For Comments Only

BUREAU OF INDIAN STANDARDS

Draft *Indian Standard*

STEEL PRODUCTS – DEFINITIONS AND CLASSIFICATION

ICS 77.140.01

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FOREWORD

(Formal clauses will be added later on)

While reviewing this standard, in the light of experience gained during these years, the Committee decided to revise it to bring in line with the present practices being followed by the Indian industry and corresponding International standards on terminology.

In this revision the following changes have been made:

a) Sheets and strips have been defined as flat products with a thickness less than 5 mm.

b) Plates have been defined as flat products with a thickness equal to or greater than 5 mm.

c) Definitions of aluminium-zinc and zinc –nickel coated sheet and strip has been added.

d) The requirements of IS 1956-3, IS 1956-4, IS 1956-5 and IS 10340 have been incorporated in the standard.

The revised standard shall supersede following standards:

i) IS 1956 (Part 3):1975 Glossary of terms relating to iron and steel Part 3 –Hot rolled steel products (excluding sheet and strip)

ii) 1956(Part 4)1975 Glossary of terms relating to iron and steel Part 4 – Steel sheet and strip (first revision)

iii) IS 1956 (Part 5)1976 Glossary of terms relating to iron and steel Part 5 : Bright steel bar and wire

iv) IS 10340:1982 Glossary of terms for cold reduced tinplate and cold-reduced blackplate

While revising the standard assistance has been derived from ISO 6929:1987

1 SCOPE

1.1 This draft standard defines and classifies steel products according to:

a) their stage of manufacture;
b) their shape and dimensions;
c) their appearance.

NOTE 1 Although the products are generally classified independently of their end uses or manufacturing processes, it has sometimes been necessary to make reference to these criteria.

NOTE 2 All dimensions given in this Indian Standard are nominal.

1.2 Section one defines and classifies steel industry products.

1.3 Section two defines and classifies other steel products as follows:

a) powder metallurgy products;
b) castings;
c) forged finished and stamped finished products;
d) bright products;
e) cold formed products;
f) welded sections;
g) wire;
h) tubes, hollow sections and hollow bars.

2 Normative references

See Annexure A.

Section one: Steel industry products

3 General classification

The range of products covered in Section one of this *draft* standard is grouped into three main categories according to their stage of manufacture:

a) crude products (clause **4**);
b) semi-finished products (clause **5**);
c) rolled finished products and end products (clause **6**) and finished products forged in lengths (clause **7**).

4 Crude products

crude products: Products which are either in the liquid state (*see* **4.1**) or solid in the form of ingots (*see* **4.2**).

NOTE Production statistics include under the definition of "crude steel" not only solid products obtained by casting into ingot moulds and liquid steel for castings, but also solid products obtained by continuous casting which are otherwise regarded as semi-finished products (*see* footnote 3 to **4.2**).

4.1 liquid steel: Steel in the liquid state ready for pouring and obtained directly from the melting of raw materials.

NOTE A distinction is made between the liquid steel for pouring into ingot moulds or for continuous casting, and liquid steel for castings.

4.2 ingots[1)]: Products obtained by pouring liquid steel into moulds of a shape appropriate to the subsequent processing[2)] into semi-finished or finished products, generally by hot rolling or forging[3)].

The shape generally resembles a truncated pyramid or truncated cone; the side surfaces may be corrugated and the corners more or less rounded.

Depending on their subsequent conversion requirements, ingots may be dressed and/or hot scarfed or cropped without altering their status as ingots.

According to their cross-section, a distinction is made between the following:

4.2.1 ingots having a cross-section which may be square, rectangular (of width less than twice the thickness), polygonal, round, oval or shaped according to the profile to be rolled.

4.2.2 slab ingots of rectangular cross-section of width twice the thickness or over.

NOTES :

1 Ingots for the production of seamless tubes are classified as crude products.

2 In the case of ingots remelted by the vacuum arc or electroslag process, the products are obtained by melting, in a mould of appropriate shape, steel electrodes that have been previously cast, forged or rolled.

3 Although their structure is similar to that of ingots, products obtained by continuous casting are regarded in this *draft* standard and in delivery statistics as semi-finished products according to their shape and dimensions, while in production statistics they are regarded as crude products.

