



Public

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Installation, Operation and Maintenance Manual

D-EIMHP01601-22_07EN

CONDENSERLESS WATER-COOLED HEAT PUMPS

EWLQ014KCW1N
EWLQ025KCW1N
EWLQ033KCW1N
EWLQ049KCW1N
EWLQ064KCW1N

Original instructions

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Figure 1- EWLQ 014-033 KCW1N refrigerant circuit scheme

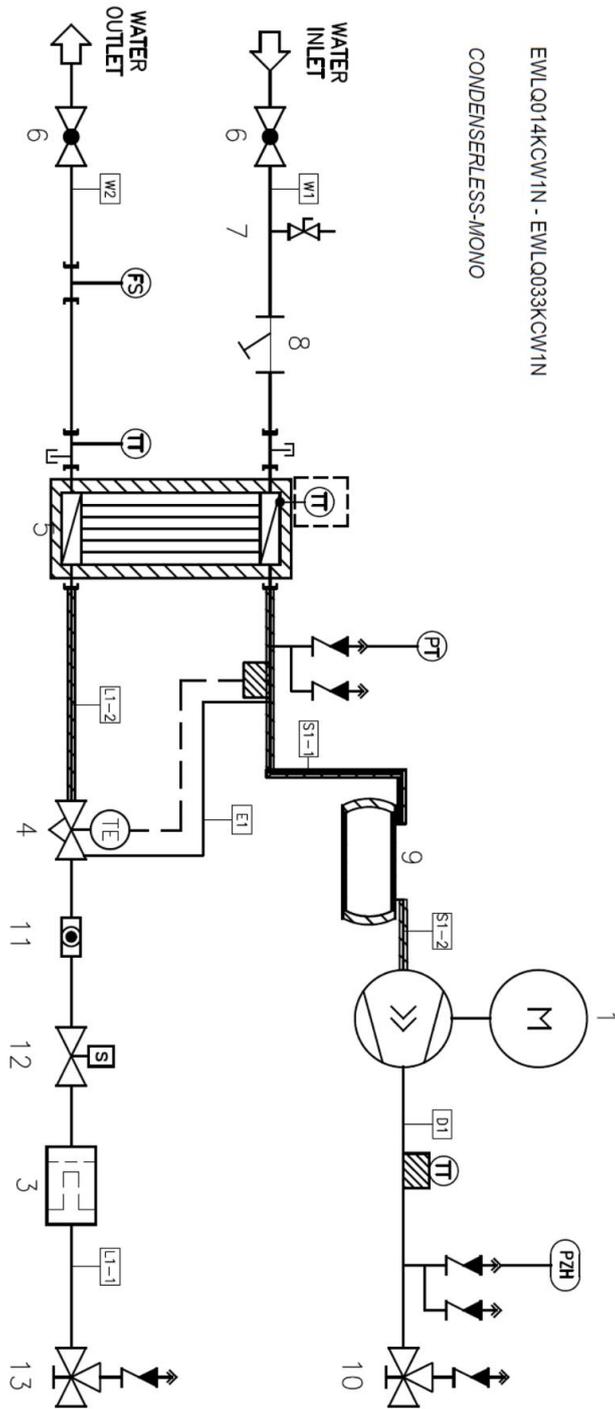
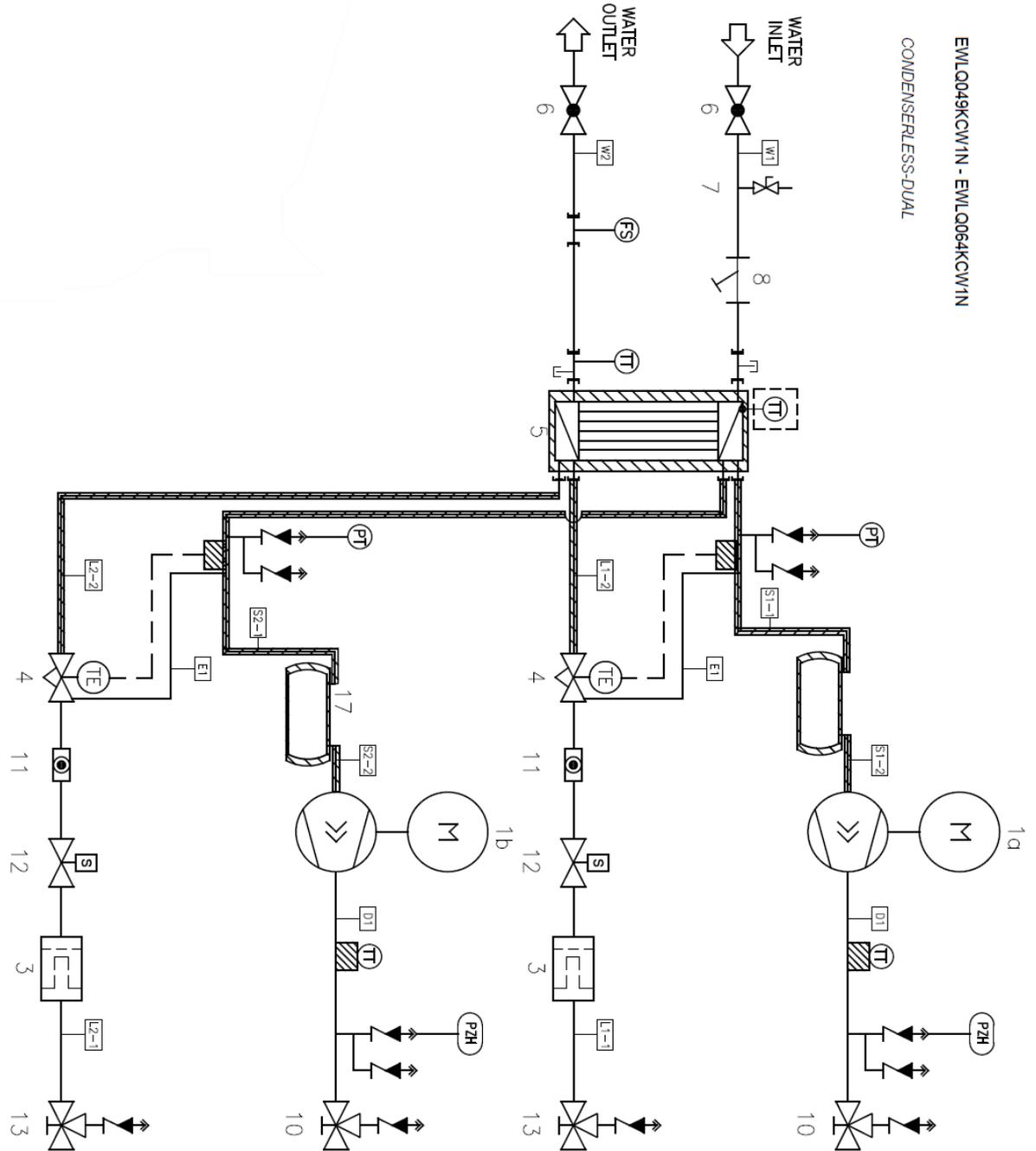


