ABSTRACT

German literature on power transformers is covered from 1888 (first book on transformers published anywhere, just three years after patenting transformers), up to most recent publications issued in 2019. The purpose of the compilation of published books on power transformers is to give a historical summary on the topic, which may also be useful to other specialists in their research.

KEYWORDS

calculation, construction, design, DIN, historical development, power transformers, testing, VDE

Books on power transformers in German – Part II

A bibliography 1920 – 1951

1920

W. Demuth et al., *Die Materialprüfung der Isolierstoffe der Elektrotechnik* (The testing of electrical engineering insulation materials), Springer, Berlin, Pages IX+149, 1920

F. Kotschi, *Der Transformator bei tiefen Temperaturen, Arbeit zur Erlangung der Würde eines Doktoringenieurs* (The transformer at low ambient temperatures, thesis for doctoral degree), self-publishing, Pages 68, 1920 [26, 27]

By the beginning of the 20th century, transformer technology reached a relatively high level of development for that time. Lots of different topics were analysed and published

H. Kyser, *Die elektrische Kraftubertragung, Band 1, Die Motoren, Umformer und Transformatoren* (The electric power transmission, Volume 1, The motors, converters and transformers), Springer, Berlin, Pages 416, 1920; Ed. 2.0, Pages 548, 1923; Ed. 3.0, Pages 544, 1930

F. Raskop, *Der Katechismus für die Ankerwickelei* (The Catechism for anchor winding), Meusser, Berlin, Pages VIII+145, 1920; Ed. 2.0, 1922; Ed. 3.0, 1929; Ed. 4.0, M. Krayn, Berlin, Pages 224, 1933; Ed. 5.0, Pages VII+241, 1937; Ed. 6.0, Pages XII+287, 1941; Ed. 8.0, De Gruyter, Berlin, Pages XII+299, 1944; Ed. 10.0, Pages XI+416, 1951 and Reprint 2019; Ed. 11.0, Pages 472, 1953; Ed. 12.0, Pages 516, 1957; Ed. 13.0, Pages 616, 1964; Ed. 14.0, 1967 and Reprint 2019; Ed. 15.0, Pages 503, 1976 [28, 29]

This book has survived 15 editions and a few reprints. At first it was a guide for manufacturing windings for electrical machines and transformers. Then the book was repeatedly expanded in the direction of increasing the volume of repairs, adding faults, testing, and monitoring. At the same time, the title of the book was changed, and its coverage naturally expanded. In the bibliography, we have combined all available publications under the popular short historical name *The Catechism for anchor winding*. Other books by the author are indicated in the bibliography for 1929, 1938 and 1948.

1921

Milan Vidmar, *Die Transformatoren* (The transformers), Springer, Berlin, Pages 702, 1921; Ed. 2.0, Pages 751,1925; Ed. 3.0, Birkhäuser, Basel, Pages 630, 1956

In this book, a famous engineer, scientist and chess player, Prof. Milan Widmar (1885–1962), outlines the basics of designing and constructing power transformers. The fundamental principles presented in it remain valid even today, despite the development of the theory, great progress in the properties of materials, technology, growth in ultimate power and voltage classes, and automation of the design process. The book has withstood many editions and has been translated into many languages. Other books by the author are indicated in the bibliography for 1927, 1928, 1935, 1940 and 1945.

In 1921, Prof. Milan Widmar published a book Die Transformatoren which treat design and construction of power transformers. Presented fundamental principles remain valid even today

F. Unger, M. Kloss, *Konstruktien der Dinamomaschinen und Transformatoren* (Constructions of dynamo machines and transformers), Fifth section p. 361-434 in book: Starkstromtechnik Pocketbook for Electrotechniker, Vol. I by E. v. Rziha and J. Seidener, Wilhelm Ernst & Sohn, Ed. 5.0, Berlin, Pages 892, 1921.

