

File Name: compressor design manual.pdf Size: 2634 KB Type: PDF, ePub, eBook Category: Book Uploaded: 3 May 2019, 20:21 PM Rating: 4.6/5 from 783 votes.

Status: AVAILABLE

Last checked: 5 Minutes ago!

In order to read or download compressor design manual ebook, you need to create a FREE account.

Download Now!

eBook includes PDF, ePub and Kindle version

<u> Register a free 1 month Trial Account.</u>

Download as many books as you like (Personal use)

Cancel the membership at any time if not satisfied.

Join Over 80000 Happy Readers

Book Descriptions:

We have made it easy for you to find a PDF Ebooks without any digging. And by having access to our ebooks online or by storing it on your computer, you have convenient answers with compressor design manual . To get started finding compressor design manual , you are right to find our website which has a comprehensive collection of manuals listed.

Our library is the biggest of these that have literally hundreds of thousands of different products represented.

×



compressor design manual

To browse Academia.edu and the wider internet faster and more securely, please take a few seconds to upgrade your browser. You can download the paper by clicking the button above. Related Papers Compressor Handbook Principles and Practice By Morteza Nejad Surface Production Operations Volumen 2, 2nd Ed By Abo Mohammed Reciprocating Compressors for Petroleum, Chemical, and Gas Industry Services By Kevin Steven Salvador Infantes Fans, Pumps, and Compressors By Jan Kowalski Forsthoffers Rotating Equipment Handbooks Vol. 1 Fundamentals of Rotating Equipment By Felix L I P H W A N Munthe READ PAPER Download pdf. Updated daily.Updated daily.A wide variety of air compressor design manual options are available to you, such as manufacturing plant, hotels, and building material shops. You can also choose from 1 year, 2 years, and 6 months air compressor design manual, as well as from none, viet nam, and united states air compressor design manual, and whether air compressor design manual is online support, free spare parts, or video technical support. There are 354 suppliers who sells air compressor design manual on Alibaba.com, mainly located in Asia. The top countries of suppliers are China, Japan, from which the percentage of air compressor design manual supply is 97%, 2% respectively. Suppose a 50mile liquid pipeline requires an origin pressure of 1120 psig based on a terminus delivery pressure of 50 psig. If the delivery pressure is increased to 100 psig, the origin pressure will increase exactly to 1170 psig. In a gas pipeline, it is not so simple. The impact of changing the delivery pressure is not linear in the case of a compressible fluid such as natural gas. We will now explore the effect of changing the contract delivery pressure at the end of a gas pipeline. In a gas pipeline, the increase or decrease in the upstream pressure will not be proportionate from the nonlinear nature of the gas pressure drop. Consider the previous problem. http://elateridae.com/images/FCKeditor/ezw-t100-manual.xml

• compressor design manual, compressor design manual pdf, compressor design manual download, compressor design manual free, compressor design manual online.



All parameters in Case A are the same except for the delivery pressure, which is increased from 870 to 950 psig. The increased delivery pressure will cause the compressibility factor to change slightly because of the change in average pressure. This compares with a value of 1066 psig we calculated if the pressure variation were linear. In general, for a gas pipeline, if the delivery pressure is increased by P, the inlet pressure will increase by less than P. Similarly, if the delivery pressure is decreased by P, the inlet pressure will decrease by less than P. We will illustrate this using the preceding example. View chapter Purchase book Read full chapter URL Airflow Rate Evaluation David Mills, in Pneumatic Conveying Design Guide Third Edition, 2016 Supply Pressure The delivery pressure, or vacuum, required depends essentially on the working pressure drop needed over the length of the conveying pipeline. Consideration will also have to be given to the pressure drop in any air supply and extraction lines and to the need for a margin on the value of conveyingline pressure drop required to convey the material through the pipeline at the specified rate. The magnitude of the conveyingline pressure drop, whether for a positive or a negative pressure system, depends to a large extent on the conveying distance and on the solids loading ratio at which the material is to be conveyed. For shortdistance dilute phase conveying, a fan or blower would be satisfactory, but for dense phase conveying or longdistance dilute phase conveying, a reciprocating or screw compressor would be required. The pressure drop is also dependent on the conveying gas velocity and a multitude of properties associated with the conveyed material. View chapter Purchase book Read full chapter URL Control System Design In Lees Loss Prevention in the Process Industries Fourth Edition, 2012 13.19 Notation Section 13.6 P d delivery pressure P s suction pressure. P pressure drop Q gas flow Section 13.<u>http://genclergida.com/userfiles/eztrend-v5-manual.xml</u>

