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Application Engineering Europe

MOTORS FOR COPELAND™ SEMI-HERMETIC COMPRESSORS

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1 Built-in motors for semi-hermetic refrigerant compressors

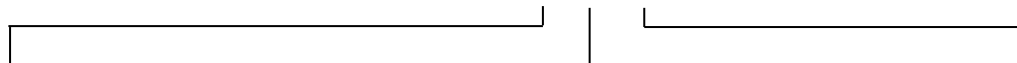
The electric motors integrated in the compressor housing have been designed especially for use in refrigerant compressors. As they are subject to various loads in the application area of the compressor and come into contact with refrigerant and refrigerant machine oil, high grade and highly resistant insulation materials have been used. The insulation material of the compressor motor windings is in accordance with heat resistances grade “B” to VDE 0530. The associated temperature limit of 130°C is not fully utilized.

All motors are adapted to each specific optimum application area so that the compressor is highly effective when using full or part load.

2 Motor code

Semi-hermetic refrigerant compressors are available in various motor versions depending upon requirements. The motor versions differ in operating voltage, type of switching, number of phases, frequency and type of motor protection. Due to the vast number of variations available a code for the motor is included in the model nomenclature to ensure correct designation. An example for a compressor model is given in **Table 1** below.

DKSJ - 15X - C A G
 D6SH - 3500 - E W L
 4MA - 22X - A W M / D



Motor type		Motor protection	Motor voltages			
			Voltage	Ph	Hz	
C	Single-phase motor, one main and one auxiliary winding with start and run capacitor and potential relay.	A	G	220-230	1	50
			D	220	1	50
			Z	220-240	1	50
L	220-240/380-420		3	50		
M	380-420		3	50		
R	220-240		3	50		
Y	500-550	3	50			
N	250-280/440-480	3	60			
D	440-480	3	60			
C	208-230	3	60			
K	220-240/380-420	3	60			
X	380-420	3	60			
T	Three-phase motor, one voltage D.O.L. only, connections only to terminals U, V, W.	W	For three-phase motors, electronic motor protection with thermistors and release module (KRIWAN or CoreSense)			
E	Three-phase motor, interchangeable for Y or Δ operation. Can be used D.O.L.					
A	Three-phase part-winding or D.O.L. start motor, not interchangeable. For part-winding start the winding is divided 2/3 – 1/3.					
B	Three-phase part-winding or D.O.L. start motor, not interchangeable. For part-winding start the winding is divided 3/5 – 2/5.					
F	Three-phase part-winding or D.O.L. start motor, not interchangeable. For part-winding start the winding is divided 1/2 – 1/2.					

Table 1: Key to motor code

3 Motor voltages and frequencies

3.1 Nominal voltage range

A nominal voltage range pertaining to the motor is stated in Copeland™ brand products Select software and on compressor nameplates as opposed to one single nominal voltage. Additionally a voltage tolerance of ± 10% is ensured, with a few exceptions - see Select software.

Example: Compressor model D4SH*-250X EWL

Nominal voltage range according to the nameplate 220-240V Δ / 380-420V Y

Motors connectable in Y or Δ

Voltage tolerance ± 10%

Voltage range:

- | | | | |
|----|------------------------|----|------------------------|
| a) | From 220V - 10% = 198V | to | 240V + 10% = 264V in Δ |
| b) | From 380V - 10% = 342V | to | 420V + 10% = 462V in Y |

The compressor can be put into full operation within the specified load limits throughout this voltage range.

3.2 Frequency

DWM Copeland semi-hermetic compressors are available for 50 and/or 60 Hz voltage supply. The use of a 50 Hz three-phase motor with 60 Hz and vice-versa is possible if the voltage is altered in the ratio of the equally altered frequency. The following calculation factors need to be considered:

	50Hz → 60 Hz	60 Hz → 50 Hz
Refrigeration capacity	1.2	0.83
Power input	1.2	0.83
Speed	1.2	0.83

Motor codes and current (Amps) factors at 50 Hz				
Code	Power supply	Nominal voltage	Con-nection	Amps factor
AWM	380-420 / 3 / 50	400	YY/Y	1
EWL	380-420 / 3 / 50	400	Y	1
EWL	220-240 / 3 / 50	230	Δ	1.73
EWM	380-420 / 3 / 50	400	Δ/Y	1
AWR	220-240 / 3 / 50	230	YY/Y	1.73
AWY	500-550 / 3 / 50	525	YY/Y	0.76
TWY	500-550 / 3 / 50	525	Δ	0.76
BWR	220-240 / 3 / 50	230	YY/Y	1.73
BWM	380-420 / 3 / 50	400	Δ / Δ	1
BWY	500-550 / 3 / 50	525	Δ / Δ	0.76

Motor codes and current (Amps) factors at 60 Hz				
Code	Power supply	Nominal voltage	Con-nection	Amps factor
EWN	440-480 / 3 / 60	460	Y	1
EWK	220-240 / 3 / 60	230	Δ	2.1
EWK	380-420 / 3 / 60	400	Y	1.2
AWX	380 / 3 / 60	380	YY/Y	1.2
EWD	440-480 / 3 / 60	460	Δ/Y	1
AWC	208-230 / 3 / 60	230	YY/Y	2.19
AWD	440-480 / 3 / 60	460	YY/Y	1
EWN	250-280 / 3 / 60	265	Δ	1.73
BWX	380 / 3 / 60	380	Δ / Δ	1.2
BWC	208-230 / 3 / 60	230	Δ / Δ	2.19
BWD	440-480 / 3 / 60	460	Δ / Δ	1

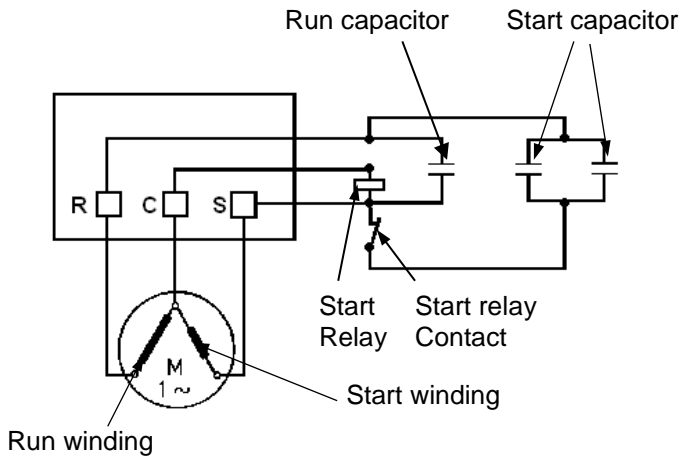
Table 2: Calculation factors

4 Internal connection of the motors

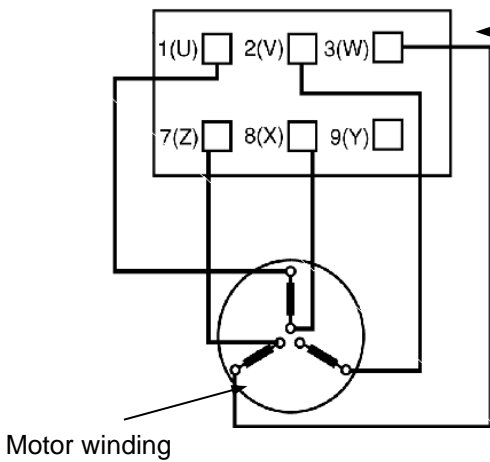
If the motor winding resistance needs to be measured the diagrams below show the internal connections for the motors used on Copeland™ semi-hermetic compressors.

