

The Greatest Recognition to the Scientist Nikola Tesla – Award of the Unit for Magnetic Induction (T) in the International System of Units (SI)

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Abstract: The paper describes the reasons and results that led to the greatest recognition that a scientist can achieve, his name Tesla given to a unit in the field of electricity and magnetism in the International System of Units (SI). The difficulties on the way from a proposal to its final adoption, through different Technical and Experts Committees of the International Electrotechnical Commission (IEC) and of the International Committee on Weights and Measures are described. Some examples for the usage of the „tesla“ unit are mentioned.

Keywords: Unit for magnetic induction „tesla“ (T).

1 Introduction

The great jubilee since Nikola Tesla's birth, celebrated by the whole mankind characterize exhibitions, concerts, theatre performances, postal stamps editing, unveiling and consecration of monuments, different editing activities etc., As recognition there is an overview of Tesla's scientific work in the field of electricity is given, and as a crown, the award of giving the name "tesla" to the unit in the field of electricity and magnetism in the International System of Units (SI) is elaborated. The greatest recognition to Nikola Tesla was given in 1960 by the decision of the 11th General Conference on Weights and Measures, by giving the name "tesla" and symbol (T) to the magnetic induction unit in the SI.

2 Tesla's Scientific Work

The year 2006. is in the sign of celebration 150 years since Nikola Tesla's birth. Born in an orthodox Serbian family, he had Serbian nationality and by living in America became an American citizen, as people often said, American-Serbian genius. The importance of Tesla's inventions is even greater if one

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knows that the whole industrial production was based on the use of coal and vapor in this period.

The main results of Tesla's work were condensed in over 100 most important patents of his inventions registered with USA, Great Britain and Canada Patent Administrations. Those patents could be selected into the following 8 fields: rotating magnetic field; motors and generators; transformation and electric power transmission; lighting; high frequencies devices and regulators; radio; telemechanics; turbines and similar equipment.

Hundreds of articles in different magazines, 39000 technical and scientific documents and hundred of books were written about Tesla. In the Nikola Tesla Museum in Belgrade 56 diplomas from the period 1873-1939 have been kept. In the book "Nikola Tesla's Diplomas" issued in 2006 by the Nikola Tesla Museum, a number of chosen letters which are in connection with them, were published to show what certain awards meant to him. It is therefore easier to understand the period of time the great inventor and researcher lived in, as well as the response of his work among the contemporaries.

Out of hundreds Tesla's inventions, three of them in the field of electricity who changed the world, are mentioned here.

The rotating magnetic field Tesla discovered in 1882 in Budapest by the aid of two or more alternating currents of the same frequency, with a time delay one after another for a certain part of period, flowing through the coils dislocated in space. Parallel to the discovery of the rotating magnetic field, Tesla worked on his induction motor concept. Five years lasted until Tesla, after the discovery of his rotating magnetic field, registered the first series of 7 fundamental patents to the USA Patent Administration in 1887: induction motor, polyphase motor, generator and transformer as well as connection triangle-star and the other elements of the polyphase system for production, transmission, distribution and use of electricity.

Beside these seven fundamental patents, during 1888 and 1889 Tesla registered the next 34 patents and completed his genius master piece, his polyphase system. In supplementary patents, Tesla finalized his three phase polyphase system with three and four conductors.

Tesla's miraculously simple induction motor admired the world not only solving the problem of an economical and good motor, but also enabling an easy transformation of AC electrical energy into mechanical work. Thanks to the use of a transformer, an economical power transmission on large distances led to the victory of Tesla's polyphase system comparing to the monophase system. Tesla's electrical energy production, transmission and distribution system is used nowadays without essential modifications.

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Commissioning the power plant on the Niagara Falls in 1896, the produced electric energy was transmitted at high voltage by two phase alternating system to the town Buffalo 37 km far away from the Falls and a model for building electric power plants at the generation place was set up.

Thanks to the friendship between Nikola Tesla and professor Djordje Stanojević, who was one of his hosts while visiting Belgrade in 1892, building small hydro power plants began at the principle of alternating current. Professor Djordje Stanojević edited his first book on Tesla's inventions in 1894. At the river Djetinja near Užice in 1900, only four years after the electric power plant on Niagara Falls, thanks to this friendship, the first Serbian electric power plant was built on Tesla's principles.

