



**194-196 DUNSBURY WAY
HAVANT, PO9 5BG**

**HAVANT BOROUGH COUNCIL REF:
APP/18/00764**

PLANT NOISE IMPACT ASSESSMENT

SEPTEMBER 2018



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Project Code:	JLLHavant(N).9
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194-196 Dunsbury Way, Havant, PO9 5BG
Plant Noise Assessment

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Plant Noise Assessment

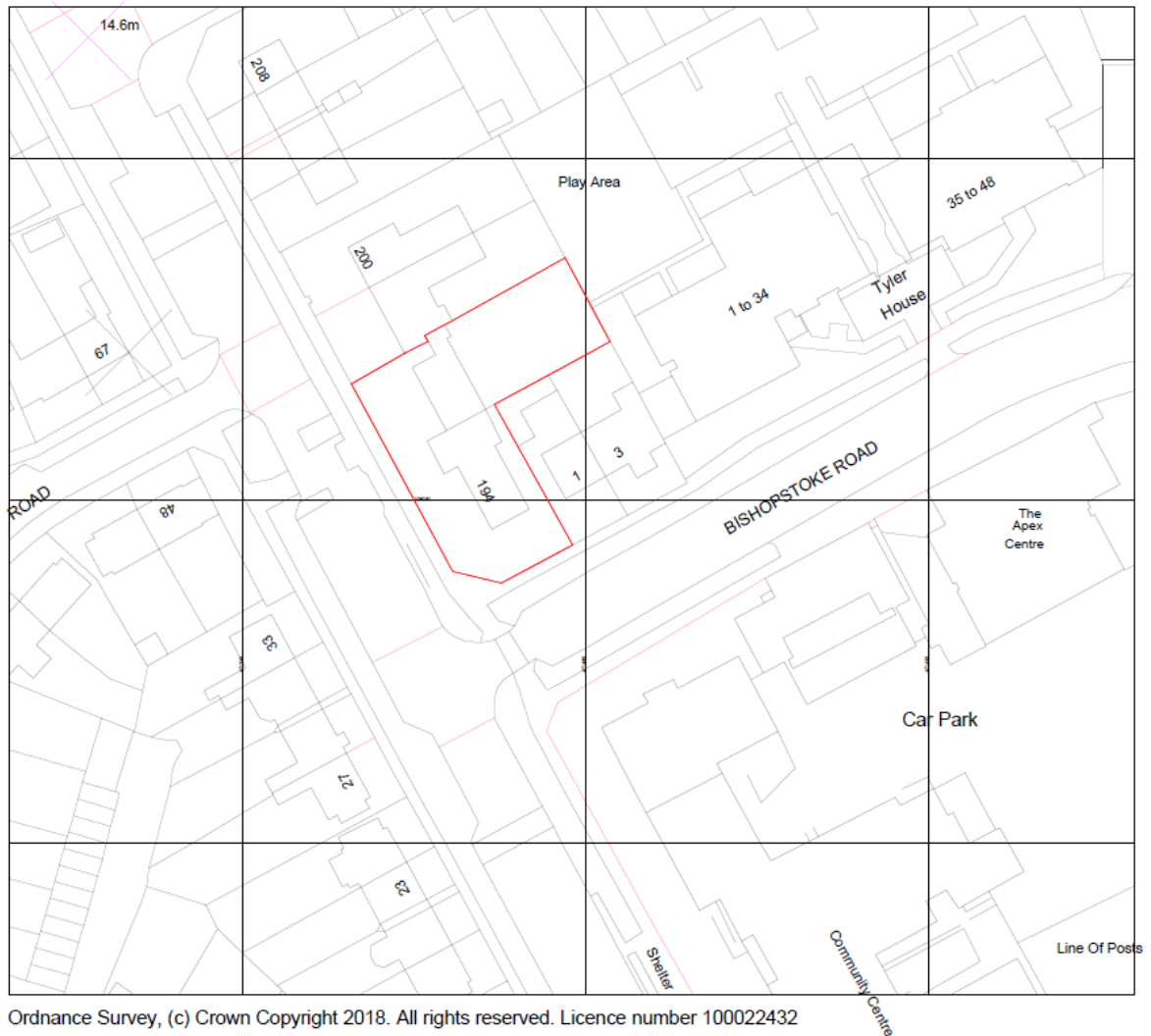
1 Introduction

- 1.1 Southern Co-operative has submitted a planning application for the change of use of 194-196 Dunsbury Way from a residential Institution (Use Class C2) to End of Life Services (Use Class A1). The application is currently being determined by Havant Borough Council, who have consulted the Council's Environmental Team. The EH team's consultation response recommends the imposition of a planning condition to ensure that noise emissions from building services plant associated with the proposed use (three external condenser units) are adequately controlled to protect the amenity of neighbouring residential properties.
- 1.2 Mayer Brown Limited has been instructed by Southern Co-operative to assess noise emissions from the proposed plant.
- 1.3 This report is structured as follows:
- **Section 2** describes the location of the site and its environs;
 - **Section 3** describes the proposed development and provides detailed technical information for the proposed plant, including noise emission data;
 - **Section 4** outlines noise monitoring that has been undertaken at the site to establish existing environmental noise levels;
 - **Section 5** outlines operational noise limits for the proposed plant installations based on the results of the environmental noise survey and the local authorities 'standard' noise control requirements for plant installations;
 - **Section 6** details the calculated plant noise emissions at the most affected receptor.
 - Conclusions are presented in **Section 7**.
- 1.4 A glossary of the acoustic terminology used in this report is attached at **Appendix A**.

Plant Noise Assessment

2 Site Location

2.1 The location of the site is shown in **Figure 2.1** below.



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Figure 2.1: Site Location

- 2.2 The site comprises an 'L' shaped plot currently occupied by a disused two storey building, previously in Class C2 use.
- 2.3 To the north-west, the site adjoins Oakleigh Family Centre.
- 2.4 To the east, the site adjoins two residential properties (2/4 Bishopstoke Road). A block of residential flats lies beyond this, at the end of the site's existing external space.
- 2.5 The south-western site boundary is formed with Dunsbury Way.

Plant Noise Assessment

3 Proposed Plant

- 3.1 Three condenser units are to be proposed to the rear of the site, adjacent to the boundary formed with nos. 1& 2 Bishopstoke Road, as shown in **Figure 3.1** below:

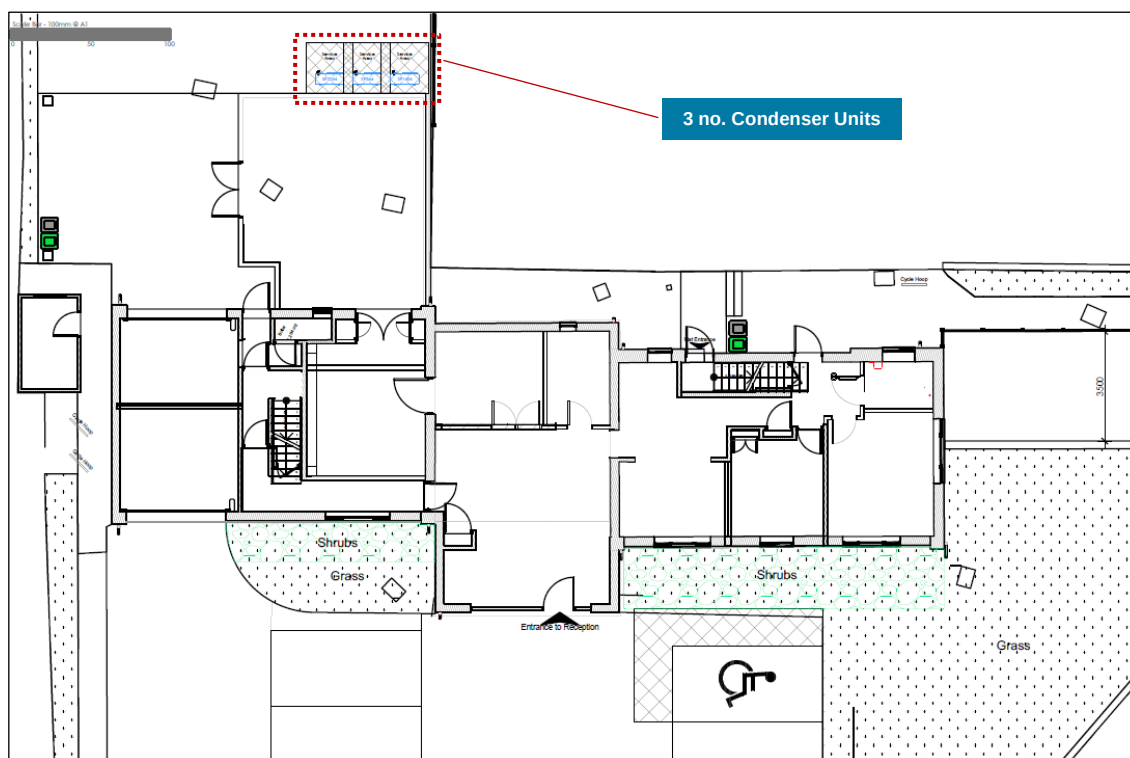


Figure 3.1: Proposed General Arrangement of Roof Plant

- 3.2 A higher resolution copy of the above general arrangement plan (Southern Co-op drawing numbered 18-XXX-200) is attached at **Appendix B**.
- 3.3 The proposed external plant is to include:
- 1 no. Toshiba RAV-SM564ATP-E
 - 1 no. J&E Hall V3 Fusion Model JEHS-0150-B2-M-1
 - 1 no. J&E Hall V3 Fusion Model JEHS-0250-B2-M-3
- 3.4 Manufacturers' noise data for the proposed plant is attached at **Appendix C**.
- 3.5 Noise levels are summarised in **Table 3.1** below.

Plant Noise Assessment

Equipment	Sound Pressure Level
Toshiba RAV-SM564ATP-E	46 dB(A) @ 1m
J&E Hall V3 Fusion Model JEHS-0150-B2-M-1	34dB(A) @ 10m
J&E Hall V3 Fusion Model JEHS—250-B2-M-3	34 dB(A) @ 10m

Table 3.1: Summary of Manufacturers' Plant Noise Data

Plant Noise Assessment

4 Existing Noise Environment

- 4.1 Automated noise monitoring was undertaken over a notional six day period between 14.00 hours on Friday 14th September 2018 to 10.30 hours on Wednesday 19th September 2018.
- 4.2 Noise levels were monitored at the rear facade of the site. i.e. at a location screened from Dunsbury Way and Bishopstoke Road and therefore considered to provide a reasonable, close to the rear 1st floor windows, as shown in **Figure 4.1** below.

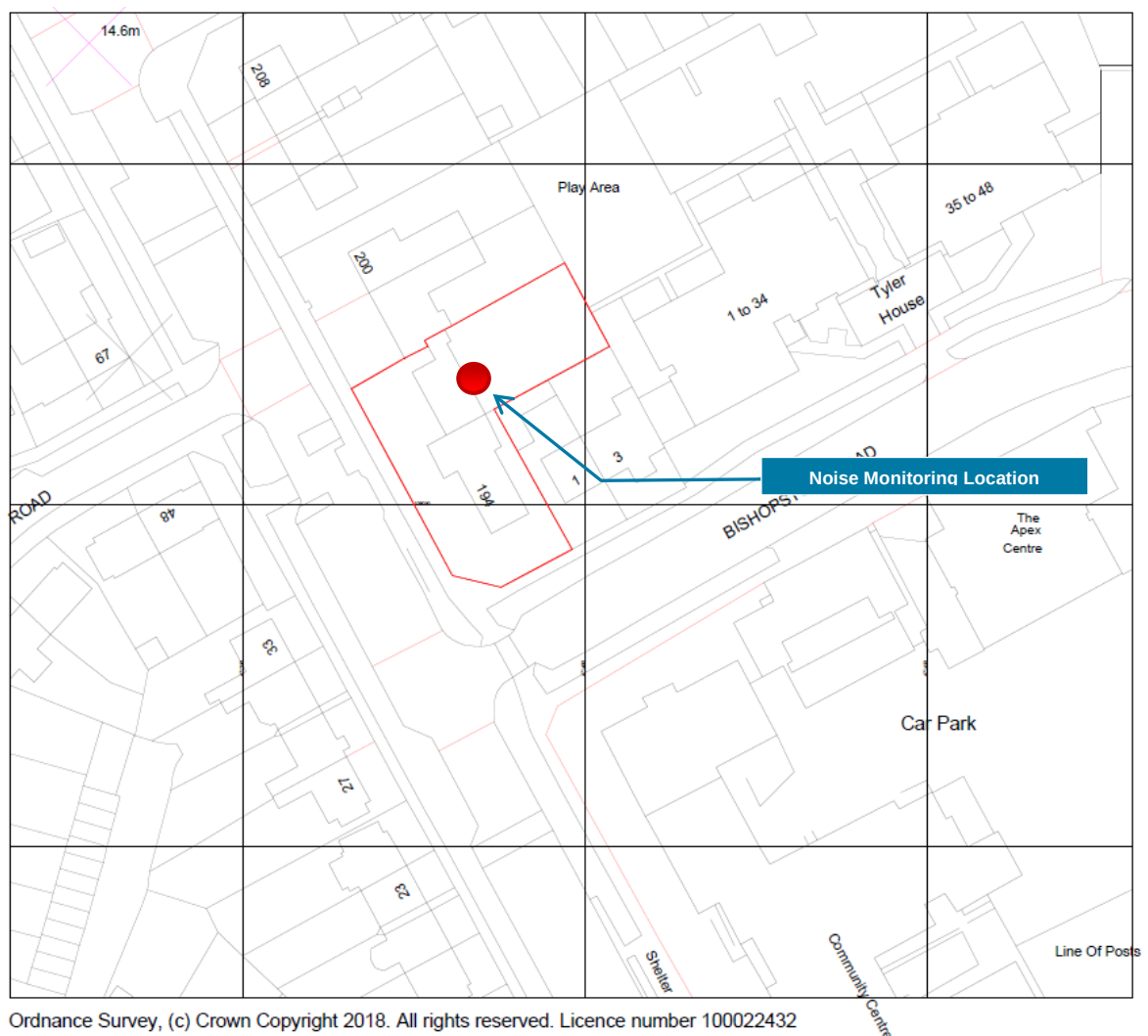


Figure 4.1: Noise Monitoring Location

- 4.3 The measurement microphone was positioned approximately 1m from a first floor window, overlooking the rear garden area of the property.

Plant Noise Assessment

Survey Procedure

- 4.4 The sound level analyser was configured to record the L_{A90} sound level over consecutive 15 minute periods to provide a detailed time history profile showing fluctuations in noise levels.
- 4.5 The sound level analyser was calibrated prior to use and the calibration was checked on completion. No drift in calibration was observed.

Instrumentation

- 4.6 The following instrumentation was used for the survey:

Description	Make	Model	Serial No.	Calibration Date
Sound Level Analyser	Svantek	SVAN 71	55550	04/06/2018
Microphone		7052E	63684	
Preamplifier		SV18	57249	
Outdoor Microphone Kit		SA271U	n/a	n/a
Calibrator	Norsonic	Nor 1251	34058	24/03/2018

Table 4.1: Instrumentation Details

Noise Monitoring Results

- 4.7 Measured noise levels (over consecutive 15-minute periods) are presented in **Figure 4.2**

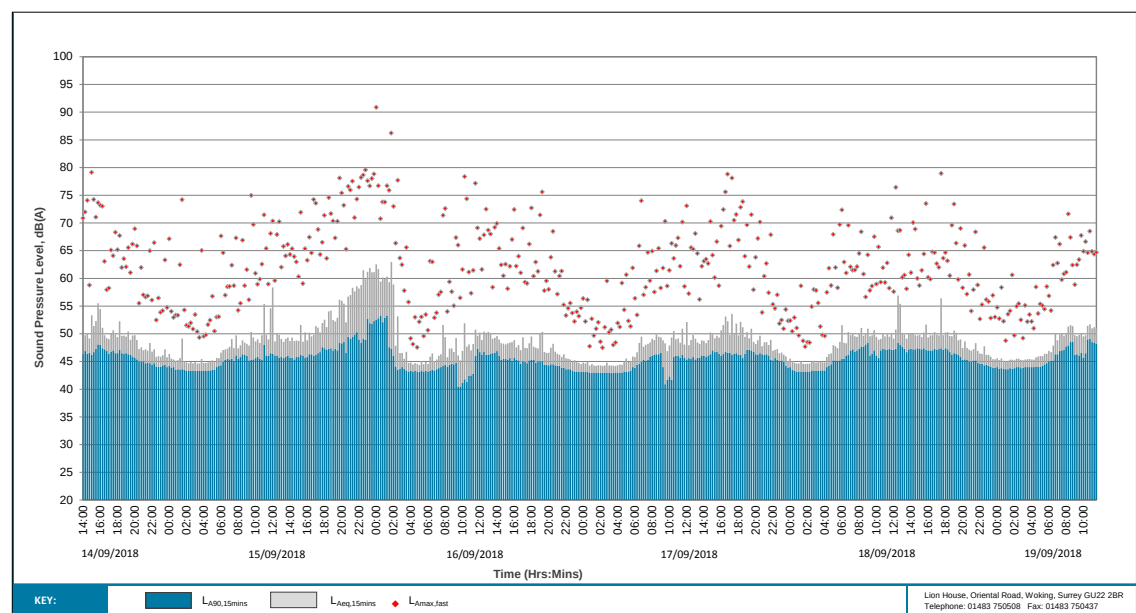


Figure 4.2: Noise Measurement Data

- 4.8 A higher resolution image of the above time history graph is attached at **Appendix D**.

Plant Noise Assessment

- 4.9 The measurement data has been statistically analysed to determine “typical” daytime and night-time background noise levels, as presented in **Figures 4.3** and **4.4** below.

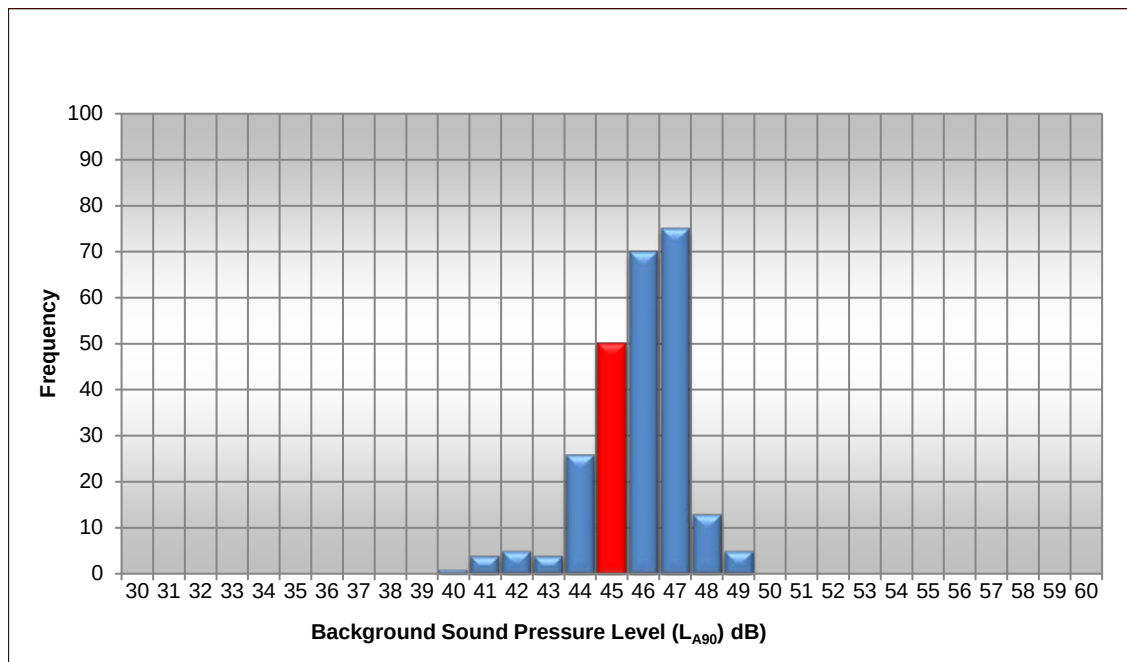


Figure 4.3: Statistical Analysis of Daytime Background Noise Levels

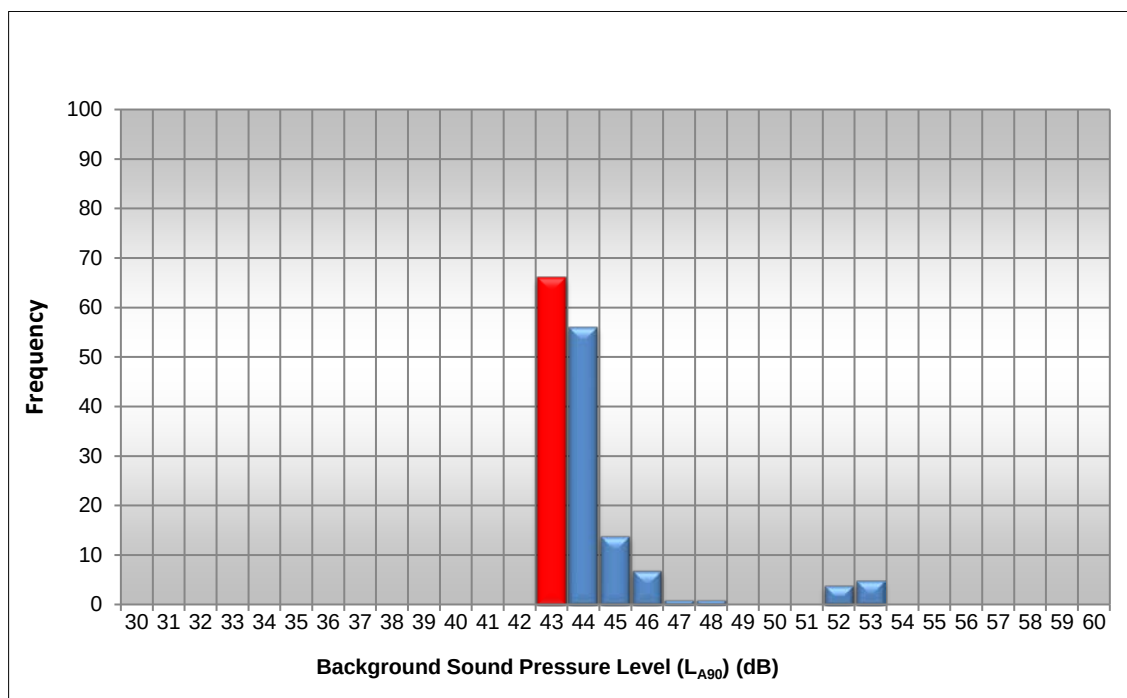


Figure 4.4: Statistical Analysis of Night-time Background Noise Levels

- 4.10 From the measured noise levels shown in **Figure 4.2** and **Figure 4.3**, the typical L_{A90} is taken to be **45dB** in the daytime, and **43dB** in the night-time.

