

ARMOX[®]
PROTECTION PLATE

ARMOX[®] GUARANTEES



SSAB

ARMOX[®] GUARANTEES

SSAB continuously improves its production processes in order to develop new and better products. As a result, you get both closer tolerances and improved workshop properties.

Armox[®] guarantees include tight thickness tolerances, tight flatness tolerances, and tight bending guarantees. These guarantees act as a complement to the Armox[®] datasheets and further enhance our promise of optimal workshop performance.

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ARMOX® THICKNESS GUARANTEE

Armox® thickness guarantee

Thickness tolerances are according to SSAB's thickness guarantee and are closer than those specified in EN 10 029 except for ≥ 80 mm, for which the tolerance range is according to standard.

Nominal Thickness (mm)	Steel Thickness (mm)		
	Min	Max	Within Plate
3.0 - 12.9	- 0.0	+ 0.6	0.4
13.0 - 19.9	- 0.0	+ 0.8	0.5
20.0 - 40.0	- 0.0	+ 1.0	0.6
40.1 - 59.9	- 0.0	+ 1.4	0.6
60.0 - 80.0	- 0.0	+ 1.6	0.7
80.1 - 100.0	- 0.0	+ 2.0	1.2
> 100	- 0.0	+ 3.2	-

Other tolerances can be supplied upon special agreement. Please contact your local sales representative for more information.

ARMOX® SURFACE QUALITY GUARANTEE

Armox® plate has surface quality according to EN 10 163 Class B subclass 3, weld repair is not permitted. For more information please contact Tech support or your local sales representant.

ARMOX® LENGTH AND WIDTH GUARANTEE

Length and width tolerances are according to those specified in EN 10 029 and the values tabulated below are valid for Oxyfuel cut plate. According to EN 10 029, the length of the plate is the length of the shorter of both longitudinal edges. The width should be measured perpendicular to the major axis of the plate.

Nominal length (mm)	Length tolerances (mm)	
	Min	Max
$l < 4000$	0	+ 20
$4000 \leq l < 6000$	0	+ 30
$6000 \leq l < 8000$	0	+ 40
$8000 \leq l < 10000$	0	+ 50
$10000 \leq l < 15000$	0	+ 75
$15000 \leq l \leq 18000$	0	+ 100

Nominal thickness (mm)	Width tolerances (mm)	
	Min	Max
$t < 40$	0	+ 20
$40 \leq t < 150$	0	+ 25
$150 \leq t \leq 160$	0	+ 30

ARMOX® FLATNESS GUARANTEE

Armox® flatness guarantee conform to EN 10 029 Class S, steel type L.
For special requests, contact your local sales representative.

Nominal thickness (mm)	Maximum permitted unflatness (mm/1m ruler)	Maximum permitted unflatness (mm/2m ruler)
	3.0 - 4.9	*
5.0 - 7.9	4	8
8.0 - 14.9	3	6
15.0 - 24.9	3	6
25.0 - 39.9	3	6
40.0 - 155.0	3	6

Short waves (300 - 1000 mm) according to EN 10 029.

In the case of discrepancies, the given class in the English version shall prevail.

FLATNESS, EDGE CAMBER & OUT-OF SQUARENESS

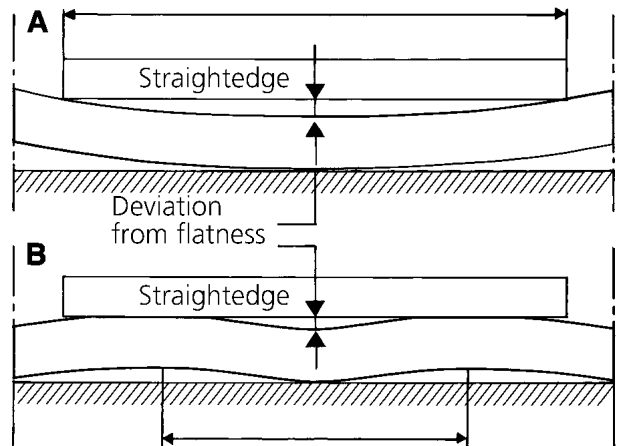
The information below is a presentation of how to inspect your SSAB deliveries using the product guarantees. This information is according to EN 10 029. For more information, please contact your local sales representant or Tech support, techsupport@ssab.com.

Flatness measurement

To determine the flatness deviation during production, the plate is measured manually or by laser. The measurement conforms to the manual procedure according to EN 10 029.

