

**JSC “Aluminium Metallurg Rus”**

**APPROVED BY**  
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“ \_\_\_\_\_ ” \_\_\_\_\_ **2022**

## **TECHNICAL REQUIREMENTS**

*for development, manufacture and delivery of the equipment for **cross cutting** line for production of sheets of aluminium and aluminium alloys of 1xxx, 2xxx, 3xxx, 5xxx, 6xxx and 7xxx series for thin and sheathing plates with the dimensions of 0.6-6.5x1000-2400x2000x12500mm*

### **T3-IIPII-071**

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The present technical requirements are applied to the development, manufacture and delivery of the equipment for cut-to-length line for production of sheets of aluminium and aluminium alloys of 1XXX, 2XXX, 3XXX, 5XXX, 6XXX and 7XXX series for thin and sheathing plates.

|                                 |  |
|---------------------------------|--|
| Customer location               | Rostov region, Belaya Kalitva, Zavodskaya str. 1   |
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Purpose: cut-to-length line is designed for the production of sheets of specified length and width by cutting of cold rolled and annealed coils of aluminium and aluminium alloys of 1XXX, 2XXX, 3XXX, 5XXX, 6XXX and 7XXX series for thin and sheathing plates.

### **Main technical characteristics**

#### **Characteristics of the initial coil:**

- outside diameter – 1000-2000mm
- inside diameter - 500mm (with a spool), 750mm (without a spool);
- width – minimum and maximum – 1060-2600mm;
- weight – minimum and maximum – 1500-12 000kg;
- telescoping – up to 60mm;
- camber – approximately up to 200mm;
- variation in thickness – up to 0.30mm for 95% of the strip length, without taking into account the thickened ends of the rolled strip and removed to side crops in the cut-to-length line:  
For strips the technological thickened ends with a thickness of up to 8.0mm are provided;
- non-flatness – up to 15mm per 1m of length;
- surface cleanliness – presence of surface defects – see **Appendix 1**;
- surface roughness – Ra not more than 2.5 or 1.25 microns (depending on the quality category of the sheets supplied);
- metal temperature, °C – from 0 to 90;
- the level of mechanical characteristics is given in **Appendix 2**.

#### **Characteristics of the finished sheet:**

- thickness – from 0.6 to 6.5mm;
- width and width tolerance – 1000-2000 +2.0mm, for width 2050-2400 +4.0 mm;
- length and length tolerance – 2000-12500 +10mm;
- non-flatness – not more than 6.0mm for the entire surface of the sheet and/or not more than 2mm per 1 meter of length and width of the sheet. When controlling small smooth waviness on sheets after straightening and cutting into sheets, there should be no non-flatness depth with the distance between the vertices of two adjacent waves;
- camber – not more than 4.0mm;
- surface cleanliness - presence of surface defects – see **Appendix 1**;
- surface roughness – Ra not more than 2.5 or 1.25 microns (depending on the quality category of the sheets supplied). The surface quality of sheets after cutting the strips in coils must meet the requirements of the various delivery categories and standards listed below (**in Appendix 1**);
- width of the cut edge maximum 100mm, minimum 10mm.
- after processing there should be no burrs on the sheet edges.

## **Quality control of sheets when cutting the coil**

Products entering the cut-to-length line should be subject to control.

1. Quality control of the upper and lower sides of the sheet is also performed on the line after the cut-to-length shears while monitoring the parameters of the sheet.
2. Control of the thickness of the cut sheets along the edge from 2 sides with registration in electronic form, with storage and possibility of taking off the archive to an external memory, as well as transferring information to the server. The sheet thickness control system must have a certificate as a measuring instrument.
3. Control of the defects of the sheet surface with registration in electronic form, with storage and possibility of online transmission of information to the server and taking off the data from the operator's workplace to removable media. Provide for the registration of the surface quality of the sheets with reference to each specific sheet with the possibility of determining the dimensions and area of defective places.
4. Control of geometric dimensions (length, width, different diagonals, deviation from flatness with fixation and registration of these dimensions with reference to the sheet. The sheet thickness control system must have a certificate as a measuring instrument.

