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## Book Descriptions:

# compressor application manual

This may be an expansion valve or capillary tube. In capillary equipped circuits, the pressures on the suction and discharge sides are equal when the compressor is stopped. In this kind of circuit, the compressor is equipped with a low starting torque motor. In an. For each problem presented, you will find its possible causes marked with a . The problems are listed in the upper part of the table. Follow the arrows and you will find a on each possible cause. In the same line as each cause you will find the number of the item related to the necessary actions to correct the problem. Look. POSSIBLE CAUSE Wrong connection in connection box first in 1st column. STEPS Item 2.2. When looking for this item in the Manual you will find Check the connections with the help of the refrigerators electrical diagram. If the connections are correct, go back to the table and you will find another in the 1st column. This will be another possible cause of the problem Thermostat does not switch off. You will find the step to take in the same line item 4.3. Look in the Manual under this. To eliminate the problem of voltages above 132 V 115 V nominal and 240 V 220 V nominal we recommend the use of a voltage stabilizer. 1.1.2 Very low voltage at power supply To eliminate problems of voltages below 103 V 115 V nominal and 198 V 220 V nominal, at the end of the Manual we recommend the use of a voltage stabilizer. Prices are indicative only and may vary by country, with changes to the cost of raw materials and exchange rates. Hermetic compressor IV. Diagnosing the problem V. Procedure for changing the hermetic compressor VI. Further important recommendations VII. Further information Compressor Application Manual 1 Since its incorporation in March 1971, Embraco has been doing its utmost to keep an ever closer relationship with its customers. <http://al-bandak.com/userfiles/7b92a-manual.xml>

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This relationship has been translated in its commitment to continuously provide timely technical information that contributes further to the professional knowhow of our refrigeration professional partners. The purpose of this Manual is to facilitate your work. It is a valuable aid to solving problems in the refrigeration system. You will find that you rarely need to change a hermetic compressor. Generally the faults are in other parts of the system. If, however, you do need to substitute the compressor, this Manual will help you do so step by step, even if you do not have all the equipment. The Manual also gives some tips on how to prolong the working life of the hermetic compressor. The information is easy to understand and useful. Always keep this Manual in your pocket. Wishing you success in your work. For further information, consult our site on the Internet, at the following address Compressor Application Manual 3 The fluid is compressed by the compressor and moves to the condenser. In the condenser the refrigerant fluid under high pressure releases heat to the environment and becomes liquid. The next component of the circuit is the control device, which may be a capillary tube or an expansion valve. The control element reduces the pressure of the liquid refrigerant which was formed in the condenser. This drop in pressure permits the refrigerant to evaporate at low temperatures and return to the gaseous state when passing through the evaporator. The change from a liquid to gaseous state requires heat. So the refrigerant fluid removes the heat from inside the refrigeration system through the evaporator. The condenser releases this heat into the environment. The control element offers a certain resistance against the refrigerant's circulation, separating the high pressure condenser from the low pressure

evaporator side. The refrigeration system also uses a filter drier with desiccant to retain any water that may be left in the system. <http://doradong.com/fckeditor/editor/filemanager/connectors/php/fckeditor/upload/202009/7b53an-manual.xml>

The oil cooling tube that exists in some compressors is used to help reduce the compressor temperature. Lastly, there are systems that use a suction accumulator to evaporate any residual liquid refrigerant, stopping it from returning through the suction line. Compressor Application Manual 5 Its function is to circulate the refrigerant fluid inside the circuit. 1 Use of compressors The choice of a compressor for certain refrigeration equipment depends on the following factors Control Device As mentioned above, every refrigeration system needs a control device. This may be an expansion valve or capillary tube. In capillary-equipped circuits, the pressures on the suction and discharge sides are equal when the compressor is stopped. In this kind of circuit, the compressor is equipped with a low starting torque motor. In an expansion valve circuit, however, refrigerant only flows through the valve when the compressor is switched on. So, the pressure between the suction and discharge are not equal when the compressor is stopped. In this case, the compressor is equipped with a high starting torque motor. 6 Compressor Application Manual Commercial food counters, soft drink machines, Refrigerated food counters and displays and walk-in refrigerators HST compressors may be used in systems using LST capillary tube compressors when the off cycles are shorter, not permitting equal equalized pressures. However, LST compressors cannot be used in expansion valve systems Evaporation temperature Another factor influencing the choice of the compressor is the evaporator temperature range required by the system. We now point out two extreme situations Freezers that work at low temperatures, varying between 25 °C 13 °F and 35 °C 31 °F. Compressor Application Manual 7 III Heat absorption by the refrigerant will depend on the evaporator temperature. A certain pressure corresponds to a certain temperature in the evaporator.

