

## Continuous Casting Slab Technical Agreement

Prepared by:



Reviewed by:



Approved by:



# Permai Metal Indonesia Steel Slab Technical Agreement

## 1 Purpose and Scope of Agreement

To ensure that the Supplier (hereinafter the “Seller”) provides the Purchaser (hereinafter the “Buyer”) with high-quality steel slabs, this Technical Agreement is hereby established. This Agreement covers technical and quality matters relating to material description, production process, technical specifications, shape/profile, surface and internal quality, marking, and other related matters.

## 2 Normative References

The following documents provide the necessary basis for the application of this Agreement. For dated references, only the dated edition applies to this Agreement; for undated references, the latest edition (including all amendments) applies to this Agreement.

YB/T 2012 Continuously Cast Steel Slab

YB/T 2012-2004 Continuously Cast Steel Slab

GB/T 222 Permissible Deviation of Chemical Composition of Finished Steel Products

YB/T 4003 Rating Chart for Low-Power (Macrostructure) Defects of Continuously Cast Steel Slab — PT. Permai Metal Indonesia Product Catalogue

## 3 Order Content

The continuous casting slab purchase contract signed under this Agreement shall include the following:

- 3.1 Product name;
- 3.2 Steel grade and chemical composition;
- 3.3 Dimensions and delivery weight (minimum order quantity not less than 4,000–5,000 tons; special cases may be agreed by both parties);
- 3.4 Other special requirements.

## 4 Terms and Definitions

Continuously cast slab: a cross-section in which the two pairs of opposite sides are of equal length, all four interior angles are 90°, and the length of the long side is greater than 2.5 times the length of the short side.

## 5 Production Equipment and Process

### 5.1 Main Production Equipment

Top-blown converter, ladle refining furnace, slab continuous casting machine.

### 5.2 Main Production Process

5.2.1 Standard process: Converter smelting → Deoxidation and alloying → Slab continuous casting

5.2.2 Special-grade process: Converter smelting → Deoxidation and alloying → Ladle refining furnace refining → Slab continuous casting

The above processes ensure that the steel slabs produced can be used to roll hot-rolled coil, medium/heavy plate, cold-rolled sheet, and other products.

### 5.3 Slab Specifications

5.3.1 Thickness: 210mm / 230mm

5.3.2 Length: 6300mm – 11700mm

5.3.3 Width: 1000mm – 1650mm

5.3.4 The Company’s standard slab widths are 1500mm / 1650mm

5.3.5 For any other special width requirements, order details shall be determined based on order quantity and actual production conditions.

## 6 Inspection Standards (Implemented in accordance with Industry Standard YB/T 2012-2014)

### 6.1 Dimensions and Tolerances

6.1.1 The dimensions and tolerances of continuously cast slabs (hereinafter “slabs”) shall comply with the provisions of Tables 1 and 2. The head-end and tail-end widths of slabs cast in each heat shall be determined by agreement between both parties.

**Table 1 Slab Thickness Tolerance (Unit: mm)**

Nominal Thickness	Tolerance
>200	±6.0

**Table 2 Slab Width Tolerance (Unit: mm)**

Nominal Width	Width Tolerance
≥1000–1600	-5, +15
>1600	-10, +15

6.1.2 Depending on Buyer’s requirements, slabs may be delivered to fixed length or non-fixed length; the length shall be agreed by both parties, with a tolerance of ±100mm for fixed-length delivery.

6.1.3 The dimensional and shape tolerances of slabs may be adjusted as appropriate by agreement between both parties.


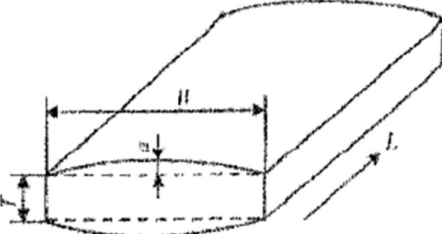
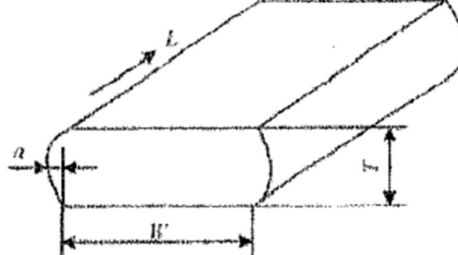

