

Project No.	7G02
Contractor Doc No.	HVC-7G02-00-04-001
Change No.	0
Revision No.	0
Page	1 / 12

Specification for HVAC

Discipline: HVAC

0	2024.02.6	Issued for Final	Wang Z.J.	Ma Y.X.	Lei M.		
C	2024.02.02	Issued for Review	Wang Z.J.	Ma Y.X.	Lei M.		
B	2023.12.28	Issued for Review	Wang Z.J.	Ma Y.X.	Lei M.		
A	2022.12.28	Issued for Review	Lei M.	Ma Y.X.	Chen B.		
Rev	Date	Purpose	ORIG. By	CHK'D By	APP'D By	F. APP'D By	Customer
Unit		Offsite & Utilities			Unit/Sub-unit Code		00
Sub-unit		General			Project Stage		FEED
 EUROCHEM MINERAL AND CHEMICAL COMPANY				Chemical Complex for Phosphates Processing Project			
				 中国天辰 中国化学 CHINA TIANCHEN			

CONTENT

1	General & Project Description	3
2	Abbreviations	3
3	Introduction	4
4	Design Scope.....	4
5	Design Basis	5
5.1	Codes and Standards	5
5.2	Outdoor Air Design Conditions	6
5.3	Indoor Air Design Conditions.....	6
5.4	Fresh Air Volume	7
5.5	Internal Heat Gains	7
6	Heating System	8
6.1	Heating Medium.....	8
6.2	Heating Method	8
6.3	Heat Exchange System	8
7	Ventilation System	9
7.1	Ventilation Method	9
7.2	Ventilation Equipment.....	9
7.3	Dust Removal	10
7.4	Ventilation Duct and Its Component Parts	10
8	Air Conditioning System	10
8.1	Air conditioning System of Buildings	11
8.2	Air Conditioning Equipment	11
8.3	Air Conditioning Duct and Its Component Parts.....	11
9	Fire Prevention and Smoke Control	12
10	Electrical and Instrumentation	12
11	Design Margin.....	13

1 General & Project Description

As part of the implementation of a strategic investment project, “EuroChem” decided to build a Chemical Complex for the processing of phosphates in the Republic of Kazakhstan. The Project Site is located approx. 25 km west of Zhanatas. This chemical complex will comprise process units and utilities as defined in the following paragraphs, and includes a set of interconnected productions:

Number	Production unit
7G16	Sulfuric Acid Plant (SAP)
7G21	Potassium Sulfate Plant (SOP)
7G25	Di Calcium Phosphate Production Plant (DCP)
7G17	Calcium Chloride (CaCl ₂)
7G02	Offsite & Utilities (O&U)

2 Abbreviations

The list of abbreviations used in this document is provided in the below table:

List of Abbreviations

Abbreviation	Description
OWNER	EuroChem Karatau, Limited Liability Company
CNCEC	China National Chemical Engineering Group Corporation Ltd.
PRAYON	Process Design Package Licensor of DCP Plant
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
BFW	Boiler Feed Water
CSC	Car Seal Close
CSO	Car Seal Open
EOR	End of Run
SOR	Start of Run
GA	General Arrangement
HMB	Heat and Mass Balance
IPDS	Instrument Process Datasheet
OSBL	Outside Battery Limit
ISBL	Inside Battery Limit
MSDS	Material Safety Datasheet
NPSHa	Net Positive Suction Head Available
TEMA	Tubular Exchanger Manufacturers Association
TL	Technology Licensor

Abbreviation	Description
TSV	Thermal Safety Valve
P&ID	Piping & Instrumentation Diagram
PDS	Process Datasheet
PFD	Process Flow Diagrams
PSV	Pressure Safety Valve
PVRV	Pressure Vacuum Relief Valve
SIL	Safety Integrity Level

3 Introduction

The specification will be applied to HVAC design of all units in Chemical Complex for Phosphates Processing Project. Additions or revisions to the specification may be proposed by licensor or sub-contractors by raising a technical query.

