Analysis Of Clean Water And Hot Water Needs Plumbing System In The Building

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ABSTRACT

The plumbing system is an inseparable part of a multi-storey building. The plumbing system at the hotel is used to provide clean water and hot water needs. To meet the need for clean water in the design of an 8 floors building with a total of 45 inhabitants, an average number of 2,706 people per month and 100 visitors per day, a *ground water tank* capacity of 404.5 is required. m3 / and for the top water tank (Roof Tank) used a water reservoir of 21.59 m3. Based on the results of calculations for hot water needs where the toll of hot water needs per day is 12,900 liters including heat loss with 100% hotel occupancy and for heating time, it is obtained 9.79 hours / day using 2 units of heater heater 21.04 Kw.

KEYWORDS
Plumbing
Hot Water
Clean Water

1. Introduction

Planning a clean water distribution system in a building is useful for serving water needs to all parts that need it with sufficient discharge and pressure. The design of the clean water supply installation is carried out after the development planning of the building in question has existed, because from that it can be seen which parts need water and how types of use it is. In the installation of clean water, a water source with a quality that is suitable for clean water is needed and has sufficient pressure at each output (fixture unit), which is ± 1bar (1 kg / m2).

In buildings, especially hotels, it consists of planning the installation of clean water and hot water in order to obtain a piping network that can meet the applicable planning standards. The planned clean water installation in question must meet water quality according to standards, use the correct technique (safe for safety and safe for pipelines) and be economical. Apart from the problem of water sources that must comply with clean water standards, the problem of water pressure in the clean water distribution pipes is also very important. The most important thing is that the water flow that is distributed must be able to meet the water needs of the building during normal use or peak use.

We hereby take an example of Hotel Max One Kramat - Jakarta which consists of 8 floors and 129 rooms. In order to support its capacity and function, it is necessary to supply water with good quality and quantity, especially in clean water and hot water. This is expected to provide satisfaction for hotel users so that it can increase profits and reputation for the progress of the hotel itself.

The purpose of this study is to determine the source of the problem of water needs when the hotel occupancy is full. The following is a picture of the plumbing installation system currently installed at Hotel Max One Kramat Jakarta.

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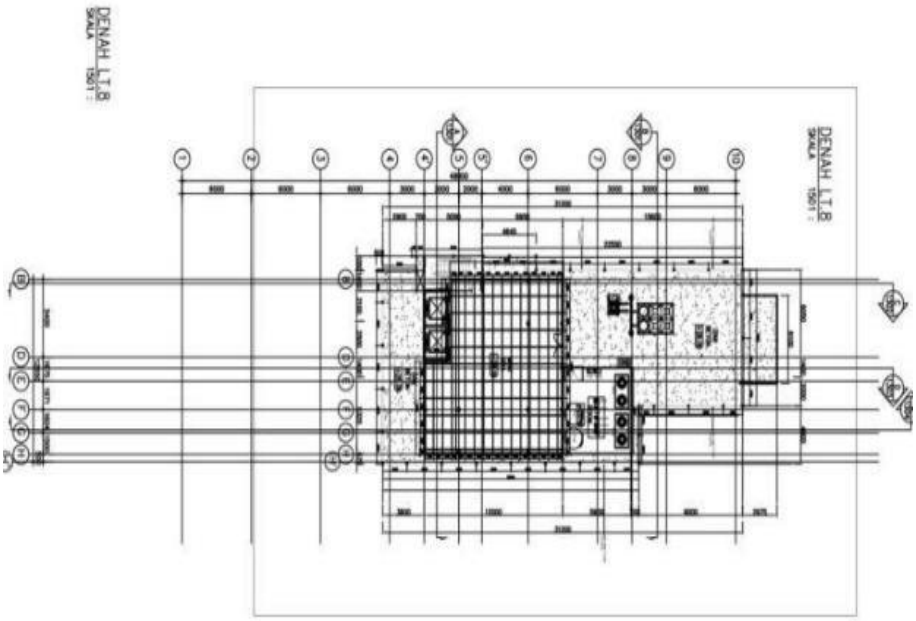

Fig. 1. The 8th floor plumbing roof top installation system at Max One Hotel Kramat Jakarta

"Plumbing is a piping system and its landing, equipment and accessories, which are installed in buildings, buildings and courtyards, originating from a source to a certain point in the building. Plumbing is also related to the type of material used, the care that is carried out, and the control of the abundant waste water, until the distribution of the waste water to the nearest final disposal site. Babbit". "Plumbing is the art and technology of piping and equipment to provide clean water to the desired place, both in terms of quantity, quality and continuity in accordance with the requirements and the distribution of wastewater from certain places without polluting other most important parts, to achieve conditions that are hygienic and the desired comfort and satisfaction. [1] ". "To improve the quality of facilities and infrastructure in order to provide comfort and satisfaction to building users where in normal conditions the user does not pose a potential danger to human health, one of the efforts is to design a good plumbing system on the inside of the building and the building environment where the building works and settlements are located. includes drinking water supply systems, waste and water distribution systems, fire suppression systems and rainwater distribution systems vent. [2] ". "Plumbing is the art and technology of piping and equipment to provide clean water to the desired place both in terms of quality, quantity and continuity that meets the requirements and dispose of used (dirty) water from certain places without polluting other important parts to achieve hygienic and comfortable conditions. desired. ". "Health is one of the most valuable human assets. Maintaining health can be started by maintaining environmental health, both the work environment and the residential environment. In this case, the facilities in the building must be well planned including sanitation facilities, considering that environmental aspects must be considered in order to achieve a healthy environment [3] ". In the installation of clean water, a water source of the appropriate quality is required and has sufficient pressure at each output (fixture unit), which is ± 1bar (1 kg / m2). Able to meet clean water during peak hours of use, by determining the capacity of the water storage tank. [4] ". "Development in the clean water sector is important, to improve infrastructure, the quantity of clean water besides having the quality of the urban sector, both for the health sector, the economic sector and other sectors. Natural resources that are needed by the community for various interests, one of which is water, so that water has a social function and must be utilized for its benefits for the welfare of the people [5]".

