भारतीय मानक **IS 18385 : 2023**

Indian Standard

वाहनीय अनुप्रयोग के लिए तप्त-निमज्जी जस्तीकृत/जस्तीनीलित इस्पात की चद्दर, प्लेट और पत्तियां — विशिष्टि

Hot-Dip Galvanized/Galvannealed Steelsheet, Plate and Strip for Automotive Applications — Specification

ICS 77.140.50

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August 2023 **Price Group 12**

Wrought Steel Products Sectional Committee, MTD 04

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

Galvanizing is a process in which a layer of zinc through hot-dip coating is bonded to steel in order to protect it against corrosion. Similarly, galvannealing is a process, involving hot-dip coating and annealing, which results in a layer of zinc-iron alloy coating on steel substrate. With the constant requirement of greater, stringent and varied requirements for steel sheets and strips for automobile industry, an endeavor is made to identify, summarize and create a new standard on coated steels. An attempt is made to cover all such requirements of Zn and Zn-iron alloy coated steels for automobile applications under a single standard.

For all the tests specified in this standard (chemical/physical/others), the method as specified in relevant ISO standard may also be followed as an alternate method.

The composition of the Committee responsible for formulation of this standard is given in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

HOT-DIP GALVANIZED/GALVANNEALED STEEL SHEET, PLATE AND STRIP FOR AUTOMOTIVE APPLICATIONS — SPECIFICATION

1 SCOPE

This standard covers the requirements for continuous hot-dip zinc coated [Galvanized (G)] and zinc-iron alloy coated [Galvannealed (A)] steel sheets, plates and strips for automotive applications. It covers sheets, plates and strips up to 6.0 mm thickness.

2 REFERENCES

The standards listed in Annex A contain provisions, which through references in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards.

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 1956 (Part 4), IS 513 (Part 1), IS 513 (Part 2), IS 1079, IS 5986 and the following definitions shall apply.

3.1 Thickness of Sheet/Strip/Plate — The thickness of a hot-dip galvanized coated steels may be specified as a combination of the base metal and metallic coating, or as the base metal alone. The purchaser shall indicate on the order which method of specifying thickness is required. In the event that the purchaser does not indicate any preference, the thickness as a combination of the base metal and coating shall be provided.

3.2 Coating Mass — The amount of coating expressed in grams per unit surface area of sheet (g/m^2).

3.3 Hot-Dip Galvanizing — Zinc coating on steel by dipping an appropriately prepared strip into a molten bath with a zinc content of at least 99 mass percent.

3.4 Hot-Dip Galvannealing — Zinc-iron alloy coating produced by dipping appropriately prepared strip into a molten bath with a zinc content of at least 99 mass percent and by subsequently performing a heat treatment. The coating formed on the base metal is composed of zinc-iron alloy (iron content 7 percent to 15 percent).

3.5 Product — Galvanized/galvannealed hot-rolled or cold-reduced carbon steel sheet, plate, strip (hereafter referred to as steel sheet, plate and strip).

4 DESIGNATIONS

4.1 Coating Class

Coating class is expressed as G“XXX” and A“XXX” for galvanized and galvannealed steels respectively, where “XXX” is the coating mass in g/m^2.

4.2 Steel Grade

Steel sheets, plates and strips covered by this standard shall be designated by the type of base metal used for coating. The grades, therefore, are classified as given in Table 1 for coated steels with cold substrate and Table 2 for coated steels with hot-rolled substrate.

4.3 Designation of Galvanized/Galvannealed Hot-Rolled and Cold-Reduced Carbon Steel Sheet, Plate and Strip

The designation of the steel sheet, plate and strip covered in the standard involves the combination of base metal and the coating class separated by ‘hyphen’.

Examples:

1) Cold-reduced carbon steel sheet base metal of carbon steel grade: IGC410LA galvanized with coating class of G070, the designation of that galvanized steel sheet will be: IGC410LA-G070.
2) Cold-reduced carbon steel sheet base metal of carbon steel grade: IAC410LA galvannealed with coating class of A070, the designation of that galvannealed steel sheet will be: IAC410LA-A070.

4.4 Surface Quality

4.4.1 *As Coated Surface* (*AC*)

Imperfections such as pimples, marks, scratches, pits, variation in surface appearance, dark spots, strip marks, and slight passivation marks are permissible. Stretch levelling marks may appear.

4.4.2 *Improved Surface* (*B*)

With this surface quality, small imperfections such as stretch levelling marks, skin pass marks, run-off marks, slight passivation stains are permissible.

4.4.3 *Best Quality Surface* I

The controlled surface shall make it possible to apply a uniform high class paint finish. The other surface shall at least have the characteristics of surface quality of the improved surface.

NOTE — With respect to surface aspect and defects, product is guaranteed for only one surface i.e. the top surface or the outer surface.

4.5 SURFACE FINISH

The surface finish of a steel, plate and strip shall be specified by the mean surface roughness (R_a) and determined in accordance with IS 15262; the classification describing the surface finish shall be as given below:

Sl No.	*Surface Finish Class*	*Surface Finish Designation*	*Surface Roughness,* μm
(1)	(2)	(3)	(4)
i)	Dull finish	D	$0.5 \leq R_a \leq 2.0$
		C	$0.5 \leq R_a \leq 1.5$

NOTES

1 Surface roughness specification for surface finish designation D is not specified. But a surface roughness range, which is commonly used, is given as an informative reference instead.

2 Surface roughness designation C Shall be specified when a controlled surface roughness is required to ensure in the coated film distinctness of the image of appearance, gloss and image clarity.

5 SUPPLY OF MATERIAL

5.1 The general requirements relating to supply of steel sheet and strip shall conform to IS 8910.

5.2 Non-Ageing Characteristics

5.2.1 The manufacturer shall guarantee the absence of stretcher strains on being cold worked in the case of non-ageing quality with a non-ageing guarantee for six months from the date of manufacture (date of skin pass), when stored at room temperature.

5.2.2 Non-ageing characteristics of sheets and strips shall be as given in Table 3.

5.2.3 Due to ageing, a reduction in formability may take place for all the products supplied according to this standard. Coil breaks or fluting can occur additionally during processing. The risk of coil break increases, for the guarantee on non-ageing for the various thicknesses more than 0.90 mm, with the duration of storage.

6 MANUFACTURE

6.1 Processes used in steel making, rolling and manufacturing process of hot-dip coating shall be left to the discretion of the manufacturer, unless there is a restriction on the steel grades or as per mutual agreement between the purchaser and the manufacturer.

6.2 For hot-dip coating process, hot-rolled or cold-rolled substrate shall be used. Hot-rolled strip shall be pickled first before hot-dip coating process.

6.3 Hot-dip galvanizing/galvannealing involves dipping strip in a suitable bath of molten metal/alloys of zinc at a temperature suitable to produce a complete and uniformly adherent coating (*see* IS 2629).

6.4 The zinc and zinc alloy ingots used for the galvanizing shall conform to any of the grades specified in IS 13229 or IS 209.

7 CHEMICAL COMPOSITION

7.1 Ladle Analysis

The ladle analysis of the base metal of steel sheet and strip shall be as per the requirements given in Table 4A or Table 4B, when carried out either by the method specified in the relevant parts of IS 228 or any other national/international standard for instrumental/chemical method. In case of dispute the procedure given in the relevant part of IS 228 shall be the referee method.

7.2 Product Analysis

Permissible variation in case of product analysis from the limits specified in Table 4A and Table 4B shall be as given in Table 5.

8 MECHANICAL PROPERTIES

8.1 Tensile Test

8.1.1 *Test Piece*

Tensile test values apply to the direction and type of specimen mentioned in Table 6A, Table 6B, Table 6C and Table 6D. Strips having a width of 250 mm and below shall be tested longitudinally.

8.1.2 *Testing Frequency*

8.1.2.1 Specimen for tensile testing shall be drawn and tested for each mother coil and the part there of or lot of sheets as defined in **12** for cold-rolled substrate.

8.1.2.2 For hot-rolled substrate one tensile test shall be taken from each cast. Where strips of more than

one thickness are rolled from the same cast, one additional tensile test shall be made from the material for variation in thickness produced as given below:

a) In the case of strips (for thickness ≤ 5 mm) — One sample shall be tested for thickness < 2.0 mm, one sample shall be tested for thickness between 2.0 mm and < 3.20 mm and one sample shall be tested for thickness ≥ 3.20 mm.

8.1.3 *Testing*

8.1.3.1 When tested as per IS 1608 (Part 1), the mechanical properties, that is, yield strength, tensile strength and percent elongation of the steel sheet and strip shall meet the requirements specified in Table 6A, Table 6B, Table 6C and Table 6D.

8.1.3.2 Testing shall be done on dumb-bell shaped tensile test samples and shall be carried out at the ambient temperature.

8.1.3.3 The yield stress values apply to the 0.2 percent proof stress, if the yield stress is not clearly distinctive, otherwise the values apply to the lower yield stressor upper yield stress, subject to mutual agreement between the purchaser and the manufacturer.

8.1.3.4 The values specified in Table 6A and Table 6B, are applicable as the per guarantee period mentioned in **5.2** & for non-ageing characteristics mentioned in Table 3. Non-ageing characteristics are not applicable for steel strips, plates & sheets, which are produced with hot-rolled substrate.

8.1.3.5 If agreed between the supplier and the purchaser a different test direction test piece may be used, but the values shall be as per Table 6A, Table 6B, Table 6C and Table 6D. Selection of gauge length can also be mutually agreed between the supplier and the purchaser.

8.2 Plastic Strain Ratio (*r*-bar/*r*-90)

8.2.1 The plastic strain ratio, an index of drawability (*r* bar/*r*-90), shall be applicable to thickness between 0.50 mm to 2.00 mm. For thickness more than 1.00 mm, (*r*-bar/*r*-90) value is reduced by 0.10 and if required, for thickness more than 2.0 mm, (*r*-bar/*r*-90) value to be reduced by 0.20.

8.2.2 The plastic strain ratio shall be checked in accordance with IS 11999 and results shall conform to as given in Table 6A and Table 6B.

