

### Control Values for the Six Substances Banned by RoHS

Shimadzu analyzes the content of substances banned under the RoHS Directive by appropriately selecting samples from all parts, assemblies, and secondary materials delivered as RoHS-compliant. These are analyzed using an energy dispersive X-ray fluorescence spectrometer (EDX) to screen for the banned substances. Then the EDX results are used to determine RoHS compliance or non-compliance and whether or not precision analysis is required.

Due to measurement error and variability, EDX analysis is not sufficient for making the above determination based on the RoHS threshold values alone.

Therefore, control values are specified based on IEC 62321 Ed. 1.0:2008, Annex D, to determine the gray zone where RoHS compliance or non-compliance cannot be determined directly from EDX analysis values.

These control values are indicated in Table 1.

Table 1 Upper and Lower Limit Control Values for EDX Analysis (units: ppm)

Banned Substance	Polymer	Metal	RoHS Threshold Value
Cd	Lower limit control value = 40*, Upper limit control value = 160		100
Pb	Lower limit control value = 600, Upper limit control value = 1400		1000
Hg			
PBB	Lower limit control value = 300 (as total Br)	-	1000
PBDE			
Cr(VI)	Lower limit control value = 600 (as total Cr)		1000

\* Lower limit control value is 75 ppm for brass, which can contain Cd as an impurity.

If the EDX analysis value for Cd, Pb, or Hg is below the corresponding lower limit control value, then it is judged RoHS compliant, whereas if the analyzed value is at or above the upper limit control value, the sample is RoHS non-compliant. If the analyzed value is at or above the corresponding lower limit control value, but below the upper limit control value, then it is judged to be in a gray zone, which requires precision analysis using plasma emission spectrometry, contacting/investigating the supplier, or other means to determine RoHS compliance or non-compliance.

If the EDX analysis value for PBB or PBDE is below the corresponding lower limit control value, then it is judged RoHS compliant.

If the analyzed value is at or above the lower limit control value, it requires precision analysis, such as by using gas chromatograph mass spectrometry (GC/MS), contacting/investigating the supplier, or other means to determine RoHS compliance or non-compliance.

If the EDX analysis value for hexavalent chromium (CrVI) is below the corresponding lower limit control value, then it is judged RoHS compliant.

If it is at or above the lower limit control value, then it is analyzed by diphenylcarbazide absorption spectrophotometry.

Compliance is determined as follows, depending on the application.

### Contained in a Polymer

Polymer samples are ground to a powder and quantitatively analyzed by alkaline extraction – diphenylcarbazide absorption spectrophotometry. If quantitated levels are at or above the RoHS threshold value (1000 ppm), it is considered non-compliant. If below the RoHS threshold value, then it is considered RoHS compliant.

### Chromate Coatings

CrVI levels are determined by quantitatively analyzing samples by hot water extraction - diphenylcarbazide absorption spectrophotometry and then calculating the quantity adhered ( $\mu\text{g}/\text{cm}^2$ ). Due to measurement error and variability from this analysis method, values are specified for determining RoHS compliance or non-compliance (CrVI criteria values), which are used in a similar manner as for EDX analysis.

Extraction parameters, hexavalent chromium criteria, and threshold values are indicated in Table 2.

Table 2 Extraction Parameters, Cr(VI) Criteria, and Threshold Values for Chromate Coatings

Extraction Parameters	10 minutes at 100 °C
Cr(VI) Criteria Value	0.02 $\mu\text{g}/\text{cm}^2$
Threshold Value	0.10 $\mu\text{g}/\text{cm}^2$

Note: The threshold value complies with EN 15205:2006 (Determination of hexavalent chromium in corrosion protection layers – Qualitative analysis).

If quantitated levels are at or above the threshold value, it is considered non-compliant. If below the Cr(VI) criteria value, then it is considered compliant. If below the threshold value, but at or above the Cr(VI) criteria value, then it is considered in the gray zone and RoHS compliance or non-compliance must be determined by other means, such as by contacting the supplier, having the supplier submit control standards and control data, and/or inspecting the manufacturing and warehouse sites.

### Contact Information

European Regulatory Measures Team, Procurement Department, Manufacturing Support Division,  
SHIMADZU Corporation

1, Nishinokyo-Kuwabara-cho, Nakagyo-ku, Kyoto 604-8511, Japan

TEL: +81-75-823-1151

FAX: +81-75-842-0141

E-mail: [green@group.shimadzu.co.jp](mailto:green@group.shimadzu.co.jp)