Maximizing Uptime, Minimizing Cost: **Fluke Tools for Data Centers**

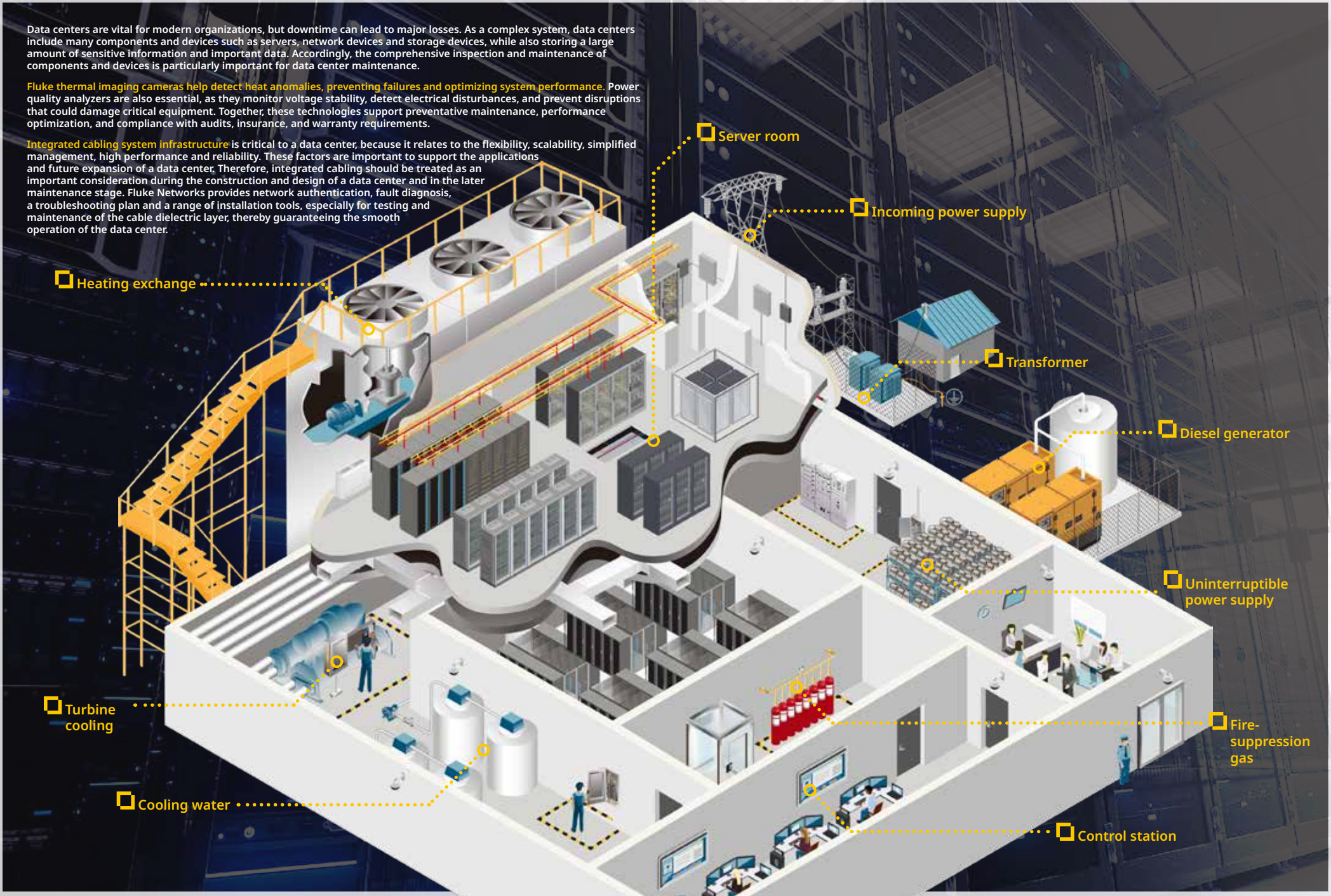
Fluke Tools That Keep Data Centers Running

FLUKE®

Data centers are vital for modern organizations, but downtime can lead to major losses. As a complex system, data centers include many components and devices such as servers, network devices and storage devices, while also storing a large amount of sensitive information and important data. Accordingly, the comprehensive inspection and maintenance of components and devices is particularly important for data center maintenance.

Fluke thermal imaging cameras help detect heat anomalies, preventing failures and optimizing system performance. Power quality analyzers are also essential, as they monitor voltage stability, detect electrical disturbances, and prevent disruptions that could damage critical equipment. Together, these technologies support preventative maintenance, performance optimization, and compliance with audits, insurance, and warranty requirements.

Integrated cabling system infrastructure is critical to a data center, because it relates to the flexibility, scalability, simplified management, high performance and reliability. These factors are important to support the applications and future expansion of a data center. Therefore, integrated cabling should be treated as an important consideration during the construction and design of a data center and in the later maintenance stage. Fluke Networks provides network authentication, fault diagnosis, a troubleshooting plan and a range of installation tools, especially for testing and maintenance of the cable dielectric layer, thereby guaranteeing the smooth operation of the data center.



