
Universal Decimal Classification

Third English full edition
FID publication no. 483

UDC 669 Metallurgy

Classification Décimale Universelle
CDU 669 Métallurgie

Dezimalklassifikation
DK 669 Metallurgie

Contents

		Page		Page	
Foreword		Inside front cover	669.17	Production of pure iron	15
Scope		Inside front cover	669.18	Production of steel	15
Related subjects		1	669.2/.8	Non-ferrous metallurgy. Non-ferrous	
Auxiliary signs and subdivisions		1		metals	18
Typographic presentation		1	669.21	Gold. Gold alloys	18
Metallic elements and alloying elements in the			669.22	Silver. Silver alloys	19
alphabetical order of their symbols		1	669.23	Metals of the platinum group	19
Committees responsible		Back cover	669.24	Nickel. Nickel alloys	20
			669.25	Cobalt. Cobalt alloys	20
Schedule			669.26	Chromium. Chromium alloys	20
Direct subdivision of principal divisions			669.27	Tungsten. Tungsten alloys	20
Special auxiliary subdivisions			669.28	Molybdenum. Molybdenum alloys	21
			669.29	Other metals of the 4th, 5th and 6th	
669-1	State of the metal or alloy with regard			groups of the periodic table	21
	to treatment	3	669.3	Copper. Copper alloys	21
669-2	Fixed and movable components of		669.4	Lead. Lead alloys	22
	machines, apparatus and equipment	4	669.5	Zinc. Zinc alloys	22
669-4	State, condition, form of metallurgical		669.6	Tin. Tin alloys	23
	products and semifinished materials	4	669.7	Light metals in general	23
669-5/-8	Details of machines and apparatus	5	669.71	Aluminium	23
669-9	Process characteristics and variables.		669.72	Magnesium. Beryllium	26
	Control conditions	5	669.73	Cadmium. Cadmium alloys	26
669.01	Metallurgy in general	5	669.74	Manganese	26
669.02/.09	Metallurgical processes and equipment	8	669.75	Antimony. Antimony alloys	26
Principal divisions			669.76	Bismuth. Bismuth alloys	26
669.1	Ferrous metallurgy. Iron. Steel	9	669.77/.78	Various alloy constituents. Metalloids	27
669.11	Iron and its alloys with carbon alone	9	669.79	Mercury. Scandium. Yttrium	27
669.12	Pure iron	10	669.82	Uranium series	27
669.13	Cast iron	10	669.84	Technetium. Rhenium	27
669.14	Alloys of iron with carbon (other than		669.85/.86	Rare earth metals	27
	cast iron). Steel in general	10	669.87	Gallium. Indium. Thallium	27
669.15	Alloys or iron with elements other than		669.88	Alkali metals	27
	carbon. Alloy steel. Alloyed cast iron.		669.89	Alkaline earth metals	27
	Ferroalloys	11	669.9	Assaying	27
669.16	Production of pig iron and ferroalloys	11	Alphabetical subject index		28

Foreword

The English version of the Universal Decimal Classification (UDC) is being prepared and published as BS 1000 by the British Standards Institution (BSI) at the original joint request of the British Society for International Bibliography (BSIB) and the Association of Special Libraries and Information Bureaux (ASLIB), now amalgamated as Aslib. It has the approval of the Lake Placid Education Foundation, New York, proprietors of the Dewey Decimal Classification, from which the UDC derives. The English full edition of the UDC is authorized by the International Federation for Documentation (FID), PO Box 90402, 2509 LK, The Hague, Netherlands.

This section is part of the English full edition. It should be used in conjunction with a concise edition, such as BS 1000M, which refers to many other subjects of interest not listed in this schedule, and provides a conspectus of the whole scheme, together with an introduction to its use. For further practical information about the principles, application and utilization of the scheme, users should refer to BS 1000C.

This edition of BS 1000 [669] which supersedes the 1979 edition, includes modifications authorized in '*Extensions and Corrections to the UDC*' (FID publication no. 248)

up to and including Series 12, No. 2 dated June 1985. Subsequent issues of '*Extensions and Corrections to the UDC*' should be consulted to keep the schedule up to date. British Standards related to this Part of BS 1000 are listed on the inside back cover.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Scope

Under 669 is classed information on both ferrous and non-ferrous metallurgy, i.e. the production of metals from ores, including the metals themselves and their alloys from the technical point of view, and semi-finished metal and alloy products.

Fabricated metal articles, however, are classed elsewhere, e.g. under 671/673 and 683. Metallic building materials are classed under 691.7 (see related subjects below).

The properties of metallic materials are included in various sections of Class 5, e.g. 539.4 Strength, 539.5 Deformability, but testing and material defects come under 620.1, which includes metallography and grain structure.

Related subjects

53	Physics
54	Chemistry. Crystallography. Mineralogy
553	Economic geology. Mineral deposits
620.1	Materials testing. Defects of materials.
	Protection of materials
621.357	Industrial applications of electrochemistry.
	Electrolysis. Electroforming. Electrodeposition.
	Electroplating
621.365	Electric heating. Heat generation by electricity.
	Electric furnaces. Electric heating apparatus
621.643	Fluid distribution and transport devices.
	Conduits. Pipes. Pipe fittings
621.7	Plastic or chipless working, forming and treatment of materials
621.8	Mechanical power transmission. Machine elements. Gearing. Materials handling.
	Mechanical attachments, fixings, fasteners.
	Lubrication
621.9	Working, machining with chip formation.
	Cutting, grinding, sheet working etc.
622	Mining
624.014	Metal structures
66.04	Heat treatment operations
661.8	Metallic compounds in general. Salts. Mineral compounds
662.6/.9	Fuel economy. Fuels. Heating
666.1.056	Metallizing (of glass)
666.293	Enamelling of metals (Ferrous metals in particular)
671	Articles of precious metals and precious stones
672	Articles of iron and steel in general
673	Articles of non-ferrous metals other than precious metals
682	Smithery. Farriery. Hand-forged ironwork
683	Ironmongery. Hardware. Locksmithing.
	Gunsmithing. Bottling. Lamps. Stoves
686.4	Metallizing: gilding, silvering, bronzing, metallic varnishing
691.7	Metallic building materials
739	Metal arts. Chased, cast, beaten, embossed repoussé, wrought metal objects

Auxiliary signs and subdivisions

Full information about the common and special auxiliary signs and subdivisions (often abbreviated to 'common and special auxiliaries') will be found in BS 1000M and BS 1000C.

Colon sign of relation. For the classification of information for the public, as in abstracts and bibliographies, maximum use of colon combination rather than of common or special auxiliaries is recommended. The use of the colon sign of relation is preferable for multiple entry systems, as it will help prevent the concealment of information. This usually results in longer notation, however, and for information for more restricted use, the application of auxiliaries, where available, may be simpler and more convenient provided that there is an adequate alphabetical subject index.

Common auxiliaries. The common auxiliaries of language = . . . , form (0 . . .), place (1/9), race and nationality (= . . .), time " . . . ", point of view .00 . . . , materials —03 . . . and persons —05 . . . are applicable throughout the UDC. However, they should be used mainly to express concepts not otherwise provided for in the schedules.

Special auxiliaries. In general, the -1/-9 and .0 special auxiliaries listed under 669 are applicable throughout the schedule (but see the notes under 669.018 and 669.05). They may be detached and applied to any subdivision where the result forms a meaningful combination, e.g.

669.018.72	Pyrophoric metals and alloys
669.245	Nickel alloys
669.245.018.72	Pyrophoric nickel alloys

The apostrophe is used to contract the notation where the composition of an actual alloy is to be specified. In each instance it replaces the digits 669 from the full notation. Details of its use are given at various places in the schedule, particularly at 669...5.

Typographic presentation

Small type is used for cancelled numbers or text. The arrow → means either 'see' or 'see also' according to the context. The symbol ≅ 'subdivide as' means that the number preceding it may be subdivided in the same way as, and with meaning analogous to the subdivisions of, the number that follows it.

Metallic elements and alloying elements in the alphabetical order of their symbols

Atomic number and symbol	UDC number	Atomic number and symbol	UDC number
47 Ag	669.22	28 Ni	669.24
13 Al	669.71	93 Np	669.823
33 As	669.778	8 O	669.787
79 Au	669.21	76 Os	669.233
5 B	669.781	15 P	669.779
56 Ba	669.893	82 Pb	669.4
4 Be	669.725	46 Pd	669.234
83 Bi	669.76	61 Pm	669.858
6 C	669.784	84 Po	669.774
20 Ca	669.891	59 Pr	669.856
48 Cd	669.73	78 Pt	669.231
58 Ce	669.855	94 Pu	669.824
27 Co	669.25	88 Ra	669.894
24 Cr	669.26	37 Rb	669.885
55 Cs	669.886	75 Re	669.849
29 Cu	669.3	45 Rh	669.235
66 Dy	669.864	44 Ru	669.236
68 Er	669.866	16 S	669.775
63 Eu	669.861	51 Sb	669.75
26 Fe	669.1	21 Sc	669.793
31 Ga	669.871	34 Se	669.776
64 Gd	669.862	14 Si	669.782
32 Ge	669.783	62 Sm	669.859
1 H	669.788	50 Sn	669.6
72 Hf	669.297	38 Sr	669.892
80 Hg	669.791	73 Ta	669.294
67 Ho	669.865	65 Tb	669.863
49 In	669.872	43 Tc	669.848
77 Ir	669.232	52 Te	669.777
19 K	669.882	90 Th	669.298
57 La	669.854	22 Ti	669.295
3 Li	669.884	81 Tl	669.873
71 Lu	669.869	69 Tm	669.867
12 Mg	669.721	92 U	669.822
25 Mn	669.74	23 V	669.292
42 Mo	669.28	74 W	669.27
7 N	669.786	39 Y	669.794
11 Na	669.883	70 Yb	669.868
41 Nb	669.293	30 Zn	669.5
60 Nd	669.857	40 Zr	669.296

SCHEDULE 669 METALLURGY

Direct subdivision of principal divisions

The subdivisions given below are intended to be added to the main numbers
669.1/.8, although most have a limited application. The ...1/...4 subdivisions apply only to 669.2/.8, ...5 applies to 669.1 as well as to
669.2/.8, ...6/...8 apply to 669.13 and 669.14 as well as to 669.2/.8.