8.3 Tensile Strain Hardening Component (*n*- value)

8.3.1 The tensile strain hardening is an index of the stretchability (*n*-value/*n*-90), shall be applicable to thickness between 0.50 mm and 2.00 mm. If required, for thickness more than 2.00 mm, the (*n*-value/*n*-90) is reduced by 0.02.

8.3.2 The tensile strain hardening component shall be checked in accordance with IS 15756 and results shall conform to as given in Table 6A and Table 6B.

8.4 Bake Hardening Index — (BH)

Bake hardening index shall be tested as per Annex B and values shall be as given in Table 6A and Table 6B.

8.5 Hole Expansion Ratio — (HER)

The hole expansion ratio shall be checked in accordance with IS 17414 and results shall conform to requirement given in Table 6A and Table 6C.

8.6 Bend Test

8.6.1 If agreed to between the manufacturer and the purchaser, Bend test shall be carried out in accordance with IS 1599 for the cold-rolled substrate.

8.6.2 The angle of bend and the inner bend radius for the different grades of material shall be as given in Table 6E.

8.6.3 The axis of the bend shall be in the direction of rolling. The test pieces shall be deemed to have passed the test if the outer convex surface is free from cracks.

9 COATING

9.1 Coating Mass

The amount of coating mass expressed in grams per square meter given for each side (same surface) shall conform to the requirements specified in the Table 7.

9.1.1 *Coating Mass Test*

9.1.1.1 The coating mass of the product is to be tested by taking a sample piece from each coil approximately 300 mm in length from each coil, and cutting three test specimens, one from the mid-width position and one from each side, not closer than 50 mm to the side edge. The minimum area of the each of three specimens shall be 1 200 mm^2.

9.1.1.2 The coating mass shall be the arithmetic mean of three samples coating mass taken in accordance with **9.1.1.1**. The least value of the three specimens should be at least 0.85 times of the minimum coating mass requirement of the respective coating designation.

9.1.1.3 The coating mass shall be determined by x-ray fluorescence method (*see* IS 12860) or by weight loss (gravimetric) method on a single surface (*see* IS 6745) by employing any suitable

method for masking the second surface as agreed to between the manufacturer and the purchaser. In case of dispute the procedure agreed to between the manufacturer and the purchaser shall be the referee method.

9.1.1.4 When the purchaser wishes to relate the thickness of coating to the mass of coating then the coating thickness can be found from the coating weight (mass) by using the following relationships:

a) g/m^2 coating mass = 0.140 micrometer coating thickness; and
b) Micrometer coating thickness = 7.14 g/m^2 coating mass.

9.1.1.5 *For zinc* — iron alloy coated/galvannealed (A) products, iron/ferrous content in the coating and the test frequency can be measured by a suitable chemical, analytical spectroscopy or x-ray fluorescence spectroscopy method based on mutual agreement between the purchaser and the manufacturer. Any other product characteristics of zinc-iron alloy/galvannealed (A) coatings can also be tested based on mutual agreement between the purchaser and the manufacturer.

9.2 Coating Adherence

Coating adhesion and powdering test should be left to the discretion of the manufacturer or as per mutual agreement between the purchaser and the manufacturer.

10 DIMENSIONS, SHAPE AND TOLERANCES

10.1 Coil Internal Diameter

Unless otherwise agreed, internal diameter of coils shall be 508 mm (± 10 mm).

10.2 Dimensions and Tolerances

10.2.1 The dimensions and tolerances of width, length, thickness, camber, out of square of steel sheet and strip shall conform to IS/ISO 16163.

10.2.2 Sheets and strips may be supplied either with mill or trimmed edges.

10.2.3. For untrimmed/hot rolled mill edges, width tolerances shall be +20/-0 mm and for edges that are trimmed before cold rolling, width tolerances shall be +7/-0 mm. For edges trimmed after cold rolling, annealing & coating, width tolerances shall be as per IS/ISO 16163.

10.2.4 For hot-rolled substrate coated steel sheet and strip with untrimmed or mill edges, thickness is measured at any point not less than 40 mm from a side edge.

11 FREEDOM FROM DEFECTS

The coated steel and sheets shall be reasonably flat and free from bare spots, pin holes, tears and other harmful defects. However, imperfections such as rough/non-uniform coating, minor dents, water/passivation marks etc. may be present at certain portions which are not harmful for intended use.

12 SAMPLING

12.1 One representative sample from a strip or a lot of sheets shall be taken for tensile testing. A lot consists of 50 tonnes or less of sheets or strips of the same quality rolled to same thickness, same coating mass and processed in same condition. If the lot consists of more than one heat, samples from each heat shall be tested.

12.1.1 The thickness to be used for the calculation of the yield point or yield strength, tensile strength and the amount of bake hardening shall be either one of the following:

a) Actual measured thickness after removing the coating layer;
b) Result after subtracting the coating thickness on each side specified in Table 7 from the actual measured thickness including the coating layers; and
c) Results after subtracting the equivalent coating thickness of the actual measured coating mass from the actually measured thickness including the coating layers.

12.1.2 The specimens shall not undergo any treatment on either surface before testing.

13 RETEST

When a part of the test results fails to comply with the requirement specified, a re-test (two more sets of test samples shall be taken for specific test requirements from the same lot) on the relevant items may be carried out to determine whether it is acceptable or not. If any of the re-test samples fail to meet the test requirements of this standard, the lot represented by the sample shall be deemed as not conforming to this standard.

14 STRAIN AGEING

14.1 Due to ageing of the coating a certain cracking of the surface can appear during processing, which can consequently reduce abrasion resistance. The user should take these characteristics into account.

14.2 It is essential that the period between final processing at the mill and fabrication be kept to a minimum. Rotation of stock, by using the oldest material first, is important. Stocking of ageing prone steels for extended periods of time should be avoided.

14.3 The details given above is for information and

the purchaser and the manufacturer may adopt the same at their discretion.

15 SURFACE TREATMENT

15.1 General

If requested by the purchaser, surface treatment of steel sheets and strips is to be done as per agreement between the purchaser and the manufacturer. The requirements for solutions used in surface treatments for paint preparation, surface passivation, or both should also be agreed upon between the interested parties at the time of ordering, taking into consideration the user's paint schedule and paint systems. Typical surface treatment procedures that can be adopted are given below for information of the purchaser and the supplier.

15.2 Surface Preparation for Painting

Steel sheet/strips may be processed chemically (such as phosphating or other suitable methods) at the site of the manufacturer to prepare the sheet/strip for painting without further treatment, except normal cleaning, if required.

15.3 Passivation

A chemical treatment is normally applied to zinc/zinc-iron alloy coating to minimize the hazard of wet storage stain (white rust) during shipment and storage. The type of chemical treatment may be agreed upon between the manufacturer and the purchaser. However, the inhibiting characteristics of the treatment are limited and, if the material becomes wet during shipment or storage, the material should be used immediately or dried.

15.4 Oiling

The Steel sheet and strip as produced may be oiled to minimize wet storage stain. When the steel sheet and strip has received a passivation treatment, oiling will minimize further the hazard of wet storage stain. Removal of the oil may create difficulties (such as staining) if an unsuitable cleaning solution is used.

15.5 Painting

Steel sheet and strip is suitable for painting, but the first treatment may be different from that used for uncoated steel. Pre-treatment primers, chemical conversion coatings or some special paints suitable for direct application on the coated surface, are all appropriate first treatment for hot-dip zinc coated sheets. In deciding a painting schedule, consideration shall be given for whether the coated sheets have been ordered in passivity or non-passivity condition.

15.6 Other Surface Treatments

Special lubricant, special rust preventive oil like high lubrication, solid lubricant and any other chemical conversions, which aids in the stamping process, rust prevention process and any additional benefits can be applied with mutual agreement between the purchaser and the manufacturer.

16 COIL BREAKS, STRETCHER STRAINS AND BENDS (KINKS)

16.1 Freedom from Coil Breaks

If particular requirements for freedom from coil breaks (fluting) are agreed at the time of enquiry and order, it is recommended to order improved surface quality B (*see* **4.4.2**)

16.2 Bends (Kinks) by Winding on Coiler Drums

For the thickness of the strips ≥ 0.90 mm bends (kinks) must be expected due to winding the strip on the coiler drum. When processing, appropriate equipment for leveling (with small diameter rolls) has to be used.

16.3 Stretcher Strains

In order to avoid the formation of stretcher strains when cold forming, it is recommended to order improved surface quality B (*see* **4.4.2**). As there is a tendency for stretcher strains to form again after some time, it is in the interest of the purchaser to use the products as soon as possible.

17 WELDABILITY

This product is normally suitable for welding when appropriate welding methods and procedures are used with special attention to the heavier coatings. zinc-iron alloy coatings (A) are usually more suitable than zinc coatings (G) for resistance welding. For achieving the required weldability, suitable product characteristics can be mutually agreed between the purchaser and the manufacturer.

18 STORAGE AND TRANSPORTATION

18.1 The coating surface can vary and change to a dark appearance by oxidation. Moisture, in particular condensation between the sheets, laps of the coil or other adjacent parts made of hot-dip coated flat products, can lead to the formation of corrosion products. The possible types of temporary surface protection are given in **15**. As a precaution, the products should be transported and stored dry and protected from moisture.

18.2 During transportation, dark spots may appear on the hot-dip coated surfaces as a result of friction. Generally, they only impair the appearance. Friction is reduced by oiling the products. Additionally, secure packing, transporting the coils laid flat and avoiding local pressure points, reduce the risk of dark spots.

19 MASS

19.1 Mass of sheets and coils shall be given in kg of actual or calculated mass.

19.2 The mass of sheets and coils shall be calculated as given in Table 8 on the basis of nominal dimensions and mass of zinc/zinc-iron alloy coating.

20 PACKING

Steel sheets and strips should be suitably packed to avoid transit/handling/storage damage and as per the agreement between the purchaser and the supplier.

21 MARKING

The following shall be legibly and indelibly marked on the top of each coil or package of sheets/plates or shown on a tag attached to each coil or package:

a) IS No. of this standard;
b) Manufacturer's name or trade-mark;
c) Material identification/coil number/packet number/batch number, etc;
d) Product dimensions;
e) Number of sheets or mass;
f) Designation of steel sheet/strip; and
g) Date of manufacture.

