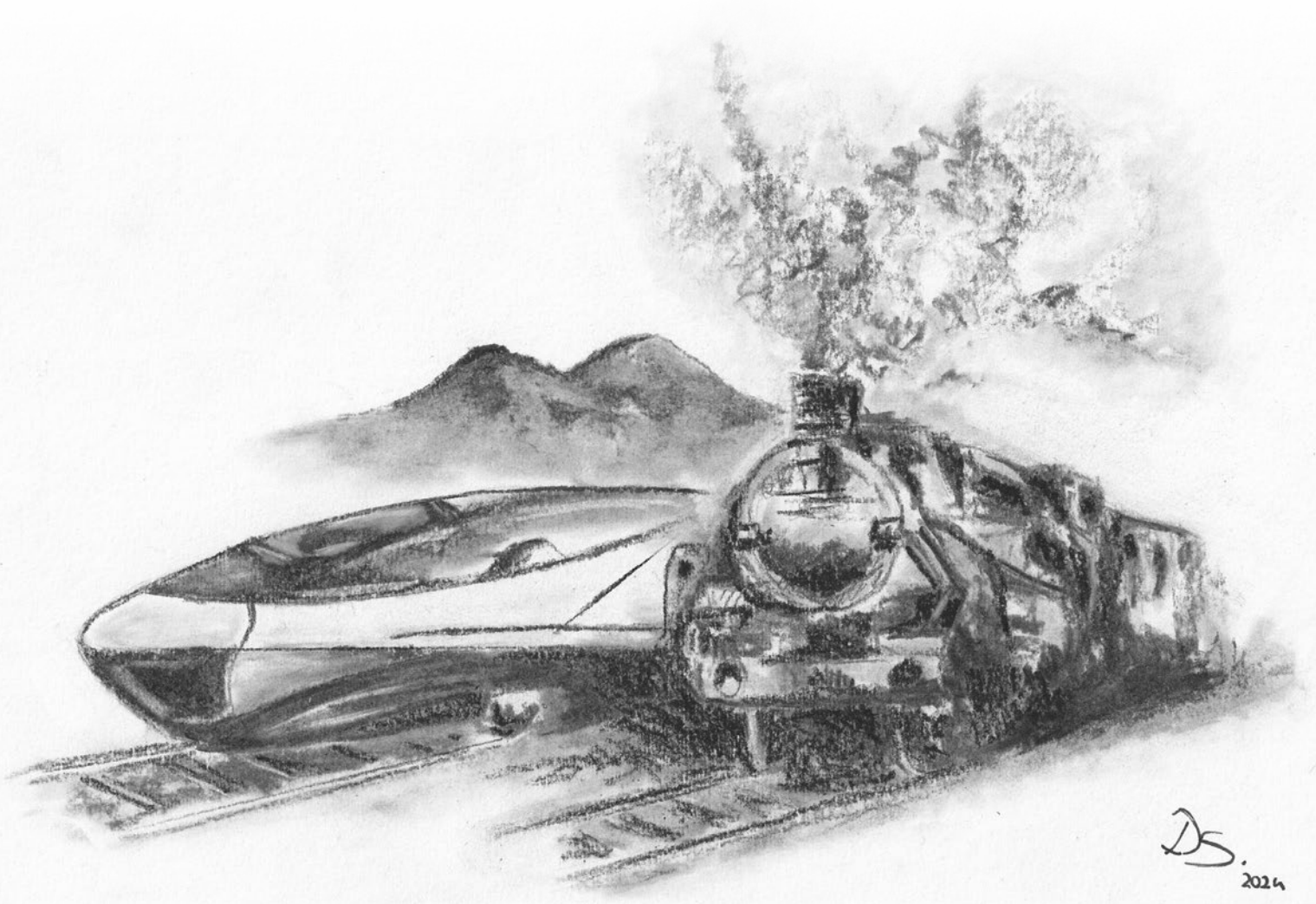
IEC TC 9 | FOUNDATION ANNIVERSARY 1924 - 2024

International Electrotechnical Commission

COMITATO ELETTROTECNICO ITALIANO

IEC TC 9: one hundred years of standards making history

Daniele Bozzolo – Franco Cavaliere – Gianosvaldo Fadin



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IEC preface

Back to the future

I am delighted to introduce this fantastic book celebrating the centenary of this great Technical Committee. IEC TC 9 is one of our earliest TCs and the first one in the IEC to develop standards for a means of transport. And what a means of transport! Trains and railways enabled the industrial revolution throughout the 19th century and have helped countries develop during the 20th. Trains have brought cities closer and have reached areas previously difficult to access. Before trains, travel was a long and fastidious process, with people relying on horse power or wind-propelled ships.

But more than that, trains are also a key form of transport for the 21st century. They produce so much less polluting emissions than shipping, aircraft and, for the time being at least, cars and trucks on our roads. They are particularly suitable for the all-electric and connected society, as they enable us to limit our carbon emissions in line with 2050 targets and the United Nations Sustainable Development Goals. Trains, trams, metros and light railway systems also help smart cities to reduce traffic congestion – one of the bear bugs of modern living and one of the main causes of carbon pollution in our modern megapolises. Trains might have been important in our past, but they will be just as essential, if not more, in our future.

Along the way, TC 9 experts have helped trains and railway systems to be used safely and efficiently by paving the route for every new technical milestone. This includes the first standards for electric traction motors in the 1920's and stretches to the first standards for the testing of rolling stock equipment in the 1950's, right down to pantographs and electric traction lines in the 1970's. More recently, standards have been produced for train communication networks in the 1990's and for the electric equipment in railway tunnels (e.g. lighting, ventilation, sensors, communication, signalling…) in the noughties. Moving with the times, recent work has focused on remote control and increased automation. Looking towards the future, standards for cyber security, hydrogen-propelled trains and energy recovery are on the cards.

This forward-looking TC, always abreast of the latest innovations, is very well placed to meet the challenges we have to meet collectively, which include the fight against climate change, using more energy efficient means of transport, the increasing role of artificial intelligence and connected ways of living.

I therefore want to pay a tribute to all 1 350 experts in the various working groups of this very driven TC. This includes previous Chair Gianosvaldo Fadin who did such a lot of work on the archives and ancient minutes of TC 9 meetings, current Chair Daniele Bozzolo who pushed for this book to be completed and Franco Cavaliere, who chaired the committee from 2003 to 2015, and who, together with both other Chairs, is a co-author of this riveting trip down memory lane.

I look forward to seeing the results of your great work make an important impact in the coming century. Happy centenary anniversary to all.

Jo Cops
IEC President

CEI preface

The Italian Electrotechnical Committee (CEI) has always had the honour and pleasure to provide, in the long history of IEC TC 9, its most talented railway experts to serve as Chairs. It is worth mentioning that Professor Guido Semenza chaired the first IEC TC 9 Plenary meeting in 1924 and, since 1930, the Chairs of IEC TC 9 have always been provided by the Italian National Committee.

The Italian NC has always been involved in the railway standardization sector as a leader, as well as providing its most advanced technical expertise and know-how.

Four years ago, Gianosvaldo Fadin, then Chair of IEC TC 9, informed the Technical Director of the CEI that 2024 would be the 100th anniversary of the foundation of IEC TC 9. He consequently asked the CEI to host the 64th Plenary meeting of IEC TC 9 and to organize social events to properly celebrate the centenary.

The proposal of hosting the centenary commemorating event at the headquarters of the National Railway Museum of Pietrarsa in Naples, Italy, was met with great enthusiasm by the management of the CEI, as this location hosts the most complete and interesting railway museum in Italy.

The Italian NC invitation was then made during the IEC TC 9 Plenary meeting which should have taken place in Seoul, Korea, but which, unfortunately, took place remotely due to the pandemic.

IEC TC 9 enthusiastically accepted the invitation.

In order to properly prepare celebration of this special milestone, even if the IEC itself is almost 120 years old, Mr Fadin started collecting, with the IEC Secretariat's help, the minutes of all IEC TC 9 meetings since its establishment.

His main goal was to write a book describing the history of IEC TC 9 along with Franco Cavaliere, his predecessor as Chair of the committee, and with Daniele Bozzolo, his successor and current IEC TC 9 Chair.

CEI Management immediately offered its support to this initiative, considering it extremely important and useful to properly honour the work of all the international experts who contributed to the preparation and production of all 163 railway standards published by IEC TC 9 in the past and which are today in force, not counting 90 previous editions.

The expectation for this book was high and CEI Management therefore wishes to thank the authors profusely for their excellent work.

This book not only offers an in-depth history of 100 years of standardization activity in the railway field but also provides an interesting chapter focused on the experience of TC 9 in standardization and innovation.

The chapter dedicated to collaboration and liaisons is very inspiring in understanding how the contribution of all stakeholders is important to produce standards which express a real consensus on the subject and are of real support for users.

Finally, this book is completed by some interesting annexes including dates, names and facts which have made the standardization activity of IEC TC 9 an outstanding reality.

The Italian CEI Management would like to wish IEC TC 9 all the best for a prosperous future.

Ivano Visintainer
CEI Technical Director

AFNOR preface

AFNOR, which stands for "Association Française de Normalisation", has a long history of participation in IEC Technical Committee 9, to prepare international standards for the railways field. Today, the "Bureau de normalisation ferroviaire" (BNF) ensures in France, by delegation of the French Standardization Association (AFNOR), the management of the European and international standardization of rolling stock, fixed installations and management systems for railway operations.

The railway standardization at a national level started in January 1938, with the creation of the Bureau de Normalisation et d'Unification (BNU), aimed at fostering standardization in France but limited to some parts. In 1943, BNU became BNCF, the "Bureau de normalisation des chemins de fer", to standardize all types of gauges.

The participation of BNF in supporting the work of IEC TC 9, Electrical Equipment and Systems for Railways, dates back to the early 1980's. As the French member of the IEC (International Electrotechnical Commission), the former UTE (Union Technique de l'Electricité) played an active role in the development of standards developed within IEC TC 9, as well as at European level.

In 2014, UTE was integrated as a department of AFNOR standardization and, at the same time, the operational management of the four national electrotechnical mirror committees (following railway electrotechnical aspects of both IEC and CENELEC) were handed over to BNF.

To meet national standardization needs and to monitor European and international standardization work, the BNF runs more than 60 standardization commissions covering all railway technical fields. Each commission has a collaborative platform hosted by AFNOR and managed by the BNF.

Over the years, UTE, then BNF, through their stakeholders' experts, have been involved in many working groups within IEC TC 9, making significant contributions to the development of standards related to safety, shock and vibration tests; cyber security; urban guided transport management and command/control systems; hydrogen fuel cells and storage systems; as well as many others.

BNF also plays a role in the coordination of the French participation in IEC TC 9, working closely with other organizations and experts in France to ensure the proper involvement of French stakeholders in the standardization work of IEC TC 9.

France is responsible for the Secretariat of IEC TC 9. The Secretariat coordinates the work of the committee, helping to develop or revise standards, animating the Chair Advisory Group and the Plenary and Management meetings. It highly contributes to the development and the maintenance of the work programme of the committee, manages the documentation of IEC TC 9's work, including providing agenda and minutes of meetings and circulating documents for vote or information. It carries out actions to secure a proper alignment of the work of the committee and the broader goals and objectives of the IEC. The Secretariat ensures fair decisions and balanced participation of the 33 National Committee P-members (participating members) in the different working groups, as well of the 12 O-members (observing members) to the Plenary meetings of IEC TC 9. The Secretariat's actions allow the process to be efficient and facilitate collaboration and communication among committee members. As of today, it represents 46 groups and more than 700 experts.

Overall, France, whether formerly through UTE or now with BNF, has always been one of the most involved and active members in IEC TC 9, providing an outstanding contribution to the development of international standards for the safety of electrical equipment of railways systems.

This centenary of IEC TC 9 is the opportunity for France to express its gratitude to all experts and convenors as well as to all involved National Committees for their strong commitment in the development of standards in IEC TC 9, not forgetting the future (participating) members who will always be supported and accompanied to take part in the work of IEC TC 9.

The Secretariat of IEC TC 9 is very honoured and dedicated to facilitating the work produced by IEC TC 9 at the start of its second century.

Looking back to the impressive achievements over the last 100 years, and looking forward to the perspectives of the railway sector and considering the challenges of the future such as the smart and digital transitions, as well as the green transition to fight against climate change, we strongly believe our work, all together, will provide valuable support for the development of the electrotechnical railway business and for the benefits of all related stakeholders.

On behalf of AFNOR and BNF,

Denis Miglianico
IEC TC 9 Secretary

Authors note

How the IEC TC 9 history book was born

The idea of this book came to our minds in October 2010 in Dolton Resort Tongshenghu, Changsha, Yashua District, People's Republic of China, whilst we were attending the 50th TC 9 Plenary meeting.

Charles Jacquemart, TC 9 Technical Officer at that time, made a speech just before the commemoration dinner, illustrating the first year of TC 9 and presented the minutes of the first meeting of Advisory Committee 9, which took place in London on 16 July 1924.

Figure 1 – Dolton Resort Tongshenghu Changsha

After the Changsha meeting, Gianosvaldo Fadin started to collect all the minutes of meetings of TC 9.

This task immediately proved to be difficult: the oldest meeting minutes had in fact been collected and bound in a volume that was hidden somewhere in the IEC Secretariat in Geneva.

We owe its finding to the tenacity of Charles Jacquemart and Joanna Goodwin who, in the end, discovered that the volume was kept on a shelf that had been forgotten.

Mrs Goodwin did what we could define as painstaking work, scanning all the minutes from 1924 until 1980.

The other minutes were obtained from the original files available in the PCs of Bernard Lerouge, TC 9 Secretary from 2009 to 2018, and Gianosvaldo Fadin, who attended TC 9 Plenary meetings since 1990.

In recent years, Gianosvaldo Fadin presented the project for a book on the history of TC 9 to Franco Cavaliere, TC 9 Chair from 2003 to 2015, and to Daniele Bozzolo, present TC 9 Chair, asking them to join as co-authors, an invitation they both enthusiastically accepted.

This is how IEC TC 9 history book was born.

Enjoy the reading.

Premiere presentation of the book

The IEC TC 9 history book was presented by the authors during the Farewell Party of the 64th TC 9 Plenary meeting, which took place in the National Railway Museum of Pietrarsa, Naples, Italy on 10 October 2024.

The authors asked Luigi Cantamessa, Director General Fondazione FS Italiane, to offer a brief memory of Alfredo D'Arbela, second TC 9 Chair, and of the trains that constituted the emblem of Italian technology at that time, which is reported here verbatim.

"With the introduction of this new vehicle, Ferrovie dello Stato's intention was to equip its fleet with a means of transport that would match the level of decorum reached by the very best facilities in the tourism and hospitality industries and other sectors".

This extract, taken from a piece published in the summer of 1953 about the new ETR300 "Settebello" train, was written by the engineer Alfredo D'Arbela, Head of the Italian railways' Ufficio Studi locomotive del Servizio Materiale e Trazione (which focused on rolling stock R&D). This was a forward-looking vision at a time when road transport had already become a fierce rival to rail and comfort had become an essential requisite for any travel.

This is how the “Settebello” became a symbol of Italy’s economic boom at a time when the country was expected to, not only overcome post-war difficulties, but to also present a new image of itself to the world. The rail industry met that challenge thanks to top level experts and designers, one of whom was Alfredo D’Arbela who held a prominent role. Aside from his focus on a modern vision of rail transport, this engineer was a formidable source of technical knowledge: his long career with the company began in operations but his particular talents soon saw him being moved to the Sezione XII del Servizio Materiale e Trazione – a sector within the Rolling Stock Department. It was while he was Head of the Ufficio Studi locomotive (rolling stock R&D sector) that the vast majority of our most recent traction units were designed, not only the “Settebello” and “Arlecchino” EMUs and the ALe 840, 540 e 601 with their related cars but also the E.424, E.636, E.645, E.646 and the E.444 “Tartaruga” electric engines as well.

In addition to the design of the traction systems, Mr D’Arbela introduced the use of electrical engineering in the power supply systems of passenger trains. To this day, railway engineering courses still study Mr D’Arbela’s splitter used in the E.645 and E.646 engines to remedy current overloads while in motion. It was a brilliant idea that symbolizes Ferrovie dello Stato’s celebrated cutting-edge design capability. His story should be shared far and wide, as part of our railway heritage, among railway workers and moreover among the wider Italian public.

Luigi Cantamessa
Director General Fondazione FS Italiane
Chief Executive Officer FS Treni Turistici Italiani

Introduction

How the IEC was born

Founding of the IEC

The IEC (International Electrotechnical Commission) history goes back to the International Electrical Congress in St. Louis in 1904. During the event, it had been recommended ”that steps should be taken to secure the cooperation of the technical societies of the world by the appointment of a representative Commission to consider the question of standardization of the Nomenclature and Ratings of Electrical Apparatus and Machinery”.

Figure 2 – IEC delegates attending the International Electrical Congress in St. Louis (1904)

This resolution led directly, two years later, to the foundation of the IEC, the International Electrotechnical Commission. The promoters were Alexander Siemens and William Thompson (Lord Kelvin).

A preliminary meeting, chaired by Alexander Siemens, was held on 26 and 27 June 1906 in London under the auspices of the British Institution of Electrical Engineers (www.theiet.org).

Of the 16 participating countries, three came from outside Europe: America (as it was listed at that time), Canada and Japan. The delegates were appointed by their national institutions or their governments.

Colonel Crompton, a mechanical engineer, inventor and skilled organizer, played an important part in setting up the Commission.

Figure 3 – IEC delegates attending the Preliminary meeting in London (1906)

On 27 June 1906, the official birthday of the Commission, the eminent physicist Lord Kelvin was elected its first President, and Colonel Crompton was appointed Honorary Secretary.

Additional outcomes of the first meeting included the following:

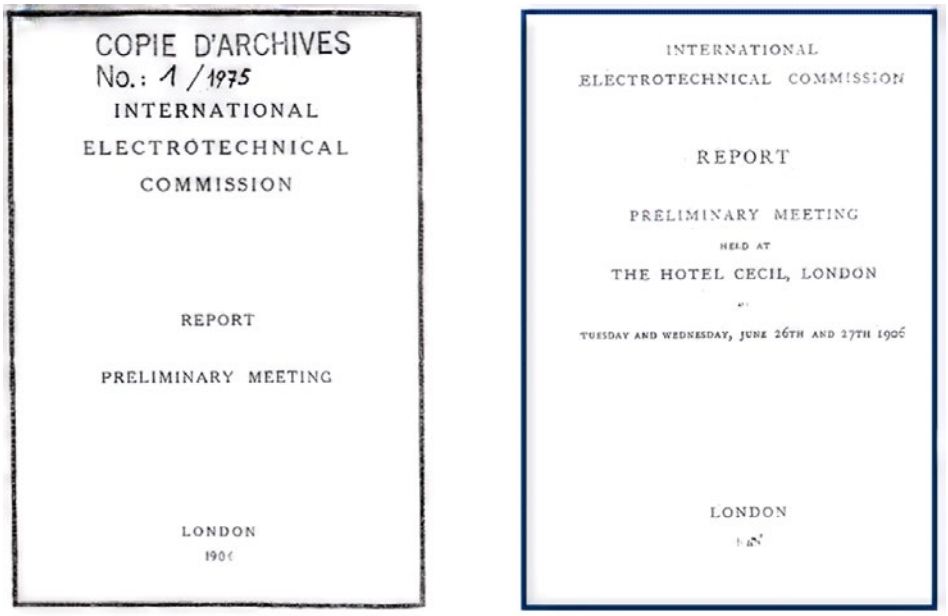
- The Rules of the Commission were approved
- The name of the Commission was amended to read International Electrotechnical (instead of Electrical) Commission
- Charles Le Maistre became the first General Secretary
- The office of the IEC was established in London

Furthermore, over time, interest for creating a coherent system of units for electricity emerged. For this reason, two “commissions” of the IEC were created:

- Electric units and standards
- Nomenclature and characteristics of electrical machines and apparatus

Interestingly enough, the IEC was constituted within the same time frame as the national bodies. This fact underlines both the high priority given to electrotechnical standards and the close coordination between national and international efforts.

Figure 4 and Figure 5 show respectively the cover and second page of the first IEC meeting and the list of participants to such meeting.



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

REPORT

PRELIMINARY MEETING

LONDON
1906

INTERNATIONAL
ELECTROTECHNICAL COMMISSION

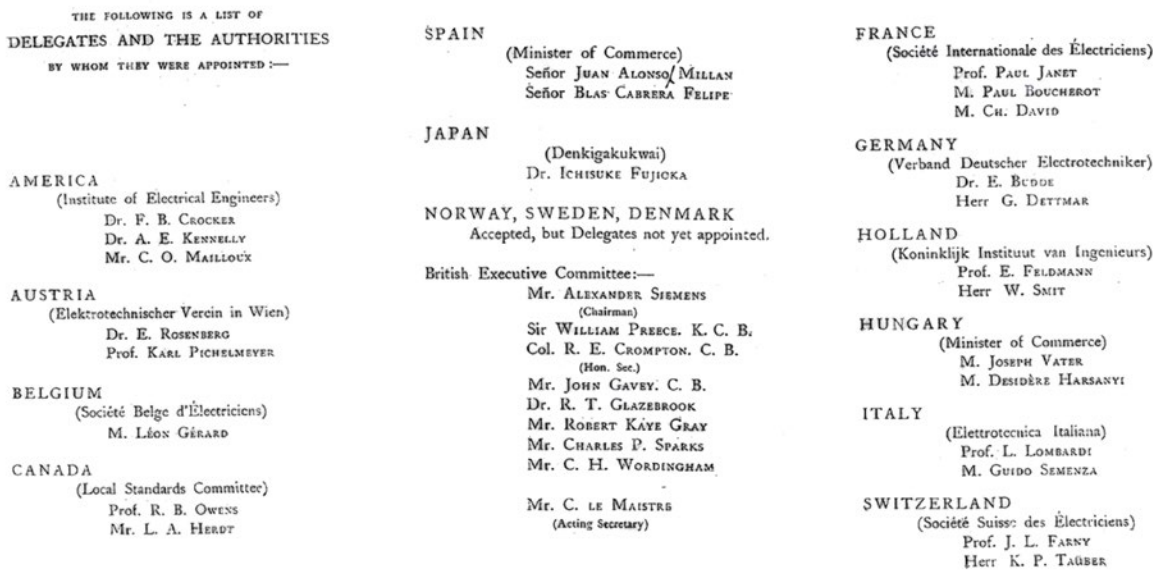
REPORT

PRELIMINARY MEETING
HELD AT
THE HOTEL CECIL, LONDON

TUESDAY AND WEDNESDAY, JUNE 26TH AND 27TH 1906

LONDON

Figure 4 – Cover and second page of MoM of the first meeting in London



THE FOLLOWING IS A LIST OF
DELEGATES AND THE AUTHORITIES
BY WHOM THEY WERE APPOINTED :—

AMERICA
(Institute of Electrical Engineers)
Dr. F. B. Crocker
Dr. A. E. Kennelly
Mr. C. O. Mailloux

AUSTRIA
(Elektrotechnischer Verein in Wien)
Dr. E. Rosenberg
Prof. Karl Pichelmeyer

BELGIUM
(Société Belge d'Électriciens)
M. Léon Gérard

CANADA
(Local Standards Committee)
Prof. R. B. Owens
Mr. L. A. Herdt

SPAIN
(Minister of Commerce)
Señor Juan Alonso Millan
Señor Blas Cabrera Felipe

JAPAN
(Denkigakukwai)
Dr. Ichisuke Fujioka

NORWAY, SWEDEN, DENMARK
Accepted, but Delegates not yet appointed.

British Executive Committee:—
Mr. Alexander Siemens
(Chairman)
Sir William Preece. K. C. B.
Col. R. E. Crompton. C. B.
(Hon. Sec.)
Mr. John Gavey. C. B.
Dr. R. T. Glazebrook
Mr. Robert Kaye Gray
Mr. Charles P. Sparks
Mr. C. H. Wordingham

Mr. C. le Maistre
(Acting Secretary)

FRANCE
(Société Internationale des Électriciens)
Prof. Paul Janet
M. Paul Boucherot
M. Ch. David

GERMANY
(Verband Deutscher Electrotechniker)
Dr. E. Budde
Herr G. Dettmar

HOLLAND
(Koninklijk Instituut van Ingenieurs)
Prof. E. Feldmann
Herr W. Smit

HUNGARY
(Minister of Commerce)
M. Joseph Vater
M. Desidère Harsanyi

ITALY
(Elettrotecnica Italiana)
Prof. L. Lombardi
M. Guido Semenza

SWITZERLAND
(Société Suisse des Électriciens)
Prof. J. L. Farny
Herr K. P. Täuber

Figure 5 – List of delegates and authorities attending the first meeting in London

First Technical Committees

By 1914, the IEC had formed four Technical Committees to deal with nomenclature, symbols, ratings of electrical machinery and prime movers. The Commission had also issued a first list of terms and definitions covering electrical machinery and apparatus; a list of international letter symbols for quantities and signs for names of units; an international standard for the resistance of copper; a list of definitions in connection with hydraulic turbines; and a number of definitions and recommendations relating to rotating machines and transformers.

