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TECHNICAL SPECIFICATION

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HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

HVAC SYSTEM

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1 INTRODUCTION

2 SCOPE AND OBJECTIVES

This Specification covers the minimum requirements for the design, supply and installation for HVAC equipment for the stations and pipelines of the natural gas transmission system.

3 REFERENCES

3.1 Reference Documents

3.2 Reference Codes and Standards

2014/34/EU	Equipment Explosive Atmospheres Directive
2014/35/EU	Low Voltage Directive
2014/30/EU	Electromagnetic Compatibility Directive
DIN EN 12101 (2017)	Smoke and heat control systems – Part 3: Specification for powered smoke and heat exhaust ventilators
DIN EN 12101 (2017)	Smoke and heat control systems – Part 8: Smoke Control Dampers
DIN EN 12086 (2013)	Thermal insulating products for building applications – Determination of water vapor transmissions properties
EN 10216-1(2014)	Seamless steel tubes for pressure purposes –Technical delivery conditions– Part 1: Non-alloy steel tubes with specified room temperature properties
EN 10216-2(2014)	Seamless steel tubes for pressure purposes –Technical delivery conditions– Part 2: Non-alloy and alloy steel tubes with specified room elevated temperature properties (including amendment A1)

DIN EN 12667 (2001)	Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter products
DIN EN 1092-1(2018)	Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 1: Steel flanges
DIN EN 13555 (2019)	Flanges and their joints – Gasket parameters and test procedures relevant to the design rules for gasketed circular flange connections
DIN EN 1514-1 (1997)	Flanges and their joints – Dimensions of gaskets for PN designated flanges- Part1: Non-metallic flat gaskets with or without inserts
DIN EN 1515-1 (1999)	Flanges and their joints – Bolting- Part1: Selection of bolting
DIN EN 1515-2 (2001)	Flanges and their joints – Bolting- Part2: Classification of bolt materials for steel flanges, PN designated
DIN EN 1515-4 (2019)	Flanges and their joints – Bolting- Part4: Selection of bolting for equipment subject to the Pressure Equipment Directive 97/23/EC
ISO 3470 (2019)	Determination of sound power levels of noise sources. Guidelines for the use of basic standards
DIN-ISO 15665 (2011)	Acoustic insulation for pipes, valves and flanges
DIN EN ISO 8497 (1996)	Thermal insulation – Determination of steady-state thermal transmission properties of thermal insulation for circular pipes
SMACNA (1995)	HVAC Duct Construction Standards, Metal and Flexible, 2nd edition 1995 with addendum #1
SMACNA (1985)	HVAC Air Duct Leakage Test Manual,1st edition
SMACNA (2001)	HVAC Systems-Testing, Adjusting and Balancing Handbook, 3rd edition
NFPA 90A (2009)	Installation of Air-Conditioning and Ventilating systems
NFPA 262	Standard Method of Test for Flame travel and Smoke of Wires and Cables for use in Air-Handling Spaces, 2007 edition
ANSI/ASHRAE15-2004	Safety Code for Mechanical Refrigeration 2001

ASHRAE 2007	Data processing and Electronic Office Areas –, Applications Handbook, Chapter 17
ELOT EN 60529	Degrees of Protection provided by Enclosures
ELOT HD 384	Requirements for Electrical Installations
ELOT HD 60364	Electrical Installations of Buildings (IP Code)
T.O.T.E.E. 20701-2/2010	Thermophysical properties of building materials & Thermo-insulating requirements acceptance procedure
T.O.T.E.E. 20701-3/2010	Greece regional Climatic data
T.O.T.E.E. 2421/86	Hot water distribution for Heating in Building Areas
TOTEE 2451/86:	Technical chamber of Greece Recommendations - Buildings Mechanical Installations: Fire Fighting Water Systems
Presidential Decree 71/81	Fire Fighting Regulation

4 ACRONYMS

AC	Alternating Current
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ATEX	ATmosphères EXplosibles (Explosive Atmospheres)
ATS	Automatic Transfer System
BMS	Building Management System
BVS	Block Valve Station
BCC	Back-up Control Centre at Nea Messimvria
CCTV	Closed Circuit Television System
CPR	Construction Products Regulation
CP	Cathodic Protection
CPU	Central Processor Unit
CS	Compressor Station
DB	Distribution Board
DC	Direct current
DCS	Distributed Control System
DEG	Detailed Engineering