Figure 2- EWLQ 049 - 064 KCW1N Refrigerant circuit scheme



LEGEND

1	Compressor	D1	Compressor-Condenser
3	Drier filter	L1-2	Therm.Exp Valve-Evaporator
4	Thermostatic expansion valve	S1	Evaporator-Compressor
5	Evaporator (BPHE)	S1-1/S2-1	Evaporator-Accumulator
6	Ball valve (optional)	S1-2/S2-2	Accumulator-Compressor
7	Air purge valve (optional)	W1/W3	Water inlet assembly (Included kit, but optional mounting)
8	Water filter (optional)	W2/W4	Water outlet assembly (Included kit, but optional mounting)
9	Accumulator	E1/E2	Equalizer pipe
10	Discharge stop valve	TT	Temperature sensor
11	Sight glass	PT	Pressure transducer (6, 5 barg)
12	Liquid solenoid valve	PZH	High pressure switch (40, 7 barg)
13	Liquid stop valve	FS	Flow switch

1. INTRODUCTION

This manual is an important supporting document for qualified personnel but it is not intended to replace such personnel.



READ THIS MANUAL CAREFULLY BEFORE INSTALLING AND STARTING UP THE UNIT. IMPROPER INSTALLATION COULD RESULT IN ELECTRIC SHOCK, SHORT-CIRCUIT, LEAKS, FIRE OR OTHER DAMAGE TO THE EQUIPMENT OR INJURE TO PEOPLE.



THE UNIT MUST BE INSTALLED BY A PROFESSIONAL OPERATOR/TECHNICIAN UNIT STARTUP HAS TO BE PERFORMED BY AUTHORIZED AND TRAINED PROFESSIONAL ALL ACTIVITIES HAVE TO BE PERFORMED ACCORDING TO LOCAL LAWS AND REGULATION.



UNIT INSTALLATION AND START UP IS ABOSOLUTELY FORBIDDEN IF ALL INSTRUCTION CONTAINED IN THIS MANUAL ARE NOT CLEAR. IN CASE OF DOUBT CONTACT THE MANUFACTURER REPRESENTATIVE FOR ADVICE AND INFORMATION.

1.1 General description

The unit is supplied and shipped with a holding charge of 0.5 bar nitrogen (N₂). This unit must be charged with R410A refrigerant.

Pay attention to the selection of your remote condenser. Make sure to select a remote condenser developed for use with R410A.

The EWLQ units can be combined with Daikin fan coil units or air handling units for air conditioning purposes. They can also be used for supplying chilled water for process cooling.

The present installation manual describes the procedures for unpacking, installing and connecting the EWLQ units.

This appliance is intended to be used by expert or trained users in shops, in light industry and on farms, or for commercial use by lay persons.

Sound pressure level is less than 70 dB(A).

Table 1-Technical specifications ⁽¹⁾

Model EWLQ	014	025	033
Dimensions HxWxD (mm)	600x600x600		
Machine Weight (kg)	104	138	149
Connections			
Chilled water inlet and outlet	G1		
Condenser discharge connection (copper)	5/8"	3/4"	3/4"
Condenser liquid connection copper)	5/8"	5/8"	5/8"
Model EWLQ			
		049	064
Dimensions HxWxD (mm)	600x600x1200		
Machine weight (kg)	252		274
Connections			
Chiller water inlet and outlet (mm)	G 1-1/2		
Condenser discharge connection (copper)	3/4"		3/4"
Condenser liquid connection (copper)	5/8"		5/8"

Table 2-Electrical specifications ⁽¹⁾

General EWLQ		014-064
Power supply		-
Phase		3N~
Frequency	(Hz)	50
Voltage	(V)	400
Voltage tolerance	(%)	±10

(1) Refer to the operation manual or engineering data book for the complete list of specifications, options, and features.

1.2 Important information about the refrigerant used

This product is factory charged with N2.

The refrigerant system will be charged with fluorinated greenhouse gases covered by the Kyoto Protocol.

Do not vent gases into the atmosphere.

Refrigerant type: R410A

GWP (1) value:2090

Please fill in with indelible ink,

- the total refrigerant charge

(1) GWP = global warming potential

1.3 Information about installation

1.3.1 Selection of location

The units are designed for indoor installation and should be installed in a location that meets the following requirements:

1. The foundation is strong enough to support the weight of the unit and the floor is flat to prevent vibration and noise generation.
2. The space around the unit is adequate for servicing.
3. There is no danger of fire due to leakage of flammable gas.
4. Select the location of the unit in such a way that the sound generated by the unit does not disturb anyone.
5. Ensure that water cannot cause any damage to the location in case it drips out of the unit.

The equipment is not intended for use in a potentially explosive atmosphere.

1.3.2 Selection of piping material

1. Foreign materials inside pipes (including oils for fabrication) must be 30 mg/10 m or less.
2. Use the following material specification for refrigerant piping:
 - construction material: Phosphoric acid deoxidized seamless copper for refrigerant.
 - size: Determine the proper size referring to "Technical specifications".
 - the pipe thickness of the refrigerant piping must comply with relevant local and national regulations. For R410A the design pressure is 4.17 MPa.
3. In case the required pipe sizes (inch sizes) are not available, it is also allowed to use other diameters (mm sizes), taken the following into account:
 - select the pipe size nearest to the required size.
 - use the suitable adapters for the change-over from inch to mm pipes (field supply).

For the RLK regulation the flare nuts on the stop valves must be replaced by flare solder connections.

2. INSPECTING AND HANDLING THE UNIT

At delivery, the unit should be checked, and any damage should be reported immediately to the carrier claims agent.