Flatness measurement for plate is according to EN 10 029. The plate is measured at least 25 mm from the long side of the plate and at least 200 mm from its short side. The vertical height is rounded off to the nearest mm. See the figure A and B.

The flatness measurement shall always be performed when the plate is placed on a flat surface.

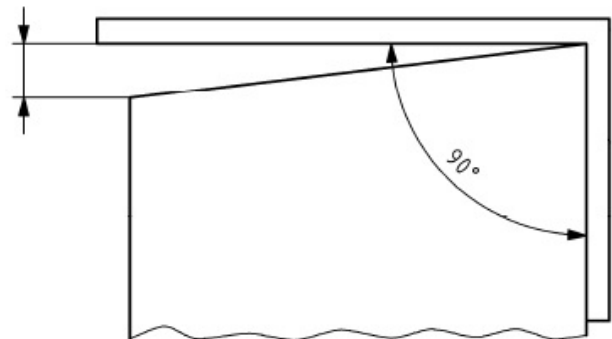
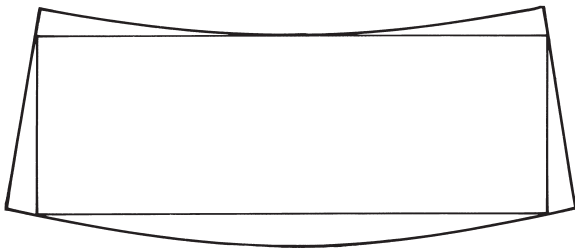


Edge camber and out-of-squareness

For plate specified with normal edge camber and out-of-squareness in the order, the edge camber and out of squareness shall be so that it is possible to inscribe a rectangle with the dimensions of the ordered plate within the delivered size.

The edge camber value is the maximum deviation between the longitudinal edge and the straight line joining the two ends of this edge. It is measured on the concave edge of the plate.

The out-of-squareness value is the orthogonal projection of one transverse edge on one longitudinal edge.



ARMOX® BENDING GUARANTEE

The bending guarantee conform to EN ISO 7438.

Product	Nominal Thickness (mm)	Punch Radius Minimum R/t ¹⁾		Die opening width W/t		90° bend
		⊥ ²⁾	∥ ²⁾	⊥ ²⁾	∥ ²⁾	Springback (°)
Armox® 370T	t < 8	3.0	3.5	9	10.5	9-13
	8 ≤ t < 15	4.0	5.0	10	11	
	≥ 15	5.0	6.0	12	13	
Armox® 440T	t < 8	4.0	4.0	10	10	11-18
	8 ≤ t < 15	4.0	4.0	10	12	
	≥ 15	4.5	4.0	12	14	
Armox® 500T	t < 8	4.0	4.0	10	12	12-20
	8 ≤ t < 15	4.0	4.0	12	14	
	≥ 15	5.5	6.0	16	18	
Armox® 600T	Contact SSAB					
Armox® Advance	Contact SSAB					

¹⁾ R/t stands for punch radius (R) divided by thickness (t)

²⁾ The rolling direction

The minimum recommended punch radius (R) and die opening width (W) for plate thickness (t) when the plate is being bent to 90° along the direction of rolling as-well-as transverse to the direction of rolling – and also the corresponding spring back.

Care should be taken during bending. The operator and other personnel shall therefore not stand in front of the press-brake, when in operation.

TESTING ARMOX® PRODUCTS

Unless otherwise agreed, inspection and testing are carried out and the results are reported as specified in the relevant material standard or in our data sheets. When placing the order, always specify whether the material requires special inspection, the scope of such inspection, and also the type of inspection document required.

Mechanical testing

Tensile testing according to ISO 6892.

Impact testing in accordance with ISO 148-1.

Hardness testing in accordance with EN ISO 6506-1, 6508-1.

Ultrasonic testing

Ultrasonic testing is performed, after agreement, according to EN 10 160, or equivalent national standard for ArmoX® plates. SSAB guarantee internal soundness corresponding to class E₃, S₃/ EN 10 160 for plates in thickness up to and including 80 mm. For plates above 80 mm thickness, SSAB guarantee internal soundness corresponding to class E₁, S₂/ EN 10 160, unless otherwise agreed. For more information, please contact your local sales representative.