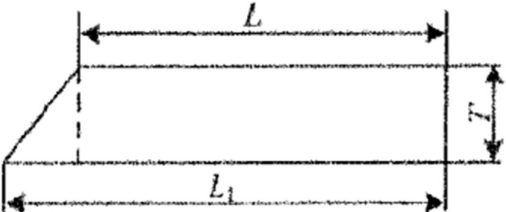
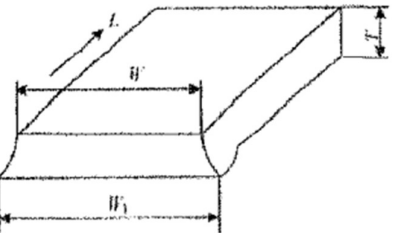
6.1.4 Upon agreement between Seller and Buyer, the permissible dimensional and shape deviations of continuously cast slabs may be adjusted as appropriate.

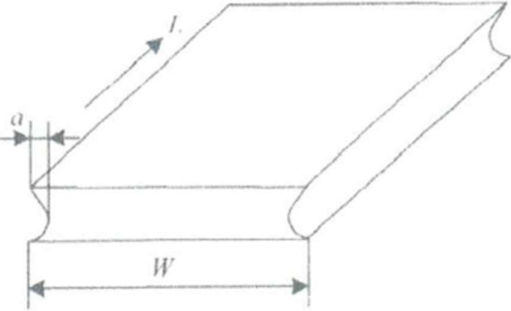
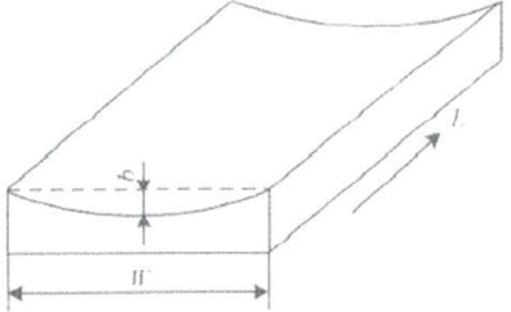
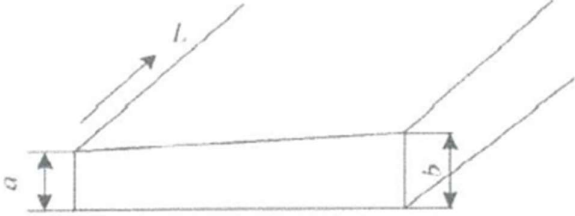

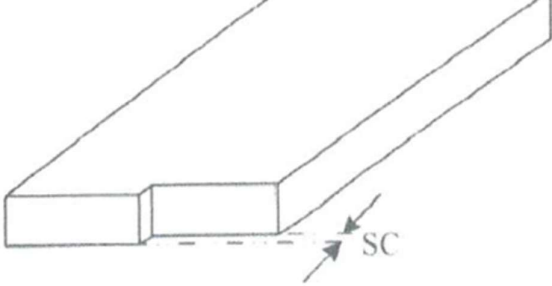
### 6.2 Shape and Profile

The shape and profile of slabs shall comply with the provisions of Table 3.

**Table 3 Slab Shape and Profile Requirements (Unit: mm)**

Shape Defect	Diagram	Permissible Deviation
Cross-section out-of-square		Nominal thickness >200, a≤8.0
Sickle bend (camber)	<p>L – slab length    W – slab width</p>	Not more than 8 per meter; When length ≤10M, A≤30; When length >10M, A≤40;
Unevenness (flatness)	<p>L – slab length    T – slab thickness</p>	Not more than 15 per meter; Total unevenness A≤1.5%L

Shape Defect	Diagram	Permissible Deviation
	 <p style="text-align: center;">L – slab length    T – slab thickness</p>	<p>Not more than 15 per meter; Total unevenness <math>LB \leq 1.5\%L</math></p>
Bulge (convexity)	 <p style="text-align: center;">L – slab length; W – slab width; T – actual minimum slab thickness</p>	<p><math>a \leq 0.8\%W</math></p>
	 <p style="text-align: center;">L – slab length; W – slab width; T – actual minimum slab thickness</p>	<p><math>a \leq 5\%T</math></p>
Skew cut (diagonal cut)	 <p style="text-align: center;">L – slab length; W – slab width;</p>	<p><math>a \leq 25</math></p>
	 <p style="text-align: center;">L – slab length; W – slab width; T – slab thickness</p>	<p><math> L - L_1  \leq 10</math></p>
Shear deformation	 <p style="text-align: center;">L – slab length; W – slab width; T – slab thickness</p>	<p><math> W - W_1  / 2 \leq 10\%T</math></p>

