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BUREAU OF INDIAN STANDARDS

Approved Minutes

Name of the Committee	No. of Meeting	Day	Date	Time	Venue
Wrought Steel Products Sectional Committee, **MTD 4**	39th	Friday	24 Sep 2021	1030h - 1730h	**BUREAU OF INDIAN STANDARDS** Manak Bhavan,9, Bahadur Shah Zafar Marg, New Delhi- 110 002 **Tel (Off.)**: (011) 23608264 **Email:** mtd4@bis.gov.in , mtd@bis.gov.in

Chairman: Shri Nirvik Banerjee **Member Secretary:** Mr Arun Pucchakayala

Members and Invitees Present: Details given at Annex-I

Item 0 GENERAL

0.1 Sh N Suryanarayana, Head MTD, welcomed the members to the 39th meeting of the sectional committee MTD 04. Also, the members were informed about recent changes in standard formulation activity of BIS comprising of MoUs with IITS, dedicated online portals, inclination of BIS to conduct hybrid meetings for better participation, change in frequency to hold meetings etc. Further, concerns were shared with members for not holding meeting of technical committee during the year 2020-21 because of pandemic and time taken in nominating new Chairman for the Committee.

0.2 Objectives by the Chairman

Sh Nirvika Banerjee, ED, SAIL-RDCIS and Chairman MTD 4 had laid down the objectives for the 39th meeting emphasizing on active participation and adhering to the time norms to the works allotted by inviting attention of the members to the fact that only 40+ standards among the 90 standards under ambit of Steel and Steel products QCO were covered under BIS certification and more work needs to be done by the committee with a view to revise standards so as to cover steels under import and also to encourage domestic manufacturers to upgrade the facilities for meetings the needs of downstream industries to cut down dependence of imports and high costs involved therein. Further, it was stated to members that such an exercise would help BIS per se the technical committee in our endeavours for adhering to the commitment given to Hon'ble Minister of Steel Sh R C P Singh by BIS during recent interaction for timely updating of Indian standards for coping up with technological advancements.

Item 1 CONFIRMATION OF MINUTES OF LAST MEETING

1.1 The committee examined the comments received from IZA and observed that the comments did not build on any value addition technically and as such it formally approved the minutes of 38th meeting of Wrought Steel Products Sectional Committee, MTD 4 held on 03-04 Dec 2018 at BIS, New Delhi and circulated by email on 01 May 2019.

Item 2 ACTION TAKEN REPORT

2.1 The committee reviewed the status of decisions taken during last meeting as given in Annex I of the Agenda and decided during the 39th meeting to take actions as mentioned at Annex **II.**

Item 3 COMPOSITION OF SECTIONAL COMMITTEE

3.1,3.2 and 3.3 The Committee noted the information given at 3.1 to 3.3 of the agenda.

3.4 The Committee reviewed the scope and composition and did not suggest any changes to its membership except for substituting SAIL DSP with SAIL ISP. The present composition of Sectional Committee MTD 4 is given at **Annex III.**

3.5 The Committee examined the three nominations received, seeking membership for sectional committee, and decided to add Sh Vipin Singhal and Sh Sushil Kumar to the mailing list. On the interest received from MRAI, it had decided to reject the nomination given the non-diversified contribution expected from an organization confined to scrap and that the activities of the committee demand for diversified knowledge to deal with more grades of plain carbon steel and steel products for various applications.

Item 4 REVIEW OF INDIAN STANDARDS

4.1 The committee noted the information on list of standards formulated by MTD 4 and mentioned at item 4.1 of the agenda.

4.2 The Committee decided to reaffirm the 31 standards(**Annex-IV**) as they were overdue in the year 2020 and requested Member Secretary to circulate the list of 31 standards among members giving 14 days' time to send comments on changes, any desired for them.

4.3 The Committee took a note of the new strategy adopted by BIS for reviewing 20 old standards (**Annex V**) and appreciated the efforts of BIS and officers from other activities for their efforts and providing working drafts and recommendation therein for the 14 old standards. Consequently, the Committee requested Member Secretary to circulate the reports received on 14 Indian Standards (**Annex VI**) among members giving 14 days' time to send comments on recommendations and suggestions or interest for coming on board of the panel to take up further action on the standards as desired by Committee in near future. Subsequently, the interests would be reviewed by respective sub-committee and submit their recommendation to the Committee to decide on further course of action.

The Committee may please deliberate and decide on further course of action.

Item 5 NEW PROPOSALS FOR STANDARDIZATION

5.1 & 5.2 The Committee noted the information given at item 5.1, 5.2 of the agenda. As per

5.3 The Committee referred the proposal for new standard received from M/s Dynaroof , Guwahati (**Annex-VII**) to Panel -22, giving one-month time to submit their recommendation to the Sub-Committee, which would subsequently be reviewing it and forwarding it to Sectional Committee for deciding on further course of action.

Item 6 Comments on Indian Standards

6.1 The Committee referred the comments received on IS 2062(**Annex VIII**) to panel-17 with a request to submit their views within One-month time to the Sub-Committee which would subsequently be reviewing it and forwarding it to Sectional Committee for deciding on further course of action.

Item 7 IMPLEMENTATION OF INDIAN STANDARDS

7.1 The Committee noted the information given at item 7.1 of the agenda.

Item 8 INTERNATIONAL ACTIVITY

8.1 Interaction with ISO

The Committee noted the information given item 8.1 of the agenda.

8.2 The Committee noted the information on list standards formulated by relevant sub-committees of ISO TC 17 as given at item 8.2 of the agenda. Also, it requested the Panel-17 to expedite work on harmonization some of the standards referred at Sl No.31 of Annex-II .

8.3 The Committee noted the information given item 8.3 of the agenda.

Item 9 Steel and steel products quality control order

The Committee noted the information about 90 products are under mandatory BIS certification through Steel and Steel Products Quality control order as mentioned at item 9 of the agenda.

Item 10. BIS Initiatives

10.1. The Committee noted the information on presence of BIS on various social media platforms as mentioned at item 10.1 of the agenda.

10.2 The Committee noted the changes in provision for representing an organization in BIS sectional committees which comprises of principal, alternate and can be extended to have a young professional under 37 years of age or a women representative having expertise in the respective discipline.

10.3 to 10.5 The committee took note of SNAP, website for free downloading Indian Standards for free of cost, concept of standardization cells and concept of Gender responsiveness in standards as part of SDG5.

10.5 The Committee took note of initiatives of BIS as National Standards Body to implement "One Nation One Standard" by working in coordination with other Standard Development Organizations(SDO) in the country to avoid duplicity of work related to standards on same product/process and to synergize standardization efforts and resultant implementation of standards.

10.6 The Committee also noted information given at 10.6 of agenda and pertinent to steps initiated by BIS towards integrating Indian Standards in the curricula of professional courses.

Item 11. R&D PROJECTS FOR ESTABLISHMENT/REVISION OF INDIAN STANDARDS

11.1 The committee noted the information shared on current guidelines for R&D projects for establishments /revision of Indian Standards given at item 11.1 of the agenda.

Item 12 DATE AND PLACE FOR THE NEXT MEETING

The Committee decided to meet in Dec 2021.

Item 13 ANY OTHER BUSINESS

13.1 The Committee took note of the summary of actions pertinent to MTD 4 and discussed during the 6th meeting of SARSO Sectoral Technical Committee on Building Materials held virtually on 28 & 29 April 2021. The Committee requested Panel-17 to address comments of SARSO Member

States on draft standard on structural steel, as and when received from BIS and adhering to the time lines and advised Sub-Committee to take decision on the matter.

13.2 The Committee took note of the comments on draft standards on glossary of steel namely SARS 0028-1 (**Annex-IX**), SARS 0028-2(**Annex-X**) and SARS 0028-3(**Annex-XI**). **Further the Sub-Committee was advised to take decision on the matter.**

13.3 The Chairman appreciated the members for having threadbare discussions on various issues during the meeting despite the hardships faced by the country during recent times because of the pandemic. As the work related to standards formulation was carried out on voluntary basis and it was an additional responsibility, which was beyond the call of duty for most of members, it was put forwarded by the Chairman that this activity should be incentivised for encouraging more members to come on board and for having active participation adhering to the timelines practically. Further, it was suggested to find means other than BIS website for ensuring that the draft documents get disseminated to all stakeholders and accordingly requested members to come up with new plan of action during the next meeting.

The meeting ended with hearty vote of thanks to the Chair.

Annex-I

Members Present			
S.no	**Name of the organisation held/attend**	**Represented by**	**Email ID**
1.	Tata Steel Ltd,Jamshedpur	Sh Avtar Singh Saini	avtar@tatasteel.com
2.	All India Induction Furnace Association, New Delhi	Sh Prabhakar Mishra	aaiifa6@gmail.com
		Sh A. K. Sharma	aksharma@alephindia.in
3.	Intitute of Steel Development and Growth, Kolkata	Dr. Jayanta K Saha	jayantaksaha@gmail.com
4.	Ministry of Defence (DGQA) Ichapur	Sh G. Subba Rao	subbarao.gaddipati15@gov.in
5.	JSW Steel Ltd. , Vasind / Bellary	Sh Devasish Mishra	devasish.mishra@jsw.in
6.	Ministry of Steel (Govt of India), New Delhi	Sh Parmjeet Singh	parmjeet.singh@gov.in
7.	SAIL,Bhilai Steel Plant,Bhilai	Sh Sandip Choudhury	sandipchoudhury@sail.in
8.	SAIL,Bokaro Steel Plant,Bokaro	Ms Biswasi Sunita Minz	b.sunitaminz@sail.in
9.	SAIL,Research & Development Center For Iron & Steel , Ranchi	Sh N. Pradhan	npradhan@sail.in
		Sh S. Srikanth	srikanth@sail.in
		Sh S. Roy	sroy1641@sail.in snehangshu.85@gmail.com
10.	SAIL- ISP	Sh A Dasgupta	arunava.dasgupta@sail.in
		Sh S K De	saikat6028@gmail.com
11.	Tata Motors Limited ,pune	Dr Pradeep Kulkarni	pradeep.kulkarni@tatamotors.com
		Shailesh Sonwane	shailesh.sonwane@tatamotors.com
		Shri kartike Karwal	kartike@siam.in

12.	Society of Indian Automobile Manufacturers(SIAM) New delhi	Mr Atanu Ganguli	aganguli@siam.in
13.	The Tin Plate Company of India Ltd, Jameshedpur	Dr Sourajyoti Dey	sourajyoti.dey@tatatinplate.com
14.	Jindal Steel & power Ltd (JSPL)	Shri Moreshwar Borkar	moreshwar.borkar@jspl.com
15.	ANMS, Hazira	Mr Deepak Gupta	deepak.gupta@amns.in
		Mr Hemant Pandare	hemant.pandhare@amns.in
16.	JSW Steel LTD, Dolvi	Mr. Subhasis Chakrabarty	subhasis.chakrabarty@jsw.in
		Shri B M Hasan	bm.hasan@jsw.in
17.	In individual capacity	Shri A.C.R.Das	ajoycrdas@gmail.com
18.	Ministry of Shipping	Sh Ramji Singh	ramji.shing@nic.in
19.	Tata BlueScope Steel Ltd, Pune	Sh Rajesh Maheshwari	rajesh.maheshwari@tatabluescopesteel.com
20.	Central Boilers Board, New Delhi	Sh T.S.G Narayannen	tsg.narayannen@nic.in
21.	SAIL, Durgapur	Sh Amarnath Banerjee	amarnath@saildsp.co.in
Invitees Present			
1	CMD-2, BIS	Sh Shivam Ahuja	shiaja.ger10@gmail.com
2	JSW	Sh Abhijit Chivane	abhijit.chivane@jsw.in
3	JSW	Sh G V Ramana	gv.ramana@jsw.in

Sl. No. (1)	Subject (2)	Decision taken in past meetings (3)	Action taken on the decision of the committee during last sectional committee meeting (4)	Decision taken during the meeting (5)
1	Zinc and Zinc alloys coated steel sheets for automotive and engineering applications	During the last meeting, it was informed that the convenor of the panel, Mr Avtar Singh had communicated that the draft of the standard was still under preparation and the revised draft will be ready for circulation within one month after discussion with the panel members. The draft thus received had to be circulated within the committee member for comments. Draft document placed below was received on 3 December 2018 and was circulated among committee members. The document was discussed on 4 December 2018. The members requested more time to review the document.  IS Coated Draft 21112018.doc The committee requested the members to review the standard and send their comments by 15 January 2019. Comments received, if any, will be discussed by the panel in its next meeting.	Comments received from SIAM & MSIL (Maruti Suzuki Industries Limited), ISUZU Motor India, Mahindra and Mahindra Limited, Volkswagen India & General Motors Technical Centre India pvt ltd were discussed in the panel and suggested changes to the draft accordingly. The subcommittee during its meeting held on 13 June 2019 was informed about the comments received and changes suggested by the panel. The recommendation of the subcommittee to the panel is mentioned below. *that different types of hot dip coated steel to be made as different parts of IS 277 which will be split into multiple parts with current IS 277 becoming Part 1 of the series and standard for electrogalvanized steel will be a separate standard. Panel 22 also requested the sub-committee that user industry like POSCO Maharashtra should also be adequately represented in it.*	Convener of the Sub-Committee Sh Avtar Singh Saini briefed the committee about the status of formulation of the standard on the subject. Also, the Committee was informed about the recommendation of the Panel to have standards on various types of hot dip coated steel, which would be formulated as different parts of IS 277 with current IS 277 for hot dip galvanizing assuming to be Part 1 of the series of standards. It was also apprised to the Committee that the recommendation of the panel was endorsed by the Sub Committee during its meeting held on 13 June 2019. **On account of the above, the Committee deliberated on the proposal and decided to have standards on various types of hot dip coated steel, which would be formulated as different parts of IS 277 with current IS 277 for hot dip galvanizing assuming to be Part 1 of the series of standards.** **Further, on concerns raised by Member Secretary on composition of the panel, the Committee advised the Sub-Committee to re-constitute the Panel-27 by having representation from organizations as under:** i) Tata Steel-Convener ii) SIAM iii) ANMS

			Committee requested the panel to submit the modified draft standard on coated steels by 31st October 2019, which is still awaited from the convener of panel 22 Sh. Avatar Singh. Though meeting of panel 22 held on 20th May 2020, the resultant draft still awaited. **HMTD comments:** *All the requirements and test methods for different types of metallic coatings does not fall under the scope of MTD 4 and should instead be dealt by Corrosion Protection and Finishes Sectional Committee, MTD 24. Hence MTD 4 may consider to recommend to MTD 24 sectional committee to prepare standards for the requirements and test methods on different types of metallic coatings such as hot dip coatings, electrolytic, thermal spraying, chemical etc used for the coatings of products used in MTD 4.* **The committee may please note the developments and may deliberate on comments of Head (MTD).** **Also, the committee may review the composition of Panel 22.**	iv) Posco Maharashtra v) JSW vi) NML vii) 1 user (appliance/solar panel manufacturer) **The Committee also advised the Sub-Committee to take decision on other recommendations of the Panel.**

2	Specification for semi-finished steel products	During the last meeting comments received from DSP as mentioned at item 5.2 of agenda, were discussed and the committee after deliberation decided that the proposal requires detailed study since a large number of raw material standards have been formulated by MTD and as per the proposal the raw material standard requirement can be incorporated in the finished product standard. All the committee members were requested to go in detail of the proposal and come prepared in the next meeting so that a fruitful discussion can be held.  Specification for semis.DSP.docx The committee members requested the Chairman for some more time to review the proposal. The Chairman agreed to the request and decided that it will be discussed in the next meeting of the committee. Comments, if any, should be sent by 15 May 2019.	No comments received from the members.	**The Sub-Committee was advised to take a decision on the proposal for having a single standard covering Semis of all grades, giving due consideration to views to be obtained from Steel making units through Induction Furnace, Re-rollers and other relevant stakeholders.**
3	Raw material for Electrical Steel	The Panel 12 consists of following members 1. Mr Kapil Kapoor - ThyssenKrupp Electrical Steel India Pvt Ltd - Convenor 2. Mr Deepak Gupta - Essar Steel, Surat 3. Mr Devasish Mishra - JSW 4. Mr Muthuswamy – SAIL, RSP, Rourkela In previous meetings committee after deliberation decided to formulate standard on hot rolled coil for electrical steel (CRNO). The panel submitted the draft standard placed at **Appendix-9** which was wide circulated among the committee members. During previous meeting the committee after	No action taken.	**The committee noted the information and advised Member Secretary to take action. The Sub-Committee was advised by the Committee to monitor the progress of work.**

		deliberation had decided to send the document for wide circulation for two months since no comments were received. The committee was informed that document is under preparation for wide circulation.		
4	New Standard on thin magnetic steel strip for use at medium frequencies - Both for CRNO and CRGO	It was suggested by Mr Kapil Kapoor to adopt IEC standard 60404-8-8 , standard for thin magnetic steel strip for use at medium frequencies - Both for CRNO and CRGO The committee after deliberation agreed that new standard on thin magnetic steel strip for use at medium frequencies needs to be formulated. Mr Kapil Kapoor of Thyssen Krupp was requested to fill the form provided at Annex IV of agenda for proposing new subjects. During the last meeting committee after discussion requested Mr Kapil Kapoor to forward Annex IV for proposing new subject. Since Tata Cogent representatives were also present in the meeting, they were requested to assist Mr Kapil Kapoor with details required for filling up Annex IV. After receipt of this, the same was to be forwarded to committee members, and if agreed by committee members and approved by Chairman, the recommendation for formulating new standard on thin magnetic steel strip for use at medium frequencies , was to be forwarded to MTDC for approval of new subject. The committee was informed that Annex IV was still awaited. The committee noted the information. Shri Kapil Kapoor informed the committee that he will submit the requisite document by 15 January 2019.	The duly filled template proposing new standard for use at medium frequencies was received on 12th June 2019 from Sh. Kapil Kapoor, and is placed at **appendix-2 of the agenda**.	Convener of Panel-18, Sh Kapil Kapoor emphasized on the need to have standard on thin magnetic steel strip for use at medium frequencies - both for CRNO and CRGO and imparted the features of the new work item proposal **(Appendix-2)** to the members and vouched for adoption of IEC 60404-8-8:2017. **The Committee agreed to the proposal in-principle and advised the sub-committee to take further actions for adoption of the IEC standard expeditiously. Also, the Sub-Committee was advised to ensure that the draft document would be circulated among ITMA and IEEMA during the wide circulation.** **Also, the Committee advised the Sub-Committee to examine the adequacy of test methods covered in IS 649 for product covered under IEC 60404-8-8:2017 and decide on the matter.**

5	New standard on Wear & Abrasion resistant steel plates	During the last meeting comments received from Volvo steel were discussed and after deliberation the committee did not agree to the comments. The committee after deliberation decided to send the document for wide circulation for two month. The document placed at **Appendix 16** is being prepared for wide circulation. The committee noted the information.	Before sending the draft for wide circulation, the draft was examined and observations were shared with the panel by MTD. Also, MTD had informed the panel convener that the composition of the panel was not balanced as there was no representation from User Industry. Subsequently, Panel meeting was held on 30 June 2020 to discuss on comments of MTD. Modified draft was received by MTD from the panel convener on 07 July 2020. Also, the panel needs to be reconstituted as it presently consists of manufacturers only. Draft received from panel convener on 07 July 2020 is placed at **Appendix-3**	During the meeting, Member Secretary had informed the committee that the comments of MTD on the draft document were not addressed by the panel even in the modified draft submitted on 07 July 2020 (**Appendix-3)**. **The Committee noted the information and requested the Panel Convener to submit the modified working draft along with work plan for validation of the grades to the sub-committee within 2 months.** **Also, the Committee took note of the concerns raised by the Member Secretary on composition of the panel and advised sub-committee to reconstitute the panel by also having representation from the organizations JCB, Volvo, Caterpillar, Tata Hitachi and BEML.** **Further, the Committee requested, Addl Industrial Advisor to Ministry of Steel to arrange for requisite samples in due course in consultation with importers, necessitated for validation of properties in the draft standard.**
6	Formulation of a new standard for raw material for API 5L pipes	For formulation of a new standard for raw material for API 5L pipes a Panel 15 consisting of following members was constituted 1. Mr Deepak Gupta, Essar Steel – Convenor 2. Dr. S. Manjini ,JSW Steel Ltd - Member 3. Mr Avtar Singh Saini, Tata Steel - Member 4. Mr M Borkar, JSPL - Member 5. Mr A Dasgupta, RSP - Member	A draft was received from the panel convener, developed on the basis of standard for API Pipes namely IS/ISO 3183. However, as mechanical properties of sheets/strip were different from those of pipes and as there was no corresponding	The committee took note of observations of MTD on the draft **(Appendix-4)** received from the panel. **Accordingly, the Committee requested the Panel Convener to re-examine the working draft by taking up analysis of MTC of importers shared by Ministry of Steel and supporting data from Domestic**

		During the last meeting committee agreed to send the draft document for wide circulation for two months. The committee was informed that the document placed at **Appendix 11** is under preparation for wide circulation. The committee noted the information.	national/international standard on the subject, incorporation of grades in the draft standard requires validation and testing. Nevertheless, the draft was discussed by the panel in a meeting dated 8 May 2020. The Panel vouched mechanical properties same as that of pipes for sheets/strips despite the observation that properties will undergo change due to various heat treatment/thermo-mechanical treatment carried out on sheets and plates to form pipes as per IS/ISO 3183 and therefore their requirements in raw material steel cannot be same as those for pipes, which was duly substantiated by carrying out an analysis on Mill test certificates obtained pertinent to imports and obtained from Ministry of Steel. It was also observed that the panel consists of manufacturers only with an exception of AMNS and as such it needs to be reconstituted to ensure balanced composition. Draft received from panel and addressing comments of MTD is placed at **Appendix-4**.	**Manufacturers and submit the resultant working draft to Sub-Committee within 2 Months. Further, Sub-Committee was advised to monitor the progress and ensure formulation of the standard expeditiously.** **On the concerns raised by Member Secretary on composition of the panel, the Committee had advised the Sub-Committee to reconstitute the panel by having representation in the panel from the organizations Welspun specialty, Jindal Saw pipes, Ratnamani and IOCL.**

7	Raw material viz Billet, ingot, slab for manufacturing HR coils as per IS 1079, IS 5986, IS 11513	During previous meetings the committee discussed and decided that at present there is no standard for raw material viz Billet, ingot, slab for manufacturing HR coils as per IS 1079,IS 5986, IS 11513. A panel 20 consisting of following members was formed to formulate a draft standard for Billet, ingot, slab for manufacturing HR coils as per above mentioined ISS 1. Mr Devashish Mishra – JSW – Convenor 2. Mr Deepak Gupta – Essar steel 3. Mr B Sarkar – SAIL, RDCIS 4. Mr A Dasgupta – SAIL, RSP 5. Mr Avtar Singh, Tata Steel The draft was received from panel member vide email dated 23/3/2018. During the last meeting The Committee decided the following on the comments received from Bokaro steel which is placed at Sl. No. 3 of ATR Point 1: Agreed Point 2. Not Agreed Point 3: Agreed to include size 225 The Committee had requested Mr Devashish Mishra to consider the above decision of the Committee in the revised draft to be submitted to BIS. The committee decided to send the revised draft for wide circulation for two months. The revised draft standard was received from Mr Devasish Mishra vide email dated 01/12/2018. The revised draft is placed at **Appendix 13.** Draft will be sent for wide circulation for two months as decided the committee in the last meeting.	No action taken.	The Committee took note of the document placed at Appendix-6. **The decision of the Committee is same as that mentioned at Sl No.2 of the table.**

8	Revision of IS 15911	IS 15911 was revised and agreed by the committee for printing. However following observations were made on draft approved for printing. 1. Title of standard is not in line with scope of the standard and not in line with IS 2062. 2. Definition of low tensile is not incorporated in the standard. 3. The word 'sheets' to be included in Sr No iii of table 4. 4. Permissible variation of % silicon in product analysis not indicated. 5. Variation allowed on which specified value is not clear .Hence definition of product analysis to be reviewed . 6. Review clause 17.2 as there is no clarity in the sentences. During the last meeting Mr Jayanta Saha, convenor of the panel responsible for revision of IS 15911 mentioned that he will study the observation and if required the revised draft shall be put up after discussion with the panel members in one month time. Report was still awaited.	The committee noted the information and again requested Shri Jayant Saha to submit its recommendations by 15 May 2019, which was awaited.	Convener of Panel-26, Dr Jayanta Saha, briefed the committee about the status of the revision. **The Committee noted the status and requested Panel Convener to submit the modified draft to the Sub Committee within two weeks.** **Also, the Committee took note of change in place of posting and/or superannuation from service against some of the members representing the panel and suggested to the Sub-Committee to reconstitute the panel by inducting Sh S Srikanth(RDCIS), Sh Arunava Dasgupta (DSP) and Sh G V Ramana (JSW) into the panel.**
9	Revision of IS 8951	Following panel 14 constituted for revision of IS 8951 1. Mr D.Karmakar - SAII RDCIS, Ranchi - Convenor 2. Mr Biswajit Ghosh - Tata Steel, Jamshedpur 3. Mr P.K.Sen –, RINL, Visakhapatnam 4. Mr Nirmal Saraf, Mr Deshmukh - Steel Wires manufacturer association During the last meeting committee after deliberation agreed to the modified draft presented in the	The Committee may please consider revision of standard instead of issuing an Amendment to the standard. Also, it was observed that changes proposed in the new version of the draft standard along with the technical justification or documentary evidences as applicable were yet to be received from the panel convener.	The Committee took note of the document placed at Appendix-6. **The decision of the Committee is same as that mentioned at Sl No.2 of the table.**

		meeting and after deliberation decided that since there are changes only in few clauses of the standard, the entire standard may not be revised and the amendment may be issued. Based on the above comments the amendment was to be formulated and same was to be circulated within the committee members for 21 days. In case no comments are received the amendment was to be sent for wide circulation for one month. The committee was informed that the draft amendment is under preparation for wide circulation.	Revised draft was submitted as Appendix-6 to the agenda.	
10	Revision of IS 2041 : 2009 Steel Plates for Pressure Vessels used at moderate and low temperature - Specification (Third Revision)	During the last meeting committee after deliberation agreed to the comments made by JSW for incorporating the definition on normalizing rolling. However the comments made by Bokaro steel plant on changing the frequency of tensile testing was not agreed as it will dilute the standard and the same shall not be acceptable for dual certification also. Based on the above comments the amendment was to be revised and the revised amendment was to be circulated within the committee members for 21 days. The draft standard was revised based on comments agreed to by the committee and sent for circulation among the members of the committee on 14/10/2018. No comments were received.	The draft was examined by MTD and comments were shared with Panel convener on 25/06/2021(Appendix-7), seeking justification for the changes. Reply was awaited.	A member of Panel-5, Dr Jayanta Saha, briefed the committee about the status of the revision (Appendix-7). **The Committee noted the status and requested Panel Convener to submit the modified draft to the Sub Committee within One Month.**
11	Revision of IS 3039	The Panel 13 consists of following members 1. Mr Deepak Gupta - Essar Steel -Convenor 2. Mr M Borkar – JSPL, Chhattisgarh 3. Mr A. Dasgupta - SAIL, Bokaro Steel, Bokaro 4. Mr Sandip Choudhury/MrK.L.Balasubramanian – SAIL, Bhilai Steel Plant, Bhilai	Comments on the draft were circulated to Panel Convener on 25 June 2021. Modified draft was awaited.	Convenor of Panel-5, Sh Deepak Gupta, briefed the committee about the status of the revision (Appendix-8). **The Committee noted the status and requested Panel Convener to submit the modified draft to the Sub Committee within One Month.**

		In the previous meetings draft received from from Mr Deepak Gupta had been sent for circulation within the committee members. Comments were received from JSPL. During the last meeting Except 2 all points were agreed and has been incorporated in Draft. Point No.1 was to be checked as per STI and revised draft was to be sent Mr Deepak Gupta of Essar steel. The revised draft thus received was to be sent for wide circulation for 1 month.		
12	Revision of IS 1875	.The following panel was formed for revision of IS 1875 1. Mr D. Karmarkar , RDCIS., SAIL – Convenor 2. Mr Sanjay Roy, RINL - Member 3. Mr Devashish Mishra, JSW - Member 4. Mr P.K. Biswal, Kalyani Carpenter Special Steel Ltd, Pune - Member 5. Mr Dinesh Singh, Vardhman Steel – Member 6. Dr M Krishnamurthy, CQA(metals) – Member 7. Member from DSP During the last meeting the comments received from Vardhman steel were discussed and agreed. Based on the comments and the discussion held in the meeting, it was decided to revise draft of IS 1875 and Mr Karmarkar was requested to send the revised draft to BIS. The revised draft thus received was to be sent for wide circulation for one month. The committee noted the information and requested the panel again to send the revised draft to BIS by 30 April 2019 and the document thus received shall	No draft was received from the convener.	**Member Secretary informed the committee about co-existence of the grades of IS 1875 in IS 13352, an Indian Standard covering steel produced through continuous casting route.** **The Committee noted the observations and advised Panel-4 to submit the modified draft to the Sub-Committee within one month. Further, the Sub-Committee was also advised to take a decision on duplicity of grades in the modified draft, which was anticipated from the Panel and IS 13352.** **Also, the Sub- Committee was advised by the Committee to reconstitute the panel by getting revised nominations from SAIL-RDCIS and by also inducting SAIL – ISP (Sh SK De).**

		be sent for wide circulation for one month. Comments on the draft were circulated to Panel Convener on 25 June 2021. Modified draft was awaited.		
13	Revision of IS 11587:1986 Structural weather resistant steels	A Panel 19 consisting of following members was formed for revision of IS 11587:1986 Structural weather resistant steels 1. Mr Jayanta K Saha - INSDAG – Convenor 2. Mr Deepak Gupta – Essar Steel 3. Mr A Dagupta – SAIL, RSP 4. Mr Avtar Singh – Tata Steel 5. Mr Devasish Mishra, JSW, Bellary 6. Mr M Borkar – JSPL 7. Representative from RDSO During the last meeting committee requested the panel to provide the revised draft based on comments received and agreed by committee by incorporating above proposed changes to BIS. The revised draft was then to be sent for wide circulation for one month. The draft placed at **Appendix 12** is being prepared for wide circulation. Committee noted the information.	Comments on the working draft was shared with panel convener on 25th June 2021 and placed at Appendix-9. Revised draft was awaited.	Convener of Panel-19, Dr Jayanta Saha, briefed the committee about the status of the revision (Appendix-9). **The Committee noted the status and requested Panel Convener to submit the modified draft to the Sub Committee within One Month.**
14	Revision of IS 4824 MTD 4(13607)	In the MTD 4 meeting no 36 held on 10-11th January 2018, Tata Steel had presented the case for amendment of this standard in line with ISO 16650, which was accepted. Tata Steel was requested to send formal amendment request and draft of amended standard, which have been received. During the last meeting, it was decided to circulate the draft to the committee for comments. Comments received will be discussed in the next	The draft placed at --- was received and circulated among members of the committee and user industry. The comments received were forwarded to Tata Steel. The modified draft based on comments received was tabled during the meeting. The committee discussed the	Convener of Sub-Committee, Dr Jayanta Saha briefed the committee about the status of the revision. Further, Member Secretary informed the Committee about modifications made to the finalized draft on test method for determination of coating mass of copper, bronze, brass on steel deriving assistance from relevant ISO standard (ISO/DIS 23475-

		meeting of MTD 4.	draft and after deliberation decided to send the draft revision for wide circulation for one month. In case no technical comments are received the document may be sent for printing after approval from the Chairman.	1). **The Committee took note of the changes and and agreed to send the document MTD 4 (13607) for printing (Appendix-10).**
15	IS 2507:1975 Cold-rolled steel strips for springs (first revision)	Comments received from Bhushan Steel Ltd, Maharashtra During the previous meetings the committee discussed the draft revision and after deliberation some of the committee members requested for some more time to go through the revised standard and give comments on same. The committee agreed to give 21 days to the committee members to give their comments on the draft. In case no comments are received in this period, the draft shall be sent for wide circulation for one month after taking approval of Chairman MTD 4. Vide email dated 3/4/2018 following clarification has been sought from Mr Murlidhar of Bhushan Steel for which reply is awaited. "In the covering letter attached you have informed that for revising this standard you have taken help of ISO 4960. You are requested to kindly inform whether the ISO 4960 can be adopted in total replacing the current standard or only a few clauses need to be taken from ISO 4960. Also as understood the changes made by you are highlighted by red colour. You are requested to inform whether the changes made are as mentioned in ISO standard particularly for chemical composition, physical properties, heat treatment temperature .	Observations made by Member Secretary, while preparing the draft for wide circulation, were shared with Panel for disposal (see **Appendix-11 pg 147-156**). Reply is awaited from the Panel Convener.	**The Committee took note of the comments of MTD (Appendix-11) and advised the Sub-Committee to take decision on the matter.**

		During the last meeting Committee decided that the Bhushan Steel should send their comments with justification in the comment format. Mr Murlidhar agreed that he shall send the same to BIS in one week's time. The same shall then be forwarded to committee member for 21 days for comments and in case no comments are received the revised document may be sent for wide circulation for one month. The committee noted the information and after deliberation decided that as no reply has been received from Bhushan Steel the draft document placed at Appendix 14 may be sent for wide circulation for one month.		
16	IS 2549 Code of classification of processed ferrous scrap	The committee could not discuss the item due to paucity of time and decided to discuss the item in the next meeting of MTD 4. A presentation was made by Shri Kundan Rai, Shri Yogesh bedi and Shri Sarthak Kahre from Tata Steel on steel scrap and their study on revision of '. Based on the presentation the committee discussed the need to revise IS 2549 and after deliberation decided to form Panel 25 consisting of following members to revise the standard: i) Shri Parmjeet Singh, Ministry of Steel (Covenor) ii) Shri Kenneth De Souza, IZA iii) Shri Sudipto Sarkar, Tata Steel iv) Mr Nagar Seth, Shipbreaking v) MSTC vi) Materials Recycling Association of India (MRAI) vii) DGFT viii) Shri ACR Das	Working draft was awaited from the Panel Convener Sh Parmjeet Singh.	**The Committee noted the information and requested the Convener of Panel-25, Sh Parmjeet Singh to submit the P-draft to the sub-committee within one-month.**
17	Review of Indian Standards	Dr S Manjini was made Convenor alongwith members Mr Dinesh Singh of Vardhman Steel and Mr Sanjay Roy RINL. The group agreed for review of the	No action taken.	The Committee was informed that no action was desired against IS 3431 as it is pertinent to MTD 16.

		standard allotted to them viz IS 3431, IS 3885 (part1) and IS 3885 (part 2) in 45 days time and send the report to BIS . IS 3431 : 1982 — Steel for the manufacture of volute, helical and laminated springs for automotive suspension IS 3885 : Part 1 : 1992 — Steel for the manufacture of laminated springs (railway rolling stock) Part 1 Flat Sections IS 3885 : Part 2 : 1992 — Steel for the Manufacture of Laminated Springs (Railway Rolling Stock) – Part 2 : Rib and Groove Sections The panel was requested to submit their report in 2 months time . The panel submitted their report in the meeting and informed the committee that no revision was required for IS 3885(Part 1):1992 and IS 3885(Part 2):1992. The panel informed that revised draft for IS 3431:1982 will be submitted by the panel by 15 May 2019. The committee noted panel's report and after		**Further, the Committee advised Sub-Committee to decide on the matter.**

		deliberation agreed to panel's report. The committee requested the member secretary to circulate draft revision of IS 3431 for 21 days among the committee members. Mr Devasish Mishra was requested to review the following standard IS 12367 : 1988 — Cold-rolled Carbon Steel Strips/Coils for Manufacture of Welded Tubes Revised draft received from Mr Devasish Mishra was discussed and after deliberation the committee observed that this standard is similar to IS 513 and thus there is no purpose in revising the standard. It was decided that it may be found whether the standard is used and whether there is any licensee for same. It was also decided that since the standard was used for tubes, the information regarding usage may also be obtained from MTD 19 committee dealing with pipes. Based on the reply received, further decision on revision or withdrawal of standard may be taken. Mr Bishwajit Ghosh of Tata Steel to review IS 280 : 2006 — Mild Steel Wire for General Engineering Purposes The committee after deliberation decided that MTD 24 may be requested to consider revision of IS 4826 based on ISO 7989 on priority , since IS 280 is proposed to come under Mandatory certification .	Reply from MTD 19 was still awaited. As only one clause was being modified through the proposed revision, it was put forward by Shri Shishir Desai to consider amendment instead of revision.	The Committee requested the Member Secretary to ensure follow-up with MTD 19 and submit the desired inputs to Sub-Committee within One-Month. **The Committee note the information (Appendix-12) and advised the Sub-Committee to decide on the matter.**

		The committee also decided the following two members may also be allowed to participate in MTD 24 meeting when revision of IS 4826 is discussed . 1. Mr Nirmal Saraf - SWMAI 2. *Mr Shishir Desai – Tata steel Wires division.* The committee noted the information. Revised draft for revision of IS 280 was tabled by Shri Shishir Desai and is placed at Appendix 15. The committee deliberated over the document and decided to send the document for wide circulation for one month. This issue was discussed in the meeting of MTD 24 and the committee after deliberation decided that since IS 4826 is cross referred in 18 Indian Standards it would not be appropriate to make any changes in the same. The committee suggested that the changes may be incorporated in the product standard i.e, IS 280 if agreed by MTD 4 committee.	Draft amendment has been prepared considering the above and comments received from CMD-II raising concern on coating requirements for galvanized wire of sizes under 0.2 mm and over 10mm. Draft amendment received from Shri Shishir Desai on 3rd April 2020 is placed at **Appendix-12(Pg 157-158)**.	
18	Comments on IS 648:2006 and IS 16585:2016 **MTD 4 5262**	Comments received from CMD 2 as mentioned at item 5.7 of agenda were discussed and after deliberation the committee agreed that in case of IS 648 the thickness and properties should not be open. As mentioned at Sr No 11 of Annex 2 of minutes a draft amendment for the same is being sent to the members for their comments . Further the changes suggested by CMD 2 in IS 16585:2016 could not be discussed as the expert on the subject was not present in the meeting. It was decided that the suggestion of CMD 2 shall be forwarded to the expert and if agreed, the draft amendment for the same can also be sent to the committee members for their comments for 21 days. Also in case no comments are received, the ammendments can be sent for wide circulation for one month after taking approval of Chairman MTD 4. During the last meeting the comments received	Modified amendment received from panel convener Shri Kapil Kapoor vide email dated 28th March 2019.	It was informed to the committee by Member Secretary that the standard IS 648 was under revision and the finalized draft for printing was received from Publication Department of BIS (Appendix-13). **The Committee note the information and advised the Panel Convenor to submit the modified draft to the Sub-Committee within One month.** **Also, the Committee was informed about the status of amendment for IS 16585 by the Member Secretary. The Committee noted the status and requested the Panel Convener to submit the draft amendment for IS 16585 to the Sub-Committee within two weeks.**

		from JSW were discussed and after deliberation the committee decided that since there could not be any consensus on the exemption stated in proposed revised clause IS 648, the matter was referred back to panel 2 and the panel was requested to decide on the comments received and send the recommendations of the panel to the MTD 4 committee. The amendment thus finalized by the panel shall be circulated within the committee members for 21 days and incase no comments are received the same shall be sent for wide circulation for one month. The draft amendment was still awaited. Shri Kapil Kapoor informed the committee that panel meeting could not be held during the period. He requested the committee for some more time. The committee agreed and requested the panel to submit the report by 30 April 2019.		
19	Amendment of IS 2830 : 2012 Carbon steel cast billet ingots, billets, blooms and slabs for re-rolling into steel for general structure purposes (third revision)	Based on the comments the draft amendment was revised. The document was circulated among the members of the committee on 11/10/2018. No comments were received. Circulated draft is placed at **Appendix 2.** The committee discussed the document. Representatives for induction furnaces requested the committee to consider increase upper limit of Phosphorous for Corrosion Resistant Steel (CRS) as it is difficult to control it through induction process. The committee deliberated over the representation and decided retain upper limit of Phosphorous as 0.06 percent max.	Comments of MTD were circulated to the panel(see appendix-14).	The Committee took note of the comments of MTD on the draft amendment (Appendix-14). **The decision of the Committee is same as that mentioned at Sl No.2 of the table.**

		The committee also decided to send the document for wide circulation for one month.		
20	Incorporation of correction factor in IS 3024	In previous meetings of the committee it was informed by Mr Kapil Kapoor of Thyssen Krupp that as per the minutes of IEC meeting, the IEC members have agreed for 0.925 correction factor. Accordingly he proposed that the same correction factor may be adopted in IS 3024 also. The committee after deliberation agreed to send the draft amendment to the committee members for their comments. During the last meeting comments received from JSW and CPRI were discussed and after deliberation the committee decided that since there could not be any consensus on the application of correction factor and for exemption stated in proposed revised clause 1.2 of IS 3024, the matter was referred back to panel 2 and the panel was requested to decide on the comments received and send the recommendations of the panel to the MTD 4 committee**. Appendix 3 & 4 (p 33 to 36) of the agenda.** The amendment thus finalized by the panel was to be circulated within the committee members for 21 days. In case no comments were received the amendment was to be sent for wide circulation for one month. The draft document was received and is placed Appendix 4. The committee discussed the document and after deliberation decided to send the document for wide circulation for one month.	Amendment was examined by MTD and corrections were suggested as per IS 12.	**The committee noted the status (Appendix-15) and requested member Secretary to take action.**

21	Amendment to IS 2002	During the last meeting committee after deliberation agreed to the comments made by JSW for incorporating the definition on normalizing rolling. However the comments made by Bokaro steel plant on changing the frequency of tensile testing was not agreed as it will dilute the standard and the same shall not be acceptable for dual certification also. Based on the above comments the amendment was to be revised and the revised amendment was to be circulated within the committee members for 21 days. In case no comments are received the amendment shall be sent for wide circulation for one month. The draft amendment was revised and sent for circulation among the members of the committee on 14/10/2018. Circulated draft was placed at **Appendix 5(p 37 to 39) of the agenda.** Comments were received from Shri TSG Narayannen DIPP as below:  Comment 2002.docx The draft amendment was revised and sent for circulation among the members of the committee on 14/10/2018. Comments were received from Shri TSG Narayannen DIPP as below:  Comment 2002.docx The committee discussed the comment received and after deliberation did not agree to it as third party verification can always be carried out over and above specified in the standard and need not be	Response to Comments of MTD on draft amendment was awaited from the Panel. A**ppendix 16**.	**The Comments took a note of the comments of MTD (Appendix-16) and requested the Convener of Panel-5 to submit the modified draft to the sub-committee within One-Month.**

		included in the standard. The committee also agreed to send the document placed at Appendix 6 for wide circulation for one month.		
22	IS 2062:2011 Hot Rolled Medium and High Tensile Structural Steel (Seventh Revision)	In the 32nd meeting, comments received from Mr P.K.Patra, JSW Steel limited were considered and after deliberation the committee decided that some more study is required before permitting higher level of nitrogen in IS 2062:2011. The committee requested Mr P.K.Patra to undertake the study and get the high nitrogen level steel samples tested in WRI,BHEL, Trichy and welding laboratory of Tata Steel and present the findings in the next meeting. Comments received from JSW and TATA Steel were discussed and after deliberatioin the committee decided not to increase the permissible nitrogen content without testing as decided in last meeting. The comments of JSW were agreed. The amendment was discussed and after deliberation and as pointed by Power Grid, the committee did not find any justification for increasing the chemical composition limits and decreasing the elongation values of existing grades. The committee thus decided to remove this from the proposed amendment. JSW informed that they shall provide justificaition for the same. During the last meeting justification received from JSW for amendment was discussed and after deliberation the committee agreed to the	The comments of MTD for want of justification for the proposed changes seeking details of reference in national/International standards was awaited from the Panel **(Appendix-17).**	**The Committee took a note of the comments of MTD (Appendix-17) and requested convener of Panel-17 to submit the modified draft to the sub-committee within three weeks.**

		justification provided. The committee also discussed the comments received from DSP and the following decision was taken for the comments made Point 1 & 2 was not agreed by the committee since there is no change in carbon equivalent. Point 3 was agreed by the committee and it was decided that in the amendment it will be mentioned that the elongation was for transverse/longitudinal direction. It was decided to circulate the revised amendment among the committee members for 21 days and incase no comments are received the same was to be sent for wide circulation for one month. The draft amendment was revised as per the comments received and agreed to by the committee and sent for circulation among the members of the committee on 14/10/2018. Following comments were received from Tata steel:  Draft Amendment to IS 2062 tata steel.do The comment received was discussed and committee after deliberation and reviewing the draft amendment decided to modify the amendment. The committee requested the member secretary to circulate the modified amendment placed at **Appendix 8** among members for 14 days. In case no comments are received the modified amendment will be sent for wide circulation for one month.		

		The committee also deliberated and decided to include Quenched and Tempered grades for higher strength material for structural use. It requested the panel revising IS 2062 to consider incorporating quenched and tempered grades in the existing standard or consider a new standard on the same. The committee noted the information and after deliberation decided to refer the matter again to the panel and requested them to submit the draft revision of document within the period of two months. The Draft revision then received will be send in wide circulation for the period of one month in consultation with the Chairman.	**No action taken.**	The Committee requested Convener of Panel-17 to expedite action on the matter. Further,Sh Saikat Kumar De(SAIL-ISP) raised concerns covering on track shoe sections IS 2062. Accordingly, the Committee advised the Sub-Committee to Constitute Panel-29 comprising of JSW, SAIL ISP(Sh SK De), Dr Ramen Dutta and L&T and take a decision on the matter.
23	Review of IS 14246, IS 15961 and IS 15965 standards	During the previous meeting the commttiee after deliberation decided to consitiute a panel 22 for deciding on amendment to IS 14246, IS 15965 and IS 15961 and submit the report in 45 days.The panel 22 shall consist of Convenor -Mr Avtar Singh- Tata steel Members – Mr Rajesh Maheshwari – Tata Bluescope CORSMA – Mr Sood/ Mr Arvind Mishra Essar Steel – Mr Hemant Pandhare IZA – Mr Kenneth de Souza/ Mr Rahul INSDAG- Mr Jayanta K Saha JSW Precoated – Mr Anil Patil Bhushan steel _ Mr Paul American Precoated steel – Dr ShubhGautam	Draft amendments seeking approval for wide circulation was sent to all members on 28th May 2021. No comments were received against draft amendment no. 1 to IS 15965 and draft amendment no. 3 to IS 15961. However, comments were received against changes suggested to cl 4.2 of IS 14246 to draft amendment no. 1 to IS 14246. Accordingly, a proposal was sent to members seeking consent for sending the draft amendments to WC in its	The Committee took note of the changes suggested to IS 15965, IS 15961 and IS 14246 (**Appendix -18, 19 & 20)**. **The Member Secretary informed the Committee that the draft amendments were circulated among the members of both the Committee and Sub-Committee. Accordingly, the Committee advised the Sub-Committee to take decision on the matter.** **With respect to changes desired for Cl 4.2 of IS 14246, the Panel was advised to submit their recommendation to the Sub-**

		During the last meeting The panel after discussion decided to send a reminder to Mr Avtar Singh of Tata Steel to conduct the panel meeting at the earliest as the report of panel not received till then. The committee after deliberation also decided to appoint Mr Jayanta K Saha - INSDAG as co convenor of panel 22. It was decided that the panel meeting should be held within one month. Panel 22 meeting was held on 25 May 2018 at Kolkata. The MOM is as below:  MoM of panel 22 meeting at Kolkata_v The committee noted and discussed the report of the panel. Committee noticed the disagreement among panel members over minimum coating thickness in all three standards and after deliberations requested the panel to provide comparison of minimum coating thickness prescribed in various international standards. The committee also requested panel to lay down specific applications, if any, for lower coating thickness recommended in the international standards. The committee also requested the panel to look into the need/possibility of a new standard for internal application. The panel was requested to submit the report by 30th April 2019.	existing form for IS 15961 & IS 15965. Also, consent was sought for sending modified amendment no.1 to IS 14246, by removing changes suggested to cl 4.2 on account of contention received. The draft documents are placed at **Appendix -18(Pg 184-185), 19 (Pg 186)& 20(Pg 187-194).** Committee may please consider sending the documents for WC for one month.	**Committee within a month.**
24	IS 10748: 2004 - Hot Rolled Steel Strip for Welded Tubes And Pipes	Modifications are proposed in Section 3 (Clause 3.1), Section 7 - Table 1 (clause 7.1), Sections 8 & 9 - Table 3 (Clauses 8.3 and 9.2.4) Presently, the hot rolled steel composition does not have any provision for addressing fire resistant properties. Inherent fire resistant properties in steel structures can be attained by adding micro-alloying element like Mo and Cr in combination with other	No action taken.	Member Secretary apprised the committee about procedures involving reference to the patented items in developing a standard, as mentioned below: *a) BIS cannot give authoritative or comprehensive information about evidence,*

		elements like Ti, V, Nb. The last three elements are already mentioned in Clause 3.1. Therefore the following modifications are being proposed: 3.1 Micro-Alloying Elements (Page No. 1) Elements, such as niobium, vanadium, titanium, molybdenum and chromium added singly or in combination to obtain higher strength levels combined with better formbility, weldability, toughness and fire resistant property as compared with non-alloyed steel produced to equivalent strength levels. Table 1 Inclusion of point No 6 in the notes against Table 1: "For fire resistant property requirement, Mo in combination with other micro alloying element Ti, Nb, V, Cr, B, Cu, W may be added up to 0.25 %" During the last meeting of the committee comments received from JSW were discussed and after deliberation the committee requested Tata Steel to submit the following clarifications 1. The reason for inclusion of this grade in IS 10748 when there is a separate standard IS 15103 for fire resistant steel . 2.As per JSW comment the validation data submitted now and submitted during previous meeting held in Jan 2018 of MTD 4.36 S.No 25 in Annex2 in which attachment AnnexII have some differences in chemical composition (Mn, Si, Mo & Cr for Trial1 & Trial2) needs to be understood. 3. The data submits very narrow range of validation.		*validity and scope of patent and like rights but it is desirable that the fullest available information be disclosed. Therefore the originator of a proposal of such a kind shall draw the technical committee's attention to any known patent and like rights on a worldwide basis or any known pending applications, although BIS is not in a position to guarantee the authority of any such information.* *b) If the proposal is accepted on technical grounds, the originator shall ask any known patent holder for a statement that he would be willing to negotiate licences under patent and like rights with applicants throughout the world on reasonable terms and conditions. A record of patent holder's statement shall be placed in the relevant technical file and shall be referred to in the standard. If the patent holder does not provide such a statement, the technical committee shall not proceed with the inclusion. of the patented item unless the respective division council gives permission.* *c) Should it be revealed after publication of the standard that licences under a patent and like rights cannot be obtained under reasonable terms and conditions, the standard shall be referred back to the technical committee for further consideration* As the current template of BIS for submitting new proposal, captures all provisions including reference to patents, the Committee suggested the Proposer (M/s Tata Steel Ltd) to submit the proposal for developing new standard on ***Steel for Elevated temperature application*** through

		4. Whether the grade proposed is fire resistant or it can be termed as heat resistant. 5. In case the grade is included in the standard, how will Tata Steel handle its patent. Tata steel was requested to send their reply on above issues to BIS. Following reply was received from Tata steel: '1. The chemistry against Trial heat (V44627/55600642) sent to BIS on Sep 13 2017 was a mistake from our side. It was for another trial heat (V27351/Coil ID 37530401), which was not up to our full satisfaction. The document sent on Jan 11 2018 along with chemistry, mechanical properties and fire resistance properties are correct and validated by an independent accredited NABL lab. 2. Regarding patent, Dr Sanjay Chandra, Chief R&D and Scientific Services Tata Steel, has already sent you an email communication on April 27 2018.' The letter mentioned above is attached below:  BIS.pdf The committee noted the information and after detailed deliberation decided that 'Fire Resistance' term is already covered in IS 15103 so including a grade with similar terminology in IS 10748 would be misleading. Also, the grade for which inclusion is being proposed by Tata steel do not meet the requirements specified in scope of IS 15103 and so		BIS portal. **Further, the sub-committee was advised to examine the proposal subsequently and send its recommendation to the Committee in due course.**

		the proposed cannot be termed as fire resistant grade or cannot be included in IS 15103. Tata steel submitted a changed nomenclature for the grade as 'Elevated temperature application'. The committee agreed to form a new standard for elevated temperature application once requisite approvals are received from BIS as it a patented grade.		
25	Amendment No.5 to IS 649: 1997 Method of testing steel sheets for magnetic circuits of power electrical apparatus	During the last meeting the committee after deliberation decided to send the draft amendment for wide circulation for one month. The document was sent for wide circulation for one month on 12/10/2018. No comments were received The committee after deliberation decided to send the draft amendment placed at **Appendix I** for printing.	The modified draft involving changes as per IS 12 was shared with Panel Convener Sh Kapil Kapoor(Appendix-21).	**The committee took note of the proposed changes to IS 649(Appendix-21). It advised the Sub-Committee to take actions on the matter.**
26	Amendment No.2 to IS 513 (Part 1): 2016	The committee in the last meeting the committee after deliberation decided to send the amendment for wide circulation for one month. The document was sent for wide circulation on 14/10/2018.No comments were received. The committee noted the information and after deliberation decided to send the draft amendment placed at **Appendix 17** for printing.	No action taken. However, the sub-committee, during its meeting held on 13rd June 2019 had proposed that the finalized amendment could be merged with another amendment proposed to the standard for stipulating width of test piece against gauge length of 50 mm for tensile test on accounts of comments received from CMD-II, BIS (Appendix-22).	**The committee took note of the proposed changes to IS 513 Pt.1 (Appendix-22) and advised the Sub-Committee to take actions on the matter.**
27	Amendment No.1 to IS 513 (Part 2):2016 Cold reduced carbon steel sheet and	 IS 513 (Pt 2) New Microsoft Word Doc	Was taken up again in the sub committee meeting held on 13 June 2019. The decision of sub committee is as follows: The committee deliberated the issue and after deliberation	**The committee took note of the proposed changes to IS 513 Pt.2 (Appendix-23) and advised the Sub-Committee to take actions on the matter.**

	strip Part 2 High tensile and multi-phase steel	The committee noted the comment received from CMD-II and after deliberation remarked that elongation of the test piece is independent of its width and depends only on its gauge length. In the view of the above committee decided that no change was required in the standard.	accepted the comments made by CMD. As there are two test piece width in IS 1608 (Part 1) for 50 mm gauge length, width of test piece to be used needs to be mentioned in the standard. Draft amendment based on the comments finalized by the sub-committee is placed at **Appendix- 23(Pg 198).**	
28	IS 10748: 2004- Hot Rolled Steel Strip For Welded Tubes And Pipes	During the last meeting comments received from JSW on the proposal fpr amendment in IS 10748 received from Mr B B Prasad of Tata steel were discussed and after deliberation the committee agreed to the comments made. It was decided that Mr B B Prasad shall draft an amendment to IS 10748 based on the agreed comments. The draft amendment shall then be circulated within MTD4 and MTD 19 committee member for 21 days and incase no comments are received , the same shall be sent for wide circulation for one month. Draft amendment received from Mr B B Prasad is given below  Amendment to IS10748.2017-R2.do The committee discussed the draft amendment and after deliberation decided to circulate the amendment among committee members of MTD 4 and MTD 19 for 21 days and if no comments are received send the draft amendment for wide circulation for one month.	No action taken.	**The committee took note of the status took note of the status and requested Member Secretary to take action (Appendix-24).**

29	Amendment No. 1 to IS 11513:2017 Hot Rolled Carbon Steel Strip for Cold (Second Revision)	During the previous meetings the amendment were discussed and after deliberation the committee suggested changes in the amendment. The amendment shall be redrafted by Mr Kapil Kapoor as per the discussion held and the committee agreed to send the revised amendment for wide circulation for one month. Reply was still awaited. Shri Kapil Kapoor informed the committee that redrafted amendment will be submitted to member secretary by 15th January 2019. The committee requested member secretary to circulate the draft amendment for one month once it is received.	The document has been received from panel convener vide email dated 28th March 2019. No further action taken.	**The committee took note of the status and requested Member Secretary to take action. (Appendix-25).**
30	Amendment to IS 277	During the last meeting comments received from CMD 2 as mentioned at item 5.1 of agenda, were discussed and after deliberation the committee decided that the additional grade included in IS 277 viz GP 230, GP 250,GP 275, GP 300, GP 350 Class 1 & 2, GP 450 & GP 550 are structural grade and thus the tensile test in these grades should be made mandatory. It was thus decided that a draft amendment shall be formulated and circulated within the technical committee members for 21 days for comments and incase no reply is received, the same shall be sent for wide circulation for one month. The amendment is currently being prepared for wide circulation. The committee noted the information.	No action taken.	**The committee took note of the status and requested Member Secretary to take action. Also, Sub-Committee was advised to monitor the progress.**
31	Harmonization of Indian Standard with ISO standards	The following panel 17 was formed to review IS standards viz.a.viz ISO standard and give suggestion for harmonization of Indian Standards with ISO standards	Report is awaited from the Panel.	The Committee noted the status and advised Sub-Committee reconstitute the Panel -17 by substituting the retired or moved away personnel by the existing personnel representing the same

		Mr P K Patra – JSW - Convenor Mr P.K.Sen - RINL Mr M Borkar -Jindal Steel & Power Ltd MR Sandip Bhattacharya– TATA STEEL Mr Jayanta Saha -INSDAG Mr Balasubramanium - SAIL, BSP Mr Rajesh Maheshwari - Tata Bluescope ltd. Mr Sarkar -RDCIS, SAIL, Ranchi Mr Deepak Sahoo - Powergrid The following panel 18 was formed to review IS standards viz.a.viz IEC standard and give suggestion for harmonization of Indian Standards with IEC standards Mr Kapil Kapoor, Thyssenkrup - Convenor Mr Devasish Mishra, JSW, Bellary Mr Manoj Mhatre, Posco electrical Mr Vipin Singhal – ITMA The committee after deliberation requested the panel to compare the following standards with Indian structural steel standard for harmonization. ISO 630-1 to 6 ISO 4950-1 to 3 ISO 4951-1 to 3 ISO 6930-1 & 2 During the last meeting committee discussed that ISO 630 is in various parts and IS 2062 does not exactly match with any of the part. Thus all the parts are to be studied deeply and the indian standard applicable to different parts are to be identified. The panel requested for ISO 4950 & ISO 4951 which are also related to high yield strength flat steel products. Mr Patra informed that based on the ISO document available, he will do the mapping with the various Indian standards and a draft of IS 2062 shall be prepared based on ISO 630. The draft thus		organization in MTD 4. **Further, the Sub-Committee to submit its recommendation to the Committee in due course.**

		prepared shall be discussed in the panel meeting in one month time. The committee was informed that Panel 17 met on 6th August 2018 at Tata centre Kolkata to discuss the issue. The MOM was placed at item 12 of the agenda. The committee discussed the report of the panel and after deliberation agreed to the plans laid out by the panel. The committee also informed the panel that extra justification is required for grades being retained in the revised draft standard which is to be submitted by 30 April 2019.		

