Science quiz questions

[illegible]

up to the designer to choose the most appropriate, considering factors such as: - capacity; - installation and operation; - ease of maintenance; - lasts; - and the place necessary for its installation, etc. 85. BUILDING INSTALLATIONS OF HOT WATER The figure in the sequence shows a residential unit with private central heating. According to the norm, it is necessary to observe some details for the installation of the heater: - The cold water supply channel must be derived from the distribution column in a size greater than the heater and must enter from the bottom; • A drawer and a safety valve register must be put in place in the cold water supply pipe and the installation of a control valve must be prohibited; • hot water pipes should come out from the opposite top, not recommending to connect it to a conjugate air intake for all floors. 86. HEATING INSTALLATIONS EXAMPLE of the private central heating system 87. BUILDING INSTALLATIONS OF HOT WATER - c- Collective Central Heating: When a single heating system powers sets of household appliances from different units of a building. (barracks, hospitals, hotels, residential buildings, etc.). • In the case of collective central heating, the flow rate of the use of hot water varies continuously and unpredictably, in this way storage heaters are used, which allow the storage of heated water during the hours of minimum consumption, thus taking into account the supply of hot water, during the hours of maximum consumption (peak flowll). Heated water can be distributed in buildings in two ways: 88. HEATING INSTALLATIONS - c.1) Simple distribution (no return): can be Descendant. It looks like uncomfortable to have a moment until you have hot water in the register of the unit you want to fill, which results in water waste, however you save on plumbing. Figures 02 and 03 show a diagram of this distribution. - c.2) Return distribution: In this case hot water constantly circulates in the pipe and can be in two ways: - c.2.1) Terms: it uses the principle that hot water is less dense that makes it have a tendency to increase. In this case more energy is consumed because the temperature must be higher to cause this effect and the distribution is upwards. 89. HOUSING INSTALLATIONS - c.2.2) Pumping: uses a heating system, causing the hot water coming out of the heating tank (storage) to rise from a column to the barrel in the lid, where it descends into itchings that feed the various appliances on each floor. Prumadas met on the floor where the storage is located, feeding again with unconsumed water. (c.2.3) Mixed distribution: hot water is carried out on the ascending and descending branches on alternating floors. It requires special attention and is therefore recommended in large buildings. 90. HEATING SYSTEMS HOT WATER SYSTEMS Ascending system without return Descending system without return 91. HEATING INSTALLATIONS HOT WATER Ascending system with siphon circulation descending system with pumping 92. BUILDING INSTALLATIONS OF HOT WATER - Mixed system . 93. 2 - BIM- CONSTITUENT PARTS OF A HOT WATER BUILDING INSTALLATION The NBR-7198 defines the same constituent parts as a cold water construction plant, e.g. barrel, column, extension and sub-extension. GENERAL CONSIDERATIONS: THE MATERIAL AND PRESSURE pipes and accessories that make up a hot water construction plant can be made of copper, carbon galvanized steel, CPVC, etc. and the minimum service pressure values, such as a cold water system, are respected. - Overpressure : <20m.c.a (200kpa)= == pressão= estática= máxima=></20m.c.a> <40.m.c.a (400kpa)== == pressão= mínima= de= serviço= :=>0.5m.c.a (5kPa) 94. SPEED The duct cannot have a speed greater than 14xD0.5 or 4.0m/s in order not to produce excessive noise. As for the minimum speed, nothing is recommended. The values calculated from the above equation in the commercial diameters are presented in the following table. 95. Speed and maximum flows for hot water. Maximum diameter speed. Max (mm) (in) m/s l/s 15 1/2 1.60 0.20 20 3/4 1.95 0.55 25 1 2.25 1.15 32 1/4 2.50 2.00 40 1 1 2 1/2 2.75 3.10 50 2 3.15 6.40 65 2 1/2 3.55 11.20 80 3 3.85 17.60 100 4 4.00 32.50 96. Estimate of consumption The estimate of hot water consumption depends on some factors</40m.c.a>such as: - habits of the population; - local climate; (residential, hotel, offices). Brazilian conditions follow the requirements contained in the Brazilian Standard NBR - 7198/93, of hot water forest systems. The suggested values are shown in the following table. 97. Estimate of hot water consumption. Building consumption liters/day Temporary construction accommodation 24 /popular person or rural house 36 /person Residence 45 /person Apartment 60 /person Barracks 45 /person School (boarding school) 45 /person Hotel (without including kitchen and laundry) 36 /guest hospital 125 /bed Restaurants and the like 12 /laundry meal 15 /Kgf dry clothes 98. Estimate of consumption You can also estimate the consumption of hot water based on the number of people and the number of household appliances. The following tables show consumption values based on the American Guide, and values are reduced to 1/3 of the original, justified by the lower standard of our facilities and the less rigorous climate. 99. Consumption of hot water in buildings, depending on the number of people. Type of building Hot water required, at 60th C Consumption on the occasion of Peak (l/s) Peak duration - Load hours Tank capacity depending on the hourly heating capacity cd, depending on daily use Residence Apartments Hotels 50 l / pess.day 1/7 4 1/5 1/7 Office buildings 2.5 l / pess.day 1/5 2 1/5 1/6 Factories 6.31 / pess.dia 1/3 1 2/5 1/8 Restaurant 3rd class 2a class 3a class 1.9 l / refeic. 3.2 l / refeic. 5.6 l / refeic. 1/10 1/10 Restaurant 3 meals a day 1/10 8 1/5 1/10 Restaurant 1 meal per day 1/5 2/5 1/6 100. Consumption of hot water in buildings, depending on the number of household appliances, in l /h at 60oC . Appliances Fit s Clubs Gyms Hospitals Hotels Factories Offices Resid. Private washbasin schools 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 2.6 Public washbasins 5.2 7.8 10.4 7.8 10.4 15.6 7.8 1 9.5 Bathrooms 26 26 39 26 26 39 26 Dishwasher 19.5 65 65 65 26 19.5 26 Lava – feet 3.9 3.9 15.6 3.9 3.9 15.6 3.9 3.93.9 Kitchen sink 13 2 6 26 26 26 13 Washing tank 26 36.4 36.4 36.4 26 Cup sink 6.5 13 13 6.5 13 Showers 97.5 195 29 2 97.5 97.5 292 97.5 292 Maximum probable consumption % 30 30 10 25 40 30 30 30 Tank capacity% 125 90 100 60 80 100 200 70 100 101. EXAMPLES a) Heating for a residence of 8 people: 1. daily consumption (CD) - 50 l / pess - 8 people - 400 l 2. Peak consumption : 400 - 1/7 - 57 l/h 3. tank capacity : 400 - 1/5 - 80 l 4. heating capacity : 400 - 1/7 - 57 l/h at 60 degrees centigrade 102. EXAMPLES b) Apartment building, with 10 housing units, With the following appliances, per unit: bidet, sink, shower and kitchen sink. 1. 