COMMERCIAL CONDENSING UNITS
INSTALLATION MANUAL

V2 FUSION SCROLL
Commercial Condensing Units

Medium Temperature Applications

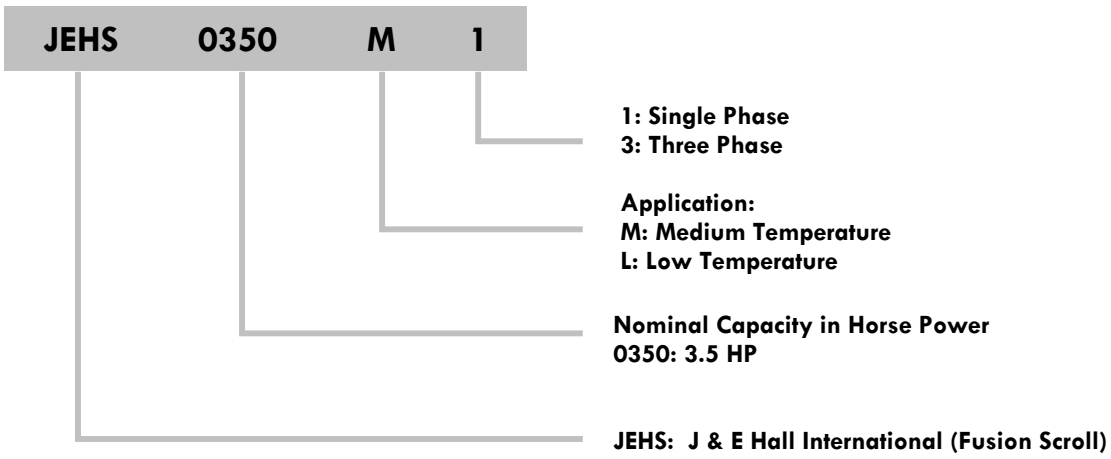
ISSUE: 01.07.2016

CE

J&E Hall International

Contents

Nomenclature



This manual specifically applies to units manufactured from July 2016

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]
												Compressor			Fan Motors										
			R134a	R404A	R407A	R407F	Type	Swept Volume	Oil Charge			NC [a]	MCC [b]	LRC [c]	No.	FLC				Liquid	Suction	Unit (W x D x H)	Mounting (W x D)		
								(m³/h)	(Litres)	(Litres)		(A)	(A)	(A)		(A)	(Litres)	(Litres)	(m³/h)	(inch)	(inch)	(mm)	(mm)	(kgs)	dB(A)
Medium Temperature	JEHS-0350-M-1	3	2.00	(2.63)	n/a	n/a	ZB26KQE-PFJ	9.9	1.50	-	C	15.1	26.5	97.0	1	1.1	4.7	7.6	4250	1/2	3/4	1332 x 556 x 884	946 x 500	114	35
	JEHS-0350-M-3		2.23	(3.01)	n/a	n/a	ZB26KQE-TFD	9.9	1.50	-		5.5	9.0	46.0	1	1.1	4.7	7.6	4250	1/2	3/4			114	35
	JEHS-0400-M-1		2.21	(2.84)	n/a	n/a	ZB29KQE-PFJ	11.4	1.36	-		15.6	28.0	114.0	1	1.1	4.7	7.6	4250	1/2	7/8	1347 x 556 x 884		121	34
	JEHS-0400-M-3		2.24	(2.86)	n/a	n/a	ZB29KQE-TFD	11.4	1.36	-		7.0	11.0	50.0	1	1.1	4.7	7.6	4250	1/2	7/8			121	34
	JEHS-0500-M-3		(2.47)	(2.91)	n/a	n/a	ZB38KQE-TFD	14.4	2.07	-		9.4	14.0	65.5	1	1.1	4.7	7.6	4250	1/2	7/8			126	35
	JEHS-0600-M-3		(2.64)	(2.48)	n/a	n/a	ZB45KQE-TFD	17.1	1.89	-		9.7	14.2	74.0	1	1.1	7.6	7.6	4150	1/2	7/8			128	40
	JEHS-0680-M-3		(2.60)	(2.46)	n/a	n/a	ZB48KQE-TFD	18.8	1.80	-		9.9	19.1	101.0	1	1.1	7.6	7.6	4150	1/2	7/8			129	40
	JEHS-0800-M-3	4	(3.32)	(2.52)	n/a	n/a	ZB58KCE-TFD	22.1	2.50	-		12.4	23.0	95.0	2	1.2	6.9	14.0	6770	1/2	1 1/8	1261 x 594 x 1435	812 x 560	201	44

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°Cte / +32°Cta MT with R404A refrigerant

[b] MCC = Maximum Continuous Current

[c] LRC = Locked Rotor Current

[d] Sound Pressure Level @10m free field at (-10/+32°C) MT conditions. Alternative conditions may produce different results

Health and Safety

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 codes, ordinances and local by-laws.