Foundation design for reciprocating compressors

Compressor operating frequencies are close to foundation natural frequencies which create resonant conditions. Use this design method to avoid operating scoblems

Suresh C. Arya and Roland P. Drewyer, The CE-Lummus Co., Houston, and George Pincus, University of Houston, Hous

n analytical procedure which provides a rational inducf evaluating the spring and damping constants for coreporation into lumped-parameter, mass-spring-dashpot forating systems. This method of approach has become be current state-of-the-art for the dynamic analysis of coriners reting on solik."

Superiors such as piono-type compresson and pumpi, sternal-combution engines and pumpi perdose recipionting locres. A single cylinder engine is induced by encoded the sternal sternal sternal sternal sternal is possible to select the size of the resulting unbalanced areas and and the sternal sternal sternal sternal cores are minimized that the resulting unbalanced areas are minimized to the primary frequency, either sternal s

Design ertterles. A: Vibration modes. A rigid block includation upporting a vibration an about ence up to six modes of vibration as about in Fig. 1 Three modes are translatory: the vertical, atomail: twisting (yaving), rocking and p modes are usually indepenvertical and the site of the site of the site of the vertical and the site or site of the site of the site of the modes. The vertical and the visiting motions are



9 f density function for a plant hazard occurring m number of equipments which must survive for trip system to survive n number of identical equipments P.In Bessarabov, D., Wang, H., Li, H., Zhao, N. Eds., PEM Electrolysis for Hydrogen Production Principles and Applications. This is evident from the numerous review publications e.g., Ursua et al., 2012; Carmo et al., 2013; Rashid et al., 2015; Babic et al., 2017; Feng et al., 2017, and industrial demonstration projects on the topic. Current industrial applications of PEM technology for powertogas will be discussed later in the book Chapter 4, PowertoGas, Volume 2. Some critical gaps that currently still exist in PEM water electrolysis development are discussed by Babic et al. 2017. These include issues associated with the selection of components, such as membranes, porous transport layers, and electrodes, as well as limitations associated with operating conditions, such as temperature, pressure, and current density. The tradeoff between lower areaspecific resistance and gas crossover is highlighted. Use of hydrocarbonbased membranes is discussed as one of the mitigation strategies to reduce gas crossover. It was pointed out that the hydrogen permeation rate as a function of current density is not yet fully understood. This will be discussed in further detail in Chapter 5, Gas Permeation in PEM Water Electrolyzers. A comprehensive review of PEM water electrolysis was also published by Carmo et al. 2013. It includes a detailed review of highpressure operation of PEM electrolysis. It is pointed out that an increase in the operating pressure results in higher thermodynamic voltages 100 mV every two orders of magnitude and that there is a slight improvement in overall cell efficiency, especially at high current densities Millet, 2011. One of the obvious advantages is that high discharge hydrogen pressure delivery allows direct storage of hydrogen in pressurized vessels.

It has however been pointed out that, with higher operating pressure, crosspermeation of gases may lead to new operating hazards. The cell voltage was expressed as the sum of the opencircuit voltage and of the overvoltages. An equivalent electrical circuit analogy was provided for the sequential kinetic and transport resistances. The model provides a relationship between applied terminal voltage of the electrolysis cell and current density in terms of Nernst potential, exchange current densities, and conductivity of polymer electrolyte. The overpotentials and resistances at the anode and cathode, and overpotential due to ohmic resistances, were individually analyzed; they were found to be in good agreement with experimental results. The reduction kinetics at the cathode was relatively fast, while the anodic overpotential was mainly responsible for the voltage drop. Datta et al. 2015 further improved a detailed lumpedparameter analytical model that took into account thermodynamics, electrode kinetics, proton transport, as well as hydrogen and oxygen crossover. In the review by Rahim et al. 2016, modeling activities in the area of PEM water electrolysis were reviewed. There it was pointed out that the diffusion overpotential, which is important for efficiency, was neglected in many models. It was suggested that more detailed studies are required on gas crossover and water mass transport. In the review by Olivier et al. 2017a, about 80 papers dealing with electrolysis modeling were reviewed. Multiphysics phenomena involved and the electrolysis stack were analyzed. These included electrical, thermal, fluid, and thermochemical domains. Empirical as well as analytical models were discussed. A structured classification based on established criteria is provided. This review highlights that electrolysis systems are characterized by complex and nonlinear models due to different energies coupling and nonstationarity and spatiotemporal dynamics.