10 bidets (washbasins) - 2.6 x 26 3. 10 showers - 97.5 - 975 4. 10 kitchen sinks.... 13 times 130 5. Total : 1157 l/h 6. Probable maximum consumption : (0.30) - 1157 - 347 l/h 7. Tank capacity : 1.25 - 347 - 434 l 103. FLOW OF PARTS FOR USE To scale the pipes it is necessary to know the flow of the parts for use, as carried out in cold water systems. The following table provides the discharge and the corresponding weight for each part. Use parts Flow l/s Weight Bath 0.30 1.0 Bidet0.10 0.1 Shower 0.20 0.5 Washbasin 0.20 0.5 Kitchen sink 0.25 0.7 Dump sink 0.30 1.0 Washing machine 0.30 1.0 1.0 1.0 1.0 1.0 1.0 104. OPERATION OF THE PARTS FOR USE The maximum possible functioning of the health parts shall be considered. Therefore, the following equation is used to estimate the sizing flow of pipelines. being: - Q - flow rate in l/s - C - exhaust coefficient (in this case 0.30 l/s) - ∑P - sum of parts likely to use PCQ 105. MINIMUM DIAMETER OF SUB EXTENSIONS . Parts of use Diameter (mm) Bathtub 15 Bidets 15 Shower 15 Kitchen sinks 15 Kitchen sink 15 Landfill sink 20 Washing machine 20 106. LOAD LOSSES To estimate load losses, the same procedure is used as described for the installation of cold water. The use of Fair-Whipple-Hsiao formulas is recommended for galvanized steel, copper and brass tubes. 107. HOT WATER PRODUCTION Producing hot water means transferring from a source the calories necessary for water to reach the desired temperature. The heat transfer can be: - direct: in contact with the heater with water; - saturated steam: in steam mixing systems - water; /: by thermal conduction by heating elements that begin with water (steam inside coils immersed in water). 108. ELECTRIC HEATING It is usually done by means of metal immersion resistors, which give good performance in heat transfer. Electric heaters can be of type: -Instantaneous heating of water in its passage through the appliance (electric showers); -Accumulation: boiler calls; must be powered by columns independent of those serving sanitary appliances. The power extension connecting the column to the boiler must derive from the column in a size greater than the heater, inserting them at the bottom -The following figure demonstrates the pattern of installation of the electric heater in a residence. 109. . . 110. Sizing indicated for electric storage heaters. Daily consumption at 700 C (litres) Heating capacity (litres) Power (kW) 60 50 0.75 95 75 0.75 130 100 1.0 20 0 150 1.25 260 200 1.5 330 250 2.0 430 300 2.5 570 400 3.0 500 4,0 850 600 4,5 1150 750 5,5 1500 1000 7,0 1900 1250 8,5 2300 1500 10,0 2900 1750 12,0 3300 2000 14,0 4200 2500 17,0 5000 3000 20,0 111. For any cold water temperature, you can also use the classical equations for mixing, given by the equation below. where: -t1 - water temperature in the heater: 700C -t2 - cold water temperature -t3 - average temperature of the mixture (consider around 400C) -V1 - volume of hot water in the heater (heating capacity) -V2 - volume of cold water mixed in the apparatus (Be V2 - V3 - V1) -V3 - final volume of hot water in the apparatus 332211 VtVtV 12. DETERMINATION OF POWER AND ENERGY CONSUMPTION The amount of heat for a specific thermal mass c and the temperature t1 rise to a temperature t2 is represented by the following equation: - - m - liquid mass (in liters) - c - specific heat (in kcal/oC; equal to 1) - t2 - final temperature (in oC) - t1 - initial temperature (in oC) - remembering 1kwh x 860 kcal. The 12 ttcmQ 113 113. EXAMPLE OF DIMENSIONING An electric heater that will meet a 2 bedroom apartment, hiring 2 people per dormitory. Heating capacity - 60 l/person - 4 people - 240 liters Meanwhile we should consider that the water to be used will have a temperature below 700C, and therefore should observe the estimated value of consumption in the standard table, therefore: heating capacity 29 l/person - 4 people - 116 liters From the heating table, a capacity of 150 liters and a power of 1.25 kWh is used. Note: You can determine the capacity of the heater using the mix equation, seen in the previous elements. 114. SOLAR HEATING The solar collector is used for heating water for domestic use, swimming pools and in industrial processes. It has the advantage of being an inexhaustible source of energy combined with other reasons why its use is spreading, such as: - self-sufficient; - completely silent; - an alternative energy source. 115. TYPES OF INSTALLATIONS Natural circulation (terms) in the open circuit 116. TYPES OF INSTALLATIONS Natural circulation (termsium) in the open circuit 117. TYPES OF INSTALLATIONS Forced circulation on closed circuit 118. TYPES OF INSTALLATIONS Forced circulation on closed circuit 119. INSTALLATION TYPES Installation of a solar collector in a 120 residence. THE COLLAR SURFACE A practical way to size the collector surface is to consider 1 m2 of manifold for 50-65 liters of hot water needed or use the equation below. being: - S - area in m2 - Q - Amount of heat required in kcal/day - I - solar radiation intensity in kWh/m2 or • - performance of the use of energy per panel (in — 50%) I Q S 121. EXAMPLE Consider a residence with 5 people. Calculate the required area of the solar collector. - daily consumption (CD) - mass (m) - 5 x 45 x 225 kg - Amount of heat Q (mc(t2-t1) - 225-1-(60-20) - 9000 kcal (assuming water enters the temperature of 200C and out of the manifold at 600C). - Assuming that I - 4,200 kcal / m2 - day (Rio de Janeiro), we have: 2 3.4 5.04200 9000 mS 122. GAS HEATING In large urban centers, the use of gas resulting from the combustion of coal, or naphtha gas, is common, which, when pure, can provide up to 5500 kcal per cubic meter; 4000 kcal per cubic meter of gas. Usually the gas heater is installed in the bathroom or kitchen, the automatic heater is the most found (the one that consists of a small gas spout). It automatically transmits the flame to a series of nozzles arranged in lines, also called burners, simply by opening a tap or register. 123. HEATING GAS Around the burners there is a coil of water, which receives calories in direct contact with flames or hot gases. The assembly is enclosed in an enamelled iron box, with a device for exhausting gases (chimney). The set can best be displayed in the following figures. There is a type of heater (Junkers) that does not require the use of fireplace, due to better combustion of gas, but in the meantime, the minimum volume that the addiction should have will be 12 m3. The following diagram provides a way to install these heaters. Heaters must have safety devices, such as: safety record, which only allows the passage of gas when the pilot is on and water passing through the coil; Safety valves that allow the gas to pass when the water is opened and obstruct the passage when the water is closed. 