2.1 Unpacking and placing the unit

1. Cut the straps and remove the cardboard box from the unit.
2. Cut the straps and remove the cardboard boxes with water piping from the pallet.
3. Remove the four screws fixing the unit to the pallet.
4. Level the unit in both directions.
5. Use four anchor bolts with M8 thread to fix the unit in concrete.
6. Remove the service front plate.

3. OPERATION RANGE

Figure 3- Operation range EWLQ014-033KC

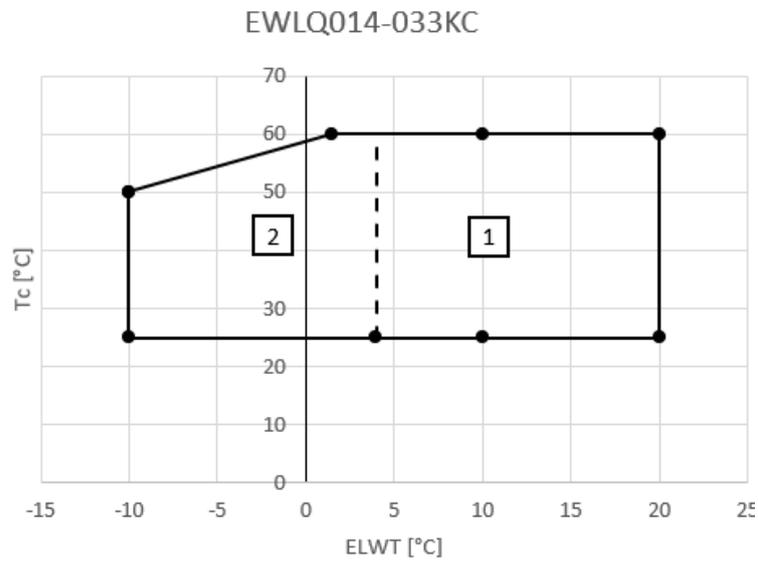
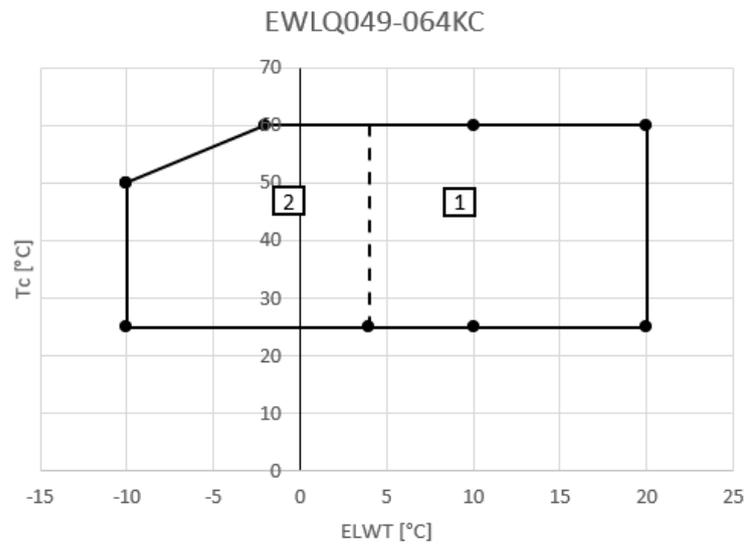


Figure 4-EWLQ049-064KC



- ELWT: Evaporator leaving water temperature
- Tc: Saturated condensing temperature
- 1: Operation with water
- 2: Operation with glycol (below ELWT=4°C)

4. MECHANICAL INSTALLATION

4.1 Connecting the refrigerant circuit



The units are equipped with a refrigerant outlet (discharge side) and a refrigerant inlet (liquid side) for the connection to a remote condenser. This circuit must be provided by a licensed technician and must comply with all relevant European and national regulations.

4.2 Precautions when handling piping

If air, moisture or dust gets in the refrigerant circuit, problems may occur. Therefore, always consider the following when connecting the refrigerant piping:

1. Use clean and dry pipes only.
2. Hold the pipe end downwards when removing burrs.
3. Cover the pipe end when inserting it through a wall so that no dust and dirt enter.



When a condenser less unit is installed below the condensing unit, the following can occur:

- when the unit stops, oil will return to the discharge side of the compressor. When starting the unit, this can cause liquid (oil) hammer.
- The oil circulation will decrease

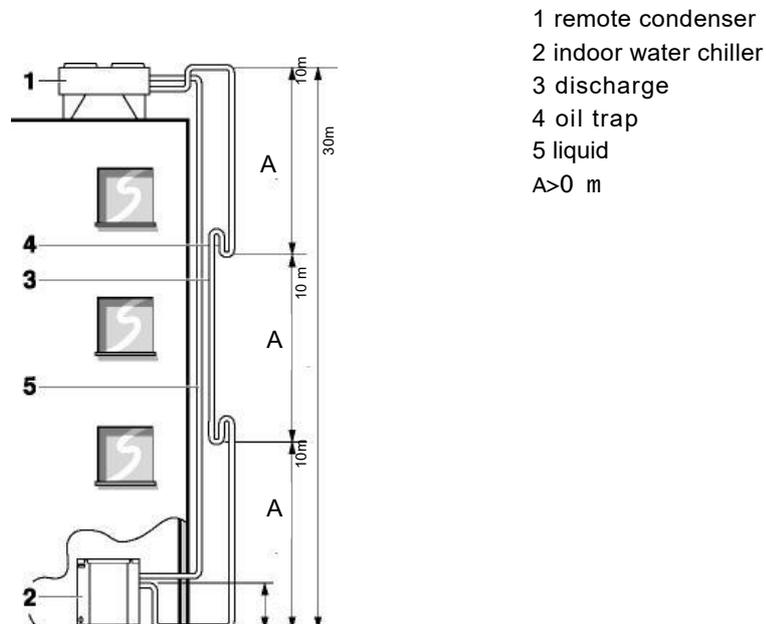
To solve these phenomena, provide oil traps in the discharge pipe every 10m if the level difference is more than 10m.

4.3 Connecting the refrigerant circuit

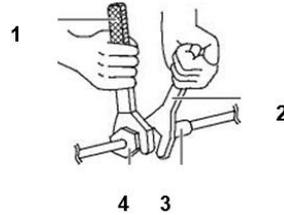
- Use a pipe cutter and flare suitable for R410A.

