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|  | SCOPE AREAS FOR CALIBRATION LABORATORIES | Document No: | GL.022-NAC.TCL |
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1. GENERAL

This guideline defines the areas of work that Calibration Laboratories must report when applying for accreditation to NAC.

Within the scope of accreditation, the measurement quantities listed below and the classes and types of devices that can be calibrated in these areas must be specified.

2. RELATED DOCUMENTS

CCAUV Classification Of Services in Acoustics, Ultrasound And Vibration, October 2010

CCEM Classification of Services in Electricity And Magnetism, Version No 7.6, 17 March 2011

CCL Length Services Classification (DimVIM), 28 October 2006 (Türkçesi için <http://www.euramet.org/index.php?id=tc-l-dimvim>)

CCM Classification of Services in Mass And Related Quantities, 21 October 2003 CCPR Classification of Services in Photometry And Radiometry, Version No 10, January 2009

CCT Classification of Services in Thermometry, May 2010

CCTF Classification of Services in Time And Frequency, Version 1.0, December 2002

| 1. MASS | |
|---|---------------|
| Mass Standard | Class E1 Mass |
| | Class E2 Mass |
| | Class F1 Mass |
| | Class F2 Mass |
| | Class M1 Mass |
| | Class M2 Mass |
| | Class M3 Mass |
| Non-Automatic Weighing Instruments | Scale |

| 2. HUMIDITY | |
|--|--|
| Hygrometers | Dew Point Temperature Meter |
| | Hygrometer |
| | Relative Humidity Meter (Capacitive, resistive, thermograph, mechanical, wet/dry bulb) |
| | Moisture Meter |
| Dynamic Sources | Dew Point Generator |
| | Relative Humidity Generator |
| | Flow Mixing |
| Static Sources | 1. Salt Solution |
| | Saturated Salt Solution |
| | Unsaturated Salt Solution |
| | 2. Reference Gases |
| Controlled Volumes (Relative Humidity Distribution) | Climatic Chamber |
| | Relative Humidity Generator |
| | Sterilizer (Autoclave) |



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| 3. TEMPERATURE | |
|--|--|
| Contact Temperature Fixed Point Cells | 1. Primary Level Fixed Point Cell 2. Secondary Level Fixed Point Cell |
| Standard Platinum Resistance Thermometers (SPRT) | 1. Capsule Type SPRT 2. Long Stem SPRT (including HTSPRT) |
| Resistance Thermometers | 1. Platinum Resistance Thermometers (PRT) 2. Industrial Platinum Resistance Thermometers (PRT) 3. Thermistor |
| Thermocouples | 1. Platinum-Based Reference Thermocouples R S B Platinum/Palladium (Pt/Pd) Gold/Platinum (Au/Pt) 2. Industrial Thermocouples T E K N J U L |
| Liquid-in-Glass Thermometers | |
| Temperature Indicators (with thermistor, resistance, thermocouple sensor) | |
| Other Thermometers | 1. Surface Temperature Thermometers 2. Air Sensors |
| Other Measurement Services | 1. Compensation Cables for Cold Junction 2. Wire Melting Point Cable for Thermocouples 3. Temperature Indicators and Calibrators Temperature Indicator Cold Junction ON Cold Junction OFF Temperature Calibrator Cold Junction ON Cold Junction OFF 4. Controlled Volumes (Temperature Distribution) Oven Incubator Cold Room (deep freezer, etc.) Climatic Chamber Sterilizer (Autoclave) Liquid Bath Ash Furnace 5. Dry Block Calibrator |

