

TECHNICAL REPORT

ISO
TR 4949

First edition
1989-07-15

Steel names based on letter symbols

Désignations des aciers fondées sur des lettres symboles

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Reference number
ISO/TR 4949 : 1989 (E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The main task of ISO technical committees is to prepare International Standards. In exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the necessary support within the technical committee cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development, requiring wider exposure;
- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports are accepted for publication directly by ISO Council. Technical reports of types 1 and 2 are subject to review within three years of publication, to decide if they can be transformed into International Standards. Technical reports of type 3 do not necessarily have to be reviewed until the data they provide is considered no longer valid or useful.

ISO/TR 4949, which is a technical report of type 2, was prepared by Technical Committee ISO/TC 17, *Steel*.

It was decided that it would be more appropriate to publish this document in the form of a Technical Report type 2 for the time being, so that the designation system described could be implemented on an experimental basis before being applied to all International Standards developed by ISO/TC 17.

Annex A of this Technical Report is for information only.

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Case postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Introduction

Historical background

The steel designations given in the various International Standards for steels were in the past established by the different sub-committees of ISO/TC 17, independently from one another, though a degree of cooperation and harmonization would have been useful.

Explanation of the system

This International Technical Report is intended to serve as a basis for such cooperation and harmonization.

It covers a designation system which is applicable to all groups of steels and which has been developed taking particularly into consideration mnemotechnical aspects. This means that the designations — hereinafter called "steel names" — give direct information about the main characteristics of the type of steel concerned.

A further designation system for steels, particularly suitable for data processing, namely a numbering system, is in preparation as a part of ISO/TR 7003. The parallel application of both steel names and steel numbers in International Standards and in practice is recommended in order to minimize the danger of confusion between materials as a result of errors in the designation, and also to overcome the difficulties likely to occur when, in the future, it becomes necessary to modify a steel number or name.

The steel names in this system consist, as indicated in tables 1 to 3, of a code-letter for the steel group, a code-number for the main characteristics of the steel and additional code-letters and code-numbers. The sequence of these symbols is always the same. Therefore, it is possible to use any letter of the alphabet for the additional code-letters without using multi-letter codes, except in the case of the codes for the heat-treatment condition (see table 5).

Future procedure

All international and national committees and groups for the standardization of steels are invited to examine in the coming years the feasibility of this new designation system and to apply it where appropriate when new designations are introduced or old ones altered.

In cases where, for some reason, steel designations not in accordance with this system are introduced, care should be taken that the letters B, C, D, E, G, H, L, M, P, R, S, T and X used in this system as the first letters of steel names are not applied in another sense as first letters (see also annex A, which lists all the code-letters in tables 1 to 3 in alphabetical order).

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Steel names based on letter symbols

1 Scope

1.1 This Technical Report establishes a system for the designation of internationally standardized steels on the basis of "steel names". It is felt that such a designation system supplies more direct information about the main characteristics of the type of steel concerned than an designation system based on "steel number" (see ISO/TR 7003, annex A).

1.2 Because steel names are more readily understood, a designation system based on names is preferable in cases where the data-processibility of the designation is of no importance.

1.3 The codes and rules given in this Technical Report are applicable to the formation of "steel names" of steels standardized or registered in national or regional steel standards or steel lists. In such cases, sub-clause 3.1 should be observed.

NOTE — It is intended at a later date to add an assigner code to the steel names to differentiate between steels registered in different countries.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1052 : 1982, *Steel for general engineering purposes*.

ISO/TR 7003 : —¹⁾, *Unified format for the designation of metals*.

ISO 7778 : 1983, *Steel plate with specified through-thickness characteristics*.

3 General requirements

3.1 Each particular type of steel shall have only one name and, conversely, a name assigned to an individual steel shall not be assigned to another, even if the steel is withdrawn.

An individual steel is a steel for which a particular set of specifications governing the **essential material characteristics** applies.