1922

J. Fischer-Hinnen, *Theoretisches und praktisches Lehrbuch für Elektrotechniker. Mit besonderer Berücksichtigung der Berechnung und Prüfung von Maschinen und Transformatoren* (Theoretical and practical textbook for electrical engineers. With special attention to the calculation and testing of machines and transformers), Raustein, Zürich, Pages 550, 1922

Walter Spath, *Über Durchschlagseigenschaften von Transformatorenölen. Inauguraldissertation.* (About electric breakdown properties of transformer oils. Inaugural Dissertation.), Springer, Jena, Pages 347, 1922

1923

VDE, *Regeln für die Bewertung und Prüfung von Transformatoren (R.E.T. 1923)* (Rules for the evaluation and testing of transformers (R.E.T. 1923)), Ed. 1.0, Springer, Berlin, Pages 23, 1923

1924

A. von Königslöw, *Transformatoren und asynchrone Drehstrommotoren, Ihre Wirkungsweise und Berechnung (=Bibliothek der gesamten Technik 308)* (Transformers and asynchronous three-phase motors, their mode of operation and calculation (=General technology library 308)), M. Janecke, Leipzig, Pages 172, 1924

1925

Egon Eichwald, *Mineralöle (=Technische Fortschrittsberichte Bd. 40)* (Mineral oils (= Technical progress reports Vol. 40)), Steinkopf, Dresden, Pages 151, 1925

1926

Conrad Aron, *Der Transformator* (The Transformer), Wilhelm Herbst Verlag, Pages 118, 1926

1927

AEG, *Anweisung zur Behandlung der Transformatoren* (Instructions on how to handle the transformers), Verlag AEG, Pages 67, 1927

Heinrich Keller, *Zur Kenntnis von Transformatorenöl. Dissertation. (Transformer oil. A Dissertation.),* Munich, Pages 41, 1927 [30, 31]

Normen der Elektrotechnik für Maschinen, Transformatoren, Apparate, DIN Taschenbuch 7 (Electrical engineering standards for machines, transformers, apparatus, DIN Taschenbuch 7), VDE, Beuth-Verlag, Berlin, Pages 133, 1927; Ed. 2.0, Pages 139, 1928

Wilchelm Schafer, *Transformatoren, Goschen Collection No. 952* (Transformers, Goschen Collection No. 952), Walter de Gruyter & Co., Berlin - Leipzig, Pages 114, 1927; Ed. 2.0, Berlin, 1949; Ed.3.0, 1957; Ed. 4.0, 1962

Milan Vidmar, *Die Transformatoren im Betrib* (The transformers in operation), Springer, Berlin, Pages 310, 1927

Rudolf Wotruba, *Der ein- und mehrphasige Wechselstrom: Einführung in das Studium der Transformatoren und Wechselstrommaschinen* (Single and multi-phase alternating current: Introduction to the study of transformers and alternating current machines), Oldenbourg, Munich and Berlin, Pages 86, 1927 [32]

1928

Gustav Haberland, *Elektrotechnische Lehrhefte IV, Transformatoren und Wechselstrommaschinen* (Electrotechnical instruction book IV, Transformers and AC machines), M. Janecke, Leipzig, Pages 174, 1928; Pages 191, 1944; Ed. 8.0, Fachbuchverlag, Leipzig, Pages 206, 1950

Siemens-Schuckert Preislisten Band M 2 Maschinen und Zubehör Transformatoren (Siemens-Schuckert price lists volume M 2 machines and accessories for transformers), Self-published printing and art publishing Haberland, Leipzig, Pages over 300, circa 1928-1936

Milan Vidmar, *Wirkungsweise elektrischer Maschinen* (Mode of operation of electrical machines), Springer, Berlin, Pages 223, 1928

Rudolf Wotruba, Adalbert Stifter, *Die Transformatoren, Theorie, Aufbau und Berechnung* (The transformers, theory, structure and calculation), De Gruyter Oldenbourg-Verlag, Munich-Berlin, Pages 203, 1928 [33, 34]