4 Design Scope

This specification covers the minimum requirements for the design, procurement, installation, testing of Heating Ventilation and Air Conditioning (HVAC) systems for buildings on the plant. The buildings to be provided with HVAC systems include but not limited:

Plant number	Unit number	Unit/Sub-unit name
7G16	20	SAP plant
7G16	64	Substation for SAP plant
7G16	11	Rack room for SAP plant
7G16	71	Cooling Water Station for SAP
7G17	50	CaCl ₂ plant
7G17	64	Substation for CaCl ₂ plant
7G17	11	Rack room for CaCl ₂ plant
7G17	71	Cooling Water Station for CaCl ₂
7G21	30	SOP plant
7G21	64	Substation for SOP plant
7G21	11	Rack room for SOP plant
7G21	71	Cooling Water Station for SOP
7G25	40	DCP plant
7G25	64	Substation for DCP plant
7G25	11	Rack room for DCP plant
7G25	71	Cooling Water Station for DCP
7G02	14	Air Compression Station

Plant number	Unit number	Unit/Sub-unit name
7G02	16	Administration building
7G02	18	Laboratory
7G02	19	Control Room
7G02	72	Demineralized Water Station
7G02	73	Potable Water Station
7G02	74	Industrial Water Station
7G02	75	Waste water treatment
7G02	76	Fire water pump station
7G02	61	Thermal power plant
7G02	64	Main Substation
7G02	81	KCl storage and transportation
7G02	82	SOP storage and transportation
7G02	83	CaCl ₂ storage and transportation
7G02	84	DCP storage and transportation
7G02	85	Gypsum storage and transportation
7G02	86	Liquid storage and transportation
7G02	87	CaCO ₃ , CaO storage, grinding, firing and transportation
7G02	88	Storage and transportation of Mg(OH) ₂
7G02	92	Building heating system
7G02	95	Maintenance Workshop
7G02	96	Guard House

5 Design Basis

5.1 Codes and Standards

The HVAC system shall be designed in accordance with the following codes and standards:

Codes and standards	Version
Fire Safety of Buildings and Facilities	SNiP RK 2.02-05-2009
Building Climatology	SP RK 2.04-01-2017
Heating, Ventilation and Air Conditioning	SP RK 4.02-101-2012

Codes and standards	Version
Heating, Ventilation and Air Conditioning	SN RK 4.02-01-2011
Rules for the Implementation of Working Documentation for Heating, Ventilation and Air Conditioning	GOST 21.602-2016
Thermal protection of buildings	SN RK 2.04-04-2011

5.2 Outdoor Air Design Conditions

Summer		Winter	
Temperature (Dry Bulb)	Relative Humidity	Temperature (Dry Bulb)	Relative Humidity
34.9℃ (for air conditioning) 32.9℃ (for ventilation)	38%	-25.6℃	81%

5.3 Indoor Air Design Conditions

Room	Summer Temperature	Winter Temperature	Relative Humidity	Air changes (times/h)
Office	26℃	21℃	NC	60 m3/h per person
Restroom	26℃	16℃	NC	60 m3/h per person
Laboratory	20~25℃	20~25℃	NC	6
HVAC Room	29℃	10℃	NC	2
Corridor	NC	18℃	NC	NC
DCS Room	24℃	22℃	40~60%	6

Room	Summer Temperature	Winter Temperature	Relative Humidity	Air changes (times/h)
Electrical Room	35℃	5℃	NC	5
Transformer Room	40℃	5℃	NC	*
Chemical Storage	NC	5℃	NC	6
Plant Areas (Closed buildings)	NC	5℃	NC	3
Pump Room	35℃	5℃	NC	*
Water Treatment and wastewater treatment Room	NC	18℃	NC	6~8

Note: 1) NC is not control

2) “*” means the ventilation flow based on the heat dissipation.

5.4 Fresh Air Volume

The fresh air volume of ventilation and air conditioning system shall be in conformity with the following requirements:

- (1) Fresh air volume shall be no less than the volume needed by occupants.
- (2) The larger one of the air volume needed for compensating exhaust and keeping indoor normal pressure.
- (3) The minimum fresh air volume in the office is 60 m³/h per person

5.5 Internal Heat Gains

When calculating the cooling load of the air conditioning system, the heat gains inside the room shall be considered.

Internal heat gains including sensible and latent heat load of personnel, lighting load, heat dissipation capacity of equipment.

- (1) Lighting load

Lighting load shall be considered according to relevant electrical standards.

- (2) Occupant load

The following are the occupant activity and heat gain data according to the Hourly Analysis Program (HAP) v5.1 which is the calculation software developed by Carrier company.

Activity	Heat gain (W/per)	
	Sensible heat	Latent heat
Sit quietly	67.4	35.2
Lighter labor	71.8	60.1
Light labor	82.1	79.1
Middle labor	86.5	133.4
High labor	153.9	271.1

(3) Equipment load

The heat dissipation capacity of equipment shall be provided by the leading discipline, such as process equipment, DCS, electrical switch cabinet etc.

6 Heating System

6.1 Heating Medium

In this project, the heating system includes two heating medium: steam-water heating system and electric heating system.

6.2 Heating Method

The production plant, warehouse and pump stations shall be adopted steam-water heating system and the heating facilities shall be radiator or unit heater.