Shape Defect	Diagram	Permissible Deviation
Dent (indentation)	 <p>L – slab length; W – slab width;</p>	$a \leq 5$
	 <p>L – slab length; W – slab width;</p>	$b \leq 5$
Thickness wedge	 <p>L – slab length;</p>	$ b - a  \leq 3$
Width wedge	 <p>W – slab width;</p>	$ W - W_2  \leq 10$ ; for head/tail slab $\leq 50$
Cutting deviation		$SC \leq 10$

## **7 Weight**

Slabs shall generally be delivered by actual weight; upon agreement between Seller and Buyer, delivery by theoretical weight is also acceptable.

## **8 Technical Requirements**

8.1 Material and chemical composition shall be implemented in accordance with the "PT. Permai Metal Indonesia Product Catalogue." Should the Customer have special requirements for the chemical composition of the material, the Customer may contact the Company's Sales Department, which will initiate a new-product review process and provide feedback to the Customer within 24 hours of completing the review.

8.2 Casting requirements: Slabs shall generally be produced by continuous casting of molten steel of the same grade. Where molten steel of different grades is cast, the quality of the transition (intermediate) slab shall be determined based on actual conditions.

### **8.3 Heat Number Division**

Method for dividing heat numbers between upper and lower adjacent continuously cast slabs: when molten steel from the ladle is poured into the tundish, the start of the next heat shall be calculated based on the quantity of molten steel remaining in the tundish.

8.4 Head/tail cropping of slabs: The head end of a newly cast slab and the tail end of the slab at the end of casting shall be cropped to a sufficient length to ensure the slab is free of shrinkage-cavity defects during subsequent use.

8.5 Macrostructure (low-power) inspection: At Buyer's request and upon agreement between Seller and Buyer, carbon structural steel and low-alloy high-strength structural steel shall be sampled for macrostructure (low-power) inspection or sulfur printing for each casting sequence.

### **8.6 Surface Quality**

8.6.1 The slab surface shall be free of visible overlap/lap defects, scabs, rolled-in scale, or inclusions. The depth or height of scratches, indentation marks, abrasion marks, pinholes, cold splashes, wrinkles, protrusions, or pits shall be less than 3mm; crack depth shall be less than 2mm; the height of flame-cutting slag shall be less than 5mm.

8.6.2 The slab cross-section shall be free of shrinkage cavities, subsurface pinholes, and cracks that would affect use.

8.6.3 Where the slab surface exhibits the defects described in Clauses 8.6.1 and 8.6.2 of this Agreement, surface defects along the rolling direction may be removed by flame conditioning or mechanical grinding.

8.6.4 Defect removal shall be carried out along the rolling direction; after removal, the surface shall be smooth and free of sharp edges. The width of the ground area shall be no less than 6 times the grinding depth, and the length shall be no less than 10 times the grinding depth. The grinding depth on a single surface shall not exceed 10% of the slab thickness, and the total grinding depth on the two opposite surfaces of the slab shall not exceed 15% of the slab thickness, calculated on actual dimensions. If the grinding depth exceeds 4% of slab thickness and the ground area is not located within the middle 1/3 zone in the width direction of the slab, an area of equal depth shall be ground at the symmetrical position on the same surface of the slab, referenced to the longitudinal centerline.

8.6.5 Surface quality requirements for slabs may be adjusted as appropriate by agreement between both parties, provided that in principle this shall not affect downstream Customer processing and use. Unless otherwise specifically required, other minor surface defects not listed under Clause 8.6.1 of this Agreement shall not constitute grounds for rejection.

## **9 Inspection Methods**

The inspection items, sampling quantity, sampling location, and test methods for each batch of slabs shall comply with the provisions of Table 4.