Water is one of the most important needs of living things on this earth. In everyday life, humans need water, especially clean water. To meet their needs, humans can determine the amount of clean water that is useful for everyday life. Soyowan is one of the villages located in the Ratatotok sub-district,

Southeast Minahasa Regency. Based on its topography, Soyowan Village is in a hilly area. There is no clean water

supply system in this area. For their daily needs, some people use wells, but if there is a dry season, the well water becomes dry, some people also have to buy water at the water depot.[6] ". "To produce optimal pressure and water flow, a good installation design is needed. To overcome this situation, it is necessary to develop a good water distribution system to ensure the availability of clean water for consumers evenly and an evaluation of the existing clean water supply system, especially the distribution pipeline network system. This is done to determine the problems that may occur in the distribution pipe network so that it causes the distribution of clean water to be smooth on each floor.[7]".

"A series of clean water supply activities need to pay attention to several factors including analysis of clean water needs (demand for water), layout of clean water supply installations, and several other factors such as the socio-economic environment of the population to be served [8] ". Apart from the problem of water sources that must comply with clean water standards, the problem of water pressure in the clean water distribution pipes is also very important. The most important thing is that the water flow that is distributed must be able to meet the water needs of the building during normal use or peak use [9] ". "The pipes used in the plumbing installation plan must have the right diameter in order to be able to distribute water at the appropriate speed. If it has a diameter that is too small, the speed will be too large which can cause water blows, noise in pipes and erosion of the inner surface of the.[10] ". In general, mechanical plumbing is a system of providing clean water and channeling waste water in buildings. Mechanical plumbing can also be defined as anything related to the implementation of pipe installation and equipment in the building or the building concerned with clean water or wastewater connected to the city drain system.[11] ".

The Use of Plumbing Tools Saving Water With Efforts to Save Clean Water With Application of Green Building Concept at Menara Cibinong ApartmenttThe Developing of construction in Bogor Regency tormented by citizen's boom due to urbanization. Citizen's growth of Bogor Regency is envisioned to attain 5,9 million human beings in 2021. Menara Apartment Cibinong creation circuitously could be increasing water wishes which affected home waste water quantity. To minimalizing that hassle, there is need to be a making plans of plumbing gadget for easy water and waste water and also the green constructing idea. With the water conservation includes the reduction of water usage. This water saving plumbing tool. The selected Water Saving Plumbing Equipment due to the fact may be saving water as much as 33% from initial water desires as quantity 305.88 m3/day.Keywords plumbing, Green Building, water saving plumbing device [12]

Application of Green Building Concept (Rainwater Harvesting) at Menara Cibinong Apartment

The implementation of Green Building criteria is relatively new in plumbing installation. Bogor regency is a city of rain, rainfall data of 18.09 mm/day so that the concept of green buildings can be applied with the use of rain water. Consequently, the integration of these criteria into the design process has the potential to change the design process itself. The implementation of the green building criteria into the conventional design process will be discussed in this paper. The concept of this project is to design an apartment that has 5 towers of 20 floors each with a green building concept. To achieve this goal, the Green Building criteria has been implemented since the beginning of the design process until the detailing process on the end of the project. Several studies were performed throughout the design process, such as Conceptual reviews, where several professionally proved theories related to plumbing installation systems and used for a reference. Rainwater harvesting can save 3,48% of clean water from water sources.[13]

, **Perencanaan Sistem Instalasi Plambing Air Bersih dengan Penerapan Alat Plambing Hemat Air Di Rumah Sakit Universitas Sam Ratulangi** The hospital is a health care building, a place of transmission of illness and potential environment Environmental pollution and health problems. One of the transmission of diseases and prevention of the environment Contamination, need to be repaired or improved using plumbing system Hygienic and eco-friendly. In this case, I needed to know how much water could be saved this way. Comparison of conventional and non-conventional plumbing tools. UNSRAT hospital Population of 2,962 people who needed 372.48 m3 of clean water / Day. compared to The traditional plumbing tool is 66.72m3 /day , on the other hand, is an unconventional plumbing tool, 39.60. m 3 / day , using non-traditional standard installation tools, has been shown to be more economical than traditional tools standard. The non-conventional water saving

rate is 40.64%. Expect results Reduced domestic wastewater by 31.68m3 / Day. This is more important than saving water Amount Rp. 3,564,000 and household sewage treatment costs Rp. 9,500,000. [14]

