ZDHC

ZDHC MRSL

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Background

The ZDHC Manufacturing Restricted Substances List (ZDHC MRSL) is a list of chemical substances banned from intentional use in the processing of textile materials, leather materials, polymers such as rubber, foams, adhesives used in the apparel and footwear industry. Intentional use means the substance is used deliberately in a chemical product to achieve a desired look or functionality.

The ZDHC MRSL goes beyond traditional approaches to chemical restrictions, which are focused on consumer safety and only apply to finished products (Restricted Substances List - RSL). The ZDHC MRSL approach also helps protect workers, local communities and the environment from the possible impacts of harmful chemicals.

Chemical formulations covered by restrictions in the ZDHC MRSL include, but are not limited to, cleaners, adhesives, paints, inks, detergents, dyes, colourants, auxiliaries, coatings and finishing agents used during raw material production, wet processing, process machinery maintenance, wastewater treatment, sanitation and pest control. ZDHC MRSL limits apply to substances in commercially available formulations, not those from earlier stages of chemical synthesis.

Using chemical formulations that conform to the ZDHC MRSL allows suppliers to assure themselves and their customers that banned chemical substances are not intentionally used during production and manufacturing processes.

The ZDHC Roadmap to Zero Programme acknowledges the vital role of the experts comprising the ZDHC MRSL Council, who independently and objectively evaluated the proposed additions/revisions to the ZDHC MRSL V4.0 and made decisions on the MRSL content.

Purpose

The ZDHC MRSL offers brands, suppliers and formulators a single, harmonised list of chemical substances banned from intentional use during manufacturing and related processes in supply chains of the textile, apparel and footwear (including leather and foam) industries.

Version 4.0 applies to textiles, leather, polymers such as rubber, foams and adhesives.

The ZDHC MRSL does not replace legal or brand-specific restrictions on harmful substances in materials or finished products.

CHAPTER 1

ZDHC MRSL Main List

This applies to chemical formulations and substances used during the wet processing of substrates (textile, leather, polymers such as rubber, foams and adhesives). For clarity purposes, the scope of ZDHC MRSL V4.0 can be found below. The scope is prepared to the best of our current knowledge and may develop over time and should not be construed as rigid.

Scope

The ZDHC MRSL substances are listed with applicable CAS numbers and provided with applicability filters for substrates (textile, leather, polymers such as rubber, foams, adhesives), supplier guidance, formulation limits and methods of analysis.

Supplier guidance includes:

- No intentional use: These substances are banned from intentional use in facilities that process raw materials and manufacture finished products.
- Not applicable: These substances are not applicable to the specific substrates.
- No intentional use^{EC*}: These are substances that are not to be used intentionally. However, for only selected and specific applications/processes they may be used for the time being and will be evaluated through suppliers evaluation in Supplier to Zero Platform.

Formulation Limits are concentration limits for the substances in commercial chemical formulations available from chemical manufacturers. These limits ban intentional use while allowing for reasonable expected manufacturing impurities, which should be consistently achievable by responsible chemical manufacturers.

Methods of Analysis describe general techniques of testing and wherever available, specific test methods.

In the ZDHC MRSL Table, Polymers (R,F,A) means Polymers (Rubber, Foams, Adhesives)

1A. Alkylphenols (APs) and Alkylphenol Ethoxylates (APEOs): including all isomers

Supplier Information:

APEOs can be used as or found in: detergents, scouring agents, spinning oils, wetting agents, softeners, emulsifier/dispersing agents for dyes and printing formulations, impregnating agents, de-gumming agents/auxiliaries for silk production, dyes and pigment preparations, polyester padding and down/feather fillings.

Testing Information:

Multiple isomers are included but only a few are mentioned in the table below. In addition to testing of given CAS numbers, certifiers should also evaluate the SDS of the formulation and discuss with the formulator to ensure that no AP or APEOs have been intentionally used.

Formulator Information:

APEOs may be used intentionally in formulations to effect detergency and emulsifying abilities. Not only are individual substances banned but the entire chemical group. While procuring any chemicals for the purpose of making formulations for listed activities, formulators are expected to evaluate the input chemicals to ensure APs and APEOs are not used intentionally in the raw materials.

1A. Alkylphenol (AP) and Alkylphenol Ethoxylates (APEOs): including all isomers

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Nonylphenol (NP), mixed isomers	Multiple, including 104-40-5 11066-49-2 25154-52-3 84852-15-3	Textiles	No intentional use	100 mg/kg	ISO 21084:2019
		Leather			
		Polymers (R,F,A)			
Octylphenol (OP), mixed isomers	Multiple, including 140-66-9 1806-26-4 27193-28-8	Textiles		100 mg/kg	
		Leather			
		Polymers (R,F,A)			
Nonylphenol ethoxylates (NPEO)	Multiple, including 9016-45-9 26027-38-3 37205-87-1 68412-54-4 127087-87-0	Textiles		100 mg/kg	ISO 18254-1:2016 ISO 18218-1:2023
		Leather			
		Polymers (R,F,A)			
Octylphenol ethoxylates (OPEO)	Multiple, including 9002-93-1 9036-19-5 68987-90-6	Textiles		100 mg/kg	
		Leather			
		Polymers (R,F,A)			

1B. Anti-microbials and Biocides

Supplier Information:

Antimicrobials and biocides are a group of chemicals that may be intentionally applied /used in textile, leather and footwear industries to preserve or increase the shelf life of formulations and to preserve semi-finished or finished articles when intentionally applied, providing effects such as odour control, and/or insect/fungus/microbes repellency. Biocides, in general, have the purpose of destroying, deterring, rendering harmless, preventing or controlling activity of harmful organisms. Whereas hazardous properties are in general unwanted within textile and leather chemicals, these properties are a precondition for the purpose of biocides to control harmful living things. Biocides used as in-can-preservatives can be found as residues on fabrics and leather articles. But the concentrations of active biocides found on finished articles are in general below the minimum inhibitory limit.

Permethrin is permitted for usage in personal protective equipment (PPE) (EU 2016/425, EPA registered product, APVMA registered product, PMRA registered product, etc.). Additionally, it is sometimes the only allowed substance for specific purposes, such as military ones. All efforts should be made to maximise the chemical finish durability and to minimise losses to the environment.

The use of O-Phenylphenol (+salts) is permitted as an in-can preservative in leather formulations under BPR PT-6 up to the formulation limit of 5000 mg/kg. Use of OPP is permitted as chemical preservation for transporting and/or storing raw hides, or tanned semi-finished products (wet-white, wet-blue). Chemical preservation of coated or uncoated finished leather is not permitted.

Testing Information:

Note: The requirements for OPP content are different for certain formulations: Use of OPP is permitted as chemical preservation for transporting and/or storing raw hides or tanned semi-finished products (wet-white, wet-blue). Chemical preservation of coated or uncoated finished leather is not permitted. It is also permitted as an in-can preservative in leather chemical formulations under the BPR PT6 up to the formulation limit of 5000 mg/kg. The certifier must get the clarification on the formulation type where OPP and their salts are allowed up to 5000 mg/kg level.

Note: Intentional use of permethrin is not allowed. Contamination level: 250 mg/kg. There is an exemption for some processes: Permethrin is approved for use on wool curtains, carpets, rugs and floor coverings under BPR PT 18. Permethrin is permitted for usage in personal protective equipment (PPE) (EU 2016/425, EPA registered product, APVMA registered product, PMRA registered product, etc.).

Formulator Information:

In general, for all biocides used in textile, leather, footwear or other chemicals that conform to the ZDHC MRSL, a formal authorisation of the biocide by a competent authority is required or at least the biocide must be registered for legal authorisation and is under review for uses in the textile, leather or footwear supply chain (e.g. listed in the EU BPR Annex I as “initial application for approval in progress”). ZDHC MRSL limits the use of authorised biocides to only authorised areas. In addition, they may only be used below the authorised concentration limit and all efforts should be made to avoid them. Additionally, the ZDHC MRSL lists some specific biocides, which have been known to be used in textile and leather processing. These specific substances are restricted in the ZDHC MRSL for intentional biocidal use with the exception of some specific applications mentioned in the ZDHC MRSL. There must be an approval for these in the authorisation documents.

Any change in the regulatory status under BPR will be applicable immediately under ZDHC MRSL.

1B. Anti-microbials and Biocides

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Dimethylfumarate (DMFu)	624-49-7	Textiles	No intentional use	10 mg/kg	ISO 16186:2021
		Leather			
		Polymers (R,F,A)			
O-Phenylphenol (+salts)	90-43-7	Textiles	No intentional use	5000 mg/kg	ISO 13365-1 :2020 EN 17134-1:2024
		Leather	No intentional use (exemption for mentioned processes)		
		Polymers (R,F,A)	Not applicable	Not applicable	
Permethrin	52645-53-1	Textiles	No intentional use	250 mg/kg	EN ISO 15913:2003 or EPA 8081/ EPA 8151A or BVL L 00.00-34:2010-09
		Leather	No intentional use (Exemption for mentioned processes)		
		Polymers (R,F,A)	No intentional use		
Triclosan	3380-34-5	Textiles	No intentional use	250 mg/kg	ISO 22992-2:2020
		Leather			
		Polymers (R,F,A)			

1C. Chlorinated Paraffins

Supplier Information:

Occasionally used as flame retardants and PVC additives in certain industries as well as fat liquoring agents in leather processing.

Testing Information:

There are multiple isomers of chlorinated paraffins, but only certain representative isomers are checked during testing. Hence, the certifier's role in expert evaluation is important in the testing.

Formulator Information:

N/A

1C. Chlorinated Paraffins

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Short-chain Chlorinated Paraffins (SCCPs) (C10-C13)	Multiple including 85535-84-8	Textiles	No intentional use	250 mg/kg	Textile chemicals: ISO 22818:2021 Leather chemicals: ISO 18219-2:2021
		Leather		250 mg/kg	
		Polymers (R,F,A)		250 mg/kg	
Medium-chain Chlorinated Paraffins (MCCPs) (C14-C17)	Multiple including 85535-85-9	Textiles		250 mg/kg	
		Leather		250 mg/kg	
		Polymers (R,F,A)		250 mg/kg	

1D. Chlorobenzenes and Chlorotoluenes

Supplier Information:

Chlorobenzenes and Chlorotoluenes can be used as carriers in the dyeing process of polyester or wool/polyester fibres as well as in levelling agents, as well as solvents. Additionally, they can be found in colourants (i.e. disperse dyes) and specialty chemicals as an impurity. When treating wool, 1,2-Dichlorobenzene contamination is of a high risk.

Testing Information:

During the analysis, there is a possibility that certain non-targeted substances may break down and produce compounds that resemble chlorobenzenes and chlorotoluenes. Therefore, any positive detection of these substances needs to be treated carefully and these false positive tests must be reconfirmed using confirmatory testing provided in EN 17137-2024.