Make sure to use installation tools (gauge manifold charge hose, etc.) that are exclusively used for R410A installations to withstand the pressure and to prevent foreign materials (e.g., mineral oils such as SUNISO and moisture) from mixing into the system.

Figure 5-Connecting the refrigerant circuit (1)



- Vacuum pump (use a 2-stage vacuum pump with a non-return valve):
 - Make sure the pump oil does not flow oppositely into the system while the pump is not working.
 - Use a vacuum pump which can evacuate to -100.7 kPa (5 Torr, -755 mm Hg).
- Be sure to use both a spanner and torque wrench together when connecting or disconnecting pipes to/from the unit.



- 1- Torque wrench
- 2- Spanner
- 3- Piping union
- 4- Flare nut

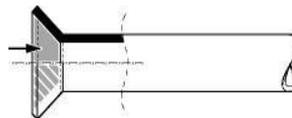
Refer to the table below for the dimensions of flare nut spaces and the appropriate tightening torque. (Overtightening may damage the flare and cause leaks.)

Table 3- Flare nut spaces dimensions and appropriate tightening torque

Pipe gauge	Tightening torque	Flare dimension A (mm)	Flare shape
$\text{Ø} 9.5$	33~39 N•m	12.0~12.4	
$\text{Ø} 12.7$	50~60 N•m	15.4~15.8	
$\text{Ø} 19.1$	97~110 N•m	22.9~23.3	

- When connecting the flare nut, coat the flare inner surface with ether oil or ester oil and initially tighten 3 or 4 turns by hand before tightening firmly.

Figure 6-Connecting the refrigerant circuit (3)

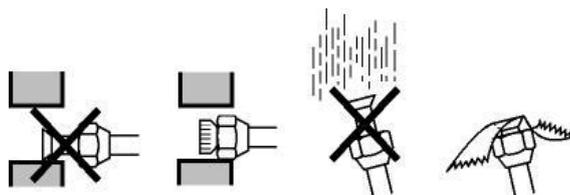


- Check the pipe connector for gas leaks.



When inserting the refrigerant piping in the wall hole, take care not to let dust or moisture come into the piping. Protect the pipes with a cap or seal the pipe end completely with tape.

Figure 7- Connecting the refrigerant circuit (4)



The discharge and liquid line are to relate to flare connections to the remote condenser piping. For use of the correct pipe diameter see "Technical specifications".

Piping length: equivalent = 50 m
 Maximum height = 30 m



Make sure the pipes are filled with N2 during welding in order to protect the pipes against soot. There should be no blockage (stop valve, solenoid valve) between the remote condenser and the provided liquid injection of the compressor.

4.4 Leak test and vacuum drying

The units were checked for leaks by the manufacturer.

After connection of the piping, a leak test must be performed and the air in the refrigerant piping must be evacuated to a value of 4 mbar absolute by means of a vacuum pump.

4.5 Open the discharge- and liquid stop valves.

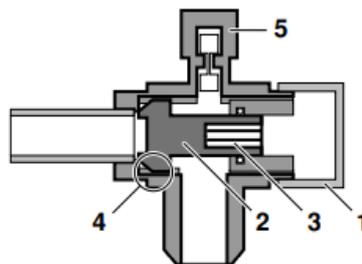
1. to open:

- Remove the cap (1) and turn the shaft (2) counterclockwise with hexagon socket screw keys (3) (JIS B 4648 nominal size 4 mm).
- Turn it all the way until the shaft stops.
- Tighten the cap firmly.

2. to close:

- Remove the cap and turn the shaft clockwise.
- Tighten the shaft firmly until it reaches the sealed area (4) of the body.
- Tighten the cap firmly.

Figure 8- Charging the unit



NOTES

- Use a charging hose with push rod when using the service port (5).
- Make sure to keep stop valve open during operation.
- Check for refrigerant gas leakage after tightening the cap.



Do not purge the air with refrigerants. Use a vacuum pump to vacuum the installation.

Table 4-Charging the unit

	Refrigerant charge (kg)
EWLQ014	$0.9+(0.06 \times \text{LLP}) +(\text{VRC} \times 0.38)$
EWLQ025	$1.5+(0.12 \times \text{LLP}) +(\text{VRC} \times 0.38)$
EWLQ033	$2.0+(0.12 \times \text{LLP}) +(\text{VRC} \times 0.38)$
EWLQ049	$2 \times [2.0+(0.12 \times \text{LLP}) +(\text{VRC} \times 0.38)]$
EWLQ064	$2 \times [2.0+(0.12 \times \text{LLP}) +(\text{VRC} \times 0.38)]$

VRC= volume of remote condenser (l)
LLP= length of liquid pipe (m)

4.6 Perform a fine-tuning

For fine-tuning of the refrigerant charge, the compressor must operate.

- If the liquid-line sight glass is showing seal after the rough charging (due to possible different conditions), add 10% refrigerant charge weight.
- If the liquid-line sight glass is showing some glass bubbles, the rough refrigerant charge is sufficient by fine-tuning the additional 10% refrigerant charge weight.
- If the liquid-line sight glass is showing flash gas, then charge until the additional 10% refrigerant charge weight. The unit must have time to stabilize which means that this charging must be done in a smooth way.



Take care for contamination of the remote condenser in order to avoid blocking of the system. It is impossible for Daikin to control the contamination of the "foreign" condenser of the installer. The Daikin unit has a strict contamination level.



Use the liquid line check valve for charging refrigerant and make sure to charge liquid

5. CHECKING THE WATER CIRCUIT

The units are equipped with a water inlet and water outlet for connection to a chilled water circuit. This circuit must be provided by a licensed technician and must comply with all relevant European and national regulations.



The unit is only to be used in a closed water system. Application in an open water circuit can lead to excessive corrosion of the water piping.

Before continuing the installation of the unit, check the following points:

5.1 Additional components not delivered with the unit:

1. A circulation pump must be provided in such a way that it discharges the water directly into the heat exchanger.
2. Drain traps must be provided at all low points of the system to permit complete drainage of the circuit during maintenance or in case of shut down.
3. Anti-vibration systems in all water piping connected to the chiller are recommended to avoid straining the piping and transmitting vibration and noise.

5.2 Additional water piping delivered with the unit

All additional water piping must be installed on the system according to the piping diagram as mentioned in the operation manual. The flow switch must be connected as described on the wiring diagram. See also chapter "Before starting".