The First World War interrupted IEC work.

Between 1919 and 1923, the number of Technical Committees had increased to 10.

The IEC Council decided to create the Committee of Action "to assist in giving effect to the decisions of the Council, to second the efforts of the Central Office and to coordinate the work of the National Committees and of the Advisory Committees".

Electrical units

The IEC established the following electrical units in the 1930's:

- Oersted for the unit of magnetic field strength
- Gauss for the unit of magnetic flux density
- Maxwell for the unit of magnetic flux
- Gilbert for the unit of magnetomotive force
- var for designating the unit of reactive power

The unit weber (for the practical unit of magnetic flux) was established in 1933, and the unit hertz (for the unit of frequency) in 1935.

It was decided to extend the existing series of practical units into a comprehensive system of physical units, which became the "Giorgi system", named after Giovanni Giorgi (1871–1950) – an Italian scientist and engineer. This system has been elaborated further and is now commonly known as the "Système international d'unités", or SI for short.

CISPR and the IEV

Between the First and the Second World Wars, several new international organizations came into being and the IEC recognized the need for cooperation to avoid overlapping efforts. In some cases, joint Technical Committees were formed, such as the International Special Committee on Radio Interference (CISPR).

In 1938, the IEC produced the first edition of the International Electrotechnical Vocabulary (IEV)[1] now known as Electropedia which was freely available to the general public. The unification of electrotechnical terminology was one of the main tasks allocated to the IEC by the St. Louis Congress. In the early days, the Nomenclature Committee was engaged in pioneer work, as no comparable international technical vocabulary had yet been published and few national electrotechnical vocabularies existed. With its 2 000 terms in French, English, German, Italian, Spanish and Esperanto, and its definitions in French and English, the IEV could rightly be considered as an outstanding achievement. It aroused wide interest among international technical organizations outside the electrotechnical field.

In September 1939, with the start of the Second World War, the activities of the IEC came to a standstill during six years.

In 1948, the IEC Secretariat moved from London, UK to Geneva, Switzerland, where it shared a villa with the newly founded ISO, the International Organization for Standardization, the brain child of Charles Le Maistre, the first IEC General Secretary. Figure 6 shows the villa in the Route de Malagnou in Geneva.

Figure 6 – The ISO and IEC office at Route de Malagnou, Geneva

1 http://www.electropedia.org/

Light current, electroacoustics and radio frequencies

Subsequently, the IEC expanded its efforts in the light current field, which had constituted only a small part of the activity of the Commission before 1939. Standards covering measurements, safety requirements and the testing and specification of components for radio receivers and televisions began to appear. Radio communication standards came into the scope of the ITU, the International Telegraph Union, which in 1932 changed its name into International Telecommunication Union, now based in Geneva.

At the same time, work on electroacoustics started, while CISPR developed standards on permissible limits for various frequency ranges used for radio broadcasting and measurement methods for interference.

New technologies... more Technical Committees

From 1948 to 1980, the number of Technical Committees grew from 34 to 80 and began to include new technologies such as capacitors and resistors, semiconductor devices, electrical equipment in medical practice, maritime navigation and radiocommunication systems and equipment.

In 1974, the IEC created TC 76 to address standards relating to lasers, with a particular focus on safety. This committee developed the four-class system for lasers that is the global reference today. The system covers lasers used in business, entertainment, education, medicine, research and industry.

The last two decades of the 20th century saw the IEC continue to address new technologies as they emerged, creating new Technical Committees to prepare standards for lightning protection, fibre optics, ultrasonics, wind turbine systems and design automation.

The Dresden Agreement was signed between CENELEC and the IEC in 1996. It provided the basis for the harmonization between IEC International Standards and European standards in electrotechnology. This agreement was superseded in 2016 by the Frankfurt Agreement. More information on the cooperation between IEC and CENELEC are given in the chapter “Cooperation with CENELEC TC 9X ”.

In 2006, the IEC celebrated its 100th anniversary.

Keeping pace with the rapid technological developments of the 21st century, the IEC created new Technical Committees for fuel cell technologies, methods to assess electric, magnetic and

electromagnetic fields associated with human exposure – including 5G, avionics, electronic displays, nanotechnology, marine energy generation, solar thermal electric plants, printed electronics, electrical energy storage systems, wearable electronic devices, personal e-transporters, and more.

The Joint Technical Committee 1 of the IEC and ISO publishes standards in the area of information and communication technology, including for example cloud computing, biometrics, AI, data management, information security, cyber security and privacy protection (ISO/IEC 27000 series of standards).

For its work for MPEG and HEVC, the IEC and ISO received three Primetime Emmy awards.

How to learn more on the IEC

Many historical documents on the IEC are available in the IEC website. See bibliography [1], [2], [3], [4].

How IEC TC 9 was born

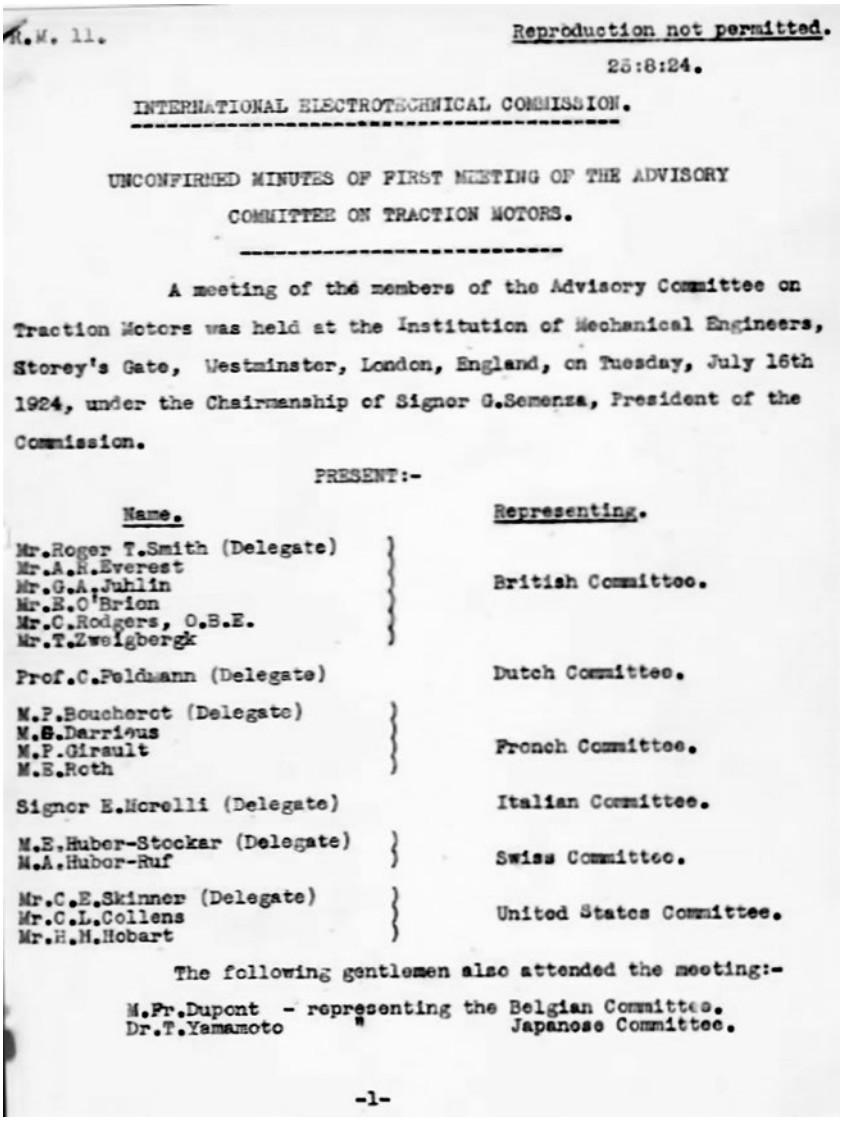
It is fair to say that TC 9 was born in 1924. However, the former name was AC 9, the Advisory Committee 9 on Traction motors, as reported in the cover of the minutes of the first meeting which is shown in Figure 7.

Advisory Committee 2 on Rating of electrical machinery was created in 1911 with a Chair from France.

During one of its own meetings, AC 2 stated that: "*Found it necessary from the start to exclude from its discussion questions relative to machinery for traction purposes.*"

Consequently, the Committee of Action decided in April 1924 to appoint a special advisory committee with instructions to consider the question of the rating of both tramway and railway motors and prepare an international specification.

Advisory Committee 9 on Traction motors was created and its first meeting was held in London on 16 July 1924. 19 delegates participated, precisely, 15 delegates from EU NCs, 1 from JP NC, 3 from US NC.



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25:8:24.

INTERNATIONAL ELECTROTECHNICAL COMMISSION.

UNCONFIRMED MINUTES OF FIRST MEETING OF THE ADVISORY COMMITTEE ON TRACTION MOTORS.

A meeting of the members of the Advisory Committee on Traction Motors was held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, London, England, on Tuesday, July 16th 1924, under the Chairmanship of Signor G.Semenza, President of the Commission.

PRESENT:-

Name.	Representing.
Mr.Roger T.Smith (Delegate) Mr.A.H.Everest Mr.G.A.Juhlin Mr.E.O'Brien Mr.C.Rodgers, O.B.E. Mr.T.Zweigbergk	British Committee.
Prof.C.Feldmann (Delegate)	Dutch Committee.
M.P.Boucherot (Delegate) M.B.Darrieus M.P.Girault M.E.Roth	French Committee.
Signor E.Morelli (Delegate)	Italian Committee.
M.E.Huber-Stockar (Delegate) M.A.Huber-Ruf	Swiss Committee.
Mr.C.E.Skinner (Delegate) Mr.C.L.Collens Mr.H.M.Hobart	United States Committee.

The following gentlemen also attended the meeting:-

M.Fr.Dupont - representing the Belgian Committee.
Dr.T.Yamamoto " Japanese Committee.

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Figure 7 – Cover of the first meeting of Advisory Committee 9 (1924)

The meeting was chaired by Professor Guido Semenza from Italy (see Figure 9), who at that time was the President of the Commission and opened the meeting with the following declaration: "*Reference was made to the decision to refer the question of traction motors to a sub-committee of the Advisory Committee on Rating, but the Committee of Action felt that it would be wiser to appoint a special Advisory Committee for this subject. It was pointed out that the proposals already circulated appeared to refer only to tramway and railway motors and they felt that the Advisory Committee should review the subject from the point of view both of tramway and railway motors.*"

However, it should be mentioned that the advances in transport, electronic and telecommunication technologies made during the First World War began to influence the market and this was quickly reflected in the need for international standards.

Further to AC 9, in 1926, TC 12 on Radiocommunications was formed with a British chair, presumably reflecting the advances made in the country of residence of the Italian inventor Guglielmo Marconi.

In 1950, after the Second World War, AC 9 changed status and became TC 9, the Technical Committee on Electric Traction Equipment.

Its first meeting, which was the 13th meeting since the beginning including the AC 9 meetings, was hosted in Italy at Tremezzo.

Plenary meetings of AC 9 on Traction motors are listed in Table 1.

Meeting	Status	Date	Location
1	AC 9	16 July 1924	Institution of Mechanical Engineers, Storey's Gate, Westminster, London – Great Britain
2	AC 9	17 April 1925	The Hague – Netherlands
3	AC 9	16 and 20 April 1926	New York – U.S.A.
4	AC 9	10 and 12 September 1927	Bellagio – Italy
5	AC 9	8 and 9 July 1929	London – Great Britain
6	AC 9	2 and 4 July 1930	Stockholm – Sweden
7	AC 9	26 and 27 October 1931	Brussels – Belgium
8	AC 9	24 and 25 April 1933	Milan – Italy
9	AC 9	24 and 25 June 1935	Brussels – Belgium
10	AC 9	21, 22 and 23 June 1937	Paris – France
11	AC 9	22, 23 and 25 June 1938	Torquay – Great Britain
12	AC 9	11 and 12 October 1948	Stockholm – Sweden

Table 1 – List of AC 9 Plenary meetings

It is to be noted that the TC 9 Chairs were from the Italian National Committee except from 1925 to 1929. During this period, AC 9 had four meetings which were chaired respectively by:

- 1925 – E. Huber-Stockar from the Swiss National Committee
- 1927 – E. Roth from the French National Committee
- 1927 – J. Peridier from the French National Committee
- 1929 – A. R. Everest from the British National Committee

The full list of all Chairs of AC 9 and TC 9 is reported in the table in the Annex "List of AC 9 and TC 9 Chairs".

The Annex “Lists of AC 9 and TC 9 Secretaries” also cites the AC 9 and TC 9 Secretaries who have been all provided by the French National Committee. The sole exception was Marco Semenza from the Italian National Committee in 1927.

In 1923, the number of Technical Committees had increased to 10 and the Council decided to appoint a “Committee of Action” of seven members “to assist in giving effect to the decisions of the Council, to second the efforts of the Central Office and to coordinate the work of the National Committees and of the Advisory Committees”.

One result was the practice of allocating to a National Committee the Secretariat of a given Technical Committee, which was started in 1926, the object being “to accelerate the work and assist the Central Office to expedite its work as well as relieve it of some of the expenses”. This proved to be a most successful arrangement, which has since made it possible for the IEC to handle a large number of projects at a minimum cost.

As reported in the minutes of the AC 9 Plenary meeting, held in London on the 8 and 9 July 1929: “*The Secretariat of the Advisory Committee had shortly afterwards been entrusted to the French Electrotechnical Committee*”.

This decision was taken during the IEC General Meeting held in Rome, Italy, in 1927.

One hundred years of IEC TC 9 standardization

Introduction

This chapter intends to offer the reader some interesting information that was drawn from reading the 63 minutes of meetings relating to the Plenary meetings of AC 9 and TC 9.

Advisory Committee 9: Traction motors

The IEC took the decision in 1923 to set up Advisory Committee 9, parent of the future Technical Committee 9.

That requirement arose because, after the First World War, the traction for electric railway, which was already rapidly growing since the end of the 19th century, went through a phase of further development and it was necessary to find out an efficient mean of propulsion capable to haul even heavier trains.

The IEC Committee of Action decided therefore to set up Advisory Committee 9 with the goal of preparing an international standard on DC traction motors and, at the same time, asked Advisory Committee 2 on Rating of electric motors, not to deal with traction motors any longer.

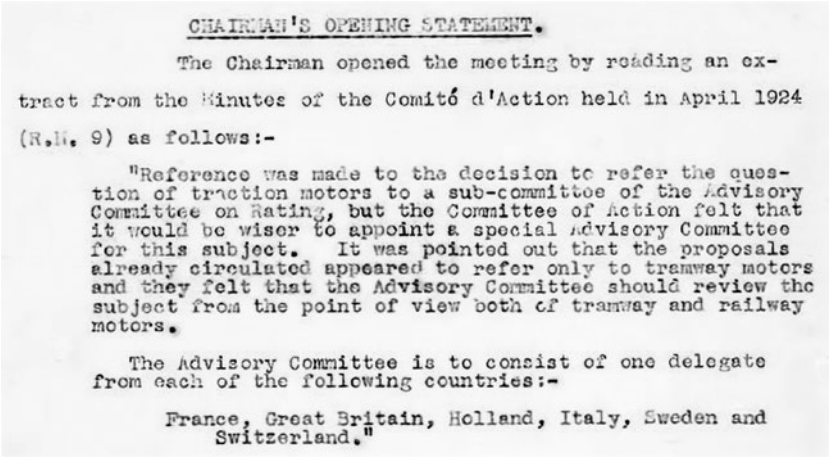
Under the chairmanship of Guido Semenza, 5th IEC President, the 1st meeting of AC 9 was held on 16 July 1924 with members of the British, Netherlands, Italian, French, United States and Swiss NCs.

During the opening of the 1st meeting of AC 9, the Chair informed the floor about the decision taken by the Committee of Action (see the excerpt from page 2 of the minutes of the 1st AC 9 meeting shown in Figure 8).

Furthermore, since time for preparation was short, the Chair asked the members to follow up the state-of-the-art standardization on traction motors in their own countries and prepare contributions for the next meeting.

The Chair stated that there appeared to be general agreement that tramway and railway motors should be dealt with together, so that he would ask each National Committee to prepare their proposals in that form.

A general discussion on the question of rating and testing to be adopted then followed. In the proposals under consideration, experts were contemplating the use of both the one-hour rating and a continuous rating and that the output should be declared at the motor shaft, because the gear should be taken as a separate device to allow all motors made in all the different manufacturing countries to be compared.



CHAIRMAN'S OPENING STATEMENT.

The Chairman opened the meeting by reading an extract from the Minutes of the Comité d'Action held in April 1924 (R.M. 9) as follows:-

"Reference was made to the decision to refer the question of traction motors to a sub-committee of the Advisory Committee on Rating, but the Committee of Action felt that it would be wiser to appoint a special Advisory Committee for this subject. It was pointed out that the proposals already circulated appeared to refer only to tramway motors and they felt that the Advisory Committee should review the subject from the point of view both of tramway and railway motors.

The Advisory Committee is to consist of one delegate from each of the following countries:-

France, Great Britain, Holland, Italy, Sweden and Switzerland."

Figure 8 – Excerpt from page 2 of the minutes of the 1st meeting of AC 9 (1924)

At the 2nd meeting in 1925, delegates from France, Great Britain, Netherlands, Italy, Sweden, Switzerland and the United States. were attending with the chairmanship of Mr Semenza (President of the Commission, see Figure 9) and the Secretary of Mr Le Maistre (General Secretary, see Figure 9).

There was unanimous agreement that the output of a traction motor be the output at the motor shaft.

Then, after discussion about the ratings, unanimous agreement was reached on the following recommendations:

- that for all types of traction motor there shall be both a continuous rating and a one-hour rating
- that for all types of traction motor there shall be an excess load test specified as a mechanical and commutation test

There was also a discussion on the issue of the temperature rise for armature & field windings as well as for commutators & collectors. The maximum insulation classes were class A and class B materials.

Figure 9 – Guido Semenza (left) and Charles Le Maistre (right)

Another discussion arose around the ambient temperature. It was pointed out that the ambient temperature was not referred to in several of the national rules. An examination of the comparison showed that one country gave an average value for the ambient temperature in service, another the maximum value. After discussion, however, it was decided to recommend that motors rated in accordance with the IEC rules now being recommended were suitable for use in ambient temperature up to 25 °C. The question as to the conditions of excitation during the test was also discussed.

Lastly it was decided to ask the Committee of Action to invite the Spanish and Czechoslovakian NCs to join AC 9. In 1924, the Royal Bavarian State Railways (part of DRG) had built the locomotive class EP2 (DRG class E32), first locomotive at 15kV 16 2/3 Hz, and three years later, in 1927, the first prototypes of locomotive class E626 were built in FS. Such locomotives were assigned to haul the trains along the Benevento-Foggia line, southern Italy, the first one being electrified at 3 kV DC. Figure 10 shows the E 626, serial number 005.[2]

Both systems needed locomotives with powerful collector motors (2 motors of 600 kW each and 6 motors of 300 kW each respectively). Nevertheless, Italy and Germany were not the first using collector motors. In fact, the Swiss Railways and the BLS Lötschbergbahn company placed several orders of 15kV 16 2/3 Hz powerful locomotives in order to haul heavy trains along the Gotthard and the Lötschberg lines during the First World War. Such locomotives were the Be 5/7, manufactured by Swiss Locomotive and Machine Works Oerlikon Works Brown, Boveri & Cie (see Figure 11).[3]

2 The locomotive E 626.005 is displayed in the Railway National Museum in Pietrarsa, Italy

3 ETH-Bibliothek Zürich, Bildarchiv / Fotograf: Unbekannt / Ans_05405-003 / Public Domain Mark – http://doi.org/10.3932/ethz-a-000096279

Figure 10 – The E626-005 locomotive

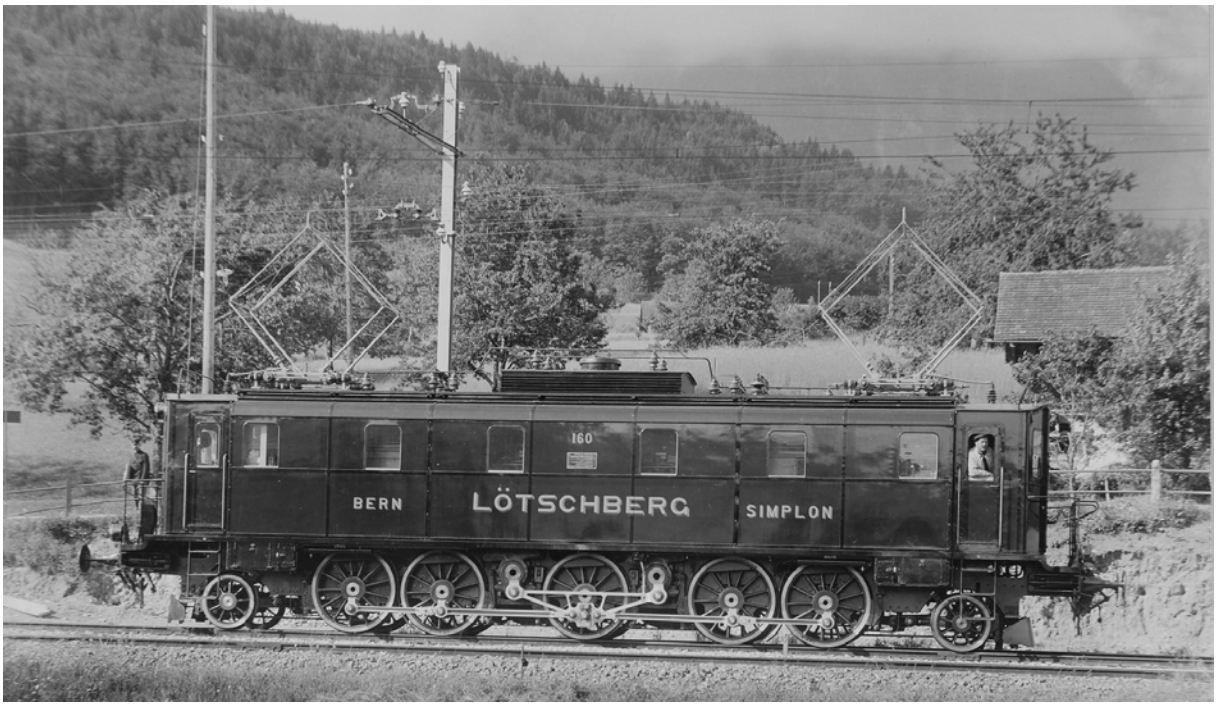


Figure 11 – Be 5/7 electrical locomotive developed for BLS (1915)

In 1933, the 1st edition of IEC Standard 48, *Rules for traction motors*, was published which, in 1948, would be replaced by IEC 349 (currently the IEC 60349 series).

In 1927, during the 4th meeting, AC 9 realized that there was the need to standardize other equipment in the railway field, other than traction motors, such as circuit breakers. Therefore, upon an Italian proposal, a resolution was approved in order to standardize all equipment on board, according to their specificity. From there onwards, AC 9 changed scope, and its name became "Advisory Committee on Electric Traction Equipment".

In 1929, during the 5th meeting, the Committee unanimously adopted the resolution that the IEC should invite, at an early date, the representatives of the International Union of Tramways (UIT), and the International Union of Railways (UIC) to hold a conference with the President and General Secretary of the IEC in order to discuss the best method to be adopted to ensure an effective co-operation of these three international organizations in the study of international rules for electric traction motors. The result was the setting up of the International Mixed Committee on Electrical Traction Equipment (CMT) whose members were:

- 5 members of the IEC
- 5 members of the UIC
- 5 members of the UIT
- 5 representatives of the manufacturers

The 1st meeting of this Committee was held in Brussels, Belgium, in May 1930, just before the 6th meeting of AC 9. The CMT was intended as a permanent organization, being the link between AC 9 and the other stakeholders, part of the CMT itself. Each decision taken by AC 9 was to be submitted to the CMT for approval.

