

Use of Neon Gas for Lighting

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Abstract: Electricity will make the atmosphere of the area around your home or business beautiful by installing lights of various colors, shapes, and made in various positions so that the atmosphere becomes beautiful. The rapid development of electronic materials has excited and stimulated the growth of household appliances and also the ornaments in the form of lamps that compete with their development. Lamps with forms and conditions of use of electric current that are energy efficient. The lamps with the transformer part coded T (engine) and Part G (glass/tube) will alternately be installed between G (glass) and T (engine) for testing. From these changes, the results of light intensity will be obtained for later analysis. The results obtained show that if T5 or G5 is replaced with G8, G11, G18, G23 it will result in a significant increase in the light intensity value. The effect of neon gas on lamps can be used at small electric power. With this research, it is hoped that optimal results will be obtained to produce more lamp products so that lamp prices become cheaper. Neon gas can be used in making lights on billboards to introduce industrial products. This research is intended so that in designing energy-saving lamps to install the desired T and G to produce energy-saving lamps.

Keywords: electricity, energy-saving lamps, light intensity.

1. Introduction

Electricity is very helpful in life to be able to develop biologically and economically in life and its development. Electricity is needed in everyday situations both inside and outside the house. Lights that save electricity are needed in everyday situations both inside and outside the home.

The intensity of lighting in human life has become a tool to make people feel comfortable when using it [5]. Many supporting facilities have been made, but there are still many things that cannot be expected, such as lamps that are wasteful in the use of electricity, cause fires and lamps that are easily damaged. Different facilities are made for lamps whose function is the same for lighting and beauty. In addition to the function of the lamp as lighting, it also has a function for beauty so that human life feels pleasant. Lamps are also made according to their function and lamps must function economically in life. The lamps have been made economical with various kinds of energy-saving lamps (Philips) and other types of LED lamps with various types of brands. Energy-saving lamps use neon gas as a means to provide a flame to other parts so that the lamp can light up. The use of neon gas to fill glass tubes needs attention, with light from various brands of lamps having different lighting even with the same electric power (watts) because they use electricity and neon gas. Neon gas in the lamp provides a function as a light transmitter from one side to the other. Neon gas is widely used as a lamp filler on billboards and also lamps for home lighting. The function of neon gas needs to be considered for the development of its use through research. Neon gas is the lightest gas after helium. Because it is lighter than other gases after helium, neon gas is widely used as a means of lighting (a characteristic of neon gas). The function of neon gas is to give a reddish white color and reduce heat in the lamp. If the neon gas increases in charge, the light will be brighter and if the neon important tool in the industrial world. Neon gas can be made for billboards to introduce industrial results which are installed in strategic places. Neon gas is formed in such a way and with a combination of colors, neon gas is very attractive for use in the design of the required lamp. Gas neon lights are widely used for billboards. Many industrial products produced by factories are introduced to the public through billboards placed in strategic places on the roadside. Selection of billboards for industrial use is much cheaper than television media.

Lamps with Neon gas are analyzed to determine the effect of neon gas on the intensity of lighting, and the ability of neon gas and its function in design for the benefit of identifying industrial products with billboards. Neon gas is used to manufacture energy-saving lamps and also lamps that are shaped like LED lamps which are very energy-efficient. Krypton, Neon and Xenon are atmospheric gases, these gases are abundant in the atmosphere [21]. Neon gas serves to manufacture energy-saving lamps and also lamps that are shaped like LED lamps which are very energy-efficient [20]. If there is a problem with breaking the fluorescent lamp, it will result in the appearance of mercury gas in the lamp fragments and the mercury fragments are very dangerous for humans [10]. Neon gas is located number 10 in the periodic system of elements below helium and neon gas is also the lightest gas under helium [17].

