ACCEPTANCE OF METALLIC MATERIALS USED FOR PRODUCTS IN CONTACT WITH DRINKING WATER

4MS Common Approach

Part A – Procedure for the acceptance

Part B – 4MS Common Composition List

Adopted by the 4MS Joint Management Committee

1st Revision:

30th March 2011

France, Germany, the Netherlands and the United Kingdom (4MS) work together in the framework of the 4MS Common Approach as laid down in the Declaration of Intent (January 2011). This common approach aims for convergence of the respective national approval schemes for materials and products in contact with drinking water.

The 4MS have adopted Part A of this document as a common basis for implementing the concept of accepting metallic materials in their national regulations. The document is subject to revisions agreed by the 4MS.

Part B of this document includes a Composition List of metallic materials accepted in all of the 4MS following the procedure described in Part A.

Further information may be obtained from any of the competent authorities of the 4MS.

Bundesministerium für Gesundheit (Deutschland)

Ministère du Travail, de l'Emploi et de la Santé (France)

Ministerie van Infrastructuur en Milieu (Nederland)

Department for Environment, Food and Rural Affairs (United Kingdom)

Part B – 4MS Common Composition List

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1 Introduction

Awaiting a European acceptance scheme the 4 MS co-operate concerning the convergence of their national acceptance schemes for products in contact with drinking water. The national implementation of the procedure for the acceptance of metallic materials described in Part A allows the compilation of a common Composition List for metallic materials that are accepted in all 4 MS.

Metallic materials on this common Composition List can be used for products in contact with drinking water. For the acceptance of products made of metallic materials the composition of the metallic materials have to be check for compliance with the listed materials. Further product specific tests (e.g. nickel release from chromium plated taps) for the acceptance are under consideration in some of the 4MS.

2 Compilation of a common Composition List

For the inclusion of a material onto the common Composition List the material has to be tested according to the procedure in Part A.

The primary responsibility for assessment of materials will remain at the national level making use of established processes and the expert resources available there. Thus a manufacturer may approach a national regulatory body (or its appointed agencies) for evaluation of a new material. There are obvious practical advantages for a manufacturer in the 4MS countries to work with his “home” assessment body, but he would not be required to do so. Applicants from outside the 4MS area would be free to use any of the national arrangements.

The national arrangements will continue to operate largely as at present, but instead of producing findings and recommendations for local decision, will create assessment information and proposals in a common form (Opinions). These draft opinions will be reviewed by the appropriate bodies within each of the other MS, who will offer their comments. The aim will be to achieve agreement on where and how a material is listed and on any restrictions or other information that should be included in the listing.

3 Structure of the Composition List **(see Part A 3.2)**

The Composition List contains different categories of metallic materials.

A Category is defined as:

> a group of materials with the same characteristics in respect of their field of application, behaviour in contact with drinking water and restrictions with regard to water composition and/or surface area.

The Composition List contains the categories’ range of compositions. A material falling within a category has to be tested individually for its acceptance on the list.

Each category has one reference material.

A Reference Material is defined as:

> a material falling within a category for which the characteristics of metal release into drinking water are known and reproducible, the composition is strictly controlled and the elements of interest will be at or near the upper limit of acceptability. Possible effects of some constituents to inhibit the metal release have to be taken into account.

Under each category commercially available metallic materials accepted for use in PDW will be listed. The materials may only be used for certain products due to the restrictions with respect to the surface area (Table 1).

Table 1: Product groups for metallic materials

Product Group	**Examples of products or parts of products**	**Assumed contact surface "a"**
A	Pipes in buildings installation Uncoated pipelines in water supply systems	100%
B	Fittings Ancillaries Parts of pumps in buildings installations Parts of valves in buildings installations	10%
C	Moving parts in water meter Parts of pumps in water supply systems Parts of valves in water supply systems	1%

4MS Composition List of accepted metallic materials

Copper alloys

Copper-zinc-lead alloys

Category

Composition limits of the Category

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
Copper	≥ 57,0	Antimony	0,02
Zinc	Remainder	Arsenic	0,02
Lead	≤ 3,5	Bismuth	0,02
Aluminium	≤ 1,0	Cadmium	0,02
Iron	≤ 0,5	Chromium	0,02
Silicon	≤ 1,0	Nickel	0,2
Tin	≤ 0,5		