1929

Dr. G. Brion, *Die elektrische Meßtechnik II: Die Messungen an elektrischen*

Figure 1. Milan Vidmar, Die Transformatoren im Betrib

Maschinen, Transformatoren und Gleichrichtern (The electrical measurement technology II: The measurements on electrical machines, transformers and rectifiers), de Gruyter & Co., Berlin, Pages 120, 1929

Friz Raskop, *Die Instandsetzungen an elektrischen Maschinen und Transformatoren, insbesondere die Herstellung von Ankerwicklungen und Transformatorenwicklungen* (The repair of electrical machines and transformers, especially the manufacture of armature windings and transformer windings), Ed.4.0, Meusser, Berlin, Pages 342, 1929

E. Roller, H. Pricks, *Schulversuche zur Elektrizitätslehre mit dem zerlegbaren Transformator und Zusatzteilen* (School trials on electricity with the dismantled transformer and additional parts), Verlag Physikalische Werkstätten AG, Goettingen, Pages 111, 1929 [35]

1930

Georg Dettmar, *Erläuterungen zu den Regeln für die Bewertung und Prüfung von elektrischen Maschinen R.E.M. / 1930, Transformatoren R.E.T. / 1930 und Maschinen und Transformatoren auf Bahn- und anderen Fahrzeugen R.E.B./1930 sowie zu den Normalen Anschlußbedingungen und den Normalen Klemmen-Bezeichnungen* (Explanations of the rules for the assessment and testing of electrical machines R.E.M. / 1930, transformers R.E.T. / 1930 and machines and transformers on trains and other vehicles R.E.B. / 1930 as well as the normal connection conditions and the normal terminal designations), Springer, Berlin, Pages 406, 1930 [36]

L. Lerch, *177 Schaltbilder von Transformatoren, Generatoren, Akkumulatoren und Umformen* (177 circuit diagrams of transformers, generators, accumulators and converters), Verlag Seefeld, Hannover, Pages 159, 1930 [37]

Karl Muhlbrett, *Die Transformatoren* (The transformers), Bonness & Hachfeld, Potsdam-Leipzig, Pages 140, 1930

1931

Emil Kosack, *Schaltungsbuch für Gleich- und Wechselstromanlagen. Dynamomaschinen, Motoren und Transformatoren, Lichtanlagen und Umformerstationen.* (Circuit book for DC and AC systems. Dynamo machines, motors and transformers, lighting systems and converter stations), J. Springer, Berlin, Pages 160, 1922; Pages 213, 1931

1932

Rudolf Richter, *Elektrische Maschinen, 3. Band: Die Transformatoren* (Electrical machines, volume 3: the transformers), Springer, Berlin, Pages 321, 1932; Ed.2.0, Birkhäuser, Basel-Stuttgart, Pages 352, 1954; Ed. 3.0, Springer Basel AG, Pages 321, 1963

Before his death, E. ARNOLD (see the year 1902-1904 in our bibliography above), suggested RUDOLF RICHTER (1877-1957) to become the leader of TH Karlsruhe. On 1 October 1912, at the age of 35, R. Richter took up the position of full professor and director of TH, and showed himself to be a worthy successor to his great predecessor, working until 1947. During 1924-1950, he published 5 volumes of his book *Electrical machines, volume 3: The transformers*, which was first published in 1932, and gained international popularity by competing with the works of M. Vidmar.

Another Richter's book, which also has a transformers section, is listed in 1949.

M-Sammelliste 1932: Maschinen und Transformatoren (M-Collection list 1932: Machines and transformers), Siemens-Schuckert, Berlin, Pages 179, 1932

Robert Spieser, *Krankheiten elektrischer Maschinen, Transformatoren und Apparate* (Fault analysis of electrical machines, transformers and apparatus), Springer, Berlin, Pages 360, 1932; Ed. 2.0, Pages 378, 1960; Reprint on Demand, Springer, Pages 396, 2012

1934

Walter Kehse, *Der praktische Transformatorenbau* (The practical transformer construction), Enke, Stuttgart, Pages 109, 1934

M-Sammelliste 1934. Maschinen und Transformatoren (M-Collection list 1934. Machines and transformers), Siemens-Schuckert, Berlin, Pages 207, 1934