21.1 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

Table 1 Type and Designation (Cold-Rolled Substrate)

(*Clause* 4.2)

Sl No.	Type and Designation		Applicable Nominal Thickness mm
(1)	(2)	(3)	(4)
i)	Mild steel sheet	IGC270C	0.40 to 3.00
		IGC270D	0.40 to 3.00
		IGC270E	0.40 to 3.00
		IGC270F	0.40 to 3.00
		IGC260G	0.40 to 3.00
		IGCCR1	0.40 to 3.00
		IGCCR2	0.40 to 3.00
		IGCCR3	0.40 to 3.00
		IGCCR4	0.40 to 3.00
		IGCCR5	0.40 to 3.00
		IGCCR6	0.40 to 3.00
ii)	Bake-hardening type steel sheets	IGC270B	0.40 to 2.30
		IGC290B	0.40 to 2.30
		IGC320B	0.40 to 2.30
		IGC335B	0.40 to 2.30
		IGC340B	0.40 to 2.30
		IGC360B	0.40 to 2.30
		IGC400B	0.40 to 2.30
		IGC440B	0.40 to 2.30
iii)	Interstitial free-high strength steel	IGC280P	0.40 to 2.30
		IGC330P	0.40 to 2.30
		IGC335P	0.40 to 2.30

Table 1 (*Continued*)

Sl No.	Type and Designation		Applicable Nominal Thickness mm
(1)	(2)	(3)	(4)
		IGC340P	0.40 to 2.30
		IGC360P	0.40 to 2.30
		IGC370P	0.40 to 2.30
		IGC380P	0.40 to 2.30
		IGC385P	0.40 to 2.30
		IGC390P	0.40 to 2.30
		IGC440P	0.40 to 2.30
iv)	Commercial type steel sheet (solid solution strengthening)	IGC340W	0.40 to 3.00
		IGC370W	0.40 to 3.00
		IGC390W	0.40 to 3.00
		IGC440W	0.40 to 3.00
		IGC490W	0.60 to 3.00
		IGC540W	0.60 to 3.00
		IGC590W	0.60 to 3.00
v)	High strength low alloy	IGC310LA	0.40 to 3.00
		IGC320LA	0.40 to 3.00
		IGC350LA	0.40 to 3.00
		IGC380LA	0.40 to 3.00
		IGC410LA	0.40 to 3.00
		IGC440LA	0.60 to 3.00
		IGC470LA	0.60 to 3.00
		IGC510LA	0.60 to 3.00
		IGC550LA	0.60 to 3.00
		IGC590LA	0.60 to 3.00
		IGC600LA	0.60 to 3.00
		IGC700LA	0.60 to 3.00
		IGC860LA	0.60 to 3.00
vi)	Dual phase steel	IGC450Y	0.40 to 3.00
		IGC490Y	0.40 to 3.00
		IGC540Y	0.40 to 3.00
		IGC590YL	0.40 to 3.00
		IGC590Y	0.40 to 3.00
		IGC590YH	0.40 to 3.00
		IGC780Y	0.60-3.00
		IGC780YH	0.60 to 3.00
		IGC980YL	0.80 to 3.00

Table 1 (*Concluded*)

Sl No.	Type and Designation		Applicable Nominal Thickness mm
(1)	(2)	(3)	(4)
		IGC980Y	0.80 to 3.00
		IGC980YH	0.80 to 3.00
		IGC1180YL	0.80 to 3.00
		IGC1180Y	0.80 to 3.00
		IGC1180YH	0.80 to 3.00
vii)	Ferrite–bainite steel	IGC440FB	0.40 to 3.00
		IGC590FB	0.60 to 3.00
viii)	TRIP steel	IGC590T	0.40 to 3.00
		IGC690T	0.60 to 3.00
		IGC780T	0.70 to 3.00
ix)	Complex phase steel	IGC600N	0.40 to 3.00
		IGC780N	0.70 to 3.00
		IGC980N	0.80 to 3.00
x)	Martensite-type steel sheet	IGC900M	0.80 to 3.00
		IGC1100M	0.80 to 3.00
		IGC1300M	0.80 to 3.00
		IGC1500M	0.80 to 3.00

NOTES

1 For any thickness greater than or less than the mentioned range, the same can be produced as mutually agreed to between the manufacturer and the purchaser. Acceptance criteria for the range out of the available product range shall be as agreed to between the purchaser and the manufacturer.

2 The nomenclature of grade is explained in Annex C.

3 For zinc-iron alloy (A) product, grade designation in above table shall be read as “IAC” instead of “IGC”

Table 2 Type and Designation (for Hot-Rolled Substrate)

(*Clause* 4.2)

Sl No.	Type and Designation		Applicable Nominal Thickness mm
(1)	(2)	(3)	(4)
i)	Mild steel sheet	IGH270C	1.4 to 6.0
		IGH270D	1.4 to 6.0
		IGH270E	1.4 to 6.0
ii)	Commercial type steel sheet (solid solution strengthening)	IGH290S	1.4 to 6.0
		IGH310S	1.4 to 6.0
		IGH330S	1.4 to 6.0
		IGH360S	1.4 to 6.0
		IGH370S	1.4 to 6.0
		IGH400S	1.4 to 6.0
		IGH410S	1.4 to 6.0
		IGH440S	1.4 to 6.0
		IGH490S	1.4 to 6.0
iii)	High hole expansion ration type steel sheet	IGH440FB	1.4 to 6.0
		IGH590FB	1.4 to 6.0
iv)	High strength low alloy (high yield ratio type steel)	IGH320LA	1.4 to 6.0
		IGH360LA	1.4 to 6.0
		IGH390LA	1.4 to 6.0
		IGH410LA	1.6 to 6.0
		IGH430LA	1.6 to 6.0
		IGH450LA	1.6 to 6.0
		IGH480LA	1.6 to 6.0
		IGH500LA	1.6 to 6.0
		IGH550LA	2.0 to 6.0
		IGH600LA	2.0 to 6.0
		IGH650LA	2.0 to 6.0
		IGH700LA	2.0 to 6.0
		IGH750LA	2.0 to 6.0
v)	High strength structural steel (HSLA type)	IGH440R	1.6 to 6.0
		IGH490R	1.6 to 6.0
		IGH540R	2.0 to 6.0
		IGH590R	2.0 to 6.0
		IGH780R	2.0 to 6.0

NOTES

1 For any thickness greater than or less than the mentioned range, the same can be produced as mutually agreed to between the manufacturer and the purchaser. Acceptance criteria for the range out of the available product range shall be as agreed to between the purchaser and the manufacturer.

2 The nomenclature of the grade is explained in Annex C.

3 For zinc-iron alloy (A) product, the grade designation in above table shall be read as “IAH” instead of “IGH”

Table 3 Ageing Properties (for Cold-Rolled Substrate)

(*Clauses* 5.2.2 *and* 8.1.3.4)

Sl No.	Type and Designation (for Cold-Rolled Substrate)		Non-Ageing Characteristics
(1)	(2)	(3)	(4)
i)	Mild steel sheet	IGC270C	—
		IGC270D	Delayed ageing
		IGC270E	Non ageing
		IGC270F	Non ageing
		IGC260G	Non ageing
		IGCCR1	—
		IGCCR2	Delayed ageing
		IGCCR3	Delayed ageing
		IGCCR4	Non ageing
		IGCCR5	Non ageing
		IGCCR6	Non ageing
ii)	Bake-hardening type steel sheets	IGC270B	Delayed ageing
		IGC290B	Delayed ageing
		IGC320B	Delayed ageing
		IGC335B	Delayed ageing
		IGC340B	Delayed ageing
		IGC360B	Delayed ageing
		IGC400B	Delayed ageing
		IGC440B	Delayed ageing
iii)	Interstitial free-high strength steel	IGC280P	Non ageing
		IGC330P	Non ageing
		IGC335P	Non ageing
		IGC340P	Non ageing
		IGC360P	Non ageing
		IGC370P	Non ageing
		IGC380P	Non ageing
		IGC385P	Non ageing
		IGC390P	Non ageing
		IGC440P	Non ageing
iv)	Commercial type steel sheet (solid solution strengthening)	IGC340W	—
		IGC370W	—
		IGC390W	—
		IGC440W	—
		IGC490W	—
		IGC540W	—
		IGC590W	—
v)	High strength low alloy	IGC310LA	—
		IGC320LA	—
		IGC350LA	—
		IGC380LA	—

Table 3 (*Concluded*)

Sl No.	Type and Designation (for Cold-Rolled Substrate)		Non-Ageing Characteristics
(1)	(2)	(3)	(4)
		IGC410LA	—
		IGC440LA	—
		IGC470LA	—
		IGC510LA	—
		IGC550LA	—
		IGC590LA	—
		IGC600LA	—
		IGC700LA	—
		IGC860LA	—
vi)	Dual phase steel	IGC450Y	—
		IGC490Y	—
		IGC540Y	—
		IGC590YL	—
		IGC590Y	—
		IGC590YH	—
		IGC780Y	—
		IGC780YH	—
		IGC980YL	—
		IGC980Y	—
		IGC980YH	—
		IGC1180YL	—
		IGC1180Y	—
		IGC1180YH	—
vii)	Ferrite — Bainite steel	IGC440FB	—
		IGC590FB	—
viii)	TRIP steel	IGC590T	—
		IGC690T	—
		IGC780T	—
ix)	Complex phase steel	IGC600N	—
		IGC780N	—
		IGC980N	—
x)	Martensite-type steel sheet	IGC900M	—
		IGC1100M	—
		IGC1300M	—
		IGC1500M	—

NOTES

1 Table 3 is applicable for corresponding zinc coating (G) and zinc-iron alloy coating (A). (—) non-ageing guarantee is not applicable.

2 For grades where the non-ageing guarantee is not applicable type of non-ageing characteristics can be mutually agreed to between the manufacturer and the purchaser, before placing an order.