669...1	General works on metallurgy of individual metals. Production. Significance —553 Economic geology. Mineral deposits 622.34 Metals (and metalloids) - Mining 622.7 Treatment, processing of minerals	669...5 (cont'd)	669.55 Zinc alloys 669.55'71 Zinc-aluminium alloys 669.55'71'3 Zinc-aluminium-copper alloys <i>The order of the alloying components is according to the relative quantities in the alloy, the component with the highest percentage coming first. However, if preferred, or when the percentage composition is doubtful, the components may be arranged in decimal numeric order</i>
...3	Extraction from ores. Extraction metallurgy, e.g. 669.33 Extraction of copper <i>For extraction metallurgy in general — 669.053</i>		
...4	Purification. Refining. Recovery <i>For refining of metals in general — 669.054</i>	...6	Fabrication and finishing of specific metals and/or alloys in general <i>Further particulars may be denoted by colon combination, e.g.</i> 669.36:621.771.2 Rolling of copper <i>For techniques and details — 621.7/.9</i> <i>For fabrication and finishing of metals in general — 669.056</i>
...41	Refining by chemical means		
...411	Use of additions, fluxes etc.		
...412	Use of gases		
...413	Use of mixtures of gases with solids or liquids		
...419	Refining by electrolysis, the metal not being the anode	...69	Surface finish, coating, colouring etc of specific metals and/or alloys in general
...42	Refining by physical means		
...43	Special processes for specific metals <i>Subdivisions are given under the metals</i>	...691	Oxidized finish. Anodized finish
...47	Electrolytic refining with the metal as anode	.2	Non-electrolytic. Blued by tempering
...472	In molten salt baths	.5	Electrolytic. Anodized
...476	In aqueous solutions	...692	Dyed finish
...479	In other electrolytes	...693	Ceramic finish. Vitreous enamelling —666.29 Enamels. Glazes. Silicate colours. Engobes
...48	Recovery from scrap, waste products or alloys 669...48 ≈ 669.054.8	...695	Rubber or plastics bonded finish —678.026 Impregnating, coating and cladding with macromolecular compound 678.066 Impregnated goods. Proofed goods. Fabrics etc.
...5	Alloys <i>All alloys are classed under the metal which forms the main component. Alloys may be classed according to their composition or according to their properties.</i> <i>1. To denote alloys according to their properties the special auxiliary .018 and its subdivisions may be used, e.g.</i> 669.14.018.841 Acid-resistant steels 669.35.018.24 Copper alloys as bearing metals 669.715.018.42 Low melting point aluminium alloys	...696 ...697 ...699 ...7	Paint finish. Lacquer finish Other non-metallic coatings Metal finishes. Cladding, plating etc. Uses, applications of specific metals and/or alloys in general <i>Further particulars may be denoted by colon combination, e.g.</i> 669.37:663.4 Applications of copper in brewing
	<i>2. To denote alloys according to their composition, the following rules apply: Alloys of iron (with elements other than carbon alone) are classed under 669.15, the alloying components being denoted by apostrophe combination if necessary (see below) and the carbon content being denoted by further addition of the -19 special auxiliaries (see 669.15), e.g.</i> 669.15-194 Alloy steels 669.15-196 Alloyed cast iron 669.15'24'25-194 Cobalt-nickel steel 669.15'24'25-196 Cobalt-nickel cast iron <i>Alloys of non-ferrous metals are classed by adding the suffix 5 to the number for the main component. The other alloying components may be denoted by adding, after the digit 5 in each instance, the appropriate subdivisions of 669 preceded by an apostrophe, the apostrophe replacing the first three digits [669], e.g.</i> 669.215 Gold alloys 669.215'22 Gold-silver alloys 669.35 Copper alloys 669.35'5'6'4 Copper-zinc-tin-lead alloys	...8 ...84 ...85 ...856 ...857 ...86 ...861 ...863 ...864	Specific metals and/or alloys applied as coating, cladding or plating <i>For industrial applications of electrochemistry — 621.357</i> <i>For technique details — 621.793</i> <i>For coating, colouring etc. of specific metals and/or alloys — 669...69</i> Coatings of the metal and/or its alloys on non-metallic materials, e.g. 669.718.4:676 Aluminium coatings on paper Coatings of the metal and/or its alloys on the same metal or its alloys Non-electrolytic coatings 669...856 ≈ 669...86 Electrolytic coatings <i>Further particulars may be denoted by colon combination with the subdivisions of 621.357</i> Coatings of the metal and/or its alloys on other metals or their alloys (non-electrolytically) From vapours In baths containing dissolved compounds With dissolved salts or other undissolved compounds



669...865	In a metal bath. Immersion method	669-151.62	Quick heating
...866	With metal powder	.64	Slow heating
...867	By spraying the metal	.7	Soaked
...868	Plating by cladding, sheathing, overlaying	.8	Defective heating
	For rolling-on and extrusion sheathing techniques — 621.771.8, 621.777	.82	Burnt
	For overlaying (building-up, hard-facing) — 621.791.92	.83	Overheated
		.84	Decarburized
...87	Electrolytic deposits of the metal and/or its alloys on other metals	.86	Dezincing or otherwise modified in surface composition
Special auxiliary subdivisions		-153	Annealed
		.3	Black annealed
		.4	Bright annealed
669-1/-9	STATE AND FORM OF THE METAL. DETAILS OF MACHINES. SPECIAL PROCESSES	.6	Annealed by processes involving phase transformation
	<i>The following -1/-9 special auxiliaries may be used only when no main number or .0 special auxiliary adequately denotes the concept required. For alloys, they are added to the number designating the alloy, e.g.</i>	.62	Fully annealed (carbon and low-alloy steels)
	669.35'5-124 Drawn brass	.63	Isothermally annealed (carbon and low-alloy steels)
	-124-418.2 Drawn brass strip	.65	Normalized (carbon and low-alloy steels)
	—note under 669-4	.7	Annealed by processes not involving phase transformation
		.71	Solution treated
		.74	Annealed intermediately (with recrystallization)
		.75	Stress relieved
		.76	Soft annealed
669-1	STATE OF THE METAL OR ALLOY WITH REGARD TO TREATMENT	.77	Graphitized. Malleabilized (with temper carbon formation)
-11	Natural state	-154	Molten
-12	Rolled. Drawn	.4	Melted in a vacuum
-122	Rolled	.9	Remelted
.2	Cold-rolled	-155	Case-carburized. Surface-hardened
.3	Hard-rolled	.1	Case-carburized (without hardening)
.4	Hot-rolled	.2	Case-hardened. Pack-hardened
.5	Soft-rolled	.3	Nitrided. Carbo-nitrided. Cyanided
-124	Drawn	.4	Surface-hardened by localized heating.
.2	Cold-drawn		Flame-hardened
.3	Hard-drawn	-156	Hardened
.4	Hot-drawn	.2	By air jet
.7	With cooling	.3	In water
-126	Extruded	.31	Boiling water
-13	Worked or wrought. Forged. Pressed. Stamped. Prepared by powder metallurgy	.32	Warm water
-131	Worked in general	.33	Cold water
.2	Cold-worked	.34	Refrigerated brine
.3	Hard-worked	.36	Aqueous solutions
.4	Hot-worked	.4	In liquid air or similar media
.5	Soft-worked	.5	In oil
-132	Beaten	.6	In molten metals or salts
-133	Hammered	.62	In molten metals. In lead baths
-134	Forged	.66	In salt baths
.4	Over a mandrel	.7	In solid media
-135	Pressed	.72	In sand
	—669-126 Extruded	.78	Between cooled metal plates
-136	Stamped	-157	Tempered. Aged
-138	Prepared by powder metallurgy	.2	Tempered
	—621.762 Powder metallurgy	.8	Aged. Age-hardened. Precipitation-hardened
.2	Green compacts		—669-157.97 Age-hardened combined with work-hardened
.8	Sintered compacts		<i>The temperature range may be denoted by the -97 special auxiliaries</i>
-14	Cast		Naturally aged
	—621.74.04 Techniques, special methods of foundry working and casting	.83	Artificially aged
		.84	Treated by combined processes
-141	Sand-cast	.9	Quenched and tempered
-142	Centrifugally-cast	.96	Age-hardened combined with work-hardened
-143	Die-cast	.97	—669-157.8 Aged. Age-hardened.
.1	Quenched		Precipitation-hardened
.6	In hot moulds		669-177 Work-hardened.
-144	Chill-cast		Strain-hardened
-145	Precision-cast, e.g. investment moulded	-158	Cooled
-146	Compound-cast	.8	Rate of cooling
-147	Continuously-cast	.81	Rapid cooling
-15	Heat-treated	.82	Moderate cooling
	669-15 is subdivided broadly in parallel with 621.785, and further particulars may be denoted by colon combination with the subdivisions of 621.785	.83	Slow cooling
	<i>The temperature level or range may be denoted by the -97 special auxiliaries</i>	-159	Other treatments
-151	Heated in general	.2	Low-temperature treated
.6	Rate of heating	-17	Structurally modified (chiefly crystal structure) by means other than heat treatment alone
		-172	Single crystal
		-174	Recrystallized

