भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
विद्युत प्रणाली अभियांत्रिकी एवं प्रौद्योगिकी विकास प्रभाग
Power System Engineering & Technology Development Division
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To,

As per Attached list

विषय : **Adoption of "Standard Technical Specifications of Transformer(s) for Solar Park pooling station" - Reg.**

महोदय,

Generally, electrical energy generated form the solar block is pooled at 33kV level and stepped up to 132kV/220kV/400 kV at the pooling station of solar power park developers and then connected to the Inter-State/Intra-State Transmission System. There are different practices among the solar park developers across the country regarding ratings, no. of LV windings, losses, % impedance, provision of OLTC & tertiary winding etc. of power transformers (400/33 kV, 220/33 kV & 132/33 kV) at the pooling stations. Hence, there was need for preparation of standard specification of transformer for solar park pooling station as they are most expensive & vital asset and play crucial role in reliable evacuation of power from solar power blocks.

CEA vide its letter no. CEA-PS-14-169/1/2020-PSETD Division dated 22.01.2021 had constituted a Standardization Committee under the Chairmanship of Chief Engineer (PSE&TD), CEA comprising members from transformer manufacturers, utilities, SECI and solar power park developers etc. for the preparation of Standard Technical Specifications of Transformer(s) for Solar Park pooling station considering importance of such transformer in present scenario when large scale integration of generation from renewable sources is taking place.

The Committee after detail discussions and deliberations on various aspects of the Transformer and on the basis of comments received from all stakeholders, have prepared the **"Standard Technical Specifications of Transformer(s) for Solar Park pooling station".**

A copy of the approved document is attached herewith (the document is also available at CEA website (www.cea.nic.in)) with a request to all stakeholders across the country for adoption of the document **in true spirit to achieve the ultimate goal of "One Nation One Specification"** which will be in the overall interest of the Power System.

Signature Not Verified

Digitally signed by YOGENDRA KUMAR SWARNKAR
Date: 2021.06.23 18:32:49 IST

भवदीय/ Regards,

(योगेन्द्र कुमार स्वर्णकार/ Y.K.Swarnkar)
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सत्यमेव जयते

Standard Technical Specifications of Power Transformers for Solar Park Pooling Station

भारत सरकार

Government of India

विद्युत मंत्रालय

Ministry of Power

केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

Standard Technical Specifications of Power Transformers for Solar Park Pooling Station

By

Power System Engineering & Technology Development

Central Electricity Authority

भारत सरकार

Government of India

विद्युत मंत्रालय

Ministry of Power

केन्द्रीय विद्युत प्राधिकरण

Central Electricity Authority

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New Delhi-110066, Dated:

MESSAGE

India has huge potential of generation from renewable energy sources and these resources, particularly solar, are going to play a major role in the electricity generation mix in future. At present, the installed capacity of renewable energy sources is about 90 GW, which is likely to reach 450 GW by 2030, with major contribution from solar.

Transformer is one of the vital assets at the pooling station and plays an important role, not only in terms of investment, but also in terms of reliability of the system. Standardization of such a vital component with emphasis on improved design, quality control during manufacturing, use of right components/accessories, ease of maintenance and safety during operation is need of hour. The document, prepared by CEA, on "*Standard Technical Specification of Power Transformers for Solar Park Pooling Station*" is an effort towards achieving this goal.

This document will, certainly, help in the proper design and standardization of specification of transformers in solar generation pooling stations, leading to quality & reliability, faster delivery and a uniform practice across the utilities in the Country.

I sincerely thank and congratulate all committee members, officers of CEA as well as experts from other contributing organizations for their excellent effort in bringing out this document, which would immensely help utilities, solar power developers and manufacturers. I hope this document would be used by all the concerned stakeholders to make the vision of 'One Nation, One Specification' a reality.

(Dinesh Chandra)

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Date : 22.06.2021

MESSAGE

India is contemplating to achieve the target set under National Solar Mission for achieving 100 GW grid connected solar plants by the year 2022. India also plans to achieve a target of about 450 GW of generation from Renewal non-fossil fuel-based energy resources by 2030, which would be about 53.3% of the total projected generation by 2030 as per report on optimal generation capacity mix for 2029-30 published by CEA in January 2020. Out of the total generation, the contribution of Solar generation is likely to be about 35.70 %. Many Solar Parks have been approved by the government and are under various stages of execution. Reliability and availability of power transformers in these solar parks play an important role in the smooth operation of a power system.