### **The proposed composition of the cut-to-length equipment:**

- collecting table;
- conveyor;
- loading trolley;
- double-headed decoiler with release drums, floating;
- centering system;
- feeding device, coil threading from decoiler to the cutting line;
- mangle with feeding rollers;
- cross-cutting shears for thickened ends (up to 8mm) with a remover and a rear end diverter;
- stabilizing centering rollers;
- side trimming shears;
- chopper with a remover;
- centering rollers;
- mangle with feeding rollers;
- cleaning device for the rollers of the mangle;
- cross-cut-to-length shears (stationary or floating);
- sheet identification plant (identification marking). Font height 5mm, number of characters from 10 to 20.
- roll table with tilter and calibration table;
- sheet stacker with feeding rollers, brake device and mobile device (for stacking sheets of the length from 2000 to 12 500mm);
- receiving trolley paired with pallets;
- electric drive and automatic process control system;
- cut-to-length system;
- hydraulics system;
- lubrication system.

Provide for the possibility of equipping, installing into the line additional equipment for monitoring and surface preparation, option:

- a system for detecting and monitoring surface defects on the surface of sheets;
- a system for monitoring the geometric dimensions of sheets (length, width, different diagonality) and deviations from the plane and their registration;
- a device for cleaning, brushing the surface of sheets and obtaining the surface quality of sheets with a surface roughness Ra not more than 1.25 microns;
- a device for applying a protective film to the surface of sheets or the possibility of laying paper between sheets;
- a device for preservation, anticorrosive protection of the surface of sheets.

Workshop: Option

- table and device for a set of blades for drums of chopper;
- device for regrinding;
- stand for checking the cutting of chopper drums;
- mangler cassettes tilter;
- stand for assembly and disassembly of work rollers;
- flushing stand;
- verification table.

The equipment should include:

6 sets of cutting tools

Spare parts for one year of equipment operation.

**The following scope of reconstruction should be provided in the quotation:**

- Installation of a specialized operator panel on the CP-2, with possibility to control the line through the ETHERNET interface.
- Development of a control program based on the S7-200 process controller or its analogues.
- Development of visualization program on a specialized panel.
- Provide for an accurate positioning with the ability to adjust the position on the width of the strip. The measuring mechanism for sheet feeding should move along the toothed rack, should have a position coordinate and be programmatically linked to the cut-to-length shears and the pull roller.
- Install two fixed width-adjustable clamps behind the shears so that there is an opportunity to hold the sheet.
- Requirements to the object on the composition of the equipment and functions: In order to ensure reliability, as well as unification and compatibility with the existing equipment, it is desirable to use a Siemens touch panel MP377-19" or similar as a specialized panel. As a controller is CPU 416 6ES7 416-2XN05-0AB0.
- The cutting line control algorithms should be expanded and supplemented in the process of adjustment, using the STEP7 software tools in LAD and FBD languages. Messages about failures, reasons for shutdown, etc. should be shown at the operator panel and stored in the archive with a cycle of 7 days. Cut cycles in the event of a line shutdown should be resumed or continue by the operator's request.
- Implement diagnostics of distributed peripherals and drives with respect to failures and module failures.
- Programs of the controller, visualization, drives are transferred to the customer in full.
- When designing a control system, ensure synchronization and tracking of the speed of movement and the distance travelled during transportation. The electric drives should be interchangeable.
- Placing of new cable products.

The main technical solutions that allow unambiguously evaluating and comparing the participants of the competition, including:

- the cost of project work on the project implementation;
- the duration of the project work (with attachment of a calendar days schedule without numbers);
- cost of equipment and materials (with specification);
- cost of assembly and disassembly work (separately);
- cost of commissioning;

other costs for the project implementation (with a detailed description of the work performed).