During the first five meetings, the chairmanship of the Advisory Committee was established each time, but from 1930 on (6th meeting), the Officers of AC 9 were appointed as follows: Marco Semenza (Italy) as Chair and J. Peridier (France) as Secretary.

Under the chairmanship of Mr Semenza, AC 9 dealt with other on-board equipment, such as transformers but also with other fixed installations equipment such as mercury-arc rectifiers (in collaboration with AC 22), contact lines and the issue of the unification of supply voltages. AC 9 was acting like a current working group, in a way that during the meeting each draft was drawn up and revised.

After World War II, in 1948, the 12th meeting was held in Stockholm, Sweden, again under the chairmanship of Mr Semenza and the secretariat of Mr Garreau (FR), but it was the last time using the name of AC 9. Members from Belgium, Denmark, France, Hungary, Italy, Netherlands, Norway, Sweden, Switzerland and United Kingdom attended the meeting. Mr Uytborck, President of the IEC, and Mr Le Maistre, General Secretary of the IEC, also participated.

IEC Technical Committee 9: Electrical equipment and systems for railways

Finally, in 1950, during the 13th meeting, AC 9 changed its name to TC 9 remaining under the chairmanship of Mr Semenza. The second edition of IEC 48 was published, while IEC 77, the future IEC 60077, *Rules for electrical equipment on board*, was going to be finalized. The first edition contained a section on monophase traction transformers that later was separated to become IEC 310, the future IEC 60310.

In 1953 (15th meeting), it was decided to work on a standard about the testing of rolling stock equipment before putting it into service. The UIC was in favour of such a specification and ready to support the new proposal.

During 1955, the first edition of IEC 77, the future IEC 60077, was published; it was the second standard to be published by TC 9.

In 1957, Alfredo D'Arbela (IT) was appointed as successor to Marco Semenza, and from that meeting (the 18th of TC 9) onwards, the Technical Committee was to meet every two years in order to have more time to get the National Committees' comments and prepare the drafts.

In 1963, Ernesto Stagni (IT) was appointed as successor to Mr D'Arbela. In Venice, Italy, during that meeting (the 21st of TC 9), several decisions were taken:

- to set up the work for a standard about power resistors
- the need to merge IEC 48, *Rules for electric traction motors*, with IEC 101, *Rules for auxiliary machines on motor vehicles*, and with IEC 102, *Rules for the electric transmission of vehicles with diesel engines*. The future standard became IEC 349.
- to prepare a draft to take in consideration the static converters on board (work to be done in collaboration with TC 22)

During the 22nd meeting in 1965, it was decided to set up a working group within TC 9 to take in consideration the revision of the comments received on the two new documents on resistors as well on transformers. It was an historical decision because, up to that meeting, all documents were revised within the Plenary meeting.

Three working groups were set up:

- WG 1 dealing with main transformers and inductors
- WG 2 dealing with power resistors
- WG 3 dealing with the merge of IEC 48 with IEC 101 and IEC 102

The British Committee proposed a structural modification in the work of TC 9 asking the creation of Subcommittees in order to speed up the work and lighten the task of the Secretariat. However, the setting up of working groups was met with concern and the proposal was rejected.

In 1970, during the 25th meeting in Rome, Italy, several activities were set up. As an example, we can recall the following:

- A preparatory working group (WG 5) was set up to prepare a set of draft rules relating to pantographs
- A preparatory working group (WG 6) was set up to prepare a set of draft rules relating to electric traction lines
- A preparatory working group (WG 7) was set up to prepare a supplement to IEC 349 relating to the criteria for assessing the commutation of rotating machinery
- A preparatory working group (WG 10) was set up to prepare a draft text on electronic controls on railway vehicles

From 1976 (28th meeting of TC 9), Giulio Giovanardi (IT) took the leadership of TC 9.

In 1988 at the 32nd meeting, Franco De Falco (IT) replaced Mr Giovanardi. It was decided to set up WG 22 with the provisional title “Communication interfaces for programmable electronic equipment on trains”. There were three possible candidates for the convenorship of the working group (FR, DE and IT), but after a long discussion the leadership was assigned to France. The work in WG 22 immediately appeared to be very complex due to different views in several issues among the National Committees.

In 1991, at the 33rd meeting in Stockholm, Sweden, the IEC Secretariat stressed that TC 9 should speed up its work, but only from 1995, the Technical Committee was in the position to meet every

year. During this meeting, the first TC 9 Strategic Business Plan, named at that time Strategic Policy Statement (SPS), was finalized (see Annex H of TC 9 minutes of meeting RM 3441 and Figure 13, Figure 14 and Figure 15 at chapter "Standardization strategy and strategic business plan").

Furthermore CLC/TC 9X, which was set up in 1989, presented its report for the first time.

The 34th meeting of TC 9 was convened in Frankfurt, Germany. Pierre-Henry Desvignes and Claude Bicard (FR) were introduced as new Secretary and new Assistant Secretary, replacing Mr Kieken and Mr Ambrun.

Following a proposal by IEC Secretariat, TC 9 took the resolution to disband the International Mixed Committee on Electrical Traction Equipment (CMT), which was set up in 1930, to ensure maximum coordination between UIC and manufacturers because it became, with years, more and more administrative. UIC agreed with the proposal of the dissolution of CMT and proposed IEC to become one of its members.

A large part of the 34th meeting of TC 9 was dedicated to debate on the activities of TC 9 WG 22, its own cooperation with UIC, ERRI (The European Railway Research Institute) and JDP (the Joint Development Project founded and supported by ABB, Siemens, AEG and Ercole Marelli Trazione) on the preparation of the Train communication networks (TCN).

Several resolutions were taken on WG 22 (Train communication networks).

The main topics which were debated were:

- The structure of the IEC Standard and the topics which are treated by leaflets developed by UIC with particular attention to TCN interoperability aspects
- The possible existence of intellectual property rights and patents of JDP and ERRI

After a long debate, TC 9 took the resolutions which are summarized hereunder:

- Resolution 34.10 clarified the contents of TCN documents and which contents shall be included in the TC 9 Standard and which shall be included into UIC leaflets in order to support the implementation of the TC 9 Standard
- Resolution 34.11 stated that the TC 9 Standard shall provide all the necessary information to implement a TCN application which should be interoperable with others avoiding the need to obtain IPR or patents granted
- Resolution 34.12 defined the development plan of the TC 9 Standards on TCN, allocating dates for CD and CDV of the six parts of TCN standards series. Furthermore, it was decided

to task the TC 9 Secretariat to contact ERRI in order to ensure that the test results on the first TCN implementation could be available to WG 22 in order to be included in Part 6: TCN Conformance Testing

The chapter "Success stories" reports an in-depth look at TCN and its success story.

In 1995, the 35th meeting of TC 9 was convened in Durban, South Africa. For the first time, a convenor's meeting was mentioned which had taken place in Autumn 1993. All the convenors were asked to report on the progress of the working groups.

Most of the 35th meeting was dedicated to WG 22 and TCN standardization. There was a long discussion on the progress of WG 22, whether to discuss all the comments received (over 700), or only the ones regarding question of principles. It was proposed to set up a task force with all the heads of the National Committee delegations, but it was impossible to reach a consensus. It was therefore decided to address all comments starting with the 79 comments which were classified as basic.

After a one-day discussion, only 29 out of the 79 basic comments of document 9/332/CD had been discussed. Following the Italian NC's proposal, it was decided to summarize the discussion in a suitable overflow-meeting which would be convened three months later in Geneva. However, at the end of the discussion, it was decided that the future standard would be stand-alone from the point of view of the train architecture and the vehicle architecture.

It was decided to amend the SPS to take into account the liaison with CLC/TC 9X.

Furthermore, following a proposal of the Polish NC, it was decided to convene TC 9 each year.

In 1996, the 36th meeting of TC 9 was convened in Zabeltitz, Germany. That year, Maurizio Cavagnaro (IT) was appointed Chair.

In 1997, during the 37th meeting in New Delhi, India, it was established that the Management meeting would take place every six months. It was reported that IEC Secretariat decided to disband IEC SC 22D: Power electronics for rolling stock, and to transfer the activities to TC 9.

During the 38th meeting in Zhuzhou, China, following an IEC Secretariat recommendation, the Railway Advisory Group on Strategy (RAGS) was established, chaired by the TC 9 Chair who reports to TC 9 and to the Committee of Action. See the chapter "Chair Advisory Group" for the contribution given by RAGS to the creation of the CAG.

In 1999, during the 39th meeting in Kyoto, Japan, the Strategic Policy Statement was updated. See chapter "Standardization strategy and strategic business plan" and the Annex F of the minutes of meeting 9/553e/RM. It was highlighted that possible future work items will probably originate in Automatic People Movers (APM).

In 2000, during the 40th meeting in Strasbourg, France, TC 9 decided to set up a working group under convenorship of France on automated people movers.

The Convenor reported on the first RAGS meeting, focusing on the future needs of standardization perceived as follows:

- Future subjects linked to the privatisation of the railways insofar as the testing procedures will be more and more important in order to verify the compliance to the standards
- The major markets in the ten forthcoming years
- The "system" approach
- The standardization of the electric equipment in railway tunnels (e.g. lighting, ventilation, sensors, communication, signalling…)
- The standardization of the electric equipment in diesel locomotives

In 2001, during the 41st meeting in Florence, Italy, a new title and new scope for TC 9 was proposed as follows:

- Title: Electrical equipment and systems for railways
- Scope: to prepare international standards for the railway field which includes rolling stock, fixed installations, management systems for rail vehicle operations, and their interfaces within the environment.

These standards cover railways and also urban transport including metros, tramways, trolleybuses and guided automated transport systems.

These standards relate to systems, components and software and they deal with electrical, electronic and mechanical aspects, the latter being limited to items depending on electrical factors.

Further to the recommendation made by RAGS, TC 9 decided to set up a survey group in order to investigate more in detail the need for a standard on fire protection and covering electrical components under the convenorship of Japan.

In 2002, during the 42nd meeting in Quebec City, Canada, IEC Secretariat reminded that, among the new modifications in the IEC procedure, the SPS had to be renamed Strategic Plan.

In 2003, at the 43rd meeting in Charlottenlund, Denmark, following the resignation of Mr Cavagnaro, Franco Cavaliere (IT) chaired the TC as acting Chair since his nomination had not arrived in time.

Following a recommendation of the IEC Secretariat on the Global Relevance, it was decided to set up an ad hoc group under the convenorship of the TC 9 Chair to investigate the topic of global relevance in the railway field. This group was named AGGR, Advisory Group on Global Relevance. The Subcommittee "Chair Advisory Group" gives more details on the AGGR.

Finally, a consensus about the structure of the TCN standard was reached as follows:

- IEC 61375-1 on WTB and all clauses of existing 61375 except MVB (resulting from TCN as existing IEC 61375)
- IEC 61375-2-1 on MVB
- IEC 61375-2-x on other VBs as necessary for other possible vehicle buses
- IEC 61375-3-1 on conformance testing resulting from existing 61375-2
- IEC 61375-3-x on conformance testing related to other vehicle buses

At the 44th meeting in Shanghai, China, it was decided to set up a task force to address the topic of railway related multimedia systems. The task of this TF was to produce by 2004 a survey questionnaire to be circulated to NCs in order to identify and prioritize the potential area of interest in the domain of railway related multimedia systems onboard. Results of the survey would be transmitted and commented at the next RAGS meeting.

At the 45th meeting in Tokyo, Japan, following the presentation of the reports of RAGS and of AGGR, it was agreed to merge both groups into a single Chair Advisory Group which would be convened once a year. Its membership is composed of both existing memberships of RAGS and AGGR.

At the 46th meeting in Helsinki, Finland, following the CAG meeting in November, a verbal report was presented to TC 9, which led to several decisions:

- The CAG Terms of Reference would be revised and circulated to cover some changes in membership process
- The Merging Strategy between CENELEC TC 9X and TC 9 would be revised to cover the revision mechanism of CENELEC originating standards
- It was noted that Japan would prepare a NWIP on the topic of linear motors

In 2007, at the 47th meeting in Bordeaux, France, it was decided to transform the current SPS in order to fit in the new Strategic Business Plan (SBP) template. A new draft SBP would be circulated in order to be discussed during the next CAG meeting.

The Italian NC proposed to start new standardization work on "Driver Information System", including recording data that refer to the driving (in a device able to survive a crash in case of accident) and recording data for "legal" use (i.e. addressing the contract between the driver and the operator).

The Italian NC agreed to prepare a NWIP proposal for the next TC 9 CAG meeting. The suggestion was also made to check what could be already available from JTC 1/SC 17.

Mr Desvignes announced that he was going to retire at the end of 2007 and would therefore resign from his position as TC 9 Secretary.

In 2008, at the 48th meeting in Kista, Sweden, the new Secretary, Christian Espitalier (FR), and the new Assistant Secretary, Thierry Laîné (FR), were presented to the members.

It was decided, considering the broad scope of the domain covered, to split WG 43 into two working groups: one dealing with TCN (WG 43) and another one dealing with onboard multimedia systems (WG 46).

The changes proposed by TC 9 CAG related to the TC 9 Strategic Business Plan were endorsed.

Moreover, provided the possible acceptance by the SMB, TC 9 took a resolution to recommend that CENELEC-originated standards, offered to TC 9, shall be circulated as CD documents.

In 2009, at the 49th meeting in Washington DC, USA, the new Secretary, Bernard Lerouge (FR), was presented to the members.

Following a Chinese NC comment, TC 9 resolved to accept it on its SBP to replace reliability aspects by reliability, availability, maintainability (RAM) aspects and to subsequently approve the resulting SBP.

Japan presented a proposal for a new work item on a procedure to determine the performance requirements for radio-based train control systems. TC 9 decided to set up an ad hoc group under Japanese leadership in charge to prepare a report covering the following topics:

- Survey of the existing radio-based train control systems
- Evaluation of the feasibility of a procedure to determine the performance requirements of a radio-based train control system
- Preparation of the draft to be used for the text of a NWIP

China presented a proposal for a new work item on measurement methods for earthing system of electrified railways and TC 9 decided to set up an ad hoc group under Chinese leadership in charge of preparing a proposed draft to be used for the text of a NWIP.

In 2010, at the 50th meeting in Changsha, China, four recommendations from CAG were discussed. They were related to:

- the continuation of the work of ahG 3 on Radio based train control systems, taking into consideration ERTMS and Modurban solutions and other existing standards (IEC 62280-1 & 62280-2)
- the need for a liaison with TC 22
- the proposal from China on wireless control of multiple freight units. The proposal would be discussed in WG 43 in order to set up a subgroup if relevant, with the objective to prepare a NP to be circulated together with a draft

Figure 12 shows the commemorative picture taken during the 50th TC 9 Plenary meeting in Changsha, China. In front: Mr Bozzolo, CENELEC TC 9X Chair (third from the left), Mr Cavaliere, TC 9 Chair (fourth from the left), Mr Jacquemart, TC 9 Technical Officer (seventh from the left), Mr Lerouge, TC 9 Secretary (nineth from the left) and Mr Laîné, TC 9 Assistant Secretary (tenth from the left) together with very distinguished persons from the Standardization Administration of People's Repulic of China and the Hunan Provincial People's Government.

At the 51st meeting in Fukuoka, Japan, five recommendations were made to TC 9 related to:

- the outcome of the work of ahG 2 on measurement methods for earthing system of electrified railways. TC 9 resolved to circulate the ahG 2 report as an INF document for NCs
- the termination of the work of ahG 3 on a procedure to determine the performance requirements for radio system applied to radio-based train control systems. TC 9 resolved to transform ahG 3 into PT 62773 under the Japanese Convenorship
- TC 9 resolved to start the revision of 61377 series of standards including considerations for permanent magnet motors. TC 9 also resolved to transform ahG 4 into MT 61377 under the FR Convenorship
- the proposal from China on onboard infrastructure database based train control system

Figure 12 – Commemorative picture of the 50th TC 9 Plenary meeting

TC 9 resolved to set up ad hoc Group 5 under the CN Convenorship in order to clarify the scope of the proposal, to evaluate the feasibility and to update the relevant NP.

A long discussion took place about the liaison with UIC and the following issues were considered:

- UIC did not grant permission to WG 43 to use UIC leaflets
- No agreement existed between UIC and the IEC
- No contribution was sent by UIC following the invitation to participate in the 51st TC 9 meeting

Considering the above, TC 9 resolved to discontinue the liaison with UIC.

At the 52nd meeting in Oslo, Norway, seven recommendations were made by CAG to TC 9 relating to:

- the change of title proposed by ahG 5 from "Railway applications – Onboard database based train control system" to "Railway applications – Onboard database for train control system". TC 9 resolved to accept it
- the circulation of a new proposal on "power supply with onboard energy storage system" with a part 1 on "series hybrid system" to be started at once, and a part 2 on "parallel hybrid systems" to be launched later. TC 9 resolved to support the proposal of ahG 7
- the continuation of the work of ahG 6. TC 9 resolved to accept it
- the preparation by WG 43 of a DTR on wireless train backbone (IEC TR 61375-2-7). TC 9 resolved to support the circulation of such DTR
- the setting up of an ahG, with the participation of TC 9 and CLC/TC 9X experts and officers, to prepare a proposal for best practices to deal with the revision of CENELEC norms, an edition of which has already been endorsed as an IEC Standard

- the setting up of an ahG to study the possibility to develop an amendment to IEC 62278 to incorporate considerations of RAM. TC 9 resolved to set up ahG 8 with the remit to prepare a proposal for best practices to deal with the revision of a CENELEC Standard, an edition of which has already been endorsed as an IEC Standard
- the setting up of an ahG to study the possibility to develop a new standard on Li+ traction batteries. TC 9 resolved to set up ahG 10 with the remit to study the possibility to develop a new standard on this topic

Mr Nishie (JP), newly appointed as ISO/TC 269 (Railway applications) Chair, explained the creation and the purpose of the new ISO TC. TC 9 resolved to recommend the setting up of a liaison between IEC TC 9 and ISO/TC 269.

In 2013, at the 53rd meeting in Florence, Italy, there was a discussion on the liaison between TC 9 and UIC. The liaison was discontinued when UIC refused to offer UIC 556 to TC 9/WG 43. UIC proposed to prepare a new agreement in October 2013. Officers from UIC, IEC Secretariat and TC 9 prepared, in August 2013, a draft Cooperation Agreement between the IEC and UIC, intended to supplement the rules related to the A-liaisons. P-members had been invited to comment on this draft Cooperation Agreement between the IEC and UIC.

Comments and clarifications were needed, as for instance in the case a UIC leaflet is proposed as IEC Standard: it was not specified if the leaflet be withdrawn from the list of UIC available leaflets. TC 9 advice was that there was no interest to keep two documents dealing with the same topic.

There was a discussion on the following issues:

- Whether or not there was a necessity of a A-liaison between the IEC and UIC, as experts from UIC members might participate in the IEC WG for the elaboration of IEC Standards
- UIC had to demonstrate a clear process for the elaboration of its leaflets
- A six-month periodicity for meetings of the Strategic Liaison Group was considered not sufficient. Furthermore, the SLG should not take decisions, especially involving TC9. The SLG might only issue recommendations
- Activities for IEC Standards should not be performed within UIC
- Intellectual property issues had to be clarified
- IEC Standards shall not be constrained by UIC leaflets
- IEC Standards shall not have to take UIC vocabulary into account

It was agreed that the text of the draft agreement should be improved.

Noting the discussions, TC 9 confirmed the TC 9 CAG recommendation and instructed TC 9 Officers to continue to negotiate the agreement with UIC, taking into account the comments from P-members. TC 9 also decided to accept the A-liaison requested by UIC.

Finally, TC 9 took a resolution explaining the issues above.

At the 54th meeting in Berlin, Germany, UIC reported on TC9/UIC cooperation and TC 9 took a resolution as detailed hereunder.

TC 9 resolved to resume the Strategic Liaison Group meetings with UIC with the objective to reach an agreement on a common work programme and to develop the *modus operandi*. The initial common work programme will concentrate on the items:

- Train Bus plus, considering the UIC documents UIC 558 on UIC Cable and IRS 50405: Railway Application – Rolling Stock – Transmission of diagnostic data
- Overhead contact line, considering the UIC documents IRS 70015: Railway application – Fixed installations – Diagnosis of the overhead contact lines; IRS 70016: Railway application – Fixed installations – Safety measures to adopt when working on or nearby overhead contact lines; IRS 70017: Railway application – Fixed installations – Evaluation of accident on the railway energy subsystem; IRS 70018: Railway application – Fixed installations – Guidelines on overhead contact lines earthing systems for safety in tunnels
- Rolling stock testing before entry into service
- Multimedia systems on rolling stock
- Provisions against electrical hazards on rolling stock

Franco Cavaliere, TC 9 Chair, was nominated as TC 9 liaison officer with UIC and Gianfranco Cau was noted as the liaison officer from UIC with TC 9.

The JP NC presented a proposal for standardization of "Direct current signalling monostable relays of spring type" as a possible alternative to the already standardized "gravity relay" to be applied in safety apparatuses. TC 9 resolved to instruct JP NC to provide input for a questionnaire to be circulated by TC 9 Officers, to set up an ahG for the preparation of a NWIP on a new standard on such relays.

In 2015, at the 55th meeting in Minsk, Belarus, the TC 9 Chair presented the current cooperation agreement with UIC. The TC 9 Chair reported that UIC and TC 9 had set up a SLG to analyze items proposed by the two partners and to advise how to cooperate on such items. If common items are selected, subgroups of the SLG can be created to elaborate internal informative documents. Each

partner can then create his own documents using informative documents elaborated by a SLG sub-group (SLG-SG). No formal documents are to be shared and to have double logo.

The UIC delegate reported on TC 9/UIC cooperation, which focused on the following items:

- Trainet Group – Trainet Group is working on "Doors system functionalities" based on several documents from different sources (UIC leaflet, EN, IEC Standards, etc.). Trainet Group will be in charge of monitoring and updating the common documents
- Overhead Contact Line Group – Overhead Contact Line Group is working on the harmonization of IEC 60913 with UIC 791 and IRSs 70014 and 10015 on the four following aspects: maintenance, OCL system and components requirements, Diagnostics, RAMS
- Vehicle testing and acceptance – There was a proposal to work on IEC 61133 and UIC 611. IEC 61133 will be the top document and UIC 611 could be an application guide. A questionnaire is about to circulate for this proposal
- Multimedia applications – There is a proposal to work on WG 46 document "Passenger Oriented Service". The scope and contents of the current document shall be analyzed to clarify the needs of users

TC 9 resolved to request its Secretary and IEC Secretariat to set up the SLG in the IEC Experts Management System and in the IEC Collaborations Tool and then to register de facto TC 9/CAG members as members of the SLG. The Convenor is the TC 9 Chair.

TC 9 resolved to request its officers to prepare a draft of process of UIC-IEC cooperation, including questionnaire circulation, collecting comments, membership (e.g. call for experts) and justifications for cooperation (e.g. solving conflicts and defining the borderline between UIC leaflets and IEC Standards) to seek additional input from final users, in accordance with the presentations which were made.

Furthermore TC 9 resolved:

- to instruct its Secretary to circulate a questionnaire to start the cooperation in accordance with the above-mentioned future process of UIC-IEC cooperation on "On board multimedia passengers orientated services"(planned as IEC 62580-4)
- to task its officers to request UIC to provide more detailed information before starting work on "Testing of vehicles" (IEC 61133/UIC 611)
- about the Project TS 62597: *Railway applications – Measurement procedures of magnetic field levels generated by electronic and electrical apparatus in the railway environment with respect to human exposure*, TC 9 resolved to set up ahG 13 to propose the future evolution of IEC TS 62597

The Russian NC presented a proposal for a NWIP on "Catenary wires of overhead catenary system of railway" and, after discussion, TC 9 resolved to task its Secretary to circulate a questionnaire to set up an ahG for the preparation of the NWIP with the following tasks:

- to investigate the existing standards
- to propose a structure for this new standard
- to prepare a NWIP to be submitted to CAG and TC 9
- the Chair, Mr Cavaliere, informed TC 9 that his current mandate will finish soon and, in accordance with the IEC rules, he would leave the Chair

In 2016, at the 56th meeting in Chengdu, China, TC 9 was chaired for the first time by Gianosvaldo Fadin (IT).