Earlier in April 2021 CEA has published "*Standard Specification and Technical Parameters for Transformers and Reactors (66 kV and voltage class)*" which has been widely welcomed and is being followed by utilities & manufacturers across the Country. On the similar lines, CEA in consultation with all stakeholders has standardize the specification and technical parameters for Power Transformers for Solar Power Park pooling Station.

This initiative would give a boost towards easy availability with reduced waiting time for the solar park transformer with standardized quality throughout the Nation. It would also help in reducing the cost of such transformers as the manufacturers could tap on the Economies of Scale after having standardized specifications. Further, the maintenance for the transformer would be easy and would directly reduce the down time. This would enable us in achieving our goal towards 100 GW of grid connected solar energy by the end of 2022. I thank members of the committee, officers of CEA and all contributing organizations for their sincere efforts to bring out the document on "*Standard Technical Specification of Power Transformers for Solar Park pooling Station*".

I am sure this document would be beneficial for all the utilities and manufacturers alike and its adoption in true spirit would enhance the pace in achievement of renewable energy targets set by the Country and would help in projecting India as a leader in solar energy.

(Goutam Roy)

S.K.Ray Mohapatra
Chief Engineer

Central Electricity Authority
Ministry of Power
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FOREWORD

Indian Power system has phenomenal growth with Installed generation Capacity (IC) of about 375GW and Peak demand of about 180-190GW. To cater to the load demand, the national grid has expanded over the years and has become one of the largest single synchronous Grid in the world. The renewable and clean energy resources is going to play a major role in the Generation mix for the future. At present, generation from RES is about 90GW (24% of Installed Capacity). Large scale integration of generation from Renewable Energy Sources (RES) is the trend of future. India has total exploitable potential of 1100 GW (750 GW from solar energy and 300 GW from wind energy) generation from renewable resources. By 2030, the generation from renewable resources is likely to increase by five times (around 450 GW), contributing about 54% of total installed generation capacity and major contribution would be from solar.

Generally, electrical energy generated form the solar block is pooled at 33 kV level and stepped up to 400 kV / 220 kV /132kV level at the pooling station of solar power park developers and then connected to the Inter State/Intra-State Transmission System. The requirement of these transformers is likely to increase in future considering the contribution from solar generation. There are different practices among the solar park developers across the country regarding ratings, no. of LV windings, losses, % impedance, provision of OLTC & tertiary winding etc. of power transformers (400/33 kV, 220/33 kV & 132/33 kV) at the pooling stations. Hence, there is need for preparation of standard specification of transformer for solar park pooling station as they are most expensive & vital asset and play crucial role in reliable evacuation of power from solar power blocks.

The standardization of ratings & technical parameters, fixation of losses eliminating the need for capitalization of losses, no. of LV winding, provision of tertiary and OLTC, use of RIP/RIS/OIP bushings and their ratings & dimensions, details of bushing current transformers, the similarity criteria with reference to Short Circuit testing of transformer, design review, improvement in basic Manufacturing & testing facility at manufacturer's works, MQP, standardization of foundation for interchangeability of different makes, roles & responsibilities of utility & manufacturer during the warranty period etc. are some of the important aspects, which affects the quality, reliability, efficiency and cost of such assets, have been addressed in the document with clarity.

A document titled “Standard Specifications and Technical Parameters for Transformers and Reactors(66 kV and above)” was released by CEA in April 2021. The document, apart from specifications of transformers and reactors, included chapters covering aspects related to ‘Transportation, Erection, Testing and Commissioning’ and ‘Condition Monitoring and Life Cycle Management’. These chapters should be referred for power transformers at solar park pooling station also.