5 Semi-finished products

semi-finished products: Products obtained either by rolling or forging of ingots or by continuous casting, and generally intended for conversion into finished products by rolling or forging.
Their cross-section can be of various shapes (*see* **5.1** to **5.4**); the cross-sectional dimensions are constant along the length, with wider tolerances than those of the corresponding finished products, and the corners are more or less rounded.

The side faces are sometimes slightly convex or concave, retaining rolling, forging or continuous casting marks, and may be partially or totally dressed, for example by tool, torch or grinding.

The semi-finished products defined in **5.1** to **5.5** are classified according to their shape, their cross-sectional dimensions and their use (*see* figure 1).

5.1 Semi-finished products of square cross-section (excluding the semi-finished products defined in **5.5**)

According to their side dimensions, these products are traditionally classified as follows:

5.1.1 square blooms: Semi-finished products with side greater than 120 mm.

5.1.2 square billets: Semi-finished products with side generally equal to or greater than 50 mm and less than or equal to 120 mm.

NOTE Dimensions of square billets can be less than as above for certain types of high alloy steels, such as high-speed steels, etc.

5.2 Semi-finished products of rectangular cross-section (excluding the semi-finished products defined in **5.3** and **5.5**)

According to their cross-sectional dimensions, these products are traditionally classified as follows:

5.2.1 rectangular blooms: Semi-finished products having a cross-sectional area greater than 14 400 mm^2, with a ratio of width to thickness greater than 1 and less than 2.

5.2.2 rectangular billets: Semi-finished products having a cross-sectional area equal to or greater than 2 500 mm^2 and less than or equal to 14 400 mm^2, with a ratio of width to thickness greater than 1 and less than 2.

5.3 Flat semi-finished products

5.3.1 slabs: Flat semi-finished products of thickness generally equal to or greater than 50 mm and with a ratio of width to thickness equal to or greater than 2. Slabs with a ratio of width to thickness greater than 4 are called “flat slabs”.
5.3.2 sheet bars: Flat semi-finished products of width equal to or greater than 150 mm and of thickness greater than 6 mm and less than 50 mm.

5.4 Blanks for sections

blanks for sections: Semi-finished products intended for the manufacture of sections and which have been preformed for that purpose. The cross-sectional area of these semi-finished products is generally greater than 2 500 mm^2.

NOTE In most cases the finished products in question are obtained directly by rolling semi-finished products of square or rectangular section.

5.5 Semi-finished products for seamless tubes

The cross-section of these products may be round, square, rectangular or polygonal.

6 Rolled finished products and end products

6.1 General

6.1.1 Rolled finished products and end products: Products which have been manufactured generally by rolling and which are normally not further hot worked in the steel works.

The cross-section is uniform over the whole length. It is usually defined by a standard, which fixes the normal size ranges and the tolerances on shape and dimension. The surface is generally smooth, but reinforcing bars or floor plates, for example, may have a regularly raised or indented pattern.

6.1.2 According to shape and dimensions, a distinction is made as follows:

a) long products (*see* **6.2.1**);
b) rod *(see* **6.2.2**);
c) flat products *(see* **6.2.6**).

6.1.3 According to the stage of manufacture, a distinction is made as follows:

a) **hot rolled finished products and end products:** Products generally obtained by hot rolling of semi-finished products and, more rarely, by hot rolling of crude products.

NOTE Finished products obtained by extrusion are classified in the statistics as hot rolled finished products. On the other hand, tyres and similar products are classified as forged products.

b) **cold rolled finished products and end products:** Products generally obtained by the cold rolling of hot rolled finished products.

6.1.4 According to the surface condition, a distinction is made as follows:

6.1.4.1 Products which have not undergone any surface treatment, apart from those products which may have received a simple protective coating against corrosion or mechanical damage in handling or storage, or to facilitate their use.