Professor Stanojević also worked on electric power plants on the rivers Nišava, Crni Timok, Vlasina, Moravica and Pek.

3 Giving the Name “Tesla” and the Symbol (T) to the Magnetic Induction Unit in the International System of Units (SI)

In the year of celebrating 150 years since Nikola Tesla's birth, we are reminding of the procedure how Tesla achieved the greatest honor through the international unit for the magnetic flux density (magnetic induction) whose name became “tesla”.

At the IV Session, the Eleventh General Conference on Weights and Measures, in October 18. 1960 the Resolution 12 was voted, by which it was decided that the magnetic induction unit in the International System of Units be named “tesla” with symbol (T). This was the greatest international award by which a permanent monument was erected to Tesla, and his name entered into the legislation of the countries all over the world, according to the saying of the Meter Convention “for all times and for all nations”. An honor was made to all the Slav nations, because for the first time, a Slavian name stood equally with the names Newton, Faraday, Ampere, Volta, Hertz, Henry, Watt etc.

After the proposal of it's Session for electrical and magnetic quantities, Advisory Committee for Nomenclature, in Shaveningen in 1935, made a decision to accept Giorgi's System with four basic units: meter, kilogram, second and the forth unit to be chosen later.

At the same session, the name Weber (Wb) was accepted for the magnetic flux unit, and the name volt per meter for electric field, weber per square meter for magnetic induction and joule per cubical meter for the energy density.

In Torquway in 1938, among the other proposals, the International Electrotechnical Commission, Technical Committee 24 (IEC TC 24) for electrical and magnetic units, proposed that the name “newton” should be given to the unit for force.

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The Second world War interrupted the international TC 24 work until 1950, when in Paris it was continued, making important decisions. For the fourth basic unit, “ampere” was proposed, a complete rationalization of SI, and National Committees were recommended to review the matter of rationalization of quantities and units. A Committee of experts was established to study the method of rationalization definitely.

Finally, the name “newton” was accepted for the force unit and at the same time, National Committees were asked to give the name of a scientist for the magnetic induction unit, instead of weber per square meter in the SI.

Belgrade Electrotechnical Faculty professors directed by prof. Pavle Miljanić and prof. Aleksandar Damjanovic, made a proposal with an explanation for giving the name “tesla” to the magnetic induction unit, and defended it at the Experts Committee TC 24 Session.

In Opatija in 1953, at the second meeting of Experts Committee, prof. Pavle Miljanić, Committee member, prof. Aleksandar Damjanović, president of the Yugoslav Electrotechnical Committee (JEK), Belgrade Electrotechnical Faculty professors Vladislav Jovanović, Vladimir Petrović and Miodrag Ranojević were present.

The Experts Committee decided to ask TC 24 Secretariat to consult National Committees about the support for the choice of the name “tesla” for the density of magnetic flux (magnetic induction) unit in the SI. Professor Miljanić was to prepare the text which is given below:

“The definition for the magnetic flux density is the density per unit surface so that expression Wb/m^2 (weber per square meter) may seem sufficient for the unit in Giorgi’s System (MKSA). The other definition is based on the law describing the induction phenomena, and gives the unit Vs/m^2 (volt second per square meter). However, the definition given in the second edition of the International Electrotechnical Vocabulary (term 05-25-035) is based on the law by which the conductor having the length l through which current I flows is exposed to a force F , if it is placed in a field whose magnetic flux density is B . This definition is more direct and leads to the presentation of the unit in Giorgi’s System by the expression N/mA (Newton per meter ampere), which is, being composed of three units, too long and impractical in teaching, and it is not convenient for the ones who use it often in their work.

Hence, the need appeared naturally-similar to the magnetic flux density unit “gaus” in the Electromagnetic System CGS for a new name for magnetic induction unit in Giorgi’s System.”

It was reported that the decision of the IEC Technical Committee 24 in Philadelphia September 10th and 11th 1954 to recommend the adoption of the

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name “tesla” for the unit of magnetic flux density in the Giorgi System had now been ratified by the National Committees under Six Months Rule.