Formulator Information:

Chlorobenzenes and Chlorotoluenes may occur through cross contamination due to improper purification steps of previous chemicals. Widely used across various intermediates, these manufacturing solvents may enter into the supply-chain due to poor quality raw materials. They are especially relevant to the manufacturing of the disperse dyes.

1D. Chlorobenzenes and Chlorotoluenes

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
1,2-Dichlorobenzene	95-50-1	Textiles Leather Polymers (R,F,A)	No intentional use	Other formulations: 20 mg/kg Pigments: 200 mg/kg	EN 17137:2024 Confirmation analysis may be required to avoid false positives.
Monochlorobenzene	108-90-7	Textiles Leather Polymers (R,F,A)	No intentional use	Sum=20mg/kg	EN 17137:2024 Confirmation analysis may be required to avoid false positives.
1,3-Dichlorobenzene	541-73-1				
1,4-Dichlorobenzene	106-46-7				
1,2,3-Trichlorobenzene	87-61-6				
1,2,4-Trichlorobenzene	120-82-1				
1,3,5-Trichlorobenzene	108-70-3				
1,2,3,4-Tetrachloroben-zene	634-66-2				
1,2,3,5-Tetrachloroben-zene	634-90-2				
1,2,4,5-Tetrachloroben-zene	95-94-3				
1,2,3,4,5-Pentachloro-benzene	608-93-5				
2-Chlorotoluene (o-)	95-49-8				
3-Chlorotoluene (m-)	108-41-8				
4-Chlorotoluene (p-)	106-43-4				
2,3-Dichlorotoluene	32768-54-0				
2,4-Dichlorotoluene	95-73-8				
2,5-Dichlorotoluene	19398-61-9				
2,6-Dichlorotoluene	118-69-4				

1D. Chlorobenzenes and Chlorotoluenes

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
3,4-Dichlorotoluene	95-75-0	Textiles Leather Polymers (R,F,A)	No intentional use	Sum=20mg/kg	EN 17137:2024 Confirmation analysis may be required to avoid false positives.
3,5-Dichlorotoluene	25186-47-4				
2,3,4-Trichlorotoluene	7359-72-0				
2,3,5-Trichlorotoluene	56961-86-5				
2,3,6-Trichlorotoluene	2077-46-5				
2,4,5-Trichlorotoluene	6639-30-1				
2,4,6-Trichlorotoluene	23749-65-7				
3,4,5-Trichlorotoluene	21472-86-6				
2,3,4,6-Tetrachlorotol-uene	875-40-1				
2,3,4,5-Tetrachlorotol-uene	1006-32-2				
2,3,5,6-tetrachlorotol-uene	1006-31-1				
2,3,4,5, 6-Pentachloro-toluene	877-11-2				
Hexachlorobenzene	118-74-1	Textiles	No intentional use	10 mg/kg	EN 17137:2024 Confirmation analysis may be required to avoid false positives.
		Leather			
		Polymers (R,F,A)			

1E. Chlorophenols

Supplier Information:

Chlorophenols are typically used as preservatives or pesticides. Pentachlorophenol (PCP) and Tetrachlorophenols (TeCP) have been used in the past to prevent mould when storing/transporting of raw hides and leather. They are now regulated and therefore, should not be used.

Testing Information:

When testing chlorphenols, if Monochlorophenols or Dichlorophenols are identified in a sample prepared for evaluation of chlorophenols using KOH extraction, the results should be confirmed in accordance with the test method provided below.

Formulator Information:

N/A

1E. Chlorophenols

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
2-Chlorophenol	95-57-8	Textiles	No intentional use	Textile, Sum of mono, di, trichlo-rophenols = 25 mg/kg Polymers (R,F,A), Sum of mono, di, trichlorophenols = 25 mg/kg Rubber, Sum of mono, di, trichlo-rophenols = 25 mg/kg Leather, Sum of mono, di, trichlo-rophenols = 50 mg/kg	EN 17134-2:2023 (Annex C to be followed in case of false positive test of monochloro and dichloro-phenols)
		Leather			
		Polymers (R,F,A)			
3-Chlorophenol	108-43-0	Textiles			
		Leather			
		Polymers (R,F,A)			
4-Chlorophenol	106-48-9	Textiles			
		Leather			
		Polymers (R,F,A)			
2,3-Dichlorophenol	576-24-9	Textiles			
		Leather			
		Polymers (R,F,A)			
2,4-Dichlorophenol	120-83-2	Textiles			
		Leather			
		Polymers (R,F,A)			
2,5-Dichlorophenol	583-78-8	Textiles			
		Leather			
		Polymers (R,F,A)			
2,6-Dichlorophenol	87-65-0	Textiles			
		Leather			
		Polymers (R,F,A)			
3,4-Dichlorophenol	95-77-2	Textiles			
		Leather			
		Polymers (R,F,A)			

1E. Chlorophenols

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
2,6-Dichlorophenol	87-65-0	Textiles	No intentional use	Textile, Sum of mono, di, trichlo-rophenols = 25 mg/kg Polymers (R,F,A), Sum of mono, di, trichlorophenols = 25 mg/kg Rubber, Sum of mono, di, trichlo-rophenols = 25 mg/kg Leather, Sum of mono, di, trichlo-rophenols = 50 mg/kg	EN 17134-2:2023 (Annex C to be followed in case of false positive test of monochloro and dichloro-phenols)
		Leather			
		Polymers (R,F,A)			
3,4-Dichlorophenol	95-77-2	Textiles			
		Leather			
		Polymers (R,F,A)			
3,5-Dichlorophenol	591-35-5	Textiles			
		Leather			
		Polymers (R,F,A)			
2,3,4-Trichloro-phenol	15950-66-0	Textiles			
		Leather			
		Polymers (R,F,A)			
2,3,5-Trichloro-phenol	933-78-8	Textiles			
		Leather			
		Polymers (R,F,A)			
2,3,6-Trichloro-phenol	933-75-5	Textiles			
		Leather			
		Polymers (R,F,A)			

1E. Chlorophenols

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
2,4,5-Trichloro-phenol	95-95-4	Textiles	No intentional use	Textile, Sum of mono, di, trichlo-rophenols = 25 mg/kg Polymers (R,F,A), Sum of mono, di, trichlorophenols = 25 mg/kg Rubber, Sum of mono, di, trichlo-rophenols = 25 mg/kg Leather, Sum of mono, di, trichlo-rophenols = 50 mg/kg	EN 17134-2:2023 (Annex C to be followed in case of false positive test of monochloro and dichloro-phenols)
		Leather			
		Polymers (R,F,A)			
2,4,6-Trichloro-phenol	88-06-2	Textiles			
		Leather			
		Polymers (R,F,A)			
3,4,5-Trichloro-phenol	609-19-8	Textiles			
		Leather			
		Polymers (R,F,A)			
2,3,4,5-Tetrachloro-phenol	4901-51-3	Textiles		For all applica-bilities Sum of all tetrachlorophenols = 15 mg/kg	
		Leather			
		Polymers (R,F,A)			
2,3,4,6-Tetrachloro-phenol	58-90-2	Textiles			
		Leather			
		Polymers (R,F,A)			
2,3,5,6-Tetrachloro-phenol	935-95-5	Textiles			
		Leather			
		Polymers (R,F,A)			
Pentachlorophenol (PCP)	87-86-5	Textiles		5 mg/kg	
		Leather			
		Polymers (R,F,A)			

1F. Dyes - Allergenic Disperse Dyes

Supplier Information:

Disperse dyes are a class of water-insoluble dyes that penetrate the fibre system of synthetic or manufactured fibres and are held in place by physical forces without forming chemical bonds. Disperse dyes are used in synthetic fibre dyeing (e.g. polyester, acetate, polyamide). Restricted disperse dyes are suspected of causing allergic reactions in sensitised individuals and should no longer be used for dyeing purposes. In addition to having skin sensitising characteristics, Disperse C.I. Yellow 3 dye is suspected to be carcinogenic.

Testing Information:

All the disperse dyes listed below are restricted dyes irrespective of whether they are azo dyes or not.

Formulator Information:

Most of the disperse dyes listed below are recognised to be hazardous by various other industries. However, formulators need to be vigilant when procuring any raw materials for their cross contamination.

1F. Dyes - Allergenic Disperse Dyes

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
C.I. Disperse Blue 7	3179-90-6	Textiles	No intentional use	250 mg/kg	DIN 54231:2022
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Blue 26	3860-63-7	Textiles	No intentional use	250 mg/kg	DIN 54231:2022
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Blue 35	12222-75-2 56524-77-7	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Blue 102	12222-97-8	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Blue 106	12223-01-7	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Blue 124	61951-51-7	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
C.I. Disperse Brown 1	23355-64-8	Textiles	No intentional use	250 mg/kg	DIN 54231:2022
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Orange 1	2581-69-3	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Orange 3	730-40-5	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Orange 37/59/76	13301-61-6	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Red 1	2872-52-8	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
C.I. Disperse Red 11	2872-48-2	Textiles	No intentional use	250 mg/kg	DIN 54231:2022
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Red 17	3179-89-3	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Yellow 1	119-15-3	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Yellow 3	2832-40-8	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Yellow 9	6373-73-5	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Yellow 39	12236-29-2	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Yellow 49	54824-37-2	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			

1G. Dyes – Carcinogenic or Equivalent Concern

Supplier Information:

There are several dyes known to have carcinogenic or equivalent concerns. The list below contains various types of dyes such as acid, basic, direct dyes or disperse dyes. Although most of these dyes are no longer used in textiles and leather, their manufacture cannot be ruled out and hence testing is required.

Testing Information:

It should be noted that some of these dyes cannot be tested directly and therefore, indirect test methods (as explained in DIN method below) need to be employed.

Formulator Information:

Most of the dyes listed below are no longer used. Formulators need to be vigilant when procuring any raw materials for their cross contamination. Further any blending should be avoided using these dyes.