Details of panels are given at Appendix-26.

Draft Indian Standard

Hot rolled and cold rolled silicon steel intended for
Semi / fully processed non grain oriented electrical steel -
SPECIFICATION

1 SCOPE

This standard covers the general technical conditions for hot-rolled steel coils / strips & cold rolled steel coils / strips having Silicon content up to a maximum of 6.0 percent. The material intended for the processing of Non Grain Oriented Electrical Steel in semi / fully processed condition

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:

IS No.	*Title*
228 (All parts)	Method for chemical analysis of steel
1730 : 1989	Dimensions for steel plates, sheets and strips and flats for general engineering purposes *(second revision)*
8910 : 2010	General technical delivery requirements for steel and steel products *(first revision)*
1956 (All parts)	Glossary of terms related to iron and steel: Part 4 Steel sheet and strip *(first revision)*
IS/ISO 16160 :2005	Continuously hot-rolled steel sheet products – Dimensional and shape tolerances
IS648 : 2006	Cold Rolled Non Oriented Electrical Steel sheet & Strip –Fully Processed Type
IS15391 : 2003	Cold Rolled Non Oriented Electrical Steel sheet & Strip –Semi Processed Type

3 SUPPLY OF MATERIAL

3.1 General requirements relating to the supply of hot-rolled carbon steel strips shall conform to IS 8910.

3.2 Hot-rolled & Cold rolled Silicon steel strip shall be supplied in coil form either with mill edges or sheared (slit) edges as agreed to between the manufacturer and the purchaser.

3.3 The material may be supplied in any one of the following conditions subject to mutual agreement between the supplier and the purchaser:

a) Hot rolled with or without pickling
b) Cold rolled condition - full hard / un-annealed

3.4 The material shall be supplied as per the chemical composition given in Table 2.

4 DESIGNATIONS

There shall be four designations of hot-rolled carbon steel strip as follows:

Table 1 Designation and Grades

(Clause 4)

S. No.	Grade & Designation	
	Grade	Designation
1	LS	Low Silicon
2	MS	Medium Silicon
3	HS	High Silicon
4	VHS	Very High Silicon

5 MANUFACTURE

5.1 Strip shall be made from steel manufactured by any process of steel making at the discretion of the manufacturer.

6 CHEMICAL COMPOSITION

6.1 Ladle analysis of the material, when carried out either by the method specified in the relevant parts of IS 228 or any other established instrumental/ chemical method shall be according to Table 2

6.2 . In case of dispute the procedure given in the relevant part of IS 228 shall be the referee method.

Table 2 Chemical Composition

(Clauses 3.3 and 6.1)

S. No.	Designation	Name	Constituent, Percent, Max Elements in wt% (max)					
			C	Si	S	P	Mn	Al
i)	LS	Low Silicon	0.06	≥0.10<0.60	0.020	0.30	1.00	0.50
ii)	MS	Medium Silicon	0.05	≥0.60-<2.00		0.20	1.00	1.00
iii)	HS	High Silicon		≥2.00-<3.00		0.20	1.00	2.00
iv)	VHS	Very High Silicon		≥3.00-<6.00		0.20	1.00	2.00

NOTES

1. **For the material intended for semi processed CRNGO Non alloy type shall have no Si limit.**
2. **The nitrogen content of the steel shall not be more than 0.012 percent.**
3. **Restricted chemistry may be mutually agreed between the purchaser and the supplier.**

6.3 Product Analysis

Permissible variation in case of product analysis from the limits specified in Table 2 shall be as given in Table 3.

Table 3 Permissible Variation for Product Analysis

(Clause 6.2)

S. No. (1)	Constituent (2)	Percentage Limit of Constituent (3)	Permissible Variations over Specified Limit, Percent, Max (4)
i)	Carbon	≤0.050	0.010
ii)	Manganese	≤1.00	0.040
iii)	Sulphur	≤ 0.010	0.005
iv)	Phosphorus	≤0.30	0.010
v)	Silicon	≥0.10<0.60 ≥0.60-<2.00 ≥2.00 ≤ 6.00	0.03 0.100 0.150

7 FREEDOM FROM DEFECTS

The steel shall be free from amounts of segregation, laminations, surface flaws and other defects which are detrimental to subsequent processing and ultimate use. The degree or amount of surface defects in a coil may be expected to be more than in cut lengths because of the impossibility of rejecting the portions of a coil. This shall be taken into account by the purchaser in his assessment of the material. An excessive amount of defects may be the cause for rejection.

8 DIMENSIONS AND TOLERANCES (For Hold Rolled Steel Strips)

8.1 Unless otherwise agreed to between the supplier and the purchaser, standard dimensions of hot rolled steel strip shall be as specified in IS 1730.

8.2 Unless otherwise agreed the thickness tolerances shall be as per IS/ISO 16160.

8.3 Crown

Crown is the difference in strip thickness from centre to edge.

$$\text{Crown} = t_c - (t_1 + t_2)/2$$

where

t_c = thickness at centre of the strip width; and
t_1 and t_2 = thicknesses measured at 40 mm inside of the 2 edges.

The crown of the hot-rolled mill edge steel strip meant for cold rolling shall be as follows:

For width up to and including 1200 mm : - 100 µm Max
For width above 1200 mm : - 150 µm Max

8.3.1 Any special tolerances to suit specific requirements shall be mutually agreed to between the manufacturer and the customer.

8.3.2 The difference in thickness across width at the two edges of slit strip shall not exceed the limits given below:

Nominal Thickness, mm		*Tolerance on Thickness Over Two Edges, mm*
From	Upto and Including	
-	3	0.06
3	4	0.08

8.4 Permissible Width Variations

The permissible tolerance on the nominal width of hot-rolled strip shall conform to the requirements specified in IS/ISO 16160.

8.5 Edge Camber

The edge camber tolerance shall be as indicated below:

Nominal Width, mm		Measured Length, mm	Camber, mm	
From	Up to and Including		Mill Edge	Slit Edge
-	600	2500	-	10
600	1500	2500	25	15

9 DIMENSIONS AND TOLERANCES (For Cold Rolled Steel Strips)

9.1 Thickness Tolerances

9.1.1 The allowable tolerance on the nominal thickness within the same acceptable unit shall be $\pm$8 percent of the nominal value for thickness 0.35 & 0.50mm and $\pm$6 percent of the nominal value for thickness 0.65mm & 1.00mm. The additional thickness due to welds, with respect to the measured thickness of the steel strip shall not exceed 0.050mm

9.1.2 The difference in the thickness in a direction perpendicular to the direction of rolling shall not exceed 0.02mm for thickness 0.35 & 0.50mm and 0.03mm for thickness 0.65mm & 1.00mm. The measurement shall be made using a micrometer with an accuracy of 0.001mm. These tolerances apply only to the materials with a width greater than 150mm.

9.1.3 The height of the weld if any & edge burr shall not exceed 50 microns

9.2 Width Tolerances

9.2.1 For material supplied with trimmed edges, the tolerances of below table shall apply

Width tolerances of trimmed Edges

(Clause 9.2.1)

Sr. No	Nominal Width	Tolerance
1	600 ≤1000	+1.0/-0.0
2	>1000≤1500	+1.5/-0.0

9.2.2 For materials supplied with as rolled edges, the tolerances on nominal width should be the subject of agreement when ordering.

9.3

Material required to tolerances other than those specified in 9.1 & 9.2 shall be subject to agreement between the purchaser and the manufacturer.

10 DELIVERY

10.1 The material shall be supplied in coil form. The mass of the coil shall be as agreed to between the contracting parties.

11. PACKING

11.1 For HRNO - The material shall be firmly strapped to prevent damage during transit.
For additional packing requirements to be as per agreement between the contracting parties.
11.2 For CRFH Coils – Packing shall be as per IS 648 clause No 11.

12. MARKING

12.1 Each strip/coil shall carry a metal tag or adhesive label/sticker bearing the cast number or identification mark or lot number traceable to the cast number and the manufacturer's name or trade-mark or shall be legibly marked at top.

12.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

12.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made there under. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

PROFORMA FOR PROPOSING NEW SUBJECTS FOR NATIONAL STANDARDIZATION

1. Proposer Kapil Kapoor, tkES Nasik
   (Name & Address)
2. Title: - IEC 60404-8-8 – Standard is required for the product specification.
   (Indicate whether the standard required is for product specification/methods of test/code of practice and define the subject in brief)
3. Scope:- This section of the IEC 404-8 is intended to define the grades of non-oriented magnetic steel strip in nominal thickness of 0.05 mm, 0.10 mm, 0.15 mm, 0.20 mm and of thin oriented magnetic steel strip in nominal thickness of 0.05 mm ,0.10 mm , 0.15 mm.
   This section applies to magnetic steel strip supplied in the finally annealed condition in coils intended for construction of magnetic circuits used for frequencies equal to or higher than 100 Hz
   (Define the limits to be considered)
4. Purpose and Justification:- For application of thin gauge for higher frequency requirements
5. Likely users of standard and their inputs:- Electrical steel mills and Electrical appliances users
6. Any related standard/series of standard/system standard required to make this subject Standard complete:- IEC 60404-8-8.
7. When the final Standard would be required (any time limit) within next 6 Months
8. Any specific bottlenecks without this standard: - As it is not covered in IS648 & Is 3024, it would have to be approved by the panel before import.
9. Bearing with Govt. legislation regulation, etc. …….
10. Name and address of manufacturers/implementing industries/purchasing organizations/component supplier/raw material supplier …….
11. Availability of test facilities :- Similar to ones applicable for IS648 & IS 3024
12. Whether related to variety reduction, export, health, safety consumer protection, mass consumption, energy conservation, technology transfer, technology upgradation, protection of environment & other national priorities. ……
13. Relevant supportive documents/standards IEC 60404-8-8
14. R&D work done in India ……..
15. Status of the industry in the country …….
16. Any foreign collaboration (give details) ……
17. Liaison with any Organization(s) ……..
18. Preparatory work:
    a) whether draft attached ……
    b) whether outline attached and draft can be prepared …….
19. Whether this project can be funded by your organization or can it be sponsored by industry/associations/professional bodies/ministry ? If yes, to what extent ?
    ……..
20. Whether your Organization would be interested to opt for BIS Standard Mark once the standard is published ? …….

Date …….. Signature

NOTES:

1. It is desirable that information is provided by the proposer for all items of the proforma in any case information against item 1 to 5 must be provided.
2. Write 'NA' wherever not applicable.
3. Add separate sheet to elaborate.

For Comments Only **Doc: MTD 4(13289)**

BUREAU OF INDIAN STANDARDS

Indian Standard

SPECIFICATION FOR WEAR AND ABRASION RESISTANT STEEL SHEETS AND PLATES

ICS 77.140.50

Last date for receipt of comments is 28 12 2018

FOREWORD

(*Formal clauses will be added later*)

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 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

This standard covers the requirements for wear and abrasion resistant steel and plates in Quenched (Q) or Quenched and Tempered (Q&T) condition.

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 edition of standard indicated below:

IS No.	*Title*
IS 228 (in various parts)	Methods for chemical analysis of Steel
IS 1599 : 2012	Metallic materials- Bend test (third revision)
IS 1956 (Part I)	Glossary of terms relating to iron and steel (General metallurgy, heat treatment and testing)
IS 1956 (Part IV)	Glossary of terms relating to iron and steel (Steel sheet and strip)
IS 1608 (Part 1) : 2018/ ISO 6892-1 : 2016	Metallic Materials – Tensile Testing Part 1 Method of Test at Room Temperature (fourth revision)
IS 1730 : 1989	Steel plates, sheets, strips and flats for structural and general engineering Purposes - Dimensions (second edition)
IS 1852 : 1985	Specification for Rolling and cutting tolerances for hot-rolled steel products (fourth edition)
IS 1757 (Part 1) :2014/ ISO 148-1 :2009	Metallic materials – Charpy Pendulum Impact Test Part 1 Test Method (third revision)
IS 4225:2004	Recommended practice for straight beam ultrasonic testing of steel plates
IS 8910 : 2010/ ISO 404 :1992	General technical delivery requirements for steel and steel products (first revision)
IS 1500 (Part 1) :2013/	Metallic Materials - Brinell hardness test Part 1 Test method

3. SUPPLY OF MATERIAL

3.1 General requirements for the supply of material shall be as laid down in IS 8910.

3.2 Steel shall be supplied in the form of sheets or plates in mill edge or cut / trimmed edge condition.

3.3 The products shall be supplied in Quenched (Q) or Quenched and Tempered (Q&T) conditions.

4 TERMINOLOGY

4.1 Quenching

The process of quenching or quench hardening involves heating the steel above the upper critical temperature, soaking for sufficient time so as to attain an uniform temperature through the thickness and then rapidly cooling the steel in water / oil / forced air / other media (Quenching) to increase the hardness of steel significantly.

4.2 Tempering

Heating to elevated temperature but below transformation zone, of hardened steel and holding for specified time at temperature followed by cooling at desired rate to develop desired mechanical properties in these steel.

4.3

Wear and Abrasion Resistant Steels

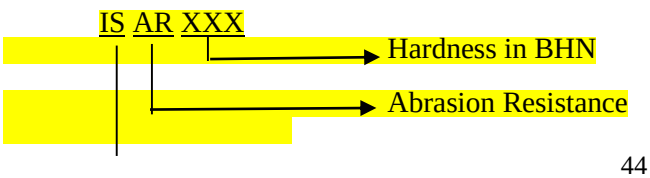
These are steels with higher hardness than conventional steels such that the sheets and plates of this steel resist surface wear and abrasion due to rubbing or friction during use.

5 DESIGNATION AND GRADES

There are five different grades of steel based on hardness levels as given below in Table 1.

Table 1 Designation and Grades

S. No.	Grade	Hardness in BHN	Designation (Quality)
1	ISAR 400	360-430	The number in front of the grade gives the indication of hardness level of steel plates in Brinell Hardness Number (BHN)
2	ISAR 450	425-475	
3	ISAR 500	470-525	
4	ISAR 550	520-575	
5	ISAR 600	560-625	



6 MANUFACTURE

6.1 The steel shall be manufactured by any process of steel making with secondary refining at the discretion of the manufacturer. The steel may be processed through vacuum degassing if agreed between the manufacturer and purchaser at the time of order.

6.2 Steel sheets and plates may be supplied in following heat treated conditions:

a) Quenched (Q)
b) Quenched and Tempered condition (Q&T)

The supply condition may be agreed between the manufacturer and purchaser at the time of order.

7 CHEMICAL COMPOSITION

7.1 Ladle Analysis

Ladle analysis of the material when carried out either by the method specified in the relevant part of IS 228 or any other established instrumental/ chemical method shall be as given in Table 2. In case of dispute, the procedure given in the relevant part of IS 228 shall be the referee method.
The Heat shall be certified based on ladle analysis. Table 3 gives the recommended values for carbon equivalent for each grade of steel.

Table 2 Chemical Composition

Steel Grade	Constituent, *Percent , Max*								
	C	Mn	Si	P	S	Cr	Mo	Ni	B
ISAR 400	0.30	1.60	0.70	0.025	0.010	1.50	0.60	1.50	0.0050
ISAR 450	0.32	1.60	0.70	0.025	0.010	1.50	0.60	1.50	0.0050
ISAR 500	0.35	1.60	0.80	0.025	0.010	1.50	0.60	1.50	0.0050
ISAR 550	0.37	1.60	0.80	0.025	0.010	1.50	0.60	1.50	0.0050
ISAR 600	0.47	1.60	0.80	0.025	0.010	1.50	0.60	1.50	0.0050

Table 3: Recommended Carbon Equivalent Limits for Different Grades

Steel Grade	Carbon Equivalent (in wt% max) Corresponding to Plate Thickness in mm Range							
	>3.00-<8.00	≥8.00-<20.00	≥20.00-<40.00	≥40.00-<50.00	≥50.00-<60.00	≥60.00-<80.00	≥80.00-<100.00	≥100.00-≤130.00
ISAR 400	0.41	0.47	0.52	0.60	0.65	0.70	0.75	0.85
ISAR 450	0.47	0.52	0.60	0.65	0.70	0.75	0.80	0.90
ISAR 500	0.50	0.65	0.70	0.75	0.80	0.85	0.85	-
ISAR 550	-	0.70	0.75	0.80	0.85	0.90	-	-
ISAR 600	-	0.70	0.75	0.85	0.85	0.90	-	-

NOTES

1 Grain refining elements such as Al, Nb, V and Ti may be added singly or in combination. Total grain refining elements shall not be more than 0.25 percent.
2. Elements other than those given in the above table may be added if agreed between the manufacturer and supplier
2. Restricted chemical composition may be mutually agreed between the purchaser and the supplier
3. Nitrogen content of steel shall not exceed 0.012 percent.
4. Carbon Equivalent (CE) based on ladle analysis = C+Mn/6+(Cr+V+Mo)/5+(Cu+Ni)/15
5. Thickness above 130 mm may be supplied if mutually agreed between the manufacturer and purchaser.
6. Carbon Equivalent (CE) for thickness above 130 mm may be mutually agreed between the manufacturer and purchaser

8 MECHANICAL PROPERTIES

Except Hardness Test, Mechanical testing like Tensile, Bend and Impact tests for Wear and Abrasion Resistance Steels are not mandatory for this standard. However, if required, these tests and their values may be mutually agreed between the manufacturer and purchaser at the time of order.

For reference, the representative values for tensile, Bend and Impact test for 20 mm thickness are given in table 5, 6 and 7 respectively.

8.1 Hardness Test

1. Surface hardness test to be conducted on sample drawn from the heat treated sheet / plate. The ranges of hardness values for different grades are mentioned in Table 4 given below:
2. For plates from plate mill, one test sample shall be taken from corner of each plate as rolled. For Sheets/plates produced from coil, three samples from each coil (Head end, Middle and Tail end) shall be taken.

Table 4. Hardness in BHN

Steel Grade	Hardness (BHN)
ISAR 400	360-430
ISAR 450	425-475
ISAR 500	470-525
ISAR 550	520-575
ISAR 600	560-625

NOTES

1 Surface Hardness testing shall be carried out as per IS 1500 Part 1 (2013)
2 Hardness testing to be done after removing a surface layer by milling or grinding as per given in below table

Sheet/ plate Thickness range (mm)	Depth of Grinding (mm)
Up to 10.0	0.50
>10.0 - 25.0	1.00
>25.0 - 50.0	1.50
>50.0 - 80.0	2.00
>80.0	3.00

3 Minimum core hardness shall be 90% of the guaranteed minimum surface hardness.

8.2 Tensile Test

Table 5 gives the indicative tensile test values for 20mm thickness plate for specified grades.

Table 5. Indicative Tensile Strength for 20mm Thickness Plate

Steel Grade	Yield Strength (in MPa)	Tensile Strength (in MPa)	%Elongation (GL: $5.65\sqrt{So}$)

ISAR 400	900-1100	1250 min	8.0 min
ISAR 450	1000-1200	1400 min	8.0 min
ISAR 500	1250-1400	1550 min	6.0 min
ISAR 550	1400-1650	1700 min	6.0 min
ISAR 600	1600-1800	1750 min	-

NOTE

1. Tensile test should be conducted as per IS 1608 (Part 1).

8.3 Bend Test

Table 6 gives the indicative bend test radii for 20mm thickness plate for specified grades.

Table 6. Bend Angle and Internal Bend Radius for 20 mm Thick Plate

Steel Grade	Bend Radius (Bend angle: 90º)	
	Sample Orientation Transverse to Rolling Direction	Sample Orientation Longitudinal to Rolling Direction
ISAR 400	3.0 x thickness	4.0 x thickness
ISAR 450	4.0 x thickness	5.0 x thickness
ISAR 500	5.0 x thickness	6.0 x thickness
ISAR 550	-	-
ISAR 600	-	-

NOTES

1. Bend test shall be carried out in accordance with IS 1599.
2. The test piece shall be bend at ambient room temperature through 90º.

8.4 Charpy V-notch Impact Test

Table 7 gives the indicative charpy impact values for 20mm thickness plate for specified grades.

Table 7. Indicative Charpy Impact Values for 20mm Plate Thickness

Steel Grade	Average Charpy Impact energy (Joules)	
	Test Temperature -20ºC	Test Temperature -40ºC
ISAR 400	27 min	20 min
ISAR 450	27 min	15 min
ISAR 500	27 min	15 min
ISAR 550	-	-
ISAR 600	-	-

NOTES

1. Impact test shall be carried out in accordance with IS 1757 (Part 1).
2. The sample orientation is longitudinal to rolling direction.

9 NON DESTRICTIVE TEST

The material may be subjected to non-destructive testing to determine the internal soundness of material subject to mutual agreement between the manufacturer/supplier and purchaser at the time of order.

10 RETEST:

10.1 If a test does not give the specified results, two additional tests shall be carried out from same plate as rolled / sheets-plates from coil. Both the retests shall conform to the requirements of the standard

10.2 If any of the retest fails to meet the mechanical requirements specified, the supplier may re-heat treat the material and in that case, all the mechanical properties shall be re-evaluated.

11 FREEDOM FROM DEFECTS

11.1 Sheets and Plates shall be well and cleanly rolled to the dimensions specified. The finished material shall be reasonably free from surface flaws, laminations, rough/jagged and imperfect edges and other harmful defects.

11.2 Minor surface defects may be removed by the manufacturer by grinding provided that the thickness of the sheet /plate shall not go below the thickness tolerance specified at the spot where dressing is done. The grinding shall be even and smooth and shall be widened enough to remove sharp ridges.

11.3 Repair welding of defective spots shall not be permitted.

12 DIMENSIONS AND TOLERANCES

Unless otherwise agreed to between the purchaser and the manufacturer, the rolling and cutting tolerances for steel products conforming to this standard shall be as per IS 1852.

13 MARKING

Each plate as rolled shall to be marked with manufacturer's name, designation of steel and details like plate no., cast/ heat number and nominal dimensions.

Sheets/plates produced from strip or coil form shall be supplied in bundles. Each bundle shall carry a metal tag or adhesive label/sticker bearing the cast/heat number or identification mark or lot number traceable to the cast/heat number and the manufacturer's name or trade mark. Alternatively, top sheet/plate shall be legibly marked with cast/heat number or identification mark or lot number traceable to the cast/heat number, name of the manufacturer or trade-mark.

14 DELIVERY

The plates may be supplied in as heat treated condition or shot blasted and primer coated condition. The technical requirement of the surface coating shall be mutually agreed between manufacture and purchaser at time of order.

15 BIS CERTIFICATION MARKING

15.1 BIS Certification Marking

The material may also be marked with the Standard Mark.

15.1.1 The products(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the BIS Act, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.

16. ORDERING INFORMATION

While placing the order, the following are the minimum information to be specified by the purchaser:

a) Grade;
b) Size;
c) Mass of the material;
d) Total order quantity;
e) Marking instruction other than specified, if any;
f) Restricted chemistry and/or properties, if used for special purpose;
g) Dimension tolerance, if any special agreements to be made; and
h) Supply condition (edge condition, delivery condition and type of surface coating if any, etc.)

For Comments Only **Doc:MTD 4 (13290)**

BUREAU OF INDIAN STANDARDS

Indian Standard

HOT ROLLED STEEL STRIP AND PLATES FOR WELDED TUBES AND PIPES FOR MANUFACTURE OF LINE PIPE—SPECIFICATION

ICS 77.140.75

Last date for receipt of comments is

FOREWORD

(*Formal clauses will be added later*)

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 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

This standard covers requirements for weldable quality hot-rolled steel strip, sheet and plates intended for the manufacture of welded steel pipes for used in pipeline transportation system in the petroleum and natural gas industries.

Commented [NS1]: What about for seamless???

Steels for manufacturing Seamless Pipes are not in the scope of this standard as the starting material for seamless pipes is neither Steel Strips nor Steel Plates. RM for seamless is steel ingot, bloom, billet rounds etc.

2 REFERENCE

The standards listed below contain provisions, which through reference in this text constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subjected to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of this standard indicated below:

IS No.	*Title*
IS 228 (Relevant Parts)	Method for chemical analysis of steel
IS 1730:1989	Steel plates, sheets, strips and flats for structural and general engineering purposes– Dimensions (second revision)
IS/ISO 16160:2005	Continuously hot-rolled steel sheet products–Dimensional and shape tolerances
IS 1956(Part 4):2013	Glossary of terms relating to iron and steel Part 4 Flat products (Second revision)
IS 3803(Part 1):1989/ ISO 2566/1:1984	Steel—Conversion of elongation values Part 1 Carbon and low alloy steels (second revision)
IS 8910:2010/ ISO 404:1992	General technical delivery requirements for steel and steel products
IS/ISO 3183	Petroleum and natural gas industries — Steel pipe for pipeline transportation systems
IS 1757 (Part 1):2014/ ISO 148-1:2009	Metallic materials — Charpy pendulum impact test Part 1 Test method
IS 1500/ ISO 6506 (all parts)	Metallic material – Brinell Hardness test

IS 1501/ ISO 6507 (all parts)	Metallic material – Vickers Hardness test
IS 1586/ ISO 6508 (all parts)	Metallic material – Rockwell Hardness test
IS 1608(Part 1):2018/ ISO 6892-1:2016	Metallic material – Tensile testing Part 1 Method of test at room temperature
ISO 6929	Steel products – Definitions and classification
IS 1599:2012/ ISO 7438:2005	Metallic material – Bend test
IS 4225:2004	Recommended practice for straight beam ultrasonic testing of steel plates
IS 4748:2009/ ISO 643:2003	Steels – Micrographic Determination of the Apparent Grain Size (second revision)
ISO 15156-2:2015	Petroleum and natural gas industries — Materials for use in H_2S containing environments in oil and gas production — Part 2 Cracking- resistant carbon and low alloy steels and the use of cast irons

3 TERMINOLOGY

For the purpose of this standard, following definitions shall apply:

3.1 Micro – Alloying Elements

Elements, such as niobium, vanadium and titanium or boron (for steel with YS>690 Mpa) added singly or in combination to obtain high strength combined with better toughness, formability and weldability.

3.2 Weldability

A metallic substance is considered to be weldable by a given process and for the given purpose, when metallic continuity to a stated degree can be obtained by welding using a suitable procedure, so that the joints comply with the requirements specified in regard to both their local properties and their influence on the construction of which they form apart.

3.3 As Rolled

The normal rolling of steel with no specific control of rolling temperature followed by air cooling. The rolling and finishing temperatures are typically in the austenite recrystallization region (above the Ar3 temperature) of the steel. The strength and toughness properties of steel produced by this process are generally less than steel rolled with other temperature controlled advanced rolling processes.

3.4 Controlled Rolling

A hot rolling process in which the temperature of the steel and its reduction ratio are controlled in order to achieve fine grain microstructure and optimum mechanical properties.

Fs

3.5 Normalizing Rolling

A hot rolling process in which the final rolling passes are carried out at a suitable temperature equivalent to normalizing temperature followed by cooling in air to a temperature below the transformation temperature, in order to produce a structure, analogous to that obtained by a separate normalizing treatment of hot rolled product.

3.6 Thermo - Mechanical controlled processing (TMCP)

A hot rolling process which consists of strict control of steel temperatures and reductions during hot rolling. A high proportion of the rolling reduction is to be carried out close to or below the Ar3 transformation temperature

and may involve rolling towards the lower end of the temperature range of the inter critical dual- phase region, thus permitting little if any recrystallization of the austenite. The process may involve accelerated cooling by water on completion of rolling.

3.7 Normalizing

A normalizing heat treatment consist of heating steel from an appropriate temperature below the transformation range to the proper temperature above the transformation range, holding for a sufficient time to effect the desired transformation and then individually cooling the steel in air. The process improves the mechanical properties of as-rolled steel by refining the austenitic grain size, provided that the steel is produced by fine austenitic grain size practice

3.8 Quenching and Tempering (QT)

Quenching involves a heat treatment process in which steel is heated to an appropriate temperature above Ac3 to austenitising temperature of steel and then cooled with an appropriate quenching media for the purpose of hardening the microstructure. Tempering subsequent to quenching is a process in which the steel is reheated to an appropriate temperature not higher than the Ac1 to restore toughness properties by improving the microstructure.

4 ABBREVIATED TERMS

CE_{IIW}	Carbon equivalent, based upon the International Institute of Welding equation
CE_{Pcm}	Carbon equivalent, based upon the chemical portion of the Ito-Bessyo carbon equivalent equation
CVN	Charpy V-notch
DWT	Drop-weight tear
HBW	Brinell hardness
HIC	Hydrogen-Induced Cracking
HRC	Rockwell hardness, C Scale
HV	Vickers hardness
PSL	Product specification Level
SSC	Sulphide Stress Cracking

5 PRODUCT SPECIFICATION LEVEL

5.1 Product Specification Level (PSL)

This specification establishes requirements for two product specification levels (PSL 1 and PSL 2). The PSL designations define different standard technical requirements. PSL 1 shall be at the discretion of the manufacturer unless a specific delivery condition is specified in the purchase order. PSL 2 shall have mandatory technical requirements for the product which may include specific technical parameters viz, carbon equicvalent values, charpy V-notch impact toughness, minimum and maximum range for yield strength and tensile strength etc.

5.2 Steel Grade and Delivery Condition

5.2.1 The steel grade for PSL 1 is identical to the steel grade (designated by a steel name) and shall be as given in Table 1. It consists of an alpha or alphanumeric designation that identifies the yield strength level of the steel.

5.2.2 The steel grade for PSL 2 shall be as given in Table 1 and consists of an alpha or alphanumeric designation that identifies the yield strength level of the steel. The steel name includes a suffix that consists of a single letter (R, N, Q or M) that identifies the delivery condition.

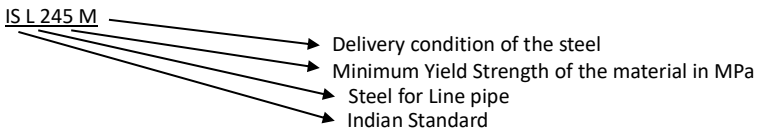
NOTE—Steel for sour service, see Annexure 2

Table 1 —Steel Grades and Acceptable Delivery Conditions

PSL	**Delivery Condition of the Steel**	Steel grade
PSL 1	As-rolled, normalizing rolled and normalized	ISL 175
	As-rolled, normalizing rolled, thermomechanical rolled, normalized, normalized and tempered; or, if agreed, quenched and tempered	ISL 245 ISL 290 ISL 360 ISL 390 ISL 415 ISL 450 ISL 485
PSL 2	As-rolled	ISL 245 R ISL 290 R
	Normalizing rolled, normalized, normalized and tempered	ISL 245 N ISL 290 N ISL 360 N ISL 390 N ISL 415 N
	Quenched and Tempered	ISL 245 Q ISL 290 Q ISL 360 Q ISL 390 Q ISL 415 Q ISL 450 Q ISL 485 Q ISL 555 Q ISL 625 Q ISL 690 Q ISL 830 Q
	Thermo-mechanical Controlled Processing (TMCP)	ISL 245 M ISL 290 M ISL 360 M ISL 390 M ISL 415 M ISL 450 M

		ISL 485 M ISL 555 M ISL 625 M ISL 690 M ISL 830 M

5.2.3 Nomenclatures of the grade is as below:



6 INFORMATION TO BE SUPPLIED BY THE PURCHAER

6.1 General Information

The purchase order shall include the following information:

a) Dimensions and quantity;
b) PSL (1or2);
c) Steel grade and supply condition

6.2 Additional Information

The purchase order shall indicate which of the following provisions apply for the specific order:

a) Items that are subject to mandatory agreement, if applicable:

1) Chemical composition for intermediate grades;

2) Chemical composition for steel with t > 25.0 mm;

3) Carbon equivalent limits for PSL 2 steel in Grade ISL 415 N; and

4) Carbon equivalent limits for PSL 2 steel in Grade ISL 555 Q, ISL 625 Q, ISL 690 Q and ISL 830 Q

b) Items that apply as prescribed, unless otherwise agreed:

1) delivery condition;
2) chemical composition limits for PSL 1 steel;
3) chemical composition limits for PSL 2 steel;
4) yield/tensile ratio for grades ISL 690 and ISL 830; and
5) Estimation and reporting of Charpy shear area.

c) Items that apply, if agreed:

1) delivery condition;
2) supply of quenched and tempered PSL 1 Grade ISL 245;

3) supply of intermediate grades
4) CVN impact test temperature lower than 0°C;
5) DWT test temperature lower than 0°C;
6) PSL 2 steel for sour service, in which case, Annex A shall apply;
7) ultrasonic inspection of plate for laminar imperfections; and
8) any other additional or more stringent requirements.

7 MANUFACTURE

7.1 The steel shall be made in basic oxygen or electric arc furnace only in combination with a secondary ladle refining process and shall be continuously cast. The steel shall be fully killed and fine grained. The steel may be vacuum degassed and micro-alloyed.

7.2 The steel may be calcium treated for inclusion shape control.

7.3 The Hot rolled strip, sheet and plates made of PSL 2 quality steel shall not contain any repair by welding.

7.4 For steel with delivery condition M, critical variables of the strip/sheet/plate rolling practice (e.g. re-heating time and temperature, rolling and cooling temperatures and tolerances) shall be refined and controlled to ensure that the mechanical properties throughout the length are suitably uniform considering:

—strip/sheet/plate characteristics and ariability;
—sensitivity of properties to rolling practice;
—appropriate cropping of strip/sheet/plate ends;

The permissible ranges of critical variables for strip/sheet/plate rolling practice shall be documented.

8 CHEMICAL COMPOSITION

8.1 For PSL 1 steel with t ≤ 25.0 mm, the chemical composition for standard grades shall be as given in Table 2, and the chemical composition for intermediate grades shall be as agreed, but consistent with those given in Table 2.

8.2 For PSL 2 steel with t ≤ 25.0 mm, the chemical composition for standard grades shall be as given in Table 3 and the chemical composition for intermediate grades shall be as agreed, but consistent with those given in Table 3.

8.3 The chemical composition based on the requirements of Tables 2 and 3 may be applied for pipe with t > 25.0 mm. Otherwise the chemical composition shall be as agreed between the purchaser and manufacturer.

8.4 For PSL 2 steel with a product analysis carbon content ≤ 0.12%, the carbon equivalent, CE_{Pcm}, shall be determined using Equation (1):

***CE* (*Pcm*) = C + Si/30 + Mn/20 + Cu/20 + Ni/60 + Cr/20 + Mo/15 + V/10 + 5B ……. (1)**

where the symbols for the chemical elements represent the mass fraction in percent (see Table 3). If the ladle analysis for boron is less than 0.0005 %, then it is not necessary for the product analysis to include boron, and the boron content may be considered to be zero for the CE_{Pcm} calculation.

Appendix-4

For PSL 2 steel with a product analysis carbon content greater than 0.12 %, the carbon equivalent, CE_{IIW}, shall be determined using Equation(2):

***CE* (*IIW*) = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15…… (2)**

Table 2 — Chemical Composition for PSL 1 Steel Grade with t ≤ 25.0 mm

Steel Grade	Mass Fraction, Based upon Ladle and Product Analyses[a] % Max						
	C[b]	Mn[b]	P	S	V	Nb	Ti
ISL 175	0.21	0.60	0.030	0.030	-	-	-
ISL 245	0.26	1.20	0.030	0.030	c,d	c,d	d
ISL 290	0.26	1.30	0.030	0.030	d	d	d
ISL 360	0.26	1.40	0.030	0.030	d	d	d
ISL 390	0.26	1.40	0.030	0.030	d	d	d
ISL 415	0.26[e]	1.40[e]	0.030	0.030	d	d	d
ISL 450	0.26[e]	1.45[e]	0.030	0.030	d	d	d
ISL 485	0.26[e]	1.65[e]	0.030	0.030	d	d	d

a Cu ≤ 0.50 %; Ni ≤ 0.50 %; Cr ≤ 0.50 % and Mo ≤ 0.15 %

b For each reduction of 0.01 percent below the specified maximum for carbon, an increase of 0.05 percent above the specified maximum for manganese is permissible, up to a maximum of 1.65 % for grades ≥ ISL245 but ≤ ISL360; up to a maximum of 1.75 % for grades > ISL360, but < ISL485; and up to a maximum of 2.00 % for Grade ISL485.

c Unless otherwise agreed, the sum of the niobium and vanadium contents shall be ≤ 0.06%.

d The sum of the niobium, vanadium and titanium contents shall be ≤ 0.15 %.

e Unless otherwise agreed.

Table 3 — Chemical Composition for PSL 2 Steel with t ≤ 25.0 mm

Steel grade	Mass Fraction, Based Upon Ladle and Product Analyses % Maximum									Carbon Equivalent[a] %	
	C[b]	Si	Mn[b]	P	S	V	Nb	Ti	Other	*IIW*	P_{cm}
As rolled and Normalized rolled or normalized											
ISL245R	0.24	0.40	1.20	0.025	0.015	c	c	0.04	e	0.43	0.25
ISL290R	0.24	0.40	1.20	0.025	0.015	0.06	0.05	0.04	e	0.43	0.25
ISL245N	0.24	0.40	1.20	0.025	0.015	c	c	0.04	e	0.43	0.25
ISL290N	0.24	0.40	1.20	0.025	0.015	0.06	0.05	0.04	e	0.43	0.25
ISL360N	0.24	0.45	1.40	0.025	0.015	0.10	0.05	0.04	d,e	0.43	0.25
ISL390N	0.24	0.45	1.40	0.025	0.015	0.10[f]	0.05	0.04	d,e	0.43	0.25
ISL415N	0.24	0.45[f]	1.40[f]	0.025	0.015	0.10[f]	0.05[f]	0.04[f]	g,h	As agreed	
Quenched and Tempered											
ISL245Q	0.18	0.45	1.40	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25
ISL290Q	0.18	0.45	1.40	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25

ISL360Q	0.18	0.45	1.50	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25
ISL390Q	0.18	0.45	1.50	0.025	0.015	0.07	0.05	0.04	d,e	0.43	0.25
ISL415Q	0.18	0.45[f]	1.70[f]	0.025	0.015	g	g	g	h	0.43	0.25
ISL450Q	0.18	0.45[f]	1.70[f]	0.025	0.015	g	g	g	h	0.43	0.25
ISL485Q	0.18	0.45[f]	1.80[f]	0.025	0.015	g	g	g	h	0.43	0.25
ISL555Q	0.18	0.45[f]	1.90[f]	0.025	0.015	g	g	g	i,j	As agreed	
ISL625Q	0.18	0.55[f]	2.10[f]	0.025	0.015	g	g	g	i,j	As agreed	
ISL690Q	0.18	0.55[f]	2.10[f]	0.025	0.015	g	g	g	i,j	As agreed	
ISL830Q	0.18	0.55[f]	2.10[f]	0.025	0.015	g	g	g	i,j	As agreed	
Thermomechanical Controlled Processing (TMCP)											
ISL245M	0.22	0.45	1.20	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25
ISL290M	0.22	0.45	1.30	0.025	0.015	0.05	0.05	0.04	e	0.43	0.25
ISL360M	0.22	0.45	1.40	0.025	0.015	d	d	d	e	0.43	0.25
ISL390M	0.22	0.45	1.40	0.025	0.015	d	d	d	e	0.43	0.25
ISL415M	0.12[f]	0.45[f]	1.60[f]	0.025	0.015	g	g	g	h	0.43	0.25
ISL450M	0.12[f]	0.45[f]	1.60[f]	0.025	0.015	g	g	g	h	0.43	0.25
ISL485M	0.12[f]	0.45[f]	1.70[f]	0.025	0.015	g	g	g	h	0.43	0.25
ISL555M	0.12[f]	0.45[f]	1.85[f]	0.025	0.015	g	g	g	i,j	0.43[f]	0.25
ISL625M	0.10	0.55[f]	2.10[f]	0.020	0.010	g	g	g	i,j		0.25
ISL690M	0.10	0.55[f]	2.10[f]	0.020	0.010	g	g	g	i,j	-	0.25
ISL830M	0.10	0.55[f]	2.10[f]	0.020	0.010	g	g	g	i,j		0.25

a The CE_{IIW} limits apply if C > 0.12 % and the CE_{Pcm} limits apply if C ≤ 0.12

b For each reduction of 0.01 percent below the specified maximum for carbon, an increase of 0.05 percent above the specified maximum for manganese is permissible, up to a maximum of 1.65 % for grades ≥ ISL245, but ≤ ISL360; up to a maximum of 1.75 % for grades >ISL360, but < ISL485; up to a maximum of 2.00 % for grades ≥ ISL485, but ≤ ISL555; and up to a maximum of 2.20 % for grades > ISL555.

c Unless otherwise agreed, the sum of the niobium and vanadium contents shall be ≤ 0.06 %.

d The sum of niobium , vanadium and titanium content shall be ≤ 0.15 %.

e Unless otherwise agreed, 0.50 % maximum for copper, 0.30 % maximum for nickel, 0.30 % maximum for chromium and 0.15 % maximum for molybdenum.

f Unless otherwise agreed

g. Unless otherwise agreed, the sum of the niobium, vanadium and titanium contents shall be ≤ 0.15 %.

h Unless otherwise agreed, 0.50 % maximum for copper, 0.50 % maximum for nickel, 0.50 % maximum for chromium and 0.50 % maximum for molybdenum.

i Unless otherwise agreed, 0.50 % maximum for copper, 1.00 % maximum for nickel, 0.50 % for chromium and 0.50 % maximum for molybdenum.

j 0.004% maximum for boron

9 TENSILE PROPERTIES

Commented [NS2]: As mentioned earlier, the tensile properties can not be as per the pipe std, IS/ISO 3183

As per page 13 of ISO 3183 ***the steel grade and pipe grade is the same*** (see below)

6 Pipe grade, steel grade and delivery condition

6.1 Pipe grade and steel grade

Appendix-4

6.1.1 The pipe grade for PSL 1 pipe is identical to the steel grade (designated by a steel name) and shall be as given in Table 1.
Also see the heading in Table 1 in ISO 3183 (given below)

Table 1 — Pipe grades, steel grades and acceptable delivery conditions

PSL	Delivery condition	Pipe grade/steel grade

9.1 For PSL 1 steel, the tensile properties shall be as given in Table 4.

9.2 For PSL 2 steel, the tensile properties shall be as given in Table 5.

Table 4 – Requirements for Tensile Tests for PSL 1 Steel

Steel Grade	**Yield strength**[a] MPa (Minimum)	**Tensile strength**[a] MPa (Minimum)	**Elongation (GL= 50 mm)** %
ISL175	175	310	24
ISL245	245	415	24
ISL290	290	415	24
ISL360	360	460	24
ISL390	390	490	24
ISL415	415	520	22
ISL450	450	535	22
ISL485	485	570	22
a For intermediate grades, the difference between the specified minimum tensile strength and the specified minimum yield strength for the steel shall be as given in the table for the next higher grade.			

Table 5 – Requirements for Tensile Tests for PSL 2 Steel

Steel grade	**Yield Strength**[a] MPa		**Tensile Strength**[a] MPa		**Ratio**a, YS/UTS	**Elongation (GL = 50 mm)** %
	minimum	maximum	minimum	maximum	maximum	Minimum
ISL245N ISL245Q ISL245M	245	450	415	760	0.93	24
ISL290N ISL290Q ISL290M	290	495	415	760	0.93	24
ISL360N ISL360Q ISL360M	360	530	460	760	0.93	24
ISL390N ISL390Q ISL390M	390	545	490	760	0.93	24
ISL415N ISL415Q ISL415M	415	565	520	760	0.93	22
ISL450Q	450	600	535	760	0.93	22

ISL450M						
ISL485Q ISL485M	485	635	570	760	0.93	22
ISL555Q ISL555M	555	705	625	825	0.93	20
ISL625M ISL625Q	625	775	695	915	0.95	18
ISL690M ISL690Q	690	840	760	990	0.97	14
ISL830M ISL830Q	830	1 050	915	1 145	0.99	12

a For intermediate grades, the difference between the specified maximum yield strength and the specified minimum yield strength shall be as given in the table for the next higher grade, and the difference between the specified minimum tensile strength and the specified minimum yield strength shall be as given in the table for the next higher grade.
For intermediate grades lower than Grade ISL555, the maximum tensile strength shall be ≤ 760 MPa. For intermediate grades higher than Grade ISL555, the maximum permissible tensile strength shall be obtained by interpolation. For SI units the calculated value shall be rounded to the nearest 5 Mpa.

10 BEND TEST

Commented [NS3]: Bend test is applicable for welded pipe only as per IS/ISO 3183.
Requirements for Bode material testing is not given

Bend Test is the normal bend test for steel strips and steel plates and not on pipes either in weld or body o pipe.

10.1 For steel grade up to ISL 485 : Mandrel diameter = 2 t (180°), No cracks/opening on convex surface
For steel grade above ISL 485 : Mandrel diameter = 3 t (180°), No cracks/opening on convex surface
where, t= thickness of strip/sheet/plate

11 HARDNESS TEST

11.1 For steel grade up to ISL 485: The maximum acceptable hardness of the steel shall be 248 HV10.
For steel grade above ISL 485 and up to ISL555: The maximum acceptable hardness of the steel shall be 275 HV10. Above steel grade ISL 555 the hardness value may be mutually agreed.

Commented [NS4]: As per I/ISO 3183, this is a test for hard spots, i.e to be tested on pipe and hence not applicable for raw material

Above Hardness test is on the steel strips or steel plates. There is no test for hard spots on steel for pipes.

12 CVN IMPACT TEST FOR PSL 2 STEEL GRADE

Commented [NS5]: It must be for body material mentioned in IS/SIO 3183.
-To be clearly mentioned.

Again Impact Test is for steel strips or steel plates and not on pipes as this standard is for steel strips and not pipes

12.1 General

12.1.1 If sub size test pieces are used, the required minimum average (set of three test pieces) absorbed energy values shall be the required values for full-size test pieces times the ratio of the specified width of the sub size test piece to the specified width of the full-size test piece, with such derived values rounded to the nearest joule.

12.1.2 Individual test values for any test piece shall be ≥ 75 % of the required minimum average (set of three test pieces) absorbed energy values.

12.1.3 Tests conducted at temperatures lower than the specified test temperature shall be acceptable if the

applicable requirements for energy absorption and shear fracture area are met at such lower temperatures.

12.2 Impact Test in Steel

12.2.1 The minimum average (set of three test pieces) absorbed energy for each test shall be as given in Table 6, based upon full-size test pieces and a test temperature of 0 °C or, if agreed, a lower test temperature.

12.2.2 If agreed, the minimum average (set of three test pieces) shear fracture area for each test shall be at least 85 %, based upon a test temperature of 0 ˚C or, if agreed, a lower test temperature.

12.2.3 If 12.2.2 does not apply for the order item, the shear fracture area should be estimated and reported for information purposes, unless otherwise agreed.

Table 6 – CVN Absorbed Energy Requirements for PSL 2 Steel

Again as this is the standard for steel strips and steel plates the CVN values are taken as the most stringent / highest values given for highest diameter pipe.

Steel Grade	≤ ISL 415	> ISL 415 ≤ ISL485	> ISL 485 ≤ ISL555	> ISL 555 ≤ ISL625	> ISL 625 ≤ ISL690	> ISL 690 ≤ ISL830
Full size CVN absorbed energy, Minimum (Joule)	40	54	68	81	95	108

Commented [NS6]:
-As per IS /SIO 3183, these values depend upon dia of pipe, where as here,maxium values were given for all

13 DWT TEST FOR PSL 2 STEEL GRADE

Again as this is the standard for steel strips and steel plates and not for pipes

13.1.1 For each test (set of two test pieces), the average shear fracture area shall be ≥ 85 %, based on test temperature of 0 °C or, if agreed, at a lower test temperature. For wall thickness > 25.4 mm, DWT test acceptance requirements shall be by agreement between manufacturer and purchaser.

The specific requirements given is for strip or plate thickness (not wall thickness) up to 25.4 mm and > 25.4 mm. The DWTT shear values are the same for steel as given for pipe in 3183

NOTE 1 Such shear fracture area ensures sufficiently ductile fracture at or above the test temperature.

NOTE 2 Sufficient shear fracture area in combination with sufficient CVN absorbed energy is essential in s teel properties to ensure the avoidance of brittle fracture propagation and the control of ductile fracture propagation in gas pipelines.

13.1.2 Tests conducted at temperatures lower than the specified test temperature shall be acceptable if the applicable requirements for shear fracture area are met at such lower temperatures.

14 INSPECTION AND TEST METHODS

14.1 Test Frequency

Test frequency of each test shall be as per table 7

Table-7 Test Frequency

Characteristic	Sample Orientation	Test frequency
Chemical Analysis (Ladle & Product)	--	One sample per heat
Tensile test	Transverse to rolling direction	One sample per heat
Bend test	Transverse to rolling direction	One sample per heat
Charpy Impact test	Transverse to rolling direction	One set of three specimens per heat
DWT test	Transverse to rolling direction	One set of two specimens per heat

14.2 Test Methods

14.2.1 *Product Analysis*

Unless otherwise agreed between the manufacturer and purchaser at the time of order, the product analysis shall be carried out either by the method specified in the relevant part of IS 228 or any other established instrumental / chemical method. In cases of dispute, the procedure given in the relevant part of IS 228 shall be the referee method.

14.2.2 *Tensile Test*

The tensile test shall be carried out in accordance with IS 1608 (Part 1). The yield strength, the tensile strength, the yield to tensile ratio and the percentage elongation after fracture shall be determined. The percentage elongation after fracture shall be reported with reference to a gauge length of 50 mm.

For test pieces having a gauge length less than 50 mm, the measured elongation after fracture shall be converted to a percentage elongation in 50 mm in accordance with IS 3803 (Part 1).

Commented [NS7]: Applicable for some dia and some thicknesses. For others as agreed, as per IS/ISO 3183. Here the same is not clearly mentioned.

Commented [NS8]: Specified Requirement is not clearly mentioned.

14.2.3 *CVN Impact Test*

The Charpy test shall be carried out in accordance with IS 1757 (Part 1).

14.2.4 *Drop-weight Tear Test*

14.2.4.1 The drop-weight tear test shall be carried out as per cl.10.2.4.4 of IS/ISO 3183.

Commented [NS9]: Which is a API Test method. The details of test method should be mentioned.