Plant Noise Assessment

Weather

- 4.11 Due to the nature of the survey, i.e. unmanned, it is not possible to accurately comment on the weather conditions throughout the entire survey period. However, observations at the time of site attendances and publicly available historic online data, suggest that weather conditions were typically characterised as set out in **Table 5.3** below:

Date	Temperature		Pressure		Average Wind Speed (kph)	Wind Direction	Rainfall (mm)
	Max.	Min.	Max.	Min.			
15/09/18	16	7	1032	1016	3	NW	0
16/09/18	17	9	1016	1003	6	W	0
17/09/18	15	8	1011	1003	4	SW	2
18/09/18	19	11	1022	1012	4	WSW	2
19/09/18	19	8	1025	1022	3	W	0

Table 4.2: Weather Conditions During Survey

Observations and Discussion

- 4.12 During site attendances, it was observed that noise levels were generally influenced by local and distant road traffic noise, and noise associated with activities at the neighbouring property uses.

5 Planning Policy Context and Acoustic Design Criteria

Havant Borough Council

- 5.1 As noted earlier, Havant Borough Council's Environmental Health Team have recommended that a planning condition is imposed should the development sought by planning application APP/18/00764 be granted, requiring that:

'Condition 1: Noise from plant and equipment - No development shall take place until an acoustic assessment to show that the rating level of any plant & equipment, as part of this development, will be at least 5 dB below the existing background levels, has been submitted to and been approved in writing by the Local Planning Authority. The assessment must be carried out by a suitably qualified acoustic consultant / engineer and be in accordance with BS4142: 2014 Methods for rating and assessing industrial and commercial sound.'

Reason: In order to safeguard the amenities of adjoining residential occupiers. The details are needed prior to the start of work so that any mitigating measures can be incorporated into the build.'

Suitably Qualified Acoustic Consultant/Engineer

- 5.2 This report has been prepared by Mayer Brown Limited, a multi-disciplinary practice providing Transport Planning, Infrastructure Design and Environmental Consultancy Services.
- 5.3 This report has been prepared by Harry Russell-Lees (Assistant Consultant) who holds Associate Membership of the Institute of Acoustics (AMIOA). The preparation of the report has been supervised, reviewed and approved by Paul Gray (Technical Director). Paul has held corporate membership of the Institute of Acoustics (MIOA) since 1994 and has over twenty seven year's practical experience in acoustic consultancy.

BS 4142: 2014: "Methods for Rating and Assessing Industrial and Commercial Sound"

- 5.4 BS 4142 provide a rating and assessment methodology for assessing the potential adverse impact of industrial and commercial noise sources on neighbouring dwellings.
- 5.5 The assessment procedure initially compares the '**Rating Level**' of the source with the '**Background Noise Level**' when the source is not present.

Plant Noise Assessment

- 5.6 The '**Rating** Level' (L_{Ar}) referred to is the specific noise level of the noise source under investigation (in terms of the L_{Aeq} noise index), to which corrections are applied if the noise has certain audible characteristics. The following corrections (based on a subjective assessment of noise source characteristics) is given:

Character Correction				
Feature / Perception	Tonality	Impulsivity	Intermittency	Other acoustic characteristics
Just Perceptible	+2dB	+3dB	When the specific sound has identifiable On/Off conditions that are readily distinctive. +3dB	+3dB
Clearly Perceptible	+4dB	+6dB		
Highly Perceptible	+6dB	+9dB		

Table 5.1: BS4142 Character Correction for Rating Level Calculation

- 5.7 The 'Background Noise Level' (L_{A90}) represents the noise level that is exceeded for 90% of the stated measurement period. For assessment purposes, the background noise level needs to be determined without the noise source under investigation operating.
- 5.8 The time of operation needs to be taken into account. During the day (normally taken to be 07.00 to 23.00 hours) a one hour measurement period is considered appropriate. During the night (normally taken to be 23.00 – 07.00 hours) a 15 minute time period is normally used.
- 5.9 The following guidance is then offered based on the outcome of this initial assessment:
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
 - A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
 - The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.
- 5.10 A note accompanying the above guidance states:

Plant Noise Assessment

“Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.”

5.11 The initial estimate of the impact should then be modified to account for its context. Such considerations include:

- The absolute level of the sound - the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low. Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.
- Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.
- The character and level of the residual sound compared to the character and level of the specific sound.
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

Local Authority Requirements

5.12 The proposed planning condition requires that the rating level of plant noise is controlled to a level at least 5dB below the typical background noise level. Based on the results of the measurement survey, the following plant noise emission limited will need to be complied with:

Period	Plant Noise Emission Limit, dB(A)
Daytime (07.00 – 23.00 hours)	40
Night-time (23:00 – 07:00)	38

Table 5.2: Plant Noise Emission Limits

Plant Noise Assessment

- 5.13 The above values are to be met at 1m from the window or any adjoining property and should represent the total cumulative value (i.e. noise emission from all plant operating at the same time).
- 5.14 Since the proposed plant will be capable of operating 24 hours a day, compliance with the night-time noise emission limit indicated above will need to be demonstrated.

Plant Noise Assessment

6 Plant Noise Assessment

- 6.1 Calculations have been undertaken to assess the environmental noise emissions from the proposed plant. Due allowance has been made for the distance between the plant and the neighbouring dwellings, plant directivity and any acoustic screening afforded by fencing and intervening structures.
- 6.2 The cumulative sound level calculated at the nearest dwellings, with all plant operating simultaneously is **L_{Aeq,T} 32dB**. This is considered to be a “worst case” assessment, on the assumption that all plant is operating simultaneously and at full capacity.
- 6.3 It should be noted that the proposed plant is not anticipated to exhibit any significant, tonal or impulsive characteristics provided it is well maintained. All proposed external plant will be inverter driven and, therefore, will gently ramp up and down depending on the demands on the various systems. Therefore, no feature correction has been applied to the noise level predictions in this case.
- 6.4 Summary calculations verifying the determination of the calculated sound level are attached at **Appendix E**.
- 6.5 The results of this assessment show the noise levels from the proposed plant should comply comfortably with the planning condition recommendation made by Havant Borough Council.

Plant Noise Assessment

7 Conclusions

- 7.1 An environmental noise survey has been undertaken to determine existing background noise levels characterising the site.
- 7.2 Based on these measurement data, acoustic design targets for proposed plant installation have been determined, in accordance with the requirements of the planning condition proposed by Havant Borough Council's Environmental Health Team.
- 7.3 Full information regarding proposed plant selections (including manufacturer's noise data) and details are provided.
- 7.4 Detailed acoustic design calculations are presented.
- 7.5 The results of this assessment demonstrate that noise emissions from the proposed plant should comply comfortably Havant Borough Council's recommended noise emission limits.

APPENDIX A

Glossary of Acoustic Terminology

General

A vibrating surface or turbulent fluid flow will cause pressure fluctuations in the surrounding air. These pressure fluctuations are perceived by the human ear as “sound”.

Measurement Units

The human ear can detect sound pressures as low as about 20 μPa , and can tolerate (for short periods) sound pressures as high as 200 Pa, an amplitude range of 10 million times. To take account of this huge amplitude range, sound pressure levels (often written in “acoustic shorthand” as SPL or Lp) are quantified using a logarithmic scale, the decibel (dB) scale. This is based on a reference pressure of 20 μPa , thus a sound pressure of 20 μPa would equate to 0dB and a pressure of 200Pa would equate to 140dB.

Frequency (Pitch) Characteristics

The sound received at any particular location is not solely influenced by the sound pressure level, the frequency characteristics (pitch) of the noise is also an important factor. Noise audible to a human (with “normal” hearing), typically covers the frequency range 20 Hertz to 20,000 Hertz. Hertz (Hz) are defined as the number of times the sound pressure fluctuates in one second. “Low” pitched sounds fluctuate less times per second than “high” pitched sounds. Whilst humans are capable of detecting a wide range of frequencies, the ear is not equally sensitive to all frequencies – the ear is most sensitive at frequencies towards the middle of the audible range and less sensitive to the lower and higher frequencies.

To take account of this frequency response, sound pressure fluctuations are normally quantified by applying a frequency-weighting network or filter which simulates the frequency response of the ear. In essence, this means that more significance is given to the frequencies at which the ear is most sensitive and less significance to those at which the ear is less sensitive. Noise measurements relating to human reaction are generally made using an “A-weighting” network. These measurements are reported as A-weighted decibels or dB(A). The A-weighted sound pressure level is written in “acoustic shorthand” as L_A .

Variation of Sound with Time

It will be appreciated that the sound pressure level of most noise sources will fluctuate with time. In order to take account of the way in which the human ear perceives noise, it is normal for the sound pressure level to be quantified using a time weighting network, to mimic the speed of response of the human ear. The standardised setting for most types of noise is a “Fast” time weighting.

The manner in which sound fluctuates with time can also influence the subjective manner in which noise is perceived. Noise can be continuous (showing no significant variation with time as in the case of a fan), intermittent (i.e. the noise is transient in it’s nature, such as a train pass-by) or impulsive (i.e. there is a sudden build up of noise - this can range from “clanking” types sounds as might be experienced next to railway goods yard or a high energy discharge such as an explosion)

Measurement of Sound

Sound pressure levels are measured using equipment comprising a pressure-sensitive microphone, associated amplifier, frequency weighting network, time weighted network and output indicator. In its simplest form this is a small hand-held instrument called a sound level meter. More sophisticated instrumentation (a sound level analyser) is also available which allows the real-time output of the frequency characteristics of the sound to be quantified.

Comparison of Sound Levels

To put the significance of noise measurement into context, the following Table presents the A-weighted sound pressure level of some typical sources:

Sound Pressure Level, dB(A)	Typical Noise Source . Activity
160	Saturn Rocket Taking Off
140	Military Jet Taking Off at 30m
100	Nightclub
90	Heavy goods vehicle driving past at 7m
80	Busy urban road
70	Domestic vacuum cleaner at 3m
60	Busy office environment
55	Normal speech at 1m
40	Whispered conversation at 2m
30	Bedroom at night (BS 8233: 1999)
20	Remote country location
0	Threshold of hearing – a very eery silence

Addition of Sound Levels

It is important to note that the use of a logarithmic scale to describe noise does not allow normal arithmetic addition. This means that two noise sources each generating a level of, say, 60dB(A) will not generate a combined sound level of 120dB(A). The values must be added logarithmically, which would actually yield a combined sound level of 63dB(A) in this example.

Subjective Perception of Sound Levels Changes

With regard to the human perception of sound level changes, the human ear:

- Cannot generally perceive a sound level difference of less than 3dB(A)
- Will perceive a sound level difference of 4-5dB(A) as “noticeable”
- Will perceive a sound level difference of 10dB(A) as a doubling (or halving) of loudness.

Acoustic Terminology

As stated previously, most sources of noise will fluctuate with time. In order to characterize such noise, it is therefore normal to represent the noise climate using a variety of noise parameters and statistical indices. The most commonly adopted noise parameters are described below:

$L_{Aeq,T}$	This is the equivalent continuous A-weighted sound level measured over a specified time period "T". This is the notional continuous sound level which, over the time T, contains the same amount of energy as the actual fluctuating sound being measured. This parameter is widely accepted as being the most appropriate noise descriptor for most environmental noise and the effects of noise on humans.
$L_{Amax,fast}$	This is maximum A-weighted sound pressure measured with a fast frequency response recorded during the stated measurement period. It is typically used to characterise the highest sound level caused during a noise event.
$L_{A90,T}$	This is the A-weighted sound pressure level exceeded for 90% of the specified time period "T". It is normally used to describe the underlying background noise level of an environment since it inherently excludes the effects of transient noise sources.

Noise Rating (NR) Level

When describing noise from building services installations, it is common to express noise levels in terms of a Noise Rating (NR) Level. The NR level is determined by plotting the measured frequency spectrum of a noise against a series of reference curves, which roughly approximate to equal loudness values. This method permits higher sound levels at low frequencies corresponding to the sensitivity of the human ear. The NR level is defined as the value of the highest curve "touched" by the plotted frequency spectrum. For typical sources of building services noise, the overall A-weighted sound level is numerically around 5-6dB higher than the NR level of the noise.

Airborne Sound Insulation Measurement Parameters

The ability of a building element to reduce airborne noise can be described by a number of different parameters relevant to both laboratory and on-site performance evaluation. In general, the higher these values, the better the resistance of the construction to the transmission of airborne sound. The most commonly used parameters include:

R_w	The " Weighted Sound Reduction Index " (R_w) is a single value measure of the intrinsic sound reduction capabilities of a construction, as measured in an acoustic laboratory. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013.
R'_w	The " Weighted Apparent Sound Reduction Index " (R'_w) is a single value measure of the apparent sound reduction capabilities of a construction, when installed on-site (which will normally be some way lower than the laboratory value due to less favourable installation conditions, the quality of workmanship, etc.). Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-1: 2013. In practice, the R'_w of a construction can only be reliably determined if "direct" sound transfer through the partition can confidently be taken as the dominant noise transfer path (i.e. there is no "flanking" sound transmission).
D_w	The " Weighted Sound Level Difference " (D_w) is a single value measure of the on-site sound reduction between two rooms. This value inherently includes "direct" sound transmission through any separating construction and "flanking" transmission through other building elements.

Measurement values are determined in accordance with BS EN ISO 140-4: 1998 (for Building Regulations compliance purposes) or BS EN ISO 16283-1: 2014 and weighted in accordance with BS EN ISO 717-1: 2013.

$D_{n,fw}$	The " Weighted Normalised Flanking Level Difference " ($D_{n,fw}$) is a single figure measure of the sound reduction between two rooms solely due to sound transmission through a specified flanking path. This parameter is frequently used to provide an indication of the sound reduction capabilities of suspended ceiling and raised access floor constructions where there is common void between adjacent rooms or as a measure of sound that may be transmitted between rooms through external curtain walling. Measurements are undertaken in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-1: 2013.
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Impact Sound Insulation Measurement Parameters

Some building elements also have the potential to generate "impact" noise, for example due to human "footfall" on floor structures, or the impact of rainfall on lightweight roofing components. A variety of parameters are again available to define the amount of noise likely to be generated. In general, the lower these values, the less sound the construction will generate as a result of impacts. Typical measurements parameters include:

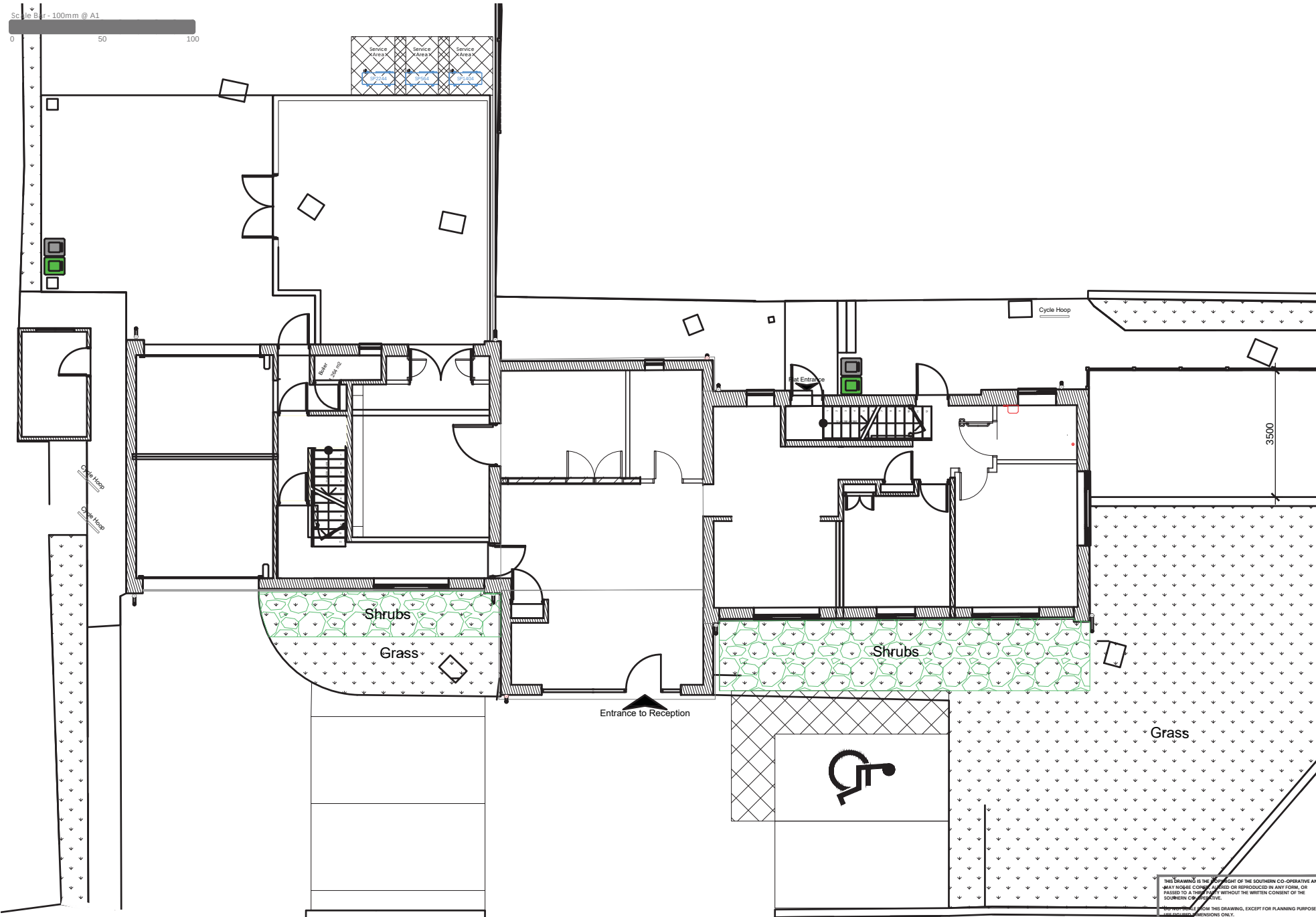
$L_{nT,w}$	The " Standardised Impact Sound Pressure Level " is a "single number" rating describing the intrinsic impact sound insulation capabilities of a construction (such as a floor system) as measured in an acoustics laboratory. Values are determined in a vertical sound transmission suite by locating a "tapping machine" in the upper room of the suite and measuring the amount of sound radiated by the floor in the room below. Measurement values are determined in accordance with the BS EN ISO 10140 series of standards and weighted in accordance with BS EN ISO 717-2: 2013.
$L_{n,fw}$	The " Normalised Flanking Impact Sound Pressure Level " is a "single number" rating describing the amount of flanking sound that would be transmitted to an adjoining space (separated by a partition) due to impacts on the test sample. It is, for example, used to indicate the amount of noise that may be generated due to footfall noise on a raised access floor system. Values are determined in a horizontal sound transmission suite by locating a "tapping machine" one side of a separating partition built off the test sample and measuring the amount of noise radiated by the floor in the adjoining space on the other side of the partition. Measurement values are determined in accordance with BS EN ISO 10848-2: 2017 and weighted in accordance with BS EN ISO 717-2: 2013.

Room Acoustic Measurements

T	The " Reverberation Time " (T) of a room is defined as the time taken for the sound energy produced by a source Time (RT) to decay by 60 dB after the source has been switched off. The reverberation time of a space can be calculated by considering the volume of the room and the areas and sound absorption qualities of room surface finishes. Small, "soft" rooms tend to give low reverberation times, whilst large, "hard" rooms tend to give long reverberation times.
α_p	The " Practical Acoustic Absorption Coefficient " (α_p) is a measure of how much sound energy is absorbed by a building element at a particular frequency, as measured in accordance with BS EN ISO 354: 2003.
α_w	The " Weighted Absorption Coefficient " (α_w) is a single figure measure of the overall sound absorption capabilities of a building element determined in accordance with BS EN ISO 11654: 1997.

APPENDIX B

Proposed Location of Plant



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DO NOT SCALE FROM THIS DRAWING, EXCEPT FOR PLANNING PURPOSES. USE FIGURED DIMENSIONS ONLY.

