# Restriction of Hazardous Substances (RoHS)

## BMF 69-Restriction of Hazardous Substances (RoHS)

**The EU Restriction of Hazardous Substances (RoHS) Directive (2011/65/EU)** which came into force 3rd Jan. 2013, restricts the maximum allowable levels of six substances including lead (Pb), cadmium (Cd), mercury (Hg), hexavalent chromium (Cr6+), poly-brominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE); the latter two are used as flame retardants in electrical equipment. In order to produce such kinds of products within the EU or to import them into the EU, manufacturers are responsible for providing appropriate documentation.


Since the adoption of the EU RoHS directive, a number of other jurisdictions have created, or are in the process of creating similar restrictions of hazardous substances including China RoHS, Korea RoHS, California RoHS, Taiwan RoHS, Turkey RoHS, and India RoHS. Similar regulations exist in other areas of the world, such as Norway, Japan and the USA.

The maximum allowed amounts by weight in homogenous materials are:

- Lead: 0.1%
- Cadmium: 0.01%
- Mercury: 0.1%
- Hexavalent chromium: 0.1%
- Polybrominated biphenyl (PBB): 0.1%
- Polybrominated diphenyl ether (PBDE): 0.1%

*n.b. Homogenous material does not imply goods in total, but every homogenous part of it.*

Testing for these substances is normally carried out according to the **method IEC 62321**. Chiron is happy to offer recommended standards for the determination of mono- to decabrominated PBBs and PBDEs, according to that method. The level of PBBs and PBDEs are determined by GC-MS after soxhlet extraction (i.e. **USEPA method 3540C**).

Polybrominated biphenyl ethers (PBDEs) are primarily used as flame retardants in plastic and foam consumer products, including electrical items. Polybrominated biphenyls (PBBs) are also brominated compounds, used for similar applications as PBDEs. PBBs have been banned in most countries since the 1970s.

**PBBs used for calibration (IEC 62321):**

| Pr. No. | Compound name | PBB | CAS No. |
|---|---|---|---|
| 3091.12 | 4-Bromobiphenyl | BB-003 | 92-66-0 |
| 3096.12 | 4,4'-Dibromobiphenyl | BB-015 | 92-86-4 |
| 2664.12 | 2,4,5-Tribromobiphenyl | BB-029 | 115245-07-3 |
| 3102.12 | 2,2',4,5'-Tetrabromobiphenyl | BB-049 | 60044-24-8 |
| 10266.12 | 3,3',4,4'-Tetrabromobiphenyl | BB-077 | 77102-82-0 |
| 3107.12 | 2,2',4,5',6-Pentabromobiphenyl | BB-103 | 59080-39-6 |
| 3108.12 | 2,2',4,4',5,5'-Hexabromobiphenyl | BB-153 | 59080-40-9 |
| 3109.12 | 3,3'4,4',5,5'-Hexabromobiphenyl | BB-169 | 60044-26-0 |
| 2679.12 | Technical mixture containing hepta-, octa-, and nonabromobiphenyls | Dow FR-250 | 27858-07-7 |
| 2677.12 | Decabromobiphenyl | BB-209 | 13654-09-6 |

**PBDEs used for calibration (IEC 62321):**

| Pr. No. | Compound name | PBDE | CAS No. |
|---|---|---|---|
| 8748.12 | 4-Bromodiphenyl ether | BDE-003 | 101-55-3 |
| 8750.12 | 4,4'-Dibromodiphenyl ether | BDE-015 | 2050-47-7 |
| 1961.12 | 2,4,4'-Tribromodiphenyl ether | BDE-028 | 41318-75-6 |
| 10267.12 | 2',3,4-Tribromodiphenyl ether | BDE-033 | 147217-78-5 |
| 1962.12 | 2,2',4,4'-Tetrabromodiphenyl ether | BDE-047 | 5436-43-1 |
| 1967.12 | 2,2',4,4',5-Pentabromodiphenyl ether | BDE-099 | 60348-60-9 |
| 1968.12 | 2,2',4,4',6-Pentabromodiphenyl ether | BDE-100 | 189084-64-8 |
| 1971.12 | 2,2',4,4',5,5'-Hexabromodiphenyl ether | BDE-153 | 68631-49-2 |
| 1972.12 | 2,2',4,4',5,6'-Hexabromodiphenyl ether | BDE-154 | 207122-15-4 |
| 1973.12 | 2,2',3,4,4',5',6-Heptabromodiphenyl ether | BDE-183 | 207122-16-5 |
| 1975.12 | 2,2',3,4,4',5,5',6-Octabromodiphenyl ether | BDE-203 | 337513-72-1 |
| 9033.12 | 2,2',3,3',4,4',5,5',6-Nonabromodiphenyl ether | BDE-206 | 63387-28-0 |
| 1811.12 | Decabromodiphenyl ether | BDE-209 | 1163-19-5 |

**Surrogate standards to monitor analyte recovery:**

| Pr. No. | Compound name | PBDE | CAS No. |
|---|---|---|---|
| 2891.12 | 4,4'-Dibromooctafluorobiphenyl | DBOFB | 10386-84-2 |

**Internal standards to correct for injection errors:**

| Pr. No. | Compound name | PCB | CAS No. |
|---|---|---|---|
| 8708.12 | Decachlorobiphenyl | CB-209 | 2051-24-3 |

**Alternative internal standards: Fluoro-PBDEs**

| Pr. No. | Compound name | F-PBDE | CAS No. |
|---|---|---|---|
| 1608.12 | 3-**Bromo**-4'-fluorodiphenyl ether | 4'-F-BDE-2 | 50904-38-6 |
| 2257.12 | 3'-Fluoro-3,4-**dibromo**diphenyl ether | 3'-F-BDE-12 | N/A |
| 2160.12 | 2'-Fluoro-2,4,4'-**tribromo**diphenyl ether | 2'-F-BDE-28 | 876310-22-4 |
| 2161.12 | 6-Fluoro-2,2',4,4'-**tetrabromo**diphenyl ether | 6-F-BDE-47 | 876310-23-4 |
| 2505.12 | 3,6-Difluoro-2,2',4,4',5-**pentabromo**diphenyl ether | 3,6-F2-BDE-99 | 886748-34-1 |
| 2163.12 | 3-Fluoro-2,2',4,4',6-**pentabromo**diphenyl ether | 3-F-BDE-100 | 887401-80-1 |
| 1929.12 | 4'-Fluoro-2,3,3',4,5,6-**hexabromo**diphenyl ether | 4'-F-BDE-160 | 863314-88-9 |
| 2166.12 | 3-Fluoro-2,2',4,4',5,5',6-heptabromodiphenyl ether | 3-F-BDE-183 | 876310-28-0 |
| 2167.12 | 4',6-Difluoro-2,2',3,3',4,5,5',6'-**octabromo**diphenyl ether | 4',6-F2-BDE-199 | 863314-96-9 |
| 2168.12 | 4'-Fluoro-2,2',3,3',4,5,5',6,6'-**nonabromo**diphenyl ether | 4'-F-BDE-208 | 876310-29-1 |

Please note: All details are without guarantee.

**Chiron also offers a large variety of different PBBs and PBDEs (see BMF 15). Please enquire.**

*Literature:*

*EU RoHS Directive (2011/65/EU).*
*IEC method 62321.*
*USEPA method 3540C.*