Details of Test method is not mentioned as ISO 3183 refers to API RP 5L3 specification which is an API spec.

14.2.4.2 Samples for DWT test are to be drawn from the strip, cut to length plates from strip and plates in transverse to rolling direction.

14.2.5 *Bend Test*

The bend test shall be carried out in accordance with IS 1599.

Commented [NS10]: Not the correct IS number as the Bend test is to be done on full length pipe

The IS 1599 no. is correct again as this is for steel strips and steel plates and not Pipes.

14.2.6 *Hardness Test*

The hardness tests shall be carried out in accordance with IS 1500, IS 1501 or IS 1586.

15 RETEST

If any mechanical test does not satisfy the results, two additional test shall be carried out at random on the same lot of production heat. Both retests shall conform to the requirements of this standard; otherwise the material shall be rejected.
If one or both of the retests representing a test unit fail to conform to the specified requirements, the manufacturer may elect to test each of the remaining lengths in the test unit for conformance to the specified requirements, with any nonconforming lengths being rejected. For such individual length tests, re-testing need only be made for the particular test or parameters that failed to comply in the specification tests.

16 SURFACE CONDITIONS, IMPERFECTIONS AND DEFECTS

16.1 All finished steel shall be well and cleanly rolled to the specified dimensions. The finish material shall be reasonably free from surface flaws, laminations, rough / jagged and imperfect edges and all other harmful defects. Minor surface defects may be removed by the manufacturer / supplier by grinding provided that thickness is not reduced locally below the lower thickness tolerance.

16.2 Laminar Imperfection in Hot Rolled Plates

The hot rolled plates may be subjected to non-destructive testing like UT (Ultrasonic testing) as per IS 4225 or any other established method to determine the soundness of material, subject to mutual agreement between the purchaser and the manufacturer/supplier.

17 DIMENSIONS

Nominal dimensions and thickness of hot-rolled steel strip/plate may be as specified in IS 1730. Sizes other than those specified in IS 1730 may also be supplied by mutual agreement between purchaser and manufacturer.

18 TOLERANCE

Unless otherwise agreed to between the purchased and the manufacturer, the rolling and cutting tolerances for steel products conforming to this standard shall be those specified in IS/ISO 16160

Commented [NS11]: This Indian standard is applicable for only up to 12.5 mm thickness only.???

Change done in the draft standard and also included IS 1852.

19 MARKING

19.1 Each strip shall carry a metal tag or adhesive label/sticker bearing the cast number or identification mark or lot number traceable to the cast number and manufacturer's name or trade-mark or shall be legibly marked at top. Marking should also include size, grade and mass of strip.

19.2 Plates and sheet (Including cut to length from strip) shall be supplied in bundles. Each bundle shall carry a metal tag or adhesive label/sticker bearing the cast number or identification mark or lot number traceable to the cast number and manufacturer's name or trade-mark. Alternatively, top sheet/plate shall be legibly marked with cast number or identification mark or lot number traceable to the cast number and manufacturer's name or trade-mark

19.3 Strip/Plates produced to a normalized heat treatment condition shall be marked with the suffix N to indicate that the plates have been normalized.

19.4 Strip/Plates produced to a thermo-mechanical control processed condition shall be marked with the suffix TM to indicate that the plates have been thermo-mechanical control processed. Strip/Plates produced to a quenched and tempered heat treatment condition shall be marked with the suffix QT to indicate that the plates have been quenched and tempered.

Commented [NS12]: Already taken care in the designation of the grades???

Above 2 paras are deleted in the draft standard

19.5 BIS Certification Marking

The material may also be marked with the Standard Mark.

19.5.1 The products(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the BIS Act, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.

Annexure A
Steel for Sour Service
(Normative)
(Clause 5.2.2)

A-1 INTRODUCTION

This annexure specifies additional provisions that apply for PSL 2 steel that is ordered for sour service

A-2 ADDITIONAL INFORMATION TO BE SUPPLIED BY THE PURCHASER

The purchase order shall indicate which of the following provisions apply for the specific order item:
a) steel casting method for HR strip (including cut to length plates from strip) or plate used
b) ultrasonic inspection of plate for laminar imperfections
c) chemical composition for intermediate grades
d) SSC test for manufacturing procedure qualification
e) HIC test method and associated acceptance criteria
f) photomicrographs of reportable HIC cracks

A-3 MANUFACTURING

A-3.1 Steel Manufacturing

A.3.1.1 The steel shall be made to a clean steel practice using either the basic oxygen steel making process or the electric furnace process and shall be fully killed and fine grained.

A-3.1.2 Vacuum degassing or alternative processes to reduce the gas content of the steel shall be used.

A-3.1.3 The molten steel shall be treated for inclusion shape control. If agreed at the time of order, inclusion content may be determined by the manufacturer as per ISO 4967. For sulfur levels ≤ 0,001 %, inclusion shape control may be waived by agreement.

A-4 ACCEPTACNE CRITERIA

A-4.1 Chemical Composition

A-4.1.1 For steel with $t \leq 25.0$ mm, the chemical composition for standard grades shall be as given in Table A.1 and the chemical composition for intermediate grades shall be as agreed, but consistent with those given for the standard grades in Table A.1. The steel designation shall be as given in Table A.1 and consists of an alpha or alphanumeric designation that identifies the grade, followed by a suffix that consists of a letter (N, Q or M) that identifies the delivery condition and a second letter (S) that identifies the service condition.

A-4.1.2. For steel with $t > 25.0$ mm, the chemical composition shall be as agreed, with the requirements given in Table A.1 being amended as appropriate.

Table A-1 – Chemical Composition for Steel with t ≤ 25.0 mm

Steel Name	Weight Percent Based Upon Ladle and Product Analyses % Maximum	Carbon Equivalent[a] %

Appendix-4

										Maximum	
	C[b]	Si	Mn[b]	P	S	V	Nb	Ti	Other[c,d]	*IIW*	P_{cm}
Normalized rolled or normalized											
ISL245NS	0.14	0.40	1.35	0.020	0.003	f	f	0.04	g	0.36	0.25[h]
ISL290NS	0.14	0.40	1.35	0.020	0.003	0.05	0.05	0.04	-	0.36	0.25[h]
ISL360NS	0.16	0.45	1.65	0.020	0.003	0.10	0.05	0.04	g	0.43	0.25[h]
Quenched and Tempered											
ISL245QS	0.14	0.40	1.35	0.020	0.003[e]	0.04	0.04	0.04	-	0.34	0.19
ISL290QS	0.14	0.40	1.35	0.020	0.003[e]	0.04	0.04	0.04	-	0.34	0.19
ISL360QS	0.16	0.45	1.65	0.020	0.003[e]	0.07	0.05	0.04	g	0.39	0.20
ISL390QS	0.16	0.45	1.65	0.020	0.003[e]	0.07	0.05	0.04	g	0.40	0.21
ISL415QS	0.16	0.45	1.65	0.020	0.003[e]	0.08	0.05	0.04	g,h,i,j	0.41	0.22
ISL450QS	0.16	0.45	1.65	0.020	0.003[e]	0.09	0.05	0.06	g,h,i,j	0.42	0.22
ISL485QS	0.16	0.45	1.65	0.020	0.003[e]	0.09	0.05	0.06	g,h,i,j	0.42	0.22
Thermomechanical Controlled Processing (TMCP)											
ISL245MS	0.10	0.40	1.25	0.020	0.002[e]	0.04	0.04	0.04	-	-	0.19
ISL290MS	0.10	0.40	1.25	0.020	0.002[e]	0.04	0.04	0.04	-	-	0.19
ISL360MS	0.10	0.45	1.45	0.020	0.002[e]	0.05	0.06	0.04	-	-	0.20
ISL390MS	0.10	0.45	1.45	0.020	0.002[e]	0.06	0.08	0.04	g	-	0.21
ISL415MS	0.10	0.45	1.45	0.020	0.002[e]	0.08	0.08	0.06	g,h,i,j	-	0.21
ISL450MS	0.10	0.45	1.60	0.020	0.002[e]	0.10	0.08	0.06	g,h,i,j	-	0.22
ISL485MS	0.10	0.45	1.60	0.020	0.002[e]	0.10	0.08	0.06	g,h,i,j	-	0.22

a. Based on product analysis, the CE_{IIW} limits shall apply if C > 0.12 % and the CE_{Pcm} limits shall apply if C ≤ 0.12 %
b. For each reduction of 0.01 percent below the specified maximum for carbon, an increase of 0.05 percent above the specified maximum for manganese is permissible, up to a maximum increase of 0.20 percent
c. Al $_{total}$ ≤ 0,060 %; N ≤ 0,012 %; Al/N ≥ 2:1 (not applicable to titanium-killed or titanium-treated steel); Cu ≤ 0,35 % (if agreed, Cu ≤ 0,10 %); Ni ≤ 0,30 %; Cr ≤ 0,30 %; Mo ≤ 0,15 %; B ≤ 0,0005%.
d. For steel where calcium is intentionally added, the calcium content shall be 0,006 % maximum. Unless otherwise agreed, Ca/S ≥ 1.5 if S > 0,0015 %.
e. If agreed at the time of order the maximum limit for sulphur content may be increased to ≥ 0.008
f. Unless otherwise agreed, the sum of niobium and vanadium contents shall be ≤ 0,06 %.
g. The sum of the niobium, vanadium and titanium contents shall be ≤ 0,15 %.
h. If agreed, the molybdenum content shall be ≤ 0,35 %.
i. If agreed, the chromium content shall be ≤ 0,45 %.
j. If agreed, Cr content shall be ≤ 0.45% and Ni content shall be ≤ 0.50%.

A-4.2 Tensile Properties

Commented [NS13]: Directly taken from IS/SIO 3183 std, which should not be!!!

Already explained earlier

A-4.2.1 The tensile properties shall be as given in Table A.2.

Table A-2 – Requirements of Tensile Tests

Steel grade	Yield Strength[a]	Tensile Strength[a]	Ratio[a,]	Elongation

Appendix-4

	MPa		MPa		YS/UTS	(GL = 50 mm) %
	minimum	maximum	minimum	maximum	maximum	Minimum
ISL245NS ISL245QS ISL245MS	245	450[d]	415	760	0.93	24
ISL290NS ISL290QS ISL290MS	290	495	415	760	0.93	24
ISL360NS ISL360QS ISL360MS	360	530	460	760	0.93	24
ISL390QS ISL390MS	390	545	490	760	0.93	24
ISL415QS ISL415MS	415	565	520	760	0.93	22
ISL450QS ISL450MS	450	600	535	760	0.93	22
ISL485MS	485	635	570	760	0.93	22
ISL555Q ISL555M	555	705	625	825	0.93	20
ISL625M ISL625Q	625	775	695	915	0.95	18
ISL690M ISL690Q	690	840	760	990	0.97	14
ISL830M ISL830Q	830	1 050	915	1 145	0.99	12

[a] For intermediate grades, the difference between the specified maximum yield strength and the specified minimum yield strength shall be as given in the table for the next higher grade, and the difference between the specified minimum tensile strength and the specified minimum yield strength shall be as given in the table for the next higher grade. For intermediate grades, the tensile strength shall be ≤ 760 MPa.

A-4.3 HIC Test

The test for evaluation of resistance to hydrogen-induced cracking shall meet the following acceptance criteria, with each ratio being the maximum permissible average for three sections per test specimen when tested in Solution A (see Table B.3 of ISO 15156-2).
a) crack sensitivity ratio (CSR) ≤ 2 %;
b) crack length ratio (CLR) ≤ 15 %;
c) crack thickness ratio (CTR) ≤ 5 %.
If HIC tests are conducted in any alternative media / solution (refer clause H 7.3.1.3 of IS/ISO 3183) to simulate specific service conditions, alternative acceptance criteria may be agreed at the time of order.

A-4.4 Hardness Test

The maximum acceptable hardness of the steel shall be 248 HV10 max.

One value given for hardness is the maximum value for all steel strip and plate thicknesses.

Commented [NS14]: Applicable only for pipes as per Cl H.7.2.4. of IS/ISO 3183

Commented [NS15]: As per IS/ISO 3183, Hardness values depend on thickness of pipe.
Here only one value is given ???

A-4.5 SSC Test

Commented [NS16]: Applicable only for pipes as per Cl H.7.2.3. of IS/ISO 3183

A-4.5.1 SSC tests shall be carried out and reported in accordance with clause H.4.5 of IS/ISO 3183

SSC Test is also applicable to steel strips and steel plates

A-4.6 Test Methods

A-4.6.1 HIC Test

A-4.6.1.1 HIC tests shall be carried out and reported in accordance to clause H.7.3.1 of IS/ISO 3183

A-4.6.2 SSC Test

A-4.6.2.1 SSC tests shall be carried out and reported in accordance to clause H.7.3.2 of IS/ISO 3183

A-4.7 Test Frequency

Test frequency is given in table A.3

Appendix-4

Table-A.3 Test Frequency

Characteristic	Sample Orientation	Test frequency
Chemical Analysis (Ladle & Product)	--	One sample per heat
Tensile test	Transverse to rolling direction	One sample per heat
Bend test	Transverse to rolling direction	One sample per heat
Charpy Impact test	Transverse to rolling direction	One set of three specimens per heat
DWT test	Transverse to rolling direction	One set of two specimens per heat
HIC test	Transverse to rolling direction	One per heat
SSC test	--	One per 10 heats

Appendix-4

Draft

Indian Standard

CARBON STEEL SLABS FOR RE-ROLLING INTO STEEL FOR DRAWING, FLANGING, FORMING, GENERAL ENGINEERING AND COLD ROLLING PURPOSES— SPECIFICATION

ICS --

B U R E A U O F I N D I A N S T A N D A R D S
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Oct 2017

Wrought Steel Products Sectional Committee, MTD 4

FOREWORD

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

This standard has been prepared for the guidance as the raw material (Semi finished) for further reprocess in to hot rolled materials such as IS 11513, IS 1079 & IS 5986 for various applications as per scope of respective latest standards. The producers of steel have a systematic method of choosing the steel base composition to satisfy physical requirements in the finished products. The basis of doing such a selection is the carbon manganese balance. For the guidance of purchasers, broad ranges of chemical composition have been included in this standard to cater for their requirements. Any closer or wider ranges of chemical composition may be supplied subject to mutual agreement between the purchaser and the manufacturer.

No tensile properties for the slabs has been specified in this standard as the tensile properties in a rolled material are not only dependent on the base chemistry, but also on the rolling conditions, particularly the finishing temperature and the end cooling condition obtained in the hot bed. It has, therefore, been felt not appropriate to lay down any guarantee for physical properties on supplies of semis made for rolling materials satisfying certain physical requirements.

While preparing this standard, in the light of experience gained during these years, the Committee decided to draft it to bring in line with that present practices being followed by the Indian industry.

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 the formulation of this standard is given in Annex A.

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 : 1960 ‘Rules for rounding off numerical values (*revised*)’. 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
CARBON STEEL SLABS FOR RE-ROLLING INTO STEEL FOR DRAWING, FLANGING, FORMING, GENERAL ENGINEERING AND COLD ROLLING PURPOSES— SPECIFICATION

1 SCOPE

This standard covers the requirements of carbon steel slabs for re-rolling into low, medium and high tensile steel including steel for cold rolling purposes. The requirements of this standard will be applicable to slabs.

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:

IS No.	Title
228 (all parts)	Method for chemical analysis of steel
8910 : 2010	General technical delivery requirements for steel and steel products (first revision)
1956 (all parts)	Glossary of terms related to iron and steel
11371 : 1985	Method for macroetch test of wrought steel products
12037 : 1987	Macrographic examination by sulphur print (Baumann method)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1956 and the following shall apply.

3.1 Slab — A semi-finished rolled, forged or continuously cast product intended for re-rolling or forging. The cross-section is rectangular. The thickness does not exceed one-third of the width.

3.2 Semi-rolled Steel Products — Partially processed material from ingot/bloom/billet/slab/round, etc, but in a form which is fit for further processing. The dimension and tolerances for this product shall be as per mutual agreement between the purchaser and the manufacturer.

4 SUPPLY OF MATERIAL

4.1 General requirements relating to the supply of steel shall conform to IS 8910.

4.2 The material shall be supplied on the chemical composition basis as given in Table 1 and Table2.

5 MANUFACTURE

5.1 Steel shall be manufactured by any process of steel making except the Bessemer process. It may be followed by secondary refining or secondary vacuum treatment.

5.2 Steel shall be supplied in semi-killed or killed condition. Rimming steel may also be supplied subject to agreement between the purchaser and the supplier.

6 CHEMICAL COMPOSITION

6.1 Ladle analysis of the material, when carried out either by the method specified in the relevant parts of IS 228 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 IS 228 shall be the referee method.

Table 1 Chemical Composition

(*Clause* 6.1)

S. No (1)	Designation (2)	Constituent, Percent	
		Carbon (3)	Manganese (4)
1	C1	0.01 max	0.60 max
2	C1Mn	0.01 max	0.60-1.60
3	C4	0.04 max	0.60 max
4	C4Mn	0.04 max	0.60-1.60
5	C6	0.06 max	0.40 max
6	C8	0.08 max	0.45 max
7	C10	0.10 max	0.50 max
8	C12	0.12 max	0.6 max
9	C12MMn	0.12 max	0.6-1.0
10	C12HMn	0.12 max	1.0-2.1 (1
11	C15	0.12-0.18	0.3-0.60
12	C15MMn	0.12-0.18	0.6-1.0
13	C15HMn	0.12-0.18	1.0-2.1 (1
14	C18MMn	0.15-0.21	0.6-1.0
15	C18HMn	0.15-0.21	1.0-2.1 (1
16	C20MMn	0.17-0.23	0.6-1.0
17	C20HMn	0.17-0.23	1.0-2.1 (1
18	C25HMn	0.25 max	1.0-2.1 (1
19	C30HMn	0.30 max	4.0 max
20	C35HMn	0.35 max	4.0 max

NOTES

1 Steels of these grades can be supplied with the addition of Micro-Alloy elements like boron, titanium, niobium and vanadium. The micro-alloying elements shall not exceed 0.006 percent in case of boron and 0.40 percent in case of other elements.

2 The nitrogen content of the steel shall not be more than 0.007 percent. For aluminium killed or silicon-aluminium killed, the nitrogen content shall not exceed 0.012 percent. This shall be ensured by the manufacturer by occasional check analysis.

3 When the steel is aluminium killed, the total aluminium content shall not be less than 0.02 percent. However aluminium less than 0.02 percent can be mutually agreed to between the purchaser and supplier for aluminium killed steel. When the steel is silicon killed, the silicon content shall not be less than 0.10

percent. When the steel is aluminium silicon killed, the silicon content shall not be less than 0.03 percent and total aluminium content shall not be less than 0.01 percent.

4 When copper bearing steel is required the copper content shall be between 0.20 and 0.35 percent. In case of product analysis, the copper content shall be between 0.17 and 0.38 percent.

5 The elements (e.g Cr, Mo, Ni, etc) not mentioned in above table can be added upto 1.0 percent maximum either singly or in combination.

6 Carbon equivalent (CE) based on ladle analysis = $C + \frac{Mn}{6} + \frac{(Cr+Mo+V)}{5} + \frac{(Ni+Cu)}{15}$ may be mutually agreed to between the purchaser and the supplier.

7 In order to get the desired properties, the chemical composition may be mutually agreed to between the manufacturer and the purchaser within the stipulation of this standard.

[1)] Manganese over the specified maximum up to 3.5 percent is permitted which may be mutually agreed to between the purchaser and the supplier.

6.1.1

All types of steel in Table 1 shall be supplied in eight grades, as per Table 2 having Sulphur Phosphorus content (on ladle analysis) which shall be in line with corresponding IS11513, IS1079 & IS 5986 latest specifications.

For example C15 A (steel designation C15 and grade A) or C20 HMn B (steel designation C20HMn and Grade B). When steel is required in copper bearing quality, it shall be designated with a suffix Cu, for example C15 A Cu or C20HMn B Cu.

Table 2

(Clause 6.1.1)

Grade (1)	**Sulphur, % max** (2)	**Phosphorous, % max** (3)
A	0.015	0.10
B	0.020	0.12
C	0.025	0.12
D	0.030	0.10
E	0.035	0.05
F	0.040	0.08
G	0.045	0.05*
I	0.050	0.08

Note: Restricted Phosphorous content shall be mutually agreed between the purchaser and the supplier in line with corresponding IS11513, IS1079 & IS 5986 latest specifications.

*Phosphorus limit of 0.12 % Maximum can be added and in such cases, carbon content shall be limited to 0.15 % Maximum.

6.2 Check Analysis

Check analysis shall be carried out on the finished product from the standard position. Permissible variation in case of check analysis from the limits specified in Table 1 & Table2 shall be as given in Table 3.

Table 3 Permissible Variation for Check Analysis
(Clause 6.2)

S. No. (1)	Constituent (2)	Percentage Limit of Constituent (3)	Permissible Variations over Specified Limit, Percent, Max (4)
i)	Carbon	Up to 0.25 Above 0.25	0.02 0.03
ii)	Manganese	Up to 1.0 Above 1.0 & Up to 2.50 Above 2.50	0.03 0.10 0.12
iii)	Sulphur	Upto 0.05	0.005
iv)	Phosphorus	Up to 0.05 Above 0.05	0.005 0.010
v)	Silicon	Up to 0.50 Above 0.50 & Up to 0.80 Above 0.80	0.03 0.05 0.10
vi)	Microalloy	-	Subject to mutual agreement between purchaser and supplier

NOTES
1 Variation shall not be applicable both over and under the specified limit in several determinations in a heat.
2 Check analysis shall not apply to rimming quality.

7 SAMPLING
At least one ladle analysis shall be taken per cast.

8 SELECTION OF TEST SAMPLE FOR CHECK ANALYSIS
8.1 The sample for check analysis shall be taken from the location as shown in Fig. 1.

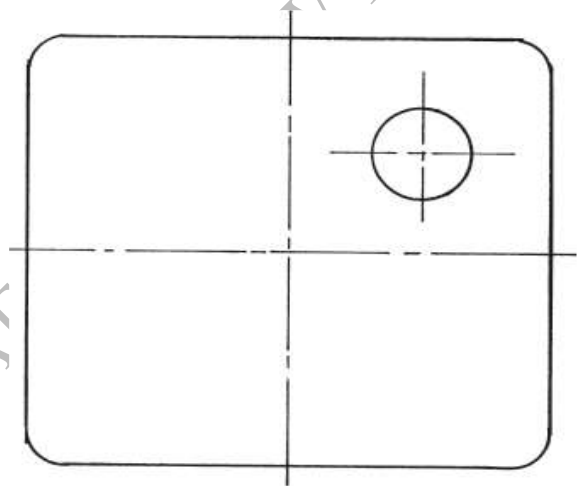


Fig. 1 Location for taking drilling for product analysis

9 FREEDOM FROM DEFECTS

9.1 The slabs shall be well and cleanly rolled to the dimensions specified. The finished slabs shall be free from all harmful defects such as cracks, surface flaws, laminations and rough, jagged and imperfect edges.

10 TESTS

10.1 If mutually agreed to between the purchaser and the manufacturer, the following tests may be carried out from the samples prepared under 8.1:

a) Macro-examination (see IS 11371); and

b) Sulphur print tests (see IS 12037).

11 DIMENSIONS

11.1 The preferred size for thickness of slabs shall be 50, 63, 75, 80, 85, 90, 100, 110, 125, 150, 165, 200, 220, 225, 250, 260, 300 and 320 mm. Thickness other than mentioned may be agreed between the purchaser and manufacturer.

11.2 Length of slabs shall be supplied in lengths between 3m and 13m as agreed between the purchaser and manufacturer.

12 TOLERANCES

12.1 For guidelines, the tolerances on thickness and width for slabs will be as per Table4. Closer tolerances than mentioned in Table4 may be mutually agreed between the purchaser and manufacturer.

12.2 A tolerance of ±150 mm shall be permitted on the specified length of slabs.

12.3 Bend: The bend shall not exceed 8 mm/m of slab length subject to a maximum of 40 mm.

12.4 Camber: The camber shall not exceed 8 mm/m of slab length subject to a maximum of 40 mm.

12.5 Other tolerances if any may be agreed between the purchaser and manufacturer.

Table 4 Tolerances on Thickness and Width

(*Clause* 12.1.)

S. No (1)	Product (2)	Width mm (3)	Thickness mm (4)	Tolerance mm (5)
iii)	Slabs	—	a) Up to and including 150	± 4
		—	b) Over 150	± 6
		a) Up to and including 900	—	± 50
		b) Over 900	—	± 100

13 MARKING

13.1 Unless otherwise agreed to between the purchaser and the manufacturer, the ends of slabs (including continuously cast) shall be painted with a suitable colour and legibly stamped or painted with the cast number; and the name or trademark of the manufacturer.

13.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

13.2.1 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made there under. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

14 ORDERING INFORMATION

While placing an order for the slabs (including continuously cast) covered by this standard, the purchaser should specify clearly the following:

a) Steel grade;
b) Size of slab;
c) Size and dimensions of end product;
d) End use;
e) Tests and test report required; and
f) Special requirements, if any.

Draft Indian Standard

STEEL CAST BILLET INGOTS, BILLETS AND BLOOMS FOR PRODUCTION OF HIGH CARBON STEEL WIRE RODS — SPECIFICATION

(Second Revision of IS 8951)

FOREWORD

This Indian Standard (Second Revision) 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.

This standard was first published in 1978 and was subsequently revised in 2001. The steel ingots, blooms and billets covered under this standard are the raw material for the production of high carbon steel wire rods which is manufactured in large quantity in the country. Since the standard for these wire rods 1S 7904: 2018 ‘High carbon steel wire rods — Specification (*second revision*)’ has already been revised, a need was felt to review this standard to ensure that the high carbon steel wire rod industry receive the requisite quality of raw material.

In this revision, the following changes have been made:

a) Scope of the standard has been modified.

b) Reference clause has been updated.

c) Clause **6** and **13** have been modified.

d) The clauses on chemical composition and tolerances have been modified.

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 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

STEEL CAST BILLET INGOTS, BILLETS AND BLOOMS FOR PRODUCTION OF HIGH CARBON STEEL WIRE RODS — SPECIFICATION
(Second Revision of IS 8951)

1 SCOPE

This standard covers the requirements of carbon steel cast billet ingots, continuously cast billets and blooms for rerolling into high carbon steel wire rods.

2 REFERENCES

The standards listed below 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:

IS No.	*Title*
228 (in various parts)	Methods for chemical analysis of steels
1956 (All Parts)	Glossary of terms relating to iron and & steel
4163 : 2004/ISO 4967 : 1998	Steel - Determination of content of nonmetallic inclusions - Micrographic method using standard diagrams (*third revision*)
7904 : 2018	High carbon steel wire rods – Specification (*second revision*)
8910 : 2010/ISO 404 : 1992	General technical delivery requirements for steel and steel products (*first revision*)
8811 : 1998	Method for emission spectrometric analysis of plain carbon and low alloy steels point to plane technique (*first revision*)
11371: 1985	Method for macroetch test of wrought steel products
12037: 1987	Micrographic examination by sulphur print (Baumann Method)

3 TERMINOLOGY

For the purpose of this standard, the following definitions in addition to those given in the relevant parts of IS 1956 shall apply.

3.1 Cast Billet Ingot – For the purpose of this standard, cast billet ingot shall be defined as ingot, generally of cross-section not more than 200 mm square which can be rolled directly into merchant products. Cast billet ingot is also sometimes known as ‘pencil ingots’.

4 GRADES

Steel shall be designated as specified in Table 1 according to their chemical composition.

5 SUPPLY OF MATERIAL

General requirements for the supply of material shall be as laid down in IS 8910.

6 MANUFACTURE

6.1 The steel shall be manufactured by any process of steel making at the discretion of the manufacturer. It may be followed by secondary refining and /or vacuum degassing. Steel can be cast into billet ingots or continuously cast into billets/blooms.

6.2 Sufficient discard shall be made from each ingot to ensure freedom from piping, segregation and other harmful defects.

7 CHEMICAL COMPOSITION

7.1 The ladle analysis of steel when analyzed in accordance with the relevant parts of IS 228 or any other established instrumental /chemical method shall be as given in Table 1. In case of dispute the procedure given in relevant parts of IS 228 shall be the referee method. However, where the method is not given in IS 228 or its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacturer. However, where the method is not given in IS 228 and its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacturer.

Table 1 Chemical Composition

(*Clauses* 4, 7.1 *and* 7.2)

Sl No.	Steel Grade	C Percent	Si Percent	Mn Percent	P Percent *Max*	S Percent *Max*	Cr Percent *Max*	Ni Percent *Max*	Mo Percent *Max*	Cu Percent *Max*	Al Percent *Max*	S+P Percent *Max*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	HC38	0.35-0.40	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
ii)	HC42	0.40-0.45	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
iii)	HC46	0.43-0.48	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
iv)	HC48	0.45-0.50	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
v)	HC50	0.48-0.53	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
vi)	HC52	0.50-0.55	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
vii)	HC56	0.53-0.58	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
viii)	HC58	0.55-0.60	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
ix)	HC60	0.58-0.63	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
x)	HC62	0.60-0.65	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
xi)	HC66	0.63-0.68	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
xii)	HC68	0.65-0.70	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
xiii)	HC70	0.68-0.73	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
xiv)	HC72	0.70-0.75	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
xv)	HC76	0.73-0.78	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
xvi)	HC78	0.75-0.80	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06

xvii)	HC80	0.78-0.83	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
xviii)	HC82	0.80-0.85	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
xix)	HC86	0.83-0.88	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06
xx)	HC88	0.85-0.90	0.10-0.35	0.30-0.90	0.035	0.035	0.15	0.20	0.05	0.25	0.04	0.06

NOTES
1 If Cr, B, Nb, V, Ti are added intentionally, the grades may contain Cr up to 0.30 percent and B up to 8 ppm as per mechanical property required in wire rods. However, the total percentage of Cr and micro alloy elements (Nb, V, Ti) individually or in combination should not exceed 0.30 percent.
2 Steel may be supplied as grade A and grade B depending upon Mn content 0.30-0.60 percent and 0.60-0.90 percent in grades respectively for example the grade will be designated as HC70A or HC70B depending upon Mn content 0.30-0.60 percent or 0.60- 0.90 percent in HC70 grades respectively.
3 The grade containing Cr > 0.15% would be designated with the suffix indicating the chemical symbol, for example HC70ACr will have chemical composition of HC70A and Cr individually or in combination with other Microalloying elements should not exceed 0.30 percent.
4 Nitrogen content of steel shall not exceed 0.012 percent, which shall be ensured by the manufacturer by occasional check analysis.
5 Stricter specification for nitrogen, phosphorus and sulphur may be mutually agreed between the manufacturer and the purchaser.
6 Tramp elements [Cr, Ni, Mo, Cu] individually or in combination can be stricter than the values mentioned in Table 1, may be mutually agreed upon between the manufacturer and the purchaser at the time of ordering.

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

Table 3 Permissible Variation for Product Analysis of Carbon Steel
(*Clause* 7.2)

Sl No.	**Constituent**	**Variation Over the Specified Maximum or Under the Minimum Limits, Percent**
		Max
(1)	(2)	(3)
i)	Carbon < 0.5	0.03
ii)	Carbon > 0.5	0.04
iii)	Manganese	0.05
iv)	Sulphur	0.005
v)	Phosphorus	0.005
vi)	Silicon	0.03
vii)	Copper	0.03
viii)	Nickel	0.03
ix)	Chromium	0.03

8 SAMPLING

At least one ladle/tundish sample analysis shall be taken per cast.

9 SELECTION OF TEST SAMPLE FOR CHECK ANALYSIS

9.1 The sample for check analysis, in case of billets and blooms (continuously cast or by forging/rolling), shall be taken from the location as shown in Fig. 1.

9.2 In the case of cast billet ingots, the samples for product analysis shall be prepared by forging/rolling down to 30 mm round section. Drilling shall be taken from the sample representing two-thirds, one-half and one-third of height from bottom of the ingot separately.

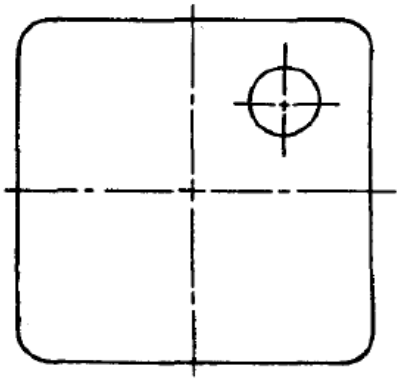


FIG. 1 LOCATION FOR TAKING DRILLING FOR CHECK ANALYSIS

10 FREEDOM FROM DEFECTS

10.1 Cast billet ingots shall be supplied free from harmful defects, such as, segregation, piping, cracks, inclusions, and blow-holes by appropriate top and bottom discard and dressing or supplied with suitable surface dressing only, without top and bottom discard if mutually agreed to between the purchaser and the manufacturer.

10.2 The billets and blooms (including continuously cast) shall be supplied to the dimensions specified. The billets and blooms shall be free from all harmful defects, such as cracks, surface flaws; laminations and rough, jagged and imperfect edges.

11 TESTS

11.1 If mutually agreed to between the purchaser and the manufacturer, the following tests may be carried out from the samples prepared, under **9.1**:

a) Macro examination (see IS 11371),
b) Inclusion content (see IS 4163), and
c) Sulphur print tests (see IS 12037).

11.2 Bend: In the case of billets, blooms and continuously cast billets and blooms, the bend shall not exceed 5 mm/m.

12 DIMENSIONS

12.1 The sizes and shapes of cast billet ingots shall be subject to mutual agreement between the purchaser and the manufacturer. The billets and blooms (including continuously cast) shall be reasonably square.

12.1.1 The preferred size for width across flat of billets and blooms (including continuously cast) shall be 50, 63, 75, 80, 85, 90, 100, 110, 125, 130, 150, 165,200, 250 and 320 mm.

12.1.2 Widths other than those specified above may be supplied as per agreement between the manufacturer and the purchaser.

12.1.3 Length of billets and blooms (including continuously cast) shall be supplied in lengths between 3 m and 13 m or as specified by the purchaser

13 TOLERANCES

13.1 In case of cast billet ingots, a tolerance of +5 mm shall be permitted on the specified width across flat.

13.2 Tolerances on width, in case of billets and blooms (including continuously cast), shall be as given in Table 3.

13.3 A tolerance of +/- 150 mm shall be permitted on the specified length of cast billet ingots, billets and blooms and continuously cast billets and blooms.

Table 3 Tolerances on Width
(*Clause* 13.2)

Product	**Width across flat [mm]**	**Tolerance on width/ thickness [mm]**
(1)	(2)	(3)
Billet	Upto and including 75	+ / - 1.5
	Over 75 and less than 150	+ / - 3.0
Bloom	Over 150	+ 6.0, - 3.0

14 MARKING

14.1 Unless otherwise agreed to between the purchaser and the manufacturer, the ends of cast billet ingot, billet and bloom (including continuously cast) shall be painted with a suitable colour and legibly stamped or painted with the cast number.

14.2 BIS Standard Mark

The material may also be marked with the Standard Mark.

14.2.1 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.

15 ORDERING INFORMATION TO BE GIVEN BY THE PURCHASER

While placing an order for the cast billet ingots and billets, blooms (including continuously cast) covered by this standard, the purchaser should specify clearly the following:
a) Steel grade;
b) Size of cast billet ingot, billet and bloom (including continuously cast);
c) Size and dimensions of end product;
d) End use;
e) Tests and test report required; and
f) Special requirements, if any.

Draft Indian Standard

STEEL PLATES AND STRIPS/COILS FOR PRESSURE VESSELS USED AT MODERATE AND LOW TEMPERATURE – SPECIFICATION

Revision of IS 2041

(Fourth Revision)

1 SCOPE

This standard covers the requirements of steel plates (including plates produced from strips/coils) and strips/coils for fabrication of fusion welded pressure vessels for moderate and low temperature services with room temperature and elevated temperature properties.

2 REFERENCES

The standards listed below 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 agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
228 (in various parts)	Methods for chemical analysis of steel
1599 : 2019	Metallic materials – Bend test *(fourth revision)*
1608 (Part 1) : 2018	Metallic materials – Tensile testing Part 1 Method of test at room temperature (*fourth revision*)
1757 (Part 1) : 2020	Metallic materials – Charpy pendulum impact test Part 1 Test method (*fourth revision*)
1956 (Part 3) : 1976	Glossary of terms relating to iron and steel Part 3 Long products (including bars, rods, sections and wires) (*second revision*)
3803 (Part 1) : 1989	Steel – Conversion of elongation values Part 1 Carbon and low alloy steels (*second revision*)
8811 : 1998	Method for emission spectrometric analysis of plain carbon and low alloy steels point to plane technique (*first revision*)
8910 : 2010	General technical delivery requirements for steel and steel products (*first revision*)
11630 : 2005	Method for ultrasonic testing of steel plates for pressure vessels and special applications (*first revision*)
1852 : 1985	Specification for rolling and cutting tolerances for hot – rolled steel products *(fourth revision)*
ISO 7778 : 2014	Through thickness characteristics for steel products (*second edition*)
IS 13805 : 2004	General standard for qualification and certification of non-destructive testing personnel – Specification (*first revision*)
IS 16998 : 2018	Hot-rolled steel plates – Tolerances on dimensions and shape

Commented [B1]: Can relevant parts of the standard introduced in this standard itself? Should we adopt the standard?

3 TERMINOLOGY

For the purpose of this standard, the following definitions in addition to those given in IS 1956

(Part 3) shall apply.

3.1 Micro-Alloying Elements – Elements, such as niobium, boron, vanadium and titanium added singly or in combination to obtain higher strength to weight ratio combined with better toughness, formability and weldability as compared to unalloyed steel of similar strength level.

3.2 ??? This term refers to the unit plate (5 mm thick and above) as rolled from the slab or directly from an ingot, in its relation to the location and number of specimens, and not its condition. Plates produced from strips/coils means the plates which have been levelled or flattened and cut to length from strip.

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3.3 Normalizing Rolling – A hot rolling process in which the final deformation is carried out within a certain temperature range equivalent to normalizing temperature, leading to a material condition equivalent to that obtained after normalizing, such that the specified mechanical properties would still be met in the event of any subsequent normalizing.

4 GENERAL REQUIREMENTS

4.1 General requirements relating to supply of material shall conform to IS 8910.

4.2 Order shall include the following information, as applicable:

a) Quantity (weight or number of pieces of plates);
b) Supply condition (i.e, Plate or Strips/coils and cut to length from strips/coils) and their dimensions;
c) Grade designation;
d) Heat treatment conditions;
e) Impact test requirements, if any;
f) Inspection and testing conditions, if any; and
g) Additional requirements, if any.

5 GRADES

The steel grades covered by this standard are given in following two qualities:

a) The room temperature quality in Grades R205, R220, R240, R260, R275, R355.
b) The elevated temperature quality in Grades H235, H265, H295, H355.

6 MANUFACTURE

6.1 Steel shall be manufactured by any process of steel making at the discretion of the manufacturer. Steel may be further treated in secondary refining process.

6.2 The steel shall be of killed quality and made to fine austenitic grain size practice where Al (total) content on ladle analysis shall be 0.02 percent (minimum).

6.3 The steel shall be in the form of plates or strips/coils. The plates are produced in either discreet cut lengths of flat product or cut to length, levelled and flattened plates from strips/coils.

6.4 When rolled from continuously cast slab, ratio of slab to plate thickness shall be minimum 2.5 to 1, except that reduction ratios as low as 2.0 to 1 are permitted if all of the following conditions are met:

i) The purchaser agrees to the use of such reduction ratios.
ii) The specified plate thickness is 75 mm or more.
iii) One or more of the following low hydrogen practices are used:

a) Vacuum degassing during steelmaking
b) Controlled soaking of the slabs or plates
c) Controlled slow cooling of the slabs or plates

iv) The sulphur content is 0.004% or less, based upon heat analysis.

v) One or more of the following practices are used:
a) Electromagnetic stirring during continuous casting
b) Soft reduction during continuous casting
c) Heavy pass reductions or other special practices during plate rolling
d) Combined forging and rolling during plate rolling

vi) The plates are ultrasonically examined in accordance with ultrasonic testing given under non destructive testing with acceptance standards level C given in **13.2.4** and based on continuous scanning over 100% of the plate surface.

vii) The plates are through thickness tension tested in accordance with ISO 7778 or any relevant national and international standards.

Commented [B3]: International/national standard reference

Commented [B4]: Can test be reproduced in this standard?

7 CHEMICAL COMPOSITION

7.1 The ladle analysis of the material, when carried out by the method specified in the relevant parts of IS 228 or IS 8811 or other established instrumental/chemical method shall be as given in Table 1. In case of dispute the procedure given in relevant part of IS 228 shall be the referee method. However, where the method is not given in IS 228 or its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacturer.

7.2 Product Analysis

Permissible variation in the case of product analysis from the limits specified in **7.1** shall be as given in Table 2.

8 HEAT-TREATMENT

8.1 Plates above 40 mm thickness shall be supplied in normalized condition. Plates 40 mm and below in thickness may be supplied in the “as-rolled” or “normalized” or “normalizing rolling” or “stress relieved” or “normalized and stress relieved” condition.

8.2 When Charpy Impact Test is required, plates greater than 12 mm in thickness shall be supplied in normalised condition, unless otherwise mutually agreed by the supplier and purchaser.

8.3 For plates produced from strips/coils and furnished “with heat treatment” or “without heat treatment” or “with stress relieving only”, additional testing requirements as per **12.1.1** apply.

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9 FREEDOM FROM DEFECTS

9.1 The finished plates or strips/coils shall be reasonably free from harmful defects, such as cracks, seams, laminations, rough and jagged edges, etc.

9.2 Superficial defects may be removed by grinding or by other suitable means, provided the material is not reduced below the permissible limits of tolerance at the dressed spot. Hammer dressing, patching by welding, etc, shall not be permitted.

9.3 Edge Imperfection

9.3.1 Line discontinuities 25 mm and less in length on the edges of a plate or strips/coils are acceptable.

9.3.2 Edge imperfections beyond the limit of **9.3.1** may be ground to the acceptable limit provided plate or strips/coils size remains within respective tolerance.

10 DIMENSIONS AND TOLERANCES

10.1 Unless otherwise agreed to between the purchaser and the manufacturer/supplier:

a) the nominal dimensions and tolerances of strips/coils and levelled and flattened plates that have been cut to length from a coiled product shall be in accordance with the IS 1852.

b) the nominal dimensions and tolerances of plates as rolled from the slab or directly from an ingot shall be in accordance with IS 16998.

11 THEORETICAL MASS

A density of 7.85 g/cm^3 shall be taken for the determination of the theoretical mass of steel products covered under this standard.

12 MECHANICAL PROPERTIES

12.1 Tensile Test

12.1.1 *Number of Tests*

One tensile test shall be taken from each plate as rolled. When plates are produced from strips/coils, three tensile tests from head end, middle and tail end of the strip shall be made from each strip. One sample per strip is to be tested in case of supply in strip form.

Commented [B6]: Is this redundant? Also covered in 12.1.3. Also should 'strip' be replaced by 'strip/coil'

12.1.2 *Orientation of Test Sample*

The longitudinal axis of the tensile test sample shall be perpendicular to the final rolling direction of the plate or strip.

12.1.3 *Location of Test Sample*

The tensile test sample shall be taken at a distance of one-fourth of the total width or corner of plate or strip from one longitudinal edge of the plate or strip. In the case of plates produced from strips/coils, the sample shall be taken from head end, middle and tail end of the strip. In case of strips/coils, sample is to be taken from the tail end.

12.1.4 When heat-treatment is specified, the test sample shall be taken from the plate in the heat treated condition or from full thickness test samples simultaneously heat treated with the plate.

12.1.5 Test sample shall be prepared in accordance with IS 1608 (Part 1).

12.1.6 *Tensile Test Result*

12.1.6.1 The tensile test shall be carried out in accordance with IS 1608 (Part 1), generally using a proportional gauge length $L_o = 5.65\sqrt{S_o}$ where S_o is the cross-sectional area of the test piece. Test pieces with a non-proportional gauge length may be used; in this case the elongation values shall be converted in accordance with IS 3803 (Part 1). The tensile strength, yield stress and percentage elongation shall be as given in Table 3.

12.1.6.2 In case of plates from strip, all material between any two test locations that meet the

Commented [B7]: Reason or Justification for the change

requirement is acceptable.

12.1.6.3 Should a tensile test piece break outside the middle half of its gauge length and if the percentage elongation is less than the specified minimum, the test may be discarded at the supplier's option and a fresh test conducted from the same plate/ strip.

12.1.6.4 Elevated temperature tensile test shall be carried out for 'H' quality grades at 300°C and the minimum yield stress values shall be as indicated in Table 3. Other temperatures and values can also be mutually agreed to. One test sample shall be taken from each thickness product per cast/heat.

12.2 Bend Test

12.2.1 Bend test shall be conducted, if agreed to at the time of ordering.

12.2.2 One bend test sample shall be taken from each plate as rolled or from each strip. Orientation and location shall be same as for tensile tests.

12.2.3 Bend test shall be carried out in accordance with IS 1599. The test piece, shall withstand, without fracture or cracking being bend over 180° against mandrel of diameter three times the thickness of test sample.

12.3 Charpy Impact Test (V-notch Tests)

12.3.1 Charpy impact test shall be conducted for all grades other than for the Grades R205, R220, R240, R260 and R355 and may be conducted for grades R205, R220, R240, R260, R275 and R355 if agreed to at time of ordering.

Commented [B8]: Reason or justification for the requirement

12.3.2 *Number of Tests*

One impact test (3 samples) shall be made from each plate as rolled or from each strip. When plates are supplied from strips/coils, the number of impact test required shall be the same as the number for tensile test.

12.3.3 *Orientation*

The orientation of impact test specimen shall be longitudinal to the rolling direction for 'R' quality grades and transverse to the rolling direction for 'H' quality grades. Notch axis shall be perpendicular to the rolled surface.

12.3.4 When heat-treatment is specified the test sample shall be taken from the plate in heat treated condition or from full thickness test samples simultaneously heat treated with the plate.

12.3.5 The average impact test values of three test samples lying next to one another in the test sample, when tested in accordance with IS 1757, and the temperature of impact test shall be as per Table 3. Any individual value may be below the specified minimum but shall not be less than 75 percent of that value.

12.3.5.1 Any other stringent impact specimen orientation, test temperature and impact values can be agreed to at the time of ordering.

12.4 Re-test

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 he rejected.

12.5 Re-heat Treatment

If any heat treated material fails to meet the mechanical requirements specified, the supplier may re-heat treat the material and in that case, all mechanical properties shall be re-evaluated.

13 ULTRASONIC TESTING

13.1 If agreed between the manufacturer and consumer, plates, 25 mm thickness and above, shall be tested for ultrasonic testing in accordance with IS 11630. Clause **4, 5.3** and **13.1.1** of IS 11630 shall be replaced by clause numbers **13.1.1**; **13.1.2** and **13.1.3** of this specification respectively.

13.1.1 Individuals performing examinations in accordance with this specification shall be qualified and certified in accordance with the requirements of the latest edition of IS 13805 or an equivalent accepted national or international standard, if mutually agreed between manufacturer and purchaser. An equivalent standard is one which covers the qualification and certification of ultrasonic on destructive examination candidates and which is acceptable to the purchaser.

13.1.2 Plates may be ultrasonically tested before or after the specified heat treatment.

13.1.3 Test reports for Auto Ultrasonic Testing machines may not include the details of the recordable indications listed in clause 7 of IS 11630. Instead they may have separate Ultrasonic Testing Scans representing the plate defects marked on it for better understanding and correlation.

13.2 Acceptance Standards

13.2.1 *Acceptance Standards Level A*

Any area where one or more discontinuities produce a continues total loss of back reflection accompanied by continuous indications on the same plane that cannot be encompassed within a circle whose diameter is 75 mm or 1/2 of the plate thickness, whichever greater is unacceptable.

13.2.2 *Acceptance Standards Level B*

~~Any area where one or more discontinuities produce a continuous total loss of back reflection accompanied by continuous indications on the same plane that cannot be encompassed within a circle whose diameter is 75 mm or 1/2 of the plate thickness, whichever greater is unacceptable.~~

~~**13.2.3**~~

In addition, two or more discontinuities smaller than described in **13.2.~~2~~ 1** shall be unacceptable unless separated by a minimum distance equal to the greatest diameter of the larger discontinuity or unless may be collectively encompassed by the circle described in **13.2.~~2~~ 1**.

13.2.3 *Acceptance Standards Level C*

Commented [B9]: Reasons for referring standards other than IS 13805

Commented [B10]: Reason or justification for change

Commented [B11]: Reason or justification for change

Commented [B12]: Reference document or national/international standard

Commented [B13]: Changes as indicated ok?

Any area where one or more discontinuities produce a continuous total loss of back reflection accompanied by continuous indications on the same plane that cannot be encompassed within a circle whose diameter is 25 mm is unacceptable.

14 RUST PROTECTION

After inspection and approval, if so desired by the purchaser, each plate shall be coated with one coat of boiler linseed oil or a suitable rust preventive material, as agreed to between the supplier and the purchaser.

15 MARKING

15.1 For plates or plates produced from strips/coils 6 mm and over in thickness, the name or trade mark of the manufacturer, cast number, grade and plate number shall be legibly "steel die stamped" or "stencil marked" or "both" in at least one place on each finished plate, at least 150 mm from one of the transverse or longitudinal edges at the middle.

15.2 For plates produced from strips/coils or plates under 6 mm in thickness, the marking specified in **15.1** shall be legibly stencilled instead of stamping.

15.3 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 product(s) may be marked with the Standard Mark.

Table 1 – Chemical Composition
(*Clause* 7)

Grade	**C** *Max*	**Si**	**Mn**	**P** *Max*	**S** *Max*	**Al (Total)** *Min*	**N** *Max*	**Nb** *Max*	**V** *Max*	**Ti** *Max*	**Nb+V+Ti** *Max*	**Cr** *Max*	**Cu** *Max*	**Mo** *Max*	**Ni** *Max*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
R205	0.20	0.15-0.35	0.60-1.20	0.035	0.035	0.020	0.012	-	-	-	-	-	-	-	-
R220	0.21	0.15-0.35	0.60-1.50	0.035	0.035	0.020	0.012	-	-	-	-	-	-	-	-
R240	0.24	0.15-0.35	0.85-1.50	0.035	0.035	0.020	0.012	-	-	-	-	-	-	-	-
R260	0.25	0.15-0.35	0.85-1.50	0.035	0.035	0.020	0.012	-	-	-	-	-	-	-	-
R275	0.16	0.40, Max	0.80-1.50	0.025	0.015	0.020	0.012	0.05	0.05	0.03	0.05	0.30	0.30	0.08	0.50
R355	0.18	0.50, Max	1.10-1.70	0.025	0.015	0.020	0.012	0.05	0.10	0.03	0.12	0.30	0.30	0.08	0.50
H235	0.16	0.35, Max	0.60-1.20	0.025	0.015	0.020	0.012	0.02	0.02	0.03	0.06	0.30	0.30	0.08	0.30

Commented [B14]: International/National standard corresponding to these grades from which these has been referred

Commented [B15]: International/National standard corresponding to these grades from which these has been referred

H265	0.20	0.40, Max	0.80-1.40	0.025	0.015	0.020	0.012	0.02	0.02	0.03	0.06	0.30	0.30	0.08	0.30
H295	0.20	0.40, Max	0.90-1.50	0.025	0.015	0.020	0.012	0.02	0.02	0.03	0.06	0.30	0.30	0.08	0.30
H355	0.22	0.60, Max	1.10-1.70	0.025	0.015	0.020	0.012	0.02	0.02	0.03	0.06	0.30	0.30	0.08	0.30

NOTES:

1. For Grades R205, R220, R240, R260, R275, R355 Carbon content over the maximum specified shall be increased by 0.03 percent for plates over 12 mm thickness
2. Microalloying elements Nb and V may be added to Grades, subject to mutual agreement between purchaser and manufacturer/supplier.
3. For product thickness < 6 mm, a minimum Mn of 0.60 percent is permitted.
4. If only Al is used for nitrogen binding, a ratio Al/N ≥ 2 shall apply.
5. Cr+Cu+Mo shall not exceed 0.45 percent.
6. Elements not listed in the table shall not be intentionally added to steel without agreement of the purchaser.
7. Closer limits of composition may be agreed to between the supplier and the purchaser.
8. Whenever microalloying elements are added for achieving the strength, maximum carbon equivalent shall not exceed 0.50 for steels used for welding.
9. Carbon equivalent (CE) based on ladle analysis = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15

Commented [B16]: Point 4 of existing version removed. Reason?

Commented [B17]: To all grades or only R 220 & R 260 as specified in present version of the standard

Table 2 Permissible Variation in Product Analysis
(*Clause* 7.2)

Sl No.	Constituent	Variation over the specified maximum or under the Minimum Limit Percent
(1)	(2)	(3)
i)	Carbon	
	Up to and including 0.23 percent	0.02
	Over 0.23 percent	0.03
ii)	Silicon	0.02
iii)	Manganese	0.05
iv)	Phosphorus	0.005
v)	Sulphur	0.005
vi)	Niobium	0.01
vii)	Vanadium	0.02
viii)	Titanium	0.01
ix)	Chromium	0.05
x)	Copper	0.05
xi)	Molybdenum	0.03
xii)	Nickel	0.05

Table 3. Mechanical Properties
(*Clause*s 12.1.6.1, 12.1.6.4 *and* 12.3.5)

Notes:

1. Impact test shall be at any one temperature as mutually agreed
2. Impact test is optional for Grades R205, R220, 240, R260, R275 and R355
3. The orientation of impact test specimen shall be longitudinal to the rolling direction for R205, R220, R240, R260, R275 and R355 grades and transverse to the rolling direction for H235, H265, H295 and H355 grades.

Grade	Yield Stress Mpa, Min				Tensile Strength MPa	Elongation Percent on Gauge Length 5.65 $\sqrt{So}$, *Min*	Impact Energy (Joules), Min (at one given temperature)				0.2% Proof stress at 300°C MPa Min
	<16 mm	>16 to 40 mm	>40 to 60 mm	>60 to 100 mm			+20°C	0 °C	-20 °C	- 40 °C	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
R205	205	205	205	205	380-515	25	50	40	27	20	-
R220	220	220	220	220	415-550	21	50	40	27	20	-
R240	240	240	240	240	450-585	21	50	40	27	20	-
R260	260	260	260	260	485-620	21	50	40	27	20	-
R275	275	265	255	235	390-510	23	80	70	50	40	-
R355	355	345	335	315	490-640	21	80	70	50	40	-
H235	235	225	215	200	360-480	24	40	34	27	-	153
H265	265	255	245	215	410-530	22	40	34	27	-	173
H295	295	290	285	260	460-580	21	40	34	27	-	192
H355	355	345	335	315	510-650	20	40	34	27	-	232

4. Stringent impact test temperature and values can be mutually agreed.
5. For thickness greater than 100 mm, mechanical properties may be mutually agreed

Commented [B18]: International/national standard referred

Commented [B19]: International/national standard referred

Commented [B20]: 485 or 490 as per existing standard

Draft Indian Standard

IS 3039
STRUCTURAL STEEL FOR CONSTRUCTION OF HULLS OF SHIPS – SPECIFICATION

1. SCOPE

This standard specifies the requirements for rolled structural steel plates, sections, flats and bars used in construction of hulls and other marine structures.