4. LENGTH / DIMENSION

| | |
|--|--|
| Radiations in the "Mise En Pratique" Document | 1. Laser 2. Spectrum Lamp |
| Linear Dimensions | 1. Length Measurement Devices Interferometers (laser, length) (system, optical equipment, refractometer) Electromagnetic/Electronic Distance Meters (EDM devices) One-Dimensional Measurement Device (Universal, etc.) Height Measurement Device One-Dimensional Advancement Measurement Devices [Transducer, Actuator, Inductive Probe] (LVDT, PZT, ...) Dial Gauge Testing Device (Dial Gauge Calibrator, Comparator Calibrator, etc.) Gauge Block Comparators |
| | 2. Dimensional Standards Gauge Block (Short 0.5 mm - 100 mm) Long Gauge Block (Length Bar) (125 mm - 1000 mm) Micrometer Setting Rod [Flat, Thread] Step Gauge Gap Gauge Thickness Gauge (Feeler Gauge, etc.) |
| | 3. Line Standards Precision Line Scale Microscope Control Micrometer (Stage Micrometer) Grid Plate 1-Dimensional Grating 2-Dimensional Grating Line Thickness Standard Tape Measure (Field, Workshop, Pi), (Geodetic) Wire Field Leveling Rod (Mira, etc.) Steel Ruler, Workshop or Mechanical Work Scales |
| | 4. Diameter Standards External Cylinder (Plug Gauge (Ref, Go-No-Go, etc.), Piston, Pin (Thread Measurement Pins), Wire, Setting Gauge) Internal Cylinder (Ring Gauge (Ref, Go-No-Go, etc.)) Sphere (Ball, Thread Measurement Probes (T-Probe)) |
| | 1. Devices/Standards Obtaining Angles by Circle Division Optical Polygon Index Table Rotary Table, Rotary Encoder Scale |
| | 2. Small Angle Generators |



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|--|---|
| | Sine (Bar, Table) |
| | 3. Angle Measurement Devices |
| | Autocollimator |
| | Electronic Level Meter |
| | Clinometer |
| | Water Level |
| | Theodolite |
| | Total Station |
| | Nivo |
| | (Bevel) Protractor |
| | Verticality Measurement Devices |
| | 4. Angle Artifacts (Standards) |
| | Angle Master Block |
| | 90° (Steel, Granite) Squareness Standard |
| | 90° Cylinder Squareness Standard |
| | Taper Gauge |
| | X- Block |
| | V- Block |
| | 5. Angle Prisms |
| | Optical Squareness Standard (Optical Square, Pentaprism) |
| | Retroreflector (Cube Corner, Cat-Eye) Prism |
| | 6. Planeness Standards |
| | Optical Flat |
| | Optical Parallel (Parallel Inclination) |
| | Mirror |
| | Plate |
| | 7. Roundness Standards |
| | External Cylinder (Roundness measurements external diameter) |
| | Internal Cylinder (Roundness measurements internal diameter) |
| | Sphere - Hemisphere |
| | Magnification Ratio Standard (Flick Standard) |
| | 8. Linearity Standards |
| | Linearity (Master) Standard |
| | Cylindrical Linearity Standard |
| | Recorder/Slider Linearity |
| | 9. Cylindricity Standards |
| | External Cylinder (Cylindricity Measurements External Diameter) |
| | Internal Cylinder (Cylindricity Measurements Internal Diameter) |
| | 10. Optical Standards |
| | Lens |
| | Radius Standards |
| | 1. Surface Roughness Standards |
| | (Groove) Depth (Step Height) Standard (e.g., ISO 5436-1 Type A) |



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| Complex Geometry | Edge Control Standard (e.g., ISO 5436-1 Type B) |
| | Wavelength Standard (e.g., ISO 5436-1 Type C) |
| | Surface Roughness Standard (e.g., ISO 5436-1 Type D) |
| | Profile Coordinate Standard (e.g., ISO 5436-1 Type E) |
| | Software Measurement Standard (Reference Software Data Set) |
| | 2. Screw Standards |
| | Plain Screw Plug Gauge |
| | Taper Screw Plug Gauge |
| | Plain Screw Ring Gauge |
| | Taper Screw Ring Gauge |
| | API Type Screw Gauge: Inner Diameter |
| | API Type Screw Gauge: Outer Diameter |
| | 3. Gear Standards |
| | Spur Gear |
| | Bevel Gear |
| | Gear Gauge |
| | Gear Lead Gauge |
| | Gear Evolvent Gauge |
| | 4. CMM Artifacts |
| | Sphere (Hole) Plate |
| | Spherical Bar |
| | Large CMM Artifact |
| | Reference Software |
| | 5. 2D-3D Measurement Devices |
| | Projection Device |
| | Measurement Microscope |
| | Three-Dimensional Measurement Device (CMM) |
| | Laser Tracker Measurement System |
| | Motion (Displacement Angle) Unit |
| | Profile Measurement Device |
| | Flatness (Wavefront) Interferometer |
| Form Measurement Device | |
| Surface Roughness Measurement Device | |
| 6. Hardness | |
| Rockwell Hardness Indenter | |
| Vickers Hardness Indenter | |
| Various Dimensional Equipment and Standards | 1. Handheld Basic Measurement Devices |
| | Micrometer |
| | - External Diameter Micrometer |
| | - Micrometer Head |
| | - Depth Micrometer |
| | - Two-Point Internal Diameter Micrometer |
| - Three-Point Internal Diameter Micrometer | |
| - Calipers | |
| Calipers | |