124. GAS HEATING Gas heater assembly 125. Detail for the installation of the Junkers heater. 126. GAS HEATING In Junkers there is a bimetadelic element that is installed near the pilot and, by expansion, opens a valve, allowing the gas to pass through. In case of flame extinction due to the action of the wind, the bimetadelic element is compressed by cooling, closing the passage of the gas. In Figure 15 we can see the pattern of a gas heater. At point A we have the automatic valve, which is composed of an M membrane that increases the H stem. When there is water circulation by opening a tap or hot water register, there is a pressure difference between the parts fed by pipes B and B'. 127. Gas heater . 128. GAS CONSUMPTION It is accepted that 1 m3 of gas can produce in 4000 kcal; we admit that the average performance of heaters is 70%. OIL LIQ-EFFECT GAS HEATING G.L.P can be used in the installation of heaters, requiring more attention in installation, due to being heavier than air and highly harmful. The heater is practically of the type observed in the following figure. 129. EXAMPLE Calculates the gas consumption for a bath where the water consumption is 25 liters, at a temperature of 500C. Consider the temperature of cold water at 200C. -Useful calories - 30 (50-20) - 750 kcal -Effective calories -Consumption - kcal1072 70.0 750 3 27.0 4000 1072 m 130. HOT WATER PRODUCTION IN CENTRAL FACILITIES Some systems used in the distribution of hot water in collective power plants have previously been mentioned. We will now consider the most common forms of hot water production in collective central systems. -Direct heating of water with street or bottled gas: there are heaters for private installation and collective systems; -Direct heating of water with oil: they have a heating chamber where the flame of a sprayed oil burner heats the inflated air from a blower. Heated the air this passes through a coil immersed in the water of the depot, which is intended to heat; 131. HOT WATER PRODUCTION IN CENTRAL INSTALLATIONS - Steam water heating: the production of hot water can be carried out using the steam generated in the steam cane boiler, a branch is derived from a tank, where the steam is mixed with the water in which it is contained or the steam is carried out in a coil placed in the water heater. In this second case, by yielding heat to the water, the condensation steam in the coil and condensation, collected, can be returned to the boiler by a condensate pump. 132. STORAGE CAPACITY AND BOILER POWER Storage must accumulate such a quantity of hot water that during the maximum consumption period there is no shortage of hot water. It is worth remembering here that while consuming water, the boiler continues to provide calories that are transferred to storage water. The hot water to be used is considered around 400C (as seen in the previous elements), and which in storage is heated around 700C or more, depending on local weather conditions. The temperature is elementary in the appliances mixing with cold water. 133. STORAGE CAPACITY AND BOILER POWER Before starting the use of hot water in the morning, a 2-hour period is available to heat the water in storage first. The longer the time that is allowed for this first heating, the lower the heat power of the boiler should be. The determination of the consumption of its duration is not easy to precision in some cases, such as apartments, hotels and hospitals. In the case of colleges, the way in which these establishments operate can be calculated, with some precision, the average consumption and the duration of maximum demand. 134. STORAGE CAPACITY AND BOILER POWER (APARTMENT AND HOTEL BUILDINGS) For the calculation of storage capacity, you can use the methods described above, for example: -Considering the mix equation; -Using the values described in the tables. You can use the simplified method applicable to residential buildings, considering the ratio of the theoretical volume of the hot water tank to the total daily consumption. With the equation below we have: -to be: A - 1/3 (large residences); A 1/5 (apartments for 5 people); At 1/7 (very large apartments) The Vitic CD 135. STORAGE CAPACITY AND BOILER POWER (APARTMENT AND HOTEL BUILDINGS) To obtain the actual volume of storage, it is sufficient to mutine Vtheoretical by factor 1.33 The power of the boiler can be determined using the following equation: - t1 - cold water temperature - t2 - temperature intended to increase water (about 700C) - T - time to heat the water in storage first (be considered 2h) T t t tstorageP - 12 136. EXAMPLE (SIMPLIFIED METHOD) Consider a building of 30 apartments, with 4 people per apartment and water temperature of 200C. Calculate the storage capacity and power of the boiler. -Daily consumption : 30-4-60 l/day - 7200 l/day - Theoretical volume - 1/5-7200 - 1440 l - Volume storage - 1.33-1440 . Boiler power - 55056 kcal/h - losses%15 2 2070 1915 137. STORAGE CAPACITY AND BOILER POWER (INDOOR COLLEGES AND ANALOG ESTABLISHMENTS) In this case you have knowledge of the maximum duration of demand and the amount of water that will be consumed. Daily consumption in colleges should be estimated based on the number of household appliances that this establishment has, whose opening hours are usually perfectly regulated in this type of establishment. The equations required for sizing are described below: storageVttknmP 13 PmVtt storage)(12,138). STORAGE CAPACITY AND BOILER POWER (INDOOR SINGS AND ANALOG ESTABLISHMENTS) being: -V - storage capacity in litres -P - heat of the boiler in kcal/hour -m - time available for heating until the start of operation of the appliances -n - operating time of the appliances -k - kilocalics received from the total amount of water spent on the appliances during the time n to pass t1 t2 -t1 - temperature of the power supply system 200C) -t2 - maximum temperature reached in storage (65-700C) -t - temperature that water should have at the end of time n - storageVttknmP (13 PmVtt Depot (12 139). EXAMPLE (HYDRAULIC AND SANITARY FACILITIES - MACINTYRE) Consider a college with 150 students, where there are 15 showers and 30 washbasins. Admit that only 2/3 of the students take a hot bath and that this bath takes place in two shifts (half bathroom in the morning and the other half of the afternoon), and m.2h and n.0.50h. Calculate the storage volume and heat power of the boiler :Suppose the bath time for each group of 150-2/3-1/2 - 50 students is 30 minutes. Adopting 30 liters of water at 400C for consumption in each shower bath, and for the 10-liter sink, we will have: -Showers: 50-30liters - 1,500 liters -Washbasins: 100-10liters - 1,000 liters - Total 2,500 liters 140. PLUMBING MATERIAL Pipes should preferably be overcooked copper with brass or brass connections. PVC tubes should be avoided because they have a high linear coefficient and still easily soften at a temperature of 1000C. At a temperature of 600C its service pressure is reduced to values of only 2 kg/cm2. Galvanized iron tubes have low corrosion resistance. It is recommended to use CPVC, developed specifically for hot water installations. 