1.1 This standard does not cover rivet bars, bolts and plain shafts used in shipbuilding.

1.2 Plate and strip which is coiled after hot rolling and subsequently uncoiled, cold flattened and cut to the required dimensions are also subject to the appropriate requirements of this specification.

1.3 The requirements apply to plates and wide flats not exceeding150 mm in thickness and sections and bars not exceeding 50 mm in thickness.

Commented [B1]: Reason/justification for the requirement or national/international standard reference

2. REFERENCES

The following standards contain provisions which through 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:

IS No	*Title*
228 (in various parts)	Methods for chemical analysis of steels
808 : 1989	Dimensions for hot rolled steel beam, column, channel and angle sections (*third revision*)
1173 : 1978	Specification for hot rolled and slit steel tee bars (*second revision*)
1252 : 1991	Hot rolled steel bulb angles – Dimensions (*first revision*)
1599 : 2019	Metallic materials – Bend Test (*fourth revision*)
1608 (Part 1) : 2018	Metallic materials – Tensile testing Part 1 Method of test at room temperature (*fourth revision*)
1730 : 1989	Steel plates, sheets, strips and flats for structural and general engineering purposes - Dimensions (*second revision*)
1732 : 1989	Steel bars, round and square for structural and general engineering purposes – Dimensions (*second revision*)
1757 (Part 1) : 2020	Metallic materials – Charpy pendulum impact test Part 1 Test method (*fourth revision*)
1863 : 1979	Specification for rolled steel bulb flats (*first revision*)
1956 (in various parts)	Glossary of terms relating to iron and steel
2314 : 1986	Specification for steel sheet pilling sections (*first revision*)
3803 (Part 1) : 1989/	Steel – Conversion of elongation values Part 1 Carbon and low alloy steels (*second revision*)
3954 : 1991	Hot rolled steel channel sections for general engineering purposes – Dimensions (*first revision*)
8910 : 2010	General technical delivery requirements for steel and steel products (*first revision*)

10182 (Part 1) : 1982	Dimensions and tolerances for hot rolled track shoe sections Sections TS-L1
(Part 2) : 1985	Sections TS- H1.
12778 : 2004	Hot rolled parallel flange steel sections for beams, columns and bearing piles – Dimensions and section properties (*first revision*)
12779 : 1989	Rolling and cutting tolerances for hot rolled parallel flange beam and column sections – Specification
4748 : 2009	Steels – Micrographic determination of the apparent grain size (*second revision*)
4163 : 2004	Steel – Determination of content of nonmetallic inclusions - Micrographic method using standard diagrams (*third revision*)
ISO 7778 : 2014	Through thickness characteristics for steel products (2nd. Edition)
ISO 7788 : 1985	Steel – Surface finish of hot rolled plates and wide flats - Delivery requirements

Commented [B2]: Can relevant parts of the standards be introduced in this standard itself? Should we adopt these standards?

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 1956 (all parts) and the following shall apply.

3.1 Micro-Alloying Elements – Elements such as niobium, vanadium and titanium added singly or in combination to obtain higher strength to weight ratio combined with better toughness, formability and weldability as compared to unalloyed steel of similar strength level.

3.2 Weldability – A metallic substance is considered to be weldable by a given process and for a given purpose, when metallic continuity to a stated degree can be obtained by welding using a suitable procedure, so that the joints comply with the requirements specified in regard to both their local properties and their influence on the construction of which they form a part of.

3.3 As-Rolled – The rolling of steel at high temperature followed by air cooling. The rolling and finishing temperatures are typically in the austenite recrystallization region. The strength and toughness properties of steel produced by this process are generally less than steel heat treated after rolling or than steel produced by advanced processes.

3.4 Controlled Rolling – A hot rolling process in which the temperature of the steel and its reduction ratio are controlled, particularly during the final rolling passes, in order to achieve fine grain micro structure and optimum mechanical properties.

3.5 Normalizing Rolling – A hot rolling process in which the final rolling passes are carried out at a suitable temperature equivalent to normalizing temperature followed by cooling in air to a temperature below the transformation temperature, in order to produce a structure, analogous to that obtained by a separate normalizing treatment of hot rolled product.

3.6 Thermo- Mechanical controlled processing (TMCP) – A hot rolling process which consists of strict control of steel temperatures and reductions during hot rolling. A high proportion of the rolling reduction is to be carried out close to or below the Ar3 transformation temperature and may involve rolling towards the lower end of the temperature range of the inter critical dual- phase region, thus permitting little if any recrystallization of the austenite. The process may involve accelerated cooling by water on completion of rolling.

Commented [B3]: Though in common knowledge of metallurgists Temperature not defined in this standard or IS 1956. May be suitably modified/defined in this standard itself.

3.7 Normalizing – A normalizing heat treatment consist of heating steel from an appropriate temperature below the transformation range to the proper temperature above the transformation range, holding for a sufficient time to effect the desired transformation and then individually cooling the steel in air. The process improves the mechanical properties of as-rolled steel by refining the austenitic grain size, provided that the steel is produced by fine austenitic grain size practice.

3.8 Quenching and Tempering (QT) – Quenching involves a heat treatment process in which steel is heated to an appropriate temperature above the Ac3 and then cooled in an appropriate cooling medium for the purpose of hardening the steel by achieving an appropriate microstructure. Tempering, subsequent to quenching, is a process in which the steel is reheated to an appropriate temperature not higher than Ac1 to restore toughness properties by improving the microstructure.

Commented [B4]: Though in common knowledge of metallurgists Temperature not defined in this standard or IS 1956. May be suitably modified/defined in this standard itself.

Commented [B5]: Though in common knowledge of metallurgists Temperature not defined in this standard or IS 1956. May be suitably modified/defined in this standard itself.

, Condition of Supply & Heat Treatment

Conditions of supply shall be in accordance with requirements given in table 4 & 9 and as defined in 1.3 to 1.8.

Commented [B6]: To Discuss

A. **General Requirements**

Commented [B7]: To discuss

4. SUPPLY OF MATERIAL

General requirements relating a supply of structural steel shall conform to IS 8910.

5. MANUFACTURE

a. Rimmed steels shall not be used.

Commented [B8]: Allowed at present for Grade I

b. Except for Grades A and B steel, semi- killed steels shall not be used.
c. Grades D, E, AH32, AH36, AH40, DH32, DH36, DH40, EH32, EH36, EH40, FH32, FH36 and FH40 shall be made using a fine grain practice. For normal - strength grades, aluminum shall be used to obtain grain refinement. For higher-strength grades, Aluminum, Vanadium, Niobium and Titanium may be used for grain refinement.
d. Plates in all thicknesses ordered to Grade E shall be normalized or thermo-mechanical control processed (TMCP). Plates over 35mm in thickness ordered to Grade D shall be normalized, control rolled, or thermo-mechanical control processed (TMCP)
e. Plates in all thicknesses ordered to Grades EH32 and EH36 shall be normalized, or thermo-mechanical control processed (TMCP). Plates in all thicknesses ordered to Grade EH40, FH32, FH36 and FH40 shall be normalized, thermo-mechanical control processed (TMCP) or quenched and tempered. Plates ordered to Grades AH32, AH36, AH40, DH32, DH36, and DH40 shall be normalized, control rolled, thermo-mechanical control processed (TMCP) or quenched and tempered.
f. The reduction ratio of continuously cast slab to plate is as below:
    (a) The ratio of reduction of thickness from a continuous cast slab to finished plate is minimum 3 : 1

    OR

    (b) The size of the slab is to be proportional to the dimensions of the final product such that the reduction ratio is minimum 3 : 1

Commented [B9]: Reference for all the clauses

The reduction ratio may be mutually agreed between the purchaser and

manufacturer.

Commented [B10]: Higher reduction ratio may be agreed or any reduction ratio allowed?

6. FREEDOM FROM DEFECTS

6.1 All materials shall be free from cracks, surface flaws, segregation, lamination, pipe and other defects which will be harmful to the service of the material**.**
6.2 Surface defects may be removed by local grinding provided that:
(a) The thickness at no place is reduced to less than 93 percent of the nominal thickness, and in no case by more than 3 mm.
(b) Each single ground area does not exceed 0.25 m^2
(c) The total area of local grinding does not exceed two percent of the total surface area of the plate.
(d) The ground areas have smooth transitions to the surrounding surface.
Where necessary, the entire surface may be ground to a maximum depth as given by the under-thickness tolerances of the product. The extent of such rectification is to be agreed in each case with customer and is to be carried out as agreed between the purchaser and the manufacturer/supplier. The customer may request that complete removal of the defect is proven by suitable non-destructive examination of the affected area.

Commented [B11]: Reference for these requirements?

6.2.1 Surface Defects which cannot be removed in the manner indicated in 6.2 may be removed by Chipping and grinding followed by weld- depositing of metal, provided that:
a) Before welding the thickness of metal shall at no place be reduced by more than 20 percent of the nominal thickness.
b) Each single weld does not exceed 0,125 m^2,
c) The total area of welding does not exceed 2% of the surface of the side involved,
d) The distance between any two welds is not less than their average width,
e) The welds are of reasonable size and made with an excess layer of beads which is then ground smooth to the surface level,
f) Elimination of the defect is proven by suitable nondestructive examination of the affected area,
g) Welding is carried out by an approved procedure and by competent operators using approved electrodes and the repaired area is ground smooth to the correct nominal thickness,
h) When agreed between the purchaser and the manufacturer/supplier, the item is normalized or otherwise suitably heat treated after welding and grinding

Commented [B12]: Reference?

6.3 Surface inspection and verification of dimensions are the responsibility of the steel manufacturer and are to be carried out on all materials prior to dispatch. Acceptance by the inspecting authority of material later found to be defective shall not absolve the manufacturer from his responsibility.

Commented [B13]: To be discussed with HMTD

7. CHEMICAL COMPOSITION

7.1 Ladle analysis of the material, when carried out either by the method specified in relevant part of IS 228 or any other established instrumental/chemical method shall be given in Table 3 and Table 7. In case of dispute, the procedure given in relevant part of IS 228 shall be the referee method. However, where the method is not given in IS 228 or its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacturer.

Commented [B14]: Added in line with other similar standards. Agreeable?

7.2 Elements designated as residual elements in the individual specifications shall not be intentionally added to the steel. The content of such elements shall be reported.

7.3 When required, the carbon equivalent value shall be calculated from the heat analysis using the formula:

$$C_{eq} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15} \quad (\%)$$

7.4 Product Analysis - The product analysis shall be carried out on the finished product from the standard position. Permissible variation in case of such product analysis from the limits specified under in table 3 and table 7 shall be as given in Table 1.

7.4.1 The product analysis shall be conducted at the rate of one per heat / cast.

Table 1 Product Analysis
(*Clause* 7.4)

Constituent	Permissible Variation Over the Specified Limit, Percent, Max
C<0.20	0.02
C>/=0.20	0.03
Mn	0.05
S	0.005
P	0.005
Si	0.03

8. SELECTION AND PREPARATION OF TEST SAMPLES

8.1 The locations for taking test samples for plates, sections and bars are indicated in Fig. 1 Alternatively, in case of sections, the samples may be taken from the web. For testing of plates (including plates produced from HR coils) tensile test pieces shall be cut in transverse to rolling direction.

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Commented [B16]: Should we add 'Selection of location of test pieces may also be mutually agreed to between the purchaser and the manufacturer/supplier' in line with IS 2062

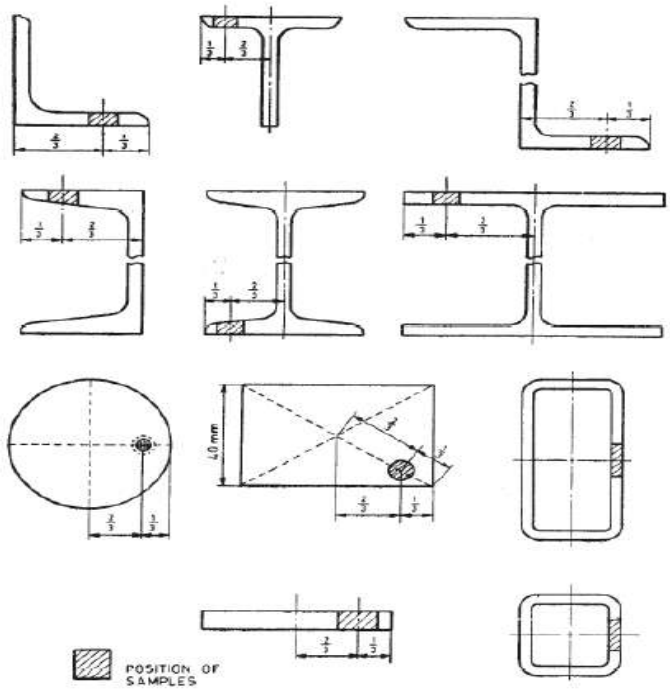

FIG. 1 STRUCTURAL STEEL SECTIONS, POSITION AND ORIENTATION OF SAMPLES

8.2 Whenever practicable, the rolled surface of the steel shall be retained on the two opposite sides of the test samples.
8.3 In case of the flat test samplers for tensile test, both surfaces are normally to be left on the test samples for strips and plates up to 32 mm thick. At least one rolled surface shall be left on rectangular test samples taken from plates exceeding 32mm in thickness, Round test samples are permitted, but should only be adopted for thickness exceeding 20 mm.
8.4 In case of flats up to 16 mm thick, the test sample shall undergo, if possible, no machining whatever, prior to use as a test piece. If this is not possible, the test sample shall undergo the minimum amount of machining.
8.5 Bars below 28 mm shall be tested without machining. In case of bars having diameters or thickness between 28 mm and 71 mm, the bars may be symmetrically reduced by machining. For bars having diameters or thickness exceeding 71mm, the test sample may be taken from the position shown in Fig. 1
8.6 Test samples shall be cut in such a manner that the deformation is avoided as far as possible. If shearing of flame-cutting is employed, an adequate allowance shall be left for removal by machining.
8.7 Test samples shall not be subjected to heat treatment unless the material from which they are cut is similarly and simultaneously treated with the material before testing. Any slight straightening of test samples which may be required shall be done cold.

9. TENSILE TEST

9.1 Number of Tensile Tests
9.1.1 For as rolled plates / TMCP rolled plates: One tensile test shall be made from each cast / heat unless the cast / heat is greater than 50 tonne in which case one extra test shall be made from each 50 tonne or part thereof. Additional tests are to be made from plates for every variation of 10 mm in thickness of

material from the same cast heat. For sections and bars, additional tests are to be made for every variation of 20 percent in thickness/diameter.

9.1.2 For Normalized plates: One tensile test shall be made on each as rolled plate.

9.1.3 For Quenched & Tempered plates: One tensile test shall be made on each plate as Quenched & Tempered.

9.2 Tensile Test Pieces

The tensile strength, yield strength and percentage elongation of steel shall be determined from standard test pieces cut crosswise from plates and strips and lengthwise from sections, flats and bars. The test shall be carried out as on the standard test pieces prepared in accordance with IS 1608 (Part 1).

9.2.1 As a rule, test pieces with a proportional gauge length complying with the requirements $L_0=5.65\sqrt{S_0}$ should be used for the tensile test, where L_0 is the gauge length and S_0 is the cross-sectional area of the test piece.

9.2.2 Test pieces with a non-proportional gauge length, other than $5.65\sqrt{S_0}$ may be used in which case, the elongation values shall be converted to $5.65\sqrt{S_0}$ in accordance with IS 3803 (Part 1)

9.3 Tensile Testing

Yield strength, tensile strength and percentage elongation, when determined in accordance with IS 1608 (Part 1), shall conform to the requirements as given in Table 5 and Table 10.

9.3.1 In case of sections, the thickness of which is not uniform throughout the profile, the limit of sizes given in Table 5 and Table 10 shall be applied according to the actual maximum thickness of the piece adopted for testing.

9.3.2 Should a tensile test piece break outside the middle half of the gauge length (see IS 1608 (Part1)) and the percentage elongation obtained is less than that specified, the test may be discarded at the manufacturer/supplier's option and another test made from the sample plate, strip, section, flat or bar.

10. IMPACT TEST

10.1 Impact test shall normally be carried out on products having thickness/diameter greater than or equal to 6 mm. The test specimen is parallel to the direction of rolling and the base closer to the rolled surface is more than 1 mm from it. The notch axis shall be perpendicular to the rolled surface.

10.1.1 Impact test for thickness less than 6 mm is not required. However, in case it is required by purchaser, the test value may be mutually agreed between purchaser and manufacturer at the time of order.

10.1.2 No individual measurement of impact test shall be less than 70 percent of the value indicated in Table 5 and Table 10.

10.1.3 The tabulated values are for standard specimens 10 mm × 10 mm. For plate thicknesses lower than 10 mm, sub-size specimens with reduced requirements may be taken as follows:
Specimen dimensions 10 mm × 7.5 mm: – 5/6 of the tabulated value
Specimen dimensions 10 mm × 5.0 mm: – 2/3 of the tabulated value
Specimen dimensions 10 mm × 2.5 mm: – 1/2 of the tabulated value

10.2 This test is carried out using a V-notch test piece (see IS 1757 (Part 1)) the value for consideration being the arithmetic mean of the results obtained on three test pieces taken side by side from the same product (see Table 5 and Table 10).

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Commented [B23]: References for the thickness and other requirements

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10.3 The test sample shall be taken from the thickest product. If the test sample taken from the thickest product rolled from a cast meets the requirements, the whole cast shall be deemed to meet the requirements of the test, if not, the test shall be performed on a section of next lower thickness rolled from the same cast, if it meets the requirements specified, this particular thickness as also other sections of lower thickness shall be deemed to satisfy this specification. If this thickness also does not meet the requirements, the test shall be carried out on the next lower thickness and so on, because the toughness of the product will be dependent on the rolling direction as well as on the section size.

10.3.1 Impact test frequency will be as per Table 5 and Table 10.

11. OTHER TESTS

11.1 The material may be subjected to non-destructive testing like UT (Ultrasonic testing) to determine the soundness of material as per any national or international standard, subject to mutual agreement between the purchaser and the manufacturer/supplier.

11.2 Metallurgical tests for grain size, directionality, inclusion content may be carried out subject to mutual agreement between the purchaser and the manufacturer/supplier.

12. RETESTS

12.1 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.

12.2 Re-heat Treatment

If any heat treated material fails to meet the mechanical requirements specified, the supplier may re-heat treat the material and in that case, all mechanical properties shall be re-evaluated.

13. STEEL WITH GUARANTEED THROUGH THICKNESS PROPERTIES – 'Z' GRADE STEEL

Commented [B25]: reference?

13.1 When plate material, intended for welded construction, will be subject to significant strains in a direction perpendicular to the rolled surfaces, it is recommended that consideration be given to the use of special plate material with specified through thickness properties, 'Z' grade steel. These strains are usually associated with thermal contraction and restraint during welding, particularly for full penetration 'T'-butt welds, but may also be associated with loads applied in service or during construction. Where these strains are of sufficient magnitude, lamellar tearing may occur. Requirements for 'Z' grade plate material are detailed in Section D. They apply to products with thicknesses greater than or equal 15 mm. The unit testing quantities shall be taken from Table 12.

13.2 Steels intended to have guaranteed through thickness properties will include the supplementary suffix Z25 or Z35 in the designation, for example: D36 Z35.

14. DIMENSIONS

Unless otherwise agreed to between the purchaser and the manufacturer / supplier, the nominal dimensions of rolled product conforming to this standard shall be in accordance with the relevant Indian Standard. Currently available Indian Standards are listed in below Table 2:

Table 2

Indian Standards Which Give Nominal Dimensions of Rolled Steel Products

Sl No.	Products	Relevant Indian Standard
(1)	(2)	(3)
i)	Beam, column, channel and angle sections	IS 808
ii)	Tee bars	IS 1173
iii)	Bulb angles	IS 1252
iv)	Plates, strips and flats	IS 1730
v)	Round and square bars	IS 1732
vi)	Bulb flats	IS 1863
vii)	Sheet piling sections	IS 2314
viii)	Channel sections	IS 3954
ix)	Track shoe sections	IS 10182 (Parts 1 and 2)
x)	Parallel beam and column sections	IS 12778

16. TOLERANCES

Unless otherwise agreed to between the purchaser and the manufacturer / supplier, the rolling and cutting tolerances for steel products conforming to this standard shall be those specified in IS 1852 (with minimum allowable thickness tolerance of 0.3 mm on lower side) except the parallel flange beams and columns covered by IS 12778 for which the tolerances shall be as per IS 12779. Other tolerance may be followed within the total tolerance range as specified in IS 1852 and IS 12779 as applicable.

Commented [B26]: Reference?

17 CALCLUATION OF MASS

The mass of steel shall be calculated on the basis that steel weight 7.85 g/cm^3

18. IDENTIFICAITON AND TRACEBILITY OF THE MATERIAL

The manufacturer shall adopt a system for the identification of ingots, slabs and finished products which shall enable the material to be traced to its original heat.

19. MARKING

19.1 Every finished product shall be clearly marked by manufacturer in at least one place. The following particulars shall be marked on each product, unless agreed otherwise;
a) Manufacturer's name, or trade-mark;
b) Grade of steel;
c) Cast number or heat number; and
d) Size of sheets or plates

19.1.1 Where a number of steel material is securely fastened together in bundles, the manufacturer may, subject to the agreement with the purchaser, mark only the top product piece of each bundle, or alternatively, a firmly fastened durable label containing the marking details may attached to each bundle.

19.2 Plates produced to a normalized heat treatment or normalizing rolling condition shall be marked with the

suffix N to indicate that the plates have been normalized.

19.3 Plates produced to a control rolled condition shall be marked with the suffix CR to indicate that the plates have been control rolled.

19.4 Plates produced to a thermo-mechanical control processed condition shall be marked with the suffix TM to indicate that the plates have been thermo-mechanical control processed.

19.5 Plates produced to a quenched and tempered heat treatment condition shall be marked with the suffix QT to indicate that the plates have been quenched and tempered.

19.6 Each product with the exception of round, square, hexagonal bars and flats shall carry a tag or be marked with the manufacturer's name or trade mark. Bars and flats shall carry a tag bearing the manufacturers name or trade mark. Designation of steel should also be similarly marked on the product or tag.

19.7 Every heavy, medium structural mill and plate mill product shall be marked with a cast / heat number. Plates produced from strip in coil form shall me marked with cast / heat number on top plate of each pile / packet.

B. Normal Strength Steel

Commented [B27]: It is felt that division of standard in to different sections can be avoided. It will also improve readability of the standard

B1. These requirements are in addition to general requirements given in section A and apply to normal strength steel. Provision is made for four grades based on the specified impact toughness and with specified minimum yield stress 235 MPa.

B2. Chemical composition- The chemical composition and deoxidation practice shall comply with the limits given in Table 3.

Table 3 Chemical composition limits and Deoxidation practice for normal strength steel

Grade	C (2)	Si	Mn (2)	P	S	Al	Deoxidation practice
A	0.21 (3)	0.50	Min. 2.5 x C	0.035	0.035	-	For t ≤ 50 mm: Any method except rimmed steel
							For t > 50 mm: Killed
B	0.21	0.35	Min. 0.80 (4)	0.035	0.035	-	For t > 50 mm: Killed
							For t ≤ 50 mm: Killed or semi killed
D	0.21	0.10-0.35	Min. 0.60	0.035	0.035	Min. 0.020 (5)	For t > 25 mm: Killed and fine grain treated
E	0.18	0.10-0.35	Min. 0.70	0.035	0.035	Min. 0.020 (5)	Killed and fine grain treated

Commented [B28]: Reference of corresponding national/international standard from which these grades have been taken

Notes:
1) Composition in percentage mass by mass maximum unless shown as a range or as a minimum.
2) %C + 1/6 Mn shall not exceed 0.40.
3) Carbon content of 0.23% maximum is acceptable for Grade A for shapes and bars.
4) For Grade B steel when fully killed lower limit of Manganese to be reduced to 0.60% minimum.
5) Where additions of any other elements are made as part of the steel-making practice, the content of each element is to be reported .
6) For semi-killed steel, silicon shall be less than 0.10 percent. For killed steel, when the steel is killed by aluminium alone, the total aluminium content shall not be less than 0.02 percent. When the steel is killed by silicon alone, the silicon content shall not be less than 0.10 percent. When the steel is silicon-aluminium killed,

Commented [B29]: Earlier 0.42. Basis/reference for change in the value

Commented [B30]: Reference for the change in requirement?

the silicon content shall not be less than 0.03 percent and total aluminium content shall not be less than 0.01 percent.

B3. Condition of supply- The condition of supply shall comply with the requirements given in Table 4.

Table 4 Condition of supply

Grade	Thickness (mm)	Plates	Sections
A & B	≤50	AR, NR, N, TM, CR	AR, NR, N, TM , CR
	>50 ≤150	AR(1), NR, N, TM , CR	AR(1), NR, N, TM , CR
D	≤35	AR, NR, N, TM , CR	AR, NR, N, TM , CR
	>35 ≤150	NR, N, TM , CR	AR(1), NR, N, TM , CR
E	≤150	N, TM , CR	AR(1), NR(1), N, TM , CR

(1) Products may be supplied in this condition when mutually agreed between manufacturer /supplier and purchaser.

Commented [B31]: Reference for the stated condition of supply?

N : Normalised condition (Heat treatment)
NR : Normalising Rolled Condition as alternative to Normalising
TM : Thermo- Mechanical Control Processing .
AR : As rolled condition
CR : Controlled rolled.

B.4 Mechanical properties

B.4.1 The mechanical properties shall comply with the values given in Table 5
B.4.2 For tensile testing, the total mass of products in a test unit shall be maximum 50 tonne. For impact testing, the maximum size of a test unit shall be as given in Table 6.

Table 5 Mechanical Properties

Commented [B32]: Reference of any national/international standard

Grade	Yield Strength [MPa] min	Tensile Strength [MPa]	Elongation (2) Lo=5.65√So (%) min	Test temp. [°C]	Notched bar impact energy [J] min (4)		
					t ≤ 50 [mm]	50 < t ≤70 [mm]	70 <
A	235	400-520 (1)	22	+20	-	34 (3)	41 (4)
B				0	27 (2)	34	41
D				-20	27	34	41
E				-40	27	34	41

t = thickness of product [mm]

1. For Grade A sections and bars, the upper limit of the tensile strength may be 550 MPa or as agreed between the purchaser and the manufacturer/supplier.
2. Notch impact tests are generally not required for Grade -B steels with thickness of 25 mm or less.
3. For Grade A products with thickness in excess of 50 mm, notch impact tests are not required provided that the steel has been fine grain treated and normalized or TM.
4. Impact tests are not required for plates less than 6 mm in thickness

Table 6 Test units for impact testing of normal strength steel

Commented [B33]: Reference?

Grade	Thickness, t (mm	Plates	Sections
A	t ≤ 50	Not required	Not required
	50 < t ≤ 150	50 tonne	Not required
B	t ≤ 25	Not required	Not required
	25 < t ≤ 150	50 tonne (1) (2)	50 tonne (2)
D	t ≤ 150	50 tonne (1) (2)	50 tonne (2)
E	t ≤ 150	Each plate	25 tonne (3)

(1) Maximum 25 tonne for plates over 50 mm in thickness supplied in the normalising rolled (NR) condition.
(2) Maximum 25 tonne for plates and sections supplied in the as rolled (AR) condition.
(3) Maximum 15 tonne for sections supplied in the as rolled (AR) or normalizing rolled (NR) condition.

B.4.3 For Grades A and B where plate is supplied from coil, results of the tensile test can be transposed from the certificate of the coil manufacture onto the certificate issued by the re-processor. If the coil mass exceeds 50 tonne, testing will additionally be required from two locations representing the start and end of the coil. For Grades D and E, the mechanical properties must be sampled from the de-coiled plate in accordance with the frequency specified in Table 6
B.4.4 For plates of thickness exceeding 50 mm in Grade E steel, one tensile test is to be made on each plate.

C. High Strength Steel

C.1 These requirements are supplementary to general requirements given in A and apply to high strength steel. Provision is made for three strength levels with specified minimum yield stress 315 MPa, 355 MPa and 390 MPa. Each strength level is further subdivided into four grades based on the specified impact toughness properties.

C.2 Chemical composition

C.2.1 The chemical composition shall comply with the limits given in Table 7. The steel grades shall be made with fine grain practice and fully killed.
C.2.2 For TM steels, the carbon equivalent value shall comply with the limits given in Table 8.
C.2.3 The cold cracking susceptibility, Pcm, may be used instead of the carbon equivalent for evaluating weldability, in which case the following formula is to be used for calculating the Pcm from the ladle analysis:

$$P_{cm} = C + \frac{Si}{30} + \frac{Mn + Cr + Cu}{20} + \frac{Ni}{60} + \frac{Mo}{15} + \frac{V}{10} + 5B$$

The maximum allowable Pcm is to be agreed at the time of order and is to be included in the manufacturing specification and reported on the test certificate.
C.2.4 Small deviations in chemical composition from that given in Table 7 for plates exceeding 50 mm in thickness in Grades E36, E40, F36 and F40 may be agreed between the manufacturer and purchaser at the time of order.

Table 7 Chemical composition limits for high strength steel

Commented [B34]: Reference?

Grade	*C Max*	*Si Max*	*Mn*	*P Max*	*S Max*	*Cr Max*	*Mo Max*	*Ni Max*	*Cu Max*	*Al Min (2) (3)*	*Nb (3)*	*V (3)*	*Ti Max (3)*	*N Max*
AH32 DH32 EH32 AH36 DH36 EH36 AH40 DH40 EH40	0.18	0.50	0.90-1.60 (1)	0.035	0.035	0.20	0.08	0.40	0.35	0.02	0.02 - 0.05	0.05 - 0.10	0.02	-
FH32 FH36 FH40	0.16	0.50	0.90-1.60	0.025	0.025	0.20	0.08	0.80	0.35	0.02	0.02 - 0.05	0.05 - 0.10	0.02	0.009 (4)

(1) Minimum Manganese of 0.70% for thicknesses up to and including 12.5 mm for AH32, AH36, AH 40.

(2) The total aluminum content may be determined instead of the acid soluble content. In such case the total aluminum content is to be not less than 0.020%
(3) The steel is to contain aluminum, niobium, vanadium or other suitable grain refining elements, either singly or in any combination. When used singly, the steel is to contain the specified minimum content of the grain refining element. When used in combination, the specified minimum content of at least one grain refining element is applicable; the sum of Nb+V+Ti is not to exceed 0.12%
(4) Percent N is 0.012 % max. when Al is present in steel

Table 8 Maximum carbon equivalent values for high strength steel supplied in TM condition

Commented [B35]: Reference?

Grade	*$t \leq 50$ mm*	*50 mm $< t \leq 100$ mm*
AH32, DH32, EH32, FH32	0.36	0.38
AH36, DH36, EH36, FH36	0.38	0.40
AH40, DH40,EH40, FH40	0.40	0.42

C.3 Condition of supply- The condition of supply shall comply with the requirements given in Table 9.

Table 9 Conditions of supply for high strength steel

Commented [B36]: Reference?

Grade	*Grain refining element*	*Thickness, t (mm)*	*Plates*	*Sections*
AH32, AH36	Al or Al+Ti	t ≤ 20	AR, NR, N, TM , CR	AR, NR, N, TM, CR
		20 < t ≤ 35	AR(1), NR, N, TM ,CR	AR, NR, N, TM, CR
		35 < t ≤ 150	NR, N, TM, QT ,CR	AR(1), NR, N, TM, QT ,CR
	Any, except Al or Al+Ti	t ≤ 12.5	AR, NR, N, TM	AR, NR, N, TM
		12.5 < t ≤ 150	NR, N, TM, QT ,CR	AR(1), NR, N, TM, ,CR QT
AH40	Any	t ≤ 12.5	AR, NR, N, TM ,CR	AR, NR, N, TM ,CR
		12.5 < t ≤ 150	NR, N, TM, QT ,CR	NR, N, TM, QT ,CR
DH32, DH36	Al or Al+Ti	t ≤ 20	AR, NR, N, TM ,CR	AR, NR, N, TM ,CR
		20 < t ≤ 25	AR(1), NR, N, TM ,CR	AR, NR, N, TM ,CR
		25 < t ≤ 150	NR, N, TM, QT ,CR	AR(1), NR, N, TM, QT ,CR
	Any, except Al or Al+Ti	t ≤ 12.5	AR, NR, N, TM ,CR	AR, NR, N, TM ,CR
		12.5 < t ≤ 150	NR, N, TM, QT ,CR	AR(1), NR, N, TM, QT ,CR
DH40	Any	t ≤ 150	NR, N, TM, QT ,CR	NR, N, TM, QT ,CR
EH32, EH36	Any	t ≤ 50	N, TM, QT ,CR	AR(1), NR(1), N, TM, QT
		50 < t ≤ 150	N, TM, QT ,CR	NR(1), N, TM, QT ,CR
FH32, FH36	Any	t ≤ 150	N, TM, QT ,CR	NR(1), N, TM, QT ,CR
EH40, FH40	Any	t ≤ 150	N, TM, QT ,CR	N, TM, ,CR

(1) Products may be supplied in this condition if mutually agreed between the manufacturer and purchaser at the time of order.

N : Normalised condition (Heat treatment)
NR : Noramlising Rolled Condition as alternative to Normalising
TM : Thermo- Mechanical Controlled Processing.
AR : As rolled condition

CR : Controlled rolled.
QT : Quenched and tempered

C.4 Mechanical properties –

C.4.1 The mechanical properties shall comply with the values given in Table 10.
C.4.2 For tensile testing, the total mass of products in a test unit shall be maximum 50 tonne. For impact testing, the maximum size of a test unit shall be as given in Table 11.

TABLE 10 Mechanical Properties

Commented [B37]: Reference?

Grade (Note 2)	Yield Strength [MPa] min	Tensile Strength [MPa]	Elongation (Note 1) Lo=5.65√So (%) min	Test temp. [°C]	Notched bar impact energy [J] min in longitudinal direction		
					t ≤ 50 [mm]	50 < t ≤70 [mm]	70 < t ≤150 [mm
AH32	315	440-590	22	0	31	38	46
DH32				-20			
EH32				-40			
FH32				-60			
AH36	355	490-620	21	0	34	41	50
DH36				-20			
EH36				-40			
FH36				-60			
AH40	390	510-650	20	0	41	46(Note 2)	55(Note 2)
DH40				-20			
EH40				-40			
FH40				-60			

(Note1) For full thickness flat test pieces with width 25 mm and gauge length 200 mm, the minimum elongation (%) is reduced to the following values:

Thickness, mm	≤5	>5 ≤10	>10 ≤15	>15 ≤20	>20 ≤25	>25 ≤30	>30 ≤40	>40 ≤50	>50
Strength grade 32	14	16	17	18	19	20	21	22	To be agreed between Manufacturer and Purchaser at the time of order
Strength grade 36	13	15	16	17	18	19	20	21	
Strength grade 40	12	14	15	16	17	18	19	20	

(Note 2) Subject to special approval the minimum tensile strength may be reduced to 470 MPa, for grades AH36, DH36, EH36 and FH36, in the TM condition when micro-alloying elements Nb, Ti or V are used singly and not in combination

Table 11 Test units for impact testing of high strength steel

Commented [B38]: Reference?

Grade	*Plates*	*Sections*
Grades A and D of all strength levels	50 tonne (1) (2)	50 tonne (2)
Grades E and F of all strength levels	Each 'as rolled' plate	25 tonne (3)

(1) Maximum 25 tonne for plates over 50 mm in thickness supplied in NR condition.
(2) Maximum 25 tonne for plates and sections supplied in AR condition.
(3) Maximum 15 tonne for sections supplied in AR or NR condition.

D. Plates with Through Thickness Properties

Commented [B39]: Reference?

D 1 These requirements are supplementary to requirements given in A, B and C and apply to plates and wide flats with thickness 15 mm and over with improved through thickness or 'Z' direction properties. The use of 'Z' grade steels is recommended for certain types of welded structures where plates are subjected to significant strains in the through thickness direction in order to minimize the possibility of lamellar tearing during fabrication.
D1.1 Provision is made for two quality classes Z25 and Z35 based on specified minimum values for reduction of area in a through thickness tensile test. Quality class Z25 is intended for normal ship applications and Z35 for more severe applications.

D.2 Manufacture
D.2.1 It is recommended that special steelmaking processes and techniques such as vacuum degassing, suitable low sulphur and / or sulphide shape control techniques are used.

D.3 Chemical composition
D.3.1 The steel grades shall made with fine grain practice and fully killed. The maximum Sulphur content shall be 0.008% unless alternative methods of improving through thickness properties have been agreed between manufacturer and purchaser.

D.4 Test material
D.4.1 Test material shall be taken close to the longitudinal centerline from one end of each as rolled plate or wide flat representing the test unit, see Fig.2 and Table 12.
D.4.2 The test material must be large enough to accommodate the preparation of six test pieces. Three test pieces shall be prepared while the rest of the sample remains for possible retest.
D.4.3 Test pieces shall be prepared in accordance with specification ISO 7778:2014 (Through Thickness Characteristics for Steel Products; 2nd. Edition)

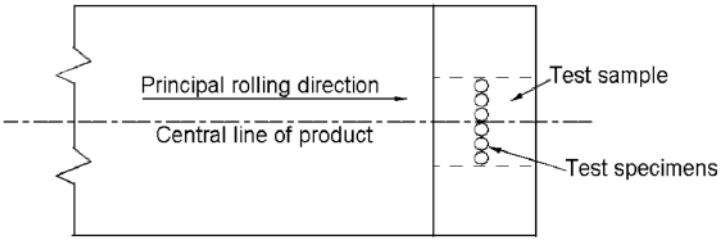

Fig 2: Plate & Wide Flat Sampling position

Table 12 Test unit (batch) size dependent on product and Sulphur content

Product	*S > 0.005%*	*S ≤ 0.005%*
Plates	Each as rolled plate	Maximum 50 t of product of the same heat, thickness and condition of supply
Wide flats of nominal thickness ≤ 25 mm	Maximum 10 t of products of the same heat, thickness and condition of supply	Maximum 50 t of products of the same heat, thickness and condition of supply
Wide flats of nominal thickness > 25 mm	Maximum 20 t of products of the same heat, thickness and condition of supply	Maximum 50 t of products of the same heat, thickness and condition of supply

D.5 Mechanical testing

D.5.1 The average reduction in area value of three test pieces shall be determined and meet the specified minimum average value given in Table 13. One individual value may be below the specified minimum average value, provided that it is not less than the specified minimum individual value.

D.5.2 Re-test - if the results do not meet the specified requirements, three additional test pieces from the same sample may be tested. The test unit will then be accepted provided that the following conditions are met:

— the average value of six test pieces meets the specified minimum average value
— not more than two of six individual values are lower than the specified minimum average value
— not more than one of six individual values is lower than the specified minimum individual value.

D.5.3 Where batch testing is permitted and failure after retest occurs, the tested piece is to be rejected. Each remaining piece in the batch may be individually tested and accepted based on satisfactory results.

D.5.4 If the fracture of a test piece occurs in the weld or in the heat affected zone the test is regarded as invalid and shall be repeated on a new test piece.

Table 13 – Reduction of Area Acceptance Values

Commented [B40]: Reference?

Quality class	*Z25*	*Z35*
Minimum average	25%	35%
Minimum individual	15%	25%

Appendix-9

Indian Standard

SPECIFICATION FOR STRUCTURAL WEATHER RESISTANT STEELS

(First Revision)

ICS 77.140.50

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

2020

Appendix-9

Wrought Steel Products Sectional Committee, MTD 4

FOREWORD

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

This standard was first published in 1986. While reviewing the standard, in the light of experience gained during these years, the Committee decided to revise it to bring in line with that present practices being followed by the Indian industry.

The atmospheric corrosion resistance of these steels is approximately four times to that of carbon structural steel. Welding is of fundamental importance, and it is pre-supposed that suitable welding procedures will be adopted for welding the steels. These steels are intended for applications where weight saving along with improved atmospheric corrosion resistance is important.

In this revision the following changes have been made:

a) Chemical and mechanical properties have been modified; Permissible Variation for Product Analysis also modified;
b) New grade designation system has been adopted; simultaneously old designations have also been given in Annex A;
c) New grades have been added;
d) Clauses are rearranged. As per rearranged clause numbers (correlation with old clause numbers), Clauses 2.0, 3.0, 11.1.1, and 19.2 are added. Clauses 5.0, 6.1, 7.2, 10.1, 10.2, 11.1, 11.3, 12.1, 12.2, 12.3, 12.4, 16, 19.1 and 19.3.1 have been modified.

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.

Assistance has been derived from ISO 630-5 : 2014 and DIN EN 10025-5 : 2004'Technical delivery conditions for structural steels with improved atmospheric corrosion resistance', ASTM A588 : 2015 'Standard Specification for High-Strength Low-Alloy Structural Steel, with atmospheric Corrosion Resistance', ASTM A 871 : 2014 'Standard Specification for High-Strength Low-Alloy Structural Steel Plate With Atmospheric Corrosion Resistance', and JIS G 3125 : 2010 'Superior atmospheric corrosion resisting rolled steels'.

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

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 : 1960 'Rules for rounding off numerical values (revised). The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Appendix-9

Indian Standard
SPECIFICATION FOR STRUCTURAL WEATHER RESISTANT STEELS
(First Revision)

1 SCOPE

This standard covers the requirements for structural weather resistant steels in the form of plates, sheets, strips, sections and bars for welded, riveted or bolted construction requiring atmospheric corrosion resistance.

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:

IS No.	*Title*
228 (in various parts)	Methods of chemical analysis of steels
808 : 1989	Dimensions for hot rolled steel beam, channel and angle sections (*third revision*)
1173 : 1978	Specification for hot rolled and slit steel tee bars (*second revision*)
1252 : 1991	Hot rolled steel bulb angles – Dimensions (*first revision*)
1599 : 2019/ ISO 7438 : 2016	Metallic materials – Bend test (*fourth revision*)
1608 (Part 1): 2018/ ISO 6892-1 : 2016	Metallic materials – Tensile testing Part 1 Method of test at room temperature (*fourth revision*)
1730 : 1989	Steel plates, sheets, strips and flats for structural and general engineering purposes – Dimensions (*second revision*)
1732 : 1989	Steel bars, round and square for structural and general engineering purposes – Dimensions *(second revision)*
1757 (Part 1) : 2014/ ISO 148-1 : 2009	Metallic materials – Charpy pendulum impact test Part 1 Test method (*third revision*)
1852 : 1985	Specification for rolling and cutting tolerances for hot rolled steel products (*fourth revision*)
1863 : 1979	Specification for rolled steel bulb flats (*first revision*)
1956 (Part 4) : 2013	Glossary of terms relating to iron and steel: Part 4 Flat products (*second revision*)
2314 : 1986	Specification for steel sheet piling sections (*first revision*)
3954 : 1991	Hot rolled steel channel sections for general engineering purposes – Dimensions (*first revision*)
4923 : 2017	Hollow steel sections for structural use – Specification (*third revision*)
5488 : 1987	Dimensions and dimensional tolerances for hot rolled steel plates for ship's hull structure *(first revision)*
8910 : 2010/ ISO 404 : 1992	General technical delivery requirements for steel and steel products (*first revision*)

12778 : 2004 Hot rolled parallel flange steel sections for beams, columns and bearing piles – Dimensions and section properties (*first revision*)

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 1956 (Part 4) and the following definitions shall apply.

3.1 Normalizing Rolling – A hot rolling process in which the final deformation is carried out within a certain temperature range equivalent to normalizing temperature, leading to a material condition equivalent to that obtained after normalizing, such that the specified mechanical properties would still be met in the event of any subsequent normalizing.

3.2 Thermo-Mechanical Rolling – A hot rolling process in which the final deformation is carried out in a certain temperature range to get fine microstructure which is achieved due to finely distributed precipitates mostly carbides and/or nitrides, leading to a material condition with certain properties that cannot be achieved or repeated by heat treatment alone, and such deformation is followed by cooling, possibly with increased cooling rates, with or without tempering, self-tempering included, but excluding direct quenching and quenching and tempering.

Note: 1) Subsequent heating above 580^0C typically can lower the strength values.

2) The term "Thermo-Mechanical Control Process" is also used.

3.3 Steel with improved atmospheric corrosion resistance (Weather resistance steels) – Steel in which a certain number of alloying elements, such as P, Cu, Cr, Ni, etc., have intentionally been added in order to increase its resistance to atmospheric corrosion, by forming an auto-protective oxide layer on the base metal under the influence of weather conditions; these steels are commonly known as "weathering steels"

4 SUPPLY OF MATERIALS

General requirements relating to the supply of material shall conform to IS 8910.

5 DESIGNATION AND GRADES

5.1 There shall be ten (10) steel grades; grades WR-Fe 360, WR-Fe 410, WR-Fe 450, WR-Fe 480, WR-Fe 500, WR-Fe 520, WR-Fe 550, WR-Fe 580, WR-Fe 680 and WR-Fe 760. Class WR denotes weathering steel. Each grade is available in up to four (4) qualities. These grades and qualities differ in their specified mechanical properties and impact energy requirements. The grades are as follows:

i) Quality A: no impact testing
ii) Quality BR: impact testing is optional, if required testing at +20 °C (~RT)
iii) Quality B0: impact testing at 0 °C
iv) Quality C: impact testing at –20 °C

5.2 Grades WR-Fe 410, WR-Fe 450, WR-Fe 480 and WR-Fe 500 are further subdivided into classes with suffix P which differ primarily in their carbon and phosphorus contents as well as in alloying element requirements for Mn, Si, Cr, Cu, and Ni (*see* Table 1). Class WR with suffix P denotes weathering steel with higher levels of phosphorus

Note: Grades are defined based on the Minimum tensile strength required

5.3 While placing the order the steel should be designated by 'Grade' and 'Quality' (*see* Table 1 and Table 3). For example, grade WR Fe360 and quality C, the order for steel shall be WR Fe360C.

6 MANUFACTURE

6.1 Steel shall be manufactured by any process of steel making except Bessemer process. It may be followed by secondary refining or secondary vacuum, treatment.

6.2 Steel shall be supplied in killed condition.

7 CHEMICAL COMPOSITION

7.1 Ladle Analysis

Ladle analysis of the material when carried out either by the method specified in the relevant part of IS 228 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 IS 228 shall be the referee method.

7.2 Product Analysis

The permissible variation in the case of product analysis from the limits specified in Table 1 shall be as given in Table 2.

Table 1 Chemical Composition

(*Clauses* 7.1 *and* 7.2)

Grade (1)	Quality (2)	Constituent, *percent*, Max							
		C (3)	Mn (4)	Si (5)	P (6)	S (7)	Cu (8)	Cr (9)	V (10)
WR-Fe 360	A, BR, B0, C	0.12	0.60	0.40	0.040	0.040	0.25-0.55	0.30-0.80	-
WR-Fe 410	A, BR, B0, C	0.15	0.50-1.20	0.40	0.040	0.040	0.25-0.55	0.40-0.80	-
WR-Fe 410P	A, BR, B0, C	0.12	0.60	0.15-0.40	0.06-0.15	0.040	0.25-0.55	0.30-0.80	-
WR-Fe 450	A, BR, B0, C	0.20	0.50-1.20	0.40	0.040	0.040	0.25-0.55	0.40-0.80	-
WR-Fe 450P	A, BR, B0, C	0.12	0.60	0.15-0.40	0.06-0.15	0.040	0.25-0.55	0.30-1.20	-
WR-Fe 480	A, BR, B0, C	0.10-0.19	0.90-1.25	0.15-0.50	0.040	0.050	0.25-0.40	0.40-0.70	0.02-0.10
WR-Fe 480P	A, BR, B0, C	0.12	0.60	0.25-0.75	0.07-0.15	0.050	0.25-0.55	0.30-1.25	-
WR-Fe 500	A, BR, B0, C	0.10-0.20	0.90-1.40	0.40	0.040	0.050	0.25-0.55	0.40-0.80	0.02-0.10
WR-Fe 500P	A, BR, B0, C	0.17	1.00	0.40	0.07-0.15	0.050	0.25-0.55	0.70-1.00	0.10
WR-Fe 520	A, BR, B0, C	0.17	0.50-1.35	0.25-0.50	0.040	0.050	0.25-0.50	0.40-0.70	0.01-0.10
WR-Fe 550	A, BR, B0, C	0.20	0.75-1.35	0.15-0.50	0.040	0.050	0.25-0.50	0.40-0.70	0.01-0.10
WR-Fe 580	A, BR, B0, C	0.12	2.00	0.15-0.55	0.030	0.020	0.30-0.55	0.45-0.75	0.02-0.10
WR-Fe 680	A, BR, B0, C	0.15	2.00	0.15-0.55	0.030	0.020	0.30-1.20	0.45-0.70	0.02-0.10
WR-Fe 760	A, BR, B0, C	0.20	2.00	0.15-0.55	0.030	0.020	0.30-1.50	0.45-1.20	0.02-0.10

Commented [B1]: Reference of national/international standard for each grade for its chemical and mechanical properties

NOTES:

1. Steels of these grades may be supplied with the addition of grain refining elements either singly or in combination, like Aluminium: ≥ 0.020%, Niobium: 0.015% to 0.06% and Titanium: 0.02% to 0.10%. If these elements are used in combination, at least one of the elements shall be present with minimum specified value.

2. The nitrogen content of the steel shall not be more than 0.009 percent. For aluminium killed or aluminium silicon killed the nitrogen content shall not exceed 0.012 percent.
3. When the steel is killed by aluminium the total aluminium content should not be less than 0.02 percent. Aluminium less than 0.02 percent can be mutually agreed between the purchaser and supplier for Al killed steel. When steel is silicon killed the silicon content shall not be less than 0.1 percent. When the steel is aluminium silicon killed the silicon content shall not be less than 0.03 percent and total aluminium content shall not be less than 0.01 percent.
4. Nickel content up to 0.65% max may be added except grades WR-Fe 680 and WR-Fe 760 for which up to 1.0% max may be added at the manufacturer's option. The element Mo can also be added up to 0.3% max. Any element other than mentioned, shall be agreement between the purchaser and the supplier.
5. Restricted chemical composition may be mutually agreed to between the purchaser and the supplier.
6. Chemical composition for thicknesses over 16 mm is subject to agreement between the purchaser and the supplier.

Table 2 Permissible Variation for Product Analysis

(*Clauses* 7.2)

S. No.	Constituent	Percentage Limit of Constituent	Variation Over the Specified Maximum Limit, Percent, Max
(1)	(2)	(3)	(4)
i)	Carbon	≤0.15 >0.15	0.02 0.03
ii)	Manganese	≤0.60 >0.60 to ≤1.15 >1.15	0.03 0.04 0.05
iii)	Sulphur	≤ 0.05	0.005
iv)	Phosphorus	≤0.05 >0.05	0.005 0.010
v)	Silicon	≤0.60 >0.60	0.03 0.06
vi)	Copper	-	0.05
vii)	Chromium	-	0.05
viii)	Nickel	-	0.05
vii)	Micro Alloy	-	Subject to negotiation

8. WELDABILITY

8.1 All steel grades specified are of weldable quality. If agreed to between the manufacturer and the purchaser, the weather resistant steel up to and including 50 mm thick plates shall be supplied with a carbon equivalent (CE) value of 0.44 Max for grades WR-Fe 360, WR-Fe 410 and 0.54 Max for grades WR-Fe 450 to WR-Fe 500P based upon the ladle analysis. For other grades CE may be mutually agreed between purchaser and supplier. The carbon equivalent may be calculated using the formula:

$$\text{Carbon equivalent (CE)} = C + \frac{Mn}{6} + \frac{(Cr+Mo+V)}{5} + \frac{(Ni+Cu)}{15}$$

8.2 If the weather resistant steels are to be used unpainted, it is advisable to select the welding electrodes with matching weathering characteristics.

8.3 Lower limits for carbon equivalent values may be agreed to between the contracting parties.

NOTES:

1 Special precautions should be taken when welding grades WR-Fe 410P, WR-Fe 450P, WR-Fe 480P and WR-Fe 500P with a high phosphorous content.

2 The steels specified in this Standard do not have unlimited suitability for the various welding processes, since the behaviour of a steel during and after welding depends not only on the material but also on the dimensions and shape, as well as on the manufacture and service conditions of the components.

Appendix-9

9. SELECTION AND PREPARATION OF TEST SAMPLES

9.1 The points from which test samples are taken shall be as located in the product as to yield the clearest possible information regarding properties in the cross-sectional and longitudinal planes. The recommended locations for taking test samples for plates, sections and bars are indicated in Fig. 1. Alternatively, in case of sections, the samples may be taken from the web.

Commented [B2]: Why complete clause 9.1 of IS 2062 not incorporated?

9.2 Wherever practicable, the rolled surface of the steel shall be retained on the two opposite sides of the test samples.

9.3 In case of flat test samples for tensile test, both surfaces are normally to be left on the test specimen for sheets, strips, and plate up to 32 mm thick. At least one rolled surface shall be left on rectangular test samples taken from plate more than 32 mm thick. Round test samples are permitted, but should only be adopted for thickness exceeding 28 mm.

Commented [B3]: 20 mm as per IS 2062. Typographical error? If not, justification/reference there of please.

9.4 In case of flats up to 16 mm thick, the test sample shall undergo, if possible, no machining whatsoever prior to use as a test piece. If this is not possible, the test sample shall undergo the minimum amount of machining.

9.5 Bars below 28 mm may also be tested without machining. In case of bars having diameters or thicknesses between 28 and 71 mm, the bars may be symmetrically reduced by machining. For bars having diameters or thicknesses exceeding 71 mm, the test sample may be taken from the position shown in Fig. 1.

Commented [B4]: Shall as per IS 2062. Is it Deliberate Change? Reasons thereof

9.6 In the case of sections, flats, strips, sheets and plates, bend tests are to be carried out on rectangular test samples which, as far as possible, should be of the full thickness of the product. In the case of sections, flats and plates exceeding 28 mm in thickness, it is permissible to remove metal from one side of the test sample before using it as a test piece. The rolled surface of the test piece shall be on the outer side of the bend during the test.