Composition of Reference Material

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
Copper	57,0 – 59,0	Antimony	0,02
Zinc	Remainder	Arsenic	0,02
Lead	1,9-2,1	Bismuth	0,02
		Cadmium	0,02
		Chromium	0,02
		Nickel	0,2
		Aluminium	0,2
		Iron	0,3
		Silicon	0,02
		Tin	0,3

Elements for consideration in the migration water:
Lead, nickel, copper, zinc

Addition of:
For each element: Acceptance factors in comparison to the mentioned reference material

Accepted alloys

Accepted alloy Brass B2 (based on CW617N CW612N)

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
Copper	57,0 – 60,0	Antimony	0,02
Zinc	Remainder	Arsenic	0,02
Lead	1,6 – 2,2	Bismuth	0,02
		Cadmium	0,02
		Chromium	0,02
		Nickel	0,1
		Aluminium	0,05
		Iron	0,3
		Silicon	0,03
		Tin	0,3

Accepted for the following product groups
Product group B
Product group C

Basis for Acceptance
German Co-normative Research Report RG_CPDW_01_074
Dossier John Nuttall (March 2006)

Accepted alloy Brass B1 (based on CW614N, CW603N)

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
Copper	57,0 – 62,0	Antimony	0,02
Zinc	Remainder	Arsenic	0,02
Lead	2,5 – 3,5	Bismuth	0,02
		Cadmium	0,02
		Chromium	0,02
		Nickel	0,2
		Aluminium	0,05
		Iron	0,3
		Silicon	0,03
		Tin	0,3

Accepted for the following product groups
Product group C

Basis for Acceptance
German Co-normative Research Report RG_CPDW_01_074
Dossier John Nuttall (March 2006)

Copper-zinc-lead-arsenic alloys

Category

Composition limits of the Category

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
Copper	≥ 61,0	Antimony	0,02
Zinc	Remainder	Bismuth	0,02
Arsenic	≤ 0,15	Cadmium	0,02
Lead	≤ 2,2	Chromium	0,02
Aluminium	≤ 1,0	Nickel	0,2
Iron	≤ 0,5		
Silicon	≤ 1,0		
Tin	≤ 0,5		

Composition of Reference Material

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
Copper	61,0-63,0	Antimony	0,02
Zinc	Remainder	Bismuth	0,02
Arsenic	0,09-0,13	Cadmium	0,02
Lead	1,4-1,6	Chromium	0,02
Aluminium	0,5-0,7	Nickel	0,2
		Iron	0,12
		Silicon	0,02
		Tin	0,3

Elements for consideration in the migration water:
Lead, nickel, arsenic, copper, zinc

Restrictions for the use of metallic materials with respect to water composition (health based)
Based on the results of ongoing dedicated research (by industry), the alloying elements (constituents) and the impurities will be limited such, that the alloys can be used in any drinking water.

Accepted for the following product groups
Product Group B
Product Group C

Basis for Proposal
Dossier John Nuttall (March 2006)

Addition of:
For each element: Acceptance factors in comparison to the mentioned reference material

Copper-tin-zinc lead alloys

Category

Composition limits of the Category

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
Copper	Remainder	Aluminium	0,01
Zinc	≤ 6,5	Antimony	0,1
Tin	≤ 13,0	Arsenic	0,03
Lead	≤ 3,0	Bismuth	0,02
Nickel	≤ 0,6	Cadmium	0,02
		Chromium	0,02
		Iron	0,3
		Silicon	0,01

Composition of Reference Material

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
Copper	Remainder	Aluminium	0,01
Zinc	5,9-6,2	Antimony	0,1
Tin	3,9-4,1	Arsenic	0,03
Lead	2,8-3,0	Bismuth	0,02
Nickel	0,5-0,6	Cadmium	0,02
		Chromium	0,02
		Iron	0,3
		Silicon	0,01

Elements for consideration in the migration water:
Lead, nickel, antimony, copper, zinc, tin

Addition of:
For each element: Acceptance factors in comparison to the mentioned reference material

