



नेपाल गुणस्तर
NEPAL STANDARD

HIGH TENSILE STRENGTH FLAT ROLLED STEEL PLATE (UP TO 6 mm), SHEET AND STRIP FOR THE MANUFACTURE OF WELDED GAS CYLINDER —SPECIFICATION



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Ministry of Industry, Commerce and Supplies
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Kathmandu, Nepal

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1 SCOPE

This standard covers the requirements for deep drawing quality hot rolled steel plate (up to 6 mm), sheet and strip for the manufacture of welded gas cylinders.

2 REFERENCES

The following standards contain provisions, which through reference 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 editions of the standards indicated below:

NS No.	Title
1.	XXX: (in various parts) Methods for chemical analysis of steels
2.	NS 203: 2046 Tensile <i>Testing of Metals</i>
3.	XXX: Steel plates, sheets, strips and flats for structural and general engineering purposes
4.	NS 414:2056 Terminology used in Iron and Steel.
5.	XXX: Steel — Conversion of elongation values: Part 1 Carbon and low alloy steels
6.	NS/ISO 404:2013: 2075 Steel and Steel Products - General Technical Delivery Requirements
7.	XXX: Recommended practice of pickling by H ₂ SO ₄ levelling and oiling of LPG sheets
8.	ISO 16160: 2005 Continuously hot-rolled steel sheet products — Dimensional and shape tolerances

3 TERMINOLOGY

For the purpose of this standard, definitions given in NS 414:2056 and the following shall apply.

3.1 Coil — A rolled flat strip product which is wound into regularly superimposed laps so as to form a coil with almost flat side. It shall have at least 50 laps.

3.2 Micro-alloying Elements — Elements, such as niobium, vanadium and titanium, added singly or in combination to obtain higher strength levels combined with better formability, weldability and toughness as compared with non-alloyed steel produced to equivalent strength levels.

4 SUPPLY OF MATERIAL

4.1 General requirements relating to the supply of material shall conform to NS/ISO 404:2013: 2075 *Steel and Steel Products - General Technical Delivery Requirements*.

4.2 Hot rolled steel plates and sheets covered by this standard shall be supplied in straight lengths and strips in coils.

5 MANUFACTURE

5.1 The processes used in making the steel and in manufacturing hot rolled steel plate, sheet and strip are left to the discretion of the manufacturer.

5.1.1 However, in case sheets and strips are manufactured through thin slab casting route, the manufacturing process shall be suitably qualified on the basis of adequate data to ensure freedom from centre line segregation, material inconsistency, internal cracks and poor surface quality.

5.2 The steel shall be of fully aluminium killed and non-ageing quality. However, other elements which, by binding the nitrogen, have a similar effect may also be used instead of, or in addition to, aluminium (*see also* Table 1).

6 CHEMICAL COMPOSITION

6.1 Ladle Analysis

Ladle analysis of the material, when carried out either by the method specified in the relevant parts of NS.... (*Methods for chemical analysis of steels*) or any other established instrumental/chemical method shall be as given in Table 1. In case of dispute, the procedure given in the relevant part of NS... (*Methods for chemical analysis of steels*) shall be the referee method.

Table 1 Chemical Composition
(*Clauses 5.2, 6.1 and 6.2*)

Sl No.	Constituent, Percent						
	Grade	Carbon <i>Max</i>	Manganese <i>Min</i>	Silicon <i>Max</i>	Sulphur <i>Max</i>	Phosphorus <i>Max</i>	Aluminium <i>Min</i>
i)	HS 235	0.16	0.30	0.25	0.025	0.025	0.015
ii)	HS 265	0.18	0.40	0.30	0.025	0.025	0.015
iii)	HS 295	0.19	0.50	0.35	0.025	0.025	0.015
iv)	HS 345	0.20	0.70	0.45	0.025	0.025	0.015

NOTES

1 Elements not listed in this table may not be added intentionally to the steel. All suitable arrangements are to be made to prevent such elements being added from scrap or other materials used during manufacture, which impair the mechanical properties and usability.

2 Steel may be supplied with the addition of micro-alloying elements like niobium, titanium, vanadium and boron. The microalloying elements shall not exceed 0.10 percent when added individually or in combination.

3 The nitrogen content of the steel shall not be more than 0.009 percent. This has to be ensured by the manufacturer by occasional check analysis.

However, where the method is not given in relevant NS and its parts, the referee method shall be as agreed to between the purchaser and the manufacturer.

6.1.1 Alternatively the method specified in relevant ISO/IEC Standard may be used.

6.2 Product Analysis

Permissible variations in case of product analysis from the limits specified in Table 1 shall be as given in Table 2.