Tracking reduction of water lead levels in two homes during the Flint Federal Emergency A federal emergency was declared in Flint, MI on January 16, 2016, 18 months after switching to Flint River spring water without phosphate corrosion controls. Remedial measures to address corresponding lead contamination during the water crisis include reconnecting to the original Lake Huron water source with orthophosphate, implementing improved corrosion control by measuring additional orthophosphate, program "Flush for Flint" to help clean lead deposits from service lines and plumbing, and possibly replace service lines. Independent sampling over a 37-month period (January 2016 to February 2019) by the United States Environmental Protection Agency and Virginia Technology to assess possible human exposure person through normal rate sampling (~2–3 L/min) with cold kitchen faucets, and to check for sediment from maintenance lines and onsite plumbing through flushing high speed (~12–13 L/min) from the sprinkler. Sampling results indicated that high lead levels in the water persisted for more than a year at two homes in Flint due to a large reservoir containing large amounts of lead deposits. The effects of a large reservoir containing loose lead deposits continued until lead service lines were completely removed in these two anomalous homes. While water conservation efforts are underway in many parts of the country, problems associated with portable lead storage tanks in service routes pose a potential risk to human health.[15]

DESIGN OF PLUMBING SYSTEM AT TUNJUNGAN PLAZA APARTMENT, SURABAYA This plumbing plan study is to plan plumbing that is compatible with clean water, wastewater and storm water management at Tunjungan Plaza Apartment, Surabaya City, Indonesia according to SNI 81532015, and meets 5 aspects edge safety, security, simple, beautiful and economic. It applies the commonly used water supply system for high-rise buildings which is the roof tank system. Methodology and Outcomes: A plumbing planning approach that collects and analyzes variability in water use, and plans for clean water and recycled water systems by approving alternative piping. for clean water and recycled water. In addition to the water supply, a recycled water system that uses recycled wastewater to wash cabinets and water plants should also be included. The average daily water consumption is 268 m3/day for clean water and 44 m3/day for recycled water with an underground reservoir capacity for clean water of 564.54 m3 and l of regenerated water of 62 m3. Conclusion, Importance and Impact Assessment: The clean water supply system will use a rooftop sump system and recycled water will reuse the wastewater for flushing toilets and watering plants. Wastewater uses a system that separates gray water and black water, and is then distributed to STP for treatment and reuse for flushing toilets and watering plants. Rainwater automatically flows down the permeable hole through the designed well. Total investment in plumbing equipment is Rp 2,157,697,501, with water supply cost per unit Rp 4,445,643, while sewage pipe cost per unit is Rp 1 070 711 . [16]

Plumbing System in High Rise Building, Plumbing is the machine of pipes and drains established in a constructing for the distribution of potable ingesting water and the elimination of waterborne wastes, and the professional change of operating with pipes, tubing and plumbing furnishings in such structures. A plumber is a person who installs or upkeep piping structures, plumbing furnishings and device which include water heaters. The plumbing enterprise is a primary and huge a part of each advanced financial system because of the want for smooth water, and right series and delivery of wastes. The word "plumbing" comes from the Latin plumbum for lead, as pipes had been as soon as crafted from lead.Plumbing became extraordinarily uncommon till the increase of current towns withinside the nineteenth centuries. During the identical time public fitness government started urgent for higher waste disposal structures to be established. Earlier, the waste disposal machine simply consisted of accumulating waste and dumping it on floor or right into a river.Supplying good enough water stress in any respect degrees of the constructing is essential for constructing occupants, even though economics, primary constructing functions, and universal heights have sizeable effect on strategies of water deliver distribution. Numerous intermediate-top or even very tall high-upward thrust homes use numerous pumping schemes. One early technique used accelerated garage tanks on the pinnacle of the constructing with fill pumps at the lowest of the constructing, a conventional gravity down feed arrangement. This technique developed into direct pumping structures the use of more than one pump applications with constant-speed, constant-stress controls. Both of those strategies proved to

be dependable and low-cost thru the years, and lots of such designs are nevertheless lively nowadays or nevertheless are utilized in

present day layout practices. Continuing enhancements and improvement of variable-frequency electric powered drives and an ever-growing emphasis on lowering power intake and prices make the variable-speed, direct-pumped package deal a current workhorse of the enterprise. The essential want to offer good enough waft and stress offers the high-upward thrust plumbing engineer adequate possibility to exercise their craft. A thorough knowledge of pumping fundamentals is essential to begin with, and one of the maximum broadly identified reassets is the Fluid Handling.[17]

RE-DESIGN SISTEM DISTRIBUSI AIR BERSIH DAN FIRE HYDRANT DI GEDUNG PLN UP3B KALSELTENG

Plumbing is a system of pipes and drainage systems installed in a building for the distribution of drinking water and domestic waste disposal, and with skills in working with pipes, pipes and fixtures. in the plumbing in those systems. A plumber is someone who installs or repairs plumbing, plumbing fixtures, and appliances like water heaters. The plumbing industry is a fundamental and important part of any developed economy due to the need for clean water and proper waste collection and transportation. The word "plumbing" comes from the Latin word for lead, as pipes were once made of lead. Plumbing was extremely rare until the development of modern cities in the 19th century. At the same time, public health agencies began pushing for the installation of better waste treatment systems. In the past, waste treatment systems simply collected waste and dumped it into the ground or into a river. Providing adequate water pressure on all floors of a building is essential to building occupants, although economics, basic building function and overall height have a significant impact. . on water distribution methods. Many tall, and even very tall buildings use multiple pumping schemes. An original method uses raised tanks at the top of the building with filling pumps at the bottom of the building, a classic gravity feed arrangement. This method has evolved into a direct injection system using multiple sets of pumps with constant speed and pressure control. Both of these methods have proven to be reliable and affordable over the years, and many such designs are still active today or are still used in current design practices. Continuous improvements and developments in electrically variable frequency drives and an increasing focus on reducing energy consumption and costs make the variable speed direct pump a modern horse of the day. industry. The critical need to provide adequate flow and pressure gives high-rise plumbing engineers many opportunities to practice their craft. A thorough understanding of pump basics is essential to get started, and one of the widely recognized sources is Fluid Handling**.** [18]