141. PLUMBING MATERIAL Pipes should preferably be of overcooked copper with brass or brass connections. PVC tubes should be avoided because they have a high linear coefficient and still easily soften at a temperature of 1000C. At a temperature of 600C its service pressure is reduced to values of only 2 kg/cm2. Galvanized iron tubes have low corrosion resistance. It is recommended to use CPVC, developed specifically for hot water installations. 142. DILATION OF THE PIPES The expansion of the pipes of a hot water system must be taken into account, allowing the expansion that takes place freely, thus avoiding the appearance of internal stresses in the pipes and considerable thrusts. As a solution to the effects of dilation in pipes, the following resources can be used: - Use a non-rectal tracing for the tube, i.e. to perform angular deviations in the plane or space, thus giving the conditions of the pipe to absorb the expansions. You can examine these solutions in Figure 16. Using the copper tube and brass connection, Table 09 can obtain the dimensions to be given to the loop, when the dilation and diameter of the pipe are known; 143. DILATATION OF PLUMBING - In long rectilinear strokes, loops or place a piece known as lyre; - If there is little space to run the cycle, use the • Hot water pipes must be able to dilate without breaking the thermal insulation. It should be avoided to incorporate feeding lines into the masonry. When possible install them in a niche or tree. 144. Loop dimensions to absorb various offset values. Outer tube diameter in inches Length L (inches) for moving (m) 1/2 1 1 1/2 2 2 1/2 3 4 5 6 7/8 10 15 19 22 25 27 30 34 38 1 1/8 11 16 20 4 27 29 33 38 42 1 3/8 11 17 21 26 29 32 36 42 47 1 5/8 12 18 28 31 35 39 46 51 2 1/8 14 20 20 25 31 34 38 44 51 57 2 5/8 16 22 27 32 42 47 56 62 3 1/8 18 18 24 30 34 39 45 53 67 4 1/8 2 0 28 34 39 44 48 58 66 75 5 1/8 22 31 39 44 54 62 70 70 78 6 1/8 24 34 42 48 54 59 68 76 83 145. Loop. 146. INSULATION OF THE PIPES Tubes must be of special copper or pure iron. The insulation must be with material of low thermal conductivity, so as not to dissipate heat before the water reaches the subaxiema. The following materials are used in insulation when they are more than 5 meters long: - Vermiculite products (mica expanded under the action of heat); Rock wool or mineral wool, silica, yarn. It is a good material, but a dangerous manipulation; Calcium silicate hydrated with asbestos fibers. It is an excellent and widely used material, specified in the P.N.B.-141 standard; Hydrated magnesium silicate. Great insulation, it gave space to the hydrated calcium silicate. It has low moisture resistance. 147. INSULATION OF THE PIPES Insulating agents are supplied in the form of gutters that adapt to the pipes. In connections and valves, mortar is used on canvas that covers the parts, or blankets of the same material are applied. The thermal insulation layer can be protected with cotton cloth, which should be painted later. When the hose is installed in damp places, it can be protective with adhesive aluminum film. You can also cover the bean gutters with bituminous cardboard glued to sheets or thin aluminum blades. The coating material is attached to the gutters with clamps or straps with straps. 148. Sizing Example - Vertical diagram of the hot water supply column Consider an 8-story building with 4 apartments per floor, 2 bedrooms per apartment for 2 people per dorm. Adopt the right foot of 3.00 meters as well as the height of the tank. 149. Sizing Example- View: Sub extension of the project Size of the hot water system given by the figure, adopting the scheme of a bathroom represented by the figure next to: 150. Solution a) Total population b) Storage capacity calculation b.1) Simplified method peopleotalPopulationT 1282248 /18224 dialpercconspessIrioConsumoDio /7860.). (/60128 15367680 5 1 literrealVolume 20431536 1.33 151. Solution c) Calculation of pipe diameters and load losses c.1) Pipe diameter (see vertical diagram) - Sub - Diameter extensions - Sub - Extension Extension Unit weight Accumulated weight PQ 30.0 Diameter Inches Speed (m/s) 1-3 0.50 - 0.20 3/4 0.63 2 -3 0.10 - 20.0 9 3/4 0.29 3-5 - 0.60 0.23 3/4 0.73 4-5 0.050 - 0.20 3/4 0.64 5-6 - 1.10 0.32 3/4 1.01 152. Solution C2) Pipe Diameter - Hot Water Column Diameter - Column Elongation Accumulated Weight Aetta PQ 30.0 Diameter Inches Speed (m/s) 6-7 - 1.1 0.31 3/4 0.987-8 - 2.2 0.44 3/4 1.40 8-9 - 3.3 0.54 3/4 1.72 9-10 - 4.40.63 1 1.28 10-11 - 5.5 0.70 1 1.43 11-12 - 6.6 0.80 1 1.63 1 2-13 - 7.7 0.83 1 1/4 1.03 13-14 - 8.8 0.90 1 1/4 1.12 153. Solution C3) Pipe Diameter - Cold Water Column Diameter - Column d) Load Losses To calculate load losses, the method of equivalent lengths was used and the equation used was the universal formula, which will be presented below so that students who have been somewhat forgotten or who have not read the flyer with due care, do not feel like navigating unexpoexpoexpeted seas, using the formula Swamee-Jann (Universal) for calculating the coefficient of friction f. Lengthen unit weight Accumulated weight Flow PQ 30.0 Diameter Inch Velocity (m/s) 14-15 - 8.8 0.90 1 1/4 1.12 154. Solution. The equation indices will not be described, as it is believed that the student already has the knowledge. gD Vl fh 2 2 2 , 2 2 9.0 Re 74.5 7.3 ln 325.1 DV Re 155. Solution The values adopted for kinematic viscosity are as follows: -- - 1-10-6 m2/s at 200C -- 0.416-10-6 m2/s at 700C d.1) Stretch Stretches 14 -. 15 materials - PVC diameter - 1 1/4 (32 mm) flow - 0.90 l/s 2 normal inputs 1.20 1 record drawer 0.40 3 curves 900 2.10 compr. equivalent 3.47 buy. pipes 40.00 total length 43.74 m f - 0.022 h , 1.95 m P14 - P15 - h14-15 - 28.05 m.c.a. to 156. Solution. Lengthen 13 -14 material - Copper diameter - 1 1/4 (32 mm) flow - 0.90 l/s normal input 0.60 record drawer 0.40 curves 900 0.70 compr. equivalent 1.70 buy. pipes 4.80 total length 6.50 m f - 0.018 h , 0.24 m P13 - P14 - h13-14 - 4.80 - 23.01 m.c.a 157. Solution. Lengthen 12 -13 materials - Copper diameter - 1 1/4 (32 mm) flow - 0.83 l/s They have direct passage 1.50 compr. equivalent 1.50 buy. piping 3.00 total length 4.50 f - 0.018 h , 0.14 m P12 - P13 - h12-13 - 3.0 - 19.87 m.c.c. to 158. Solution. Lengthen 11 -12 material - Copper diameter - 1 (25 mm) flow - 0.80 l/s They have direct passage 0.90 compr. 