The most preferable option of the contractor's participation in the project implementation is a full range of services from design and survey work to commissioning.

Comparison of sheet surface quality for delivery according to GOST 21631-76 with the increased surface quality, with the required one according to OST 1 90070-92

| <b>OST 1 90070-92, standard quality:<br/>front/opposite side</b>   |   | <b>GOST 21631-76, increased surface quality</b>  |   |
|--|---|--|---|
| <b>Defect description</b>  | <b>Dimensions, acceptability</b>  | <b>Defect description</b>  | <b>Dimensions, acceptability</b>  |
| Roughness  | Not more than Ra=1.25 micron  |  |   |
| Single small scratches   | Depth ≤0.02mm for sheets X*4000mm, up to 1500*more than 4000mm; depth ≤0.05mm for sheets more than 1500*more than 4000mm.<br>Depth ≤0.05mm without disturbing the cladding layer  | Single small scratches   | Depth ≤0.05mm, quantity ≤8/200x200mm, for back side only depth                                  |
| Group scratches  | Not more than 1 group / 2m <sup>2</sup> of sheets X*4000mm, up to 1500*more than 4000mm; not more than 1group / 1m <sup>2</sup> of sheets more than 1500*more than 4000mm.<br>In 1 group – not more than 5 pcs/in a square 150*150mm <sup>2</sup> , depth – according to p. 3.13.B.<br>Depth ≤ 0,05mm without disturbing the cladding layer | Group small scratches  | Depth ≤0.05mm, quantity ≤8/200x200mm, for back side only depth                                  |
| Minor abrasion with roughness parameters Ra=3.2 microns.<br>Abrasion with roughness parameters Ra=6.3 microns.                               | Total area ≤ 0.2 %/m <sup>2</sup><br><br>Total side ≤ 2 %/m <sup>2</sup>  | Minor abrasion   | Total area ≤ 2 %.<br>Back side ≤ 5 %.   |
| Abrasion with roughness parameters Ra=6.3 microns – for painted products   | Total side ≤ 1 %/m <sup>2</sup>   |  |   |
| Oxidation tint   | -   | Oxidation tint.<br>Diffusion spots and areas without cracks on sheets with technological cladding. | -   |
| Minor notch and pick up of aluminium in the form of strokes  | Stroke length ≤ 7mm, removable during control cleaning with an abrasive powder, micron sandpaper, without disturbing the cladding layer.<br>The same.   | Notch and pick up of aluminium in the form of strokes  | Length ≤ 5mm  |
| Prints from the rolls in the form of separate "lugs" (pick up of aluminium)  | Length*width ≤ 50*5mm, ≤ 2 pcs./ sheet.   | Prints from the rolls in the form of separate "lugs" (pick up of aluminium)                        | Length*width ≤ 50*5mm, total area ≤ 3 %   |
| Prints from the rolls in the form of light and dark stripes – for painted products. Prints from rolls in the form of light and dark stripes. | With smooth surface without tears, location – along rolling   | Prints from the rolls in the form of light and dark stripes.                                       | Without tears   |
| Prints in the form of small dents and bumps  | Total area ≤ 0.5 %, the value does not exceed half the minus thickness tolerance.<br>Does not exceed half the minus thickness tolerance.  | Prints in the form of small dents and bumps  | -   |
| Metal small laps   | Each ≤ 5mm <sup>2</sup> /m <sup>2</sup> , total ≤ 50mm <sup>2</sup> / side.<br>The same   | Metal small laps   | Total area ≤ 50mm <sup>2</sup> /m <sup>2</sup> , back side ≤ 100mm <sup>2</sup> /m <sup>2</sup> |
| Chambers from lap chipping   | Depth ≤ half the minus thickness tolerance, without disturbing the cladding layer.<br>The same.   | Chambers from lap chipping   | -   |