TC 9 decided to set up MT 62597 to replace ahG 13, and to start the work to transform IEC TS 62597 into an international standard.

Since it was expected that Ni-MH battery for auxiliary power supply systems would become widely used and there was a need to standardize it, TC 9 decided to set up an ahG to prepare a NWIP on Ni-MH batteries with a JP NC expert as rapporteur.

TC 9 decided to include the item on energy feedback systems (EFS) for consideration in the next IEC TC 9-UIC SLG meeting.

Furthermore, TC 9 decided to circulate a questionnaire to set up an ahG on transducers to prepare a NWIP with a CN NC expert as rapporteur.

In 2017, at the 57th meeting in Vladivostok, Russia, Mr Lerouge, TC 9 Secretary, announced his retirement and that Denis Miglianico (FR) would replace him as Secretary.

The SLG decided that priorities of the TRAINET subgroup would be as follows:

1. "Traction and remote control" in parallel with "Passenger alarm system"
2. "Passenger communication system" in parallel with "Braking"
3. "Diagnostics"

Ms Calleja was recorded as Liaison Officer between TC 9 and UIC.

TC 9 decided to circulate a questionnaire proposing to set up a new ad hoc group with the task to draft a new technical report on the topic of durability.

TC 9 decided to circulate a questionnaire on the advisability to set up an ad hoc group whose task would be to prepare a NWIP on "Electronic Power Quality Compensators for Single Phase AC Traction Systems".

TC 9 decided to ask the Chinese NC to produce a NWIP on "Energy feedback systems" to be submitted to ahG 19 for review.

TC 9 decided to circulate a questionnaire with a view to setting up an ad hoc group whose task would be to prepare a working draft and to review the Chinese NWIP on lead acid batteries (future IEC 62973-3).

At the 58th meeting in Tokyo, Japan, the Chair introduced Mr Chiah, who was to replace Mr Jacquemart as IEC Secretariat Officer.

Regarding the advisability to transform IEC TS 62773 into an international standard, TC 9 decided to keep IEC TS 62773, *Railway applications – Procedure to determine the performance requirements for radio system applied to radio-based train control systems.*

TC 9 decided to circulate a questionnaire proposing a new WG 50 on "Railway applications – Fixed installations – Electronic power converters" with DE NC convenorship, including 5 parts of IEC 62590 with the following structure according to the report of ahG 21:

- IEC 62590-1, *Railway applications – Fixed installations – Electronic power converters, Part 1: General* (NP proposed by DE NC, based on IEC 62590)
- IEC 62590-2-1, *DC traction applications – Uncontrolled rectifiers* (NP proposed by DE NC, based on IEC 62589)
- IEC 62590-2-2, *DC traction applications – Controlled rectifiers, inverters & DC/DC converters* (NP proposed by DE NC)
- IEC 62590-3-1, *AC traction applications – Electronic power compensators* (NP proposed by JP NC)
- IEC 62590-3-2, *AC traction applications – Static frequency converters* (NP proposed by DE NC)

Two new proposals were presented:

- LU NC proposal on the safe transmission protocol for ground systems according to IEC 62280. The proposed protocol is intended for ground equipment, mainly when signalling aspects are involved. After discussion, TC 9 decided to task WG 43 to analyze the LU proposal within the scope of WG 43 and to provide a report with a proposal for the way forward by the next CAG meeting

- DE NC proposed to add a part 5 to IEC 62973-5, *Railway applications – Rolling stock – Batteries for auxiliary power supply systems – Part 5: Lithium Ion batteries*. After discussion, TC 9 decided to set up ahG 25 and to circulate a questionnaire on the proposal, to launch a call for experts and to confirm the convenor to be proposed by the JP NC

At the 59th meeting in Nice, France, TC 9 decided to task the Secretary to circulate a questionnaire on the creation of an ad hoc group related to the NP "Signalling system safe transmission protocol".

Noting the report of the Convenor of ahG 19, TC 9 decided to task the Secretary to circulate for information the results of the analysis of the existing TC 9 documents (IS, TS, TR) from the point of view of energy efficiency aspects. TC 9 also invited the Chinese NC to provide an updated NP on "Energy Feedback Systems" for circulation by the TC 9 Secretary before the next CAG meeting.

Noting the report of the Convenor of ahG 20, Study ACSEC Guides, TC 9 decided to task MT 62278: Railway applications – Specification and demonstration of reliability, availability, maintainability and safety (RAMS), to propose a nomination for a representative in ACOS. TC 9 also decided to task ahG 20, ACSEC, to investigate on:

- the application of cyber security to legacy systems
- the relationship between cyber security and functional safety
- cyber security for test equipment

Noting the report of the Convenor of ahG 24, TC 9 decided to task the TC 9 Secretary to circulate a questionnaire as well as the working document "Consideration of durability during life cycle", asking NCs whether or not this document should be included in the TC 9 work programme as a CD and to provide a justification for their decision.

Noting the report of the Convenor of ahG 25, TC 9 decided to circulate the NP for the future PT 62973-5, *Railway applications – Rolling stock – Batteries for auxiliary power supply systems – Part 5: Lithium ion batteries*.

Noting the presentation of the Korean NC on Interoperability and safety of dynamic wireless power transfer (WPT) for railways, TC 9 decided, after discussion, to invite the Korean NC to investigate the technology.

The 60th meeting was convened in 2020 online because of the pandemic.

Since it was experienced that some TCs, for example TC 204, were not aware of the scope of TC 9 and that the application of any kind of technology to railways should be standardized solely by TC 9, the committee decided to add "supervision" and "information" to the list of management systems for railway operation addressed in the scope and tasked the Secretariat to modify the SBP accordingly.

TC 9 decided to setup an ad hoc group on the topic of "Safe transmission protocols".

TC 9 decided to allocate the proposed NP, *Electronic railway equipment – On board driving data recording system – Part 3: Audio and video recording*, to the IEC 62625 series.

TC 9 decided to set up an ad hoc group on the technical criteria for the co-ordinations in neutral-section passing system for train, confirming a CN NC as Convenor of the ahG.

TC 9 decided to create an ad hoc group on railway applications – Coordination requirements and energy-saving performance evaluation for energy feedback systems in DC traction power systems, and to confirm a CN NC member as Convenor. The remit of this ahG is to clarify the scope and to remove the overlap with other existing standards and active projects within this field and to work in close cooperation with WG 50.

With regard to the cooperation with UIC, it was agreed that the following topics were of common interest and should be investigated:

- New TRAINET subgroup activity on HVAC
- Continuation of the cooperation on OCL
- SFERA IRS 90940: How to exchange messages between on-board and ground equipment of the Infrastructure Manager and/or Railway Undertaker
- 5G network technology
- Fuel cell hydrogen integration in railway system

The 61st meeting was convened in 2021 online again because of the pandemic.

After being informed by Gianosvaldo Fadin, that he would be chairing his last committee meeting, the French NC proposed Daniele Bozzolo as candidate to be the successor.

During the meeting, TC 9 decided to apply for a Type B liaison with the European Union Agency for Railways (ERA).

After discussions, TC 9 decided to task ahG 20 to prepare a NP for an international standard related to the cyber security in railway applications. ahG 20 was tasked to take into account CLC/TS 50701:2021, *Railway Applications – Cybersecurity*, issued by CENELEC TC 9X.

Regarding the activities of ahG 27: Technical criteria for the co-ordinations in neutral-section passing system for train, TC 9 decided to circulate the following four proposals from the Chinese NC as Documents for Comments:

- Part 1-1: Without power supply – General requirements
- Part 1-2: Without power supply – Particular requirements for automatic neutral-section passing onboard by ATP and ground pointing installations
- Part 2-1: With power supply – General requirements for change-over auto-energizing
- Part 2-2: With power supply – General requirements for continuous and flexible auto-energizing

In 2022, at the 62nd meeting held in Milan, Italy, chaired for the first time by Daniele Bozzolo (IT), TC 9 decided to create ahG 30: Standards map, and confirmed a CN NC member as Convenor.

TC 9 decided to establish a liaison with ISO/TC 269/SC 2: Rolling stock, on the topic Prognostics and Health Management (PHM). TC 9 tasked the Secretariat to launch a call for a liaison representative recommending the creation of an UIC-IEC SLG subgroup dedicated to PHM.

Standardization strategy and strategic business plan

The 1st draft of the TC 9 strategic business plan (SBP), previously called strategic policy statement (SPS), was finalized during the 33rd TC 9 Plenary meeting in Stockholm, Sweden, in 1993.

The text, which is reported in Annex H of the minutes of the meeting, is presented in Figure 13, Figure 14 and Figure 15.

At the 47th Plenary meeting in Bordeaux, France, TC 9 decided to transpose the contents of the SPS into the new SBP template issued by the IEC and to circulate the draft of the SBP in due time for discussion during the next CAG meeting.

ANNEX H

Strategic Policy Statement

1. BACKGROUND

TC 9: Electric traction equipment was established on the 24th April 1924 and has the task of preparing publications dealing with electrical equipment for rolling stock, trolleybuses and the track side equipment feeding railway and tramway traction networks. These tasks are undertaken in close liaison with the UIC and UITP and more recently with CENELEC TC9X.

2. ENVIRONMENT

2.1 Technical, industrial and economic evolution

In recent years, the railway sector has been subject to changes which have greatly influenced the design of railway systems.

These changes concern operating characteristics as well as the technology involved.

The expansion of urban and suburban transport systems together with the increasing speed of inter-city trains should be emphasized.

From the technical point of view, techniques based on power electronics have contributed to improvement of the performance (power-to-weight and power-to-volume ratios) of equipment.

Development of control electronics and the use of microprocessors have made possible new operating procedures, automation of some functions and facilitate diagnostic and maintenance procedures.

This evolution has nevertheless not changed some specific conditions applying to the use of electrical equipment on railways, namely electric propulsion by motors, particular environmental conditions on board vehicles, an exceptional life cycle (up to 40 years) and high reliability.

Mergers and takeovers and political pressures constrain manufacturers and operators to work on a supranational basis.

2.2 Demand for standards

International standardization in the railway field has until now been limited to guidance and general considerations.

In the present political and economical circumstances, insufficiency of existing international standardization and discrepancies between national development are always a hindrance to obtaining the greatest efficiency from both manufacturers and operators.

Preparation of a set of harmonized standards for the railway sector at the European level, as is requested by the European Commission, complies with the present and future needs of the partners concerned.

Many aspects should be studied at worldwide level but some others should be adapted to fit the regional needs of populations due to different local economical and cultural conditions.

Figure 13 – Annex H, Strategic Policy Statement, first page

2.3 Trends in technology and trade

The traditional approach i.e. product by product should be supplemented by an approach making better allowance for the functional aspects of systems and subsystems. This approach is justified by the increasing complexity of interaction between equipment and by the application of quality control procedures (ISO 9000) during the design and testing phases.

The design of electrical installation (protection and wiring) is likely become important for rolling stock as well as for fixed installations. Such considerations have already been made by TC9X CENELEC. IEC/TC 9 is kept permanently informed of priorities proposed by CENELEC TC9X.

At present these priorities are similar to the existing programme of work of IEC/TC 9.

Companies which appoint experts to Working Groups request the duplication of work, and that a close permanent relationship be maintained or reactivated between the three entities at present involved in international and regional railway standardization work, namely IEC/TC 9 and SC 22D, UIC, UITP and CENELEC TC9X.

2.4 Perceived priorities

The current priorities are listed in the work programme. Due to limited resources all other items have been withdrawn from the programme of work and the corresponding Working Groups disbanded.

3. WORK PROGRAMME

On existing standards the situation could be summarized as follows:

Subject	Status	Publishing year
- Transformers and reactors	Completed	1991
- Vehicle testing	At the approval stage	1993
- Rotating machines	Near completion	1992
- Electrical equipment	In progress	/
- Electronic equipment	Revision is a New Work item proposal	

The following new subjects are already in the programme of work:

- Vibration and shock behaviour testing		1994
- Interfaces between programmable equipment		1993
- Power electronic convertors	Being considered by IEC/SC 22D	

Figure 14 – Annex H, Strategic Policy Statement, second page

4. FUTURE WORK (Long term view e.g. 5 to 10 years)

- Automatic train control
- Liaison (communication) between rolling stock and ground
- Track side equipment
- Energy saving
- Earth stray currents
- Protection of the environment (cooling media for equipment, noise)
- EMC standards

Note : Some aspects are to be studied in liaison with others IEC TC's or other organizations.

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Figure 15 – Annex H, Strategic Policy Statement, last page

Since that 1st draft, the SBP was revised to include new technologies and new areas of standardization, respectively emerging from the research activities and from the market.

For example, during the 16th CAG meeting held on 18 April 2013 in Geneva, Switzerland, the Italian NC proposed to include aspects relevant to energy efficiency into the SBP.

Following the Italian proposal the SBP was updated adding the following text in the Annex I – Environment:

"TC9 is exploring further possibilities for standardization projects to pursue energy management in view of assisting and promoting the energy efficiency in trains and associated infrastructure.

Particularly TC9 promotes or currently works on new work items in the following areas:

- on-board energy measuring for supporting energy calculation and savings;
- energy savings, e.g. assisting driver for optimal driving and energy management by Train Control and Monitoring System (TCMS);
- recovery of braking energy, e.g. reversible electrical sub-station, hybrid traction and onboard or stationary energy storage.

In consideration of the merging strategy, TC9 will coordinate this topic with CENELEC TC 9X."

In November 2013, during the 53rd Plenary meeting, TC 9 approved the SBP with the new text relevant to energy efficiency.

During the TC 9 CAG, held in Volgograd, Russia, in May 2017, the IEC Chair reported on the activities of IEC ACSEC.

Tackling that the data security issue was quite urgent at global level, the TC 9 Chair proposed to set up an ad hoc group with the following tasks:

- To study the ACSEC guide
- To report to TC 9 comments on the guide for being forwarded to IEC ACSEC
- To investigate the relationship between safety and security

Furthermore, the TC 9 Chair asked to consider the introduction of data security issues in the TC 9 SBP.

Following the proposal, the chapter A – State title and scope of TC of the SBP was updated introducing the following text:

"Security aspects

- Confidentiality
- Integrity
- Availability
- Non-repudiation

NOTE: all the security aspects covered above are relevant to "cyber security". Non electrotechnical aspects of security such as societal security are excluded, except where they directly interact with electrotechnical security."

During the 57th Plenary meeting, in Vladivostok, Russia, in October 2017, TC 9 took the decision 57/02:

"TC 9 decides to circulate the proposal of update to the Strategic Business Plan for comments and vote."

The Secretariat launched the enquiry in 2018 and the new text of the SBP was approved.

Chair Advisory Group

The predecessors of the Chair Advisory Group of TC 9 were two advisory groups:

- RAGS, the Railway Advisory Group on Strategy
- AGGR, the Advisory Group on Global Relevance

As reported in chapter "One hundred years of IEC TC 9 standardization", the RAGS was established during the 38th meeting convened in Zhuzhou, China, in November 1998.

During the plenary, it was decided that the following principles should be fulfilled by RAGS:

- A limited membership
- A balance between manufacturers and users
- Members should be: European manufacturers, non-European manufacturers, users' representatives (e.g. UIC)
- Guests should be: Chairs of SCs concerned (if any) of TC/SC in liaison (e.g. TC 98), TC 9 Secretaries, CENELEC/TC9X Chair

As reported in chapter "One hundred years of IEC TC 9 standardization", the AGGR was established during the 43rd meeting in Charlottenlund, Denmark, in October 2003.

TC 9 decided that the remit of the AGGR was to act as an advisory group only and to identify the items impacted by:

- European Interoperability Directives
- European TSIs
- Regulations in Asia
- Regulations in America
- Any other…

and to provide guidance to convenors and project leaders for the drafting of their documents.

As reported in chapter "One hundred years of IEC TC 9 standardization", the TC 9 CAG was established during the 45th TC 9 meeting in Tokyo, Japan, in November 2005, merging the advisory groups RAGS and AGGR into one group.

It was decided that the CAG would be chaired by the TC 9 Chair, the Secretariat being that of TC 9. The Chair of CENELEC TC 9X was invited as guest.

With respect to CAG membership, the following principles should be fulfilled:

- A limited membership
- A balance between manufacturers and users
- Members should be: European manufacturers, non-European manufacturers, users' representatives
- Guests should be: Chairs of SCs concerned (if any), and of liaison TC/SCs (e.g. TC 98)

This CAG covers all the remits below resulting from both former RAGS and AGGR groups:

- To guide TC 9 in defining its SPS
- To review and identify priorities in the technical activities of TC 9
- To identify technologies to be standardized
- To identify subjects needed but not covered by current standardization
- To identify and evaluate any existing PAS and/or de facto standards
- To review market needs of the particular sector taking into account the needs of users including consumers where appropriate
- To assess effectiveness of the programme of work and the needs of the railway sector
- To advise the SMB on possible overlaps, conflicts and gaps and recommend corrective actions
- To review all new work items
- To act in the framework of IEC Policy on global relevance and as an advisory group only

Therefore, to identify the items impacted by:

- European Interoperability Directives
- European TSIs
- Regulations in Asia
- Regulations in America
- Any other…

All CAG meetings, from the establishment until the Centenary Plenary meeting, are listed in Table 11 of chapter "List of CAG Meetings".

Management meeting

In 1995, during the 35th meeting of TC 9 which was convened in Durban, South Africa, it was reported that the first convenor's meeting took place in Autumn 1993. All the convenors were asked to report on the progress of their working groups.

In 1997, during the 37th meeting in New Delhi, India, it was established that the Convenor's meetings should be renamed Management meetings and that such meetings would take midyear.

The Management meetings, which usually take place in May, aim to verify the status of TC 9 standardization work through reports presented by WG Convenors, ahG Convenors, Project Leaders and Maintenance Leaders.

Possibly, critical situations can be singled out and then discussed in the CAG in order to advise the TC 9 Officers on possible prompt actions or to advise TC 9 for the next plenary meeting.

All Management meetings, from the establishment until the Centenary Plenary meeting, are listed in Table 12 of chapter "List of Management meetings".

Committee structure

A century has passed since the foundation of the Advisory Committee on Traction motors and 74 years have passed since AC 9 became TC 9.

Many new technologies and standardization areas started to be relevant to railway applications and, consequently, to TC 9 standardization activity.

Examples are control systems and communication systems.

Even though TC 9 recognized the need of a system approach and considered railway as a system constituted by three subsystems, i.e. signalling sub-system. rolling stock sub-system and fixed installation sub-system, the original “flat” structure was never abandoned, and TC 9 decided over the years that it was not necessary to set up Subcommittees.

The organizational structure of TC 9 is shown and described in chapter “Organization chart” in the Annex.

When standardization means innovation

Standardization and innovation

Aspects relating to innovation become increasingly crucial in a market context in which competitiveness can be improved by innovative contents for both the products and services offered. Recently, SDOs and ESOs have identified the existence of close relationships between innovation and standardization. This relationship is well analyzed by the document *Towards a greater contribution from standardization to innovation in Europe*, which was published in 2008 as a communication of the European Commission to the Council, the European Parliament and Social Committee.

In general, innovation outcomes, produced by research, can be of great value for standardization and, vice versa, research and innovation projects must consider the state of the art that is optimally provided by standardization.

In some cases, standardization itself can generate the need for research activities for the definition of functional and system specifications and for the definition of appropriate test methods for verifying the conformity of these functions and systems.

Standardization constitutes voluntary cooperation between stakeholders, such as industry, user associations, public authorities and others, to develop technical specifications that are based on consensus. One of the objectives of standardization is the complementation of market competition to achieve product and service interoperability and to prepare common requirements and test methods for safety, health and product/service performance.

Innovation is the implementation, in terms of novelty or significant improvement, of a product (understood as a good or service), a process or an organizational method.

Innovation is achieved through scientific, technological, organizational and financial activities.

A product is innovative when it introduces a good or service onto the market that has new or significantly improved characteristics or ways of use. The same applies to organizational processes and methods.

Why is an approach which integrates standardization and innovation needed?

Such an integrated approach between standardization and innovation brings significant benefits which are listed here.

In general, standardization offers the following contributions to innovation:

- Access to a global market
- Health and environmental protection
- Economy of scale and cost reduction
- Compatibility and interoperability of research results

Specifically, organizations that fund research and innovation can benefit from the following:

- Dissemination of the results on a much wider basis than scientific publications and patents
- Implementation of research results including patents that can be integrated into standards
- Maximization of practical applications based on the results provided by research

The integrated approach is exemplified by Table 2 in which the global process is presented as a succession of coordinated steps:

Steps	Status	Date
1	Identification of areas of innovation	Critical analysis of these areas for comparison with existing standards
2	Drafting proposals and programmes	Selection using the standardization criterion
3	Execution of projects	Identification of topics of probable standardization
4	Protection, dissemination and implementation of research results	Standardization used as a channel for transferring results to the technical-industrial community
5	Evaluation of results	Number of standards produced as evaluation criteria

Table 2 – Steps of an integrated approach between innovation and standardization

Success stories

The Train Communication Network (TCN) – How the TCN was born

At the beginning of the nineties, the railway companies, the railway industry and UIC considered it mature and even urgent to equip the train with a communication backbone that met the following essential requirements:

- Suitability for railway environmental conditions with particular reference to climatic conditions, the high level of electromagnetic disturbances and hostile conditions in terms of vibrations
- Ability to configure and reconfigure the network automatically in response to the dynamic coupling and decoupling of vehicles
- Ability to adequately transfer both data with temporal determinism constraints and data in massive quantities
- High reliability, availability and integrity
- Openness

The experts from railway companies, the railway industry and UIC, found that the answer to these requirements was not offered by the communication networks that existed at the time, despite having analyzed over 50 different solutions.

The belief was born that the network had to be “invented” by experts from the railway world in collaboration with data communications experts and that this network had to be interoperable and therefore required a consensus that could only be guaranteed by standardization.

Thus, a standardization proposal was born which, due to its innovative content, was supported by a “liaison” between the standardization body IEC and UIC, the association of railway companies.

It was also believed that the result should be a standard with greater validity than research work among experts and therefore should be subjected to the scrutiny of an experimental verification with a real implementation.

Thus, JDP, a group of railway industries was created, for the first implementation of the TCN, the train communication network.

An industrial initiative, made up of two associations, one between railway industries (IGZ – Industrie Gruppe Zugbus) and a second between railway companies (BGZ – Bahnhof Gruppe Zugbus) was set up.

The initiative consisted in an experimentation on a real train, the Interlaken-Amsterdam train, which was in passenger service throughout 1996.

Table 3 shows, in a synoptic view, the stakeholders involved, the standardization documents produced and the experimental implementations carried out.

IEC Standards	UIC leaflets (fiches)	Railway implementation and verification
IEC 61375-1 Specification of requirements and protocols for the TCN	UIC 558 Extension of the specification of the old 13 poles cable to the new 18 poles cable in order to include the communication wires	JDP/IGZ First implementation of the TCN on a real on-service train (see below)
IEC 61375-2 Specification of the test methods for the TCN	UIC556: specification of the interoperable data sets to be transferred on TCN UIC557: specification of the diagnostic data sets to be transferred on the TCN	International train on service between Interlaken (Switzerland) and Amsterdam (Netherlands) Exploited by BGZ and equipped by JDP/IGZ

Table 3 – TCN Standards, leaflet and experimental exploitation synoptic table

The first edition of IEC and UIC documents were issued in 1999, also following the contribution of the research project ROSIN (Railway Open System Interconnection Network), which was active between 1995 and 1999, funded by the European Commission under the 4th Framework Programme, where all major railway stakeholders were participating, including UIC.

The IEC 61375 series was regularly updated to include new technologies like ethernet protocols and wireless protocols.

Synergy between European research projects and TCN standardization

Following the first applications of TCN, a significant number of European research projects have seen the light and have been a stimulus to broaden the scope of the IEC 61375 Standard.

In addition to the already cited ROSIN project, it is useful to mention:

- TRAINCOM, Integrated Communication System for Intelligent Train Applications, project started in 2000 and focused on wireless communication between the on-board TCN network and fixed installations on ground in 2004
- EUROMAIN, European Railway Open Maintenance System, project started in 2002 to apply TRAINCOM results to remote diagnostics and maintenance

- MODTRAIN, Innovative Modular Vehicle Concepts for an Integrated European Railway System, project started in 2004 and focused on the functional description of on-board applications
- INTEGRAIL, Intelligent Integration of Railway Systems, project started in 2005 and focused on extending the results of TRAINCOM to the specification of on-board and on-board/land communication systems using ethernet and internet technologies, also showing like data exchange (by means of a railway ontology) was able to achieve system level optimization

All the projects indicated above included in their objectives the preparation of documents that could be used as standardization inputs.