1G. Dyes – Carcinogenic or Equivalent Concern

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
C.I. Acid Red 26	3761-53-3	Textiles	No intentional use	250 mg/kg	DIN 54231: 2022
		Leather	No intentional use		
		Polymers (R,F,A)	Not applicable	Not applicable	
C.I. Acid Violet 49	1694-09-3	Textiles	No intentional use	250 mg/kg	
		Leather		250 mg/kg	
		Polymers (R,F,A)	Not applicable	Not applicable	
C.I. Basic Blue 26 (with Michler's Ketone > 0.1%)	2580-56-5	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Basic Green 4 (Malachite Green)	10309-95-2	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Basic Green 4 (Malachite Green Chloride)	569-64-2	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Basic Green 4 (Malachite Green Oxalate)	2437-29-8	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Basic Green 4 leuco base	129-73-7	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
C.I. Basic Red 9	569-61-9	Textiles	No intentional use	250 mg/kg	DIN 54231: 2022
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Basic Violet 14	632-99-5	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Basic violet 3 (with Michler's Ketone > 0.1%)	548-62-9	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Direct Black 38	1937-37-7	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Direct Blue 6	2602-46-2	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
C.I. Direct Red 28	573-58-0	Textiles	No intentional use	250 mg/kg	DIN 54231: 2022
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Blue 1	2475-45-8	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Blue 3	2475-46-9	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
C.I. Disperse Orange 11	82-28-0	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			
Solvent Green 1, acetate salt [4-[[4-(dimethylamino) phenyl]-phenyl-methylidene] cyclohexa-2,5-dien-1-ylidene]-dimethylazanium; acetate	41272-40-6	Textiles	No intentional use	250 mg/kg	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			

1H. Flame Retardants

Supplier Information:

Flame retardant chemicals are deliberately applied to meet legal and contractual flammability standards.

The use of any halogenated flame retardants, including those listed below, are not permitted for fashion, sport or outdoor clothing and apparel and, with certain exemptions, home textiles.

It should be noted that there may be certain critical (technical textile) end uses where legally or contractually mandated standards may only be achieved using these substances (e.g. technical textiles, military, medical, protective clothing, (public) transportation, (public) buildings, legally regulated home textiles). The formulations will always be deemed ZDHC MRSL NON-CONFORMANT, but it is intended that the ZDHC Supplier Platform will appraise any of these mandatory end uses of any flame retardants within an inventory. Even if the substances listed in this section are used for purposes other than flame retardancy, these substances are subject to the specified conditions below and formulations will be rated as ZDHC MRSL NON-CONFORMANT.

Testing Information:

In order to confirm the absence of any halogenated flame retardants, certifiers must evaluate the use category and use type and the SDS of the formulation. A mention of Antimony Trioxide in an SDS can be considered as an indicator of intentional use of halogenated flame retardant in the formulation and further investigation must be done by the certifier with the formulator.

Other than this, the certifier can perform a total halogen screening test with the limit value of 1000 mg/kg using ASTM D7359/ EN 17813 CIC method. If more than 1000 mg/kg is found, the cause of the exceedance should be clarified with the help of formulators. Formulations exceeding the limit value due to halogenated flame retardant substances, including those listed below, are considered ZDHC MRSL NON-CONFORMANT. Certifiers can seek information on such substances and their use in the formulation and use their technical knowledge to confirm the same. The individual substances testing will be followed if Total Halogen screening test is less than 1000 mg/kg. For the inorganic boron based flame retardants, the limit values given below are for total boron content.

Formulator Information:

Formulators are expected to help solution providers to understand the testing requirements. If required formulators can sign NDAs under which the information can be disclosed.

1H. Flame Retardants

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Inorganic flame retardants					
Boric acid	10043-35-3 11113-50-1	Textile Leather Polymers (R,F,A)	No intentional use	Sum of total boron content= 250 mg/kg	Total acid digestion followed by determination of total boron content. To be reported as a sum of all.
Diboron trioxide	1303-86-2				
Disodium octaborate	12008-41-2				
Disodium tetraborate, (anhydrous/decahydrate)	1303-96-4 1330-43-4				
Tetraboron disodium heptaoxide, hydrate	12267-73-1				
Perboric acid, sodium salt	Multiple, including 11138-47-9 15120-21-5 7632-04-4 13517-20-9 125022-34-6 90568-23-3				
Sodium borohydride	16940-66-2				
Organic Phosphorus based flame retardants					
Tris(1-aziridinyl)phosphine oxide (TEPA)	545-55-1	Textile Leather Polymers (R,F,A)	No intentional use	250 mg/kg	ISO 17881-2:2016
Tris(1,3-dichloro-isopropyl) phosphate (TDCP)	13674-87-8				
Tris(2-chloro-1-methylethyl) phosphate (TCPP)	13674-84-5				
Tris(2-chloroethyl) phosphate (TCEP)	115-96-8				
Tris(2,3-dibromopropyl) phosphate (TRIS)	126-72-7				
Trixylyl phosphate (TXP)	25155-23-1				
Tri-o-cresyl phosphate	78-30-8				

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Organic Halogenated flame retardants					
Monobromobiphenyls (MonoBB)	2052-07-5, 2113-57-7 92-66-0, 26264-10-8	Textile Leather Polymer (R,F,A)	No intentional Use	250 mg/kg	ISO 17881-1:2016 (Certifiers are expected to perform total organic halogens screening by relevant test methods such as ASTM D7359 / EN 17813 CIC etc with the limit value of 1000 mg/kg)
Dibromobiphenyls (DiBB)	Multiple including 13029-09-9, 115245-06-2, 53592-10-2, 57422-77-2, 59080-32-9, 92-86-4			250 mg/kg	
Tribromobiphenyls (TriBPs)	Multiple including 507241-82-9, 855255-46-8, 59080-35-2, 59080-33-0, 59080-36-3, 855255-44-6			250 mg/kg	
Tetrabromobiphenyls (TetBPs)	Multiple including 60044-24-8, 59080-37-4, 60044-25-9, 59080-38-5, 59080-39-6, 59080-40-9, 59080-41-0			250 mg/kg	
Pentabromobiphenyl (PentaBPs)	Multiple including 67888-96-4			250 mg/kg	
Hexabromobiphenyls (HexBPs)	Multiple including 59261-08-4, 59536-65-1, 60044-26-0			250 mg/kg	
Heptabromobiphenyls (HeptaBPs)	Multiple including 67733-52-2, 88700-06-5			250 mg/kg	
Octabromobiphenyls (OctaBB)	Multiple including 27858-07-7, 67889-00-3			250 mg/kg	
Nonabromobiphenyls (NonaBB)	multiple including 69278-62-2, 27753-52-2			250 mg/kg	
Decabromobiphenyl (DecaBB)	13654-09-6			250 mg/kg	
Tetrabromobisphenol A (TBBPA)	79-94-7			250 mg/kg	
Tetrabromobisphenol A bis(2,3-dibromopropyl ether)	21850-44-2			250 mg/kg	
2,2-Bis(bromometh-yl)-1,3-propanediol (BBMP)	3296-90-0			250 mg/kg	

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Bis(2,3-dibromopropyl) phosphate (BDBPP)	5412-25-9	Textile Leather Polymer (R, F,A)	No intentional Use	250 mg/kg	ISO 17881-1:2016 (Certifiers are expected to perform total organic halogens screening by relevant test methods such as ASTM D7359 / EN 17813 CIC etc with the limit value of 1000 mg/kg)
1,1'-(ethane-1,2-diyl)bis[pen-tabromobenzene] (DBDPE)	84852-53-9			250 mg/kg	
Monobromobiphenyl ether (MonoBDEs)	Multiple including 6876-00-2, 101-55-3			Sum of all 350 mg/kg	
Dibromobiphenyl ether (DiBDEs)	Multiple including 51452-87-0, 189084-59-1				
Tribromobiphenyls ether (TriBDEs)	Multiple including 147217-75-2, 147217-78-5, 337513-54-9, 337513-56-1, 41318-75-6				
Tetrabromobiphenyl ether (TetBDEs)	Multiple including 5436-43-1, 40088-47-9, 189084-62-6, 327185-09-1, 93703-48-1				
Pentabromobiphenyl ether (PentaBDE)	Multiple including 32534-81-9, 60348-60-9, 189084-64-8, 189084-65-9, 189084-66-0 446254-56-4				
Hexabromobiphenyl ether(HexaBDE)	Multiple including 68631-49-2, 207122-15-4				
Heptabromobiphenyl ether (HeptaBDE)	Multiple including 68928-80-3,189084-67-1, 207122-16-5, 407606-61-5				
Octabromobiphenyl ethers (OctaBDE)	Multiple including 446255-39-6, 337513-72-1, 446255-56-7				
Nonabromobiphenyl ether (NonaBDE)	Multiple including 63936-56-1, 437701-79-6				
Decabromobiphenyl ether (DecaBDE)	1163-19-5				
Hexabromocyclododecane (HBCDD)	3194-55-6, 25637-99-4, 134237-51-7		No intentional use	75 mg/kg	
Trimethyl phosphate	512-56-1		No intentional use	250 mg/kg	ISO 17881-2:2016

1I. Glycols / Glycol Ethers / Glycol Esters

Supplier Information:

In apparel and footwear, glycol ethers/glycol esters have a wide range of uses including as solvents for finishing/cleaning, printing agents and dissolving and diluting fats, oils (e.g. in degreasing or cleaning operations) and adhesives.

Testing Information:

Glycols/Glycol Ethers/Glycol Esters can be determined by GC-MS analysis. However, testing them from varied matrices can be tricky. Laboratories are required to pay extra attention on extraction step. GC-MS Headspace at 120 °C for 45 mins or solvent extraction with ethyl acetate have been found to be effective. Exception values are given for 2-Methoxypropanol and 2-Methoxypropyl acetate for leather formulations and the certifier must confirm the applicability of such formulations for its use category and use type from the formulator to apply the limits given in the table.

Formulator Information:

2-Methoxypropyl acetate is produced as an unintentional by-product in certain leather finishing formulations. Current technology does not allow to reduce this further and hence for this purpose, such formulations are allowed to have unintentional contamination of this restricted substance up to 1000 mg/kg. Industries are expected to reduce this over time and an intention to reduce this limit value to 50 mg/kg is proposed for ZDHC MRSL V5.0.

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
2-Ethoxyethanol	110-80-5	Textiles	No intentional use	50 mg/kg	Based on HG/T 5700-2020 (EtOAc extraction followed by GCMS OR GC/MS Headspace at 120 °C for 45 Mins
		Leather		50 mg/kg	
		Polymers (R,F,A)		50 mg/kg	
2-Ethoxyethyl acetate	111-15-9	Textiles		50 mg/kg	
		Leather		50 mg/kg	
		Polymers (R,F,A)		50 mg/kg	
2-Methoxyethanol	109-86-4	Textiles		50 mg/kg	
		Leather		50 mg/kg	
		Polymers (R,F,A)		50 mg/kg	
2-Methoxyethyl acetate	110-49-6	Textiles		50 mg/kg	
		Leather		50 mg/kg	
		Polymers (R,F,A)		50 mg/kg	
2-Methoxypropanol	1589-47-5	Textiles		50 mg/kg	
		Leather		2500 mg/kg	
		Polymers (R,F,A)		50 mg/kg	

1l. Glycols / Glycol Ethers/ Glycol Esters

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
2-Methoxypropyl acetate	70657-70-4	Textiles	No intentional use	50 mg/kg	Based on HG/T 5700-2020 (EtOAc extraction followed by GCMS OR GC/MS Headspace at 120 oC for 45 Mins
		Leather		50 mg/kg (1000 mg/kg for Leather finishing formulations)	
		Polymers (R,F,A)		50 mg/kg	
Bis(2-methoxyethyl) ether	111-96-6	Textiles		50 mg/kg	
		Leather		50 mg/kg	
		Polymers (R,F,A)		50 mg/kg	
Ethylene glycol dimethyl ether	110-71-4	Textiles		50 mg/kg	
		Leather		50 mg/kg	
		Polymers (R,F,A)		50 mg/kg	
Triethylene glycol dimethyl ether	112-49-2	Textiles		50 mg/kg	
		Leather		50 mg/kg	
		Polymers (R,F,A)		50 mg/kg	

1J. Halogenated Solvents

Supplier Information:

In apparel, footwear and leather processing, halogenated solvents are used as finishing/cleaning and printing agents, for dissolving/diluting fats, oils (e.g. in degreasing or cleaning operations) and adhesives.

