



TRAILBLAZING EQUIPMENT FOR PRECISION MEASUREMENT

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Abstract: This paper presents an in-depth examination of the evolution and challenges in developing precision measurement tools, with a focus on the pioneering contributions of Veer Electronics Pvt. Ltd. since its inception. It delves into the critical aspects of accuracy, precision, miniaturization, cost-effectiveness, and interoperability that define the current landscape of precision instrumentation.

By exploring Veer Electronics' innovative approach to overcoming these challenges, including their adoption of advanced calibration methodologies and integration of state-of-the-art sensor technologies, the paper highlights the company's significant role in transforming and advancing the field of precision measurement. This exploration not only sheds light on the complexities involved in the development of such tools but also underscores the impact of technological innovation in meeting the increasing demands for precision in science, industry, and technology.

Key Words – Testing Instrument's, Quality Equipment's, Precision Measurement, Sensor Technology, Transformer Testing, Digital Oil Breakdown Voltage Tester

I.INTRODUCTION

In the vast landscape of science, industry, and technology, precision measurement tools serve as indispensable aids for accurately understanding, monitoring, and controlling various processes. As technology marches forward, the demand for even greater precision in these tools continues to rise [1]-[5]. This is where Veer Electronics steps in. Renowned for their expertise in crafting exceptionally accurate measurement tools, this organization relies on ingenious designs and cutting-edge materials to meet this growing need.

This paper embarks on a journey to explore the intricacies of developing precision measurement tools and how they are addressing these challenges. In the forthcoming sections, we embark on a nuanced expedition into the multifaceted challenges inherent in precision measurement equipment, unravelling the complexities of accuracy, precision, miniaturization, cost constraints, and interoperability. Additionally, we will delve into the story of Veer Electronics, a company that emerged in 2008 and since then it became a trailblazer in the field of precision instrumentation.

Throughout its journey, Veer Electronics Pvt. Ltd. has garnered a reputation for groundbreaking advancements, revolutionizing the landscape of precision measurement through a series of landmark innovations. From pioneering calibration methodologies to integrating cutting-edge sensor technologies, it remains at the forefront of innovation, driving transformative change and shaping the future trajectory of precision measurement instrumentation.

II. DETAILED DESCRIPTION OF MEASURING EQUIPMENT'S

2.1 Pump Testing Panel

The Pump Testing Panel Fig.1, offers comprehensive functionality for assessing various types of pumps, including submersible, Monoblock, and centrifugal pumps. Its key features encompass a range of tests such as No-Load Test, Block Rotor Test, and Pump Performance Test, providing direct measurements of crucial parameters like voltage, current, power factor, frequency, and RPM. Compliance with multiple BIS standards ensures quality assurance and reliability [6]. The provision of changeover switches, push buttons for easy operation, and an emergency stop button enhances safety and usability. Additionally, features like adjustable output voltage, data storage capability, and interface options including USB and RS-232/RS-485, with free software, facilitate efficient testing and data analysis. Compared to other companies' products, this panel stands out with its extensive test coverage, high accuracy, and customizable current rating options. Its applications extend from pump manufacturing and repair shops to research and testing labs in engineering colleges, highlighting its versatility and suitability for various industries and educational institutions.

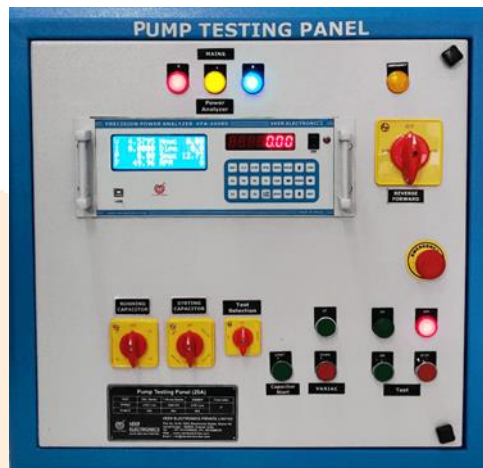


Figure 1: Pump Testing Pane (Courtesy: Veer Electronics)