Data center temperature measurement

Heating, ventilation and air conditioning (HVAC)

- Pipe leakage
- Air supply/return adjusting device
- Air balance/laminar flow
- Liquid flow in pipe
- Blower/motor
- Roof
- Cabinet ventilation effect

Electrical

- Transformers core and windings
- Backup generators
- Circuit breakers and switchgear
- Busbars
- Overheated batteries
- Loose connections on PDUs

Mechanical

- Hydraulic components
- Gear
- Shaft alignment condition
- Bearing
- Motor temperature rising above environment temperature

Fluke Ti401-PRO and Ti480-PRO Infrared Thermal Camera

- Multi-point focus and laser auto focus quickly detect hot spots or abnormal temperatures in electrical and battery systems, enabling fast issue identification
- Scan remotely to assess equipment temperature safely and efficiently, reducing inspection time and improving workflow
- Advanced sensor and optical system deliver sharp, high-quality heat maps for enhanced image clarity
- UltraFocus technology with image algorithm and laser distance autofocus ensures clear imaging

Fluke iSee Mobile Thermal Camera TC01A/TC01B

- Compact and portable, 256 X 192 pixels, detailed ima quality
- -20°C to 550°C, covers a wide range of applications
- Real-time temperature alarm for prompt response to abnormal conditions

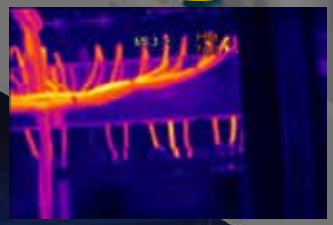
Fluke TiS75+ Handheld Infrared Thermal Camera

- Up to 384 x 288 pixels, 3.5 inch touch screen
- -20°C to 550°C, wider range, more possibilities
- Smart archiving and management of equipment heat maps, easy generation of temperature tendency charts

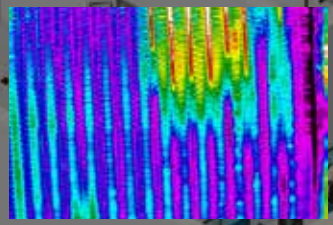
Fluke CV Series of Infrared Window

- Quick installation: Quick and easy installation in 5 minutes without removing the panel door
- Compliance with electrical safety requirements: panel arc test ratings up to 63kA, KEMA certified, etc
- The ClirVu® coating system eliminates moisture degradation and helps to repel airborne dust and grime, keeping both sides of the window clean
- With AutoGround™ technology, windows can be automatically grounded during installation to ensure safety and compliance
- IP67 rated for many years of maintenance-free operation