Formulations containing any of the listed solvents, above the published limits, are NON CONFORMANT with the ZDHC MRSL. Despite the advancement of water-based systems, there are a small number of solvent-based systems that remain the most prevalent in the industry and ZDHC recognises that it will take time to phase these out completely. ZDHC's guidance is to avoid the deliberate use of listed solvents wherever possible, with a transition to water-based formulations being preferable, and to ensure that worker exposure and emissions are minimised. It is intended that the ZDHC Supplier Platform will assess the implementation of best practices for Emission and Exposure Control as well as the usage of waterbased formulations at a facility.

Note: There are some solvent-based technologies that are generally regarded as having lower overall environmental impacts than aqueous alternatives (e.g. solvent scouring) and every specific scenario information will be gathered through the ZDHC Supplier to Zero evaluation.

Testing Information:

Some of the halogenated solvents below (such as dichloromethane) are highly volatile and losses due to mishandling of the sample may lead to erroneous results. Extra care may be required while handling such formulations while testing to avoid such losses. Under GC-MS analysis conditions, benzyl chloride may appear as a degradation product of the analyte. In cases of positive results, LC-MS confirmation is essential to rule out false positives.

Formulator Information:

N/A

1J. Halogenated Solvents

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Benzyl chloride	100-44-7	Textiles	No intentional use	All formulations =50 mg/kg Dyes =100 mg/kg	EN 17137:2024 (In case of positive detection confirmation with LCMS is recommended)
		Leather			
		Polymers (R,F,A)			
1,2-Dichloroethane	107-06-2	Textiles		5 mg/kg	GC/MS headspace 45 minutes at 120° C
		Leather		5 mg/kg	
		Polymers (R,F,A)		5 mg/kg	
Methylene chloride	75-09-2	Textiles		5 mg/kg	
		Leather		5 mg/kg	
		Polymers (R,F,A)		5 mg/kg	
Tetrachloroethylene	127-18-4	Textiles	No intentional use[EC*]	5 mg/kg	
		Leather	No intentional use	5 mg/kg	
		Polymers (R,F,A)		5 mg/kg	
Trichloroethylene	79-01-6	Textiles		40 mg/kg	
		Leather			
		Polymers (R,F,A)			

1K. Organic Solvents

Supplier Information:

In apparel, footwear and leather processing, organic solvents are used to facilitate cleaning, dyeing, coating and finishing processes, glues/adhesives. Although, they have found to improve dye penetration and material flexibility, they are often associated with Volatile Organic Compounds (VOC) emission and hence suppliers are expected to shift to safer alternatives. For all organic solvents, proper Emission and Exposure Control should be implemented.

ZDHC guidance is to avoid the deliberate use of listed solvents wherever possible, with a transition to water-based formulations being preferable, and to ensure that worker exposure and emissions are minimised.

Testing Information:

The test methods given are required to be adjusted for the extraction and effective determination of the respective analyte. The Cresol limit of 500 mg/kg for biocidal products is given only to accommodate unintentional by-product formation and intentional use at any concentration is ZDHC MRSL non-conformant. Certifiers must check the SDS and get more information from formulators to confirm that the formulation sample is a biocidal product and then apply the higher limit for cresols in their testing.

Formulator Information:

Cresol based formulations are restricted in the ZDHC MRSL. However, certain biocidal formulations are known to contain cresol-like structures and may form cresols on degradation. Hence, the limit values for biocidal products are kept at 500 mg/kg for such formulations. However, formulators are required to note that this increased value is to accomodate such unwanted impurities and does not mean intentional addition at any concentration of cresol (or any other solvents) is allowed.

1K. Organic Solvents

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Cresol (all isomers) o-Cresol m-Cresol p-Cresol	1319-77-3 95-48-7 108-39-4 106-44-5	Textiles	No intentional use	Sum of isomers = 100 mg/kg	Extraction with methanol followed by GC-MS
		Leather		Sum of all isomers =100 mg/kg Biocide formulations Sum of all isomers = 500 mg/kg	
		Polymers (R,F,A)		Sum of all isomer = 100 mg/kg	
N,N-Dimeth-ylacetamide (DMAC)	127-19-5	Textiles	No intentional use[EC*]	500 mg/kg	ISO 16189:2021 EN 17131-1:2025
		Leather			
		Polymers (R,F,A)			
N,N-Dimeth-ylformamide (DMFa)	68-12-2	Textiles			
		Leather			
		Polymers (R,F,A)			
N-Ethyl-2 pyrrolidone (NEP)	2687-91-4	Textiles			
		Leather			
		Polymers (R,F,A)			
N-Methyl-2-Pyrrolidone (NMP)	872-50-4	Textiles			
		Leather			
		Polymers (R,F,A)			

1K. Organic Solvents

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Benzene	71-43-2	Textiles	No intentional use	50 mg/kg	DIN EN 17131-2:2025-06
		Leather			
		Polymers (R,F,A)			
Toluene	108-88-3	Textiles	No intentional use[EC*]	500 mg/kg	
		Leather			
		Polymers (R,F,A)			
Xylene (all isomers) o-Xylene m-Xylene p-Xylene	1330-20-7 95-47-6 108-38-3 106-42-3	Textiles		Sum= 500 mg/kg	
		Leather			
		Polymers (R,F,A)			

1L. Organotin Compounds

Supplier Information:

Organotins are a class of chemicals combining tin and organics such as butyl and phenyl groups. Organotins are predominantly found to be used as antifoulants in marine paints, but they can also be used as biocides (e.g. antibacterials), catalysts in plastic and glue production and heat stabilisers in plastics/rubber. In textiles and apparel, organotins are associated with plastics/rubber, inks, paints, metallic glitter, polyurethane products and heat transfer material.

Testing Information:

Organotin compounds can come in different forms such as their oxides, halides, sulphates, etc. All organotin compounds are banned from intentional use. However, for testing purposes, only the ones that have been used in the past to be used in textile, apparel, footwear and leather industries are listed. These substances may be present as multiple isomers and all these isomers are banned as well. During the testing, the corresponding organotin compound is converted into its ethyl derivatives, which renders identification of di, tri and tetrethyl tin difficult. Evaluation of SDS for intentional use can be a useful tool.

Formulator Information:

Use of any organotin compounds irrespective of whether mentioned in the list below or not, is restricted.

1L. Organotin Compounds

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Dibutyltin (DBT)	Multiple, including 77-58-7, 683-18-1, 818-08-6, 1067-33-0	Textiles	No intentional use	20 mg/kg	Solvent extraction, GC MS, ISO 16179:2025, ISO 22744-1:2020
		Leather			
		Polymers (R,F,A)			
Dipropyltin compounds (DPT)	Multiple, including 867-36-7, 38802-82-3, 1655-80-7, 20756-81-4, 56535-52-5, 23668-80-6	Textiles		5 mg/kg	Solvent extraction, GC MS, ISO 16179:2025
		Leather		5 mg/kg	
		Polymers (R,F,A)		5 mg/kg	
Mono- and tri- butyltin derivatives	Multiple, including 1118-46-3, 2406-65-7, 23850-94-4, 1461-22-9, 56-35-9,	Textiles		5 mg/kg	
		Leather		5 mg/kg	
		Polymers (R,F,A)		5 mg/kg	
Mono-, di- and tri- methyltin derivatives	Multiple, including 993-16-8, 753-73-1, 1066-45-1,54849-38-6, 2273-45-2, 1067-34-1, 3659-65-4	Textiles		5 mg/kg	
		Leather		5 mg/kg	
		Polymers (R,F,A)		5 mg/kg	

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Mono-, di- and tri- octyltin derivatives	Multiple, including 3091-25-6, 3542-36-7, 2587-76-0, 26401-97-8, 870-08-6, 1067-32-9, 3648-18-8, 13323-61-2, 15571-58-1,	Textiles	No intentional use	5 mg/kg	Solvent extraction, GC MS, ISO 16179:2025
		Leather		5 mg/kg	
		Polymers (R,F,A)		5 mg/kg	
Mono-, di- and tri- phenyltin derivatives	Multiple, including 1124-19-2, 1135-99-5, 639-58-7, 98-13-5, 12627-19-9, 900-95-8, 2273-43-0, 900-97-0, 3658-48-8, 76-87-9,	Textiles		5 mg/kg	
		Leather		5 mg/kg	
		Polymers (R,F,A)		5 mg/kg	
Tetrabutyltin compounds (TeBT)	1461-25-2	Textiles		1 mg/kg	
		Leather		1 mg/kg	
		Polymers (R,F,A)		1 mg/kg	

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Mono, Di, tri and Tetraethyltin compounds (TeET)	Multiple, including 597-64-8, 994-31-0, 866-55-7, 818-07-5, 900-96-9, 994-32-1	Textiles	No intentional use	1 mg/kg	Solvent extraction, GC MS, ISO 16179:2025 Fails must be repeated without derivatization, as a derivatization of any ethyl-tin-compound gives TeET
		Leather		1 mg/kg	
		Polymers (R,F,A)		1 mg/kg	
Tetraoctyltin compounds (TeOT)	Multiple, including 3091-25-6, 870-08-6, 1067-32-9, 3648-18-8, 13323-61-2, 15571-58-1, 3091-29-0	Textiles		1 mg/kg	Solvent extraction, GC MS, ISO16179:2025
		Leather		1 mg/kg	
		Polymers (R,F,A)		1 mg/kg	
Mono, Di, Tri and tetracy-clohexyltin (TCyHT)	"Multiple, including 3091-32-5, 3091-31-4"	Textiles		1 mg/kg	
		Leather		1 mg/kg	
		Polymers (R,F,A)		1 mg/kg	
Mono, Tri and Tetrapropyltin Compounds (TPT)	"Multiple, including 2279-76-7, 2176-98-9"	Textiles		1 mg/kg	
		Leather		1 mg/kg	
		Polymers (R,F,A)		1 mg/kg	

These are other chemicals/substances with a usage ban.