Source Water Characteristics and Building-specific Factors Influence Corrosion and Point of Use Water Quality in a Decentralized Arctic Access to clean and safe drinking water is a perpetual concern in Arctic communities because of challenging climatic conditions, limited options for the transportation of equipment and process chemicals, and the ongoing effects of colonialism. Water samples were gathered from multiple locations in a decentralized trucked drinking water system in Nunavut, Canada, over the course of one year. The results indicate that point of use drinking water quality was impacted by conditions in the source water and in individual buildings and strongly suggest that lead and copper measured at the tap were related to corrosion of onsite premise plumbing components. Humiclike substances were the dominant organic fraction in all samples, as determined by regional integration of fluorescence data. Iron and manganese levels in the source water and throughout the water system were higher in the winter and lower in the summer months. High concentrations of copper (>2000 µg L1) and lead (>5 µg L1) were detected in the tap water of some buildings. Field flux fractionation combined with inductively bound plasma mass spectrometry and ultraviolet-visible spectrometry were used to demonstrate the association between spring water properties (high organic matter, iron and manganese) with lead and copper in drinking water at the point of use.[19]

Penjernihan Air Bersih dengan Filter Alami dan Aerasi di Teluk Bakung, Sungai Ambawang, Kubu Raya Fresh water is an essential requirement in human's daily life. The village of Teluk Bakung depends on a fresh water supply from the Ambawang River and wells dug by the community. Well water in Teluk Bakung village tends to have a groundwater color influenced by tree roots, dark brown color and high iron content. The purpose of this community service is to perform gambut aboveground water purification to improve the condition of fresh water at AlMuhajirin Mosque in Mu`allaf Village, Teluk Bakung Village, Sungai Ambawang District, Kubu Raya Regency, Kalimantan Barat in accordance with the needs of the mosque and society. The method of application of IPTEKS is to transfer IPTEKS by improving the physical condition of the AlMuhajirin Mosque

building, applying clean water purification as well as training the local staff on operation and maintenance as well as the road network water pipe. It is expected that the addition of groundwater from the iron-containing aeration system will make the water clearer than the simple filtration that has been performed at the site. [20]

Managing water quality in premise plumbing: Subject matter experts' perspectives and a systematic review of guidance documents, Research shows that 18 design themes and 11 operational themes are crucial for water quality management in buildings. No guidance document covers all of these topics, suggesting that a summary of the guidelines is available. Remaining disinfectant and temperature measurements are most often recommended by SMBs as good measurements for monitoring a building's overall water quality. The EMS and the temperature guideline recommendations for controlling opportunistic pathogen growth are reasonably consistent with a water heater setpoint >60°C. However, the temperature recommendations do hot water varies between 50 and 55°C for other locations (i.e. water temperature at the faucet or at the end of the return rotation). In contrast, recommendations regarding disinfectant residue levels (0.22.0 mg/L), wash frequency (114 days), and time to allow hot water to reach the faucet (1060 seconds) were inconsistent. . While this study was able to reconcile differing views on a number of water quality topics, such as defining general guidelines for a water heater set point of at least 60°C, it also emphasized the lack of definitive guidance on other important topics, such as redundancy. , toilet flushing frequency, hot water time to faucet, and thermostatic agitator valve usage, suggest these are important knowledge gaps that need further investigation. The study concludes that there is a need to develop evidence-based guidance, especially on topics on which expert opinion diverges.[21]

Perencanaan Sistem Plambing Air Bersih dan Air Buangan Gedung SMK Negeri 3 Kota Jambi Plumbing installation is an important part of building design. To build SMK Negeri 3, Jambi City needed to design and install good plumbing to meet the sanitation needs of its residents. The purpose of this study is to design a domestic water and wastewater pipeline system at SMK Negeri 3 Jambi City office building. The plumbing design is based on SNI 0370652005 on the Plumbing Design Standard (Tata Cara Perencanaan Sistem Plambing). Clean water is pumped from the underground water source to the rooftop storage tank then distributed to the plumbing units by gravity. The water capacity at the office building is calculated as 34.2 m3/day. The capacity of the roof tank to collect clean water is 7600 liters per day, using the double roof tank is 5000 liters each. Roof tank is located on the tower 1.71 m high. The diameter of the clean water pipe is 5065 mm. The power of the water pump is 0.77 kW. The wastewater distribution system uses a separate system in which the gray water is directed to the treatment plant and the black water is directed to the septic tank. The diameter of the gray water pipe is 6575 mm, while the diameter of the black water pipe is 100 mm. The type of pipe used in this plumbing installation is polyvinyl chloride (PVC).[22]