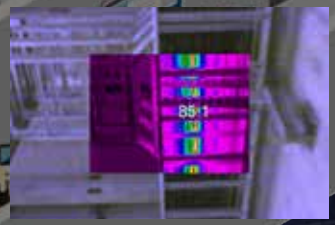
Joint overheated



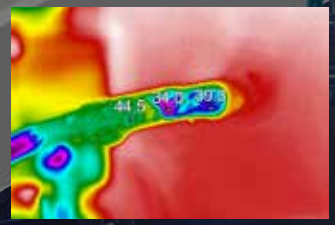
Electrical circuit overloaded



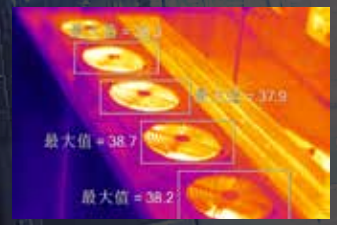
Air conditioning evaporator



Circuit overloaded



HVAC compressor inspection



Air conditioning unit fan

FLUKE®

Dynamic Environment Monitoring

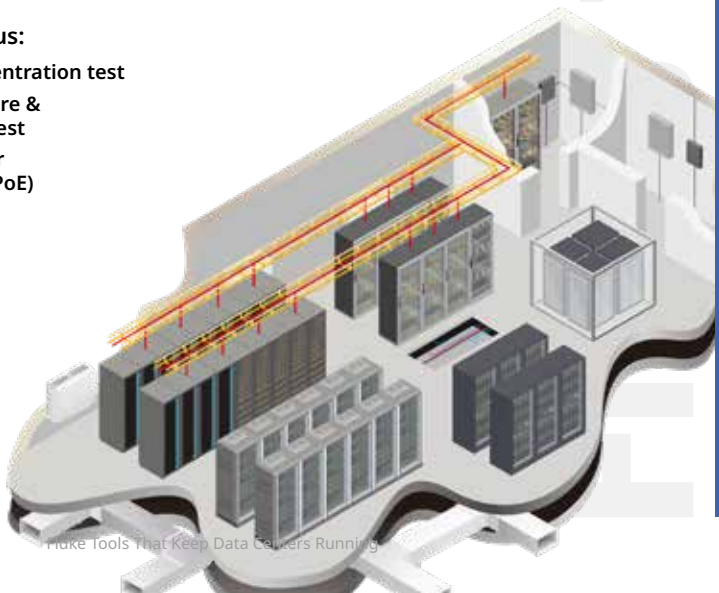
Application Points Technical Analysis

Ensuring that the physical environment of a data center is always kept in optimal condition through dynamic environment monitoring, thereby guaranteeing the stability of devices and prolonging their lifespan. A range of environment sensors are typically arranged in a data center, including temperature, humidity and smoke detectors and water intrusion detectors that collect data in real time and conduct analysis and reporting through the Data center Infrastructure Management (DCIM) system.

Devices monitoring temperature, humidity, security and other key parameters are networked together and powered over Ethernet (PoE). Troubleshooting problems with these devices can be difficult, as problems may lie in the cabling, the PoE systems, the network or the device itself. Tools that can quickly isolate the problem can save time, avoid contractor calls, and get these critical monitoring devices back on line quickly.

Test Focus:

- **Dust concentration test**
- **Temperature & humidity test**
- **Power over Ethernet (PoE)**



Dynamic Environment Monitoring

Recommended Products

Fluke 985 Particle Counter

- Detect the concentration of particulate matter in indoor air quality, so as to better explore the cleanliness of indoor environment
- Six channels and particle of 0.3 - 10.0 µm: ISO Class 5–9 certificated
- Store up to 10,000 records, and quickly obtain history records
- Ultra-lightweight design: easy single-hand operation in tight or awkward spaces

LinkIQ™ Duo Cable+Network+Wi-Fi Tester

- Validate cable performance, and identify common faults
- Detect POE class and power
- Network connectivity test: switch configuration information and Ping test
- Wi-Fi analysis to Wi-Fi 6E: networks, channels, and access points