The simple protective coating may be produced, for example, by one of the following methods:

a) passivation (with chromic or phosphoric acid) – the product is electrochemically or chemically coated with a layer of chromate or phosphate; as distinct from surface treatment by chromating or phosphating (*see* **6.3.1.2.3**), the layer deposited is so thin as to be hardly discernible by optical means (7 to10 mg/m^2 per side);
b) application of an organic coating – the coating itself offers no protection against corrosion but serves as a surface preparation for the subsequent application of other undercoats or coatings forming part of an anti-corrosion system;
c) application of protective films, e.g. adhesive coating, adhesive paper, lacquer;
d) application of a film of grease, oil, tar, asphalt, lime or any soluble material.

6.1.4.2 Products which have been surface treated (*see* **6.3.1**).

6.2 Rolled finished products

6.2.1 Hot rolled long products

hot rolled long products: Products as defined in **6.1.1**, **6.1.3**a) and **6.1.4**, with the cross-section resembling the shapes described in **6.2.1.1** and **6.2.1.2** or similar shapes. These products are rolled generally in box passes or in universal rolling mills. When the cross-section is rectangular, the dimensional limitations given in **6.2.1.2.1.3** apply to differentiate them from wide flats. `

These products are mostly delivered in straight lengths, rarely in folded bundles, but never in coils (which differentiates them from rod).

6.2.1.1 heavy sections: Hot rolled long products with cross-section resembling the letter I, H or U (*see* fig. 2). They have the following characteristics:

a) the web height *h* is equal to or greater than 80 mm;
b) the surfaces of the webs are continued by fillets to the inside faces of the flange;
c) the flanges are generally symmetrical and of equal widths *b (see also* **6.2.1.1.4***);*
d) the outside faces of the flanges are parallel;
e) the flanges are either of decreasing thickness from the web to the edge, in which case it is called “sloping flanged” or “tapered flanged”, or of uniform thickness, in which case the corresponding section is called “parallel flanged”.

Heavy sections are sub-divided into:

6.2.1.1.1 I and H sections: Hot rolled long products with cross-section resembling the letter I or H and with characteristic listed in **6.2.1.1**.

NOTE - Subsequent slitting of I or H sections in order to obtain two Tee sections does not alter their classification.

A distinction is made between:

a) **parent sections:** Sections with web and flange thickness considered as standard.
b) **thin sections:** Sections manufactured with the same series of rolls as used in producing the corresponding parent section but which, for an approximately equal web height, have thinner web and/or flanges (as a result of adjustment of the vertical or horizontal rolls).
c) **thick sections:** Sections manufactured with the same series of rolls as used in producing the corresponding parent section but which, for an approximately equal web height, have a thicker web and /or flanges (as a result of adjustment of the vertical or horizontal rolls).

Among I and H sections a further distinction is made between:
6.2.1.1.1.1 I sections with narrow and medium flanges: I sections in which the flange width is equal to or less than 0.66 × the nominal height of the section and less than 300 mm.

6.2.1.1.1.2 H sections and columns with broad or very broad flanges: H sections and columns in which the flange width is greater than 0.66 × the nominal height, or 300 mm or over (except sections for colliery arches). Sections with flanges wider than 0.8 × the nominal height are sometimes called “columns”.

6.2.1.1.1.3 bearing piles: I or H sections in which the thickness of web and flanges are identical.

6.2.1.1.2 U sections (channels): Hot rolled long products with cross-section resembling the letter U and with characteristics listed in 6.2.1.1. In the normal series, the flanges with tapered internal faces have a maximum width of 0.5*h* + 25 mm. There are series which are thinner or thicker than the parent series, and series with parallel flanges.

6.2.1.1.3 sections for colliery arches: Hot rolled long products with cross-section resembling the letter I or the Greek letter Ω. In the first case, these sections are sometimes distinguished from other I sections by a greater slope of the inside face of the flanges (of about 30 %). They also have width greater than 0.70 × the nominal height.

6.2.1.1.4 special heavy section: I, H and U or similar sections having a height as given in 6.2.1.1 but with special features such as unequal or asymmetric flanges and/or non-standard web thickness and height.
These products are generally manufactured in limited quantities.

6.2.1.2 Bars, and medium and light sections

6.2.1.2.1 Bars (including flat bars) (with the exception of products for the fabrication of concrete reinforcement, covered by **6.2.3**)

6.2.1.2.1.1 rounds: Bars having a circular cross-section, the diameter being generally at least 8 mm.