Implementation and evaluation of the water safety plan approach for buildings

The World Health Organization (WHO) promotes water safety plans (WSPs) a riskbased management approach for premise plumbing systems in buildings to prevent deterioration of drinkingwater quality. Experience with the implementation of WSPs in buildings were gathered within a pilot project in Germany. The project included an evaluation of the feasibility and advantages of WSPs by all stakeholders who share responsibility in drinking water safety. While the feasibility of the concept was demonstrated for all buildings, benefits reported by building operators varied. The more technical standards were complied with before implementing WSP, the less pronounced were the resulting improvements. In most cases, WSP has increased systemic knowledge and awareness of drinking water quality issues. WSPs have also improved the operation of the facility's plumbing and benefited supervisory agencies. A survey by the European Drinking Water Authority Network on the current regulatory framework relating to the safety of drinking water in buildings found that countries are aware of the need to manage risks. risks in the installation of buildings, but experience with WSP is rare. Based on the successful implementation and positive impacts of WSP on drinking water quality, it is recommended to establish regulatory frameworks that require WSP for priority buildings while also taking into account other conditions. each other of buildings and countries.[23]

Identification The Application of Water Conservation in Hotel, Water conservation aspect is a part of Green Building concept. In addition, to save more first clean water consumption, The X Hotel

applied water conservation aspect, which are the WAC 3 (Water Recycling), WAC 4 (Alternative Water Resources), and the WAC 5 (Rainwater Harvesting) (GBCI, 2013). The plumbing installation system with water conservation aspects at X Hotel aims to distribute first class clean water, dispose of the wastewater

to a treatment site with appropriate water requirements refers to SNI 03-7065-2005. X Hotel required 114,640 m3 /day of first class clean water, and 91,71 m3 /day of the total wastewater discharge, includes 18,35 m3 /day of black water and 73,36 m3 /day of gray water. The X Hotel has additional alternative sources of water condensate from air conditioner (AC) about 44,16 m3 /day and 52,53 m3 of rainwater, that can be used for water closet and urinal flushing in the public area at the Hotel, after through the anaerobic – aerobic biofilter STP (Sewerage Treatment Plant) and membrane filtration unit . After the calculation, water conservation aspects application can reduce first class clean water needs with an efficiency around 10 %.[24]

Considerations for large building water quality after extended stagnation, The unprecedented number of building closures related to the coronavirus disease (COVID-19) pandemic is concerning because water stagnation will occur in many buildings that do not have water management plans in place. Stagnant water can have chemical and microbiological contaminants that pose potential health risks for occupants. Health officials, building owners, utilities, and other entities are rapidly developing guidance to address this issue, but the scope, applicability, and details included in the guidance vary widely. To provide a primer of large building water system preventative and remedial strategies, peer-reviewed, government, industry, and nonprofit literature relevant to water stagnation and decontamination practices for plumbing was synthesized. Preventative practices to help avoid the need for recommissioning (e.g., routine flushing) and specific actions, challenges, and limitations associated with recommissioning were identified and characterized. Considerations for worker and occupant safety were also indicated. The intended audience of this work includes organizations developing guidance.[25]

2. Method

2.1 Research Step

Permit applications were addressed to the management of Hotel Max One Kramat Jakarta and to PT. Bernadi Utama as the contractor for the installation of the water heater and installation of the water heater system. Request for permission for plumbing drawings that are the piping installation route to the Max One Kramat Hotel Jakarta. Request for permission to calculate needs from the Planning Consultant and from the Contractor who installs the Water Heater installation system at Hotel Max One Kramat Jakarta Conduct field checks between drawings, calculation data and the system installed in the field.

The planning stage is carried out by the following steps:

- Calculating tank volume and heating time at Max One Kramat Hotel Jakarta
- Calculating the amount of clean water usage for residents, lodgers and visitors.
- Calculating the dimensions (diameter) of the clean water pipeline that has been made.

2.2 Dataset

Data The research data used is the calculation data of water requirements for the plumbing system, both hot water and clean water, to determine the system installed at Hotel Max. One Kramat Jakarta and Cad and As built Drawing Drawings.

2.3 Reference in Clean Water Plumbing System Planning

In planning a clean water plumbing system in a building, the piping system must use clear references. reference is used so that the planning of the building plumbing system is in accordance with the determined standards and the system can run well. References used in the planning of this fresh water plumbing systems, namely:

- SNI 03-6481-2000 About SistemPlambing
- SNI 03-7065-2005 About Plumbing System Planning Procedures
- Soufyan M. Noerbambang and Takeo Morimura About Plumbing System

3. Results and Discussion

3.1. Calculation Hot Water System

Table 1. The Calculation Result

DATA								
Project name	:	Max One Hotel Kramat Jakarta						
Number of rooms (n)	:	129	Room					
Number of People / Rooms	:	2	Person					
Total Person		258	Person					
Number of bathtubs	:	0						
Number of showers	:	129						
Number of sinks	:	0						
Total Kitchen	:	0						
Raw Water Temperature (Tc)	:	27	°C					
Water Out Temperature (Th)	:	55	°C					
ΔT	:	28	°C					
Occupancy	:	100	%					
TDL	:	Rp.1.500	/kW	**(assumption)**				
Type Pamanas	:	Heat Pump Water Heater						
Calculation of Hot Water Requirements (Qd):								
Shower	:	Volume	x	person	Occupancy			
		40	x	258	100	%		
	=	10.320	Liter /Day					
Sink	:	Volume	x	person	Occupancy			
		5	x	0	100	%		
	=	0	Liter /Day					
Kitchen	:	Volume	x	person	Occupancy/2			
		10	x	0	50	%		
	=	0	Liter /Day					
Bathtub	:	Volume	x	Room	Occupancy			
		80	x	0	100	%		
	=	0	Liter /Day					
Total Hot Water Needs	=	Shower + Sink + Kitchen + Bathtub						
	=	**10.320**	Liter /Day					
Heat loss	:	Total Hot Water Needs	x	25	%			
	=	2.580,00	Liter /Day					
Qd	:	Total Hot Water Needs	+	Heatloss				
	=	10.320,00	+	2.580,00				
	=	12.900,00	Liter /Day					
Storage Tank Capacity	:							
	:	Volume total	/	3				
	=	4.300,00	/	3				
	~	4000	Liter					
Tank Capacity	=	2000	Liter					
Number of units	:	2	Unit					
Heat Pump Power Requirements								
H(kW)	:	**Qd**	x	**ΔT**	x	constant		
		12.900,00	x	28	x	0,00116		
	=	418,99	kW /Day					
Water Heater Specifications								
Heat Capacity	:	21,40	kW					
Power Input (Q_{hp})	:	7,58	kW					
Power Supply	:	380-415 V, 3 ph, 50 Hz						
Number of units	:	2	Unit					
Calculation of Initial Heat pump Heating time								
t	:	H(kW)	:	Heat Capacity	x	Number of units		
	=	418,99	/	21,4	x	2		
	=	418,99	/	42,8				
	=	9,79	Hour /Day					
Calculation of Operational Costs (BO):								
BO (Estimated)	:	Number of units	x	Q_{hp}	x	t	x	TDL (Rp./kW)
	=	2	x	7,58	x	9,79	x	1500
	=	**Rp.222.625**	**/Day**					