3 For zinc-iron alloy (A) product, the grade designation in above table shall be read as “IAC” instead of “IGC”

Table 4A Chemical Composition (for Cold-Rolled Substrate)

(*Clauses* 7.1, 7.2 *and Table* 5)

Sl No.	Type and Designation		Constituents, Percent *Max*			
			C	Mn	S	P
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Mild steel sheet	IGC270C	0.15	1.00	0.035	0.040
		IGC270D	0.1	0.60	0.030	0.030
		IGC270E	0.01	0.45	0.030	0.025
		IGC270F	0.01	0.30	0.020	0.020
		IGC260G	0.01	0.20	0.020	0.020
		IGCCR1	0.12	0.60	0.045	0.065
		IGCCR2	0.10	0.50	0.045	0.065
		IGCCR3	0.08	0.50	0.030	0.030
		IGCCR4	0.01	0.40	0.025	0.025
		IGCCR5	0.01	0.30	0.020	0.025
		IGCCR6	0.01	0.30	0.020	0.025
ii)	Bake-hardening steel	IGC270B	0.04	0.80	0.020	0.080
		IGC290B	0.04	0.80	0.020	0.080
		IGC320B	0.04	0.80	0.020	0.080
		IGC335B	0.04	1.00	0.020	0.100
		IGC340B	0.04	1.20	0.020	0.100
		IGC360B	0.04	1.20	0.020	0.120
		IGC400B	0.04	1.20	0.020	0.120
		IGC440B	0.04	1.40	0.020	0.120
iii)	Interstitial free-high strength steel	IGC280P	0.01	0.80	0.025	0.080
		IGC330P	0.01	0.80	0.025	0.080
		IGC335P	0.01	0.80	0.025	0.080
		IGC340P	0.01	1.00	0.025	0.080
		IGC360P	0.01	1.20	0.025	0.100
		IGC370P	0.01	1.20	0.025	0.100
		IGC380P	0.01	1.60	0.025	0.120
		IGC385P	0.01	1.80	0.025	0.120
		IGC390P	0.01	1.80	0.025	0.120
		IGC440P	0.01	1.80	0.025	0.120
iv)	Commercial type steel sheet (solid solution strengthening)	IGC340W	0.12	0.90	0.030	0.060
		IGC370W	0.15	1.30	0.030	0.060
		IGC390W	0.20	1.50	0.030	0.060
		IGC440W	0.20	1.70	0.030	0.060
		IGC490W	0.20	2.00	0.030	0.060
		IGC540W	0.20	2.50	0.030	0.060
		IGC590W	0.25	2.50	0.030	0.060
v)	High strength low alloy	IGC310LA	0.10	1.00	0.025	0.070
		IGC320LA	0.10	1.00	0.025	0.070
		IGC350LA	0.10	1.20	0.025	0.070

Table 4A (*Concluded*)

Sl No.	Type and Designation		Constituents, Percent Max			
			C	Mn	S	P
(1)	(2)	(3)	(4)	(5)	(6)	(7)
		IGC380LA	0.12	1.40	0.025	0.070
		IGC410LA	0.12	1.50	0.025	0.070
		IGC440LA	0.12	1.60	0.025	0.070
		IGC470LA	0.14	1.60	0.025	0.070
		IGC510LA	0.14	1.80	0.025	0.070
		IGC550LA	0.14	1.80	0.025	0.070
		IGC590LA	0.16	2.50	0.025	0.070
		IGC600LA	0.16	2.50	0.025	0.070
		IGC700LA	0.16	2.50	0.025	0.070
		IGC860LA	0.18	3.00	0.025	0.070
vi)	Dual phase steel	IGC450Y	0.15	2.00	0.020	0.100
		IGC490Y	0.15	2.00	0.020	0.100
		IGC540Y	0.15	2.20	0.020	0.100
		IGC590YL	0.15	2.50	0.020	0.100
		IGC590Y	0.15	2.50	0.020	0.100
		IGC590YH	0.15	2.50	0.020	0.100
		IGC780Y	0.18	2.50	0.020	0.100
		IGC780YH	0.18	2.50	0.020	0.100
		IGC980YL	0.25	3.50	0.020	0.100
		IGC980Y	0.25	3.50	0.020	0.100
		IGC980YH	0.25	3.50	0.020	0.100
		IGC1180YL	0.30	3.50	0.020	0.100
		IGC1180Y	0.30	3.50	0.020	0.100
		IGC1180YH	0.30	3.50	0.020	0.100
vii)	Ferrite-bainite steel	IGC440FB	0.15	2.00	0.020	0.100
		IGC590FB	0.15	2.50	0.020	0.100
viii)	TRIP steel	IGC590T	0.30	2.20	0.015	0.100
		IGC690T	0.35	2.50	0.015	0.100
		IGC780T	0.35	2.50	0.015	0.100
ix)	Complex phase steel	IGC600N	0.18	2.20	0.015	0.100
		IGC780N	0.18	3.00	0.015	0.100
		IGC980N	0.20	3.50	0.015	0.100
x)	Martensite-type steel sheet	IGC900M	0.25	3.50	0.015	0.100
		IGC1100M	0.30	4.00	0.015	0.100
		IGC1300M	0.30	4.00	0.015	0.100
		IGC1500M	0.30	4.00	0.015	0.100

NOTES

1 Steels of these grades can be supplied with the addition of micro-alloying elements like boron, titanium, niobium and vanadium either singly or in combination as per the above table. However, boron addition will be restricted to 0.006 percent max.

2 The nitrogen content of the steel shall not be more than 0.009 percent. For aluminum killed or aluminum silicon killed the nitrogen content shall not exceed 0.012 percent. This shall be ensured by occasional checking.

3 The elements (e.g. Cr, Mo, Ni, etc) not mentioned in the above table can be added up to 1 percent max either singly or in combination.

4 Restricted chemical composition may be mutually agreed to between the purchaser and the supplier.

5 For zinc-iron alloy (A) product, the grade designation in the above table shall be read as “IAC” instead of “IGC” for cold-rolled substrate and “IAH” instead of “IGH” for hot-rolled substrate.

Table 4B Chemical Composition (for Hot-Rolled Substrate)

(*Clauses* 7.1, 7.2 *and Table* 5)

Sl No.	Type and Designation (for Hot-Rolled Substrate)		Constituents, Percent *Max*				
			C	Mn	S	P	Micro-Alloy
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mild steel sheet	IGH270C	0.08	0.45	0.035	0.035	0.15
		IGH270D	0.08	0.40	0.030	0.030	0.15
		IGH270E	0.08	0.35	0.030	0.030	0.15
ii)	Commercial type steel sheet (solid solution strengthening)	IGH290S	0.12	0.60	0.040	0.040	0.15
		IGH310S	0.15	0.80	0.030	0.040	0.15
		IGH330S	0.15	0.80	0.040	0.040	0.15
		IGH360S	0.17	1.20	0.040	0.040	0.15
		IGH370S	0.17	1.20	0.030	0.040	0.15
		IGH400S	0.20	1.30	0.030	0.040	0.15
		IGH410S	0.20	1.30	0.040	0.040	0.15
		IGH440S	0.24	1.50	0.030	0.040	0.15
		IGH490S	0.24	1.60	0.040	0.040	0.15
iii)	High hole expansion ratio type steel sheet	IGH440FB	0.16	1.60	*	*	0.20
iv)	High strength low alloy (high yield ratio type steel)	IGH320LA	0.12	1.20	0.020	0.025	0.22
		IGH360LA	0.12	1.20	0.020	0.025	0.22
		IGH390LA	0.12	1.30	0.020	0.025	0.22
		IGH410LA	0.12	1.40	0.020	0.025	0.22
		IGH430LA	0.12	1.50	0.020	0.025	0.22
		IGH450LA	0.12	1.50	0.020	0.025	0.22
		IGH480LA	0.12	1.50	0.015	0.025	0.22
		IGH500LA	0.12	1.60	0.015	0.025	0.22
		IGH550LA	0.12	1.70	0.015	0.025	0.22
		IGH600LA	0.12	1.80	0.015	0.025	0.22
		IGH650LA	0.12	1.90	0.015	0.025	0.22
		IGH700LA	0.12	2.00	0.015	0.025	0.22
		IGH750LA	0.12	2.10	0.015	0.025	0.22
v)	High strength structural steel (HSLA type)	IGH440R	0.20	1.50	0.020	0.030	0.20
		IGH490R	0.20	1.60	0.020	0.030	0.20
		IGH540R	0.20	1.70	0.020	0.030	0.20
		IGH590R	0.20	1.80	0.020	0.030	0.20
		IGH780R	0.20	2.00	0.020	0.030	0.25

NOTES

1 Steels of these grades can be supplied with the addition of micro-alloying elements like boron, titanium, niobium and vanadium either singly or in combination as per the above table. However, boron addition will be restricted to 0.006 percent max.

2 The nitrogen content of the steel shall not be more than 0.009 percent. For aluminum killed or aluminum silicon killed the nitrogen content shall not exceed 0.012 percent. This shall be ensured by occasional checking.

3 The elements (e.g. Cr, Mo, Ni, etc) not mentioned in the above table can be added up to 1 percent max either singly or in combination.

4 Restricted chemical composition may be mutually agreed to between the purchaser and the supplier.

5 For zinc-iron alloy (A) product, the grade designation in the above table shall be read as "IAC" instead of "IGC" for cold-rolled substrate and "IAH" instead of "IGH" for hot-rolled substrate.

*As per mutual agreement between the purchaser and the supplier.

Table 5 Variation in Product Analysis (for Cold-Rolled & Hot-Rolled Substrate as Mentioned in Table 4A & Table 4B Respectively)

(*Clause* 7.2)

Sl No.	**Element**	**Specified Chemical Composition Limit** Percent	**Variation Over/Under Specified Limit** Percent, *Max*
(1)	(2)	(3)	(4)
i)	Carbon	≤ 0.150	0.020
		> 0.150	0.030
ii)	Manganese	≤ 0.600	0.030
		> 0.600, ≤ 1.150	0.040
		≥ 1.150	0.050
iii)	Sulphur	≤ 0.050	0.005
iv)	Phosphorus	≤ 0.050	0.005
		> 0.050	0.010
v)	Silicon	≤ 0.600	0.03
		> 0.600	0.06
vi)	Micro-alloy	—	Subject to mutual agreement between the manufacturer and the purchaser

NOTE — For carbon content less than 0.10 percent, variation over/under the specified limit can be mutually agreed to between the purchaser and the manufacturer.