The essential characteristics may, for example, be defined on the basis of the specifications for the chemical composition ranges or the requirements on its characteristic properties or, in certain cases, special manufacturing procedures (e.g. remelted roller-bearing steels in comparison to non-remelted steel) or, in special cases, the end use. Where materials may be delivered in different treatment conditions (heat treatment or cold reduction), which will influence the material properties, these treatment conditions shall not be covered in the steel name itself, but in a suffix. Differences in delivery requirements which do not affect the material characteristics (such as the type of marking, the surface appearance and the amount of testing) shall not be a reason to assign a different steel name.

3.2 The steel name shall be as short as possible without contravening the requirements specified in 3.1.

3.3 The steel name shall not normally be changed. If, under exceptional circumstances, a change becomes unavoidable, it shall be done only after ensuring that the change does not contravene the requirements specified in 3.1.

4 Structure of international steel names and symbols used

4.1 The structure of the international steel names and the symbols used shall be as specified in the following tables:

- table 1 for (unalloyed and low-alloy) steels which are primarily characterized by their minimum yield stress;
- table 2 for steels primarily characterized by their application or by properties other than minimum yield stress;

1) To be published.

— table 3 for steels primarily characterized by their chemical composition.

An alphabetical listing of all code-letters used is given in annex A.

5 Codes for treatment condition of the steel

5.1 The codes used for the various treatment conditions of the steel are given in table 5.

6 Responsibilities

6.1 Responsibility for allocation of steel name

When a sub-committee proposes the international standardization of a steel, it should also make a proposal for the designation of this steel in accordance with this Technical Report. The sub-committee making the proposal shall inform the Secretariat of TC 17/SC 2 of its proposal, and sub-committee 2 shall check whether the rules of this Technical Report have been applied correctly and, in particular, that the proposed name is not identical with an already existing name.

6.2 Responsibility for administration of the designation system

The responsibility for the maintenance of lists of international steel names shall be that of the Secretariat of TC 17/SC 2, while the responsibility for the publication and sale of such lists shall be that of the ISO Central Secretariat.

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Table 1 — Structure of and symbols used in international steel names based primarily on the minimum yield stress

1	2	3	4	5	6
<p>Structure of international steel name</p> <p>(ISN-) α α n n (α xx)</p>	<p>Explanation of symbols used</p> <p>α = code-letter; n = code-number; x = code-letter of number () means code-letter or number may not be necessary</p> <p>ISN = International steel name (see note to 1.3)</p> <p>G = cast steel (the symbol C is reserved for carbon steel — see table 3)</p>				
<p>Group codes</p>	<p>S Structural steels (see also column 6)</p> <p>SD for bright drawing</p> <p>SB for flanging or bending</p> <p>SV for die forging</p> <p>SS for cold-rolling into sections</p> <p>SW for welded tubes</p> <p>SF for special formability¹⁾ applications</p>	<p>P Steels for pressure purposes</p> <p>PL at low temperatures</p> <p>PH at high temperatures</p> <p>PLH at low and high temperatures</p>	<p>L Steels for pipelines</p>	<p>B Steels for reinforcement of concrete</p> <p>BP Steels for prestressing of concrete</p>	<p>E Steels for engineering purposes and bolted constructions (ISO 1052)</p>
<p>Main characteristic</p>	<p>Codes indicating the application</p> <p>Represented in the designation by the value of 0,1 \times the minimum yield stress ($R_{e, min}$), in newtons per square millimetre, specified for the smallest thickness. In special cases, e.g. in the case of sheet in the as cold-rolled condition, $R_{e, min}$ is not specified, the symbol T (tensile) followed by the value of 0,1 \times $R_{m, min}$ (R_m = tensile strength, also in newtons per square millimetre) shall be given.</p>				
<p>1) As achieved, for example, by the addition of elements to modify the sulfide structure or by other special metallurgical methods.</p>					

Table 1 — Structure of and symbols used in international steel names based primarily on the minimum yield stress (continued)