General information

Before Installation

- Ensure the units received are the correct models for the intended application.
- Ensure the refrigerant, voltage 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.

During Installation and subsequent maintenance

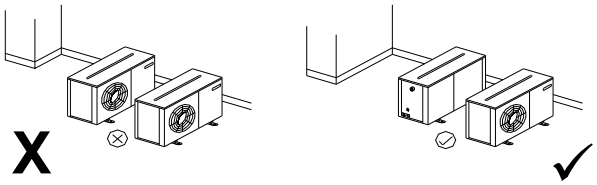
- Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations, and experienced with this type of equipment.
- If lifting equipment is required, ensure that it is suitable for purpose, certificated and that the operatives are qualified 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 and 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.
- 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.

Installation

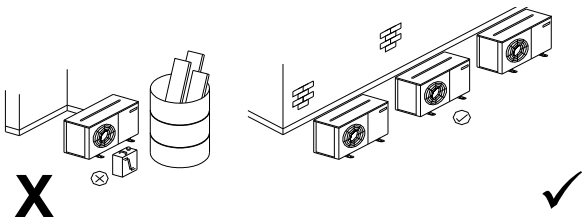
Unit location

- 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.

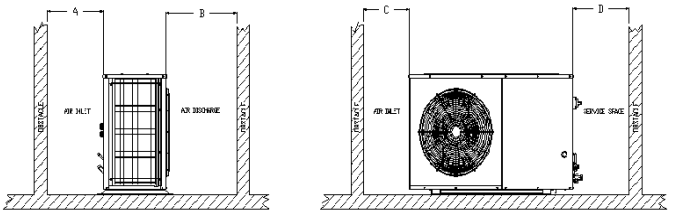


- The location must be well ventilated, so the unit can draw in and distribute plenty of air thus lowering the condensing temperature.
- To optimize the unit running conditions, the condenser coil must be cleaned at regular intervals.
- The unit must be level in all directions.

Installation

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

Field piping

Important Note:

Pipe sizing should only be determined by qualified personnel. All local codes of practice must be observed in the installation of refrigerant piping.

To ensure satisfactory operation and performance, the following points should be noted for field piping arrangements:

- 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 6m).
- Maximum recommended pipe length is 25m for Reciprocating units and 50m for Scroll units.

Correct line sizing will minimize the pressure drop and maintain sufficient gas velocity for proper oil return.

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

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.

Installation

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 local regulations.
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.

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 on Fusion Scroll units, ensure that the compressor motor rotates in the correct direction. Please see note on page 7.

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 9–10.

To gain access to the electrical box, turn the mains isolator switch on the end of the unit to the OFF position, remove the screws from the end cover panel and remove panel. The electrical box is located behind the panel. Remove the screws in the electrical box cover to access components.

Important Note:

There must be no more than 10 compressor starts per hour. A higher number reduces the service life of the compressor. There is no minimum off time for scroll compressors, as they start unloaded. However, consideration should be given to ensuring an adequate minimum run time to ensure proper oil return. A minimum runtime of 3 minutes after each compressor start and a minimum idle time of 3 minutes after each stop are recommended. Only during the pump down cycle may the compressor run for shorter intervals.

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.
- 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 energized for a minimum of 12 hours before compressor start-up.
- Gauge manifold connected to both low and high sides of system.

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 switch 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 3). 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.
- Ensure that the customer / responsible person are provided with basic operating instructions and where electrical isolators are situated in case of emergency.