AREAS	M ²	FT ²
SALES	133	1431
GROSS	290	3121
FIRST	59	635
SUB-LET	55	592
MOTHBALLED	NA	NA

[illegible]

ISSUED FOR

GROUND FLOOR

southern coop

Property Development
1000 Lakeside, Western Road, Portsmouth. PO6 3FE
T: 023 9222 2500 | F: 023 9222 2650

PROJECT
194-196 DUNSBUY WAY
LEIGH PARK
HAVANT
HAMPSHIRE

DRAWING TITLE

PROPOSED
GROUND FLOOR

DRAWING SCALE	SHEET SIZE	SHEET No.	DRAWN	CHKD	DATE
1:50	A1	1 of 1	SL		19-06-2019
DRAWING NUMBER					REVISION
18-XXX-200					-

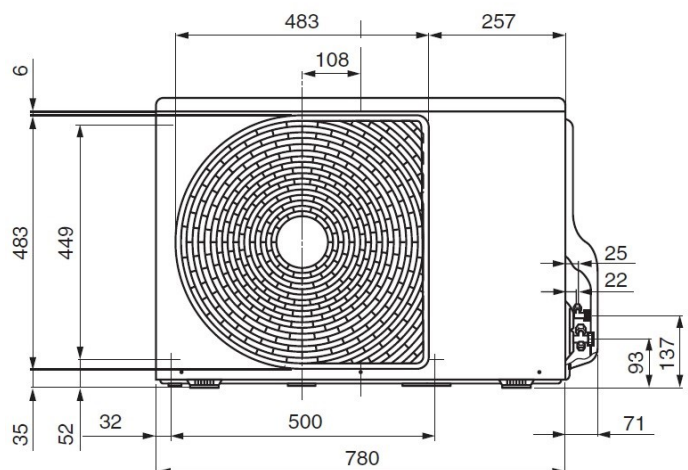
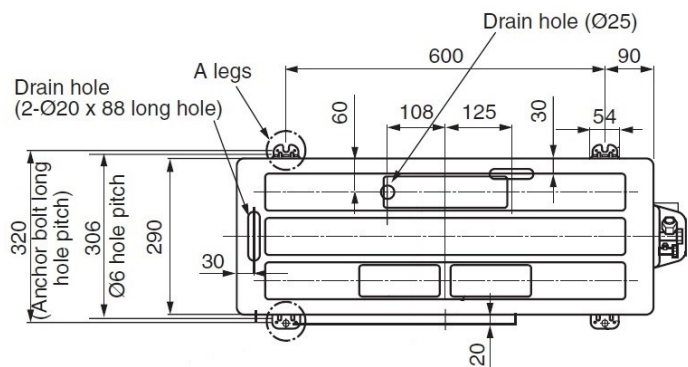
APPENDIX C

Manufacturer's Plant Noise Data

RAV-SM564ATP-E Outdoor Unit

- R22 & R407C replacement technology
- Wide operating range (Cooling mode -15°C to $+46^{\circ}\text{C}$)
- Auto diagnostic function
- Flexible, can be utilised for single, twin, triple indoor applications
- Compact size

Model Reference	RAV-SM564ATP-E	
Nominal Cooling	(kW)	5.0
Nominal Heating	(kW)	5.3
Air Flow Standard	(m ³ /h)	2,400
Air Flow Standard	(l/s)	667
Sound Power- Cool / Heat	(dB(A))	63-65
Sound Pressure- Cool/Heat	(dB(A))	46-48
Dimensions (HxWxD)	(mm)	550 x 780 x 290
Unit Weight	(kg)	40
Power Supply—Outdoor	(V-ph-Hz)	220/240-1- 50/60
Interconnecting Cable	3 core plus earth	
Suggested Fuse Size (SM)	(A)	10
Max. Operating current (Cooling)	(A)	7.9
Operating range, Cooling	($^{\circ}\text{C}$)	-15 / +46
Operating range, Heating	($^{\circ}\text{C}$)	-15 / +15
Pipe Sizes (Liquid / Suction)	(Inch)	1/4—1/2
Pipe length, Min—Max	(m)	5—30
Maximum height difference	(m)	30
Pipe length pre-charge	(m)	20
Additional R410A	(g/m)	20



Cool Designs Ltd

Raising the Standards in Air Conditioning Distribution

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All UK duties are based on Cooling Indoor air temperature 22°C DB/ 16°C WB Outdoor air temperature 28°C DB 50% RH, high fan speed, 5m pipe run.
Heating Indoor air temperature 21°C DB Outdoor air temperature -4°C DB 100% RH, high fan speed, 5m pipe run. Values are based on the maximum compressor output.
Data obtained from Toshiba Air Conditioning Web Data July 2013.

V3 FUSION & FUSION SCROLL Commercial Condensing Units

Medium & Low Temperature Applications

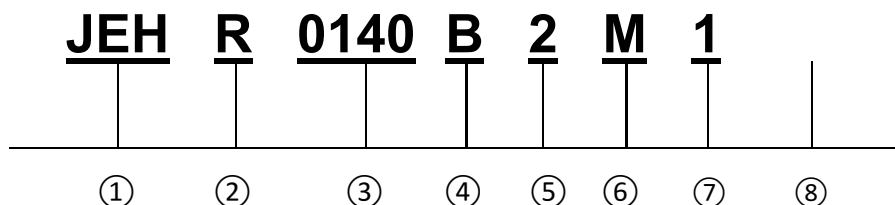
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Nomenclature



①	J & E Hall International	⑤	Unit Series
②	R: Reciprocating S: Scroll	⑥	M: Medium Temperature L: Low Temperature
③	Approximate HP (0140 = 1.4hp)	⑦	Power Supply: 1: 230V / 1Ph / 50Hz 3: 400V / 3Ph / 50Hz
④	Unit Generation	⑧	EVI (Enhanced Vapour Injection) – LT 0950 Unit Only

Standard product configuration

- Tecumseh and Maneurop reciprocating compressors
- Copeland scroll compressors
- Microchannel condenser coil (S1/S2 units)
- Liquid receiver with fusible plug
- Fitted liquid line drier & sight glass
- Dual LP/HP Pressure control
- Gomax flexible pressure hoses
- External service valves
- IP rated control panel
- Combined mains isolator with short circuit / overload protection
- Fuse protection to fan & control circuit
- Fan speed control (not S1 units)
- Crankcase heater on compressor (not all unit models)
- Alarm output available from HP switch
- Acoustic insulation to compressor compartment

Specifications

Unit Model		Series	COP / (SEPR)						Compressor			Oil Sep. Charge	Oil Type	Electrical Data					Coil Volume	Liquid Receiver	Airflow	Connections		Dimensions		Unit Dry Weight	SPL @ 10m ^d	
			R134a	R404A	R407A	R407F	R448A	R449A	Type	Swept Volume (m³/h)	Oil Charge (Litres)			Compressor			Fan Motors					Liquid	Suction	Unit (W x D x H)	Mounting (W x D)			
														NC ^a	MCC ^b	LRC ^c	No.	FLC										
																												(A)
Medium Temperature	JEHR-0050-B1-M-1	1	n/a	145	133	147	n/a	144	AE4460Z-FZ1C	1.80	0.28	-	A	3.4	5.9	19.4	1	0.4	0.44	1.2	1300	1/4	3/8	876 x 420 x 607	545 x 400	45	29	
	JEHR-0067-B1-M-1		n/a	161	137	149	n/a	145	CAJ9480Z	2.64	0.89	-		3.1	6.7	22.6	1	0.4	0.44	1.2	1300	3/8	1/2			54	28	
	JEHR-0100-B1-M-1		n/a	161	142	151	n/a	145	CAJ9510Z	3.18	0.89	-		3.9	8.4	30.0	1	0.4	0.44	1.2	1300	3/8	1/2			54	28	
	JEHR-0113-B1-M-1		n/a	160	152	158	n/a	153	CAJ9513Z	4.21	0.89	-		4.9	11.3	33.0	1	0.4	0.44	1.2	1300	3/8	1/2			55	28	
	JEHR-0140-B2-M-1	2	n/a	168	157	175	n/a	196	CAJ4517Z	4.52	0.89	-		B	5.3	12.7	38.5	1	0.6	0.51	4.5	2700	3/8	1/2	1101 x 444 x 662	703 x 408	68	34
	JEHR-0140-B2-M-3		n/a	180	150	167	n/a	188	TAJ4517Z	4.52	0.89	-			2.3	4.0	18.0	1	0.6	0.51	4.5	2700	3/8	1/2			68	34
	JEHR-0150-B2-M-1		157	178	177	178	n/a	n/a	MTZ18-5VM	5.26	0.95	-			6.5	10.0	40.0	1	0.6	0.51	4.5	2700	3/8	5/8			68	37
	JEHR-0150-B2-M-3		171	181	183	185	n/a	n/a	MTZ18-4VM	5.26	0.95	-			2.6	5.0	20.0	1	0.6	0.51	4.5	2700	3/8	5/8			68	37
	JEHS-0200-B2-M-1	2	185	2.25	2.13	188	196	196	ZB15KQE-PFJ	5.90	1.24	-	C		7.3	18.5	58.0	1	0.6	0.51	4.5	2700	3/8	3/4	1101 x 444 x 662	703 x 408	70	33
	JEHS-0200-B2-M-3		2.12	2.06	2.07	181	196	196	ZB15KQE-TFD	5.90	1.24	-			2.9	7.0	26.0	1	0.6	0.51	4.5	2700	3/8	3/4			70	33
	JEHS-0250-B2-M-1		2.14	2.00	2.01	179	187	187	ZB19KQE-PFJ	6.80	1.30	-			9.3	20.5	61.0	1	0.6	0.51	4.5	2700	3/8	3/4			72	34
	JEHS-0250-B2-M-3		2.13	2.07	195	179	187	187	ZB19KQE-TFD	6.80	1.36	-			4.2	7.0	32.0	1	0.6	0.51	4.5	2700	3/8	3/4			72	34
	JEHS-0300-B2-M-1	3	2.13	188	189	169	179	179	ZB21KQE-PFJ	8.60	1.45	-		C	12.2	21.5	82.0	1	0.6	0.51	4.5	2700	3/8	3/4	1353 x 575 x 872	945 x 500	74	36
	JEHS-0300-B2-M-3		2.10	194	186	165	179	179	ZB21KQE-TFD	8.60	1.45	-			4.4	10.3	40.0	1	0.6	0.51	4.5	2700	3/8	3/4			74	36
	JEHS-0350-B2-M-1		186	(2.26)	n/a	n/a	(2.28)	(2.28)	ZB26KQE-PFJ	9.90	1.50	-			14.8	25.0	97.0	1	0.6	0.51	4.5	2700	3/8	3/4			74	39
	JEHS-0350-B2-M-3		2.08	(2.61)	n/a	n/a	2.28	2.28	ZB26KQE-TFD	9.90	1.50	-			5.8	9.0	46.0	1	0.6	0.51	4.5	2700	3/8	3/4			74	39
	JEHS-0350-B3-M-1	3	2.06	(3.06)	(3.38)	(3.13)	(2.97)	(2.97)	ZB26KQE-PFJ	9.90	1.50	-	C		13.9	25.0	97.0	1	0.9	4.42	7.6	4250	1/2	3/4	1353 x 575 x 872	945 x 500	112	37
	JEHS-0350-B3-M-3		2.29	(3.48)	(3.44)	(3.20)	(2.97)	(2.97)	ZB26KQE-TFD	9.90	1.50	-			5.9	9.0	46.0	1	0.9	4.42	7.6	4250	1/2	3/4			112	37
	JEHS-0400-B3-M-1		2.28	(3.24)	(3.55)	(3.53)	(3.08)	(3.08)	ZB29KQE-PFJ	11.40	1.36	-			16.1	28.0	114.0	1	0.9	4.42	7.6	4250	1/2	7/8			119	37
	JEHS-0400-B3-M-3		2.29	(3.36)	(3.73)	(3.48)	(3.08)	(3.08)	ZB29KQE-TFD	11.40	1.36	-			7.3	11.0	50.0	1	0.9	4.42	7.6	4250	1/2	7/8			119	37
	JEHS-0500-B3-M-3		(2.69)	(3.08)	(3.16)	(3.05)	(2.92)	(2.92)	ZB38KQE-TFD	14.40	2.07	-		8.2	13.5	65.5	1	0.9	4.42	7.6	4250	1/2	7/8	123			38	
	JEHS-0600-B3-M-3		(2.63)	(3.08)	(3.16)	(3.09)	(2.90)	(2.90)	ZB45KQE-TFD	17.10	1.89	-		8.7	14.2	74.0	1	0.9	6.89	7.6	4100	1/2	1 1/8	125			40	
	JEHS-0680-B3-M-3		(2.57)	(3.04)	(2.90)	(2.87)	(2.62)	(2.62)	ZB48KQE-TFD	18.80	1.80	-		11.4	19.1	101.0	1	0.9	6.89	7.6	4100	1/2	1 1/8	126			40	
	JEHS-0800-B4-M-3		4	(3.04)	(3.35)	(3.08)	(2.93)	(2.83)	(2.83)	ZB58KQE-TFD	22.10	2.50		-	C	11.2	23.0	95.0	2	1.8	8.73	13.6	8500	3/4			1 1/8	1348 x 612 x 1727
	JEHS-1000-B4-M-4	(3.29)		(3.16)	(2.71)	(2.73)	(2.77)	(2.77)	ZB76KQE-TFD	29.10	3.20	-	14.4	28.0		118.0	2	1.8	8.73	13.6	8500	3/4	1 3/8	226	43			
Low Temperature	JEHR-0175-B2-L-1	2	n/a	100	n/a	n/a	n/a	n/a	NTZ048-5VM	8.40	0.95	0.50	B	4.5	11.0	37.0	1	0.6	0.51	4.5	2700	3/8	5/8	1101 x 444 x 662	703 x 408	73	37	
	JEHR-0175-B2-L-3		n/a	111	n/a	n/a	n/a	n/a	NTZ048-4VM	8.40	0.95	0.50		2.1	4.8	16.0	1	0.6	0.51	4.5	2700	3/8	5/8			72	37	
	JEHR-0225-B2-L-1		n/a	104	n/a	n/a	n/a	n/a	NTZ068-5VM	11.80	0.95	0.50		9.2	17.0	53.0	1	0.6	0.51	4.5	2700	3/8	5/8			75	40	
	JEHR-0225-B2-L-3		n/a	111	n/a	n/a	n/a	n/a	NTZ068-4VM	11.80	0.95	0.50		3.5	8.4	25.0	1	0.6	0.51	4.5	2700	3/8	5/8			74	40	
	JEHS-0200-B2-L-3	2	n/a	0.97	0.89	0.93	0.86	0.86	ZF06K4E-TFD	5.90	1.30	0.50	C	2.7	6.0	26.0	1	0.6	0.51	4.5	2700	3/8	3/4	1101 x 444 x 662	703 x 408	76	32	
	JEHS-0300-B2-L-3		n/a	109	0.85	0.91	0.92	0.92	ZF09K4E-TFD	8.00	1.50	0.50		3.8	6.5	40.0	1	0.6	0.51	4.5	2700	3/8	3/4			78	33	
	JEHS-0400-B3-L-3	3	n/a	(188)	(167)	(165)	(167)	(167)	ZF13K4E-TFD	11.80	1.90	0.60		4.9	10.0	51.5	1	0.9	4.42	7.6	4250	1/2	7/8	1353 x 575 x 872	945 x 500	132	37	
	JEHS-0500-B3-L-3		n/a	(179)	(167)	(164)	(153)	(153)	ZF15K4E-TFD	14.50	1.90	0.60		6.7	12.0	64.0	1	0.9	4.42	7.6	4250	1/2	7/8			132	39	
	JEHS-0600-B3-L-3		n/a	(180)	(152)	n/a	(153)	(153)	ZF18K4E-TFD	17.10	1.90	0.60		7.6	12.5	74.0	1	0.9	4.42	7.6	4250	1/2	7/8			133	41	
	JEHS-0750-B4-L-3	4	n/a	(182)	(151)	n/a	(164)	(164)	ZF25K5E-TFD	21.40	1.90	0.60		C	6.9	16.6	102.0	2	1.2	4.14	13.6	5750	1/2	1 1/8	1348 x 605 x 1727	940 x 560	203	41
	JEHS-0950-B4-L-3 EVI		n/a	(179)	(176)	(163)	(176)	(176)	ZF18KV/E-TFD EVI	17.10	1.90	0.60			7.3	13.0	74.0	2	1.2	8.70	13.6	5870	1/2	7/8			200	37

Oil Type A = Uniqema Emkarate RL32CF / **Oil Type B** = Maneurop Ester 160PZ / **Oil Type C** = Polyolester Oil - (Copeland Ultra 22 CC, Copeland Ultra 32 CC, Copeland Ultra 32-3MAF, Mobil EAL Arctic 22CC, Uniqema Emkarate RL32CF)

^a NC = Nominal Current @ condition -10°C_{te} / +32°C_{ta} MT and -35°C_{te} / +32°C_{ta} LT with R404A refrigerant

^b MCC = Maximum Continuous Current

^c LRC = Locked Rotor Current

^d Sound Pressure Level measured in an anechoic room (-10/+32°C) MT & (-25/+32°C) LT conditions. Alternative conditions may produce different results

Important Note:

Only qualified personnel, who are familiar with refrigeration systems and components including all controls, should perform the installation and start-up of the system. To avoid potential injury, use care when working around coil surfaces or sharp edges of metal cabinets. All piping and electrical wiring should be installed in accordance with all applicable standards and local by-laws.

General information

Before Installation

- Ensure the units received are the correct models for the intended application.
- Ensure the refrigerant; electrical supply and MWP are all suitable for the proposed application.
- Check there is no damage to the units. Any damage should be advised to the supplier immediately.
- Check that the proposed equipment locations are suitable and provide adequate support for the weight of the units.

Offloading and Lifting

- Whenever a condensing unit is lifted, it should be from the base and, where possible, all packing and protection is kept in position.
- If lifting equipment is required, ensure that it is suitable, certificated, and that the operatives are qualified to use it.
- When using a fork-lift or pallet truck to lift the unit, the two support points should be sufficiently apart to give stability when lifting and suitably placed to distribute the load on the forks.
- If slings are used, care should be taken to ensure that the slings do not crush the casework or coil.
- When lifting by crane, use spreader bars to prevent compressing the top of the equipment.
- Do not drop the unit. Should this inadvertently happen, it should be immediately unpacked and inspected for damage.
- Use the appropriate spreader bars/lifting sling with the holes and lugs provided.

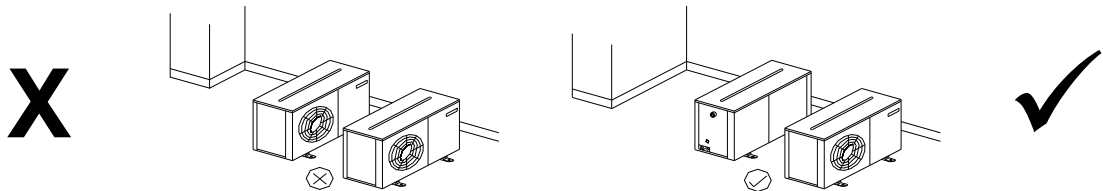
During Installation and subsequent maintenance

- Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations, and experienced with this type of equipment.
- If lifting equipment is required, ensure that it is suitable for purpose, certificated and that the operatives are qualified to use it.
- Safe working methods are identified and operatives have suitable Personal Protective Equipment (PPE).
- Ensure the working area has adequate ventilation during brazing procedures.
- The units contain moving machinery and electrical power hazards, which may cause severe injury or death. Disconnect and shut off power before installation or service of the equipment.
- Refrigerant release into the atmosphere is illegal. Proper evacuation, recovery, handling and leak testing procedures must be observed at all times.
- Units must be earthed.
- No maintenance work should be attempted prior to disconnecting the electrical supply.
- The electrical covers and fan guards must remain fitted at all times.
- Use of the units outside of the design conditions and the application for which the units were intended may be unsafe and be detrimental to the units, regardless of short or long term operation.
- The units are not designed to withstand loads or stresses from other equipment or personnel. Such extraneous loads or stress may cause failure/leak/injury.

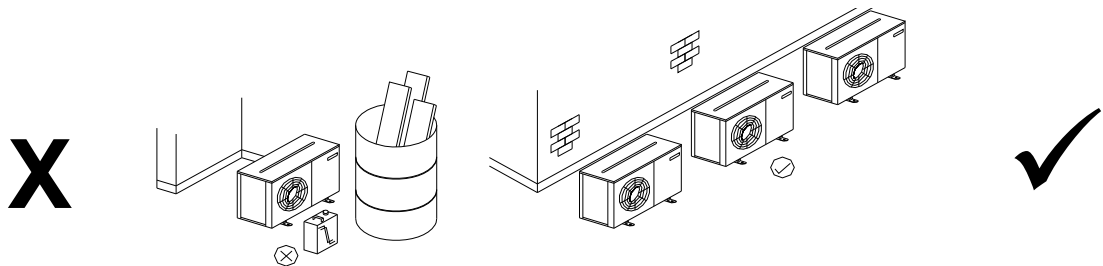
Installation

Unit location

- In order to achieve maximum cooling capacity, the installation location for the condensing unit should be carefully selected.
- Install the condensing unit in such a way so that hot air ejected by the condensing unit cannot be drawn in again (short circuit of hot discharge air). Allow sufficient space for maintenance around the unit.



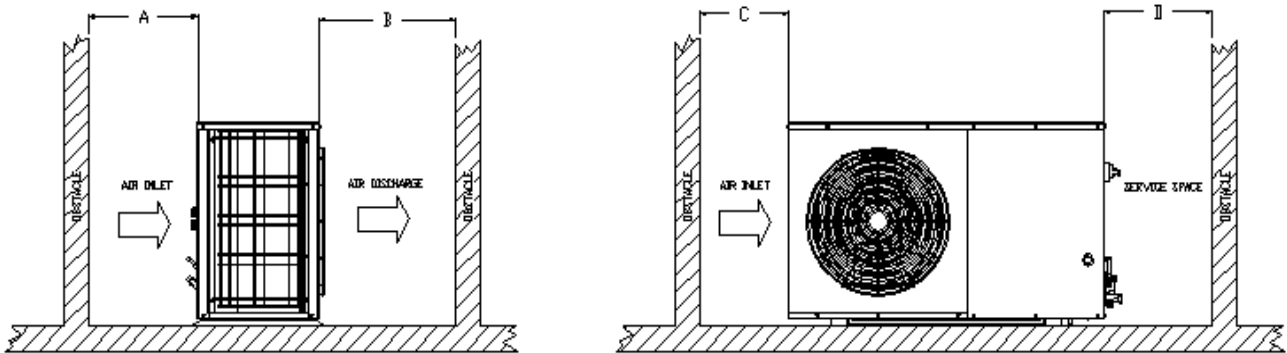
- Ensure that there is no obstruction to air flow into or out of the unit. Remove obstacles which block air intake or discharge.



- The location must be well ventilated, so the unit can draw in and distribute plenty of air thus lowering the condensing temperature.
- To optimize the unit running conditions, the condenser coil must be cleaned at regular intervals.
- The unit must be level in all directions.

Installation clearances

- The installation location should allow sufficient space for air flow and maintenance around the unit.



ALL MODELS	A	B	C	D
Minimum Distance	300 mm	1000 mm	300 mm	500 mm

Installation

Field piping

Important Note:

Pipe sizing should only be determined by qualified personnel. Correct line sizing will minimize the pressure drop and maintain sufficient gas velocity for proper oil return. All applicable standards must be observed in the installation of refrigerant piping.