Fluke test tools

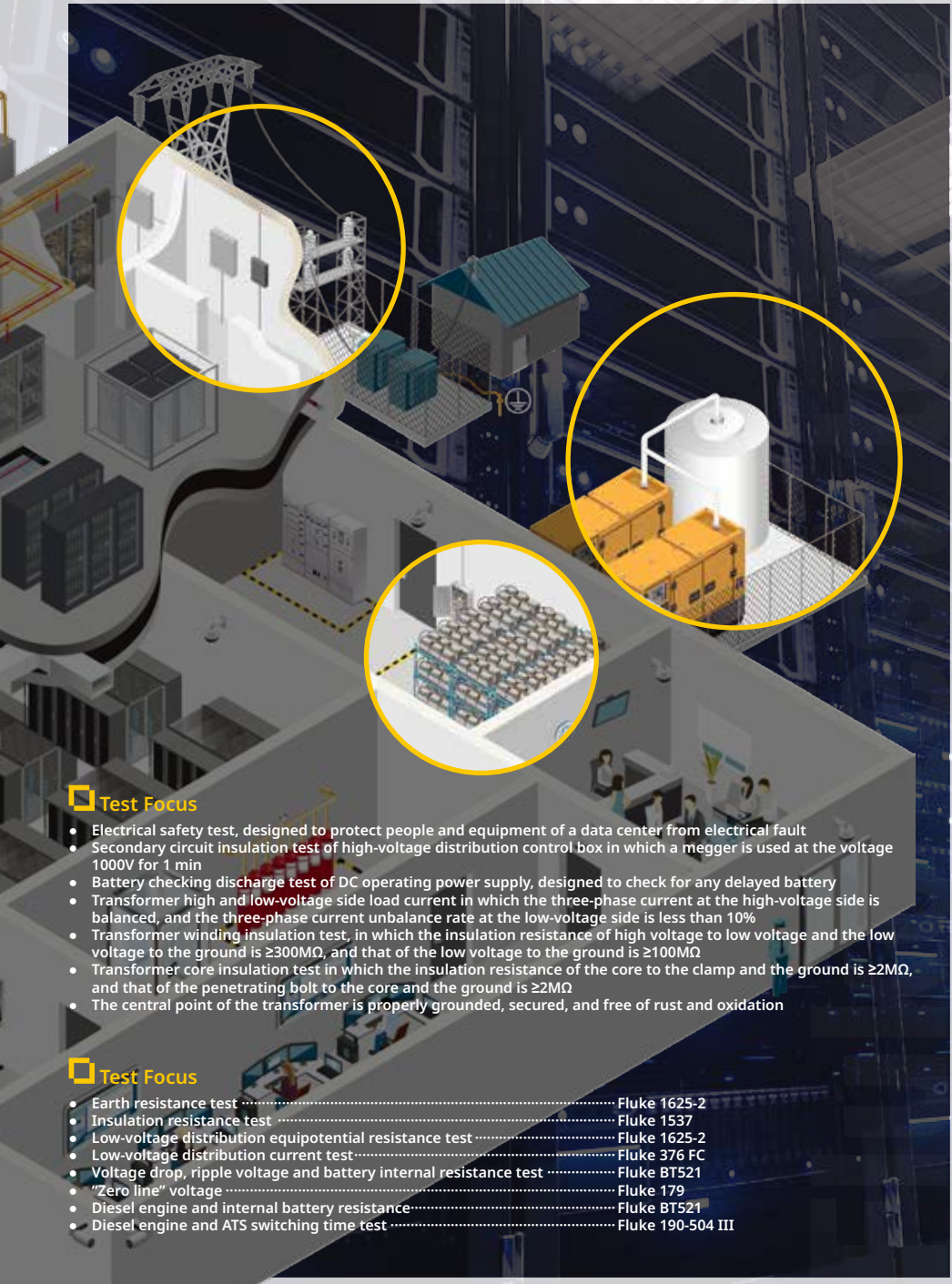
Dynamic Environment Monitoring

Recommended Products

Fluke 971 Temperature Humidity Meter

- Backlit dual display shows temperature and humidity with quick-response sensor
- Stores 99 data sets for review; compact and lightweight for easy field use
- Measures dew point and wet bulb temperatures for comprehensive diagnostics
- Ergonomic design with belt clip and protective holster for durability on the job

Fluke test tools



Test Focus

- Electrical safety test, designed to protect people and equipment of a data center from electrical fault
- Secondary circuit insulation test of high-voltage distribution control box in which a megger is used at the voltage 1000V for 1 min
- Battery checking discharge test of DC operating power supply, designed to check for any delayed battery
- Transformer high and low-voltage side load current in which the three-phase current at the high-voltage side is balanced, and the three-phase current unbalance rate at the low-voltage side is less than 10%
- Transformer winding insulation test, in which the insulation resistance of high voltage to low voltage and the low voltage to the ground is ≥300MΩ, and that of the low voltage to the ground is ≥100MΩ
- Transformer core insulation test in which the insulation resistance of the core to the clamp and the ground is ≥2MΩ, and that of the penetrating bolt to the core and the ground is ≥2MΩ
- The central point of the transformer is properly grounded, secured, and free of rust and oxidation

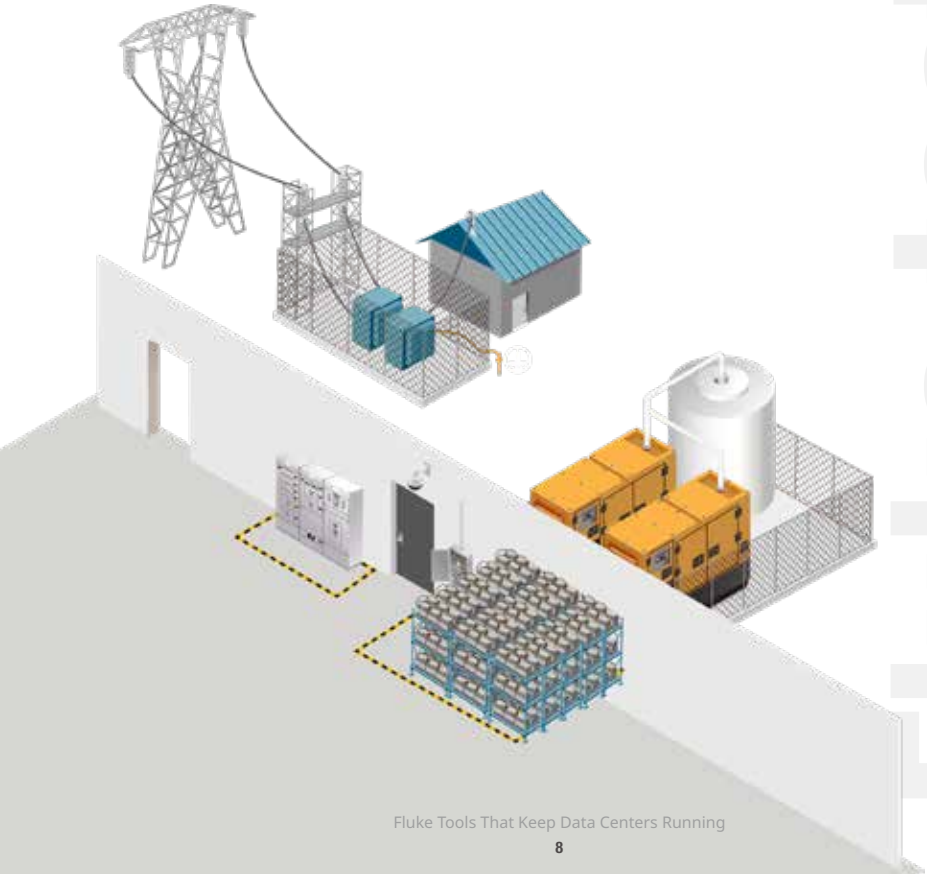
Test Focus

- Earth resistance test ····· Fluke 1625-2
- Insulation resistance test ····· Fluke 1537
- Low-voltage distribution equipotential resistance test ····· Fluke 1625-2
- Low-voltage distribution current test ····· Fluke 376 FC
- Voltage drop, ripple voltage and battery internal resistance test ····· Fluke BT521
- "Zero line" voltage ····· Fluke 179
- Diesel engine and internal battery resistance ····· Fluke BT521
- Diesel engine and ATS switching time test ····· Fluke 190-504 III