This availability of results led to the proposal in 2004 to extend the TCN to ethernet and internet technologies.

In 2005, the working group WG 43 was founded with the task of specifying the TCN network by combining ethernet and CANopen technologies with the existing WTB and MVB technologies and extending communication also to the edge/ground.

Furthermore, it was decided to specify a middleware capable of decoupling applications from network technology by offering a standard application interface.

In 2007, WG 46 was founded with the aim of specifying on-board applications in terms of service-oriented architecture.

The standardization activity of WG 43 has therefore launched a new standardization challenge, leading to the specification of new Information Communication Technology (ICT) solutions with innovative content for application on trains since existing technologies such as ethernet and internet are required to apply the TCN paradigms that require determinism of data transmission, data security both in terms of safety and security and management of all dynamic aspects and reconfiguration of a network embarked on a train.

Once again, research, innovation and standardization have been coordinated, particularly with research projects defined by the Shift2Rail Joint Undertaking and now by Europe's Rail Joint Undertaking, to produce the set of standards shown in Table 4.

IEC Standard	Description
IEC 61375-1	Electronic railway equipment – Train communication network (TCN) – Part 1: General Architecture
IEC 61375-2-1	Electronic railway equipment – Train communication network (TCN) – Part 2-1: Wire Train Bus (WTB)
IEC 61375-2-2	Electronic railway equipment – Train communication network (TCN) – Part 2-2: WTB conformance testing
IEC 61375-2-3	Electronic railway equipment – Train communication network (TCN) – Part 2-3: TCN communication profile
IEC TS 61375-2-4	Electronic railway equipment – Train communication network (TCN) – Part 2-4: TCN application profile
IEC 61375-2-5	Electronic railway equipment – Train communication network (TCN) – Part 2-5: Ethernet train backbone
IEC 61375-2-6	Electronic railway equipment – Train communication network (TCN) – Part 2-6: On-board to ground communication
IEC TR 61375-2-7	Electronic railway equipment – Train communication network (TCN) – Part 2-7: Wireless Train Backbone (WLTB)
IEC 61375-2-8	Electronic railway equipment – Train communication network (TCN) – Part 2-8: TCN conformance test of ETB, ECN and communication profile
IEC 61375-3-1	Electronic railway equipment – Train communication network (TCN) – Part 3-1: Multifunction Vehicle Bus (MVB)
IEC 61375-3-2	Electronic railway equipment – Train communication network (TCN) – Part 3-2: MVB conformance testing
IEC 61375-3-3	Electronic railway equipment – Train communication network (TCN) – Part 3-3: CANopen Consist Network (CCN)
IEC 61375-3-4	Electronic railway equipment – Train communication network (TCN) – Part 3-4: Ethernet Consist Network (ECN)

Table 4 – List of TCN Standards

Acknowledgment

The history of TCN is not complete unless we remember the small group of experts who first steered the proposal and then the standardization of a communication system suitable to be installed on board of railway vehicles. Amid them, the authors wish to remember Hubert Kirrmann, Gernot Hans, Armin Heindel and Gianosvaldo Fadin.

At that time, the only applicable reference was the communication system on board of civil airplanes. However, the specificity of the application on-board of railway vehicles required a new solution, not resembling any local area network formerly known or used.

It was clear from the beginning that the challenge was a big one and that many bright ideas were necessary to specify such a special communication network.

Today, we can say that TCN was and is a success.

However, in the field of standardization, very few are aware that so much is owed to Hubert Kirrmann. He is the noble father of TCN, the real soul and brain of that small group of experts.

In particular, he invented the Real Time Protocols, gave an important contribution to the TCN Link Layer and suggested the concept of functional addressing.

He steered the TC 9 WG 22 from the start in 1990 until the publication of the first edition in 1999.

In the following years, Mr Kirrmann has been a respected and dedicated expert of SC 65C, TC 57 and received a 1906 Award in 2013 for his outstanding contribution to the development of High Availability Network Protocols.

He fostered collaboration with IEEE, in particular with IEEE 1473 and IEEE 1588 contributing to the transposition of the IEC Standards into IEEE publications.

In addition, Mr Kirrmann has been a long-standing delegate and head of delegation for the Swiss NC in TC 65 Plenary meetings, and still attended the last (remote) plenary in 2020. He regrettably passed away in 2021.

Conclusion

Since 1999, more than 100 000 of TCN implementations were installed on trains around the world.

The European Community issued regulations which ask the implementation of TCN as a mandatory requirement for interoperability.

TCN has demonstrated to be a story of innovation and success.

Energy Measurement System

At the beginning of the century, the railway sector started to consider that there were two different aspects relating to the measurement of energy on board trains:

- Invoicing
- Energy savings and energy efficiency

These two aspects are closely linked in consideration of the fact that there is no incentive for energy efficiency and energy savings if billing is done with an indirect method based on the average theoretical consumption per ton/km.

This aspect could no longer be overlooked when European directives established the free energy market and the liberalization of access to the railway infrastructure on a non-discriminatory basis. To complete this, the commitment for the states belonging to the EU to reduce CO_2 emissions must then be considered.

Furthermore, sustainability became a hot topic giving birth in 2012, to the UN Sustainable Development Goals.

In 2007, these considerations pushed ERA to include the basic requirements and essential parameters of the On-Board Energy Measuring System (EMS) in the Technical Specification for Interoperability (TSI) of rolling stock and to request CENELEC to prepare a harmonized standard for the specification and verification of conformity of EMS.

As part of the merging strategy, TC 9 was informed and accepted the offer of transposing the European norm, which specifies the EMS, into an international standard.

At the time of the launch of the standardization activity, the state of the art of on-board train energy measurement was represented by the following aspects:

- There were no installations in Europe of energy meters on board trains, with the exception of Deutsche Bahn trains which in any case used meters comparable to those of the industrial and residential type
- No installations in the rest of the world
- No conceptual metering model applicable to the “train” case or similar cases characterized by:
  - a mobile “point of consumption”, able to cross energy borders thus changing the supplier
  - using voltages greater than 1 000 Volts
  - requiring a measurement related to the position and over time in order to manage data reconciliation

The stakeholders involved were all the railway players:

- Railway infrastructure management companies
- Railway operators
- Energy producers and suppliers

- Rolling stock manufacturers and EMS industries
- Trade associations, e.g. UIC, ERESS

So, the railway community joined its own efforts in order to develop a complete solution for energy measurement which resulted in the following:

- Standardization documents at European and international level, respectively the EN 50463 series and the equivalent IEC 62888 series, which specify the energy measuring system
- Regulatory documents issued by the European Commission (the on-ground part of the system, for data collection and billing, was specified in the TSI Energy with references to EN 50463 parts 3 and 4)
- Operational documents, which describe the business model for the application of energy measurement to railways, prepared by UIC

Candidates to success stories

The following examples refer to ongoing standardization activities which TC 9 started aiming to produce standards in parallel with research activities, so as to offer railway standards users the latest state-of-the-art documents on rapidly evolving technologies.

Cyber security

The standardization of cyber security provisions tailored for the railway sector was started in 2020 at CENELEC TC 9X in relation to the so-called merging strategy with TC 9.

In 2022, after publishing the first draft of the document CLC/TS 50701: *Railway Applications – Cybersecurity*, CENELEC TC 9X offered the document to TC 9 PT 63452.

TC 9 PT 63452 is working on a standard which aims to include the horizontal cyber security aspects published in TC 65 standards and the European Union Cyber Security Resilience Act.

This is a big challenge as it aims to be on the one hand innovative and on the other hand coordinated with all the European and international entities which are involved in the process of producing cyber security standards for the railway field, as shown in Figure 16.

The scheme is split into two parts separated by a vertical dash line.

The entities (project teams and working group) which are involved in cyber security standardization for the railway sector are reported on the left part of the scheme.

The right part of the scheme shows the entities which are involved into the preparation of horizontal standards to be applied to many sectors like, for example, industrial automation, building automation, power plants, railway and switchgears.

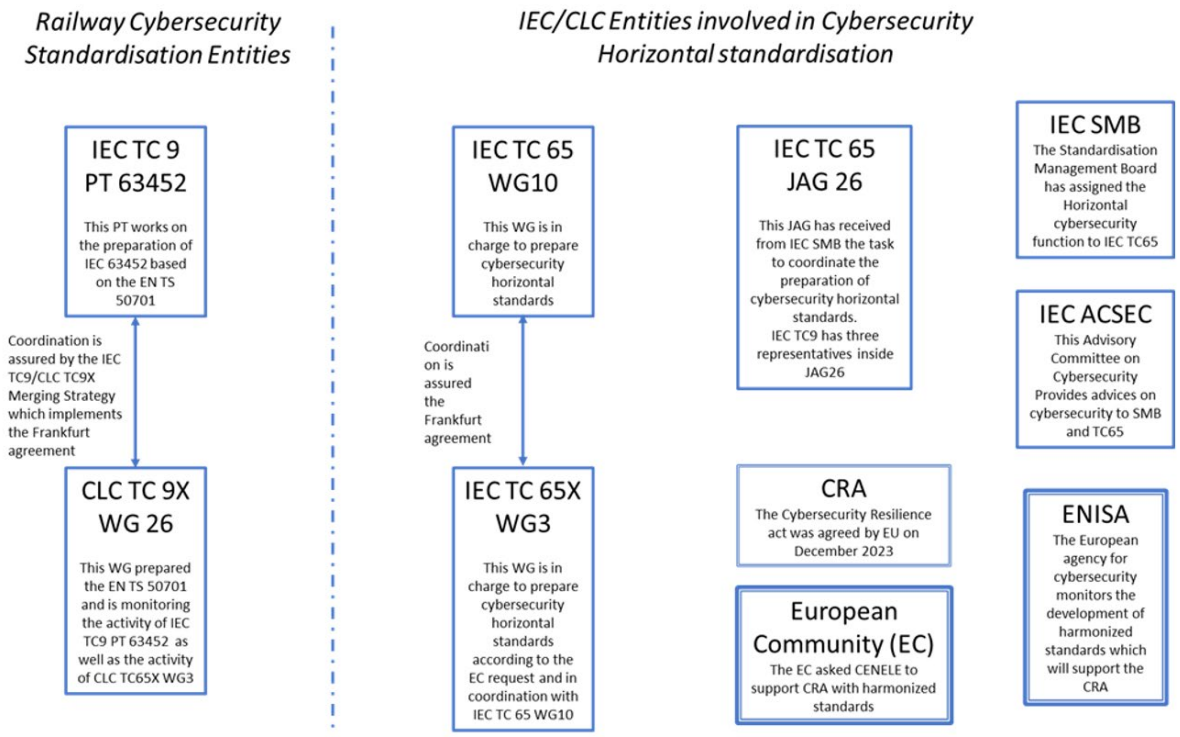


Figure 16 – Entities involved in railway cyber security standardization

Fuel cells

According to its own business plan and the relevant policy for introducing energy efficiency aspects in standardization, TC 9 developed the following international standards for subsystems which can apply new traction technologies to achieve increasingly sustainable solutions:

- IEC 62864-1:2016, *Railway applications – Rolling stock – Power supply with onboard energy storage system – Part: 1 Series hybrid system*
- IEC 61287, *Railway applications – Power converters installed on board rolling stock – Part 1: Characteristics and test methods*
- IEC 60349, *Electric traction – Rotating electrical machines for rail and road vehicles*
- IEC 62928, *Railway applications – Rolling stock – Onboard lithium-ion traction batteries*

To meet sustainable propulsion targets, TC 9 investigated possible cooperation with TC 105, the IEC Technical Committee which deals with fuel cell technologies.

The result of the investigation was the following standardization programme started in 2022 and summarized in Figure 17.

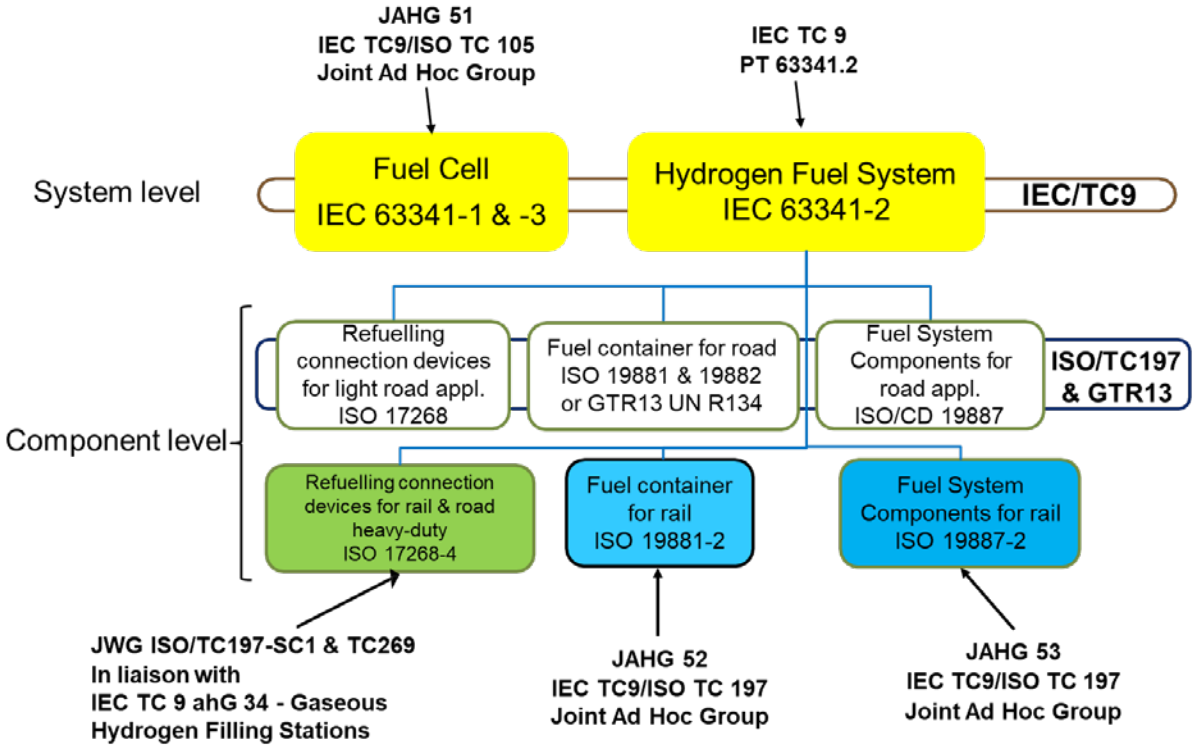


Figure 17 – TC 9 framework of the fuel cells standardization programme

- JAHG 51: Fuel cell systems for railway applications linked to TC 105
  Scope: To develop a series of standards on fuel cell systems for railway, with reference number 63341-X

- PT 63341-2: Railway applications – Rolling stock – Fuel cell systems for propulsion – Part 2: Hydrogen storage system
  Scope: To develop IEC 63341-2, *Railway applications – Rolling stock – Fuel cell systems for propulsion – Part 2: Hydrogen storage system*

- ahG 34: Gaseous Hydrogen Filling Stations
  Scope: Definition of the scope of a future standard on hydrogen fueling stations, taking into account the liaison with ISO/TC 269

- JAHG 52 – IEC TC 9 / ISO/TC 197 Joint ad hoc Group: Fuel container for rail, linked to ISO/TC 197/SC 1 under the administrative responsibility of TC 9
  Scope: Elaborate a roadmap for standards for hydrogen containers

- JAHG 53 – IEC TC 9 / ISO/TC 197 Joint ad hoc Group: Fuel system components for rail, linked to ISO/TC 197/SC 1 under the administrative responsibility of TC9
  Scope: Elaborate a roadmap for standards for hydrogen components for rail

Dynamic wireless power transfer

Aiming to innovate, TC 9 investigated, on proposal of the Korean NC, a new emerging technology that can be an alternative to the conventional way of feeding energy to rolling stock, e.g. the contact line.

The investigated technology is called dynamic wireless power transfer (DWPT).

Nowadays, it is very common to power your own smartphone using a wireless power supply.

A completely different issue is to transfer one megawatt of electric energy from fixed installations to a running locomotive.

Figure 18 shows a real implementation in South Korea.

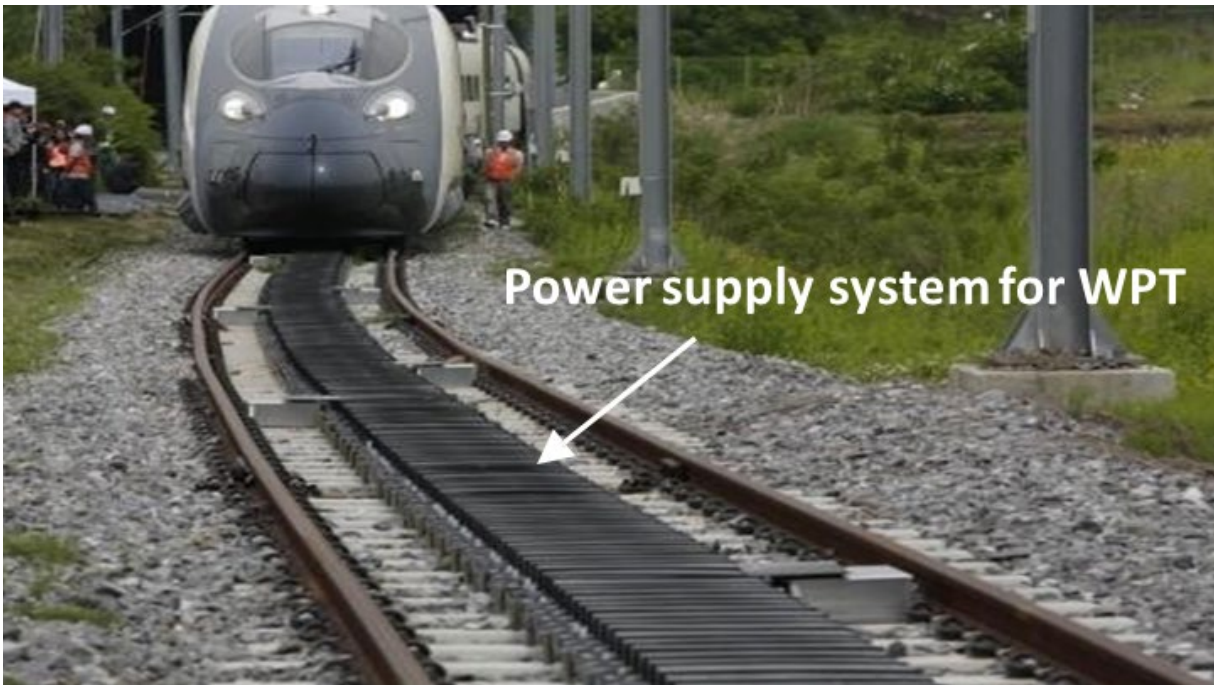


Figure 18 – 1 MW DWPT for next generation HS train

Understanding that the issue is very challenging and following the presentation of Professor Yoon from the Korean NC, TC 9 decided to set up an ad hoc group during the Plenary meeting which was held in 2020 online because of the pandemic.

Following the circulation of a questionnaire, the creation of TC 9 ahG 29: Interoperability and safety of dynamic wireless power transfer (WPT) for railways, was approved and the convenorship was assigned to Prof. U. Yoon (KR).

The assigned tasks of ahG 29 were:

- to provide answers to the results of the questionnaire 9/2624/DC
- to assess the exposure to the human body and equipment to electromagnetic fields
- to review the economics study
- to assess the level of recovery of energy

TC 9 ahG 29 worked for two years and produced an exhaustive report on the DWPT technology and its readiness for exploitation. Consequently, during the Plenary meeting in Milan, Italy, in 2022, TC 9 decided to launch the vote on the new proposal (NP) for an IS on "Interoperability and safety of dynamic wireless power transfer (WPT) for railways". If the NP was approved, TC 9 would decide to disband ahG 29.

The NP was approved by unanimity of all the National Committees replying.

The PT 63495 was set up in spring 2023 and started to work on the preparation of IEC 63495, *Interoperability and safety of dynamic wireless power transfer (WPT) for railway*s, under the convenorship of Prof. Yoon, which is expected to be published in 2026.

Cooperations and liaisons

Internal cooperation

Over years, TC 9 established many liaisons with other IEC committees as reported in the following list:

- TC 8: System aspects of electrical energy supply
- TC 20: Electric cables
- TC 21: Secondary cells and batteries
- SC 21A: Secondary cells and batteries containing alkaline or other non-acid electrolytes
- TC 36: Insulators
- TC 37: Surge arresters
- TC 40: Capacitors and resistors for electronic equipment
- SC 48B: Electrical connectors
- TC 56: Dependability
- TC 65: Industrial-process measurement, control and automation
- TC 69: Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks
- TC 79: Alarm and electronic security systems
- TC 99: Insulation co-ordination and system engineering of high voltage electrical power installations above 1,0 kV AC and 1,5 kV DC
- TC 100: Audio, video and multimedia systems and equipment
- TC 103: Transmitting and receiving equipment for radiocommunication
- TC 105: Fuel cell technologies
- TC 106: Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure
- TC 109: Insulation co-ordination for low-voltage equipment
- PC 128: Operation of electrical installations
- PC 131: Rotating electrical machines for the traction of road vehicles
- CIS/B: Interference relating to industrial, scientific and medical radio-frequency apparatus, to other (heavy) industrial equipment, to overhead power lines, to high voltage equipment and to electric traction

- SyC SET: Sustainable Electrified Transportation
- SyC SE: Smart Energy

Cooperation with ISO/TC 269

Foundation of TC 269, the ISO Technical Committee on railways

ISO/TC 269 (Railway applications) was created in 2012 with the following scope:

Standardization of all systems, products and services specifically related to the railway sector, including design, manufacture, construction, operation and maintenance of parts and equipment, methods and technology, interfaces between infrastructure, vehicles and the environment, excluding those electrotechnical and electronic products and services for railways which are within the scope of TC 9.

Currently ISO/TC 269 counts for the following figures:

- 32 published ISO standards (including updates) of which 2 under the direct responsibility of ISO/TC 269
- 28 ISO standards under development (including updates) of which 4 under the direct responsibility of ISO/TC 269
- 26 participating National Committee members
- 13 observing National Committee members

ISO/TC 269 Officers

- Chair (until end 2026): Hiroshi Tanaka (JP)
- Secretariat: DIN (DE)
- Committee Manager: Elena Kamps (DE)
- ISO Technical Programme Manager [TPM]: Monja Korter
- ISO Editorial Manager [EM]: Sanjali Jain

Under ISO/TC 269, there are 3 Subcommittees, all created in 2016.

ISO/TC 269/SC 1 – Infrastructure

- Officers:
  - Chair (until end 2024): Francisco Parente (PT)
  - Secretariat: AFNOR (FR)
  - Committee Manager: Jijun Wang (CN)
  - ISO Technical Programme Manager [TPM]: Monja Korter
  - ISO Editorial Manager [EM]: Sanjali Jain
- Scope: Standardization in the field of railway infrastructure, including areas such as railway tracks, platforms, stations and shunting yards, as well as railway specific needs for tunnels, bridges and other civil works. It also addresses design, construction and installation requirements, testing and conformity assessment of ground equipment as well as maintenance criteria for the entire life cycle of all the parts of the infrastructure.
- Number of standards:
  - published: 15
  - under development: 7

ISO/TC 269/SC 2 – Rolling stock

- Officers:
  - Chair (until end 2028): Baoshi Huo (CN)
  - Secretariat: AFNOR (FR)
  - Committee Manager: Gilles Chopard-Guillaumot (FR)
  - ISO Technical Programme Manager [TPM]: Monja Korter
  - ISO Editorial Manager [EM]: Sanjali Jain
- Scope: Standardization in the field of railway rolling stock products, equipment and systems, including areas such as locomotives, passenger cars, freight wagons, on track machines, multiple units, underground and light rail vehicles. It also addresses design, construction and installation requirements, testing and conformity assessment of ground equipment as well as maintenance criteria for the entire life cycle of all the parts of the infrastructure.
- Number of standards:
  - published: 12
  - under development: 13

ISO/TC 269/SC 3 – Operations and Services

- Officers:
  - Chair (until end 2027): Andrea Nicola Ancona (IT)
  - Secretariat: JISC (JP)

  - Committee Manager: Kiyotaka Seki (JP)
  - ISO Technical Programme Manager [TPM]: Monja Korter
  - ISO Editorial Manager [EM]: Sanjali Jain
- Scope: Standardization of requirements and guidance relating to operations and services in the railway system and related equipment, which are required in and between railway stakeholders as well as at the technical interfaces between railway operators and railway users such as passengers and shippers in order to realize safe, reliable, convenient and sustainable railway transport
- Number of standards:
  - published: 3
  - under development: 4

The split of standardization work and coordination

As reported in the scope of ISO/TC 269, all electrotechnical and electronic products and services for railways which are within the scope of TC 9 are excluded.