To ensure satisfactory operation and performance, the following points should be noted:

- Pipework routes must be as simple and as short as possible.
- Avoid low points on pipework where oil can accumulate.
- Suction gas velocity must be sufficient to ensure good oil return.
- Use only clean, dehydrated refrigeration grade copper tube with long radius bends.
- Avoid flare type connections and take great care when brazing. Use only silver alloy rods.
- Run braze without over filling to ensure there is no leakage into the tube.
- To prevent oxidation, blow oxygen free nitrogen through pipework when brazing.
- Install insulation on all suction lines and on all pipes penetrating walls or passing through hot areas.
- Adequately support all pipe work at a maximum of 2 metre intervals.
- Where the condensing unit is situated below the indoor unit (coldroom evaporator / display case), the height difference between the two units should be no more than 6 metres.
- In vertical pipework, the use of U-trap and double suction risers is often required. These suction risers must always be fitted with a U-trap at the bottom and a P-trap at the top and never be higher than 4m unless a second U-trap system is fitted.
- Additional oil may be required if piping length exceeds 20m or multiple oil traps are fitted. Check the oil level closely during commissioning and add oil as necessary. Add oil in small amounts. Do not overfill the compressor!
- When installing a single compressor condensing unit with multiple evaporators connected which operate independently, care should be taken to ensure that the evaporating pressure/temperature does not fall outside the compressor operating limit at minimum load. If there is a potential for this scenario, consider multiple evaporators fed by a single solenoid valve or separate condensing units.
- Suction pipework should slope gently back towards the unit to assist oil return to the compressor. A fall of approximately 2cm per metre of pipework is acceptable.
- Liquid lines should be sized to ensure a full supply of liquid refrigerant to the expansion device. Careful attention should be paid to sizing of liquid lines on large risers (maximum rise 6m).
- In some circumstances, a suction accumulator (not supplied) may be required. It offers protection against refrigerant flood back during operation and also against off-cycle migration by adding internal free volume to the low side of the system.
- Tests must be conducted to ensure the amount of off-cycle migration to the compressor does not exceed the compressor's charge limit.
- Wherever possible the system should be installed to utilize a pump down configuration.
- An MOP expansion valve is recommended for all Low Temperature installations.
- Maximum recommended pipe length is 25m for Reciprocating units and 50m for Scroll units.

Important Note:

One of the main factors affecting equipment reliability and compressor service life is refrigeration circuit contamination. During installation, circuit contamination can be caused by:

- Brazing & Welding Oxides
- Filings & Particles from de-burring pipework
- Brazing Flux
- Moisture & Air

Installation

Pipe size selection (For EVI unit only)

Sizing of liquid and suction lines for EVI model will be different from standard scroll models. Piping sizes of this model need to follow the recommended correction coefficient of cooling capacity. This is vital as if the pipework selected is oversized, especially for the suction pipe, the gas velocity will be decreased at low mass flow rate / low evaporating temperature, causing oil return problems. Undersized suction lines will also cause decreased capacity due to increased pressure drop.

The correction factor of refrigerant R404A is shown as below table:

Ta \ Te	(Watts)	-40	-35	-30	-25	-20
27	CF	0.64	0.66	0.68	0.70	0.72
32	CF	0.61	0.63	0.65	0.67	0.69
35	CF	0.59	0.61	0.63	0.65	0.67
38	CF	0.57	0.59	0.61	0.63	0.65
43	CF	0.54	0.55	0.57	0.58	0.60

For instance,

At condition of Te -35°C, Ta +32°C

Refrigerant R404A

Published cooling capacity = 5.9kW.

Cooling capacity = Correction factor x Published cooling capacity
= 0.63 x 5.9 kW
= **3.707kW**

Therefore, the pipe sizes should be selected against the **corrected** capacity of 3.71kW.

The correction factor of refrigerant R407A is shown as below table:

Ta \ Te	(Watts)	-40	-35	-30	-25	-20
27	CF	0.73	0.73	0.73	0.73	0.73
32	CF	0.68	0.69	0.69	0.70	0.70
35	CF	0.65	0.66	0.67	0.67	0.68
38	CF	0.62	0.63	0.64	0.65	0.66
43	CF	0.57	0.58	0.60	0.61	0.63

The correction factor of refrigerant R407F is shown as below table:

Ta \ Te	(Watts)	-40	-35	-30	-25	-20
27	CF	0.72	0.73	0.73	0.73	0.72
32	CF	0.68	0.68	0.69	0.69	0.69
35	CF	0.65	0.66	0.66	0.67	0.67
38	CF	0.62	0.63	0.64	0.65	0.65
43	CF	0.57	0.58	0.60	0.61	0.62

The correction factor of refrigerant R448A/R449A is shown as below table:

Ta \ Te	(Watts)	-40	-35	-30	-25	-20
27	CF	0.71	0.72	0.71	0.72	0.72
32	CF	0.67	0.68	0.68	0.68	0.69
35	CF	0.65	0.65	0.65	0.66	0.67
38	CF	0.62	0.63	0.63	0.64	0.65
43	CF	0.58	0.59	0.59	0.60	0.61

Installation

Insulation selection (For EVI unit only)

The liquid pipe connecting CCU service valve to the evaporator must be well insulated with recommended wall thickness of minimum ¾".

Expansion valve selection (For EVI unit only)

The lower liquid temperature of the EVI unit can increase evaporator expansion valve capacities. Selection of the expansion valve needs to be done based on the expected amount of sub-cooling shown in below tables:

(A.) R404A

Amount of Sub-cooling (K)					
Ta\Te	-40	-35	-30	-25	-20
27	39.9	36.9	33.9	30.9	27.9
32	40.9	37.9	34.9	31.9	28.9
35	41.5	38.5	35.5	32.5	29.5
38	42.1	39.1	36.1	33.1	30.1
43	43.1	40.1	37.1	34.1	31.1

(B.) R407A

Amount of Sub-cooling (K)					
Ta\Te	-40	-35	-30	-25	-20
27	33.1	32.8	32.4	32.1	31.8
32	38.0	37.0	35.9	34.9	33.8
35	41.0	39.5	38.0	36.5	35.0
38	43.9	42.0	40.1	38.1	36.2
43	48.9	46.2	43.5	40.9	38.2

(C.) R407F

Amount of Sub-cooling (K)					
Ta\Te	-40	-35	-30	-25	-20
27	33.8	33.5	33.1	32.8	32.5
32	38.8	37.8	36.7	35.7	34.6
35	41.9	40.4	38.8	37.3	35.8
38	44.9	42.9	41.0	38.9	37.0
43	50.0	47.2	44.5	41.8	39.0

(D.) R448A/R449A

Amount of Sub-cooling (K)					
Ta\Te	-40	-35	-30	-25	-20
27	33.1	32.8	32.4	32.1	31.8
32	37.9	36.9	35.8	34.8	33.8
35	40.9	39.4	37.9	36.4	34.9
38	43.8	41.9	40.0	38.0	36.1
43	48.8	46.1	43.4	40.8	38.1

Installation

Pressure testing

The condensing units are pressure tested in the factory prior to dispatch. All units come with a holding charge of oxygen free nitrogen.

Once the pipework installation is complete, it should be pressure tested prior to evacuation to test for leaks.

A pressure leak test should be carried out using oxygen free nitrogen (OFN). NEVER USE OXYGEN FOR PRESSURE TESTING SYSTEMS. A calibrated nitrogen pressure regulator must always be used. Before starting any pressure testing, ensure the area surrounding the system is safe, inform relevant personnel and fit warning signs indicating high pressure testing. Also, use correct PPE as required.

Always pressurize the system slowly, preferably in stages up to the maximum required pressure. Maximum test pressures applicable to the unit are as follows:

Test pressure	
High side	Low side
28 barG (405 psiG)	19 barG (275 psiG)

Listen for any possible leaks and check all joints with bubble spray. If any leaks are discovered, release pressure slowly from system until empty, repair leak and then restart pressure testing procedure. Never attempt to repair a leak on a pressurized system.

A strength test should also be incorporated (to installed pipework only) according to applicable standards.

Once testing has been completed satisfactorily, release the pressure from the system gradually and safely to external atmosphere.

Evacuation & Charging

Important Note:

Moisture prevents proper functioning of the compressor and the refrigeration system. Ensure that a good quality vacuum pump is used to pull a minimum vacuum of 250 microns (0.25 torr).

Once pressure testing has been completed, the system can now be evacuated to remove air and any moisture from the piping. This can be done as follows:

- Ensure any nitrogen charge is safely released from the system.
- Connect a gauge manifold to the connections on the service valves on the condensing unit.
- Connect a vacuum pump and vacuum gauge to the system.
- Ensure all gauge manifold and service valves are open as required.
- Evacuate the system until vacuum is below 250 microns (0.25 torr).

Note: A triple evacuation procedure is recommended for all new systems or where moisture is suspected.

Once the system is isolated and the vacuum pump is switched off, any rise in pressure indicates that either there may be a leak in the system or moisture is still present. In this case, recheck the system for leaks, repair as necessary, and then restart the evacuation procedure. Once completed satisfactorily, the vacuum pump and vacuum gauge can be removed.

At this point, the refrigerant charge can be added to the system as required. Refrigerants must be charged in the liquid phase. **Charging of liquid into the suction side of the system should ONLY be done with a metering device.** Use calibrated weighing scales to record the amount of refrigerant added to the system.

Installation

Electrical

Important Note:

The mains electrical supply to the condensing unit must be via a suitable motor rated circuit breaker or fuse. A mains isolator is fitted to all condensing units therefore an additional isolator is not required unless site conditions or regulations dictate differently.

J & E Hall Fusion condensing units require either a 230 volt / 1 phase / 50Hz supply or a 400 volt / 3 phase / 50Hz supply, both of which must include a Neutral and an Earth. These systems are not suitable for any other supply voltages (other than a deviation of +/- 10% of the above values) and are not suitable for 60Hz supplies.

When utilizing a three phase supply, ensure that the compressor motor rotates in the correct direction (Fusion Scroll models only). See note on page 13.

Mains cable type and sizing must be selected for the particular application and the electrical installation should conform to the current local standards.

- Cables to the condensing unit should wherever possible be routed through the cable glands supplied on the rear of the units.
- Connect the mains supply to the units as per the wiring diagrams on pages 21 – 27.

To gain access to the electrical box, turn the mains isolator switch on the unit to the OFF position, loosen the two screws on the left hand side of the door and open door. The electrical box is located behind the door. Remove the screws in the electrical box cover to access components.

Commissioning

Pre startup checks

Before starting the condensing unit the following checks should be carried out as a minimum:

- Check electrical supply is correct and all connections are sound.
- All moving parts are free and guards fitted.
- Check all mechanical connections for tightness – especially compressor rotalocks.
- Compressor oil level satisfactory.
- Initial settings for safety switches and fan speed control.
- Overload set correctly.
- All valves in correct operating position.
- Initial refrigerant charge.
- Crankcase heater (where fitted) energized for a minimum of 12 hours before compressor start-up.
- Gauge manifold connected to both low and high sides of system.
- Check the tightness of rotolock connection based on recommended torque setting shown in below table.

Unit Model	Series	Compressor Model	Rotolock (Suction) Thread: Tightening Torque (N.m)	Rotolock (Discharge) Thread: Tightening Torque (N.m)
JEHR-0050-B1-M-1	1	AE4460Z-FZ1C	NOT APPLICABLE (BRAZED- CONNECTION)	
JEHR-0067-B1-M-1		CAJ9480Z		
JEHR-0100-B1-M-1		CAJ9510Z		
JEHR-0113-B1-M-1		CAJ9513Z		
JEHR-0140-B2-M-1	2	CAJ4517Z	1"-14 UNS (70-80N.m)	
JEHR-0140-B2-M-3		TAJ4517Z		
JEHR-0150-B2-M-1		MTZ18-5VM		
JEHR-0150-B2-M-3		MTZ18-4VM		
JEHS-0200-B2-M-1	2	ZB15KQE-PFJ	NOT APPLICABLE (BRAZED-CONNECTION)	
JEHS-0200-B2-M-3		ZB15KQE-TFD		
JEHS-0250-B2-M-1		ZB19KQE-PFJ		
JEHS-0250-B2-M-3		ZB19KQE-TFD		
JEHS-0300-B2-M-1	2	ZB21KQE-PFJ		
JEHS-0300-B2-M-3		ZB21KQE-TFD		
JEHS-0350-B2-M-1		ZB26KQE-PFJ		
JEHS-0350-B2-M-3		ZB26KQE-TFD		
JEHS-0350-B3-M-1	3	ZB26KQE-PFJ		
JEHS-0350-B3-M-3		ZB26KQE-TFD		
JEHS-0400-B3-M-1		ZB29KQE-PFJ		
JEHS-0400-B3-M-3		ZB29KQE-TFD		
JEHS-0500-B3-M-3	3	ZB38KQE-TFD		
JEHS-0600-B3-M-3		ZB45KQE-TFD		
JEHS-0680-B3-M-3		ZB48KQE-TFD		
JEHS-0800-B4-M-3	4	ZB58KQE-TFD		
JEHS-1000-B4-M-3		ZB76KQE-TFD	1-3/4"-12UNF (135-160 N.m)	1-1/4"-12UNF (110-135 N.m)
JEHR-0175-B2-L-1	2	NTZ048-5VM	1-1/4"-12UNF (110-135 N.m)	
JEHR-0175-B2-L-3		NTZ048-4VM		
JEHR-0225-B2-L-1		NTZ068-5VM		
JEHR-0225-B2-L-3		NTZ068-4VM		
JEHS-0200-B2-L-3	2	ZF06K4E-TFD		
JEHS-0300-B2-L-3		ZF09K4E-TFD		
JEHS-0400-B3-L-3	3	ZF13K4E-TFD		
JEHS-0500-B3-L-3		ZF15K4E-TFD		
JEHS-0600-B3-L-3	3	ZF18K4E-TFD		
JEHS-0750-B4-L-3		ZF25K5E-TFD		
JEHS-0950-B4-L-3 EVI	4	ZF18KVE-TFD-EVI		
				1-1/4"-12UNF (110-135 N.m)
				1"-14 UNS (70-80N.m)

Commissioning

Running the unit

- Run the unit and check compressor and condenser fan operation.
- Check system pressures and temperatures, gas charge and running currents of motors to ensure correct operation.
- Check compressor suction superheat. This should be between 10K and 20K at normal operating conditions.
- Final adjustment of safety switches settings and fan speed control.
- Allow the system to run for 3 – 4 hours. Check compressor oil level and top up with the correct oil type as required (see page 4). Recheck the compressor oil level again after 24 hours operation.
- Carry out final leak test and ensure all panels/covers are fitted and screws tightened.
- Log all information along with the system model and serial numbers for future reference.
- Complete refrigerant labelling to comply with F-Gas regulations.
- Ensure that the customer / responsible person are provided with basic operating instructions and where electrical isolators are situated in case of emergency.

Important Note:

There must be no more than 10 compressor starts per hour. A higher number reduces the service life of the compressor and can cause carry-over of oil into the system. If necessary, use an anti-short-cycle timer in the control circuit. A minimum 2 minute runtime after each start of the compressor and a 3 minute idle time after each stop are recommended. Only during the pump down cycle may the compressor run for much shorter intervals.

Compressor operation

Scroll compressor motors are designed to run only in one direction. This is not an issue with single phase compressors as they will always run in the correct direction. The correct rotation of a three phase compressor motor depends on the connection of the three incoming phases to the unit. Correct rotation can be determined by a drop in suction pressure and a rise in discharge pressure when the compressor is energized. Running the compressor for a short period of time in reverse direction will have no negative impact but prolonged running in reverse direction may cause premature failure. **To reverse the rotation of a three phase scroll compressor, shut off the incoming power supply to the unit, swap connection of any two of the three incoming phases at the unit isolator, reapply power to the unit and following compressor restart, recheck operating pressures.**

Vacuum operation

Do not operate scroll compressors in a vacuum condition, as this will cause the scrolls to overheat very quickly causing premature failure.

System charge

Ensure an adequate liquid charge has been introduced to the high side of the system before starting to ensure a minimum operating pressure on the suction side of 0.5 bar is maintained, otherwise overheating of the scrolls and subsequent damage may occur.

Commissioning

Safety pressure switch settings

The Saginomiya DNS HP/LP pressure switch fitted to all JEH model condensing units with auto reset for low pressure and manual reset for high pressure is **NOT** factory preset. **BOTH THE LP AND HP SWITCH SETTINGS MUST BE ADJUSTED TO SUIT THE APPLICATION BEFORE STARTING THE UNIT.** Be sure that the high pressure setting does not exceed the receiver's maximum service pressure.

High pressure safety

The high pressure safety switch is required to stop the compressor should the discharge pressure exceed the values shown in the following table. The high pressure switch can be set to lower values depending on the application and ambient conditions.

Unit Series	Compressor	AE/CAJ/TAJ	AE/CAJ/TAJ
	Refrigerant	R404A/R407A/R407F/R449A	R134a
S1/S2	Max. HP Set	27 bar	n/a
Unit Series	Compressor	MTZ	MTZ
	Refrigerant	R404A/R407A/R407F	R134a
S2	Max. HP Set	27 bar	18 bar
Unit Series	Compressor	ZB/ZF	ZB
	Refrigerant	R404A/R407A/R407F/R448A/R449A	R134a
S2/S3/S4	Max. HP Set	27 bar	18 bar

Low pressure safety

The low pressure safety switch protects the compressor against deep vacuum operation, a potential cause of failure due to internal arcing and also operation outside the compressor limits.

The low pressure safety cut out should never be set below the settings as shown in the following table. For systems without pump-down the LP switch signal contact shall be used to energize a low pressure safety alarm.

Compressor Model	AE/CAJ/TAJ		MTZ		ZB		NTZ	ZF
Unit Series	1 & 2		2		2 & 3 & 4		2	2 & 3 & 4
Refrigerant	R404A R407A R407F R449A	R134a	R404A R407A R407F	R134a	R404A R407A R407F R448A R449A	R134a	R404A R407A R407F	R404A R407A R407F R448A R449A
Application	M*	M*	M*	M*	M*	M*	L*	L*
Min. Cut Out (barG)	15	0.5	1	0.6	2	0.6	0.1	0.3
Min. Cut Out (psi)	22	7	15	9	30	9	2	5

Commissioning

Compressor operating pressures

Compressor operating pressures should be kept within the following limits:

Recommended compressor working pressure range								
Compressor Model	AE/CAJ/TAJ		MTZ		ZB		NTZ	ZF
Unit Series	1 & 2		2		2 & 3 & 4		2	2 & 3 & 4
Refrigerant	R404A R407A R407F R449A	R134a	R404A R407A R407F	R134a	R404A R407A R407F R448A R449A	R134a	R404A	R404A R407A R407F R448A R449A
Application	M*	M*	M*	M*	M*	M*	L*	L*
High Side (barG)	13.2 ~ 27.7	n/a	13.2 ~ 27.7	7.9 ~ 15.8	7.1 ~ 27.7	6.6 ~ 15.8	13.2 ~ 27.7	13.2 ~ 27.7
Low Side (barG)	1.5 ~ 8.3	n/a	1.0 ~ 7.2	0.6 ~ 4.7	2.0 ~ 7.1	0.6 ~ 3.8	0.1 ~ 3.3	0.1 ~ 3.3

M* Medium Temperature L* Low Temperature

XGE Fan Speed Controller

The fan speed controller is factory set to 19 bar for operation with R4*** series refrigerant to ensure compressor always operates within envelope at all declared working condition. This can be adjusted to suit site conditions / application or alternative refrigerants as described on page 31. The XGE controls are set to stop fan at Pmin. Recommended settings to gain higher energy efficiency as published in the Ecodesign data are as follows:

Medium Temperature

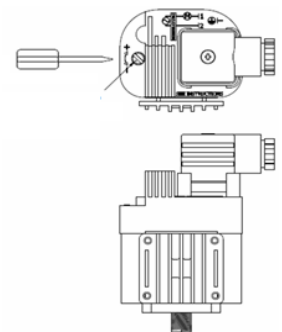
Refrigerant	R404A/R407A/R407F/R448A/R449A		R134a
Setting	Series 2	19	13
	Series 3	10	13
	Series 4	10	10

Low Temperature

Refrigerant	R404A/R407A/R407F/R448A/R449A	
Setting	JEHR Models- Series 2	19
	JEHS Models - Series 2 & 3 & 4 (except EVI)	13
	JEHS Models - EVI unit	17

Clockwise: Increase pressure set point
Anticlockwise: Decrease pressure set point

360° = 1 turn
Approx. 1.5 barG



Units with microchannel condenser coils

Care must be taken during charging a unit with refrigerant when a microchannel condenser coil is fitted. Because the microchannel coils hold less refrigerant than traditional fin/tube coils, it is easier to overcharge, especially if the system is commissioned during winter time when the ambient temperature is colder. If too much refrigerant is added, this may cause tripping of the high pressure switch in warmer weather. Always check that the amount of condenser sub cooling is not excessive which may indicate refrigerant overcharge.

System operation

Once the system is correctly charged with refrigerant and the operating condition is stable, check that the compressor suction superheat is between 10K and 20K and that the compressor discharge temperature is between 50°C and 90°C. A suction superheat that is too low may indicate liquid refrigerant return to the compressor, whereas a suction superheat that is too high will not provide enough cooling effect for the compressor and will also cause high discharge temperatures. In either case, it is likely that compressor damage/failure will occur.

Commissioning

For EVI unit only:

Controller EXD-HP1

The controller EXD-HP1 used in the Series 4 EVI unit operates as an economizer control. The setting of controller is preset by the factory and is password protected. Users are not allowed to change any settings in the controller.



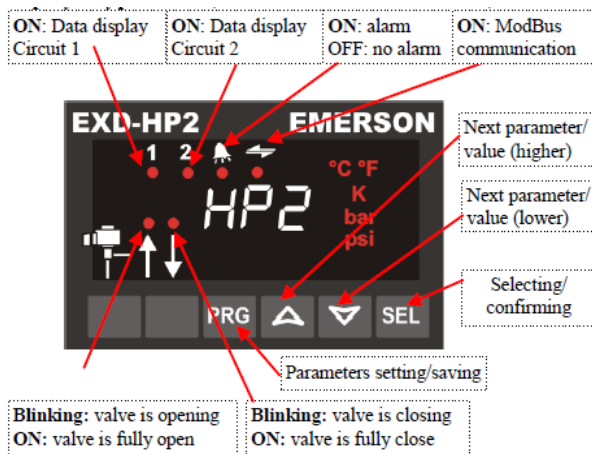
Safety Instructions:

1. Read installation instruction carefully. Failure to comply can result in device failure, system damage or personal injury.
2. Only person having appropriate knowledge and skill are allowed to manipulate the controller.
3. Disconnect all voltages from system before installation.