http://www.jfvtransports.com/home/content/boss-dd-5-manual

Only a few models deal with a systemic approach; most about 90% focus only on stack description. One of the main conclusions was that much more development is still required in the modeling field, specifically, an understanding of phenomena, control design, system diagnostics, and prognostics Olivier et al., 2017a. Olivier et al. 2017b very recently presented a modeling tool based on the statespace representation of an electrolyzer system using a bond graph BG modeling approach. This method enables the integration of four levels of modeling using only one tool, specifically 1 the technological level, given by the term BG, which represents the architecture of the system in a modular fashion; 2 the physical level, using an energy description of the physical phenomena based on BG elements; 3 the mathematical level, which describes the system behavior by writing the constitutive equations of BG elements; and 4 the algorithmic level, indicating how the mathematical models are calculated. Furthermore, there are several factors responsible for degradation in PEM electrolysis components, e.g., strongly acidic and oxidation environment at the anode and due to PFSA membrane; high overpotential; operating conditions temperature, pressure cycles, current density, and power load cycles. All can significantly affect the degradation rate of components. Material choices also greatly affect the degradation rate of PEM water electrolysis. Water quality is also known as detrimental factor for degradation of PEM electrolysis systems. Feng et al. 2017 further provided a comprehensive review of degradation mechanisms for components such as the electrocatalyst and catalyst layer, membrane, bipolar plates, and current collectors.Much more details pertaining to the PEM water electrolysis will be provided in later sections. We now conclude this chapter and the historical background of water electrolysis with Table 2.

http://moskewicz.com/images/casio-5034-manual.pdf



3, by summarizing the key features of electrochemical water splitting technologies. Table 2.3. Key Attributes of Different Types of Water Electrolysis Some Comparison Attributes of Main Water Electrolysis Technologies Listed According to Technology Maturity Level Alkaline With Liquid Electrolyte Acidic With SPE PEM Solid Oxide With Oxygen Ion Conductor Alkaline With SPE AEM Maturity Commercial for largescale use; MWscale Commercial for smallscale use; MWscale demonstrated. Difficult to upscale due to material properties at high temperatures. Lifetime still needs to be determined. Membrane durability needs to be improved Advantage Proven technology for largescale production No liquid corrosive electrolyte. High discharge H 2 pressure. High current density demonstrated. Fast response to dynamic conditions. High efficiency. Various important coelectrolysis reactions are possible. View chapter Purchase book Read full chapter URL The application of the Universal Modeling Method to development of centrifugal compressor model stages Y.B. Galerkin, K.V. Soldatova, in 8th International Conference on Compressors and their Systems, 2013 INTRODUCTION Industrial centrifugal compressors are used in wide range of flow rates, delivery pressures and pressure ratio. Constructive limitations add diversity to compressor designs. In most cases compressor manufacturers develop new compressor flow paths as a sum of previously designed and tested model stages. Problem arouses if existed model stages do not correspond to necessary gas dynamic and constructive parameters, or to modern efficiency level. New model stage development is long and costly process 1. Russian and some foreign manufacturers invite TU Saint Petersburg Compressor Department to new compressor gas dynamic design when similarity theory cannot be applied. Therefore the programs are able to design any necessary flow path and calculate proper performance curves. Variants' comparison leads to flow path optimization.