(Free) Aniline

Supplier Information:

Used in the manufacture of indigo and some azo dyes. Residues from manufacturing can remain in the formulation.

Testing Information:

For all dyes other than indigo, it is important that non-reductive methods are used so that only the free aniline is analysed rather than that which could be formed by the cleavage of a dye molecule. For indigo however, aniline can be tied up in insoluble clusters of dye and so a reductive method that fully solubilises the dye and liberates free aniline is used. The levels of aniline in indigo must be achieved by removal of the aniline and not by dilution, with a minimum indigo content of 30% being required. Thus, solution providers are required to evaluate the indigo content as well.

Formulator Information:

Formulators are required to know about the aniline content test method and the free aniline content. Special attention may be required during synthesis of indigo dyes and internal quality control checks to detect the free aniline content.

1M. Other/Miscellaneous Chemicals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
(Free) Aniline	62-53-3	Textiles	No intentional use	Indigo dyes = 2000 mg/kg Other dyes = 500 mg/kg	Indigo - Reductive method (ISO 14362-1:2017) Other - Non-reductive (ISO 14362-1:2017 without reductive step)
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			

AEEA

Supplier Information:

AEEA is used in chelating agents, surfactants and fabric softeners.

Testing Information:

Formulations such as surfactants and softeners are known to give high peak tailing due to amine nature of the substance. Laboratories are requested to validate the methods meticulously to avoid such challenges during analysis.

Formulator Information:

Formulators are required to evaluate the safer alternatives for chelating purposes and avoid the use of AEEA in their products.

1M. Other/Miscellaneous Chemicals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
2-(2-Amino-ethylamino) ethanol (AEEA)	111-41-1	Textiles	No intentional use	100 mg/kg	HG/T 5664-2019 (which includes Extraction with methanol using soxhlet method followed by GCMS
		Leather			
		Polymers (R,F,A)			

Borate, Zinc salt

Supplier Information:

Borate, Zinc salt can be used primarily as buffering agent, pH stabiliser and processing aid in wet processing stages like dyeing, tanning and finishing where it helps control alkalinity in dye baths for even colour uptake and neutralise chrome tans or soften hides in leather productions. Any Borate, Zinc salt formulation is ZDHC MRSL non-conformant and hence suppliers are required to use other safer alternatives for their efficiency and work.

Testing Information:

Borates and Zinc salts need to be tested as elemental Zinc and Boron (as there is no direct determination possible). The limit value of 1000 mg/kg is for individual Boron and Zinc – not as a sum. This means that a formulation is ZDHC MRSL non-conformant only if both Boron and Zinc values are detected above 1000 mg/kg.

Formulator Information:

Formulators are requested to disclose the source of boron or zinc (or both) in their formulation to the certifying laboratory (under the NDA). Note that there are different types of borate, zinc salt based formulations available in market. Any borate, zinc formulation is non-conformant and hence formulators are required to use other safer alternatives.

1M. Other/Miscellaneous Chemicals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Borate, zinc salt	1332-07-6	Textiles	No intentional use	1000 mg/kg	Acid digestion followed by ICP-OES for determination of Zinc and total boron.
		Leather			
		Polymers (R,F,A)			

Cyclosiloxanes

Supplier Information:

Cyclosiloxanes can be present as contaminants in the formulations that contain Silicone, such as softeners or formed after prolonged improper storage conditions. It is formed as a by-product in the silicone-based raw material.

Testing Information:

Testing cyclosiloxanes can be challenging due to high volatility and matrix interferences. Method artifacts and poor recoveries in complex formulations can further add challenges to low-level detection. Hence, care must be taken for such analytes.

Formulator Information:

D4, D5 and D6 can be formed in the manufacturing of the silicon based molecule. Although they are highly volatile, purification can be a real challenge. Further, linear siloxanes, under suitable conditions, can undergo cyclisation forming unwanted side products. High molecular weight cyclosiloxanes may undergo degradation to produce these small cyclosiloxanes as well.

1M. Other/Miscellaneous Chemicals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
D4 (Octamethylcyclotetrasiloxane)	556-67-2	Textiles	No intentional use	1000 mg/kg	TEGEWA method, GB/T 40323-2021, Ultrasonic extraction with nonchlorinated organic solvent for 30 min at 40°C then GC/MS For Leather chemicals: ISO 23649:2025
		Leather			
		Polymers (R,F,A)			
D5 (Decamethylcyclopentasiloxane)	541-02-6	Textiles		1000 mg/kg	
		Leather			
		Polymers (R,F,A)			
D6 (Dodecamethylcyclohexasiloxane)	540-97-6	Textiles		1000 mg/kg	
		Leather			
		Polymers (R,F,A)			

ADCA and OBSH

Supplier Information:

ADCA and OBSH are used as a blowing agent in the foaming processes. The risk of ADCA is associated with the powder form and it may invoke an allergenic reaction through inhalation whereas OBSH is an acute aquatic toxic substance.

Testing Information:

Testing of ADCA and OBSH can be carried out by using LC/MS or LC/DAD. Laboratories can develop their internal validated test methods as there are no specific internationally published test methods in formulations available.

Formulator Information:

ADCA and OBSH are banned from the intentional use (including in the beads form). Safer alternatives for ADCA and OBSH are claimed to be available in the market which can provide the required performances.

1M. Other/Miscellaneous Chemicals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Diazene-1,2-di-carboxamide [C,C`-azodi(-formamide)] (ADCA)	123-77-3	Textiles	Not applicable	Not applicable	LC/MS, LC/DAD
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)	No intentional use[EC*]	1000 mg/kg	
4,4'-Oxydiben-zenesulfonyl Hydrazide (OBSH)	80-51-3	Textiles	Not applicable	Not applicable	
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)	No intentional use[EC*]	1000 mg/kg	

Quinoline

Supplier Information:

Quinoline is not intentionally used in the formulations but is rather present as an impurity from the raw material from the chemical manufacturing processes, especially for disperse dyes or some dispersing agents.

Testing Information:

Quinoline is expected to be tested as free quinoline.

Formulator Information:

Formulators (especially dyes manufacturers who use quinoline as a raw material) should take extra care that the residual quinoline amount is kept under control. Whenever possible, cleaner and safer chemistries should be used to avoid the use of quinoline as a raw material.

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Quinoline	91-22-5	Textiles	No intentional use	1000 mg/kg	DIN 54231:2022 LC-MS
		Leather			
		Polymers (R,F,A)			

Thiourea

Supplier Information:

Thiourea is primarily used in footwear manufacturing as a cross-linking and vulcanising agent for Ethylene-Vinyl Acetate (EVA) foam and rubber. It is also used as a reducing agent and for reduction clearing of synthetic fibres. The substance is known to be highly toxic to aquatic life.

Testing Information:

Testing of thiourea can be carried out by using solvent extraction followed by validated method developed by labs on LC MS/MS or LC-DAD MS.

Formulator Information:

N/A

1M. Other/Miscellaneous Chemicals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Thiourea	62-56-6	Textiles	No intentional use	1000 mg/kg	Solvent extraction, LC MS/MS, LC-DAD MS
		Leather			
		Polymers (R,F,A)			

Dicumyl peroxide

Supplier Information:

Dicumyl peroxide (DCP) is primarily used in footwear manufacturing as a cross-linking and vulcanising agent for Ethylene-Vinyl Acetate (EVA) foam and rubber. The substance is known to be highly toxic to aquatic life.

Testing Information:

Testing of DCP can be carried out by using LC/DAD or corresponding ASTM test methods.

Formulator Information:

N/A

1M. Other/Miscellaneous Chemicals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Dicumyl peroxide (DCP)	80-43-3	Textiles	Not applicable	Not applicable	Solvent extraction and LC-DAD analysis ASTM E1090-96 LC-MS/MS
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)	No intentional use	1000 mg/kg	

Triphenyl Phosphate

Supplier Information:

Triphenyl phosphate (TPP) can be used as plasticiser in polymer coatings or flame retardant in textile finishing. It is added to the formulations in making of PU-based textile coating or in the manufacturing of the synthetic leather production processes. TPP was added into the SVHC list for its bioaccumulative properties.

Testing Information:

Testing is required for the free triphenyl phosphate and typically HPLC-MS/MS can be used to determine its use.

Formulator Information:

Triphenyl phosphate and its derivatives have been used as substitutes to the currently listed flame retardants.

1M. Other/Miscellaneous Chemicals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Triphenyl phosphate	115-86-6	Textiles Leather Polymers (R,F,A)	No intentional use	1000 mg/kg	ISO 17881-2 : 2016 Determination of Certain Flame Retardants Part 2 : Phosphorous Flame Retardants

1,4, Dioxane

Supplier Information:

Traditionally, 1,4-Dioxane can occur as residue from manufacturing in solvent, wetting as well as dispersing agents based on non-ionic surfactants in textile and leather formulations. Today, 1,4-Dioxane is not used intentionally, but is produced as a by-product in the ethoxylation step. If undetected, it can build up in the concentration more than the limit value given below.

Testing Information:

1,4-Dioxane can be detected by using headspace analysis using GC-FID as given in the ISO test method below. It should not be confused with dioxin (those are separate substances).

Formulator Information:

N/A

1M. Other/Miscellaneous Chemicals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
1,4-Dioxane	123-91-1	Textiles Leather Polymers (R,F,A)	No intentional use	1000 mg/kg	ISO 17280:2015

Styrene

Supplier Information:

Styrene is found mostly as a free monomer in the manufacturing of the styrene-based polymers. Styrene by itself is not used as such in textile or footwear industries.

Testing Information:

For ZDHC MRSL V4.0 purposes, styrene is required to be tested for its free monomer content and thus a suitable test method must be employed. Usually, the bound styrene will not be detected. However, care must be taken to test only the free monomeric styrene.

Formulator Information:

N/A

1M. Other/Miscellaneous Chemicals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Styrene (as free monomer)	100-42-5	Textiles	Not applicable	Not applicable	ISO 2561:2023
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)	No intentional use	1000 mg/kg	

1N. Perfluorinated and Polyfluorinated Chemicals (PFAS)

Supplier Information:

Formulations containing PFAS (Per- and Polyfluorinated alkylated substances) are traditionally used for water and/or stain repellency. However, it is known that they may be also added to formulations intentionally to aid and act as lubricants, surfactants, wetting and levelling agents, emulsifications and other functions. There are different definitions to what is considered PFAS. ZDHC acknowledges the OECD 2021 definition. Thus, substances whose structures fall under this definition will be considered as PFAS for ZDHC MRSL conformance evaluation purposes.

The use of any formulation based on or including intentionally added PFAS, added intentionally is not permitted for fashion, sport or outdoor clothing, apparel and home textiles.