2. Literature Review

Lights are very necessary in everyday life because lights are a primary need that cannot be separated from human life. Lamps that use neon gas as raw material dominate the economic market and needs. The choice of a lamp that has a neon base material is because it has a very bright light [3]. Neon is a light gas that melts at -245.98°C and has a boiling point of 2.6°C. This characteristic causes neon to be chosen and used as a basic material for lighting lamps [4]. Fluorescent lamps require a high AC voltage to ignite, therefore they are always synonymous with high voltage AC lamps. It cannot be applied to low voltage DC supply systems. If the fluorescent lamp is to be operated with a low-voltage DC supply, it must be preceded by a step-up converter unit [5]. Philips PL is an early generation of modern fluorescent lamps which are categorized as CFL (Compact Fluorescent Lamp) lamps. In its development, CFLs apply more special electronic circuits to drive the ignition of lights, often called electronic ballasts. CFLs, a new generation of energy efficient lamps CFL lamps continue to be developed and are now being produced by many companies in the world. Another development is that gas neon lamps are made and lamps are made for billboard lights as a means to introduce industrial products with various variations and the desired shape according to the shape of billboards [6]. The development of neon lights must be taken seriously in order to make the economy better.

3. Materials and Methods

3.1 Materials

Analysis of the materials used are lamps on the market such as Phillips lamps.

The intensity of lighting is very important and needs to be considered because it is in direct contact with humans. Light intensity is needed when humans do activities at night. During the day it is also not uncommon to use neon lights because they have not utilized sunlight in space design. Ultra Violet radiation from fluorescent lighting can cause eye strain, migraines and dizziness [14]. However the effect can be reduced by placing fluorescent lights at least 1 to 2 feet above the seat. Especially if working under the light for long hours will stress the body and cause health problems, such as sleep disorders, cancer and migraines. Light sensitivity can also cause headaches due to the brightness of the fluorescent lamps used.

3.1.1 Health problems

Symptoms of physical pain from exposure to fluorescent light can develop within minutes of exposure. From this disease, a good working theory is needed to avoid this condition. The theory of work in question is how we work to get a break that is done while working for a few minutes by doing sports on the spot. Rest in place is done to relieve fatigue and aches in the body and limbs. If you work at a computer, then every hour you have to look elsewhere for a few minutes. Neon gas is a periodic chemical element, in the periodic table neon gas has the symbol Ne with atomic number 10. Neon gas belongs to the noble gas group which is colorless and inert. This neon gas gives off a characteristic reddish glow when used in vacuum tubes and fluorescent lamps. In this life, we can hardly escape the light. Lights are considered as a basic need that must be owned and installed in the house so that it is bright for comfort. However, users often do not understand that the lamps they have do not support the Go Green concept. As a result of being exposed to neon gas lights for too long, it triggers the anger factor in children and can have a bad impact on children, namely lowering IQ and decreasing IQ, of course, is very influential in old age. Neon gas if inhaled can cause shortness of breath if there is not enough oxygen to breathe.

3.1.2 Characteristics of neon gases

Neon gas gives a reddish glow when used in vacuum tubes and is used in neon lamps and this property of neon gas makes it widely used as a material for making street signs, houses where it is needed. Environmentally friendly neon gas can emit ionized light and can pass through smog. Neon gas is lighter than air which is a monatomic gas made up mostly of nitrogen (N₂). Neon gas can fill hot air balloons so that hot air balloons can rise into the air. Its density is 0.9×10^{-3} g/cm³ at 2000 C with a melting point of -24900 C and a boiling point of -24900 C. These conditions allow neon gas to be used in various forms and can be processed as desired and neon gas as a liquid or gas, comparatively more expensive - for a small amount. The price of liquid neon gas can be more than 5 times that of liquid helium.

3.1.3 Benefits of neon gas

Besides being used as lighting at home, neon gas is widely used for laser neon, vacuum tubes, lightning rods, high voltage indicators and billboards. Another use for neon is that neon gas is 40 times more effective as a refrigerator than liquid helium and 3 times better than liquid hydrogen because of its high cooling

capacity[15]. Fluorescent gas (liquid), which is a liquid that can be used in cryonics to freeze corpses. Neon gas lamps can create new problems, namely creating harmonics which cause excessive heat in the line wire [19].

3.1.4 Lamp installation formula

Installation of lights must meet the requirements and criteria for existing room conditions and adjust to the size of the room [7]. It is hoped that the lights do not often cause problems and the lights can help provide optimal lighting[1]. Electrical theory can provide clues as to how many lights are needed [8].:

$$\emptyset = Ex A \text{ (lumen)} \quad (1)$$

Where:

E is the light intensity (lux)

A is the area of the work area (m²)

\emptyset is the fluctuation of light (lumen)

Equally important is the armature which can make the lighting emit a more directional light intensity. The armature efficiency must also be known because it will determine the amount of light emitted depending on the material and shape of the armature [8].

$$V = \frac{\text{fluk of light emitted by the armatur (light fittings)}}{\text{fluk of light emitted by light source}} \quad (2)$$

In this study we will use PHILIPS brand lamps on the market. Philips lamps are lamps that have good standards and quality. The PHILIPS lamp used is a type of essential lamp with energy-saving conditions and does not have heat properties. The PHILIPS lamps used have a capacity of 5 watts, 8 watts, 11 watts, 18 watts and 23 watts.