Figure 9- Water piping evaporator-plastic bag 1

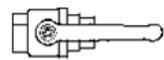
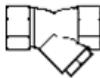
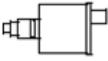
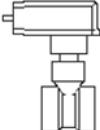
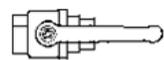
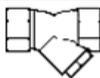
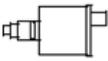
	2x Ball valve
	1x Water filter
	1x Air purge
	1x T-joint for air purge
	2x Flow switch pipe
	1x Flowswitch + 1x T-joint

Figure 10-Water piping condenser-plastic bag (2)

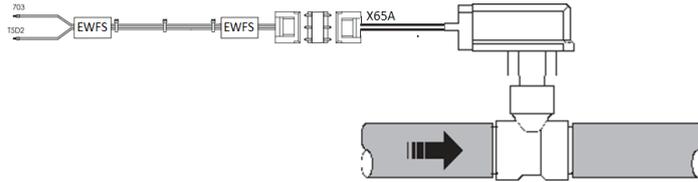
	2x Ball valve
	1x Water filter
	1x Air purge
	1x T-joint for air purge

1. A flow switch must be installed in the water outlet pipe of the evaporator to prevent the unit from operating at a water flow which is too low.



It is very important to install the flow switch as shown in the figure. Observe the position of the flow switch in relation to the direction of the water flow. If the flow switch is mounted in any other position, the unit is not protected properly against freezing.

Figure 11-Flowswitch installation



A specific terminal is provided in the switch box for the electrical connection of the flow switch. Refer to the wiring diagram

2. Shut-off valves must be installed at the unit so that normal servicing of the water filter can be accomplished without draining the complete system.
3. Air purge valves must be provided at all high points of the system. The vents should be located at points which are easily accessible for servicing.
4. The water filter must be installed in front of the unit for removing dirt from the water to prevent damage to the unit or malfunctioning of the evaporator.
5. The water filter must be cleaned on a regular base.

Table 5- Water quality specification

DAE Water quality requirements	BPHE
pH (25°C)	7.5-9.0
Electrical conductivity (25°C)	<500 µS/cm
Chloride ion	
Chlorine molecular	<1.0mg Cl ₂ /l
Sulphate ion (SO ₄ ²⁻ /l)	<100 mg SO ₄ ²⁻ /l
Alkalinity	<100 mg CaCO ₃ /l
Total Hardness	80-150 mg CaCO ₃ /l
Iron	
Copper	
Ammonium ion (NH ₃)	<0.5mg NH ₄ ⁺ /l
Silica	
Dissolved Oxygen	
Total dissolved solids	
Hydrogen carbonate (HCO ₃ ⁻)	60-200 mg HCO ₃ /l
(HCO ₃ ⁻)/(SO ₄ ²⁻)	>0.5
(Ca+Mg)/(HCO ₃ ⁻)	>1.6

5.3 Connecting the water circuit

The evaporator is provided with GAS female pipe thread connections for the water inlet and outlet (refer to the outlook diagram). Evaporator water connections are to be made in accordance with the outlook diagram, respecting the water in- and outlet.

If air, moisture or dust gets in the water circuit, problems may occur. Therefore, always consider the following when connecting the water circuit:

1. Use clean pipes only.
2. Hold the pipe end downwards when removing burrs.
3. Cover the pipe end when inserting it through a wall so that no dust and dirt enter.



Use a good thread sealant for the sealing of the connections. The sealing must be able to withstand the pressures and temperatures of the system, it must also be resistant to the used glycol in the water.

The external surface of the water pipes must be adequately protected against corrosion.

5.4 Water charge, flow and quality

To assure proper operation of the unit a minimum water volume is required in the system and the water flow through the evaporator must be within the operation range as specified in the table below.

Table 6-Water flow operation range

	Minimum water volume (l)	Minimum water flow	Maximum water flow
EWVQ014	62	31 l/min	75 l/min
EWVQ025	134	53 l/min	123 l/min
EWVQ033	155	76 l/min	186 l/min
EWVQ049	205	101 l/min	247 l/min
EWVQ064	311	152 l/min	373 l/min

5.5 Plant water content

The water content of the systems should have a minimum water amount to avoid excessive stress (start and stops) on the compressors. Design considerations for water volume are the minimum cooling load, the water temperature setpoint differential and the cycle time for the compressors.

As a general indication, the system water content should not be less than the values deriving from the following formula:

$$\text{Single circuit Unit} \rightarrow 5 \frac{\text{lt}}{\text{kW nominal}}$$

$$\text{Dual circuit Unit} \rightarrow 3,5 \frac{\text{lt}}{\text{kW nominal}}$$

kW_{nominal} = Cooling capacity at 12/7°C OAT=35°C

The above rule of thumb derives from the following formula, as the relative volume of water capable of maintaining the water temperature setpoint differential during the minimum load transient avoiding an excessive starts and stops of the compressor itself (which depends on the compressor technology):

$$\text{Water Volume} = \frac{CC [W] \times \text{Min load \%} \times DNCS[s]}{FD \left[\frac{g}{L} \right] * SH \left[\frac{J}{g^{\circ}C} \right] * (DT)[^{\circ}C]}$$

CC = Cooling Capacity

DNCS = Delay to next Compressor Start

FD = Fluid Density

SH = Specific Heat

DT = Water Temperature Setpoint Differential

A properly designed storage tank should be added if the system components do not provide sufficient water volume.

By default, the unit is set to have a water temperature setpoint differential in line with Comfort application which allows to operate with the minimum volume mentioned in the previous formula.

However, if a smaller temperature differential is set, as in the case of Process applications where temperature

fluctuations must be avoided, a larger minimum water volume will be required.

To ensure proper operation of the unit when changing the value of setting, the minimum water volume must be corrected.

In case of more than one installed unit, the overall capacity of the installation must be considered in the calculation so summing the water content of each unit.

5.6 Water piping insulation

The complete water circuit, inclusive all piping, must be insulated to prevent condensation and reduction of the cooling capacity.

5.7 Refrigerant piping insulation

To prevent burning injuries by accidental touching the hot (max 135 °C) discharge pipe, it must be insulated thoroughly. A minimum of insulation to protect the liquid pipe from damage is advisable.

5.8 Antifreeze protection for BPHE and recovery exchangers

If the exchangers are completely empty and cleaned with antifreeze solution, additional methods can be used against freezing.