4.1 Present motor versions (C, E & A)

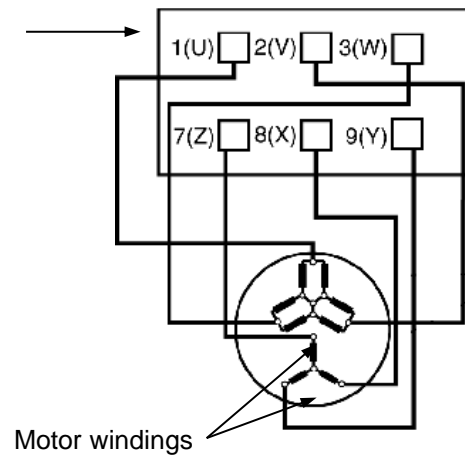
Single-phase: motor code C



Star-Delta (Y/Δ): motor code E

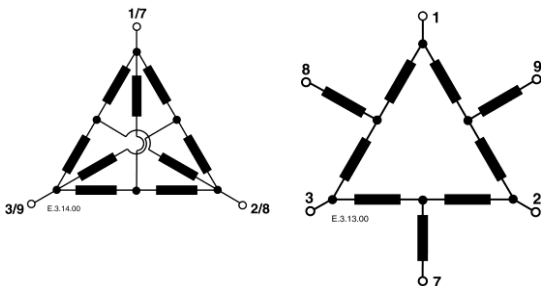


Part Winding 2/3:1/3: motor code A



4.2 Discontinued motor versions (T & B)

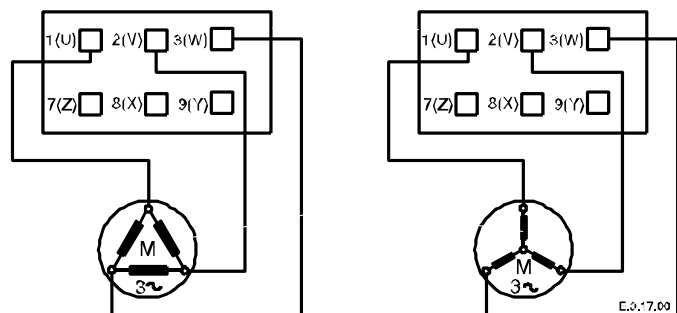
Part winding 3/5:2/5: motor code B



Direct-On-Line start winding arrangement

Part-winding start with bridges

Three-phase: motor code T



Delta connected (internally)

Star connected (internally)

5 Single-phase motor: motor code C

For operation with single-phase power supply, compressors with single-phase motors are available with options up to compressor model DKSL-15X. They have one main and one auxiliary winding. In order to achieve the starting torque for automatic start and optimum operation, as in the case of three-phase motors, a capacitor and relay assembly consisting of a start and run capacitor and a potential relay will be supplied. Assembly must be in accordance with the position of the capacitors and relay shown on the wiring diagram.

Compressor model	Run capacitor		Start capacitor		Potential relay
	µF	Voltage	µF	Voltage	
DKM-5X / -50	10	420	72-88	330	GE 3ARR3CE5AA1
DKM-7X / -75	16	420	2 x (72-88)	330	GE 3ARR3CE3AC1
DKJ-7X / -75	16	420	2 x (72-88)	330	GE 3ARR3CE3AC1
DKJ-10X / -100	20	420	2 x (72-88)	330	GE 3ARR3CE3AC1
DKSJ-10X / -100	20	420	2 x (72-88)	330	GE 3ARR3CE3AC1
DKSJ-15X / -150	20	420	2 x (88-108)	250	GE 3ARR3CE3AC1
DKL-15X / -150	25	420	2 x (88-108)	250	GE 3ARR3CE3AC1
DKSL-15X	25	420	2 x (88-108)	250	GE 3ARR3CE3AC1

Table 3: Single-phase compressor models

6 Three-phase motors

All DWM Copeland three-phase compressors can be started Direct-On-Line (DOL). The positions of the bridges for Direct-On-Line start depending on type of motor and/or mains voltage are shown on the wiring diagrams.

6.1 Three-phase motor (Star-Delta (Y/Δ)): motor code E

The 6 ends of the three windings of this three-phase motor are led into the terminal box of the compressor via cable bushings. This motor is interchangeable for star (Y) or delta (Δ) operation by means of bridges in the terminal box or via contactors. The voltage versions L, N & K are suitable for two voltages, eg, 400V in star connection, 230V in delta. The voltage versions M, D & Y of this motor shall be used for full load in delta connection. The star connection is primarily used here for the starting procedure and also for power supply with 660V / 3 / 50 Hz (only "EWM" version).

6.2 Three-phase motor (Part-winding start (YY/Y)): motor code A

Part-winding start motors contain two separate windings (2/3:1/3) which are internally connected in star and operated in parallel. One cannot change the voltage by changing the electrical connections as the motor is only suitable for one voltage range (see **Table 1**). The first part winding (2/3) on terminals 1-2-3 can be used for part winding start. After a time delay of 1 ± 0.1 seconds, the second part winding, the 1/3 winding on terminals 7-8-9 must be brought on line.

The part winding motor can be regarded as two motors, if its winding, due to the part-winding start, is separately connected to the power supply. The winding ratio 2/3:1/3 applies, taking the tolerance into consideration for winding resistances and the magnetic flow. The partial currents flowing during operation under load have a mutual interference and a current ratio arises which does not correspond to the geometric division. This means that the current of the first part winding drops down from 67 to 61% depending upon the load and can rise up from 33 to 39% in the second part winding. We recommend that with motor code "A" part-winding start the 4- & 6-cylinder compressors start unloaded whereas unloaded start with 8-cylinder AW* compressors is not normally required.

Therefore in order not to overload the motor unnecessarily, voltage on one-part winding (except during starting with the first winding) should be avoided. The motor should be safeguarded by one common fuse group.

NOTE: In order not to endanger the motor, the connection of first terminals 1, 2 & 3 and second terminals 7, 8 & 9 part-winding to the mains must be identical. The connections of the first and second part-winding must be equiphase.

NOTE: Replacement compressors: Prior to 1984 part-winding motors with a winding division of 1/2:1/2 were marked with a motor code "F". From January 1994 until September 2006 semi-hermetic 8-cylinder compressors were equipped with a BW* part-winding motor 3/5, 2/5.

NOTE: When replacing a part-winding motor version "F" or "B" with a motor code "A" part-winding motor (2/3:1/3), it is essential to check whether the electrical installation is suitable or not.

In part-winding motors with a 2/3:1/3 arrangement, current distribution is dependent on the respective load. It is approximately 61-67% for the first part-winding and 39-33% for the second part-winding. Fuses, circuit breakers and cable cross-sections should be checked to ensure that the permissible values (making and breaking capacity, current load) are not exceeded. This applies in particular to installations where the fuses, circuit breakers and conductors were designed separately for each part-winding.

6.3 Three-phase motor (Part-winding start (Δ/Δ)): motor code B (discontinued)

From January 1994 until September 2006 DWM Copeland semi-hermetic 8-cylinder compressors were equipped with a BW* part-winding motor 3/5, 2/5. Compared to the motor code "A" part-winding motor used before the torque has been increased both for Direct-On-Line start and for part-winding start. Additionally, in order to improve the starting characteristics, the entire motor winding was divided in such a way that 3/5 of the entire motor current flows through terminals 1-2-3 and 2/5 through terminals 7-8-9. One cannot change the voltage by changing the electrical connections as the motor is only suitable for one voltage range. In spite of the increased torque provided the locked rotor current (full winding) and the maximum operating current remain unchanged.

- a) **Start-up wiring via terminals 1-2-3:** If the motor is supplied with power by terminals 1–2–3 a part-winding start without unloading is put into effect. The starting current is **68%** of the value for Direct-On-Line starting. After a time delay of 1 ± 0.1 seconds the second part winding, the 2/5 winding on terminals 7-8-9 must be brought on line.
- b) **Start-up wiring via terminals 7- 8- 9:** When the motor is started via terminals 7-8-9, the starting current is **54%**. With 2/5 part-winding start the compressor must be unloaded.

NOTE: In order not to endanger the motor, the connection of first and second part-winding to the mains L1, L2 and L3 must be identical. The connections of the first and second part-winding must be equiphase. Unloaded start is not normally required with the 8-cylinder BW* compressor using the first part-winding (3/5) to start.

The distribution of current to both windings is **independent** from the load:

- Winding on terminals 1-2-3 60%
- Winding on terminals 7-8-9 40%

6.4 Three-phase motor (DOL): motor code T (discontinued)

For standardisation reasons 6-pole cable bushings are used for not interchangeable motors for three-phase supply. This motor is only suitable for one voltage and can only be started Direct-On-Line. The motor windings are internally connected into star or delta and 3 winding ends are connected to the terminals U, V, W in the terminal box. The cable bushings X, Y and Z are not connected to the motor.

NOTE: Motor version TWY should not be confused with the special motor TWK which is a part-winding motor with 9 terminals and is not described here.

7 Winding resistance measurements

Should measuring of resistance be necessary for servicing, the resistance shall be measured with an ohmmeter with a maximum of 4.5V DC voltage at the terminals in the terminal box.