The gas density is higher at low temperatures and, therefore, only a small quantity of heat may be absorbed during evaporation. If there is evaporation at a higher temperature, for instance, 0 °C 32 °F, the pressure and density will increase and more heat will be absorbed. For this reason, we can conclude that the work required by the motor in a compressor for a high evaporation temperature will be more than that required by the same compressor at a low evaporation temperature. Consequently, motors to be used in high evaporation pressure systems must have a higher operating torque. The compressors can be classified according to their use as follows HBP High Back Pressure High evaporation temperature MBP Medium Back Pressure Medium evaporation temperature LBP Low Back Pressure Low evaporation temperature 8 Compressor Application Manual As you know, the compressors operating conditions can vary according to each design. These compressors differ from each other inside motor, pump, oil type, displacement, etc. in order to provide the best performance and guarantee a highly reliable product. Compressor Application Manual 9 III Figure 2 Compressor label Figure 3 Compressor label for R 600a refrigerant fluid Figure 4 Compressor label for R 134a refrigerant fluid Since September 1997, Embraco has approved some refrigerant blends to be used in its compressors and only those with the respective label will be suitable for the blends. The blends approved to be used in the Embraco compressors are FX 56, MP 39, MP 66 and ISCEON 49. Attention Blends approved only for use with the R 12 compressors Figure 5 Label for Compressors that can use blends 10 Compressor Application Manual The following table shows the most frequent failures in a refrigeration system and their possible causes. For each problem presented, you will find its possible causes marked with a . The problems are listed in the upper part of the table.

Follow the arrows and you will find a on each possible cause. In the same line as each cause you will find the number of the item related to the necessary actions to correct the problem. Look in the Manual for the item corresponding to that action and proceed with care. Compressor Application

Manual 11 IV POSSIBLE CAUSE Wrong connection in connection box first in 1st column. STEPS Item 2.2. When looking for this item in the Manual you will find Check the connections with the help of the refrigerators electrical diagram. If the connections are correct, go back to the table and you will find another in the 1st column. This will be another possible cause of the problem Thermostat does not switch off. You will find the step to take in the same line item 4.3. Look in the Manual under this item and the step will be there Check if the thermostat bulb is correctly installed. Turn the thermostat button to the lowest point least cold and check if the compressor disconnects. If the problem continues, substitute the thermostat. If necessary, you will also find other possible causes for the problem, always accompanied by the necessary steps. Try for yourself. You will see that it is much easier than it looks. 12 Compressor Application Manual When the compressor does not start, the problem can be solved most often by using the right starting capacitor Very high voltage To eliminate the problem of voltages above 132 V 115 V nominal and 240 V 220 V nominal we recommend the use of a voltage stabilizer. 2 Electrical Parts Interrupted electric cable or wiring Using a test lamp or ohmmeter, check if the cable or wiring is not interrupted. Also check the plug. Compressor Application Manual 15 IV Wiring or electrical components touching metal parts Check if there is a fault in the insulation of an electrical component that is touching metal parts.