The following protection methods must be considered when designing the system as a whole:

1. continuous water flow circulation inside piping and exchangers.
2. addition of an appropriate amount of glycol inside the water circuit or, as alternative, an additional heat insulation and heating of exposed piping (internal and external to the unit).
3. if the unit does not work during the winter season, emptying and cleaning of the heat exchanger.

It is the responsibility of the installer and/or of local maintenance personnel to ensure that described antifreeze methods are used.

Make sure that appropriate antifreeze protection is always maintained. Failing to follow the instructions above could result in unit damage.



Damage caused by freezing is excluded from the warranty, therefore Daikin Applied Europe S.p.A. declines all responsibility.

6. ELECTRICAL INSTALLATION



All electrical maintenance activities must be followed by qualified personnel. Make sure the system is switched off and the main switch of the unit open. Failure to observe this rule could result in serious personal injury. When the unit is turned off, but the disconnection switch is in the closed position, the unused circuits will still be active.

The maintenance of the electrical system consists of the application of some general rules as follows:

1. the current absorbed by the compressor must be compared to the rated value. Normally the value of the absorbed current is lower than the rated value that corresponds to the absorption of the full load compressor at the maximum operating conditions.
2. at least once every three months all the security checks must be made to verify their functionality. Each appliance, with aging, can change its point of operation and this must be monitored to adjust it or replace it. The pump interlocks and flow switches must be checked to make sure that they interrupt the control circuit if they intervene.



All field wiring and components must be installed by a licensed electrician and must comply with relevant European and national regulations.

The field wiring must be carried out in accordance with the wiring diagram supplied with the unit and the instructions given below.

Be sure to use a dedicated power circuit. Never use a power supply shared by another appliance.



During the removal of the control cabinet door, disconnect the display cable before removing the panel completely. the display cable can be disconnected without the need to unlock any latch.

Power circuit and cable requirements

1. The electrical power supply to the unit must be arranged so that it can be switched on or off independently of the electrical supply to other items of the plant and equipment in general.
2. A power circuit must be provided for connection of the unit. This circuit must be protected with the required safety devices, i.e., a circuit breaker, a slow blow fuse on each phase and an earth leak detector. Recommended fuses are mentioned on the wiring diagram supplied with the unit.



Switch off the main isolator switch before making any connections (switch off the circuit breaker, remove or switch off the fuses).

Connection of the water-cooled water chiller power supply

1. Install cable gland to proper tight main power supply cable
2. Using the appropriate cable, connect the power circuit to the N, L1, L2 and L3 terminals of the unit. (cable section 2.5~16mm²).
3. Connect the earth conductor (yellow/green) to the earthing terminal PE.

6.1 Point for attention regarding quality of the public electric power supply

This equipment complies with EN/IEC 61000-3-11(1) provided that the system impedance Z_{sys} is less than or equal to Z_{max} at the interface point between the user's supply and the public system. It is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator, if necessary, that the equipment is connected only to a supply with a system impedance Z_{sys} less than or equal to Z_{max} .

Table 7-Zmax (Ω)

	Zmax (Ω)
EWLQ014	0.28
EWLQ025	0.23
EWLQ033	0.21
EWLQ033	0.22
EWLQ064	0.20

Complying with EN/IEC 61000-3-12(2)

7. OPERATION

7.1 Operator's responsibilities

It is essential that the operator is appropriately trained and becomes familiar with the system before operating the unit. In addition to reading this manual, the operator must study the microprocessor operating manual and the wiring diagram to understand start-up sequence, operation, shutdown sequence and operation of all the safety devices.

During the unit initial start-up phase, a technician authorized by the manufacturer is available to answer any questions and to give instructions as to the correct operating procedures.

The operator must keep a record of operating data for every installed unit. Another registration must also be kept for all the periodic maintenance and assistance activities.

If the operator notes abnormal or unusual operating conditions, he is advised to consult the technical service authorized by the manufacturer.



If the unit is switched off, the compressor oil heater cannot be used. Once the unit is reconnected to the mains, leave the compressor oil heater charged for at least 6 hours before restarting the unit.

Failure to observe this rule may cause damage to the compressors due to excessive accumulation of liquid inside them.

This unit represents a substantial investment and deserves the attention and care to keep this equipment in good working order.

However, during operation and maintenance it is essential to observe the following instructions:

- Do not allow unauthorized and / or unqualified personnel to access the unit.
- It is forbidden to access the electrical components without having opened the unit main switch and switched off the power supply.
- It is forbidden to access the electrical components without using an insulating platform. Do not access the electrical components if water and/or moisture are present.
- Verify that all operations on the refrigerant circuit and on the components under pressure are carried out exclusively by qualified personnel.
- The replacement of the compressors must be carried out exclusively by qualified personnel.
- Sharp edges and the surface of the condenser section could cause injury. Avoid direct contact and use adequate protection device.
- Do not introduce solid objects into the water pipes while the unit is connected to the system.
- It is absolutely forbidden to remove all protections of moving parts.

In case of sudden stop of the unit, follow the instructions on the Control Panel Operating Manual which is part of the on-board documentation delivered to the end user.

It is strongly recommended to perform installation and maintenance with other people.



Avoid installing the unit in areas that could be dangerous during maintenance operations, such as platforms without parapets or railings or areas not complying with the clearance requirements around the unit.

8. MAINTENANCE

Table 8-R410A Pressure / temperature table

°C	Bar	°C	Bar	°C	Bar
-13	5.22	14	12.30	41	24.95
-12	5.41	15	12.65	42	25.56
-11	5.60	16	13.02	43	26.18
-10	5.79	17	13.39	44	26.81
-9	6.00	18	13.77	45	27.45
-8	6.20	19	14.15	46	28.10
-7	6.42	20	14.55	47	28.77
-6	6.63	21	14.95	48	29.44
-5	6.86	22	15.37	49	30.13
-4	7.09	23	15.79	50	30.84
-3	7.32	24	16.22	51	31.55
-2	7.56	25	16.65	52	32.28
-1	7.81	26	17.10	53	33.02
0	8.06	27	17.56	54	33.78
1	8.32	28	18.02	55	34.55
2	8.59	29	18.49	56	35.33
3	8.86	30	18.98	57	36.13
4	9.14	31	19.47	58	36.95
5	9.42	32	19.97	59	37.78
6	9.71	33	20.48	60	38.62
7	10.01	34	21.01	61	39.48
8	10.32	35	21.54	62	40.36
9	10.63	36	22.08	63	41.25
10	10.95	37	22.63	64	42.16
11	11.27	38	23.20	65	43.09
12	11.61	39	23.77	66	44.04
13	11.95	40	24.36	67	45.01

8.1 Routine maintenance

This unit must be maintained by qualified technicians. Before beginning any work on the system, the personnel shall assure that all security precautions have been taken.