9.7 Before test samples are detached, full particulars regarding cast number, size and mass of plates, strips, sections, flats and bars in each case shall be furnished by the manufacturer to the purchaser. In case of plates, the number of plates in each cast shall also be given.

9.8 Test samples shall be cut in such a manner that deformation is avoided as far as possible. If shearing or flame-cutting is employed, an adequate allowance shall be left for removal by machining.

9.9 Test samples taken from rolled steel which have undergone deformation through bending or twisting-shall in all cases be straightened cold. If the deformation is too severe to allow cold straightening, it is permissible in the case of materials to be delivered in the annealed or normalized condition, to carry out straightening under the application of heat, provided the temperature does not exceed 650°C. While straightening test samples, care shall be taken to avoid any cold-working or temperature rise which will alter the properties of the samples as compared with the finished product which they represent.

9.10 Test samples shall not be annealed or otherwise subjected to heat treatment unless the material from which they are cut is similarly treated, in which case the test samples shall be similarly and simultaneously treated with the material before testing. Any slight straightening of test samples which may be required shall be done cold.

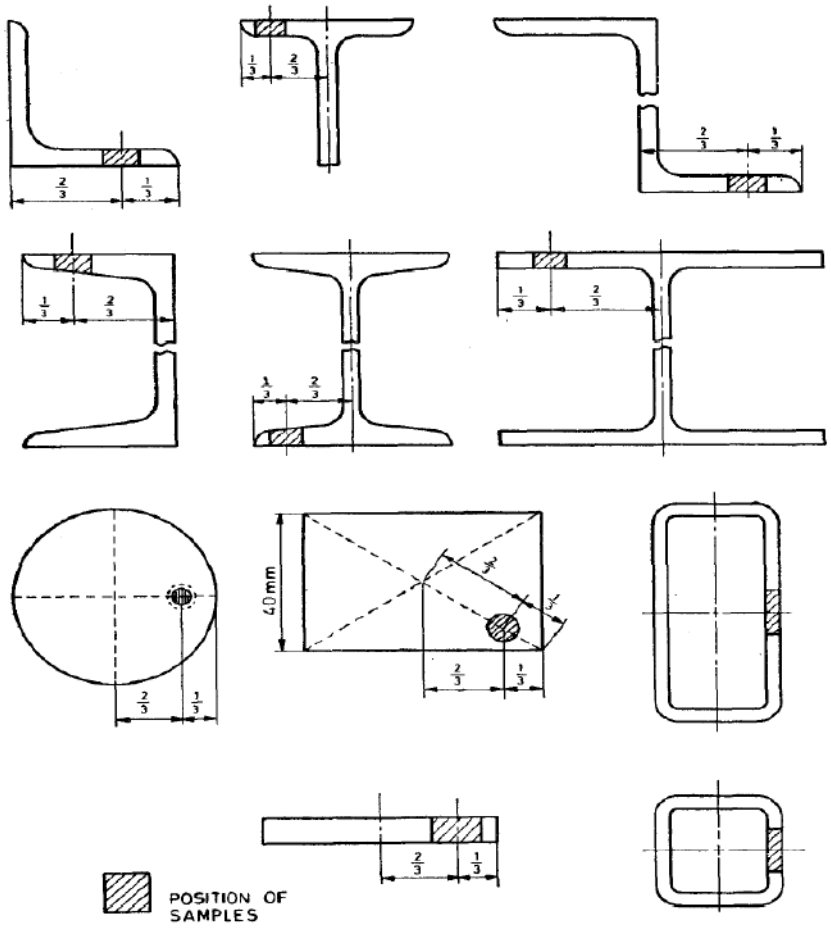

FIG. 1 STRUCTURAL STEEL SECTIONS, POSITION AND ORIENTATION OF SAMPLES

10 TENSILE TEST

10.1 Number of Tensile Tests
One tensile test shall be taken from each cast. Separate test being made for each class of steel product (namely, plates, strips, sections and flats) rolled from a cast.

10.1.1 Where plates, strips, sections or flats of more than one thickness are rolled from the same cast, one additional tensile test shall be made from the material in each class of product for each variation in thickness of 6 mm.

10.1.2 *Bars (Round, Square and Hexagonal)*
When more than one diameter or thickness of the bar is specified, one additional tensile test

shall be made for each diameter or thickness of the bar ordered, if so desired, by the purchaser.

10.2 Tensile Test Pieces

The tensile strength, yield stress and percentage elongation of steel shall be determined from standard test pieces cut transverse to the rolling direction from plates, strips and lengthwise from sections, flats and bars. The tests shall be carried out on test pieces prepared in accordance with IS 1608 (Part 1). If agreed between the supplier and purchaser different orientation test piece may be used, but the values shall be as per Table 3.

10.3 Tensile Test

When tested in accordance with IS 1608 (Part 1) as applicable, the mechanical properties shall conform to requirements as given in Table 3.

10.3.1 In case of sections, the thickness of which is not uniform throughout the profile, the limits shall be applied according to the actual maximum thickness of the piece selected for testing.

10.3.2 Should a tensile test piece break outside the middle half of its gauge length [see IS 1608 (Part 1)] and the percentage elongation obtained is less than that specified in the test may be discarded at the option of the manufacturer and another test made from the sample selected representing the same plate, strip, section, flat or bar.

Table 3 Mechanical Properties
(*Clause* 5.3, 10.2, 10.3 *and* 11.3.1)

Grade	Quality	Yield Strength, Mpa, Min Thickness in mm			Tensile Strength MPa, Min	Percentage Elongation Gauge Length 5.65√So, Min	Internal Bend Diameter, min t = Thickness in mm	
		≤ 12	>12-40	>40-50			t≤25	t>25
WR-Fe 360	A, BR, B0, C	235	225	215	360	24	1t	2t
WR-Fe 410	A, BR, B0, C	255	245	235	410	23	2t	3t
WR-Fe 410P	A, BR, B0, C	255	245	235	410	23	2t	3t
WR-Fe 450	A, BR, B0, C	315	305	295	450	22	2t	3t
WR-Fe 450P	A, BR, B0, C	315	305	295	450	22	2t	3t
WR-Fe 480	A, BR, B0, C	345	345	340	480	21	2t	3t
WR-Fe 480P	A, BR, B0, C	345	325	320	480	21	2t	3t
WR-Fe 500	A, BR, B0, C	355	345	325	500	20	2t	3t
WR-Fe 500P	A, BR, B0, C	355	345	325	500	20	2t	3t
WR-Fe 520	A, BR, B0, C	410	400	380	520	18	2t	-
WR-Fe 550	A, BR, B0, C	450	440	420	550	17	2.5t	-
WR-Fe 580	A, BR, B0, C	460	450	430	580	16	2.5t	-
WR-Fe 680	A, BR, B0, C	600	580	560	680	14	3t	-
WR-Fe 760	A, BR, B0, C	700	690	660	760	12	3t	-

NOTES:

1) 1Mpa = 1N/mm^2

2) 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 stress.

3) Other gauge length can also be mutually agreed between supplier and purchaser, however for 200mm gauge length,

elongation values shall be reduced by 2%.
4) Restricted properties may be agreed between purchaser and manufacturer.

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11 BEND TEST

11.1 Number of Bend Test

One bend test shall be taken from each cast. Separate test being made for each class of steel product (namely, plates, strips, sections and flats) rolled from a cast.

11.1.1 Where plates, strips, sections or flats of more than one thickness are rolled from the same cast, one additional test shall be made from the material in each class of product for each variation in thickness of 6 mm.

11.2 *Bend Test Pieces*

The test pieces shall be cut longitudinal or transverse from plates, sheets, strips and longitudinal from sections, flats and bars. When sections permit, these shall be not less than 40 mm wide. Round, square, hexagonal and flat bars shall be bent in the full section as rolled, if the manufacturer so desires.

11.2.1 In all bend test pieces, the rough edges arising as a result of shearing may be removed by filing or grinding or machining, but the test pieces shall receive no other preparation.

11.2.2 The test pieces shall not be annealed or otherwise subjected to heat treatment unless the material from which they are cut is similarly treated, in which case the test pieces shall be similarly treated with the material, before testing.

11.3 Bend Test

Bend test shall be conducted in accordance with IS 1599.

11.3.1 For bend test, the test piece at room temperature shall withstand bend through 180° to an internal diameter not greater than that given in Table 3 without cracking.

12 IMPACT TEST

12.1 If agreed at the time of enquiry and stated in the order impact test shall normally be carried out on products having thickness greater than or equal to 12 mm. The test specimen shall be machined in such a way that the axis of the test specimen is parallel to the direction of rolling and the base closer to the rolled surface is more than or equal to 1 mm from it. The notch axis shall be perpendicular to the roll surface.

12.1.1 The test piece shall be taken at l/4 of the thickness for the product above 40 mm thick.

12.2 This test is carried out using a V-notch test piece [*see* IS 1757 (Part 1)], the value for consideration being the arithmetic mean of the results obtained on three test pieces taken side by side in the same product.

12.2.1 The average value for acceptance as per Table 4 shall be considered only if not more than one specimen exhibits a value below the specified minimum average and in no case shall

an individual value be below two-thirds of the specified minimum average.

Table 4
Longitudinal Charpy V-notch properties
(*Clause* 12.2.1)

Quality	Temperature, °C	Minimum Energy, J
BR	RT	27
B0	0	27
C	-20	27

12.2.2 If more than one specimen is below the specified minimum average, or if one value is below two thirds the specified minimum average, a retest of three additional specimens shall be made, the results shall comply as per specified minimum requirement.

12.2.3 More stringent values at specified temperature and values at different temperature may be mutually agreed between the supplier and purchaser.

12.3 If agreed at the time of enquiry and stated in the order impact tests may be carried out on products having thickness less than 12 mm, the dimensions of test piece shall be as specified in IS 1757 (Part 1).

12.4 The average impact value required for material less than 12 mm and more than 16 mm thick will be as per mutual agreement between the purchaser and the manufacturer.

12.5 A test sample shall be taken from each heat. If different thicknesses have been rolled from slabs of a same heat, test sample shall be taken from the thickest products. If this thickest product test sample meets the requirement, all subsequent lower thicknesses rolled from the same cast/heat shall be deemed to satisfy the specification. If the sample does not meet the requirement, the test shall be carried out on the next thickest coil and so on.

13 FLATTENING TEST

13.1 Flattening test shall be carried out for circular hollow section. If agreed upon between the manufacturer and the purchaser, this test may also be carried out on rectangular hollow sections.

13.2 A ring not less than 40 mm in length shall be cut for every 40 tonnes or part thereof and the inner and outer edges of the ring shall be rounded off.

13.3 The ring shall be flattened cold between the parallel plates with the weld, if any, at 45° in accordance with IS 2328. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original outside diameter. The test shall continue until the weld, if any, opens and the weld shall show no sign of incomplete fusion. No crack or breakage in the metal elsewhere than the weld shall occur until the distance between the plates is 2/3 of the original outside diameter.

14 RETEST

Should any one of the test pieces first selected fail to pass any of the tests specified in 10, 11, 12 and 13, two further samples shall be selected for testing in respect of each failure. Should

the test pieces from both these additional samples pass, the material represented by the test samples shall be deemed to comply with the requirements of that particular test. Should the test pieces from either of these additional samples fail, the material represented by the test samples shall be considered as not having complied with this standard.

15 FREEDOM FROM DEFECTS

15.1 All finished steel shall be well and cleanly rolled to the dimensions, sections and mass specified. The finished material shall be free from cracks, surface flaws, laminations, rough jagged and imperfect edges, and all other harmful defects.

15.2 Minor surface defects may be removed by the manufacturer by grinding provided that the thickness is not reduced locally by more than 4 percent (with a maximum of 3 mm). Reductions greater than 4 percent but not exceeding 7 percent may be made only with the agreement of the purchaser.

15.2.1 Imperfections that are greater in depth than the limits previously listed may be removed and then weld metal deposited subject to the following limiting conditions.

15.2.1.1 The total area of the chipped or ground surface of any piece prior to welding shall not exceed 2 percent of the total surface area of that piece.

15.2.1.2 The reduction of thickness of the material resulting from removal of imperfections prior to welding shall neither exceed 20 percent of the nominal thickness at the location of the imperfection nor shall the depth of depression prior to welding exceed 30 mm in any case.

15.2.1.3 The flange of angles, beams and channel sections, and the web and flanges of tee-sections may be conditioned by grinding, chipping or arc-air gouging and welding. Prior to welding, the depth of depression, measured from the toe inward, shall be limited to the thickness of the material at the base of the depression, with a maximum depth limit of 13 mm.

15.2.1.4 The edges of plates may be conditioned by the manufacturer to remove injurious imperfections by grinding, chipping or arc-air gouging and welding. Prior to welding, the depth of depression measured from the plate edge inward shall be limited to the thickness of the plate, with a maximum depth of 25 mm.

15.2.1.5 The reduction of sectional dimensions of a round, square, or hexagon bar; or the reduction in thickness of a flat bar, resulting from removal of an imperfection prior to welding, shall not exceed 5 percent of the nominal dimension or thickness at the location of the imperfection.

15.2.1.6 For the edges of flat bars, the depth of the conditioning depression prior to welding shall be measured from the edge inward and shall be limited to a maximum depth equal to the thickness of the flat bar or 12.5 mm, whichever is less.

16 DIMENSIONS AND TOLERANCES

16.1 Unless otherwise agreed to between the purchaser and the manufacturer, the nominal dimensions of rolled steel products conforming to this specification shall be in accordance with the relevant Indian Standards. Currently available Indian Standards are listed in Table 5.

Table 5 Indian Standards which give nominal dimensions of rolled steel products
(*Clause* 16.1)

Sl No	PRODUCT	RELEVANT INDIAN STANDARD
i)	Beam, channel and angle sections	IS 808 and Part 1 to Part 3
ii)	Tee bars	IS 1173
iii)	Bulb angles	IS 1252
iv)	Plates, sheet and strip	IS 1730
v)	Flats	IS 1731
vi)	Round and square bars	IS 1732
vii)	Bulb flats	IS 1863
viii)	Sheet, piling sections	IS 2314
ix)	Channel sections	IS 3954
x)	Hollow sections	IS 4923
xi)	Plates for Ship's hull structure	IS 5488
xii)	Parallel beam and column sections	IS 12778

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16.2 Unless otherwise agreed to between the purchaser and the manufacturer, the rolling and cutting tolerances for steel products conforming to this standard shall be those specified in IS 1852 except for parallel flange beams and columns covered by IS 12778 for which the tolerances shall be as per IS 12779. Other tolerances may be followed within the total tolerance range as specified in IS 1852 and IS 12779 as applicable.

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17 CALCULATION OF MASS

Material shall be supplied on the basis of actual weight. If weighing is not possible, the mass of the steel shall be calculated on the basis of steel density 7.85 g/cm^3.

18 DELIVERY

Subject to prior agreement between the manufacturer and the purchaser, a suitable protective treatment may be given to the material after rolling.

19 MARKING AND PACKING

19.1 Each product shall carry a metal tag or adhesive label/sticker bearing the cast number or identification mark or lot number traceable to the cast number and the manufacturer's name or trade mark. Alternatively, top sheet/plate in each bundle shall be legibly marked with the cast number or identification mark or lot number traceable to the cast number, name of the manufacturer or trade mark.

19.2 Unless otherwise agreed the packing shall be adequate to ship the material safely and in good condition.

19.3 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.

ANNEX A
(Informative)
(Foreword)

Mapping of old Grade and new grade designation system is as follows:

S. No.	New Grade	Old Grade
1	WR Fe480P	WR-Fe 480A
2	WR Fe480	WR-Fe 480B
3	WR Fe500P	WR-Fe 500

Doc: MTD 4 (13607)F
IS 4824 : 2020

भारतीय मानक

टायरों के लिए बीड़ तार – विशिष्टि
(तीसरा पुनरीक्षण)

Indian Standard

BEAD WIRE FOR TYRES — SPECIFICATION
(*Third Revision*)

B U R E A U O F I N D I A N S T A N D A R D S
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG,
NEW DELHI 110 002

October **2020** **Price Group**

Wrought Steel Products Sectional Committee, MTD 04

FOREWORD

This Indian Standard (Third Revision) 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.

This standard was first published in 1968 and was subsequently revised in 1973 and 2006. While reviewing this standard, in the light of experience gained during these years, the Committee decided to revise the standard to keep pace with the latest technological developments and international practices. In this revision following major changes have been made:

a) All sizes of bead wires from 0.80 mm to 2.10 mm are now covered in the standard;
b) Bead wires have been split in two categories, NT and HT, based on their tensile strength;
c) Test methods for testing coating weight have been incorporated in the standard;
d) Chemical composition of the bead wire has been updated bringing it in line with international practices; and
e) Requirements of breaking load and bend test have been done away.

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

Assistance has been derived from ISO 16650 : 2004 'Bead wire' during the formulation of this standard.

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

For the purpose of 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 : 1960 'Rules for rounding off numerical values (revised)'. 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

BEAD WIRE FOR TYRES — SPECIFICATION

(*Third Revision*)

1 SCOPE

1.1 This standard covers the requirements for bead wire for use in tyre reinforcement.

1.2 The bead wire mentioned in this specification can be supplied in the form of rounds for the sizes specified in the standard

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 agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
228 (in parts)	Methods for chemical analysis of steels
1387 : 1993	General requirements for the supply of metallurgical materials (*second revision)*
1608 (Part 1) : 2018/ ISO 6892-1 : 2016	Metallic materials — Tensile testing Part 1 Method of test at room temperature *(fourth revision)*
1717 : 2018/ ISO 7800 : 2012	Metallic materials – Wire – Simple torsion test *(fourth revision)*
1956 (Part 3) : 2019	Glossary of terms relating to iron and steel : Part 3 Long products (including bars, rods, sections and wires) (*second revision*)

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 1956 (Part 3) shall apply.

4 SUPPLY OF MATERIAL

General requirements relating to the supply of material shall conform to IS 1387.

5 MANUFACTURE

5.1 Unless agreed otherwise in the order the processes used for making the steel and the product are left to the discretion of the manufacturer. When so desired, the purchaser, shall be informed of the steel making process.

5.2 Bead wire is supplied in two levels of tensile strength, designed as:

NT – Normal standard (or regular) tensile strength
HT – High tensile strength

6 CHEMICAL COMPOSITION

6.1 The ladle analysis of steel, when carried out either by the method specified in relevant parts of IS 228 or any other established instrumental/chemical method shall be as given in Table 1. In case of any dispute, the procedure given in IS 228 and its relevant parts shall be the referee method. However, where the method is not given in IS 228 or its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacture.

Table 1 Chemical Composition
(*Clause* 6.1)

Sl. No	Element	C	Si	Mn	S	P	N
	Tensile strength Grade				*Max*	*Max*	*Max*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	NT	0.60 to 0.76	0.10 to 0.30	0.40 to 0.70	0.035	0.035	0.009
ii)	HT	0.77 to 0.90	0.10 to 0.30	0.40 to 0.60	0.025	0.020	0.009

6.2 Permissible variation in case of product analysis from the limits specified in **6.1** shall be as given in Table 2.

Table 2 Permissible Variation for Product Analysis
(*Clause* 6.2)

Sl. No.	Constituent	Permissible Variation above the Maximum and below the Minimum Limit
(1)	(2)	(3)
i)	Carbon	± 0.04
ii)	Silicon	± 0.03
iii)	Manganese	± 0.04
iv)	Sulphur	± 0.005
v)	Phosphorus	± 0.005
vi)	Nitrogen	± 0.0005

7 MECHANICAL PROPERTIES

7.1 General

The mechanical properties are determined on the material as delivered. If so agreed upon between the purchaser and the supplier, the tests may be performed on thermally stabilized samples. In such case, the samples are heated in an oven at 150ºC for 1 h and allowed, in air, to cool to room temperature before testing.

7.2 Tensile Test

7.2.1 The wire shall satisfy the values of tensile strength and % elongation listed in Table 3 when carried out in accordance with IS 1608 (Part 1).

7.2.2 The specified minimum tensile strength and elongation are specified for each grade in Table 3.

7.2.3 0.2% proof strength

The strength corresponding to the 0.2% proof strength, $R_{p0.2}$, shall be at least 80% of the minimum tensile strength specified in Table 3.

Table 3 Requirements for Tensile Strength and Elongation
(*Clauses* 7.2.2 *and* 7.2.3)

Sl. No.	Diameter	Tensile strength	Tensile strength	Minimum elongation at rupture (gauge length = 200 mm)
		NT	HT	A_t
	Mm	N/mm^2	N/mm^2	%
(1)	(2)	(3)	(4)	(5)
i)	0.80 ≤ d < 0.95	1 900 to 2 300	2 150 to 2 500	5.0
ii)	0.95 ≤ d < 1.25	1 850 to 2 250	2 050 to 2 400	5.0
iii)	1.25 ≤ d < 1.70	1 750 to 2 150	2 050 to 2 400	5.0
iv)	1.70 ≤ d < 2.10	1 500 to 1 800	2 050 to 2 400	5.0

1 N/mm^2 = 1 MPa

NOTES

1 The variation of the tensile strength between the samples of a lot shall not be more than 300 N/mm^2.
2 The purchaser may specify a different minimum tensile strength. This tensile strength shall be not more than 100 N/mm^2 above the minimum specified in Table 3 and not more than 10 % below the same minimum tensile strength.

7.3 Torsion Test

The wire shall withstand the minimum number of turns listed in Table 4 without fracture.

Table 4 Minimum Number of Torsions

(*Clause* 7.3)

Nominal wire diameter *d* mm	**Minimum number of turns** N_t
0.80 ≤ d < 1.00	50
1.00 ≤ d < 1.25	25
1.25 ≤ d < 1.50	22
1.50 ≤ d	20

7.4 Protective Coating

7.4.1 The wire is supplied with one of the following coatings: low-tin bronze or high-tin bronze, brass or copper. The chemical composition of coating material shall be in accordance with Table 5 and shall be determined as per XRF test method given in clause B-1 of Annex B.

7.4.2 *Surface quality*

Surface should be smooth and free from grease and any other contaminants. The wire shall be free from scales, splits, spills and other harmful defects.

Table 5 Chemical Composition of the Coating

(*Clause* 7.4.1)

Coating material	**% Mass Fraction**		
	Cu	**Sn**	**Zn**
(1)	(2)	(3)	(4)
Bronze low-tin (Sn)	97 to 99	1 to 3	-
Bronze high-tin (Sn)	80 to 94	6 to 20	-
Brass	60 to 77	-	23 to 40
Copper	99.99	-	-

7.4.3 *Coating weight*

Weight and tolerance of the coatings shall be as per Table 6. Higher coating weight, if required, shall be as agreed to between the purchaser and the supplier.

Table 6 Coating Weight
(*Clause* 7.4.3)

Type of coating (1)	**Weight of coating** **g/kg** (2)
Copper	0.30 – 1.5
Bronze high-tin (Sn)	0.30 – 1.5
Bronze low-tin (Sn)	0.30 – 1.5
Brass	0.30 – 1.5

7.5 Delivery Conditions

7.5.1 *Unit package*

The wire shall be supplied in units of one single length. The unit package of wire shall be wound on spools or as spool less cores, of dimensions to be agreed upon between the parties concerned.

7.5.2 *Welds*

Welds at final size are permitted in so far as they permit proper processing. For that purpose, the welds shall be smooth, properly cleaned and sufficiently ductile. The weld and heat-affected zone shall have a tensile strength of at least 40 % of the tensile strength specified in Table 3.

7.5.3 *Wire straightness*

The wire shall be reasonably straight and without excessive residual torsions.

7.5.4 *Residual torsions*

The number of residual torsions shall be less than or equal to one revolution on 9 m or equivalent in case of other test lengths.

7.6 Dimensions and Tolerances

7.6.1 *Dimensions*

The round wires from 0.80 to 2.10 mm diameter can be supplied under this specification.

7.6.2 *Size Tolerances*

For round wire, the tolerance is as specified in Table 7.

Table 7 — Tolerance on the Wire Diameter
(*Clause* 7.5.1)

Wire diameter d mm	**Tolerance** mm
d <= 1.00	± 0.03
1.00 < d	± 0.04

7.6.3 *Out-of-roundness*

The out-of-roundness shall not be more than half the tolerance range.

7.6.4 *Requirements for Adhesion*

The finish of the wire shall be such as to give satisfactory adhesion. The bead wire shall be subjected to an adhesion test as given in Annex A. The minimum pull out load and mean pull out load observed during the test shall be as agreed between the purchaser and the manufacturer.

8 TESTING PROCEDURES AND INSPECTION

8.1 Tensile Test

The tensile test shall be carried out in accordance with IS 1608 (Part 1) on samples with the full cross-section of the wire for determination of the tensile strength, the elongation, A_t, at the moment of rupture and 0.2 percent proof stress $R_{p0.2}$.

8.2 Torsion Test

The torsion test shall be performed in accordance with IS 1717. The test length is specified in Table 8.

Table 8 — Test Length for the Torsion Test
(*Clause* 8.2)

Wire diameter *d* mm	**Test Length**
0.80 d < 1.00	200 *d*
1.00 <= *d* <= 2.10	100 *d*

8.3 Protective Coating Test

Copper and bronze coating weight shall be checked by gravimetric method (weight difference before and after stripping the coating from measured length of samples) or by X-Ray Fluorescence (XRF) method or by using colorimetric principles (GEDET instrument). For brass coating, test method for checking coating weight shall be checked by XRF method. Refer Annex B.

8.4 Diameter and out-of-roundness

The diameter shall be measured using a micrometer with a precision of ± 0.001 mm.

8.5 Straightness

The wire sample is put on a smooth surface on which two parallel lines, 3 m long and 600 mm apart, are marked. The wire sample is checked to see if it stays within the two lines.

8.6 Residual torsions

The wire end is bent at a right angle. A test sample of about 9 m is pulled from the unit package without cutting off or releasing the end. The end of the wire shall not rotate in either direction more than one full revolution around its axis.

8.7 Adhesion test

The test conditions for executing the adhesion test shall be agreed upon between the parties. Annex A gives information about one of the most widely used methods.

9 SAMPLING AND CRITERIA FOR CONFORMITY

The method of drawing representative samples of the material and the criteria for conformity shall be as prescribed in Annex C.

10 MARKING

10.1 Each coil of wire shall carry a tag which shall be legibly marked with the following:

a) Manufacturer’s name or trade-mark,
b) Type of coating,
c) Grade of wire, and
c) Size and weight of the wire

10.2 The material may also be marked with the Standard Mark.

10.3 The use of Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 2016* the Rules and Regulations made thereunder. 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 the Bureau of Indian Standards.

ANNEX A
(*Clause* 7.6.4)
METHOD FOR ADHESION TEST BETWEEN WIRE AND RUBBER

A-1 OUTLINE OF THE METHOD

A-1.1 The wires are vulcanized into a block or pad of rubber and the load necessary to pull the wires out of the rubber is measured. The direction of pull-out is axial.

A-2 APPARATUS

A-2.1 Mould

The mould is designed for a 13 mm thick block of rubber, 205 mm long and 50 mm wide across the short dimension of the mould, thus giving a 50 mm wide across the short dimension of the mould, thus giving a 50 mm length of embedment; bevelled lots shall be located for spacing 15 wires 13 mm apart and at the middle of the block thickness. In addition to, the mould itself, top and bottom plates shall be provided. The mould and plates are shown in Fig. 1.

A-2.1.1 *Testing Machine*

A suitable tension testing machine shall be used. The machine shall be of such capacity that the maximum load required to pull out the wires shall not exceed 85 percent nor be less than 15 percent of the rated capacity. The rate of travel of the power actuated grip shall be 50 ± 5 mm/min. Other rates of travel up to 150 ± 15 mm/min may be used by agreement between the purchaser and the manufacturer.

A-2.2 Grips

The top grip shall be of a special holder made for the cured block sample with a slot in the bottom to permit the block to be inserted with the wire protruding. The closed end of the slot shall be centred at the line of pull of the tester (*see* Fig. 2). The bottom grip shall be a wedge type designed to exert increasing tightening as the wire is pulled.

A-2.3 Press

A curing press, large enough to take the mould and capable of at least 90 kN total pressure to the mould. Electrical or steam heat for-the top and bottom plates shall be of sufficient capacity to maintain the mould components at the required temperature for the rubber compound being used.

A-3 MATERIALS

A-3.1 Solvent

The solvent used for the preparation of the rubber and wire in this method shall be such that the surface of the rubber will be freshened without adversely affecting the adhesion. A suitable solvent has been found to be a special lead-free gasoline with distillation range from 4° to 141 °C and minimum recovery of 97 percent.

A-3.2 Rubber

The rubber stock used shall be furnished by the purchaser of the wire together with pertinent information on the temperature and time for the cure of that particular rubber as well as aging time limits for holding the block between curing and testing.

Since the efficiency of the uncured rubber is affected by its storage and age, the purchaser of the wire shall also specify the conditions of storage and any time limit for such storage of the batch. The rubber stock shall be provided, stored and used uncured in sheet form between 7 and 8 mm thick without any remilling before using. It has been found convenient to store the rubber already cut to size for the mould.

A-4 PROCEDURE

A-4.1 Preparation of Materials

It is necessary that all the materials be prepared in advance of the building step so that the mould can be filled quickly at the proper time. Prepare these materials as follows.

A-4.1.1 *Wire Specimens*

Lay out 250 to 300 mm cut lengths of wire specimens on a clean surface, such as cloth or paper. The wires should be touched only at their ends. Unless otherwise specified the wires shall be tested ‘as is’ representing the condition in which the wire lot and samples were received. If washing the surface of the wire before test is specified, gently wipe the wire with a soft cloth dampened with solvent.

A-4.1.2 *Rubber Stock*

Cut the rubber sheet stock to the size of the mould cavity, unless the stock has been pre-cut to that size for storage; two pieces are required for each block. Lay these out and freshen their top surface with the solvent, applied with a soft cloth or brush. Plan the freshening so that a drying time of at least 10 min but not more than 20 min will have elapsed at the building step of the procedure.

A-4.2 Preparation of the Mould

Preheat the mould including top and bottom plates to the cure temperature of the rubber used.

A-4.3 Build-up of the Block

A-4.3.1 Remove the mould from the preheating and take off the top plate.

A-4.3.2 Press down into the mould with a metal or rubber wooden peg, or knife butt the bottom piece of rubber with freshened side up.

A-4.3.3 Lay the wires one by one into the tapered slots making note of their identification for later moulding of the test remelts. Position the wires so that about 25 mm sticks out from one side of the mould and about 150 mm from the other. Do not touch the wires within the 50 mm length that will be in contact with the rubber.

NOTE — Slots 1 and 15 should be filled with dummy length of wire which will be subsequently pulled but their test values should not be recorded nor included in the calculations.

A-4.3.4 Press down firmly with knife butt or roller the top piece of rubber with freshened side down.

A-4.3.5 Replace the top plate, put the mould in the press and apply a pressure of at least 90 kN to the mould. Excessive pressures are not necessary and may damage the mould.

A-4.3.6 It is important that the entire sequence of steps takes not over 3 min, from the removal of the mould from the heat and replacing it in the press. This time limit also applies during the building of blocks subsequent to the first one where the mould is already hot and when a cured block must be removed from the mould before it can be filled.

A-4.4 Cure

Cure the block under pressure for the time and temperature conditions of the rubber being used.

A-4.5 Preparation of the cured block

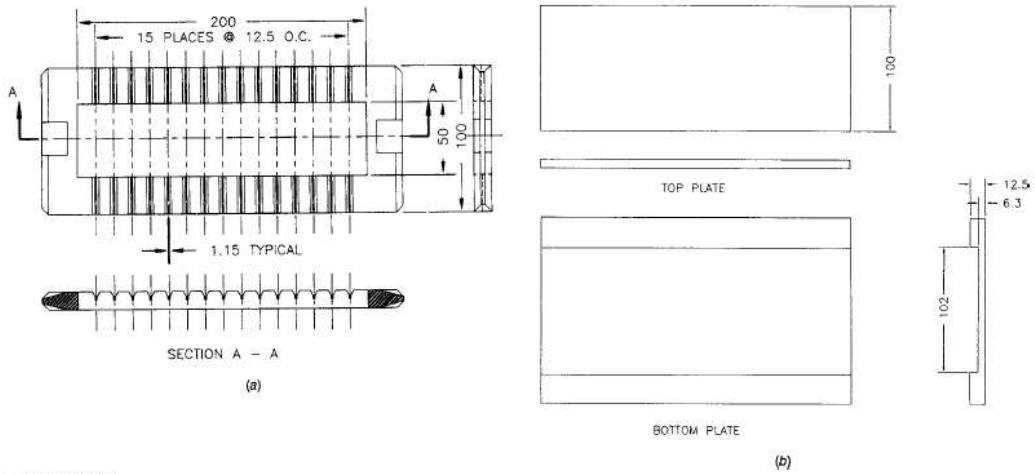
Remove the mould from the press and push out the cured block. If there are other blocks to prepare proceed with the building operations as outlined in **A-4.3**. Age the cured block at room temperature (27 + 2°C) for the required time limits specified by the rubber stock supplier. Cut off the 25 mm length of protruding wire close to the edge of the block. Pull off any extraneous flesh from both edges of the block.

A-4.6 Testing

Push the block into the top grip of the testing machine until the first wire meets the stop. This will centre that wire at the line of pull of the tester. Clamp the first wire in the wedge clamp, make sure reading attachment of tester is at zero, and start the machine (see Fig. 3). When the wire pulls out, note the pull-out load to the nearest 5 N and release the wedges. Pull the tested wire out of the block by hand and slide the block in the holder until the next wire hits the stop. Clamp it in the wedges and note its pull out load. Repeat the procedure with the other wires of the block. There is no need to stop the lower jaw after each wire pull. Continue sliding each subsequent wire into the wedges until they lower too far to grasp the wire length. Then return the lower grips to its highest position and start it down again.

A-5 TEST REPORT

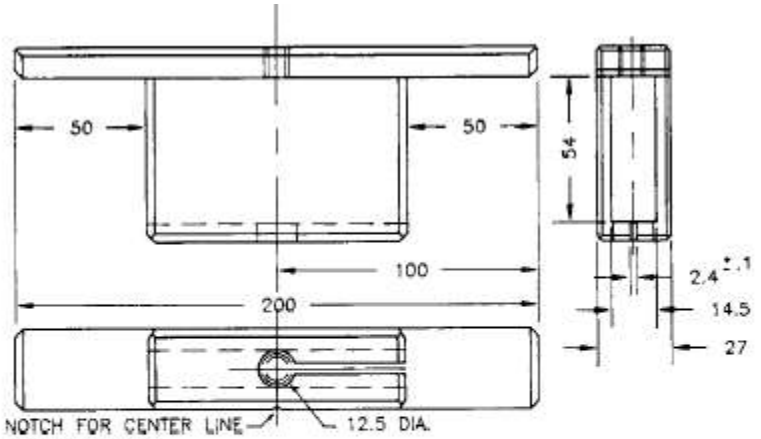
Report individual test results and their mean plus any other calculated data as agreed to between the purchaser and the manufacturer.



TOLERANCES
All dimensions ±0.2
Angular ±½ °
Except where noted

NOTE 1—Material—Steel.
NOTE 2—Break all sharp corners.
NOTE 3—All dimensions in millimetres except where noted.

FIG. 1 Mold with Top and Bottom Plates



TOLERANCES
All dimensions ±0.2
Except where noted

NOTE 1—Material—Steel.
NOTE 2—Break all sharp corners.
NOTE 3—All dimensions in millimetres except where noted.

FIG. 2 Top Grip

ANNEX B
TEST METHODS TO DETERMINE COATING WEIGHT FOR COPPER AND BRONZE COATING
(*Clause* 8.3)

B-1 METHOD FOR DETERMINATION OF COPPER, BRASS AND BRONZE COATING WEIGHT ON BEAD WIRE FOR TYRES BY X-RAY FLUORESCENCE SPECTROSCOPY METHOD

B-1.1 Principle

In XRF, X-rays produced by a source irradiate the sample. The elements present in the sample will emit fluorescent X-ray radiation with discrete energies that are characteristic for these elements. XRF spectrometers are generally divided into two main groups: Energy dispersive systems (EDXRF) and wavelength dispersive systems (WDXRF). ED-XRF spectrometers have a detector that is able to measure the different energies of the characteristic radiation coming directly from the sample. WDXRF spectrometers use an analyzing crystal to disperse the different wavelengths. The crystal diffracts the different wavelengths in different directions which can be measured by the detector.

B-1.2 Apparatus

List of apparatus required to carry out this test is as follows:

i) WDXRFS or EDXRFS
ii) Weighing balance, which can be read to nearest 0.001g
iii) Dispenser, with the accuracy of 25.00 ml ± 0.05 ml
iv) X/Y shaker, with variable frequency

B-1.3 Reagents

During the analysis, unless otherwise stated, use only reagents of recognized analytical grade and distilled or demineralized water. Following reagents are required depending on type of coating material used:

i) **For brass:** Acetone or diethyl ether, Ammonium persulphate (>98%), Ammonia (>25%, density not more than 0.91g/cc' at temperature 20°C) and distilled water (corresponding Indian standard)

ii) **For copper and bronze:** Acetone or diethyl ether, Ammonium persulphate (>98, %) Ammonia (>25%, not more than 'd=0.91' at temperature 20°C), Zinc Sulphate ($ZnSO_4$) and distilled water (as per Indian standard)

B-1.3.1 Stripping solution

For Brass: Weigh 16g ammonia persulphate into a beaker of 600ml and dissolve in 400ml demineralize water. Transfer quantitatively into a 1L volumetric flask. Add 120ml ammonia. Fill up to the mark with demineralized water. Shake well.

For Copper or Bronze: Weigh 20g ammonia persulphate into a beaker of 600ml and dissolve in 400ml demineralize water. Transfer quantitatively into a 1L volumetric flask. Add 100ml ammonia and 8.80g of zinc sulphate. Fill up to the mark with demineralized water. Shake well.

B-1.3.2 Standard solution: The matrix range should cover sample range. Prepare the calibration standard solution according to Table 1 for brass and as per Table 2 for copper/bronze.

Table 1 — Calibration standard for brass

Standard	w_{Cu}(mg/l)	w_{Zn}(mg/l)
ST1	48	24
ST2	80	40
ST3	112	56
ST4	144	72
ST5	176	88
ST6	208	104
ST7	240	120

Table 2 — Calibration standard copper and bronze

Standard	w_{Cu}(mg/l)	w_{Sn}(mg/l)
ST1	35	2
ST2	60	4
ST3	80	6
ST4	100	8
ST5	125	10
ST6	150	12
ST7	175	15

B-1.4 Preparation of test samples

Take about 6 grams of a sample wire to the nearest 0,001g with wrap. Wash the samples with acetone to remove contamination. Wait till acetone evaporates completely Weigh the samples with accuracy to 1 mg by an electronic balance and place inside a 50 cc or 100 cc beaker.

NOTE - Samples should be free of dirt or grease. If a renewed sample taking is impossible, wire samples should be degreased with cotton wool with ether. Wire samples should be degreased with proper solvent. If necessary, dried in a drying furnace at 105 °C and cooled down in a desiccator.

B-1.5 Procedure

a) Calibrate the XRF with the standard solution mentioned at B-1.3.2 as per the user manual of the equipment.

b) The weighted sample is transferred in a dry and clean test tube (or beaker of 100ml) with cap. With a dispenser, add accurately 25.00 ml stripping solution. Make sure the sample is complete immersed. Close the tube or beaker to avoid evaporation. Put the beaker or tube in the X/Y shaker to accelerate the speed of dissolution. When the coating is complete dissolved, homogenize the solution. Decant the solution to a dry and clean sample cup and measure in XRFS with the setting application.

NOTE - Complete coating dissolution is a must.

B-1.6 Expression of results

The coating mass, coating composition and thickness are calculated from below formula (8), (9) and (10)

For brass:
$C_{Cu}(\%) = W_{Cu}/(W_{Cu} + W_{Zn}) * 100$
$C_{Zn}(\%) = W_{Zn}/(W_{Cu} + W_{Zn}) * 100$

$W = (W_{CU} + W_{Zn}) * 25/1000*m$
where,
C_{Cu} is coating composition of copper, expressed in %
C_{Sn} is coating composition of zinc, expressed in %
W_{Cu} is direct reading of Cu composition in solution, in milligram per litre (mg/L)
W_{Zn} is direct reading of Zn composition in solution, in milligram per litre (mg/L)
W is coating mass, in grams per kilogram (g/kg)
m is sample mass before stripping, in grams (g)

For bronze:
$C_{Cu}(\%) = W_{Cu}/(W_{Cu} + W_{Sn}) * 100$
$C_{Sn}(\%) = W_{Sn}/(W_{Cu} + W_{Sn}) * 100$

$W = (W_{CU} + W_{Sn}) * 25/1000m$
where,
C_{Cu} is coating composition of copper, expressed in %
C_{Sn} is coating composition of zinc, expressed in %
W_{Cu} is direct reading of Cu composition in solution, in milligram per litre (mg/L)
W_{Sn} is direct reading of Sn composition in solution, in milligram per litre (mg/L)
W is coating mass, in grams per kilogram (g/kg)
m is sample mass before stripping, in grams (g)

B-1.7 Test report

Report the coating mass in g/kg brass to resolution 0.01 g/kg Report the coating composition in %Cu to resolution 0.01%

B-2 METHOD FOR DETERMINATION OF COPPER OR BRONZE COATING ON TYRE BEAD WIRE BY GRAVIMETRIC ANALYSIS

B-2.1Summary of Method

Coating mass of the samples is calculated by stripping the copper or bronze coating and measuring the weight difference.

B-2.2 Apparatus and Chemicals

List of apparatus required to carry out the test is as follows:

1. Beakers
2. Ammonium Hydroxide 25-30 % lab grade
3. Hydrogen Peroxide 6 % lab grade
4. Wire Cutter
5. Carbon tetrachloride (CTC)

B-2.3 Preparation of Test Specimen

B-2.3.1 Take about 40 grams of a samples wire and cut it into about 3 to 4 cm length. Wash the cut samples with carbon tetrachloride (CTC) to remove contamination and dry it in air.

B-2.3.2 Weigh the sample with accuracy to 1 mg by an electronic balance and put it into 100 cm^3 beaker. Record the weight as W1.

B-2.3.3 Add ammonia solution in the beaker until the samples are completely dipped, add Hydrogen peroxide solution in the beaker drop by drop to dissolve the bronze plating completely, repeat the same operation 2-3 times to thoroughly dissolve the bronze plating.

B-2.3.4 Remove the wire samples from the beaker and dry it in the hot air oven until the samples are fully dried. Cool the wire sample to room temperature and measure the weight of the samples and record the weight as W2.

Then calculate the coating mass by as:

Coating Mass (g/kg) = (W1 – W2)/W2 x 1000

B-2.4 Reporting

Report coating mass (copper or bronze) in g/kg by rounding off to two decimal point.

B-3 METHOD FOR DETERMINATION OF COPPER OR BRONZE COATING ON BEAD WIRE FOR TYRES USING GEDET METHOD

B-3.1 Summary of the Method

Coating mass of the samples are calculated by stripping off the copper or bronze coating on GEDET Machine by coulometric principle.

B-3.2 Apparatus and Chemicals

List of apparatus required to carry out the test is as follows:

i) 40% sodium nitrate solution

ii) Measuring Scale
iii) Table Lamp
iv) GEDET Machine
i) Carbon tetrachloride (CTC)

B-3.3 Test Procedure

B-3.3.1 Take 50 ml of 40 % sodium nitrate solution in the cup provided in GEDET equipment. Measure the diameter of sample accurately. Remove the coumarone on wire by wiping with a cloth dampened with CTC.

B-3.3.2 Mark 1 inch length (1.0 mm and above diameter)/2 inch (below 1 mm diameter) on the sample with the help of scale.

B-3.3.3 Start the lamp to ensure the dip length is exactly matching with marked length.

B-3.3.4 Dip the wire up to the marking. Push start button to start the counter. After all coating is removed automatically counter will stop with a beep. Record the reading on indicator as N.

B-3.3.5 Calculate the coating mass using as:

Coating mass (g/kg) = N x F/D2

where,

F = is multiplying factor, which varies with the gasket area. It is provided by the equipment manufacturer; and

D = is diameter of the wire in mm

B-3.4 Reporting

Report coating mass (Copper or bronze) in g/kg by rounding off to two decimal point.

ANNEX C
(*Normative*)
(*Clause* 9)
SAMPLING AND CRITERIA FOR CONFIRMITY

C-1 LOT

In any consignment, all the coils of wires of the same diameter manufactured under essentially similar conditions of manufacture shall be grouped together to constitute a lot.

C-2 SAMPLING FOR SIZES AND SURFACE CONDITIONS

C-2.1 The number of coils to be examined from each lot size and surface condition and the corresponding criteria for conformity shall be as agreed to between the supplier and the purchaser.

C-3 SAMPLING FOR OTHER CHARACTERISTICS

C-3.1 From each lot, the number of coils as specified in Table 6 (depending upon the number of coils in the lot) shall be selected at random.

C-3.2 A test piece, cut from each end of each coil so selected, shall be subjected to the chemical analysis (*see* **6**).

C-3.2.1 The lot shall be considered as conforming to the requirements of the chemical composition laid down in this specification if the average of the test results complies with the limits specified in **6**.

C-3.3 From each of the coils selected as in **C-3.1** one test piece for each of the applicable tests given under 7, namely, tensile test (*see* **7.2**) and torsion test (*see* **7.3**) shall be cut from each end and subjected to these tests. All the selected coils shall also be subjected to dead wire test after cutting the necessary specimens for the other test mentioned above.

Table 12 Scale of Sampling
(*Clause* C- 3.1)

Number of coils in a lot	Number of coils to be selected
Upto 25	2
26-50	3
51-150	5
151-300	8
301 and above	13

C-3.3.1 The lot shall be considered as conforming to the requirements of various tests enumerated in **C-3.3**, if each result complies with the relevant requirements specified in the respective clauses. **C-3.3.2** in case there is only one failure in any tests, then an equal number of fresh specimens shall be cut from a second set of randomly chosen coils and subjected to the tests in which the failure has occurred. On finding this new set of specimens satisfactory, the lot shall be declared as conforming to the requirements of that test, otherwise not.

C-3.3.2 In case there is only one failure in any tests, then an equal number of fresh specimens shall be cut from a second set of randomly chosen coils and subjected to the tests in which the failure has occurred. On finding this new set of specimens satisfactory, the lot shall be declared as conforming to the requirements of that test, otherwise not.

Appendix-11

Indian Standard
SPECIFICATION FOR HEAT TREATABLE STEEL STRIPS AND SHEETS
(*Second Revision*)

1 SCOPE

This standard covers the requirement for cold-rolled carbon steel strips with a mass fraction ~~or~~ of carbon over 0.35% ~~made from the steels specified in table 1~~ for the manufacture of steel springs and also for highly stressed parts of many different types like auto components, wood & metal cutting band saws, leather band knife, masonry tools for various purposes, etc.

2 REFERENCES

The following standards contain provisions which through 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:

IS No.	*Title*
228 (Relevant Parts)	Method for chemical analysis for steel
1387 : 1993	General requirements for the supply of metallurgical materials (*second revision*)
1501 (Parts 1) : 2020	Metallic materials – Vickers hardness test Part 1 Test method (*fifth revision*)
1586 (Part 1) : 2018	Metallic materials – Rockwell hardness test Part 1 Test method (*first revision*)
1608 (Part 1) : 2018	Metallic materials – Tensile testing Part 1 Method of test at room temperature (*fourth revision*)
1956 (Part 4) : 2013	Glossary of terms relating to iron and steel Part 4 Flat products (*second revision*)
3711 : 2012	Steel and steel products – Location and preparation of samples and test pieces for mechanical testing (*second revision*)

3 TERMINOLOGY

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

3.1 Mill edge – Normal side edge without any definite contour produced in hot rolling. Mill edges may contain some irregularities, such as cracked or torn edges or thin edges.

3.2 Sheared edge – Normal edge obtained by shearing, slitting or trimming a mill edge product.

3.3 Full hard quality – Material rolled to the final thickness with a minimum hardness.

3.4 Annealed quality – Annealed to a hardness or tensile strength properties.

3.5 Quenched and tempered quality – Quenched and tempered steel strip for steel designation of 45C8 and above.

3.6 Intermediate quality – Temper rolled to a hardness range after a

nnealing.

Commented [B1]: Need to relook definitions and redraft them for more clarity. Also, reference of any national/international standard, if available, may also be provided.

4 SUPPLY OF MATERIAL

General requirements relating to the supply of steel strips shall confirm to IS 1387.

5 MANUFACTURE

5.1 Steel shall be manufactured by the open hearth, electric duplex, basic oxygen or a combination of these processes. In case any other process is employed by the manufacturer, prior approval of the purchaser shall be obtained.

5.2 Steel shall be of killed type. Cold reduced carbon steel strips are furnished in semi hard, full hard, annealed, quenched and tempered condition.

Commented [B2]: can be replaced by 'shall be'?

6 CHEMICAL COMPOSITION

6.1 The ladle analysis of steel, when carried out either by the methods specified in relevant parts of IS 228 or any other established international instrumental/chemical method, shall be as given in Table 1. In case of any dispute, the procedure given in relevant parts of IS 228 shall be the referee method

6.2 Product Analysis

A product analysis may be made by the purchaser, in order to verify the specified analysis of the semi-finished or finished steel and shall take into consideration any normal heterogeneity. For killed steels, the sampling method and deviation limits shall be agreed upon between the interested parties at the time of ordering. The permissible variation in the case of product analysis from the limits specified in Table 1 shall be as follows:

Commented [B3]: Not present in similar clause of other standards. Kindly provide reason/justification for the same.

Constituent	*Permissible Variation Over Specified Limits* Percent
Carbon	±0.03
Manganese	±0.04
Silicon	±0.03
Sulphur	±0.005
Phosphorous	±0.005
Chromium	±0.03
Vanadium	±0.02

NOTE – Variations shall not be applicable both over and under the specified limits in several determinations in a heat.

7 FREEDOM FROM DEFECTS

7.1 Strips shall be free from harmful defects, such as scale, rust, blisters, laminations, cracked edges, etc.

NOTE – Where coil is supplied, the degree or amount of surface defect may be expected to be more than in cut lengths because of the impossibility of rejecting portions of coil. This shall be taken into account by the purchaser in his assessment of the material. An excessive amount of defects may be cause for rejection.

7.1.1 In case strips are supplied with mill edges, complete plus partial decarburization, as indicated by the proportion of ferrite, shall not extend to a depth below the surface greater than 3 percent of the nominal thickness of the material at a distance not less than 20 mm from

Commented [B4]: Test method?

the edge.

7.1.2 In case of strips supplied with slit edges, decaburization shall not exceed 2 percent at any point of the strip.

7.2 Strips shall be usually supplied with mill edges. When supplied with sheared edges, the edges shall be free from burrs.

7.2.1 Any edge condition other than that mentioned in **7.2** shall be subject to mutual agreement between the purchaser and the supplier.

TABLE 1 CHEMICAL COMPOSITION

(*Clauses* 0.2, 4.1, 6.1 *and* 6.2)

Please refer excel file IS 2507_5_15_ref_ISO

Grade	Designation	Constituent						
	[see IS 1762 (Part 1)]	Carbon percent	Silicon percent	Manganese percent	Sulphur percent, *Max*	Phosphorus percent, *Max*	Chromium percent	Vanadium percent
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	45C 8	0.40 to 0.50	0.10 to 0.35	0.60 to 0.90	0.035	0.035	–	–
2	55C 6	0.50 to 0.60	0.10 to 0.35	0.50 to 0.65	0.035	0.035	–	–
3	65C 6	0.60 to 0.70	0.10 to 0.35	0.50 to 0.80	0.035	0.035	–	–
4	70C 6	0.65 to 0.75	0.10 to 0.35	0.50 to 0.80	0.035	0.035	–	–
5	75C 6	0.70 to 0.80	0.10 to 0.35	0.50 to 0.80	0.035	0.035	–	–
6	80C 6	0.75 to 0.85	0.10 to 0.35	0.50 to 0.80	0.035	0.035	–	–
7	85C 6	0.80 to 0.90	0.10 to 0.35	0.50 to 0.80	0.035	0.035	–	–
8	98C 6	0.90 to 1.05	0.10 to 0.35	0.30 to 0.60	0.035	0.035	–	–
9	55Si7	0.50 to 0.60	1.50 to 2.00	0.80 to 1.00	0.035	0.035	–	–
10	50Cr4	0.45 to 0.55	0.10 to 0.35	0.60 to 0.90	0.035	0.035	0.90 to 1.20	–
11	50Cr4V2	0.45 to 0.55	0.10 to 0.35	0.50 to 0.80	0.035	0.035	0.90 to 1.20	0.15 to 0.30
12	75Cr1							
13	75Ni8							
14	51CrV4							

8. ROLLING TOLERANCES

8.1 Product is produced from a hot rolled pickled coil which has been given substantial cold reduction. The product is characterized by an improved surface, greater uniformity in thickness and improved mechanical properties compared to hot rolled strip. Cold rolled strip is also characterized by tighter thickness tolerances.

8.1.1 Skin pass

Commented [B5]: Test method for determination of decarburisation not provided

Commented [B6]: Changed from 3 to 2 percent. Reason/justification for the same. Also, Reference from any national/international standard?

Commented [B7]: ?? Document not available

Commented [B8]: ?? Editorial mistake? Should it be 50-80 as in present standard. If not, justification thereof.

Commented [B9]: Values?

Commented [B10]: Delete as per Amd 1 to IS 2507

The purpose of skin pass is to minimize the appearance of coil breaks, stretcher strains, fluting to obtain the required surface finish and to control the shape as well.

8.1.2 Edges

Material is normally as described in **3.1** and **3.2**. Other edges may be supplied as agreed between the manufacturer and purchaser.

Commented [B11]: Informative….why required in standard?

~~**8.1.3** Specified qualities appropriate to the particular grade;~~

8.2 Tolerance on thickness of the steel strip shall be as specified in Table 2. The thickness of the steel strip shall be measured at a position not less than 10 percent of the ordered width from the edge for the width up to and including 75 mm. For higher widths the position of measurement of thickness shall be less than 10 mm from the edge.

8.2.1 The variation in thickness of material across the width shall not exceed half the total tolerance given in Table 2.

Commented [B12]: Note as per Amd 1 also to be included?

8.2.2 Tolerances other than those specified in Tables 2 and 3 are subject to mutual agreement between the purchaser and the supplier.