1935

M-Sammelliste 1935. Maschinen, Schalter und Transformatoren (M-Collection list 1935. Machines and transformers), Siemens-Schuckert, Berlin, Pages 240, 1935

Milan Vidmar, *Der kupferarme Transformator* (The low-copper transformer), Springer, Berlin, Pages 92, 1935 [38]

Paul Werners, *Energieübertragung und -umwandlung mit Wechselstrom. Einheitliche Theorie der Leitungen, Transformatoren und Maschinen* (Energy transmission and conversion with alternating current. Uniform theory of lines, transformers and machines), Teubner, Leipzig-Berlin, Pages 204, 1935 [39]

1936

F. J. Gemmert, *Transformator (Starkstrom - Schwachstrom)* (Transformer (high current and low current)), Otto Maier Verlag Ravensburg, Pages 31, 1936 [40-42]

1937

M-Sammelliste 1937: Maschinen, Schalter und Transformatoren (M-Collection list 1937: Machines and transformers), Siemens-Schuckert, Berlin, Pages 302, 1937

Figure 2. Der praktische Transformatorenbau, Walter Kehse

The purpose of the compilation of published books on power transformers is to give a historical summary on the topic, which may also be useful to other specialists in their research

1938

Karl Bolte, Rudolf Kuchler, *Transformatoren mit Stufenregelung unter Last: Theorie, Aufbau, Anwendung* (Transformers with On-Load Tap-Changers: Theory, construction and application), R. Oldenbourg, Munchen-Berlin, Pages 182, 1938

Paul - Eduard Klein, *Transformatoren und Drosseln: Theorie, Bau und Berechnung* (Transformers with On-Load Tap-Changers: theory, construction, application), Ed. 2.0, J. Schneider, Berlin, Pages 88, 1934; Ed. 3.0, Pages 128, 1938

Fritz Raskop, *Isolierlacke, deren Eigenschaften und Anwendung in der Elektrotechnik, insbesondere im Elektromaschinen- und Transformatorenbau* (Insulating varnishes, their properties and application in electrical engineering, especially in electrical machine and transformer construction), Krayn, Berlin, Pages VII+132, 1938

Friedrich Riepenber, *Praktische Anleitung zur Instandsetzung von Elektromaschinen und Transformatoren sowie zur Herstellung von Elektromaschinenwicklungen und Transformatorenwicklungen* (Practical instructions for the repair of electrical machines and transformers as well as for the production of electrical machine windings and transformer windings), F. Klett, Berlin, Pages 175, 1938; Pages 192, 1940; Ed. 5.0, Pages 182, 1947 [43]

1939

Richard Elsner, *Zur Theorie des schwingungsfreien Drehstromtransformators* (The theory of the vibration-free three-phase transformer), Special print from Springer, Berlin, Pages 23, 1939

Niederspannungs-Transformatoren Liste T I. Ausgabe 1939 (Low voltage transformers List T I. Edition 1939), Koch & Sterzel, Dresden, Pages 40, 1939

Wilhelm Schäfer, *Transformatoren, Sammlung Göschen Band 952* (Transformers, Göschen Collection Volume 952), de Gruyter, Berlin, Pages 127, 1939; Ed.2.0, 1949

1940

Milan Vidmar, *Transformatoren - Kurzschluse, Sammlung Vieweg 118* (Transformers – under short circuit, Vieweg 118 collection), Braunschweig, Pages 136, 1940; Ed. 2.0, 1954

1944

G. Haberland, *Wechselstrommaschinen. Transformatoren und Stromrichter.* (AC machines. Transformers and converters.), M. Janecke, Leipzig, Pages 191, 1944

1945

Milan Vidmar, *Transformazion und Energieubertragung* (Transformation and energy transfer), Kleinmeyer u. Bamberg, Laibach, Pages 754, 1945

1948

Herbert Kunze, *Netz- und Kleintransformatoren* (Large and small transformers), Deutscher Funk-Verlag, Berlin, Pages 40, 1948 [44-46]