Neglecting unit maintenance could degrade all parts of the units (coils, compressors, frames, pipes, etc.) with negative effect on performances and functionality.

There are two different levels of maintenance, which can be chosen according to the type of application (critical/noncritical) or to the installation environment (highly aggressive).

Examples of critical applications are process cooling, data centres, etc.

Highly Aggressive Environments can be defined as the follows:

- Industrial environment (with possible concentration of fumes result of combustion and chemical process).
- Coastal environment.
- Highly polluted urban environment.
- Rural environment close to of animal excrement and fertilizers, and high concentration of exhaust gas from diesel generators.
- Desert areas with risk of sandstorms.
- Combinations of the above.
- Unit exposed to a highly aggressive environment can face corrosion in a shorter time than ones installed on a standard environment. Corrosion causes a rapid rusting of the frame core, consequently, decreases unit structure lifetime. To avoid that, it is necessary to wash periodically the frame surfaces with water and suitable detergents.
- In case of part of unit frame paint came off, it is important to stop its progressive deterioration by repainting the exposed parts using proper products. Please contact factory to get the required products specifications.
- In case of just salt deposits are present, it is enough to rinse the parts with fresh water.

8.2 Service and limited warranty

All units are factory tested and guaranteed for 12 months as of the first start-up or 18 months as of delivery.

These units have been developed and constructed according to high quality standards ensuring years of failure free operation. **However, the unit requires maintenance even during the warranty period, from the time of installation and not just from the commissioning date.** We strongly advise stipulating a maintenance contract with a service authorized by the manufacturer to ensure efficient and problem free service, thanks to the expertise and experience of our personnel.

It must be borne in mind that operating the unit in an inappropriate manner, beyond its operating limits or not performing proper maintenance according to this manual can void the warranty. Observe the following points, to conform to warranty limits:

1. The unit cannot function beyond the specified limits.
2. The electrical power supply must be within the voltage limits and without voltage harmonics or sudden changes.
3. The three-phase power supply must not have an unbalance between phases exceeding 3%. The unit must stay turned off until the electrical problem has been solved.
4. No safety device, either mechanical, electrical or electronic must be disabled or overridden.
5. The water used for filling the water circuit must be clean and suitably treated. A mechanical filter must be installed at the point closest to the BPHE inlet.
6. The value of the BPHE water flow must be included in the declared range for the unit considered, refer to the CSS selection software.

Table 9– Standard Routine Maintenance Plan

List of Activities	Weekly	Monthly (Note 1)	Semiannual	Yearly/Seasonal (Note 2)
General:				
Reading of operating data (Note 3)	X			
Visual inspection of unit for any damage and/or loosening		X		
Verification of thermal insulation integrity		X		
Cleaning		X		
Paint where necessary				X
Analysis of water (Note 4)				X
Check of flow switch operation		X		
Electrical Installation:				
Verification of control sequence				X
Verify contactor wear – Replace if necessary				X
Verify that all electrical terminals are tight – Tighten if necessary		X (Quarterly)		
Clean inside the electrical panel				X
Visual inspection of components for any signs of overheating		X		
Verify operation of compressor and electrical resistance		X		
Refrigeration circuit:				
Check for any refrigerant leakage (leak test)		X		
Analyse compressor vibrations				X
Check and application of additional protective paint layer (Note 7)			X	
Hydraulic circuit:				
Check for any water leakage		X		
Check hydraulic connections		X		
Check the pressure at the exchangers water inlet		X		
Clean the water filter				X
Check the glycol concentration				X
Check the water flow rate		X		
BPHE:				
Check the cleaning of the BPHE				X

Notes:

1. Monthly activities include all the weekly ones.
2. The annual (or early season) activities include all weekly and monthly activities.
3. Daily reading of the operating values of the unit allows maintaining high observational standards.
4. Check for any dissolved metals.
5. Clean condenser banks with clean water and water heat exchangers with appropriate chemicals. Particles and fibres could clog up the exchangers, especially for water exchangers pay attention if water rich in calcium carbonate is used. An increase in pressure drops or a decrease in thermal efficiency means that the heat exchangers are clogged. In environments with a high concentration of airborne particles, it might be necessary to clean the condenser bank more often.
6. Units placed or stored in a Highly Aggressive Environment for long time without operation are still subject to those routine maintenance steps.
7. The protective paint layer must be applied on: all brazing and joints of copper refrigerant pipes; drier filter plate; Rotalock valves and flanges of refrigerant circuit; all BPHE not insulated; anti-chattering capillars.

Table 10- Routine Maintenance Plan for Critical Application and/or Highly Aggressive Environment

List of Activities	Weekly	Monthly (Note 1)	Semiannual	Yearly/Seasonal (Note 2)
General:				
Reading of operating data (Note 3)	X			
Visual inspection of unit for any damage and/or loosening		X		
Verification of thermal insulation integrity		X		
Cleaning		X		
Paint where necessary				X
Analysis of water (Note 4)				X
Check of flow switch operation		X		
Electrical Installation:				
Verification of control sequence				X
Verify contactor wear – Replace if necessary				X
Verify that all electrical terminals are tight – Tighten if necessary				X
Clean inside the electrical control board		X		
Visual inspection of components for any signs of overheating		X		
Verify operation of compressor and electrical resistance		X		
Measure compressor motor insulation				X
Refrigeration circuit:				
Check for any refrigerant leakage (leak test)		X		
Analyse compressor vibrations				X
Check and application of additional protective paint layer(Note 7)			X	
Hydraulic circuit:				
Check for any water leakage		X		
Check hydraulic connections		X		
Check the pressure at the exchangers water inlet		X		
Clean the water filter				X
Check the glycol concentration				X
Check the water flow rate		X		
BPHE:				
Check the cleaning of the BPHE				X

Notes:

1. Monthly activities include all the weekly ones.
2. The annual (or early season) activities include all weekly and monthly activities.
3. Daily reading of the operating values of the unit allows maintaining high observational standards.
4. Check for any dissolved metals.
5. Clean condenser banks with clean water and water heat exchangers with appropriate chemicals. Particles and fibres could clog up the exchangers, especially for water exchangers pay attention if water rich in calcium carbonate is used. An increase in pressure drops or a decrease in thermal efficiency means that the heat exchangers are clogged. In environments with a high concentration of airborne particles, it might be necessary to clean the condenser bank more often.
6. Units placed or stored in a Highly Aggressive Environment for long time without operation are still subject to those routine maintenance steps.
7. The protective paint layer must be applied on:all brazing and joints of copper refrigerant pipes; drier filter plate; Rotalock valves and flanges of refrigerant circuit; all BPHE not insulated; anti-chattering capillars.