8.3 Materials when supplied shall be reasonably flat. Dish (concavity across width) in hardened and tempered strips shall not exceed 0.025 mm per 25-mm width or part thereof for thickness up to and including 1.5 mm and 0.035 mm per 25-mm width or part thereof for thickness over 1.5 mm (*see* Fig. 1)

8.3.1 When a 5 m length of strip is allowed to lie on a flat surface by its own weight, no part of the strip shall lift more than 3 mm from the flat surface. For this purpose, rise should be measured from the surface nearer to the flat surface.

Commented [B13]: Reference/justification for change?

TABLE 2 TOLERANCE ON THICKNESSES OF STEEL STRIPS

(*Clauses* 8.2, 8.2.1 *and* 8.2.2)

All dimensions in millimetres

THICKNESS*	TOLERANCE FOR WIDTHS				
	Upto and Including 100	Above 100 Up to and Including 125	Above 125 Up to and Including 250	Above 250 Up to and Including 400	Above 400 Up to and Including 650
(1)	(2)	(3)	(4)	(5)	(6)
0.10	±0.01	±0.01	--	--	--
0.15	±0.01	±0.01	±0.02	±0.02	±0.02
0.20	±0.02	±0.02	±0.02	±0.02	±0.03
0.25	±0.02	±0.02	±0.02	±0.03	±0.03
0.30	±0.02	±0.02	±0.03	±0.03	±0.03
0.40	±0.02	±0.03	±0.03	±0.03	±0.04
0.50	±0.03	±0.03	±0.03	±0.04	±0.04
0.60	±0.03	±0.03	±0.04	±0.04	±0.05
0.80	±0.03	±0.04	±0.05	±0.05	±0.05
1.00	±0.04	±0.04	±0.05	±0.06	±0.06

1.25	±0.04	±0.05	±0.06	±0.06	±0.07
1.50	±0.05	±0.05	±0.06	±0.07	±0.08
1.80	±0.05	±0.06	±0.07	±0.08	±0.08
2.00	±0.06	±0.06	±0.07	±0.08	±0.09
2.50	±0.06	±0.07	±0.08	±0.09	±0.10
3.00	±0.07	±0.08	±0.09	±0.10	±0.11
3.55	±0.08	±0.09	±0.10	±0.11	±0.12
4.00	±0.08	±0.09	±0.11	±0.12	±0.13
5.00	±0.09	±0.10	±0.13	±0.14	±0.15

*When Intermediate thicknesses are specified, the tolerance of the next larger thickness step is applicable.

8.4 The tolerances on width when supplied in sheared or mill edges shall be as given in Table 3. When the strip is supplied in the round or dressed edge condition, the tolerance on minus side shall also be permissible, which shall be up to 0.5 mm, *Max*.

TABLE 3 TOLERANCES ON WIDTH WHEN SUPPLIED IN MILL EDGE AND SHEARED EDGE

(*Clauses* 7.2.2 *and* 7.4)

All dimensions in millimetres

NOMINAL THICKNESS	TOLERANCE ON NOMINAL WIDTH						
	Up to and Including 100	Above 100 Up to and Including 250	Above 125 Up to and Including 320	Above 250 Up to and Including 400	Above 320 Up to and Including 500	Above 400 Up to and Including 600	Above 500 Up to and Including
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			For Mill Edge				
0.10 to 5.0	±1.5	±1.60	±2.20	±2.50	±3.30	±4.40	±6.00
			For Sheared Edge				
0.10 to 0.60	±0.15	±0.20	±0.25	±0.30	±0.40	±0.50	±0.60
0.61 to 1.00	±0.20	±0.25	±0.30	±0.35	±0.45	±0.55	±0.65
1.01 to 2.00	±0.25	±0.30	±0.40	±0.50	±0.60	±0.70	±0.80
2.01 to 3.00	±0.30	±0.40	±0.50	±0.60	±0.70	±0.85	±1.00
Above 3	S u b j e c t to a g r e e m e n t						

FIG. 1 FLATNESS OF STRIP – From IS 2507

8.5 Edge camber (lateral departure of the edge of the material from straight line forming a chord) shall not exceed the tolerances given in Table 4 (*see* Fig. 2)

TABLE 4 TOLERANCES ON EDGE CAMBER FOR COLD- ROLLED UNHARDENED, HARDENED AND TEMPERED STEEL STRIPS

All Dimensions in millimetres.

SPECIFIED WIDTH		SPECIFIED THICKNESS		MAXIMUM TOLERANCE ON EDGE CAMBER IN ANY 2000-mm LENGTH	
Over	Up to and Including	Over	Up to and Including	Cold Rolled Unhardened	Hardened and Tempered
(1)	(2)	(3)	(4)	(5)	(6)
-	50	-	2	10	2
-	50	2	-	13	3
50	250	-	2	6.5	2
50	250	2	-	13	3
250	600	-	2	6.5	2
250	600	2	-	13	3

FIG 2 EDGE CAMBER OF STRIP – From IS 2507

NOTE

1. Where it is not practicable to measure over 2000mm, equivalent tolerances may be calculated from the following formula, the result being rounded to the next highest millimeter

$$\text{Edge camber tolerance} = \frac{(\text{non standard length})^2}{(\text{standard length})^2} \times \text{edge camber tolerances as per above table}$$

2. The tolerances in table 4 are only applicable to narrow strip of width at least 10 times the thickness.
3. For strip in the hardened and tempered condition, edge camber tolerances may be reduced if agreed at the time of ordering.

Commented [B14]: Reference for new notes?

9 CALCULATION

The weight of steel strips shall be calculated on the basis that steel weight 7.85g/cm^3.

10 TREATMENT

The material may be supplied in the cold-rolled, annealed or hardened and tempered condition or in any other condition subject to mutual agreement between the purchaser and the supplier. Recommended heat treatment for the material is given in Appendix B.

11 PHYSICAL PROPERTIES

11.1 Physical properties of cold-rolled steel strips for springs are given in Appendix C for information.

11.2 When specified in the order, the frequency of tests for physical properties shall be subject to mutual agreement between the purchaser and the supplier.

12 DELIVERY

The material shall be delivered either in coils or in straight lengths (cut to specified length) as agreed between the purchaser and the supplier.

13. SURFACE CONDITION

13.1 The cold reduced carbon steel strip is produced in a regular bright finish by rolling on rolls having a moderately smooth finish or in a dull finish by rolling on rolls roughened by mechanical or chemical means. Quenched and tempered strips/sheet may be supplied with the surface finish of unpolished bright/grey/blue/grey blue, bright, polished bright, polish blue/bronze/grey.

13.2 As a deterrent to rusting, a coating of oil is usually applied to the product. The oil is not intended as a forming lubricant and should be easily removable using degreasing chemicals. The product may be ordered unoiled, if required, in which case the supplier has limited responsibility if oxidation occurs. Strips shall be adequately coated with rust-preventive oil as agreed to between the purchaser and the supplier.

Commented [B15]: Informative. Not required. If required justification thereof

14. PACKING

14.1 Strips shall be supplied in coils or bundles of cut lengths or in packages each weighing not more than three tonnes as may be agreed to between the purchaser and the supplier.

14.2 Strips shall be packed in VCI paper then stretch film and finally bituminized alkathene lined hessian and securely tied around with hoop iron. A number of coils may be bundled with wooden or steel pallets in between or may be packed in wooden boxes. Strips may also be packed with separate thin metallic sheets wrapped around and with bands of hoop iron.

Commented [B16]: Full form?

Commented [B17]: Changes suggested ok?

15. MARKING

15.1 Each bundle or package of steel strips shall be legibly marked with the name or trade-mark of the manufacturer, size, grade and the cast number or identification mark, by which the steel can be traced to the cast or casts which it represents. Steel designation should also be marked on each bundle or package.

15.2 BIS Certification Making

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 product(s) may be marked with the Standard Mark.

16. SAMPLING

16.1 Sampling for Chemical Analysis --- The ladle sample analysis shall be supplied by the manufacturer. If the product analysis is required by the purchaser, at least one sample product shall be taken from each cast.

16.1.1 For product analysis the selection of sample shall be carried out in accordance with 'Indian Standard methods of selection and preparation of sample for product analysis' (under preparation) (see Note).

Commented [B18]: Which standard is this?

NOTE- Till such time the standard under preparation is published, sampling plan shall be as agreed to between the parties concerned.

16.2 Sampling for Mechanical Tests - If required for the purpose of mechanical tests, one sample for every 20 tonnes or part thereof with a minimum of one per cast shall be selected.

16.2.1 Test pieces for mechanical properties shall be taken in the direction of the fibre, the rolling direction.

16.3 Selection and preparation of sample and test pieces shall be in accordance with IS 3711.

17. RETEST

Should any one of the test pieces first selected fail to pass any of the tests specified in this standard, two further samples shall be selected from the same lot for testing in respect of each failure. Should the test pieces from both these additional samples pass, the material represented by the test samples shall be deemed to comply with the requirements of that particular test. Should the test pieces from either of these additional samples fail, the material represented by the test samples shall be deemed as not conforming to this standard.

A P P E N D I X A
(Clause 0.5)

INFORMATION TO BE GIVEN BY THE PURCHASER

A-1 BASIS FOR ORDER

A-1.1 While placing an order for the purchase of steel strips for springs covered by this standard,the purchaser should specify the following:

a) Description regarding grade, designation, size, etc,
b) Condition of delivery
c) Method of manufacture,
d) Any special requirement, and
e) Test report, if required.

APPENDIX B
(*Clause* 9.1)

MECHANICAL WORKING AND HEAT TREATMENT

B-1. SHAPING

B-1.1 Shaping is performed cold by cutting, shearing, stamping, die pressing, bending and coiling. In case of difficulties being encountered in shaping, intermediate annealing is required. If hardened parts have to be annealed, the annealing temperatures stated in Table 5 shall be used, paying particular attention to the statements made in **B-2.1.**

TABLE 5 RECOMMENDED TEMPERATURE FOR THE HEAT TREATMENT OF COLD-ROLLED STEEL STRIPS
(Clauses B-1.1, B-2.1 and B-3.1)

Grade Designation		SOFT ANNEALING °C	HARDENING (IN OIL/Molten Lead bath) ^{0}C	TEMPERING °C
(1)	(2)	(3)	(4)	(5)
1	45C8	640 to 690	840 to 940	250 to 600
2	55C6	640 to 690	840 to 940	250 to 600
3	65C6	640 to 690	840 to 940	250 to 600
4	70C6	640 to 690	840 to 940	250 to 600
5	75C6	640 to 690	840 to 940	250 to 600
6	80C6	640 to 690	840 to 940	250 to 600
7	85C6	640 to 690	840 to 940	250 to 600
8	98C6	640 to 690	840 to 940	250 to 600
9	55Si7	640 to 690	840 to 940	250 to 600
10	50Cr4	640 to 690	840 to 940	250 to 600
11	50Cr4V2	640 to 690	840 to 940	250 to 600
12	75Cr1	640 to 690	840 to 940	250 to 600
13	75Ni8	640 to 690	840 to 940	250 to 600
14	51CrV4	640 to 690	840 to 940	250 to 600

Commented [B19]: All values changed. Reference for new values?

B-2 ANNEALING

B-2.1 The material shall be progressively and uniformly heated to the temperature stated in Table 5 and soaked for a period depending upon the cross selection and shall then be cooled down as slowly as possible (being left in the annealing furnace).

B-3. HARDENING AND TEMPERING

B-3.1 The material shall be progressively and uniformly heated to the hardening temperatures as indicated in Table 5 and soaked for a period depending on its cross section. The lower limits of the temperature ranges are applied to relatively small dimensions, the upper limits to the large dimensions. The tempering temperatures indicated in Table 5 (approximate value) have to be selected in accordance with the strength properties required. To maintain narrow ranges of strength properties by suitable hardening and tempering treatments, it is necessary to pay attention to the fact that the different casts as delivered may exhibits uniform hardening properties but may require certain gradation of the tempering temperature. To avoid difficulties

in maintaining the strength values required, it is therefore advisable to carry out the fabrication keeping the different casts separate. Tempering should be carried out directly after the hardening treatment to avoid cracking on hardening.

Carbon Steel Strips produced by continuous heat treatment acquire a unique combination of flexibility and toughness, which is best obtained by the time tested "Metal Quenching Technology" for producing Hardened & Tempered Steel. The Hardened & Tempered Steel thus produced acquires an excellent proportion of "Hardness and Ductility" with superior Flatness and Straightness ; therefore performs well with equal proficiency for diverse applications in different industries including Wood working, Automobile, Stone Cutting, Masonry Tools, Springs, Textile and Leather processing Industries.

Commented [B20]: Only Informative….required?

APPENDIX C
Clause 10.1
PHYSICAL PROPERTIES
C-1 PHYSICAL PROPERTIES OF COLD-ROLLED STEEL STRIPS FOR SPRINGS

C-1.1 Physical properties of cold-rolled steel strips in the annealed and hardened and tempered conditions are given in Table 6.

C-1.2 The Vickers hardness test shall be carried out in accordance with IS 1501 (Part 1).

C-1.3 The tensile strength, yield stress and percentage elongation shall be determined in accordance with IS 1608 (Part 1).

C-1.4 The hardness shall be determined in accordance with IS 1586 (Part 1).

TABLE 6 to be typed. Amd 1 and Amd 2 to be incorporated in the table.

Commented [B21]: Values for new grades?

AMENDMENT NO. 2 TO

IS 280 : 2006

MILD STEEL WIRE FOR GENERAL ENGINEERING PURPOSES
(*Fourth Revision*)

(*Page* 1, *clause* **2**) — Substitute '6745 : 1972 Methods for determination of mass of zinc coating on zinc coated iron and steel articles' *for* '4826 : 1979 Hot-dipped galvanized coatings on round steel wires (*first revision*)'

(*Page* 2, *clause* **11.1**) — Substitute the following for the existing clause:

'**11.1** When determined in accordance with IS 6745 the galvanized coating of steel wire shall conform to the requirements for any one of the types of coatings given Table 3'

(*Page* 2, Table 3) — Insert following new table after clause **11.1**:

'

Table 3 Coating on wire

(*Clause* 11.1)

Diameter mm	Classes[a]					
	A	AB	B	C	D	A × 3[b]
	g/m²	g/m²	g/m²	g/m²	g/m²	g/m²
0.15 ≤ d < 0.20	-	-	15	-	10	
0.20 ≤ d < 0.25	30	20	20	20	15	
0.25 ≤ d < 0.32	45	30	30	25	15	
0.32 ≤ d < 0.40	60	30	30	25	15	
0.40 ≤ d < 0.50	85	55	40	30	15	
0.50 ≤ d < 0.60	100	70	50	35	20	
0.60 ≤ d < 0.70	115	80	60	40	20	
0.70 ≤ d < 0.80	130	90	60	45	20	
0.80 ≤ d < 0.90	145	100	70	50	20	
0.90 ≤ d < 1.00	155	110	70	55	25	
1.00 ≤ d < 1.20	165	115	80	60	25	
1.20 ≤ d < 1.40	180	125	90	65	25	540
1.40 ≤ d < 1.65	195	135	100	70	30	585
1.65 ≤ d < 1.85	205	145	100	75	30	615
1.85 ≤ d < 2.15	215	155	115	80	40	645
2.15 ≤ d < 2.50	230	170	125	85	45	690
2.50 ≤ d < 2.80	245	185	125	95	45	735
2.80 ≤ d < 3.20	255	195	135	100	50	765
3.20 ≤ d < 3.80	265	210	135	105	60	795
3.80 ≤ d < 4.40	275	220	135	110	60	825
4.40 ≤ d < 5.20	280	220	150	110	70	840
5.20 ≤ d < 8.20	290			110	80	870
8.20 ≤ d < 10.00	300			110	80	900

[a] The coating class with a designation starting with A relates to thick coatings (generally final coating). Designations ending in B relate to classes usually but not always obtained (zinc coating) and subsequent drawing. Classes C and D are standard classes for low mass coating which are usually produced but not exclusively, produced by hot zinc dipping and then wiping

[b] A × 3 relates to very high mass requirement three times higher than Class A. Other multiples of Class A are possible, and these classes will be identified in the way, e.g. A × 4

Commented [B1]: Reference to IS 12753 for electrogalvanized wires as given in the present standard not required?

Commented [SVD2R1]: Reference of IS 12753 may be retained, as the Zn coating for electrogalvanised wire is mentioned in IS12753 itself, without mentioning IS 4826. Also, for electrogalvanised wires, there is a provision of '***coating as per agreement between the purchaser and supplier***'. This should be removed. If it cannot be retained then same needs to be made applicable to hot dip galvanised wires also.

Commented [B3]: Coating requirements for 0.125 mm, 0.140 mm, 11.2 mm and 12.5 mm?

Commented [SVD4R3]: For any wire seize below 0.15 mm and 10.00 mm & above, coating can be as agreed between the purchaser and supplier. Wires of such diameters are normally not required in as galvanised condition

‘

(*Page* 2, *clause* **15.2**) — Substitute the following for the existing clause:

‘15.2 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 product(s) may be marked with the Standard Mark.’

(*Page* 2, *clause* **15.2.1**) — Delete

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भारतीय मानक
Indian Standard

IS 648 : 2018

अतप्त बेल्लित गैर दिशात्मक विद्युत इस्पात की चद्दर एवं पत्ती — पूर्ण प्रक्रमित प्रारूप — विशिष्टि

(छठा पुनरीक्षण)

Cold Rolled Non-Oriented Electrical Steel Sheet and Strip — Fully Processed Type — Specification

(Sixth Revision)

ICS 77.140.40

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली-110002
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Price Group 5

FOREWORD

This Indian Standard (Sixth Revision) 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.

This standard was first published in 1955 and subsequently revised in 1962, 1970, 1980, 1994 and 2006. While reviewing this standard in the light of experience gained during these years, the Committee decided to revise it to bring in line with the present practices being followed by the Indian industry and overseas standards of cold rolled non- oriented electrical steel sheet and strip.

In this revision the following modifications have been made:

a) Amendment No. 1, 2, 3, 4 and 5 have been incorporated.

b) Additional definitions have been incorporated.

c) Changes made in clauses **6.1.3**, **7.1.2.1**, Annex B.

d) Clause **9.2.1** and Clause **10** have been added.

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

A conversion factor table is given in Annex A for information.

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 : 1960 'Rules for rounding off numerical values (*revised*)'. 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

COLD ROLLED NON-ORIENTED ELECTRICAL STEEL SHEET AND STRIP — FULLY PROCESSED TYPE — SPECIFICATION

(Sixth Revision)

1 SCOPE

This standard covers the requirement for non-oriented electrical steel with silicon content up to 3.5 percent, cold rolled, both insulated and uninsulated, fully processed electrical steel and strip primarily intended for static and rotating machines operating at power frequencies.

This standard defines grades of coldrolled non-oriented electrical steel sheet and strip in nominal thicknesses of 0.35 mm, 0.5 mm, 0.65 mm and 1.00 mm.

If required and agreed to between the purchaser and the manufacturer, the typical, physical and mechanical properties of the steel sheets/strips shall be supplied by the manufacturer to the purchaser.

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 revisions and parties to agreements based on these standards are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
649 : 1997	Methods of testing steel sheets for magnetic circuits of power electrical apparatus (*second revision*)
8910 : 2010	General technical delivery requirements for steel and steel products
13795 (Part 1) : 1993	Glossary of terms relating to special alloys: Part 1 Soft magnetic materials

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 13795 (Part 1) and the following shall supply.

3.1 Electrical Steel Sheet/Strip — Electrical steel/strip is a material used for making cores for rotating electrical machines and static apparatus.

3.2 Non-oriented Electrical Steel Sheet/Strip — Steel sheet/strip having substantially the same magnetic and electrical characteristics in all direction of the plane of the sheet.

3.3 Cold Rolled Electrical Steel Sheet/Strip — Electrical steel sheet/strip which is reduced to final gauge after cold rolling.

3.4 Silicon Steel — Electrical steel made with deliberate alloying addition of silicon.

3.5 Fully Processed Material — Material which does not require further processing by the purchaser to give the specified properties.

3.6 Sheet — A cold rolled flat product in rectangular section of thickness below 5 mm and supplied in straight lengths. The width is at least 100 times the thickness and the edges can be mill, trimmed and sheared.

3.7 Strip — A cold rolled flat product approximatelyin rectangular cross-section of thickness normally 12mm or below with mill, rolled trimmed or sheared edges and supplied in coil form.

3.7.1 *Wide Strip* — Cold rolled strip of width normally equal to or greater than 600 mm.

3.7.2 *Narrow Strip* — Cold rolled strip of width normally less than 600 mm.

3.8 Coil Interleaves — Laps at the junctions between sub-coils for the purpose of building up larger continuous coils.

3.9 Coil Butt Welds — Butt welds at the junctions between sub-coils for the purpose of building up larger continuous coils.

3.10 Batch — A single charge of the product of one or more cast heat treated together with similar quality grading.

3.11 Stacking Factor — A numeric, less than unity and usually expressed as a percentage, which is defined as the ratio of the uniform solid height of the magnetic material in a laminated core to the actual height(core build up) when, measured under a specified pressure is thus equal to the ratio of the volume of magnetic material in a uniform laminated core to the overall geometric volume in the core.

3.12 Flatness (Wave Factor) — The property of a sheet or of a length of strip which is characterized by the wave factor, that is, by the relation of the height of the wave to its length.

3.13 Insulated Sheet — Insulated sheet shall mean electrical sheets in sheet/strip form coated on both sides with organic or inorganic or combined organic and inorganic materials to provide interlaminar insulation resistance.

3.14 Density — The ratio of mass to the volume of a magnetic material, in kg/m^3.

3.15 Anisotropy of Losses — The anisotropy losses is the difference between the specific loss measured perpendicular and parallel to the direction of the rolling expressed as percentage to the sum of two total specific losses measure

$$P, \text{percent} = \frac{(P_a - P_l)}{(P_a + P_l)} \times 100$$

where

P = anisotropy of losses;

P_a = total specific loss P at 1.5 Tesla perpendicular to the direction of rolling; and

P_l = total loss P at 1.5 Tesla parallel to the direction of rolling.

3.16 Edge Camber — Greatest distance between a longitudinal edge of the sheet and the line joining the two extremities of the measured length of this edge.

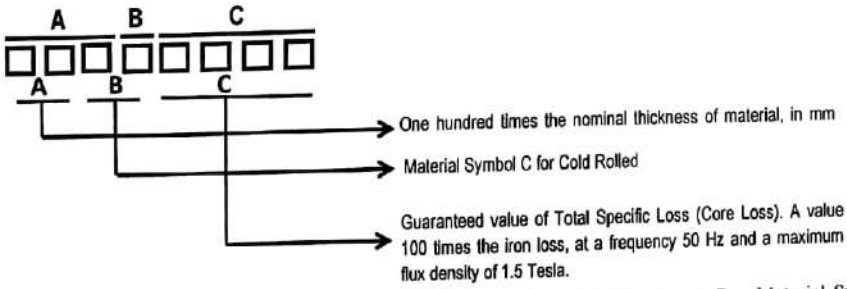
3.17 Number of Bends — Number of alternate bends possible before the appearance in the base metal of the crack visible to the naked eye; it constitutes an indication of the ductility of the material.

3.18 Internal Stresses — Stresses which are characterized by a deviation in the relation to the line of cutting.

4 CLASSIFICATION OF GRADES

This standard covers the grades listed in Table 1,with the forms and condition of supply as specified in IS 8910. The grades are classified according to the maximum value of total loss at a polarization of 1.5T and according to the nominal thickness (0.35, 0.50, 0.65 and 1.00 mm).

5 DESIGNATION



NOTE A = One hundred times the nominal thickness of the product, in mm. B = Material Symbol C for Cold Rolled. C = One hundred times the maximum value of specific total loss in W/kg at 1.5 Tesla, 50 Hz.

Examples

A sheet or strip of 0.50 mm thickness, tested at 1.5 Tesla, 50 Hz and specific total loss 2.70 W/kg shall be designated as 50C270.

6 GENERAL REQUIREMENTS

6.1 Condition of Delivery

6.1.1 The product shall be supplied in the fully processed condition.

6.1.2 The material can be supplied either without insulation or with insulation on one or both sides. If the material is supplied with insulation, the nature of the insulation, its properties and stacking factor and their verification shall be agreed at the time of ordering.

6.1.3 The thickness of the material supplied for each grade shall be as given in Table 1. If the material is required in thicknesses other than those specified in Table 1, these may be supplied as per the properties mutually agreed to between the purchaser and the manufacturer. However, the properties shall be superior to the properties specified in Table 1.

6.1.4 The sizes of the strips and sheets supplied in coil or in cut length shall be subject to mutual agreement between the purchaser and the manufacturer.

6.1.5 When the material is supplied in coils, the following shall be considered as preferred dimensions of the coils for all the grades specified in this standard:

Internal diameter 400/430/450/510/610.

6.1.6 When supplied in cut length form, the packet mass shall not be more than 3.5 tonne or as mutually agreed to between the manufacturer andthe supplier.

6.1.7 *Interleaves and Welds*

Strips can occasionally exhibit welds or interleaves, resulting from the removal of defective zones subject to prior agreement between the parties. If necessary, marking of welds or interleaves may be agreed on at the time of ordering.

6.1.7.1 Small grade coils may be joined together by butt welding to form larger continuous coils in which case the welds shall be marked as for interleaves. The

Table 1 Designation of Electrical Steel Grades
(*Clauses* 4,6.1.3, 7.1.1.2, 7.1.2.1,7. 1.2.4 *and* 9.2)

Designation	Nominal Thick-ness	Maximum Specific Total Loss W/kg			Minimum a.c. Magnetisation in T			Maximum anisotropy of loss percent at 1.5 T	Minimum Stacking Factor	Minimum Numbers of Bends	Con-ventio-nal Density kg/dm^3
		1.0 T	1.5 T		2500 A/M	5000 A/M	10000 A/M				
		50Hz	50Hz	60Hz							
35C230	0.35	0.95	2.30	2.90	1.49	1.60	1.70	±17	0.95	2	7.60
35C235		0.95	2.35	2.97	1.49	1.60	1.70	±17		2	7.60
35C250		1.00	2.50	3.14	1.49	1.60	1.70	±17		2	7.60
35C270		1.10	2.70	3.36	1.49	1.60	1.70	±17		2	7.65
35C300		1.20	3.00	3.74	1.49	1.60	1.70	±17		3	7.65
35C330		1.30	3.30	4.12	1.49	1.60	1.70	±17		3	7.65
35C360		1.45	3.60	4.55	1.49	1.60	1.70	±17		3	7.65
50C250	0.50	1.05	2.50	3.21	1.49	1.60	1.70	±17	0.97	2	7.60
50C270		1.10	2.70	3.47	1.49	1.60	1.70	±17		2	7.60
50C290		1.15	2.90	3.71	1.49	1.60	1.70	±17		2	7.60
50C310		1.25	3.10	3.95	1.49	1.60	1.70	±14		3	7.65
50C330		1.35	3.30	4.20	1.49	1.60	1.70	±14		3	7.65
50C350		1.50	3.50	4.45	1.50	1.60	1.70	±12		5	7.65
50C400		1.70	4.00	5.10	1.53	1.63	1.73	±12		5	7.70
50C470		2.00	4.70	5.90	1.54	1.64	1.74	±10		10	7.70
50C530		2.30	5.30	6.66	1.56	1.65	1.75	±10		10	7.70
50C600		2.60	6.00	7.53	1.57	1.66	1.76	±10		10	7.75
50C630		2.80	6.30	7.90	1.58	1.68	1.76	±10		10	7.75
50C700		3.00	7.00	8.79	1.60	1.69	1.77	±10		10	7.80
50C800		3.60	8.00	10.06	1.60	1.70	1.78	±10		10	7.80
50C900		3.80	9.00	11.31	1.61	1.70	1.78	±10		10	7.80
50C940		4.20	9.40	11.84	1.62	1.72	1.81	± 8		10	7.85
50C1000		4.40	10.00	11.90	1.62	1.72	1.81	±10		10	7.85
65C310	0.65	1.25	3.10	4.08	1.49	1.60	1.70	±15	0.97	2	7.60
65C330		1.35	3.30	4.30	1.49	1.60	1.70	±15		2	7.60
65C350		1.50	3.50	4.57	1.49	1.60	1.70	±14		2	7.60
65C400		1.70	4.00	5.20	1.52	1.62	1.72	±14		2	7.65
65C470		2.00	4.70	6.13	1.53	1.63	1.73	±12		5	7.65
65C530		2.30	5.30	6.84	1.54	1.64	1.74	±12		5	7.70
65C600		2.60	6.00	7.71	1.56	1.66	1.76	±10		10	7.75
65C700		3.00	7.00	8.98	1.57	1.67	1.76	±10		10	7.75
65C800		3.60	8.00	10.26	1.60	1.70	1.78	±10		10	7.80
65C1000		4.40	10.00	12.77	1.61	1.71	1.80	±10		10	7.85
100C600	1.00	2.60	6.00	8.14	1.53	1.63	1.72	±10	0.98	2	7.60
100C700		3.00	7.00	9.38	1.54	1.64	1.73	±8		3	7.65
100C800		3.60	8.00	10.70	1.56	1.66	1.75	±6		5	7.70
100C1000		4.40	10.00	13.39	1.58	1.68	1.76	±6		10	7.80
100C1300		5.80	13.00	17.34	1.60	1.70	1.78	±6		10	7.80

NOTES

1 Properties tested and reported at 60Hz shall conform to the specified values of above table when tested in importing country at 50 Hz.

2 a.c. Magnetisation can be checked and reported in any value between 2 500 to 10 000 A/m as per mutual agreement apart from above (at 2 500, 5 000 and 10 000).

3 In case any grade that is not covered in Table 1 can be considered, if the grade designation as defined in clause 4 is followed and properties are certified based on the values in Table 1 to the nearest thickness and then the next best grade within the table.

supplier shall ensure that the welds are made in such a manner as not to damage areas of the coils adjacent to the weld.

6.1.7.2 The edges of parts welded together shall not be so much out of alignment so as to affect the further processing of the material.

6.1.8 *Stability*

Coils shall be sufficiently tightly wound to prevent collapse to an extent that would prelude their being mounted on a mandrel appropriate to the ordered internal diameter.

6.2 Chemical Composition — The chemical composition of steel is left to the manufacturer's discretion. However, the chemical composition may be provided, if agreed to between manufacturer and the purchaser at the time of placing the order.

6.3 Surface Condition

6.3.1 The surface shall be smooth and clean, free from grease and rust (the same should not be confused with some coloration of insulation coating inherent in manufacturing process). Dispersed defects such as scratches, blisters, aesthetic type physical damages, etc, are permitted if they are within limits of thickness tolerance and not detrimental to method of working or correct use of supplied material. The limit, classification and disposition shall be subject to agreement between the purchaser and the manufacturer.

6.3.2 When an insulation coating is present on the surface of the material, it shall be sufficiently adherent so that it does not become detached during cutting operations. During an alternating bend test, the coating shall not detach after a bend of 90°. If the coating becomes detached during the test, the piece from which the sample was taken shall be subjected to shearing test. During the test, it shall not be admissible for large pieces of the coating to become detached. However, the slight chipping of this coating at the shearing edges shall be tolerated.

7 TECHNICAL REQUIREMENT

7.1 Magnetic Characteristics

7.1.1 *Magnetization Test*

7.1.1.1 *a.c. magnetization test* — The Minimum specified values of a.c. magnetization for magnetic field strengths H of 2500 A/m, 5000 A/m, 10000 A/m shall be given in Table 1.

The a.c. magnetization shall be determined in an alternating magnetic field (expressed as a peak value) at 50 Hz

7.1.2 *Total Specific Loss/Core Loss*

7.1.2.1 The specified values of maximum total specific loss at 50 Hz to be guaranteed at 1.5 T shall be as given in Table 1. They apply –

a) for the nominal thicknesses 0.35 mm, 0.50 mm and 0.65 mm to aged or non aged test pieces;

b) for the nominal thickness 1.00 mm to non-aged test pieces; and

c) the values of the specific total loss at 1.0 T given in Table 1 are for information only.

NOTE — The ageing shall be carried out as specified in IS 649.

7.1.2.2 The test sample shall be prepared and tested as described in IS 649 at a peak magnetic flux density of 1.5 T at 50 Hz. Wherever, relevant the samples shall be annealed in accordance with the manufacturer's recommendations before testing.

7.1.2.3 *Anisotropy of losses*

If required by the purchaser the anisotropy of losses should be tested. The maximum values of Table 1 should be guaranteed.

7.1.2.4 If agreed to between the purchaser and the manufacturer, the manufacturer shall supply characteristics curves for properties agreed upon mutually.

7.1.2.5 If agreed to between purchaser and the manufacturer, the manufacturer should also give information for the following properties to the purchaser on request:

a) Typical electrical resistivity values for each grade, and

b) Typical thermal conductivity values for each grade.

7.2 Surface Insulation Characteristics

7.2.1 Unless otherwise specified, fully processed cold rolled electrical sheets shall be supplied without coating, they shall be coated with either organic or inorganic material as specified by the purchaser. The description of the coatings is given in Annex B.

7.2.2 The coating should have uniform colour throughout the surface of the coil tightly adherent to both sides.

7.2.3 If insulated material is required for subsequent annealing this should be stated by purchaser on his enquiry and order. The coating supplied shall withstand annealing under condition specified by the supplier.

7.2.4 Material when supplied with insulation, the nature of the insulation and its properties shall be subject to mutual agreement between the purchaser and the manufacturer.

7.2.5 Method of measurement of insulation resistance shall be as per IS 649.

7.2.6 *Thermal Effect on Coating*

If agreed between the purchaser and the manufacturer, twelve specimens of the coated strip shall be clamped together under a pressure of 1 N/mm^2 approximately and heated in a laboratory oven at a temperature of 150°C for a period of 7 days. After cooling to the room temperature the insulation surface resistance (two sides coated) shall be not less than the minimum specified values as mutually agreed to between the manufacturer and the purchaser.

7.2.7 *Resistance to Solvents and Cleanliness*

If agreed to between the user and the manufacturer, the specimens shall be kept in a container filled with boiling trichloroethylene or xylene for 5 min. After removal and cooling to room temperature, the film should not get soft enough so that it can be wiped off.

8 GEOMETRIC CHARACTERISTICS AND TOLERANCES

8.1 Thickness Tolerances

8.1.1 The nominal thickness of the material are 0.35 mm, 0.50 mm, 0.65 mm and 1.00 mm. The allowable tolerance on the nominal thickness within the same acceptable unit shall be ± 8 percent of the nominal value for thicknesses 0.35 mm and 0.50 mm and ± 6 percent of the nominal value for thicknesses 0.65 mm and 1.00 mm. The additional thickness due to welds, with respect to the measured thickness of the steel sheet or strip shall not exceed 0.050 mm.

8.1.2 The difference in thickness in a direction perpendicular to the direction of rolling shall not exceed 0.020 mm for thicknesses of 0.35 mm and 0.50 mm and 0.030 mm for thicknesses of 0.65 mm and 1.00 mm, the measurements being made at least 30 mm from the edges. This measurement shall be made using a micrometer with an accuracy of 0.001 mm. These tolerances apply only to materials with a width greater than 150 mm. For narrow strip and for materials supplied with as rolled edges, other agreements may be reached while ordering.

8.1.3 The height of the weld, if any and edge burr shall not exceed 50 microns.

8.2 Width Tolerances

8.2.1 This tolerance is applicable to widths less than or equal to 1250 mm. For the width tolerances a distinction is made between material supplied with edges in the as rolled condition and material delivered with trimmed edges.

8.2.2 For material supplied with trimmed edges, the tolerances of Table 2 shall apply.

8.2.3 For materials supplied with as rolled edges and / or widths above 1250 mm the tolerance on nominal width be a subject of agreement while ordering

Table 2 Width Tolerance
(*Clause* 8.2)

All dimensions in millimetres.

Sl No. (1)	Nominal Width '*l*' mm (2)	Tolerance mm (3)
i)	$l \leq 150$	+0.2
ii)	$150 < l \leq 300$	+0.3
iii)	$300 < l \leq 600$	+0.5
iv)	$600 < l \leq 1000$	+1.0
v)	$1000 < l \leq 1250$	+1.5

NOTE — As per agreement, width tolerance can be –ve or +ve or both –ve and +ve subject to tolerance band as given in above table.

8.3 Length Tolerance

The tolerance on length of sheets in relation to length ordered shall be $^{+0.5}_{-0.0}$ percent but subject to maximum value of 6 mm.

8.4 Tolerances on sizes other than those covered under **8.1**, **8.2** and **8.3** shall be subject to an agreement between the purchaser and the manufacturer.

8.5 Tolerance on Shape

8.5.2 *Out of Squareness*

Out of square, tolerances shall not be more than 1 percent of the length and the width.

8.5.3 *Edge Camber*

Verification of Edge camber applies only to material supplied with trimmed edges, and width greater than 30 mm.

The edge camber shall not exceed for a measuring length of 2 m.

a) 2 mm for a nominal width $l > 150$ mm

b) 4 mm for a nominal width l, $30 < l \leq 150$

8.5.4 *Residual Curvature*

The verification of residual curvature does not apply

to material supplied with as rolled edges and material of width less than or equal to 100 mm.A requirement concerning residual curvature can be specified by agreement when ordering in this cast, the distance between the bottom edge of the test specimen and the supporting plate shall not exceed 35 mm for the products of thicknesses 0.35 mm, 0.50 mm and 0.65 mm. For the thickness 1.00mm,this distance shall be subject to an agreement between the supplier and the purchaser.

8.6 Flatness (Wave Factor)

This tolerance is applicable to material of width more than 100 mm. The wave factor, expressed as a percentage, shall not exceed 2 percent.For material supplied with as rolled edges the flatness values shall be subject of agreement while ordering.

8.7 Sheet and Strip for Specific Purposes

Material required to tolerances other than those specified in **8.1** and **8.6** shall be subject to agreement between the purchaser and the manufacturer.

9 TECHNOLOGICAL CHARACTERISTICS

9.1 Stacking Factor

The surface quality of the uninsulated cold rolled sheet/ strip and when measured in terms of stacking factor as specified in IS 649 shall comply with minimum values given in Table 1. For insulated it is an agreement between the manufacturer and the purchaser.

9.2 Bend Test

The bend test shall be carried out as specified in IS 649.The test piece shall withstand the number of bends as given in Table 1. The radius of jaws shall be 5.0 mm.The test may be terminated when the number of bends exceeds the minimum requirements as given in Table 1, subject to agreement while ordering.

9.2.1 *Bend Calculation*

First 90° bend is counted as 'First Bend', then through 180° in reverse direction as 'Second Bend' and again when the sample is bend through 180° in the first direction as 'Third Bend' and so on till the fracture / crack appears.

10 INSPECTION AND TESTING

10.1 General

Each mother coil (acceptance Unit) is around 17 MT (Including coils greater than 17 MT, depending on width of material) or the remaining fraction thereof of the same grade and the same nominal thickness. Different acceptance units can be adopted by special agreement.

Except by special agreement, the same rules apply to the inspection of suitability for cutting, surface insulation resistance and tolerances of shape and dimensions.

When the products are delivered in the form of slit coils, the test results applying to the mother coil of acceptance shall apply.

10.2 Selection of Samples

Test samples shall be taken from each acceptance unit. The first internal turn and last external turn of the coils shall be considered as wrapping and not as representative of the quality of the rest of the coil. The selection shall be made from the first internal or external turns, excluding the wrapping turn and outside any welding zones or interleaves. In the case of sheets, the selection shall be made preferably from the upper part of the bundle.

10.3 Preparation of Test Specimens

10.3.1 *Magnetic Properties*

For the measurement of a.c.magnetisation polarization and total specific loss/core loss using the 25 cm Epstein frame, the test specimen shall consist of a minimum of Epstein test strips as per IS 649 having the following dimensions:

a) length 280 mm to 320 mm, the lengths being equal within a tolerance of ± 0.5 mm; and

b) width 30 mm ± 0.2 mm.

Half of the strips shall be cut parallel to direction of rolling and other half perpendicular, giving even distribution across the width of the material. The test strips shall be carefully cut without deformation. Cutting or punching shall be carried out only with well sharpened tools.

10.3.2 *Insulation Resistivity*

Each test specimen shall be formed from a single sheet or length of strip. The width and length of the test specimen shall be respectively greater than the width and length of the contact assembly. This measurement is destructive; the test specimen can only be used once. To obtain a representative result, test specimens shall be taken from the full sheet width.

10.4 Geometrical Characteristics and Tolerances

For the measurement of thickness, width, flatness and edge camber, the test specimen shall consist of a sheet or a 2 m length of strip.

For the measurement of the residual curvature, the test specimen shall consist of a sample $500\ ^{+2.5}_{0}$ mm, in

length and of width equal to the delivery width of the sheet or strip.

11 RETEST

11.1 Should a test sample fail, two further samples shall be selected at random from the same batch of material and tested in a same manner.

11.2 If either of both of the retest samples on testing indicates that the core loss is greater than maximum loss specified for the respective grade, the batch represented by these samples shall be taken as not complying with the requirements of that grade.

12 PACKING

The sheets/strips shall be suitably packed in metal protected containers lined with water-proof material lining to avoid any damage and to ensure protection from rust during transit. The method of packing shall be subject to the approval by the purchaser before shipment from manufacturer's works.

13 MARKING

13.1 Every bundle/coil of sheet/strip shall be legibly marked with the following:

a) Manufacturer's name;

b) Grade and thickness;

c) Gross and net mass (at the top of bundle);

d) Cast number or identification mark by which the sheets/strips may be traced to the cast from which they were made; and

e) Type of coating, if coated.

13.2 BIS Certification Marking

The material shall be marked with the Standard Mark.

13.2.1 The use of the Standard Mark is governed bythe provisions of *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for useof the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau ofIndianStandards.

14 TEST CERTIFICATE

The manufacturer shall provide with each consignment, a test certificate giving the following as per the agreement between the manufacturer and the purchaser at the time of placing the order:

a) Grade;

b) Nominal Dimension (Thickness/Width/Length (If supplied in Sheet form);

c) Density;

d) Specific total loss for each coil/packet;

e) a.c. magnetization;

f) Insulation resistance, if coated;

g) Number of bends;

h) Anisotropy;

j) Stacking factor;

k) Chemical composition;

m) Insulation thickness;

n) Adherence;

p) Resistance to solvent; and

q) Thermal effect.

15 ORDERING INFORMATION

While placing an order for cold rolled non-oriented electrical steel sheet and strip (fully processed type) covered by this standard, the purchaser should specific, clearly the following:

a) Grade of electrical steel sheet/strip required (*see* Table 1);

b) Length, width and thickness of sheets or the width, thickness, maximum and minimum acceptable mass and internal diameter of coils required (*see* Table 1, **6.1.5**, **8.2** and **8.3**);

c) Number of interleaves and/or butt welds acceptable in a coil (*see* **6.1.7.2**);

d) Type of coating and nominal thickness;

e) Any optional test required; and

f) Any special requirements (*see* **4**, **6.1.4**, **8.4**, **8.7** and **10.1**).

ANNEX A

(*Foreword*)

CONVERSION FACTOR

Term (1)	To (2)	From (3)	Conversion Factor (4)
Magnetic flux density (B)	Tesla (Wb/m²)	Gauss	10^4
	Gauss	Tesla (Wb/m²)	10^{-4}
Magnetic field strength (H)	Ampere-turns/meter	Oersted	0.0126
	Oersted	Ampere-turns/meter	79.6
	Ampere-turns/meter	Ampere-turns/inch	0.0254
	Ampere-turns/meter	Ampere-turns/cm	0.01
Core loss	Watt/kg	Watt/pound	0.4536
	Watt/pound	Watt/kg	2.205
	Watts/kg at 60 Hz (1.5T)	Watts/kg at 50 Hz (1.5T)	0.79
	Watts/lb at 60 Hz (1.5T)	Watts/kg at 50 Hz (1.5T)	1.74
Length (l)	Centimetre	Inch	0.3937
	Inch	Centimetre	2.54
Area (A)	Square cm	Square inch	0.155
	Square inch	Square cm	6.45
Volume (V)	cm³	Cubic inch	0.061
	Cubic inch	cm³	16.4
Mass (m)	gm	Ounce	0.0353
	Kg	pound	2.205
	Ounce	gm	28.35
	Pound	Kg	0.4536
Tensile strength (R_m)	N/mm²	Kg/mm²	0.102
	Kg/mm²	N/mm²	9.81
Temperature (T)	°C	°F	× 1.8 + 32
	°F	°C	× 0.556 – 17.8

ANNEX B

(*Clause* 7.2.1)

CLASSIFICATION OF SURFACE INSULATIONS OF ELECTRICAL STEEL SHEET, STRIP AND LAMINATIONS

Insulation Designation	Insulation Description — Characteristics — Typical Application, Limits of Use
C-0	Oxide that is formed naturally on the steel surface during mill processing. This oxide layer is thin, tightly adherent, and provides sufficient insulating quality for most small cores. The oxide layer will withstand normal stress-relief annealing temperatures. The insulation quality is affected by the oxidizing potential of the user's anneal, that is, the oxidized surface condition may be enhanced by controlling the atmosphere to be more or less oxidizing to thesurface. It is not appropriate to assert a maximum acceptable Franklin test current (Insulation resistivity) for this coating.
C-1	An oxide layer that is created on the surface of the steel laminations by contact with an oxidizing furnace atmosphere at the end of the user's heat treatment cycle. This oxide layer is usually bluish to grey in colour. This oxide layer is primarily relevant to steel sheet, strip and laminations in the semi-processed state. It is not appropriate to specify the surface insulation resistance for this type of insulation.
C-2	An inorganic insulation coating predominantly comprised of magnesium silicate. It is formed on the surface of grain oriented electrical steel by the reaction of the annealing separator with the steel surface during high temperature annealing. This coating is often referred to as 'mill glass' or 'glass', even though the coating is not technically a glass.This coating is very abrasive. Steels coated with C-2 only are not typically used for stamped laminations.The primary application of this coating is for materials used in wound core transformers. This coating will withstand normal stress-relief annealing temperatures. It is not appropriate to specify the surface insulation resistance for this type of coating.
C-3	An organic varnish/enamel coating that is applied to the steel surface.It is preferably used for fully processed non-oriented electrical steels.It may be appropriate to specify the surface insulation resistance for this type of coating. This coating generally improves the punchability of the steel and, hence, is quite suitable for stamped laminations.This coating may adversely affect weldability and will not withstand normal stress relief annealing temperatures. The coating is normally suitable for operating temperatures up to about 180 °C. The user should take into account any problems due to coating off-gassing during welding or exposure of the steel coated with this type of coating to elevated temperatures (>180°C).
C-4	A coating formed by phosphating or some other chemical treatment of the steel surface followed by a curing treatment at elevated temperature. This type of coating is used in applications requiring moderate levels of surface insulation resistance. This type of coating will withstand normal stress-relief annealing temperatures but some reduction of the surface insulation resistance may result. It may be appropriate to specify the surface insulation resistance for this type of coating.
C-5	Inorganic or mostly inorganic coating similar to C-4, to which ceramic fillers or film-forming inorganic components have been added to increase the insulating ability of the coating. The coating typically is a phosphate, chromate, or silicate coating, or combination thereof. Such coatings are applied to the steel surface and cured by heating. The coatings can be applied to grain-oriented electrical steels, nonoriented electrical steels, and cold rolled motor lamination steels.

Insulation Designation	Insulation Description — Characteristics — Typical Application, Limits of Use
	A C-5 coating may be applied over top of a C-2 coating for applications in which extra surface insulation is required, forexample, sheared laminations of grain-oriented electrical steel for cores of power transformers. C-5 coatings are used for applications requiring a high-surface resistivity. It is appropriate to designate a maximum Franklin test current for this type of coating before stress-relief annealing. The required Franklin test current is subject to agreement between the producer and user. The coating will withstand stress-relief annealing up to 1550°F (840°C) in neutral or slightly reducing furnace atmospheres, but some reduction in surface in solution resistivity may occur during the anneal. The coating will withstand burn-off treatments at 600-1000°F (320-540°C) used to remove statorwinding insulation during rebuilding of motors. The coating can be used in air-cooled or oil-immersed cores.In some cases, organic components may be added to C-5 coatings to enhance punchability. The applications, use, and properties of such coatings aresimilar to those of inorganic C-5 coatings. The user should consult the producer if there are particular concerns with coating off-gassingduring welding or elevated temperature exposure of the coated steel.
C-6	Organic-based coating to which inorganic fillers have been added to increase the insulating ability of the coating. The coating is applied to the steel surface and cured by heating. C-6 coatings typically are used for fully processed nonoriented electrical steels. It is appropriate to designate a maximum Franklin test current for this type of coating. The required Franklin test current is subject to agreement between the producer and user. The coating will withstand burn-off treatments used to remove stator winding insulation during rebuilding of motors, done at 600-1000°F (320-540°C), but is not considered to be a coating that will withstand normal stress-relief annealing. The coating generally improves the punchability of the steel, and hence, is suitable for stamped laminations.The user should take into account any problems due to coating decomposition or off-gassing during welding or exposure of the steel coated with this type of coating to elevated temperatures (>180 °C)

NOTES

1 The surface insulation resistance may be determined according to IS 649.

2 Any requirement for this property and the corresponding method of evaluation should be agreed between the steel producer and the purchaser.

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Review of Indian Standards

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This Indian Standard has been developed from Doc No.: MTD 4 (5262).

Amendments Issued Since Publication

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Appendix-14

BUREAU OF INDIAN STANDARDS
Draft Amendment No. 2
TO
IS 2830 : 2012 CARBON STEEL CAST BILLET INGOTS, BILLETS, BLOOMS AND SLABS FOR RE-ROLLING INTO STEEL FOR GENERAL STRUCTURAL PURPOSES — SPECIFICATION
(*Third Revision*)

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(*Page* 2, *Table* 1) — Substitute the following for the existing table:

Table 1 Chemical Composition
(*Clause* 6.1)

Sl No.	**Designation**	**% Carbon**	**% Manganese**
(1)	(2)	(3)	(4)
i)	C8	0.12, *Max*	0.30-0.60
ii)	C8 MMn	0.12, *Max*	0.60-1.00
iii)	C8 HMn	0.12, *Max*	1.00-1.80
iv)	C15	0.12-0.18	0.30-0.60
v)	C18	0.15-0.21	0.30-0.60
vi)	C20	0.17-0.23	0.30-0.60
vii)	C15 MMn	0.12-0.18	0.60-1.00
viii)	C18 MMn	0.15-0.21	0.60-1.00
ix)	C20 MMn	0.17-0.23	0.60-1.00
x)	C15 HMn	0.12-0.18	1.00-1.80
xi)	C18 HMn	0.15-0.21	1.00-1.80
xii)	C20 HMn	0.17-0.23	1.00-1.80
xiii)	C25 HMn	0.30, *Max*	1.80, *Max*
xiv)	C30 HMn	0.32, *Max*	1.80, *Max*

(*Page* 2, *Table* 1, *Notes* 3) — Substitute the following for the existing note:

'**3** When micro-alloying elements like Nb, V and Ti are used individually or in combination the total content shall not exceed 0.30 percent.'

(*Page* 2, *clause* **6.1.1**) — Substitute the following for the existing clause:

6.1.1 All types of steel in Table 1 may be supplied in four grades, namely A, B, C and X having following Sulphur, phosphorus content (on ladle analysis).

Grade	Sulphur *Max*	Phosphorous *Max*	S + P
A	0.050	0.050	
B	0.045	0.045	
C	0.040	0.040	0.075
X	0.060	0.060	0.110

(*Page* 2, *clause* **6.2**) — Substitute the following for the existing clause:

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Commented [B1]: Reference Indian / International standard for the grade

Commented [B2]: Reference Indian / International standard for the grade

Commented [B3]: Justification and reference of Indian/International standard

Commented [B4R3]:

Commented [B5]: Reference and justification

Commented [B6]: Reference and justification

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'**6.2** CRS (Corrosion Resistant Steel) grade may be produced by adding alloying elements like Cr, Cu, Ni, Mo and P either individually or in combination to improve corrosion resistance properties. However, the total content of these elements shall not be less than 0.40 percent. In such case, the manufacturer shall supply the purchaser or his authorized representative a test certificate stating the individual contents of all the elements. In such low alloy steels when phosphorous is used, it shall not exceed 0.12 percent and when used beyond the limit prescribed in **6.1.1**, the carbon shall be restricted to 0.15 percent, and in such case the restriction to maximum content of sulphur and phosphorous as given in **6.1.1** and the condition of minimum all content 0.40 shall not apply. When steel is Cu-bearing quality, Cu content shall conform to requirements of IS 1786 / IS 2062 as applicable.'

(*Page* 3, *clause* **13.3**) — Substitute the following for the existing:

'The ends of cast billet ingots, billets, blooms and slabs (including continuously cast) shall be suitably painted as per agreement between the purchaser and the manufacturer to identify the grade.'

(*Page* 3, *clause* **13.4**) — Substitute the following for the existing:

'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 product(s) may be marked with the Standard Mark.'

(*Page* 3, *clause* **13.4.1**) — Delete.

(*Page* 4, *Table* 4) — Delete.

(MTD 04)

For Comments Only **Doc:MTD 04(12171)**

BUREAU OF INDIAN STANDARDS

Draft AMENDMENT NO. 3
TO
IS 3024 : 2015 GRAIN ORIENTED ELECTRICAL STEEL SHEET AND STRIP
(*Third Revision***)**

(*Cover Page and Page* 1*, Title*) **—** Substitute the following for the existing:

'Cold rolled grain oriented electrical steel strip and sheet delivered in fully processed state'

(*Page* 1, *clause* **1.2**) **—** Substitute the following for the existing clause:

'This standard does not cover intermediate material such as MgO coated steel and strip, cold rolled batch annealed steel and strip and cold rolled full hard steel and strip, intended for manufacture of grades as defined in Table 1 and Table 2 or any CRGO products'

(*Page* 4, *Table* 2, *Note* 2) **—** Substitute the following for the existing:

'2 High Permeability grades may be delivered in domain or non-domain refined condition. In case if it is delivered with domain refinement than it is necessary to apply suffix 'd' or else the grade nomenclature can be devoid of suffix 'd'. Suffix 'd' indicates the test method to be used to certify a grade for domain refined grades. Test method to be used shall be as per **15.5**. Further, as a clarification the designation for grade supplied with domain refinement and without domain refinement would be 27HP95^{d} – if domain refined & 27HP95 – if it is non domain refined.'

(*Page* 7, *clause* **15.5**) — Insert the following new clause after clause **15.4**

'15.5 The testing method used shall be done as follows:

i) In case of domain refined grades (not amenable for heat treatment) will be tested as per IS 649 by single sheet method and convert the SST values to equivalent Epstein values by using a conversion factor of 0.925 at 1.7 T.

ii) In case of domain refined grades (amenable for heat treatment) will be tested as per IS 649 by Epstein Method.

iii) In case of Non-domain refined grades, it would be tested as per IS 649 by Epstein Method'.