http://most-trade.com/images/casio-5-alarm-watch-manual.pdf



Twodecade long design practice demonstrates consistence of Universal modeling. Several dozens of designs are realized, guaranteeing necessary delivery pressure at given flow rate without preliminary tests. The Authors analyzed algorithms and models of 4 th generation computer programs that were applied for design purposes. Some simplifications connected with low ability of old PC and incomplete modeling were responsible for modest results at offdesign flow rates. The algorithms and models were improved and realized in the computer programs of 5 th generation. The plant test data of 16 compressors were used to find new set of model empirical coefficients. The satisfactory modeling of performance curves in all performance range demonstrated validity of the new modeling instrument. The Authors suppose that good modeling of complete compressor performance curves means also that performance curve of its stages are predicted with acceptable accuracy. Altogether with known flow path shape and calculation method to predict similarity criteria influence the stages can be used in new designs the same way as traditional model stages are used. View chapter Purchase book Read full chapter URL Air Supply Systems David Mills, in Pneumatic Conveying Design Guide Third Edition, 2016 Staging Arranging two or more compressors in series, in order to achieve higher delivery pressures, is possible with most types of compressor, as mentioned earlier with respect to the staging of positivedisplacement blowers. To improve the efficiency of compression it is usual to cool the air between the stages. Because of the high delivery temperature of air from compressors, which is considered in detail below, this cooling is essential.

The lower volumetric flow rate of the air, as a result of the increase in pressure, and the reduction in temperature, will mean that the size of the next compression stage can be reduced, apart from improving conditions with regard to lubrication as a result of the lower air temperature. Intercooling by means of an air blast, or a waterbased heat exchanger, are the normal means of cooling the air between stages. With regard to the staging of positivedisplacement blowers, considered earlier, it was mentioned that water sprays could also be used. Some compressors, however, are susceptible to damage by water drops and so it is generally recommended that the air between stages should not be cooled to a temperature below that of the prevailing dew point. The elimination of water between stages will also minimize the problems caused by the possible rusting of materials in this area. However, in all applications, reliability and long life and high efficiency low power consumption are critical specifications. Similar to all rotating devices, bearing wear and friction needs to be

minimised by applying lowfriction and wearresistant coatings. Air preheat Air needs to be preheated to the operating temperature of the fuel cell. In high temperature fuel cells in particular the air stream is used for heatup of the stack and thermal management and thus is described in more detail in Section 2.5.3. View chapter Purchase book Read full chapter URL Biomethane injection into natural gas networks Wolfgang Urban, in The Biogas Handbook, 2013 16.3.2 Gas compression The design of the compressor depends on the grid pressure of the natural gas grid delivery pressure and the gas upgrading system inlet pressure. The higher the pressure difference the more power is necessary. The work the compressor must perform and therefore the cost of compression increases by the power of two of the pressure difference.

http://windcampus.com/wp-content/plugins/formcraft/file-upload/server/content/files/162850a07dd0 69---Burdick-atria-6100-service-manual.pdf

When selecting a suitable compressor for a feedin station, it should be noted that oillubricated compressors may contaminate the biogas. According to DVGW G 260 DVGW, 2008a, the biomethane must be technically free of oil vapor and dust. Oilfree compressors are thus preferred; although they are free of contaminants, more methane might be lost and equipment wear is distinctly higher. In many facilities, lost gas is returned to the biogas treatment facility. The efficiency of a dry running compressor is also lower. Furthermore, it should be noted that the compression of steamsaturated gas produces water, which must be removed. If higher pressure differentials are required, the compressor needs to be cooled. Depending on the end pressure, flow rate and initial pressure, onestage or twostage compressors can be used. Critical parameters for the selection of a compressor are volume flow and pressure after compression network pressure. Because only low volume flows are involved, screw or piston compressors are most often used. Screw compressors require less maintenance and are less susceptible to technical trouble than piston compressors, but they have distinctly higher capital expenditure and operating costs. The higher purchase price and operating costs of a screw compressor must be weighed carefully against the benefit of higher availability. If the biogas is fed into a highpressure transport network, twostage compression is usually necessary. In this case, a screw compressor can serve as the first compression stage and the second stage is provided by a piston compressor. View chapter Purchase book Read full chapter URL Optimizing and Uprating of Existing Systems David Mills, in Pneumatic Conveying Design Guide Third Edition, 2016 Control and Instrumentation Although reducing the speed of the blower can produce the additional benefit of a slight increase in delivery pressure, it is not very convenient in terms of control and gradual adjustment.