9. CHECKS FOR THE FIRST START-UP



The unit should not be started, not even for a very short period, before the following pre-commissioning checklist is filled out completely.

Table 11-Pre-commissioning checklist

Tick/when checked	Standard stops to go through before starting the unit
1	Check for external damage .
2	Install main fuses, earth leak detector and main switch . Recommended fuses: aM according to IEC standard 269-2. <i>Refer to the wiring diagram for size.</i>
3	Supply the main voltage and check if it is within the allowable $\pm 10\%$ limits of the nameplate rating. The electrical main power supply must be arranged so, that it can be switched on or off independently of the electrical supply to other items of the plant and equipment in general. Refer to the wiring diagram, terminals N, PE, L1, L2 and L3.
4	Supply water to the evaporator and verify if waterflow is within the limits as given in the table under "Water charge, flow and quality".
5	The piping must be completely purged . See also chapter "Checking the water circuit".
6	Connect the flow switch and pump-contacts , so that the unit can only come in operation when the waterpumps are running and the waterflow is sufficient. Make sure a water filter is installed before the water inlet of the unit.
7	Connect the field wiring for pumps start-stop .
8	Connect the field wiring for remote control .

NOTE:

1. Try to reduce the drilling in the unit to a minimum. If drilling is not preventable, remove the iron filling thoroughly in order to prevent surface rust!
2. It is necessary to read the operation manual delivered with the unit before operating the unit. It will contribute to understand the operation of the unit and its electronic controller.
3. Verify on the wiring diagram all electrical mentioned above, in order to understand the operation of the unit more deeply.
4. Close all switch box doors after the installation of the unit.

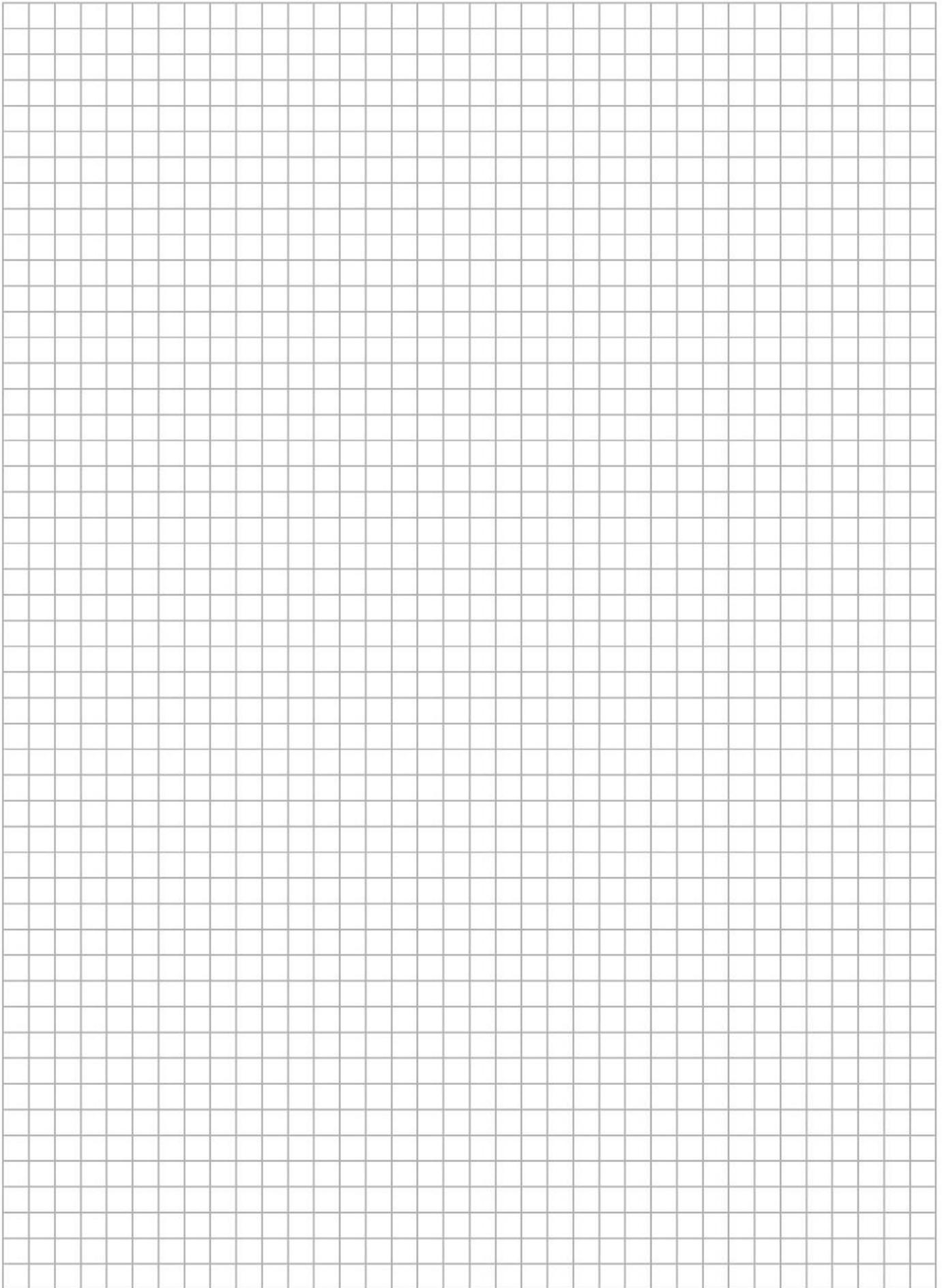
I do confirm having executed and checked all the above mentioned above.

Date

Signature

Keep for future reference.

NOTES



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