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:

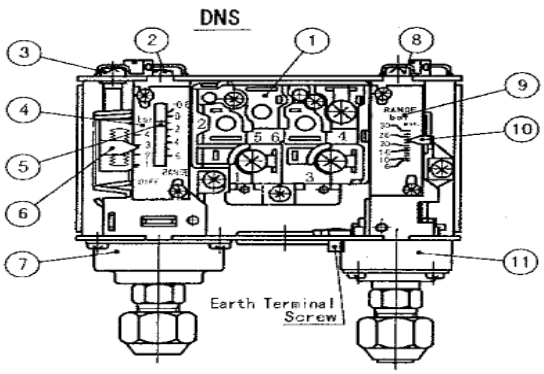
Do not operate scroll compressors in a vacuum condition, as this will cause the scrolls to overheat very quickly causing premature failure.

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.

DNS Dual Pressure Switch

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



Commissioning

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.

Safety pressure switch settings

The Saginomiya DNS pressure switch fitted to JEHS 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 Type	Series 3 & 4			
Refrigerant	R404A	R407A	R407F	R134a
Cut Out (bar g)	27	25	26	16
Cut Out (psi g)	392	370	385	235

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 overheating.
For ZB compressors, the low-pressure cut-out should be set as high as possible.
For ZF compressors, the low-pressure cut-out should be set no lower than 0.3 bar(g).
Care should be taken because the scroll sets will unload at a pressure ratio of approximately 10:1 for ZB compressors and approximately 20:1 for ZF compressors.
If the unit fails to pump down, the pump down pressure should be reset to a higher value.

Unit Type	Series 3 & 4	
Refrigerant	R404A / R407A/F	R134a
Application	M*	M*
Cut Out (bar g)	2.0	0.6
Cut Out (psi g)	30	9

** M: Medium Temperature;*

XGE Fan Speed Controller

The fan speed controller is factory set to 19 bar for operation with R4*** series refrigerants. This can be adjusted to suit site conditions / application or alternative refrigerants. The XGE controls are set to stop fan at Pmin. Recommended settings to gain higher energy efficiency as published in the Ecodesign data sheets are as follows:

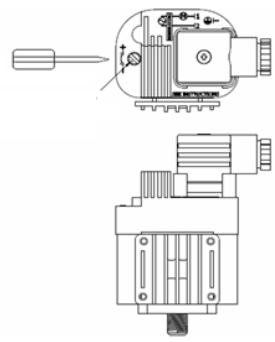
Refrigerant	R404A / R407A/C/F	R134a
Setting (bar g)	14	13

The setting is the point at which the fan reaches its maximum speed. The controller has a fixed differential of 6 bar – meaning the fan stops at 6 bar below its setting.