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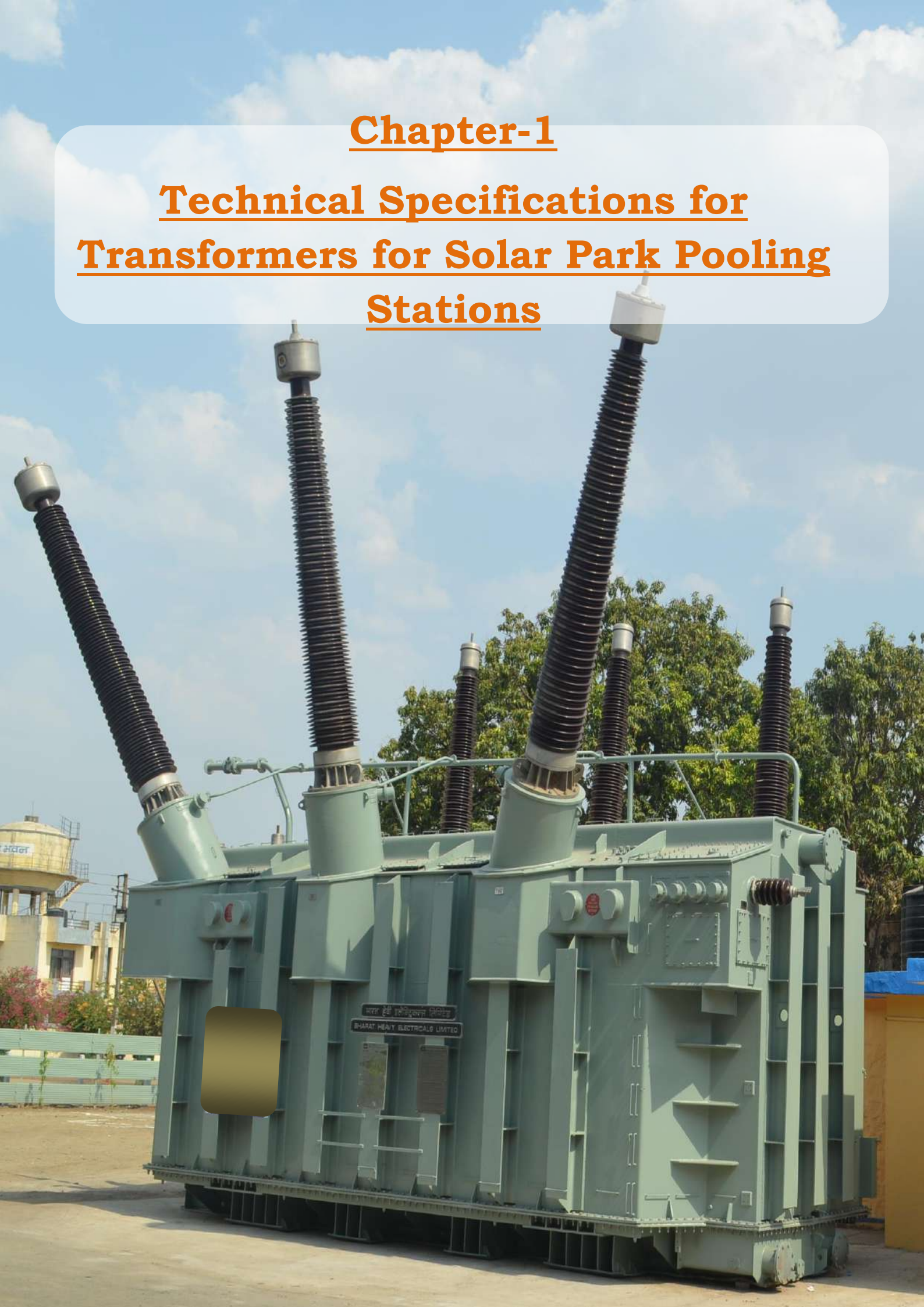
The process of standardisation would simplify the procurement process, bring faster delivery and would place all manufacturers at a level playing field. I am sure that this document would benefit all the utilities, solar park developers and manufacturers across the country and adoption of this standard specifications of Transformer in true spirit would bring uniform practice across the utilities in the country, facilitate interchangeability of transformers of different make and would achieve ultimate goal of quality, reliability & trouble free service of such vital assets in power delivery chain, which will be in overall interest of the Power System.

(S.K.Ray Mohapatra)

CONTENTS

Chapter-1

Technical Specifications for Transformers for Solar Park Pooling Stations



CHAPTER-1

TECHNICAL SPECIFICATIONS

1.0 GENERAL

1.1 This chapter covers specification for design, engineering, manufacture, testing, delivery at site including all materials, accessories, unloading, handling, proper storage at site, erection, testing and commissioning of the Power Transformer for solar park pooling station.

1.2 For transportation, erection, testing and commissioning and condition monitoring & life cycle management, the document "Standard Specifications and Technical Parameters for Transformers and Reactors (66 kV & above Voltage Class)" issued by CEA (available on CEA website: www.cea.nic.in) may be referred.

1.3 The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life.

1.4 Any material and equipment not specifically stated in this specification but which are necessary for satisfactory operation of the equipment shall be deemed to be included unless specifically excluded and shall be supplied without any extra cost.

1.5 Components having identical rating shall be interchangeable.

2.0 STANDARD RATINGS OF TRANSFORMER

Standard ratings of transformer for Solar Park pooling stations shall be as given below:

Sr. No.	MVA Rating	Line Voltage Rating	Phase	No. of Secondary windings
1.	315 MVA	400/33-33 kV	Three Phase	Two
2.	250 MVA	400/33-33 kV	Three Phase	Two