Electrical Installation

- Do not operate system before all cable connections are completed.
 - Refer to wiring diagram for electrical connections.
 - Class II category transformer is required for 24VAC power supply
 - Do not connect any EXD-HP1 input to main voltage as it will permanently damage the controller.
 - When connecting wires of expansion valve and pressure sensor, consider color coding as follow:
1. EXM : BR: BROWN; BL: BLUE, OR: ORANGE; YE: YELLOW; WH: WHITE
 2. PT5 : BN: BROWN; WH: WHITE

Display/ keypad unit (LEDs and button functions)



- In standard mode the superheat is shown at the display. In case of liquid injection and economizer function this changes to discharge temperature.
- To display other data of EXD-HP1 press “SEL” button for 1 second until index number according to below table appears. Release “SEL” button and the next variable data will appears. By repeating the procedure variable data can be displayed in sequence as measured superheat (K) → Measured suction pressure (bar) → valve position (%) → Measured suction gas temperature (°C) → Calculated saturated temperature (°C) → Measured discharge temperature (°C) (if economizer function is selected) → REPEATING

Commissioning

Variable data	Controller EXD-HP1
Default Superheat, K	1 1
Suction pressure, bar	1 0
Valve position, %	1 0
Suction gas temperature, °C	1 0
Saturation temperature, °C	1 0
Discharge temperature, °C	1 0

Digital input Di1/Di2

- The digital input Di1 is the interface between controller EXD-HP1 and system controller if Modbus communication has not been used.
- The digital status is dependent to operation of system's compressor or demand.

Operating Condition	Digital input status
Compressor starts	Closed (Start)
Compressor stops	Open (Stop)

Manual mode operation

Warning: All alarms are disabled during manual control. We do not recommend unattended operation of system during manual control.

- Press **PRG** and  together for 5 seconds to access to manual mode operation.

- List of parameters in scrolling sequence by pressing  button

Code	Parameter description and choices	Min	Max	Factory setting	Field setting
1Ho	Manual mode operation; circuit 1 0 = disabled; 1 = Enabled	0	1	0	
1HP	Valve opening (%)	0	100	0	
2Ho	Manual mode operation; circuit 2 0 = disabled; 1 = Enabled	0	1	0	
2HP	Valve opening (%)	0	100	0	

Manual alarm reset clearing functional alarms (except hardware error)

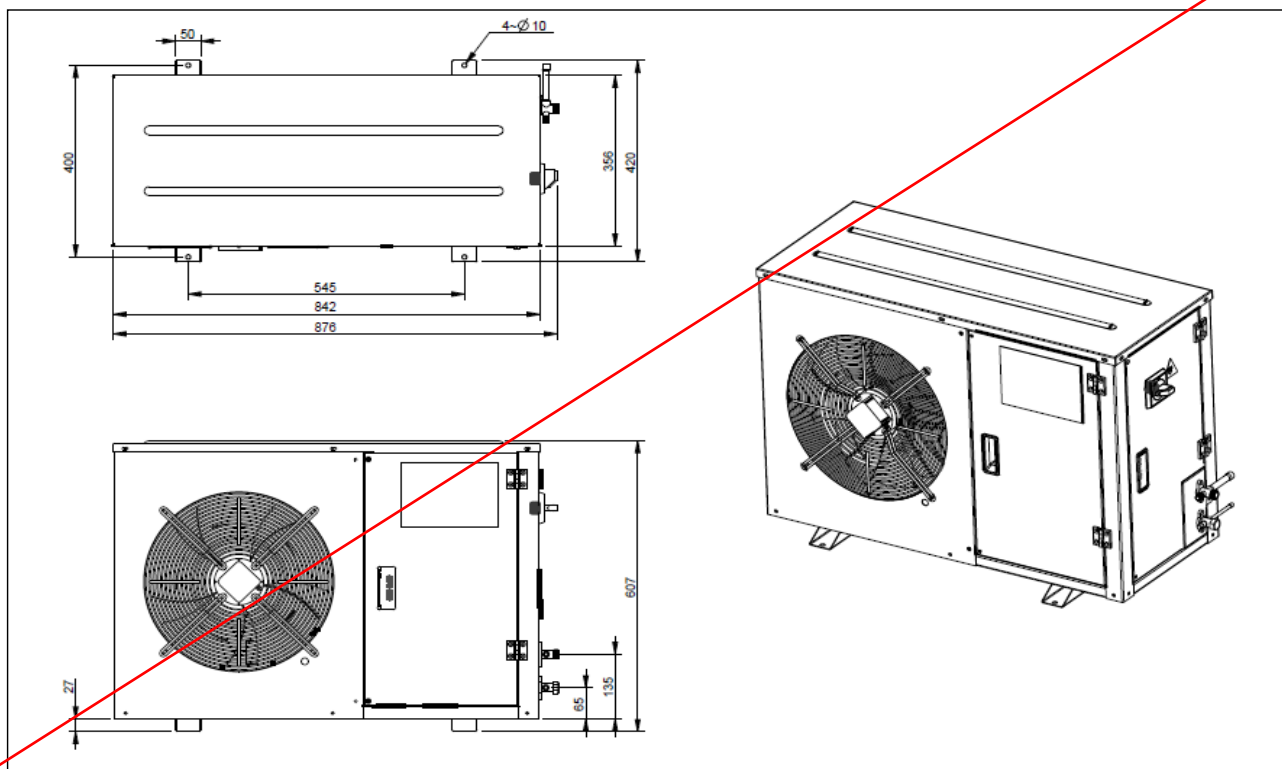
- Press **PRG** and **SEL** together for 5 seconds. When the clearing is done, "CL" message appears for 2 seconds.

EXD – HP1 Error/ Alarm handling

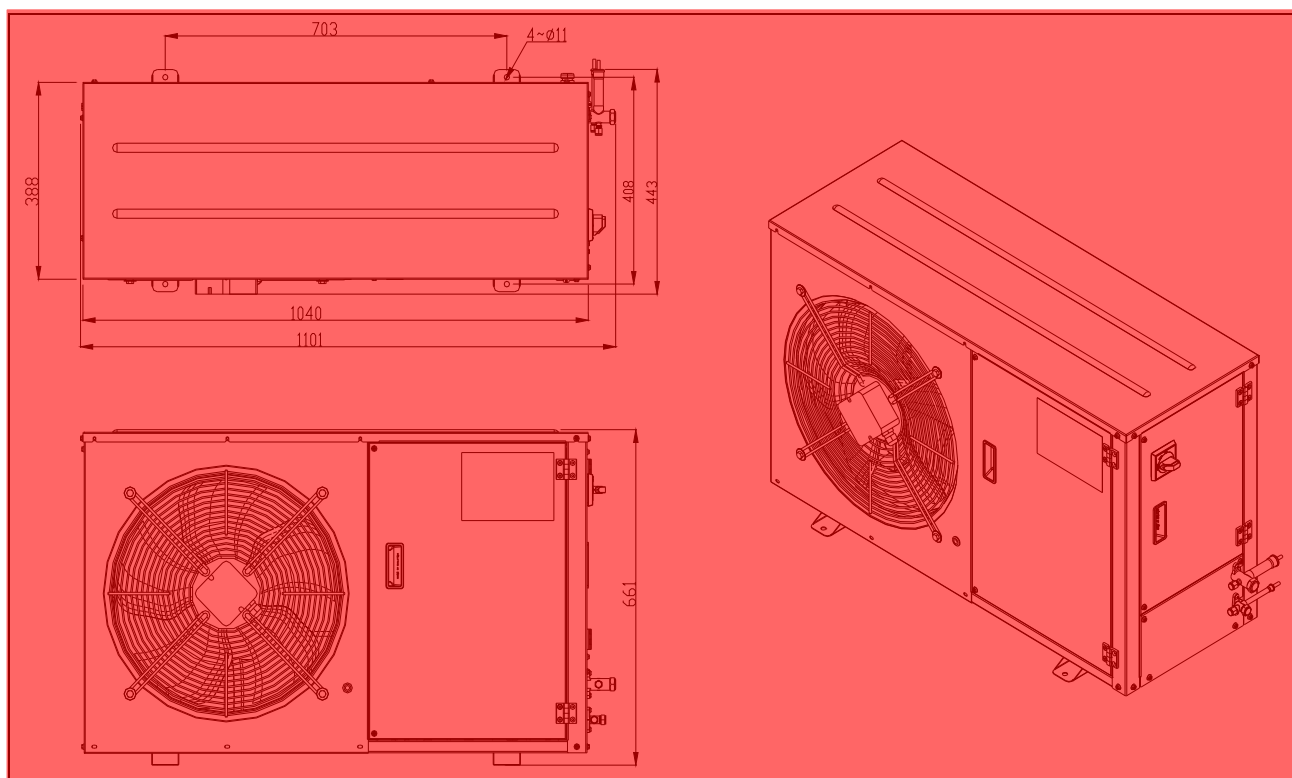
Alarm code	Description	Related parameter	Valve	What to do?	Requires manual reset after resolving alarm
1E0/2E0	Pressure sensor 1/2 error	-	Fully close	Check wiring connection and measure the signal 4 to 20 mA	No
1E1/2E0	Temperature sensor 1/2 error	-	Fully close	Check wiring connection and measure the resistance of sensor	No
1Ed	Discharge hot gas temperature sensor 3 error	-	Operating	Check wiring connection and measure the resistance of sensor	No
1AII/2AII	EXM/EXL electrical connection error	-	-	Check wiring connection and measure the resistance of winding	No
1Ad	Discharge hot gas temperature above limit		Operating	Check valve opening/ check liquid flow for flash gas free/check discharge hot gas temperature sensor	No
AF	Freeze protection	1P4/2P4: 1	Fully close	Check the system for cause of low pressure such as insufficient load on evaporator	No
AF blinking		1P4/2P4: 2	Fully close		Yes
AL	Low superheat (<0.5K)	1uL/2uL: 1	Fully close	Check wiring connection and operation of valve	No
AL blinking		1uL/2uL: 2	Fully close		Yes
AH	High superheat	1uH/2uH: 1	Operating	Check the system	No
AP	Low pressure	1P9/2P9: 1	Operating	Check the system for cause of low pressure such as refrigerant loss	No
AP blinking		1P9/2P9: 2	Operating		Yes

Dimensional Drawings

JEHR-0050-B1-M-1, JEHR-0067-B1-M-1, JEH2-0100-B1-M-1, JEHR-0113-B1-M-1

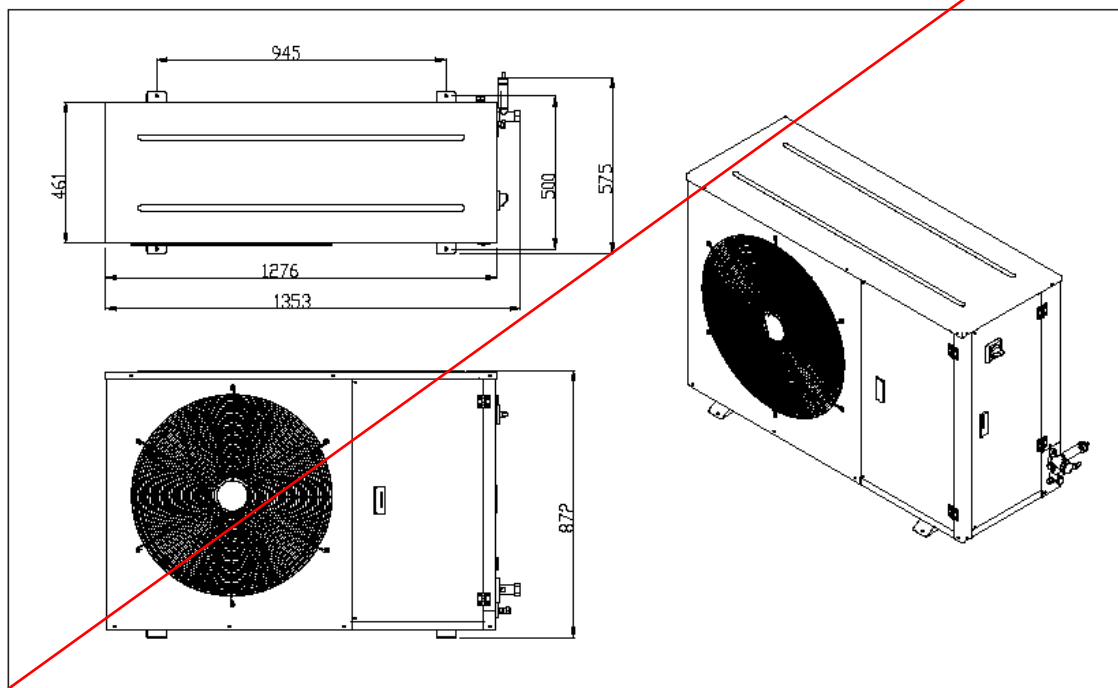


JEHR-0140-B2-M-1/3, JEHR-0150-B2-M-1/3, JEHS-0200-M-1/3, JEHS-0250-B2-M-1/3, JEHS-0300-B2-M-1/3, JEHS-0350-B2-M-1/3, JEHR-0175-L-1/3, JEHR-0225-L-1/3, JEHS-0200-B2-L-3, JEHS-0300-B2-L-3

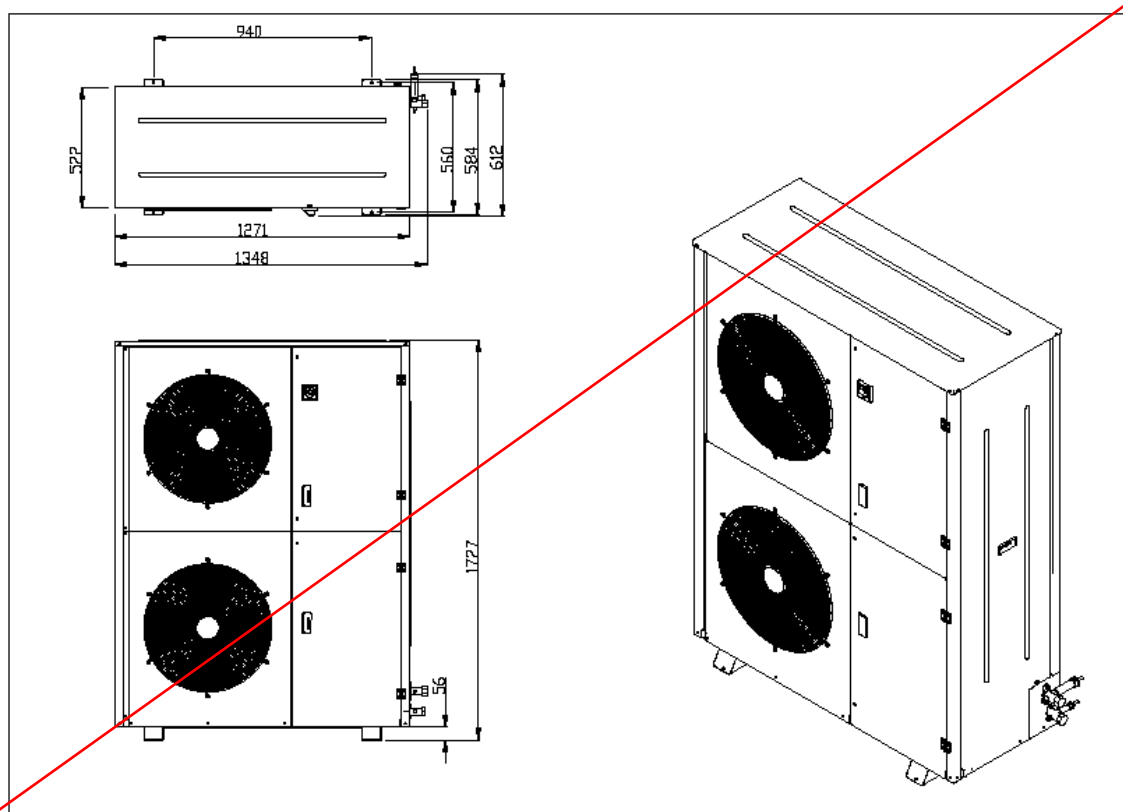


Dimensional Drawings

JEHS-0350-B3-M-1/3, JEHS-0400-B3-M-1/3, JEHS-0500-B3-M-3, JEHS-0600-B3-M-3, JEHS-0680-B3-M-3
JEHS-0400-B3-L-3, JEHS-0500-B3-L-3, JEHS-0600-B3-L-3

