28.27 - Chlorides, chloride oxides and chloride hydroxides; bromides and bromide oxides; iodides and iodide oxides.

2827.10 - Ammonium chloride

2827.20 - Calcium chloride

- Other chlorides :

2827.31 - - Of magnesium

2827.32 - - Of aluminium

2827.35 - - Of nickel

2827.39 - - Other

- Chloride oxides and chloride hydroxides :

2827.41 - - Of copper

2827.49 - - Other

- Bromides and bromide oxides :

2827.51 - - Bromides of sodium or of potassium

2827.59 - - Other

2827.60 - Iodides and iodide oxides

Subject to the **exclusions** specified in the introduction to this sub-Chapter, this heading covers chlorides, chloride oxides (oxychlorides), chloride hydroxides (hydroxychlorides), bromides, bromide oxides (oxybromides), iodides and iodide oxides (oxyiodides) of metals or of the ammonium ion (NH_4^+). Halides and halide oxides of non-metals are **excluded** (**heading 28.12**).

(A) CHLORIDES

This group covers the salts of hydrogen chloride (heading 28.06).

The main chlorides included here are :

(1) **Ammonium chloride** (sal ammoniac, ammonium muriate) (NH_4Cl). Results from the neutralisation of hydrogen chloride with ammonia. It may be in crystalline masses or in powder, flowers or cakes obtained by sublimation. Colourless when pure, otherwise yellowish; soluble in water. Its uses include the pickling of metals, in the textile dyeing or printing industry, in tanning, as a fertiliser, in the manufacture of Leclanché cells, for hardening varnishes or glues, in electroplating, in photography (fixing solutions), etc.

See Explanatory Note to heading 31.02 regarding fertilisers containing ammonium chloride.

(2) **Calcium chloride** ($CaCl_2$). This compound is either extracted from natural Stassfurt salts, or obtained as a by-product of the manufacture of sodium carbonate. It is white, yellowish or brown in colour, according to the degree of purity. A hygroscopic product, it may be in cast or melted form, in porous masses or in flakes, or may be hydrated with 6 H_2O (crystalline or granulated). It is used in refrigerating mixtures, for cold weather concrete work, as an anti-dust dressing for roads or for hard-earth floorings, as a catalyst, as a dehydrating or condensation agent in organic synthesis (e.g., preparation of amines from phenol) and for drying gases. It is also used in medicine.

(3) **Magnesium chloride** ($MgCl_2$). A by-product of the extraction of potassium salts. Occurs either in anhydrous translucent masses, cylinders, tablets or prisms, or hydrated in colourless needles. Soluble in water. Used in the manufacture of very hard cement (e.g., for floor coverings cast in one piece), of cotton or other textile dressings, as a disinfectant or antiseptic in medicine and for fire-proofing wood.

The heading **excludes** natural magnesium chloride (bischofite) (**heading 25.30**).

(4) **Aluminium chloride** ($AlCl_3$). Obtained by the action of chlorine on aluminium, or of hydrogen chloride on aluminium oxide. Anhydrous or crystalline; or in aqueous solutions of syrupy consistency. The anhydrous salt fumes on exposure to air. The solid chloride is used in organic synthesis, as a mordant in dyeing, etc. In aqueous solutions it is used for preserving wood, pickling wool, as a disinfectant, etc.

(5) **Iron chlorides**.

(a) **Ferrous chloride** ($FeCl_2$). Anhydrous (scales, flakes or greenish-yellow powder) or hydrated with, for example, 4 H_2O (green or bluish crystals); or may be in green aqueous solutions. Oxidises in the air and becomes yellow. Usually presented in carefully stoppered bottles with a few drops of alcohol added to prevent oxidation. A reducing agent and a mordant.

(b) **Ferric chloride** ($FeCl_3$). Prepared by dissolving iron oxide or carbonate or iron metal in hydrochloric acid or in *aqua regia*, or by passing gaseous chlorine over red-hot iron. Anhydrous, in yellow, brown or garnet-coloured masses, deliquescent and soluble in water, or hydrated (with 5 or 12 H_2O) in orange-coloured, red or purple crystals; the liquid iron chloride on the market is a dark red aqueous solution. More widely employed than ferrous chloride, e.g., for purifying industrial water, as a mordant, in photography and photo-engraving, to give a patina to iron, in medicine (haemostatic or vasoconstrictive preparations), and, principally, as an oxidising agent.

(6) **Cobalt dichloride** (cobaltous chloride) ($CoCl_2.6H_2O$). In pink, red or purple crystals turning blue when heated; soluble in water. Used in the manufacture of hygrometers, as a sympathetic ink or as an absorbent in gas masks.

(7) **Nickel dichloride** ($NiCl_2$). Anhydrous, in yellow scales or flakes, or hydrated (with 6 H_2O) in deliquescent green crystals; very soluble in water. Used as a mordant in dyeing, in electrolysis (nickel-plating baths) or as an absorbent in gas masks.