Fritz Raskop, *Das Elektromaschinenbauer-Handwerk. Instandsetzung, Neuwicklung und Umbau elektrischer Maschinen, Transformatoren und Apparate.* (The electrical engineering trade. Repair, new development, and conversion of electrical machines, transformers and apparatus.), Ed.2.0, Cram, Berlin, Pages 384, 1948; Ed.3.0, 1949 [47,48]

1949

J. Friedrich, H. Kroncke, *Der zerlegbare Transformator. Versuche zur Elektrizitätslehre.* (The demountable transformer. Attempts to study electricity.), Lax, Hildesheim, Pages 210, 1949

Karl Muttersbach, *Feststellung und Beseitigung von Fehlern an elektrischen Maschinen Transformatoren und Geräten* (Detection and elimination of faults in electrical machines, transformers and devices), Ed.4.0, Fachverlag, Frankfurt, Pages 158, 1949

Rudolf Richter, *Kurzes Lehrbuch der Elektrischen Maschinen* (Short textbook on electrical machines), Springer, Berlin, Pages 400, 1949

1950

W. Kehse, *Handbuch des Transformatorenbaus* (Manual of transformer construction), Enke, Stuttgart, Pages 380, 1950

Franz Unger, *Bemessung von Transformatoren* (Dimensioning of transformers), Wang Chong, Shanghai / China, Pages 28, 1950

1951

Adalbert Varduhn, Walter Nell, *Handbuch der Elektrotechnik, Band 1, Grundlagen der Elektrotechnik, Elektrische Maschinen, Transformatoren, Stromrichter, Kondensatoren, Akkumulatoren* (Manual of electrical engineering, Volume 1, Basics of electrical engineering, electrical machines, transformers, converters,

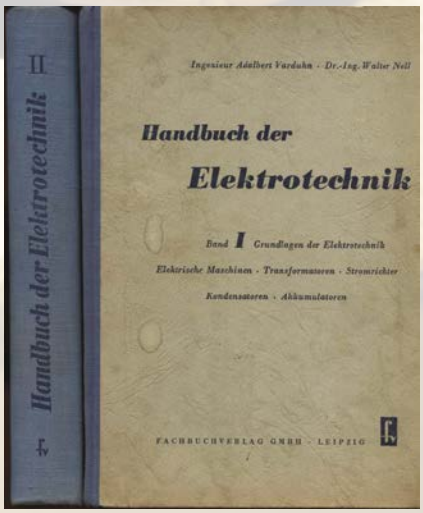

Figure 3. Handbuch der Elektrotechnik, Adalbert Varduhn and Walter Nell

capacitors, accumulators), Fachbuchverlag, Leipzig, Pages 333, 1951 [49]

Bibliography

[26] https://www.booklooker.de/B%C3%BCcher/Angebote/autor=Kotschi+Franz, current on 7 May, 2020

[27] https://www.booklooker.de/B%C3%BCcher/Angebote/titel=Der+Transformator+bei+tiefen+Temperaturen+Arbeit+zur+Erlangung+der+W%C3%BCrde+eines, current on 7 May, 2020

[28] https://www.worldcat.org/search?q=au%3ARaskop%2C+Fritz.&qt=hot_author, current on 7 May, 2020

[29] https://www.zvab.com/servlet/BookDetailsPL?bi=30385315695&searchurl=an%3Draskop%26hl%3Don%26sortby%3D20%26tn%3Dkatechismus%2Bfuer%2Bdie%2Bankerwickelei&cm_sp=snippet-_-srp1-_-title3, current on 7 May, 2020

[30] https://www.booklooker.de/B%C3%BCcher/Angebote/autor=Heinrich+Keller, current on 7 May, 2020

[31] https://www.booklooker.de/B%C3%BCcher/Angebote/titel=Zur+Kenntnis+von+Transformatoren%C3%B6l+Dissertation, current on 7 May, 2020

[32] https://www.abebooks.de/servlet/SearchResults?an=wotruba%20rudolf&cm_sp=det-_-bdp-_-author, current on 7 May, 2020