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|--|--|
| | - Caliper (External diameter, internal diameter, depth, step measurements) |
| | - Depth caliper |
| | Depth Gauge |
| | Gauge Clock |
| | - Dial Comparator (Precision Indicator) |
| | - Gauge Clocks (Comparator) |
| | - Indicator |
| | Fork Caliper (internal, external) |
| | Profile Gauges |
| | Thread Pitch Gauges |
| | Radius Gauges |
| | Eddy Current Test Blocks |
| | Ultrasonic Test Blocks |
| | Applicator |
| | Grindometer |
| | Paint Adhesion Test Comb (Cross-Cut) EN ISO 2409 |
| | Bore Gauge (Bore Gauge, etc.) |
| | Hole Template |
| | Thickness Gauge (Internal, external, thickness gauges, etc.) |
| | 2. Pressure Artifacts |
| | Piston/Cylinder Unit |
| | 3. Thermal Expansion |
| | Thermal Expansion Coefficient Artifact |
| | 4. Long Distance |
| | Geodetic Station Points (Survey Points) |
| | 5. Reference Materials |
| | Standard Particle |
| [Aper, Mesh] Opening (Aperture) | |
| 6. Coating Thickness | |
| Coating Thickness Standard (Thickness Foils) | |
| Coating Thickness Measurement Device | |
| 7. Refractive Index | |
| Refractometer for Optical Materials | |

| 5. ELECTRICAL | |
|------------------------------|---|
| DC Voltage (≤ 1100 V) | 1. DC Voltage Sources |
| | DC Voltage Standard |
| | DC Voltage Source |
| | Calibrator: DC Voltage |
| | 2. DC Voltage Meters |
| | Multimeter: DC Voltage |
| | Multifunction Transfer Standard: DC Voltage |
| | Nanovoltmeter |



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|--------------------------------|---|
| | Microvoltmeter |
| | DC Voltmeter |
| | 3. DC Voltage Ratios |
| | Resistance Divider |
| | DC Voltage Divider |
| | Ratio Meter |
| DC Resistance | 1. DC Resistance Standards and Sources |
| | DC Resistance Standard |
| | Calibrator: Resistance |
| | DC Current Shunt |
| | Resistance Box |
| | Resistance: Temperature Coefficient |
| | Resistance: Power Coefficient |
| | 2. DC Resistance Meters |
| | Multimeter: Resistance |
| | Multifunction Transfer Standard: Resistance |
| | Microohmmeter |
| | Ohmmeter |
| | Teraohmmeter |
| | Resistance Bridge |
| Insulation Test Device | |
| Electrical Conductivity | Metal Materials |
| | Semiconductor and Similar Materials |
| | Electrical Conductivity Meter (for Metal Materials) |
| DC Current (<100 A) | 1. DC Current Sources |
| | DC Current Source |
| | Calibrator: DC Current |
| | Transconductance Amplifier |
| | 2. DC Current Meters |
| | Multimeter: DC Current |
| | Multifunction Transfer Standard: DC Current |
| | Picoammeter |
| Nanoammeter | |
| Ammeter | |
| Clamp Meter | |
| AC Resistance | 1. AC Resistance Standards |
| | Real Component |
| | Imaginary Component |
| | 2. High Current AC Resistance Standards (Shunts) |
| | 3. AC Resistance Meters |
| | LCR Meter: AC Resistance |
| Capacitance | 1. Capacitor |
| | Capacitance Standards |
| | Capacitance Boxes |
| | 2. Dissipation Factor |