Table 6A Mechanical Properties [for Cold-Rolled Substrate on Type 3 Specimen as Per IS 1608 (Part 1)]

(*Clauses* 8.1.1, 8.1.3.1, 8.1.3.4, 8.1.3.5, 8.2.2, 8.3.2, 8.4, 8.5 *and Annex* B)

Sl No.	**Type and Designation**		**Tensile Strength** N/mm^2 *Min*	**Yield Point or Proof Stress** N/mm^2			**Elongation,** Percent								**BH** N/mm^2	**HER** Percent	**Testing Direction**	**Mean Plastic Strain Ratio (*r*-bar)**, *Min*	**Strain Hardening Component (*n*–bar)**, *Min*
				Specified Thickness *t*, mm			Specified Thickness *t*, mm												
				$0.4 \leq t < 0.8$	$0.8 \leq t < 1.0$	$1.0 \leq t < 3.0$	$0.4 \leq t < 0.6$	$0.6 \leq t < 0.8$	$0.8 \leq t < 1.0$	$1.0 \leq t < 1.2$	$1.2 \leq t < 1.6$	$1.6 \leq t < 2.0$	$2.0 \leq t < 2.5$	$2.5 \leq t \leq 3.0$					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
i)	Mild steel sheet	IGC270C	270	185 to 305	175 to 295	165 to 285	35 to 44	36 to 45	37 to 46	38 to 47	39 to 48	40 to 51	41 to 53	42 to 55	—	—	Rolling	—	—
		IGC270D	270	135 to 225	125 to 215	115 to 205	40 to 49	41 to 50	42 to 51	43 to 52	44 to 54	45 to 56	46 to 58	47 to 58	—	—	Rolling	1.1	0.150
		IGC270E	270	130 to 205	120 to 195	110 to 185	42 to 50	43 to 51	44 to 52	45 to 53	46 to 55	47 to 57	48 to 59	49 to 60	—	—	Rolling	1.3	0.180
		IGC270F	270	120 to 185	110 to 175	100 to 165	44 to 52	45 to 53	46 to 54	47 to 55	48 to 57	49 to 59	50 to 60	—	—	—	Rolling	1.4	0.200
		IGC260G	260	110 to 185	100 to 175	90 to 165	45 to 53	46 to 54	47 to 55	48 to 56	49 to 57	50 to 59	51 to 61	—	—	—	Rolling	1.5	0.220
ii)	Bake-hardening steel	IGC270B	270	135 to 225	125 to 215	115 to 205	40 to 50	41 to 51	42 to 52	43 to 53	44 to 54	45 *Min*			30 *Min*	—	Rolling	—	0.180
		IGC340B	340	195 to 295	185 to 285	175 to 275	33 to 43	34 to 44	35 to 45	36 to 46	37 to 47	38 *Min*			30 *Min*	—	Transverse	—	0.150
		IGC440B	440	265 to 375	255 to 365	245 to 355	25 to 36	26 to 37	27 to 38	28 to 39	29 to 40	29 *Min*			30 *Min*	—	Transverse	—	0.120

Table 6A (*Continued*)

Sl No.	**Type and Designation**		**Tensile Strength** N/mm² *Min*	**Yield Point or Proof Stress** N/mm²			**Elongation,** Percent								**BH** N/mm²	**HER** Percent	**Testing Direction**	**Mean Plastic Strain Ratio (*r*-bar)**, *Min*	**Strain Hardening Component (*n*–bar)**, *Min*
				Specified Thickness *t*, mm			Specified Thickness *t*, mm												
				$0.4 \leq t < 0.8$	$0.8 \leq t < 1.0$	$1.0 \leq t < 3.0$	$0.4 \leq t < 0.6$	$0.6 \leq t < 0.8$	$0.8 \leq t < 1.0$	$1.0 \leq t < 1.2$	$1.2 \leq t < 1.6$	$1.6 \leq t < 2.0$	$2.0 \leq t < 2.5$	$2.5 \leq t \leq 3.0$					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
iii)	Interstitial free-high strength steel	IGC340P	340	175 to 265	165 to 255	155 to 245	34 to 44	35 to 45	36 to 46	37 to 47	38 to 48	39 *Min*			—	—	Transverse	—	0.200
		IGC370P	370	185 to 275	175 to 265	165 to 255	32 to 42	33 to 43	34 to 44	35 to 45	36 to 46	37 *Min*			—	—	Transverse	1.3	0.180
		IGC390P	390	215 to 315	205 to 305	195 to 295	30 to 41	31 to 42	32 to 43	33 to 44	34 to 45	35*Min*			—	—	Transverse	1.3	0.160
		IGC440P	440	255 to 365	245 to 355	235 to 345	26 to 37	27 to 38	28 to 39	29 to 40	30 to 41	31 *Min*			—	—	Transverse	1.2	0.150
iv)	C -Mn steel	IGC340W	340	215 to 315	205 to 305	195 to 295	32 to 42	33 to 43	34 to 44	35 to 45	36 to 46	37 *Min*			—	—	Transverse	—	—
		IGC370W	370	225 to 325	215 to 315	205 to 305	29 to 39	30 to 40	31 to 41	32 to 42	33 to 43	34 *Min*			—	—	Transverse	—	—
		IGC390W	390	255 to 365	245 to 355	235 to 345	28 to 39	29 to 40	30 to 41	31 to 42	32 to 43	33 *Min*			—	—	Transverse	—	—
		IGC440W	440	295 to 400	285 to 390	275 to 380	25 to 37	26 to 38	27 to 39	28 to 40	29 to 41	30 *Min*			—	—	Transverse	—	—
		IGC490W	490	315 to 420	305 to 410	305 to 410	—	22 to 34	22 to 34	23 to 35	23 to 35	23 *Min*			—	—	Transverse	—	—
		IGC540W	540	335 to 440	325 to 430	325 to 430	—	19 to 31	19 to 31	20 to 32	20 to 32	20 *Min*			—	—	Transverse	—	—

Table 6A (*Continued*)

Sl No.	Type and Designation		Tensile Strength N/mm² *Min*	Yield Point or Proof Stress N/mm²			Elongation, Percent								BH N/mm²	HER Percent	Testing Direction	Mean Plastic Strain Ratio (*r*-bar), *Min*	Strain Hardening Component (*n*–bar), *Min*
				Specified Thickness *t*, mm			Specified Thickness *t*, mm												
				$0.4 \leq t < 0.8$	$0.8 \leq t < 1.0$	$1.0 \leq t < 3.0$	$0.4 \leq t < 0.6$	$0.6 \leq t < 0.8$	$0.8 \leq t < 1.0$	$1.0 \leq t < 1.2$	$1.2 \leq t < 1.6$	$1.6 \leq t < 2.0$	$2.0 \leq t < 2.5$	$2.5 \leq t \leq 3.0$					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
		IGC590W	590	365 to 470	355 to 460	355 to 460	—	16 to 28	16 to 28	17 to 29	17 to 29	17 *Min*			—	—	Transverse	—	—
v)	High strength low alloy	IGC590LA	590	440 to 590	430 to 580	420 to 570	—	14 to 29	15 to 30	16 to 31	17 to 32	17 *Min*			—	—	Transverse	—	—
vi)	Dual phase steel	IGC450Y	450	270 to 360	260 to 370	250 to 340	24 to 40	25 to 41	26 to 42	28 to 44	28 to 44	28 *Min*			—	—	Transverse	—	—
		IGC490Y	490	245 to 390	235 to 380	225 to 370	20 to 36	21 to 37	22 to 38	23 to 39	24 to 40	24 *Min*			—	—	Transverse	—	—
		IGC540Y	540	265 to 410	255 to 400	245 to 390	16 to 33	17 to 34	18 to 35	19 to 36	20 to 37	20 *Min*			—	—	Transverse	—	—
		IGC590YL	590	300 to 400	290 to 390	280 to 380	16 to 31	17 to 32	18 to 33	19 to 34	20 to 35	22 *Min*			—	—	Transverse	—	—
		IGC590Y	590	340 to 460	330 to 450	320 to 440	—	16 to 31	17 to 32	18 to 33	19 to 34	20 *Min*			—	—	Transverse	—	—
		IGC590YH	590	425 to 570	415 to 560	405 to 550	—	15 to 30	16 to 31	17 to 32	18 to 33	18 *Min*			—	—	Transverse	—	—
		IGC780Y	780	420 to 645	410 to 635	400 to 625	—	11 to 24	12 to 25	13 to 26	14 to 27	15 *Min*			—	—	Transverse	—	—
		IGC780YH	780	570 to 690	560 to 680	550 to 670	—	10 to 23	11 to 24	12 to 25	13 to 26	13 *Min*			—	—	Transverse	—	—
		IGC980YL	980	—	580 to 750	580 to 740	—	—	9 to 19	10 to 20	11 to 21	12 *Min*			—	—	Transverse	—	—
		IGC980Y	980	—	580 to 930	580 to 920	—	—	8 to 19	9 to 20	10 to 21	11 *Min*			—	—	Transverse	—	—

Table 6A (*Continued*)