It should be noted that there may be certain critical end uses where legally or contractually mandated performance requirements may only be achieved using these substances (e.g. military, technical textile, medical, protective clothing, transportation, workwear). The formulations for such end uses will always be considered ZDHC MRSL NON-CONFORMANT.

Testing Information:

There are thousands of individual substances that fall under OECD's PFAS definition and with the current knowledge not all PFAS can be detected with a single test method approach. Also, consideration of the OECD definition is a critical evaluation step prior to testing.

The ZDHC MRSL conformance to PFAS should be carried out through the following steps:

1) Certifier carries out a complete review of product documentation and type of application information for a risk analysis of the formulation for PFAS, including applicability of the OECD definition.

2) Based on this risk analysis, certifier identifies the formulation as "high risk" or "low risk" based on the transparency and information disclosure in the form of documentary evidence. The final decision will be made by the certifiers.

High risk

Sufficient information from the formulator (present in the safety data sheet, other supply chain documentation or ancillary documents, application type, ZDHC Gateway category, formula of intentionally added fluorinated substances and unintentionally present fluorinated residues from manufacturing etc.) is not available (or insufficiently available) to discern whether the chemical product contains components at risk to be covered by the OECD definition. All fluorine sources, both PFAS and non-PFAS, should be evaluated.

These requirements are especially valid for:

- Water, stain and oil repellents
- Soil release agents
- Soil repellents
- Coating and laminating agents
- Dyes and pigments that are classified as PFAS under OECD definition

Low risk

NON-REPELLENT formulation types with sufficient documentation for which in general deliberate use of PFAS should not be expected but for which certain applications were reported such as:

- Lubricants
- Defoaming agents for solvent applications
- Synthetic printing thickeners
- Polymeric softeners
- Handle modifiers

Formulations identified as high risk shall be tested for Total Fluorine AND Targeted PFAS analysis. Based on the test results, the formulation is:

ZDHC MRSL non-conformant if fluorine > 50 ppm and Target PFAS > MRSL Limits

ZDHC MRSL non-conformant if Total fluorine < 50 ppm and Target PFAS > MRSL Limits

ZDHC MRSL conformant if Total fluorine < 50 ppm and Target PFAS < MRSL Limits

Where Total fluorine> 50 ppm but Target PFAS < MRSL Limits, a further investigation is initiated by the certifier to confirm the source of Fluorine and conformance to the OECD definition of PFAS before certifying the formulation as ZDHC MRSL conformant.

Formulations identified as low risk shall be tested for Total Fluorine. Based on the test results, the formulation is:

ZDHC MRSL conformant if Total fluorine < 50 ppm

If Total fluorine > 50 ppm, a target PFAS analysis should be conducted to confirm the conformance along with document review and investigation with the formulator.

PFAS testing is mandatory at ZDHC MRSL Level 1, with reference to AFIRM's list of PFAS substances (1 Sept 2026 version). For ZDHC MRSL Level 2 and Level 3, testing may not be mandatory provided certifiers are satisfied that the principles of Level 1 were followed by the formulator during the onsite assessment as per the conformance guidance provided by ZDHC.

Formulator Information:

Intentional use of any PFAS in any formulation, including oil, water and stain repellency functional finishes, is not acceptable. Formulators are expected to read, understand and follow the OECD definition of PFAS and avoid the deliberate use of any such substances that can lead to classification of a formulation as PFAS under this definition. Formulators should share all information regarding PFAS, including all sources of fluorine in their formulation, if any, with the certifier for a complete and accurate risk analysis prior to testing.

Formulators should also be aware that a few dyes and pigments are categorised as PFAS as per OECD definition. All formulations based on or containing these dyes are not conformant to ZDHC MRSL.

1N. Perfluorinated and Polyfluorinated Chemicals (PFAS)

Substance	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Please refer to AFIRM V11 List of PFAS	Textiles	No intentional use	Total Fluorine content - 50 mg/ kg Individual PFAS - 25 µg/kg and Sum of all PFAS - 250 µg/kg	Test on TF: (EN 14582-2021 or ASTM D7359-2023 or EN ISO 20999-2026)
	Leather			
	Polymers (R,F,A)			Targeted PFAS Analysis: (EN 17681-1:2025)

1O. Phthalates – including all other esters of ortho-Phthalic acid

Supplier Information:

Esters of ortho-phthalic acid (phthalates) are a class of organic compounds commonly added to plastics to increase flexibility. They sometimes are used to facilitate moulding of plastic by decreasing its melting temperature.

Phthalates can be found in:

- Flexible plastic components (e.g. PVC)
- Print pastes
- Adhesives
- Plastic buttons
- Plastic sleevings
- Polymeric coatings

Testing Information:

All esters of phthalic acids are banned and thus certifiers should take extra care when reporting or analysing the samples for phthalates. The list given below is of select phthalates and not an exhaustive list.

Formulator Information:

Formulators should note that substituting the below listed phthalates with other non-listed phthalates will not be considered as a safer substitutes and thus will make the formulation non-conformant to the ZDHC MRSL.

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
1,2-Benzenedicarboxylic acid, di-C6-8-branched and linear alkyl esters, C7-rich (DIHP)	71888-89-6	Textiles Leather Polymers (R,F,A)	No intentional use	Sum = 250 mg/kg	ISO 14389:2022, CPSC-CH-C1001-09.4
1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters (DHNUP)	68515-42-4				
1,2-Benzenedicarboxylic acid, dipentylester, branched and linear	84777-06-0				
1,2-Benzenedicarboxylic acid, dihexyl ester, branched and linear	68515-50-4				
Benzyl butyl phthalate (BBP)	85-68-7				
Bis(2-methoxyethyl) phthalate (DMEP)	117-82-8				
Dicyclohexyl phthalate (DCHP)	84-61-7				
Diisohexyl phthalate	71850-09-4				
Diethyl phthalate (DEP)	84-66-2				
Dibutyl phthalate (DBP)	84-74-2				
Dinonyl phthalate (DNP)	84-76-4				

1O. Phthalates – including all other esters of ortho-Phthalic acid

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Di(ethylhexyl) phthalate (DEHP)	117-81-7	Textiles Leather Polymers (R,F,A)	No intentional use	Sum = 250 mg/kg	ISO 14389:2022, CPSC-CH-C1001-09.4
Di-n-propyl phthalate (DPRP)	131-16-8				
Di-n-pentyl phthalate (DnPP)	131-18-0				
Di-n-hexyl phthalate (DnHP)	84-75-3				
Di-n-octyl phthalate (DNOP)	117-84-0				
Di-iso-butyl phthalate (DIBP)	84-69-5				
Di-iso-pentyl phthalates (DIPP)	605-50-5				
Di-iso-octyl phthalate (DIOP)	27554-26-3				
Di-iso-nonyl phthalate (DINP)	28553-12-0				
Di-iso-decyl phthalate (DIDP)	26761-40-0				
n-Pentyl-isopentyl phthalate	776297-69-9				
Di(2-propylheptyl) phthalate (DPHP)	53306-54-0				
1,2 benzenedi-carboxylic acid, di-C6-10-alkyl esters	68515-51-5				
1,2 benzenedicar-boxylic acid, mixed, decyl and hexyl and octyl diesters	68648-93-1				
Dimethyl phthalate	131-11-3				

1P. Polycyclic Aromatic Hydrocarbons (PAHs)

Supplier Information:

Oil containing PAHs are added to rubber and plastics as a softener or extender and may be found in rubber, plastics, lacquers and coatings. Within the footwear producing industry, PAHs are often found in the outsoles of footwear and in printing pastes for screen prints. PAHs can be present as impurities in carbon black dyestuffs.

Testing Information:

PAHs are usually not used intentionally. However, they may come in as an impurities. Identification of individual isomers may be challenging.

Formulator Information:

Formulators that use any source of oils or lacquers are advised to evaluate those for the absence of PAHs.

1P. Polycyclic Aromatic Hydrocarbons (PAHs)

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Benzo[a]pyrene (BaP)	50-32-8	Textiles Leather Polymers (R,F,A)	No intentional use	20 mg/kg	ISO 16190:2021 EN 17132:2019 AfPS GS 2019
Naphthalene	91-20-3			Sum = 200 mg/kg	
Acenaphthene	83-32-9				
Acenaphthylene	208-96-8				
Anthracene	120-12-7				
Benzo[a] anthracene	56-55-3				
Benzo[b] fluoranthene	205-99-2				
Benzo[e]pyrene	192-97-2				
Benzo[ghi] perylene	191-24-2				
Benzo[j] fluoranthene	205-82-3				
Benzo[k] fluoranthene	207-08-9				
Chrysene	218-01-9				
Dibenz[a,h] anthracene	53-70-3				
Fluoranthene	206-44-0				
Fluorene	86-73-7				
Indeno[1,2,3-cd] pyrene	193-39-5				
Phenanthrene	85-01-8				
Pyrene	129-00-0				

1Q. Restricted Aromatic Amines (cleavable from azo-colourants)

Supplier Information:

Azo dyes and pigments are colourants that incorporate one or several azo groups (-N=N-) bound with aromatic compounds. Multiple azo dyes exist, but only those azo dyes which, by reductive cleavage of one or more azo groups, may release one or more of the aromatic amines listed below, shall not be used in dyeing or as colourant. Azo dyes that release these amines are regulated and should no longer be used for dyeing.

Testing Information:

Reductive cleavage for water soluble dyes are relatively easy but for pigments a robust internal methodology may be required, especially for diarylide pigments, which are not highly soluble in testing solvents. For the salts of amines, corresponding amines are required to be tested and reported. If the corresponding 4 amines are observed (individually or multiple) the individual amines along with salts are considered to be non-conformant.

Formulator Information:

The use of colourants having azo dyes that may yield under reducing conditions the above amines are banned from usage. This categorises several azo dyes and thus before preparing the final formulations, individual component dyes and pigments are required to be checked for its structure. The final formulation may fail ZDHC MRSL conformance due to low level intentional addition of certain azo dyes generating the above listed amines.