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|-------------------------------|---|
| | Capacitance Standards |
| | Capacitance Boxes |
| | 3. Capacitance Meters |
| Inductance | LCR Meter: Capacitance |
| | Capacitance Bridge |
| | 1. Inductor |
| | Inductance Standard |
| | Mutual Inductance Standard |
| | Inductance Box |
| AC Voltage (≤ 1100 V) | 2. Inductance Meters |
| | LCR Meter: Inductance |
| | 1. AC-DC Transfer Standards |
| | Thermal Converter |
| | AC-DC Transfer Standard |
| | Micropotentiometer |
| | AC Measurement Standard |
| | 2. AC Voltage Sources |
| | AC Voltage Source |
| | Calibrator: AC Voltage |
| | AC Calibrator |
| | 3. AC Voltage Meters |
| | Multimeter: AC Voltage |
| | Multifunction Transfer Standard: AC Voltage |
| | AC Measurement Standard |
| | AC Voltmeter |
| | 4. AC Voltage Ratios |
| | Real |
| | - Inductive Voltage Divider |
| | - AC Bridge Standard |
| - Synchro-resolver | |
| Imaginary | |
| - Inductive Voltage Divider | |
| - AC Bridge Standard | |
| - Synchro-resolver | |
| Attenuation | |
| - Inductive Voltage Divider | |
| - Attenuator Box | |
| Gain | |
| - Attenuator Box | |
| AC Current (<100 A) | 1. AC-DC Current Transfer Standard |
| | Thermal Current Converter |
| | Thermal Converter and AC/DC Current Shunt |
| | AC-DC Transfer Standard and AC/DC Current Shunt |
| | AC/DC Current Shunt |
| | 2. AC Current Sources |
| AC Current Source | |



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|---|--|
| | Calibrator: AC Current |
| | Transconductance Amplifier |
| | 3. AC Current Meters |
| | Multimeter: AC Current |
| | Multifunction Transfer Standard: AC Current |
| | AC Ammeter |
| | Clamp Meter |
| AC Power and Energy | 1. Active Power: Single Phase |
| | Power Meter |
| | Wattmeter |
| | Power Converter |
| | 2. Active Power: Three Phase |
| | Power Meter |
| | Wattmeter |
| | 3. Reactive Power: Single Phase |
| | Power Meter |
| | Wattmeter |
| | 4. Reactive Power: Three Phase |
| | Power Meter |
| | Wattmeter |
| | 5. Apparent Power: Single Phase |
| | Power Meter |
| | Wattmeter |
| | 6. Active Energy: Three Phase |
| Energy Meter | |
| 7. Reactive Energy: Three Phase | |
| Energy Meter | |
| DC High Voltage (> 1100 V) | 1. DC High Voltage Sources |
| | DC Kilovolt Source |
| | Insulation Test Device |
| | 2. DC High Voltage Meters |
| | DC Kilovoltmeter |
| | DC High Voltage Measurement System |
| | 3. DC High Voltage Ratios |
| High Voltage Resistance Divider | |
| High Voltage Probe | |
| AC High Voltage (> 1100 V) | 1. AC High Voltage Sources |
| | AC High Voltage Source |
| | 2. AC High Voltage Meters |
| | AC High Voltage Meter |
| | AC High Voltage Measurement System (Resistance and Capacitive Divider) |
| High Voltage Probe | |
| 3. AC High Voltage Peak Value Meters | |



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|--|---|
| | AC High Voltage Meter AC High Voltage Measurement System (Resistance and Capacitive Divider) High Voltage Probe |
| | 4. Ratio Error |
| | Voltage Transformer Voltage Transformer Bridge |
| | 5. Phase Shift |
| | Voltage Transformer Voltage Transformer Bridge |
| DC High Current (> 100 A) | 1. DC High Current Sources |
| | 2. DC High Current Meters |
| | 3. DC High Current Ratio |
| AC High Current (> 100 A) | 1. AC High Current Sources |
| | 2. AC High Current Meters |
| | 3. Ratio Error |
| | Current Transformer Current Transformer Bridge |
| | 4. Phase Shift |
| | Current Transformer Current Transformer Bridge |
| Electrical Discharge | 1. Apparent Load |
| | Partial Discharge Calibrator Partial Discharge Measuring Device |
| | 2. Response |
| | Electrostatic Discharge Target |
| Pulsed High Voltage and Current | 1. Lightning Impulse Voltage Parameter |
| | Lightning Impulse Voltage Measurement System Impulse Calibrator Digital Recorder/Measuring Device |
| | 2. Lightning Impulse Time Parameter |
| | Lightning Impulse Voltage Measurement System Impulse Calibrator Digital Recorder/Measuring Device |
| | 3. Switching Impulse Voltage Parameter |
| | Switching Impulse Voltage Measurement System Impulse Calibrator Digital Recorder/Measuring Device |
| | 4. Switching Impulse Time Parameter |
| | Switching Impulse Voltage Measurement System Impulse Calibrator Digital Recorder/Measuring Device |
| | 5. Impulse Current Parameter |
| | Impulse Current Measurement System |