Sl No.	Type and Designation		Tensile Strength N/mm² *Min*	Yield Point or Proof Stress N/mm²			Elongation, Percent								BH N/mm²	HER Percent	Testing Direction	Mean Plastic Strain Ratio (*r*-bar), *Min*	Strain Hardening Component (*n*–bar), *Min*
				Specified Thickness *t*, mm			Specified Thickness *t*, mm												
				0.4 ≤ *t* < 0.8	0.8 ≤ *t* < 1.0	1.0 ≤ *t* < 3.0	0.4 ≤ *t* < 0.6	0.6 ≤ *t* < 0.8	0.8 ≤ *t* < 1.0	1.0 ≤ *t* < 1.2	1.2 ≤ *t* < 1.6	1.6 ≤ *t* < 2.0	2.0 ≤ *t* < 2.5	2.5 ≤ *t* ≤ 3.0					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
		IGC980YH	980	—	730 to 930	720 to 920	—	—	8 to 18	9 to 19	10 to 20	11 *Min*			—	—	Transverse	—	—
		IGC1180YL	1 180	—	750 to 990	740 to 980	—	—	5 to 15	6 to 17	7 to 17	7 *Min*			—	—	Transverse	—	—
		IGC1180Y	1 180	—	700 to 1 225	700 to 1 215	—	—	5 to 16	5 to 17	6 to 18	7 *Min*			—	—	Transverse	—	—
		IGC1180YH	1 180	—	870 to 1 210	860 to 1 200	—	—	5 to 16	6 to 17	7 to 18	8 *Min*			—	—	Transverse	—	—
vii)	Ferrite–bainite steel	IGC440FB	440	295 to 400	285 to 390	275 to 380	25 to 37	26 to 38	27 to 39	28 to 40	29 to 41	30 *Min*			—	65*Min*	Transverse	—	—
		IGC590FB	590	370 to 590	360 to 580	350 to 570	—	14 to 29	15 to 30	16 to 31	17 to 32	17 *Min*			—	45*Min*	Transverse	—	—
viii)	TRIP steel	IGC590T	590	370 to 520	360 to 510	350 to 500	—	26 to 41	27 to 42	28 to 43	29 to 44	30 *Min*			—	—	Transverse	—	—
		IGC690T	690	390 to 540	380 to 530	370 to 520	—	21 to 36	22 to 37	23 to 38	24 to 39	24 *Min*			—	—	Transverse	—	—
		IGC780T	780	420 to 570	410 to 560	400 to 550	—	16 to 31	17 to 32	18 to 33	19 to 34	20 *Min*			—	—	Transverse	—	—
ix)	Complex phase steel	IGC600N	600	350 to 540	350 to 530	350 to 520	12	13	14 *Min*						—	—	Transverse	—	—
		IGC780N	780	500 to 720	500 to 710	500 to 700	—	8							—	—	Transverse	—	—
		IGC980N	980	—	690 to 910	700 to 900	—	—	6 *Min*	7 *Min*					—	—	—	—	—
x)	Martensite-type steel sheet	IGC900M	900	—	700 to 1 000		—	—	3 *Min*						—	—	Transverse	—	—
		IGC1100M	1100	—	860 to 1 100		—	—	3 *Min*						—	—	Transverse	—	—

Table 6A (*Concluded*)

Sl No.	Type and Designation		Tensile Strength N/mm² *Min*	Yield Point or Proof Stress N/mm²			Elongation, Percent								BH N/mm²	HER, Percent	Testing Direction	Mean Plastic Strain Ratio (*r*-bar), *Min*	Strain Hardening Component (*n*–bar), *Min*
				Specified Thickness *t*, mm			Specified Thickness *t*, mm												
				$0.4 \leq t < 0.8$	$0.8 \leq t < 1.0$	$1.0 \leq t < 3.0$	$0.4 \leq t < 0.6$	$0.6 \leq t < 0.8$	$0.8 \leq t < 1.0$	$1.0 \leq t < 1.2$	$1.2 \leq t < 1.6$	$1.6 \leq t < 2.0$	$2.0 \leq t < 2.5$	$2.5 \leq t \leq 3.0$					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
		IGC1300M	1300	—	1 030 to 1 300		—	—	2 *Min*						—	—	Transverse	—	—
		IGC1500M	1500	—	1 200 to 1 500		—	—	2 *Min*						—	—	Transverse	—	—

NOTES

1 1 N/mm² = 1MPa.

2 Stricter mechanical properties requirement may be agreed to between the manufacturer and the purchaser, before placing the order.

3 Mechanical properties apply only to annealed followed by skin-passed products.

4 The values of yield stress are the 0.2 percent proof stress for products which do not represent a marked yield point and the lower yield stress for the others.

5 (*r*-bar/*r*-90) and (*n*-values/*n*-90) values may be modified or excluded from this requirement, by agreement between the manufacturer and the purchaser.

6 (---) → not required.

7 Based on the mutual agreement between the purchaser and the manufacturer, different testing directions can be applied while conducting tensile tests. For such cases, mechanical properties requirement will be based on the mutual agreement and those agreed values should be reasonably close to the values mentioned in Table 6A and Table 6B.

8 Choice of properties: Properties are applicable as per thickness range provided in Table 6A and Table 6B. If mutually agreed to between the manufacturer and the purchaser and properties range (yield point of proof stress and elongation) is not required as per thickness range, the minimum and maximum values of the respective grade (yield point or proof stress and elongation) shall be considered as limits of yield point or proof stress and elongation. For example: in grade IGC270C, properties are not required as per thickness range, then, limits of yield point or proof stress: 165 MPa - 305 MPa and elongation: 36 percent – 55 percent.

9 For zinc-iron alloy (A) product, the grade designation in the above table shall be read as “IAC” instead of “IGC”

Table 6B Mechanical Properties [for Cold-Rolled Substrate on Type 2 Specimen as Per IS 1608 (Part 1)]

(*Clauses* 8.1.1, 8.1.3.1, 8.1.3.4, 8.1.3.5, 8.2.2, 8.3.2, 8.4 *and Annex* B)

Sl No.	**Type and Designation**		**Tensile Strength** N/mm^2 *Min*	**Yield point or proof stress** N/mm^2			**Elongation,** Percent *Min*			**Testing Direction**	**BH** N/mm^2	**Plastic strain Ratio (*r*-90)**, *Min*	**Strain Hardening Exponent Value (*n*-90)**, *Min*
				Thickness *t*, mm			Thickness *t*, mm						
				≤ 0.5	0.50 < *t* ≤ 0.7	t > 0.70	≤ 0.5	0.50 < t ≤ 0.7	*t* > 0.70				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
i)	Mild steel	IGCCR1	270	140 to 320	140 to 300	140 to 300	26	27	28	Transverse	—	—	—
		IGCCR2	270	120 to 260	120 to 240	120 to 240	32	33	34	Transverse	—	1.3	0.16
		IGCCR3	270	120 to 230	120 to 210	120 to 210	36	37	38	Transverse	—	1.8	0.18
		IGCCR4	270	120 to 200	120 to 180	120 to 180	37	38	39	Transverse	—	1.9	0.2
		IGCCR5	260	110 to 190	110 to 170	110 to 170	39	40	41	Transverse	—	2.1	0.22
		IGCCR6	260	110 to 180	110 to 160	110 to 160	40	41	42	Transverse	—	2.2	0.22
ii)	Bake-hardening steel	IGC290B	290	180 to 260	180 to 240	180 to 240	28	30	34	Transverse	30 *Min*	1.5	0.16
		IGC320B	320	220 to 300	220 to 280	220 to 280	28	30	32	Transverse	30 *Min*	1.2	0.15
		IGC335B	335	240 to 320	240 to 300	240 to 300	25	27	29	Transverse	30 *Min*	1.2	0.15
		IGC360B	360	260 to 340	260 to 320	260 to 320	24	26	28	Transverse	30 *Min*	—	—
		IGC400B	400	300 to 380	300 to 360	300 to 360	22	24	26	Transverse	30 *Min*	—	—
		IGC440B	440	340 to 420	340 to 400	340 to 400	20	22	24	Transverse	30 *Min*	—	—

Table 6B (*Continued*)

Sl No.	Type and Designation		Tensile Strength N/mm^2 *Min*	Yield point or proof stress N/mm^2			Elongation, Percent *Min*			Testing Direction	BH N/mm^2	Plastic strain Ratio (***r*-90**), *Min*	Strain Hardening Exponent Value (***n*-90**), *Min*
				Thickness *t*, mm			Thickness *t*, mm						
				≤ 0.5	0.50 < *t* ≤ 0.7	t > 0.70	≤ 0.5	0.50 < t ≤ 0.7	*t* > 0.70				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
iii)	Interstitial free - high strength steel	IGC280P	280	160 to 240	160 to 220	160 to 220	34	36	38	Transverse	—	1.9	0.20
		IGC330P	330	180 to 260	180 to 240	180 to 240	30	32	34	Transverse	—	1.7	0.18
		IGC335P	335	210 to 290	210 to 280	210 to 280	28	30	32	Transverse	—	1.5	0.17
		IGC360P	360	240 to 320	240 to 310	240 to 310	27	29	31	Transverse	—	1.4	0.16
		IGC380P	380	260 to 340	260 to 330	260 to 330	26	28	30	Transverse	—	1.4	0.16
		IGC385P	385	300 to 380	300 to 370	300 to 370	23	25	27	Transverse	—	1.3	0.15
iv)	High strength low alloy	IGC310LA	310	210 to 310	210 to 290	210 to 290	24	26	28	Transverse	—	—	0.16
		IGC320LA	320	240 to 340	240 to 320	240 to 320	22	24	26	Transverse	—	—	0.15
		IGC350LA	350	260 to 360	260 to 340	260 to 340	20	22	24	Transverse	—	—	0.15
		IGC380LA	380	300 to 400	300 to 380	300 to 380	17	19	23	Transverse	—	—	0.14
		IGC410LA	410	340 to 440	340 to 420	340 to 420	16	18	20	Transverse	—	—	0.13
		IGC440LA	440	—	380 to 480	380 to 480	13	15	17	Transverse	—	—	0.12
		IGC470LA	470	—	420 to 520	420 to 520	12	14	16	Transverse	—	—	0.11
		IGC510LA	510	—	460 to 580	460 to 580	—	10	12	Transverse	—	—	—
		IGC550LA	550	—	500 to 620	500 to 620	—	9	10	Transverse	—	—	—

Table 6B (*Concluded*)

Sl No.	**Type and Designation**		**Tensile Strength** N/mm^2 *Min*	**Yield point or proof stress** N/mm^2			**Elongation,** Percent *Min*			**Testing Direction**	**BH** N/mm^2	**Plastic strain Ratio (*r*-90)**, *Min*	**Strain Hardening Exponent Value (*n*-90)**, *Min*
				Thickness *t*, mm			Thickness *t*, mm						
				≤ 0.5	0.50 < *t* ≤ 0.7	t > 0.70	≤ 0.5	0.50 < t ≤ 0.7	*t* > 0.70				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
		IGC600LA	600	—	550 *Min*	550 *Min*	—	8	9	Transverse	—	—	—
		IGC700LA	700	—	—	650 *Min*	—	—	9	Transverse	—	—	—
		IGC860LA	860	—	—	800 *Min*	—	—	3	Transverse	—	—	—

NOTES

1 1N/mm^2 =1MPa.