2.2 Transformer Testing Panel

The Transformer Testing Panel as shown in Fig.2, boasts several key features, including its capability to test up to 3 MVA, with other ranges available upon request. It facilitates crucial tests such as No-Load Test (O.C.), Load Test (S.C.), DVDF Test, and HV Test, ensuring comprehensive evaluation. Its motorized control of output power and test mode selector switch enhance operational convenience, while features like overvoltage and overcurrent protection ensure safety. Additionally, the panel offers computer interfacing software for data analysis and an emergency stop switch to prevent accidents, thus meeting stringent safety standards [6], [14]. Comparatively, when compared with products from other companies, the inclusion of an inbuilt computer/monitor (optional) and a temperature scanner for temperature rise tests stand out, enhancing efficiency and accuracy. Its versatile applications across various transformer types, including distribution, control, isolation, solar, and wind transformers, highlight its adaptability. Furthermore, its ability to conduct various tests such as open circuit, short circuit, induced overvoltage, and high voltage withstand tests positions it as a comprehensive solution for transformer evaluation, meeting the needs of diverse industries and applications.



Figure 2: Transformer Testing Panel (Courtesy: Veer Electronics)

2.3 Motor Testing Panel

The motor testing panel Fig.3, boasts an extensive array of features tailored for comprehensive motor evaluation. Encompassing a wide spectrum of tests including No Load, Full Load, Block Rotor, Temperature



Rise, and more, it facilitates meticulous examination of both 3-Phase and 1-Phase motors. With precision measurement capabilities spanning voltage, current, power factors, torque, and efficiency, it adheres to industry standards such as IS:12615 and IS 15999, ensuring accuracy and reliability. Additionally, its versatility is enhanced by provisions like Change Over Switch for starters, Phase Change Over for motor rotation, and Excitation Unit for dynamometer control [6] - [8]. Comparatively, other companies' products may lack such a comprehensive feature set, potentially compromising testing thoroughness and efficiency. The inclusion of USB, RS-232/RS-485 interfaces, along with free demo software, facilitates seamless data management and analysis. With applications spanning motor manufacturing, repair shops, maintenance departments, and educational institutions, its utility extends to diverse industrial and academic settings, making it an indispensable asset for motor testing and research endeavors. Finally, allowances of 10 seconds and 5 seconds were given for the top-edge and bottom-edge operations respectively.

Figure 3: Motor Testing Panel (Courtesy: Veer Electronics)

2.4 Pre-Core Loss Testing Panel

The Pre-Core Loss Testing Bench Fig.4, offers comprehensive testing capabilities for transformer cores, particularly focusing on No Load Test (Open Circuit Test). With the capacity to test up to 1000 KVA transformer cores, this bench provides essential features such as mains indication, test ON/OFF indication, and motorized control of output power. Its hold feature allows freezing of all measurements for detailed analysis, while the inclusion of MCB protection ensures safety for both equipment and operators. Additionally, the availability of computer interfacing software enhances data collection and analysis efficiency [14], [17]. Comparatively, when evaluating similar products from other companies, factors such as testing range, control mechanisms, and safety features must be considered. While some may offer similar testing capacities, the inclusion of motorized control and computer interfacing software distinguishes this bench. Furthermore, the provision of MCB protection for all meters and instruments ensures comprehensive safety measures. The mobility feature, facilitated by panel mounting on wheels, enhances convenience in laboratory or field settings, adding another layer of practicality to this testing solution.



Figure 4: Pre-Core Loss Testing Panel (Courtesy: Veer Electronics)

2.5 Automatic Oil Breakdown Voltage Tester

The Automatic Oil Breakdown Voltage Tester is a cutting-edge device meticulously crafted to assess the breakdown voltage of dielectric liquids with precision Fig.5.