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|---|--|
| | Impulse Divider |
| | 6. Impulse Current Time Parameter |
| | Impulse Current Measurement System |
| | Impulse Divider |
| | 7. Impulse Energy |
| | Impulse Calibrator |
| | Shunt Transducer |
| High Voltage Impedance | 1. Capacitance and Loss Factor |
| | Compressed Gas Capacitor High Voltage Capacitor |
| | 2. Inductance and Loss Angle |
| | High Voltage Reactor |
| | 3. Resistance |
| | High Voltage Resistor |
| | 4. Impedance |
| | Standard Loads for Measuring Transformers |
| | 5. Phase Shift |
| | Standard Loads for Measuring Transformers |
| Radio Frequency (RF) Power | 1. Absolute RF Power |
| | RF Power Source - Reference Power Output for RF Power Meters - Signal Source |
| | RF Power Meter - RF Wattmeter - Spectrum Analyzer |
| | 2. Calibration Factor, Effective Efficiency |
| | Thermistor Power Sensor (Thermocouple, Diode Sensor) |
| | |
| Reflection Coefficient and Attenuation Ratio Magnitude (when Vector Network Analyzer and similar devices are not used) | 1. Reflection Coefficient |
| | Passive Microwave Circuit Element |
| | 2. Attenuation Ratio |
| | Attenuator Two-Port Passive Microwave Circuit Element |
| | 3. Directivity, Effective Source Reflection Coefficient |
| | Directional Couplers Power Splitters |
| | |
| Scattering (S) Parameters (Vectorial) | 1. Reflection Coefficient (S_{ii}) |
| | Passive Microwave Circuit Element |
| | 2. Transmission Coefficient (S_{ij}) |
| | Attenuator Two-Port Passive Microwave Circuit Element |
| | 3. Directivity, Effective Source Reflection Coefficient |
| | Directional Couplers Power Dividers |



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|---|---|
| RF Noise | 1. Noise Temperature or Excess Noise Ratio (ENR) |
| | Noise Source |
| | 2. Amplifier Noise Parameters |
| | Amplifier |
| RF Voltage and Current | 3. Phase Noise |
| | Signal Source |
| | 1. RF-DC Difference |
| | Thermal Voltage Converter |
| | AC-DC Current Standard |
| | 2. RF Voltage Source |
| | 3. RF Voltmeter |
| | 4. RF Current Source |
| | 5. RF Transfer Impedance |
| | RF Current Clamp |
| | ESD Target |
| | 6. RF Voltage Divider Factor |
| | Burst Adapter |
| | Oscilloscope Probe |
| 7. RF Coupling Factor | |
| Coupling-Decoupling Network (CDN) | |
| Electromagnetic Current Clamp | |
| Absorbing Clamp | |
| Electrostatic Field Intensity | Electrostatic Field Meter |
| | Electrostatic Generator |
| Electric Field Intensity | Electric Field Intensity Meter |
| | Electric Field Probe |
| Magnetic Flux | Flux Meter |
| | Flux Standard |
| DC Magnetic Flux Density and Intensity | Magnetic Flux Density Meter |
| | Magnetic Field Intensity Meter |
| AC Magnetic Flux Density and Intensity | Magnetic Flux Density Meter |
| | Magnetic Field Intensity Meter |
| Antenna Properties | 1. Antenna Factor |
| | 2. Antenna Gain |
| Signal and Pulse Characteristics | 1. Vertical Deflection (Gain) |
| | Oscilloscope |
| | 2. Horizontal Deflection (Time) |
| | Oscilloscope |
| | 3. Rise Time |
| | Oscilloscope |
| | 4. Bandwidth |
| | Oscilloscope |
| 5. Pulse Amplitude | |