In view of the celebration of the centenary of the birth of Nikola Tesla, which was to be held in Belgrade in July, 1956 and which Dr. Dunscheath will attend, it was decided on the proposal of Mr. Sogge that the President of the IEC should convey the following message on behalf of the Commission to the Nikola Tesla centenary Committee:

“The Committee of Action of the IEC desires the President of the IEC as its personal representative at the Tesla Centenary Celebration to convey to all who are there assembled, the warm greetings of the IEC on this occasion in commemoration of the great Tesla.

It is always with a sense of profound respect and admiration that the name Tesla is remembered throughout the electrical world and the IEC is very mindful that its work today for international agreement in the electrical field is dependent in a very large measure on the fundamental scientific work of Nikola Tesla.

The IEC is very happy that this fact has been marked this year by the agreement they have reached for the world unit of magnetic flux density in the Giorgi system to be called the “tesla”.”

In Munich in 1954 at the IEC Action Committee meeting the name “tesla” was adopted for the magnetic induction unit. In this way, further adoption was continued through the International Committee on weights and measures (CIPM). The IEC proposal to adopt the name “tesla” for the magnetic induction unit, CIPM discussed and in 1956 and submitted for approval at the 11. General Conference, having Sessions each fourth year, whose decisions are final and obligatory for all the members. Finally, at the 11th General Session of CIPM in Paris from 11th to 20th October 1960 in the presence of 34 countries Meter convention members, the proposal was submitted and the decision was made that the name “tesla” be given to the magnetic induction unit. It took 10 years from the proposal to the adoption the unit “tesla”, and this fact speaks about seriousness and importance of making such decisions.

4 Some Examples for Usage of the “Tesla” Unit

The “tesla” unit is the measure of concentration of magnetic field, number of field lines per square meter. One “tesla” is a big unit and makes 10 000 gauss (Gs), the unit in CGS system. All medical devices for magnetic resonance are calibrated in “tesla” units from 0,5 to 1 T. In the outer space magnetic flux density is between 0,1 and 10 η T (10^{-10} T and 10^{-8} T). At the latitude of 50° magnetic induction is 58 μ T ($5,8 \times 10^{-5}$ T) and on the equator at the latitude of 0° 31 μ T ($3,1 \times 10^{-5}$ T).

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In the magnetic field of a huge horseshoe magnet, magnetic induction is 1 mT (0,001 T). Sunspots have 10 T while the strongest continuous magnetic field yet produced in a laboratory (in Tallahassee, USA) has the magnetic induction 45 T. The strongest pulsed magnetic field yet obtained by non-destructive methods in a laboratory in Osaka University has magnetic induction 80 T. The strongest pulsed magnetic field ever obtained with explosives in a laboratory in Russia, Sarov, has the magnetic induction 2800 T. Maximal theoretical magnetic induction of a neutron star and therefore for any known phenomenon is 10^{13} T.

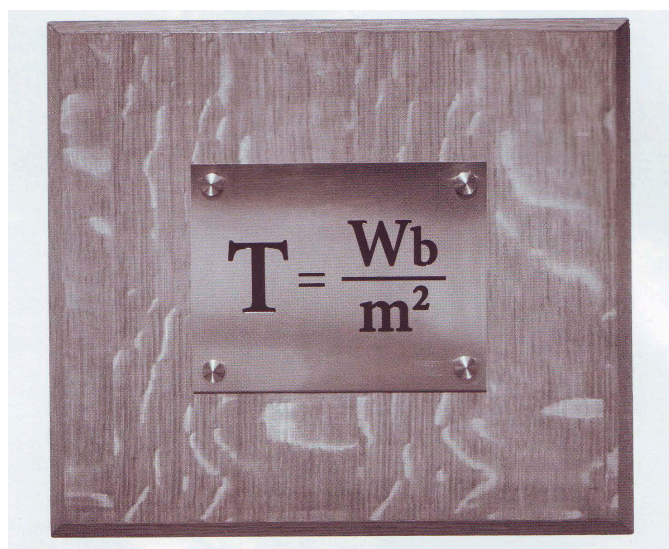


Fig. 1 – „tesla“ unit, $1T = 1kg \cdot s^{-2} \cdot A^{-1} = 1N \cdot A^{-1} \cdot m^{-1} = 1Wb \cdot m^{-2}$.

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