Figure 5: Automatic Oil Breakdown Voltage Tester (Courtesy: Veer Electronics)

Compliant with IS6792:2017/IEC 60156:1995 standards, it offers both user and standard modes for versatile operation. Boasting features such as a wide voltage range (60kV/80kV/100kV), ± 1 kV accuracy, automatic testing, LCD display, and HV chamber interlock for enhanced safety, it stands as a beacon of reliability [9]. Additionally, its magnetic stirrer, earth voltage monitoring, USB communication, and robust construction ensure seamless functionality in diverse settings. When compared to similar products in the market, its comprehensive feature set, including short circuit fuse protection, adjustable stirring/wait times, and extensive data storage capabilities (up to 500 tests), sets it apart as a leader in its category. The inclusion of optional ambient/oil temperature measurement further underscores its adaptability to varied testing environments. Ideal for assessing the breakdown voltage of insulating oils, this tester excels in accuracy, safety, and ease of use, making it an indispensable tool for professionals in the field.

2.6 Digital Oil Breakdown Voltage Tester

The Digital Oil Breakdown Voltage Tester Fig.6, available in models VOT-60E, VOT-80E, and VOT-100E, is a portable instrument crucial for maintaining electrical systems. It accurately measures the breakdown strength of insulating oil, ensuring operational safety. With features like the HV chamber interlock for operator safety and a high-glow seven-segment LED display for precise KV measurement, it's versatile for both field and laboratory use. Additionally, it comes with a 2.5 mm GO-NOGO gauge to set electrode gaps as per industry standards [14]. Comparatively, while Company X offers a similar product, its voltage range may be lower, affecting its suitability for certain applications. Meanwhile, Company Y's tester might lack the robust build and precision of the VOT series. However, the VOT series lacks warranty coverage for accessories, unlike some competitors. Nevertheless, its reliability, accuracy, and portability make it a standout choice for testing breakdown voltage in insulating oils, ensuring the integrity and safety of electrical systems across various industries.



Figure 6: Digital Oil Breakdown Voltage Tester (Courtesy: Veer Electronics)

2.7 CT Core Tester

The CT Core Tester VCCT Fig.7, is a portable instrument designed for assessing voltage and current characteristics of electrical steel, particularly Toroidal Cores. It enables efficient evaluation of Toroidal Cores' quality through voltage and current comparison, primarily benefiting Toroidal Core, Dimmer, and CT manufacturers. Its versatility extends to research and educational institutions, facilitating experimentation and comprehension of core material properties.

Compared to similar products, the VCCT offers a comprehensive range of specifications, including adaptable input voltages and multiple output voltage options for varied testing requirements. With an accuracy of 2% on Full Scale Deflection (FSD) and a tripping current range of 10A, it ensures precise measurements across diverse scenarios. Its compact yet stable design, reflects its reliability and durability [9].

In summary, the VCCT stands out as a comprehensive solution for Toroidal Core testing, offering versatility, precision, and portability. Its unique features make it a preferred choice for manufacturers, users, and educational institutions, contributing to improved quality control and deeper insights into core material properties.

2.8 AC High Voltage Tester

AC High Voltage Tester VHT is a specialized instrument designed to assess dielectric strength, ensuring proper insulation in electrical devices Fig.8. This testing is crucial for preventing power loss due to leakage current, which can lead to overheating and compromise device reliability and lifespan. With applications spanning various sectors including transformer, motor pump, and generator manufacturing, it also serves at electronics component testing and repair workshops, educational institutes, and research laboratories.

Comparing with competitors, VHT offers a wide range of output voltage options from 3KV to 100KV AC, ensuring flexibility for diverse testing needs. It boasts an accuracy of 2% on Full Scale Deflection (FSD) and allows flexibility in tripping current range selection. Despite its robust capabilities, it maintains energy efficiency and compactness, balancing portability and functionality [9].

In conclusion, AC High Voltage Tester VHT stands as a comprehensive solution for high voltage testing, offering precision, versatility, and reliability essential for ensuring the safety and performance of electrical equipment across various industries.