3.2. Of The above calculation can be concluded

The total need for hot water per day is 12,900 liters including heat loss with 100% hotel occupancy. The need for a storage tank for hot water is 4,000 liters and to facilitate repair, the tank is made of 2 units with a capacity of 2,000 liters x 2 units. The number of heaters used at Hotel Max One Kramat Jakarta is 21.40 x 2 heating units. The preheating time obtained by using a heater is 21.40 Kw x 2 units, namely 9.79 hours / day For electricity operational costs, pay attention to using this water heater. namely Rp. 222,425 / day Preheating.

If using 4 heating units, the calculation obtained is:

Table 2. Conclusion Of Calculation

Storage Tank Capacity	:						
	:	Volume total	/	3			
	=	4.300,00	/	3			
	~	4000	Liter				
Tank Capacity	=	2000	Liter				
Number of units	:	2	Unit				
Heat Pump Power Requirements							
H(kW)	:	**Qd**	**x**	**ΔT**	**x**	constant	
		12.900,00	x	28	x	0,00116	
	=	418,99	kW /Day				
Water Heater Specifications							
Heat Capacity	:	21,40	kW				
Power Input (Q_{hp})	:	7,58	kW				
Power Supply	:	380-415 V, 3 ph, 50 Hz					
Number of units	:	4	Unit				
Calculation of Initial Heat pump Heating time							
t	:	H(kW)	:	Heat Capacity	x	Number of units	
	=	418,99	/	21,4	x	4	
	=	418,99	/	85,6			
	=	4,89	Hour /Day				
Calculation of Operational Costs (BO):							
BO (Estimated)	:	Number of units	x	Q_{hp}	x	t	x TDL (Rp./kW)
	=	4	x	7,58	x	4,89	x 1500
	=	**Rp.222.397**	**/Day**				

Time obtained by using a heater 21.40 Kw x 4 units, namely 4.89 hours / day. For electricity operational costs, pay attention to using this water heater, namely Rp. 222,397 / day. *Max One Hotel Jakarta Hot Water Installation System*

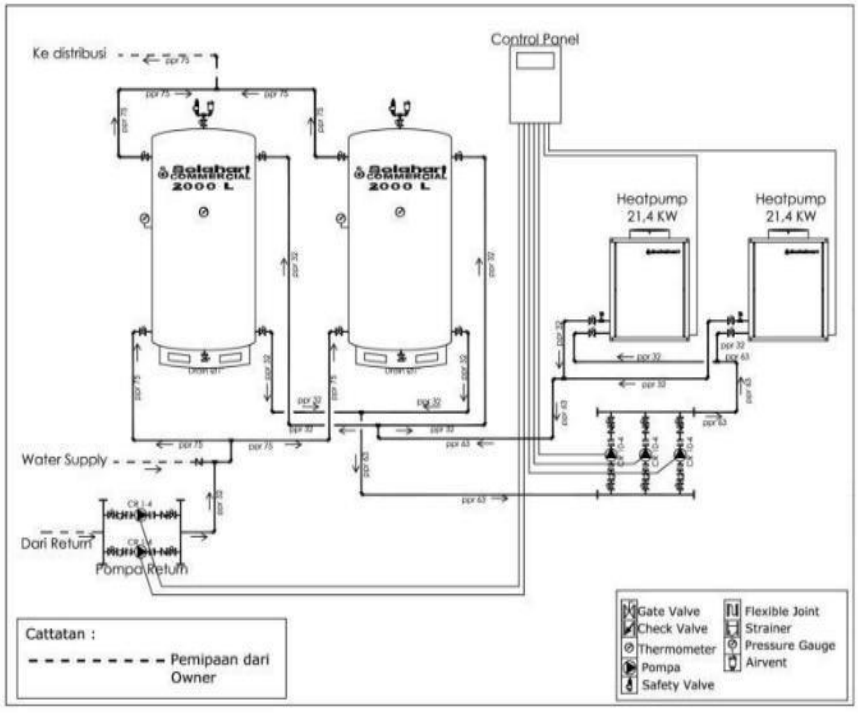

Fig. 2. Schematic of piping using 2 heat pump heating units and 2 pressure tank units

The installation system and water heater currently installed at Hotel Max One Kramat Jakarta, namely using the Heat Pump Water Heater system for heating and using a pressure tank (pressure tank). The working principle of the pressure tank system (*hydrosfor*) is as follows, the water that has been collected in the lower tank is pumped into a closed tank which causes the air inside to be compressed so that there is water with sufficient initial pressure to be distributed to the plumbing equipment throughout the planned building. The working pump is automatically regulated by a pressure detector, which opens and closes the ignition switch of the electric motor driving the pump. The pump will stop running when the tank pressure has reached the set maximum limit and start running when the minimum pressure limit is reached.