3.1.5 The use of electronic materials in energy-saving lamps.

General function:

- a) The capacitor is a store of electric current to balance circuit conditions. Capacitors can provide electricity in case of an imbalance in the amperage [16].
- b) Resistance (ohms)
The resistance functions as a barrier to the electric current passing through the circuit so that an excess of electric current does not occur.
- c) Diodes
The diode functions as a rectifier for the passing electric current. The diode directs the electric current flowing from AC to DC.
- d) Transistors
The transistor functions as an amplifier, controller, rectifier, oscillator and modulator. In the lamp, the transistor serves as an amplifier for the electricity passing through it[22].
- e) Inductor
An inductor is a coil of wire that functions as an energy store in a magnetic field generated by an electric current [2].
- f) Transformer
The transformer serves as the main line for the entry of electric power. The transformer has the property of raising and lowering the voltage. In energy-saving lamps, the transformer functions as a voltage reducer so that it can be used in a series of lamps[23].

The development of electronic materials has become the basis for producing energy-saving lamps with all the advantages of electronic materials, making the world of the lighting industry develop very rapidly. Currently the world is full of electronic material, so everything is electronic. The development of the electronic world influences other fields that make it live and take advantage of electronic developments to develop. The use of electronic materials can make life easier and make human life more comfortable.

The function of electronic materials is very important because the properties and characteristics of electronic devices can function as needed. The required electronic devices must be able to work according to their functions and duties. Energy-saving lamps require an electronic device to regulate the incoming electrical power to provide electrical power input so that energy-saving lamps can light up properly. Energy-saving lamps consist of 2 (two) parts according to their function, namely as a machine (T) in which there is electronic material and a tube in which there is neon gas (G). These two parts have different functions, namely as a supplier of

energy (T) and which has the property of giving light is a tube (G). The circuit on the machine (T) is a closed circuit that supplies electricity to the tube (G).

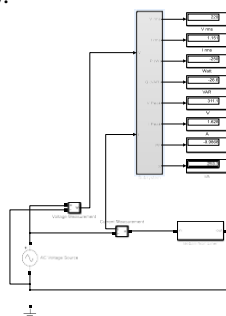


Fig. 1. Energy Saving Lamp

3.2 Methods

This problem-solving method is useful for getting how much influence neon gas has in making energy-saving lamps and the possibility that its use can be developed.

The method in this discussion is to use the data search method through measurement and the data obtained is analyzed. Data is obtained by exchanging G (G5, G8, G11, G18, G23) on T5 or T8 and so on. Exchange between place (G) and place (T) to measure the level of light intensity and electric current used. The measurement results were obtained with a measuring instrument and then analyzed to obtain results.

3.2.1 Conduct research

Research conducted:

- A. Prepare research tools.
- B. Conduct research by installing lights and replacing them alternately until finished.
- C. Data collection by measuring all lamp conditions to obtain light intensity with a lux meter (SANWA: LX.3131).
- D. Retrieval of electric current data on lamps using a digital clamp meter (KEW2117R).
- E. e. Record research results.
- F. Analysis.

4. Results and Discussion

4.1 Research Results

The research results were obtained from measuring the number of T (engine according to the size in watts) and G (tube).

The results of the study of lights using a lux meter obtained the value of light intensity. Light intensity measurement is intended to determine the addition of light intensity at each lamp replacement.