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|---------------------|--|
| | Pulse Source |
| | Function Generator |
| | 6. Pulse Timing Parameters |
| | - Pulse Source |
| | - Function Generator |
| | 7. Modulation, AM and FM |
| | - Signal Generator |
| | - Spectrum Analyzer |
| | - Modulation Meter |
| | - Jitter Meter |
| | 8. Distortion and Harmonic Components |
| | - Signal Generator |
| | - Distortion Meter |
| - Spectrum Analyzer | |

| 6. TIME and FREQUENCY | |
|-----------------------|---------------------------------|
| Frequency | 1. Frequency Sources |
| | Frequency Standard |
| | Frequency Generator |
| | 2. Frequency Meters |
| | Frequency Counter |
| | Tachometer |
| Stroboscope | |
| Time Interval | 1. Period Sources |
| | Period Source |
| | 2. Time Interval Sources |
| | Rise/Fall Time Source |
| | Pulse Width Source |
| | Time Difference Source |
| | Delay Source |
| | 3. Period Meters |
| | Period Meter |
| | 4. Time Interval Meters |
| | Rise/Fall Time Meter |
| | Pulse Width Meter |
| | Time Difference Meter |
| -Frequency Counter | |
| -Stopwatch | |
| -Timer | |
| Delay Meter | |

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| 7. RADIATION TEMPERATURE | |
|---|-------------------------------------|
| Radiation Temperature Fixed Point Cells | 1. Primary Level Fixed Point Cell |
| | 2. Secondary Level Fixed Point Cell |
| Reference Radiation Thermometers | |
| Industrial Radiation Thermometers | Pyrometer |
| | Thermal Camera |
| | IR Thermometer |
| | IR Ear Thermometer |
| Variable Temperature Black Body Sources | Black Body |
| | IR Calibrator |
| Strip Lamps | Vacuum Lamp |
| | Gas Lamp |

| 8. AKUSTİK | |
|----------------|---|
| Sound in Air | 1. Microphone: Pressure Sensitivity |
| | 2. Microphone: Free-Field Sensitivity |
| | 3. Microphone: Diffuse-Field Sensitivity |
| | 4. Sound Calibrator: Sound Pressure Level: Single Frequency |
| | 5. Sound Calibrator: Sound Pressure Level: Multiple Frequencies |
| | 6. Sound Level Meter: Sound Pressure Response Level |
| | 7. Sound Level Meter: Free-Field Response Level |
| | 8. Sound Level Meter: Diffuse-Field Response Level |
| | 9. Sound Level Meter: Sound Intensity Response Level |
| | 10. Artificial Ear: System Response Level |
| | 11. Artificial Ear: Acoustic Impedance |
| | 12. Reference Sound Source: Sound Power Level |
| | 13. Reference Sound Source: Directivity Response |
| | 14. Audiometer: Air Conduction Response Level |
| | 15. Audiometer: Bone Conduction Response Level |
| Sound in Water | 1. Ultrasonic Hydrophone: Free-Field Sensitivity |
| | 2. Non-Ultrasonic Hydrophone: Free-Field Sensitivity |
| | 3. Non-Ultrasonic Hydrophone: Pressure Level |
| | 4. Ultrasonic Transducer: Ultrasonic Power |
| | 5. Ultrasonic Transducer: Directivity |
| | 6. Ultrasonic Transducer: Ultrasonic Pressure |

| 9. VIBRATION | |
|------------------|---|
| Linear Vibration | 1. Vibration Measurement Device: Frequency Response |
| | 2. Vibration Measurement Device: Shock Response |
| | 3. Accelerometer Calibrator: Acceleration Output (Sine) |
| | 4. Accelerometer Calibrator: Shock Output |
| | 5. Accelerometer: Charge Sensitivity |

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| | 6. Accelerometer: Shock Sensitivity |
| | 7. Accelerometer Measurement Chain: Voltage Sensitivity |
| | 8. Accelerometer Measurement Chain: Shock Sensitivity |
| Angular Vibration | 1. Angular Vibration Measurement Device: Angular Acceleration Response |
| | 2. Angular Vibration Measurement Device: Shock Response |
| | 3. Angular Acceleration Calibrator: Angular Acceleration Output (Sine) |
| | 4. Angular Accelerometer: Charge Sensitivity |
| | 5. Angular Accelerometer Measurement Chain: Voltage Sensitivity |