669-175	With abnormal grain size	669-413 (cont'd)	<i>The surface condition may be denoted by the -408 special auxiliaries, e.g.</i>
.2	Very small grains		669-413-408.8 Heavy plate with ribbed surface
.4	Very large grains		
-176	With preferred orientation		
-177	Work-hardened. Strain-hardened	-414	Medium thick plate and sheet (3 mm to below 4.75 mm)
	—669-122.3 Hard-rolled		Thin plate and sheet (0.5 mm to below 3 mm)
	669-124.3 Hard-drawn	-415	Very thin plate and sheet (below 0.5 mm), e.g. foil
	669-131.3 Hard-worked	-416	Non-uniform flat objects
	669-157.97 Age-hardened combined with work-hardened	-417	—669-418.7 Non-uniform strip or band
-178	Electromagnetically modified, hardened etc.		Corrugated
-179	Structurally modified by means not mentioned elsewhere in 669-1	.2	Expanded
		.4	Curved. Dished
-19	Characterized by other special features	.5	Strip. Band
	<i>Subdivisions are given under individual metals, e.g. 669.15, 669.35</i>	-418	—669-419 Multilayer sheet and strip
			669-422 Solid sections
669-2	FIXED AND MOVABLE COMPONENTS OF MACHINES, APPARATUS AND EQUIPMENT		<i>The surface condition may be denoted by the -408 special auxiliaries, e.g.</i>
	669-2 $\approx$ 62-2		669-418-408.3 Plated strip
669-4	STATE, CONDITION, FORM OF METALLURGICAL PRODUCTS AND SEMIFINISHED MATERIALS	.1	Strip. Tube skelp
	669-4 $\approx$ 62-4	.2	Strip according to width
	<i>The following -4 special auxiliaries may be added to the complex main number for an alloy, e.g.</i>	.22	Narrow strip
	669.15'24'26-194-415 Nickel-chromium steel sheet	.25	Wide strip
	<i>If a classification primarily by shape or form is required, the 669-4 ... numbers may be colonned to the number for the material, e.g.</i>	.3	Thick strip
	669-415:669.14'24'26-194 Sheet of nickel-chromium steel	.5	Thin strip
		.7	Non-uniform strip, e.g. corrugated strip, profiled sectional strip
		-419	Multilayer plate, sheet and strip
		.3	Of more than two layers, joined with adhesive
		.4	Of two layers, joined without adhesive, e.g. bimetallic strip
		.5	Of more than two layers, joined without adhesive, e.g. triplex sheet, multiplex sheet
		.7	Of two layers, joined with adhesive, e.g. compound metal
		.8	Strengthened with woven material, fibres etc.
-403	Gaseous state	-42	Profiled objects. Sectional material
	669-403 $\approx$ 54-13, e.g.	-422	Solid sections
	669-403.2 Rarefied	.1	Solid sections with curved boundaries.
	669-403.3 Compressed		Rounds
-404	Liquid state	.11	Circular. Rounds
	669-404 $\approx$ 54-14, e.g.	.12	Curved polygonal, e.g. fluted sections
	669-404.1 Mobile	.13	Elliptical
	.2 Viscous	.14	Lenticular
	.3 Molten	.15	Drop-shaped. Streamlined
	.5 Solutions	.16	Oval
	.8 Colloidal state in the liquid phase. Gels. Foams etc.	.2	Solid sections with straight boundaries in general, e.g. beams, posts, bars, rods
	.9 Semicolloidal state. Coarse suspensions. Pastes. Doughs etc.	.3	Triangular
		.4	Quadrangular. Tetragonal
		.41	Square
-405	Solid state	.42	Rectangular
.8	Porous. Cellular. Sponge-like		—669-418 Strip. Band
-408	Surface condition of objects	.44	Rhomboidal
	—621.9.015 Surface finish. Resultant condition of workpiece - Machining	.45	Parallelogrammatic
	621.9.016 Working conditions (of material and surface) - Machining	.46	Trapeziform (USA usage - trapezoidal)
		.47	Trapezoidal (USA usage - trapeziform)
		.5	Pentagonal
		.6	Hexagonal
.2	Covered. Clad	.7	With more than six sides
.3	Plated. Lined	.9	Solid sections with both straight and curved sides. Quarter-rounds. Half-rounds. Round flats (half-lenticular)
.4	Wrapped. Wound		Sections with shaped profiles
.6	Shape of surface	-423	—669-424 Rail sections
.62	Plane		I-sections. H-sections
.64	Curved	.1	Angles. L-sections. V-sections. Quarter-circle channels
.66	Irregular	.2	S-sections
.7	Smooth	.3	T-sections
.8	Rough. Granular. Grooved. Ribbed.	.4	U-sections. C-sections. Semi-circular channels
	Corrugated. Scored	.5	—669-461 Open hollow sections
-41	Flat objects, e.g. ingots, plate, sheet, strip	.7	Z-sections
	<i>The surface condition may be denoted by the -408 special auxiliaries, e.g.</i>	.9	Other sections, e.g. A-sections
	669-41-408.3 Plated sheet	-424	Rail sections
-412	Forms for further processing, e.g. ingots, slabs, billets, bars, sheet bars, plate bars		—625.143 Rails and rail fastenings
-413	Thick plate and sheet (4.75 mm and above), e.g. heavy plate, armour plate	-426	Wires. Threads
		.2	Round wires

669-426.3	Shaped wires	669-465	Hemispherical, cylindrical and similar open hollow objects, e.g. crucibles, beakers, pots, bottles, barrels
.4	Hollow wires		Perforated objects, e.g. sieves of perforated plate. Rings. Annular objects
	—669-462 Closed hollow sections		—669-427.5 Mesh, sieves and similar objects
-427	Objects made from wires or threads, e.g. rope, yarn, laces, nets	-47	Objects with holes, bores
.4	Ropes. Cables. Bundles		With blind holes
.42	Of circular cross-section		With through holes
.43	Of sector-shaped cross-section	-472	With depressions
.44	Of hollow cross-section	.1	Annular objects. Rings
.47	Of parallel wires or threads	.2	Perforation for weight reduction, air circulation etc., e.g. hollow bricks
.48	Of wires or threads pressed together	.3	Forms and make-up of fibrous materials and products
.5	Mesh, sieves and similar objects	-477	669-48 $\approx$ 677-48
	—669-417.4 Expanded flat objects	-478	Objects with shapes other than those listed above
	669-47 Perforated objects		Powders. Grains
-428	Helical, spiral and twisted objects, e.g. screw-shaped objects	-48	Powders
.2	Helical		Grains. Shot
.3	Spiral	-49	Small objects of irregular shape, e.g. splinters, shavings, chips
.4	Twisted		Flakes
-43/-49	Objects not listed under 669-41/-42	-492	Objects made of irregular fibres, e.g. felt products, metal wools
-43	Solid objects of various shapes	.2	
-431	Short prismatic objects (with relatively small differences between their various dimensions), e.g. bricks, tiles	.3	
		-493	
-433	Edge shapes. Chamfers. Bevels. Mouldings. Roundings	.5	
	—669-44 Shaped mouldings, including serrated mouldings. Mitres. Dovetails	-494	
.1/.3	According to disposition	669-5/-8	DETAILS OF MACHINES AND APPARATUS
.1	On plane surfaces	-5	Operation and control of machines and processes
.2	On convex surfaces		669-5 $\approx$ 62-5
.3	On concave surfaces	-6	Fuel and other heat source characteristics of machinery and installations
.4/.6	According to shape		669-6 $\approx$ 62-6
.4	Plane. Chamfers. Bevels	-7	Servicing, maintenance, protection of machines, apparatus, plant and installations
.5	Curved. Mouldings. Roundings		669-7 $\approx$ 62-7
.52	Convex	-8	Motive force or motive power characteristics of machines and apparatus
.53	Concave		669-8 $\approx$ 62-8
.6	Combination of plane and curved	-9	Process characteristics and variables. Control conditions
-434	Short cylindrical and conical objects (length less than three times the diameter)		669-9 $\approx$ 66-9
.1	Cylindrical objects	-97	Thermal characteristic data. Temperature or temperature range
.5	Conical objects		<i>Specific temperatures in recognized temperature scales may be denoted by -97 together with appropriate addition, e.g.</i>
-436	Spherical and spheroidal objects		669-97 °C Freezing point of water = 0°C
	—669-492.3 Grains. Shot		-97 °F32 = 32°F = 273 K
.1	Balls. Beads		-97 °K273
.2	Spheroids (ellipsoids of rotation)		-97 °C100 Boiling point of water = 100°C
.21	Axis of rotation greater than diameter		-97 °F212 = 212°F = 373 K
.22	Axis of rotation smaller than diameter		-97 °K373
.4	Ellipsoids (three different axes)		—621.78 Heating for working. Heat treatment. Hardening
.5	Ovoids		669.04 Heating, melting and refining processes and plant
.7	Barrel-shaped solid objects		
-437	Streamlined objects		
	<i>For streamlined solid sections — 669-422.15</i>		
-44	Shaped mouldings, including serrated mouldings. Mitres. Dovetails	-973	Very low temperature
-45	Slotted, grooved and splined objects	-974	Low temperature (below 0°C)
-46	Hollow objects. Material of hollow section	-975	Room temperature (20 + 2°C)
-461	Open hollow sections, e.g. open channels, gutters	-976	Medium or moderate temperature
	—669-423.5 U-sections. C-sections. Semi-circular channels	-977	High temperature
		-978	Very high or extremely high temperature
-462	Closed hollow sections, e.g. pipes, tubes, hoses	-98	Pressure or pressure range
	—669-426.4 Hollow wires	-982	Vacuum. In vacuo
.2	Seamed	-984	Low pressure
	669-462.2 $\approx$ 669-422, e.g.	-985	Atmospheric (normal) pressure
	669-462.241 Square seamed pipes	-987	High pressure. Elevated pressure
	—621.774.2 Seamed tube manufacture	-988	Very high or extremely high pressure
.3	Seamless		
	669-462.3 $\approx$ 669-422, e.g.		
	669-462.313 Elliptical seamless tubes		
	—621.774.3 Seamless tube manufacture		
	621.774.4 Electrolytic manufacture of seamless tube		
-463	Closed hollow objects of irregular cross-section	669.01	METALLURGY IN GENERAL
-464	Spherical hollow objects		<i>For metallography — 620.18</i>
	669-464 $\approx$ 669-436		