Table 1 Results of Light Intensity Measurement (Lux) (19).

| | G5 | G8 | G11 | G18 | G23 |
|-----|-----|-----|-----|-----|-----|
| T5 | 50 | 75 | 85 | 120 | 145 |
| T8 | 70 | 95 | 115 | 140 | 150 |
| T11 | 80 | 85 | 110 | 195 | 205 |
| T18 | 115 | 135 | 145 | 200 | 225 |
| T23 | 120 | 185 | 195 | 240 | 250 |

Where:

T = Machine

G = Glass

The code terms T and G mean that T is a machine which is then replaced with a glass (glass filled with neon gas) according to the wishes of the researcher. The results of this study were carried out by replacing the glass containing neon gas to obtain value data with the results of measuring light intensity (lux). The obtained light intensity is carried out on one machine with various types of glass being measured. In Table 1. it can be seen the results of the light intensity on each machine with a variety of glass with different amounts of neon gas.

Looking at Table 1. and Figure 2. in general, it can be seen that there is an increase in neon gas which can provide a periodic increase in light intensity.

Look at figure 1. In general, it can be seen that there is a periodic increase in light intensity in conditions where there is an increase in the use of neon gas.

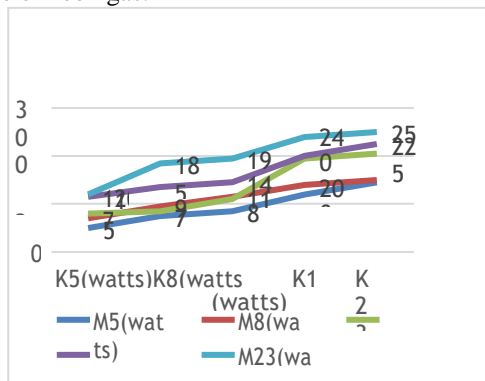


Fig.2. LightIntensity

4.1.1 Percentage of Research Results

The percentage of research results is deliberately sought, namely the difference from each measurement on the condition of the value of the magnitude T and the condition of the magnitude of G which is different. The difference in the value of T and G will be used as a model in determining the appropriate conditions for research, so that the results of the study can be seen the difference.

Table 2 Percent Light Intensity Results of Research (19).

| | Percent of G5 | Percent of G8 | Percent of G11 | Percent of G18 | Percent of G23 |
|-----|---------------|---------------|----------------|----------------|----------------|
| T5 | 0 | 0.50 | 0.13 | 0.12 | 0.08 |
| T8 | 0 | 0.36 | 0.21 | 0.22 | 0.07 |
| T11 | 0 | 0.06 | 0.29 | 0.77 | 0.05 |
| T18 | 0 | 0.17 | 0.07 | 0.38 | 0.13 |
| T23 | 0 | 0.54 | 0.05 | 0.23 | 0.04 |

Looking at Figure 3. which shows percentages, it can be seen that the percentage results show a decrease in the percentage value.

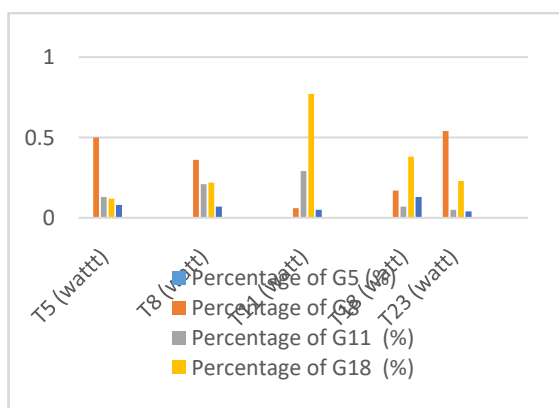


Fig.3.Percentage of Research Results

4.1.2 Results of electric current measurements

The measurement results table is used to find the magnitude of the current in each condition when the machine (T) is installed in a tube (G) containing different fluorescent gases.

Table 3 Results of Electric Current Measurements (19)

| | G5 | G8 | G11 | G18 | G23 |
|-----|------|------|------|------|------|
| T5 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 |
| T8 | 0.03 | 0.04 | 0.06 | 0.07 | 0.08 |
| T11 | 0.06 | 0.07 | 0.07 | 0.09 | 0.10 |
| T18 | 0.08 | 0.09 | 0.10 | 0.11 | 0.15 |
| T23 | 0.09 | 0.11 | 0.11 | 0.14 | 0.15 |

Figure 4. Shows that the results of electric current measurements show an increase in current at each change in conditions with the addition of neon gas. It should be noted that the magnitude of the addition of electric current that occurs at each addition of neon gas or at each change in conditions G and T remains constant.