[33] https://www.google.com.ua/search?hl=uk&tbo=p&tbm=bks&q=inauthor:%22Rudolf+Wotruba%22, current on 7 May, 2020

[34] https://www.google.com.ua/search?hl=uk&tbo=p&tbm=bks&q=inauthor:%22Adalbert+Stifter%22, current on 7 May, 2020

[35] https://www.zvab.com/servlet/SearchResults?an=roller%20ernst%20pricks%20helmut&cm_sp=det-_-bdp-_-author, current on 7 May, 2020

[36] https://www.springer.com/gp/book/9783662002520, current on 7 May, 2020

[37] https://www.zvab.com/177-Schaltbild-er-Transformatoren-Generatoren-Akkumulatoren-Umformen/5870512200/bd, current on 7 May, 2020

[38] https://www.zvab.com/servlet/BookDetailsPL?bi=19450779965&searchurl=hl%3Don%26sortby%3D20%26tn%3Dder%2Btransformator&cm_sp=snippet-_-srp1-_-title3, current on 7 May, 2020

[39] https://www.abebooks.de/servlet/SearchResults?an=paul%20werners&cm_sp=det-_-bdp-_-author, current on 7 May, 2020

[40] https://www.booklooker.de/B%C3%BCcher/Angebote/autor=F+J+Gemmert, current on 7 May, 2020

[41] https://www.booklooker.de/B%C3%BCcher/Angebote/titel=Transformator+Starkstrom+-+Schwachstrom, current on 7 May, 2020

[42] https://www.booklooker.de/B%C3%BCcher/FJ-Gemmert+Transformator-Starkstrom-Schwachstrom/id/A01pkv1D01ZZw, current on 7 May, 2020

[43] https://www.booklooker.de/B%C3%BCcher/Angebote/autor=Fritz+Raskop, current on 7 May, 2020

[44] https://www.booklooker.de/B%C3%BCcher/Angebote/autor=Herbert+Kunze, current on 7 May, 2020

[45] https://www.booklooker.de/B%C3%BCcher/Angebote/titel=Netz-+und+Kleintransformatoren, current on 7 May, 2020

[46] https://www.booklooker.de/B%C3%BCcher/Angebote/verlag=Deutscher+-Funk-Verlag, current on 7 May, 2020

[47] https://www.booklooker.de/B%C3%BCcher/Angebote/titel=Das+Elektromaschinenbauer-Handwerk+Instandsetzung+Neuwicklung+und+Umbau+elektrischer+Maschinen, current on 7 May, 2020

[48] https://www.booklooker.de/B%C3%BCcher/Angebote/verlag=Berlin+Technischer+Verlag+Herbert+Cram+2+Auflage+1948, current on 7 May, 2020

[49] https://www.abebooks.de/servlet/SearchResults?an=varduhn%20adalbert%20walter&cm_sp=det-_-bdp-_-author, current on 7 May, 2020

Authors

Vitaly Gurin graduated from Kharkov Polytechnic Institute (1962) and graduate school at the Leningrad Polytechnic Institute. Candidate of technical sciences in the Soviet scientific system (1970). For 30 years he tested transformers up to 1.150 kV at ZTZ, including the largest one of that time in Europe, and statistically analysed the test results. For over 25 years he was the Executive Director of Trafoservis Joint-Stock Company in Sofia (the diagnosis, repair and modernisation in the operating conditions of transformers 20 – 750 kV). He has authored about 150 publications in Russian and Bulgarian, and is the main co-author of GOST 21023.

P. Ramachandran started his career in transformer industry in 1966 at TELK, Kerala, a Hitachi Joint venture, in India. He worked with ABB India during 1999-2020. He has more than 50 years of experience in the design and engineering of power products including power transformers, bushings, and tap-changers. He received Bachelor of Science Degree in Electrical Engineering from the University of Kerala, India, and Master of Business Administration Degree from Cochin University, India. He is a Fellow of Institution of Engineers (India), and he represented India in CIGRE Study Committee A2 for transformers during 2002 – 2010.