

Foreword

The formulation of this National Standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled "Enhancing the Implementation of AFMA Through Improved Agricultural Engineering Standards" which was funded by the Bureau of Agricultural Research (BAR) of the Department of Agriculture (DA).

This standard has been technically prepared in accordance with PNS 01-4:1998 (ISO/IEC Directives Part 3:1997) – Rules for the Structure and Drafting of International Standards. It provides specifications metal sheets and plates for agricultural machinery and structures.

The word “shall” is used to indicate requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted.

The word “should” is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that certain course of action is preferred but not necessarily required.

In the preparation of this standard, the following references were considered:

AS 2848.1, Aluminium and aluminium alloys – Compositions and designations, Part 1 – Wrought products

PNS 67:2000, Galvanized steel sheets and coils – Specifications

PNS 1431:1996, Hot-rolled steel flat products

PNS 1433:1996, Aluminium and aluminium alloy – Flat sheet coil and plate

Engineering Materials – Metal sheets and plates – Specifications

1 Scope

This standard establishes specifications and provides technical information for sheets and plates for agricultural machinery and structures.

2 References

The following normative reference contains provisions which, through reference in this text, constitute provisions of this standard:

AS 2848.1, Aluminium and aluminium alloys – Compositions and designations, Part 1 – Wrought products

PNS 67:2000, Galvanized steel sheets and coils – Specifications

PNS 1433:1996, Aluminium and aluminium alloy – Flat sheet coil and plate

3 Application

Sheets and plates are used for structural components for agricultural machinery and structures.

4 Definitions**4.1****aluminium and aluminium alloy sheet**

rolled rectangular section of thickness over 0.15 mm up to 6.0 mm, with sheared, slit or sawn edges

4.2**galvanized steel sheet**

galvanized flat or corrugated metal product cut to the standard or specified length and has a nominal base metal thickness ranging from 0.20 mm to 1.6 mm and a flat width of 760 mm to 1,220 mm

NOTE Sheets are available as coiled, with slit edges; or flat (flattened or leveled), with sheared, slit or sawn edges.

4.3**hot-rolled steel sheet**

hot-rolled product supplied in cut lengths and produced by cutting from a coil rolled on a continuous mill. It has a width of at least 600 mm and a nominal thickness of less than 3 mm. The edges of the sheet may be either trimmed or untrimmed

4.4**continuous hot-dip aluminium/zinc-coated steel sheet**

product obtained by hot-dip coating steel sheet coils on a continuous aluminium/zinc coating line to produce either coated coils or cut lengths

4.5**aluminium and aluminium alloy plate**

rolled rectangular section of thickness greater than 6.0 mm with either sheared or sawn edges

4.6**hot-rolled steel plate**

hot-rolled product supplied in cut lengths and produced by cutting from a coil rolled on a continuous mill. It has a width of at least 600 mm and a nominal thickness of 3 mm minimum. The edges of the sheet may be either trimmed or untrimmed

4.7**galvanized commercial quality**

flat sheet which is intended for general fabricating purposes where it is used as such or for bending or moderate forming

4.8**galvanized lock-forming quality**

sheet or coil which is intended for lock-seaming and other similar applications and have better formability than commercial quality

4.9**galvanized drawing quality**

sheet or coil which is intended for drawing or severe forming but excluding deep drawing

4.10**proof stress**

quotient of the load (when the specified permanent elongation occurs in a tensile test) divided by the original cross-sectional area

4.11**ageing**

term applied to changes in physical and mechanical properties of low carbon steel that occur with the passage of time and adversely affect formability

4.12**deoxidation**

removal of oxygen which causes oxidation of steel

5 Materials

Materials of sheets and plates discussed in this standard shall be hot-rolled steel, galvanized steel, and aluminium and aluminium alloys.

6 Hot rolled steel sheets and plates

6.1 Designation

6.1.1 Analysis grades

The designation for analysis of grades shall consist of a five-character alphanumeric system in accordance of the following:

(a) First character, a letter indicating deoxidation practice, as follows:

A:	Aluminium killed
K:	Silicon killed, with or without aluminium addition
R:	Rimmed
U:	Unspecified deoxidation

NOTE: The character “U” indicates that the steelmaker has the option to decide on the deoxidation practice.

(b) A four-digit series designation as follows, wherein the first two digits of the number indicate the type of steel (10 for plain carbon steel and 15 for carbon-manganese steel) and the last two digits indicate the approximate mean of the specified carbon range

Example of designation: A1006, XK1016, K10B55

6.1.1.1 Modification symbols for analysis of grades

Modification symbols may be added to the grade designation given in Clause 5.1.1 as follows:

(a) The prefix letter “X” is used to indicate a major deviation in chemical composition of any grade from the corresponding AISI-SAE grade.