0.90 buy. piping 3.00 total length 3.90 f - 0.018 h , 0.38 m P11 - P12 - h11-12 - 3.0 - 16.49 m.c. to 159. Solution. Lengthen 10 -11 material - Copper diameter - 1 (25 mm) flow - 0.70 l/s They have direct passage 0.90 compr. equivalent 0.90 buy. pipes 3.00 total length 3.90 f - 0.018 h - 0.30 m P10 - P11 - h10-11 - 3.0 - 13.19 m.c.c.a. 160. Solution. Lengthen 9 - 10 material - Copper diameter - 1 (25 mm) flow - 0.63 l/s They direct passage 0.90 compr. equivalent 0.90 buy. pipes 3.00 total length 3.90 f - 0.018 h , 0.24 m P9 - P10 - h9-10 - 3.0 - 9.95 m.c.a. to 161. Solution. Lengthen 8 -9 material - Copper diameter - 3/4 (20 mm) flow - 0.54 l/s They have direct passage 0.80 compr. equivalent 0.80 buy. piping 3.00 total length 3.80 f - 0.018 h - 0.53 m P8 - P9 - h8-9 - 3.0 - 6.42 m.c.a 162. Solution. Lengthen 7 - 8 materials - Copper diameter - 3/4 (20 mm) flow - 0.80 l/s They have direct passage 0.80 compr. equivalent 0.80 buy. piping 3.00 total length 3.80 f - 0.019 h , 0.37 m P7 - P8 - h7 -8 - 3.0 - 3.05 m.c.a. to 163. Solution. Lengthen 6 -7 material - Copper diameter - 3/4 (20 mm) flow - 0.31 l/s They have direct passage 0.80 compr. equivalent 0.80 buy. pipes 3.00 total length 3.80 f - 0.02 h , 0.20 m P6 - P7 - h6-7 - 3.0 - 0.15 m.c.a. to 164. Solution It can be verified that, in order for the minimum load on the sanitary parts to be satisfied (in the most critical case, the shower), the load at point 6 must have a value greater than 1 m.a.a.(because load losses must be calculated at this value). Then there is the need to install a recalculation pump next to the hot water column near the depot. 165. Solution Possibility: Two hypotheses can be considered 1) The designer could increase the diameter of the main columns, managing to reduce the load losses. Therefore, a slight increase in load in point 6 could be achieved at a value compatible with that required by the health parties. 2) With the knowledge of the load required in point 6 and with the pressure value available at this point the designer would be able to obtain the manometric height, for the choice of the most convenient pump for the problem. 166. SANITARY SEWAGE ABNT-NBR 8160/1999 PUBLIC INSTALLATIONS: Sewerage System - Design and execution. OBJECTIVES A construction plant for sanitary sewers aims to meet the minimum housing requirements in terms of hygiene, safety, economy and comfort of users. Poorly designed projects of sanitary purification plants are eipped in a number of problems such as: wastewater reflux, the appearance of foams in drains, bad smell in health facilities. 167. STRUCTURES SANITARY SEWAGE To properly design such plants, it is necessary that: - the rapid flow of wastewater. this is achieved through rational tracing, avoiding vertical and horizontal curves. If necessary, the curves should preferably be 45o. When 90o curves are inevitable they should be of long rays, using inspection parts before and after them. Connections between pipes should be made whenever possible through the shortest path, with priority for the largest diameter; - seals the passage of gases and animals from pipes to buildings with water closure parts or ducts (net column at least 50 mm high), which must be kept in any operating condition of the network; 168. BUILDING INSTALLATIONS OF SANITARY SEWAGE - preventing pollution of drinking water and food products: avoid interconnections, as well as the passage of water pipes into low floors or wastewater channels. In any case, the existence of leaks in the sewer age pipe can cause problems of contamination of the water supply and food products; - gas leaks, gas leaks and the formation of deposits inside the pipes. To avoid leakage, the installation must be tested (smoke) before it is put into operation in order to detect possible failures in the execution of the same. Packages allowing the deposition of particulate matter present in sewers should be avoided; 169. PUBLIC SANITARY SEWAGE INSTALLATIONS - Inspection tubes (special parts or inspection parts) must be provided to allow network maintenance by introducing equipment used to clean them. Finally, the durability of the systems is directly linked to the quality of the material used, which must be resistant to corrosion, and to the execution of services, so that the plant is never sympathetic to the structure of the building; - allow continuous ventilation of the public wastewater collection network by keeping the hydraulic system open in the atmosphere and connected directly to the public network without any obstruction. This condition is met by ventilation systems that have as their sole objective, the supply of gas and air. 170. PROJECT STEPS are the same as a cold water construction plant, however plants and sections should have a 1:50 scale and 1:20 details. In addition, they must meet the previously proposed objectives and use a convention for project drawings. The following figure shows a widely used convention. 171. DESIGN STEPS . 172. STEPS DESIGN The standard requires each sanitary wastewater construction project must have what is called a vertical scheme, where the diameters of the fall pipes, grease pipes, fan tubes and others are indicated for each floor. See figure showing diagram based on the Standard and the figure showing the types of arrangements usually made for the sewer connections of a residential bathroom. 173. DESIGN STEPS. 174. DESIGN STEPS. 175. PARAMETERS The following table shows the minimum slope recommended by the standard for so-called horizontal sanitary waste water pipes. Horizontal tubes (1) DN(2) (mm) Slope (%) 75 2 100 1 1): Tube installed horizontally or at an angle of less than 45 degrees with horizontal. 2): Nominal tube diameter 176. CONSTITUENT PARTS AND TERMINOLOGIES OF A PREAL INSTALLATION BY SANITARY SEWAGE For better understanding, the terminologies most used by NBR8160 and the second figures, taken by Hélio Creder, for a better visualization of these. 177. CONSTITUENT PARTS AND TERMINOLOGY OF A SANITATION TREATMENT PLANT. 178. . 179. . - SANITARY APPARATUS: Equipment connected to the building plant and intended for the use of water for hygienic purposes or for the reception of waste and waste water. - COLLECTOR BOX (CC): Box in which liquid waste is collected that requires mechanical lifting. - INSPECTION BOX (CI): Box designed to allow inspection, cleaning and removal of pipes. - PASSAGE BOX (CP): Box with a grate or blind cover intended to receive washing water from the floors and secondary tributaries of the same autonomous unit. - BUILDING COLLECTOR: The pipe runs between the last insertion of the subcollector, the extension of waste or waste water and the public collector or private system. - PUBLIC COLLECTOR: A tube belonging to the public sewer system and intended to receive and conduct the effluents of the building collectors. - DISCONNECTOR: Water closure device designed to seal the passage of gases. - SEWAGE: Liquid waste that must be taken to a final destination. 