(8) **Zinc chloride** ($ZnCl_2$). Zinc chloride is obtained by passing hydrogen chloride over roasted zinc ores (blende or calamine) (heading 26.08); or it can be extracted from the ashes and residues classified in heading 26.20. White crystalline masses (butter of zinc), fused or granulated. It is highly deliquescent, soluble in water, caustic and very toxic. Used as an antiseptic, fungicide, dehydrating agent, for fire-proofing wood, preserving hides, hardening cellulose (preparation of vulcanised fibre), and in organic synthesis. Also used as a flux in soldering, as a mordant in dyeing or printing, for purifying oils, and in the manufacture of dental cements or of medicaments (cauterising antiseptics).

(9) **Tin chlorides**.

(a) **Stannous chloride** (tin dichloride) ($SnCl_2$). Masses with a resinous fracture, or in white or yellowish crystals (with 2 H_2O). Also in solutions of the same colours. Corrosive; deteriorates in the air. Used as a reducing agent or mordant in textile dyeing, in vat dyes (dyers' tin salt), as tin size for silk or in electrolytic tin-plating.

(b) **Stannic chloride** (tin tetrachloride) ($SnCl_4$). In the anhydrous state this is a colourless or yellowish liquid, giving off white fumes in a humid atmosphere. Hydrated it gives colourless crystals; it also occurs in gelatinous masses (butter of tin). Used as a textile mordant or size (tin size for silk), or, mixed with stannous chloride and gold salts, in the preparation of purple of Cassius for decorating porcelain.

(10) **Barium chloride** ($BaCl_2$). Prepared from natural barium carbonate (witherite) or sulphate (barytes). Soluble in water; may be anhydrous or fused (yellow powder), or hydrated with 2 H_2O (in lamellar crystals or tablets). Used in dyeing, in ceramics, as a parasiticide or rat-poison, for purifying industrial water, etc.

(11) **Titanium chlorides**. The most important is titanium tetrachloride ($TiCl_4$) obtained in the metallurgy of titanium by the action of chlorine on a mixture of carbon and native titanium dioxide (rutile, brookite, anatase). Colourless or yellowish liquid with a pungent odour; fumes in moist air; absorbs and is hydrolysed by water. Used in the manufacture of mordants for dyeing (titanium mordants), for giving ceramics an iridescent appearance, for making smoke-screens or in organic synthesis.

(12) **Chromium chlorides**.

(a) **Chromous chloride** ($CrCl_2$). Needle-shaped crystals or azure-blue solutions. Reducing agent.

(b) **Chromic chloride** ($CrCl_3$). Pink or orange crystalline scales, or hydrated (with 6 or 12 H_2O) in green or purple crystals. Used as a mordant in textile dyeing, in tanning, in electrolytic chromium plating, in organic synthesis and for preparing sintered chromium.

(13) **Manganese dichloride** ($MnCl_2$). Obtained by treating the natural carbonate, rhodocrosite or dialogite (heading 26.02) with hydrogen chloride. Rose-coloured, crystalline masses when anhydrous; or hydrated (e.g., with 4 H_2O) in rose-coloured crystals, deliquescent and soluble in water. Used in the manufacture of brown colouring agents or of certain medicaments, as a catalyst and in textile printing.

(14) **Copper chlorides**.

(a) **Cuprous chloride** (copper monochloride) ($CuCl$). Crystalline powder or colourless crystals, practically insoluble in water, oxidising in the air. Used in the metallurgy of nickel and silver, or as a catalyst.

(b) **Cupric chloride** ($CuCl_2.2H_2O$). Deliquescent green crystals, soluble in water. Used in textile printing, photography or electrolysis; as a catalyst, an antiseptic, disinfectant or insecticide; in the dyestuff industry and in pyrotechnics (Bengal fires).

Nantokite, natural copper chloride, falls in **heading 25.30**.

(15) **Antimony chlorides**.

(a) **Antimony trichloride** (butter of antimony) ($SbCl_3$). Prepared by treating natural sulphide (stibnite) (heading 26.17) with hydrogen chloride. Occurs in colourless, translucent lumps; absorbs atmospheric moisture to take on an unctuous appearance; it is caustic. Used for " bronzing " or pickling metals, as a mordant, for making lakes, for leather dressing, and in the preparation of antimony oxide or veterinary remedies.

(b) **Antimony pentachloride**($SbCl_5$). Colourless liquid, fuming in moist air; decomposed by water. Used as a chlorine carrier in organic synthesis and as a fumigant.

This group **excludes** sodium chloride and potassium chloride which, even in the pure state, fall in **headings 25.01** and **31.04** or **31.05**, respectively. The heading also **excludes** the compound wrongly known as "chloride of lime" which is commercial calcium hypochlorite (**heading 28.28**). Mercury chlorides (mercurous chloride and mercuric chloride) fall in **heading 28.52**.