(MTD 04)

DRAFT AMENDMENT NO. 2

to

IS 2002 : 2009 STEEL PLATE FOR PRESSURE VESSEL FOR INTERMEDIATE AND HIGH TEMPERATURE SERVICE INCLUDING BOILERS

(*Third Revision*)

(*Page* 1, *clause* **2**) — Substitute the following for the existing clause:

'**2 REFERENCES**

The standards listed below 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:

IS No.	*Title*
228 (relevant parts)	Methods of chemical analysis of steel
1599 : 2019/ ISO 7438 : 2016	Metallic materials – Bend test (*fourth revision*)
1608 (Part 1) : 2018/ ISO 6892-1 : 2016	Metallic Materials — Tensile Testing Part 1 Method of Test at room temperature (*fourth revision*)
1852 : 1985	Specification for rolling and cutting tolerances for hot rolled steel products (*fourth revision*)
1956 (Part 4) : 2013	Glossary of terms relating to iron and steel Part 4 Flat products (*second revision*)
3803 (Part 1) : 1989/ ISO 2566/1 : 1984	Steel – Conversion of elongation values Part 1 Carbon and low alloys steels (*second revision*)
4748 : 2009/ ISO 643 : 2003	Steels – Micrographic determination of the apparent grain size (*second revision*)
8811 : 1998	Method for emission spectrometric analysis of plain carbon and low alloy steels point to plane technique (*first revision*)
8910 : 2010/ ISO 404 : 1992	General technical delivery requirements for steel and steel products (*first revision*)
11630 : 2005	Method for ultrasonic testing of steel plates for pressure vessels and special applications (*first revision*)
12457 : 1988	Code of practice for evaluation, repairs and acceptance limits of surface defects in steel plates and wide flats
IS/ISO 7452 : 1990	Hot rolled steel sections for doors, windows and ventilators – Specification (second revision)
ISO 7778 : 2014	Through thickness characteristics for steel products

'

(*Page* 1, *clause* **3.3**) — Substitute following for existing clause:

'**3.3 Normalizing rolling -** A hot rolling process in which the final deformation is carried out within a certain temperature range equivalent to normalizing temperature, leading to a material condition equivalent to that obtained after normalizing, such that the specified mechanical properties would still be met in the event of any subsequent normalizing.'

(*Page* 2, *clause* **4**) — Substitute the following for the existing clause:

' 4 GENERAL REQUIREMENTS

4.1 General requirements relating to the supply of steel plates for pressure vessels shall conform to IS 8910.

4.2 Order shall include the following information, as applicable:

a) Quantity (weight or number of pieces of plates);
b) Supply condition (i.e. Plate, Strips/coils and cut to length from strips/coils) and their dimensions
c) Grade designation;
d) Heat treatment conditions;
e) Impact test requirements, if any;
f) Inspection and testing conditions, if any; and
g) Additional requirements, if any

‘

(*Page* 2, *clause* **5.1.3**) — Substitute the following for the existing clause: clause 5.1.3:

‘5.1.3 The plates are produced in either discrete cut lengths of as rolled flat product or cut to length and leveled plates from strips/coils.’

(*Page* 2, *clause* **5.2**) — Insert the following new clause after **15.1.3**:

‘5.2 When rolled from continuously cast slabs, ratio of slab to plate thickness shall be minimum 2.5 to 1, except that reduction ratios as low as 2.0:1 are permitted if all of the following conditions are met:

i) The purchaser agrees to the use of such reduction ratios.
ii) The specified plate thickness is 75 mm or more.
iii) One or more of the following low hydrogen practices are used:
    a) Vacuum degassing during steelmaking
    b) Controlled soaking of the slabs or plates
    c) Controlled slow cooling of the slabs or plates
iv) The sulphur content is 0.004% or less, based upon heat analysis.
v) One or more of the following practices are used:
    a) Electromagnetic stirring during continuous casting
    b) Soft reduction during continuous casting
    c) Heavy pass reductions or other special practices during plate rolling
    d) Combined forging and rolling during plate rolling
vi) The plates are ultrasonically examined in accordance with ultrasonic testing given under Non Destructive Testing with Acceptance Standard “Level C” given in **15.2.4** of this specification and based on continuous scanning over 100% of the plate surface.
vii) The plates are through-thickness tension tested in accordance with ISO 7778.

(*Page* 2, *clause* **6.1**) — Substitute the following for existing clause:

‘The ladle analysis of — material, when carried out either by the method specified in the relevant parts of IS 228/IS 8811 or any other established instrumental/ chemical method shall be as given in Table 1. In case of dispute the procedure given in IS 228 and its relevant parts shall be the referee method**.** However, where the method is not given in IS 228 or it’s relevant parts, the referee method shall be as agreed to between the purchaser and manufacturer.’

(*Page* 2, *clause* **7.1**) — Substitute the following for the existing clause:

‘7.1 Plates above 50 mm in thickness shall be supplied in normalized condition. Plates 50

mm and below in thickness may be supplied in “as-rolled” or “normalized” or “normalizing rolling” or “stress relieved” or “normalized and stress relieved” condition.’

Delete (Clause 8.2, Page2), Retain 8.2.1, 8.2.2, 8.2.3

(*Page* 3, *clause* **9**) — Substitute the following for existing clause:

‘9 DIMENSIONS AND TOLERANCES

9.1 Unless otherwise agreed to between the purchaser and the manufacturer/supplier:

a) the nominal dimensions and tolerances of leveled plates that have been cut to length from strip/coil shall be in accordance with IS 1852.

b) the nominal dimensions and tolerances of plates as rolled from the slab or directly from an ingot shall be in accordance with IS / ISO 7452.

9.2 Rolling Mass

Permissible upper deviation from the theoretical mass shall comply to Table 2. The permissible lower deviation shall be calculated based on the negative tolerance on the thickness as per **9.1**.’

(*Page* 3, *clause* **11**) — Substitute the following for the existing clause:

’**11 SELECTION OF TEST SAMPLES**

11.1 For plates produced from plate mill, one test sample shall be taken in transverse to the rolling direction from one fourth of total width or corner of each plate as-rolled.

11.2 One tensile test shall be taken from each plate as rolled. When plates are produced from strips/coils, three tensile tests from head end, middle and tail end of the strips/coils shall be made from each strips/coils. When plates are produced from strips/coils with heat treatment or with stress relieving, three tensile tests from plates corresponding to head end, middle and tail end of the strips/coils shall be made from each strips/coils. Test sample shall be taken from one fourth of total width or corner of the plate in transverse to the rolling direction.

11.3 When heat-treatment is specified, the test sample shall be taken from the plate in the heat treated condition or from full thickness test sample simultaneously heat treated with the plate.

(*Page* 3, *clause* **12.2**) — Substitute the following for existing clause.

‘**12.2** The tensile strength, yield strength and percentage elongation, when determined in accordance with IS 1608 (Part 1), shall conform to the requirements specified in Table 3, generally using a proportional gauge length Lo = 5.65√So where So is the cross-sectional area of the test piece. Test pieces with a non-proportional gauge length may be used. In such cases the elongation values shall be converted in accordance with IS 3803 (Part 1).’

(*Page* 5, *clause* **15**) — Substitute the following for the existing clause:

‘15 ULTRASONIC TESTING (25 MM THICKNESS AND ABOVE)

15.1 If agreed between the manufacturer and consumer, plates (25 mm thickness and above) shall be tested for ultrasonic testing in accordance with IS 11630. Clause Numbers **4**, **5.3** and **13.1.1** of IS 11630 shall be replaced by clause numbers **15.1.1**, **15.1.2** and **15.1.3** of this specification respectively

Commented [B1]: Justification for change in the clause. Why 50 mm and above? Any international/national reference?

Commented [B2]: Why delete the clause if it is subject to agreement b/w manufacturer and purchaser?

15.1.1 Individuals performing examinations in accordance with this specification shall be qualified and certified in accordance with the requirements of the latest edition of IS 13805 or an equivalent accepted national or international standard. An equivalent standard is one which covers the qualification and certification of candidates which is acceptable to the purchaser.

15.1.2 Plates may be ultrasonically tested before or after the specified heat treatment.

15.1.3 Test reports for Auto Ultrasonic Testing machines may not include the details of the recordable indications listed in clause **7** of IS 11630. Instead they may have separate Ultrasonic Testing Scans representing the plate defects marked on it for better understanding and correlation.

15.2 Acceptance Standards

15.2.1 Acceptance Standard "Level A"

Any area where one or more discontinuities produce a continues total loss of back reflection accompanied by continuous indications on the same plane that cannot be encompassed within a circle whose diameter is 75 mm or 1/2 of the plate thickness, whichever greater, is unacceptable.

15.2.2 *Acceptance Standard "Level B"*

~~Any area where one or more discontinuities produce a continuous total loss of back reflection accompanied by continuous indications on the same plane that cannot be encompassed within a circle whose diameter is 75 mm or 1/2 of the plate thickness, whichever greater, is unacceptable.~~

~~**15.2.3**~~
In addition, two or more discontinuities smaller than described in **15.2.2 ~~–~~1** shall be unacceptable unless separated by a minimum distance equal to the greatest diameter of the larger discontinuity or unless may be collectively encompassed by the circle described in **15.2.~~2~~ 1.**

Commented [B3]: Changes ok?

15.2.4 *Acceptance Standard "Level C"*

Any area where one or more discontinuities produce a continuous total loss of back reflection accompanied by continuous indications on the same plane that cannot be encompassed within a circle whose diameter is 25 mm is unacceptable.

(*Page* 8, *clause* **20.4**) — Substitute the following for existing clause:

'**15.3 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 product(s) may be marked with the Standard Mark.'

(*Page* 8, *clause* **20.4.1**) — Delete.

(MTD 04)

DRAFT AMENDMENT NO.2
To
IS 2062 : 2011 HOT ROLLED MEDIUM AND HIGH TENSILE STRUCTURAL STEEL – SPECIFICATION
(*Seventh Revision*)

(*Page* 2, *clause* **5**, *line* 1) — Substitute 'eleven' *for* 'nine'.

(*Page* 2, *clause* **5**, *line* 2) — Substitute 'E 235' for 'E 250'.

(*Page* 2, *clause* **7.3**) — Substitute the following for the existing clause:

' **7.3** Welding as mentioned in **7.2.1** is not permissible for grade designation E 235C, E 250C, E 275C, E 300 to E 650 material.'

(*Page* 3, *Table* 1) — Substitute the following for the existing table:

Table 1 Chemical Composition
(*Clauses* 5, 8.1 *and* 8.2)

Grade Designation	Quality	Ladle Analysis, Percent, Max					Carbon Equivalent (CE), *Max*	Mode of Deoxidation
		C	Mn	S	P	Si		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E 235	**A**	0.23	1.50	0.045	0.045	0.40	0.42	Semi-killed/killed
	BR B0	0.22	1.50	0.045	0.045	0.40	0.41	Semi-killed/killed
	C	0.20	1.50	0.040	0.040	0.40	0.39	Killed
E 250	**A**	0.23	1.50	0.045	0.045	0.40	0.42	Semi-killed/killed
	BR B0	0.22	1.50	0.045	0.045	0.40	0.41	Semi-killed/killed
	C	0.20	1.50	0.040	0.040	0.40	0.39	Killed
E 275	**A**	0.23	1.50	0.045	0.045	0.40	0.43	Semi-killed/killed
	BR B0	0.22	1.50	0.045	0.045	0.40	0.42	Semi-killed/killed
	C	0.20	1.50	0.040	0.040	0.40	0.41	Killed
E 300	**A BR B0**	0.22	1.50	0.045	0.045	0.45	0.44	Semi-killed/killed
	C	0.20	1.50	0.040	0.040	0.45	0.44	Killed
E 350	**A**		1.60	0.045	0.045	0.45	0.47	Semi-

Commented [B1]: Limit increased for E 350, E 410, E 450 and E 550. Justification?

Commented [B2]: Reference?

Commented [B3]: Justification for change?

	BR	0.20						killed/killed
	B0	0.20	1.60	0.045	0.045	0.45	0.47	Semi-killed/killed
	C	0.20	1.60	0.040	0.040	0.45	0.45	Killed
E 410	**A** **BR** **B0**	0.22	1.65	0.045	0.045	0.45	0.50	Semi-killed/killed
	C	0.20	1.65	0.040	0.040	0.45		Killed
E 450	**A** **BR**	0.22	1.70	0.045	0.045	0.45	0.52	Semi-killed/killed
E 500	**A** **BR**	0.22	1.70	0.025	0.025	0.50	0.53	Semi-killed/killed
E 550	**A** **BR**	0.22	1.70	0.020	0.025	0.50	0.54	Semi-killed/killed
E 600	**A** **BR**	0.22	1.70	0.020	0.025	0.50	0.54	Semi-killed/killed
E 650	**A** **BR**	0.22	1.70	0.015	0.025	0.50	0.55	Semi-killed/killed

Commented [B4]: Justification for change?

Commented [B5]: Reference of other international/national standard from where it has been taken

NOTES

1 New grade designation system based on minimum yield stress has been adopted.

2 For semi-killed steel, silicon shall be less than 0.10 percent. For killed steel, when the steel is killed by aluminium alone, the total aluminium content shall not be less than 0.02 percent. When the steel is killed by silicon alone, the silicon content shall not be less than 0.10 percent. When the steel is silicon-aluminium killed, the silicon content shall not be less than 0.03 percent and total aluminium content shall not be less than 0.01 percent.

3 Steels of qualities A, BR, B0 and C are generally suitable for welding processes. The weldability increases from quality A to C for grade designation E 235, E 250 and E 275.

4 Carbon equivalent (CE) would be calculated based on ladle analysis, only.

CE = C +Mn/6 + (Cr + Mo + V)/5+(Ni + Cu)/15

5 Upto E 350 for designation A and BR, %C upto 0.24 is allowed in case the steel is not microalloyed.

Commented [B6]: Reference?

6 Alloying elements such as Cr, Ni, Mo and B may be added under agreement between the purchaser and the manufacturer. The limit of Cr and Ni, either singly or in combination, shall not exceed 0.50 percent.

Commented [B7]: Similar to note 7. Should it be same as existing note 5 in the standard?

7 Alloying elements such as Cr, Ni, Mo and B may be added under agreement between the purchaser and the manufacturer. The limit of these elements, either singly or in combination, shall not exceed 0.50 percent and 0.60 percent respectively.

8 Copper may be present within 0.20 to 0.35 percent as mutually agreed to between the purchaser and the manufacturer. The copper bearing quality shall be designated with a suffix Cu, for example E 250 Cu. As residual maximum permissible limit of Cu is 0.20%

9 *Incidental element* — Elements not quoted in Table 1 shall not be intentionally added to steel without the agreement of the purchaser, other than for the purpose of finishing the heat. All reasonable precautions shall be taken to prevent the addition from scrap or other materials used in manufacture of such elements which affect the hardenability, mechanical properties and applicability.

10 Nitrogen content of steel shall not exceed 0.012 percent which shall be ensured by the manufacturer by occasional check analysis.

11 The steel, if required, may be treated with calcium based compound or rare earth element for better formability.

12 Lower limits for carbon equivalent and closer limits for other elements may be mutually agreed to between the purchaser and the manufacturer.

(*Page* 4, *Table* 2) — Substitute the following for the existing table:

Table 2 Mechanical Properties
(*Clauses* 5, 10.3, 10.3.1, 11.3.1, 12.2 *and* 12.4)

Grade Designation		**Tensile Strength** R_m, *Min* MPa[1)] (See Note 1)	Yield Stress R_{eH}, *Min* MPa[1)]				**Percentage Elongation A,** *Min* **at Gauge Length, $L_o=5.65\sqrt{A}$**	**Internal Bend Diameter** *Max* (See Note 2)		**Charpy Impact Test** (See Note 3)	
			<=20 mm thick	>20-40 mm thick	>40-100 mm thick	>100 mm thick		<=25 mm thick	>25 mm thick	Temp °C	Min. J
(1)	(2)	(3)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
E 235	**A**	360	235	225	215	195	24	2*t*	3*t*	--	--
	BR									RT	27
	B0									0	27
	C									(-)20	27
E 250	**A**	410	250	240	230	210	23	2*t*	3*t*	--	--
	BR									RT	27
	B0									0	27
	C									(-)20	27
E 275	**A**	430	275	265	255	225	22	2*t*	3*t*	--	--
	BR									RT	27
	B0									0	27
	C									(-)20	27
E 300	**A**	440	300	290	280	250	22	2*t*	--	--	--
	BR									RT	27
	B0									0	27
	C									(-)20	27
E 350	**A**	490	350	330	320	290	20	2*t*	--	--	--
	BR									RT	27
	B0									0	27
	C									(-)20	27
E 410	**A**	540	410	390	380	350	20	2*t*	--	--	--
	BR									RT	25
	B0									0	25
	C									(-)20	25
E 450	**A**	570	450	430	420	390	17	2.5*t*	--	--	--
	BR									RT	25
E 500	**A**	600	500	480	470	440	14	3*t*	--	--	--
	BR									RT	25
E 550	**A**	650	550	530	520	490	12	3*t*	--	--	--
	BR									RT	15
E 600	**A**	730	600	580	570	540	12	3.5*t*	--	--	--
	BR									RT	15
E 650	**A**	780	650	630	620	590	12	4*t*	--	--	--
	BR									RT	15

Commented [B8]: Reference?

Commented [B9]: Reference?

Commented [B10]: Justification for change?

Commented [B11]: Reference for values?

NOTES

1 In case of product thickness/diameter more than 100 mm, lower minimum limit of tensile strength may be mutually agreed to between the purchaser and the manufacturer/supplier.
2 Bend test not required for thickness > 25 mm for grades E 300 to E 650. '*t*' is the thickness of the test piece.
3 For sub-quality BR, impact test is optional; if required, at room temperature (25 ± 2°C).
4. For thickness < 3.0 mm &> 40.0 mm,% minimum elongation may be mutually agreed to in between manufacturer & purchaser
5. Higher minimum value of impact strength may be mutually agreed between manufacturer and purchaser.

[1)] 1MPa = 1N/mm2 = 1MN/m2 = 0.102 kgf/mm2 = 144.4 psi.

Commented [B12]: This may lead to dilution. Justification for the same and reference, if any?

(*Page* 5, *Table* 3, *sl no* i), *col* 2) — Substitute 'a) Carbon ≤ 0.20' *for* 'a) Carbon < 0.20'.

(*Page* 6, *clause* **10.1**) — Substitute the following for the existing clause:

'10.1 Number of Tensile Tests

Number of test samples shall be 2 per cast or 2 per heat. Sample to be taken from minimum and maximum thickness/size manufactured in the cast for a class of steel product irrespective of cast/heat size.'

(*Page* 6, *clause* **11.1**) — Substitute the following for the existing clause:

'**11.1 Number of Bend Test**

Number of bend test shall be 1 per cast or 1 per heat for thickness/size upto 25mm and 1 per cast or 1 per heat for thickness/size above 25mm. In both the cases sample of maximum thickness/size manufactured in the cast shall be tested.

Commented [B13]: There seems to be a typographical error. Please provide justification for changes suggested.

For E 300 & higher strength grade, no bend test is required for > 25 mm as per Table 2.

Commented [B14]: Justification/Reference?

Class of Steel Product	Direction of Bend Tests
Plates strips	Crosswise
Sections	Lengthwise for each type
Flats and bars (round hexagonal, etc)	Lengthwise

'

(*Page* 7, *clause* **12.1.1**, *line* 6) — Insert 'E 235' before 'E 250'.

(*Page* 6, *clause* **20.2**) — Substitute the following for existing clause:

'**15.3 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 product(s) may be marked with the Standard Mark.'

(*Page* 6, *clause* **20.2.1**) — Delete.

Doc : MTD 04 ( )

AMENDMENT NO. 3 TO

IS 15961 : 2012

HOT DIP ALUMINIUM — ZINC ALLOY METALLIC COATED STEEL STRIP AND SHEET (PLAIN)

(*Page* 1, *clause* **1.1** *and* **1.2**) — Substitute the following for the existing clause:

'**1.1** This standard covers the requirement of continuously hot-dip aluminium-zinc alloy metallic coated steel strip and sheet (plain) specification of 0.20 mm to 3.0 mm thick base steel.

1.2 Sheets and coils are produced by uniformly coating over both surfaces of cold rolled steel coil as base as per the coating classes given in Table 2.'

(*Page* 2, *clause* **6(e)**) — Substitute the following for the existing clause:

'(e) Surface treatment condition (passivated, other coating, etc)

Example: IS 15961 – 2012 YS550 AZ150 NT'

(*Page* 3, *clause* **9.5**) — Substitute the following for the existing clause:

'**9.5 Single Spot Coating Mass**

The minimum coating mass on any one of the three specimens used for triple spot test. For products 600 mm in width and narrower, only single spot test is required. Specimens shall be taken at least 10 mm away from strip/sheet edge.'

(Page 3, *Table* **2**) — Substitute the following table for the existing table:

Table 2 Coating Class and Coating Mass
(*Clause* **9.1**)

Sl.No.	**Coating Class**	**Minimum Coating Mass, g/m^2**		
		Total Both Surfaces		One Surface
		Triple Spot	Single Spot	Single Spot
(1)	(2)	(3)	(4)	(5)
i)	AZ200	200	180	80
ii)	AZ180	180	155	72
iii)	AZ165	165	150	66
iv)	AZ150	150	135	60
v)	AZ120	120	105	48
vi)	AZ100	100	90	40
vii)	AZ70	70	63	28

NOTE — 1. As per the mutual agreement between the customer and supplier, the steel strip and sheet with minimum coating mass other than the specified above may be supplied for each coating class. However, in such case, the agreed minimum coating mass shall not be less than the minimum coating mass specified for each of the above coating classes.
2. Coating class for thickness above 1.50 mm shall be AZ 150 or above.

(*Page* 3, *clause* **13.1**) — Substitute the following clause for the existing clause:

'**13.1** Unless otherwise agreed, internal diameter of coils shall be 508 mm or 610 mm (±10 mm).'

AMENDMENT NO. 1 APRIL 2020

TO

IS 15965 : 2012 PRE-PAINTED ALUMINIUM ZINC ALLOY METALLIC COATED STEEL STRIP AND SHEET (PLAIN)

(*Page* 3, *clause* **8.7**, *line* 2) — Substitute 'method 6B of ISO 2808' for 'method 5B of ISO 2808'.

(*Page* 6, *clause* **16.2**) — Substitute the following for the existing clause:

'**16.2 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 product(s) may be marked with the Standard Mark.'

(*Page* 6, *clause* **16.2.1**) — Delete.

(MTD 04)

Doc : MTD 04 ( )

AMENDMENT NO. 1 TO

IS 14246 : 2013

CONTINUOUSLY PRE-PAINTED GALVANIZED STEEL SHEETS AND COILS (*First Revision*)

(*Cover page and Page 1, Title*) — Substitute the following for the existing title:

'Continuously pre-painted galvanized steel strip and sheet (*First Revision*)'

(*Foreword*, *para* 6) — Substitute 'Annex C' *for* 'Annex B'

(*Page* 1, *clause* **1.3**) — Insert following new clause after clause **1.2**:

'This standard covers requirements for different classes of durability of paint coatings in accordance with the severity of the application.'

(*Page* 1, *clause* **2**) — Insert the following rows at the end of the table:

'101 (Part 5/Sec 1) : 1988	Methods of sampling and test for paints, varnishes and related products Part 5 Mechanical test on paint films Section 1 Hardness test
ISO 4628-2 : 2003	Paints and varnishes Part 2 Assessment of degree of blistering'

(*Page* 1, *Table* 1, *Note*) — Substitute the following for the existing:

'Different top paint system gives different paint durability at given exposure. Paint systems with higher paint durability are for long term colour and gloss retention requirement. Class 3 denotes products with paint durability better than that of class 2.'

(*Page* 2, *clause* **6.1**, *line* 3) — Substitute '25 t' *for* '10 t'

(*Page* 2, *clause* **6.3.1**) — Substitute the following clause for the existing:

'Standard pencils of hardness as given in Table 2 should be used for pencil hardness test as per IS 101 (Part 5/ Sec 1)'

(*Page* 3, *clause* **6.4.3**) — Insert following new clause after clause **6.4.2**:

'**6.4.3** The test is applicable for minimum base cold rolled steel thickness of 0.40 mm.'

(*Page* 3, *clause* **8**) — Substitute the following for the existing clause:

'The test shall be carried out in accordance with IS 9844 for the duration as given in Table 1. Requirements given in Table 4 are to be met with when tested for duration (h) specified in Table 1.'

(*Page* 3, *clause* **8**) — Insert following new table after the clause:

Table 4 Requirements for Salt Spray Resistance

(*Clause* 8)

Sl No.	Type of deterioration	Method of Test, Ref to	Requirement
(1)	(2)	(3)	(4)
i)	Undercut at scribed lines	B-1	Rating of 2.0 or less with no corrosion of base metal, no red dust formation
ii)	Corrosion of the base metal	B-2	Rating 0
iii)	Blistering	B-3	Not worse than rating 2(S3)

(*Page* 4, *clause* **10.3,** *line* 2) — Substitute 'Table 5' *for* 'Table 4'

(*Page* 4, *Table* 4) – Renumber as Table 5.

(*Page* 6, *Annex* A) — Insert the following new Annex after Annex A:

ANNEX B

(*Clauses* 8 and *Table* 4)

METHODS OF ASSESSMENT OF SALT SPRAY AND HUMIDITY TEST RESULT

B-1. UNDERCUT AT SCRIBED LINES

B-1.1 This method describes the assessment of the degree of deterioration for a metal substrate that has been coated by a paint system.

B-1.2 Principle

Coated test panels are exposed to an accelerated corrosive (Salt Spray Test) or humid (Humidity Test) environment. The corrosion on the surface of the paint film and on the metal surface beneath the paint film is assessed by comparison with photographic reference standards and rating table.

B-1.3 Procedure

a) Remove loose corrosion products and any coating that has lost adhesion from the vicinity of the scribed line by scraping with a metal spatula or dull knife.

b) Rate the mean creepage of undercut corrosion or loss of paint extending from the scribed line, as prescribed in Table 7.

Table 7 Rating for Failure at Scribe and Panel Edge

Rating Scale	Representative Mean Creepage of Under Film Corrosion from Scribed Line mm
(1)	(2)
0	0
1	> 0 ≤ 1.0
2	> 1.0 ≤ 3.0
3	> 3.0 ≤ 7.0
4	> 7.0 ≤ 13.0
5	> 13

B-2CORROSION OF THE BASE METAL

B-2.1 This method describes the assessment of the degree of deterioration for a metal substrate that has been coated by a paint system.

B-2.2 Principle

Coated test panels are exposed to an accelerated corrosive environment. The corrosion on the metal

surface beneath the paint film is assessed by comparison with photographic reference standards.

B-2.3 Procedure

c) Carefully remove a portion or whole of the paint film using a suitable solvent-based paint remover.

d) Determine the severity of corrosion by referring to the pictorial standards in the following Fig. 2.

B-3 BLISTERING

B-3.1 This Annex sets out a method for determining the degree of blistering in a paint film exposed to accelerated weathering conditions.

B-3.2 Principle

The test is visually evaluated for the degree of blistering by comparing with diagram reference standards, which shows rated stages of blistering.

NOTE — The diagram reference standards have been adopted from ISO 4628-2.

B-3.3 Apparatus

Diagram standards (*see* Fig. 3, 4 and 5) — required for comparison with the test film.

B-3.4 Viewing Environment

Examination of the films should be carried out under lighting conditions of at least 500 lux or lumen/m^2.

B-3.5 Procedure

e) Visually examine the test film by comparing the surface finish with the reference diagram standards (*see* **B-3.2**) that shows a similar amount of blistering.

f) Using Table 8 determine the rating for density of blistering and Table 9 for the size of blistering.

g) Record the rating as for example 2(S3) where 2 stands for density and S3 stands for size of blister.

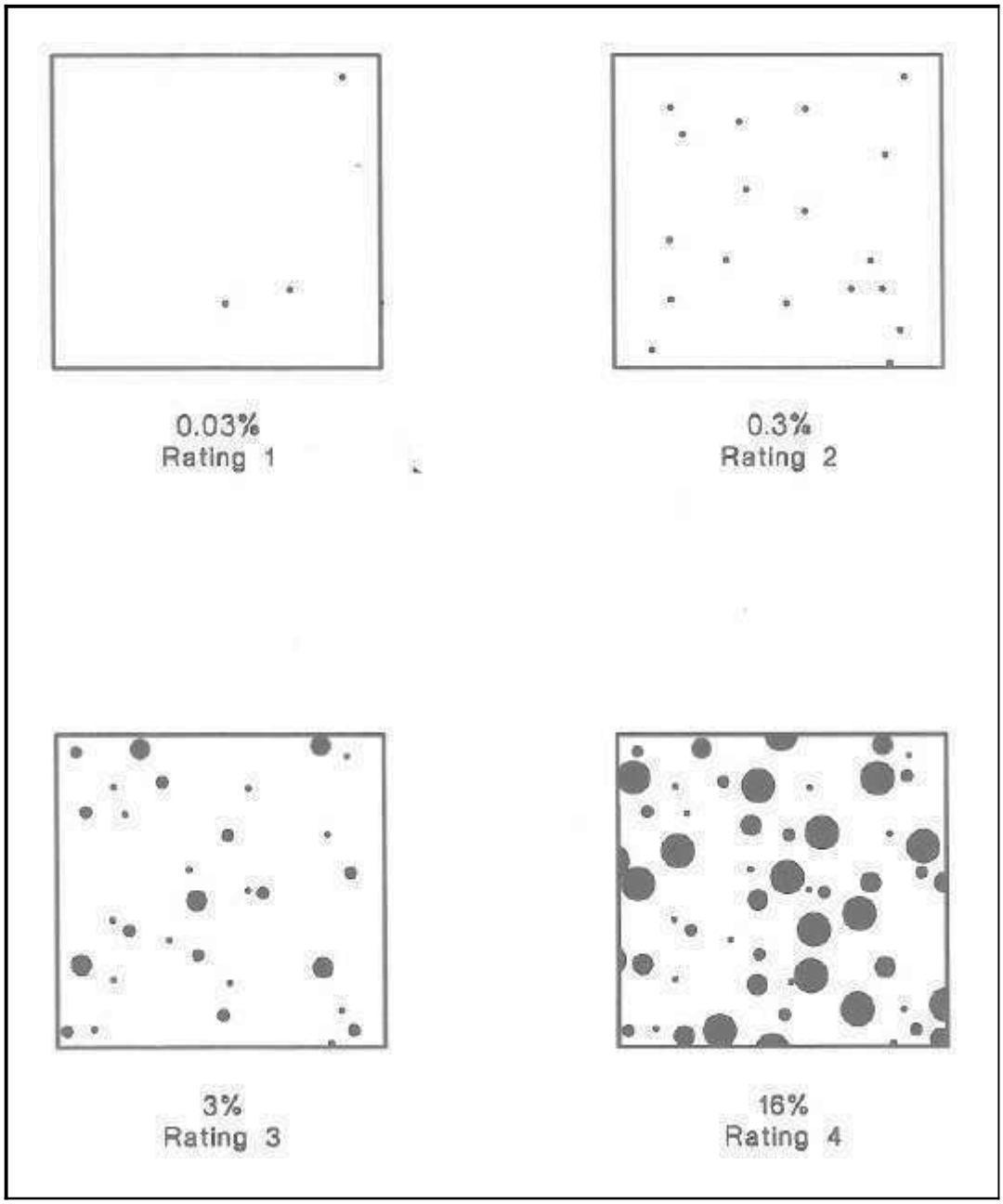


FIG. B1 TYPICAL CORROSION ON THE STRIPPED METAL SUBSTRATE

Table 8 Rating for Density of Blistering
(*Clause* B-3.5)

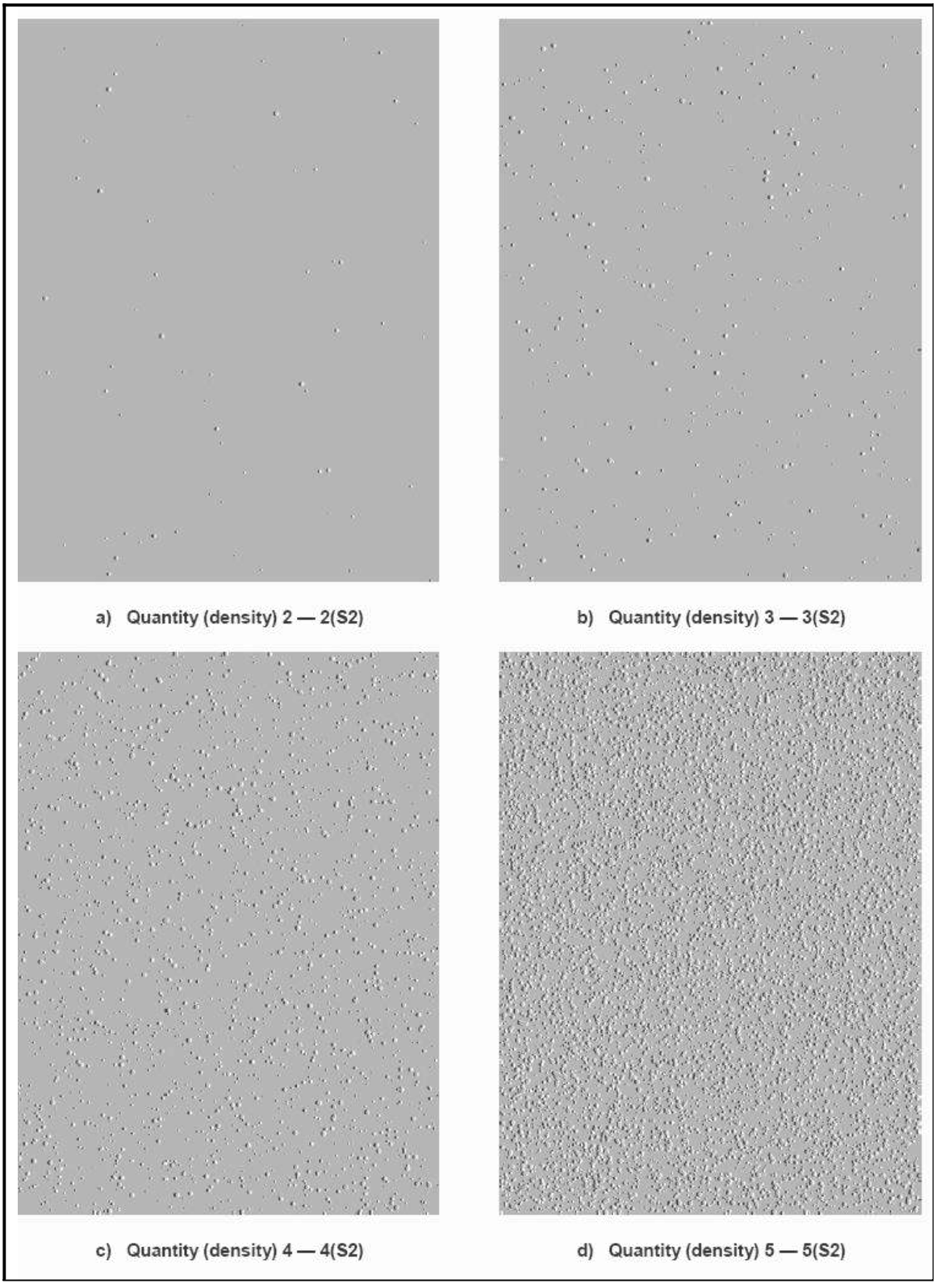
Rating Scale[1)]	Density of Blistering
0	None
1	Less than few
2	Few
3	Medium
4	Medium-dense
5	Dense

[1)] The rating scale conforms to current ISO practice.

Table 9 Rating for Size of Blisters
(*Clause* B-3.5)

Rating Scale[1)]	Size of Blistering
1	Finer than in Fig. 3
2	See Fig. 3
3	See Fig. 4
4	See Fig. 5

[1)] The rating scale conforms to current ISO practice.



a) Quantity (density) 2 — 2(S2)

b) Quantity (density) 3 — 3(S2)

c) Quantity (density) 4 — 4(S2)

d) Quantity (density) 5 — 5(S2)

FIG. 3 BLISTERS OF SIZE 2

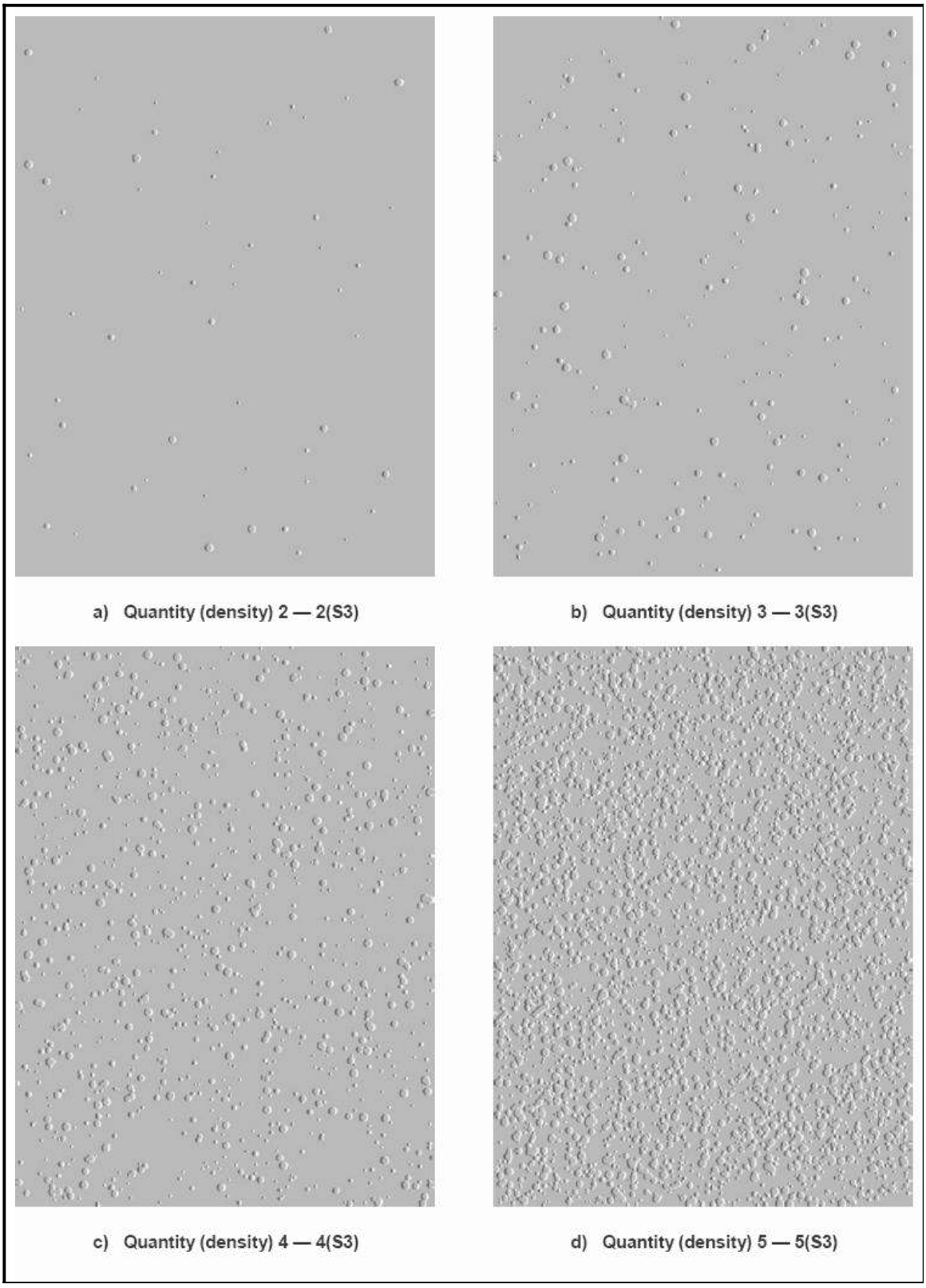


FIG. 4 BLISTERS OF SIZE 3

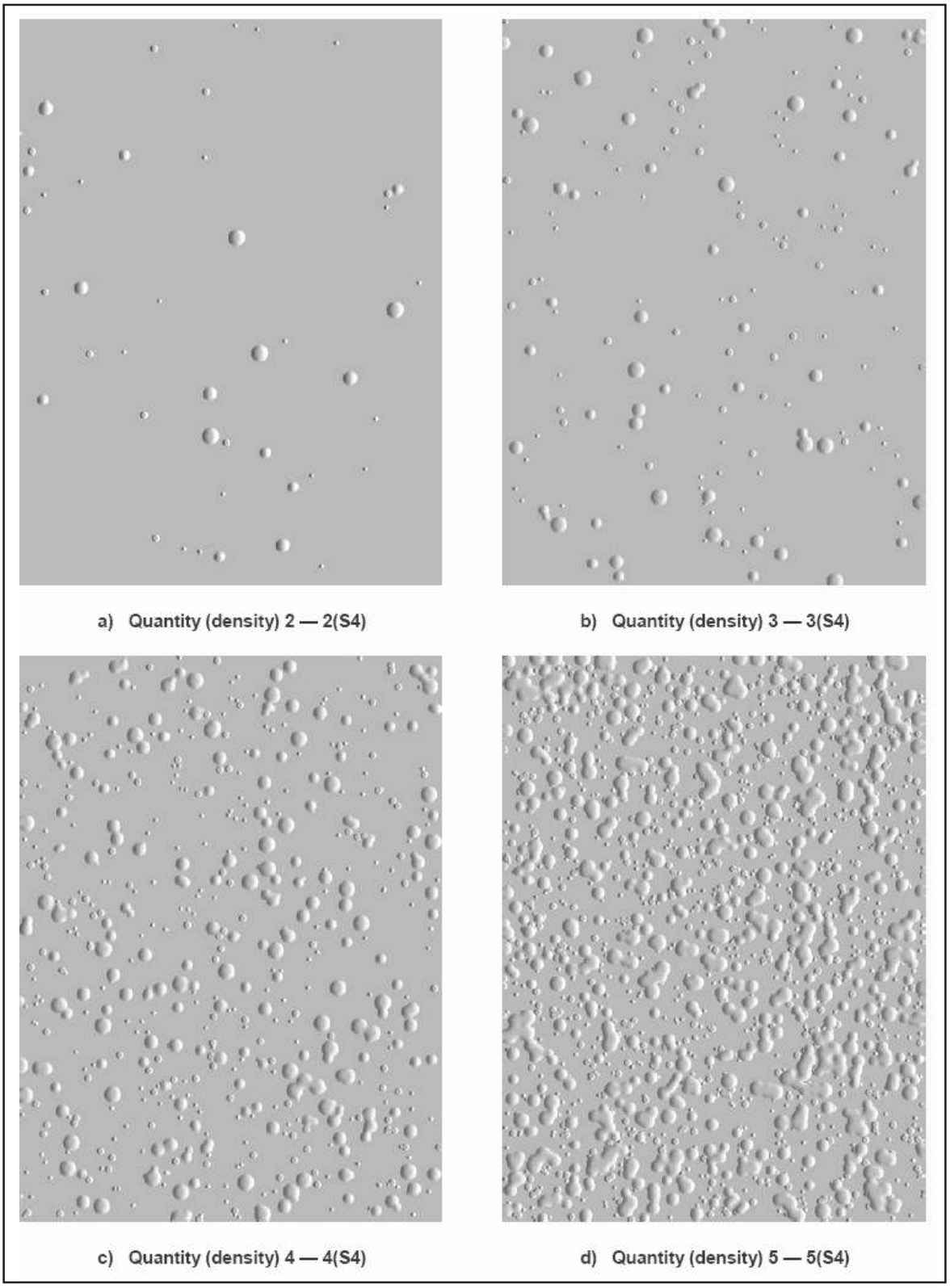


FIG. 5 BLISTERS OF SIZE 4

(*Page* 7, *Title*) – Substitute ‘Annex C’ for ‘Annex B’.

Appendix-21

BUREAU OF INDIAN STANDARDS

Draft AMENDMENT NO. 5
TO
IS 649 : 1997 METHODS OF TESTING STEEL SHEETS FOR MAGNETIC CIRCUITS OF POWER ELECTRICAL APPARATUS
(*Second Revision***)**

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[*Page* 21, *clause* **49**, *Sub heading*] — Insert Sub heading after the heading of the clause:

'Method 1'

[~~(~~*Page* 21, *clause* **49**, *line* 3 (*see also Amendment No.* 3)]~~)~~ — Substitute the following for the sentence:

'It is intended for Non-oriented electrical sheet or strip covered under IS 648 and Grain oriented electrical sheet and strip covered under IS 3024' for 'It is intended for grain oriented and non-oriented electrical sheet or strip' ~~'It is intended for non-oriented electrical sheet or strip covered under IS 648 : 1994~~'.

(*Page* 21, *clause* **50**, *line* 8) — Substitute ~~the~~ following for the existing sentence:

'measure of the ductility' *for* 'measure of the brittleness'

(*Page* 22, clause **52.4**) — Insert the following at the end of the clause:

'In case of grain oriented sample along the long axis i.e, in the direction of rolling only to be considered'

(*Page* 22, *clause* **53.1**) — Substitute following for the existing FIG . 9 ~~Replace the image as mentioned as Fig 9 and addition of test condition~~

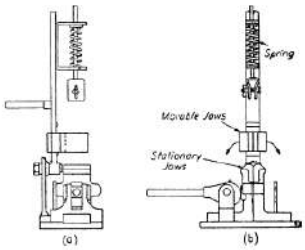

FIG. 9 APPARATUS FOR BEND TEST

(*Page* 22, clause **51.3**, ***line* 3**) — Insert the following at the end of the clause:

'Test is carried out under controlled conditions shall be made at a temperature of 27 ± 5 ºC'
~~'Test is carried out under controlled conditions shall be made at a temperature of 27 ± 5 ºC.'~~

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Appendix-21

(*Page* 22, *clause* **53.2**) — ~~Replace the image as mentioned as Fig 10~~ Substitute following for the existing FIG.10

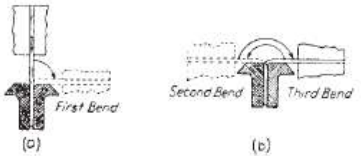

FIG.10 Diagram Illustrating Method of Making Bends and Arrows indicate the count – stating as first bend , second bend etc.

(*Page* 22, *clause* **53.2**, *line* 6) — Substitute 'bend' *for* 'bent'

(*Page* 22, *clause* **53.3**) — Substitute ~~the~~ following for the existing clause

'**53.3** Bend at a uniform rate without shock. If necessary, reduce the rate of bending to ensure that heat generated does not affect the result of the test'

(*Page* 22, *clause* **53.4**) — Insert new clause

'**53.4** Do not interrupt the testing between successive bends if the fracture / crack or failure has not occurred'.

(*Page* 22, *clause* **53.5**) — Insert new clause

'**53.5** First 90° bend is counted as "First Bend", then when sample is bend through 180° in reverse direction as "Second Bend" and again when the it is bend through 180° in the first direction as "Third Bend" (as shown in Fig 10) and so on till the fracture / crack appears.'

(Page 22, *clause* **55***)* — Insert the following at the end of the clause~~Insert at the end~~:

'It can be used as an alternative method to Method 1, in case ~~of~~ full width evaluation is required and agreed between manufacturer and supplier.'

[*Page* 22, *clause* **55**, *Annex A, A-1, last line* (*see also Amendment No.* 2)] — Substitute following for the existing sentence:

'measure of the ductility' *for* 'measure of the brittleness'

[*Page* 22, *clause* **55**, *Annex A, A-4.1, last line* (*see also Amendment No.* 2)] — Insert following at the end of the clause:

'Test is carried out under controlled conditions shall be made at a temperature of 27 ± 5 ºC'

(Page 23, *clause* **61.3***)* — Substitute the following for the existing clause:

'When evaluating steel strip narrower than 610 mm-, method 1 can be used to determine the ductility.'

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Appendix 22

For Comments Only **Doc : MTD 04 (13189)W**

BUREAU OF INDIAN STANDARDS

Draft **AMENDMENT NO. 2**
TO
IS 513 (PART 1) : 2016 COLD REDUCED CARBON STEEL SHEET AND STRIP
PART 1 COLD FORMING AND DRAWING PURPOSE
(*Sixth Revision*)

Last date for received of comments is 24 11 2018

(*Page* 4, Table **3**, *Note* 4) — Substitute the following for the existing Note:

'**4** The steel can be made with micro-alloying elements like niobium, vanadium, titanium and boron either individually or in combination , on mutual agreement in which case the total micro-alloying elements shall not exceed 0.25 percent in ladle analysis. However, in case of boron, the limit shall be 0.006 percent maximum.'

(Page 6, Table 5A) – Substitute 'Gauge Length - 50 mm (Width – 12.5 mm)' for 'Gauge Length - 50 mm'.

(Page 7, Table 5B) – Substitute 'Gauge Length - 50 mm (Width – 12.5 mm)' for 'Gauge Length - 50 mm'.

(Page 8, Table 5C) – Substitute 'Gauge Length - 50 mm (Width – 12.5 mm)' for 'Gauge Length - 50 mm'.

(Page 6, Table 5A, Note 12) – Insert the following after NOTE 12:

'13. Elongation values for gauge length 50 mm and width 25 mm shall be calculated as per IS 3803 (Part 1)'.

(Page 8, Table 5C, Notes for Table 5B and 5C) – Insert the following after NOTE 10:

'11. Elongation values for non-proportional cross-sectional area of test piece other than the values specified in the table shall be calculated as per IS 3803 (Part 1)'

(MTD 04)

AMENDMENT NO. 1 TO

IS 513 (Part 2) : 2016

COLD REDUCED CARBON STEEL SHEET AND STRIP
PART 2 HIGH TENSILE AND MULTI-PHASE STEEL

(*Page* 6 *and* 7, Table 4A) – Substitute ‘Gauge Length - 50 mm with width –12.5 mm’ for ‘Gauge Length - 50 mm’

(*Page* 8, Table 4B, Notes for Table 4A and 4B) – Insert the following after NOTE **8**: ‘Elongation values for non-proportional cross-sectional area of test piece other than the values specified in the table shall be calculated as per IS 3803 (Part 1)’

AMENDMENT 3 TO IS 10748 : 2004 HOT ROLLED STEEL STRIP FOR WELDED TUBES AND PIPES - SPECIFICATION

(*Second Revision*)

(*Page* 2, *Table* 1) — Substitute the following for existing table:

Table 1 Chemical Composition

(*Clauses* 7.1 *and* 7.2)

Grade	**Constituent, Percent, *Max***				**Carbon Equivalent**
	Carbon	Manganese	Sulphur	Phosphorous	**(CE), *Max***
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
1	0.10	0.50	0.040	0.040	—
2	0.12	0.80	0.040	0.040	—
3	0.16	1.20	0.040	0.040	—
4	0.20	1.30	0.040	0.040	—
5	0.25	1.30	0.040	0.040	—
6	0.25	1.30	0.040	0.040	—
7	0.25	1.50	0.040	0.040	—
8	0.25	1.65	0.040	0.040	—

NOTES

1 CE based on ladle analysis= C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15
2 For semi-killed quality. silicon content shall be 0.08 percent, maximum.
3 When the steel is killed by aluminium alone, the total aluminium content shall not be less than 0.02 percent. When the steel is killed by silicon alone, the silicon content shall not be less than 0.10 percent. When the steel is silicon-aluminium killed, the silicon content shall not be less than 0.03 percent and total aluminium content shall not be less than 0.01 percent.
4 Micro-alloying may be allowed subject to mutual agreement between the purchaser and the supplier. Micro-alloying elements like Nb. V or Ti, when used individually or in combination, the total content shall not exceed 0.20 percent.
5 Nitrogen content of steel shall not exceed 0.012 percent, which shall be ensured by the manufacturer by occasional check analysis.
6 Closer limits of composition may be agreed to between the supplier and the purchaser

(*Page* 2, *Table* 1) — Substitute the following table for the existing:
‘

Table 3 Tensile Properties

(*Clauses* 8.3 *and* 9.2.4)

Grade	**Tensile Strength *Min*, MPA**	**Yield Stress *Min*, MPA**	**Percentage Elongation Minimum at gauge length $5.65\sqrt{So}$**	**Internal Diameter of Bend**
(1)	(2)	(3)	(4)	(5)
1	290	170	30	t
2	330	210	28	2t
3	410	240	25	2t
4	430	275	22	3t
5	450	310	22	3t
6	490	355	22	3t
7	540	410	20	4t
8	570	450	20	4t

NOTES

1. t = Nominal thickness of the test piece

2. 1 Mpa = 1 N/mm2 =0.1020kgf/mm2
3. Mechanical properties other than those specified in the table may be as per the agreement between the purchaser and the manufacturer for specific application.

(*Page* 4, *clause* **16.2**) — Substitute the following for the existing clause:

‘16.2 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 product(s) may be marked with the Standard Mark.’

(*Page* 4, *clause* **16.2.1**) — Delete.

AMENDMENT NO. 1
TO
IS 11513 : 2017
Hot rolled carbon steel strip for cold rolling purposes (Second Revision)

Addition to Scope – Add clause 1.2

"This standard does not cover Hot Rolled Coils, intended for manufacture of grades as defined in Table 1 of IS 648 or any CRNO products".