<https://johannstraussensemble.at/images/cambridge-audio-a500-user-manual.pdf>

Correct the defect Electrical components interrupting the current flow to the compressor Defect in such components as thermostat, auxiliary transformer, timer, etc. Check Internal light does not switch off Check if the light switch has a problem, such as a poor contact, incorrectly installed, etc Inadequate transformer Check if the transformer is the one specified in the table in Chapter VI, item Inadequate Grounding Electrical discharge Check the ground connection. If necessary, redo the grounding. 16 Compressor Application Manual If the compressor starts, substitute the thermostat Thermostat does not switch off Check if the thermostat bulb is correctly installed. Turn the thermostat button to the minimum least cold and check if the compressor disconnects. If the problem continues, substitute the thermostat Thermostat adjusted to the maximum coldest Turn the thermostat button to the minimum least cold and check if the compressor disconnects within the range of use. Regulate the thermostat and instruct the user how to use it correctly Thermostat adjusted to the minimum least cold Regulate the thermostat to the correct position and instruct the user how to use it correctly. Compressor Application Manual 17 In any case, please check whether the thermostat is correctly installed. IV Thermostat with loose bulb Correctly install the thermostat bulb Thermostat with incorrect bulb position Install the bulb according to manufacturers specifications Thermostat with failure or irregular operation Substitute the thermostat Inadequate thermostat Check if the thermostat model used is recommended by the manufacturer. If necessary, consult the manufacturer of the refrigeration system. 5 Thermal Protector Incorrect overload protector Check if the overload protector is as recommended. If not, change the start relay and protector kit for that specified. If necessary, consult the authorized wholesaler or Embraco. 18 Compressor Application Manual.

<http://kansascreative.com/images/cambridge-audio-a1-service-manual.pdf>

In case of damage or no current, substitute the 4TM protector fig. 8. Figure 84 TM thermal protector Compressor Application Manual 19 22 6 Start Relay Remove the compressor relay, check to see if the start relay is to specification. This connection must be made through the start capacitor. If not, change the relay Figure 11 Short F and PW relay Figure 12 Long F and PW Relay With the relay in the vertical position, coil upwards, check if there is continuity between relay terminals 10 and 11. If there is, change the relay and repeat item Figure 13 Short F and PW Relay Figure 14 Long F and PW Relay 20 Compressor Application Manual 23 IV EM electromechanical relay With the relay in any position, check if there is continuity between relay terminals 1 and 2. If not, change the relay Figure 15 EM relay Figure 16 EM relay With the relay in the vertical position, relay coil upwards,

check if there is continuity between relay terminals 1 and 3. If not, change the relay and repeat item With the relay in the vertical position, coil downwards, check if there is continuity between terminals 1 and 3. If there is, change the relay. Electrical Bridge Figure 18 Standard starting relay Figure 19 With capacitor 22 Compressor Application Manual 25 IV 7 Starting Capacitor Incorrect starting capacitor Check if the capacitance and voltage values are suitable for the compressor. Consult the Embraco Compressor Application Table or the manufacturer of the refrigeration system. If the capacitance value is wrong, change the capacitor for the one recommended. Faulty starting capacitor Check that the voltage in the output is the same as that showing on the capacitor. Caution Do not touch the terminals of a charged capacitor. This could be fatal. Figure 20 Starting Capacitor Next, connect the capacitor in series with a test bulb and observe normal luminosity of the bulb faulty. Capacitor plates shortcircuiting. Capacitor plates open.