Power Supply and Distribution System

Application Points Technical Analysis

The power supply and distribution system ensures the safety, reliability and easy maintenance of a data center. It consists of incoming power supply, generator, uninterruptible power supply, battery pack, power distribution unit and other important components.



Fluke test tools

Power Supply and Distribution System

Application Points
Technical Analysis

Electrical System Temperature Measurement

Temperature monitoring is crucial for the power supply and distribution system of a data center. It can help discover potential problems, such as electrical fault or overload, and overheated cable, wiring and elements, allowing measures to be taken in advance to reduce fire risk. In addition, it can optimize the system operation, avoid excessive load and energy waste, and improve system efficiency.

For the electrical equipment that cannot be opened or detected directly (especially middle and high-voltage electrical cabinet and switchgear, etc.), the infrared thermal camera can only detect the surface of the observation window but not the heat emission conditions inside. To solve this problem, the most efficient way is to install an infrared window, which not only ensures personal safety during electrical equipment detection, but also completes the temperature measurement quickly and effectively. Currently, the technique is widely applied to the power supply bureau, power generation, metallurgy, petrochemical, rail transit and other fields.

Power Supply and Distribution System

Recommended Products

- Fluke Ti401-PRO Infrared Thermal Camera
- Fluke iSee Mobile Thermal Camera TC01A/TC01B
- Fluke TiS75+ Handheld Infrared Thermal Camera
- Fluke CV Series of Infrared Window

Fluke test tools

Power Supply and Distribution System

Application Points Technical Analysis

Power Quality Test

Because data center equipment requires uninterrupted power, machine rooms rely heavily on UPS systems and switch-mode power supplies, resulting in significant energy consumption. The input of these devices is three-phase rectification, which produces plenty of harmonics. The switch power and UPS equipment rectify AC into DC, and then convert to corresponding DC and AC through secondary conversion. During the period, a switch is used to control the on/off of the transformer primary current, which produces harmonics during rectification, and reflects the harmonics of high frequency to the power supply when the switch is turned off. In addition, in the power consumption environment of the machine room, the refrigeration air conditioning, water cooling pumps and fans for ensuring the constant temperature and humidity are also the sources to produce harmonics.

The loads of a data center may vary with actual demand, thus the harmonic test is recommended once a month. The harmonics may be suppressed by using active or passive filters, etc.

Energy Consumption Test

The power usage effectiveness (PUE) of a data center is an important index to measure its energy efficiency of which represents the ratio of the total energy consumption to the IT device energy consumption. The lower the PUE, the higher the energy efficiency.

The PUE of a data center can be evaluated by monitoring the parameters related to power quality, such as voltage fluctuation, current fluctuation, harmonics, voltage sag, voltage surge, etc., so that appropriate measures can be taken for adjustment and optimization.

Power Supply and Distribution System

Recommended Products

Fluke 1777 Power Quality Analyzer

- Three-phase power quality analyzer
- Class A compliant (IEC 61000-4-30)
- Detects harmonics up to the 100th order
- Captures 500+ power quality parameters continuously
- Quick, user-friendly setup and operation
- Portable, rugged design for tough environments
- Powered directly from measurement circuit—no outlet needed
- Includes software for easy analysis and reporting

Fluke test tools

Power Supply and Distribution System

Application Points Technical Analysis

Uninterruptible Power Supply Switching Test

The battery capacity of the backup power supply in a data center is very important, which directly affects the uptime of the backup power system. The battery resistance is one of the important parameters to measure the backup power supply.

The UPS is required to be switched in 4ms, and longer switching time may cause the equipment to break down. The Fluke 190 Series III provides 2.5Gs/s sampling rate, i.e. nanosecond resolution, which can identify and log clearly the microsecond switching time of the UPS.

Fluke test tools

Power Supply and Distribution System

Recommended Products

Fluke 190-II Oscilloscope

- Four independent floating isolated inputs up to 100 V; up to 5GS/s real-time sampling
- 10,000 points per trace waveform capture (scope mode)
- TrendPlot™ Paperless Recorder mode with deep memory for long-term automatic measurements
- CATIII 1000V/CATIV 600V safety rating

Fluke test tools

Power Supply and Distribution System

Application Points Technical Analysis

Internal Resistance Test of Backup Power Supply

Periodic inspection and maintenance for the battery can be carried out by testing its internal resistance using the checking discharge method according to actual situations. It is recommended to test the battery voltage and internal resistance on a quarterly basis with reference to IEEE1188.