(B) CHLORIDE OXIDES AND CHLORIDE HYDROXIDES

This group covers chloride oxides (oxychlorides) and chloride hydroxides (hydroxychlorides) of metals.

It includes :

(1) **Copper chloride oxides and chloride hydroxides**. Crystalline, blue powders, used as insecticides, fungicides or pigments.

The heading **excludes** natural copper chloride hydroxide (atacamite) (**heading 26.03**).

(2) **Aluminium chloride hydroxide** ($Al_2Cl(OH)_5.xH_2O$). Yellowish-white powder. Used as anti-perspirant in cosmetics.

(3) **Chromium chloride oxide** (chromyl chloride) ($CrCl_2O_2$). Red liquid with an irritating odour; fumes in moist air and decomposed by water. Used in tanning, as a mordant and as an oxidising agent.

(4) **Tin chloride oxide**. Grey or white amorphous lumps, soluble in water. Used as a mordant.

(5) **Antimony chloride oxide** (SbClO). A white powder used in the manufacture of smokes, pigments, medicaments.

(6) **Lead chloride oxides and chloride hydroxides**. White powders obtained by treating lead oxide (litharge) with an alkaline chloride. Used for preparing lead chromates, as pigments (Cassel yellow) for water paints, oil paints or distempers, and in the preparation of other more complex pigments.

(7) **Bismuth chloride oxide** (bismuthyl chloride) (BiClO). White powder used as a pigment (" pearl white ") in the manufacture of artificial pearls.

(C) BROMIDES AND BROMIDE OXIDES

This group covers the salts of hydrogen bromide (heading 28.11) and bromide oxides (oxybromides).

(1) **Sodium bromide** (NaBr). Prepared in a similar way to ammonium bromide, or by treating with a sodium salt the iron bromide obtained by direct action of bromine on iron turnings. It can be obtained in the rather unstable anhydrous state by crystallisation above 51 °C. When crystallised below that temperature it is hydrated (with 2 H_2O), in large cubic crystals. Colourless, hygroscopic, soluble in water. Used in medicine and in photography.

(2) **Potassium bromide** (KBr). Similar manufacturing processes and same uses as sodium bromide. Anhydrous, in large crystals.

(3) **Ammonium bromide** (NH_4Br). Produced by the action of hydrogen bromide on ammonia. Colourless crystals, soluble in water, turning yellow and slowly disintegrating when exposed to air, and volatilised by heat. Used in medicine as a sedative, in photography (as a restrainer in developing solutions), and as a fire-proofing material.

(4) **Calcium bromide** ($CaBr_2.6H_2O$). Prepared from calcium carbonate and hydrogen bromide; deliquescent colourless crystals, very soluble in water. Used in medicine and in photography.

(5) **Copper bromides**.

(a) **Cuprous bromide** (CuBr). Obtained by reduction of cupric bromide; colourless crystals, insoluble in water. Used in organic synthesis.

(b) **Cupric bromide** ($CuBr_2$). Prepared by direct action of bromine on copper. Deliquescent crystals, soluble in water. Used in organic synthesis and in photography.

(6) **Other bromides and bromide oxides**. These include strontium bromide (used in medicine), and barium bromide.

(D) IODIDES AND IODIDE OXIDES

This group covers the salts of hydrogen iodide (heading 28.11) and iodide oxides (oxyiodides).

(1) **Ammonium iodide** (NH_4I). Obtained by the action of hydrogen iodide on ammonia or ammonium carbonate. White, crystalline, hygroscopic powder, very soluble in water. Used in medicine (for circulatory ailments or emphysema) and in photography.

(2) **Sodium iodide** (NaI). Obtained by the action of hydrogen iodide on sodium hydroxide or carbonate, or by treating with a sodium salt the iron iodide obtained by the direct action of iodine on iron filings; also prepared by calcining iodates. Crystalline, anhydrous. Deliquescent and very soluble in water, decomposing on exposure to air and light. Used in medicine, to iodise table or kitchen salt and in photography.

(3) **Potassium iodide** (KI). Similar manufacturing processes and similar uses, but keeps better than sodium iodide. Anhydrous, colourless or opaque crystals.

(4) **Calcium iodide** (CaI_2). Prepared from calcium carbonate and hydrogen iodide. Colourless shiny crystals or pearly white scales. Soluble in water and turns yellow in the air. Used in photography.

(5) **Other iodides and iodide oxides**. These include :

(a) Iodides of lithium (used in medicine), of strontium, of antimony, of zinc or of iron (both used in medicine and as antiseptics), of lead (with a metallic glint, used in the preparation of rubber colours), of bismuth (reagent).

(b) Antimony iodide oxide, copper iodide oxide and lead iodide oxide.

Mercury iodides (mercurous iodide and mercuric iodide) are **excluded (heading 28.52)**.