6.2.1.2.1.2 squares, hexagons and octagons: Bars having a square, hexagonal or octagonal cross-section, the side being generally at least 8 mm for square bars, or 14 mm for hexagonal and octagonal bars.

6.2.1.2.1.3 flats: Bars having a rectangular cross-section rolled on the four faces, the thickness being generally at least 5 mm and the width not greater than 150 mm.

6.2.1.2.2 Medium and light sections

6.2.1.2.2.1 small U sections (small channels): Hot rolled long products with cross-section resembling the letter U and height *h* (*see* figure 2) less than 80 mm.

6.2.1.2.2.2 angles: Hot rolled long products with cross-section resembling the letter L. The classification into equal or unequal angles depends on the ratio of the flange widths. The corners of the flanges are rounded.

6.2.1.2.2.3 T sections with equal flanges: Hot rolled long products with cross-section resembling the letter T. The corners are rounded, and the flanges and web are slightly tapered. The flanges are equal**.**

6.2.1.2.2.4 bulb **flats:** Hot rolled long products with cross-section which are generally rectangular, with a bulge along the full length of a longitudinal edge of one of the wider surfaces and a width generally less than 430 mm.

6.2.1.2.3 special bars and special medium and light sections: Hot rolled long products rolled in lengths usually of small cross-section or of very special shape, generally in limited quantities, and not referred to in **6.2.1.1**, **6.2.1.2.1** and **6.2.1.2.2**. This class includes in particular trapezoids, hollow drill bars, bars for grooved springs, semi-rounds and half-flat semi-rounds, Z sections, small I and H sections of height *h* (see figure 2) less than 80 mm, Tees with unequal flanges, square-edged L, U and Tee sections.

6.2.2 Rod

rod: Hot rolled finished product having a nominal size generally 5 mm or over and hot-wound into irregular coils. The cross-section may be circular, oval, square, rectangular, hexagonal, octagonal, half-round or other shape. Rod has a smooth surface and is generally intended for subsequent conversion.

NOTE 1 Rod intended for reinforcement and prestressing of concrete is covered by **6.2.3**.

NOTE 2 Rod used for wire-drawing purposes in coil form is generally termed wire rod.

6.2.3 Rolled finished products for reinforcement and prestressing of concrete

The cross-section is generally round, sometimes square with rounded corners, with the diameter or side at least 5 mm, and may be supplied as:

a) bars in lengths with a smooth surface;
b) bars in lengths with a crenellated, deformed or ribbed surface;
c) rod in coils with a smooth surface;
d) rod in coils with a crenellated, deformed or ribbed surface.

Products supplied in lengths may have undergone a controlled cold deformation, for example lengthening or twisting about their longitudinal axis.

6.2.4 Railway track and similar material

6.2.4.1 Included in the category of railway track material are:

a) hot rolled products used in the construction of railway tracks: for example rails, sleepers, fish plates, sole and tie plates, base plates;
b) hot rolled products of a similar shape and use, such as
   - crane rails;
   - live conductor rails;
   - grooved rails;
   - rails for switches/crossings;
   - special rails: guide rails, brake rails.

6.2.4.2 Railway track materials are sub-divided as follows:

a) heavy track materials, which includes
   - rails of linear mass 20 kg/m or over;
   - sleepers of linear mass 15 kg/m or over;
b) light track material, which includes
   - rails of linear mass up to 20 kg/m;
   - sleepers of linear mass up to 15 kg/m;
   - fish plates, sole and tie plates, base plates and other hot rolled light;
   - materials for the construction of railway tracks.

6.2.5 Piling

6.2.5.1 sheet piling: Product obtained by hot rolling or cold forming (drawing, bending, cold rolling, etc.) to a shape such that, by interlocking of the joints or by fitting together on longitudinal grooves or by means of special fasteners, it can be used to form partitions or continuous walls.