Testing ¹⁾

As per EN 10 160	Distance between parallel scanninglines (mm)	Min. defect area to register (mm ²)	Max. permissible defect area (mm ²)	Max. number of local defects (defects/m ²)
-	100	1000	10000	1
S ₀	100	1000	5000	20
S ₁	100	100	1000	15
S ₂	50	50	100	10
S ₃	50	20	50	10

As per EN 10 160	Edge zone width ²⁾ (mm)	Min. defect length to register (mm)	Max. permissible defect length (mm)	Max. permissible defect area (mm ²)	Max. number of defects per m length
E ₀	50 - 100	50	100	100	6
E ₁	50 - 100	25	50	50	5
E ₂	50 - 100	20	40	40	4
E ₃	50 - 100	15	30	30	3
E ₄	50 - 100	10	20	20	2

¹⁾ Testing can be ordered and carried out either as total testing e.g E₁, S₁ or E₂, S₂ or as edge or surface testing individually e.g E₁, S₁

²⁾ The width of the edge zone on edge scanning varies with the plate thickness

DISTRIBUTION OF INSPECTION DOCUMENTS

SSAB has a certificate system that electronically produces, distributes and records all types of inspection documents. The documents are delivered electronically as PDF files. The certificate system offers excellent opportunities for simple and rational handling of inspection documents.

Inspection documents

Unless otherwise agreed, certificates are issued in English in accordance with SS-EN 10 204:2004. The certificates include the particulars specified in the material standard, which usually includes:

- Name of manufacturer.
- Clear reference to the purchase agreement and delivery batch.
- Material designation in accordance with the purchase agreement.
- Description of product.
- Nominal dimensions.
- Quantity.
- Results of inspection.
- Date of issue.

The following types of inspection certificates:

Inspection certificate 3.1.

The inspection certificate declares that the products delivered conform to the requirements of the purchase agreement. The results of testing are shown for the products that will be delivered or on inspection batches comprising part of the products delivered. The document is validated by an inspection representative who is authorized by the manufacturer and who is independent of the production department.

Inspection certificate 3.2.

The inspection certificate declares that the products delivered conform to the requirements of the purchase agreement. The results of testing are shown for the products that will be delivered or on inspection batches comprising part of the products delivered. Document issued both by the inspection representative authorized by the manufacturer and either by an inspection representative authorized by the customer or by an inspector appointed in accordance with official regulations.



EXAMPLE OF A ARMOX CERTIFICATE

Inspection certificate EN 10 204 - 3.1		Issuing department Quality inspection		Purchaser order no		Our order no		Invoice no		Certificate no and date	
Purchaser		Product ARMOUR STEEL		Marking (Stamping)		Customer marks		Our order no		Invoice no	
Quantity 1		Dimensions [mm] T W L		Weight [kg]		Deliv. Cond.		Internal code		Our order no	
Consignee		Standard/rules Steel grade ARMOX 500T		Standard/rules Steel grade ARMOX 500T		Deliv. Cond.		Internal code		Our order no	
MATERIAL ID											

Chemical composition											
Heat no		C	Si	Mn	P	S	Cr	Ni	Mo	Al	B
Heat no		C71-C92 Carbon equivalent etc									

Test type	C04 Millcode	C00	C01 Specimen position	C02 Direction	B05 Treatment	C10 Specimen type	C03 Temp [degr C]	C03 Test results
Tensile test								C11 Rp0.2 [MPa] C12 Rm [MPa] C13 A50 [%] C11 C12 C13 Rp0.2 [MPa] Rm [MPa] A50 [%]
Impact test								C42 E [J] C43 Ave [J] C42 E [J] C43 Ave [J]
Hardness test (HBW)								C32 Ave

		This certificate is produced with EDP and valid without signature Quality Inspection Department/ A Backlund / S Koekkoek		It is hereby certified that the material described above complies with the requirements of the order.			
		Z02		Z01		A22	

HOW TO READ A CERTIFICATE

Unless otherwise agreed, certificates are issued in English in accordance with SS-EN 10 204:2004. Additional Information can be found in EN 10 164. SSAB guarantees that the certificates are according to compliance and that the measured test result is according to the products performed result.

The basic rule of a certificate is that every box is containing information from the placed order data and the measured test result is from the specific ordered material. In the top end of the certificate you find reference information important for your and SSABs administration, these boxes are marked in the upper right corner with an A. This information is purchaser order no which is the customer reference number, SSABS order No, invoice No, certificate No and the date when the certificate was issued.

Below the administration information you will find information around the ordered product and it's visible appearance, these boxes are marked in the upper right corner with a B. This includes; marking, purchaser, consignment address, customer marks the product dimension and weight, delivery condition, steel grade and reference number. This section ends with the material ID, which is the product reference number from the production.