If the capacitor leaks or has a crack, it must be changed. Compressor Application Manual 23 26 8 Pipes and Components Condenser improperly fixed metal tubes touching With the compressor in operation, check the metal parts in contact. For example, the capillary touching the filter dryer, condenser incorrectly installed in the cabinet etc. fig. 21. IV Partial blockage in tubes Blocked tubes generally occur as a result of incorrect brazing excessive additional material, solid particles from deterioration of the filter drier desiccant or excessive bending in the tube. Thorough investigation is required to solve this kind of problem. Warm this point and check if the refrigerant fluid starts circulating. If so, it is a sign that there is water in the system. In this case, you must remove the water from the circuit replace the filter drier and put in a new refrigerant fluid charge. See the necessary procedures for changing the hermetic compressor from page 34 onwards in this Manual. IV 9 Noise caused by other Components or Problems Incorrect leveling of refrigerator or compressor base If there is a noise, check if it disappears when the refrigerator is leveled Noise caused by other components Check if the noise starts in components such as fan, thermostat, transformer, voltage stabilizer, etc Compressor touching the wall or cabinet If the compressor is in one of those conditions, its vibrations can become noisy. Move the compressor away and the noise should disappear Poor Door Sealing Door or packing Check to see if the door is fitting badly or if the gasket rubber sealing strip of door is damaged, unglued etc. The refrigeration system loses its performance when in the aforementioned situations. Figure 22 Kitchen 12 Very High Relative Humidity over 85% Climatic conditions Explain to the customer that this is not a defect in the refrigerator but a characteristic of the regional climate.

Compressor Application Manual 27 30 13 Refrigerator without Freezer Tray Missing or wrong use of the tray Check if the dividing tray is being used and if it is installed correctly in singledoor refrigerators. IV 14 Refrigerator Used in Excess Frequent door opening Instruct the user not to open the door so frequently Refrigerator Used Incorrectly Lack of internal air circulation Instruct the user not to use plastic towels on the shelves, nor use the tray deflector in the defrosting position, etc Thermal Insulation Wet insulation glass wool Discover where the water enters and correct it Deterioration of or no heat insulation Locate and substitute or complete the thermal insulation. 28 Compressor Application Manual 31 IV 17 Refrigerant Fluid Expansion of refrigerant in evaporator Explain to the customer that it is normal that there is a certain noise when expansion occurs. The noise level varies according to the type of evaporator and refrigerator Excess refrigerant fluid charge in the refrigerator Check if there is condensation on the suction line, outside the cabinet. If so, install the correct refrigerant fluid charge No refrigerant fluid charge An irregular layer of ice forms in the evaporator. Install a new refrigerant fluid charge in the system Leakage of refrigerant fluid Check the leakage point, remove it or change the part. Install a new refrigerant fluid charge Use of Expansion Valve High starting torque Check if the refrigeration system uses an expansion valve. IV 19 Compressor Compressor connected to a voltage different from the one specified Use a transformer or change the compressor Compressor winding interrupted or burned out With the help of an ohmmeter, measure the main and auxiliary coil resistances. The ohmic resistance can vary 8%

one way or the other. If there is no ohmmeter available, then use a test lamp and check if there is any break in the coil. Place the test ends on the main and auxiliary terminals.

If the lamp does not light up in either case, change the compressor. Figure 23 Compressor Coil Test 30 Compressor Application Manual 33 IV Compressor with current leakage to the housing Connect the megohmmeter terminals to the common pin of the hermetic terminal and grounding terminal of the compressor. If there is no megohmmeter, use a test lamp as follows connect one of the test points to the common pin of the hermetic terminal and another to the grounding terminal of the compressor. If the bulb lights up, change the compressor. P A If the lamp lights up in any of the cases the compressor must be changed. If so, loosen them, otherwise this detracts from the vibration damping. IV Bolt Nut Rubber dampers Washer Sleeve Compressor base Cabinet base INCORRECT CORRECT Figure 25 Rubber Dampers Compressor inadequate for the system Consult the Embraco Compressor Application Table. Change the compressor for the right model Compressor with low capacity This defect is not common. If you are not absolutely sure whether this is the defect, move on to the other possible causes. If none apply, then change the compressor. 32 Compressor Application Manual 35 IV. Compressor with internal noise If the noise continues after analyzing all the aspects described above, it might come from the compressor. Important In this case, change it. Do not mistake noises inside the compressor with noises from the refrigeration system see items 8.1, 9.1, 9.2 and 9.3 Compressor locked stalled Check all possible causes described above. If necessary, change the compressor.! Important Compressor with high amperage high current Check all possible causes described above. If necessary, change the compressor.