6.2.5.2 Sheet piling is differentiated according to its cross-sectional shape or its application, for example:

a) S, U, Z and Ω sheet piling;
b) flat sheet piling;
c) fabricated sheet piling (built up from sheet piles, angles and other sections);
d) lightweight sheet piling (trench sheeting);
e) interlocking H sheet piling;
f) box and tubular sheet piling

NOTE -Sections and pilings resulting from assembly and which do not have lateral clamping devices are not considered as sheet piling. Typical diagrams of different types of piling sections are given in figure 3.

6.2.5.3 fabricated bearing piling: Fabricated piling, made up of U or similar shaped cross-sections, used for bearing purposes (*see* figure 4).

6.2.5.4 tubular bearing piling: Tube of circular or rectangular (including square) cross-section, driven into the ground for transmitting the weight of a structure to the soil by the resistance developed at its base and by friction along its surface.

6.2.5.5 Certain finishing operations such as drilling, punching, welding of attachments or similar operations do not alter the classification of the product.

6.2.6 Finished flat products *(see* **6.1.4.1**)

6.2.6.1 Definition

finished flat products: Finished rolling mill products of almost rectangular cross-section and with a width much greater than the thickness.

6.2.6.2 Uncoated flat products: Flat products without any coating or surface treatment.

NOTE Flat products which have received a simple coating for the purpose of protection from corrosion or mechanical damage (e.g. passivation, organic coating, paper, oil, lacquer, etc.) are defined as uncoated products.

6.2.6.2.1 Hot rolled uncoated flat products: Flat products manufactured by hot rolling semi-finished products, more rarely by hot rolling ingots.

NOTE Hot rolled flat products include those which have been given a very light cold rolling pass, normally less than 5%, known as a “skin-pass” or “dressing pass”.

Hot rolled uncoated flat products comprise the following:

6.2.6.2.1.1 wide flat: Fat product of width greater than 150 mm and a thickness generally over 4 mm, always supplied in lengths, i.e. not coiled. The edges are sharp; the wide flat is not-rolled on the four sided (or in box passes) or produced by shearing or frame-cutting wider flat products. Wide flats rolled on all four sides are sometimes termed universal plates.

6.2.6.2.1.2 hot rolled plate and sheet: Hot rolled **f**lat product, the edges being allowed to deform freely, supplied flat and generally in a square or rectangular shape, with a width greater than 600 mm, but also in any other shape, for example circular or according to the design sketch. The edges may be as-rolled or sheared or flame-cut or chamfered. The product may also be delivered pre-curved.

According to the thickness, hot rolled plate and sheet are defined as:

a) **sheet:** thickness less than 5 mm (except electrical sheet, *see* **6.2.6.5.1**);
b) **plate:** thickness 5 mm or over.

Hot rolled plate and sheet may be produced

a) directly on a reversing mill, or by cutting from a parent plate rolled on a reversing mill;
b) by cutting from hot rolled strip rolled on a continuous mill.

NOTE 1 Plate produced on a Reversing mill is known generally as “quarto plate”.

NOTE 2 Plate and sheet produced on a continuous mill is know generally as “hot rolled plate and sheet”.

6.2.6.2.1.3 Hot rolled strip: Hot rolled flat product which, immediately after the final rolling pass or after pickling or continuous annealing is wound into laps so as to form a coil.

Hot rolled strip as rolled has slightly convex edges, but it may also be supplied with sheared edges or slit from wider strip.

According to its actual width, hot rolled strip is classified as:

a) **hot rolled wide strip:** strip of a width 600 mm or over;
b) **hot rolled narrow strip:** strip of a width less than 600 mm.

After decoiling and cutting to length, hot rolled narrow strip may be supplied as cut lengths.

6.2.6.2.2 Cold rolled uncoated flat products: Uncoated flat products which during finishing have undergone a reduction in cross-section of at least 25 % by cold rolling without prior reheating. In the case of flat products of a width less than 600 mm and for certain qualities of special steel, levels of reduction of cross-section less than 25 % may be included.

Cold rolled uncoated flat products comprise the following:

6.2.6.2.2.1 Cold rolled plate and sheet: Cold rolled flat product, the edges being allowed to deform freely, supplied flat and generally in a square or rectangular shape, with a width greater than 600 mm, but also in any other shape, for example circular or according to the design sketch. The edges may be as-rolled or sheared or flame-cut or chamfered. The product may also be delivered pre-curved.

