Energy Dispersive X-ray Fluorescence Spectrometer for RoHS/ELV Screening

EDX-LE
No experience necessary—great for beginners

“This is the first time I’ve used a spectrometer. Will it be easy for me to use without any special knowledge?” “Can it make correct judgments even with very strict threshold values?”

When it comes to the demands required of X-ray fluorescence spectrometers for RoHS/ELV hazardous element screening, Shimadzu provides:

Security—provided by user-friendly features that allow judgments to be entrusted to the instrument
Reliability—provided by performance that allows precise analysis of a wide range of elements

The EDX-LE is optimized to the extreme to meet these user needs.
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EDX-LE
Light and Easy, destined to be the Leading Expert for screening

Making the Difficult Simple

- The [Screening Analysis] window makes operation easy
- Fully automatic, from determining main components to selecting conditions
- Simple screening setting functions can be easily changed according to the control system on the user side

Fully Equipped with Essential Functions

- RoHS/ELV analysis functions are standard
- Large Sample Chamber enables as-is measurement of large samples
- Protection functions restrict changing conditions or data

Comparison of Applicability of EDX-LE for Screening Applications

<table>
<thead>
<tr>
<th>Element</th>
<th>Cl</th>
<th>Br</th>
<th>Hg</th>
<th>Cr</th>
<th>Pb</th>
<th>Cd</th>
<th>Sb</th>
<th>As</th>
<th>Ba</th>
<th>Se</th>
<th>Ni</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDX-LE</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- : Standard applicability
- : Optional applicability
- : Applicability depends on analytical conditions

*Additional function kit is required.
Making the Difficult Simple

Easy Screening, Even for First-time Users

Start sample measurement from [Screening Analysis] using simple steps. The selection of measurement conditions, which typically relies on the judgment of the experimenter, is determined automatically. This means that even first-time users can rest assured.

1st Step

Simply set the sample and click [START].

Place the Sample

- After placement, the sample observation camera observes the sample and confirms the sample’s analysis position.
- Set the analysis area to 3 mm, 5 mm, or 10 mm diameter.
- Close the sample chamber.

To check the results to date...

Results List: Lists data of completed measurements (with photographs)
Making the Difficult Simple

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Start sample measurement from [Screening Analysis] using simple steps. The selection of measurement conditions, which typically relies on the judgment of the experimenter, is determined automatically. This means that even first-time users can rest assured.

Simply set the sample and click [START].

Place the Sample

- After placement, the sample observation camera observes the sample and confirms the sample's analysis position.
- Set the analysis area to 3 mm, 5 mm, or 10 mm diameter.
- Close the sample chamber.

Select Analysis Conditions/Enter Sample Name

- The [Measurement Preparation] window displays the current sample image. Use this window to select analysis conditions and enter a sample name.
- Start measurement with a single click.

Display of Analysis Results

- After measurements are completed, [Pass/Fail Judgment], [Concentration], and [3σ (Measurement Variance)] are displayed for all 5 elements in an easy-to-understand layout.
- Display the [Result List] and [Individual Report] with a single mouse click.

If you want to create a report...

**Individual Report: Displays a report of the current sample**

Create reports in Excel or HTML format. Reports can also be created for non-RoHS 5 element data.

*Note that this requires installation of Microsoft Office Excel before use.*

EDX-LE
Energy Dispersive X-ray fluorescence Spectrometer
Screening Software Features

A single click in the [Screening Analysis] window automatically performs everything from measurement to the display of results, in accordance with your pre-registered analysis conditions.

All steps, from judgment of the main components to the selection of conditions, are automated

Automatic Calibration Curve Selection Function

The following are user-determined steps

(If the user cannot determine the main component, selecting the optimal calibration curve is difficult.)

Conventionally

- Requires no user decisions.

EDX-LE

Start measurement with a single click!

EDX-LE automatically determines the main component, selects the optimal calibration curve, and performs measurement.

Results
Variety of functions makes screening easier

Simple Screening Setup
Screening conditions can be customized easily according to the control system.

Changing Threshold Values
Threshold values can be set for each material or element. The screening judgment method can also be changed in accordance with the input method used for threshold values. Furthermore, lower limits for threshold values can be referenced for each material, which helps to set threshold values.

