coated with polyester powder for full weather resistance.
Paint reference: RAL 7035 textured finish.

Refrigeration Circuit

Unit designed with independent refrigeration circuits for each compressor, ensuring operational continuity and ease of maintenance.
Each circuit includes:

- Electronic thermostatic expansion valve

- High and low pressure transducers
- Digital pressure level display via controller
- High-pressure safety switch
- High and low pressure safety valves
- Liquid line shut-off device (via electronic expansion valve with ultracap)
- Integrated gas discharge non-return valve
- Compressor discharge valve
- Liquid line shut-off valve
- Liquid flow indicator with humidity detection
- Replaceable cartridge-type dehydrator filter

VARIABLE-SPEED SCREW COMPRESSOR

Screw compressors model CSCV, designed according to Climaveneta specifications or equivalent, for exclusive use in this application.
Extremely compact compressors with integrated oil separator, frequency modulation inverter, and inverter cooling system housed in a single casing.
Semi-hermetic screw compressors with dual rotors (five-lobe male and six-lobe female); the five-lobe rotor is directly coupled to the motor without gear multipliers.
The motor drives the male rotor with a variable speed range of 1:6 via a dedicated inverter.
Cooling capacity is delivered continuously, with modulation from 30% to 100%.
Inverter cooling is achieved via an integrated plate traversed by refrigerant, regulated by dedicated valves—no additional heat exchangers required, only a connection to the liquid line.

Rotor shaft bearings are housed in a dedicated chamber isolated from the compression chamber, made of carbon steel for maximum durability and long life under all speed conditions.
Lubrication is achieved by distributing oil to mechanical components without an oil pump, optimizing compression performance.
Integrated three-stage oil separator ensures compactness, using a 10-micron steel mesh filter to maintain constant oil presence in the compressor.

Innovative mechanical design includes an internal slider, managed by proprietary parameters, to vary the internal volume ratio (Vi) according to operating conditions, maximizing efficiency even under high part-load conditions.

High reliability is ensured by continuous monitoring of operating parameters and automatic intervention functions that return the compressor within safe operating limits.

Each compressor is equipped with:

- Manual-reset motor thermal protection
- Discharge temperature monitoring
- Oil level control
- Crankcase heater for idle periods
- Inverter power circuit with line reactor for conducted emission control, compliant with EN 61000-6-4 for industrial environments
- Non-return valve on refrigerant discharge to prevent reverse rotor rotation
- Discharge shut-off valve for refrigerant isolation if needed

Start-up includes soft-start functionality with smooth current ramp-up and no peaks.

USER-SIDE HEAT EXCHANGER

Shell-and-tube evaporator with direct expansion function.
Refrigerant flows through the tubes; water flows through the shell.
Designed and manufactured internally by MEHITS, the single-pass tube bundle ensures near-perfect counterflow heat exchange.
Shell includes baffles to increase turbulence and heat transfer efficiency.

Shell insulation:

- Anti-condensation mat with thermal conductivity of 0.033 W/mK at 0°C
- Flexible closed-cell black elastomeric foam
- Laminated with 3 mm cross-linked PE foam and embossed black PE film
- Total thickness: 9 mm

Tube bundle:

- Internally and externally grooved copper tubes
- Mechanically expanded into tube sheets
- Equipped with differential pressure switch to monitor water flow and prevent freezing

- Anti-freeze function via dedicated heating element
- Compliant with PED pressure equipment directive

SOURCE-SIDE HEAT EXCHANGER

Modular “V”-shaped microchannel coil assembly.
Entirely made of aluminum, eliminating galvanic corrosion risk.
Fins and headers: aluminum AA3003
Channels: Long Life Alloy (LLA) with fine-grain microstructure for enhanced mechanical strength and corrosion resistance
Reduced channel cross-section increases refrigerant turbulence and improves heat exchange
Tube geometry maximizes air contact surface, reducing exchanger size and refrigerant charge

SOURCE-SIDE FAN SECTION

Axial fans with IP54 protection and Class F insulation, external rotor, profiled blades, housed in aerodynamic nozzles with safety guards.
Fan + nozzle assembly meets EcoDesign Regulation 327/11 efficiency requirements.
Six-pole electric motor with built-in thermal protection.
DVVF (Variable Fan Speed Device) controls condensation via step voltage regulation (autotransformer), enabling segmented ventilation for low ambient temperatures.
Independent ventilation logic for each condensing circuit.

