

BASIC KNOWLEDGE

ELECTRICAL ENGINEERING IN REFRIGERATION

Refrigeration systems contain many electric components, such as compressors, pressure switches, thermostats, fans, control valves or controls. Therefore, electrical engineering is an important part of refrigeration. This is reflected in the high share of electrical engineering content in the training of the technicians engineer for refrigeration. The technicians engineer for refrigeration should be capable of planning, installing and commissioning electrical systems.

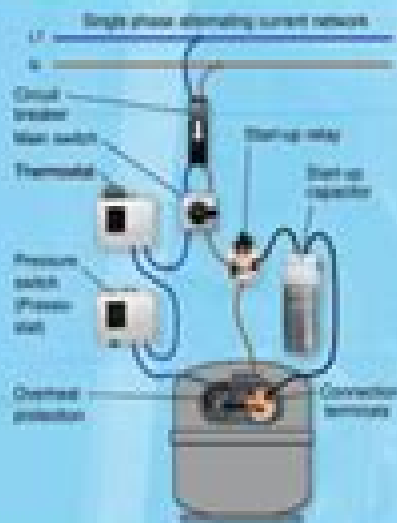
In the service field the testing, fault finding and repair of electrical systems is also an important task. During service jobs are often confronted with incomplete documentation, which is why the technicians engineer for refrigeration must be able to analyse the system and components in operation. This requires a good basic knowledge of electrical engineering.

Electric connection of a refrigerant compressor to the alternating current network

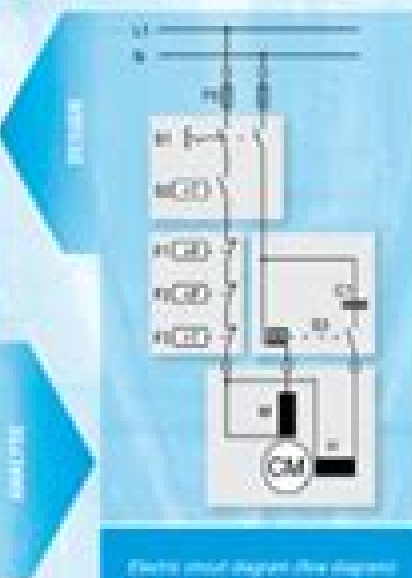
The connection of a refrigerant compressor and its protective elements to the single phase alternating current network is part of the standard activities of the technicians engineer for refrigeration. This task requires the correct preparation of an electric circuit diagram (flow diagram) and the practical wiring of the electrical components in the refrigeration system.

The wiring of the compressor UM consists of three functional groups:

- Control, consisting of main switch S1 and thermostat S2
- Safety module, consisting of pressure switches (Pressurestat) P1, P2 and overload protection of the compressor P3
- Start-up circuit, consisting of the start-up relay S3 and start-up capacitor C1



Electrical components



Electric circuit diagram (flow diagram)
S1 main switch, S2 thermostat
P1 pressure switch, P2 pressure switch,
P3 overload protection, S3 start-up relay
C1 start-up capacitor, CM motor
M main winding, F auxiliary winding

Start-up circuits for single phase compressor motors

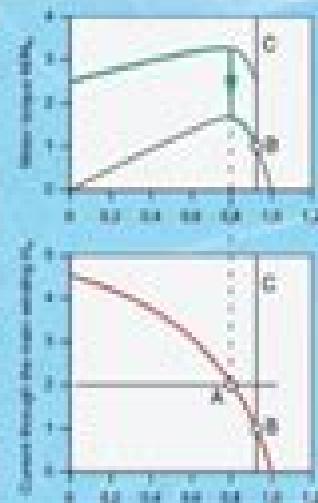
Drive motors for refrigerant compressors require a high start-up torque. For low compressor capacities single phase alternating current motors are used as drive motors. These are of simple design, maintenance-free, cheap and can run inside the refrigerant (hermetic compressor).

Due to their principle of operation these motors do not have any or only a low torque at rest. To increase the torque the motors must be equipped with a start-up circuit. Here an auxiliary winding is additionally supplied with current via a capacitor until the operating speed is reached. The automatic switching on and off of the auxiliary winding can be implemented via different options.