The winding resistances must always be specified with the terminal designations between which measurements were made; further it must be stated whether the measurements were made with or without bridges.

7.1 Single phase motor (CAG)

Measuring is carried out between terminals R and C for the main winding and between S and C for the auxiliary winding. Disconnect capacitor and relay assembly during measuring.

7.2 Start-Delta start motor (EW...)

Measure the resistance between terminals U-V, U-W and V-W with assembled star- or delta-connection bars (motor version T does not have connection bars!).

Measuring without connection bars is carried out between terminals U-X, V-Y and W-Z (motor version E only).

The resistances are as follows:

$$R = 1/2 R_y \text{ or } R_y = 2 R$$

$$R = 3/2 R_{\Delta} \text{ or } R_{\Delta} = 2/3 R$$

$$R_y = 3 R_{\Delta} \text{ or } R_{\Delta} = 1/3 R_y$$

R = resistance measured without connection bars
 R_y = resistance measured with star connection bars
 R_Δ = resistance measured with delta connection bars

7.3 Part-winding motor 2/3 - 1/3 (AW...)

If the resistance is measured between terminals 1-2, 1-3 and 2-3 with connection bars, the measuring value corresponds to the resistance value of the "full winding" (R_v); if it is measured without connection bars, it corresponds to the resistance value of the first part-winding (R_{1T}). The resistance of the second part-winding (R_{2T}) is measured at terminals 7-8, 7-9, and 8-9 (without connection bars).

The resistances are as follows:

$$R_v = \frac{R_{1T} R_{2T}}{R_{1T} + R_{2T}}$$

R_v = resistance of "full winding"
 R_{1T} = resistance of 1st part-winding
 R_{2T} = resistance of 2nd part-winding

7.4 Part-winding motor 3/5 - 2/5 (BW...)

Resistance R_v of the complete winding is measured **with bridges** between terminals:

	1/7 - 2/8	1/7 - 3/9	2/8 - 3/9
Resistance R ₁ , without bridges between terminals:	1 - 2	1 - 3	2 - 3
Resistance R ₂ , without bridges between terminals:	7 - 8	7 - 9	8 - 9

The following designations apply: R₁ = 2.5 R_v & R₂ = 4.325 R_v

7.5 Consideration when measuring winding resistance:

Greater measuring uncertainty is caused by the winding temperature. Therefore, we recommend measuring the resistance at constant ambient temperature. However, smaller compressors (DK.to D2...) must have been out of operation for at least 5 hours, and larger compressors for 8 to 12 hours so that they have an ambient temperature.

In order to be able to compare and check the measuring results, the winding temperature during measuring must be 25°C. Deviations up to ± 5K are allowable, as they cause mistakes of less than +2%.

For greater deviations in temperature the measuring result shall be calculated based on the formula for 25°C:

$$R_{25} = \frac{260 \cdot R_w}{235 + \vartheta_w}$$

R_w = measured, warm resistance
 R₂₅ = resistance calculated for 25°C
 ϑ_w = winding temperature during measuring

NOTE: The resistance values of the three windings of a motor may deviate from each other by up to ±3%. The values of different compressors of the same motor type may deviate from each other by up to ±10%.

8 Insulation resistance

Caution: Do not carry out insulation measurements if the compressor housing is under vacuum.

DWM Copeland motors have an insulation resistance of over 10 Megaohm during production and thus greatly supersede 2 Megaohm for new machines as required in accordance with VDE 0700 Part 1.

If the insulation condition of the compressor motor is to be tested, use 500VDC voltage to measure insulation resistance. The measuring device, usually a hand generator, but also a battery or solid state device, must meet the conditions in accordance with VDE 0413 Part 1.

Measuring is carried out between terminals U, V, W (without connection bars) and the housing. The following resistance values may not fall below:

- New compressor (in accordance with VDE 0700 Part 1): 2 Megaohm
- After overhauling (in accordance with VDE 0701 Part 1): 0.5 Megaohm

NOTE: Moisture in the area of the terminal box and dirt which may arise even from transport and storage result in smaller values during measuring. In this case, clean the terminal box carefully to exclude any influence due to dirt and moisture and repeat measuring.

9 Current asymmetry

If different currents are measured in the three lead lines of the compressor motor, this is called current asymmetry which leads to additional heating of the motor.

Deviations of currents from one another are allowable within the scope of nominal voltage ($\pm 5\%$) up to $\pm 15\%$.

As current asymmetry can also be caused by voltage asymmetry, the external conductor voltage must also be measured during each current measuring. If the voltages deviate by more than 2%, the measured currents shall be linearly calculated to obtain the rated voltage U.

Only after calculation to rated voltage the current asymmetry can be calculated according to the example and the result shows if the motor can be considered good or bad.

10 Power factor Cos ϕ

The power factor $\cos \phi$ is the scale for utilization of electrical equipment. It states the ratio of transferred actual power (P) to apparent power (S). The smaller the factor is, the poorer the power generator and energy distribution plants are utilized. Therefore, attempts are made to keep the proportion of reactive power as small as possible or to decrease, ie, compensate reactive power with the aid of capacitors. In the following table, the correlations which are given between the electric factors are specified in formulas enabling rapid calculation or conversion of the required factors.

				Single-phase supply	Three-phase supply
Apparent power	S	(VA)	$S = \sqrt{P^2 + Q^2}$	$S = U \cdot I$	$S = \sqrt{3} \cdot U \cdot I$
Actual power	P	(W)	$P = S \cdot \cos \phi$	$P = U \cdot I \cdot \cos \phi$	$P = \sqrt{3} \cdot U \cdot I \cdot \cos \phi$
Reactive power	Q	(var)	$Q = S \cdot \sin \phi$	$Q = U \cdot I \cdot \sin \phi$	$Q = \sqrt{3} \cdot U \cdot I \cdot \sin \phi$
Power factor	$\cos \phi$		$\cos \phi = \frac{P}{S}$	$\cos \phi = \frac{P}{U \cdot I}$	$\cos \phi = \frac{P}{\sqrt{3} \cdot U \cdot I}$

Table 4: Calculation formulas

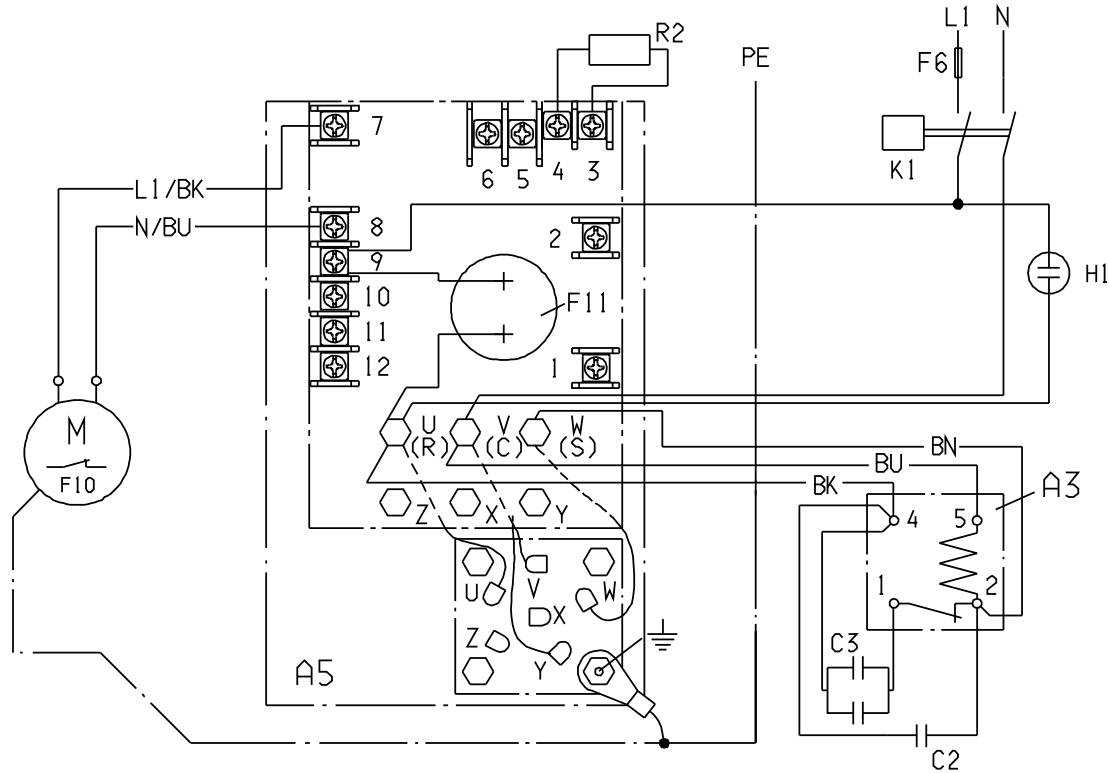
The motor current and power input depend on the operating point (evaporating temperature, condensing temperature and refrigerant) of the compressor.