The substations, control room and rack room shall be adopted electric heating system and the heating facilities shall be electric heater or air handling unit.

The offices, meeting rooms, laboratories and guard house shall be adopted electric heating system and the heating facilities shall be electric heater or air conditioner.

The electrical heaters shall have the functions of temperature control and overheating protection.

If the buildings need to design a mechanical air supply system, the make-up air needs to be heated in winter.

6.3 Heat Exchange System

For the steam-water heating system, the heat source will be 95/70℃ hot water which shall be provided through steam exchange.

A heat exchange unit will be selected and installed, which includes two heat exchangers, two circulating pumps (one redundancy). two make-up water pumps (one redundancy) and pressurization system, control system etc.

7 Ventilation System

7.1 Ventilation Method

The ventilation design for elimination of excess heat or moisture shall first give priority to natural ventilation. When natural ventilation fails to meet the requirements on indoor sanitary condition and production, mechanical or combined mechanical and natural ventilation shall be adopted.

The building with heating and mechanical exhaust ventilation should be installed with a mechanical air supply system when natural air makeup fails to meet the requirements on indoor sanitary condition and process technique. When setting mechanical air supply system, air volume balance and heat balance shall be calculated. The air handling unit will be installed in the HVAC room. The air handling unit includes preliminary filter, medium efficiency filter, hot water or electric heating coil, air supply fan function section.

If the enclosure plant buildings emits explosive gas in the production process, the mechanical exhaust ventilation of air changes is not less than 3 times /h shall be adopted.

A building with possibility of sudden release of great amount of harmful or explosive gas shall be provided with emergency ventilation equipment. The air rate for emergency ventilation shall be determined after calculation as per the process design requirements with air changes no less than 8 times per hour. The switches for the fans of emergency ventilation shall be installed separately in places convenient for operation both indoors and outdoors.

Exhaust air after gas fire extinguishing shall be discharged from the lower part and the upper part respectively, and the air changes shall be at least 4 times/h. The damper on exhaust air duct shall be interlocked with exhaust fan; the fan shall be installed with switch in outdoors place convenient for operation.

The fresh air from the outdoor should first enter the settling chamber for naturally settling large particles of dust and sand, and then enters the ventilation or air conditioning system.

7.2 Ventilation Equipment

Explosion proof ventilation equipment shall be used in explosion hazard areas. The explosion proof ventilation equipment shall be selected according to the hazardous area division drawing provided by the electrical discipline and the determined electrical equipment type selection requirements, and the corresponding explosion proof grade and temperature group shall be indicated.

The air supply and exhaust system of rooms containing flammable and explosive hazardous substances in the air shall adopt explosion proof ventilation equipment.

Ventilation equipment and air-ducts used for repelling and conveying of flammable or explosive mixture shall take anti-static earthing measures (including flange joints) and shall not be made of insulation materials easy to produce static.

Ventilation equipment of discharging corrosive gas or moist air such as centrifugal fan, axial fan or duct fan should be anticorrosive and flame retardant FRP or Carbon steel with anti-corrosion coating equipment, if there are explosion proof requirements, the motor should be explosion proof.

7.3 Dust Removal

The conveying system of various products in the factory will produce dust in the process of transferring through the belt. Local exhaust hoods shall be installed at the head and tail of the belt to collect the dusty gas to the dust collector through the pipeline and discharge it to the atmosphere after purification.

Bag type dust collector shall be selected and installed. The dust cleaning method of the dust collector adopts impulse blowing, and the air source is the compressed air from the plant area.

Air duct shall be laid vertically or in slope, the angle between duct and the horizontal plane shall be more than 45 °. Duct section laid with slight slope or levelly shall not be too long and shall be applied with measures against dust settlement.

The dust collector shall be installed on the negative pressure section of the system.

7.4 Ventilation Duct and Its Component Parts

The supply & exhaust air duct should be galvanized steel sheet, angle steel flange connection. If there is corrosive medium, the exhaust duct shall be made of flame retardant FRP duct or stainless steel sheet. The air duct and flange specification and sheet material thickness shall comply with Kazakhstan standards SP RK 4.02-101-2012.

The air opening of the ventilation and air conditioning system should use aluminum alloy square or rectangular diffuser and single, double layer aluminum alloy register according to the air duct position. The air opening in the exterior wall should use aluminum alloy rainproof shutter.

The thermal insulation material of the supply & exhaust air duct is centrifugal glass wool. The protective layer material of indoor duct is aluminum foil, the protective layer material of outdoor duct is aluminum plate.