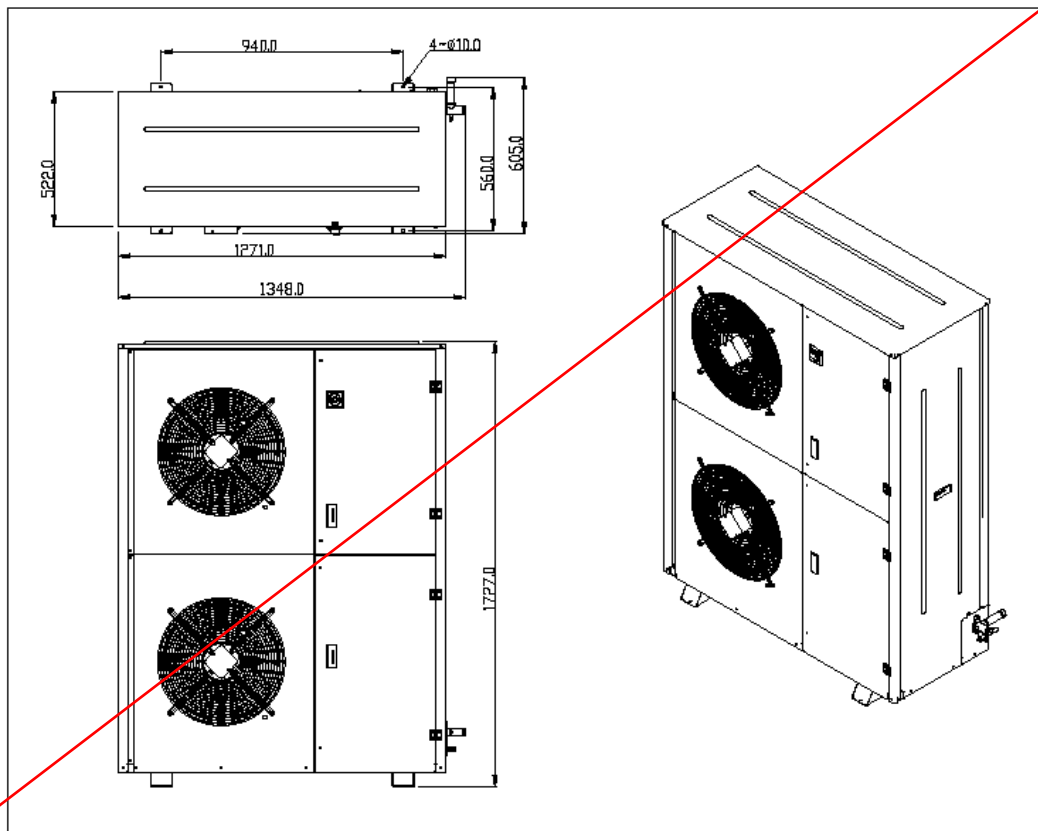


JEHS-0800-B4-M-3, JEHS-1000-B4-M-3



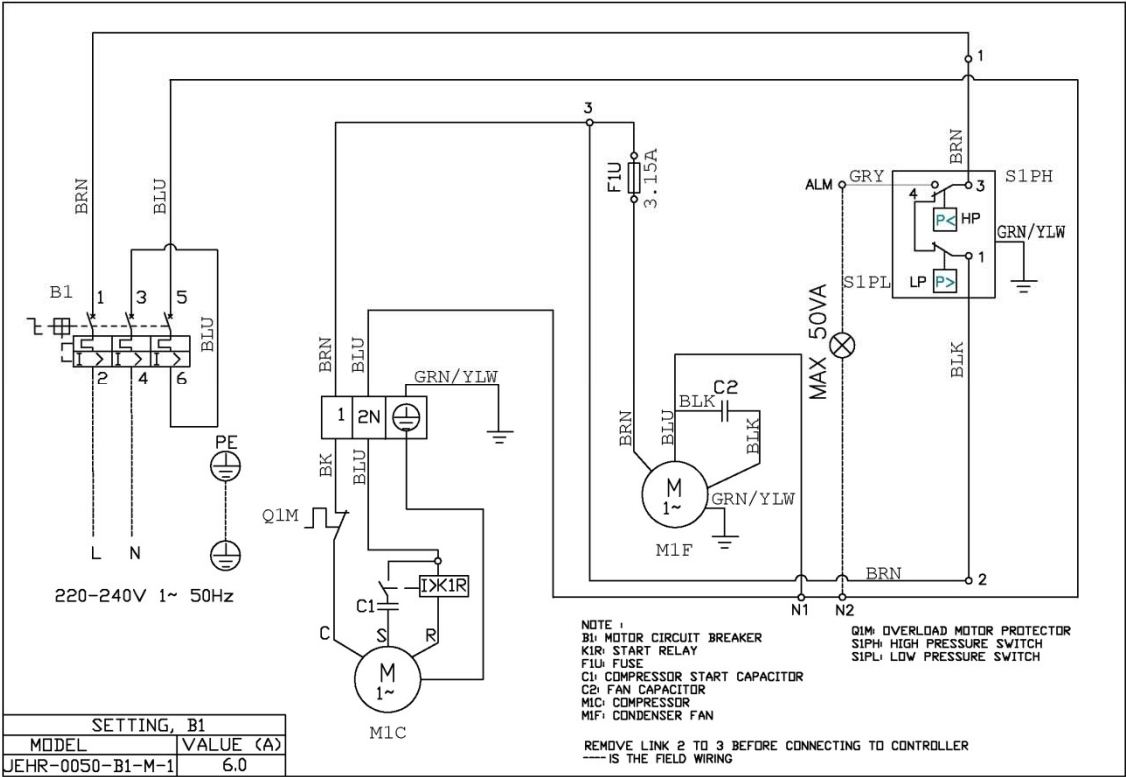
Dimensional Drawings

JEHS-0750-B4-L-3, JEHS-0950-B4-L-3 EVI

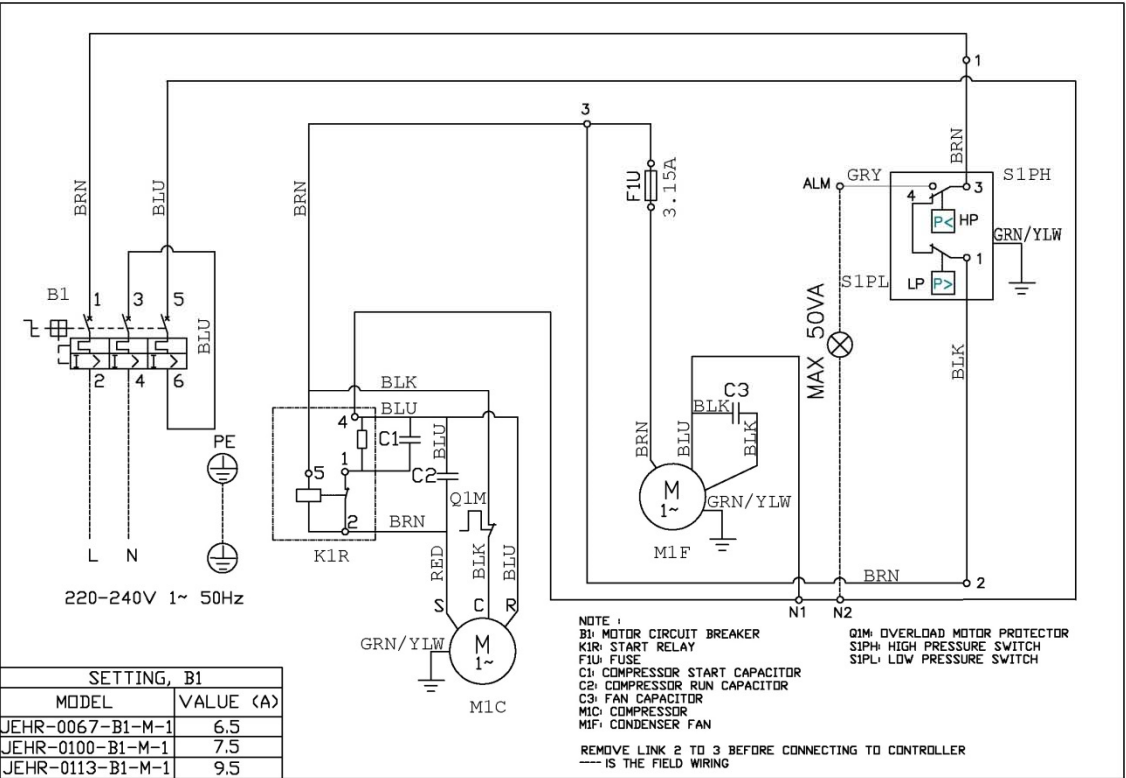


Electrical Wiring Diagrams

JEHR-0050-B1-M-1

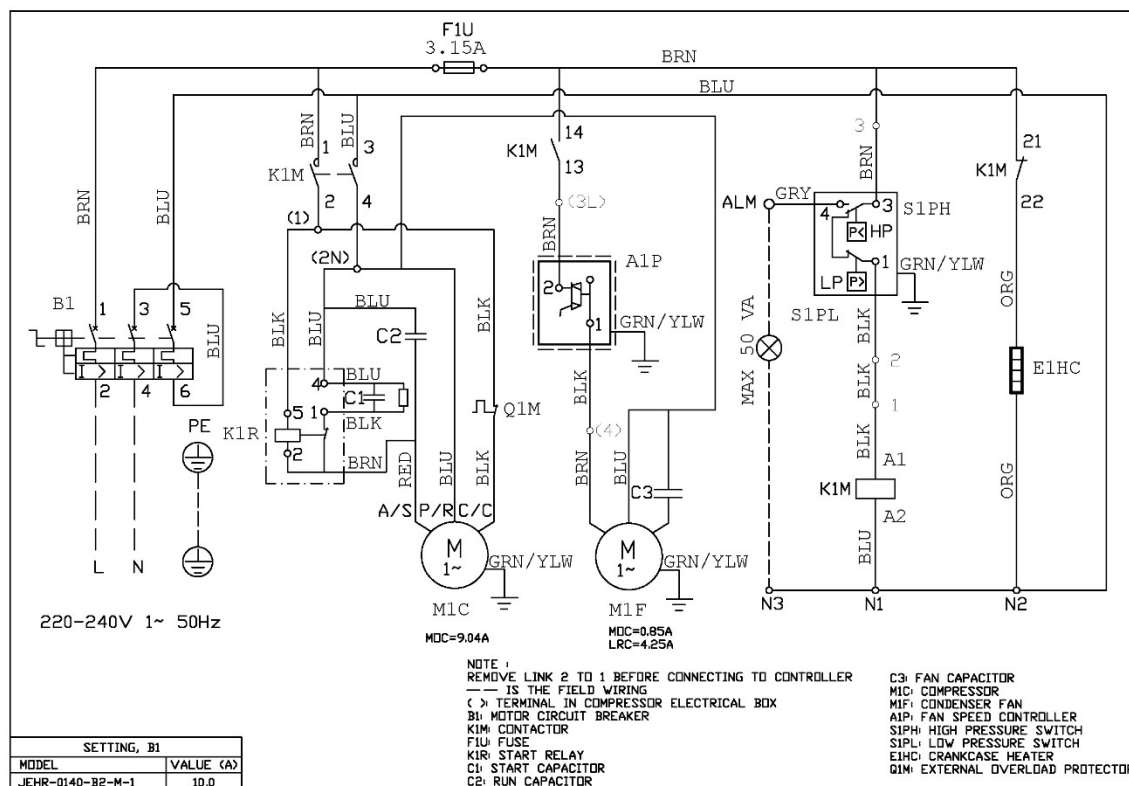


JEHR-0067-B1-M-1, JEHR-0100-B1-M-1, JEHR-0113-B1-M-1

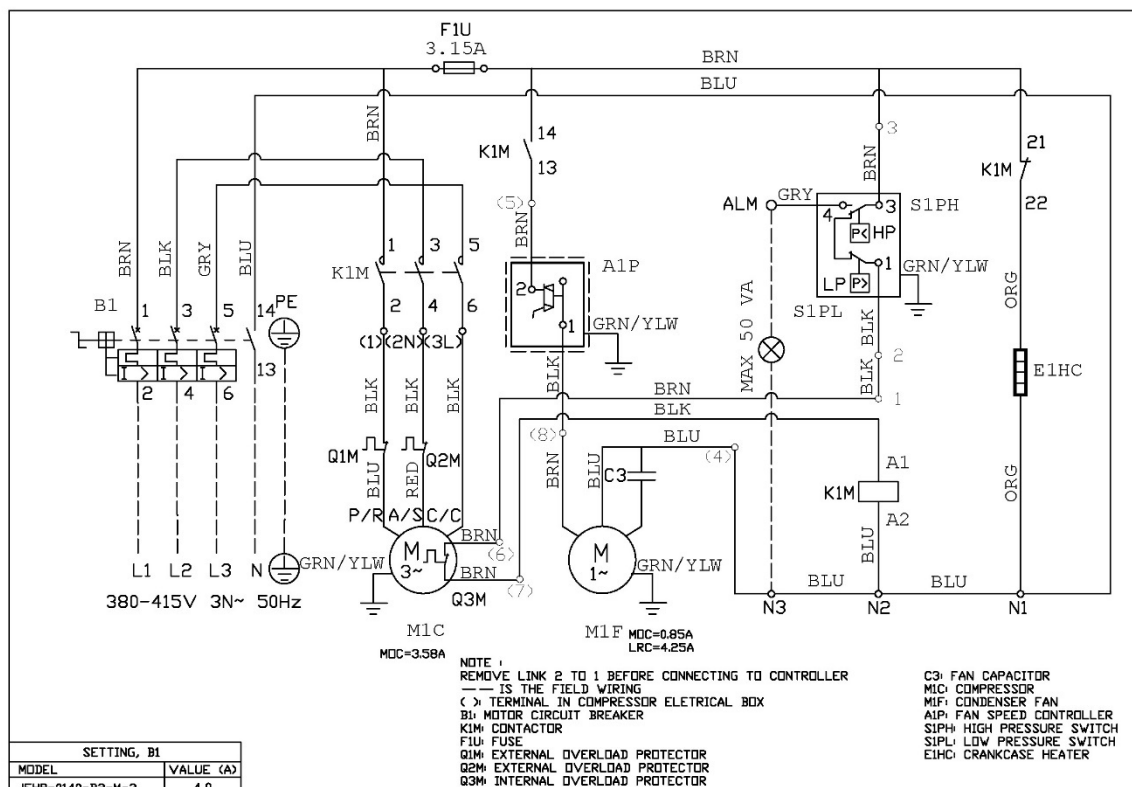


Electrical Wiring Diagrams

JEHR-0140-B2-M-1

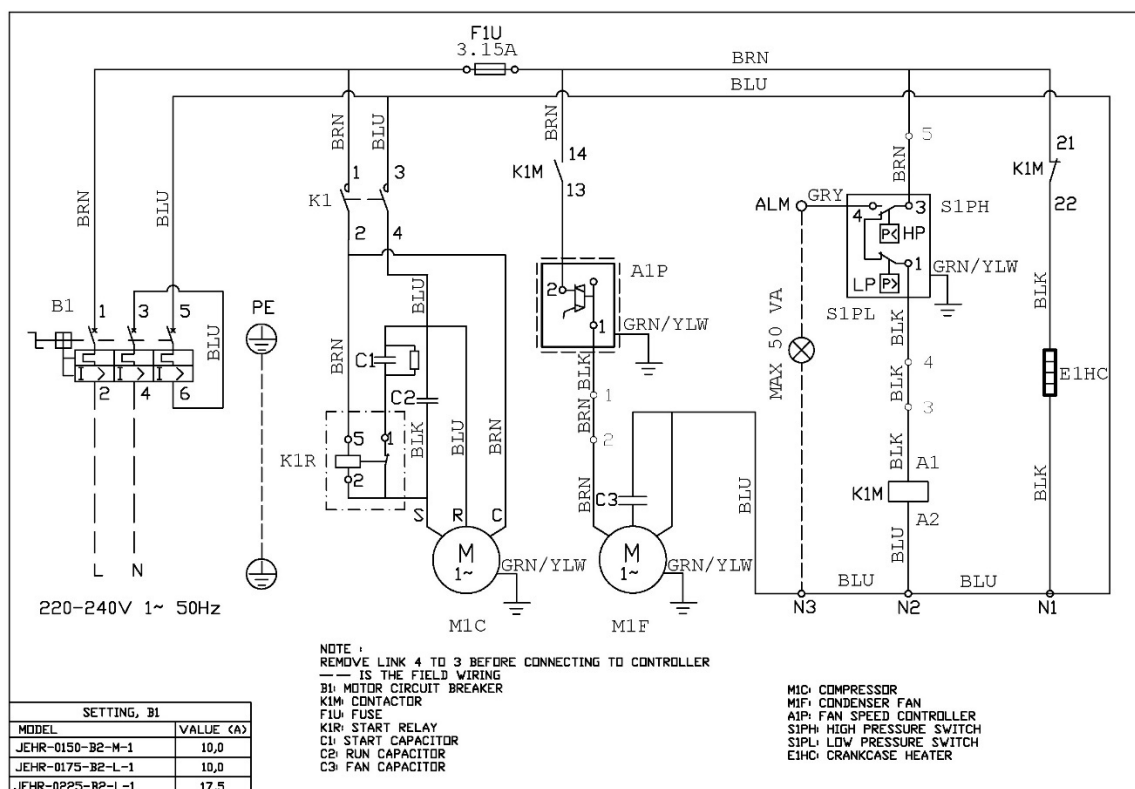


JEHR-0140-B2-M-3

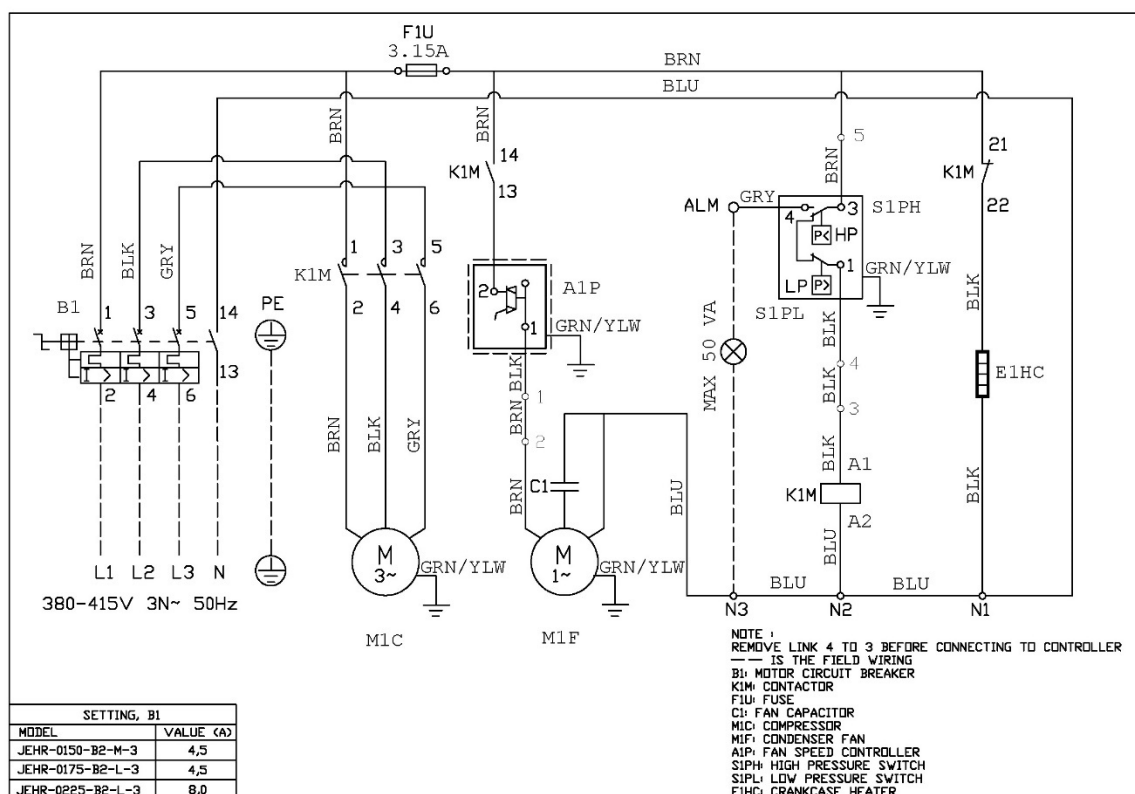


Electrical Wiring Diagrams

JEHR-0150-B2-M-1, JEHR-0175-B2-L-1, JEHR-0225-B2-L-1

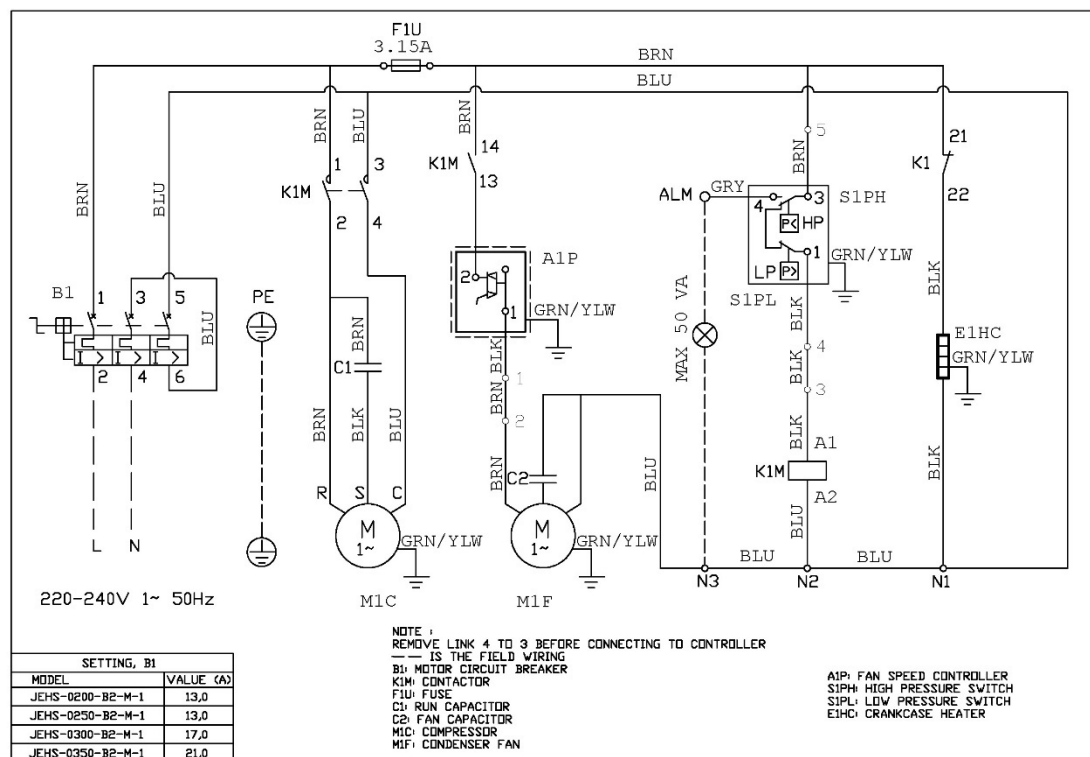


JEHR-0150-B2-M-3, JEHR-0175-B2-L-3, JEHR-0225-B2-L-3

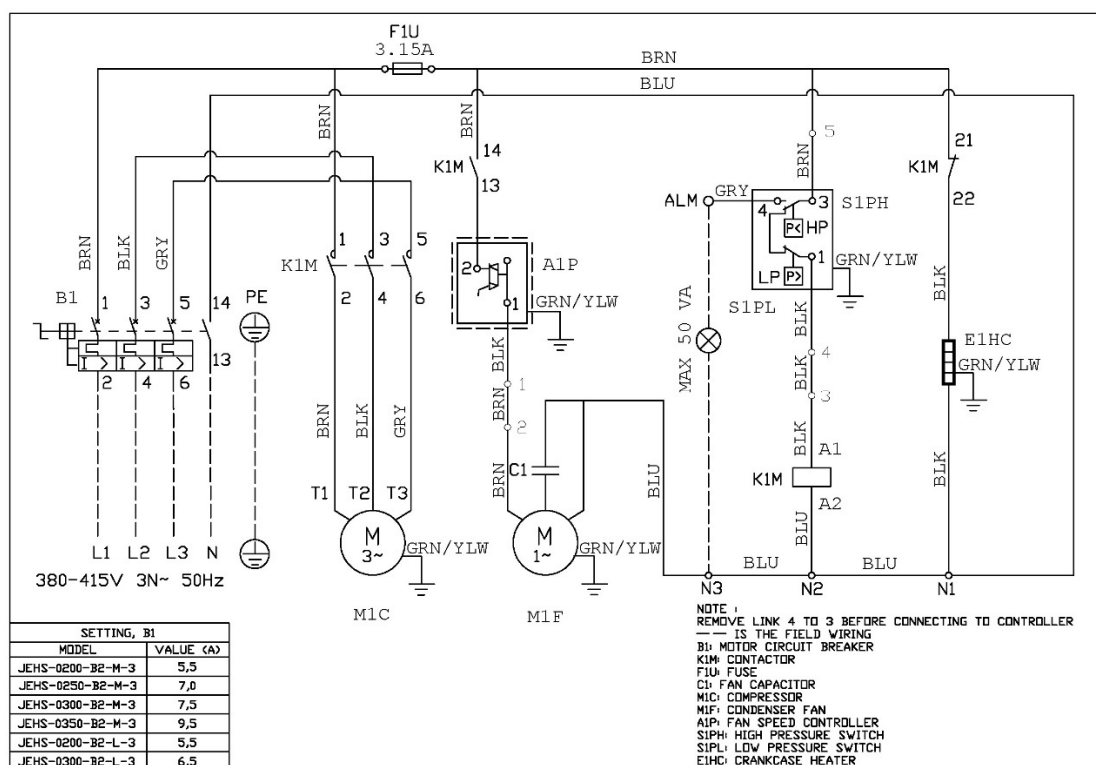


Electrical Wiring Diagrams

JEHS-0200-B2-M-1, JEHS-0250-B2-M-1, JEHS-0300-B2-M-1, JEHS-0350-B2-M-1

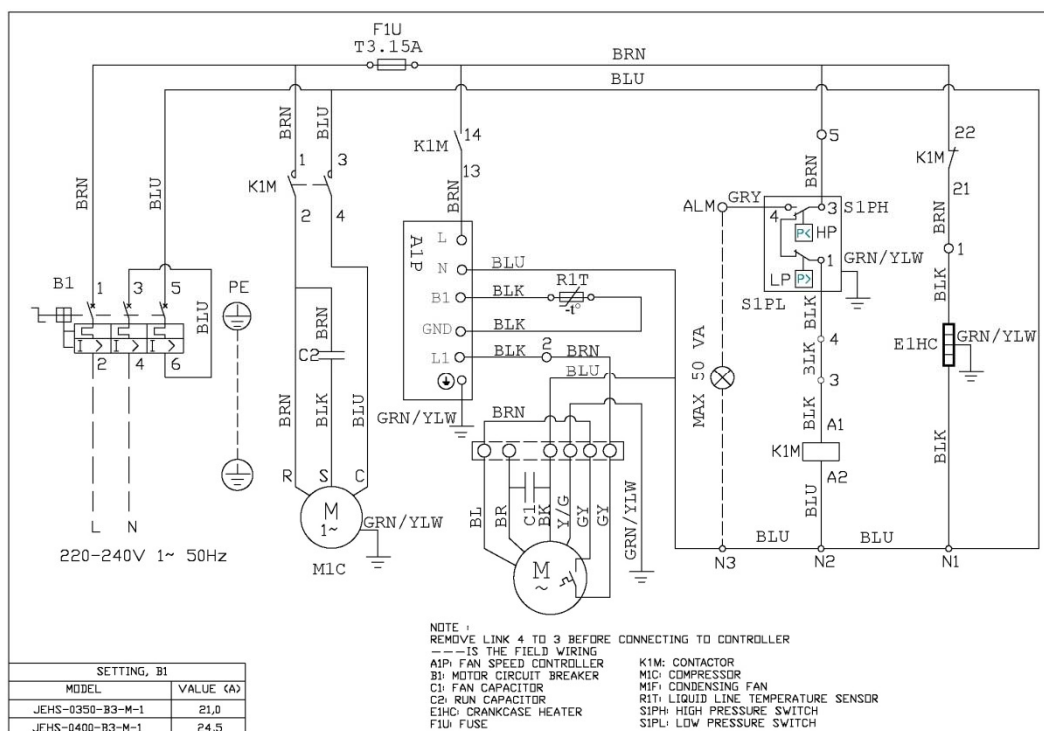


JEHS-0200-B2-M-3, JEHS-0250-B2-M-3, JEHS-0300-B2-M-3, JEHS-0350-B2-M-3
JEHS-0200-B2-L-3, JEHS-0300-B2-L-3

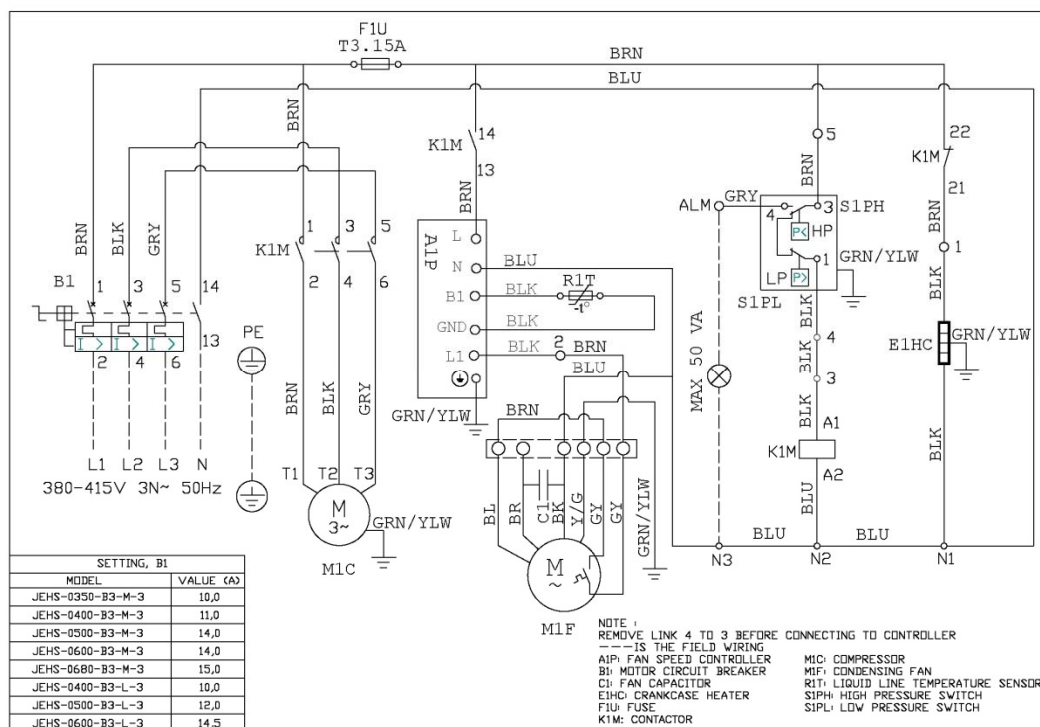


Electrical Wiring Diagrams

JEHS-0350-B3-M-1, JEHS-0400-B3-M-1

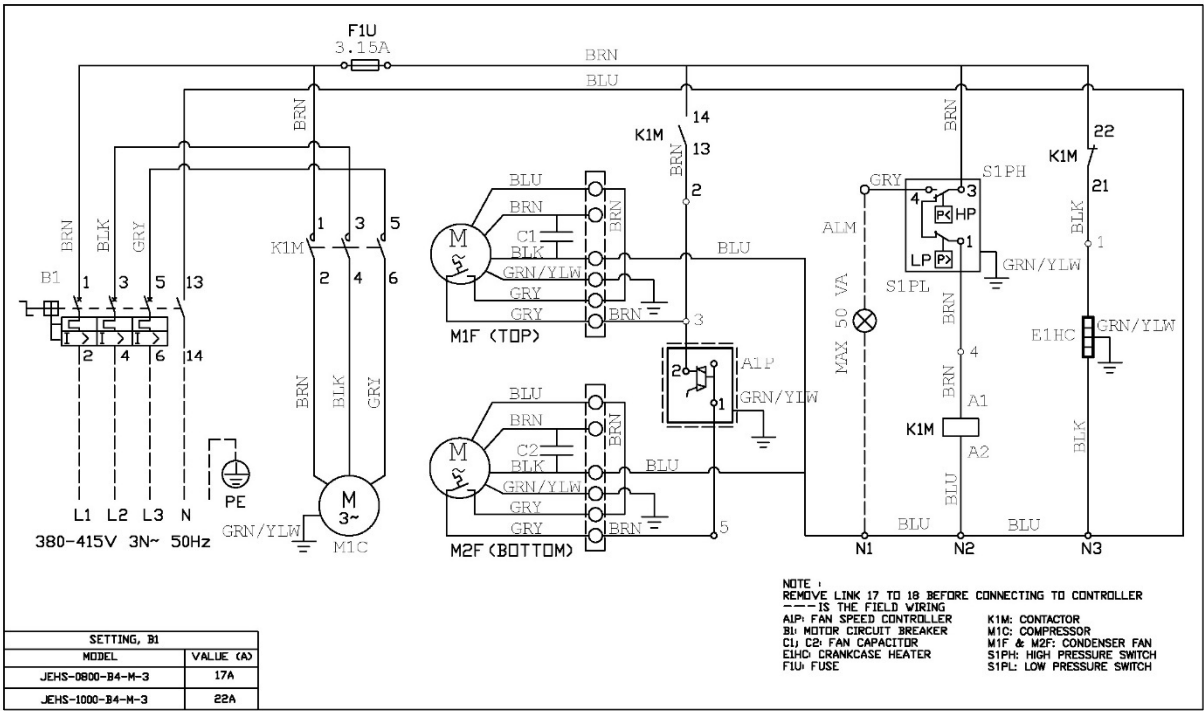


JEHS-0350-B3-M-3, JEHS-0400-B3-M-3, JEHS-0500-B3-M-3, JEHS-0600-B3-M-3, JEHS-0680-B3-M-3
 JEHS-0400-B3-L-3, JEHS-0500-B3-L-3, JEHS-0600-B3-L-3

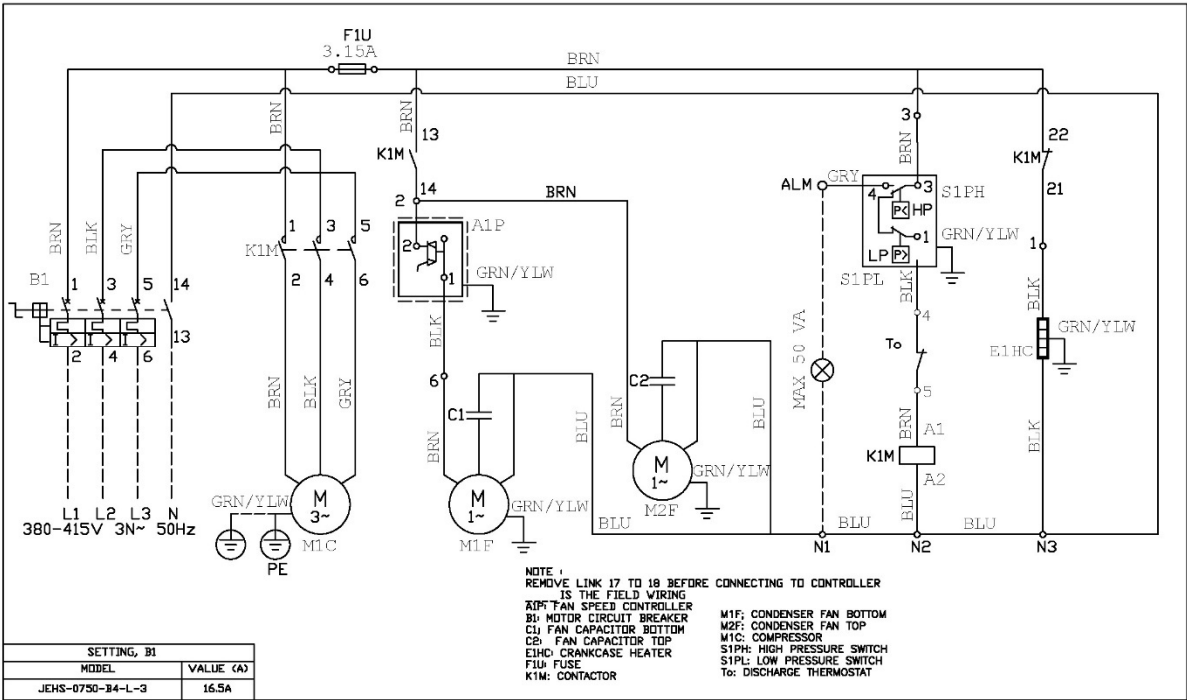


Electrical Wiring Diagrams

JEHS-0800-B4-M-3, JEHS-1000-B4-M-3

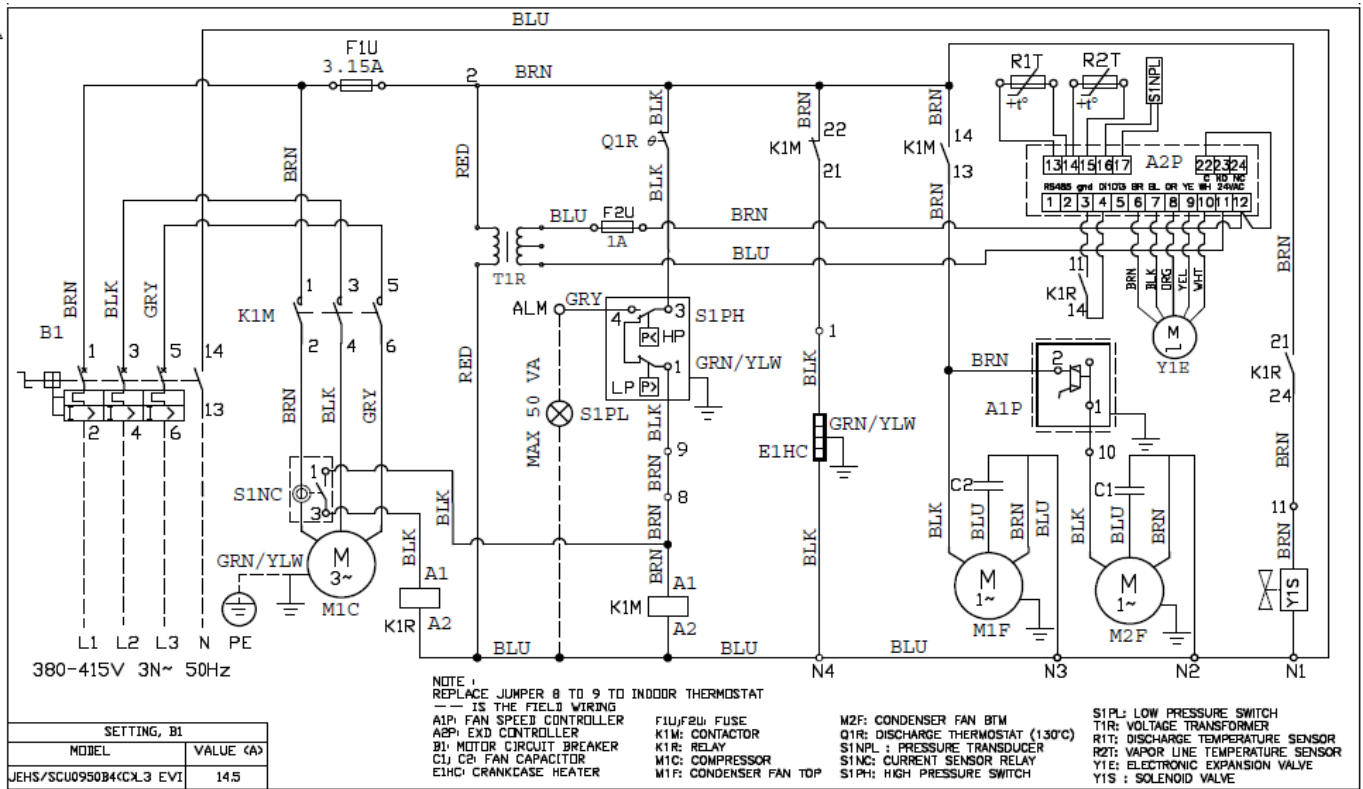


JEHS-0750-B4-L-3



Electrical Wiring Diagrams

JEHS-0950-B4-L-3



Service & Maintenance

Important Note:



Warning! – Disconnect the mains electrical supply before servicing or opening the unit.

The condensing units are designed to give long life operation with minimum maintenance. However, they should be routinely checked and the following service schedule is recommended under normal circumstances:

The removal of the top, side and front panels ensures that all parts are accessible.

1. Compressor – Inspect at regular intervals

- Check for refrigerant leaks on all joints and fittings.
- Check mountings for tightness and wear.
- Check operation of crankcase heater.
- Check electrical connections.
- Ensure that no abnormal noise or vibration is detected during test run.
- Check the compressor oil levels and top up if required. The oil level should be $\frac{1}{2}$ to $\frac{3}{4}$ way up the sight glass (where fitted).

2. Condenser Fan Motor & Blade – Clean and inspect at regular intervals

- Check for abnormal noise, vibration and fan imbalance.
- Ensure that the fan motor is clean and spins freely.
- Check that the condenser fan blade is clean and free from restriction and damage/imbalance.
- **Note:** The fan motor is pre-lubricated and factory sealed so no maintenance is necessary.

3. Microchannel Condenser Coil – Clean and inspect at regular intervals.

- Remove surface dirt, leaves etc. with a vacuum cleaner (preferably with a brush or other soft attachment rather than a metal tube), compressed air blown from the inside out, and/or a soft bristle (not wire!) brush. Do not impact or scrape the coil with the vacuum tube, air nozzle, etc.
- Do not use any chemicals (including those advertised as coil cleaners) to wash micro channel heat exchangers. They can cause corrosion. **Rinse only.** Hose the MCHE off gently, preferably from the inside out and top to bottom, running the water thru every fin passage until it comes out clean. Micro channels fins are stronger than traditional tube & fin coil fins but still need to be handled with care. Do not bang the hose into the coil. We recommend putting your thumb over the end of the hose rather than using a nozzle end because the resulting spray is gentler and the possibility for impact damage is less.
- Micro channel heat exchangers, because of their fin geometry, tend to retain water more than traditional fin & tube coils. Depending on the specific design and installation of your coil, it may be beneficial to blow or vacuum out the rinse water from your unit to speed drying and prevent pooling.

4. Compact Brazed Heat Exchanger (BPHE)

- Any soldering process done on the heat exchanger needs to be brazed with minimum 45% silver solder at maximum 450°C (840°F) when soft soldering and 450-800°C (840-1470°F) when hard soldering.
- Do not direct flame at BPHE and use wet rag to avoid overheating of BPHE.

5. Rotolock Torque

- Before unit commissioning and at every subsequent maintenance visit the compressor rotolock valve connections must be checked for tightness based on table shown in page 12.

6. Controls

- Check settings and operation of pressure switches.
- Check overload setting.
- Check fan speed control setting and operation.

7. Power Supply – Inspect at regular intervals.

- Check the running current and voltage for the condensing unit.
- Check the electrical wiring and tighten the wires onto the terminal blocks if necessary.

8. Refrigerant Charge

- Check the refrigerant charge by ensuring that the system is operating correctly, the pressures are as expected and that the liquid line sight glass shows a full bore of liquid refrigerant.
- Carry out a full leak test.

9. Unit decommissioning and disposal

- At the end of the unit's useful life, a suitably qualified engineer should decommission it. The refrigerant and compressor oil are classed as hazardous waste and as such must be reclaimed and disposed of in the correct manner, including completion of waste transfer paperwork. The unit components must be disposed of or recycled as appropriate in the correct manner.

F-Gas Information

From 1/1/2015, F-Gas Regulation EU 517/2014 came into force replacing the old Regulation EC 842/2006. This affects system labelling, information supplied within documentation and also the way in which thresholds for frequency of leak testing refrigeration systems are calculated. Please be aware of the following:

- The models of equipment covered in this Technical Manual rely on fluorinated greenhouse gases for their functioning.
- All unit models come from the factory pressurized with OFN (Oxygen Free Nitrogen) only.
- The GWP (Global Warming Potential) values of refrigerants which are specified for use along with the three new thresholds for leak testing requirements based on TCO₂Eq (Tonnes CO₂ Equivalent) are as follows:

Refrigerant	GWP	Refrigerant Charge - kg		
		5T CO ₂ Eq	50T CO ₂ Eq	500T CO ₂ Eq
R134a	1430	3.5	35.0	350
R404A	3922	1.3	12.7	127
R407A	2107	2.4	23.7	237
R407F	1825	2.7	27.4	274
R448A	1387	3.6	36.0	360
R449A	1397	3.6	35.8	358

- Changes to leak testing requirements are as follows:

OLD LEGISLATION	NEW LEGISLATION	LEAK CHECKING FREQUENCY
3-30 kgs	5-50 TCO ₂ Eq	Every 12 months but can be increased to 24 months if fitted with a fixed leak detection system.
30-300 kgs	50-500 TCO ₂ Eq	Every 6 months but can be increased to 12 months if fitted with a fixed leak detection system.
300+ kgs	500+ TCO ₂ Eq	Every 6 months - however automatic leak detection system is mandatory which requires servicing every 12 months

To calculate TCO₂Eq value: $\frac{\text{Refrigerant charge (kgs)} \times \text{Refrigerant GWP}}{1000}$

Please note: From 1st January 2017, the new legislation applies to systems which previously were exempt from leak testing under the 'below 3kg' charge limit.

A refrigerant charge label is supplied with each unit (inside the electrical box) manufactured from January 2015. The total refrigerant charge for the system and the TCO₂Eq value must be entered on the label with indelible ink and must be adhered in the proximity of the product charging port. The label supplied will represent the refrigerants approved for use with that particular unit. An example of the unit labels is as follows:


Contains fluorinated greenhouse gases

Ref.	GWP	Charge (kg)	TCO ₂ Eq.
R404A	3922		
R407A	2107		
R407F	1825		
R448A	1387		
R449A	1397		
R134a	1430		



XGE Fan Speed Controller



SAGINOMIYA

Read all instructions thoroughly

ENGLISH

Installation Instructions: XGE Fan Speed Controller

IMPORTANT

Failure to read and follow all instructions carefully before installing or operating this Fan Speed Controller could cause personal injury and/or property damage. Save these instructions for future use.

NOTES FOR SAFETY

⚠ WARNING

- Before wiring and service, be sure to turn off power supply. Otherwise, may cause electrical shock.
- Before connection of a plug and disassembly of a plug, be sure to turn off power supply as it may cause electrical shock.
- Do not touch the main body during driving. Otherwise, it may burn a hands.

OUTLINE

The XGE controls Fan Motor Speed of air cooled condenser of general purpose cold/cooling unit by phase control, and keeps a definite condensing pressure and makes it to drive stably. Further, the XGE has a noise filter, and is suitable to the following Council Directive of European Communities.

ELECTROMAGNETIC COMPATIBILITY & SAFETY FOR ELECTRICAL EQUIPMENT

As for the XGE, Saginomiya declared for the above directives as follows.

- 1) Electromagnetic Compatibility
 - Directives: 89/336/EEC, 92/31/EEC, 93/68/EEC
- 2) Safety for Electrical Equipment
 - Directives: 79/232/EEC, 93/68/EEC

MOUNTING

Directly mount onto the pressure line (see Fig. 1a) in a location where pressure can be detected accurately (eg. After the condenser). Alternatively it is possible to remove mount to a side panel using the optional fixing bracket (see fig. 6) and connect to the pressure line with a refrigeration pipe (not supplied).

⚠ CAUTION

- Don't install at the place to require degrees of protection over IP65 Category 2 enclosures.
- Don't tighten with excessive force whilst holding the unit.

since this can result in deformation of the controller. For direct mounting, tighten the connection using an appropriately sized spanner and with a torque of 12.7 ~ 15Nm (see Fig. 2).

- The mounting position should be in the vertical axis and should not be tilted more than 45° from the vertical (See Fig. 1b).
- Failure to install the Copper Packing at the connection portion cause leak of refrigerant gas.
- Provide adequate ventilation space so that heat doesn't build up. At least 50mm clearance above the top and below the bottom of XGE is necessary. Don't mount this instrument directly above equipment that generates large amount of heat. (heaters, transformers, large-wattage resistors.)

WIRING

Please refer to the diagram embossed on the controller (see Fig. 4) for use of correct terminals on the plug (supplied). Connect Ground terminal to the earth line. Please also make sure not to exceed the electrical rating of the XGE when connecting to the fan motor. It is possible to connect fan motors in parallel as long as the rating is not exceeded. The plug can wired so that orientation is possible in 4 directions as desired. (see Fig. 6)

⚠ CAUTION

- For connecting fan motor, use one phase 200 to 240V, AC, one-phase induction motor which suited for phase control and with heat preventing thermostat, or shaded pole motor.

- There is a case that the XGE does not control the fan speed of the motor having large angle of its leading current.

- When connect with the power, make sure to use a Circuit Breaker or a Fuse with the rated ampere or less of each XGE model as shown by the cover.

- Fix the plug onto the XGE, using the gasket provided and securely tighten with the screw (also provided) using a torque of 0.4 ~ 0.6 Nm (see Fig. 5). CAUTION: It is important to use the gasket (DIN 43650) between the plug and controller as well as tightening the screw sufficiently to avoid the risk of electrical shock or short circuit.

- When using a forced operation switch or fuse, make sure to connect across terminals No. 1 and No. 2.
- When a fan with selectable speed is being used, please

first check that the fan functions correctly after connecting to the XGE, and before turning in normal operating mode.

- When using a 4A fan motor, the ambient temperature should not exceed 40°C (104°F). Please refer to Fig. 10 for the details of "the relationship between electric current and ambient temperature."

ADJUSTING (Fig. 3)

Turn the Range Adjusting Screw to	Catalog No.	1 Turn
XGE-4*	Approx. 1.5bar	
XGE-6*	Approx. 2.5bar	

clockwise (+) for increasing the setting value, and to counterclockwise (-) for decreasing the setting value.

(Please use the right chart as reference for adjusting.)

⚠ CAUTION

- Do not move the screw other than the Range Adjusting Screw.