| 10.OPTICS | |
|--|---|
| Photometry | 1. Luminous Intensity |
| | Tungsten Lamp |
| | LED |
| | 2. Luminous Sensitivity |
| | Lux Meter |
| | 3. Luminous Flux |
| | Tungsten Lamp |
| | LED |
| | 4. Illuminance |
| | Tungsten Lamp |
| | 5. Luminance |
| | Tungsten-Based Source |
| | 6. Luminance Sensitivity |
| Luminance Meter | |
| 7. Light Exposure | |
| General Source | |
| Flash Photometer | |
| Dedektörlerin Özellikleri | 1. Sensitivity, Spectral, Power |
| | Broadband Detector |
| | 2. Sensitivity, Spectral, Radiance Level |
| | Broadband Detector |
| | Spectroradiometer |
| | 3. Sensitivity, Spectral, Irradiance |
| | Spectroradiometer |
| 4. Sensitivity, Laser, Power | |
| General Detector | |
| 5. Sensitivity, Laser, Energy | |
| General Detector | |
| 6. Sensitivity, Solar, Power | |
| General Detector | |
| 7. Sensitivity, Solar, Radiance Level | |



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|---|--|
| | General Detector |
| | 8. Sensitivity, Black Body, Total Radiance Level |
| | Broadband Detector |
| | 9. Sensitivity, Ultraviolet, Broadband Radiance Level |
| | UV Radiometer |
| | 10. Sensitivity, Ultraviolet, Broadband Irradiance Exposure |
| Spectral Emission Characteristics of Sources | UV Radiometer |
| | 1. Radiance Level, Spectral |
| | Tungsten Lamp |
| | Deuterium Lamp |
| | 2. Irradiance, Spectral |
| | Tungsten Lamp |
| | Deuterium Lamp |
| | 3. Optical Power, Spectral Total Irradiance |
| | Laser |
| | 4. Radiance Intensity, Spectral |
| | Tungsten Lamp |
| | Deuterium Lamp |
| Spectral-Total Measurements of Sources and Detectors | 1. Distribution Temperature |
| | Tungsten Lamp |
| | 2. Correlated Color Temperature |
| | Tungsten Lamp |
| | 3. Correlated Color Temperature Sensitivity |
| | Color Temperature Meter |
| | 4. Emitted Color |
| | General Source, x-y |
| | General Source, u-v |
| | General Source, u'-v' |
| | 5. Indicator, Color Space, L*a*b* |
| | 6. Tristimulus Sensitivity |
| Colorimeter | |
| 7. Color Rendering Index, Ra | |
| General Source | |
| 8. Total Irradiance | |
| Black Body | |
| Properties of Materials | 1. Transmittance, Regular, Spectral |
| | Spectral Neutral Material |
| | 2. Transmittance, Diffuse, Spectral |
| | Spectral Neutral Material |
| | 3. Absorption, Regular, Spectral |
| | Spectral Neutral Material |
| | 4. Absorption, Diffuse, Spectral |
| Spectral Neutral Material | |
| 5. Reflectance, Regular, Spectral | |



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|---|--|
| | Spectral Neutral Material |
| | 6. Reflectance, Diffuse, Spectral |
| | Spectral Neutral Material |
| | 7. Emissivity |
| | General Material |
| | 8. Emission, Spectral |
| | General Material |
| | 9. BRDF (Bidirectional Reflectance Distribution Function) |
| | General Material |
| | 10. Reflectance Factor |
| | General Material |
| | 11. Irradiance Factor |
| | General Material |
| | Fluorescent Material |
| 12. Luminescent Irradiance Factor | |
| Fluorescent Material | |
| 13. Wavelength | |
| Spectrally Selective Transmittance Material | |
| Spectrally Selective Reflective Material | |
| Color and Other Spectral-Total Measurements of Materials | 1. Color, Surface, x, y, Y |
| | General Material |
| | Fluorescent Material |
| | Diffuse Reflective Material |
| | 2. Color, Surface, L*a*b* |
| | General Material |
| | Fluorescent Material |
| | Diffuse Reflective Material |
| | 3. Color, Transmitted, x, y, Y |
| | General Material |
| | 4. Color, Transmitted, L*a*b* |
| | General Material |
| | 5. Retroreflection |
| | General Material |
| | 6. Gloss |
| | General Material |
| | 7. Haze |
| | General Material |
| | 8. Luminance Factor |
| | General Material |
| 9. Luminance Coefficient | |
| General Material | |
| 10. Whiteness | |
| General Material | |
| Fiber Optics | 1. Sensitivity |