We can only consider high amperage if the thermal protector is working Compressor Application Manual 33 36 Procedure for changing the hermetic compressor V After completing all the analyses on possible faults in the refrigeration system, you will be able to decide whether the compressor really needs to be changed or not. Before starting the change process, you must be sure that a compressor model is available with identical characteristics to the original system, refrigerant and compatible filter drier, in addition to the proper tools and equipment. When it is not possible to identify the compressor to be substituted, the new compressor may be chosen with the help of the Embraco Application Table or from information with the refrigerators manufacturer. Don t Forget Before choosing the compressor, check the original refrigerant of the system and follow the instructions below. Original System R 12 R 134a R 600a Recommendation R 12 R 134a R 600a Alternative Blends With regard to the use of hermetic compressors, extra care must be taken because this is a special component consisting basically of an electric motor, mechanical kit compression pump, lube oil and the body with the whole hermetic kit sealed. 34 Compressor Application Manual 37 V The compressor must not be switched on without its being properly installed in the refrigeration system. When buying a new Embraco compressor, do not do unnecessary tests. The factory has already tested it, as you can see in the guarantee seal accompanying it. Only remove the plugs from the compressor tubes at the time when it is installed in the refrigeration system. Connect the perforating valve to the recovery equipment that is then connected to the receiving cylinder. Now just connect the recovery equipment. Open the receiving cylinder valve and then the perforating valve. It is very important to keep the recovery equipment operating as long as it is necessary to collect all refrigerant.

The duration of this process will depend on the equipment used and refrigeration system. Preferably, during the removal of the capillary, make nitrogen circulate to prevent the capillary end from blocking up. After cooling, close off the end of the capillary tube with a rubber plug. V Important comments Another procedure that normally prevents blocking the capillary is to remove the end that had been brazed to the filter drier. Using a file, make a small groove around the capillary and bend it until it breaks. Nevertheless, in cases of successive reoperations of the same system, the shortening of the tube will significantly alter the capillary flow and jeopardize the performance of the



refrigeration system. When removing the filter, you must not heat it unnecessarily otherwise water retained in it will enter the system piping. Emission of CFCs R 12, R 11 etc. into the air affects the ozone layer. Until a more effective solution appears for collecting, recovering, recycling and neutralizing the harmful effect of the refrigerant, please attempt not to release CFCs into the environment. Proper equipment is 38 Compressor Application Manual 41 V available for refrigeration professionals to recycle used refrigerants. More information may be obtained from the refrigerant wholesalers. Never use alcohol or other byproducts as a solvent. They cause corrosion on the compressor tubes and metallic parts and the electric insulation becomes brittle. Only use filters with desiccants suitable for the type of refrigerant see table 2, Chapter VI. 4 How to Clean a used Refrigeration System Not all compressor changes require cleaning the low and high pressure tubes. Cleaning is recommended in cases where it is suspected that there are high levels of contamination of water and residues resulting from the burnout of the compressor winding. In these cases In R 12 systems, you should make the actual R 12 or R 11, or the degreaser R 141b, or VERTREL XF circulate when it is liquid.

In systems operating with R 134a, you may use the R 141b degreaser or VERTREL XF for cleaning. To protect the environment and reduce expenses when changing compressors, fluid for cleaning the units components must circulate in closed circuits. At this stage when changing the compressor, the return line shall be disconnected from the compressor and the capillary disconnected from the filter drier. Compressor Application Manual 39 42 To complete the cleaning operation, proceed as follows Place a fast coupling on the return line and connect it on the cleaning machines outlet side; Connect the capillary to the cleaning machine s suction side, leaving it operating for around 15 minutes; Blast some nitrogen into this circuit to remove any cleaning fluid residue. Lastly, the condenser. Important must be cleaned. To do so, you must repeat the previous operation, connecting one end of the condenser to the outlet side and the other to the cleaning machines suction tube. V If it is not possible to use a blowtorch with proper capacity to braze the oil cooler tubes TRO in the systems tubes, proceed as follows before placing the compressor in the refrigeration system, tip it to the opposite side from the TRO, braze approximately 50 mm 1.97 copper tube at each end of the TRO. With the TRO extended, it will certainly not be difficult to braze it onto the systems tubes. 5 Installation of filter drier Make a small bend in the capillary to prevent it from going too far into the filter, approximately 15 mm 0.59 ; Using a clamp, open up the two sides of the filter drier when brazing. Important Only use filters that contain molecular sieve desiccants inside. Figure 27 Capillary tube 15 mm 0.59 Figure 28 Inserting the capillary into the filter drier 40 Compressor Application Manual 43 V Braze the filter into the condenser and capillary. Do not unnecessarily heat the body of the filter dryer, and take great care not to block the tubes.