The current and power input data for each compressor can easily be found in Copeland™ brand products Select software which can be downloaded for free at www.emersonclimate.eu.

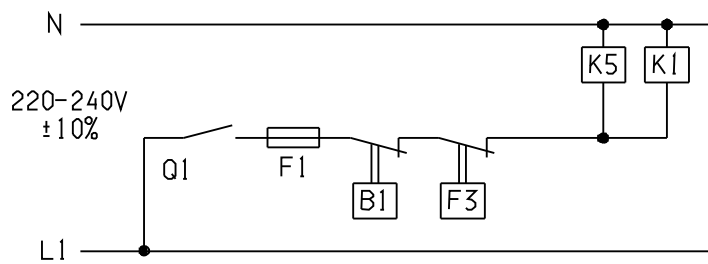
11 Wiring diagram

Each compressor terminal box contains wiring diagrams. Always ensure the supply voltage, the phases and the frequency match the nameplate prior to connecting the compressor to the system power supply.

11.1 Single-phase CAG, DK



Recommended control circuit

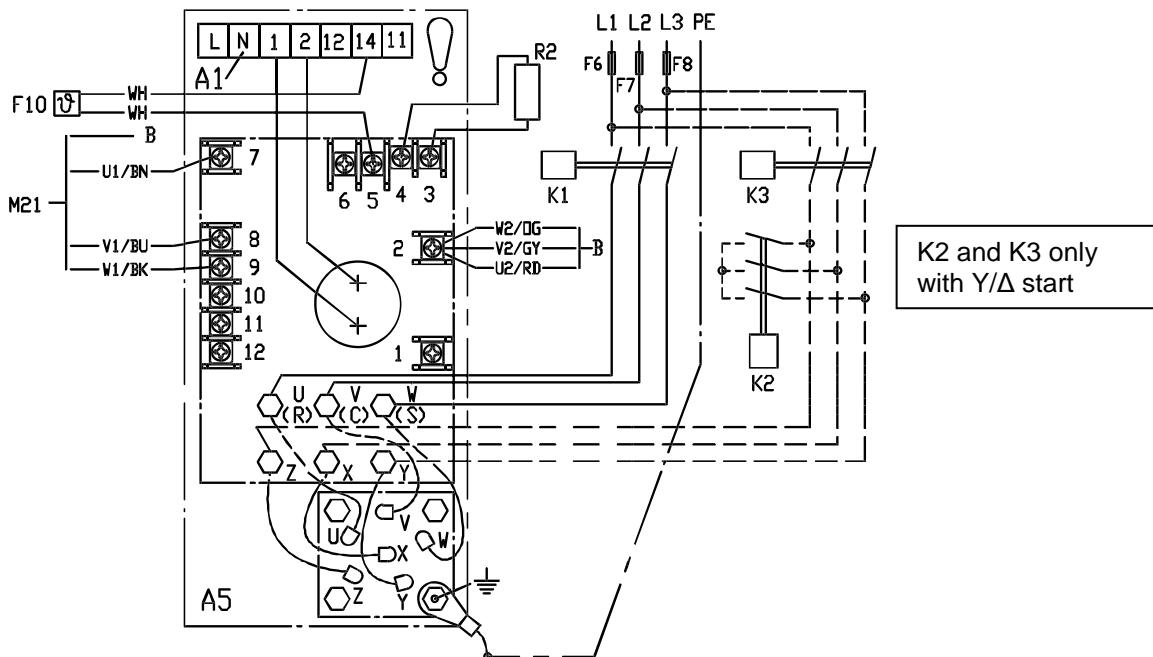


11.2 Three-phase direct or Y/Δ start, EW...

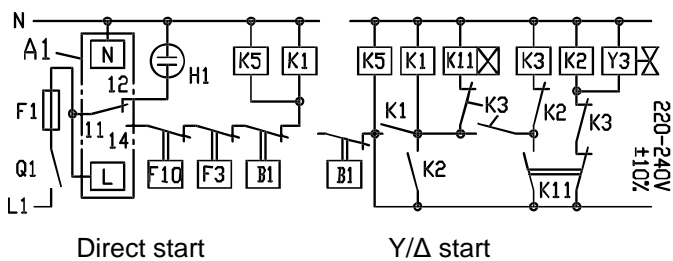
Star/Delta motors can be connected Direct-On-Line or Star/Delta start.

	Direct-On-Line start Δ	Direct-On-Line start Y	Star/Delta start Y - Δ
Star/Delta motor Y - Δ Code E			

11.2.1 DK, DL - Direct or Y/Δ start, EW...

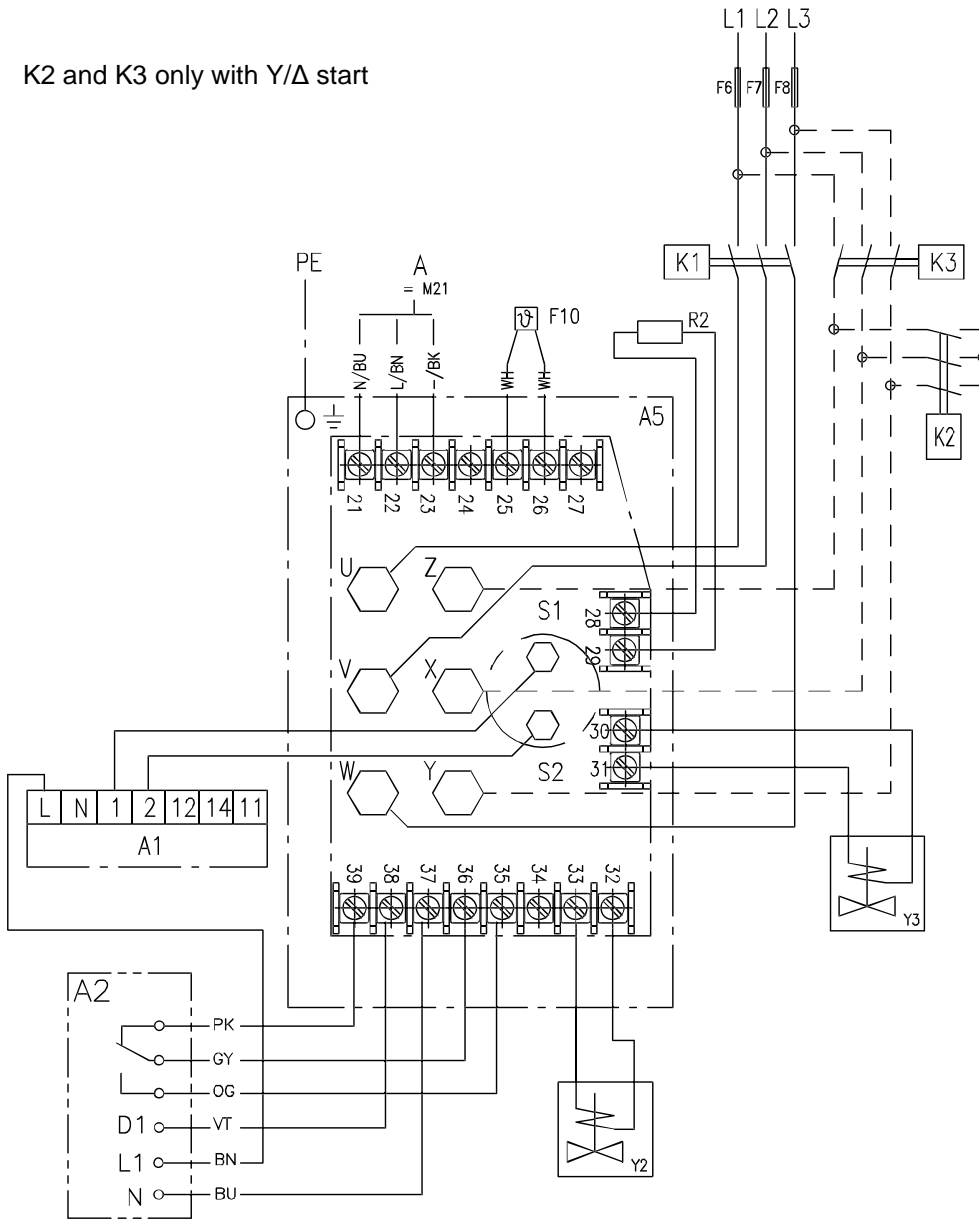


Recommended control circuit:

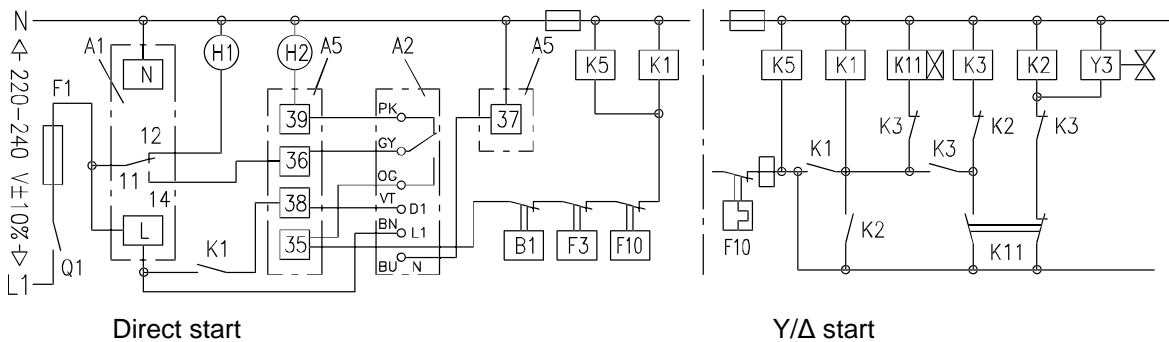


11.2.2 D2, D3, D9 - Direct or Y/D start, EW...

K2 and K3 only with Y/Δ start



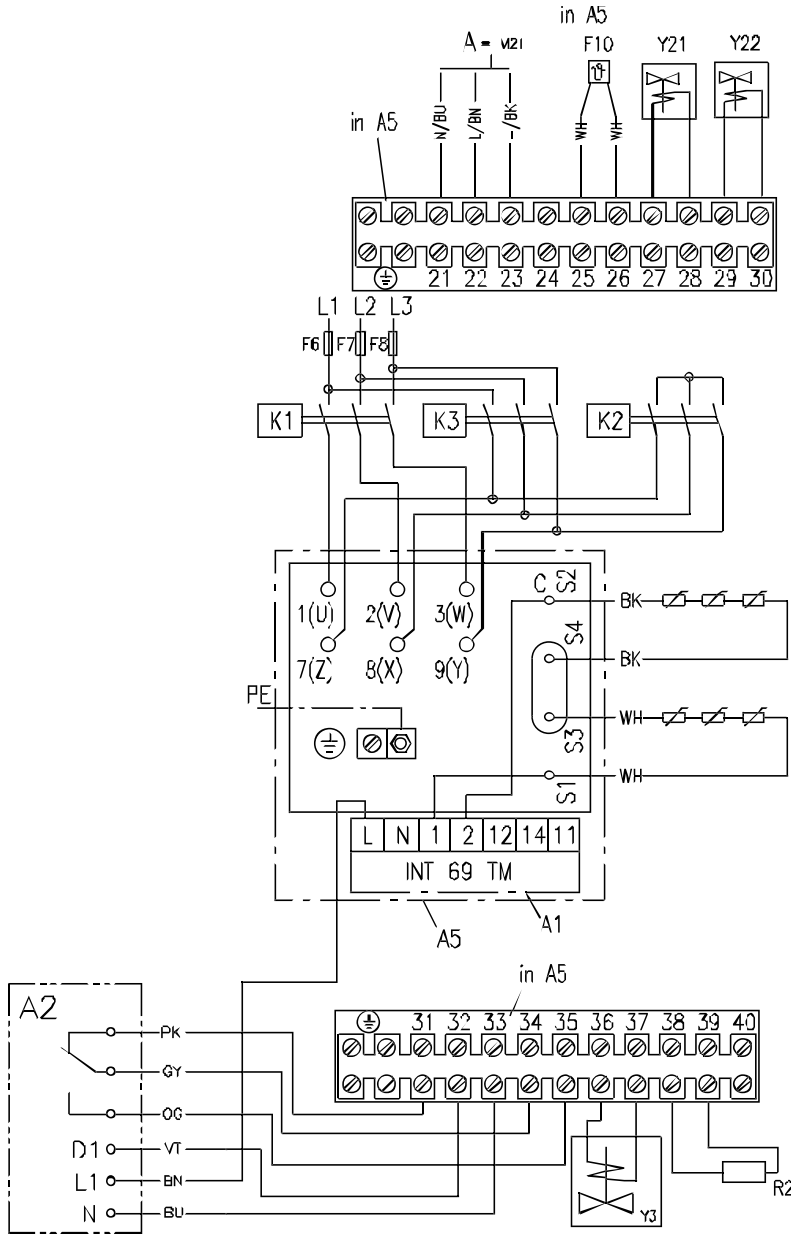
Recommended control circuit:



Direct start

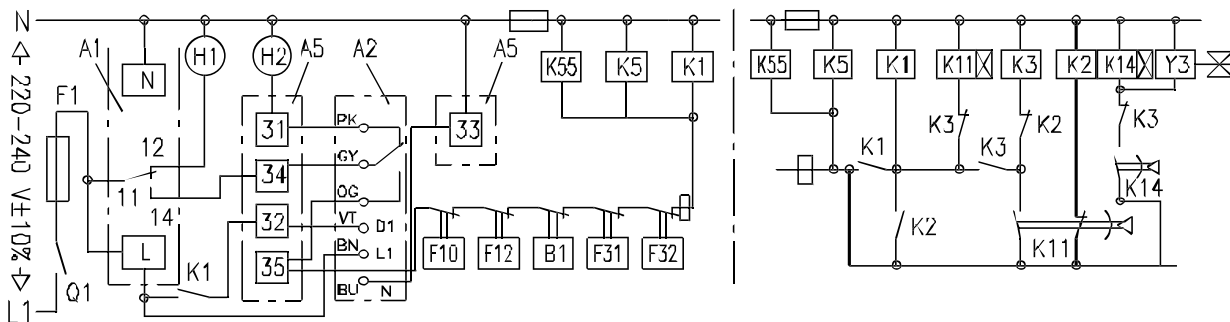
Y/Δ start

11.2.3 D4, D6, D8 - Direct or Y/D start, EW...



K2 and K3 only with Y/Δ start

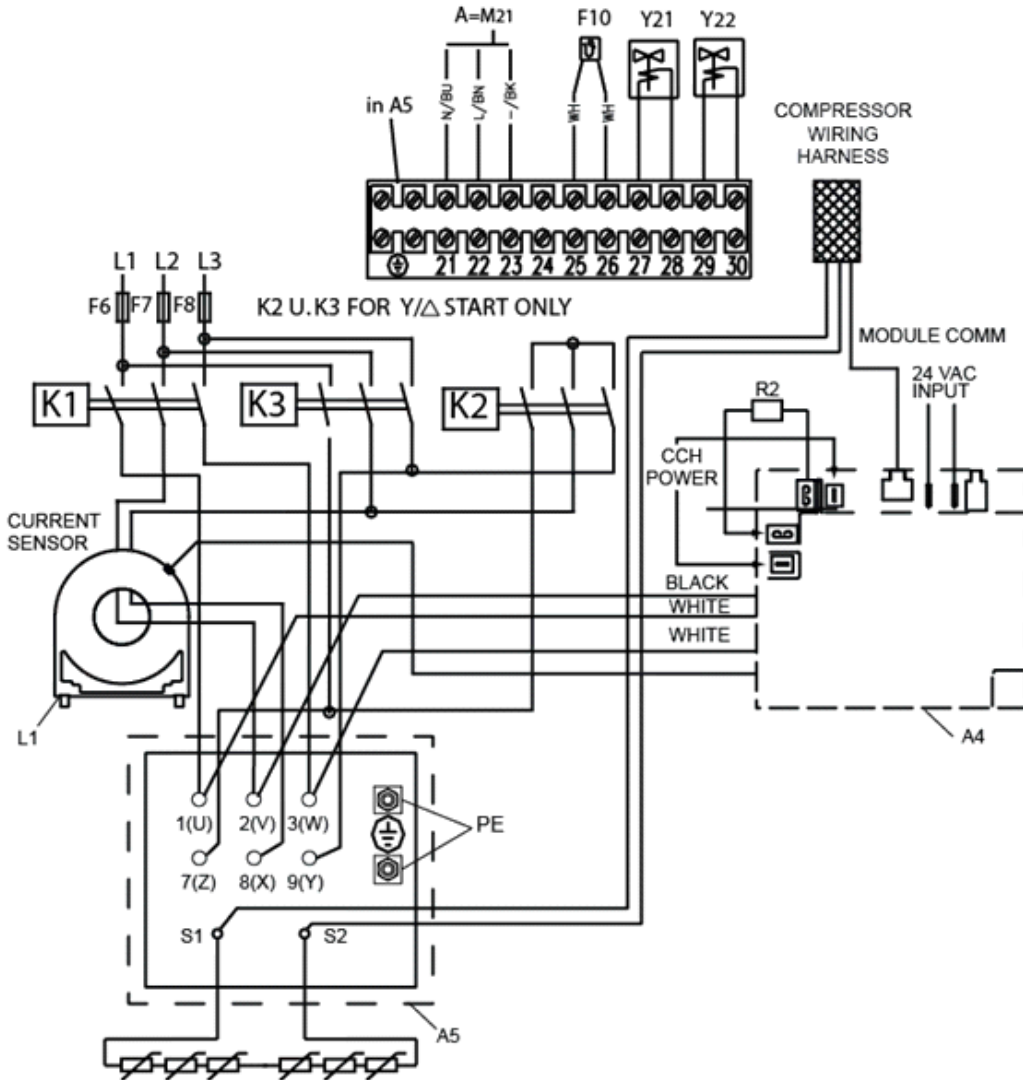
Recommended control circuit:



Direct start

Y/Δ start

11.2.4 4M, 6M - Direct or Y/D start, EW...



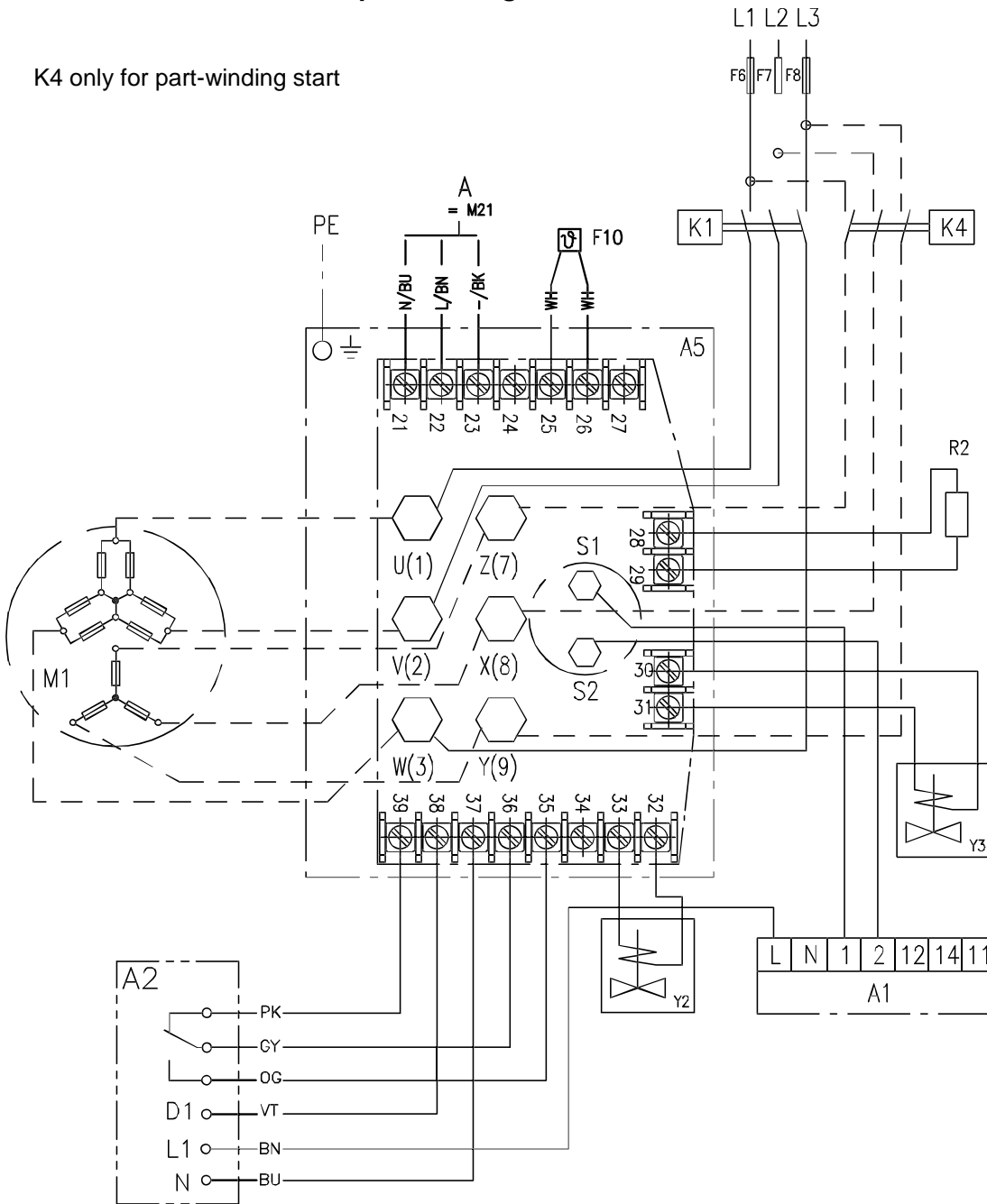
11.3 Three-phase direct or part-winding start AW...

Part-winding motors can be connected Direct-On-Line or part-winding start.

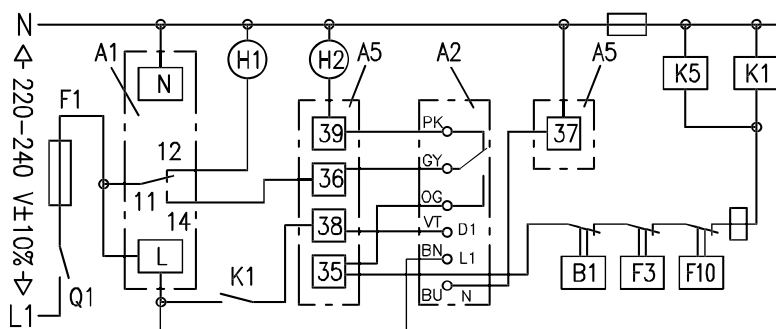
	Direct-On-Line start Y - Y	Part-winding start First start step 1-2-3 Y - Y
Part-winding motor: Y - Y Code A		

11.3.1 D2, D3, D9 - Direct or part-winding start AW...

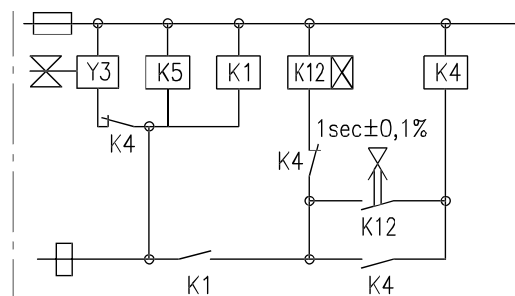
K4 only for part-winding start



Recommended control circuit:

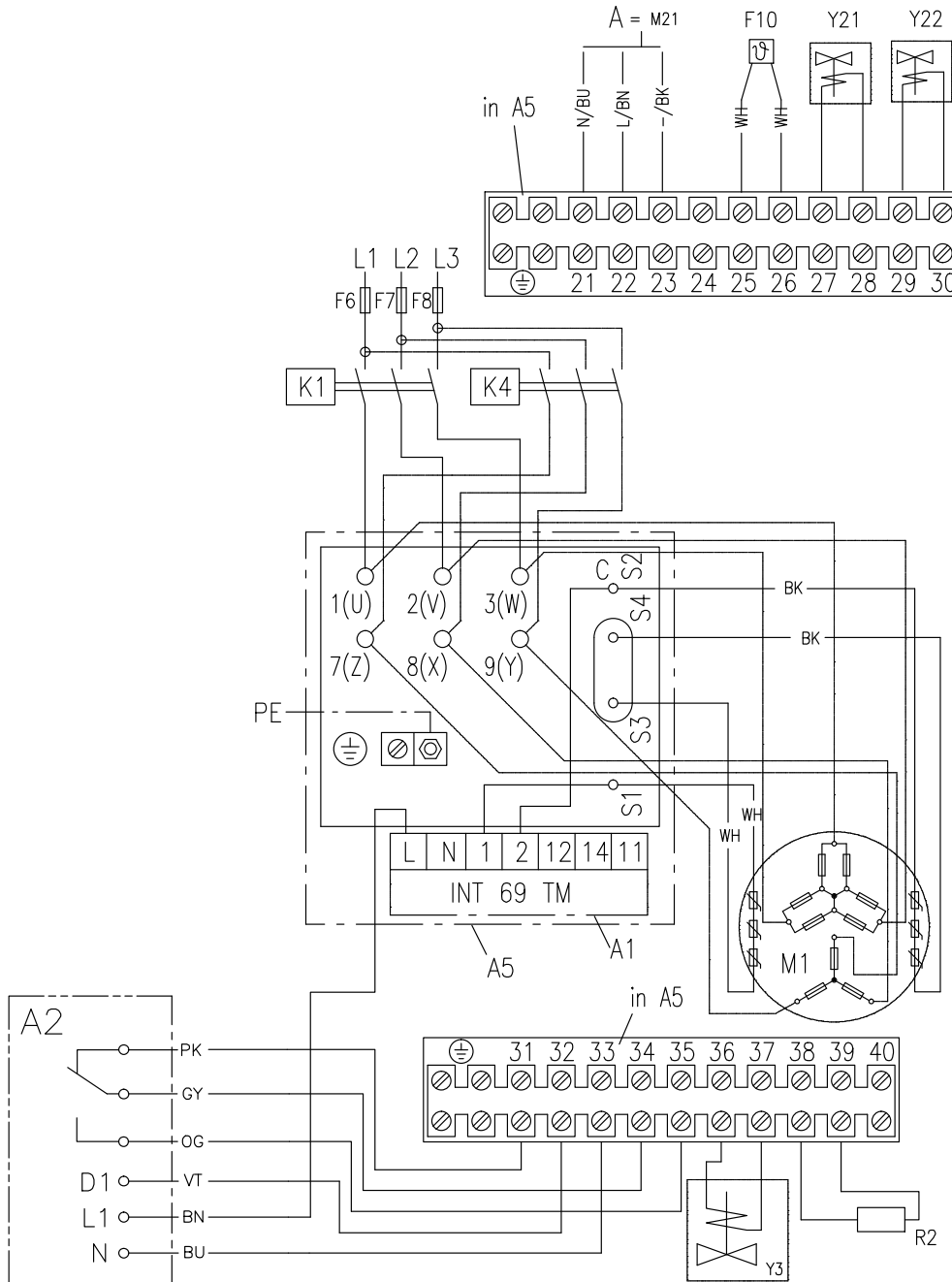


Direct start

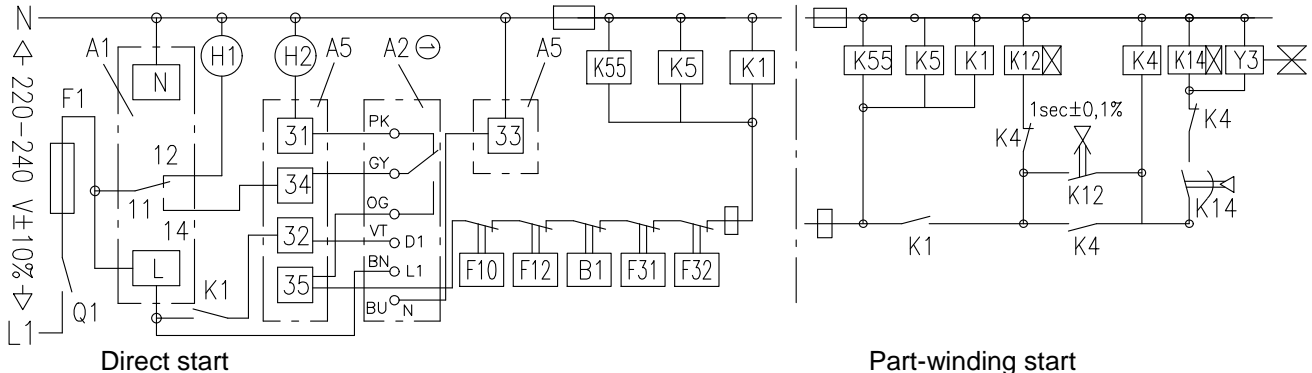


Part-winding start

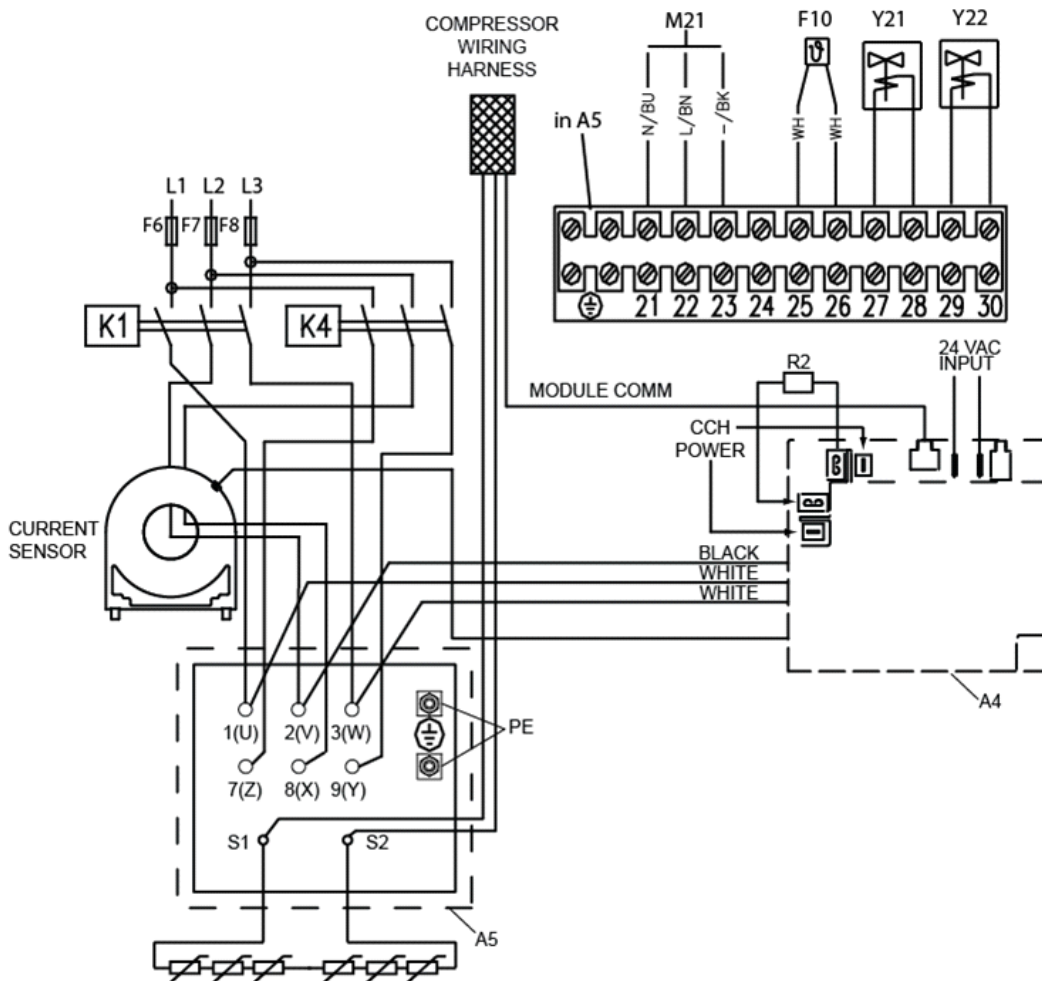
11.3.2 D4, D6, D8 - Direct or part-winding start AW...



Recommended control circuit:



11.3.3 4M, 6M - Direct or part-winding start AW...