1	2	3	4	5	6
(ISN-) (α) (α) (α) nm (α.xx)	Explanation of symbols used				
	Codes indicating additional properties and features of the manufacturing process	Additional codes	Codes indicating additional properties and features of the manufacturing process		
<p>A B C CC D DD E</p>	<p>Quality class¹⁾</p>	<p>T_{27J} °C</p> <p>T_{40J} °C</p>			
<p>R X K F</p>	<p>See column 3</p>	<p>R Rimming S Semi-killed X Non-rimming (mixture) K Killed (= fully killed) F Fine-grained or $A_{\text{hot}} \geq 0,015$ etc.</p>	<p>X K F</p>	<p>See column 3</p>	<p>C Cold-worked H Hot-rolled Q Quenched + tempered</p>
<p>W N Q -TM</p>	<p>Weather-resistant</p>	<p>N²⁾ Normalized (or controlled-rolled³⁾ Q²⁾ Normalized + tempered Quenched and tempered (or precipitation-hardened) fine grain steels -TM Thermomechanically treated³⁾</p>	<p>-TM</p>	<p>See column 3</p>	

1) Where possible, the quality class is characterized by the impact-energy transition temperature T_{27J} or T_{40J} for longitudinal ISO V-notch test pieces and/or the requirements for the composition and de-oxidation of the steel.

2) Treatment conditions N and Q are listed here mainly for the purpose of characterizing the steel group concerned. In neither case do they represent the actual treatment condition of the steel. It may for example occur that, with a view to subsequent hot-forming operations, a P 42 Q steel is ordered untreated, i.e. with the designation P 42 Q-TU as required by table 5.

3) See table 5, footnote 3.

Table 1 — Structure of and symbols used in international steel names based primarily on the minimum yield stress (concluded)

1		2	3	4	5	6
(ISN-) α (α) (α) nn (α xx)						
Additional codes		Explanation of symbols used				
<p>Codes indicating additional properties and features of the manufacturing process</p> <p>Z nn Reduction of area in the direction of thickness > nn % (see ISO 7778)</p> <p>Gx Grade x ($x = 0$ to 9 or A to Z)</p> <p>-Txxx Treatment xxx (see table 5)</p>						
Examples: ISN		S 23 B S 35 D S 42 EZ 25 S 42 Q	P 20 P 20 R PH 35 PH 42 PH 42 Q	L 23 L 23 F L 35 L 35-TM	B 50 B 50 C BP 157 C BP 157 Q	E 29 E 33 E 36

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Table 2 – Structure of and symbols used in international steel numbers based primarily on the application

Example illustrating structure of international steel name		1	2	3
		rails	Steels for or in form of flat products for drawing	
ISN-R 68 C5		uncoated		metal-coated ²⁾
		ISN-R 68 C5	ISN-D H 2 R	ISN-D4TL - Z 275 M
Explanation of symbols used	Group codes	R Rail	D For drawing H Hot-rolled and intended for cold rolling D Hot-rolled and intended for direct drawing No code — Cold-rolled	See column 2 Z Hot-dip Zn-coated ZF Zn-coated Zn-Fe alloy ZE Electrolytic Zn-coated AS Al-Si-coated SN SN-coated T Term-coated
	Main characteristic	68 Minimum tensile strength $\approx 680 \text{ N/mm}^2$	1 Commercial quality 2 Drawing quality 3 Deep-drawing quality 4 Extra-deep drawing quality	Minimum mass of coating in g/m^2 according to the triple-spot test ³⁾
	Additional codes	(C5) ¹⁾ $C_{\text{mean}} \approx 0,50 \%$ — If appropriate, additional codes for alloying elements	(R) ¹⁾ Ageing (rimming) (A) ¹⁾ Al-killed (low Si) or corresponding non-ageing quality	Symbols for additional characteristics explained in the standard (M = minimum spangle)
		Gx Grade x ($x = 0$ to 9 or A to Z)	-Txxx Treatment xxx (see table 5)	

1) Codes given in brackets shall only be used where appropriate to differentiate between steel types.

2) A complete designation system for coatings, also covering chromium/chromium oxide and organic coatings, will be included when the work on an International Standard for organic-coated flat products has reached a more advanced stage.