3.3. Evaluation of Clean Water Needs

3.3.1 Plumbing System

To produce optimal pressure and water flow, a good installation design is required. To overcome this situation, it is necessary to develop a good water distribution system to ensure the availability of clean water for consumers evenly and an evaluation of the existing clean water supply system, especially the distribution pipeline network system. This is done to determine the problems that may occur in the distribution pipe network so that it causes the distribution of clean water to be smooth on each floor. (Susilo, 2014).

3.3.2 Provision of Clean Water

Planning for a clean water installation is made in the steps of supplying clean water to meet the needs of its inhabitants in water issues. The installation of clean water supply in buildings is planned to achieve the fulfillment of the amount of water with sufficient flow and pressure, using the correct and economical techniques. Planning for clean water needs is adjusted to the number of occupants and the load needs of the plumbing tool unit based on the nature of the plumbing tool usage, not all are used simultaneously (normal use). This clean water supply system basically provides all the needs of clean water (water that is fit for consumption) in a building. The source of clean water supply used comes from ground wells, and then pumped for distribution. In this system, a pump is used to flow water to a reservoir on the roof of the hotel. The pump must be considered in all respects so that water can be flowed to the intended place without being contaminated.

3.3.3 Determination of Plumbing Tool Load Unit

Determining the load unit of the plumbing tool is done by looking at the type of plumbing tool connected to the pipeline, for example the plumbing tool *kitchen sink* (KS), *faucet* (FC), and *jetsprey* (JS). If more than one plumbing tool is connected to the line, then the unit load is added (cumulative). The value of the load unit for the plumbing tool can be seen in the following table:

Table 3. Determination of the load unit and the plumbing tool.

No	Type of plumbing tool	UBAP Privat	UBAP General
1.	Bath tub	2	4
2.	Bedpan washer		10
3.	Bidet (jet sprey)	2	4
4.	Wash Basin	1	1
5.	Drinkin Water Jets	1	2
6.	Lapatory/faucet	1	2
7.	Kitchen Sink	2	2
8.	Service sink	2	4
9.	Pedestal Feet		10
10.	Firecrackers wall lip		5
11.	Firecrackers, troughs		5
12.	Sink, round or plural (each faucet)		2
13.	Toilet with flushing valve	6	10

Analysis of clean water supply includes:

- Analyzing the amount of clean water usage.

- Analyze the piping for clean water.

3.3.4 Data of Residents, Residents and Visitors

Data on the number of residents, lodgers and visitors is used to determine the estimated amount of clean water discharge used at Hotel Max One Kramat Jakarta.

Table 4. Number of Max One Kramat Jakarta

No	Type Of Employee	Number Of People
1	General Manager	5
2	Staff Accounting	8
3	Marketing	5
4	Engineering	8
5	Employess	19
Total		45

Occupants include the number of employees at Max One Kramat Jakarta Hotel. The number of employees in 2019 at Max One Kramat Jakarta is 45 employees (General Manager + Staff Accounting + Marketing + Engineering + Employees). Above table 2 the number of employees at Hotel Max One Kramat Jakarta.

3.3.5 Lodger

Table 5. Number lodgerMax One Kramat Jakarta

No	Month	number of lodgers
1	February	2.250
2	March	2.539
3	April	4.050
4	Mey	1.986
Amount Average		2.706,25
Rounded		2.706

Every month lodger Hotel Max One Kramat Jakarta has fluctuated and has a number of differences because they belong to the hotel. The number of stayers in February - May 2019 at Hotel Max One Kramat Jakarta averaged 2,219 people with the details presented in Table 2 above.

3.3.6 Visitors

Number of visitors to Hotel Max One Jakarta who come every day is a lot and each visitor has specific needs and the amount reaches 100 people every day. *Estimation of the need for clean water for residents The* following is an example of calculating the occupants' water needs max one kramat Jakarta.

Qsehari = number of residents x average water consumption

= 45 x 250

= 11,250 liters / hour = 11.25 m3 / day

Qd = Qsehari x 1.20

= 11.25 x 1.20

= 13.5 m3 / day

Qh = $Qd10$ = 13.510

= 1.35 m3 / hour

Qh max = Qh x C1

= 1.35 x 2

= 2.7 m3 / hour

Qm-Qmax = $Qh\ x\ C260$ = 1.35 x 360

= 0.045 m3 / min

Table 6. Results of the water supply to the inhabitants

Type Of Building	Q	Qd	Qh	Qh Max	Qm max
Hotel	11,25 m3/day	13,5 m3/day	2,7 m3/hour	2,5 m3/hour	0,045 m3/minute

As seen in Table 4.5, the volume of water used daily occupants of 11.25, the average water consumption per day is 13.5 m3,use of water for 10 hours at 2.7m3/ h, water consumption peak hour of 2.5 m3/ h, and the use of water-minute peak of 0,045 m3/ min.