However, today, many standardization areas may interest both committees, e.g. protection of the environment, artificial intelligence, fuel cells, heating ventilation and air conditioning, etc.

In order to improve the cooperation and avoid double work, TC 9 and ISO/TC 269 meet twice a year at least.

One of the two annual meetings is extended to UIC which participates with the aim of coordinating its own work with the work of TC 9 and ISO/TC 269.

TC 9 and ISO/TC 269 have set up three liaisons in order to actively cooperate:

- Liaison between TC 9 and ISO/TC 269
- Liaison between TC 9 and ISO/TC 269/SC 2
- Liaison between TC 9 and ISO/TC 269/SC 3

Cooperation with CENELEC TC 9X

Foundation of CENELEC TC 9X, the European Technical Committee on railway

Task

CENELEC TC 9X and its Subcommittees are in charge:

- to prepare a single set of electrotechnical standards in the field of railway applications for Europe to achieve a free market for goods and services inside Europe
- to mirror TC 9 following the 1990 agreement between the IEC and CENELEC (replaced in 2016 by the Frankfurt Agreement)

CENELEC TC 9X scope

Standardization of electrical and electronic systems, equipment and associated software for use in all railway applications, whether on vehicles or fixed installations, including urban transport. This includes communication, information, supervision and control systems.

History

CENELEC TC 9X was set up in 1989 by CENELEC as a new committee, with the specific task to prepare European standards in support of the EU Directive 93/38/CEE dealing with the opening of the European market in the excluded sectors (water, railways...). After a preliminary survey during 1988, sent to all the interested parties (railway operators, industry, standardization bodies) both CEN and CENELEC decided to create two railway specific standardization bodies, one within CEN mainly dealing with mechanical contents, and one within CENELEC dealing with the electrical and electronic systems and components.

The first official CENELEC TC 9X meeting took place in May 1990, with an agreement reached on the title and scope of the committee “Electric and Electronic applications for Railways” aims to investigate the first TC 9X work programme and requirements for standards. Four survey groups were set up, dealing with the different disciplines, i.e. signalling, rolling stock, fixed installations, and common items like fire protection, RAMS, and systems.

These survey groups were mandated with identifying the different European standards to be produced, and whenever possible, the existing documents to be considered as starting points (for instance existing IEC Standards, UIC leaflets, national standards). Some months later, these survey

groups became the Subcommittees that exist today; common disciplines were incorporated within the main committee.

The 2nd TC 9X Plenary meeting in December 1990 in Brussels, Belgium, resolved the setting up of the committee organization, with a plenary committee TC 9X and three Subcommittees SC 9XA, SC 9XB and SC 9XC. The first working groups of the main committee and of the Subcommittees were agreed and decided. The structure today and tasks/scopes of TC 9X and its Subcommittees fully reflect the original structure. New working groups in accordance with the specific needs were of course decided and set up in the following years. Once the Interoperability Directives (96/48/CE, etc...) had come into force, TC 9X was also mandated in the following years to set up the European standards needed for supporting the TSI, the Technical Specifications for Interoperability.

Current situation

Currently, TC 9X has the task to prepare standards for the railway and urban guided transport fields which include rolling stock, fixed installations, management systems (including communication, signalling and processing systems) for railway and mass transit operations, their interfaces, their sustainability and cyber security. These standards therefore cover the fields of railway networks, metropolitan transport networks (including metros, tramways, trolleybuses and fully automated transport systems) and magnetic levitated transport systems. They relate to various parts such as systems, subsystems, software and hardware components and they deal with electrical, electronic and mechanical aspects, the latter being limited to items depending on electrical factors. TC 9X tasks take into account the needs expressed by the European Railway Agency (EUAR), the European Commission (EC) and the users (e.g. UNIFE, UITP, EIM and CER). TC 9X works in close liaison with TC 9. A major feature of the railway industry is its specificity: even if some topics are similar to those covered in other industrial fields, the requirements have to take into account the overall constraints of the railway system. TC 9X working groups are dealing with subjects that are related to the whole railway system or to interfaces between sub-systems, as its three Subcommittees are considering subjects that are related to a single subsystem such as signalling, rolling stock and fixed installations for energy supply. The three TC 9X SCs cover different fields of expertise addressing different stakeholders and having pretty much no overlap amongst them, as it will be better described below. Whenever new standards to be developed have to deal with cross-SCs areas of competences, then dedicated WG are directly managed by TC 9X and not allocated to a particular SC. SC 9XA field of activities is communication, signalling and processing systems, taking into account the relevant safety requirements. SC 9XB field of activities is electrical, electronic and electromechanical material on board rolling stock, including associated software. SC 9XC field of activities is electric AC and DC supply lines, both overhead and as part of a third rail, and earthing systems for public transport equipment and ancillary apparatus,

machinery and equipment of special feature for traction, installations and safety requirements in fixed installations. As the railway system is a fully integrated system, its subsystems cannot be considered separately. This is the reason why the business plans of TC 9X Subcommittees are presented together with the TC 9 business plan. Whenever new standards are needed whose topics are too generic and not falling under one single SC's assignments, the working group in charge of preparing the standard is directly managed by TC 9X and not allocated in one single specific SC. An example is the WG 21 in charge of safety standards, whose scope of work is across the three SCs and whose Convenor reports directly to TC 9X.

TC 9X currently counts on the cooperation of almost 1 350 experts.

The Frankfurt Agreement

The IEC and CENELEC signed an agreement on "Common planning of new work and parallel voting", better known as the "Frankfurt Agreement" (the first agreement was signed in 1991, known as the "Lugano Agreement", then replaced by the "Dresden Agreement" in 1996 until it was revised as the "Frankfurt Agreement" in 2016).

The Frankfurt Agreement concerns the adoption of international standards as European standards. Other deliverables, i.e. technical specifications and technical reports are not part of the agreement (see item [5] in Bibliography).

CENELEC published Guide 13 to help in the implementation of the Frankfurt Agreement (see item [6] in Bibliograph).

The aim of this agreement is to promote the exchange of information, to increase transparency and to avoid duplication of work.

The work is mainly developed by the IEC and adopted through parallel procedures at CENELEC level. In some cases, work is initiated by CENELEC and offered to the IEC, either as a European Work Item (EWI) or as a published European standard.

The main objective of the Frankfurt Agreement is to ensure that we make the best use of the resources available for standardization. It helps the IEC and CENELEC in exchanging information and increasing the transparency of IEC work to CENELEC members, as well as helping to avoid duplication, i.e. at the regional (European) and international level.

The Agreement underlines the fact that (as stipulated in the WTO Code of Conduct) international standardization has primacy over regional and national standardization. This is because international standards are designed to support the harmonization of national standards, and national or regional technical regulations, reducing non-tariff technical barriers to trade. Where an international standard is adopted as a European standard, there is an obligation of the CENELEC members to implement it as a national standard and withdraw any conflicting standards.

However, the Agreement also recognizes that European stakeholders may have particular needs that cannot be accommodated at an international level, e.g. in supporting the Single European Market.

The Frankfurt Agreement consists of three main pillars of cooperation between the IEC and CENELEC:

- Offering CENELEC new work items for European standards to the IEC
- Parallel vote on draft international standards
- Offering European standards to the IEC for possible conversion into international standards

NOTE: This also applies to harmonization documents (HD).

Principles

TC 9 and CENELEC TC 9X agree upon the following:

1. One shall keep a single set of standards for the IEC and CENELEC on railway applications whenever possible
2. No duplication of work shall be done
3. The Dresden agreement shall be met, i.e. the adoption of parallel voting on IEC originated documents, as extensively as possible
4. CLC/BT Decision D119/107 shall be met, i.e. no proceeding shall be started by CENELEC on IEC Standards known as “boomerang cases” (this decision covers all IEC Standards originating from CLC/TC 9X home-grown standards that were offered to TC 9 and processed through the “TC 9 specific fast track procedure” (as approved by the IEC SMB – see SMB/3978A/RV) and subsequently coming back for consideration at CLC level)
5. To take into account the European specific issues in the merging process (Directives, TSIs, etc.)
6. To endeavour to limit in the future the existing technical discrepancies between CENELEC and IEC Standards
7. Whilst respecting the above mentioned CLC/BT Decision 119/107 on boomerang cases, and with the aim of improving item 6 above, CLC/TC 9X will endeavour, when IEC Standards originating from CLC would offer significant added value in comparison with the original CLC standard, to apply the following provisions on a case-by-case basis (this decision is left to CLC/TC 9X only)

To start the proceedings for the endorsement of those IEC 60xyz publications however ensuring that:

- the original EN 50abc numbering is kept
- the CENELEC references are restored
- the European specific issues, if any, are reintroduced
- the so-called Annex ZZ (related to the covering of essential requirements of the concerned European Directives), whenever applicable, is introduced.

This will be ensured through common modifications or relevant CLC/BT decisions.

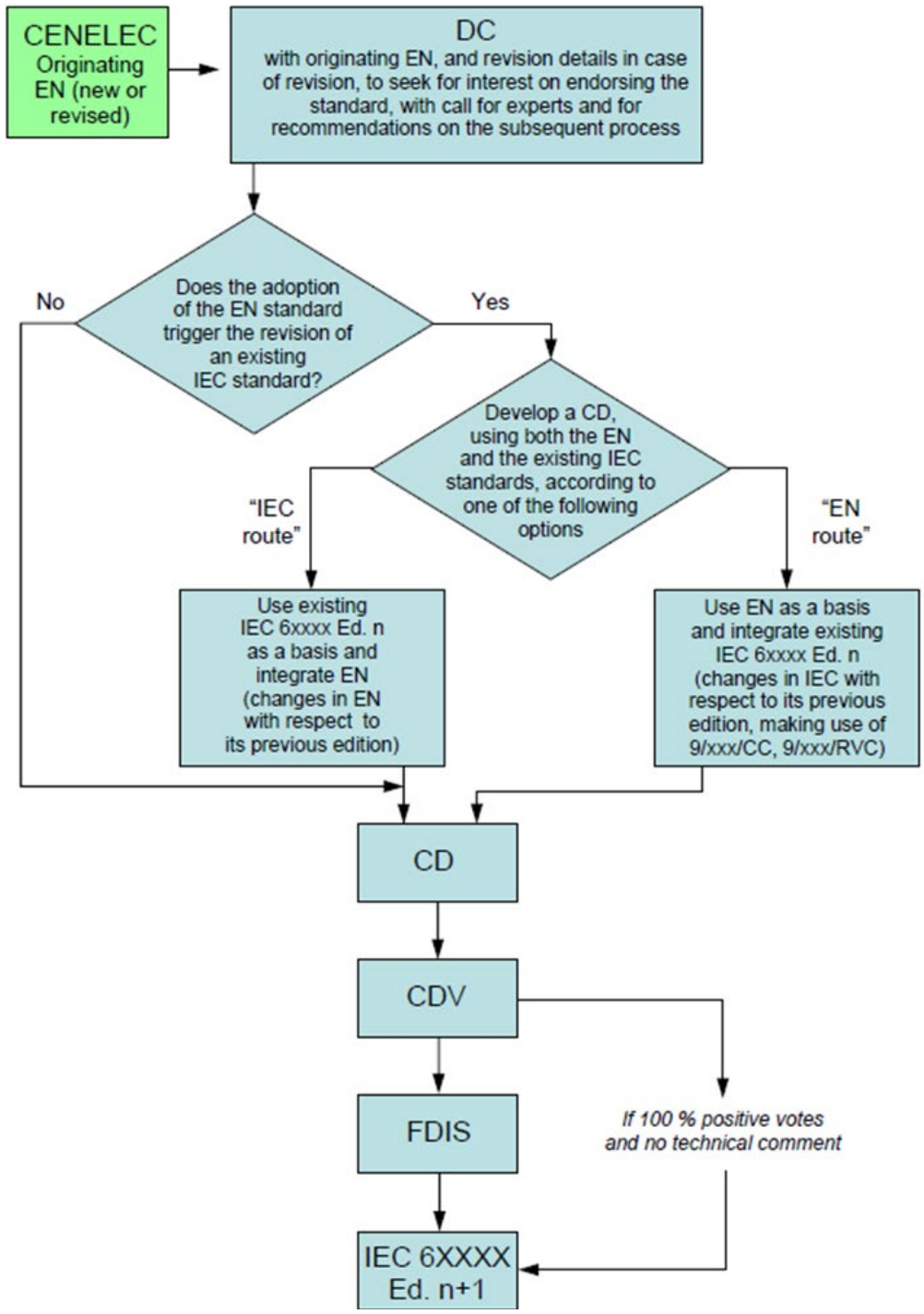
The aim will be to publish a revised edition of EN 50abc that is technically equivalent to IEC 60xyz.

CENELEC will facilitate endorsement by the IEC of the standards originating from CENELEC TC 9X and its Subcommittees by adopting the TC 9 specific fast track procedure as preferred route when required by TC 9.

Standards set up by CLC/TC9X and offered to TC 9 through the TC 9 specific fast track procedure shall be exempted from parallel procedures.

As far as the future revisions of the CLC home-grown standards offered to the IEC through the TC 9 specific fast track procedure are concerned, these revisions will be produced at CLC level and then offered to IEC through the TC9 specific fast track procedure as it was the case for the original standards.

The TC 9 specific fast track procedure, as approved by the SMB is illustrated by the following diagramme:


CENELEC
Originating EN (new or revised)
DC
with originating EN, and revision details in case of revision, to seek for interest on endorsing the standard, with call for experts and for recommendations on the subsequent process
Does the adoption of the EN standard trigger the revision of an existing IEC standard?
No
Yes
Develop a CD, using both the EN and the existing IEC standards, according to one of the following options
"IEC route"
"EN route"
Use existing IEC 6xxxx Ed. n as a basis and integrate EN (changes in EN with respect to its previous edition)
Use EN as a basis and integrate existing IEC 6xxxx Ed. n (changes in IEC with respect to its previous edition, making use of 9/xxx/CC, 9/xxx/RVC)
CD
CDV
FDIS
If 100 % positive votes and no technical comment
IEC 6XXXX Ed. n+1

The DC and CD stages shall be separated in all cases, EN being the first or a revised edition. The DC will be circulated together with the questionnaire on endorsement, and the CD will be circulated later after processing by the PT or MT.

In order to avoid a loss of information in the case of the IEC endorsing a revised edition of a CLC-originated standard, which itself will trigger the revision of an existing IEC Standard, the existing IEC Standard and the EN standard should be merged into one single document at IEC level, one standard being used as the basis and changes from the other one being integrated.

In this case, there will be no need for IEC NCs (normally non-European countries) to resubmit technical comments on topics which were already submitted in the development of the previous edition of the IEC Standard.

The first task of the MT is to choose the right option ("IEC route" versus "EN route" in the diagramme) when developing the CD in view of minimizing the associated effort. When submitting comments on the DC, IEC NCs are invited to express their views on the subsequent merging process.

When the IEC publication is used as a basis and EN changes are integrated ("IEC route"), it is assumed that the foreword of the new EN edition contains a list of all changes with respect to its previous edition, or at least that the detail of all changes is submitted together with the EN.

When the EN publication is used as the basis and IEC changes are integrated ("EN route"), all comments received on previous CDs and CDVs, as well as new comments received on the DC, need to be considered by the MT.

Merging strategy

In order to implement the Frankfurt Agreement in a strategic way and to promote the adoption of European standards at international level, CENELEC and the IEC agreed upon a merging strategy between CENELEC TC 9X and TC 9.

This merging strategy is organized as a document covering the general principles, referred to as 9/1831/DC and approved without comments in 9/1859/INF, and an implementation document (the most recent being 9/2486/INF). These documents are regularly updated by the Officers of TC 9 and CENELEC TC 9X.

In general, TRs and TSs are not offered on a regular basis due respectively to their lower importance and to their short life cycle. When a decision is taken to not offer an EN, the justifications are included in the implementation document. These documents are regularly updated by the Officers of CENELEC TC 9X and of TC 9.

The implementation of the merging strategy

The implementation of the merging strategy is carried out by using two tables in a Word document.

The first table includes the full list of TC 9 origin IS, TS and TR Standards that have been adopted by CENELEC as EN either via parallel voting (maintaining the same numbering but replacing IS with EN) or directly (adding EN before the IS followed by the numbering). This table records as well the instances in which, in order to adopt TC 9 Standards, CENELEC TC 9X has to withdraw its own standards in order to remove inconsistencies between the two.

An example of this first table is shown hereafter:

Part 1: Documents of IEC origin

IEC reference	CLC reference	Title	IEC situation	CLC situation	Merging strategy
60077-1 Ed.2	EN 60077-1:2017	Railway applications – Electric equipment for rolling stock – Part 1: General service conditions and general rules	Published (1999) Published (2017)	Published (2002) following // vote Published (2017) following // vote	Done Done
60077-2 Ed.2	EN 60077-2:2017	Railway applications – Electric equipment for rolling stock – Part 2: Electrotechnical components - General requirements	Published (1999) Published (2017)	Published (2002) following // vote Published (2017) following // vote	Done Done
60077-3 Ed.2	EN 60077-3:2019	Railway applications – Electric equipment for rolling stock – Part 3: d.c. circuit breakers	Published (2019)	Published (2019) following // vote	Done
60077-4 Ed.2	EN 60077-4:2019	Railway applications – Electric equipment for rolling stock – Part 4: a.c. circuit breakers	Published (2019)	Published (2019) following // vote	Done
60077-5 Ed.2	EN 60077-5:2019	Railway applications – Electric equipment for rolling stock – Part 5: HV fuses	Published (2019)	Published (2019) following // vote	Done
60310 Ed.4	EN 60310:2016	Railway applications – Rolling stock – Traction transformers and inductors	Published (2004) Published (2016) Corrigendum published (2018)	Published (2004) Published (2016)	Done

The second table includes the full list of EN, TS and TR standards that CENELEC TC 9X has offered to TC 9. The IS numbering follows IEC process regardless of the CENELEC EN numbering.

An example of this second table is shown hereafter:

Part 2: Documents of CENELEC origin

2.1: Works processed in TC9X

CLC reference	IEC reference	Title	CLC situation	IEC situation	Merging strategy
EN 50121:2017 series	62236 Ed.2 series	Railway applications – Electromagnetic compatibility	Published (2006). Published (2015) Published (2017) Amendments in progress	Published (2008) Published (2018)	Done Done Amendment not offered to IEC (amendment includes only Annex ZZ)
EN 50124-1:2017	62497-1 Ed.1.1	Railway applications – Insulation co-ordination – Part 1 : Basic requirements – Clearances and creepage distances for all electrical and electronic equipment	Published (2017)	Published (2010) A1 published (2013)	Done There is no need to offer the document to IEC as EN 50124-1:2017 considers changes made in IEC 62497-1. To wait for the revision of IEC/TC 109 : IEC 60664-1 and IEC/TS 62993
EN 50124-2:2017	62497-2 Ed.1	Railway applications – Insulation co-ordination – Part 2 : Overvoltages and related protections	Published (2017)	Published (2010)	Done There is no need to offer the document to IEC as EN 50124-2:2017 considers changes made in IEC 62497-2 To wait for the revision of IEC/TC 109 : IEC 60664-1 and IEC/TS 62993

UIC cooperation

A little bit of history

In 1929, during the 5th meeting, the Committee unanimously adopted the resolution that UIC, the International Union of Railways, and UIT, the International Union of Public Transportation, shall be invited to a conference with the President and General Secretary of the IEC and the representatives of IEC AC 9 in order to discuss how to cooperate. The result was the setting up of the International Mixed Committee on Electrical Traction Equipment (CMT) in 1930.

During the 34th meeting of TC 9 in Frankfurt, Germany, following a proposal by IEC Secretariat, TC 9 took a resolution to disband the CMT because it had become, over the years, more and more administrative. UIC agreed with the proposal of dissolution of the CMT but asked the IEC to become one of its members.

Consequently, UIC and the IEC established a liaison and started to work together to develop the first implementation of the train communication network and consequently the relevant IEC Standards and UIC leaflets.

The story of this cooperation is reported in this book in the chapter “Success stories – The Train communication network (TCN)”.

Further details are given by the reporting on the 34th TC 9 meeting in the chapter “IEC Technical Committee 9: Electrical equipment and systems for railways”.

The roles issue

At the 51st TC 9 meeting in Fukuoka, Japan, a long discussion took place about the liaison with UIC and the need to update the IEC 61375 series, relevant to TCN, taking into account the new requirements for on-board communications and the need to use ethernet technology on-board of trains.

Unfortunately, UIC did not accept to cooperate in order to migrate the UIC leaflet developed for the WTB technology to the ethernet technology.

The following issues were considered:

- UIC did not grant permission to WG 43 to use UIC leaflets
- No agreement between UIC and the IEC
- No contribution was sent by UIC following the invitation to participate in TC 9’s 51st meeting

Following the discussion, TC 9 resolved to discontinue the liaison with UIC.

However, the talks between UIC and the IEC continued in order to find a way to continue a- cooperation that was so fruitful in the past.

The new deal

At the 55th meeting in Minsk, TC 9 Chair presented the result of the talks between TC 9 and UIC and the draft of a cooperation agreement between the two.

The foreseen way forward for the cooperation between UIC and TC 9 consisted in setting up a strategic liaison group (SLG) to analyze items proposed by the partners and to advise both partners. If common items were selected, subgroups of the SLG could be created to elaborate internal informative documents. Then each partner could create his own documents using informative documents elaborated by a SLG-SG. No formal documents are to be shared and have a double logo.

Cooperation agreement and the strategic liaison group

Following the presentation by Mr Cavaliere, TC 9 resolved to request its Secretary and IEC Secretariat to set up the SLG in the IEC Expert Management System and in the IEC Collaboration Tool and then to register de facto TC 9 CAG members as members of the SLG. The Convenor is the TC 9 Chair.

(For further details on this matter see the 55th meeting in Minsk, the 56th meeting in Vladivostok and the 62nd meeting in Milan which are reported in the chapter "IEC Technical Committee 9: Electrical equipment and systems for railways")

Cooperation with EUAR, the European Union Agency for Railways

In the context of the European Green Deal, rail has the potential to become the backbone of the European multimodal transport and mobility system.

EUAR, formerly ERA, as a European Union (EU) agency, is governed by EU public law but operates independently from the EU institutions (Council, Parliament, Commission, etc.) and has its own legal personality. The European Commission is, however, a crucial institutional stakeholder for ERA and a partner in the implementation of its mandate.

In 2016, ERA changed its acronym and name respectively to EUAR and European Union Agency for Railways following the new Regulation (EU) 2016/796. It closely cooperates with national safety authorities, national investigation bodies and representative bodies inside networks and workgroups.

Representative bodies include organizations and associations that represent the railway sector, rail workers, freight customers and passengers.

ERA engages in cooperation activities with the following organizations:

- European Standardisation Organisations (ESOs)
- Coordination group of notified bodies (NB-Rail)
- Organisation for Co-operation between Railways (OSJD)
- Intergovernmental Organisation for International Carriage by Rail (OTIF)
- United Nations Economic Commission for Europe (UNECE)
- Peer regulatory agencies

ERA also takes an active role in the EUMedRail project, set up by the European Commission, by providing technical assistance in railways, with a view on further developing an integrated, safe and efficient transport system in the South Mediterranean region.

The Agency works closely with the European Commission to foster the improvement of the interoperability and the safety of national networks.

Over the last 26 years, the Commission has been very active in restructuring the European rail transport market and strengthening the position of railways vis-à-vis other transport modes.

Commission efforts have concentrated on three major areas which are all crucial for developing a strong and competitive rail transport industry:

- Opening of the rail transport market to competition
- Improving the interoperability and safety of national networks
- Developing a rail transport infrastructure

EUAR Vision

EUAR wants to show that rail is part of a more global transport system. The Vision is that rail will be fully incorporated in our transport and mobility patterns due to its high environmental performance: high energy efficiency and low externalities, hence the word “sustainable”, and keeping a high level of safety performance, hence the word “safe”.