OPERATION CHECK

Install and calibrate the product correctly and then check its operation to confirm correct function of the whole system.

⚠ CAUTION

- It can not be used for ammonia refrigeration system.
- This product is not available for the system which apply pressure more than 47bar (681Psi) because the rated maximum working pressure of this product is 47bar (681Psi) if the pressure more than the rated maximum working pressure is applied to this product, it causes transformation of characteristics or the destruction. Operation will become unstable when using other than sine waves for the power supply. In this case, proper control may not be achieved.

SPECIFICATIONS

Catalog number	F.V.S. Setting Factory Set	Adjusting Range Min. [Psig]	Max. [Psig]	E.P.B. bar [Psig]	Refrigerants	Electrical Rating	Pressure admission Port	Weight g	Function 1	Function 2
XGE-4C	19 [276]	10 [145]	25 [363]	Fixed 6 [87]	R22, R404A, R407C	Single phase 200 to 240V~ 50/60Hz (0.2 to 3A)	7/16-20UNF Female flare	190	Out. off	Min. speed
XGE-4M	25 [363]	10 [145]	39 [556]	Fixed 7 [102]	R404A	Single phase 200 to 240V~ 50/60Hz (0.2 to 3A)	7/16-20UNF Female flare	190	Out. off	Min. speed
XGE-6C	25 [363]	10 [145]	39 [556]	Fixed 7 [102]	R404A	Single phase 200 to 240V~ 50/60Hz (0.2 to 3A)	7/16-20UNF Female flare	190	Out. off	Min. speed
XGE-6M	25 [363]	10 [145]	39 [556]	Fixed 7 [102]	R404A	Single phase 200 to 240V~ 50/60Hz (0.2 to 3A)	7/16-20UNF Female flare	190	Out. off	Min. speed

Ambient Temperature of Fan Speed Controller Housing : -20 to 55°C (-4 to 131°F) (With 4A rated fans : 40°C (104°F) maximum ambient temperature.) Vibration : 2G or less in normal use / Shock : 100G or less.

Special specification : F.V.S. factory setting can be set the different points within the Adjusting Range on demand. These model were approved CSA with c-ULS. (Master Contract: 170124)

* Applicable requirements: CMAA-22.2 No. 1010.1-42 and UL Std. No. UL61010C-1-1st Ed.

F.V.S. : Full Voltage Set point.

The pressure at which the control delivers 95% out put effective voltage. (R.M.S. (V%))

E.P.B. : Effective Proportional Band

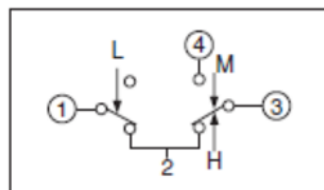
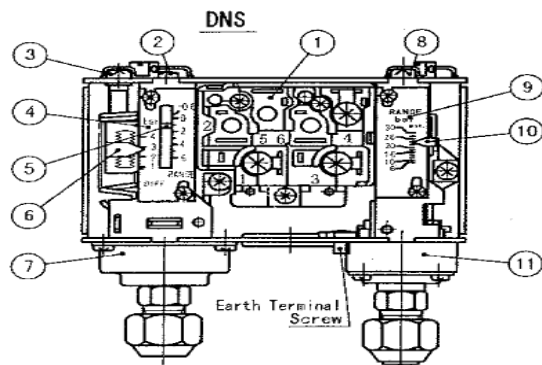
The decrease in pressure below the calibration set point required to transmit a 45% of effective voltage. (R.M.S. (V%))

Technical Information

Dual Pressure Switch

Safety pressure switch settings

The pressure switches fitted to condensing units with auto reset for low pressure and manual reset for high pressure are **NOT** factory preset.



- | | | |
|---------------------------------|--|---------------------------------|
| 1. Micro Switch | 5. Low Pressure Range pointer | 9. High Pressure Scale plate |
| 2. Range Adjusting Screw | 6. Differential pointer | 10. High Pressure Range pointer |
| 3. Differential Adjusting Screw | 7. Low Pressure Bellows cover | 11. High Pressure Bellows cover |
| 4. Low Pressure Scale plate | 8. High Pressure range Adjusting Screw | |

Setting procedure for DNS Pressure switch

High Pressure side:

Turning the adjusting screw (8) clockwise will increase the cut-out pressure setting. Turning the adjusting screw anti-clockwise will decrease the cut-out pressure setting. The differential setting is fixed so the cut-in will vary with the cut-out setting. Lock the spindle with locking plate after setting.

Low pressure side:

Range: Turning the range adjusting screw (2) clockwise will decrease the cut-in pressure setting. Turning the range adjusting screw anti-clockwise will increase the cut-in pressure setting.

Differential: Turning the differential adjusting screw (3) clockwise will increase the differential pressure setting. Turning the differential adjusting screw anti-clockwise will decrease the differential pressure setting.
Lock the spindle with locking plate after setting.



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42700 BANTING, SELANGOR DARUL EHSAN, MALAYSIA.

declare under our sole responsibility that the products
bescheinigen auf unsere eigene Verantwortung, daß die Produkten
déclarons sous notre seule responsabilité que les produits
verklaren onder onze uitsluitende verantwoordelijkheid de producten
declaramos sobre nuestra sola responsabilidad que los productos
dichiariamo sotto nostra sola responsabilità che i prodotti
erklærer som eneansvarlige, at produktet
declaramos sob a nossa responsabilidade exclusiva que os produtos
δηλώνει υπό την αποκλειστική της ευθύνη ότι τα προϊόντα
oświadcza z pełną odpowiedzialnością, że produkty

COMMERCIAL REFRIGERATION CONDENSING UNIT

Unidad que condensa comercial de la refrigeración
Unité de condensation commerciale de réfrigération
Commerciële condenserende koel-unit
Kommerzielle kondensierende Macinheit der Abkühlung
Unità condensate commerciale di refrigerazione
kølekondenseringenheden til kommercielt brug
Unidade de condensação de refrigeração
Εμπορική Μονάδα Συμπύκνωσης Ψύξης
AGREGAT SKRAPLAJACY - CHŁODNICTWO KOMERCYJNE

Model Designations:
Baumuster-Bezeichnungen:
Désignations Modèles:
Aanduidingen Model:
Designaciones Modelo:
Indicazioni de Modello:
modelbetegnelse:
Designações do modelo:
Ονομασίες μοντέλων:
Oznaczenia modelu:

See Appendix 1 overleaf
Sehen sie anhang 1 umseitig
Voir l'annexe 1 au verso
Zie ommezijde voor bijlage 1
Vea el apendice 1 a la vuelta
Veda overleaf l'appendice 1
se appendiks 1 på bagsiden
Ver Apêndice 1 verso
Βλ. Παράρτημα 1 στο πίσω μέρος της σελίδας
Patrz na odwrocie Załącznik 1

which this declaration relates is in conformity with the requirements of the following directives
auf diese Bescheinigung sich beziehen, sind den Vorschriften der Normen entsprechend
auxquels se réfèrent cette déclaration, sont conformes aux prescriptions des directives
waarop deze verklaring betrekking heeft, in overeenstemming is/zijn met de eisen van de volgende richtlijnen
a los cuales se refieren esta declaración, son conformes a las prescripciones de las directivas
alla quale si riferisce questa dichiarazione, sono conformi alle prescrizioni delle direttive
som denne erklæring vedrører, er i overensstemmelse med kravene fremsat i følgende direktiver
que esta declaração está conforme os requerimentos das seguintes directrizes
τα οποία αφορά αυτή η δήλωση συμμορφώνονται με τις απαιτήσεις των παρακάτω οδηγιών
których dotyczy ta deklaracja są zgodne z wymaganiami następujących Dyrektyw

Machinery Directive *

IEC/ EN 60335-1
IEC/ EN 60335-2-89

2006/42/EC

Safety of Household and Similar Electrical Appliances: Part I
Safety of Household and Similar Electrical Appliances: Part II

Eco-design Directive

Commission regulation (EU) 2015/1095

2009/125/EC

Ecodesign requirements for condensing units

- * J&E Hall International is authorised to compile the Technical Construction File.
- * J&E Hall International hat die Berechtigung die Technische Konstruktionsakte zusammenzustellen.
- * J&E Hall International est autorisé à compiler le Dossier de Construction Technique.
- * J&E Hall International is gevolmachtigd het Technisch Constructiedossier op te stellen.
- * J&E Hall International está autorizado a compilar el Archivo de Construcción Técnica.
- * J&E Hall International è autorizzata a redigere il File Tecnico di Costruzione.
- * J&E Hall International er bemyndiget til at kompilere teknikkonstruktionsfilen.
- * J&E Hall International tem autorização para compilar o Ficheiro de Construção Técnica.
- * J&E Hall International είναι εξουσιοδοτημένη να καταρτίσει τον Τεχνικό Φάκελο Κατασκευής.
- * J&E Hall International jest upoważniony do opracowania dokumentacji technicznej.

J & E Hall Limited, Hansard Gate, West Meadows, Derby, DE21 6JN, United Kingdom.

General Manager

Teh Yeow Chong

Issue Date: 09 May 2017

Declaration of Conformity

Konformitätsbescheinigung
Déclaration de Conformité
Conformiteitsverklaring
Declaracion de Conformidad
Dichiarazione di Conformità
Overensstemmelseserklæring
Declaração de Conformidade
Δήλωση Συμμόρφωσης
Deklaracja zgodności

**DAIKIN REFRIGERATION MALAYSIA SDN. BHD.**

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42700 BANTING, SELANGOR DARUL EHSAN, MALAYSIA.

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Deklaracja zgodności

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Designaciones Modelo:
Indicazioni de Modello:
modelbetegnelse:
Designações do modelo:
Ονομασίες μοντέλων:
Oznaczenia modelu:

JEHR-0050-B1-M-1
JEHR-0067-B1-M-1
JEHR-0100-B1-M-1
JEHR-0113-B1-M-1
JEHR-0040-B1-M-1
JEHR-0051-B1-M-1
JEHR-0063-B1-M-1
JEHR-0077-B1-M-1
JEHR-0095-B1-M-1
JEHR-0140-B2-M-1
JEHR-0140-B2-M-3
JEHR-0150-B2-M-1

JEHR-0175-B2-L-1
JEHR-0225-B2-L-3
JEHS-0400-B3-L-3
JEHS-0750-B4-L-3

JEHSD-0400-B3-M-3

JEHR-0150-B2-M-3
JEHR-0225-B2-M-1
JEHR-0225-B2-M-3
JEHR-0300-B2-M-1
JEHR-0300-B2-M-3
JEHS-0200-B2-M-1
JEHS-0200-B2-M-3
JEHS-0250-B2-M-1
JEHS-0250-B2-M-3
JEHS-0300-B2-M-1
JEHS-0300-B2-M-3

JEHR-0175-B2-L-3
JEHS-0200-B2-L-3
JEHS-0500-B3-L-3
JEHS-0950-B4-L-3 EVI

JEHSD-0600-B3-M-3

JEHS-0350-B2-M-1
JEHS-0350-B2-M-3
JEHS-0350-B3-M-1
JEHS-0350-B3-M-3
JEHS-0400-B3-M-1
JEHS-0400-B3-M-3
JEHS-0500-B3-M-3
JEHS-0600-B3-M-3
JEHS-0680-B3-M-3
JEHS-0800-B4-M-3
JEHS-1000-B4-M-3

JEHR-0225-B2-L-1
JEHS-0300-B2-L-3
JEHS-0600-B3-L-3

JEHSD-0800-B4-M-3



Certification

DAIKIN REFRIGERATION MALAYSIA SDN. BHD. (34543-W)

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PED Statement for Product

Refrigeration Condensing Unit

Model Designations :

JEHR-0050-B1-M-1	JEHR-0095-B1-M-1	JEHR-0300-B2-M-3	JEHS-0350-B2-M-3
JEHR-0067-B1-M-1	JEHR-0140-B2-M-1	JEHS-0200-B2-M-1	JEHR-0175-B2-L-1
JEHR-0100-B1-M-1	JEHR-0140-B2-M-3	JEHS-0200-B2-M-3	JEHR-0175-B2-L-3
JEHR-0113-B1-M-1	JEHR-0150-B2-M-1	JEHS-0250-B2-M-1	JEHR-0225-B2-L-1
JEHR-0040-B1-M-1	JEHR-0150-B2-M-3	JEHS-0250-B2-M-3	JEHR-0225-B2-L-3
JEHR-0051-B1-M-1	JEHR-0225-B2-M-1	JEHS-0300-B2-M-1	JEHS-0200-B2-L-3
JEHR-0063-B1-M-1	JEHR-0225-B2-M-3	JEHS-0300-B2-M-3	JEHS-0300-B2-L-3
JEHR-0077-B1-M-1	JEHR-0300-B2-M-1	JEHS-0350-B2-M-1	

Which are containing refrigerating fluids classified in Group 2 and classified in category I according to **PRESSURE EQUIPMENT DIRECTIVE 2014/68/EU**.

The products are provided with a **CE** marking of conformity as they fulfill the following requirements:

Technical standards and specification:

are in conformity with the **Machinery Directive 2006/42/EC** and **Eco-design Directive 2009/125/EC**.

MD IEC/ EN 60335-1 & IEC/ EN 60335-2-89

Eco Commission regulation (EU) 2015/1095



J & E Hall Limited, Hansard Gate, West Meadows, Derby, DE21 6JN, United Kingdom

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Tel: +603-31872911 Fax: +603-31878597

EU Declaration of Conformity 2014/68/EU

We declare under our sole responsibility that the following products:

Refrigeration Condensing Unit

Model Designations:

JEHS-0350-B3-M-1	JEHS-0600-B3-M-3	JEHS-0500-B3-L-3	JEHSD-0400-B3-M-3
JEHS-0350-B3-M-3	JEHS-0680-B3-M-3	JEHS-0600-B3-L-3	JEHSD-0600-B3-M-3
JEHS-0400-B3-M-1	JEHS-0800-B4-M-3	JEHS-0750-B4-L-3	JEHSD-0800-B4-M-3
JEHS-0400-B3-M-3	JEHS-1000-B4-M-3	JEHS-0950-B4-L-3 EVI	
JEHS-0500-B3-M-3	JEHS-0400-B3-L-3		

Which are assemblies that containing refrigerating fluids classified in Group 2 and comply the requirements of **PRESSURE EQUIPMENT DIRECTIVE 2014/68/EU**. The details of pressure equipment as listed below.

Pressure equipment	Part description	Category	Conformity assessment
Safety device	High pressure switch	IV	Module B & D
Vessel	Compressor	I or II	- or Module A2 or Module D1
Vessel	Liquid receiver	II	Module A2 or Module D1 or Module B & D
Vessel	Oil separator	I	Module A or Module D1 or Module B & D
Vessel	Check valve	SEP	-
Vessel	Filter drier	SEP	-
Piping	System Piping	SEP	-
Piping	Sight glass	SEP	-
Piping	Coil	SEP	-
Piping	Service valve	SEP	-

Category: II

Evaluation module: A2

Notified body number: 2561

Notified body name & address: Hartford Steam Boiler UK Limited

Unit 7, Brewery Yard, Deva City Office Park, Trinity Way, Salford, M3 7BB, United Kingdom.

Technical standards and specification:

are in conformity with the **Machinery Directive 2006/42/EC** and **Eco-design Directive 2009/125/EC**.

MD IEC/ EN 60335-1 & IEC/ EN 60335-2-89

Eco Commission regulation (EU) 2015/1095

The products are provided with a  2561 marking of conformity.



J & E Hall Limited, Hansard Gate, West Meadows, Derby, DE21 6JN, United Kingdom

DAIKIN REFRIGERATION MALAYSIA SDN. BHD.

Teh Yeow Chong
General Manager
Issued Date: 09 May 2017

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APPENDIX D

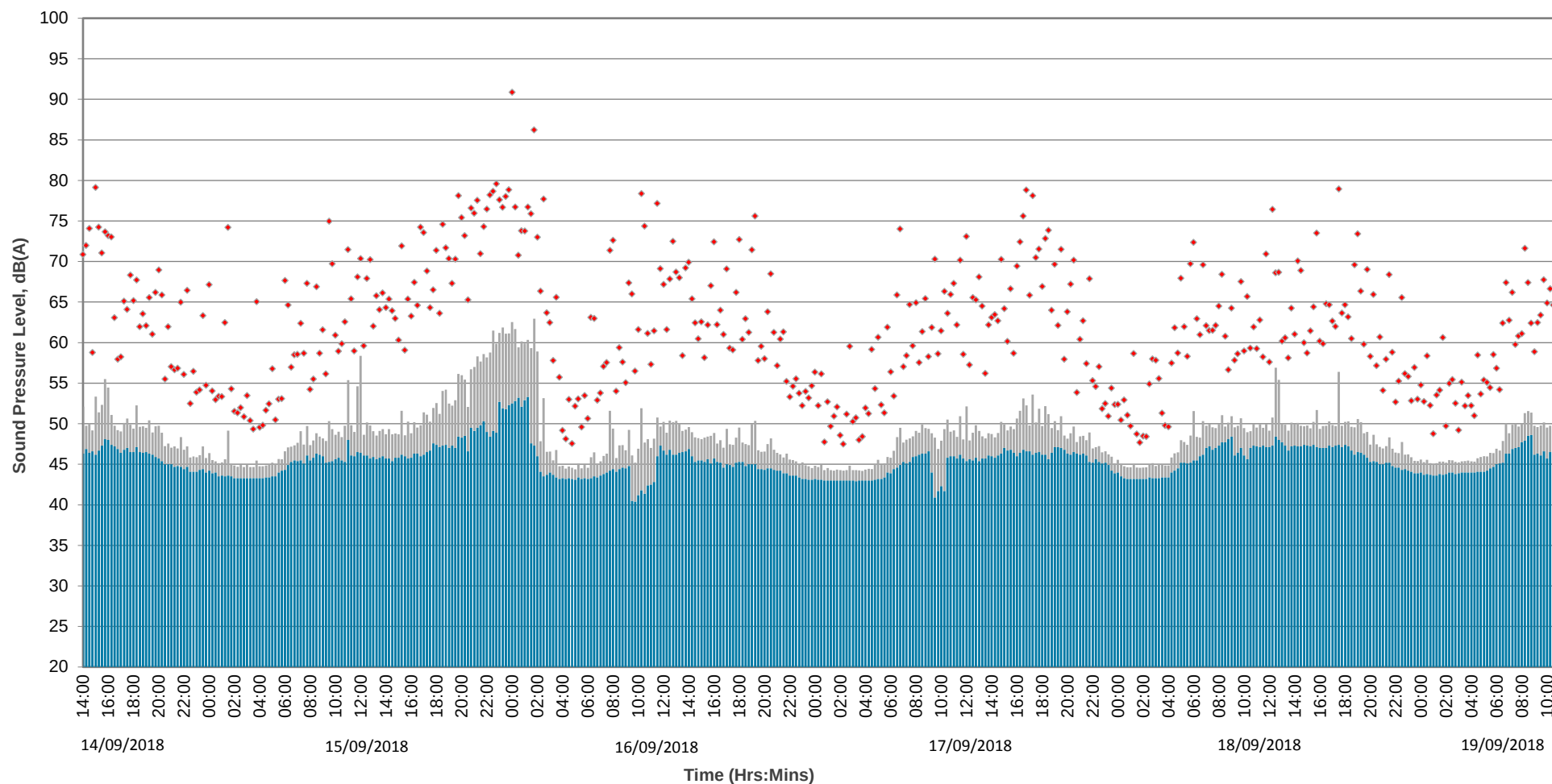
Noise Monitoring Data

Time History Graph A1

Project: 194-196 Dunsbury Way, Havant

Measurement Location: Rear of Existing Building at First Floor Level

Survey Period: 14/09/18 to 19/09/18



KEY:

LA90,15mins LAeq,15mins LAmax,fast

Lion House, Oriental Road, Woking, Surrey GU22 2BR
Telephone: 01483 750508 Fax: 01483 750437

APPENDIX E

Plant Noise Summary Calculation

CALCULATION SHEET	CS1	PAGE	1 of 1
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PROJECT	Dunsbury Way
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RECEIVER LOCATION	2 Bishop Stoke Road, Havant
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Toshiba	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	51	50	50	45	43	38	32	27
Directivity Correction, D _c	-2	-2	-2	-2	-2	-2	-2	-2
Geometric Divergence, A _{div} (Distance = 10m)	20	20	20	20	20	20	20	20
Atmospheric Absorption, A _{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A _{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A _{bar}	5	6	6	7	9	11	13	16
Miscellaneous Attenuation, A _{misc}	0	0	0	0	0	0	0	0
Reflections	5	5	5	5	5	5	5	5
Lp Condenser Unit P1	29	27	27	21	17	10	2	-6
Component Noise Level	23 dB(A)							

J&E #1	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lp @ 1m	60	61	53	51	48	43	35	28
Directivity Correction, D _c	-2	-2	-2	-2	-2	-2	-2	-2
Geometric Divergence, A _{div} (Distance = 10m)	20	20	20	20	20	20	20	20
Atmospheric Absorption, A _{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A _{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A _{bar}	5	6	6	7	9	11	13	16
Miscellaneous Attenuation, A _{misc}	0	0	0	0	0	0	0	0
Reflections	5	5	5	5	5	5	5	5
Lp Condenser Unit P2	38	38	30	27	22	15	5	-5
Component Noise Level	29 dB(A)							

J&E #2	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Source Noise Level, Lw	60	61	53	51	48	43	35	28
Directivity Correction, D _c	-2	-2	-2	-2	-2	-2	-2	-2
Geometric Divergence, A _{div} (Distance = 10m)	20	20	20	20	20	20	20	20
Atmospheric Absorption, A _{atm}	0	0	0	0	0	0	0	0
Ground Attenuation, A _{gr}	0	0	0	0	0	0	0	0
Barrier Attenuation, A _{bar}	5	6	6	7	9	11	13	16
Miscellaneous Attenuation, A _{misc}	0	0	0	0	0	0	0	0
Reflections	5	5	5	5	5	5	5	5
Lp Condenser Unit P3	38	38	30	27	22	15	5	-5
Component Noise Level	29 dB(A)							

TOTAL	Octave Band Sound Level							
	63Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz	4kHz	8kHz
Octave Band Noise Levels	41	41	34	31	26	19	9	-1
TOTAL SPECIFIC NOISE LEVEL	32 dB(A)							