Fluke test tools

Power Supply and Distribution System

Recommended Products

Fluke BT521 Internal Battery Resistance Tester

- Measure the internal battery resistance, DC and AC voltage, DC and AC current, ripple voltage, frequency and temperature
- Sequence measurement mode: Automatic or manual sequence testing of battery strings with automatic measurement storage
- CATIII 600V, 1000V DC max. rated for safe measurements all around the battery power supply equipment

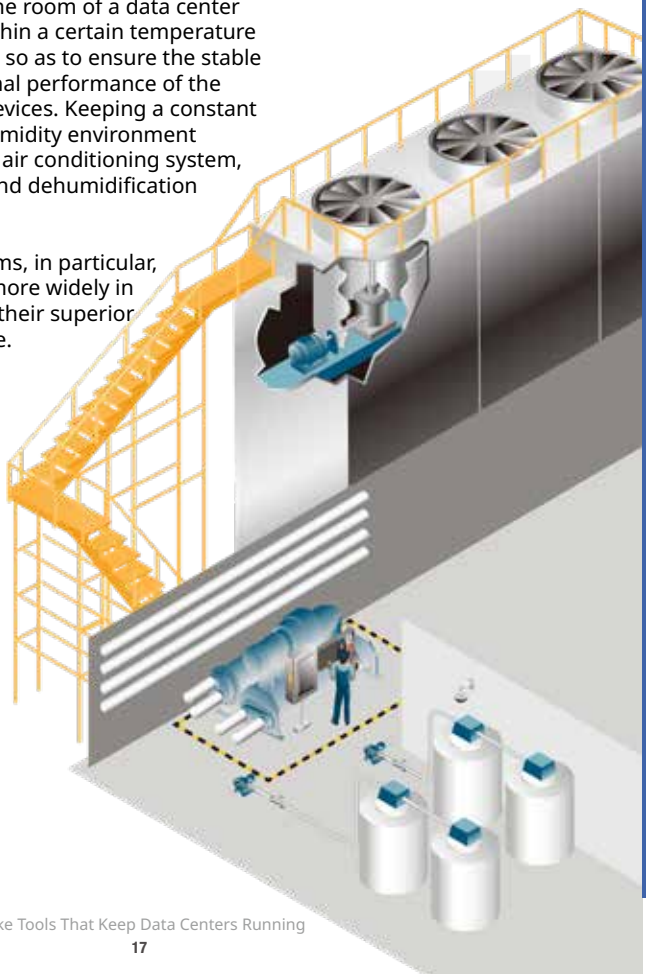
Fluke test tools

Cooling and Refrigeration System

Application Points Technical Analysis

Typically, the machine room of a data center needs to be kept within a certain temperature and humidity range, so as to ensure the stable operation and optimal performance of the servers and other devices. Keeping a constant temperature and humidity environment relies on a precision air conditioning system, refrigeration cycle and dehumidification system.

Water cooling systems, in particular, are being adopted more widely in data centers due to their superior cooling performance.



Cooling and Refrigeration System

Application Points
Technical Analysis

Temperature Monitoring of Cooling and Refrigeration System

It needs to measure the temperature of the cooling and refrigeration system to ensure that the equipment runs within an appropriate temperature range, and to prevent equipment faults that may be caused by overheating or overcooling of the system. Temperature measurement may find abnormal temperatures in time, monitor the temperature, help optimize the energy usage, and ensure that the system runs at the optimal efficiency.

Cooling and Refrigeration System

Recommended Products

- Fluke Ti401-PRO Infrared Thermal Camera
- Fluke iSee Mobile Thermal Camera TC01A/TC01B
- Fluke TiS75+ Handheld Infrared Thermal Camera
- Fluke CV Series of Infrared Window

Fluke test tools

Cooling and Refrigeration System

Application Points
Technical Analysis

Test Focus

The cooling and refrigeration system is composed of many mechanical rotating devices. To ensure the healthy operation of these core devices, a vibration testing instrument is recommended to evaluate the health of the rotating device, while paying attention to the pressure check and process control in the system.