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

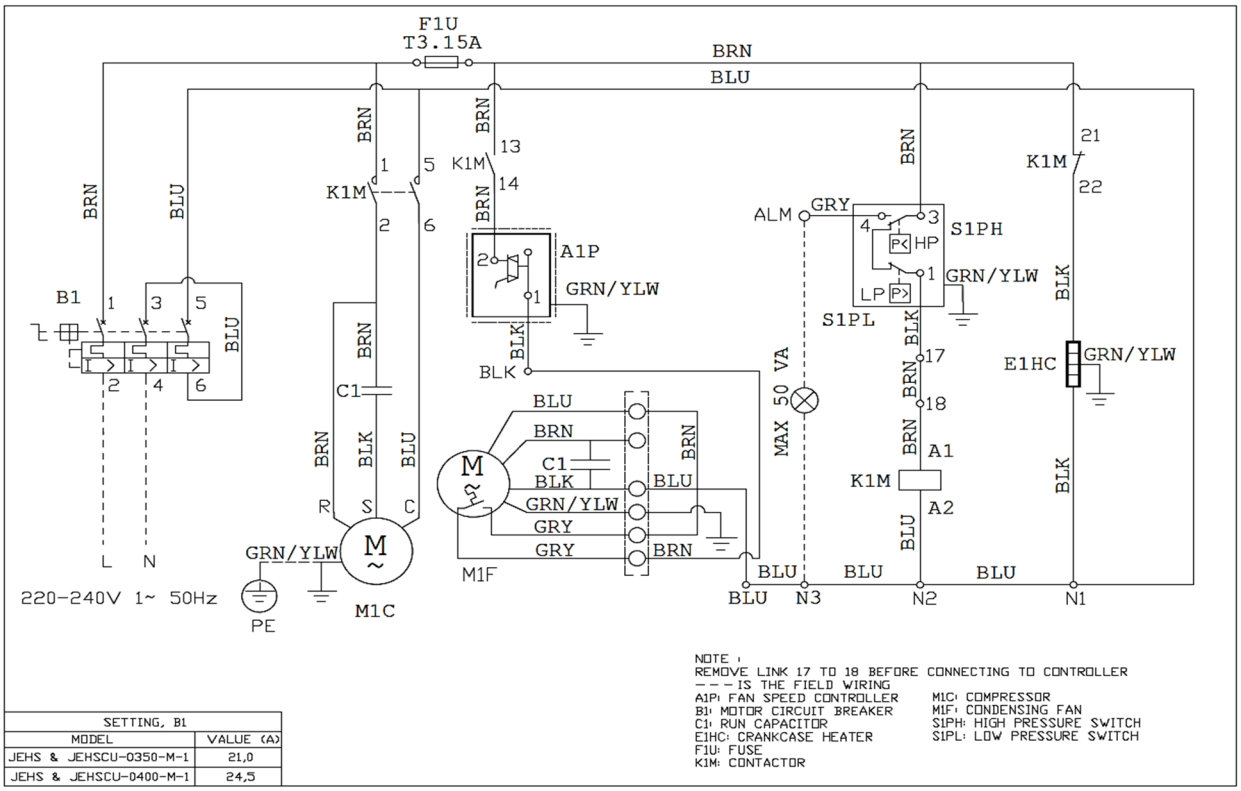
360 ^{0} = 1 turn

Approx. 1.5 barg



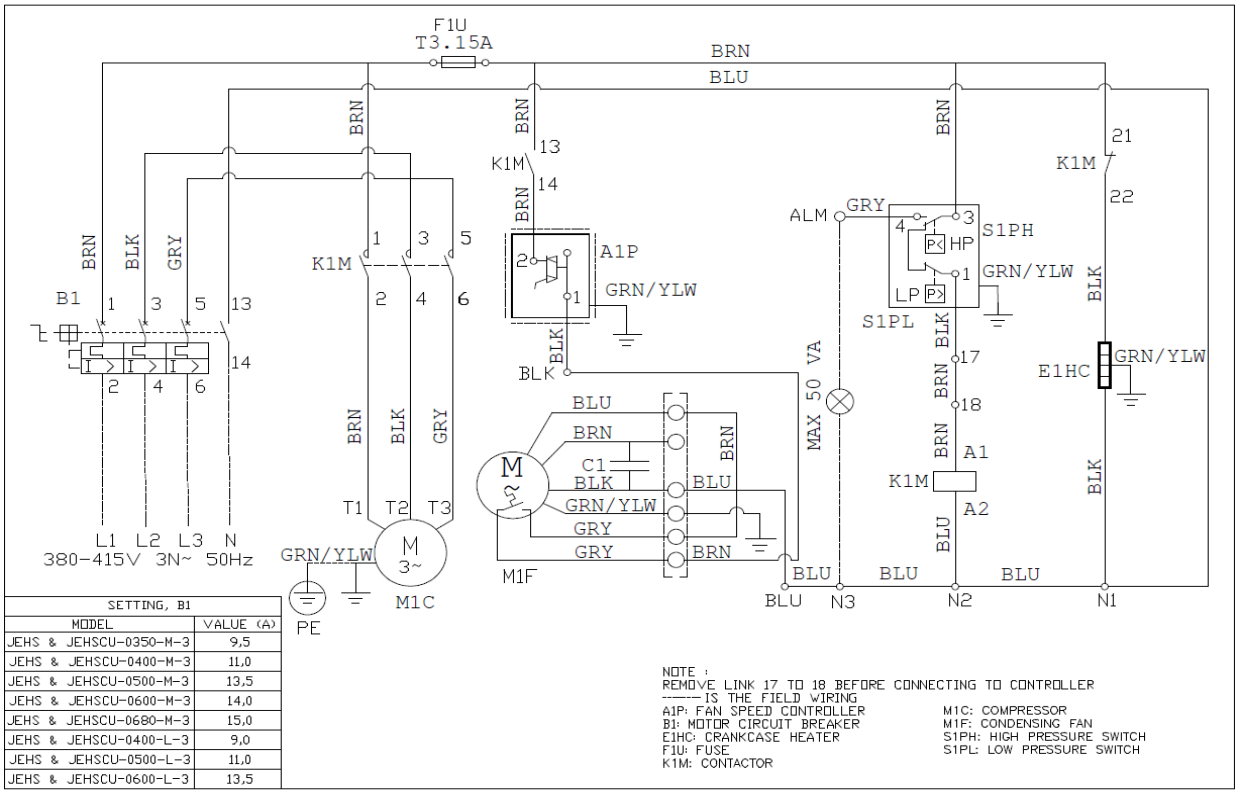
Wiring Diagrams

JEHS-0350-M-1, JEHS-0400-M-1(EBM Fan)