Last section includes measured testing results and information of special agreement, these boxes are marked in the upper right corner with a C. The box number are broken down by sections and specified below.

Administration and delivery information

A01 - Production site where the certificates is issued from.
A02 - Control standard.
A03 - Certificate number and the issued date.
A04 - Product logo and web address.
A05 - Issuing dep, whom responsible for the document.
A06 - Consignee /delivery address.
A07 - Purchasers own reference (order) number.
A08 - SSABs order number.
A11 - Purchaser.
A19 - Invoice number.
A22 - CE mark.

Mechanical testing and result

C00 - Millcode, test sample id.
C01 - Specimen position on the plate.
C02 - Test direction, transverse/along.
C03 - Temperature the test was performed in.
C04 - Test type.
C10 - Specimen type.
C71 - C92 - Chemical composition result.
C93 - C99 - carbon equivalent equation.

Product information

B01 - Ordered product.
B02 - Standard/rules and steel grade.
B04 - Delivery conditions.
B05 - Treatment.
B06 - Marking (stamping) on the plate.
B07 - Material ID.
B08 - Quantity, the amount of ordered plates.
B09 - B011 - Thickness, width and length.
B12 - Weight in kg.
B15 - Customer marks.
B16 - internal reference number.

Control information

Z01 - Certificates of compliance.
Z02 - Signatures from quality department.

MARKING ARMOX[®] PRODUCTS

All products are clearly marked on delivery. The steel grade and the product identity are stamped, unless the relevant standard specifies no stamping or after special agreement. For thicknesses of 5 mm or below and if stamping is not carried out for any other reason, stamping is replaced by marking with white paint.

Product identity

All production systems (works, plants, facilities) within the SSAB group have their own production identity systems and identity codes. The product identity code combines numbers, letters and symbols in one text string. The maximum number of characters is 25. The product identity is unique and is specified by two groups or three groups of digits, with each group containing up to six or seven digits, respectively. These groups of digits give every product a unique identity. Example of product identities from SSAB are listed below. For certain production facilities, the location of the stamped marking may be shown by two white-painted dots. Contact your local sales representative for more detailed options.

Heat number (6) - Serial number (6 or 7) = 13 - 14 characters.

Example: 095150 - 555621.

Marking and stamping

The steel grade and plate identity are always low-stressed stamped perpendicular to the rolling direction. For products without stamping, the steel grade and product identity are marked and the rolling direction is ink marked with arrows. Marking with paint may be carried out in the direction of rolling.

The customer's mark, product dimensions of length, width and thickness, product identity and the pile number for internal use are marked on the product. The marking is performed with white paint dot-matrix printing or black ink jet marking. The location of the stamp is occasionally indicated with two white-paint dots.

Brand marking

Unless otherwise agreed, to maintain traceability of the material at its destination SSABs products are marked as follows: Painted product is normally marked in a number of rows over the entire product surface. Unless otherwise agreed, a simplified steel grade designation and SSAB are painted. The product identity number can also be marked in rows over the product surface.

Note that the complete steel grade designation in accordance with the standard/data sheet or specification is stamped or is included in the paint marking.

ANTI-CORROSION PRIMERS ON ARMOX® PRODUCTS

Unprotected steel plate will corrode. SSAB can therefore provide the plate with effective anti-corrosion treatment known as shop primer. This protects the product while it is in transit.

The primer types we use have been tested by various institutes to ensure good working conditions for the end user. If good ventilation is provided, the hygienic limit values will not be exceeded in conjunction with welding, cutting or grinding.

Regardless of the anti-corrosion treatment specified, the appearance and cleanliness of the steel surface before treatment are decisive for the effectiveness of the anti-corrosion treatment. We shot-blast the plate, which is then immediately anti-corrosion painted. The primers used are mainly of low-zinc silicate.

The plate we keep in stock is painted with low-zinc silicate primer, since it does not need to be removed before normal welding. In order to provide visual distinction, our steel grades are painted in different colors.

Armox® is primed with a grey color if nothing else is agreed. Before selecting the final paint system, the relevant paint supplier should be consulted.

The information in the shop primer table below and SSAB anti-corrosion guarantee is valid for direct orders from ssab. The plates protection time is valid as of the plates delivery day.

Shop primers

Type	Color	Protection time
Low zinc	grey	6 months

Degree of blasting SA 2.5 as per ISO 8501 - 1.

PALLETIZING ARMOX® PLATE

Our delivery standard presents rules and guidelines for palletizing the deliveries. When placing your order, always specify whether the material should be subject to to special agreement.