An offtake to atmosphere in the air supply line between the blower and the point at which the material is fed into the pipeline provides much more flexibility. This can easily be arranged by fitting a teepiece into the line, with a control valve on the offtake. If there is not already a pressure gauge on the air supply line, one could be fitted at the same time, as this will be needed to record the air supply pressure, or conveyingline pressure drop. If a rotameter, or some other form of airflow rate measuring device, is also fitted so that the air is discharged through it to atmosphere, a measure of the airflow rate discharged will be obtained as well. As many valves have nonlinear characteristics, a rotameter would be particularly useful in ensuring that the desired proportion of air was discharged. By this means it will be possible to exercise full control over the airflow rate and guite accurately determine the amount actually used for conveying. Once this offtake is installed, tests can be carried out on the plant with little disruption to production. In most plants the supply or receiving hoppers are mounted on load cells, or have some other weighing mechanism, and so material flow rates can be determined reasonably quickly and accurately, whether conveying is continuous or batchwise. By gradually opening the offtake valve, a number of tests can be carried out, and if the air supply pressure and the material flow rates are recorded for each test, it will be possible to construct a small part of the conveying characteristics for the material being conveyed. Depending on the

method of feeding the material into the pipeline, it may be necessary to make adjustments to the feed rate so that this can be varied as well. It is recommended that the amount of air bypassed to atmosphere should not exceed more than about 15% of the total supply from the blower at any one time.

When this point is reached, the speed of the blower should be reduced to match the reduced airflow rate required before discharging any more air to the atmosphere. This is necessary to prevent the possibility of a surge in material feed from blocking the pipeline. A momentary increase in material flow rate will demand an increase in pressure, and if the offtake valve is wide open, a much higher proportion of air will be lost than intended in the transient situation that follows. As a result the conveying line could be starved of air and the line could block. View chapter Purchase book Read full chapter URL Nonautomatic Control Elements D. GRAY B.SC, M.I.E.E., M.I.MAR.E., M.A.I.E.E.E., in Centralized and Automatic Controls in Ships, 1966 c Reducing Valves The reducing valve is a regulating device which serves to reduce the air pressure supply to the required delivery pressure. A typical example is shown in Fig. 8.3. FIG. 8.3. Pneumatic reducing valve. This particular design is constructed in two main sections; the upper portion which consists of a combined inlet and exhaust valve assembly and the lower portion which houses a diaphragm, the diaphragm spring and the spring adjuster. With the valve in the inoperative position the upper inlet ball is held off its seat by the effort of the diaphragm control spring upon the lower exhaust ball seat, which in turn closes the exhaust valve. When air is applied to the supply connection it flows past the inlet ball valve to the chamber surrounding the valve unit and thence to the delivery line. At the same time supply pressure is felt on top of the diaphragm. As the pressure increases so the diaphragm moves downwards, allowing the inlet spring to close the inlet ball valve, when balance is achieved between diaphragm spring force and delivery air pressure.

Should the supply air pressure increase above that called for by the valve setting, the diaphragm will be forced downwards against the control spring, taking with it the exhaust valve seat. Thus the excess supply pressure is vented to atmosphere through the slot in the control spring casing. If the delivery line pressure decreases the control spring will overcome the force of the air pressure on top of the diaphragm and the diaphragm plus exhaust seat will move upwards. This results in the inlet ball valve being unseated and further air supply can flow to delivery thus restoring the pressure to the desired value. View chapter Purchase book Read full chapter URL About ScienceDirect Remote access Shopping cart Advertise Contact and support Terms and conditions Privacy policy We use cookies to help provide and enhance our service and tailor content and ads. By continuing you agree to the use of cookies. Thats why were committed to offering you the most current information you need to wisely install, operate, and maintain yours. Call us to find your local office. By using our services, you agree to our use of cookies. You can find out more about cookies by clicking on the following link. Find out more about cookies. Allow all cookies. Chapters and subjects includeCall us to find your local office. By using our services, you agree to our use of cookies. If not, cu 1 of the actual component will be zero no inlet swirl. Multi stage These settings are used in further design steps and can be modified by selecting the Change settings button. Of course these default settings can be modified manually in the appropriate design steps. Main Dimensions are forming the most important basis for all following design steps. Secondary flows, separation and reattachment in boundary layers, transient recirculation areas and other features may occur.