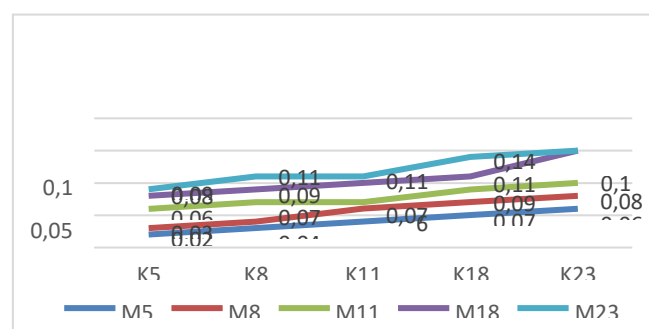


Fig.4. Electrical Current Measurement Results (Amperes)

4.2 Discussion

Effect of neon gas on light intensity (lux)

The results of the research in Table 1 show that it produces a large light intensity value with a significant increase in neon gas. The magnitude of the results showed that neon gas can be used at the smallest electric current (because neon gas has low melting and boiling points). With a small electric current T, if it is attached to G with a larger neon gas it will still light up. In Table 1. at T5, even though G (tube) was changed from G8 to G23 the lamp still lit, this proves that neon gas is suitable for small electric current capacities. If seen in Figure 1, there is an increase in light intensity, even though it is exchanged to a fairly high level. This shows that neon gas can be used for energy-saving lamps. In Table 1 it can be seen that the results of the T8 study were installed at G5, T11, T18 to T23, which means that they are still experiencing a fairly bright flame. T11, T18 and T23 also experience the same thing as T8 and the results are the same, namely the lights produced are quite bright. So that neon gas is suitable for making billboards that require a small electric current with bright enough lighting. The use of neon gas is currently being developed in the manufacture of household lamps with high light levels and low electric currents. Due to the shape and characteristics of neon gas, development is underway to obtain energy efficient lighting. Currently energy-saving lamps can be accepted by the community as a suitable lamp because the price of electricity is increasingly expensive.

4.2.1 Reasons for using energy-saving lamps.

1. Save costs from electricity bills per month, the intensity of the light emitted is brighter than the electricity used [12].
2. Saves monthly expenses, seen from the use of lights, because there is no need to buy a bulb every month.
3. Whiter color, good white light which is almost the same as sunlight so that at night you can see colors more clearly.
4. The movement called Go Green means the use of energy-saving lamps, it is not uncommon to buy lamps by reducing lamp production so that factories reduce their production. With a little factory production, factory smoke can be reduced.

4.2.2 Changes in the light intensity of the lamp with a difference in neon gas.

The results of the research can be seen in Table 1. Following are the results of the data which can show that neon gas can be used for the smallest power source as needed. By providing neon gas with a different electrical power, it is still able to transmit light from the burning wire to be passed on to all the vacuum tubes. It is proven that the electric power from T5 can still provide light intensity on the vacuum tube in G23. For T23 to G5 the electricity will turn on but is still in a critical condition (the light is quite red, the G5 light will go out). As for the T8, T11, T18, and T23 which were paired with a different G, there were no problems.

In Table 2. shows the change in the intensity of the light emitted in each G (glass tube). Even though it is given a different electric power, G still lights up even though the intensity of the light emission is slightly reduced. If seen from Figure 2, it is clear that the decrease in the level of light intensity emitted from each G (glass). In Table 2. it is clearer the percentage of light intensity reduction which is the condition of neon gas in connection with its use as a means of lighting which is good enough to be used as lighting or as decoration because neon gas is white in color and can even be colored as desired. Neon gas plays an important role because neon gas provides cooling against the heat that occurs due to heating due to the flame of the wire.

4.2.3 Use of neon gas in the development of other lamps with the resulting light intensity

It is important to do research on the relationship between neon gas and light intensity. It is important to make changes so that there are energy-saving lamps at lower prices. The existence of energy-saving lamps other than the Philips brand shows that the use of neon gas can be used properly. Judging from the measurement results, it turns out that other brands of lamps have a light intensity far below that of the PHILIPS brand. The light intensity of other brands with an electric power of 7 watts has a light intensity of 37.5 lux, and with an electric power of 18 watts it has a light intensity of 75 watts. If these two other brands of lamps are crossed (replaced with glass filled with neon gas) then M7 and K18 produce a light intensity of 50 lux and if M18 and K7 produce a light intensity of 62.5 lux. So that the light intensity of other brands of lamps has a light intensity that is far below that of the PHILIPS brand lamps (see Table 1.).