The aim of the standard is to palletize the material in a way that avoids handling damage to the greatest extent possible, and that creates cost-effective and manageable volumes.

For deliveries in which SSAB is responsible for loading, the goods are always secured in accordance with the laws and regulations in force at that time. To regulate who pays for freight and insurance, we apply either CIP or CIF 2020 delivery conditions.

Concepts

Pallet	A platform loaded with packages. The pallets are separated with timber spacers measuring 63 x 90 mm.
Stack	A partial load on a pallet. Separated from other stacks by timber spacers measuring 32 x 32 mm.
Pallet label	A label attached to the top plate on a pallet containing the printed pallet number, legible text, bar code, painted colour code, quantity, weight, and the identity of the top plate.
Colour	Painted colour coding on the short and/or coding long side of the plate for delivery by sea.
Short plate	Plate <6100 mm long.

General pallet rules

- The maximum pallet weight is 12 tonnes.
- Thick and thin plates are never loaded on the same pallet, when order from stock.
- Painted and unpainted plates are never loaded on the same pallet.
- The widest plate is always at the bottom on the pallet.
- Graduated width loading (widest plate on the pallet, gradually diminishing to the narrowest at the top) is employed for plate thicknesses <30.1 mm.
- Random length loading (plates of different lengths are loaded in random order) is employed.
- Some thin plate may be strapped.

Options

- Strapping with steel straps around both the pallet and the stack. 6099 mm maximum plate length.
- Stack weights as agreed.
- Pallet weights as agreed.
- Special colour coding.
- Delivery codes outside the standard.
- Other requirements on dimensional separation.

Optional marking

- On the top plate on a pallet or stack. Up to 3 lines with 21 characters (manuell marking)* stack, up to 3 lines.
- Edge label attached on the thickness surface of the short side. Available in three variants with different information about the plate. Edge label possible above 8 mm thickness.

* Carried out free of charge, if required.

MINIMUM ORDER QUANTITIES FOR DIRECT MILL ORDERS

As a general rule, plates that are smaller than one of the following limit values of weight or dimensions can be supplied only subject to special agreement. For more information regarding dimension, weight or preferred quantities see respective products dimensional program or contact your local sales person.

Minimum order quantities ArmoX® plate

The minimum quantity per item for plate rolled to order. Minimum length is 2000 mm. For more information see respective products dimension program.

Thickness	Min quantity weight (t)
4.0 - 60.0	2.5
60.1 - 100.0	3.5
100.1 - 120.0	4.0
120.1 -	5.0

HANDLING OF SENSITIVE PRODUCTS

Armox® Advance is a ultra-high-hard ballistic steel primary intended for use as an add-on armour application in protection. The recommendations below are suitable for all products, but extra important when handling Armox® Advance

Armox® Advance is produced to be used in applique armour solutions with high demands. The properties are excellent for its purpose but plates need to be handled with care during delivery, storing and processing in order to avoid cracks. Please carefully read the following recommendations.

When lifting

- Avoid "three point bending".
- When using a crane, always lift the plates with evenly widespread attachment points.
- When using a truck, adjust the lifting forks along the length of the material for an even weight distribution.

When storing

- Store the plates indoor.
- Avoid rust.
- Stack with timber with air flow between the plates and timber.
- The timber should be place directly vertical under each other in order to avoid three point bending.



Example of a three point lift with a crack as an result.

When Processing

- Appropriate health and safety precautions must be taken.
- Follow SSAB processing recommendations.
- Before processing, let the plate adjust to the room temperature (+20 °C).
- Let the material rest at room temperature (+20 °C) after being processed.

SERVICE AND SUPPORT

SSAB offers extensive service and support to customers. We have a long tradition of helping customers to develop their steel products and processes with our unique knowledge. Unlike other steel mills SSAB offers two different services, Tech Support and the Knowledge Service Center. We offer technical and innovation support as well as technical training, handbooks and tools to help you become more productive.

SSAB offers advanced logistics solutions, including stock services worldwide, mill-direct deliveries, processing and logistics management solutions.



CONTACT INFORMATION

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SSAB is a Nordic and US-based steel company. SSAB offers value added products and services developed in close cooperation with its customers to create a stronger, lighter and more sustainable world. SSAB has employees in over 50 countries. SSAB has production facilities in Sweden, Finland and the US. SSAB is listed on Nasdaq Stockholm and has a secondary listing on Nasdaq Helsinki. www.ssab.com.



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