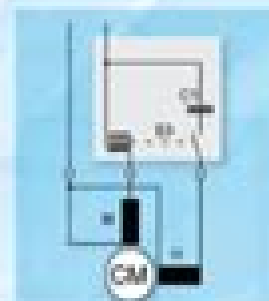
The most common is a start-up relay whose winding is connected in series to the main winding. When starting the motor a very high current first flows through the main winding, the start-up relay responds and activates the auxiliary winding via the capacitor. Once the motor has reached its speed, the current through the main winding drops. If the current falls below a certain value, the relay is released and the auxiliary winding is deactivated.

The switching of the auxiliary winding can also take place via a centrifugal force switch directly dependent on the speed. In some motors the auxiliary winding is permanently activated via an operating capacitor. Here a second start-up capacitor is connected in parallel during start-up to increase the torque.

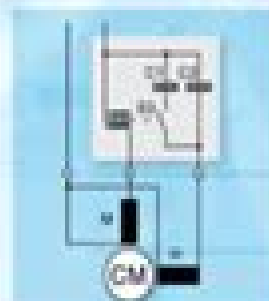
Another particularly wear-free method is the use of a PTC element. This heats due to the current flowing in the auxiliary winding and increases its resistance. This reduces the current through the auxiliary winding after a brief period of time.



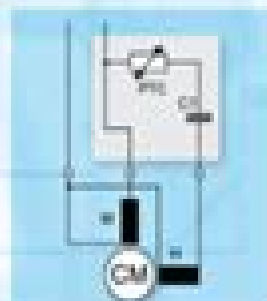
Start of a single phase alternating current motor with auxiliary winding
auxiliary winding is switched off at $i = 2 I_N$
 I_N nominal current, I_A start-up current
 I_A start-up current
A switching point, B operating point
C $n/n_0 =$ nominal speed



Start-up capacitor C1 via start-up relay S3



Operating capacitor C2 and start-up capacitor C1 via start-up relay S3



Start-up capacitor C1 via PTC

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**United States. Department of Defense.
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Refrigeration Engineering, 1928 English abstracts from Kholodil naia tekhnika Basic Information Sources on Electrical and Gas Appliances, 1954 **A Guide to Educational Programs in Noncollegiate Organizations** University of the State of New York. Office on Noncollegiate Sponsored Instruction, American Council on Education. Project on Noncollegiate Sponsored Instruction, 1976 *The 1984 Guide to the Evaluation of Educational Experiences in the Armed Services* American Council on Education, 1984 *The 1980 Guide to the Evaluation of Educational Experiences in the Armed Services: Army* American Council on Education, 1980 **Report, Basic Facts about Military Service** United States. Department of Defense. High School News Service, 1974 **Resources in Education**, 1990-04 The Electrical World and Engineer, 1903 People's Daily Graphic Sam Clegg, 1984-06-09 Decisions and Orders of the National Labor Relations Board United States. National Labor Relations Board, 1987 Veterans' Education and Employment Assistance Act of 1976 United States. Congress. Senate. Committee on Veterans' Affairs. Subcommittee on Readjustment, Education, and Employment, 1976 **Journal of the American Institute of Electrical Engineers** American Institute of Electrical Engineers, 1925 Includes preprints of Transactions of the American Institute of Electrical Engineers ISSN 0096 3860

Popular Mechanics, 1966-03 Popular Mechanics inspires instructs and influences readers to help them master the modern world Whether it s practical DIY home improvement tips gadgets and digital technology information on the newest cars or the latest breakthroughs in science PM is the ultimate guide to our high tech lifestyle Government and the Food Industry: Economic and Political Effects of Conflict and Co-Operation L. Tim Wallace, William R. Schroder, 2012-12-06 This book s purpose is to shed light on the threats and opportunities arising from the incentives and restrictions of governmental actions which food industry managers discover in their search for profits The food industry as defined here includes farmers their input suppliers processors and distributors This text explores how the private sector reacts to the stimulus of public support measures rules and regulations which are usually motivated by entirely different ends than those desired within the private sector No current single model of economic behavior as yet adequately encompasses or quantifies these complex vectors and forces Management is comprised of many factors most of which can be identified ex post but few of which can be appraised precisely ex ante The perceptual processes by which managers respond to governments are influenced by culture aptitudes individual and collective goals details of most government business relationships are discussed Few openly since management and government officials are understandably often reluctant to share the decision tree route by which trust is built and understandings are negotiated Our text differs from others in that we combine both a theoretical and experiential approach to the subject The insights provided by the case study material give a more macro and yet realistic view than tha t usually offered elsewhere We indicate the risks and dynamics of the situations faced by management while also showing the importance and strategic relevance of a solid analytical foundation for managerial purposes General Motors Engineering

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