(b) The letter “B” is used to indicate that the steel is boron-treated and is placed between the second and third characters of the four-digit series designation.

6.1.2 Formability grades

The designation of formability shall consist of a three-character alphanumeric system in accordance with following:

- (a) First character, the letter “H” to indicate hot-rolled steel.
- (b) Second character, a letter, U, A, K or R, indicating deoxidation practice (see clause 6.1.1(a)).
- (c) Third character, a digit indicating formability in accordance with the following:
 - 1. Commercial forming
 - 2. Commercial drawing
 - 3. Deep drawing
 - 4. Extra-deep drawing

Example of designation: HU1

6.1.2.1 Modification symbols for formability

The suffix letter “N” maybe added to the grade designation given in clause 5.1.2 to indicate that the steel is non-ageing.

Example of designation: HA4N

6.1.3 Extra-formability grades

The designation for extra-formability grades shall consist of a five-character alphanumeric system in accordance with the following:

- (a) First two characters, the letters “XF” to indicate extra-formability.
- (b) Third to fifth characters, three digits indicating the nominal yield strength.

Example of designation: XF300, XF500

6.1.4 Structural grades

The designation for structural grades shall consist of a five-character alphanumeric system in accordance with the following:

- (a) First character, the letter “H” to indicate hot-rolled steel.
- (b) Second character, a letter, U, A, K, or R, indicating the deoxidation practice (see clause 5.1.1(a)).
- (c) Third to fifth, three digits indicating the nominal minimum yield strength, in megapascals.

Example of designation: HA200, HW350

6.1.4.1 Modification symbol for structural grade

A suffix number preceded by a slash shall be added to the grade designation given in clause 5.1.4 to indicate any deviation from the base grade mechanical property requirements.

Example of designation: HU300/1

6.2 Mechanical properties

Mechanical properties of hot-rolled sheets and plates shall be in accordance with Tables 1 and 2.

Table 1 – Mechanical properties for formability, structural and weather resistant grades

Grade	Minimum yield strength MPa	Minimum tensile strength MPa
Hd1	(Note 2)	(Note 2)
Hd2	(Note 2)	(Note 2)
Hd3	(Note 2)	(Note 2)
Hd4	200	320
Hd200	200	300
Hd250	250	350
Hd300	300	400
Hd300/1	300	430
Hd350	350	430
HW350	340	450
Hd400	400	460

NOTE:

- 1) The letter “d” indicates deoxidation practice, which may be U, R or A
- 2) For design purposes, yield and tensile strength approximate those of structural grade Hd 200

Table 2 – Mechanical properties for extra formability grades

Grade	Nominal thickness mm	Minimum yield strength MPa*	Minimum tensile strength MPa
XF300	≤3	300	440
	>3	300	440
XF400	≤3.5	380	460
	>3.5	360	440
XF500	≤13	480	570

* If yielding does not occur, the 0.2% proof stress should be determined.

6.3 Markings

Each shipping unit shall be clearly and durably marked or tagged to indicate the following:

- a) Steel grade designation
- b) Dimensions
- c) Name or registered name or trademark of the manufacturer
- d) Batch identification

7 Galvanized steel sheets

7.1 Classification

Galvanized steel sheets shall be produced according to the classification shown in Table 3.

Table 3 – Classification of galvanized steel sheets

Classification Zinc coating designation	Applicable thickness range of base metal, mm					
	Z 120	Z 150	Z 180	Z 215	Z 250	Z 275
Commercial	0.20 to 0.60 inclusive			0.20 to 1.60 inclusive		
Drawing and lock forming	0.20 to 1.60 inclusive			0.80 to 1.60 inclusive		
Roofing and roofing accessories				0.2*	0.4	0.6

NOTE: Sheet with zinc coating designation of Z 180 or less is not suitable and should not be used for roofing purposes.
* For corrugated and roofing application, 0.2 mm full hard with a strength of 550 MPa (80,000 psi) must be used while for roofing accessories, like gutters, 0.2 mm annealed is applicable.

7.2 Mass of galvanized sheets

The theoretical and calculated mass of sheets shall be expressed in kilogram. The method of calculation for the mass shall be in accordance with procedure presented in PNS 67:2000. The unit mass of sheets are presented in Table 4.