Table 2 Permissible Variations for Product Analysis
(Clauses 5.2, 6.1 and 6.2)

Sl No.	Constituent,	Permissible Variations Over the Maximum and Under the Minimum Specified Limit, Percent, <i>Max</i>
i)	Carbon	0.02
ii)	Manganese	0.03
iii)	Silicon	0.03
iv)	Sulphur	0.005
v)	Phosphorus	0.005

NOTE — Aluminium content shall not be less than 0.015

7 TENSILE TEST

7.1 Number of Tensile Tests

Number of samples to be tested from a cast/heat, rolled or processed, shall be as follows:

- a) For cast/heat size up to 100 tonnes — 2 samples;
- b) For cast size between 100 and 200 tonnes — 3 samples; and
- c) For cast size over 200 tonnes — 4 samples.

The test pieces taken for tensile test shall be from the direction transverse to the direction of rolling. In case of coils, one sample shall be tested from each coil.

7.1.1 When plate, sheets and strips of more than one thickness are rolled from the same cast, one additional tensile test shall be made for each thickness.

7.2 Tensile Test

The tensile test shall be carried out in accordance with NS 203: 2046 (*Tensile Testing of Metals*), generally using a proportional gauge length $L_0 = 5.65 \sqrt{S_0}$, where S_0 is the cross-sectional area of the test piece. Test pieces with a nonproportional gauge length may be used; in this case the elongation values shall be converted in accordance with NS... (*Steel - Conversion Of Elongation Values: Part 1 Carbon And Low Alloy Steels*). The tensile strength, yield stress and percentage elongation shall be as given in Table 3.

7.2.1 Should a test piece break outside the middle half of its gauge length and the percentage elongation obtained is less than that specified, the test may be discarded at the option of the manufacturer and another test made from the sample selected representing the same cast and batch.

8 RETEST

If a test does not give the specified results, two additional tests shall be carried out at random on the same lot. Both retests shall conform to the requirements of this standard, otherwise, the lot shall be rejected.

9 FREEDOM FROM DEFECTS

The finished material shall be free from harmful defects such as seams, pipe, lamination, cracks, slivers, rolled-in-scale, blisters and pitted surface which will impair the drawability.

Table 3 Mechanical Properties
(Clause 7.2)

Sl No.	Grade	Tensile Strength MPa <i>Min</i>	Yield Stress MPa <i>Min</i>	Percent Elongation at Gauge 5.65 <i>S Min</i>	Reference Heat Length Treatment Austenitizing Temperature,
i)	HS 235	360-460	235	25	920-960
ii)	HS 265	410-510	265	22	890-930
iii)	HS 295	450-560	295	20	890-930
iv)	HS 245	490-610	345	18	880-920

NOTE — *The above properties are specified for cold formed and normalized cylinder. However tensile properties of hot rolled plate/sheet/strip are to be mutually agreed upon by the producer and by the cylinder manufacturer.*
Time at austenitizing temperature: approximately 2 min/mm of plate thickness.

NOTE — *When the material is supplied in the form of coils, the degree or amount of surface defects are expected to be more than in cut length sheets since the inspection of coils does not afford the same opportunity to reject the portion containing defects as with cut length. However, an excessive amount of defects may be a cause for rejection. It may be noted that hot rolled material may have some tertiary scale on the surface of the product and the presence of such scale should not be considered as surface defect.*

10 DIMENSIONS AND TOLERANCES

10.1 Unless otherwise specified, the dimensions of steel plate, sheet and strip shall conform to the dimensions as given in NS... (*Dimensions for steel plates, sheets strips and flats for general engineering purposes*).

10.2 Unless otherwise specified, the dimensional and shape tolerances of steel plate, sheet and strip shall conform to the requirements as given in ISO 16160.

11 CONDITION OF DELIVERY

11.1 The delivery condition shall be agreed at the time of enquiry and order. The material may be supplied in 'hot rolled and normalized' or 'hot rolled under controlled conditions'.

The products can however, also be delivered in other conditions such as,

- a) hot rolled;
- b) hot rolled and pickled;
- c) cold rolled; and
- d) cold rolled and annealed.

NOTE — *The terms 'hot rolled normalized' or 'hot rolled under controlled conditions' refer to the conditions leading to a structure and to properties typical of those for material in the normalized condition.*

11.2 Subject to prior agreement between the manufacturer and the purchaser, the material may be pickled and levelled with a suitable protective treatment in accordance with NS... *Recommended Practice of Pickling by H₂SO₄ Levelling and Oiling of LPG Sheets*).

12 WELDABILITY

The steels are weldable by the usually fusion welding processes.

13 MARKING

13.1 Steel plates and sheets shall be supplied in bundles and strips in coils. The mass of the bundle or coil shall be as agreed to between the purchaser and the manufacturer. Each plate and sheet in each bundle shall be legibly marked with the cast/coil number. The top sheet in each bundle shall also be marked with the name of the manufacturer or trademark.

Each bundle shall further carry a metal tag bearing the cast/coil number and the manufacturer's name or trade-mark or such information may be given on the top of the steel envelope containing the sheets during packing. In case of coils, each coil shall be legibly marked with the cast/coil number, grade and manufacturer's name or trade-mark.

13.2 NS Certification Marking

The material may also be marked with Standard Mark.

13.2.1 The use of the Standard Mark is governed by the provisions of the *Nepal Standards Act, 2037* and the Rules and Regulations made there under. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from NBSM.