**Table 4 Slab Inspection Method Requirements**

No.	Inspection Item	Sampling Quantity	Sampling Location	Test Method
1	Chemical composition	1 per heat	Per GB/T 20066	Analytical method per the applicable product standard
2	Macrostructure (low-power) inspection	Per YB/T 4003		GB/T 226, GB/T 4236, YB/T 4003
3	Dimensions	Every slab	—	Straightedge, calipers, etc.
4	Surface	Every slab	—	Visual inspection
5	Shape and profile	Every slab	—	Visual inspection, straightedge, calipers, etc.

*Note: The Seller shall ensure that the dimensions, shape/profile, and surface quality of slabs can all be sampled and inspected.*

## 10 Inspection Rules

### 10.1 Inspection and Acceptance:

Inspection and acceptance of slabs shall be the responsibility of the Seller's quality inspection department; the Buyer has the right to re-inspect the slabs.

### 10.2 Dimensional Measurement

10.2.1 Thickness: measured at a point 200mm–300mm from the end of the slab.

10.2.2 Width: measured at the midpoint of the slab length.

10.2.3 Length: measured along the centerline of the slab's wide face.

10.2.4 Where Seller and Buyer disagree on the minimum dimension of a slab, the location of the minimum dimension shall be used as the measurement point.

10.3 Re-inspection and Determination: Re-inspection and determination of slabs shall be carried out in accordance with GB/T 2101.

## 11 Transportation, Storage, Marking, and Quality Certificate

11.1 Special requirements for transportation and storage shall be determined by agreement between both parties.

11.2 The steel grade, heat number, and other information shall be marked on the end face, or the side surface near the end, of each slab.

11.3 The quality certificate shall comply with the provisions of GB/T 247.

## Permai Metal Indonesia Products Outline (Steel Slab)

### Attachment 1 Chemical Composition

Unit: %

Steel Grade	C	Si	Mn	P	S	Alt	Cr	Ni	Cu	N	V	Ceq	Remarks
SPHC	≤0.06	≤0.03	0.15–0.30	≤0.025	≤0.025	0.015–0.070	≤0.30	≤0.30	≤0.30				
SAE1006-L	≤0.06	≤0.03	0.13–0.30	≤0.025	≤0.025	0.020–0.070	≤0.08	≤0.08	≤0.08				Dedicated for cold rolling
SAE1006	0.03–0.06	≤0.03	0.15–0.30	≤0.025	≤0.025	0.020–0.070	≤0.08	≤0.08	≤0.10	≤0.008			
SAE1006-A1	0.02–0.06	≤0.03	0.15–0.30	≤0.025	≤0.025	0.015–0.070	≤0.08	≤0.06	≤0.08	≤0.010	≤0.008		Mo≤0.02, Nb/Ti≤0.008, B≤0.0007, Cu+Ni+Cr≤0.20
SS400/SS400-3	0.13–0.18	≤0.03	0.35–0.55	≤0.025	≤0.025	0.020–0.070	≤0.30	≤0.30	≤0.30	≤0.008	≤0.020		
Q235/Q235B	0.14–0.20	0.10–0.20	0.35–0.50	≤0.035	≤0.035		≤0.30	≤0.30	≤0.30				
Q355/Q355B	0.16–0.23	0.20–0.40	0.90–1.20	≤0.035	≤0.035		≤0.30	≤0.30	≤0.30			≤0.45	
S235JR/S235JR-5/S235JR+AR	0.13–0.17	≤0.03	0.35–0.60	≤0.025	≤0.025	0.020–0.070			≤0.55	≤0.012			Si+2.5P≤0.090
S235JR53234	0.07–0.11	≤0.03	0.35–0.50	≤0.030	≤0.025	0.025–0.065	≤0.08	≤0.08	≤0.10	≤0.008	≤0.008	≤0.35	Mo≤0.015, Nb≤0.008, Pb/Ti≤0.010, B≤0.0007, Sn≤0.030
S235JR53235	0.13–0.17	≤0.03	0.40–0.55	≤0.030	≤0.025	0.025–0.065	≤0.08	≤0.08	≤0.10	≤0.008	≤0.008	≤0.35	Mo≤0.015, Nb≤0.008, Pb/Ti≤0.010, B≤0.0007, Sn≤0.030
S275JR	0.14–0.18	≤0.03	0.60–0.75	≤0.035	≤0.035	0.015–0.070			≤0.55	≤0.012			
S355JR	0.16–0.20	≤0.03	1.20–1.40	≤0.035	≤0.035	0.015–0.070			≤0.55	≤0.012			