Table 4 – Unit mass of galvanized sheets

Classification Zinc coating designation	Applicable thickness range of base metal, mm						Unit:kg/m ²
	Z 120	Z 150	Z 180	Z 215	Z 250	Z 275	
0.20	1.750	1.785	1.815	1.875	1.910	1.950	
0.25	2.142	2.178	2.208	2.268	2.302	2.342	
0.30	2.535	2.570	2.600	2.660	2.695	2.735	
0.35	2.928	2.962	2.992	3.052	3.088	3.128	
0.40	3.320	3.355	3.385	3.445	3.480	3.520	
0.50	4.105	4.14	4.170	4.230	4.265	4.305	
0.60	4.890	4.925	4.955	5.015	5.050	5.090	
0.80	6.460	6.495	6.525	6.585	6.620	6.660	
1.00	8.030	8.065	8.095	8.155	8.190	8.230	
1.20	9.600	9.635	9.665	9.725	9.760	9.800	
1.40	11.170	11.205	11.235	11.295	11.330	11.370	
1.60	12.740	12.775	12.805	12.865	12.900	12.940	

7.3 Dimensions

7.3.1 The standard nominal thickness of sheets and coils shall be as specified in Table 5. Gauge thickness of sheets are specified in Table 6.

Table 5 – Standard nominal thickness

Units: mm

0.20	0.40	1.00
0.25	0.50	1.20
0.30	0.60	1.40
0.35	0.80	1.60

NOTE: The nominal thickness of sheets is the thickness of the base metal in millimeters measured prior to galvanizing.

Table 6 – Gauge thickness of sheets

Gauge thickness	Thickness in millimeter	Gauge thickness	Thickness in millimeter
14	2.03	23	0.79
15	1.80	24	0.71
16	1.63	25	0.64
17	1.47	26	0.56
18	1.32	27	0.51
19	1.17	28	0.48
20	1.02	29	0.43
21	0.94	30	0.41
22	0.86		

7.3.2 The standards widths of flat sheets and the lengths of sheets shall conform to Table 7.

Table 7 – Standard width and length

Units: mm

Standard width	Standard length					
	760	1830	2140	2440	2750	3050
915	1830	2140	2440	2750	3050	3660
1000	-	2140	2440	-	3050	3660
1220	-	-	2440	-	3050	3660

7.3.3 The dimensions of sheets prior to corrugation shall conform to 7.3.1 and 7.3.2. The standard shapes and dimensions of corrugation shall be in accordance with Figure 1. The width before and after corrugation, other than those given in Figure 1 shall be subject to the agreement between the purchaser and the manufacturer.

7.4 Markings

Galvanized sheets shall be legibly marked or stamped with the following information:

- a) Name, trademark and address of manufacturer
- b) Zinc coating designation
- c) Roofing (for roofing sheets only)

NOTE: Thicknesses such as 0.25 mm, 0.30 mm and 0.35 mm were not included because there are no demands for these sizes and are not used nor being manufactured locally. Thickness 0.2 mm full hard with Z 215 coating and above is for low cost roofing and can compare with 0.4 mm for sturdiness.