2 Stricter mechanical properties requirement may be agreed to between the manufacturer and the purchaser, before placing the order. **3** Mechanical properties apply only to annealed followed by skin-passed products.

4 The values of yield stress are the 0.2 percent proof stress for products which do not represent a marked yield point and the lower yield stress for the others.

5 (*r*-bar/*r*-90) and (*n*-values/*n*-90) values may be modified or excluded from this requirement, by agreement between the manufacturer and the purchaser.

6 (—) → not required.

7 Based on the mutual agreement between the purchaser and the manufacturer, different testing directions can be applied while conducting tensile tests. For such cases, mechanical properties requirement will be based on the mutual agreement and those agreed values should be reasonably close to the values mentioned in Table 6A and Table 6B.

8 Choice of properties: Properties are applicable as per thickness range provided in Table 6A and Table 6B. If mutually agreed to between the manufacturer and the purchaser and properties range (yield point of proof stress and elongation) is not required as per thickness range, the minimum and maximum values of the respective grade (yield point or proof stress and elongation) shall be considered as limits of yield point or proof stress and elongation. For example: in grade IGC270C, properties are not required as per thickness range, then, limits of yield point or proof stress: 165 MPa - 305 MPa and elongation: 36 percent – 55 percent.

9 For zinc-iron alloy (A) product, the grade designation in the above table shall be read as “IAC” instead of “IGC”

Table 6C Mechanical Properties [for Hot-Rolled Substrate on Type 3 Specimen as Per IS 1608 (Part 1)]

(*Clauses* 8.1.1, 8.1.3.1, 8.1.3.5 *and* 8.5)

Sl No.	**Type and Designation**		**Tensile Strength** N/mm^2, *Min*	**Yield point or proof stress** N/mm^2, *Min*			**Elongation**, Percent *Min*			**Testing Direction**	**HER** Percent
				Specified Thickness *t*, mm			Specified Thickness *t*, mm				
				$t < 2.0$	$2.0 \leq t < 3.2$	$3.2 \leq t \leq 6.0$	$t < 2.0$	$2.0 \leq t < 3.2$	$3.2 \leq t \leq 6.0$		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	Mild steel sheet	IGH270C	270	170 *Min*	170 *Min*	170 *Min*	26	26	31	Transverse	—
		IGH270D	270	170 *Min*	170 *Min*	165 *Min*	29	29	34	Transverse	—
		IGH270E	270	165 *Min*	155 *Min*	145 *Min*	32	32	37	Transverse	—
ii)	Commercial type steel sheet (Solid solution strengthening)	IGH310S	310	195 *Min*	185 *Min*	175 *Min*	33	34	36	Rolling	—
		IGH370S	370	225 *Min*	215 *Min*	205 *Min*	32	33	36	Rolling	—
		IGH400S	400	245 to 375	235 to 365	225 to 355	31	32	35	Rolling	—
		IGH440S	440	285 to 410	275 to 400	265 to 390	29	30	33	Transverse	—
iii)	High strength structural steel (HSLA type)	IGH440R	440	305 to 450	305 to 440	305 to 430	26	27	28	Transverse	—
		IGH490R	490	375 to 500	365 to 490	355 to 480	22	23	24	Transverse	—
		IGH540R	540	430 to 570	420 to 560	410 to 550	19	20	21	Transverse	—
		IGH590R	590	480 to 630	460 to 620	450 to 610	17	17	19	Transverse	—
		IGH780R	780	—	685 to 835	675 to 825	—	14	15	Transverse	—

Table 6C (*Concluded*)

Sl No.	**Type and Designation**		**Tensile Strength** N/mm^2, *Min*	**Yield point or proof stress** N/mm^2, *Min*			**Elongation**, Percent *Min*			**Testing Direction**	**HER** Percent
				Specified Thickness *t*, mm			Specified Thickness *t*, mm				
				$t < 2.0$	$2.0 \leq t < 3.2$	$3.2 \leq t \leq 6.0$	t < 2.0	2.0 ≤ t < 3.2	3.2 ≤ t ≤ 6.0		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
iv)	High hole expansion ratio type steel sheet	IGH440FB	440	285 to 410	275 to 400	265 to 390	28	29	33	Rolling	70 *Min*

NOTES

1 N/mm^2 = 1MPa.

2 Stricter mechanical properties requirement may be agreed to between the manufacturer and the purchaser, before placing the order. Maximum values on yield point (yield strength) and elongation may be agreed to between the manufacturer and the purchaser.

3 Mechanical properties apply only to annealed followed by skin-passed products.

4 The values of yield stress are the 0.2 percent proof stress for products which do not represent a marked yield point and the lower yield stress for the others.

5 (---) → Not required.

6 Choice of properties: Properties are applicable as per thickness range provided in Table 6C and Table 6D. If mutually agreed to between the manufacture and the purchaser and properties range (yield point of proof stress and elongation) is not required as per thickness range, the minimum and maximum values of the respective grade (yield point or proof stress and elongation) shall be considered as limits of yield point or proof stress and elongation. For example: in grade IGH270E, properties are not required as per thickness range, then, limits of yield point or proof stress -145 MPa, *Min* and elongation - 32 percent, *Min*.

7 For zinc-iron alloy (A) product, the grade designation in the above table shall be read as “IAH” instead of “IGH”.

Table 6D Mechanical Properties [for Hot-Rolled Substrate on Type 2 Specimen as Per IS 1608 (Part 1)]

(*Clauses* 8.1.1, 8.1.3.1 *and* 8.1.3.5)

Sl No.	**Type and Designation**		**Tensile Strength** N/mm^2, *Min*	**Yield Point or Proof Stress** N/mm^2, *Min*	**Elongation (for $t \leq 3$ mm)**, Percent, *Min*	**Elongation (for $t > 3$ mm and GL $5.65\sqrt{S_o}$)**, Percent, *Min*	**Testing Direction**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Commercial type steel sheet (solid solution strengthening)	IGH290S	290 to 440	165	22	30	Transverse
		IGH330S	330 to 440	205	20	28	Transverse
		IGH360S	360 to 470	235	19	26	Transverse
		IGH410S	410 to 520	255	17	23	Transverse
		IGH490S	490 to 630	355	16	20	Transverse
ii)	High strength low alloy	IGH320LA	320 to 420	255	25	27	Transverse
		IGH360LA	360 to 460	300	23	25	Transverse
		IGH390LA	390 to 510	315	20	24	Transverse
		IGH410LA	410 to 520	340	20	23	Transverse
		IGH430LA	430 to 550	355	19	23	Transverse
		IGH450LA	450 to 570	380	18	21	Transverse
		IGH480LA	480 to 620	420	16	19	Transverse
		IGH500LA	500 to 670	450	14	18	Transverse
		IGH550LA	550 to 700	500	12	14	Transverse

Table 6D (*Concluded*)

Sl No.	**Type and Designation**		**Tensile Strength** N/mm^2, *Min*	**Yield Point or Proof Stress** N/mm^2, *Min*	**Elongation (for $t \leq 3$ mm)**, Percent, *Min*	**Elongation (for $t > 3$ mm and GL $5.65\sqrt{S_o}$)**, Percent, *Min*	**Testing Direction**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		IGH600LA	600 to 760	550	12	14	Transverse
		IGH650LA	650 to 820	600	11	13	Transverse
		IGH700LA	700 to 880	650	10	12	Transverse
		IGH750LA	750 to 950	700	10	11	Transverse

NOTES

1 N/mm^2=1MPa.

2 Stricter mechanical properties requirement may be agreed to between the manufacturer and the purchaser, before placing the order. Maximum values on yield point (yield strength) and elongation may be agreed to between the manufacturer and the purchaser.

3 Mechanical properties apply only to annealed followed by skin-passed products.

4 The values of yield stress are the 0.2 percent proof stress for products which do not represent a marked yield point and the lower yield stress for the others.

5 (---) → Not required.

6 Choice of properties: Properties are applicable as per thickness range provided in Table 6C and Table 6D. If mutually agreed to between the manufacture and the purchaser and properties range (yield point of proof stress and elongation) is not required as per thickness range, the minimum and maximum values of the respective grade (yield point or proof stress and elongation) shall be considered as limits of yield point or proof stress and elongation. For example: in grade IGH270E, properties are not required as per thickness range, then, limits of yield point or proof stress-145 MPa *Min* and elongation- 32 percent *Min*.

7 For zinc-iron alloy (A) product, the grade designation in the above table shall be read as “IAH” instead of “IGH”.

Table 6E Bend Test

(*Clause* 8.6.2)

Sl No.	Minimum Tensile Strength MPa	Bend Angle	Inside Bend Radius
(1)	(2)	(3)	(4)
i)	340	180^0	Close
ii)	370	180^0	Close
iii)	390	180^0	Close
iv)	440	180^0	Close
v)	490	180^0	Close
vi)	540	180^0	0.5 *t*
vii)	590	180^0	1.0 *t*
viii)	780	180^0	3.0 *t*
ix)	900	180^0	4.0 *t*
x)	980	180^0	4.0 *t*
xi)	1100	180^0	4.0 *t*
xii)	1300	180^0	4.0 *t*
xiii)	1500	180^0	4.0 *t*

NOTES

1 For grades, where a minimum tensile requirement is not mentioned in the above table, requirement for the nearest minimum tensile strength value can be applied.

2 bend radius *t* = nominal thickness.