POWER AND CONTROL PANEL

Constructed in compliance with EN60204-1 and EC204-1 standards.
Includes:

- Main door interlock switch
- Control circuit transformer
- IP44 XW protection rating
- Power distribution via busbar system
- Spring terminal blocks for control circuits
- Forced ventilation
- Phase sequence monitoring
- Over/under-voltage relays

- Fuses and contactors for compressors and fans
- Internal thermal protection for compressors
- Electronic controller
- Terminals for remote ON/OFF
- Terminals for cumulative alarm lockout
- Power supply: 400V / 3ph / 50Hz

CERTIFICATIONS AND APPLICABLE DIRECTIVES

Unit complies with the following directives and certifications:

- EUROVENT Certification Program
- CE – European Union Declaration of Conformity
- EAC – Quality Certification for Russian Federation
- M&I – Quality Certification for Australia and New Zealand
- Machinery Directive 2006/42/EC
- Pressure Equipment Directive (PED) 2014/68/EC
- Low Voltage Directive 2006/95/EC
- Electromagnetic Compatibility Directive 2004/108/EC
- ErP Directive 2009/125/EC
- ISO 9001 – Quality Management System Certification
- ISO 14001 – Environmental Management System Certification

TESTING

Quality controls performed throughout the production process in accordance with ISO 9001 procedures.
Optional performance or acoustic testing available in the presence of the client, conducted by highly qualified technical personnel.

Performance testing includes measurement of:

- Electrical data
- Water flow rates

- Operating temperatures
- Absorbed electrical power
- Delivered cooling capacity
- Water-side pressure drops under full load (selection conditions and worst-case condenser conditions) and part-load

Alarm condition simulation is also available during performance testing.
Acoustic testing verifies unit sound emission levels per ISO 9614

ELECTRONIC CONTROLLER

The controller features advanced proprietary functions and regulation algorithms.
KIPlink – Keyboard In Your Pocket is an innovative WiFi-based user interface that allows full unit operation via smartphone or tablet.
KIPlink enables:

- Unit start/stop
- Setpoint adjustment
- Real-time graphing of key operating parameters
- Detailed monitoring of refrigeration circuits, compressors, fans, and pumps (if present)
- Alarm display and reset

Optional interfaces (in addition to or replacing KIPlink):

- **Touch Interface**: 7” color WVGA touchscreen with front USB port
- **Large Keyboard**: Wide LCD display with LED icons

Temperature regulation is based on continuous capacity modulation using PID algorithms with dynamic neutral zone, referenced to chilled water supply temperature.

Diagnostics include:

- Comprehensive alarm management
- “Black box” function (via PC)
- Alarm history (via user interface or PC) for enhanced unit behavior analysis

For multi-unit systems, resource regulation is available via proprietary optional devices. Energy consumption and performance metering are also supported.

Supervision options include:

- Proprietary systems
- Integration with third-party systems via ModBus, BACnet, BACnet-over-IP, LonWorks protocols
- Compatibility with remote keyboard (up to 8 units)

Internal clock allows creation of operating profiles with up to 4 day types and 10 time slots.

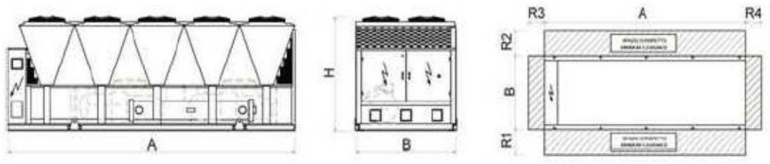
Optional **VPF Package** integrates capacity modulation with hydraulic flow modulation via inverter-driven pumps and dedicated hydraulic circuit resources.