The conclusion that can be drawn is that art and creativity can produce new products. New products appear that use neon gas as a commodity to produce new economic products.

4.2.4 Changes in electric current for lamp design

In Table 3. shows the change in current that occurs in engine conditions (T) with changes in the tube filled with neon gas (G) used. This change corresponds to changes in the neon gas cylinder used. This change indicates a change in light intensity that occurs followed by a change in the use of electric current. The greater the intensity of the light that occurs also requires a greater change in electric current. The conclusion that can be drawn is that the manufacture of lamps using neon gas must be adjusted to the amount of electric current used (in Table 1. and Table 3. can be compared). This means related to the engine (T) which will be designed according to the needs of neon gas cylinders which will be made as needed. Neon gas is widely used to make billboards, it is necessary to pay attention to the design of the machine (T) in adjusting the tube used so that the lights can light up according to the design. This means that an increase in the use of neon gas indicates an increase in the electric current used. If you design a lamp using neon gas, you must use an electric current design that is adapted to the use of neon gas.

4.2.5 Making billboards with neon gas lights for industrial use.

Advertising is a tool that is used as a tool for the purpose of introducing industrial products. The industrial results produced must be known by the wider community that a product is produced for certain needs as well [11]. Seeing the current conditions, the industrial products produced by these factories are numerous and varied. With the rapid release of industrial products, alternative choices are needed to introduce industrial products so that they can be chosen and recognized by the public. This alternative is needed because it is very expensive to introduce industrial output through television [9]. Through industrial product introduction advertisements can be minimized again through the use of electric current used (Table 3). See Table 3. Utilization of electric current using neon gas can be carried out to a certain extent according to the design of the electronic equipment used. The electronic equipment used must be based on calculations to be able to carry the required electric current. Based on the measurement results obtained, the provisions in table 3. really need to be applied to the lamp design to be made [5]. Making lamps with neon gas can be minimized by reducing the electric current so that the designed lamps can be energy efficient [13].

4.2.6 Efficient light intensity in neon gas exchange

From the efficiency of light intensity obtained, it can be interpreted that any addition or increase in the use of neon gas will also be adjusted to the use of the electric current used. Making lights on billboards must be based on Table 3 and Table 1. to predict the minimum value of the use of inrush current in electronics. To make a source of electric current by assembling electronic devices, you must calculate the electronic devices used so that the desired current can come out, electronic devices can be used to make glowing gas. So every addition of neon gas can certainly increase the electric current periodically. The use of electric current can be reduced according to the benefits and functions of the billboards that are made (Table 1). Although the use of neon gas is related to electric current, in making billboards the use of electric current can be reduced because billboards do not have to have optimal intensity. The use of neon gas lamps in making billboards uses more neon gas and reduces electric current and even efficiency can certainly be reduced. The aim of looking for efficiency is to get the limit of the use of electric current and neon gas to get the minimum analysis value between the use of electric current and neon gas. The use of neon gas is widely used as a means of energy-saving lamps. Energy-saving means that have to use a small energy lamp but can provide a bright enough light intensity [18].

5. Conclusion

Conclusions that can be conveyed from the discussion of this study:

From the research results and discussion results it is known that the effect of neon gas on light intensity results in a significant change in light intensity. If you look at the effect of neon gas on light intensity, it can be concluded that it produces and shows that neon gas can be used at the smallest electric current source as needed. By providing a different electric current, neon gas can continue to transmit the light intensity from the burning wire to be passed on to all vacuum tubes. Currently there has been an encouraging development of energy-saving lamps other than the PHILIPS brand. Through this research, it is hoped that more and more lamp models will be produced as energy-saving lamps to enliven the economic market. The development of making lights on billboards to introduce industrial products that are more cost-effective in electricity. In addition to energy-saving lamps, neon gas can also be used to produce lights on billboards which are used as a means to introduce industrial products produced in factories with various designs. In designing energy-saving lamps, you really need to pay attention to Table 1. and Table 3. And the design choices are T11 with G18, and G32 or T8 with G11, G18, and G32.

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