669.01 (cont'd)	<i>Although now listed under 66 because of their general applicability, the special auxiliaries .011/.013 (for production and process control, throughput, efficiency, etc.) are nevertheless applicable to 669.</i>	669.017.112	Solid solutions
		.113	Eutectics. Monotectics
		.2	Hypoeutectic alloys
		.3	Hypereutectic alloys
.013.5	Metallurgical plants and works	.114	Peritectics
.52	Integrated works		669.017.114 $\approx$ 669.017.113
	—669.18.013.52 Integrated steelworks	.115	Eutectoids
.53	Non-integrated works		669.017.115 $\approx$ 669.017.113
	—669.18.013.53 Non-integrated steelworks	.116	Peritectoids
			669.017.116 $\approx$ 669.017.113
.6	Power supply	.118	Spinodal decomposition
669.014	REACTIONS	.12	Binary alloys
	<i>Where the concepts given below are included in 669.1/.8 as main numbers, those main numbers should be preferred</i>		669.017.12 $\approx$ 669.017.11
.3	Reactions involving water and carbonate	.13	Ternary alloys
	669.014.3 $\approx$ 66.093		669.017.13 $\approx$ 669.017.11
.4	Treatment with other agents	.14	Quaternary alloys
	669.014.4 $\approx$ 66.094		669.017.14 $\approx$ 669.017.11
.6	Behaviour of the individual elements	.15	Alloys of higher complexity
	<i>The elements may be denoted by colon combination with the subdivisions of 669</i>		669.017.15 $\approx$ 669.017.11
.7	Reactions according to where they take place	.16	Structures of alloys
.72	In the combustion zone		—539.2 Properties and structure of molecular systems. Solid state physics
.74	Between the gas evolved and the ores and fluxes		548.7 Fine structure of crystals.
.76	In the zone of formation of the metal		Discontinuum theory of crystals
.8	Irregularities in the reactions	.162	Substitutional solid solutions
	—669.162.264 Irregularities in blast furnace operation and their prevention	.2	—548.58 Solution - Crystallography
.82	Irregular working of furnace. Too hot. Too cold	.3	Size factor effect
.83	Defects due to excess or shortage of ores or fluxes	.4	Electrochemical effect
.84	Deposits on the walls. Bridging. Jamming of the charge. Scaffolding	.163	Relative valency effect
.85	Explosions. Eruptions	.164	Interstitial solid solutions
.89	Other irregularities	.2	Intermetallic phases
669.015	PRODUCTS		Intermediate phases with variable solubility of components. Subtractional solid solutions
	<i>Only general matters are classed here. Individual products are classed under the appropriate subdivisions of 669.1/.8</i>	.165	Intermetallic compounds
.2	Intermediate products	.166	Electron compounds
.3	Crude metal products	.167	Ordered structures
.4	Pure metal products	.2	Short-range order
.5	Super-pure metal products	.3	Long-range order
.7	Gases. Flue gases	.3	Phase transformations
.72	Composition		<i>For phase transformations of the iron-carbon system, and systems with these two elements and others — 669.11</i>
.73	Regeneration	669.018	METALLIC MATERIALS FROM THE POINT OF VIEW OF THEIR GENERAL PROPERTIES. ALLOYS IN GENERAL
.74	Distribution		<i>This section conforms as far as possible to the conventional grouping of metallic materials in the metals industry</i>
.78	Recovery of individual constituents from furnace gases	.2/.8	Metals and alloys from the point of view of their general properties
.8	Solid by-products		<i>This section deals principally with alloys from the point of view of their technically important properties. Metallic materials are generally alloys and these properties depend essentially on the alloy constituents. In certain instances a high degree of purity is of great importance with regard to a technical property; this section may then be applied also to pure metals</i>
	—66.046.58/.59 Slag. Ash. Waste products. Solid residues etc.		Metals and alloys with special mechanical properties
.9	Losses	.23	Easily machinable metals and alloys, e.g. free-machining alloys
.91	Due to evaporation	.24	Bearing metals and alloys
.92	Due to slagging	.25	Exceptionally hard or wear-resisting metals and alloys, including hard metals, e.g. for tools
.93	Due to waste	.252	Metals and alloys for processing with chip formation
669.017	PHYSICAL METALLURGY OF INDIVIDUAL METALS		<i>For cutting tools, irons — 621.9.025</i>
	<i>For physical properties of metals — 53, especially 539</i>	.2	Unalloyed or low alloy materials
	<i>For crystallographic properties of metals — 548</i>	.3	Metals and alloys for high-speed working
	<i>For metallography — 620.18</i>	.4	Metals and alloys for milling
	—66.017 Properties of materials	.5	Metals and alloys for filing, sawing, cutlery
.1	Alloy systems	.253	Metals and alloys for shearing, e.g. blanking, punching, stamping out
	—669...5 Alloys		
.11	Phase diagrams		
	<i>For the iron-carbon diagram — 669.112.2</i>		
	<i>For phase diagrams of other systems, use 669...5.017.11</i>		
.111	Liquid solutions		

669.018.254	Metals and alloys for pressing, upsetting, cold-heading tools etc. <i>For form-reproducing dies and moulds — 621.7.073</i>	669.018.48 .5	Non-strain-ageing metals and alloys Metals and alloys with special electrical and magnetic properties
.255	Metals and alloys for drawing dies, cold rolls, etc.	.52	Metals and alloys with low electrical resistance <i>Further particulars may be denoted by colon combination, e.g.</i> 669.018.52:621.315.1 Alloys for overhead lines
.256	Wear-resisting metals and alloys, e.g. for rock-drilling, crushing, disintegrating tools		
.258	Metals and alloys for hot working and die casting	.54	Metals and alloys with high electrical resistance
.2	Metals and alloys for hot forging, hot pressing dies	.55	Metals and alloys with constant electrical resistance
.4	Metals and alloys for mandrels	.57	Metals and alloys for thermoelements
.5	Metals and alloys for hot rolls	.58	Metals and alloys with special magnetic properties
.8	Metals and alloys for moulds, e.g. for die casting	.582	Metals and alloys for permanent magnets, e.g. permanent magnet steels
.26	Easily deformable metals and alloys, e.g. forgeable alloys deep-drawing alloys. Soft metals and alloys	.583	Metals and alloys for the magnetic circuit in electric machines, transformers e.g. Dynamo steels, transformer steels etc.
.262	Metals and alloys for deep drawing		Non-magnetic metals and alloys
.263	Metals and alloys for chipless production of screws, nuts and similar threaded parts <i>For easily machinable metals and alloys — 669.018.23</i>	.584 .588	Metals and alloys with other special magnetic properties, e.g. remanence-free steels
.265	Metals and alloys for extrusion, extrusion moulding	.6	Metals and alloys with other special physical properties
.27	High elasticity metals and alloys, e.g. for springs	.62 .64	Weldable metals and alloys
.28	Casting metals and alloys (used principally in the cast state)	.65	Metals and alloys with special acoustic properties
.29	Structural and constructional metals and alloys —691.7 Metallic building materials	.67	Metals and alloys with special optical properties
.291	Ordinary (heavy) structural and constructional metals and alloys, e.g. structural steels, concrete steels	.672 .674 .7	Low-density and high-density metals and alloys
.292	High-strength structural and constructional metals and alloys	.72	Low-density metals and alloys
.293	Shipbuilding metals and alloys	.73	High-density metals and alloys
.294	Railway structural and constructional metals and alloys	.74	Metals and alloys with special chemical properties
.2	Metals and alloys for rails		Pyrophoric metals and alloys
.3	Metals and alloys for tyres		Metals and alloys with reducing properties, e.g. for production of hydrogen
.7	Metals and alloys for points, soleplates, sleepers etc.	.8	Non-sparking metals and alloys —62-768.3 Protective measures against sparking
.295	High-strength metals and alloys		Corrosion-resistant metals and alloys 669.018.8 ≅ 620.193, e.g.
.2	Metals and alloys for wire rope, cables, chains		669.018.821 Alloys resistant to climatic effects in general
.3	Metals and alloys for use under stress, e.g. prestressed concrete steels		.822 Alloys resistant to effects of air, of oxygen
.296	Metals and alloys for construction of aircraft, spacecraft		.841 Alloys resistant to inorganic acids
.298	Metals and alloys for hardening by heat treatment, e.g. case-hardening steels, heat-treatable steels		.842 Alloys resistant to inorganic alkalis
.2	Metals and alloys for case-hardening or other surface-hardening	.9	.85 Alloys resistant to hot gases and vapours
.22	Metals and alloys for carbon case-hardening		.891.8 Alloys resistant to ageing
.23	Metals and alloys for nitriding, carbo-nitriding		Pseudo-alloys and similar (metallic) combinations, e.g. cermets
.25	Metals and alloys for surface-hardening using materials other than carbon or nitrogen		<i>Only information specific to pseudo-alloys is classed here. Information stressing special properties of metallic materials (whether pure metal, true alloy or pseudo-alloy) is classed under 669.018.2/.8, e.g.</i>
.3	Metals and alloys suitable for other kinds of heat treatment, e.g. by quenching, isothermal transformation. Heat-treatable steels, recrystallization hardening aluminium alloys etc.		669.018.25 Exceptionally hard metals and alloys, including hard metals
.4	Metals and alloys with special thermal properties		<i>Purely metallic combinations may be denoted by colon combination with 669...5 numbers, e.g.</i> 669.018.9:669.35'4 Copper-lead pseudo-alloys
.41	Low-temperature metals and alloys		<i>Alternatively, the above numbers may be combined to denote the concept, e.g.</i> 669.35'4.018.9 Copper-lead pseudo-alloys
.42	Low-melting-point metals and alloys		Combinations of metals with metallic compounds, e.g. cermets
.44	Heat-resistant and creep-resistant metals and alloys		<i>The metallic compound may be denoted by colon combination with the subdivisions of 661.8, e.g.</i>
.45	High-melting-point metals and alloys —669.018.95 Combinations of metals with metallic compounds, e.g. cermets	.95	
.47	Metals and alloys with special expansion properties		
.472	Low-expansion metals and alloys, e.g. Invar		
.473	Metals and alloys for precision instruments		