UNIT TECHNICAL SPECIFICATIONS

- **Cooling Capacity**: 865 kW
- **Water Temperatures**: 15–21°C
- **Ambient Air Temperature**: 39.5°C
- **EER**: 3.72 (excluding pump power)
- **Total Electrical Power Input (at 39.5°C)**: 249 kWe

The specified cooling capacity must be equal to 90% of the chiller's maximum capacity under design ambient conditions (39.5°C).

WEIGHT & DIMENSIONS		
A	mm	9000
B	mm	2260
H	mm	2500
Operating weight	kg	8500
R1	mm	1500
R2	mm	2300
R3	mm	1500
R4	mm	1500



SIZING CONDITIONS

Sizing is based on external air temperature conditions per ASHRAE N=20 2017 (Tair = 39.5°C) and evaporator temperatures as required by ECMWF:

- Version 1: 15/21°C
- Version 2: 20/26°C

For ambient temperatures above 45°C, the manufacturer confirms operational capability up to 50°C.

UNIT DESCRIPTION		Chiller, air source for outdoor installation
OPTIONS		Unit with NOISE REDUCER + HT accessory selected
Power supply	V/ph/Hz	400/3/50
PERFORMANCE AT DESIGNED CONDITIONS		
RUNNING CONDITIONS		
HEAT EXCHANGER USER SIDE		
Fluid inlet temperature (cooling mode)	°C	21,0
Fluid outlet temperature (cooling mode)	°C	15,0
Fluid type		WATER
Glycol	%	0
Fouling factor	m²K/W	0,000044
OUTDOOR CONDITION		
Air temperature (cooling mode)	°C	45,0
COOLING (Gross value)		
Cooling capacity	kW	921
Compressors power input	kW	308
Fans power input (cooling mode)	kW	23,1
Total power input	kW	331
EER	kW/kW	2,78
ESEER CALCULATED	kW/kW	4,91
EXCHANGERS		
HEAT EXCHANGER USER SIDE		
Typology		SHELL&TUBE
Quantity	N°	1
Fluid type		WATER
Glycol	%	0
Fouling factor	m²K/W	0,000000
Type of connections		FLEXIBLE JOINT
Diameter of connections		6"
Min flow	m³/h	69,0
Max flow	m³/h	202
K pressure drop		1,89
Water content	l	210
COOLING		
Fluid inlet temperature (cooling mode)	°C	21,0
Fluid outlet temperature (cooling mode)	°C	15,0
Water flow	m³/h	132
Pressure drop	kPa	33,1
Available unit's head	kPa	0,00
FANS		
Fans type		AXIAL
Fans number	N°	14
Fans power input	kW	1,65
F.L.I.	kW	2,00
F.L.A.	A	4
COOLING		
Fans number	N°	14
Fans power input	kW	1,65
Air flow	m³/s	71,16
Available static pressure	Pa	0