Nevertheless it is useful and it is common practice in the compressor design theory to simplify the realistic flow applying representative streamlines for the first design approach. At Quincy Compressor, we make air compressors that are built to last. Watch our latest video to learn what can happen when you choose an air compressor provider that offers lowquality products and services. Save a buck today with Quincy Compressor. Canfor Southern Pine Find out how Canfor Southern Pine as improved their operation by switching to Quincy Compressor. In addition to continually

producing the most innovative products in our industry, a key reason for our longevity is our willingness to provide the best possible service to our customers. Whether you need the latest instruction manual, a performance data sheet or 24hour emergency service, Quincy compressor is committed to customer support. Our distributors have the knowledge and expertise to assist you with everything from choosing the best air compressor system design for your applications to providing valuable tips for keeping your air compressor in peak operating condition. Our distributors can also serve as your onestop source for air compressor replacement parts. And should your unit need repairs, your local Quincy distributor can get the job done quickly and affordably, while keeping costly downtime to a minimum. You'll come to view your distributor as a trusted advisor. Find a Dealer Instruction Manuals While all Quincy Compressor models are designed for simple operation, they are highly complex, technical machines that are not necessarily easy to understand. That's why we offer a wide assortment of air compressor manuals that include everything you need to know about our products. Review any Quincy Compressor manual to find air compressor diagrams, technical specifications, specific product features and benefits, easytofollow operating instructions and much more.

A "musthave" for any Quincy Compressor owner is the "All Quincy Products" brochure that provides a wealth of valuable information about our entire product line. Find A Manual Performance Data Sheets All applicable Quincy Compressor air compressors feature performance data sheets that include lots of relevant technical data about each model. You can download the performance data sheets at no cost. Download a Performance Data Sheet Material Safety Data Sheets MSDS Safety is of utmost importance in any industry, and the air compressor industry is no exception. That's why we provide our customers with easy access to material safety data sheets MSDS where applicable. MSDS sheets provide detailed information regarding hazard identification, appropriate first aid and firefighting measures, and how to protect your workers against the accidental release of toxic substances. You'll also learn the appropriate steps for safe handling and storage of lubricants and other potentially hazardous materials. As with our performance data sheets, you can download MSDS materials for free. Download a Data Sheet Parts Books You're bound to need replacement parts for your Quincy air compressor at some point. Our air compressor parts books are your onestop resource for all of your parts needs. You can quickly locate the right part for your compressor, as well as obtain parts ordering information. Find a Parts Book Contact Us With Questions About Any of Our Air Compressor Guides Feel free to contact your local authorized Quincy Compressor dealer if you have questions about any of our air compressor manuals. And if you can't find the information you need, just let us known and we'll be happy to assist you. All Rights Reserved. Website by Rokusek. Coventor is a device that repurposes the Bag Valve Mask manual resuscitator "Ambu bags", which are commonly used by paramedics and emergency medicine specialists in ICUs and ambulances.

This mechanical ventilator consists of a mechanism that can continuously compress and release a reservoir bag, and a control system to adjust the respiratory rate and limit the pressure of air pushed into patients. The design specifications package of this is now available for download at no cost.Please submit a request using this form. Upon submission, directions for obtaining the license and design package will be sent to you. These instructions are not meant to cover every possible condition and situation that may occur. We reserve the right to change this product at any time without prior notice.A copy of the sales receipt is required. TABLE OF CONTENTS RECOGNIZE SAFETY SYMBOLS, WORDS AND LABELS. 2 SERVICE. 6 PACKAGE CONTENTS. 6 COMPONENTS. 6 ASSEMBLY. 7 OPERATION. 8 MAINTENANCE. 10 PARTS LIST. 11 PARTS DIAGRAM. 11 RECOGNIZE SAFETY SYMBOLS, WORDS AND LABELS What You Need to Know About Safety Instructions Warning and Important Safety Instructions appearing in this manual are not meant to cover all possible conditions and situations that may occur. Common sense, caution and care must be exercised when assembling or using this product. Always contact your dealer, distributor, service

agent or manufacturer about problems or conditions you do not understand. This is a safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death. It is used to alert you to potential personal injury hazards. If any parts are missing or broken, please call Customer Service at 18882876981.Cluttered work benches and dark work areas may cause accidents or injury. Keep bystanders, children and visitors away while operating the compressor. Distractions can cause you to lose control. Do not force tool. Use the correct tool for your application. The correct tool will do the job better and safer at the rate for which it is designed.

http://www.familyreunionapp.com/family/events/boss-dd-5-manual