Moving from a patchwork to a network also requires to focus on the “without frontiers” as EUAR is contributing to establish a European network of transport taking advantage of all the inherent qualities of the different modes of transport.

EUAR Mission Statement

The EUAR Mission Statement is more railway focused. However, EUAR applies the same principles in the Mission Statement as to the Vision using the key terms of sustainability and safety. Interoperability is not forgotten as the terms “without frontiers” emphasizes the key role of interoperability to reach the objective of a Single European railway area (SERA).

Finally, the terms “moving Europe” indicates that the Agency is driving the work to make sure that the railway system remains a very safe mode of transport and breaks the barriers to build a truly European

network resulting in an increase of the rail modal share in the global transport and mobility system. Reaching these goals will help our society achieve a carbon neutral transport system by mid-century.

EUAR values

- Stakeholder focus
- Ethical values commitment
- Legal compliance
- Staff involvement and development
- Everybody's commitment to quality
- Continuous improvement
- Business continuity
- Information governance
- A culture of sustainability

EUAR tasks

- Promote a harmonized approach to railway safety
- Devise the technical and legal framework in order to enable the removal of technical barriers, and acting as the system authority for ERTMS and telematics applications
- Improve accessibility and use of railway system information
- Act as the European Authority under the 4th Railway Package issuing vehicle (type) authorizations and single safety certificates, while improving the competitive position of the railway sector

TC 9 and EUAR Cooperation agreement

At its 61st Plenary meeting in October 2021, TC 9 took the following decision: "Decision 61/02 – Noting the recommendation 33/06 from the CAG, TC 9 decides to apply for a Type B liaison with the European Union Agency for Railways (EUAR) and tasks the TC 9 secretary to provide to IEC SEC technical officer the copies of the liaison form completed by EUAR."

The need to establish a liaison with EUAR was felt, shared, and the request approved unanimously by all the NC's participating in the meeting.

It was considered that establishing this liaison type B would have the following benefits for both parties:

- Promote communication and regular exchange of information between TC 9 and EUAR on topics of mutual interest
- Contribute with expertise or provide information within the framework of events organized by TC 9 or EUAR
- Promote the use of international standards as a co-regulation tool in support of European legislation in the railway transport domain
- Raise awareness of the role and activities of EUAR and of the European regulatory framework, TSIs in particular, in the railway transport domain and inform about its evolution
- Follow the evolution of relevant standardization work, avoid duplication
- Exchange of expertise and knowledge on topics of mutual interest via the participation in relevant TC 9 meetings
- Support the Commission's policy aiming at aligning European standards as much as possible with international standards (Reg 1025)
- Promote the use of relevant international standards when devising technical regulations or conformity assessment procedures (WTO TBT 2.4)
- Simplify existing European Regulations, taking into consideration overlaps with international standards

According to ISO/IEC Directives, Part 1, Clause 1.17, liaison type B can be set up with organizations that have indicated a wish to be kept informed of the work of the Technical Committee or Subcommittee. Such organizations are given access to reports on the work of such Technical Committee or Subcommittee. Category B is reserved for inter-governmental organizations.

During TC 9's 63rd Plenary meeting held via web in October 2023, TC 9 with Decision 63/35 finally approved the EUAR request to establish the liaison: "Noting the request received from the European Union Agency for Railways (ERA) for a liaison type 'B', its justification and the compliance with the eligibility criteria, TC 9 decides to approve the liaison with EUAR. The liaison incoming representatives are Mr Andreas Schirmer and Mr Valery Genin."

Annexes

List of AC 9 and TC 9 Chairs

Table 5 lists all the people who have been AC 9 and TC 9 Chairs from the foundation up to the Centenary Anniversary.

It is worth mentioning that from the foundation up to 1929, AC 9 Chairs were nominated at each meeting.

The Chair of the first meeting, Guido Semenza, was also President of the IEC from 1923 to 1927. During this period, he presided over the New York and Bellagio General Meetings of the Commission. In 1929, he was awarded the Faraday Medal of the Institution. In 1896, he had founded and presided the Italian Electrotechnical Association.

From 1930, with the appointment of Marco Semenza, brother of Guido Semenza, as Chair of AC 9, the Plenary meetings were presided by the Chair in office.

Marco Semenza was also the first Chair of TC 9.

Mr Bozzolo started his term as Mr Fadin's successor in 2022 during the TC 9 Plenary meeting in Milan, Italy. He is the current TC 9 Chair.

	Chair		Chair NC and duty terms		
	First name	Family name	NC	Term start	Term end
1	Guido	Semenza	IT	1924	1924
2	Emil	Huber-Stockar	C	1925	1925
3	E.	Roth	FR	1926	1926
4	J.	Peridier	FR	1927	1927
5	A. R	Everest	UK	1929	1929
6	Marco	Semenza	IT	1930	1956
7	Alfredo	D'Arbela	IT	1957	1963
8	Ernesto	Stagni	IT	1963	1976
9	Giulio	Giovanardi	IT	1976	1988
10	Franco	De Falco	IT	1988	1996
11	Maurizio	Cavagnaro	IT	1996	2002
12	Franco	Cavaliere	IT	2003	2015
13	Gianosvaldo	Fadin	IT	2016	2021
14	Daniele	Bozzolo	IT	2022	

Table 5 – List of AC 9 and TC 9 Chairs

Lists of AC 9 and TC 9 Secretaries

Table 6 lists all the persons who have been AC 9 and TC 9 Secretaries from the foundation up to the Centenary Anniversary.

In 1924, the first meeting was presided by Guido Semenza and no one was appointed for the secretariat function, as well as in 1925 for the second meeting which was presided by Mr Huber-Stockar from the Swiss NC and no one was appointed as Secretary.

The 3rd meeting, in 1927, was the first meeting where a Secretary was appointed: Marco Semenza from the Italian NC.

In 1927, shortly after the IEC General Meeting in Rome, the Secretariat of AC 9 had been entrusted to the French NC.

It is to be noted that Mr A. Cossié was not able to attend the Montreal Meeting in 1985 and he was replaced by Mr M. Ambrun.

Denis Miglianico started to serve TC 9 as Secretary in 2018 during the Plenary meeting held in Tokyo, Japan. He is currently the TC 9 Secretary.

	Secretary		Secretariat NC and duty terms		
	First name	Family name	NC	Term start	Term end
1	–	–	–	1924	1926
2	Marco	Semenza	IT	1927	1927
3	–	French Committee	FR	1929	1929
4	J.	Peridier	FR	1930	1937
5	H.	Parodi	FR	1938	1938
6	M.	Garreau	FR	1948	1973
7	R.	Boileau	FR	1974	1975
8	A.	Cossié	FR	1976	1987
9	J. P.	Kieken	FR	1988	1993
10	Pierre-H.	Desvignes	FR	1993	2007
11	Christian	Espitalier	FR	2008	2008
12	Bernard	Lerouge	FR	2009	2018
13	Denis	Miglianico	FR	2018	

Table 6 – List of AC 9 and TC 9 Secretaries

List of AC 9 and TC 9 Assistant Secretaries

Table 7 lists the Assistant Secretaries of AC 9 and TC 9 since the foundation.

No Assistant Secretaries were nominated until 1938.

During the last AC 9 Plenary meeting in Torquay, UK, Mr Royer was appointed as the first Assistant Secretary.

Mr G. Lacombe participated in all TC 9 Plenary meetings from 1950 until 1958 except the meeting in Philadelphia, USA, which was held in 1954.

The successor, Mr L. Loussert, served as TC 9 Assistant Secretary for “some twenty years” until the TC 9 Plenary meeting in 1978, in Florence, Italy, where he was joined by Mr M. Ambrun, his successor.

Claude Bicard was the successor of Mr M. Ambrun, serving as IEC Assistant Secretary from 1993 until 2003. During the TC 9 Plenary meeting in Quebec City, Canada, he served as Secretary and Mr Desvignes as Vice Chair, as Mr Cavagnaro, the Chair on duty, "was obliged to relinquish to attend the meeting due to unforeseen demands".

In 2018, at the TC 9 Plenary meeting in Tokyo, Japan, Ian Luca succeeded to Benjamin Subtil. Mr Luca is the current TC 9 Assistant Secretary.

	First name	Family name	NC	Term start	Term end
1	No Assistant Secretary nominated		–	1924	1938
2	J.	Royer	FR	1938	1949
3	G.	Lacombe	FR	1950	1958
4	L.	Loussert	FR	1959	1978
5	M.	Ambrun	FR	1978	1992
6	Claude	Bicard	FR	1993	2003
7	Thierry	Lainé	FR	2004	2012
8	Jean-Pierre	Gilbert	FR	2013	2014
9	Gabriel	Staniul	FR	2015	2015
10	Benjamin	Subtil	FR	2016	2017
11	Ioan	Luca	FR	2018	

Table 7 – List of AC 9 and TC 9 Assistant Secretaries

List of AC 9 and TC 9 meetings attended by IEC Central Office (now IEC Secretariat)

Table 8 lists the participation of the IEC Secretariat representative as it is reported by the "participation list" of the Plenary meeting minutes of AC 9 and TC 9.

	IEC Secretariat representative		Nationality and TC 9 Plenary date	
	First name	Family name	Nationality	Plenary meeting date
1	Guido R. E. C.	Semenza Crompton Le Maistre	Italy Great Britain France	1925
2	C. L.	Le Maistre Ruppert	France	1931
3	C.	Le Maistre	France	1933

	IEC Secretariat representative		Nationality and TC 9 Plenary date	
	First name	Family name	Nationality	Plenary meeting date
4	E. C	Uyborck Le Maistre	France	1948
5	C.	Le Maistre	France	1950
6	P. C. L.	Dunsheath Le Maistre Ruppert	France	1951
7	L.	Ruppert		1953 – 1957
8	P.	Bonnet		1974 – 1976 – 1978 – 1981
9	U. V.	Otrokhov		1985
10	G. P.	Erofitsky Strübin		1988
11	P.	Strübin		1991 – 1993
12	R. J.-P.	Cordelier Brotons Dias	France	1995
13	R.	Cordelier	France	1996
14	R. M.	Cordelier Cocimarov	France	1997
15	R.	Cordelier		1999 – 2000 – 2001 – 2004
16	Charles	Jacquemart	Swiss	2003 – 2005 – 2007 – 2008 – 2009 –2010 – 2011 – 2012 – 2013 – 2014 – 2015 – 2016 – 2017
17	Anson	Chiah	Singapore	2018 – 2019 – 2020 – 2021 – 2022 – 2023
18	Gennaro	Ruggiero	Italy	2024

Table 8 – List of AC 9 and TC 9 Plenary meetings attended by IEC Secretariat

List of P-members and O-members

Table 9 lists all the National Committees which are members of TC 9.

Out of 45 TC 9 members, 12 have the status of O-member, i.e. observing member, and 33 have the status of P-member, i.e. participating member.

A P-member actively participates in the work, with an obligation to vote on all questions formally submitted for voting within the committee, on new work item proposals, enquiry drafts and final draft international standards, and to contribute to meetings.

An O-member follows the work as an observer, and therefore receives committee documents and has the right to submit comments and to attend meetings.

Each member has a membership level which can be full member or associate member.

A full member has the possibility to send experts to actively participate in any Technical Committee/ Subcommittee. A full member is also able to apply for management positions and functions and has voting rights in the IEC General Assembly.

An associate member accesses all working documents and opts to send experts to participate in a limited number of Technical Committees/Subcommittees. An associated member cannot occupy management positions and functions and does not have voting rights in the IEC General Assembly.

	TC 9 members		Membership	
	Country	Country code	Status	Level
1	Austria	AT	P-member	Full member
2	Belarus	BY	O-member	Full member
3	Belgium	BE	P-member	Full member
4	Brazil	BR	O-member	Full member
5	Bulgaria	BG	O-member	Full member
6	Canada	CA	P-member	Full member
7	China	CN	P-member	Full member
8	Croatia	HR	O-member	Full member
9	Czech Republic	CZ	P-member	Full member
10	Denmark	DK	P-member	Full member
11	Egypt	EG	P-member	Full member
12	Ethiopia	ET	P-member	Associate member
13	Finland	FI	P-member	Full member
14	France	FR	P-member	Full member
15	Germany	DE	P-member	Full member
16	Greece	GR	O-member	Full member
17	Hungary	HU	O-member	Full member
18	India	IN	P-member	Full member
19	Indonesia	ID	O-memberr	Full member
20	Iran	IR	P-member	Full member
21	Israel	IL	P-member	Full member

	TC 9 members		Membership	
	Country	Country code	Status	Level
22	Italy	IT	P-member	Full member
23	Japan	JP	P-member	Full member
24	Korea, Republic of	KR	P-member	Full member
25	Luxembourg	LU	P-member	Full member
26	Netherlands	NL	P-member	Full member
27	New Zealand	NZ	O-member	Full member
28	Nigeria	NG	P-member	Full member
29	Norway	NO	P-member	Full member
30	Poland	PL	O-member	Full member
31	Portugal	PT	P-member	Full member
32	Romania	RO	P-member	Full member
33	Russian Federation	RU	P-member	Full member
34	Serbia	RS	P-member	Full member
35	Singapore	SG	P-member	Full member
36	Slovakia	SK	O-member	Full member
37	Slovenia	SI	O-member	Full member
38	South Africa	ZA	P-member	Full member
39	Spain	ES	P-member	Full member
40	Sweden	SE	P-member	Full member
41	Switzerland	CH	P-member	Full member
42	Thailand	TH	P-member	Full member
43	Ukraine	UA	O-member	Full member
44	United Kingdom	GB	P-member	Full member
45	United States of America	US	P-member	Full member

Table 9 – List of TC 9 P-members and O-members

Statistics on TC 9 documents

Referring to the standardization activities, the current numbers of documents issued by TC 9 are the following:

- **163 documents published in use**. They cover all the railway areas relevant to rolling stock, fixed installation and signalling
- **37 documents** are currently under revision
- **13 documents** are currently under preparation at CD stage
- **7 documents** are currently under preparation at CDV stage
- **6 documents** are currently under preparation at New Proposal stage
- **5 documents** were published in 2023

List of TC 9 Plenary meetings

Table 10 lists all the AC 9 and TC 9 Plenary meetings from its origins until today.

It shall be noted that even though the 2024 Anniversary meeting is the 64th meeting, the total number of Plenary meetings totals 65, considering that the TC 9 Plenary meeting held in Geneva in 1996 was the overflow meeting of the 35th TC 9 Plenary meeting held in Durban, South Africa, in 1995.

Meeting no.	Body	Date	Location	RM filename
1	AC 9	16 July 1924	Institution of Mechanical Engineers Storey's Gate, Westminster London – England	AC9_1924-07_London-GB_en-fr_RM11
2	AC 9	17 April 1925	Koninklijk Instituut van Ingenìeurs Princessegracht 23 The Hague – Netherlands	AC9_1925-04_The-Hague-NL_en-fr_RM17
3	AC 9	16 and 20 April 1926	New York – USA	AC9_1926-04_New York-USA_en-fr_RM43
4	AC 9	10 and 12 September 1927	Bellagio – Italy	AC9_1927-09_Bellagio-IT_en-fr_RM59
5	AC 9	8 and 9 July 1929	British Engineers Standard Association London – Great Britain	AC9_1929-07_London-GB_en-fr_RM72

Meeting no.	Body	Date	Location	RM filename
6	AC 9	2 to 4 July 1930	Stockholm – Sweden	AC9_1930-07_Stockholm-SE_en-fr_RM84
7	AC 9	26 and 27 October 1931	Brussels – Belgium	AC9_1931-10_Brussels-BE_en-fr_RM100
8	AC 9	24 and 25 April 1933	Milan – Italy	AC9_1933-04_Milan-IT_en-fr_RM104
9	AC 9	24 and 25 June 1935	Brussels – Belgium	AC9_1935-06_Brussels-BE_en-fr_RM125
10	AC 9	21 to 23 June 1937	Paris – France	AC9_1937-06_Paris-FR_en-fr_RM150
11	AC 9	22, 23 and 25 June 1938	Torquay – Great Britain	AC9_1938-06_Torquay-GB_en-fr_RM162
12	AC 9	11 and 12 October 1948	Stockholm – Sweden	AC9_1948-10_Stockholm-SE_en-fr_RM196
13	AC 9	5 and 6 June 1950	Tremezzo, Lake Como – Italy	TC9_1950-06_Tremezzo-IT_en-fr_RM222
14	TC 9	24 and 25 September 1951	London – Great Britain	TC9_1951-09_London-GB_en-fr_RM254
15	TC 9	8 and to 9 June 1953	Interlaken – Switzerland	TC9_1953-06_Interlaken-CH_en-fr_RM298
16	TC 9	3 and 4 September 1954	Philadelphia – USA	TC9_1954-09_Philadelphia-US_en-fr_RM338
17	TC 9	3 and 4 July 1956	Munich – Germany	TC9_1956-07_Munich-DE_en-fr_RM417
18	TC 9	8 to 10 July 1957	Moscow – Russia	TC9_1957-07_Moscow-RU_en-fr_RM455
10	TC 9	6 to 8 July 1959	Madrid – Spain	TC9_1959-07_Madrid-ES_en-fr_RM541
20	TC 9	26 to 28 June 1961	Interlaken – Switzerland	TC9_1961-06_Interlacken-CH_en-fr_RM649
21	TC 9	29 to 30 May 1963	Venice – Italy	TC9_1963-05_Venice-IT_en-fr_RM775
22	TC 9	18 to 20 October 1965	Tokyo – Japan	TC9_1965-10_Tokyo-JP_en-fr_RM950
23	TC 9	17 to 19 July 1967	Prague – Czechoslovakia	TC9_1967-07_Prague-CZE_en-fr_RM1088
24	TC 9	12 to 13 September 1968	London – Great Britain	TC9_1968-09_London-GB_en-fr_RM1169
25	TC 9	1 and 2 October 1970	Rome – Italy	TC9_1970-10_Rome-IT_en-fr_RM1363
26	TC 9	6 to 10 November 1972	Athens – Greece	TC9_1972-11_Athens-GR_en-fr_RM1542

27	TC 9	10 to 13 September 1974	Bucharest – Romania	TC9_1974-09_Bucharest-RO_en-fr_RM1745
28	TC 9	25 to 28 May 1976	Nice – France	TC9_1976-05_Nice-FR_en-fr_RM1919
29	TC 9	26 to 29 June 1978	Florence – Italy	TC9_1978-06_Florence-IT_en-fr_RM2124
30	TC 9	23 to 26 June 1981	Montreux – Switzerland	TC9_1981-06_Montreux-CH_en-fr_RM2445
31	TC 9	21 to 24 May 1985	Montreal – Canada	TC9_1985-05_Montreal-CA_en-fr_RM2837
32	TC 9	11 to 13 October 1988	Istanbul – Turkey	TC9_1988-10_Istanbul-TR_en-fr_RM3195-RM3195A
33	TC 9	21 to 24 May 1991	Kista, Stockholm – Sweden	TC9_1991-05_Stockholm-SE_en-fr_RM3441
34	TC 9	22 to 24 June 1993	Frankfurt – Germany	TC9_1993-06_Frankfurt-DE_en_RM3659
35	TC 9	23 to 28 October 1995	Durban – South Africa	TC9_1995-10_Durban-ZA_en_RM-379
36	TC 9	22 to 24 October 1996	Zabeltitz – Germany	TC9_1996-10_Zabeltitz-DE_en_RM-416
37	TC 9	13 to 16 October 1997	New-Delhi – India	TC9_1997-10_New-Delhi-JP_en_9_467e_RM
38	TC 9	5 to 7 November 1998	Zhuzhou – China	TC9_1998-11_Zhuzhou-CN_en_9_510e_RM
39	TC 9	26 to 29 October 1999	Kyoto – Japan	TC9_1999-10_Kyoto-JP_en_9_553e_RM
40	TC 9	26 to 29 September 2000	Strasbourg – France	TC9_2000-09_Strasbourg-FR_en_9_603e_RM
41	TC 9	17 to 20 October 2001	Florence – Italy	TC9_2001-10_Florence-IT_en_9_672e_RM
42	TC 9	16 to 18 September 2002	Quebec City – Canada	TC9_2002-09_Quebec City-CA_en_9_714e_RM
43	TC 9	20 to 24 October 2003	Charlottenlund – Germany	TC9_2003-10_Charlottenlund-DK_en_9_782e_RM
44	TC 9	25 to 28 October 2004	Shanghai – China	TC9_2004-10_Shanghai -CN_en_9-845e-RM
45	TC 9	14 to 17 November 2005	Tokyo – Japan	TC9_2005-11_Tokyo-JP_en_9_927e_RM
46	TC 9	13 to 17 November 2006	Helsinki – Finland	TC9_2006-11_Helsinki-FI_en_9_1021e_RM
47	TC 9	12 to 16 November 2007	Bordeaux – France	TC9_2007-11_Bordeaux-FR_en_9_1126e_RM
48	TC 9	3 to 7 November 2008	Kista, Stockholm – Sweden	TC9_2008-11_Kista-SE_en_9_1253ea_RM

Meeting no.	Body	Date	Location	RM filename
49	TC 9	17 to 19 November 2009	Washington DC – USA	TC9_2009-11_Washington DC-USA_en_9_1385e_RM
50	TC 9	26 to 28 October 2010	Changsha – China	TC9_2010-10_Changsha-CN_ en_9_1527e_RM
51	TC 9	15 to 18 November 2011	Fukuoka – Japan	TC9_2011-11_Fukuoka-JP_ en_9_1662ea_RM
52	TC 9	2 to 5 October 2012	Oslo – Norway	TC9_2012-10_Oslo-NO_ en_9_1762e_RM
53	TC 9	5 to 8 November 2013	Florence – Italy	TC9_2013-11_Florence-IT_ en_9_1893ea_RM
54	TC 9	18 to 21 November 2014	Berlin – Germany	TC9_2014-11_Berlin-DE_ en_9_2007ea_RM
55	TC 9	13 to 16 October 2015	Minsk – Belarus	TC9_2015-10_Minsk-BY_ en_9_2088e_RM
56	TC 9	18 to 21 October 2016	Chengdu – China	TC9_2016-10_Chengdu-CN_ en_9_2239e_RM
57	TC 9	10 to 13 October 2017	Vladivostok – Russia	TC9_2017-10_Vlaidvostok-Ru_en_9_2349ea_RM
58	TC 9	19 to 22 November 2018	Tokyo – Japan	TC9_2018-11_Tokyo-JP_en_9-2466ea-RM
59	TC 9	5 to 8 November 2019	Nice – France	TC9_2019-11_Nice-FR_ en_9_2566ea_RM
60	TC 9	5 to 10 October 2020	Web meeting (Covid time)	TC9_2020-10_Web Meeting_ en_9-2650e-RM
61	TC 9	25 to 29 October 2021	Web meeting (Covid time)	TC9_2021-10_Web Meeting_ en_9_2781ea_RM
62	TC 9	25 to 30 October 2022	Milan – Italy	TC9-2022-10_Milan-IT_ en_9_2912ea_RM
63	TC 9	15 to 17 October 2023	Web meeting (planned in Cairo)	TC9_2023-10_Cairo-EG_en_9_XXXXea_RM
64	TC 9	8 to 11 October 2024	Naples – Italy (100 Years Anniversary)	TC9_2024-10_Naples-IT_en_9-XXXXe-RM

Table 10 – List of AC 9 and TC 9 Plenary meetings

List of CAG meetings

Table 11 lists the Chair Advisor Group meetings that took place from the actual CAG establishment.