Install the fast coupling to make a vacuum on the high pressure side; The filter dryer must be installed in the vertical position with the capillary at the bottom see figure 29. This position prevents the desiccant grains from rubbing and releasing residues. It also helps equalize a pressure faster capillary systems.! Important Condenser If the refrigeration system has not been designed to use the compressors oil cooling tube TRO, do not forget to connect it. Otherwise the compressor will have a shorter working life. Filter Drier! Important Brazing Do not forget to clean the surface to be brazed well. Remember blockage of the outlet tube will damage the compressor valve system. Capillary Figure 29 Filter Drier The system is now ready to receive the new compressor. Install it in the correct position and fix it to the base. Braze the suction and discharge tubes to the respective compressor tubes. Also braze a tube of approximately 100 mm 3.94 to the process tube. Compressor Application Manual 41 44 At the other end of this tube, install a fast coupling or similar register to make the vacuum and gas charge. 6 Caution with Vacuum and Refrigerant Fluid Charge Never use the new compressor as a vacuum pump. It may absorb dirt and water from the tubes, which will be detrimental to its operation and working life. Now, with alternative refrigerant fluids, it is even more important to proceed correctly and use proper equipment for this operation. Example a system with

an internal volume of liters normally operates with grams ounces of R 12 refrigerant. 42 Compressor Application Manual 45 V With R 600a, the systems in this range of inside volume may only have grams ounces, that is, approximately 40% of the R 12 charge. In relation to the original charge with R 12, the R 134a refrigerant fluid charge is approximately 90% and blends 80%. If the system does not have this data, consult the manufacturer.

Compressor Application Manual 43 46 If you are using scales and chargereceiver cylinder a Weigh the empty cylinder. With the compressor switched off, open the register until the quantity stipulated by the manufacturer flows out or until the pressures in the refrigeration system cylinder are equal. If it equalizes before the charge is 44 Compressor Application Manual 47 V! Caution The system must be accompanied for the first hour after starting up. If it is not possible to increase the pressure in the charge cylinder through the resistance, you may lock the register of the charge cylinder, switch the compressor on and then slowly open it until the correct refrigerant charge is transferred. This operation requires that the refrigeration professional takes great care. In the case of excessive refrigerant fluid, the compressor may draw in the liquid refrigerant fluid and break the cylinder joints or other components. 2 1 Any fault will detract from the systems good performance Closing the sealed unit a With the compressor connected, flatten the process tube as close as possible to the fast coupling 1. Next, again flatten it, keeping the pliers fixed to the tube 2 and switch the compressor off. If not, solder the end of the tube. Remove the pliers and check to see if there is no leakage. Compressor Application Manual 45 48 Further important recommendations VI 1 Embraco Compressor Tubes The drawings and tables in the sequence show the position, diameters and tube material of the compressors. In PW and FF compressors this inversion is permitted. See the following table VI Refrigerant Recommended Filter Drier R 12 R 134a R 600a Blends XH5, XH6, Universal MS594 XH7, XH9, Universal MS594 XH5, XH6, Universal MS594 XH9, Universal MS594 3 Start Capacitor EMBRACO compressors with an LST motor were designed to work without a start capacitor, under normal conditions of use.