3) In the case of electrolytic-coated flat products, the nominal coating thickness in μm is given instead of the minimum mass. In the case of differential coatings (e.g. a nominal thickness of $38 \mu\text{m}$ on one side and $25 \mu\text{m}$ on the other), the designation is structured as indicated in the following example: ZE 38/25.

Table 2 — Structure of and symbols used in international steel numbers based primarily on the application (concluded)

Example illustrating structure of international steel name		4	5	6
		Steel for or in form of		
		black plate or strip	thin flat products tin plate or strip	electrical sheet or strip
		ISN-T P 50 D	ISN-T P 50 D - E 5, 6/2, 8	ISN-M G 111 - 35
Explanation of symbols used	Group codes	T Thin flat products (tin plate and its substitutes and black plate and strip)	See column 4 (E) ¹⁾ Electrolytic coated (H) ¹⁾ Hot-dip coated	M Electrical (magnetic) sheet or strip G Grain-oriented No code — Non-grain-oriented
	Main characteristic	P50 Average proof stress (P) 500 N/mm ² H50 Average hardness 50 HR 30T	Nominal coating mass 5,6 g/m ² on one side and 2,8 g/m ² on other side	111 The core loss at an induction of 1,5 tesla and a frequency of 50 Hz for the thickness given in the last code ²⁾ is about 0,01 × 111 W/kg
	Additional codes	D Double-reduced No code — Single reduced		35 The nominal thickness is 0,01 × 35 mm
		Gx Grade x (x = 0 to 9 or A to Z)		
		Txxx Treatment xxx (see table 5)		
<p>1) Codes given in brackets shall only be used where appropriate to differentiate between steel types.</p> <p>2) According to the present specifications, in the case of non-grain-oriented steel half of the sample mass shall be cut in the rolling direction and half perpendicular to the rolling direction. In the case of grain-oriented steel, all samples shall be cut in the rolling direction.</p>				

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Table 3 — Structure of and symbols used in international steel names based primarily on chemical composition (concluded)

Example illustrating structure of international steel name	1				2				3				4			
	Unalloyed steels with $Mn_{mean} < 1\%$, except free-cutting steels, but including steels with $Mn_{mean} < 1\%$ alloyed with B only ISN-C 45 M 4				Low-alloy ¹⁾ steels except steels with $Mn_{mean} < 1\%$ alloyed with B only, but including all unalloyed free-cutting steels ISN-20 CrMoB 5-7				High-alloy ¹⁾ steels except high-speed steels ISN-X 2 CrNiD 18-10				High-speed steels ISN-HS 2-9-1-1-8			
Main characteristic	45 % $C_{mean} \approx 0,45\%$				Value corresponding to $\approx 100 \times \% C_{mean}^{(2)}$ Symbols for alloying elements placed in order of decreasing content. Content of the first and, when appropriate, the second and third element, in %, multiplied by the factor given in table 4.				in %				\approx % W \approx % Mo \approx % V \approx % Co			
	M(n) Special steel with minimum sulfur content ($n \approx \% S_{max} \times 100$) E(n) Special steel with no minimum sulfur content ($n \approx \% S_{max} \times 100$) H With hardenability specifications R Rimming X Non-rimming K Killed (fully killed) A Al-killed (low Si) F Fine grain C Coarse grain B Boron-treated				B Bearing-steel quality E For cold-heading or extruding F Fine grain H With hardenability specification											
Explanation of symbols used																
(Instead of inserting a code describing additional characteristics of the steel, a slightly different code may be used for the chemical composition in order to differentiate between e.g. the normal grade and the bearing grade of a certain steel — for example: 15 MnCr 5 instead of 16 MnCr 5)																
Gx Grade x (x = 0 to 9 or A to Z) -Txxx Treatment xxx (see table 5)																

1) Alloyed steels with a total alloy content of < 5 %, for example, shall be regarded as low-alloy steels, and others as high alloy steels.
 2) If no range is given, a realistic mean value shall be used.