Accepted alloys

Accepted alloy Gunmetal GM1 (based on CC491K)

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
Copper	84,0 – 88,0	Aluminium	0,01
Zinc	4,0 – 6,0	Antimony	0,1
Tin	4,0 – 6,0	Arsenic	0,03
Lead	2,5-3,0	Bismuth	0,02
Nickel	0,1-0,6	Cadmium	0,02
		Chromium	0,02
		Iron	0,3
		Silicon	0,01

Accepted for the following product groups
Product Group B
Product Group C

Basis for Proposal
German Co-normative Research Report RG_CPDW_01_074
Dossier John Nuttall (March 2006)

Coppers

Copper

Category

Composition limits for the Category

Constituent	Content (%)	Impurity	Maximum (%)
Copper	≥ 99,9	Others total	≤ 0,1
Phosphorus	≤ 0,04		

Reference Composition

Constituent	EN number
Cu-DHP	CW 024A

Elements for consideration in the migration water:
None: no need for comparative testing

Accepted alloys

Copper (Cu-DHP)

Constituent	Content (%)	Impurity	Maximum (%)
Copper	≥ 99,9	Others total	≤ 0,1
Phosphorus	≤ 0,04		

Accepted for the following product groups
Product group A
Product group B
Product group C

Restrictions for the use of metallic materials with respect to water composition (health based)
The formation of the copper compounds on the surface of copper pipes and consequently the dissolution is strongly influenced by minor components of the water composition. In some water compositions, the rate of leaching of copper may be unacceptably high. Member States may need to offer guidance to the water industry and to suppliers and installers of copper pipe on restrictions that may need to be introduced on use of copper pipe in water compositions where excessive leaching of copper might occur.
Further research into the compatibility of copper with certain compositions of water needs to be carried out using harmonised procedures for investigation and evaluation.

Basis for Proposal
Research results and practical experience in several Member States are needed to characterise the conditions for safe use.

Note
The contamination of drinking water by copper pipes depends on several characteristics of water composition. There is no consensus view on their combined action and interaction at this time. In particular, there is inadequate information on the range of compositions of drinking water where non-compliance with the DWD is likely to occur.

Tinned Copper Tubes and tinned Copper Fittings

For tinned copper tubes and tinned copper fittings as base material copper according to 4.3.1 is used. On this substrate material a tin layer is deposited by different processes. By diffusion of copper ions into the tin layer the formation of an increasing intermetallic phase consisting of tin and copper (η-phase = Cu_6Sn_5) is formed.

Category

Composition limits of the Category: tin layer

Constituent	**Content (%)**	**Impurity of**	**Maximum (%)**
Tin and Copper	$\geq$ 99,90	Antimony	0,01
		Arsenic	0,01
		Bismuth	0,01
		Cadmium	0,01
		Chromium	0,01
		Lead	0,01
		Nickel	0,01

Reference composition

Copper tube according to EN 1057

Constituent	**EN number**
Cu-DHP	CW 024A

Accepted alloys

CW 024A copper with a tin layer thickness 1 µm with the following composition:

Constituent	**Content (%)**	**Impurity of**	**Maximum (%)**
Tin	$>$ 90	Antimony	0,01
Copper	< 10	Arsenic	0,01
		Bismuth	0,01
		Cadmium	0,01
		Chromium	0,01
		Lead	0,01
		Nickel	0,01

Accepted for the following product groups
Product group A
Product group B
Product group C

Basis for proposal:

1. Leaching tests

a: rig tests in representative German drinking waters, published: A. Baukloh, S. Priggemeyer, U. Reiter, B. Winkler, Chemically inner tinned Copper Pipes, Less Copper in Corrosive Drinking Waters, Metall 10-11 (1998) 592 - 600.

b: Rig tests according to DIN 50931 (rig test): Technical report DVGW/TZW, 2000

2. Already existing approvals without restrictions in drinking waters

- Netherlands: according to BRL-K19005,
- Germany: according to DIN 50930, T6 and DVGW GW 392)
- Denmark, ETA

Galvanised steel

Category

The zinc coating resulting from used in the galvanising process shall comply with the following requirements.