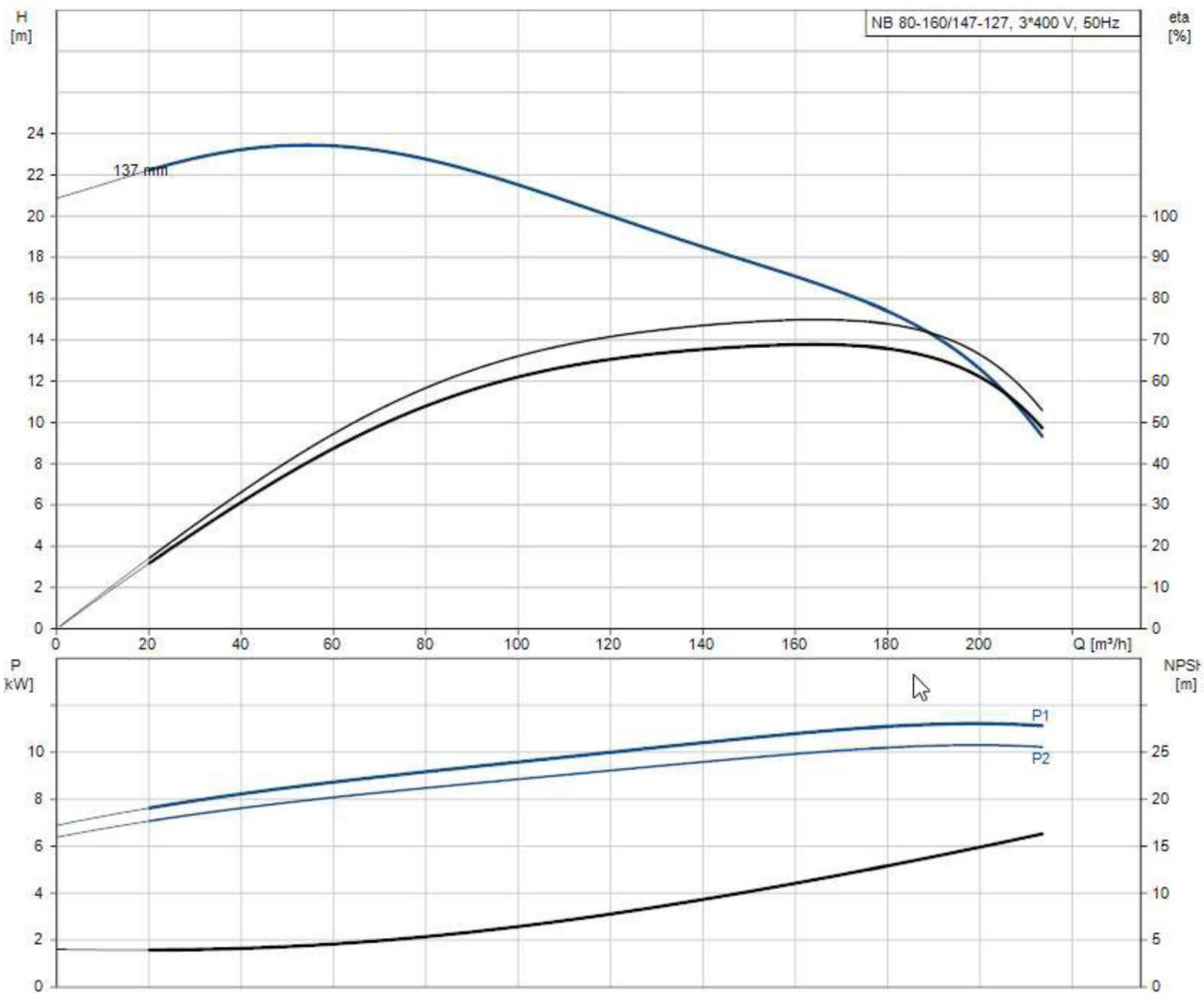
Evaluation NPLV - 865 kW - 15/21°C							
T_{amb}	15°C	20°C	25°C	30°C	35°C	39,5°C	45°C
Cooling Power	865 kW	865 kW	865 kW	865 kW	865 kW	865 kW	865 kW
EER	7,7	6,63	5,65	4,77	4,01	3,55	2,93

Evaluation NPLV - 865 kW - 20/26°C							
T_{amb}	15°C	20°C	25°C	30°C	35°C	39,5°C	45°C
Cooling Power	865 kW	865 kW	865 kW	865 kW	865 kW	865 kW	865 kW
EER	8,68	7,53	6,48	5,49	4,58	4,08	3,51

Evaluation NPLV - 925 kW - 15/21°C							
T_{amb}	15°C	20°C	25°C	30°C	35°C	39,5°C	45°C**
Cooling Power	925 kW	925 kW	925 kW	925 kW	925 kW	925 kW	921 kW
EER	7,3	6,31	5,37	4,55	3,84	3,47	2,78

Evaluation NPLV - 925 kW - 20/26°C							
T_{amb}	15°C	20°C	25°C	30°C	35°C	39,5°C	45°C**
Cooling Power	925 kW	925 kW	925 kW	925 kW	925 kW	925 kW	925 kW
EER	8,47	7,33	6,41	5,38	4,48	3,94	3,4

Note: Electrical power input values must include the additional power consumption of primary pumps installed within the units (refer to characteristic curve below).