Table 4 – Multiplication factors to be used with the alloy content of low-alloy steels¹⁾

Element	Multiplication factor
Cr, Co, Mn, Ni, Si and W	4
Al, Be, Cu, Mo, Nb, Pb, Ta, Ti, V and Zr	10
Ce, N, P and S	100
B	1 000

1) The mean content of the alloying element is multiplied by the factor and rounded to the nearest whole number in accordance with the requirements of table 3, column 2.

Table 5 – Codes for the treatment condition of the steel

Treatment condition	Code ^{1), 2)}
Untreated	TU
Annealed (soft-annealed)	TA
Annealed to achieve spheroidized carbides	TAC
Thermomechanically treated ³⁾	TM
Normalized (or controlled-rolled) ³⁾	TN
Solution-treated	TST
Quenched or hardened	TQ
Quenched in water	TQW
Quenched in oil	TOO
Quenched in salt bath	TQS
Quenched in air	TQA
Ausformed	TQF
Austempered (Austenite-Bainite transformation)	TQB
Precipitation hardened	TP
Tempered	TT
Stress-relieved	TSR
Treated for cold-shearability	TS
Cold-worked	TC
Cold-worked to achieve a minimum tensile strength of xxx N/mm ²	TC _{xxx}
Lightly cold-worked (skin pass)	TLC
Hot/cold-worked	THC

1) If more than one treatment is carried out which is characteristic of the final treatment condition, then the codes for all the various treatment conditions shall be given in the chronological order of the treatments with a + sign between them – for example: hardened + tempered is written TQ + TT

2) Whereas, in the case of, for instance, normalized or quenched and tempered fine-grain steels and cold-drawn or quenched and tempered prestressed-concrete steel, the treatment condition can be regarded as a characteristic of the relevant steel group, it may be advantageous to use other symbols, e.g. Q instead of TQ + TT or N instead of TN (see also table 1, footnote 2).

3) For greater clarity, the term "controlled-rolled" will, in future, probably be replaced by "normalizing-formed". This term is understood to mean a thermomechanical treatment with end-forming in the range of the normalizing temperature and with complete recrystallization of the austenite.

The term "thermomechanical treatment" is used here, as in various other International Standards, only to mean a thermomechanical treatment with end-forming in a range of temperatures in which austenite does not, or does not substantially, recrystallize.

Since the final condition has not, in this case, been obtained by heat treatment alone, it is not reproducible as it is in the case of normalizing-forming.

Annex A

(informative)

Alphabetical listing of the code-letters used in tables 1 to 3 (except chemical symbols for alloying elements)

Code-letters		Meaning	See table		
1)	2)		1	2	3
	A	Al-killed (low Si)		2	1
	A	Quality class A for general structural steels (i.e. no impact properties specified)	2		
	-AS	Coated with Al-Si-alloy		3	
B		Concrete-reinforcing steel (béton)	5		
	B	Quality class B for general structural steels (impact-energy transition temperature $T_{27J} = 20\text{ °C}$)	2		
	B	Boron-treated steel			1
	B	Bearing-steel quality			2
BP		For prestressed concrete	5		
C		Heat-treatable carbon steel			1
	C	Quality class C for general structural steels (impact-energy transition temperature $T_{27J} = 0\text{ °C}$)	2		
	C	Cold-worked concrete steel	5		
	C	Coarse-grain steel			1
CC		Carbon steel not intended for heat treatment, of cold-heading or cold-extrusion quality			1
	CC	Quality class CC for structural steels (impact-energy transition temperature $T_{40J} = 0\text{ °C}$)	2		
CD		Carbon steel for wire drawing			1
CE		Heat treatable carbon steel, of cold-heading or cold-extrusion quality			1
CF		Carbon steel for flame and induction hardening			1
CS		Heat-treatable carbon steel for springs			1
CT		Heat-treatable carbon steel for tools			1
CW		Carbon steel for welding wire			1
D		Flat products for drawing		2	
	D	Hot-rolled flat products intended for direct-drawing		2	
	D	Double-reduced tinplate, black plate or black strip		4	
	D	Quality class D for structural steels (impact-energy transition temperature $T_{27J} = -20\text{ °C}$)	2		
	DD	Quality class DD for structural steels (impact-energy transition temperature $T_{40J} = -20\text{ °C}$)	2		
E		Unalloyed steels for engineering applications and bolted constructions, with tensile properties as main characteristics (see ISO 1052)	6		
	E	Quality class E for structural steels (impact-energy transition temperature $T_{27J} = -50\text{ °C}$)	2		
	E	Low-alloy steels of cold-heading or cold-extruding quality			2
	E	Electrolytically coated		5	
	E(n)	Unalloyed special steel (extra grade), with no minimum sulfur content ($n \approx \% S_{\max.} \times 100$)			1
	F	Fine-grain	2-4		1, 2