Changing Judgment Character Strings
The character strings displayed for judgments in analysis results, used to indicate whether they are below the threshold value, in the gray zone, or above the threshold value, can be specified.

Changing the Report Template
The style used for reports can be changed. The standard templates provided can be selected.

EDX-LE Offers Improved Security for Software Operations

Condition Protection Function
Restrictions can be specified for screening conditions and various other settings.

EDX-LE Offers Improved Security for Software Operations

Condition Protection Function
Restrictions can be specified for screening conditions and various other settings.

Variety of functions minimizes instrument maintenance requirements

Automatic X-ray Tube Ageing Function
If the instrument has not been used for a long time, the X-ray tube must be aged when it is restarted. To prevent malfunction, this process has been automated.

Detector Does Not Require Liquid Nitrogen
The EDX-LE is equipped with a detector that does not need to be cooled with liquid nitrogen, providing significantly reduced operating costs.
**Fully Equipped with Essential Functions**

**All-in-One Design Includes All Functions Required for RoHS/ELV Screening**

Overall RoHS/ELV analysis performance is tied to the smooth coordination of a variety of analytical systems, creating a synergistic effect.

For this reason, EDX-LE standard equipment includes all the functions required for RoHS/ELV analysis, providing users with the optimal RoHS/ELV screening System.

**Obtaining highly reliable analytical results**

**Calibration Curve Method and FP Method**

To improve the reliability of analysis results for elements specified by the RoHS/ELV directive, the elements are analyzed using the calibration curve method and standard sample (check sample) provided with the instrument. (The Fundamental Parameter (FP) method is used to analyze some RoHS elements in metal samples.) Any other elements detected are analyzed using the FP method, which uses theoretical calculations to provide additional information.

**Compensates for the influence of differences in shape of actual samples on analysis results**

**Shape Correction Function**

X-ray intensity differs with the shape and thickness of samples, even if they contain the same material, and will have an impact on quantitative values. EDX-LE utilizes a BG internal standard method* to eliminate the effect of shape and thickness in order to provide highly precise results.

* BG internal standards method: Fluorescent X-ray intensity of each element is standardized using scattered X-ray intensity.

**Organize measurement results in a list**

**List Creation Function**

List data stored in Excel format.

Note that this requires installation of Microsoft Office Excel before use.

**Accommodates a Variety of Samples**

**Sample Observation Function**

When measuring foreign substances and samples with multiple parts, the sample observation camera allows the analysis position to be easily specified by checking the camera image. If the sample is small or if specific locations on the sample are being measured, the collimator can be used to change the X-ray exposure region.

**Large Sample Chamber**

Despite its compact body, the EDX can accommodate samples up to W370 mm × D320 mm × H155 mm.
Qualitative-Quantitative Analysis *Additional function kit is required.
The EDX-LE can perform qualitative analysis and non-standard quantitative analysis based on the FP method. This means it can be used to analyze foreign substances or differentiate between different materials.

Matching (Steel Type Identification, Product Identification) *Additional function kit is required.
Comparing measurement data to a data library of steel types allows automatic identification for everything from materials closest to the sample, to the 10th position on the library list. In addition to matching by intensity, matching by content is also available if the user creates and registers libraries of concentrations and elements.

Thin-Film Analysis *Additional function kit is required.
The Film FP method obtains not only single layer, but multilayer film thickness, composition, and deposit volume. It is also well-suited to the measurement of Pb contained in plating. (Information on the layer order (including base) and the constituent elements is necessary.)
Screening Method Proposed by Shimadzu for Revised RoHS Directive

Shimadzu offers customers comprehensive assistance with establishing capabilities for complying with RoHS/ELV requirements. In addition to developing and manufacturing energy dispersive X-ray fluorescence spectrometers (EDXRF), which account for a major share of testing equipment used for RoHS/ELV directive compliance, Shimadzu also develops and manufactures ICP atomic emission spectrometers (ICP-AES), ICP mass spectrometers (ICP-MS), atomic absorption spectrophotometers (AA), ultraviolet-visible spectrophotometers (UV-VIS), Fourier transform infrared spectrophotometers (FT-IR), gas chromatograph mass spectrometers (GC/MS), high performance liquid chromatographs (HPLC), and ion chromatographs (IC), develops applications, and even offers guidance for testing methods.