180. . - SANITARY DRAINS: These are landfills from the use of water for hygienic purposes. - WATER CLOSURE: Liquid layer that, in a disconnect, seals the passage of gases. - PRIMARY SEWAGE INSTALLATION: A set of pipes and devices in which the gases of the public collector or treatment devices are accessed. - SECONDARY INSTALLATION OF SEWAGE: A set of pipes and devices in which no gas from the public collector or treatment devices is accessible. - DISCHARGE EXTENSION (RD): Tube that receives directly effluent from sanitary appliances - EXTENSION OF (RE): A tube that receives effluent from drain extensions. 181. . - VENTILATION EXTENSION (RV): A fan tube that connects the extension of the disconnector drain to one or more toilets to a ventilation column or primary fan tube. - SUBCOLLECTOR (SC): A tube that receives effluent from one or more fall tubes or sewer extensions. - FALL PIPE (TQ): Vertical pipe that receives effluent from sub-glues, sewer extensions and drain extensions. - OPERCULATED TUBE (TO): Inspection piece in the form of a tube equipped with an opening with removable lid. - FAN TUBE (TV): A tube intended to allow airflow from the atmosphere to the installation of waste water and vice versa or to circulate air inside the system in order to protect the closure of the detachers' water from breakage by suction or compression and to direct gases from the public collector to the atmosphere. 182. . - RELIEF FAN TUBE: Secondary fan tube that connects the fall pipe or drain or drain extension to the ventilation column. - CIRCUIT FAN TUBE (VC): Secondary fan tube connected to a sewer area and serving a set of appliances without individual ventilation, see Secondary fan tube. - INVERTED FAN TUBE (VIn): Fan tube in the shape of an individual staff, which connects the hole in the high neck of the toilet cable to the respective exhaust extension, see Individual fan tube. - PRIMARY FAN TUBE (VP): Extension of the fall tube above the highest extension connected to it and with upper end open to the atmosphere located above the roof of the building. - SECONDARY FAN TUBE (VSE): extension of the fall tube under the same conditions described for that of the primary fan, but without any sanitary equipment connected to it. - SUPPLEMENTARY FAN TUBE (VSu): A pipe that connects a sewer extension to the corresponding circuit fan tube. 183. . - PRIMARY PIPING: A tube accessed to public collector gases or treatment devices. - SECONDARY PIPE: Tube protected from disconnection against gas access of primary pipes. - UNIT AUTONOMOUS: Part of the building connected to an ideal hamlet of land, subject to the limitations of the law, consisting of premises and structures for private use, intended for residential or non-residential purposes, marked by a special numerical or alphabetical designation of identification and discrimination. - CONTRIBUTION HUNTER UNIT (UHC): A numerical probabilistic factor that represents the usual frequency of use associated with the typical flow of each of the different parts of a set of devices. 184. PIPES FOR THE COLLECTION AND REMOVAL OF WASTE WATER can be primary or secondary. In primary ducts they have access to gases from the public collector, and secondary ones are protected by disconnector, against these gases. These are exhaust extension pipes, wastewater extension, fall pipe, undercolletes, building manifold, inspection or passage box and inspection parts (see figure). 185. DECONNECTOR It is each sanitary siphon connected to a primary duct, that is, it is a hydraulic device intended to seal the passage of gases from inside the sewer pipes inside the buildings. 186. DISCONNECTOR The ventilation of the disconnectors also prevents the interruption of the closure of the water by suction, which can occur if the primary drain pipe works as a forced duct, even for a short time. See the figure showing in an illustrative way how this can occur: 187. . . ventilation branch ventilation hose primary hydraulic fan piston siphon drain pipe drain fall 188. UNCONNECTOR The Brazilian standard also makes several recommendations, some worthy of mention and therefore listed below: - the pantry and kitchen sinks must be approved with siphons even when connected to fat maintenance boxes. - Siphons, siphons or siphon housing the closure of water depends on the action of moving parts or removable internal divisions that, in case of defect, can allow the passage of gas should not be used. 189. UNCONNECTOR - All must meet the following conditions: a) Have a water closure with a minimum height of 50 mm. (b) Present the outlet hole with a diameter equal to or greater than that of the exhaust extension connected to it. - Siphons must be water-based with a minimum height of 50 mm and must be equipped with screwed plugs on the bottom or any other means for easy cleaning and inspection. In general, the individual sanitary siphon is used only in urinal, sanitary basins, kitchen sinks, landfill sinks and washing tanks. The most commonly used type of installation is to connect the drain extensions of washbasins, bathtubs, bidets and drains (from shower boxes, or floor water collection), to siphoned boxes. 190. . . 191. . . 192. DECONNECTOR In this way, the extension of effluent wastewater from the siphoned box would be a primary duct, while discharge extensions would be conducted secondary. 193. VENTILATION PIPES The ventilation network consists of pipes that start near the siphons and end up open outwards, thus allowing air and gas to be delivered by them. These are primary and secondary ventilation pipe ducts, ventilation extension, etc. 194. . . 195. 195. Special elements that may be needed may be necessary, although not common to most plants, are included. It is cited as an example, the case of there are devices installed at a lower altitude than the public road, it is not possible that waste is released by gravity into the public collector, it is therefore necessary to satisfy all these landfills in a collection box, and then recalque of them up to the favorable quota for release by gravity in the public sewer network. 196. LAYOUT OF SEWAGE AND VENTILATION FACILITIES The correct arrangement of the purification and ventilation systems is obtained respecting the basic principles, they are: - a correct use of the connections and other elements that must carry out the installation. In this way, each change of direction must be made correctly, using connections or pass-through boxes. After the small-scale study, the designer must present the final installation on a larger scale (1:20), because not taking into account the size of the connections, it may be impossible to perform the installation designed due to lack of space for the placement of all the necessary connections. - integrated pipes, which should not be included with the structural parts of the building. This allows you to change the choice of the descent tips of the autumn tubes, to get as close as possible to the pillars or the projection of the pillars and walls of the ground floor. 