Figure 7: CT Core Voltage Tester (Courtesy: Veer Electronics)



Figure 8: AC High Voltage Tester (Courtesy: Veer Electronics)

2.9 Vacuum Interrupter Tester

The Vacuum Interrupter Tester Fig.9, is a vital tool for evaluating the integrity of vacuum interrupters in electrical systems. By applying Pulse DC Voltage, it assesses the interrupter's ability to prevent flashovers, providing clear pass or fail indications through an electronic buzzer and red/green LEDs. With applications ranging from substation testing to educational and research institutes, it ensures the reliability of critical electrical components while facilitating learning and experimentation [10].

Comparing with competitors, the VIT-30 model offers a voltage range of 3KV to 30KV with 3% accuracy, ensuring versatility and precision in testing. Its adaptable charging input options, operational duration of 36 hours, and rechargeable battery guarantee reliable performance in various settings. Despite a longer charging time, its compact size and lightweight design ensure portability without compromising functionality.

Overall, the Vacuum Interrupter Tester emerges as a dependable solution, offering precision, durability, and user-friendly features suitable for industrial and educational applications alike.



Figure 9: Vacuum Interrupter Tester
(Courtesy: Veer Electronics)



Figure 10: Holiday Detector (Courtesy: Veer Electronics)

2.10 Holiday Detector

The Holiday Detector Fig.10, a versatile tool designed to detect pinholes and defects in anticorrosive coatings on metallic surfaces. By applying high tension to an electrode moved over the coating, it triggers a spark upon detecting any imperfections. Simultaneously, an electronic buzzer emits audio signals, while a fault LED provides visual confirmation of faults. This device finds extensive application in testing various insulative coatings like coal tar, paint, polyurethane, asphalt, PVC, glass, and resin coatings, ensuring the integrity of protective layers against corrosion [6].

Comparing with competitors' products, this Holiday Detector offers a range of models (VHD-05D to VHD-30D) with varying voltage ranges and coating thickness capabilities, catering to diverse requirements. Despite a longer charging time of about 15 hours, it delivers a commendable operational duration of 24 hours post full charging. Compact in size and lightweight, it facilitates easy handling and portability.

In essence, Holiday Detector stands as a comprehensive solution for detecting coating imperfections, offering versatility, precision, and reliability suitable for various industrial applications.

2.11 Single Sheet Tester

The Single Sheet Tester Fig.11, SST-500 is a standalone instrument designed for measuring AC magnetic properties of electrical steel, adhering to IEC 60404-3 Standard. It employs the widely accepted SST sensor testing method to accurately assess crucial magnetic parameters such as Watt/kg, VA/kg, Magnetizing Force, Permeability, and Form Factor across different induction levels. The instrument comes with software for generating test reports and graphs, and can analyses Hysteresis Curves (B/H). It finds applications in various sectors including electrical steel and transformer lamination suppliers, transformer manufacturers, and research/educational institutions [11].

Compared to competitors, the SST-500 offers a sine wave generator covering a frequency range of 30Hz to 70Hz, with a sourcing current capacity of 3 Amp Peak or 2 Amp RMS. It features safety measures like auto protection against source overload and mains power protection through fuses. Operating within a temperature range of 10°C to 50°C and humidity levels below 75%, it remains consistent in varied environments. Compact and portable, it consumes 85 VA power.

In summary, the SST-500 is a versatile, accurate, and reliable solution for AC magnetic property measurement, meeting industry standards and contributing to enhanced quality control and research



Figure 11: Single Sheet Tester (Courtesy: Veer Electronics)

capabilities.

2.12 Core Loss Tester

The Core Loss Tester Fig.12, VCL is a crucial tool in the electrical industry, ensuring the quality of cores used in various equipment through AC magnetic property measurement. It assesses watt loss and magnetizing force across different flux densities, supported by user-friendly software for report generation and analysis. Particularly useful for materials like CRGO, CRNO, and CRCA, it serves industries including motor, pump, alternator, and generator manufacturing, as well as research and educational institutions [12], [13]. Compared to other products, the VCL series offers multiple models with varying voltage and current ranges, ensuring accuracy and versatility.

In summary, the Core Loss Tester VCL provides a comprehensive solution for core testing, with user-friendly features and versatility suited for diverse industrial applications, instilling confidence in its accuracy and reliability.