Substances Restricted by RoHS II and Start Date

<table>
<thead>
<tr>
<th>Restricted Substances</th>
<th>Max. Allowable Conc.</th>
<th>Date of Applicability (Categories 1 to 7 and 10)</th>
<th>Date of Applicability (Categories 8 and 9)</th>
<th>Date of Applicability (Category 11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>0.1%</td>
<td>July 01, 2006</td>
<td></td>
<td>July 22, 2014</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.01%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexavalent chromium</td>
<td>0.1%</td>
<td></td>
<td></td>
<td>July 22, 2014</td>
</tr>
<tr>
<td>Brominated flame retardants</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBB</td>
<td>0.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBDE</td>
<td>0.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phthalate esters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEHP</td>
<td>0.1%</td>
<td>July 22, 2019</td>
<td></td>
<td>July 22, 2019</td>
</tr>
<tr>
<td>BBP</td>
<td>0.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DBP</td>
<td>0.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIBP</td>
<td>0.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Categories
1: Large household appliances, 2: Small household appliances, 3: IT and telecommunications equipment, 4: Consumer equipment, 5: Lighting equipment, 6: Electrical and electronic tools, 7: Toys, leisure and sports equipment, 8: Medical devices, 9: Monitoring and control instruments including industrial monitoring and control instruments, 10: Automatic dispensers, and 11: Other electrical and electronic equipment
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*1: Pass/fail criteria are determined by respective institutions.
*2: Conforming and non-conforming refer to conformance/non-conformance with criteria of institution.

### Substances Restricted by RoHS II and Start Date

<table>
<thead>
<tr>
<th>Categories</th>
<th>Date of Applicability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Large household appliances</td>
<td>July 01, 2006</td>
</tr>
<tr>
<td>2: Small household appliances</td>
<td>July 22, 2014</td>
</tr>
<tr>
<td>3: IT and telecommunications equipment</td>
<td>July 22, 2016</td>
</tr>
<tr>
<td>4: Consumer equipment</td>
<td>July 22, 2017</td>
</tr>
<tr>
<td>5: Lighting equipment</td>
<td></td>
</tr>
<tr>
<td>6: Electrical and electronic tools</td>
<td></td>
</tr>
<tr>
<td>7: Toys, leisure and sports equipment</td>
<td></td>
</tr>
<tr>
<td>8: Medical devices</td>
<td></td>
</tr>
<tr>
<td>9: Monitoring and control instruments including industrial monitoring and control instruments</td>
<td></td>
</tr>
<tr>
<td>10: Automatic dispensers</td>
<td></td>
</tr>
<tr>
<td>11: Other electrical and electronic equipment</td>
<td>July 22, 2019</td>
</tr>
</tbody>
</table>

### Screening Method Proposed by Shimadzu for Revised RoHS Directive

1. Screen by X-ray fluorescence
2. Py-GC/MS Screening
3. Compare to criteria*1
   - Pass: Conforming*2
   - Fail: Measure accurately
5. Compare to criteria*1
   - Fail: Non-conforming*2
   - Pass: Conforming*2

*1: Pass/fail criteria are determined by respective institutions.
*2: Conforming and non-conforming refer to conformance/non-conformance with criteria of institution.
RoHS Compliance Screening Analysis Instruments

Energy Dispersive X-ray Fluorescence Spectrometer

EDX-7000/8000/8100

- High Sensitivity, High Speed, and High Resolution
  High speed, high sensitivity, and high resolution SDD detector and optimized hardware achieve the highest level of analysis performance in its series.

- Accommodates Various Types and Sizes of Samples
  The combination of Small Spot Analysis Kit and EDXIR-Analysis Software facilitate the contaminant analysis. Turret for 12 samples permits continuous measurement.

- EDX-7000/8000/8100:
  Vacuum Measurement Unit (also accommodates EDX-8000) and Helium Purge Unit enable the analysis of liquid, powder and solid samples.

- EDX-8000/8100:
  The wide-range detector permits the range of detected elements from C to U.

- Easy Operation
  PCEDX-Navi software allows easy operation for RoHS directive restricted material analysis and report creation even for beginners.