197. LAYOUT OF SEWAGE AND VENTILATION FACILITIES - With this principle the layout of the installations is transformed into geometric studies, thus establishing some rules, as indicated below: - a position of the fall tube: the fall tube must be incorporated into a wall and located near the projection of the pillar or wall of the ground floor. - the connection of the sanitary basin socket with the fall pipe: this connection must be as direct as possible, providing the possible need for the placement of the joints to allow the connection of the siphoned box in the sewer extension. - siphoned box positions and connection to the sewer extension: - a siphoned box with grid - aesthetic aspects should be taken into account, since the floor should have favorable slope to the flow of water to the box. 198. LAYOUT OF SEWAGE AND VENTILATION FACILITIES - blindcover siphon box - its position is allowed at any point in the compartment. - connection of the exhaust extensions to the siphoned box: the normal siphonbox allows the connection of up to seven drain extensions. - connection of the fan tube to the extension and ventilation column: each siphon must be ventilated, so the distance between the of the fan the siphon must not exceed certain distances, depending on the diameter of the 199. . . projection of pillar 200. DIMENSIONING The estimation of discharges is associated with the number of sanitary appliances connected to the pipes. The NBR-8160 standard defines the values of these units for the most commonly used devices. This unit is called the Contribution Hunter Unit (UHC) and is standardized as a sink drain unit at home and is equal to 28 l/min. 201. DISCHARGE EXTENSIONS The following tables are used: 202. DISCHARGE EXTENSIONS The following tables are used: Discharge Extensions Nominal Diameter (DN) Minimum UHC DN appliance (mm) Residence bathtub 3 40 General purpose bathtub 4 40 Hydrotherapy bath, continuous flow 6 75 Emergency bath, hospital 4 40 children's bathroom, hospital 2 40 Seating basin, hydrotherapy 2 40 Bebedouro 0.5 30 Bidets 2 30 Residence shower 2 40 Collective shower 4 40 Hydrotherapy shower 4 75 Hydrotherapy shower, tubular type 4 75 Scottish shower 6 75 Shower forina 2 30 Comadre washing machine 6 100 Washbasins from home 1 30 General washbasins 2 40 Lavabi nurse 1 30 Surgical washbasins 3 40 Lava legs, hydrotherapy 3 50 203. DISCHARGE EXTENSIONS The following tables are used: arm washing, hydrotherapy 3 50 feet of lava, hydrotherapy 2 50 Urinal, exhaust valve 6 75 Urinal, exhaust box 5 50 Urinal, automatic descaga 2 40 Urinal, trough per meter 2 50 Autopsy table 2 40 Residence sink 3 40 Service sink, landfill 5 landfill 75 Sinking laboratory tube 2 40 hospital 2 40 Industrial kitchen sink, preparation 3 40 Industrial kitchen sink, pot washing 4 50 Laundry tank 3 40 Dishwasher 4 75 Washing machines up to 30 Kg 10 75 Washing machines from 30Kg to 60 Kg 12 100 Washing machines over 60Kg 14 150 Toilet 6 100 204. DISCHARGE EXTENSIONS For special/unrelated appliances in the previous tables. Exhaust Extensions (1) Nominal diameter (DN) Minimum UHC DN (mm) 1 - 30 2 40 3 50 5 75 6 100 205. DRAIN EXTENSIONS The exhaust units of all appliances served by the extension must be added and then inserted into the table. Discharge Extensions (1) Nominal diameter (DN) Minimum UHC diameter (mm) 1 30 40 6 50 20 75 160 100 620 150 1) The extension of siphon box sewers shall be sized taking into account the sum of the UHC of the apparatus contributing to it. 206. . It should be noted: - minimum slope; - washbasins, toilets, bidets, drains, showers and tanks are thrown into disconnectors (siphons) and then into secondary or primary plumbing systems. - and urinal are launched into primary ducts or their inspection boxes. Urinals can only be connected to siphoned boxes with blind lids. - Dump sinks are poured then into the primary tubes. • Washing machines and/or tanks, located on overlapping floors, can discharge into individual drop tubes, which connect to the siphoned box located on the ground floor. Kitchen sinks connect to drop tubes, which are released into fat boxes and then to primary pipes or inspection boxes. Your fat boxes, depending on the number of units collected, must comply: 207. . a) For 1 sink, the so-called small fat box with the following dimensions can be used, according to NBR 8160: diameter 30 cm submerged septal

20 cm Keep the 18 litres Output tube (DN)

75mm b) Up to 2 kitchens, the fat box will be simple with a volume of more than 30 liters or: Diameter 60 cm Altezza

60 cm) c) From 2 to 12 kitchens, double fat box with a volume of at least 120 litres or: Diameter

60 cm 80 cm d) For more than 12 kitchens the volume, in liter, of the fat box should be: V - 120 x 2 x (number of people served) 208. . The Standard provides other recommendations, such as: -When siphon or siphon box is adopted to receive landfills from washbasins, bathtubs, bidets, drains and tanks, the respective discharge extensions must be connected individually or through a passing box to the siphonbox or siphone box. They are exceptional compared to the previous provisions. (a) the sets of sinks or urinal installed in the battery in collective toilets, provided that the waste water extension which combines the exhaust extensions of each appliance is easily inspected. b) Washbasins and kitchen sinks with two tubs. -In systems that can use grease-retaining boxes, the exhaust extensions of kitchen sinks must be connected directly to the same boxes, or to drop pipes that discharge. Drain extensions of toilets, boxes or discharges, maintenance boxes and siphons must be connected, where possible, directly to an inspection box or other perfectly inspected primary tube. Exhaust or purification extensions, siphoned boxes or drains, maintenance boxes and siphons cannot be connected to deviations from fall tubes with a slope of less than 1% or receiving effluent from more than four overlapping planes. In cases where the limits set in the preceding item are exceeded, exceeded, appliances located on the bypass floor shall be carried out below this deviation. 209. . Sewer extensions that receive effluent from washing machines and drain sinks from hospitals, medical practices and others should be primary pipes. The insertion of an extension of the waste or waste water into the building manifold, sub-network or other extension of waste water should preferably be carried out by means of an inspection box or a simple junction at an angle not exceeding 45 degrees, in the latter case, the same extension provided by an inspection part. The connection of the extension of the discharge or extension of waste water to the extension of the toilet drain is to be made through the existing inspection on the knee or curve. 