DIN	Deutsches Institut für Normung (German Institute of Standardization)
DVA	Digital Voice Announcer
DVD	Digital Video Disc
EDG	Emergency Diesel Generator
ELOT	Hellenic Organization for Standardization
ELV	Extra Low Voltage (nominal voltage not exceeding 50 V AC or 120 V DC (ripple-free) between conductors or to earth, as defined by the Standard EN 61558)
EN	European Norms
EPC	Engineering, Procurement and Construction
EU	European Union
ESD	Emergency Shut Down
F&G	Fire and Gas
FACP	Fire Alarm Central Control Panel
FARP	Fire Alarm Repeater Control Panel
FAT	Factory Acceptance Test
FEG	Field Engineering
FC	Floe Computer
FOC	Fibre Optic Cable
GCC	Gas Control Centre at Patima
HEDNO	Hellenic Electricity Distribution Network Operator
HDPE	High Density Polyethylene
HMI	Human Machine Interface
HVAC	Heating Ventilation Air Conditioning
I/O	Input / Output
IEC	International Electrotechnical Commission
ISO	International Organization for Standarization
ITU	International Telecommunication Union
LAN	Local Area Network
LCS	Local Control System

LED	Light Emitting Diode
LFEP	Local Fire Detection & Fire Extinguishing Panel
LV	Low Voltage
LSP	Load Share Panel
MSC/MCS/SMC	Main Station Controller
MV	Medium Voltage
MPS	Master Project Schedule
MPR	Monthly Progress Report
NFPA	National Fire Protection Association
NNGTS	National Natural Gas Transmission System
NTSC	National Television System Committee
O&M	Operation and Maintenance
PID	Piping and Instrumentation Diagram
PA/GA	Public Address / General Alarm
PCS	Process Control System
PED	Pressure Equipment Directive
PEP	Project Execution Plan
PFD	Process Flow Diagram
PLC	Programmable Logic Controller
PMS	Power Management System
POC	Project Organization Chart
PAL	Phase Alternate Line
PPC	Public Power Corporation
PTZ	Pan, Tilt, Zoom
PVC	Poly Vinyl Chloride
QA	Quality Assurance
RCC	Remote Communications and Controls
RFI	Radio Frequency Interference
RTD	Resistance Temperature Detectors
RTU	Remote terminal Unit
S/S	Scraper Station

SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition (including Telemetry)
SCS	Station Control System
SFP	Small Form-factor Pluggable
SPD	Surge Protection Device
SPL	Sound Pressure Level
UDP	User Datagram Protocol
UPS	Uninterruptible Power Supply
UV	Ultraviolet
VGA	Video Graphics Array
VMS	Video Management Software

5 HVAC SYSTEM DESIGN

5.1 General Description

The HVAC system of Station's Building, has cooling requirements, either for electrical / electronic equipment, or for ensuring personnel working conditions. For all conditioned areas inside the building, local air conditioning split type Heat Pump units (inverter type), wall mounted, shall be installed. Outdoor units will be installed at outdoor walls. A wall type temperature transmitter shall monitor room temperature and also shall transfer low and high temperatures signals to station PLC.

Heating and Cooling shall be provided by electrically powered air-conditioning units (split type-inverter) for the Station's Building.

Especially for the extreme ambient low temperature (< -10oC), heating shall be supported by an electric convector heating system. This system will be put in operation after owners' decision, as a back-up solution (failure of heat pump or extreme weather conditions).

Ventilation system is considered for all rooms in the Station's Building. Ventilation system (on/off fan operation and ventilation dampers) will be installed in the rooms and will be combined with the emergency systems (firefighting/fire dampers) and with the air conditioning systems (extreme weather conditions). The ventilation system design for each

room serving space, operating equipment and if any special needs (etc. due to ATEX requirements).

5.2 Design Conditions

For Internal design conditions see the following table lists the desired interior temperatures and required ventilation in each room.

Station's Building	**Temperature in Winter**	**Temperature in Summer**	**Relative Humidity**	**Ventilation**
Control room *Note (3)*	20^0C *Note (1)*	24^0C *Note (1)*	50%±10%	YES
UPS room	20^0C *Note (1)*	24^0C *Note (1)*	50%±10%	YES *Note (2)*
RCC	20^0C *Note (1)*	24^0C *Note (1)*	50%±10%	YES *Note (2)*
EDG room	5^0C *Note (4)*	Not required	Not controlled	YES *Note (5)*
Boiler room	5^0C *Note (4)*	Not required	Not controlled	YES
Odorizer room	5^0C *Note (4)*	Not required	Not controlled	Not controlled
Utility room	5^0C *Note (4)*	Not required	Not controlled	YES
WC	5^0C *Note (4)*	Not required	Not controlled	YES

Note (1): For the heating / cooling loads calculation, the following temperature values shall be considered:

a. Basic load scenario: the above desired interior temperatures, while the outside air temperatures are the ones provided by the Greek Regulations for heating, cooling and air conditioning for the region of installations.

b. Extreme load scenario: the following interior temperatures under the written extreme ambient temperatures:

- Cooling system: maximum interior temperature in summer +30oC, while the outside air temperature is +44oC.
- Heating system: minimum interior temperature in winter +15oC, while the outside air temperature is -10oC.