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|--|--------------------------------|
| | Fiber Optic Power Meter |
| | 2. Wavelength |
| | Fiber Optic Source |
| | Optical Spectrum Analyzer |
| | Wavelength Meter |
| | 3. Attenuation |
| | Optical Fiber |
| | Optical Fiber Component |
| | 4. Chromatic Dispersion |
| | Optical Fiber |
| | Zero Wavelength, Optical Fiber |
| | Slope, Optical Fiber |
| | 5. Length |
| | Optical Fiber |
| Optical Time Domain Reflectometer (OTDR) | |

| 11. FORCE | |
|-----------------------------------|-------------------------------------|
| Force Measurement Devices | Load Cell |
| | Force Transducer |
| | Dynamometer |
| Force Calibration Machines | |
| Material Testing Machines | Tensile/Compression Testing Machine |
| | Compression Testing Machine |
| | Tensile Testing Machine |
| | Concrete Testing Presses |
| | Notch-Impact Testing Device |
| | Extensometer |

| 12. HARDNESS | | |
|------------------------------------|---|---|
| Hardness Reference Block | Rockwell Hardness Reference Block | |
| | Brinell Hardness Reference Block | |
| | Vickers Hardness Reference Block | |
| Hardness Testing Device | Rockwell Hardness Testing Device | |
| | Brinell Hardness Testing Device | |
| | Vickers Hardness Testing Device | |
| | Portable (Handheld) Hardness Testing Device | |
| | Shore Hardness Testing Device | |
| | IRHD Hardness Testing Device | |
| | Hardness Indenter | Rockwell Spherical-Conical Diamond Indenter |
| | | Vickers Pyramid Diamond Indenter |
| Brinell and Rockwell Ball Indenter | | |
| Shore, IRHD, and Other Indenters | | |



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13. TORQUE

| | |
|-----------------------------------|-------------------------------------|
| Torque Measurement Devices | Torque Calibration Machine |
| | Torque Transducer |
| | Reference Torque Wrench |
| | Torque Hand Tools Calibration Setup |
| | Torque Hand Tools |
| | Torque Multiplier |

14. PRESSURE

| | |
|--|--|
| Relative Pressure (Hydraulic/Pneumatic) | Analog Manometer |
| | Digital Manometer |
| | Pressure Calibrator |
| | Pressure Transducer |
| | Pressure Transmitter |
| | Piston Pressure Standard (Dead Weight Tester) |
| | Differential Pressure Gauge |
| Absolute Pressure | Analog Manometer |
| | Digital Manometer |
| | Pressure Transducer |
| | Pressure Transmitter |
| | Analog Barometer |
| | Digital Barometer |
| Vacuum Gauge Calibration | Capacitance Diaphragm Type Vacuum Gauge |
| | Rotary Rotor Type Vacuum Gauge (SRG) |
| | Hot and Cold Cathode Type Vacuum Gauge |
| | Pirani, Thermal Conductivity, Thermocouple Type Vacuum Gauge |

15. FLUID FLOW

| | |
|------------------------------------|--|
| Volumetric Liquid Flow Rate | 1. Volumetric Water Flow Rate |
| | Water Meter |
| | 2. Volumetric Hydrocarbon Flow Rate |
| Volumetric Gas Flow Rate | Fuel Meter |
| | Gas Meter |
| Mass Liquid Flow Rate | 1. Mass Water Flow Rate |
| | Water Meter |
| | 2. Mass Hydrocarbon Flow Rate |
| Mass Gas Flow Rate | Fuel Meter |
| | Gas Meter |
| Flow Velocity | 1. Gas Flow Velocity |
| | Anemometer |
| | 2. Liquid Flow Velocity |
| | Anemometer |



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|-----------------------|------------------|
| Heat Flow Rate | Hot Water Meters |
|-----------------------|------------------|

| 16. DENSITY | |
|--|---|
| Solid Density | |
| Liquid Density | |
| Hydrometer (Density Measurement Device) | Specific Gravity (Relative Density) Hydrometers |
| | Alcoholometers (% Hydrometers) |
| | Baumé Hydrometer |
| | API Hydrometer / Thermohydrometer |

| 17. VOLUME | |
|--------------------------|------------------------------|
| Volumetric Flasks | 1. Balloon Flask |
| | 2. Graduated Cylinder |
| | 3. Pycnometer |
| | 4. Pipette |
| | 5. Burette |

| 18. VISCOSITY | |
|----------------------|--|
| Flow Cups | |