210. FALL PIPES The table next to it is used: Fall Tubes(1) Nominal Diameter (DN) Minimum number of floors for buildings -3 On 1 floor Throughout the tube DN Maximum UHC number (mm) 2 2 30 4 2 8 40 10 9 24 50 30 16 70 70 240 905 000 100 960 350 1900 150 2200 600 3600 200 3800 1000 5600 250 600 1500 8400 300 1): minimum diameter DN 100 must be used for pipes discharged from toilets. 211. . For proper sizing, in addition to the use of the table above, the following recommendations must be followed: - fat drop tube of the sinks must be ventilated. - minimum for pipes that receive toilet dumps is 100mm DN. - In the interconnections of horizontal and vertical tubes, single or double joints of 45 degrees must be used. The NBR 8160 does not allow the use of sanitary crosses. - no drop tube must have a smaller diameter than the larger pipe connected to it. • No fall tube receiving discharges from kitchen sinks or landfills shall have a diameter of less than 75 mm of DN, with the exception of buildings up to 2 floors with the fall pipe receiving up to 6 UHC, when the diameter can be DN 50 mm. The fall tubes must be extended with the same diameter to above the roof of the building, without this extension when there is already a ventilation pipe with DN 100 mm, such that: a) The length of this fall pipe does not exceed 1/4 of the total height of the building, vertically. b) This autumn tube only receives up to 36 UHC. c) When the ventilation column is already extended above the lid or in connection with another existing one, the limits of the ventilation table are respected. 212. . When there are contiguous bathrooms in the same building, located next to each other, the sewer extensions of each bathroom, can connect to the same drop tube, as well as the individual ventilation pipes, which connect to the same ventilation column. The same drop tube should not be used separate buildings. falling pipe must have a uniform diameter and whenever be installed in a single straight alignment. When there are deviations from the vertical in the fall tubes, proceed as follows: a) When the deviation forms an angle less than or equal to 45 degrees with the vertical, climb the pipe through Table 5. (b) If the deviation is greater than 45 degrees with the vertical, provide adequate ventilation, in addition to: b1) Resize the upper and lower parts of the pipe by uhc load, taking into account all the apparatus that discharges them. b2) Dimensions of the horizontal part even of the uhc sums, and the lower part of the diverted pipe cannot have a diameter less than that of the horizontal part, see figure. 213. . . 214. SUBCOLLECTOR AND COLLECTOR IS The table next to: Building Collectors(1) and Subcollectors Nominal Diameter (DN) Minimum minimum slope (%) 0.5 1 2 4 DN Maximum UHC number (mm) - 180 216 250 100 - 700 840 1000 150 1400 1600 1920 2300 200 2500 29 0 0 3500 4200 250 3900 4600 5600 6700 300 7000 8300 1000 12000 400 1) The manifold must have a nominal diameter DN 100. 215. . It is observed that the minimum diameter must be 100 mm. They should preferably be rectilinear and in deflection sections imposed by the configuration of buildings or land, placed inspection boxes or inspection parts allowing the cleaning and clearing of adjacent sections. The collector and ed ed ector must be built, whenever possible, on the unbuilt part of the land. When its construction in a built area is inevitable, special care should be taken to protect them and easy inspection. In changes in the direction of collectors where inspection boxes cannot be interspersed, maximum central angle curves of 90, preferably 45 degrees, shall be used provided that the inspection parts are used for cleaning and compensating adjacent sections. The NBR 8160 also recommends: - In the dimensioning of collectors and sub-collectors, it should be considered only the maximum discharge device of each bathroom of residential building, for the calculation of the number of UHCs. In other cases, all contributing devices should be considered for the calculation of the UHC number. • There must be no devices or embarrassments in the collection or sub-collector of the building for the natural flow of landfills such as siphons, bottom of inspection boxes below the profile of the collector or sub-collector of the building, bags of pipes inside inspection boxes, etc. 216. . • When the pipes are buried, the interconnections of the drain extensions, sewage extensions and must be carried out through an inspection box or visiting wells. When When pipes are not buried, 45-degree joints should be used, with inspection parts in adjacent sections and parts in (T) or double (T) are not allowed. 217. Ventilation pipes are intended to allow atmospheric air to flow to the sewer system, in order to protect the closure of the detachers' water from breakage. There are different types of plumbing for this purpose, such as: - primary fan tube: it must have the same diameter as the fall pipe as it is extended. Since the min is 75 mm. • ventilation; - ventilation column and/or barrel; - circuit fan tube; - additional hose or single fan tube: diameter not less than half the diameter of the sewer extension to which it is connected. - exhaust fan tube: equal to the diameter of the ventilation column to which it is connected. The Commission can support Question No 218. VENTILATION PIPES The table next and below is used: Ventilation extensions Sizing group of sanitary appliances without vessels with UHC DN ships (mm) UHC DN (mm) up to 2 30 to 17 50 3 to 12 40 18 18 to 60 75 13 to 18 50 - - 19 to 36 75 - - 219. VENTILATION HOSES . Distance from a disconnector to the ventilation pipe serving the exhaust extension DN (mm) Maximum distance (m) 30 0.70 40 1.00 50 1.20 75 1.80 100 2.40 220. PIPE VENTILATION In addition to the above recommendations for the maximum diameter and distance, the standard indicates that: - In single-floor buildings there must be at least one DN 100 fan tube, connected directly to the inspection box or in combination with the collector, undercover or drain extension of a toilet and extended to the roof of that building. If the building is residential and has a maximum of three toilets, the fan tube can have a nominal diameter DN 75. - In buildings of two or more floors, the fall tubes must be extended up to above the roof, all of which are non-connected (toilets, siphons and siphon boxes) equipped with fans, single connected to the ventilation column, according to the requirements presented in their specific elements. 221. GENERAL CASE WORKSHEET