Figure 12: Core Loss Tester (Courtesy: Veer Electronics)

2.13 Digital Epstein Tester

The Digital Epstein Tester Fig.13, VET-1608A is a standalone instrument adhering to international standards for measuring AC magnetic properties of electrical steel. Using the Epstein Frame testing method, it accurately assesses critical magnetic parameters across different induction levels. This tester serves various industries, ensuring the quality of materials like CRGO, CRNO, CRNGO, and CRCA used in transformer laminations and motor stamping.

Compared to competitors, its two variants (500g and 1000g) offer flexibility in testing requirements, featuring a sine wave generator covering a frequency range of 30Hz to 70Hz and robust source current capacities. Both variants boast peak magnetizing forces suitable for precise measurements across different materials and thicknesses. Safety features include auto protection mechanisms against overload and overvoltage. Operating on standard power supply voltages, they are compatible with various electrical systems and designed for reliability in different environmental conditions.

In summary, the Digital Epstein Tester VET-1608A provides a comprehensive solution for ensuring the quality of electrical steel, offering precision, versatility, and reliability crucial for industry standards and quality



assurance.

Figure 13: Digital Epstein Tester (Courtesy: Veer Electronics)

2.14 Digital Iron Loss Tester

The Digital Iron Loss Tester VDW-2065A as revealed in Fig.14, its practical applications extend across various industries. In transformer lamination manufacturing, the tester's capability to directly assess final products like stamping and laminations streamlines quality control, ensuring only materials with optimal watt loss characteristics are used. Similarly, in motor stamping manufacturing, it aids in selecting suitable materials for efficient motor operation, contributing to energy savings and performance optimization. Moreover, its compatibility with educational institutions allows students and researchers in electrical or metallurgical departments to conduct experiments and gain hands-on experience in material testing and analysis, fostering learning and innovation.

This practical application facilitates quality assurance, performance optimization, and educational advancement in various sectors, making the Digital Iron Loss Tester VDW-2065A a versatile and indispensable tool. By providing efficient, accurate, and user-friendly testing capabilities, it plays a pivotal role in ensuring the quality and efficiency of electrical steel components used in critical applications across industries, ultimately contributing to enhanced product performance, energy efficiency, and educational outcomes.



Figure 14: Digital Iron Loss Tester (Courtesy: Veer Electronics)



Figure 15: Power Analyzer (Courtesy: Veer Electronics)

2.15 Power Analyzer

The Power Analyzer Fig.15, is the result of extensive research and development, offering unmatched accuracy and reliability for testing single-phase electrical machines. With its high sampling rate and simultaneous parameter measurement, it ensures precise results without the need for internal adjustments, maintaining accuracy over time. It finds applications in a wide range of domestic appliances and serves as a crucial tool for calibrating various measurement devices. Featuring TRMS voltage and current measurements, along with precise accuracy and resolution, it operates efficiently within specified temperature and humidity ranges [15], [16]. With compact dimensions and a 12-month warranty against manufacturing defects, the Power Analyzer is a standout choice among similar products, thanks to its robust design, comprehensive functionality, and long-term precision, ensuring user satisfaction across diverse applications.

III. SUMMARY

This paper navigates through the expansive realm of precision measurement tools, illuminating their pivotal role across science, industry, and technology. As the pursuit of greater precision evolves with advancing technology, Veer Electronics emerges as a beacon of expertise, crafting remarkably accurate measurement instruments with innovative designs and cutting-edge materials.

Here, we embark on a nuanced exploration of the intricate challenges inherent in precision measurement equipment, unravelling the complexities of accuracy, precision, miniaturization, cost considerations, and interoperability. Alongside, the narrative unfolds the journey of Veer Electronics Pvt. Ltd. a dynamic entity that has reshaped the landscape of precision instrumentation since its inception in 2008.

Veer Electronics' repertoire spans a diverse range of instruments, from transformer testing panels to AC high voltage testers, each a testament to their commitment to groundbreaking innovation. With a legacy of pioneering advancements and transformative solutions, it continues to shape the trajectory of precision measurement instrumentation, driving progress and innovation in the field.

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