Meeting no.	Body	Date	Location
1	CAG	16 November 2005	Tokyo – Japan
2	CAG	5 April 2006	Fontenay-aux-Roses – France
3	CAG	15 November 2006	Helsinki – Finland
4	CAG	20 April 2007	Florence – Italy
5	CAG	14 November 2007	Bordeaux – France
6	CAG	16 April 2008	Puteaux – France
7	CAG	4 November 2008	Kista – Sweden
8	CAG	23 April 2009	Villafranca – Italy
9	CAG	16 November 2009	Washington – USA
10	CAG	2 April 2010	Geneva – Switzerland
11	CAG	25 October 2010	Changsha – China
12	CAG	13 April 2011	Rome – Italy
13	CAG	14 November 2011	Fukuoka – Japan
14	CAG	18 April 2012	Berlin – Germany
15	CAG	2 October 2012	Oslo – Norway
16	CAG	18 April 2013	Geneva – Switzerland
17	CAG	5 November 2013	Florence – Italy
18	CAG	3 April 2014	Milan – Italy
19	CAG	18 November 2014	Berlin – Germany
20	CAG	23 April 2015	Tokyo – Japan
21	CAG	13 October 2015	Minsk – Belarus
22	CAG	13 April 2016	Florence – Italy
23	CAG	18 October 2016	Chengdu – China
24	CAG	11 May 2017	Volgograd – Russia
25	CAG	10 October 2017	Vladivostok – Russia
26	CAG	24 May 2018	Cologne – Germany
27	CAG	19 November 2018	Tokyo – Japan
28	CAG	29 May 2019	Milan – Italy
29	CAG	5 November 2019	Nice – France
30	CAG	29 May 2020	Web meeting only

Meeting no.	Body	Date	Location
31	CAG	24 September 2020	Web meeting only
32	CAG	24 February 2021	Web meeting only
33	CAG	2 June 2021	Web meeting only
34	CAG	19 October 2021	Web meeting only
35	CAG	19 May 2022	Erlangen – Germany
36	CAG	25 October 2022	Milan – Italy
37	CAG	25 May 2023	Lyon – France
38	CAG	5 October 2023	Web meeting only
39	CAG	22 May 2024	Tokyo – Japan

Table 11 – List of CAG meetings

List of Management meetings

Table 12 lists the Management meetings that took place from the actual MM establishment.

Meeting no.	Body	Date	Location
1	MM	1993	Convenors Day in autumn 1993
2	MM	1995	Unknown location
3	MM	1996	Unknown location
4	MM	1997	Unknown location
5	MM	1998	Unknown location
6	MM	1999	Verona – Italy
7	MM	27 and 28 March 2000	Florence – Italy
8	MM	2001	Paris – France
9	MM	15 and 16 April 2002	Venice – Italy
10	MM	2 and 3 April 2003	Turin – Italy
11	MM	24 March 2005	Milan – Italy
12	MM	5 April 2005	Milan – Italy
13	MM	4 April 2006	Fontenay-aux-Roses – France
14	MM	19 April 2007	Florence – Italy
15	MM	15 April 2008	Puteaux – France
16	MM	22 April 2009	Villafranca – Italy
17	MM	20 April 2010	Geneva – Switzerland
18	MM	12 April 2011	Rome – Italy
19	MM	17 April 2012	Berlin – Germany

20	MM	17 April 2013	Geneva – Switzerland
21	MM	2 April 2014	Milan – Italy
22	MM	22 April 2015	Tokyo – Japan
23	MM	12 April 2016	Florence – Italy
24	MM	10 May 2017	Volgograd – Russia
25	MM	23 May 2018	Cologne – Germany
26	MM	28 May 2019	Milan – Italy
27	MM	27 May 2020	Web meeting only
28	MM	21 May 2021	Web meeting only
29	MM	18 May 2022	Erlangen – Germany
30	MM	24 May 2023	Lyon – France
31	MM	22 May 2024	Tokyo – Japan

Table 12 – List of Management meetings

Organization chart

The original structure of TC 9 was constituted by a simple Advisory Committee on traction motors and evolved into a complex structure which is shown in Figure 19 and is represented as the main diagramme of the organization chart.

TC 9 set up two advisory groups, some ad hoc groups, working groups, project teams and maintenance teams.

It shall be noted that the Chair Advisory Group supports the TC 9 Officers in managing strategic aspects such as to guide TC 9 in defining its Strategic Policy Statement and to review and identify priorities in the technical activities of TC 9.

The second advisory group is the Strategic Liaison Group between TC 9 and UIC which covers the cooperation on the Train communication network, the on-board multimedia systems, the fixed installations relevant to the contact line and the prognostic and health management of rolling stock.

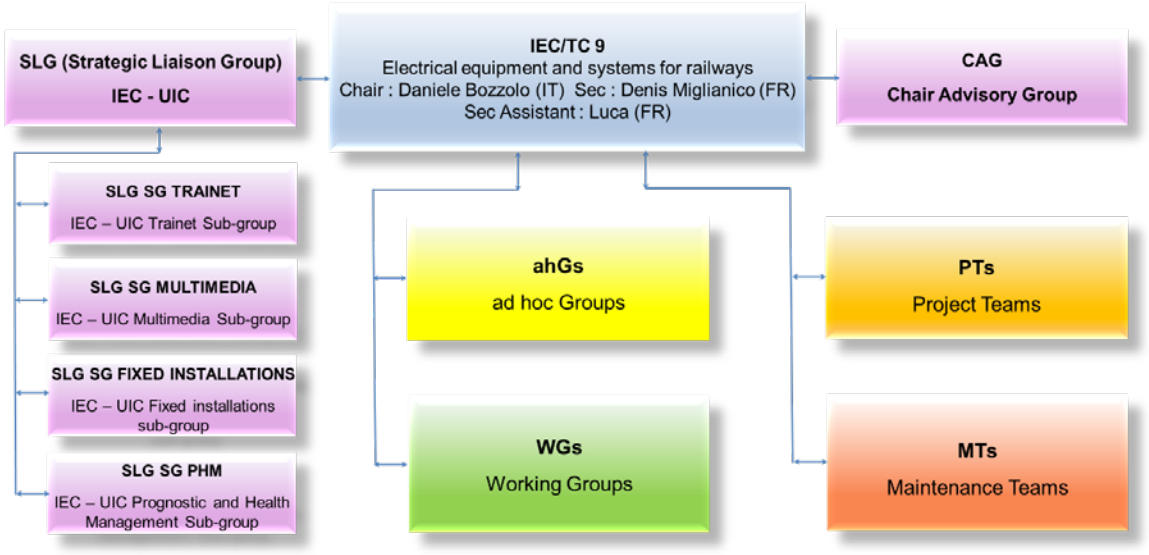


Figure 19 – TC 9 organization chart main diagramme

Figure 20 shows the ad hoc groups which exist at the time this book was written. According to the ISO/IEC Directives Part 1, an ad hoc group is an advisory group which has the purpose of studying a precisely defined problem on which the group reports to its parent committee.

Figure 20 – TC 9 ad hoc groups organization chart

Also, Figure 21 shows the working groups which are active in TC 9. According to ISO/IEC Directives Part 1, TC 9 set up working groups when more than one project is developed on a specific standardization matter.

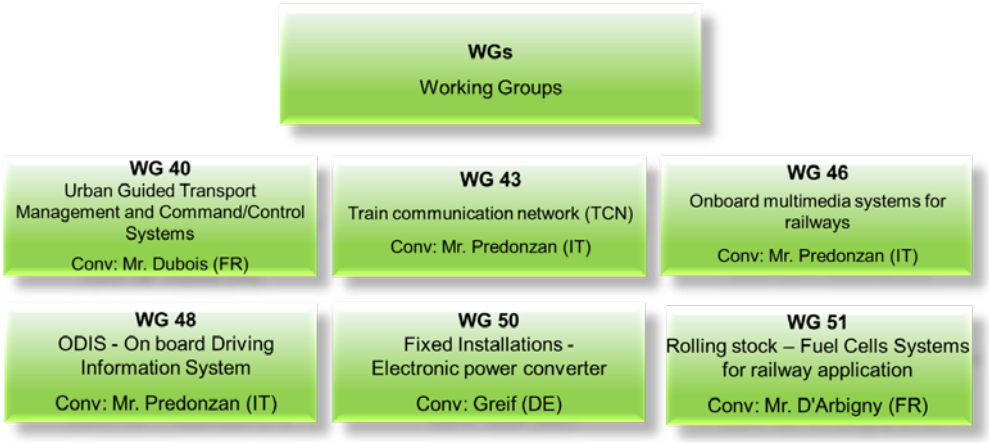


Figure 21 – TC 9 working groups organization chart

TC 9 has many single projects which are under preparation as it is shown in Figure 22. It shall be noted that most of the TC 9 projects cover sustainability aspects, e.g. specification of traction batteries, fuel cells, energy efficiency and energy savings.

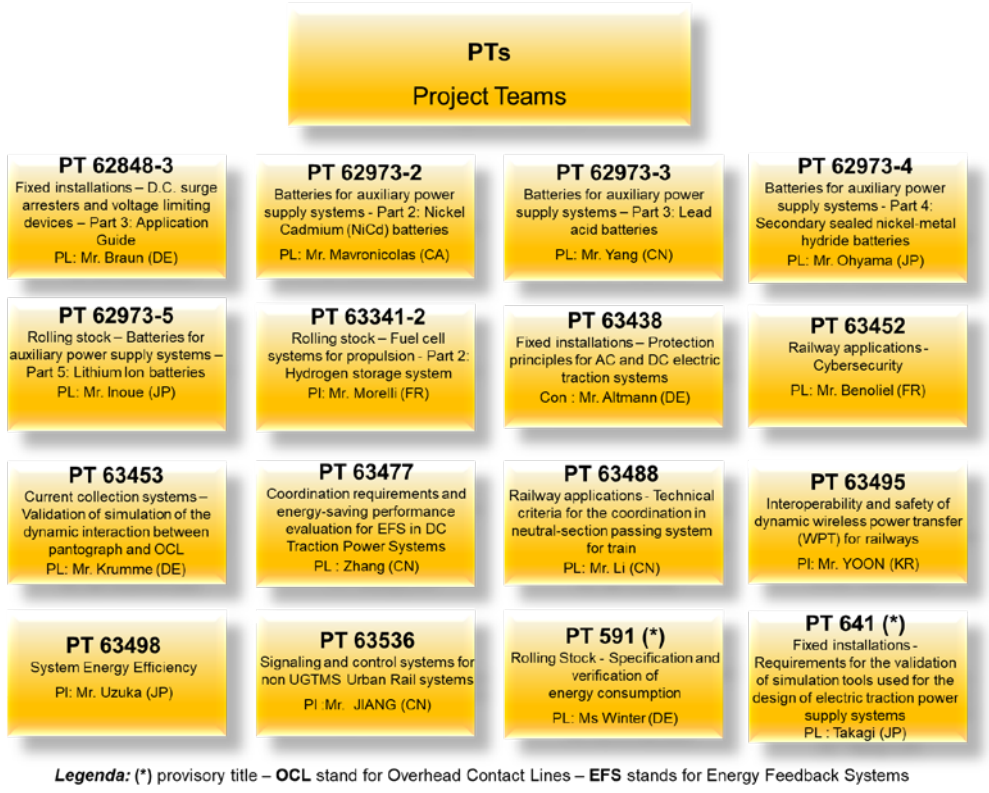


Figure 22 – TC 9 project teams organization chart

According to ISO/IEC Directives Part 1, TC 9, during each Plenary meeting, considers the documents which are near to the end of the stability date. If no revision is necessary, the stability date is prolonged. Should a revision be requested, TC 9 starts the procedure and sets up the relevant maintenance team. For the time being, the 11 maintenance teams are active as shown in Figure 23.

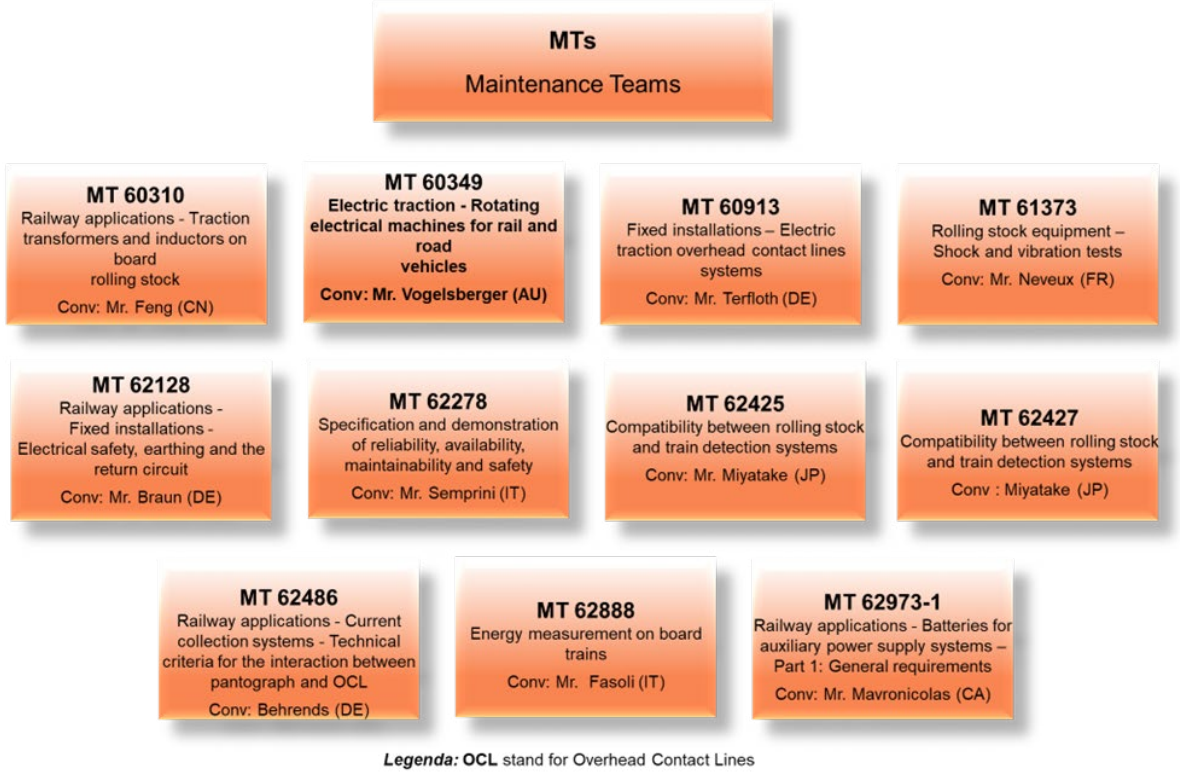


Figure 23 – TC 9 maintenance teams organization chart

IEC 1906 Awards: TC 9 recipients

Created in 2004 by the IEC Executive Committee, the 1906 Award commemorates the year of foundation of the IEC and honours experts around the world whose work is fundamental to the IEC.

The Award recognizes exceptional and recent achievement relevant to "a project or other specific contribution" related to the activities of the IEC and which contributes in a significant way to advancing the work of the Commission.

Beyond recognizing technical experts' efforts in a meaningful way, the 1906 Award wishes to draw attention to the work of these experts in industry management circles.

The aim of this Award is to recognize current achievements that can be considered as major contributions to furthering the interests of electrotechnology standardization, conformity assessment and related activities. Specifically, the Award must be granted for exceptional, recent contribution to work related to the development, either technical or from an organizational point of view, of a specific project.

Table 13 lists all TC 9 experts who have been IEC 1906 Awardees.

Year	Awardee name	Awardee surname	National Committee
2004	No TC 9 recipients		
2005	No TC 9 recipients		
2006	No TC 9 recipients		
2007	Daniel Gianosvaldo Tomoki	Coineau Fadin Watanabe	France Italy Japan
2008	Wolfgang Francois Guido	Kropp Maumy Picci	Germany France Italy
2009	No TC 9 recipients		
2010	Chris Hiroki	Llewellyn Nagasawa	United Kingdom Japan
2011	Walter Korefumi	Güntensperger Tashiro	Switzerland Japan

Year	Awardee name	Awardee surname	National Committee
2012	Gui Egid	Liu Schneider	China Germany
2013	Masayuki Marco	Matsumoto Predonzan	Japan Italy
2014	Ulrich Gernot Koichiro Roger Jin	Feucht Hans Kasahara Short Wang	Germany Germany Japan United Kingdom China
2015	Daniel Zhang Akira	Coineau Lizhi Morisada	France China Japan
2016	Armin Christian Marco	Heindel Krömer Marella	Germany Germany Italy
2017	Gui Ryo	Liu Takagi	China Japan
2018	Takefumi Hiroyuki	Inoue Matsumura	Japan Japan
2019	Franco Carlo	Cavaliere Fasoli	Italy Italy
2020	Makoto	Yagi	Japan
2021	Andrea Hideaki	Gatti Ohyama	Italy Japan
2022	Attilio Stéphane Maurice Jianghua Axel Lothar Hiroshi	Ciancabilla Dubois Feng Schmieder Tanaka	Italy France China Germany Japan NC
2023	Gianosvaldo Laurent Ted	Fadin Lasnier Mavronicolas	Italy France Canada
2024	Domenico Takefumi Haitao	Giordano Inoue Liu	Italy Japan China

Table 13 – List of TC 9 recipients of the IEC 1906 Award

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https://www.cencenelec.eu/media/Guides/CEN-CLC/cenclcguide13.pdf

About the authors

Daniele Bozzolo is Technical Advisor of ANIE-ASSIFER, the Italian Association of Railway Industries.

After a short involvement in ISO with the USA NC in 1993, since 1998 he has also been working in railway standardization and is currently Chair of IEC TC 9, Vice Chair of the IEC System Committee for Sustainable Electrified Transportation, Convenor of the SLG with UIC, Chair of the CEI CT 326 and Convenor for IEC TC 9 ahG 31.

He held the position of Chair of CENELEC TC 9X from 2009 to 2015. In 2016, he was awarded the CEN/CENELEC Gold Pin for his outstanding contribution to standardization. He is still currently member of the CENELEC TC 9X as well of the Italian UNI CT 50.

He started his career in the railway field by spending five years cooperating with the most prestigious universities in the USA, such as Carnegie Mellon in Pittsburgh (PA), MIT in Cambridge (MA), Duke University in Durham (NC) and Virginia Tech (VA). During that period, he also got his Master in Business Administration from the School of Business at the Carnegie Mellon University in Pittsburgh (PA).

After almost 30 years working with one of the largest worldwide railway suppliers holding apical positions, in 2015, he opened his own company as a Senior Railway Transportation Systems Consultant and has been working for most of the major worldwide railway suppliers. He regularly teaches Signalling Control Systems courses at the Italian Electrotechnical Committee (CEI) as well as at the Italian Railway Engineers Institute (CIFI). He has also been member of the Board of Appeal of the European Union Agency for Railways (EUAR) as well as an independent expert in the domain of technical cooperation of EUAR. Due to his previous job, he travelled pretty much all around the world including the Middle East, Far East, Australia and North America. All this travel exposed him

to knowing, appreciating and managing relationships with different cultures, mentalities and ways of behaving, all of which are very important elements to be able to effectively carry out his current standardization tasks. Since January 2024, he serves as member of two editorial committees for specialized journals in the railway field such as the “Electric Drive for Locomotives” and the “Control and Information Technology”.

Franco Cavaliere is now an independent HAS Consultant on behalf of the European Commission in the railway sector. He is an electrical engineer with a comprehensive experience in the Rolling Stock Department of FSI (the Italian State Railways).

During his career at FSI, he was responsible for all the project activities related to EMUs and high-speed trains, for the major overhaul maintenance plan of ETR 500 (current FRECCIAROSSA), for the maintenance planning and design of TRENITALIA rolling stock. Furthermore, he was responsible for planning and monitoring of rolling stock investment, for design and maintenance procedure activities of rolling stock and for rolling stock maintenance of the Marche region.

Franco left the FSI group and became responsible for the Rolling Stock Laboratory of ITALCERTIFER, the laboratory tests and conformity assessments company of the FSI group.

From 1991 to 1994, he was the Convenor of CLC/SC9XB/WGB2 in charge of writing the first edition of EN 50153 (Electrical safety on board railway vehicles). From1998 to 2018, he was Chair of SC9B, Italian mirror of CLC/SC9XB. From 2004 to 2016, Chair of IEC TC 9. From 2005 to 2007, CER speaker of the Mirror Group “Traction”, in charge of writing the TSI standard on rolling stock conventional traction.

He has made several publications and presentations at national and international conferences such as the World Congress on Railway Research (WCRR).

In 2011, CEI, the Italian National Committee, awarded him the Giorgi Prize for his outstanding contribution to the development of standardization and the promotion of the CEI image in the world. In 2019, he was awarded the IEC 1906 in recognition for his exceptional and highly professional

contribution, technical as well as organizational, to the development and management of the cooperation between IEC TC 9 and UIC in the area of standardization of TCN, on-board multimedia systems and overhead contact line systems.

Gianosvaldo Fadin is Technical Advisor of ANIE-ASSIFER, the Italian Association of Railway Industries. Since 1990, he works in railway standardization and is currently President of CEI CT9, IEC TC 9 Representative in ACSEC, TC 65 and CENELEC TC 9X Chair Advisor. He is also a member of UNI, CENELEC, AICQ, AEIT and IEEE. His past experience includes co-founding and managing FAR Systems, a railway electronic industry.

In 2007, he was awarded the IEC 1906 Award for his considerable contribution to IEC TC 9 in the development of the train communication network set of standards. He contributed to these standards for over more than 15 years as an expert and project leader.

In 2015, he was nominated Chair of CEI CT 9 - Sistemi e componenti elettrici ed elettronici per trazione, the Italian mirror committee of CENELEC TC 9X and IEC TC 9, a role he currently still has.

In 2017, he was nominated Chair of IEC TC 9 and kept the role until 2022.

In 2017, CEI, the Italian National Committee, awarded him the Giorgi Prize for his outstanding contribution to the development of standardization and the promotion of the CEI image in the world.

In 2023, he was awarded, for the second time, the IEC 1906 Award for about 30 years of standardization activity within the Italian National Committee, the IEC and CENELEC with many different roles, e.g. IEC WGs Convenor, IEC TC 9 Chair, IEC TC 9 Liaison Officer, CENELEC TC 9X Chair Advisor.

Always aware of the new evolving technology challenges, he never stopped investigating new frontiers and promoting innovative solution in the field of standardization. For example, he introduced cyber security in the IEC TC 9 strategic business plan. Since 2015, he promoted cyber security standardization in the railway field as IEC TC 9 Representative in ACSEC. As IEC TC 9 Representative in IEC TC 65, he contributed and contributes to the preparation of the horizontal standards in IEC TC 65/JAG 26.

Acknowledgements

About the cover drawing

The authors of this book owe a huge debt of gratitude to Davide Scafariello.

In fact, the cover drawing was explicitly requested by Gianosvaldo Fadin to his friend Davide who enthusiastically welcomed the challenge of representing 100 years of railway standardization.

Davide has masterfully placed an old steam locomotive next to a high-speed train against the backdrop of the Vesuvius skyline; ideally uniting two railway technologies 100 years apart that stand out in the landscape of the Vesuvius volcano, one of the most important symbols of the city of Naples where the centenary of IEC TC 9 took place.

Davide Scafariello was born in Bolzano, Italy. He grew up in the beautiful Dolomites, in what he refers to as “my mountains.” He had his exposure to colour – shades of white, blue, and grey in winter and vibrant greens, reds, and pinks in the summer.

His mother, also an artist, was his main inspiration and guide into painting. He learned to paint at an early age, partly copying his mother’s work and partly self-teaching, using his imagination as his inspiration. He mainly used oil colours.

He then went on to study law, became a successful lawyer, and worked in different business lines in the industry. However, he continued to paint in his free time, photographing the beautiful nature wherever he travelled, and kept the fire alive.

Around Covid, he started to shift his focus from oil to black ink drawing and studied this technique at length, producing a variety of black ink drawings from animals to children to buildings and architecture. Today, he continues to produce both oil paintings and black ink drawings; he finds his main inspiration still in nature, as is observed in his work, and at times forays into his imagination with the abstract work he produces.

Editors

This book was submitted to an internal review which was performed by the authors themselves.

In fact, Mr Fadin provided the drafting of some chapters which were reviewed by Mr Bozzolo and Mr Cavaliere. The same happened for the chapters written by Mr Bozzolo and revised by Mr Fadin and Mr Cavaliere. Finally, chapters written by Mr Cavaliere were reviewed by Mr Fadin and Mr Bozzolo.

An independent review was carried out by Mr Paolo Umiliacchi and Mr Chris Llewellyn, to whom the authors are indebted for the useful and important suggestions provided which improved the text of this book.

Finally, the text was edited by the IEC. The authors therefore give special thanks to the Communications Division at IEC Secretariat for having carried out the editorial revision of the English language and having enriched this book with a professional layout.

Sponsors

The Italian Electrotechnical Committee oversaw the creation of this book as well as the success of the events in which the book was presented and which celebrated the centenary of IEC TC 9 during the 64th Plenary meeting in Naples, Italy.

All this could never have been achieved without the contribution of all the organizations and companies that gave their active support and to whom the Italian Electrotechnical Committee and the authors extend their heartfelt thanks:

- IEC – International Electrotechnical Commission
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- ANIE Assifer – Italian Association of Railway Industries
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- China National Committee
- CIFI – Collegio Ingegneri Ferroviari Italiani
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