According to the thickness, cold rolled plate and sheet are defined as:

a) **sheet:** thickness less than 5 mm (*see* **6.2.6.5.1**, electrical sheet, and **6.2.6.5.2**, blackplate);
b) **plate:** thickness equal to or greater than 5 mm.

6.2.6.2.2.2 Cold rolled strip: Cold rolled flat product which, immediately after the final rolling pass or after pickling or continuous annealing is wound into laps so as to form a coil.

Cold rolled strip as rolled has slightly convex edges, but it may also be supplied with sheared edges or slit from wider strip.

According to its actual width, cold rolled strip is classified as:

a) **cold rolled wide strip:** strip of width 600 mm or over. Cold rolled wide strip, rolled in a width 600 mm or over, but delivered in a width less than 600 mm, is called "slit cold rolled wide strip";
a) **cold rolled narrow strip:** strip of a width less than 600 mm.

After decoiling and cutting to length, cold rolled narrow strip may be supplied as cut lengths.

6.2.6.3 Coated hot or cold rolled flat products: Hot or cold rolled flat products with a permanent coating other than those defined in **6.2.6.2.1** and **6.2.6.2.2** The permanent coatings may be applied

a) on both sides
   - of equal coating on each side,
   - of different thickness (differential coating);
b) on one side only.

According to the type of coating and type of surface treatment, the products are classified as follows**:**

6.2.6.3.1 metal coated sheet and strip

6.2.6.3.1.1 tinplate: Unalloyed, low carbon steel sheet and strip of thickness less than 0.50 mm, and coated on both surfaces with tin either by hot dipping (dipping in a bath of molten tin) or electrolytically.

6.2.6.3.1.2 tin coated sheet and strip: Unalloyed, low carbon steel sheet or strip of thickness 0.50 mm or over, and tin coated on both surfaces.

6.2.6.3.1.3 chromium/chromium oxide-coated sheet and strip (ECCS): Unalloyed, low carbon steel sheet or strip of thickness less than 0.50 mm, and coated on both surfaces with a duplex film of metallic chromium adjacent to the steel substrate with an outer layer of hydrated oxide or hydroxide.

NOTE Electrolytic chromium/chromium coated steel sheet or strip is normally supplied with a protective coating of oil and is suitable for varnishing (lacquering) or printing.

6.2.6.3.1.4 zinc coated sheet and strip: Sheet and strip coated with zinc:

a) by dipping in a bath of molten zinc: the mass of the zinc varies in general between 100 and 700 g/m^2 total both sides. The coating may have a spangle finish, minimized spangle or be without spangle;
b) electrolytically: the mass of the zinc varies in general between 7 and 107 g/m^2 per side, which corresponds to a coating thickness of 1 to 15 µm per side.

After zinc coating, the surfaces may be passivated by chromating or phosphating. This surface treatment does not alter the classification of these products in the category of "zinc coated flat products".

6.2.6.3.1.5 aluminium/aluminium-silicon alloy coated sheet and strip: Sheet and strip coated with aluminium or an aluminium-silicon alloy by dipping in a molten bath. The mass of the alloy varies in general between 80 and 300 g/m^2 total both sides, which corresponds to a coating thickness of 15 to 55 µm per side.

6.2.6.3.1.6 lead-tin alloy coated sheet and strip(terne plate): Sheet and strip coated with lead-tin alloy either by dipping in a bath of molten alloy or electrolytically. In general, the highest nominal mass specified for the coating corresponds to a minimum of 120 g/m^2 including both sides.

6.2.6.3.1.7 aluminium-zinc alloy coated sheet and strip: Sheet and strip coated with aluminium-zinc alloy by dipping in a bath of molten alloy. The mass of the alloy varies in general between 90 and 450 g/m^2. According to the aluminium content a distinction is made between:

a) Aluminium-zinc alloys (aluminium 50 % or over);
b) Zinc-aluminium alloys (aluminium over 3 % and up to 50 %).

6.2.6.3.1.8 zinc-nickel alloy coated sheet and strip: Sheet and strip coated electrolytically with a zinc-nickel alloy, with a coating thickness generally between 1 to 8.5 µm per side.