Note (2): In case of a Hydrogen alarm (hydrogen detection system), a ventilation fan (explosion proof) should be automatically activated.

Note (3): Two air-conditioning units (split type-inverter) shall be installed inside the Control room. Each unit will cover the thermal and cooling needs (100% redundancy).

Note (4): The heating system will ensure an interior temperature of +5°C when outdoor temperature is -20°C.

Note (5): Ventilation for heat removal will keep area temperature below +50°C while the ambient temperature is +44°C.

For normal ventilation operation: Minimum 2 air changes per hour (ach).

For heat removal ventilation, in non-air-conditioned spaces, the required air volume shall be calculated in order internal temperature to be +6°C (maximum) from outdoors.

6 TECHNICAL REQUIREMENTS

The HVAC Equipment installed in the Station's Building consist of:

6.1 Split type, Air Conditioning Units

Two Air Conditioning Units, DX Heat Pump, split type, for cooling and heating at mild winter seasons, in Control room, 100% redundancy.

Two Air Conditioning Units, DX Heat Pump, split type, for cooling and heating at mild winter seasons, in UPS room and RCC, one per room respectively.

Air Conditioning Split units shall be of Heat Pump, direct expansion type (DX), equipped with inverter technology. Direct expansion (DX) coil will be foreseeing for cooling mode operation as an evaporator coil. The outdoor part is consisting from a condenser coil (in summer) a compressor of refrigerant medium and axial fan(s) all housed in a single unit (Air Cooled Heat Pump Unit).

DX Split Unit will be able to alternate between cooling/heating operating mode and automatic restart after a power failure. A/C Unit shall operate with ecological coolant (i.e. R-407C, R-410A) of HFC type (chlorine-free). Energy efficiency class shall be A, for Air Conditioning Split Unit.

Each cooling system shall have an outdoor electrical unit. The refrigerant connections between the indoor and outdoor unit shall be done with an insulated copper pipe, both for liquid and gas coolant phase. The control system shall be automatic, and it shall allow the possibility of manual actuation. In case of a power failure the Split Unit shall be able to automatically restart, in the previous mode of operation.

6.2 Temperature Monitoring System

Wall mounted temperature controllers will be foreseeing for setting for split units. The temperature controllers shall be installed (indoor) in order upper-lower temperature limits to be monitored and to be selected room temperature set point.

Wall type temperature transmitters shall monitor rooms temperature and also shall transfer low and high temperatures signals to station PLC. The relative signals will be transferred to SVC and GCC. These temperature transmitters shall be installed indoor at every room of the Station building.

6.3 Ventilation

6.3.1 Control room

Normal space ventilation for personnel healthy and less for heat removal will be predicted as part of building ventilation system. One ventilation air duct system with axial-centrifugal fan, for general ventilation and an opening for inlet air with louvres, pre-filter (G4 class) and a motorized dumper (spring return) shall be installed.

6.3.2 UPS room - RCC

Normal ventilation for heat removal, due to battery banks heat dissipation will also be installed. An exhaust fan will perform the required heat removal ventilation and also

keeping room slightly in under-pressure state, in order to prevent hydrogen, possibly present (due to vents from battery banks) in the room, to ignite or to escape in adjacent areas. The fan shall be ATEX classification (explosion proof), with air ducts and exhaust grilles.

Total required exhaust volume fan will extract air from near ceiling level. Inlet air opening shall incorporate pre-filter (G4 class) and a motorized on-off damper, with fail safe principle (spring return), in order space to be kept clean (also “PVC coated” or stainless steel SS316).

One fresh air intake louvered opening system, with motor actuator damper, filter, will be used. The motor actuator damper shall be ATEX classification (explosion proof), with air ducts and exhaust grilles.

6.3.3 EDG room

Under normal conditions, ventilation for combustion of the diesel engine and for internal thermal loads removal due to diesel engines heat dissipation (and other auxiliary equipment) is achieved by natural aeration, from the foreseen room openings.

Mechanical ventilation is foreseeing for extreme conditions in order keep anytime a Δt= +6°C (increased indoor temperature) to outdoors and smoke exhaust (minimum 15 air changes per hour).

Two air inlet openings will be foreseeing, fitted with motorized multi-leaf (on-off) smoke rated dampers with fail safe principle (spring return), for diesel engines charge air inlet and for make-up air, when ventilation fan is on.

Fan will extract air from near ceiling level. Fan outlet air opening and two air inlet openings, fitted with motorized multi-leaf (on-off) smoke rated dampers with fail safe principle (spring return) in order to seal the place in case of an emergency situation and make fire suppression easier to achieve or when the EDG (diesel engine) is out of service and the interior temperature is less than +5°C.

Engines radiator cooling air shall be ducted directly to outdoors.