- d) Base metal thickness, mm
- e) Length and width, mm

Unit: mm

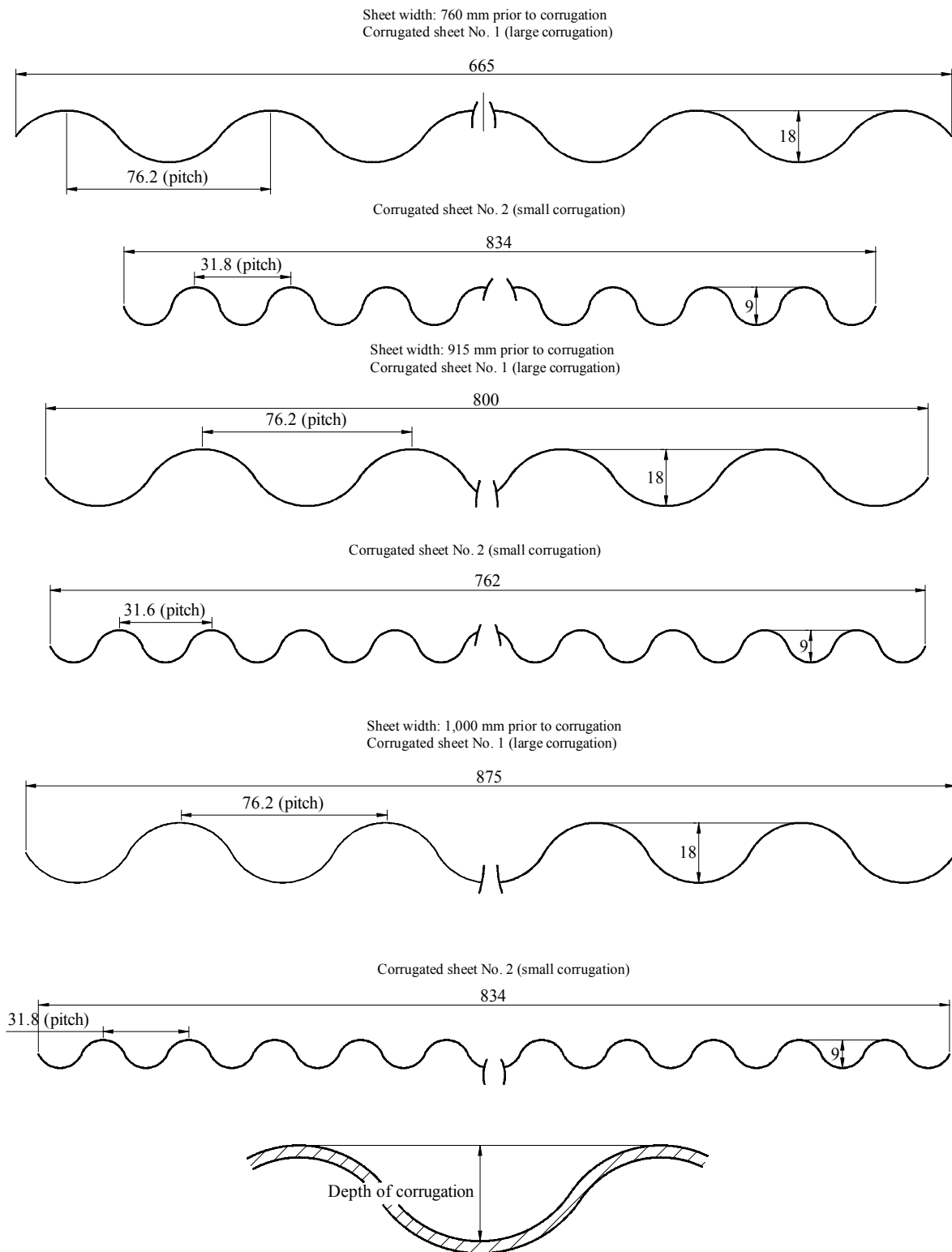


Figure 1 – Standard shapes and dimensions of corrugated sheets

8 Aluminium and aluminium alloy sheets and plates

8.1 Designation

8.1.1 Alloy designation

The aluminium and aluminium alloy designation shall be in accordance with AS 2848.1.

8.2.2 Temper designation

The temper designation shall be in accordance with AS 2848.1 and shall be used for all its forms of wrought aluminium and aluminium alloys. It shall follow the alloy designation, the two being separated by a dash.

8.2 Mechanical properties

Mechanical properties shall be in accordance with PNS 1433:1996.

8.3 Markings

Each flat sheet or plate shall be marked or tagged at each end with the following information:

- a) Manufacturer's name or trademark
- b) Product size
- c) Alloy and temper
- d) Batch number or other identification number

9 Hot-dip aluminium/zinc-coated steel sheet

9.1 Designation

Hot-dip aluminium/zinc coated steel sheet shall be designated by the following data in the sequence shown: coating mass designation, coating condition, surface treatment, quality and grade of steel.

9.1.1 General

The letters AZ are used to indicate an aluminium/zinc coating.

9.1.2 Coating mass

The coating mass designations are 90, 100, 150, 165, 185 and 200. The coating is expressed as the total mass on both surfaces in grams per square meter. The coating mass specified should be compatible with the desired service life, the thickness of the base metal, and with the forming requirements involved.

9.1.3 Coating type

The coating type is designated as:

- N Normal spangle coating
- S Skin-passed for improved surface (smoother condition)

9.1.4 Surface treatment

The surface treatment is designated as:

- A Oiling;
- B Mill passivation plus oiling
- C Mill passivation
- D No surface treatment

9.1.5 Base metal quality

This is designated as shown in Table 8.

Table 8 – Designation of base-metal quality

Quality	Designation
Commercial quality	01
Lock-forming quality	02
Structural quality	Indicated by three digits specified in Table 9

Table 9 – Mechanical properties of structural-quality steels

Grade	Lower yield stress, R_{eL} (min.) N/mm^2	Tensile strength, R_m (min.) N/mm^2
220	220	310
250	250	360
280	280	380
320	320	430
350	350	450
550	550	570

9.2 Dimensions

Aluminium/zinc coated steel sheet is produced in thicknesses up to 5.0 mm inclusive after coating, and in widths of 600 mm and over in coils and cut lengths.

9.3 Mechanical properties

The mechanical properties for structural quality grades shall be stated in Table 7.

9.4 Workmanship

The aluminium/zinc coated steel sheet in cut lengths shall be free from amounts of laminations, surface flaws and other imperfections that are detrimental to subsequent appropriate processing.

9.4 Markings

Unless otherwise stated, the following minimum requirements for identifying the steel shall be legibly stenciled on the top of each lift or shown on a tag attached to each coil or shipping unit.

- a) Manufacturer's name or identifying brand;
- b) Designation
- c) Dimensions
- d) Mass