6.2.6.3.2 sheet and strip with organic coatings: Uncoated or metal coated (e.g. zinc coated) sheet and strip, subsequently coated with an organic material or a mixture of metal powder and organic material by either of the following continuous processes:

a) by the application of one or more coats of paint or other type of product; after drying, the thickness of the coating varies according to its character from 2 to 400 µm per side.
b) by the application of an adhesive film, whether or not followed by a coating of organic materials. The coating may have different surface designs and a thickness generally between 35 and 500 µm per side.

6.2.6.3.3 Sheet/plate and strip with inorganic coatings comprise

a) **chromated sheet/plate and strip:** The mass of the coating of chromate varies from 1 to 20 g/m^2 per side.

   NOTE - Products with a lesser coating thickness of chromate or phosphate are described as passivated by chromating or phosphating. They do not belong to the category of products, which have undergone surface treatment, but to the category of products, which have not undergone surface treatment (see 6.1.4.1)

b) **phosphated sheet/plate and strip:** The mass of the coating of phosphate varies from 1 to 20 g/m^2 per side.
c) **sheet/ plate and strip with miscellaneous inorganic coatings** (e.g. vitreous enameled products)

6.2.6.4 Composite products

Composite products comprise:

a) plate, sheet and strip clad with steels or alloys in order to resist wear, chemical corrosion or heat distortion. Bonding is usually achieved by rolling, and more rarely by spraying, welding or explosion;
b) sandwich steel sheet formed from two sheets bonded together by means of a synthetic sound-insulating plastic layer;
c) sandwich panels fabricated from two ribbed sheets bonded by an insulating layer (see Figure 2).

6.2.6.5 Other end products

6.2.6.5.1 electrical plate, sheet and strip: Flat products which are distinguished from other flat products by the fact that they are intended for electromagnetic applications and their principal characteristic lies in the specified requirements with regard to specific permissible losses and sometimes magnetic induction and buckling factor. Their thickness is generally equal to or less than 3 mm and width equal to or less than 1 250 mm. There is a distinction between the following:

a) **grain oriented products:** These show significantly improved magnetic properties in the rolling direction compared with those in the transverse direction, and are always supplied with an insulating coating on both surfaces.

b) **non-grain oriented products:** These show similar magnetic properties in both the rolling and transverse directions, and may be supplied either uncoated or with an insulating coating on one or both surfaces.

6.2.6.5.2 blackplate: Unalloyed, low carbon steel sheet or strip, which has been single or double cold, reduced.

Single reduced blackplate is supplied in thicknesses from 0.17 mm up to and including 0.49 mm, and double reduced blackplate is supplied in thicknesses from 0.14 mm up to and including 0.29 mm.

NOTE Blackplate is normally used to manufacture tinplate or electrolytic chromium/chromium oxide coated steel (ECCS), but in certain packaging applications it may be used as such. In such cases the product must be suitable for varnishing (lacquering) or printing.

7 Finished forged long products

finished forged long products : Steel products formed by forging and showing the characteristics described in 6.1.1 and 6.2.1.2.1.

Section two: Other steel products

8 Powder metallurgy products

8.1 steel powder: Collection of discrete steel particles of dimensions usually less than 1 mm.

8.2 sintered steel components: Products produced from powder by pressing and sintering and sometimes re-pressing. The products often have close dimensional tolerances and are generally ready for use.

NOTE - sintering: Thermal treatment of a powder or compact at a temperature below the melting point of the principal constituent with the object of increasing its strength.

9 Castings

castings: Finished products whose shape and final dimensions, apart from any dressing or machining, are directly obtained by the solidification of liquid steel cast in moulds of sand, fire clay or other refractory materials and, more rarely, in metal or graphite permanent moulds.

10 Forged finished and stamped finished products

10.1 open die forgings (with the exception of semi-finished products defined in clause 5 and finished products defined in clause 7): Products obtained by forming steel at a suitable temperature by impact or pressure, using an open die to produce approximate shapes which do not require further hot forming. They are generally machined to final shape.

Forged finished products are classified according to their application (e.g. railways, automobiles, general engineering) or their shape (e.g. wheels, discs).