SETTING, B1	
MODEL	VALUE (A)
JEHS & JEHSCU-0350-M-1	21,0
JEHS & JEHSCU-0400-M-1	24,5

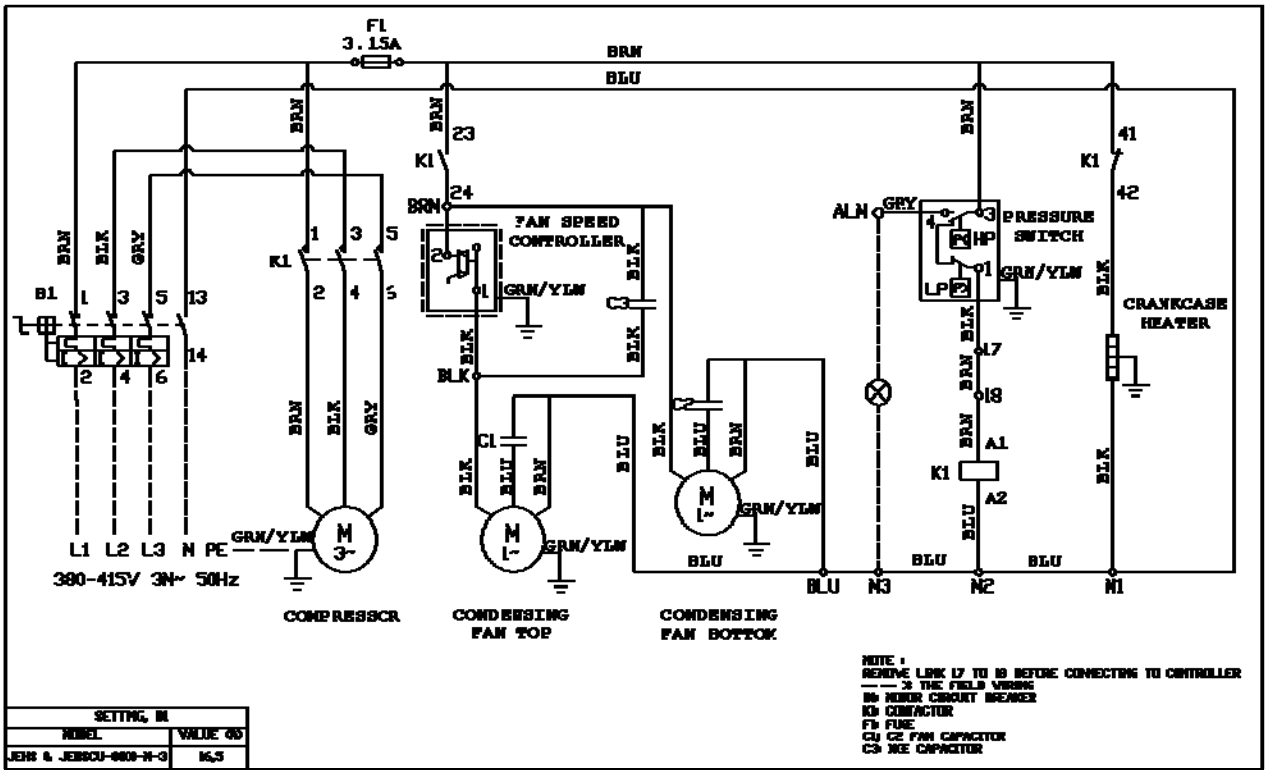
JEHS-0350-M-3, JEHS-0400-M-3, JEHS-0500-M-3, JEHS-0600-M-3, JEHS-0680-M-3 (EBM Fan)