669.018.95 (cont'd)	669.018.95:661.878.621 Cermets containing tungsten carbide <i>Information stressing special properties of these materials is classed under 669.018.2/.8, e.g. 669.018.45 High melting point metals and alloys</i>	669.046.543 .545 .2 .4 .546 .2	Behaviour of silicon Behaviour of phosphorus Dephosphorization Rephosphorization Behaviour of sulphur Desulphurization —669.094.527 Removal of sulphur. Desulphurization
669.019	MATERIAL DEFECTS AND THEIR PREVENTION 669.019 ≈ 620.19	.22 .23 .24 .547 .548	By slag By ferromanganese By segregation Behaviour of manganese Behaviour of other metals Behaviour of added metals Behaviour of metals already in the melt Behaviour of elements introduced in scrap. Tramp elements
669.02/.09	METALLURGICAL PROCESSES AND EQUIPMENT 669.02/.09 ≈ 66.02/.09	.2 .4 .5	Refining by deoxidation For refining — 669.054 and 669...4
669.04	HEATING, MELTING AND REFINING PROCESSES AND PLANT 669.04 ≈ 66.04	.55 .551 .552	Deoxidation period Mechanism of deoxidation
.041	Furnaces. Ovens <i>Preferably use 66.041</i>	.3	Separation of carbon, oxygen, hydrogen and nitrogen
.042	Furnace ancillary equipment <i>Preferably use 66.042</i>	.5 .7	Diffusion on deoxidation Efficiency of deoxidation
.043	Furnace materials, linings <i>Preferably use 66.043</i>	.553	Deoxidation in the furnace
.045	Heat transfer. Heat exchange. Cooling and coolers 669.045 ≈ 66.045	.554 .555 .557	Deoxidation in the ladle Deoxidation in the ingot mould Self-deoxidation. Reduction by manganese from slag (basic). Reduction by silicon from slag (acid)
.046	Heating and melting processes <i>For refining — 669.054 and 669...4</i>	.558	Deoxidizing agents and their effects
.4	Heating processes in the solid state <i>For heat treatment of metals — 621.78</i> <i>For heat treatment of ores — 622.78</i>	.2 .22 .28	Carbon-bearing additions Coke. Graphite. Anthracite Other carburizing additions (silicon carbide, calcium carbide)
.41	Calcining	.3	Silicon-bearing additions
.412	Drying and removal of hydrate water	.4	Other non-metals, e.g. phosphorus
.414	Decomposition of carbonates	.5	Additions containing various metals <i>Further particulars may be denoted by colon combination with the subdivisions of 669</i>
.416	Other dissociation reactions	.6	Complex deoxidizers
.42	Oxidizing roasting	.7	Slags as deoxidizers. Perrin process
.421	Purely oxidizing roasting of sulphide materials	.8	Gaseous deoxidizers
.422	Sulphatizing roasting of sulphide materials	.56	Carburization. Decarburization
.423	Chloridizing roasting of sulphide materials	.562	Carburization
.424	Other types of roasting of sulphide materials	.2	In the furnace
.426	Oxidation of lower oxides	.4	In the ladle
.428	Reaction with other gases, e.g. chloridizing of oxide	.564	Decarburization
.44	Heating with simultaneous sintering	.5	With oxygen lance or jet
.442	Sinter roasting of sulphide materials	.6	Oxygen-steam decarburization
.444	Sinter roasting of oxide materials	.7	Argon-oxygen decarburization
.446	Sinter roasting of other materials	.58	Slag formation. Properties of slag
.46	Heating with simultaneous reduction	.581	Slagging materials. Slag formation
.462	Reduction with intermixed solid reducing agents, e.g. manufacture of nickel pellets	.2	Slagging material, e.g. bauxite, lime, sand, fluorspar
.464	Reduction with gaseous reducing agents, e.g. manufacture of sponge iron	.4	Slag formation
.5	Melting processes <i>For refining — 669.054 and 669...4</i>	.582	Reactions between slag and bath
.51	General processes	.2	Equilibrium between slag and bath
.511	Charging. Starting-up	.3	Reactivity of slag
.2	Charging	.5	Viscosity of slag
.3	Starting-up. Lighting. Blowing-in	.584	Components of slag
.512	Melting process. Melting period	.1	Neutral or amphoteric oxides. Heavy metal oxides
.514	Tapping of slag	.2	Bases
.515	Leaving molten metal (quiescent) to stand	.5	Acids. Acid-forming oxides
.516	Control of chemical composition. Alloying. Modification. Improvement	.6	Metal taken up from bath
.2	Alloying	.585	Slags according to their mode of formation
.4	Modification. Improvement	.4	Running slag
.517	Degassing the melt	.5	Tapping slag
.518	Tapping	.6	Finishing slag in the furnace
.52	Additions. Fluxes. Modifying agents	.7	Ladle slag
.521	Quantity. Method of addition	.586	Slags according to their composition
.522	Solid additions	.2	Carbide slag
.523	Liquid additions	.3	Calcium phosphate slag
.527	Inoculants	.4	Vanadium slags
.53	Melt containers. Burden	.6	Halide slags
.54	Melting with refining by oxidation <i>For refining — 669.054 and 669...4</i>	.587	Slags according to function
.541	Oxidation period	.2	Protecting slags
.542	Behaviour of carbon. Combustion of carbon		

669.046.587.4	Conducting slags, e.g. from electroslag refining	669.058 (cont'd)	<i>For metallizing techniques — 621.357, 621.793</i>
.6	Active slags, e.g. desulphurizing slags, softening slags in lead refining		<i>For specific metals, applied as coating or finish — 669...8</i>
.588	Irregularities in working of slag		
.048	Distillation (for separation of metallic phases), e.g. fractional distillation of zinc	669.09	OTHER METALLURGICAL PROCESSES
.049	Heating for phase separation		<i>The subdivisions given below should be used only to express concepts not otherwise provided for in the schedule</i>
.4	Separation of solid and liquid metallic phases by partial fusion		669.09 $\approx$ 66.09, e.g.
.42	With falling temperature (liquation), e.g. decoppering of lead, deleading of zinc		669.094 Treatment with various agents
.44	With rising temperature. Zone melting. Zone refining		.1 Reduction in general.
.5	Separation of solid and liquid non-metallic phases, e.g. by slags, drosses, mattes		Hydrogenation
.6	Sublimation of metallic phase		.2 Other reduction processes
.7	Volatilization of non-metallic phases, e.g. of chlorides		.22 With charcoal, coke or other substances with a high carbon content
669.05	GENERAL AND FUNDAMENTAL METALLURGICAL PROCESSES		.23 With metals in general, e.g. aluminium (Goldschmidt process)
	<i>The .051/.054 subdivisions are to be used only as main numbers; they may not be appended to the 669.1/.8 subdivisions</i>		.24 With alkali metals
	—621.7 Plastics or chipless working, forming and treatment of materials		.28 By precipitation from gaseous media
	621.9 Working, machining with chip formation. Cutting, grinding, sheet-working etc.		.3 Oxidation
	667.76 Colouring (staining) of metal		.34 Oxidation by air current
.051	Generalities on ores and metallurgy	669.1	Principal divisions
	—622.34 Metals (and metalloids) - Mining		669.1 FERROUS METALLURGY. IRON. STEEL
.052	Generalities on treatment of ore mixtures		<i>Further particulars may be denoted by special auxiliaries, e.g.</i>
	—622.7 Treatment, processing of minerals		669.1.017 Physical metallurgy of ferrous metals
.053	Generalities on extraction of metals.		
	Extraction metallurgy in general		
	<i>For extraction of specific metals — 669...3</i>	669.11	IRON AND ITS ALLOYS WITH CARBON ALONE
.2	Dry extraction. Pyrometallurgy		<i>For alloys of iron with elements other than carbon alone — 669.15</i>
.4	Wet extraction. Hydrometallurgy		Condition of carbon in iron and steel
.054	Generalities on refining of metals		<i>The effect of other alloying elements may be denoted by colon combination with the subdivisions of 669.15</i>
	<i>For refining of specific metals — 669...4</i>	.111	
	<i>For melting with refining — 669.046.54/.55</i>		As elementary carbon (graphite)
.1	Refining by chemical and similar means	.2	Graphite formations
.2	Refining by physical means	.22	Kish graphite
	<i>Further particulars may be denoted by colon combination with the subdivisions of 66.06/.08</i>	.223	Flaky graphite
	—669.04 Heating, melting and refining processes and plant	.225	Nodular graphite-austenite
.7	Refining by electrolysis	.226	Temper carbon
.72	In molten salt baths	.3	As carbide
.76	In aqueous solutions	.31	Cementite (Fe ₃ C)
.79	In other electrolytes	.32	Other iron carbides, e.g. Fe ₂ C
.8	Utilization of scrap or waste products.	.35	Carbides not occurring in alloys of carbon and iron alone
	Generalities on the recovery of metals from scrap	.4	As dissolved carbon
.82	Utilization of slags	.112	Form of iron and carbon in various types of iron and steel
	<i>For tapping of blast furnace slag — 669.162.266.4</i>	.2	Iron-carbon system (iron-carbon phase diagram)
.83	Utilization of dust and slurry		—669.017.11 Phase diagrams
.85	Utilization of workshop scrap		<i>The effect of other alloying elements may be denoted by colon combination with the subdivisions of 669.15</i>
.86	Recovery of metal from metal coatings		Above liquidus
.87	Separation of alloy components		Iron-cementite region (metastable system)
.056	Fabrication, treatment and finishing of metals in general	.21	Beginning of solidification (liquidus)
	<i>For techniques and details — 621.7/.9</i>	.22	Delta range
	<i>For fabrication and finishing of specific metals — 669...6</i>	.221	End of solidification (solidus)
.9	Surface finish, coatings, colourings etc. on metals in general. Surface finished metals, e.g. coated, coloured, anodized	.222	Eutectic (ledeburite)
	669.056.9 $\approx$ 669...69	.223	Gamma range
	<i>For finishing techniques — 621.79</i>	.224	Austenite
.058	Metals applied as finish (on metal or any other material). Metal coatings, platings, claddings etc.	.227	Transformation of austenite
	669.058 $\approx$ 669...8	.1	<i>Further particulars may be denoted by common auxiliaries, e.g.</i>
		.3	