High Sensitivity  – Lower Limit of Detection Improved 1.5 to 5 Times!  –

The high-performance SDD detector and combination of optimized optics and primary filters achieve previously unheard-of high levels of sensitivity. The sensitivity is higher than the previous Si (Li) semiconductor detector across the entire range from light to heavy elements.

Comparison of the Lower Limit of Detection in a Light Element Matrix

Profile Comparison for Lead (Pb) in Copper Alloy

Ultra-Light Element Analysis by EDX-8000/8100

The EDX-8000/8100 features an SDD detector with a special ultra-thin-film window material that is able to detect ultra-light elements such as carbon (C), oxygen (O), and fluorine (F)

Profile of Fluorine (F) by EDX-8000
Screening System for Phthalate Esters

Py-Screener

Making the Difficult Simple
The Py-Screener system is designed to screen for phthalate esters in polymers. The use of phthalate esters in toys and food packaging is currently restricted. Moving forward, they are expected to be regulated as restricted substances under the RoHS (II) Directive. The Py-Screener system consists of special software, special standard samples, and a sampling toolkit, which supports the entire process from sample preparation to data acquisition, data analysis, and maintenance. It provides an environment in which operations are simple, even for novices.

Feature
Organics Solvents Are Not Required for Sample Preparation
Analytical standards and test samples can be prepared without using organic solvents. To prepare a sample, just use the cutter to remove a portion from the test material, place it in the sample cup, and weigh it. Sample preparation videos provide support so that even novices can easily prepare samples.


Easy to Operate Using Special Software
The special software leads you through the required procedures, so even novices can perform the operations in accordance with the software instructions. The Py and GC-MS analysis conditions are preset. To automatically start continuous analyses, just place the prepared standard samples and test samples in the autosampler, and enter the number of samples, the sample names, and their weights. Continuous measurements can be performed overnight, so approximately 30 samples can be measured per day.
Instrument Specifications

Primary Specifications

<table>
<thead>
<tr>
<th>Measurement Principle</th>
<th>X-ray fluorescence spectrometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement Method</td>
<td>Energy dispersive</td>
</tr>
<tr>
<td>Measurement Sample Type</td>
<td>Solids, liquids, or powder</td>
</tr>
<tr>
<td>Elements to be Detected</td>
<td>13Al to 92U</td>
</tr>
<tr>
<td>Sample Chamber Size</td>
<td>Max. W 370 mm × D 320 mm × H 155 mm</td>
</tr>
</tbody>
</table>

X-Ray Generator

<table>
<thead>
<tr>
<th>X-Ray Tube</th>
<th>Rh target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube Voltage</td>
<td>5 kV to 50 kV</td>
</tr>
<tr>
<td>Tube Current</td>
<td>1 μA to 1,000 μA</td>
</tr>
<tr>
<td>Cooling Method</td>
<td>Air cooling (with fan)</td>
</tr>
<tr>
<td>Exposure Area</td>
<td>Automatic switching between 3, 5, and 10 mm dia. areas (1 mmø is an option)</td>
</tr>
<tr>
<td>Primary Filter</td>
<td>Automatic switching between 5 types + OPEN</td>
</tr>
</tbody>
</table>

Detector

<table>
<thead>
<tr>
<th>Type</th>
<th>Si-PIN semiconductor detector</th>
</tr>
</thead>
<tbody>
<tr>
<td>LN₂ Supply</td>
<td>Not required</td>
</tr>
<tr>
<td>Counting Method</td>
<td>Digital filter counting</td>
</tr>
</tbody>
</table>

Sample Chamber

<table>
<thead>
<tr>
<th>Measurement Atmosphere</th>
<th>Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Observation</td>
<td>CCD camera</td>
</tr>
</tbody>
</table>

Data Processing Unit

<table>
<thead>
<tr>
<th>Memory</th>
<th>1 GB min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDD</td>
<td>80 GB min.</td>
</tr>
<tr>
<td>Resolution</td>
<td>1024 x 768 pixels min.</td>
</tr>
<tr>
<td>Printer</td>
<td>Color inkjet printer</td>
</tr>
<tr>
<td>CD</td>
<td>CD-ROM drive</td>
</tr>
<tr>
<td>OS</td>
<td>Windows 7*</td>
</tr>
</tbody>
</table>

* Microsoft Office is not included in this OS.