Ventilation ducts must be equipped with points for measuring environmental parameters.

8 Air Conditioning System

8.1 Air conditioning System of Buildings

Process air conditioning system shall meet the requirements of production process or product on air environment parameters; Comfortable air conditioning system shall meet the requirements of human comfort and health on air environment parameters.

In order to meet the comfort requirements of personnel, offices, laboratories, guard room, offices in the workshop and other auxiliary building will design split air conditioning system. The indoor units are wall mounted or cabinet type; the outdoor unit will be installed on the outdoor ground, wall or roof.

In order to meet the requirements of room temperature, the switchgear room and the field cabinet room will adopt air handling unit. The air handling unit will be installed in the HVAC room. The air handling unit includes preliminary filter, medium efficiency filter, cooling coil, electric heating coil, electrode humidifier (if necessary), air supply fan function section.

In order to meet the requirements of temperature and humidity in the instrument equipment room, the central control room shall equip with a constant temperature and humidity air conditioning system. The air handling unit includes preliminary filter, medium efficiency filter, cooling coil, electrical heating coil, electrode humidifier function section. The constant temperature and humidity air conditioning units are one duty and the other standby. When one unit fails, the other unit could still meet the requirements 100%, and their power supply load level should be consistent with the production device.

In order to reduce the corrosivity of outdoor harmful gas to instrument cabinet, fresh air shall be filtered by chemical filter unit at the area where harmful gas is possible existing. The combustible and harmful gas detection will be set at the fresh air inlet. When the combustible and harmful gas detector alarm, the control system will automatically shut down the supply air system and exhaust system.

8.2 Air Conditioning Equipment

The outdoor unit of the air conditioner shall be able to work normally in the outdoor high temperature environment. The cooling capacity of the air conditioner shall consider the attenuation caused by the high temperature environment and the length of the refrigerant pipe.

All air conditioning equipment shall use environment protection type refrigerant such as R410A or R407C.

8.3 Air Conditioning Duct and Its Component Parts

The air conditioning duct should be galvanized steel sheet, angle steel flange connection. The air duct and flange specification and sheet material thickness shall comply with Kazakhstan standards SP RK 4.02-101-2012.

Components of air conditioning system (such as air opening, air damper, fire damper, muffler, etc.) shall be factory produced products.

The thermal insulation material of air conditioning duct is centrifugal glass wool, and the external protective layer is aluminum foil.

9 Fire Prevention and Smoke Control

The design of fire prevention and smoke control of HVAC discipline must meet the codes and standards of Kazakhstan.

Fire damper shall be installed in the duct of ventilating and air conditioning system if the duct meets one of the following conditions:

- (1) Penetrating the fire compartment separation
- (2) Penetrating the partition wall and floor of the ventilating or air conditioning machine room

In case of fire alarm in the building, all ventilation and air conditioning equipment in the building shall be powered off.

When the DCS control room, cabinet room and other rooms are equipped with gas fire extinguishing system, the air conditioning duct shall be installed with electrically closed fire damper to isolate it from other rooms, and the closing of the fire damper shall be controlled by the fire alarm system.

Places in the building where smoke control system needs to be considered shall meet the requirements of clause 9.16 in Kazakhstan standards SP RK 4.02-101-2012.

Places in the building where smoke exhaust system needs to be considered shall meet the requirements of clause 9.2 in Kazakhstan standards SP RK 4.02-101-2012.

10 Electrical and Instrumentation

10.1 The power supply for HVAC equipment is 230V or 400V.

- (1) axial fan, centrifugal fan: 400V
- (2) Ceiling Fan: 230V
- (3) AHUs: 400V
- (4) Electric Heater: 230V
- (5) Split air conditioner: 230V or 400V

10.2 The control principles for AHUs

The temperature and humidity sensors of the air conditioning system in the DCS control room and cabinet room are installed in the important areas of the room. The control system of the constant temperature and humidity air conditioning unit will control and adjust the indoor air parameters.

Operation and fault signals of air conditioning units in DCS control room can be transmitted to DCS through communication or cable.

Differential pressure indicating instrument shall be installed in front of and behind the air filter of air handling unit and fresh air chemical filter unit. The signals shall be displayed on the control panel of air conditioning unit.

11 Design Margin

In the HVAC design, the following designs margins shall be considered:

- | | |
|--|-----|
| (1) Cooling & heating loads | 20% |
| (2) Air volume of air conditioning unit and fan | 20% |
| (3) Pressure loss of air conditioning and ventilation system | 20% |
| (4) Cooling & heating capacity of air conditioning unit | 20% |
| (5) Motor kW rating - Minimum 15% over absorbed power | |