Fluke test tools

Cooling and Refrigeration System

Recommended Products

Fluke MDA-550 Variable Frequency Drive Analyzer

- Test the special feature of the frequency converter, and quickly test the input and output quality of the frequency converter
- Detect the DC bus of frequency converter, and understand the ripple size and rectifier state
- Test the reflected voltage at the variable frequency motor to ensure the safe turn-to-turn insulation and identify the root cause of the problem

Fluke test tools

Cooling and Refrigeration System

Recommended Products

Fluke 810 Vibration Tester

- On-board identification and location of bearings, misalignment, unbalance, looseness
- Four vibration level allows you to quickly assess overall machine health and determine the maintenance priority
- Use the laser tachometer to accurately measure the operating speed of the machine, and improve the diagnosis accuracy
- Reduce the measurement time by 2/3 by using a triaxial accelerometer compared with the traditional uniaxial accelerometer
- Provide diagnosis reports and spectral diagrams, and narrow down the root cause of failures

Fluke test tools

Cooling and Refridgeration System

Recommended Products

Fluke 754 Multifunction Process Calibrator

- Detect if the temperature and pressure of chilled water, cooling water and cold media is normal
- More intelligent and convenient full-featured process calibrator, easier to use in harsh environment
- Meeting the professional needs of pressure calibration, and test, control and calibrate the HART instrument
- Measurable voltage, current (mA), RTDs, thermocouples, frequency and resistance
- Output/analog voltage, current (mA), thermocouples, RTDs, frequency, resistance, and pressure to calibrate transmitters
- Create and run automated pre-calibration/ post-calibration procedures to meet the quality plan or regulation. Document and archive the results.

Fluke test tools

Cooling and Refridgeration System

Recommended Products

Fluke 773 High-Precision Milliamp Process Clamp Meter

- Quickly detect the loop signal on/off of the connection cabinet
- Deliver 0.2% accuracy, 0.01mA resolution and sensitivity
- Measure 4 to 20mA signals without breaking the loop
- Measure the mA signal of PLC and control system analog I/O
- Power supply of 24V loop; measure the loop mA signal and verify the 24V power supply or the voltage I/O signal for the DC
- Output 4 to 20mA signal source to test the control system I/O or I/P, and automatically change 4 to 20mA output to
- Enable the remote test

Fluke test tools

Grounding System

Application Points Technical Analysis

The grounding system is an active system to protect the personnel and equipment. Appropriate grounding is essential for effective network performance. It creates a low-impedance grounding path for the surge, transient voltage, lightning strike, fault current, and circuit switch (motor on/off). An effective grounding system can minimize the adverse effects of these surges.

The metal components of data center infrastructure (such as devices, racks, ladders, chassis, cable bridges, etc.) must be bonded to the grounding system.

Earth resistance test

The grounding structure of the whole building: grounding electrodes are led from the grounding grid; the grounding electrodes are connected to the grounding busbar; and the devices are connected to the grounding busbar by grounding. Therefore, this test should include: grounding grid resistance; resistance from the equipment ground point to the busbar; and contact resistance between ground points/poles.

The grounding loop impedance is tested by the non-auxiliary electrode method, sometimes called double the clamp method. Check the grounding circuit for virtual grounding or poor contact of joints. Measure the earth resistance of the main ground electrode by building ground piles.

Grounding System

Recommended Products

Fluke 1625-2 KIT GEO Earth Ground Tester Kit

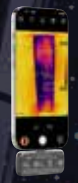
- Feature the AFC (Automatic Frequency Control) to shield the stray current in the ground grid
- Use the AC-DC bipolar method to measure the equipotential resistance between the grounding busbar and the main ground electrode of the equipment
- Test the 3-pole and 4-pole fall-of-potential earth resistance loop
- Measure and calculate earth impedance at 55 Hz to better represent the conditions experienced during an actual fault

Fluke test tools

Electrical Equipment Temperature Measurement

Fluke Ti401 PRO Infrared Thermal Camera

Locate heat anomalies that indicate potential issues so they can be fixed before serious failures occur



Fluke iSee Mobile Thermal Camera TC01A/TC01B

Compact and portable, 256 X 192 pixels, detailed image quality

Fluke TiS75+ Handheld Infrared Thermal Camera

Up to 384 x 288 pixels, -20 °C to 550 °C, more possibility

Dynamic Environment Monitoring

Fluke 985 Particle Counter

Measure environmental cleanliness

Fluke 971 Temperature Humidity Meter

Easily log/read temperature and humidity data

LinkIQ™ Duo Cable+ Network+Wi-Fi Tester

Test the Power over Ethernet (PoE) class and power and understand the Wi-Fi environment

Cooling and Refrigeration System

Fluke MDA-550 Variable Frequency Drive Analyzer

Test the input and output quality of the frequency converter

Fluke 810 Vibration Tester

Assess overall machine health

Fluke 754 Multifunction Process Calibrator

Detect if the temperature and pressure of chilled water, cooling water and cold media is normal