669.112.227.3 (cont'd) 669.112.227.3(084.21) TTT curves (S curves) and curves illustrating the transformation of austenite isothermally or during cooling

- .31 Pre-eutectoid transformation
- .312 Precipitation of alpha-iron (ferrite)
- .313 Precipitation of secondary cementite
- .32 Pearlite formation
- .322 Pearlite
 - .1 Lamellar pearlite
 - .2 Granular pearlite
 - .3 Globular pearlite
 - .8 Abnormal pearlite
- .33 Bainite formation
- .333 Bainite
- .34 Martensite formation
- .342 Martensite
- .343 Retained austenite
- .346 Transformation of martensitic structure on tempering
 - .2 Transformation of martensite
 - .3 Transformation of retained austenite
- .228 Alpha range
 - .1 Ferrite
 - .2 Solubility of carbon in ferrite
 - .3 Precipitation of carbon from ferrite. Formation of tertiary cementite
- .24 Iron-graphite region (stable system)
- .241 Beginning of precipitation of graphite
- .243 Graphite-austenite eutectic
- .245 Precipitation of graphite from gamma solid solution
 - .2 Ferrite-graphite eutectoid
- .247 Transformation from cementite to graphite
- .4 Change during tempering
- .6 Graphitic steel

669.12

PURE IRON

*Only general matters are classed here
For production of pure iron — 669.17
For iron as chemical element — 546.72
Further particulars may be denoted by colon combination, e.g.
669.12:539.52 Ductility of pure iron*

- .127 Forms of pure iron
 - .3 Electrolytic iron
 - .4 Chemically-produced iron
 - .42 Iron carbonyl
 - .44 Ferrum reductum
 - .5 Soft iron and other commercially-pure qualities
 - .8 Special forms of pure iron
 - Further particulars may be denoted by special auxiliaries, e.g.
669.127.8-172 Iron single crystals*
- .82 Pyrophoric iron
- .83 Colloidal iron
- .84 Mirrors. Thin films. Hair-like forms

669.13

CAST IRON

*For alloyed cast iron — 669.15-196
For pig iron — 669.162.275.12
Further particulars may be denoted by common auxiliaries, e.g.
669.13(088.72) Trade marks
Cast irons from the point of view of their general properties may be denoted by the .018 special auxiliaries listed under 669, e.g.
669.13.018.255 Cast irons for drawing dies, cold rolls etc.
.256 Wear-resisting cast irons, e.g. for crushing tools
.258 Cast irons for hot working
.5 Cast irons for hot rolls
.29 Structural and constructional cast irons*

669.13.018 (cont'd)

669.131

- .2
- .22
- .24
- .4
- .6
- .62
- .621
- .622
- .64
- .7
- .8
- .82
- .84
- .89

.132

- .2
- .3
- .4
- .6

.136

- .9

.138

669.14

669.13.018.298 Cast irons suitable for hardening by heat treatment
.47 Cast irons with special expansion properties
.472 Low-expansion cast irons
.473 Cast irons for precision instruments

Types of cast iron

White cast iron
Hypoeutectic
Hypereutectic
Mottled cast iron
Grey cast iron
Hypoeutectic
Untreated
Inoculated
Hypereutectic
Spheroidal graphite cast iron
Malleable cast iron
Whiteheart cast iron
Blackheart cast iron
Other types

Influence of non-metals other than carbon

Phosphorus
Silicon
Sulphur
Arsenic

Fabrication and finishing of cast iron

Coatings on cast iron
— 666.293.11 Enamelling of cast iron
Cast iron applied as coating

ALLOYS OF IRON WITH CARBON (OTHER THAN CAST IRON). STEEL IN GENERAL

Steels without any special properties and steels unmodified by alloying additions are classed here, as are all unalloyed steels with high carbon content from the point of view of their chemical composition and, from the point of view of use and properties, all steels (alloyed and unalloyed) irrespective of their composition

For alloy steels according to composition — 669.15

*Further particulars may be denoted by common auxiliaries, e.g.
669.14(088.72) Trade marks*

[superfluous] — 669.018/.018.8

Steels according to the method of production

Steels produced by direct processes
Krupp Renn steel. Bloomery steel
Indian steel. Wootz steel
Osmund iron
Sponge iron
Wrought iron made by the decarburization of pig iron. Steel made by decarburization of pig iron or by remelting of scrap
Wrought iron
From the charcoal furnace
From the puddling furnace
Faggotted iron
Damask steel
Wrought Damask steel
Special Damask steel
Mild steel
Killed, semi-killed and unkilld steel
Killed steel
Balanced (semi-killed) steel
Unkilld steel
.243/.247 Open hearth steel. Acid and basic Bessemer steel. Electric steel
Killed, semi-killed or unkilld types may be denoted by adding the digit 1 to any of the following subdivisions, and subdividing the resultant number as 669.141.241
Open hearth steel
Acid open hearth steel