Panel	Title/Scope	Composition			
		Sl.No.	**Organization**	**Representative**	**Role**
Panel- 1	For Clarifications on all items/issues falling under the scope of MTD 4, except on electrical steels and steel used for automotive applications	1	Tata Steel	Dr Sandip Bhattacharya	Convenor
		2	SIAM	Mr Sushil Kumar	Member
		3	Tata BlueScope	Mr Rajesh Maheshwari,	Member
		4	CBB	Mr T.S.G.Narayanan,	Member
		5	RDCIS	Mr D. Karmarkar	Member
		6	RINL	Mr Sanjay Roy,	Member
		7	SAIL,BSL	Mr A. Dasgupta,	Member
		7	JSW	Mr. S Chakrabarty	Member
		9	JSW	Mr Devasish Mishra,	Member
		10	SAIL, BSP	Mr Sandip Chaudhary,	Member
		11	Essar Steel	Mr Deepak Gupta,	Member
		12	INSDAG	Dr Jayanta K Saha	Member
		13	CORSMA.	Mr Arvind Mishra	Member
		14	SWMAI	Mr Nirmal Saraf	Member
		15	ITMA	Mr V.C.Singhal	Member
		16	Vardhman Special steel ltd	Mr Dinesh Singh	Member
		17	Deepak Kumar Sahoo	Mr Deepak Kumar	Member
Panel-2	Provide clarifications on all items/issues pertaining to electrical steels, falling under the scope of MTD 4	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Thyssenkrup	Mr Kapil Kapoor,	Convenor
		2	SAIL,RSP	Mr C. Muthuswamy,	Member
		3	CPRI	Mr. Kishore Kumar	Member
		4	Power Grid	Mr K K Tyagi	Member
		5	CEA	MrA.K. Rajput	Member
		6	BHEL	Representative	Member

		7	JSW, Bellary	Mr Devasish Mishra,	Member
		8	ITMA	Mr V.C.Singhal	Member
		9	RDCIS, SAIL	Mr B Sarkar	Member
		10	Posco electrical	MrManoj Mhatre	Member
		11	Hitachi Metals	Mr Thukaram K	Member
Panel 3	Constituted to provide clarifications on all steel used for automobiles .	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Tata Steel	Mr Avtar Singh	Convenor
		2	CORSMA	Mr Arvind Mishra	Member
		3	Tata Bluescope	Mr Rajesh Maheshwari	Member
		4	SIAM	Mr Sushil Kumar	Member
		5	JSW	Mr Devasish Mishra	Member
		6	Essar Steel	Mr Deepak Gupta	Member
		7	Bokaro Steel	Mr A. Dasgupta	Member
		8	ITMA	Mr V.C.Singhal	Member
		9	RDCIS, SAIL	Dr Anjana Deva	Member
		10	Tata Motors	Mr B.R.Galgali	Member
		11	Maruti	Mr Kanchan Srivastav	Member
		12	Posco Maharashtra	Representative	Member
		13	Volkswagen	Dr Sanjay Arole	Member
Panel 4	Revision of IS 1875	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	SAIL (RDCIS)		Convenor
		2	RINL	Mr Sanjay Roy	Member
		3	JSW	Debashish Mishra	Member
		4	Kalyani Carpenter Special Steel Ltd, Pune	Mr P.K. Biswal	Member
		4	Vardhman Steel	Mr Dinesh Singh	Member
		6	CQA(metals)	Dr M Krishnamurthy	Member

		7	Member from DSP	Mr A.Dasgupta	Member
Panel 5	To examine IS 2002 and IS 2041 and the corresponding ISO 9328 (in various parts) with a view to adopt ISO standards as Indian Standards, within a time period of 6 months	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	SAIL, DSP	Mr A.Dasgupta	Convenor
		2	ANMS	Mr Deepak Gupta	Member
		3	JSPL	Mr Ashwani Kumar	Member
		4	JSW	Debashish Mishra	Member
		5	Tata Steel.	Avtar Singh Saini	Member
		6	INSDAG	Dr Jayanta K Saha	Member
Panel-6	Revision of IS 2830 : 2012 Carbon steel cast billet ingots, billets, blooms and slabs for re-rolling into steel for general structure purposes (third revision)	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	JSW	Debashish Mishra	Convenor
		2	RDCIS	B Sarkar	Member
		3	ANMS	Deepak Gupta	Member
		4	JSPL	Ashwani Kumar	Member
		5	DSP	A Dasgupta	Member
		6	RINL	Sanjoy Roy	Member
		7	NIST	P.K.Bagchi	Member
		8	INSDAG	Jayanta K Saha	Member
		9	Tata Steel	B.Ghosh	Member
		10	RDCIS	S.K.De	Member
Panel-11	Provide clarifications on all steel used for automobiles.	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Tata Steel	Mr Avtar Singh	Convenor
		2	CORSMA.	Mr Arvind Mishra	Member
		3	Tata Bluescope	Mr Rajesh Maheshwari	Member
		4	SIAM	Mr Sushil Kumar	Member
		5	JSW	Mr Devasish Mishra	Member

		6	Essar Steel	Mr Deepak Gupta	Member
		7	Bokaro Steel	Mr A. Dasgupta	Member
		8	ITMA	Mr V.C.Singhal	Member
		9	RDCIS, SAIL	Mr S K Shukla	Member
		10	Tata Motors	New Nomination	Member
		11	Maruti	MR Kanchan Srivastav	Member
		12	Posco	Mr Jagadeesh Nandam	Member
		13	Volkswagen	Mr Dinesh Joshi	Member
		14	IZA	Mr.Kenneth De Souza	Member
Panel-12	Raw material for Electrical Steel - formulate standard on hot rolled coil for electrical steel (CRNO).	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	ThyssenKrupp Electrical Steel India Pvt Ltd	Mr Kapil Kapoor	Convenor
		2	Essar Steel, Surat	Mr Deepak Gupta	Member
		3	JSW	Mr Devasish Mishra	Member
		4	SAIL, RSP, Rourkela	Mr Muthuswamy	Member
Panel 13	Revision of IS 3039	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Essar Steel	Mr Deepak Gupta	Convenor
		2	JSPL, Chhattisgarh	Mr M Borkar	Member
		3	SAIL, Bokaro Steel, Bokaro	Mr A. Dasgupta	Member
		4	SAIL, Bhilai Steel Plant, Bhilai	Mr Sandip Choudhury/Mr K. L. Balasubramanian	Member
Panel 14	revision of IS 8951.	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	SAIl RDCIS, Ranchi	Mr D.Karmakar	Convenor
		2	Tata Steel Jamshedpur	Mr Biswajit Ghosh	Member
		3	RINL, Visakhapatnam	Mr P.K.Sen	Member

		4	Steel Wires manufacturer association	Mr Nirmal Saraf, Mr Deshmukh	Member
Panel 15	Formulation of a new standard for raw material for API 5L pipes	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Essar Steel	Mr Deepak Gupta	Convenor
		2	JSW Steel Ltd	Mr Devasish Mishra	Member
		3	Tata Steel	Mr Avtar Singh Saini	Member
		4	JSPL	Mr M Borkar	Member
		5	RSP	Mr A Dasgupta	Member
Panel 17	Harmonization of Indian Standard with ISO standards -- Work out for ISO 630-1 to 6, ISO 4950-1 to 3, ISO 4951-1 to 3, ISO 6930-1 & 2	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	JSW	Debashish Mishra	Convenor
		2	RINL	G. Rajaraman	Member
		3	Jindal Steel & Power Ltd	Mr M Borkar	Member
		4	TATA STEEL	Avtar Singh Saini	Member
		5	INSDAG	Mr Jayanta Saha	Member
		6	SAIL, BSP	Mr Balasubramanium	Member
		7	Tata Bluescope ltd.	Mr Rajesh Maheshwari	Member
		8	RDCIS, SAIL, Ranchi	Mr Sarkar	Member
		9	Powergrid	Mr Deepak Sahoo	Member
Panel 18	To review IS standards viz-a-viz IEC standard and give suggestion for harmonization of IS with IEC standards	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Thyssenkrup	Mr Kapil Kapoor,	Convenor
		2	JSW, Bellary	Mr Devasish Mishra	Member
		3	Posco electrical	Mr Manoj Mhatre	Member
		4	Personal capacity	Mr Vipin Singhal	Member
Panel 19		**Sl.No.**	**Organization**	**Representative**	**Role**
		1	INSDAG	Mr Jayanta K Saha	Convenor

	Revision of IS 11587:1986 Structural weather resistant steels	2	Essar Steel	Mr Deepak Gupta	Member
		3	SAIL, RSP	Mr A Dagupta	Member
		4	Tata Steel	Mr Avtar Singh	Member
		5	JSW, Bellary	Mr Devasish Mishra	Member
		6	JSPL	Mr M Borkar	Member
		7	RDSO	Representative	Member
Panel 20	Raw material viz Billet, ingot, slab for manufacturing HR coils as per IS 1079,IS 5986,11513	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	JSW	Mr Devashish Mishra	Convenor
		2	Essar steel	Mr Deepak Gupta	Member
		3	SAIL, RDCIS	Mr B Sarkar	Member
		4	SAIL, RSP	Mr A Dasgupta	Member
		5	Tata Steel	Mr Avtar Singh	Member
Panel 22	Review of IS 14246, IS 15961 and IS 15965 standards	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Tata steel	Mr Avtar Singh-	Convenor
		2	Tata Bluescope	Mr Rajesh Maheshwari	Member
		3	CORSMA	Mr Sood/ Mr Arvind Mishra	Member
		4	Essar Steel	Mr Hemant Pandhare	Member
		5	IZA	Mr Kenneth de Souza/ Mr Rahul	Member
		6	INSDAG	Mr Jayanta K Saha	Member
		7	JSW Precoated	Mr Anil Patil	Member
		8	Bhushan steel	Mr Paul	Member
		9	American Precoated steel	Dr Shubh Gautam	Member
Panel 25	Revise IS 2549	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Ministry of Steel	Shri Parmjeet Singh	Convenor
		2	IZA	Shri Kenneth De Souza	Member

		3	Tata Steel	Shri Sudipto Sarkar	Member
		4	Shipbreaking	Mr Nagar Seth,	Member
		5	MSTC		Member
		6	Materials Recycling Association of India (MRAI)		Member
		7	DGFT		Member
		8	In individual capacity	Shri ACR Das	Member
Panel 26	To prepare draft revision of IS 15911	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	INSDAG	Dr Jayanta K Saha	Convenor
		2	SAIL, Rourkela	B Sarkar (CGM Quality)	Member
		3	JSW	G V Ramana	Member
		4	DSP	Mr A. Dasgupta	Member
		5	RDCIS, SAIL.	S Srikanth	Member
Panel 27	Coated Steel for general engineering and automobile applications	1	i) Tata Steel	Avtar Singh Saini	Convenor
		2	ii) SIAM		Member
		3	iii) ANMS	Deepak Gupta	Member
		4	iv) Posco Maharashtra		Member
		5	v) JSW	Debashish Mishra	Member
		6	vi) NML		Member
		7	vii) 1 user (appliance/solar panel manufacturer)		Member
Panel 28	New standard on Wear & Abrasion resistant steel plates	1	ANMS	Deepak Gupta	Convener
		2	JSW	Debashish Mishra	Member
		3	Volvo	Details to be provided by Panel Convener within a week time	Member
		4	Tata Hitachi		Member
		5	Caterpillar		Member

		6	JCB		Member
Panel 29	Concerns on track shoe sections covered in IS 2062	1	JSW		Convener
		2	SAIL-ISP	Sh S K De	Member
		3	Personal capacity	Dr Raman Dutta	Member
		4	L&T		Member

Panel	Title/Scope	Composition			
		Sl.No.	**Organization**	**Representative**	**Role**
Panel-1	For Clarifications on all items/issues falling under the scope of MTD 4, except on electrical steels and steel used for automotive applications	1	Tata Steel	Dr Sandip Bhattacharya	Convenor
		2	SIAM	Mr Sushil Kumar	Member
		3	Tata BlueScope	Mr Rajesh Maheshwari,	Member
		4	CBB	Mr T.S.G.Narayanan,	Member
		5	RDCIS	Mr D. Karmarkar	Member
		6	RINL	Mr Sanjay Roy,	Member
		7	SAIL,BSL	Mr A. Dasgupta,	Member
		7	JSW	Mr. S Chakrabarty	Member
		9	JSW	Mr Devasish Mishra,	Member
		10	SAIL, BSP	Mr Sandip Chaudhary,	Member
		11	Essar Steel	Mr Deepak Gupta,	Member
		12	INSDAG	Dr Jayanta K Saha	Member
		13	CORSMA.	Mr Arvind Mishra	Member
		14	SWMAI	Mr Nirmal Saraf	Member
		15	ITMA	Mr V.C.Singhal	Member
		16	Vardhman Special steel ltd	Mr Dinesh Singh	Member
		17	Deepak Kumar Sahoo	Mr Deepak Kumar	Member
Panel-2	Provide clarifications on all items/issues pertaining to electrical steels, falling under the scope of MTD 4	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Thyssenkrup	Mr Kapil Kapoor,	Convenor
		2	SAIL,RSP	Mr C. Muthuswamy,	Member
		3	CPRI	Mr. Kishore Kumar	Member
		4	Power Grid	Mr K K Tyagi	Member
		5	CEA	MrA.K. Rajput	Member
		6	BHEL	Representative	Member

		7	JSW, Bellary	Mr Devasish Mishra,	Member
		8	ITMA	Mr V.C.Singhal	Member
		9	RDCIS, SAIL	Mr B Sarkar	Member
		10	Posco electrical	MrManoj Mhatre	Member
		11	Hitachi Metals	Mr Thukaram K	Member
Panel 3	Constituted to provide clarifications on all steel used for automobiles .	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Tata Steel	Mr Avtar Singh	Convenor
		2	CORSMA	Mr Arvind Mishra	Member
		3	Tata Bluescope	Mr Rajesh Maheshwari	Member
		4	SIAM	Mr Sushil Kumar	Member
		5	JSW	Mr Devasish Mishra	Member
		6	Essar Steel	Mr Deepak Gupta	Member
		7	Bokaro Steel	Mr A. Dasgupta	Member
		8	ITMA	Mr V.C.Singhal	Member
		9	RDCIS, SAIL	Dr Anjana Deva	Member
		10	Tata Motors	Mr B.R.Galgali	Member
		11	Maruti	Mr Kanchan Srivastav	Member
		12	Posco Maharashtra	Representative	Member
		13	Volkswagen	Dr Sanjay Arole	Member
Panel 4	Revision of IS 1875	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	SAIL (RDCIS)		Convenor
		2	RINL	Mr Sanjay Roy	Member
		3	JSW	Debashish Mishra	Member
		4	Kalyani Carpenter Special Steel Ltd, Pune	Mr P.K. Biswal	Member
		4	Vardhman Steel	Mr Dinesh Singh	Member
		6	CQA(metals)	Dr M Krishnamurthy	Member

		7	Member from DSP	Mr A.Dasgupta	Member
Panel 5	To examine IS 2002 and IS 2041 and the corresponding ISO 9328 (in various parts) with a view to adopt ISO standards as Indian Standards, within a time period of 6 months	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	SAIL, DSP	Mr A.Dasgupta	Convenor
		2	ANMS	Mr Deepak Gupta	Member
		3	JSPL	Mr Ashwani Kumar	Member
		4	JSW	Debashish Mishra	Member
		5	Tata Steel.	Avtar Singh Saini	Member
		6	INSDAG	Dr Jayanta K Saha	Member
Panel-6	Revision of IS 2830 : 2012 Carbon steel cast billet ingots, billets, blooms and slabs for re-rolling into steel for general structure purposes (third revision)	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	JSW	Debashish Mishra	Convenor
		2	RDCIS	B Sarkar	Member
		3	ANMS	Deepak Gupta	Member
		4	JSPL	Ashwani Kumar	Member
		5	DSP	A Dasgupta	Member
		6	RINL	Sanjoy Roy	Member
		7	NIST	P.K.Bagchi	Member
		8	INSDAG	Jayanta K Saha	Member
		9	Tata Steel	B.Ghosh	Member
		10	RDCIS	S.K.De	Member
Panel-11	Provide clarifications on all steel used for automobiles.	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Tata Steel	Mr Avtar Singh	Convenor
		2	CORSMA.	Mr Arvind Mishra	Member
		3	Tata Bluescope	Mr Rajesh Maheshwari	Member
		4	SIAM	Mr Sushil Kumar	Member
		5	JSW	Mr Devasish Mishra	Member

		6	Essar Steel	Mr Deepak Gupta	Member
		7	Bokaro Steel	Mr A. Dasgupta	Member
		8	ITMA	Mr V.C.Singhal	Member
		9	RDCIS, SAIL	Mr S K Shukla	Member
		10	Tata Motors	New Nomination	Member
		11	Maruti	MR Kanchan Srivastav	Member
		12	Posco	Mr Jagadeesh Nandam	Member
		13	Volkswagen	Mr Dinesh Joshi	Member
		14	IZA	Mr.Kenneth De Souza	Member
Panel-12	Raw material for Electrical Steel - formulate standard on hot rolled coil for electrical steel (CRNO).	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	ThyssenKrupp Electrical Steel India Pvt Ltd	Mr Kapil Kapoor	Convenor
		2	Essar Steel, Surat	Mr Deepak Gupta	Member
		3	JSW	Mr Devasish Mishra	Member
		4	SAIL, RSP, Rourkela	Mr Muthuswamy	Member
Panel 13	Revision of IS 3039	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Essar Steel	Mr Deepak Gupta	Convenor
		2	JSPL, Chhattisgarh	Mr M Borkar	Member
		3	SAIL, Bokaro Steel, Bokaro	Mr A. Dasgupta	Member
		4	SAIL, Bhilai Steel Plant, Bhilai	Mr Sandip Choudhury/Mr K. L. Balasubramanian	Member
Panel 14	revision of IS 8951.	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	SAIl RDCIS, Ranchi	Mr D.Karmakar	Convenor
		2	Tata Steel Jamshedpur	Mr Biswajit Ghosh	Member
		3	RINL, Visakhapatnam	Mr P.K.Sen	Member

		4	Steel Wires manufacturer association	Mr Nirmal Saraf, Mr Deshmukh	Member
Panel 15	Formulation of a new standard for raw material for API 5L pipes	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Essar Steel	Mr Deepak Gupta	Convenor
		2	JSW Steel Ltd	Mr Devasish Mishra	Member
		3	Tata Steel	Mr Avtar Singh Saini	Member
		4	JSPL	Mr M Borkar	Member
		5	RSP	Mr A Dasgupta	Member
Panel 17	Harmonization of Indian Standard with ISO standards -- Work out for ISO 630-1 to 6, ISO 4950-1 to 3, ISO 4951-1 to 3, ISO 6930-1 & 2	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	JSW	Debashish Mishra	Convenor
		2	RINL	G. Rajaraman	Member
		3	Jindal Steel & Power Ltd	Mr M Borkar	Member
		4	TATA STEEL	Avtar Singh Saini	Member
		5	INSDAG	Mr Jayanta Saha	Member
		6	SAIL, BSP	Mr Balasubramanium	Member
		7	Tata Bluescope ltd.	Mr Rajesh Maheshwari	Member
		8	RDCIS, SAIL, Ranchi	Mr Sarkar	Member
		9	Powergrid	Mr Deepak Sahoo	Member
Panel 18	To review IS standards viz-a-viz IEC standard and give suggestion for harmonization of IS with IEC standards	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Thyssenkrup	Mr Kapil Kapoor,	Convenor
		2	JSW, Bellary	Mr Devasish Mishra	Member
		3	Posco electrical	Mr Manoj Mhatre	Member
		4	Personal capacity	Mr Vipin Singhal	Member
		Sl.No.	**Organization**	**Representative**	**Role**

Panel 19	Revision of IS 11587:1986 Structural weather resistant steels	1	INSDAG	Mr Jayanta K Saha	Convenor
		2	Essar Steel	Mr Deepak Gupta	Member
		3	SAIL, RSP	Mr A Dagupta	Member
		4	Tata Steel	Mr Avtar Singh	Member
		5	JSW, Bellary	Mr Devasish Mishra	Member
		6	JSPL	Mr M Borkar	Member
		7	RDSO	Representative	Member
Panel 20	Raw material viz Billet, ingot, slab for manufacturing HR coils as per IS 1079,IS 5986,11513	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	JSW	Mr Devashish Mishra	Convenor
		2	Essar steel	Mr Deepak Gupta	Member
		3	SAIL, RDCIS	Mr B Sarkar	Member
		4	SAIL, RSP	Mr A Dasgupta	Member
		5	Tata Steel	Mr Avtar Singh	Member
Panel 22	Review of IS 14246, IS 15961 and IS 15965 standards	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Tata steel	Mr Avtar Singh-	Convenor
		2	Tata Bluescope	Mr Rajesh Maheshwari	Member
		3	CORSMA	Mr Sood/ Mr Arvind Mishra	Member
		4	Essar Steel	Mr Hemant Pandhare	Member
		5	IZA	Mr Kenneth de Souza/ Mr Rahul	Member
		6	INSDAG	Mr Jayanta K Saha	Member
		7	JSW Precoated	Mr Anil Patil	Member
		8	Bhushan steel	Mr Paul	Member
		9	American Precoated steel	Dr Shubh Gautam	Member
Panel 25	Revise IS 2549	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	Ministry of Steel	Shri Parmjeet Singh	Convenor

		2	IZA	Shri Kenneth De Souza	Member
		3	Tata Steel	Shri Sudipto Sarkar	Member
		4	Shipbreaking	Mr Nagar Seth,	Member
		5	MSTC		Member
		6	Materials Recycling Association of India (MRAI)		Member
		7	DGFT		Member
		8	In individual capacity	Shri ACR Das	Member
Panel 26	To prepare draft revision of IS 15911	**Sl.No.**	**Organization**	**Representative**	**Role**
		1	INSDAG	Dr Jayanta K Saha	Convenor
		2	SAIL, Rourkela	B Sarkar (CGM Quality)	Member
		3	JSW	G V Ramana	Member
		4	DSP	Mr A. Dasgupta	Member
		5	RDCIS, SAIL.	S Srikanth	Member
Panel 27	Coated Steel for general engineering and automobile applications	1	i) Tata Steel	Avtar Singh Saini	Convenor
		2	ii) SIAM		Member
		3	iii) ANMS	Deepak Gupta	Member
		4	iv) Posco Maharashtra		Member
		5	v) JSW	Debashish Mishra	Member
		6	vi) NML		Member
		7	vii) 1 user (appliance/solar panel manufacturer)		Member
Panel 28	New standard on Wear & Abrasion resistant steel plates	1	ANMS	Deepak Gupta	Convener
		2	JSW	Debashish Mishra	Member
		3	Volvo		Member
		4	Tata Hitachi		Member

		5	Caterpillar	Details to be provided by Panel Convener within a week time	Member
		6	JCB		Member
Panel 29	Concerns on track shoe sections covered in IS 2062	1	JSW		Convener
		2	SAIL-ISP	Sh S K De	Member
		3	Personal capacity	Dr Raman Dutta	Member
		4	L&T		Member

MTD 4 COMPOSITION

S.no	Name of the organisation held/attend	Represented by	Email ID
1.	Tata Steel Ltd,Jamshedpur	Mr. Avtar Singh Saini	avtar@tatasteel.com
		Mr. Sudipto Sarkar	sudiptos@tatasteel.com
2.	All India Induction Furnace Association, New Delhi	Shri Prabhakar Mishra	aaiifa6@gmail.com
		Shri A. K. Sharma	aksharma@alephindia.in
3.	Bharat Heavy Electrical Ltd, Bhopal	Shri S K Mahajan	skmahajan@bhel.in, corporatestandards@bhel.in
		Shri Arun Khare	a_khare@bhel.in
4.	Defence Metallurgical Research Laboratory, Ministry of Defence, Hyderabad	R V S Nagesh	nagesh@dmrl.drdo.in
5.	Intitute of Steel Development and Growth, Kolkata	Dr. Jayanta K Saha	jayantaksaha@gmail.com
6.	Ministry of Defence (DGQA) Ichapur	Shri K Yadav	kameshwar.yadav@gov.in
		Shri G. Subba Rao	subbarao.gaddipati15@gov.in
7.	JSW Steel Ltd. , Vasind / Bellary	Mr Anil Patil	anilpatil.tpr@jsw.in
		Mr Devasish Mishra	devasish.mishra@jsw.in
8.	Ministry of Steel (Govt of India), New Delhi	Shri Parmjeet Singh	parmjeet.singh@gov.in
		Shri S.K Bhatnagar	shakubha@nic.in
9.	Power Grid Corporation ,Gurgaon	Shri K.K Tyagi	kktyagi@powergridindia.com;
		Shri Deepak Kr Sahoo	deepak.sahoo@powergridindia.com
10.	Rashtriya Ispat Nigam Ltd (VSP) vishakapatnam	Sh Raja Raman G	grr@vizagsteel.com
		Sh Sanjay Roy	sanjay@vizagsteel.com
11.	SAIL,Bhilai Steel Plant,Bhilai	Shri Sandip Choudhury	sandipchoudhury@sail-bhilaisteel.com;

		Shri K.L Balasubramanian	klbalasubramanian@sail-bhilaisteel.com;
12.	SAIL,Bokaro Steel Plant,Bokaro	Ms Roselin Dodrae	cchsaibsl@gmail.com, mistimirchi@gmail.com
		Ms Biswasi Sunita Minz	sunitajane@gmail.com
13.	SAIL,Research & Development Center For Iron & Steel , Ranchi	Shri N. Pradhan	npradhan@sail.in
		Shri S. Srikanth	srikanth@sail.in
		Shri S. Roy	sroy1641@sail.in
14.	SAIL,Rourkela Steel Plant, Rourkela	Shri A Dasgupta	arunava.dasgupta@sailrsp.co.in
		Shri C. Samal	chandan.samal@sailrsp.co.in
15.	Tata Motors Limited ,pune	Pradeep Kulkarini	pradeep.kulkarni@tatamotors.com
		Shailesh Sonwane	shailesh.sonwane@tatamotors.com
16.	Society of Indian Automobile Manufacturers(SIAM) new delhi	Shri kartike Karwal	kartike@siam.in
		Sh Atanu Ganguli	aganguli@siam.in
17.	The Tin Plate Company of India Ltd, Jameshedpur	Dr Sourajyoti Dey	sourajyoti.dey@tatatinplate.com
		Shri Abesh Chatterjee	abesh.chatterjee@tatatinplate.com
18.	Jindal Steel & power Ltd (JSPL)	Shri Moreshwar Borkar	moreshwar.borkar@jspl.com
19.	Essar Steel, Hazira	Mr Deepak Gupta	Deepak.Gupta@essar.com
		Shri Bobby Pujara	bobby.pujara@amns.in
20.	JSW Steel LTD, Dolvi & Salem	Sh. Subhasis Chakrabarty	subhasis.chakrabarty@jsw.in
		Shri B M Hasan	bm.hasan@jsw.in
21.	In individual capacity	Shri A.C.R.Das	ajoycrdas@gmail.com
22.	Ministry of Shipping	Shri Ramji Singh	ramji.shing@nic.in
		Anil Pruthi	anil.pruthi@nic.in
23.	Tata BlueScope Steel Ltd, Pune	Shri Rajesh Maheshwari	rajesh.maheshwari@tatabluescopesteel.com

24.	Central Boilers Board, New Delhi	Shri T.S.G Narayannen	tsg.narayannen@nic.in
		Shri S.K.Jain	sushilk.jain@nic.in
25.	Ministry of Defence (DGOFB), Kolkata	Shri P.S Bandhopadhyay	psbandyo0104@yahoo.co.in
		RD Barma	rohitdebbarma.ofb@ofb.gov.in
		AK Hazra	akhazra1.ofb@ofb.gov.in
26.	Ministry of Railways (RDSO), Lucknow	Shri B.L Jatav	bhorelaljatav@gmail.com;
		Shri Baji Nath (Alt-I)	
		Shri Dallu Ram (Alt-II)	
27.	SAIL,Central Marketing Organisation New Delhi/Mumbai	Shri Amitava Kundu	amitabh_k@sail-steel.com
28.	Indian Machine Tools Association	Sh Y Balaramaiah	director@ amttf.in
29.	SAIL, Durgapur	Shri Amarnath Banerjee	amarnath@saildsp.co.in
30.	Confederation of Indian Steel Producers Association	Nomination Awaited	

Annex-IV

Sl No	IS No.	Product
1	IS 279 : 1981	Specification for galvanized steel wire for telegraph and telephone purposes (Third Revision)
2	IS 280 : 2006	Mild steel wire for general engineering purposes (Fourth Revision)
3	IS 1673 : 2004	Specification for mild steel wire, cold heading quality (Second Revision)
4	IS 1875 : 1992	Carbon steel billets, blooms, slabs and bars for forgings - Specification (Fifth Revision)
5	IS 1990 : 2009	Steel rivet and stay bars for boilers (Second Revision)
6	IS 3975 : 1999	Low carbon galvanized steel wires, formed wires and tapes for armouring of cables - Specification (Third Revision)
7	IS 8910 : 2010	General technical delivery requirements for steel and steel products (First Revision)
8	IS/ISO 10474 : 1991	Steel and steel products - Inspection documents
9	IS 14650 : 2004	Carbon steel cast billet ingots, billets, blooms and slabs for re-rolling purposes - Specification
10	IS/ISO 16124 : 2004	Steel wire rod - Dimensions and tolerances
11	IS 9550 : 2001	Bright steel bars - Specification (First Revision)
12	IS 10748 : 2004	Hot - Rolled steel strip for welded tubes and pipes - Specification (Second Revision)
13	IS 4454 (Part 1) : 2001	Steel wire for mechanical springs - Specification: Part 1 cold drawn unalloyed steel wire (Third Revision)
14	IS 4454 (Part 2) : 2001	Steel wire for mechanical springs - Specification february 2001: Part 2 oil hardened and tempered steel wire (Second Revision)
15	IS 4454 (Part 4) : 2001	Steel wires for mechanical springs: Part 4 stainless steel wire (Second Revision)
16	IS 513 (Part 1) : 2016	Cold reduced carbon steel sheet and strip: Part 1 cold forming and drawing purpose (Sixth Revision)
17	IS 513 (Part 2) : 2016	Cold reduced carbon steel sheet and strip: Part 2 high tensile and multi - Phase steel (Sixth Revision)
18	IS 1148 : 2009	Steel Rivet Bars (medium And High Tensile)--For Structural Purposes--For Structural Purposes
19	IS 2062 : 2011	Hot rolled medium and high tensile structural steel - Specification (Seventh Revision)
20	IS 2507 : 1975	Specification for cold - rolled steel strips for springs (First Revision)
21	IS 3024 : 2015	Grain oriented electrical steel sheet and strip (Third Revision)
22	IS 3502 : 2009	Steel chequered plates (Third Revision)
23	IS 5872 : 1990	Cold rolled steel strips (Box Strappings) - Specification
24	IS 8951 : 2001	Steel cast billet ingots, billets and blooms for production of high carbon steel wire rods - Specification (First Revision)

25	IS 8952 : 1995	Steel ingots, blooms and billets for production of mild steel wire rods for general engineering purposes - Specification (First Revision)
26	IS/ISO 11951 : 2016	Cold - Reduced tinmill products - Blackplate (First Revision
27	IS/ISO 14284 : 1996	Steel and iron - Sampling and preparation of samples for the determination of chemical composition
28	IS 15647 : 2006	Hot rolled steel narrow width strip for welded tubes and pipes
29	IS 15911 : 2010	Structural steel (Ordinary Quality) - Specification
30	IS 15914 : 2011	High tensile strength flat rolled steel plate (Up To 6 Mm), sheet and strip for the manufacture of welded gas cylinder - Specification
31	IS 16585 : 2016	Magnetic materials - Specification for individual materials - Fe - Based amorphous strip delivered in the semi - Processed state
32	IS 16586:2016	Magnetic materials - Methods of measurement of the magnetic properties of fe-based amorphous strip by means of a single sheet tester

SL No	IS No.	IS Title	Year of Publication	Under QCO	Name of the Allotted Officer	Alloted in
1.	IS 1029	Specification for hot-rolled steel strip Baling First Revision	1970	YES	Shri Vinith Kumar G,	Feb-21
2.	IS 2100	Specification for steel billets bars and sections for boilers First Revision	1970	YES	Shri Kanan Govindaraj,	Feb-21
3.	IS 4224	Specification for steel wire for staples pins and clips First Revision	1972	YES	Shri Rajiv Ranjan,	Feb-21
4.	IS 6902	Specification for steel wire for spokes	1973	YES	Shri Ajay Kumar Soni,	Feb-21
5.	IS 6967	Specification for steels for electrically welded round link chains	1973	YES	SANDESH SUDHAKAR GOKANWAR	Aug-21
6.	IS 7226	Specification for cold - Rolled medium high carbon and low alloy steel strip for general engineering purposes	1974	YES	Kavin	Aug-21
7.	IS 412	Specification for expanded metal steel sheets for general purposes Second Revision	1975	YES	JAIN PRANAY ABHAY	Aug-21
8.	IS 2507	Specification for cold - rolled steel strips for springs First Revision	1975	YES	Shri Sudipt Kumar,	Feb-21
9.	IS 2589	Specificaiton for hard drawn steel wire for upholstery springs First Revision	1975	YES	Shri Anant Kumar,	Feb-21
10.	IS 4072	Specification for steel for spring washers First Revision	1975	YES	Shri Sachin Dev Meena,	Feb-21

11.	IS 4223	Steel Wire For Umbrella Ribs	1975	YES	Shri Baireddy Rohit Reddy,	Feb-21
12.	IS 1835	Specification for round steel wire for ropes Third Revision	1976	YES	Shri Kunal Kumar,	Feb-21
13.	IS 2255	Specification for mild steel wire rod for the manufacture of machine screws By Cold Heading Process Second Revision	1977	YES	Not allotted	
14.	IS 2385	Specification for hot - Rolled mild steel sheet and strip in coil form for cold - Reduced tinplate and cold - Reduced blackplate First Revision	1977	YES	Shri Mainak Gantait,	Feb-21
15.	IS 8510 (Part 1 to 3)	Specification for tinned steel wire for banding of armatures and rotors	1977	YES	Not allotted	
16.	IS 8563	Specification for half round mild steel wlRe for the manufacture of split pins	1977	YES	Shri Arnab Samui,	Feb-21
17.	IS 8564	Specification for steel wire for nipples for spokes	1977	YES	Shri K. Chandan Rao,	Feb-21
18.	IS 8565	Specification for heald wire	1977	YES	Shri Piyush Gediya,	Feb-21
19.	IS 8566	Specification for steel wire for reeds	1977	YES	Shri Sudhanshu Suman,	Feb-21
20.	IS 8917	Specification for steel plates for galvanizing pots	1978	YES	Shri Manish Raj,	Feb-21

Sl. No.	IS No.	Title of Indian Standard due for review	Unique Project Number	Recommendation by the Offciers Allotted
1	IS 1029:1970	Specification for hot-rolled steel strip Baling	**AR/352**	1. In view of above, it is recommended to update the following changes in IS 1029:1970, 1) The test methods for the parameters indicated in the IS 1029:1970 were all outdated. The latest Indian standards for these tests may be considered as follows: - Chemical Composition – IS 228 (Part 1 to 24) – reference method/ Other established instrumental/chemical methods for routine testing - Tensile Strength - IS 1608 (Part 1): 2018 - Bend test - IS 1599:2019 2) General Supply of Materials Shall be as per IS 1387:1993.
2	IS 1835:1976	Specification for round steel wire for ropes	**AR/358**	After going through the Indian/ International standards as mentioned above and the inputs/comments received from the Manufacturer and consumers of the product, the following is recommended for

				consideration – a) In Clause- 1.1 of IS 1835 - Scope- Nominal Diameter Range may be revised as 0.13 mm to 6.0 mm. b) In Clause- 9.1 of IS 1835 – Galvanizing requirements- Zn- Al coating may be included for Type-A wires. c) In Clause 8.1, Table 2 of IS 1835 – Additional Tensile designations 1180, 1370 and 2160 may be added.
3	IS 2100:1970	Specification for steel billets bars and sections for boilers	**AR/359**	Following tests may be included in the scope of the Standard: 1.Vickers Hardness test as per IS 1501:2002 2. Evaluation procedure for Y-groove weld crackability test in structural steel as per IS 10842:1984 3. Ultrasonic testing for detection of defects in the weldment as per IS 11630: 2005
4	IS 2385:1977	Specification for hot - Rolled mild steel sheet and strip in coil form for cold - Reduced tinplate and cold - Reduced black plate	**AR/361**	IS 2385:1977 may be withdrawn as the product is raw material for manufacturing tinplates and blackplates as per IS 1993:2018. However, the requirement of raw material is already specified in final product IS 1993:2018.
5	IS 2507:1975	Specification for cold - rolled steel strips for springs	**AR/363**	Standard may specify alternate use of instrumental method like spectrometer for chemical analysis
6	IS 2589:1975	Specification for hard drawn steel wire for upholstery springs	**AR/364**	The committee may consider to revise the standard based on the above review analysis and the latest available international standards and practices.

7	IS 4072:1975	Specification for steel for spring washers	**AR/371**	• Reference given of IS 6914:1973 may be deleted from cl.7.2 of IS 4072 as it has been superseded by IS 2830 • May be substituted IS 2830 : 2012 with IS 2830 : 1975 in cl.7.2 of IS 4072. • May be substituted IS 1387 : 1993 (Reaffirmed Year : 2018) with IS 1387 : 1967 • May be substituted IS 228 :Part 1 to Part 24 with IS 228 : 1959 in cl. 5.1 of IS 40 IS 228 : 195972. • Cl. 4.1 may be modified by adding new processes of steel making e.g. basic oxygen process, electric arc etc. • Incorporation of requirements as decarburization depth, delivery condition (i.e. As rolled, As rolled-annealed, Hardened and tempered) with specified mechanical properties for every delivery condition w.r.t every steel designation to and freedom from nonmetallic inclusions for steel designation 50CrV4.
8	IS 4223:1975	Steel Wire For Umbrella Ribs	**AR/373**	
9	IS 4224:1972	Specification for steel wire for staples pins and clips	**AR/374**	Each referred clause of IS 4224: 1972 was read. It is observed that specification is relevant to contemporary times. Hence, non phenomenonal change is required is with certain Amendments. However, revised version of referred standards may be referred.
10	IS 6902:1973	Specification for steel wire for spokes	**AR/388**	1. Reference to revised IS is proposed for all referred standards. 2. Si composition may be added in clause 4.

11	IS 8563:1977	Specification for half round mild steel wlRe for the manufacture of split pins	**AR/393**	i. Cl 6.1 of IS 7887:1992 may be referred in Cl 5.1 of IS 8563:1977 ii. In Cl 7.1, Tensile test IS 1521: 1972 may be replaced by IS 1608-1: 2018/ISO 6892-1 : 2016. iii. In Cl 7.2, Wrapping Test – IS 1755: 1961 may be replaced by IS 1755:2018/ISO 7802:2013 iv. In Cl 7.3 of IS 8563 : 1977, IS 1599 : 2019/ISO 7438 : 2016 may be included for Bend Test. v. In Cl 3.1, Supply of Materials IS 1387: 1967 may be replaced by IS 1387: 1993. vi. In IS 549: 2005, Raw material MS may be included and IS 8563 may be referenced.
12	IS 8564:1977	Specification for steel wire for nipples for spokes	**AR/394**	The standard may be revised incorporating the changes as detailed above .
13	IS 8565:1977	Specification for heald wire	**AR/395**	standard does not need any change, except updating of standards referred
14	IS 8566:1977	Specification for steel wire for reeds	**AR/396**	Revision of the Standard to include the changes proposed in ARP and to cover the current variety manufactured by the Industry
15	IS 8917:1978	Specification for steel plates for galvanizing pots	**AR/399**	Not yet submitted.

Annex VII

A. Proposal Details

Part - 1

Organization Type: Industry/Industry Association

1. Name of Proposer	Sushil Kumar Jain
2. Email ID	sushil@dynaroof.com
3. Phone	9435012530
4. Address	5th Floor Anil Plaza 1 , ABC Bus Stop , G.S.Road , Guwahati-5.

Part - 2

5. Proposed title of Standard	IS for Pre-Painted Aluminium Zinc Alloy Metallic Coated Hi RIB Profile Roofing Sheet , Tiles Profile and Profile Accessories.
6. Aspect	Product Specification
7. Define subject of standard	Pre-Painted Aluminium Zinc Alloy Metallic Coated Hi RIB Profile Roofing Sheet and Profile Accessories defining Customised Length, Standard Width and diff erent Thickness with applicable Tolerance and other specifications. (Details attached as annexture 1)
8. Most Relevant Technical Department	MTD (Metallurgical Engineering Department)

Part - 3

9. Scope of proposed standard	Pre-Painted Aluminium Zinc Alloy Metallic Coated Hi RIB Profile Roofing Sheet and Profile Accessories is utilized for all kinds of Roofing Solution. There are several brands available in the market, of this product. IS to be made for product certification of same to avoid confusion among the end consumers.
10. Purpose and Justification	These particular Products are made from the Raw material which has some Dimensional Tolerances under BIS norms (IS15965:2012 followed by IS 16163:2012). The Final Finished Products is made from the above specified supplied Raw Material without changing any Physical and Chemical Properties of the Supplied Raw Material during the entire Production Process. However, to clear confusions raised by the End Users and also from diff rent Govt. Bodies regarding the dimensional tolerances, the IS norms of the finished product is required.
11. Likely users of standards and their inputs	Manufacturers of Pre-Painted Aluminium Zinc Alloy Metallic Coated Hi RIB Profile Roofing Sheet and Profile Accessories.
12. Any related standards/series of standard/system standard required to make this subject standard complete	IS 15965 : 2012
13. When the final standard would be required	31-07-2021
14. Any specific problem being faced without this standard	The enquiry for Product Specification of Pre-Painted Aluminium Zinc Alloy Metallic Coated Hi RIB Profile Roofing Sheet came to DynaRoof Pvt. Ltd. It is found that no Indian standard is available on this particular product. The closest Product for which IS isavailable, is Pre-Painted Aluminium Zinc Alloy Metallic Coated Steel Strip andSheet (Plain) as per IS 15965 : 2012. Since no IS is available for this particular product, potential applicants are confused as to: against which IS they should get their product specified.

15. Bearing with Govt legislation regulation, etc	Not Specified
16. Name and address of manufacturers/ implementing/ industries/ purchasing organization /component supplier/ raw material supplier, if any	1.TATA STEEL BSL, Address :-Narendrapur,Meramandall,Dhenkanal,Odisha. 2. BHUSHAN POWER & STEEL LIMITED.Address :-Vill. Thelkoloi, Post- Lapanga,Distt : Sambalpur (Odisha) .
17. Status of the industry in the country	Comes under Building and Construction Industry
18. Availability of test facilities in the country	Yes, for the supplied RAW Materiels
19. Whether related to variety reduction, export, health, safety consumer protection, mass consumption, energy conservation, technology transfer, technology upgradation, protection of environment & other National priorities	No
20. Whether subject requires consideration to be given to women/girl issues in line with Sustainable Goal 5 of the UN. If so, whether the issues are proposed to be addressed suitably in the proposed standard	Not Applicable
21. Relevant supportive document (download docs)	IS for Pre -Painted Aluminium Zinc Alloy Metallic Coated Steel and Sheet (Plain) 1. Attachment 2. Attachment 3. Attachment
22. R & D work done in india	Not Known
23. Any foreign collaboration (give details)	Not Known
24. Liaison with any organisation(s)	Not Yet
25.A. Preparatory work	No draft possible
25.B. Preparatory work (Details)	No draft is prepared
26. Whether this project can be funded by your organization	No
27. Whether your organisation would be interested to opt for BIS Standard Mark once the standard is published?	Yes
28. Any Other Attachment (extra)	Techinecal Specification ofthe products. 1. Attachment

B. Action Logs

Circulate Proposal to Members

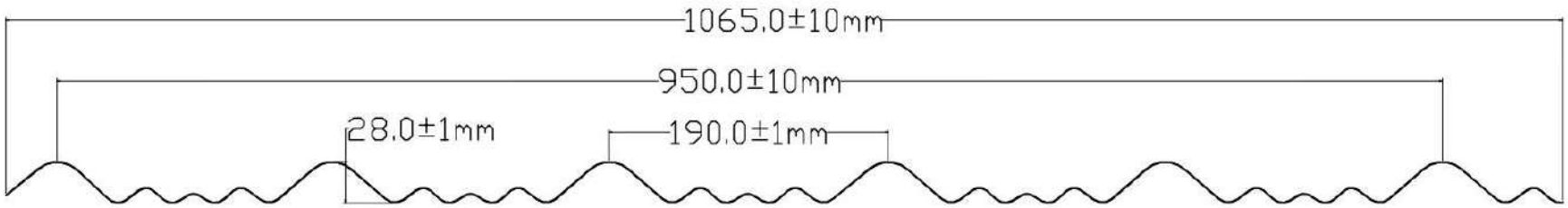
Action/Update

Specification for Pre-Painted Aluminium Zinc Alloy Metallic Coated Hi RIB Profile Roofing Sheet and Profile Accessories

Profile Sheet

Sl.No.	Specification	Range / Tolerance	Remarks
1	Length	Customised	
2	**Width**	1070±20 mm	
3	Crest height	28.5±2 mm	
4	**Pitch**	200±2 mm	
5	Thickness	0.35 mm to 0.80 mm	As per raw material Tolerances under BIS norms (IS15965:2012 followed by IS 16163:2012)

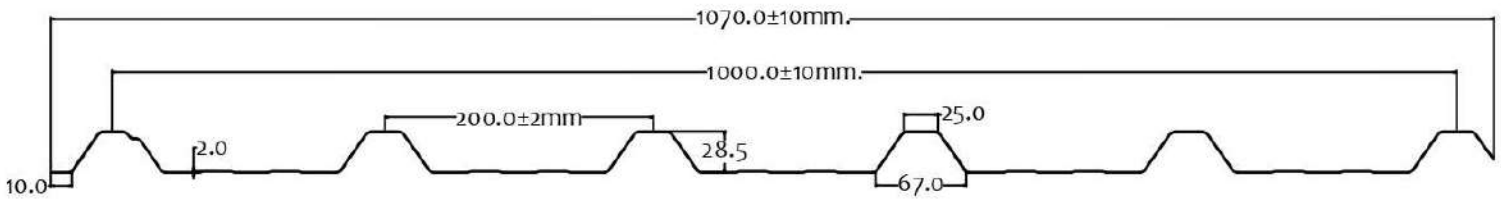
Note: All accessories are customised



SHEET THICKNESS 0.35 to 0.60mm
SHEET WIDTH 1220mm

DYNA ROOF PVT LTD

DRN. BY		ALL DIMS ARE IN MM.	
CHKD.BY		DESCRIPTION:-	TILES PROFILE SHEETS
APVD.BY			
DATE	09/07/2021		
SCALE	1:100		
ANGLE			
QTY.		DWG. NO.	



SHEET THICKNESS 0.30 to 0.80mm
SHEET WIDTH 1220mm

DYNA ROOF PVT LTD		
DRN. BY		ALL DIMS ARE IN MM.
CHKD.BY		DESCRIPTION:
APVD.BY		HI- RIB PROFILE SHEETS
DATE	09/07/2021	
SCALE	1:100	
ANGLE		
QTY.		DWG. NO.

With Regards

Ojha Yogesh

+918493867150

Please don't print this e-mail unless you really need to.

Save trees for our children.

On Wed, Aug 11, 2021 at 12:46 PM MTD FOUR Metallurgical Engineering Department <mtd4@bis.gov.in> wrote:

Dear Sir,

Please refer trailing mails. The matter has been referred to members of technical committee, MTD 4. We will revert to you on the matter in due course on receipt of clarification from them.

This is for kind information.

Regards,
Arun Pucchakayala
Scientist-D, MTD

From: ojhayogesh@gmail.com
To: "CENTRAL MARKS" <cmd3@bis.gov.in>
Sent: Thursday, August 5, 2021 10:02:19 AM
Subject: Definition of Minor

Dear Sir ,
As per IS 2062 : 2011 Clause 7.2
Quote

7.2 Minor surface defects may be removed by the manufacturer/supplier by grinding provided the thickness is not reduced locally by more than 4 percent below the minimum specified thickness.
Unquote

In the above clause code allows steel plate manufacturers to perform grinding to remove **Minor** surface defects , i would like to know :-
1. What is the maximum surface area % of the total plate that comes under **Minor ?**
2. Is **Minor** means small patches at scattered locations , if yes then what is the maximum size of patches ?
3. Is **Minor** allow steel manufacturers to perform continuous grinding throughout the length of plate 30-50 mm from the edges ? As shown below

4. Is continuous grinded plates come under Prime Plates or Non-Prime (Seconds & defective) steel products.

I wish you to reply as soon as possible.

Template for Comments on SARSO Deliverables

Member States:	SARSO's Deliverable Name: SARS 0028-01		Date:2018-09-19			
Comment Number	**Line Number**	**Clause No/ Sub clause No/ Annex/Paragraph/Figure/ Table/Note**	**Type of comment (General/ Technical /Editorial)**	**Comments**	**Proposed change with justifications**	**Secretariat observations on each comment submitted**
1	*2*	*3*	*4*	*5*	*6*	*7*
02		Introduction	General	The part number of SARS 0028 -5 standards has changed under the name of standard as "Glossary & terms relating to Iron & steel ,Part 6 – Forging (including drop forging"	It should be corrected as Part 6 or part 5 or vice versa.	Accepted
03		Introduction	General	The part number of SARS 0028 -7 standards has changed under the name of standard as "Glossary & terms relating to Iron & steel ,Part 8 – Steel tubes & pipes"	It should be corrected as Part 7 or part 8 or vice versa.	Accepted
05		Clause 2.11	Technical	Definition of alloy steel has certain deviation so it should be given very clearly.	It shall change as follows, steel containing one or more alloying elements as a result of which it develops specific characteristics as per ISO 4948.	Specially limits of alloying elements to be included/annexed considering both relevant Indian and ISO standards.

Template for Comments on SARSO Deliverables

Member States:	SARSO's Deliverable Name: SARS 0028-01		Date:2018-09-19			
Comment Number	**Line Number**	**Clause No/ Sub clause No/ Annex/Paragraph/Figure/ Table/Note**	**Type of comment (General/ Technical /Editorial)**	**Comments**	**Proposed change with justifications**	**Secretariat observations on each comment submitted**
1	*2*	*3*	*4*	*5*	*6*	*7*
06		Clause 2.47	General	Upper parts of Brinell Hardness equation stated that, Load in Kg (Capital K and simple g)	It shall be changed as simple kg as per metric units.	Accepted
07		Clause 2.90	Technical	Salt spray test is not included in near to clause 2.90	It is better to introduce salt spray test near to clause 2.90	Irrelevant
08		Clause 2.258	Technical	Under parenthesis in second line mentioned as " not exceeding 10 diameters "	It shall be corrected as "not exceeding * 10 or 10 magnification"	Accepted
09		Clause 2.258	Technical	Stainless steel has different grades. Hence it is better to introduce those grades.	Add "refer relevant ISO standard for different grades "	Definition is sufficient.
10		Clause 2.402	editorial	It was mentioned as "Satving"	It shall be corrected as "Stoving"	Accepted
11		Clause 2.436	editorial	It was mentioned as "Weld Decay Teat"	It shall be corrected as "Weld decay test"	Accepted

Template for Comments on SARSO Deliverables

Member States:	SARSO's Deliverable Name: SARS 0028-02		Date:2018-08-28			
Comment Number	**Line Number**	**Clause No/ Sub clause No/ Annex/Paragraph/Figure/ Table/Note**	**Type of comment (General/ Technical /Editorial)**	**Comments**	**Proposed change with justifications**	**Secretariat observations on each comment submitted**
1	*2*	*3*	*4*	*5*	*6*	*7*
01		SARS 0028-2 standard	General	Whole standards represents the line number in right side of the documents such as 1,2,3,4,5,..etc	It is better to remove line numbers.	Accepted
02		Normative references	Technical	It refers " IS 7598 Classification of steels"	It should be changed to ISO 4948.	Classification of steels to be included/annexed considering both relevant Indian and ISO standards.
05		Clause 3.6	Technical	Definition of alloying elements has certain deviation so it should be given very clearly.	It shall change as follows, An element (a metal or non-metal) added deliberately to another metal to modify its mechanical and or physical properties as per ISO 4948.	It is a Simple definition, so no reference is required
07		Clause 3.26	editorial	It was mentioned as "Fash"	It shall be corrected as "Flash"	Accepted

Template for Comments on SARSO Deliverables

Member States:	SARSO's Deliverable Name: SARS 0028-02		Date:2018-08-28			
Comment Number	**Line Number**	**Clause No/ Sub clause No/ Annex/Paragraph/Figure/ Table/Note**	**Type of comment (General/ Technical /Editorial)**	**Comments**	**Proposed change with justifications**	**Secretariat observations on each comment submitted**
1	*2*	*3*	*4*	*5*	*6*	*7*
08		Clause 3.34	Technical	It was mentioned as " An unalloyed steel (*see* IS 7598)."	It shall be corrected as " an unalloyed steel (see ISO 4948)."	The information to be included/annexed considering both relevant Indian and ISO standards.
09		Clause 4.1	Technical	Definition of steel has deviated with ISO 4948.	It is better to use definition of ISO 4948 standard instead of IS 7598.	India to review
10		Clause 4.8	Technical	It was referred to IS 7598.	It shall be referred ISO 4948.	The information to be included/annexed considering both relevant Indian and ISO standards.
11		Clause 4.9, Clause 4.10 & clause 4.11	Technical	All these definitions are referred to IS 7598.	It is better to use ISO 4948 standard for definitions. Because Sri Lankans normally use following definition for low carbon steel, "Low-carbon steels are unalloyed steels containing up to 0.20 percent carbon"	India to review

Annex-X

Template for Comments on SARSO Deliverables

Member States:	SARSO's Deliverable Name: SARS 0028-02		Date:2018-08-28			
Comment Number	**Line Number**	**Clause No/ Sub clause No/ Annex/Paragraph/Figure/ Table/Note**	**Type of comment (General/ Technical /Editorial)**	**Comments**	**Proposed change with justifications**	**Secretariat observations on each comment submitted**
1	*2*	*3*	*4*	*5*	*6*	*7*
		Clause 4.12,clause 4.13,clause 4.14 & clause 4.15	Technical	All these definitions are referred to IS 7598.	It is better to use ISO 4948 standard for definitions.	India to review

Template for Comments on SARSO Deliverables

Member States:	SARSO's Deliverable Name: SARS 0028-03		Date: 2018-08-28			
Comment Number	**Line Number**	**Clause No/ Sub clause No/ Annex/Paragraph/Figure/ Table/Note**	**Type of comment (General/ Technical /Editorial)**	**Comments**	**Proposed change with justifications**	**Secretariat observations on each comment submitted**
1	*2*	*3*	*4*	*5*	*6*	*7*
01		SARS 0028-3 standard	General	Whole standards represents the line number in right side of the documents such as 1,2,3,4,5,..etc	It is better to remove line numbers.	Line numbers are removed when the draft is finalized.
02		Clause 3.3.4.1	Technical	It refers to clause 2.3.4.1.1 to 2.3.4.1.4 for cross sections .but that clauses are not in the standard.	It is better to include cross sections otherwise we cannot comment on this.	Editorial and accepted
03		Clause 3.3.4.1.1	Technical	It includes Bars having a circular cross-section of diameter generally 8 mm or above.	Since Sri Lanka has less than 8 mm size of bars, It is better to introduce 5.5 mm & 6 mm sizes bars.	India to review the international practice

NOTE: Columns 3, 4, 5 and 6 are compulsory.
Member States: AF, BD, BT, IN, MV, NP, PK and LK