ACCESSORIES

AUTOMATIC TRANSFER SWITCH (ATS)

Includes installation of an ATS (Automatic Transfer Switch) inside the electrical panel.
The device automatically switches the electrical load from the primary power source (e.g., grid) to an alternative source (e.g., backup generator).
The ATS continuously monitors voltage on both power lines and switches to the secondary line in case of failure, returning to the primary source once restored.
Priority settings and voltage return check intervals are configurable.

DUAL SAFETY VALVES WITH ISOLATION TAP

Allows isolation of a safety valve for maintenance without requiring extended unit shutdown.

COMPRESSOR POWER FACTOR CORRECTION

Power factor correction capacitors installed on compressor power supply.
Improves unit cos(ϕ).

MAGNETOTHERMAL PROTECTION ON LOADS

Overcurrent protection switch applied to main onboard electrical loads.
Allows reset without fuse replacement in case of overcurrent.

MODBUS PROTOCOL INTERFACE BOARD

Serial ModBUS interface board for integration into supervisory systems using ModBUS protocol.

MODBUS RS485 – MID CERTIFIED MONITORING SYSTEM

Includes the following onboard devices:

- Power analyzer with ModBUS RS-485 interface and MID certification
- Current transformers
- Controller firmware upgrade
- Software release LA09 or later

This accessory enables monitoring of electrical energy consumption and data sharing via ModBUS serial communication.
Measured parameters include: supply voltage, absorbed current, frequency, power factor ($\cos_{\varphi}$), electrical power input, and energy consumption.
MID certification allows energy data to be used for fiscal energy accounting.
System management can acquire all key operating variables and unit statuses via serial communication with the onboard controller.

FAST RESTART (EXTERNAL UPS)

Minimizes unit downtime in case of power failure, preserving unit safety.
Requires external UPS power supply: 230V AC, 300VA (provided by customer).

COMPRESSOR SUCTION SHUT-OFF VALVE

Suction-side shut-off valve for compressor isolation.

HT KIT

Extends unit operating limits.
Full-load operation guaranteed up to 50°C ambient air temperature (limit depends on unit version).
Part-load operation possible up to 53°C (with 15°C chilled water production).

PRE-COATED FIN COIL

Finned coil heat exchanger made with copper tubes and aluminum fins treated with chemical cleaning and protective coating:

- Polyester resin-based protective coating
- Salt spray corrosion resistance per ASTM B117 ≥ 1000 hours (intact fins and protected edges)
- Excellent UV resistance

EV – 2P 2P BP (VARIABLE SPEED PUMPS)

Hydronic module for evaporator, compatible with constant or variable flow control.
Includes two variable-speed pumps with 2-pole motors.
Useful head as per performance curve.
Duty/standby logic with runtime balancing and automatic switchover in case of failure.

EV – VPF.D MULTI-UNIT SYSTEM

Unit configured for variable water flow in the evaporator (primary circuit).
Pump start/stop controlled by the unit to minimize pumping costs.
Pump speed regulated via 0–10V signal.
VPF.D logic maintains constant delta T in the primary circuit, significantly reducing pumping energy during part-load operation.

EC FANS

Electronically Commutated (EC) fans.
Brushless motor controlled by dedicated controller for continuous speed modulation.
Minimized energy consumption and startup current.
Efficiency gain: +1% EER, +4–5% ESEER.
Noise decreases proportionally with load reduction.

EVAPORATOR WATER FLOW SWITCH

Stainless steel paddle flow switch (AISI 316L), IP65 rated, suitable for industrial piping.
Must be installed in a straight pipe section free of filters, valves, etc., at least 5× pipe diameter upstream and downstream.

Detects flow loss or excessive reduction, triggering an alarm with automatic or manual reset depending on number of alarms/hour and pump runtime under low-flow conditions.

ELECTRONIC FLOW SWITCH WITH BACKUP BATTERY

Includes backup battery to maintain microcontroller operation during power loss, enabling fast restart.

TIMER

Timer installed in the chiller’s electrical panel.

NOISE REDUCER

Includes fan speed reduction and compressor sound enclosure.
Proper tuning of fan cruise speed combined with acoustic insulation of critical components significantly reduces sound emissions