669.141.243.4	Basic open hearth steel	669.15-196.58	Ledeburitic
.6	Tandem furnace steel	.591	Acicular
.244	Bessemer steel	-198	Ferroalloys, e.g.
.1	Acid Bessemer steel		669.15'74-198 Ferromanganese
.2	Basic Bessemer steel		Principal divisions (continued)
.245	Steel made by various pneumatic processes, e.g. LD, LD/AC, Rotor, Kaldo	669.16	PRODUCTION OF PIG IRON AND FERROALLOYS
	<i>Further particulars may be denoted by alphabetic subdivisions (Table 1h), e.g.</i>		<i>For roasting, sintering, briquetting of ores — 622.78</i>
	669.141.245K Steel made by the Kaldo process		<i>For aftertreatment of ores — 622.79</i>
.246	Crucible steel		<i>Further particulars may be denoted by special auxiliaries, e.g.</i>
.247	Electric steel		669.162.013.5 Pig iron plant
.2	Steel made in electric furnaces	.162	Production of pig iron. First smelting
.5	Electrically remelted steel	.1	Raw materials and additions and their preparation for use in blast furnace. Burden
.52	Vacuum remelted steel		<i>Only general matters are classed here</i>
.522	Vacuum induction remelted steel		<i>The type of ore may be denoted by colon combination with the subdivisions of 622.341.1, e.g.</i>
.524	Vacuum arc remelted steel		669.162.1:622.341.15 Siderite ores
.526	Electron-beam remelted steel		—622.7 Treatment, processing of minerals
.56	Electroslag refined steel		622.782 Roasting. Calcining
.58	Plasma remelted steel		622.785 Sintering
.25	Steel for castings		622.788 Manufacture of shaped agglomerates: briquettes, pellets, nodules
	669.141.25 ≈ 669.141.24		
.3	Carburized steel. Cemented steel. Shear steel		
.31	Carburized steel		
.32	Cemented steel		
.33	Shear steel		
.146	Fabrication and finishing of steel	.12	Iron ores
.148	Steel (and alloy steel) applied as coating	.14	Additions
669.15	ALLOYS OF IRON WITH ELEMENTS OTHER THAN CARBON. ALLOY STEEL. ALLOYED CAST IRON. FERROALLOYS	.142	Basic additions. Limestone. Limey earths.
	<i>The alloying components may be denoted according to the instructions given under 669...5, e.g.</i>		Low-iron, high-lime ores. Calcium phosphate
	669.15'24 Nickel alloy of iron		—553.55 Sedimentary and carbonate rocks
	669.15'24-194 Nickel steels		666.92 Lime industry. Limes. Lime products
	669.15'26'27'292-194 Chromium-tungsten-vanadium steel	.8	Evaluation of lime. Quality indices
	<i>Carbon-free alloys, steels, cast irons and ferroalloys may be distinguished by the 669.15-192/-198 special auxiliaries</i>	.143	Acidic additions. Aluminium silicates. Quartz, fluorspar etc.
	<i>Alloy systems, phase diagrams etc. may be denoted by the 669.017.1 special auxiliaries, e.g.</i>	.144	Slags. Blast furnace slag. Welding slag, cinder. Puddling slag. Open hearth slag etc.
	669.15'74.017.1 Iron-manganese systems	.149	Other metallic and non-metallic additions.
	.11 Iron-manganese phase diagram		Ladle scrap
	<i>For iron-carbon system (phase diagram) — 669.112.2</i>	.16	Coal. Coke
	<i>For cast iron — 669.13</i>	.2	Blast furnaces. Operation of blast furnaces
	<i>For steel in general — 669.14</i>	.21	Generalities
	Special auxiliary subdivisions for 669.15	.211	Dimensions of blast furnaces. Profiles
669.15-192	Carbon-free ferrous alloys, e.g.	.1	Hearth. Hearth diameter, depth
	669.15'25'24-192 Carbon-free iron-cobalt-nickel alloys	.2	Bosh. Bosh height, angle
-194	Low-carbon ferrous alloys. Alloy steels, e.g.	.28	Blast furnace with bosh
	669.15'26'24'28-194 Chromium-nickel-molybdenum steel	.3	Upper bosh line
.2	Low-alloy steels	.4	Stack. Stack height, batter
.3	High-alloy steels	.5	Throat. Throat diameter
.5	Steels according to structure	.7	Cross section of furnace (circular, elliptical, square, rectangular etc.)
.52	Hypoeutectoid. Hypoppearlitic	.212	Blast furnace lining materials
.53	Eutectoid. Pearlitic	.1	Thin inwall. Thick inwall
.54	Hypereutectoid. Hyperpearlitic	.2	Stack lining
.55	Martensitic	.3	Dam stone. Tymp stone. Baffle stone
.56	Austenitic	.4	Bosh lining
.57	Ferritic	.6	Hearth lining
.58	Ledeburitic	.8	Brick dimensions, quality. Selection of bricks
.591	Bainitic	.9	Destruction of lining
-196	High-carbon ferrous alloys. Alloyed cast iron, e.g.	.213	Armouring of blast furnaces. Mantle ring.
	669.15'24'25-196 Nickel-cobalt cast iron		Supporting structure
.52	Hypoeutectoid. Hypoppearlitic	.2	Armouring
.53	Eutectoid. Pearlitic	.22	Blast furnace jacket
.54	Hypereutectoid. Hyperpearlitic	.221	Hearth bottom shell. Hearth shell
.55	Martensitic	.222	Bosh shell
.56	Austenitic	.223	Stack shell
.57	Ferritic	.23	Bustle pipe casing. Hearth band
		.24	Banding-in of tuyere belt
		.242	Van Vloten's ring
		.3	Mantle ring. Mantle ring columns
		.38	Water-cooled mantle ring
		.4	Supporting structure
		.6	Throat armour
		.62	Stuffing boxes
		.64	Protection of stack wall from impact of charge

- 669.162.214 Cooling of blast furnace
- .2 Stack cooling
 - .22 Stack coolers
 - .3 Bosh cooling
 - .32 Bosh coolers
 - .38 Bosh-shell cooling
 - .384 By cold compressed air
 - .4 Tuyere cooling
 - .42 Blast tuyere cooling
 - .422 Blast tuyere coolers
 - .44 Slag-notch cooling
 - .442 Slag-notch coolers
 - .46 Tap-hole cooling
 - .464 Trickle-type cooling
 - .6 Hearth cooling
 - .8 Cast-iron blast furnace (Burger)
 - .215 Furnace tops. Gas offtakes
 - .2 Furnace tops
 - .22 Open-top furnaces
 - .24 Closed-top furnaces
 - .242 Hoppers
 - .2 Single
 - .4 Double
 - .243 Bells
 - .2 Single
 - .4 Double
 - .244 Furnace tops with rotating distributors
 - .245 Furnace tops with lip rings
 - .4 Gas offtakes
 - .42 Eccentric gas offtakes
 - .44 Central gas offtakes
 - .48 Bleeders
 - .216 Tap-hole fittings. Mixtures for plugging
 - tap-hole. Slag notch
 - .2 Tap-hole fittings
 - .22 Simple tap-hole
 - .23 Cast iron tap-hole fittings
 - .25 Machines for plugging tap-hole
 - The method of operation and the type of drive may be denoted by the hyphen auxiliaries listed under 62, e.g. 669.162.216.25-519 Remote control*
 - .252 In which the stopping is pressed in by pistons
 - .254 Without pistons
 - .4 Mixtures for plugging tap-hole
 - .6 Slag notch
 - .62 Lurmann's slag notch
 - .218 Securing the wall and hearth against break-outs
 - .2 By metal jacketing
 - .22 Sheet metal
 - .24 Cast steel
 - .3 By protective wall
 - .4 By ramming with refractory clay
 - .5 By formation of a bear
 - .6 By water-cooling
 - .22 Supply of blast to the furnace
 - .221 Tuyeres. Tuyere connections
 - .2 Tuyeres
 - .22 Straight type
 - .23 Venturi type
 - .24 Oval type
 - .28 Cast iron tuyeres with cast-in cooling pipes
 - .4 Tuyere connections
 - .42 Bellows pipes. Leg pipes. Goose necks
 - .48 Various tuyere connection designs
 - .482 With safety valve
 - .483 Eccentric
 - .484 'Open' form
 - .8 Bosh tuyeres
 - .222 Blast main. Blast furnace gas main. Explosion valves
 - .2 Blast main
 - .22 Cold-blast main
 - .24 Hot-blast main. Bustle pipe. Insulation. Bricking-in
 - .4 Blast furnace gas main. Explosion valves
 - .223 Blowers

- 669.162.223 (cont'd) *Further particulars may be denoted by colon combination with the subdivisions of 621.61, e.g. 669.162.223:621.611 Simple blowers. Bell blowers, drum blowers etc.*
- :621.612 Blowers with reciprocating pistons
 - :621.614 Blowers with rotary vanes
 - :621.615 Centrifugal blowers
 - .224 Drying of blast. Oxygen enrichment of blast
 - Blast drying particulars may be denoted by the .047 special auxiliaries listed under 66*
 - .4 Oxygen enrichment of blast
 - .225 Regulation of moisture in blast. Steam injection
 - .227 High top pressure working
 - .228 Blast volume, pressure and consumption. Total cross section at which blast applied. Number of tuyeres and emergency tuyeres
 - .2 Blast volume. Blast losses
 - .3 Blast pressure. Pressure losses
 - .4 Blast consumption
 - .5 Total cross section at which blast applied. Number of tuyeres and emergency tuyeres
 - .23 Blast heating. Hot-blast stoves
 - .231 Brick stoves with intermittent heating
 - .1 Whitwell stoves
 - .3 Cowper stoves
 - .38 Modifications of Cowper stoves
 - .384 Hot-blast stoves without combustion chamber, heated from above
 - .386 Multiple-zone blast stoves
 - .8 Brickwork. Checkers. Combustion chamber. Burners
 - .82 Brickwork
 - .83 Checkers. Checker grids
 - .832 Checkers
 - .836 Checker grids
 - .84 Combustion chamber
 - .842 Design of combustion chamber
 - .2 Eccentric
 - .4 Central
 - .844 Cross section of combustion chamber
 - .2 Round
 - .4 Oval
 - .6 Other cross sections
 - .85 Burners
 - .852 With natural draught
 - .854 With artificial draught. Forced heating
 - .2 Forced heating with induced draught
 - .4 Forced heating by compressed gas and air
 - .856 Additional burners for liquid fuels
 - .9 Other matters
 - .92 Combustion in Cowper stoves
 - .93 Heat transmission to checkers. Heating surface of checkers
 - .932 Heat transmission to checkers
 - .934 Heating surface of checkers
 - .94 Bricks
 - .942 Selection of bricks
 - .944 Shapes of bricks
 - .2 Checker bricks
 - .4 Flue bricks
 - .6 Insulating bricks
 - .8 Other bricks
 - .946 Weights of bricks
 - .95 Various factors influencing heat transmission
 - .232 Cast iron hot-blast stoves
 - .233 Continuous-pipe stoves
 - .2 With vertical pipes
 - .4 With horizontal pipes
 - .6 Steel recuperators
 - .236 Equalizers
 - .237 Fittings for hot-blast stoves
 - .2 Cold-blast valves. Hot-blast valves
 - .3 Gas valves. Chimney valves. Blow-off valves