Open-die forgings include products pre-forged and finished in ring rolling mills (e.g. tyres)

10.2 closed die forgings and stampings: Products obtained by forming steel at a suitable temperature by impact or pressure, using a closed die which determines the required shape and volume of the product. Deformation may be carried out in a press (closed die forging) or under a drop hammer (stamping).

11 Bright products

11.1 drawn products: Products of various cross-sectional shapes obtained, after descaling, by drawing of hot rolled bars or rod, on a draw bench (cold deformation without removing material). This operation gives the product special features with respect to shape, dimensional accuracy (ISO 286 class IT11 or better) and surface finish. In addition, the process causes cold working of the product, which can be eliminated by subsequent heat treatment. Products in lengths are delivered straightened regardless of size.

11.2 turned (or peeled) products: Round bars having the special features of drawn products (see 11.1) concerning shape, dimensional accuracy and bright surface finish, produced by turning on a lathe (or peeling) followed by straightening and polishing. The removal of metal by peeling is carried out in such a way that the bright product is generally free from rolling defects and surface decarburization.

> NOTE For technical reasons, some bars ordered as hot rolled products may be delivered roughly turned; nevertheless, such products are classified as hot rolled products and not bright products.

11.3 ground products: Drawn or turned round bars, given an improved surface quality and dimensional accuracy by grinding or grinding and polishing.

12 Cold-formed products

cold formed products: Products having various cross-sectional shapes, constant along their total length, made from coated or uncoated hot or cold rolled flat material whose thickness is slightly modified by the cold-forming process (e.g. profiling, drawing, press forming, flanging).

12.1 Cold-formed sections [2)]

cold formed sections: Products formed cold in lengths having various open or closed cross-sectional shapes.

Examples:

12.2 Cold-formed sheet piling

See 6.2.5.

12.3 Profiled sheets

profiled sheets: Cold formed products having a cross-section distinctly greater in width than height and normally showing along their total length several parallel undulations of constant cross-section.

Examples:

Products of sinusoidal profile are classified as end products (see 6.3.1)

13 Welded sections

welded sections: Long products of open cross-section which have a shape characteristic of those products defined in 6.2.1, but instead of being obtained directly by hot rolling are made up by welding together combinations of hot rolled long products, hot rolled flat products and cold rolled flat products.

14 Wire

wire: Cold-worked product generally of constant cross-section throughout its length, the dimensions of the section being very small compared with the length. The cold working is accomplished by drawing rod through a reducing die or by passing under pressure between driven rolls and recoiling the drawn product. The cross-section is generally circular, though sometimes oval, rectangular, square, hexagonal, octagonal or of any other convex shape.

Heat treatment or surface treatment may be carried out during production to improve the properties of wire. The manufacturing processes give close control of geometric (size, surface condition) and mechanical properties. Wire may be supplied uncoated (as drawn, annealed) or coated (e.g. with zinc, copper, nickel or plastic material).

15 Steel tubes, hollow sections and hollow bars

15.1 tubes: Long, hollow products, open at both ends, of round or polygonal cross-section. Tubes may be finished at the ends, e.g. by threading or flaring, or coated on the interior and/or exterior surfaces (organic or metallic coating), or have integral or fitted flanges.

NOTE For the purpose of this Indian Standard, no difference is made between “pipe” and “tube”, although idiomatic use prefers sometimes the one and sometimes the other.

15.2 seamless tubes: Tubes without a seam, manufactured from an ingot, billet or bar, or by centrifugal casting.

Seamless tubes are made by piercing ingots, billets or bars to obtain tube hollows. These hollows are then transformed into tubes by rolling, extrusion or drawing over a mandrel. Seamless tubes may be finished by reducing the cross-section by hot or cold rolling or by drawing.

15.3 welded tubes: Tubes formed from either hot or cold rolled flat products, welded across the abutting edges. The weld may be either longitudinal or spiral.

15.4 hollow sections: Tubes used for structural and similar purposes, e.g. structural hollow section.

15.5 hollow bars: Seamless tubes intended principally for machining applications and distinguished by its close tolerances, which ensure clean-up dimensions with minimal machining allowances.