1Q. Restricted Aromatic Amines (Cleavable from azo-colourants)

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
2-Naphthylamine	91-59-8	Textiles Leather Polymers (R,F,A)	No intentional use	150 mg/kg (each)	Textile and Footwear: EN ISO 14362-1:2024 and EN ISO 14362-3:2017 Leather: ISO 17234-1:2024, ISO 17234-3:2024
2,4-Xylidine	95-68-1				
2,4,5-Trimethylaniline	137-17-7				
2,6-Xylidine	87-62-7				
3,3′-Dichlorobenzi-dine	91-94-1				
3,3′-Dimethoxyben-zidine	119-90-4				
3,3′-Dimethylbenzi-dine	119-93-7				
4-Aminoazobenzene	60-09-3				
4-Aminobiphenyl	92-67-1				
4-Chloro-o-toluidine	95-69-2				
4-Chloroaniline	106-47-8				
2,4-Diaminoanisol	615-05-4				
2,4-Toluenediamine	95-80-7				
4,4′-Methy-lene-bis-(2-chloroan-iline)	101-14-4				
4,4′-Methylene-di-o-toluidine	838-88-0				
4,4′-Diaminodiphenyl-methane	101-77-9				
4,4′-Oxydianiline	101-80-4				

1Q. Restricted Aromatic Amines (Cleavable from azo-colourants)

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
4,4′-Thiodianiline	139-65-1	Textiles Leather Polymers (R,F,A)	No intentional use	150 mg/kg (each)	Textile and Footwear: EN ISO 14362-1:2024 and EN ISO 14362-3:2017 Leather: ISO 17234-1:2024, ISO 17234-3:2024
2-Amino-4-nitrotoluene	99-55-8				
Benzidine	92-87-5				
p-Cresidine	120-71-8				
o-Aminoazotoluene	97-56-3				
o-Anisidine	90-04-0				
o-Toluidine	95-53-4				
Salt of 2-Naphthylam-monium acetate	553-00-4				
Salt of 2,4,5-trimeth-ylaniline hydrochloride	21436-97-5				
Salt of 4-chloro-o-tolui-dinium chloride	3165-93-3				
Salt of 4-methoxy-m-phenylene diammonium sulphate	39156-41-7				

1R. Total Metals

Supplier Information:

Some metals that are hazardous or regulated are often present in formulations as contaminants from improper storage or cross-contamination. However, in some dyes and pigments, one or more metals may be intentionally used in manufacture, as part of the colorant structure, such as in metal complex dyes, double salts of certain cationic colourants, or colourants with extenders like Barium sulfate. In such verified cases, those metals are out of scope for ZDHC MRSL. Even then, other metals remain in scope and must comply with their respective MRSL limits, so these formulations are still within ZDHC MRSL scope. Wet processors should also pay close attention to ZDHC wastewater metal limits and brand RSL limits for extractable metals from dyed materials when using colourants that contain listed metals as an inherent part of their composition. Where RSL and/or wastewater issues arise, wet processors should discuss them with their chemical suppliers.

Testing Information:

The expected testing on the formulations is for the total metals content and not the extractable metals. The formulation limits for As, Cd, Hg, Pb, and Cr (VI) in the list below apply to all types of formulation. The limits for the metals do not apply to colourants containing a listed metal as an inherent compositional part (e.g. metal-complex colourants, the double salts of certain cationic colourants or extenders like Barium sulfate). However, even for these formulations the other listed metals are required to be tested and be conformant. Laboratories are required to read the different limit values for dyes and pigments according to the table given. Certifiers must ensure that the limit value as given in the table for Mn is applied when testing for denim-fading chemicals.

Formulator Information:

Metals are the most common contaminants and may appear unintentionally through cross contamination of products during manufacturing, storing and transporting and from metal catalysts used in synthesis of dyes. Formulators are advised to take utmost care to avoid such unintentional contaminations. For dyes and pigments, where broader metals are applicable, raw materials contamination and cross contamination should be especially monitored through proper chemical management practices.

1R. Total Metals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Antimony (Sb)	7440-36-0	Textiles	No intentional use	Dyes = 50 and Pigments = 250 mg/kg	EN 16711-1:2016 inlcluding microwave assisted acid digestion followed by ICP (OES or MS) analysis
		Leather			
		Polymers (R,F,A)			
Arsenic (As)	7440-38-2	Textiles		50 mg/kg (all formulations and colorants)	
		Leather			
		Polymers (R,F,A)			
Barium (Ba)	7440-39-3	Textiles		Dyes = 100 mg/kg Pigments=100 mg/kg	
		Leather			
		Polymers (R,F,A)			
Cadmium (Cd)	7440-43-9	Textiles		All formulations and dyes = 20mg/kg. Pigments = 50mg/kg	
		Leather			
		Polymers (R,F,A)			
Chromium (Cr)	7440-47-3	Textiles		Dyes = 100 mg/kg Pigments=100 mg/kg	
		Leather			
		Polymers (R,F,A)			

1R. Total Metals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Chromium (VI)	18540-29-9	Textiles	No intentional use	10 mg/kg (for all formulations and colorants)	EN ISO 17075-2:2017 or IS 17338:2019 if Cr is detected
		Leather			
		Polymers (R,F,A)			
Cobalt (Co)	7440-48-4	Textiles		Dyes 500 mg/kg Pigments: Not applicable	EN 16711-1:2016 inlcluding microwave assisted acid digestion followed by ICP (OES or MS) analysis
		Leather			
		Polymers (R,F,A)			
Copper (Cu)	7440-50-8	Textiles		Dyes 250 mg/kg Pigments: Not applicable	
		Leather			
		Polymers (R,F,A)			
Lead (Pb)	7439-92-1	Textiles		100 mg/kg (for all formulations and colorants)	
		Leather			
		Polymers (R,F,A)			
Mercury (Hg)	7439-97-6	Textiles		4 mg/kg, for all formulations and dyes (25 mg/kg for pigments)	
		Leather			
		Polymers (R,F,A)			

1R. Total Metals

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Nickel (Ni)	7440-02-0	Textiles	No intentional use	Dyes 250 mg/kg Pigments: Not applicable	EN 16711-1:2016 inlcluding microwave assisted acid digestion followed by ICP (OES or MS) analysis
		Leather			
		Polymers (R,F,A)			
Selenium (Se)	7782-49-2	Textiles		Dyes 20 mg/kg Pigments 100 mg/kg	
		Leather			
		Polymers (R,F,A)			
Silver (Ag)	7440-22-4	Textiles		Dyes 100 mg/kg Pigments: Not applicable	
		Leather			
		Polymers (R,F,A)			
Tin (Sn)	7440-31-5	Textiles		Dyes 250 mg/kg Pigments: Not applicable	
		Leather			
		Polymers (R,F,A)			
Zinc (Zn)	7440-66-6	Textiles		Dyes = 1500 mg/kg Pigments 1000 mg/kg	
		Leather			
		Polymers (R,F,A)			
Iron (Fe)	7439-89-6	Textiles		Dyes 2500 mg/kg Pigments: Not applicable	
		Leather			
		Polymers (R,F,A)			
Manganese (Mn)	7439-96-5	Textiles		Dyes 1000 mg/kg Pigments Not applicable Denim fading chemicals: 1000 mg/kg	
		Leather			
		Polymers (R,F,A)			

1S. UV Absorbers

Supplier Information:

UV absorbers are used in the formulations with specific intent for formulations to be light stable. They may also be usedto protect the final article from UV-light and thus may be used in the finishing formulations.

Testing Information:

The testing method described here in is to detect and test the UV-absorbers from the final article. Labs are requested to make sure these methods can be extrapolated to the chemical formulations and thus validations are requested to be done.

Formulator Information:

N/A

1S. UV Absorbers

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
2-Benzotriazol-2-yl-4,6-di-tert-butylphenol (UV-320)	3846-71-7	Textiles	No intentional use	1000 mg/kg	ISO 24040:2022
		Leather		1000 mg/kg	
		Polymers (R,F,A)		1000 mg/kg	
2,4-Di-tert-butyl-6-(5-chlorobenzotriazole-2-yl) phenol (UV-327)	3864-99-1	Textiles		1000 mg/kg	
		Leather		1000 mg/kg	
		Polymers (R,F,A)		1000 mg/kg	

1S. UV Absorbers

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol (UV-328)	25973-55-1	Textiles	No intentional use	100 mg/kg	ISO 24040:2022
		Leather			
		Polymers (R,F,A)			
2-(2H-benzotriazol-2-yl)-4-(tert-butyl)-6-(sec- butyl) phenol (UV-350)	36437-37-3	Textiles		1000 mg/kg	
		Leather		1000 mg/kg	
		Polymers (R,F,A)		1000 mg/kg	
2-tert-Butyl-6-(5-chloro-2H-benzotriazol-2-yl)-4-methylphenol / Bumetrizole (UV-326)	3896-11-5	Textiles		1000 mg/kg	
		Leather		1000 mg/kg	
		Polymers (R,F,A)		1000 mg/kg	
2-(2H-benzotriazol-2-yl)-4-(1,1,3,3-tetramethylbutyl) phenol (UV-329)	3147-75-9	Textiles		1000 mg/kg	
		Leather		1000 mg/kg	
		Polymers (R,F,A)		1000 mg/kg	

1T. Bisphenols

Supplier Information:

Some of the Bisphenols are known to be endocrine disruptors. They are widely used as a raw material in the manufacturing of syntans (particularly BPS and BPF) during retanning process, in the polymeric finishes such as water repellents, PVC printings, dye after treatment agent for polyamide fibres and textiles, etc.

Testing Information:

There are various methods available for testing Bisphenols. However, most of them are for final articles. Prior validation of these methods for quality assurance is highly recommended. Note that Bisphenol AF, as per the OECD definition, is classified as PFAS and hence it is also covered under the PFAS group. Note the different limit values of BPA and other Bisphenols.

Formulator Information:

Formulators are suggested to search for suitable safer chemical substitute if they are using any of the below Bisphenols in their manufacturing. When substituting, it is advisable to perform safe substitution studies before the substitute is implemented at the manufacturing level, since some of the bisphenols are under regulatory scrutiny. Bisphenols can be formed as side reaction during the manufacturing and hence formulators should be cautious of such reactions.

1T. Bisphenols

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Bisphenol A (BPA)	80-05-7	Textiles	No intentional use	100 mg/kg	Leather formulations: ISO 21135:2024 Other formulations: Alternatively sample dissolution in THF followed by ultrasoni-cation for 60 mins at 60°C followed by precipitation with methanol or acetonitrile prior to LC/MS.
		Leather			
		Polymers (R,F,A)			
Bisphenol F	620-92-8	Textiles		1000 mg/kg	
		Leather			
		Polymers (R,F,A)			
Bisphenol AF[1]	1478-61-1	Textiles		25 µg/kg*	
		Leather			
		Polymers (R,F,A)			
Bisphenol S	80-09-1	Textiles		1000 mg/kg	
		Leather			
		Polymers (R,F,A)			
Bisphenol B	77-40-7	Textiles		1000 mg/kg	
		Leather			
		Polymers (R,F,A)			

1 *BPAF is categorised as PFAS according to the OECD definition and hence is also governed by certain pieces of PFAS legislation with the corresponding limit values. However, ZDHC acknowledges current analytical challenges regarding the detection of Bisphenol AF at such low levels. Until analytical testing methods are developed that can reliably quantify BPAF at ppb levels in complex formulations, the listed, established laboratory methods for detecting the intentional use, along with unintentional contamination, are acceptable to indicate its absence in the formulation.*

1U. Aldehydes and Ketones

Supplier Information:

Although formaldehyde is restricted in formulations, suppliers are required to know that changes in the application conditions (such as curing time and temperature and other parameters) may impact the Released-Formaldehyde in the final article. A ZDHC conformant formulation, if not applied as per formulators instructions, may give rise to Released-Formaldehyde in the final article, eventually failing the RSL requirements. Suppliers are therefore required to apply such formulations critically and are requested to have a system of checking the RSL conformance periodically.