6.3.4 Boiler room

Boiler room shall have natural ventilation through two inlet air openings that shall have combined area more than 1/12 m2 of the Boiler room area. Inlet air openings shall incorporate pre-filters (G4 class) and motorized on-off dampers, with fail safe principle (spring return), in order space to be kept clean (also “PVC coated” or stainless steel SS316).

6.3.5 Utility room - WC

Normal space ventilation for personnel healthy and less for heat removal will be predicted as part of building ventilation system. One ventilation air duct system with axial-centrifugal fan, for general ventilation and an opening for inlet air with louvres, pre-filter (G4 class) and a motorized dumper (spring return) shall be installed.

6.4 Heating System

For heating system, hot water panel radiators shall be installed indoor of each room, with a thermostatic head at water inlets. Hot water piping (galvanized iron tubes insulated in their entire length) will be wall mounted near ceiling. Radiator shall be fed from wall hanging Gas Boiler inside Boiler room as a back-up solution (failure of heat pump or extreme weather conditions).

The Gas Boiler, will be sized to cover building Station 100% total heating demand, at each site worst case temperature-load scenario. The Gas Boiler installed inside Boiler room of building, will be wall hung boiler, “packaged” equipped with internal circulator pump, expansion tank and safety features. Hot water piping supplies heating radiator panels.

Heating piping of the building will be done via a two pipe (insulated) distribution.

The hot water distribution piping (initiate from Boiler room), shall be common for all building rooms. Thermostat input on Gas Boiler controller shall come from EDG room where a wall type temperature transmitter shall monitor room temperature and also shall transfer low and high temperatures signals to station PLC, while thermostatic heads on panel radiators water inlet connection, will control the other rooms temperature.

6.5 Electric Convector

The electric convertor shall be installed inside the RCC, as a back-up solution (failure of heat pump or extreme weather conditions). It shall be wall or floor mounted. The Electric Convector shall be equipped with thermostat and control panel for temperature control.

6.6 H.V.A.C Control System

For controlling and monitoring HVAC systems local automation features will be installed. These local systems must be interconnected to local PLC (RTU) system inside Control room, in order HVAC system fault to monitoring (as alarm) from SVC and GCC. H.V.A.C. Control System will be combined with the emergency systems (firefighting, extreme weather conditions) and with the ventilation systems.
I/O sensors (thermostats), timers on electrical feeding panels and relay contacts, shall be able to connect in PLC (analogue or digital inputs) from the different sensors, placed at HVAC equipment and rooms. Output cards shall be able to send a digital alarm.

The following conditions scenarios are indicative and they shall be confirmed / converted during detail design:

Normal conditions

Station's Building	Split unit	Damper	Ventilation (Fan)	Heating System
Control room	ON (Auto)	Closed (1)	Off (1)	Closed (4)
UPS room	ON (Auto)	Closed (1)	Off (1)	Closed (4)
RCC	ON (Auto)	Closed (1)	Off (1)	Closed (4)
EDG room	-	Closed (2)	Off (2)	Closed (4)
Boiler room	-	Closed (3)	-	Closed (4)
Odorizer room	-	-	-	Closed (4)

Utility room	-	Closed (1)	Off (1)	Closed (4)
WC	-	Closed (1)	Off (1)	Closed (4)

Notes:

1. Under normal conditions dampers and fans are closed. They can be in operation automatically to ensure 2 air changes per hour by timer switch or by selector switch manually.
2. Under normal conditions dampers and fans are closed. They can be in operation automatically in case EDG is in operation, or for heat removal ventilation is needed.
3. Under normal conditions dampers are closed. They can be in operation automatically in case any Boiler is in operation or by selector switch manually.
4. In case extreme cold weather conditions scenario, the heating system shall be put in operation after owners' decision.

The intended actions to be taken by the automatic control systems in case of fire protection or gas detection are as follows:

Fire protection scenario

Station's Building	**Split unit**	**Damper**	**Ventilation (Fan)**	**Heating System**
Control room	Closed	Closed	Closed	Closed
UPS room	Closed	Closed	Closed	Closed
RCC	Closed	Closed	Closed	Closed
EDG room	-	Closed	Closed	Closed
Boiler room	-	Closed	-	Closed
Odorizer room	-	-	-	Closed
Utility room	-	Closed	Closed	Closed
WC	-	Closed	Closed	Closed

Gas detection scenario

Station's Building	Split unit	Damper	Ventilation (Fan)	Heating System
Control room	-	-	-	Closed
UPS room	Closed	Open	On	Closed
RCC	Closed	Open	On	Closed
EDG room	-	-	-	Closed
Boiler room (1)	-	Open	-	Closed
Odorizer room	-	-	-	Closed
Utility room	-	-	-	Closed
WC	-	-	-	Closed

Notes:

1. In case gas detection in Boiler room: The gas supply inlet valves will be closed, power interruption of Boiler Distribution Board and boilers shut down.