- 669.162.237.4 Seals for dust traps, manholes and combustion air
- .238 Operation of hot-blast stoves. Heat balance
- .2 Operation of hot-blast stoves
- .21 Blast temperatures. Temperature control gear
- .22 Reversal of hot-blast stoves. Reversal period
- .222 Heating-up
- .223 Reversal to gas
- .224 Reversal to air
- .24 Cleaning of hot-blast stoves
- .3 Control of operation
- .4 Heat balance of hot-blast stoves
- .5 Stove chimneys
- .24 Charging. Furnace hoists
- .242 Charging by means of inclined hoists, skip bridges, bucket elevators
- .244 Furnace hoists
- The motive power may be denoted by the -8 special auxiliaries listed under 62, e.g.*
- 669.162.244-81 Steam-driven
- 822 Hydraulic, driven by water or oil under pressure
- 83 Electrically driven
- 85 Pneumatically driven
- .2 Vertical furnace hoists
- .27 Hoist engines
- .28 Water-box hoists
- .4 Inclined elevators
- .42 With automatic discharge skips
- .43 Bucket charging
- .432 With tipping buckets
- .434 With bottom discharge buckets
- .48 Other types of inclined elevator
- .5 Charging by means of cableways, ropeways, overhead trolleys
- .6 Charging by means of belt conveyors
- .8 Emergency charging
- .25 Cleaning and utilization of blast furnace gas
- .251 Utilization of blast furnace gas in recuperators
- .252 Gas cleaning. Gas cleaners
- For dust separation, extraction and collection — 621.928.9*
- For cleaning, drying and solution of gases — 66.074*
- .2 Coarse cleaning
- .22 By alteration of direction of gas flow
- .23 By dust catchers
- .24 By dust scrubbers
- .25 By whirlers
- .3 Cooling and washing of gases
- .32 In hurdle washers
- .34 In Bian washers
- .4 Fine cleaning
- .42 Wet cleaning
- .422 By centrifugal cleaners
- .2 Zschocke system
- .3 Theisen system
- .4 Schwarz system
- .428 Separation and clarification of water
- .44 Dry cleaning
- .442 Filtering
- .2 Cloth filters
- .3 Bag filters
- .4 Revolving filters
- .8 Filter materials
- .46 Electric cleaning
- 621.359.4 Electrical precipitation from gases
- 66.087.9 Electrocapillarity.
- Electroprecipitation
- .462 Lodge-Cottrell system and related systems
- .464 Wet electric cleaning
- .468 Electrodes. Dust separators
- .2 Electrodes
- .22 Collecting electrodes
- .24 Discharge electrodes
- .4 Dust separators
- .42 Tubular collectors
- 669.162.252.468.44 Plate collectors
- .46 Wire netting collectors
- .8 Dust in blast furnace gas
- .82 Dust quantity
- .84 Dust grain-size
- .85 Utilization of dust
- .253/.258 Utilization of blast furnace gas
- .253 For heating boilers
- .254 In blast furnace gas engines
- .255 For blast heating
- 669.162.23 Blast heating. Hot-blast stoves
- .256 In reheating furnaces, open-hearth furnaces, mixers, rolling-mill furnaces
- .259 Other means of utilizing blast furnace gas
- .26 Operation of blast furnaces
- .261 Putting into operation
- .2 Drying of lining
- .3 Charging. Lighting. Blowing-in
- .4 Regular working
- .262 Calculation of charge and burden
- .2 Determination of the quantity of ore and composition of pig iron required
- .3 Burdening
- .4 Composition of the burden
- .42 Acid burden
- .44 Basic burden
- .48 Self-fluxing burden
- .5 Calculation of the burden
- .52 Slag rates. Silica content
- .525 Calculation of alumina
- .57 Graphical methods
- .58 Shortened methods
- .6 Calculation of additions
- .263 Reactions and processes in the blast furnace
- .2 Course of the reactions
- .21 Evaporation of moisture
- .22 Decomposition of hydrates, carbonates
- .222 Decomposition of hydrates
- .224 Decomposition of carbonates
- .23 Reduction of oxygen compounds
- .232 Reduction by carbon monoxide (indirect reduction). Zone of indirect reduction
- .8 Reduction point
- .234 Reduction by solid carbon (direct reduction). Zone of direct reduction
- .236 Mixed reduction
- .24 Melting of gangue, additions, coke ash (slagging)
- .25 Melting and carburization of iron
- .4 Reactions in the blast furnace
- .42 Combustion at the tuyeres
- .43 Reactions between ascending gases and charge
- .44 Reactions in the hearth
- .45 Behaviour of individual elements
- The elements may be denoted by colon combination with the subdivisions of 669*
- .264 Irregularities in blast furnace operation and their prevention
- 669.014.8 Irregularities in the reactions
- .2 Furnace too cold, too hot
- .3 Lime set. Excess sulphur
- .4 Scab adhering to the walls. Scaffolding of the charge
- .5 Explosions. Break-outs
- .8 Other irregularities
- .82 Channelling
- .265 Acid smelting in the blast furnace
- .266 Tapping of the blast furnace
- .2 Tapping of pig iron
- .21 Opening of the tap-hole
- .212 By sledging
- .214 With oxygen
- .216 By using explosives. Shaped charges. Jet tapping
- .22 Pig iron troughs. Tilting troughs. Slag separation
- .23 Tapping into pig beds. Preparation of pig beds

- 669.162.266.232 Tapping into pig beds. Open pig beds. Cast houses
- .2 Tapping into sand moulds
 - .4 Tapping into cast iron moulds
 - .6 Tapping into casting machines
 - .62 Casting machines with turntables
 - .64 Casting machines with conveyor belts
 - .8 Open pig beds
- .233 Preparation of pig beds
- .8 Pig moulding machines
- .234 Distribution of pig iron in pig beds
- .235 Pig breaking. Pig breakers
- .236 Preparation of sand
- .24 Tapping into hot metal ladle
- .242 Bogies for hot metal ladles
- 621.746.32 Ladles - Casting
 - .2 With fixed ladle
 - .4 With tilting ladle
 - .6 Pig iron ladles serving as mixers
 - .8 Ladle lining
- .26 Granulation of pig iron
- .28 Tapping times
- .4 Tapping of slag. Transport of slag
- .42 Tapping of slag
- .422 Slag trough. Sand stopping
- .44 Obtaining different types of slag. Granulation of slags. Foaming of slags
- 669.054.82 Utilization of slags
- .442 Solidification in ladle
- .443 Tipping on to dumps
- .5 Lump slag
- .444 Tipping into beds or moulds
- .2 Into beds
 - .4 Into moulds. Slag bricks
 - For slag paving — 625.821.4
 - For manufacture of paving stones — 625.822
- .446 Granulating of slag
- .2 By wet methods
 - .22 By tipping slag into running water
 - .24 By water jet
 - .3 With steam jet
 - .4 By dry methods
 - .42 By air jet
- .448 Foaming of slag. Slag foams. Artificial pumice
- For formation and properties of slag — 66.046.58
 - For slag and pumice aggregates — 691.322
- .45 Transport of slag
- .452 In skips
- .454 By bucket conveyors
- .267 Various blast furnace operations
- .2 Changeover to other grades of pig iron
 - .3 Reduction of output. Damping-down.
 - Blowing-out
 - .32 Reduction of output
 - .33 Damping-down
 - .332 For short periods
 - .334 For long periods
 - .34 Blowing-out
 - .4 Operation with various fuels. Injection of solid, liquid or gaseous fuels
 - The fuel injected may be denoted by colon combination, e.g.
 - 669.162.267.4:665.612.3 Injection of natural gas
- .5 Blowing-in of flue gas
- .6 Desulphurization of pig iron
- .62 By slag in hearths
- .64 After tapping of the iron and slag
- .642 In the ladle
- .644 In the mixer
- 669.184.41 Pig iron mixers
- .645 In special installations
- .646 By alkalis (soda) and alkaline earths (lime)
- .2 In solid form
 - .4 In liquid form
 - .6 Melting appliances for alkaline desulphurizing agents
- 669.162.267.7 Desiliconization of pig iron
- .8 Elimination or recovery of elements other than sulphur or silicon from pig iron
- The elements may be denoted by colon combination with other subdivisions of 669, e.g.
- 669.162.267.8:669.292 Recovery of vanadium
- .27 Economy. Output
- Further particulars may be denoted by the .012 special auxiliaries listed under 66
- .275 Composition of products
- .1 Pig iron. Iron cast in the first melt
 - .12 Pig iron
 - .122 Pig iron according to structural fracture
 - .2 White pig iron
 - .4 Mottled pig iron
 - .6 Grey pig iron
 - .124 Pig iron according to application
 - .1 Hematite pig iron
 - .2 Foundry pig iron. Malleable pig iron
 - .3 Acid Bessemer pig iron
 - .4 Puddle pig iron
 - .5 Open hearth pig iron
 - .6 Basic Bessemer pig iron
 - .7 Spiegeleisen
 - .8 Special qualities of pig iron
 - .82 Cold blast pig iron
 - .14 Iron cast in the first melt
 - .142 White cast iron
 - .144 Grey cast iron
 - .146 Special cast iron
 - .2 Blast furnace slags
 - For utilization of slags — 669.054.82
 - .22 Flushing slag
 - .23 Roughing slag
 - .25 Desulphurizing slags
 - .3 Blast furnace gas
 - For utilization of blast furnace gas — 669.162.25
 - .32 Composition. Precalculation of composition
 - .33 Regeneration of blast furnace gas
 - .34 Distribution of blast furnace gas
 - .38 Recovery of individual components from blast furnace gas
 - .4 Flue dust
 - .8 By-products (recovery of zinc)
 - .28 Studies of the blast furnace process
 - .281 Theories of the blast furnace
 - .282 Reduction experiments
 - .283 Study of blast furnace reactions
 - .2 At the tuyeres
 - .3 In the bosh
 - .4 In the stack
 - .3 Charcoal blast furnaces
 - 669.162.3 ≈ 669.162.2
 - .4 Electric blast furnaces
 - 669.162.4 ≈ 669.162.2, e.g.
 - 669.162.46 Operation of electric blast furnaces
 - .47 Economy. Output
 - Details of economy, output etc. may be denoted by the .012 special auxiliaries listed under 66
 - Further particulars may be denoted by the .04 special auxiliaries listed under 66, e.g.
 - 669.162.4.041.531 High-shafted electric blast furnaces
 - .532 Low-shafted electric blast furnaces
 - .6 Production of synthetic pig iron
 - .61 Raw materials for production
 - .62 Production methods
 - .622 Methods for production in reverberating furnaces
 - .624 Methods for production in electric furnaces
 - .68 Other matters
 - .682 Carburization
 - .683 Desulphurization. Dephosphorization
 - .2 Desulphurization