Fluke 773 High-precision Milliamp Process Clamp Meter

Quickly detect the loop signal on/off of the connection cabinet

Grounding System

Fluke 1625-2 KIT GEO Earth Ground Tester

Earth resistance test

Power Supply and Distribution System

Fluke 1777 Power Quality Analyzer

Measure and optimize PUE by detecting and resolving power quality issues

Fluke 190-III Oscilloscope

Uninterruptible power supply switching test

Fluke BT521 Battery Analyzer

Internal resistance, voltage drop, ripple voltage, and backup power performance

Fluke 1537 Insulation Tester

Insulation resistance test

Fluke 1625-2 GEO Earth Ground Tester

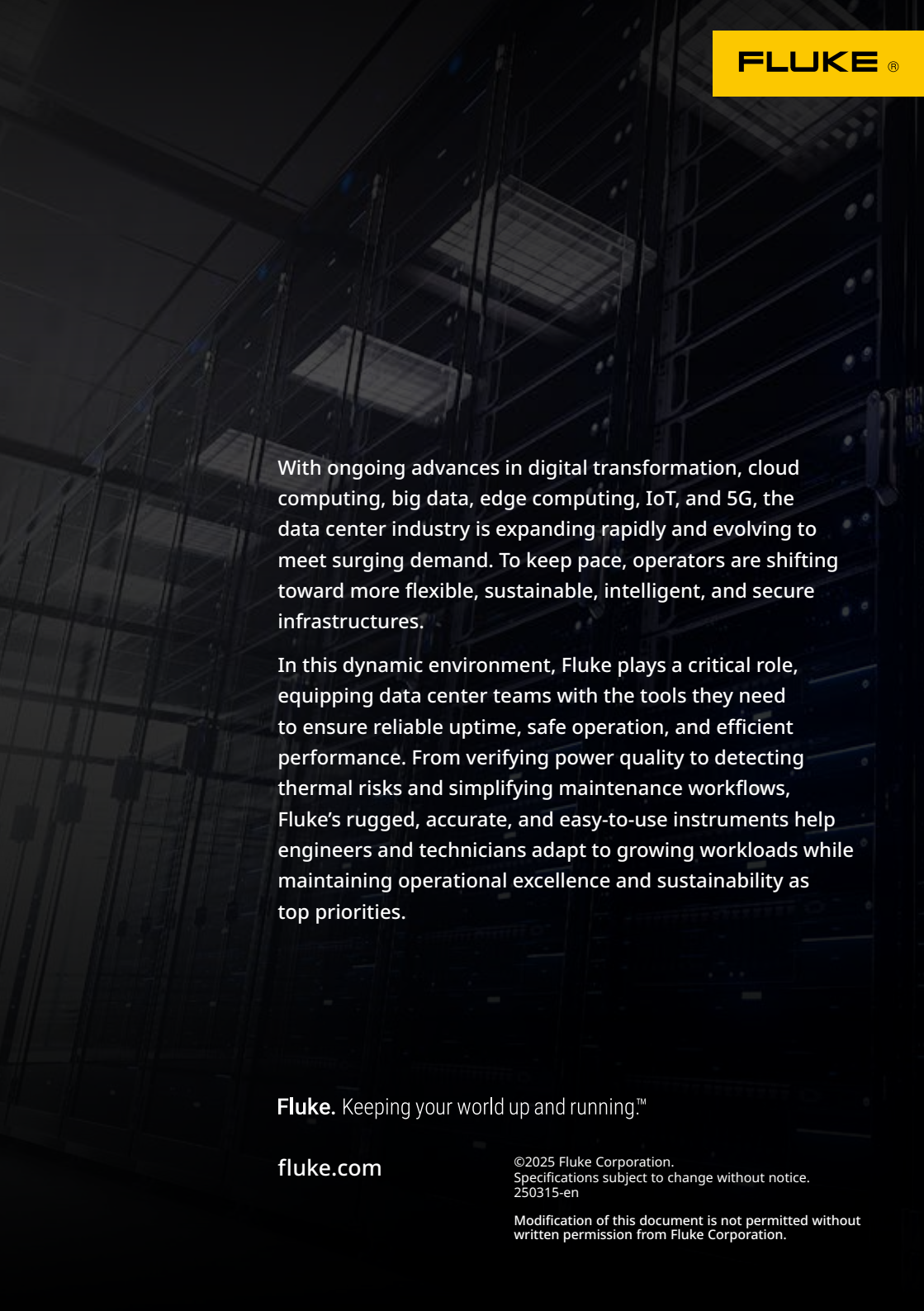
Low-voltage distribution equipotential resistance test,,earth resistance test

Fluke 376 FC True-RMS AC/ DC Clamp Meter

Low-voltage distribution current test

Fluke 179 True-RMS Digital Multimeter

“Zero line” voltage



With ongoing advances in digital transformation, cloud computing, big data, edge computing, IoT, and 5G, the data center industry is expanding rapidly and evolving to meet surging demand. To keep pace, operators are shifting toward more flexible, sustainable, intelligent, and secure infrastructures.

In this dynamic environment, Fluke plays a critical role, equipping data center teams with the tools they need to ensure reliable uptime, safe operation, and efficient performance. From verifying power quality to detecting thermal risks and simplifying maintenance workflows, Fluke's rugged, accurate, and easy-to-use instruments help engineers and technicians adapt to growing workloads while maintaining operational excellence and sustainability as top priorities.

Fluke. Keeping your world up and running.™

fluke.com