Table 7 Coating Mass on Each Side

(*Clauses* 9.1 *and* 12.1.1)

SI No.	Coating Mass Designation g/m^2	Average Mass by One Side Triple – Spot Test g/m^2		Coating Density g/cm^3	Coating Thickness µm
		Min	*Max*		
(1)	(2)	(3)	(4)	(5)	(6)
Galvannealed (A) (cold-rolled and hot-rolled substrate)	A 25	25	45	7.1	3.5 to 6.3
	A 30	30	50		4.2 to 7.0
	A 35	35	55		4.9 to 7.7
	A 40	40	60		5.6 to 8.5
	A 45	45	65		6.3 to 9.2
	A 50	50	70		7.0 to 9.9
	A 55	55	75		7.7 to 10.6
	A 60	60	80		8.5 to 15.5
Galvanized (G) (cold-rolled and hot-rolled substrate)	G 30	30	50	7.1	4.2 to 7.0
	G 40	40	60		5.6 to 8.5
	G 50	50	70		7.0 to 9.9
	G 60	60	90		8.5 to 12.7
	G 70	70	100		9.9 to 14.1
	G 90	90	120		12.7 to 16.9
	G 100	100	130		14.1 to 18.3
	G 140	140	170		19.7 to 23.9
	G 275	275	320		38.7 to 45.1
	G350	350	400		49.3 to 56.3
	G450	450	520		63.4 to 73.2

NOTES

1 Equivalent Coating Thickness from the one side coating mass can be calculated by the following:

$$Tc = Ms/7.1$$

Where

Tc = Coating thickness on one side (µm); and

Ms = Single side coating mass (g/m^2).

2 Coating thickness provided here is for information only.

Table 8 Calculations of Mass of Sheets or Coils

(*Clause* 19.2)

Sl No.	Type of Material	Order of calculation	Methods of calculations	Number of Numerals in Resultant Value
(1)	(2)	(3)	(4)	(5)
i)	Sheet/plate	a) Mass of single sheet	Nominal mass of single sheet plus mass of zinc coating	Round off to 4 effective figures
		b) Total mass	Mass of single sheet (kg) × number of sheets	Round off to integral value of kg
ii)	Coil	a) Unit mass of coil	Unit mass of sheet (kg/m^2) × width (mm) × 10^4	Round off to 3 effective figures
		b) Mass of single coil	Unit mass of coil (kg/m) × length	—
		c) Total mass (kg)	(m) Total mass of each coil	Integral number of kg

NOTES

1 Nominal mass of single sheet shall be calculated by calculating the volume of the sheet and multiplying the same with density of sheet (density 7.85 g/cm^3) and rounding the same to 4 effective figures.

2 Mass of the coating shall be calculated by multiplying the surface area of the single sheet with indicated nominal coating mass (g/m^2) as shown for triple spot test (*see* Table 7).

ANNEX A

(*Clause* 2)

LIST OF REFERED STANDARDS

IS No.	*Title*
IS 209 : 1992	Zinc ingot — Specification (*fourth revision*)
IS 228 (all parts)	Method for chemical analysis of steel
IS 513	Cold reduced carbon steel sheet and strip:
(Part 1) : 2016	Cold forming and drawing purpose (*sixth revision*)
(Part 2) : 2016	High tensile and multi-phase steel (*sixth revision*)
IS 1079 : 2017	Hot rolled carbon steel sheet, plate and strip — Specification (*seventh revision*)
IS 1599 : 2019/ ISO 7438 : 2016	Metallic Materials — Bend Test (*fourth revision*)
IS 1608 (Part 1) : 2022/ISO 6892-1 : 2019	Metallic materials — Tensile testing: Part 1 Method of test at room temperature (*fifth revision*)
IS 1956 (Part 4) : 2013	Glossary of terms relating to iron and steel: Part 4 Flat products (*second revision*)
IS 2629 : 1985	Recommended practice for hot-dip galvanizing of iron and steel (*first revision*)
IS 5986 : 2017	Hot rolled steel sheet, plate and strip for forming and flanging purposes — specification (*fourth revision*)
IS 6745 : 1972	Methods for determination of mass of zinc coating on zinc coated iron and steel articles
IS 8910 : 2022/ ISO 404 : 2013	Steel and steel products — General technical delivery requirements (*second revision*)
IS 11999 : 2022/ ISO 10113 : 2020	Metallic materials — Sheet and strip — Determination of plastic strain ratio (*second revision*)
IS 12860 : 1989	Metallic coating thickness by X-rayfluorescence technique method — Determination
IS 13229 : 1991	Zinc for galvanizing — Specification
IS 15262 : 2002/ ISO 4287 : 1997	Geometrical product specifications (GPS) — Surface texture: Profile method — terms, definitions and surface texture parameters
IS 15756 : 2022/ ISO 10275 : 2020	Metallic materials — Sheet and strip — Determination of tensile strain hardening exponent (*first revision*)
IS/ISO 16163 : 2012	Continuously hot — Dipped coated steel sheet products — Dimensional and shape tolerances (*first revision*)
IS 17414 : 2020/ ISO 16630 : 2017	Metallic materials — Sheet and strip — Hole expanding test

ANNEX B

(*Clause* 8.4)

BAKE HARDENING TEST

The bake hardening index (BH) is the increase in the yield point that is found in the bake hardening test carried out. Bake hardening of steel is achieved during the paint baking treatment. The test procedure for the determination of bake hardening index is as follows:

a) Test specimen shall be collected from annealed and skin passed material in the direction mentioned as per Table 6A and 6B. Tensile specimen to be prepared as per IS 1608 (Part 1);

b) Parallel portion area of the test piece shall be noted as A_0;

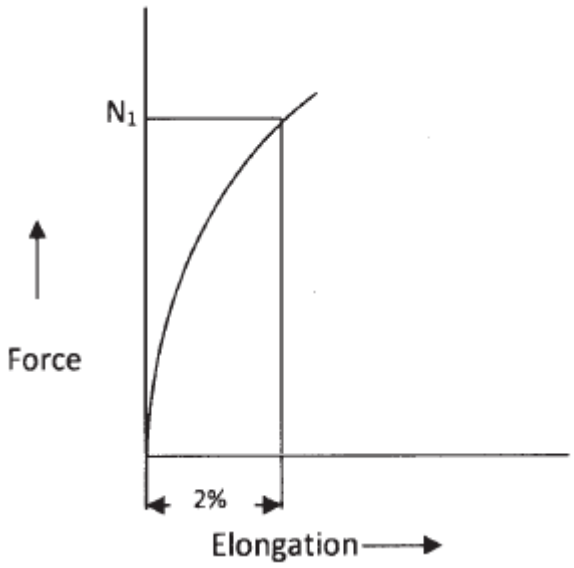
c) The test specimen shall be strained to 2 percent tensile elongation. The corresponding force shall be noted as N1;

d) The specimen shall be unloaded from tensile tester and heat treated for 20 min at a temperature of 170 ^oC;

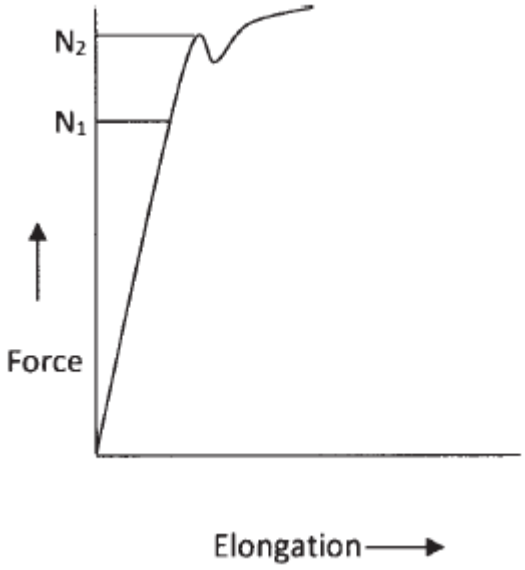
e) After the heat treatment, the test specimen shall be subjected to tensile testing again. The sharp yield point is expected to appear along with the yield drop phenomenon. The force corresponding to the upper yield point shall be noted as N_2;

f) The BH value calculation shall be obtained as $BH = (N_2 – N_1)/A_0$; and

g) BH value calculation is schematically represented in below Fig.



Preliminary strain loading



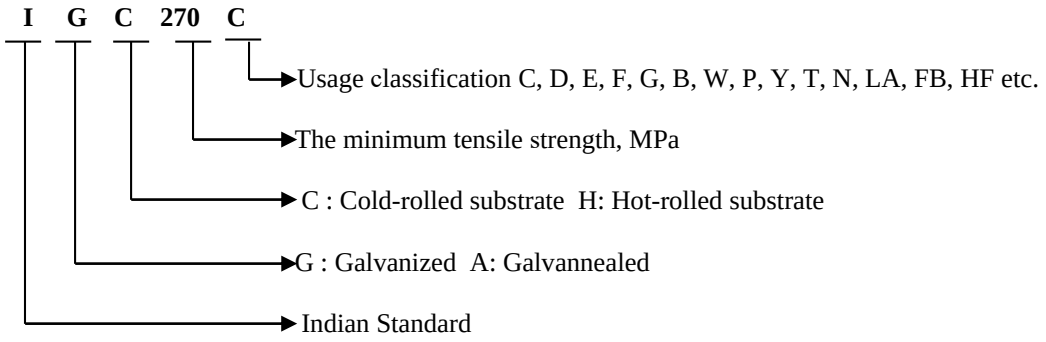
After heat treatment.

FIG. 2 BAKE HARDENING

ANNEX C

(*Table* 1 *and Table* 2)

NOMENCLATURE



YH: High yield ratio type of "Y" grade YL: Low yield ratio type of "Y" grade.

ANNEX D

(*Foreword*)

COMMITTEE COMPOSITION

Wrought Steel Products Sectional Committee, MTD 04

Organization	*Representative(s)*
SAIL, Research & Development Centre for Iron & Steel, Ranchi	SHRI NIRVIK BANERJEE **(*Chairperson*)**
All India Induction Furnace Association, New Delhi	SHRI A. K. SHARMA SHRI PRABHAKAR MISHRA (*Alternate*)
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Indian Machine Tools Manufacturers Association Begaluru	SHRI Y. BALARAMAIAH
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Tata Motors Ltd, Pune	SHRI PRADEEP KULKARNI SHRI LOKESH PALIWAL (*Alternate*)
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This Indian Standard has been developed from Doc No.: MTD 04 (21677).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Published by BIS, New Delhi