11.4 Wiring diagrams legend

A1..... INT69 Electronic module
A2..... Oil differential pressure switch
A4..... Sensor module
A5..... Terminal box compressor
B1..... Room thermostat
C1 Run capacitor
C3 Start capacitor
CCH Crankcase heater
F3..... Pressure control switch
F6..... Fuse for control circuit
F7..... Fuse for control circuit
F8..... Fuse for control circuit
F10..... Thermal protection switch M21
F12..... Thermal protection Switch M3
H1 Signal lamp A1
H1 Signal lamp A2

K1 Contactor M1
K2 Y - Contactor M1
K3 Δ - Contactor M1
K4 Contactor M1 for second part-winding
K5 Contactor M21
K55 Contactor M3
M1..... Compressor motor
M21..... Fan motor/condenser
M3..... Motor cylinder head cooling
Q1..... Main switch
R2 Crankcase heater
Y2 Solenoid valve capacity control
Y21 Solenoid valve capacity control 1
Y22 Solenoid valve capacity control 2
Y3 Solenoid valve unloaded start

Cable colours

BK – Black	BN – Brown	BU – Blue
GY – Grey	OG – Orange	PK – Pink
RD – Red	VT – Violet	WH – White

Information in this document is subject to change without notice

12 Troubleshooting

Flash code	Alarm conditions	Possible failure reasons	Troubleshooting measures
1 Insufficient oil pressure	<p>Alert: Appears when the differential oil pressure is less than 0.48 – 0.62 bar for 4 seconds.</p> <p>Lockout: Appears when the differential oil pressure is less than 0.48 – 0.62 bar for 2 minutes continuous or intermittent but determined to be unsafe.</p>	<ul style="list-style-type: none"> Loose wiring connections between CoreSense module and oil sensor. Faulty oil sensor (missing O-ring or clogged sensor screen). Faulty oil pump. Clogged strainer screen or worn bearings. 	<ul style="list-style-type: none"> Check the oil level present in the sight glass. If the oil is not present, resolve reservoir oil supply problem or oil level control setting issues. Check that the harness is fully engaged to the sensor. Measure oil pump differential pressure. If less than 0.48 to 0.62 bar, inspect for clogged oil screen, faulty oil pump, liquid floodback or worn bearings. If good oil pressure exists, measure resistance across the oil sensor while the compressor runs. If the sensor resistance is "open" inspect for clogged sensor screen or missing O-ring. If sensor resistance is "closed", temporarily jumper across the harness connector pins (do not damage the pins!) while the compressor runs. If the oil warning does not go away, check harness connector engagement at the module circuit board.
2 Motor overheat	<p>Trip: Appears when the motor is overheated.</p>	<ul style="list-style-type: none"> Motor rotor is mechanically seized. Open circuit in harness. Connector pin not engaging at connector on control module. Faulty CoreSense module. 	<ul style="list-style-type: none"> In case of trip alarm, allow the motor to cool down for a minimum of 2 minutes (it may take longer) and the compressor will start automatically. If resistance is low, inspect for loose terminal strip connections, harness connection failure at circuit board, open harness circuit or high motor temp due to return gas temperature, motor voltage or load condition.
3 Discharge temp protection	<p>Alert: Appears when the discharge temperature sensor is defective or disconnected.</p> <p>Trip/Lockout: Appears when the discharge temperature is > 154°C for 2 seconds.</p>	<ul style="list-style-type: none"> Open discharge probe (faulty). The probe connection has not been made to the harness connector. The connector is not plugged into the CoreSense circuit board. The discharge temperature has exceeded the maximum limit 154°C. Blocked condenser. Possible loss of refrigerant. 	<ul style="list-style-type: none"> If there is an alert, check proper probe connection to the harness and proper harness connection into the circuit board. If there is an alert, unplug the discharge temp probe and check if the resistance of the probe is as specified vs its approximate ambient temperature. If the probe resistance is correct inspect the harness connector receptacle for damage and apply NyoGel 760G connector lubricant. Trip or Lockout: resolve system issues (high superheat, high head pressure), inspect for mechanical damage that can lead to high temps (valve plate gasket, suction or discharge valve failure).

Flash code	Alarm conditions	Possible failure reasons	Troubleshooting measures
4 Connection lost between sensor module and current sensor	Alert: Appears when the signal from current sensor is not communicated to the sensor module.	<ul style="list-style-type: none"> The current sensor is not connected to the sensor module. Faulty current sensor. Faulty sensor module. 	<ul style="list-style-type: none"> Check if the CT connector is connected to the sensor module. If not connect the 4-pin current sensor connector into the sensor module. Check if there is continuity between pin 3 & 4 (closest to the latch) of the current sensing connector. The resistance should be less than 1 Ω. If the resistance is greater than 1 Ω, replace the current sensing module. Be certain that the receptacles are fully engaged in the connector block. Check if the Amp and Volts values are correctly displayed. If not, inspect the wire harness connector to ensure that the pins are fully engaged. If the above-mentioned trouble shooting measures did not give positive results, the reason is mis-installed connector or faulty sensor module. Replace the faulty sensor module with new one.
5 Communication error	Alert: Appears when there is no communication between control module and sensor module or pack controller	<ul style="list-style-type: none"> Communication between CoreSense control module and pack controller has been lost. Communication between CoreSense control module and sensor module has been lost. 	<ul style="list-style-type: none"> Is there a communication network? If not, set the network dip-switch to "stand-alone" and press reset. Is there a communication network? If not, check that the communication harness is engaged at both the CoreSense module and the sensor module. If the LED on the top edge of the sensor module is dark, check 24 VAC power to the sensor module, or replace the sensor module. If communication network amber light is continuously on, reverse the communication wire polarity. If voltage between centre pin and the right or left pin is not 2.3-2.6 VDC, inspect for communication wire failure or wire strands that are "shorting" between the wires or to ground.
6 Locked rotor	Trip: Appears when excessive current is present in the compressor. Refer to AE bulletin for more details. Lockout: Appears when 10 consecutive locked rotor trip alarms occur.	<ul style="list-style-type: none"> Motor rotor is mechanically seized. Excessive current present in the compressor. Damaged valve plates in cylinder head. 	<ul style="list-style-type: none"> Check that motor voltage is adequate (\pm 10% of nominal rated voltage), especially during the starting event. Start compressor with no load. If it does start with no load, inspect the valve plate(s) for damage or look for other causes of leak-back.
7 Missing phase	Trip: Appears when there is a missing phase / single phasing. Lockout: Appears when 10 consecutive missing phase trip alarms occur.	<ul style="list-style-type: none"> Loose wiring connections at the terminals inside compressor T-Box. Worn out contactors. Line break in one of the phases. 	<ul style="list-style-type: none"> Check voltage supply from the main power buss. Check voltage into and out of contactor. Repair or replace contactor if necessary. Check that motor electrical connections are tight at the compressor motor terminals.

Flash code	Alarm conditions	Possible failure reasons	Troubleshooting measures
8 Low voltage	<p>Trip: Appears when there is a low compressor voltage.</p> <p>Lockout: Appears when 10 consecutive low voltage trip alarms occur.</p>	<ul style="list-style-type: none"> ▪ Supply voltage is not in the specified range. ▪ Loose wiring connections at the terminal plate. ▪ Worn out contactors. ▪ Faults with other peripheral electrical loads. 	<ul style="list-style-type: none"> ▪ Check voltage supply from the main buss. ▪ Check voltage into and out of contactor. Repair or replace contactor if necessary. ▪ Measure voltage at the compressor terminal. ▪ Check that motor electrical connections are tight at the compressor. ▪ Check that there are not any faults with other peripheral electrical loads (for example fan motors).
9 Voltage imbalance	<p>Trip: Appears when the voltage imbalance value exceeds the set value (default 5%).</p>	<ul style="list-style-type: none"> ▪ Loose wiring connections at the compressor terminal plate inside T-Box. ▪ Worn out contactors. ▪ Faults with other peripheral electrical loads. ▪ Single phasing conditions. 	<ul style="list-style-type: none"> ▪ Check voltage supply from the main buss. ▪ Check voltage into and out of contactor. Repair or replace contactor if necessary. ▪ Measure voltage at the compressor terminal. ▪ Check that motor electrical connections are tight at the compressor. ▪ Check that there are not any faults with other peripheral electrical loads (for example fan motors).