3.3.7 Estimated Needs of Clean Water for Shoppers

For the number of lodgers can be seen in Table 3, namely the data on the number of lodgers in February - May because the number of lodgers cannot be calculated using the same method as the estimated number of residents, for the calculation of clean water the highest number of lodgers is used, namely 4,050 which coincidentally the number exceeds the 149 rooms that have been provided

Table 7. Results of the provision of clean water for guests

Type Building	Q	Qd	Qh	Qh Max	Qm max
Hotel	1012,5 m3/day	1.215m3/day	121,5m3/hour	243 m3/hour	6,075 m3/minute

3.3.8 Assessment of Clean Water Needs for Visitors

The average use for visitors is assumed to be 5% of clean water use because not all visitors use the clean water facilities available at Hotel Max One Kramat Jakarta. The following is an approximate table of clean water needs for residents at Hotel Max One Kramat Jakarta.

Table 8. The results of the provision of clean water for visitors

Type Building	Q	Qd	Qh	Qh Max	Qm max
Hotel	5 m3/day	6 m3/day	0,6 m3/hour	1,2 m3/hour	0,03 m3/minute

From all the calculations above, it is recapitalized in the following table:

Table 9. Recapitulation of clean water needs

Type of User	Q	Qd	Qh	Qh Max	Qm max
Occupant	11,25 m3/day	13,5 m3/day	2,7 m3/hour	2,5 m3/hour	0,045 m3/minute
Lodger	1012,5 m3/day	1.215m3/day	121,5m3/hour	243 m3/hour	6,075 m3/minute
Visitors	5 m3/day	6 m3/day	0,6 m3/hour	1,2 m3/hour	0,03 m3/minute
Total	1028,75 m3/day	1.234,5 m3/day	124,8 m3/hour	246,7 m3/hour	6,15 m3/minute

As seen in table 6, the amount of discharge of clean water needs per day reaches 1,028.75 m3 / day, the average water usage is daily average of 1,234.5 m3 / day, water consumption for 10 hours is 124.8 m3 / hour, peak hour water consumption is 246.7 m3 / hour, and water consumption in peak minutes is 6.15 m3 / minute.

3.3.9 Determination of the Size of the Ground Water Tank.

With the water that is stored in the lower water tank, it is necessary to have an appropriate size for the storage capacity so that the use of water at peak hours can be fulfilled. Determination of the size of the bottom water tank (Ground Water Tank) is determined based on the following:

Calculations service pipe capacity is calculated, with the following equation:

Qs = 23x Qh

Where

Qh = 124.8 m3 / hour

Qs = Service Pipe Capacity (m3 / hours)

So that

Qs = 23x 124.8 m3 / hour

Qs = 83 m3 / hour

Calculated the volume of the ground water tank, with the following equation:

Volume GWT = [Qd− (Qs xt)] x 1 day

Where

Qd = 1.234.5 m3 / day

Qs = 83 m3 / hour

T = 1 day

t = 10 hours / day

So:

Volume GWT = [1.234.5– (83 x 10 hours / day)] x 1 day

GWT volume = [1.234.5– 830 m3 / day] x 1 day

GWT volume = 404.5 m3

So, the volume of the ground water tank (Ground Water Tank) is 404.5 m3. In this design, a ground water tank is used.

3.3.10 Determination of the Size of the Upper Water Tub

In determining the dimensions of the upper water tank (Roof Tank), it must first determine the volume capacity of water that must be accommodated in the tub. Determination of the volume capacity of the upper water tank using the equation can be determined through calculations such as the following:

Qp = Qm-max

= 6.15 m3 / minute

Qh-max = 246.7 m3 / hour

= 246.7 m3 / hour x $\frac{1\ hour}{60\ minutes}$

= 4.11 m3 /

min.In this design, the Qpu value is assumed to be Qh-max, so:

Qpu = Qh max

= 4.11 m3 / minute

In addition, it is also assumed that:

Tp = 60 minutes

Tpu = 25 minutes

From these data, then it can be determined the effective volume for the upper water tank, namely:

Ve = ((Qp xQh-max) Tp - (Qpu x Tpu)]

where:

VE = volume of the top water tank (m3)

Qp = 6.15 m3 / minute

Qh-max = 4.11 m3 / minute

Qpu = 4.11 m3 / minute

Tp = 60 minutes

Tpu = 1 minutes

So:

VE = ((6.15 x4.11 x m3 / minute) x60 minutes - (4.11m3 / minute x 1 minute)

VE = ((25.27 x m3 / minute) x 60 minutes - 4.11 m3]

VE = [25.7 m3 - 4.11 m3]

VE = 21.59 m3

So, the effective volume of the roof tank is: 21.59 m3.

4. Conclusion

Number of employees at Hotel Max One Kramat Jakarta is 45 people, the highest number of lodgers is 4050 people and the number of visitors reaches 120 people / day. Of the total number of users can know the amount of total water needs of residents, visitors, and lodger is 1028.25 m3/ day and for the hot water needs of the first calculation that is obtained when preheating using a pressure tank of 2000 liters x 2 units and heaters 21.40 Kw x 2 units i.e. 9.79 hours / day (currently installed system). If you add a unit with the same capacity, namely 21.40 kw x 2 units, the heating time will be faster, which is 4.89 hours / day. To avoid guest complaints when the hotel occupancy is full, you should add 21.40 x 2 units, so that heating time is faster and the need for hot water is sufficient for each room.

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