1) Code-letters which come before the code-numbers representing the main characteristic of the steel (i.e. group codes except those for coatings).

2) Code-letters which come after the code-numbers representing the main characteristic of the steel (i.e. group codes for coatings and additional codes).

Code-letters		Meaning	See table		
1)	2)		1	2	3
G		Cast steel	2-6		1-4
	G	Grain-oriented electrical sheet or strip		6	
	G(x)	Grade x (x = 0 to 9 or A to Z)	2-6	1-6	1-4
	H	Hot-rolled	5		
	H	Hot-rolled and intended for cold-rolling		2	
	H	Hot-dip coated		5	
	H (nn)	Average hardness of nn HR 30T for tinplate, black plate or black strip		4	
HS		High-speed steel			4
	K	Killed (= fully killed)	2, 3		1
L		Pipeline	4		
M		Electrical sheet or strip (soft magnetic)		6	
	M	Zn coatings with minimum spangle		3	
	M(n)	Unalloyed special steel with a minimum sulfur content ($n \approx \% S_{max.} \times 100$)			1
	N	(Fine-grain structural) steels normally delivered in the normalized condition	2, 3		
P		For pressure purposes	3		
PH		with specified elevated (high) temperature properties	3		
PL		with specified low-temperature properties	3		
PLH		with specified low and elevated (high) temperature properties	3		
	P (nn)	Average proof stress of $10 \times nn$ N/mm ² for tinplate or black plate or black strip		4	
	Q	(Fine-grain structural) steels normally delivered in the quenched + tempered condition	2, 3		
R		Rails		1	
	R	Rimming	2, 3		1
	R	Ageing (rimming)		2	
S		Structural steels	2		
	S	Semi-killed	3		
SB		Structural steels for flanging or bending	2		
SD		Structural steels for bright drawing	2		
SF		Structural steels for special formability applications (e.g. steel with modified sulfide structure)	2		
	-SN	Sn-coated flat products for drawing		3	
SS		Structural steels for cold-rolling into sections	2		
SV		Structural steels for die forging	2		
SW		Structural steels for welded tubes	2		
T		Thin flat products (tinplate, black plate or black strip)		4, 5	
	T (nn)	Minimum tensile strength of $10 \times nn$ N/mm ²	2-6		
	-T	Terne (= Pb-Sn-alloy) coated		3	
	-TM	Thermomechanically treated (see footnote 3, table 5)	2-4		
	-Txxx	Treatment xxx (see table 5)	2-6	1-6	1-4
	W	Weather-resistant structural steels	2		
X		High-alloy steel			3
	-Z	Hot-dip Zn-coated		3	
	Z 15	Minimum reduction of area (Z) in through-thickness direction of flat products equals 15, 25 and 35 % respectively			
	Z 25				
	Z 35		2, 3		
	-ZE	Electrolytic Zn-coated		3	
	-ZF	Hot-dip Zn-Fe-alloy coated		3	

1) Code-letters which come before the code-numbers representing the main characteristic of the steel (i.e. group codes except those for coatings).

2) Code-letters which come after the code-numbers representing the main characteristic of the steel (i.e. group codes for coatings and additional codes).