Software

<table>
<thead>
<tr>
<th>Screening Analysis</th>
<th>Simple operation software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantitative Analysis</td>
<td>Calibration curve method</td>
</tr>
<tr>
<td></td>
<td>FP method</td>
</tr>
<tr>
<td></td>
<td>Thin-film FP method (Option)</td>
</tr>
<tr>
<td></td>
<td>BG-FP method (Option)</td>
</tr>
<tr>
<td>Matching Software</td>
<td>Option</td>
</tr>
<tr>
<td>Utilities</td>
<td>Automatic calibration functions (energy calibration, full-width half-maximum calibration)</td>
</tr>
<tr>
<td>Other Functions</td>
<td>System-status Monitoring Function</td>
</tr>
<tr>
<td></td>
<td>Analysis-results Tabulation Function</td>
</tr>
<tr>
<td></td>
<td>Analysis-results Report Creation Function</td>
</tr>
</tbody>
</table>

Installation Requirements

<table>
<thead>
<tr>
<th>Guaranteed Performance</th>
<th>Guaranteed Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>10°C to 30°C (fluctuations should be 2°C/hour max.)</td>
</tr>
<tr>
<td>Humidity</td>
<td>40% to 70% (No condensation)</td>
</tr>
<tr>
<td>Power Source</td>
<td>AC 100 V to 240 V ± 10% (50/60 Hz), 150 VA grounded outlet</td>
</tr>
</tbody>
</table>

Installation Example

<table>
<thead>
<tr>
<th>Dimensions of the Main Unit</th>
<th>W 520 mm × D 650 mm × H 420 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Unit Weight</td>
<td>Approx. 60 kg</td>
</tr>
</tbody>
</table>

At least 200 mm between unit and wall.
**Options**

**Halogen Screening Analysis Kit**
P/N 212-24908-91
This kit includes an instruction manual for Halogen analysis and a check sample required for measurement of 6 elements (Cd, Pb, Hg, Cr, Br, and Cl) specified by the RoHS directive and Halogen regulation.

**RoHS, Halogen, and Antimony Screening Analysis Kit**
P/N 212-24922-91
This kit includes an instruction manual and a check sample required for measurement of 7 elements including those specified by the RoHS directive, Halogen regulation, and Antimony (Cd, Pb, Hg, Cr, Br, Cl, and Sb).

**Small Spot Solder Analysis Kit**
P/N 212-24850-41
This kit includes an instruction manual for small spot solder analysis and a small spot collimator plate required for measurement of a print circuit board.

**Additional Function Kit for EDX-LE**
P/N 212-24714-42
Adds a general-analysis function to the EDX-LE. For details, please contact your Shimadzu representative.

**Sample Cells**

**3571 General Open-End X-Cell (no lid)**
P/N 219-85000-55 (100 pcs/set)
(Outer diameter: 31.6 mm, volume 10 mL)
Polyethylene sample cell used for liquid and powder samples. Used with Mylar or polypropylene films.

**3529 General X-Cell (with lid)**
P/N 219-85000-52 (100 pcs/set)
(Outer diameter: 32 mm, volume 8 mL)
Used for liquid samples. Equipped with relief hole and liquid retainer in case of liquid expansion.

**3577 Micro X-Cell**
P/N 219-85000-54 (100 pcs/set)
(Outer diameter 31.6 mm, volume 0.5 mL)
For trace samples. Use with a collimator is recommended to reduce scattered radiation emitted by sample cell.

**3561 Universal X-Cell**
P/N 219-85000-53 (100 pcs/set)
(Outer diameter 31.6 mm, volume 8 mL)
For liquid and thin-film samples. Equipped with a relief hole and liquid retainer in case of liquid expansion. Equipped with a ring for tightly holding thin-film samples with film.

**Polypropylene Film**
P/N 219-82019-05 (73 mm W × 92 m roll)
Sample-holding film. (For light element analysis)

**Mylar Film**
P/N 202-86501-56 (500 sheets/set)
Sample-holding film. (For heavy element analysis)
This unit is designated as an X-ray device.

For Research Use Only. Not for use in diagnostic procedures.

Shimadzu Corporation
www.shimadzu.com/an/