SETTING, B1	
MODEL	VALUE (A)
JEHS & JEHSCU-0350-M-3	9,5
JEHS & JEHSCU-0400-M-3	11,0
JEHS & JEHSCU-0500-M-3	13,5
JEHS & JEHSCU-0600-M-3	14,0
JEHS & JEHSCU-0680-M-3	15,0
JEHS & JEHSCU-0400-L-3	9,0
JEHS & JEHSCU-0500-L-3	11,0
JEHS & JEHSCU-0600-L-3	13,5

Wiring Diagrams

JEHS-0800-M-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 visible at least ½ 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. Condenser Coil – Clean and inspect at regular intervals.

- Check and remove the dirt and debris between the fins using a soft brush, low pressure compressed air/inert gas or a low pressure sprayer utilizing clean water. A suitable chemical coil cleaner may be used as required. Accumulations of dirt on the condenser face can be removed with a soft bristle hand brush. When using liquids, ensure electrical items are isolated and correctly protected.
- DO NOT USE HIGH PRESSURE JET WASHERS.
- Check and remove any obstacles which may hinder the airflow through the condenser coil.

4. Controls

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

5. 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.

6. 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.

7. 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 TCO_2Eq (Tonnes CO_2 Equivalent) are as follows:

		Refrigerant Charge - kg		
		5T	50T	500T
Refrigerant	GWP	CO_2Eq	CO_2Eq	CO_2Eq
R134a	1430	3.5	35	350
R404A	3922	1.3	12.7	127
R407A	2107	2.4	23.7	237
R407F	1825	2.7	27.4	274

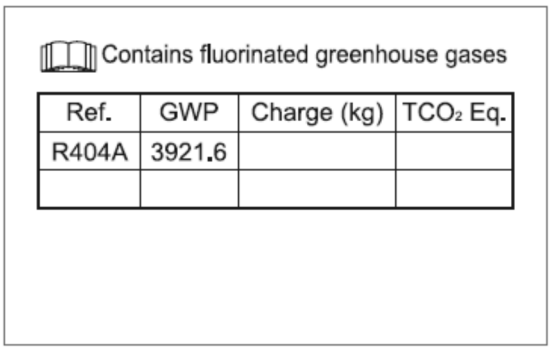
- Changes to leak testing requirements are as follows:

OLD LEGISLATION	NEW LEGISLATION	LEAK CHECKING FREQUENCY
3-30 kgs	5-50 TCO_2Eq	Every 12 months but can be increased to 24 months if fitted with a fixed leak detection system.
30-300 kgs	50-500 TCO_2Eq	Every 6 months but can be increased to 12 months if fitted with a fixed leak detection system.
300+ kgs	500+ TCO_2Eq	Every 6 months - however automatic leak detection system is mandatory which requires servicing every 12 months

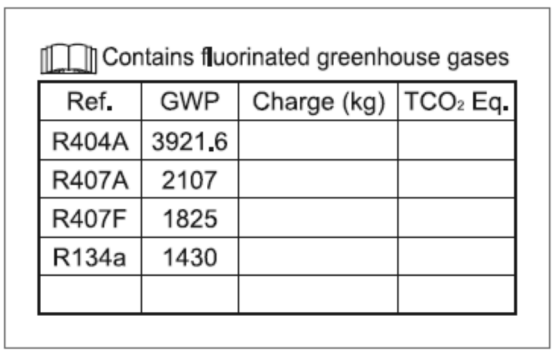
To calculate TCO_2Eq value: $\frac{\text{Refrigerant charge (kgs) x Refrigerant GWP}}{1000}$

Please note: For systems with a charge below 3kg, the changes to the leak checking regime will not apply until 2017. Currently, there is no requirement for regular leak testing of systems with a total charge below 3kg.

A refrigerant charge label is supplied with each unit (inside the electrical box) manufactured from January 2015. The total refrigerant charge for the system 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. Examples of the unit labels are as follows:


Contains fluorinated greenhouse gases

Ref.	GWP	Charge (kg)	TCO_2 Eq.
R404A	3921.6		


Contains fluorinated greenhouse gases

Ref.	GWP	Charge (kg)	TCO_2 Eq.
R404A	3921.6		
R407A	2107		
R407F	1825		
R134a	1430		

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