Testing Information:

Labs are required to test the Free-Formaldehyde in the formulation using the test methods prescribed. Formaldehyde is highly volatile and under testing conditions may be formed/released from the formulations, eventually generating the non-conformance to the overall formulation. Therefore, the results of formaldehyde analysis are so strongly method dependent that it is essential to define an arbitration method: ISO 27587. Arbitration is required in case of dispute or not keeping the limit and in cases where the used method is different than that of ISO 27587, the results of ISO 27587 will be considered correct/more reliable.

ISO 17226 is an older method, written and recommended for leather articles and if used, it must be adapted to leather formulations. Limits refer to Free-Formaldehyde, with the use of ISO 27587:2021 arbitration is required. For textile formulations, the method based on TEGEWA is suggested which is specific for free formaldehyde. However, the method is required to be validated by individual labs before the use.

Formulator Information:

The use of formaldehyde in formulations is restricted. However, certain formulations such as easy-care or wrinkle-free resins require the use of formaldehyde in their manufacturing. However, formulators must ensure that the specified limits for free formaldehyde in the ZDHC MRSL are met in their final formulations.

Formulations for textile processing used with the intention of wrinkle and crease resistance, shrink proofing, dye retention, stain and water repellency and durability such as fixing agents, dispersing agents, binders, resins and crosslinkers, permanent flame-retardant finishing for cotton will have a limit of 1000 mg/kg as Free-Formaldehyde, whereas the limit of free Formaldehyde for other formulations will be 250 mg/kg.

Formulations for leather processing with a hydrolysable structure such as amino resins, resin tanning agents, cationic dyeing auxiliaries, syntan/resin hybrids and reactive organic tanning agents will have a limit of Free-Formaldehyde of 1000mg/kg, whereas the limit of Free-Formaldehyde for other formulations will be 250 mg/kg.

1U. Aldehydes and Ketones

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Formaldehyde	50-00-0	Textiles Leather Polymers (R,F,A)	No intentional use	1000 mg/kg (Formalde-hyde-based formulations) 250 mg/kg (Non-formal-dehyde based formulations)	For leather formulations: ISO 27587: 2021 (recommended method and arbitration required) For textile formulation: HPLC method after polymer precipitation and derivatization with DNPH for quantifying free formaldehyde

1V. Polychlorinated biphenyls (PCBs)

Supplier Information:

PCBs are known to be used as plasticisers and flame retardants in specialised textile coatings, rubber and treated leather products. In certain cases, they may also be created inadvertently during the synthesis processes, arising as unintentional contamination in the final formulation. They are banned due to their toxicity to humans and environmental bioaccumulation.

Testing Information:

All PCBs are banned from intentional use with limit values for unintentional contamination. PCBs are a group of chemicals and not a specific one substance (209 congeners are known and all of them are banned). From the testing point of view however, the listed congeners in the below test methods are expected to be tested. Intentional use of any other congeners can be evaluated by SDS check and a specific substance (if found risky can be tested as per solution providers discretion).

Formulator Information:

N/A

1V. Polychlorinated biphenyls (PCBs)

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Polychlorinated biphenyls (PCBs)	1336-36-3 and multiple	Textiles Leather Polymers (R,F,A)	No intentional use	10 mg/kg for all formulations Organic dyes and pigments: 25 mg/kg Silicon based formulations: 50 mg/kg	ISO 18475:2023 (for all formulations except pigments and extenders) ISO 787-Part 28:2019 (for Pigments and extenders)

1W. Oxidising and Reducing agents

Supplier Information:

Potassium permanganate and other permanganate salts must not be intentionally used in textile processing due to their occupational and environmental hazards. The ban covers use as substance (as it is) and use in formulations as well. Occupational safety measurements (such as water curtains and spot exhaust extraction, appropriate personal protective equipment, robotised spraying instead of manual spraying etc.) are not sufficient because they do not consider the environmental risks that permanganate salts has upon use, e.g, the substance's classification as Aquatic Chronic 1 (H410 – very toxic to aquatic life with long lasting effect) and other environmental risks in the use process.

Testing Information:

It is expected for Labs to test formulations for $KMnO_4$ and certifiers are required to make sure (especially for denim facilities) that Potassium permanganate is not used intentionally.

Formulator Information:

The ban covers use as substance (as it is) and use in formulations as well. Thus, formulators are requested to avoid using permanganates in their formulations intentionally.

1W. Oxidising and Reducing agents

Substance	CAS No.	Applicability	Supplier Guidance	Formulation Limit	Methods of Analysis
Potassium permanganate and other permanganates salts	7722-64-7	Textiles	No intentional use[EC*]	1000 mg/kg	Testing done for total Mn content as given in the metals section 1R
		Leather	Not applicable	Not applicable	
		Polymers (R,F,A)			

CHAPTER 2

ZDHC MRSL Candidate List

The ZDHC MRSL Candidate List contains proposed for addition to the ZDHC MRSL, as described in the ZDHC MRSL Principles and Procedures document, as they lack safer alternatives at scale or more information needs to be collected. Substances on the candidate list encourage the innovation of alternatives. Substances on the candidate list may be restricted in the next ZDHC MRSL update. Hence, these substances must be prioritised by the chemical industry to find non-regrettable alternatives. ZDHC MRSL Candidate List substances are not required to be tested for ZDHC MRSL conformance.

2A C.I. Disperse Orange 61

Substance	CAS No.	Comment
C.I. Disperse Orange 61	55281-26-0	CI Disperse Orange 61 is intended to be put in the Main list in the ZDHC MRSL V5.0.

2B Phenol

Substance	CAS No.	Comment
Phenol	108-95-2	ZDHC is looking for safe limits for phenol as a contaminant in textile chemical formulations.

2C Methanol

Substance	CAS No.	Comment
Methanol	67-56-1	Methanol is a concern because of its toxicity and in ZDHC MRSL V5.0 it is intended to introduce maximum allowable limits and encourage substitution by safer solvents, which in many cases will be ethanol. However, we are aware that human consumption of industrial ethanol can be a problem and there is a requirement in some jurisdictions for industrial ethanol to be deliberately tainted with methanol to make it undrinkable. This will need to be considered as we draw up recommendations.

2D Vinyl Chloride

Substance	CAS No.	Comment
Vinyl Chloride	75-01-4	Vinyl chloride as free monomer is intended to be introduced in the ZDHC MRSL V5.0.

2E Drometrizole

Substance	CAS No.	Comment
Drometrizole	2440-22-4	Drometrizole has shown long term toxicity to aquatic animals with some skin sensitisation as well. Some suppliers use UV-P (Drometrizole) as a substitution for UV-320/326/327/328 etc. To avoid regrettable substitution by formulators/ suppliers, this specific substance is put in the Candidate List with intention to gather more evidence about the substance.

2F Polethoxylated tallow amines

Substance	CAS No.	Comment
Polyethoxylated Tallow Amines	61791-26-2	More information is required on specific substances in this group of chemicals to make a jugment on restrictions

CHAPTER 3

ZDHC MRSL Archived List

The ZDHC MRSL Archive List contains without strong evidence of current use in industry, but with clear evidence of historical use. The archived substances should not be reintroduced by a chemical manufacturer in their commercial chemical products. This list should be reviewed by ZDHC Approved Certifier - Chemicals to Zero - Foundational through the chemical product's Safety Data Sheet or any other relevant document to confirm the absence of these substances in the chemical formulation that is being certified for ZDHC MRSL Conformance.

3A. Dyes - Carcinogenic or Equivalent Concern

Potential Uses:

Most of these substances are regulated and should no longer be used for the dyeing of textiles.

Substance	CAS No.	Supplier Guidance
C.I. Solvent Yellow 2	60-11-7	No intentional use
C.I. Solvent Yellow 14	842-07-9	
D&C Red No. 19	81-88-9	

3B. Dyes - Navy Blue Colourant

Potential Uses:

Navy Blue Colourant is regulated and should no longer be used for the dyeing of textiles.

Substance	CAS No.	Supplier Guidance
Component 1: C39H23ClCrN7O12S.2Na	118685-33-9	No intentional use
Component 2: C46H30CrN10O20S2.3Na	Not allocated	No intentional use

3C. Other/Miscellaneous Chemicals

Substance	CAS No.	Supplier Guidance
Auramine hydrochloride	2465-27-2	No intentional use
Silica (particles of respirable size)		No intentional use

3D. Solvents

Potential Uses:

In the past, those substances were used to make several types of polymers, resins and textiles, but their use is now highly restricted.

Substance	CAS No.	Supplier Guidance
Bis(chloromethyl)ether	542-88-1	No intentional use
Carbon tetrachloride	56-23-5	No intentional use

General comments on testing

The testing of a chemical formulation is complex because it can exist in different matrices such as solids, waxes (water- or solvent-soluble) or liquids (miscible with water or solvents), pastes, emulsions, etc. which leads to challenges in extraction and sample preparation.

For chemical testing, only a limited number of internationally accepted and published test methods can be applied directly without modification. Most referenced test methods are intended for the final substrate. Therefore, when testing other matrices, laboratories should apply their technical knowledge and expertise to adapt the referenced method, where necessary, for the specific matrix.

The test methods specified in this document represent the best available methods at the time of publication. Solution Providers and laboratories are responsible for ensuring that the latest available version of the applicable test method is used at all times. Any updated version supersedes the previous version and shall be implemented from its effective date.

EC*

In the ZDHC MRSL V4.0, some substances are marked with EC* which means “Emissions and Exposure Control”.

These are the substances that ZDHC recognises as hazardous and therefore being added in the ZDHC MRSL V4.0. Any use of these substances in the formulations or at suppliers’ facilities will ALWAYS be deemed ZDHC MRSL non-conformant.

However, ZDHC acknowledges that there may be some specific processes where facilities may intentionally use these EC* substances, since an immediate phase-out may not be feasible and may take some time. Suppliers must initiate an action plan for a practical phase-out of such substances with a defined deadline and ensure that proper control on the emissions of and exposure to these substances is implemented at their facility.

Until then, formulations containing such substances will be deemed ZDHC MRSL non-conformant in their Performance InCheck report and Chemical Inventory List. Suppliers can demonstrate this plan of action during the ZDHC Supplier to Zero V2 evaluation to justify their inclusion in their Chemical Inventory List. In the future ZDHC MRSL updates, based on information of phase out by the manufacturing industry of these substances, the EC* marks on those substances may be removed.

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