Constituent	Content (%)	Impurity	Maximum (%)
Zinc		Antimony	0,01
		Arsenic	0,02
		Cadmium	0,01
		Chromium	0,02
		Lead	0,05
		Bismuth	0,01

Accepted alloys

The zinc coating resulting from used in the galvanising process complying with the following:

Constituent	Content (%)	Impurity	Maximum (%)
Zinc		Antimony	0,01
		Arsenic	0,02
		Cadmium	0,01
		Chromium	0,02
		Lead	0,05
		Bismuth	0,01

Guidance on restrictions for the use of metallic materials with respect to water composition

The following formula is proposed as a means identifying water compositions where corrosion rates for galvanised steel is acceptable.

	pH ≥ 7.5 or free CO_2 ≤ 0.25 mmol/L
AND	Alkalinity ≥ 1.5 mmol/L
AND	S_1 < 2 (*definition of S_1 below*)
AND	Calcium ≥ 0.5 mmol/L
AND	Conductivity ≤ 600 µS/cm at 25°C
AND	S_2 <1 or S_2>3 (*definition of S_2 below*)

$$S_1 = \frac{c(Cl^-) + c(NO_3^-) + 2\,c(SO_4^{2-})}{c(HCO_3^-)}$$ concentrations in mmol/l

$$S_2 = \frac{c(Cl^-) + 2\,c(SO_4^{2-})}{c(NO_3^-)}$$ concentrations in mmol/l

Accepted for the following product groups
Product group A
Product group B
Product group C

Basis for proposal
There are regulations with respect to water composition in France (DTU 60.1 / NF P 40-201) and in Germany (DIN 50930-3). These limits are based on practical experience but are expressed in different ways. The proposal covers mainly the same water compositions as both regulations. The proposal takes into account available results from research in Germany and co-normative research.
The proposal incorporates also the recommendations given EN 12502-3 with regard to the risk of localised corrosion. This localised corrosion frequently leads to deterioration in water quality as a result of corrosion products of iron.

The proposal is based on results that have been obtained with galvanised steel pipes with lead concentrations between 1.0% and 0.6 % in the zinc layer, assuming a similar behaviour of pipes with lower lead concentrations.

Carbon steel

Carbon Steel for pipes and tanks

Carbon steel without permanent protective layers is not suitable for use in contact with drinking water.

Carbon Steel for ancillaries

Unprotected carbon steel can be used for specific applications (e.g. pumps, valves) and only for small surface in contact with water.

Category

The constituents and impurities should not exceed the maximum limits stated below:

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
Iron		Antimony	0,02
Carbon	≤ 2,11	Arsenic	0,02
Chromium	≤1,0	Cadmium	0,02
Molybdenum	≤1,0	Lead	0,02
Nickel	≤0,5		

Accepted alloys

The constituents and impurities should not exceed the maximum limits stated below:

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
Iron		Antimony	0,02
Carbon	≤ 2,11	Arsenic	0,02
Chromium	≤1,0	Cadmium	0,02
Molybdenum	≤1,0	Lead	0,02
Nickel	≤0,5		

Accepted for the following product groups
Group C

Basis for proposal
Draft Italian Regulation
Calculation of possible impact on DW

Cast iron

Cast iron for pipes and tanks

Cast iron without permanent protective layers is not suitable for pipes and fittings in contact with drinking water.

Cast iron for ancillaries

Unprotected cast iron can be used for specific applications (e.g. pumps, valves) and only for very small surface in contact with water. Their composition needs to be regulated.

Category

The constituents and impurities should not exceed the maximum limits stated below:

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
		Antimony	0.02
Iron		Arsenic	0.02
Carbon		Cadmium	0.02
Chromium	≤1.0	Lead	0.02
Molybdenum	≤1.0		
Nickel	≤6.0		

Accepted alloys

The constituents and impurities should not exceed the maximum limits stated below:

Constituent	**Content (%)**	**Impurity**	**Maximum (%)**
		Antimony	0.02
Iron		Arsenic	0.02
Carbon		Cadmium	0.02
Chromium	≤1.0	Lead	0.02
Molybdenum	≤1.0		
Nickel	≤6.0		

Accepted for the following product groups
Group C

Basis for proposal
Draft Italian regulation.
French regulation.
Calculation of possible impact on DW