|   |   |   |  |
|---|---|---|--|
| Quenched sheets with transverse banding (at quenching in the furnace with air circulation). Feebly-marked stains – for painted products |   | Quenched sheets with transverse banding (at quenching in the furnace with air circulation). Feebly-marked stains.   | Total area $\leq 3\%$ ,<br>back side $\leq 5\%$  |
| Single bend marks: “fractures”  | $\leq 3$ pcs on sheet T and M dims.<br>0.5-0.6*1200mm and more.<br>The same   | Single fractures from bends.  | For sheets T and M with thickness 0.5-0.8mm<br>dimensions $\geq 1000*4000$ mm<br>and $\geq 1500*4000$ mm.    |
| Light traces of warping from quenching  | Not tangible by hand – for quenched sheets with thickness 0.5-0.6mm.<br>The same.   | Light traces of warping from quenching (cross breaks)   | Not tangible by hand for quenched sheets with thickness of 0.5-0.8mm.  |
| Transverse waviness from vibration of the ends of the sheets during cold-working  | Depth up to 0.1mm at a distance up to 700mm from the ends of sheets H, with the length more than 5500mm.<br>The same.   |   |  |
| On the side reverse to the face side on the finally chemically milled surface it is allowed -   | Single shallow dimples with a total area of 0.5%, depth $\leq 3\%$ of the sheet thickness: at a distance of dimples at least 5mm from each other and group dimples (group of not more than 5 pcs.), excluding chains of not more than $40\text{mm}^2 / \text{m}^2$ of the sheet surface with depth of not more than 10%.<br>Diameter $\leq 3$ mm. | -   | -  |
| Allowable defects - all defects on both sides   | The depth should not take the sheet out of the minus tolerance and disturb the cladding layer   | Allowable defects   | Separate defects should not take the sheet out of maximum thickness tolerance.                               |
| All defects from both sides   | It is allowed to set standards for sheet surface quality  | All defects from both sides   | It is allowed to set standards for sheet surface quality as agreed between the manufacturer and the customer |
|   |   | Not allowable defects:<br>- all defects exceeding the dimension indicated above;<br>- cracks;<br>- tears;<br>- laminations;<br>-diffusion spots;<br>- slag inclusions;<br>- areas exposed from cladding;<br>- blurred whitish spots of quenching origin;<br>- non-metallic inclusions of metallurgical origin, not removed during the control etching   |  |
|   |   | Allowable defects on the surface of sheets with increased surface finish according to GOST 21631-76 ..<br>Allowable surface defects are:<br>- prints from rolls in the form of light and dark lugs (pick up of aluminium);<br>- prints from rolls in the form of light and dark stripes without tears, running along the direction of rolling;<br>- notch and pick up of aluminium in the form of strokes having a length of not more than 5mm;<br>- minor abrasion with a total area of not more than 2% of the sheet surface;<br>- single and group small scratches with a depth of not more than 0.05 mm;<br>The depth of all the listed allowable defects does not exceed half of the maximum thickness deviations and does not disturb the cladding layer.<br>Other technical requirements for sheets - in accordance with the requirements of DIN EN. |  |

The level of mechanical characteristics of strips before cutting on the cutting line

| Alloy    |          | Temper | Tensile Strength, MPa |      | Yield Stress, MPa |      | Elongation, % |      |
|----------|----------|--------|-----------------------|------|-------------------|------|---------------|------|
| To GOST  | Analogue |        | min.                  | max. | min.              | max. | min.          | max. |
| В9504/пч | 7075     | М      | 188                   | 214  | 82                | 115  | 10,8          | 19   |
| В9504/пч | 7075     | Н      | 270                   | 380  | 250               | 320  | 1,5           | 3,5  |
| АМг6     | 5059     | Н      | 385                   | 428  | 285               | 337  | 6,0           | 14,7 |
| АМг6     | 5059     | М      | 315                   | 366  | 155               | 234  | 16,2          | 27,3 |
| 1163     | 2124     | М      | 178                   | 188  | 280               | 289  | 12,8          | 20,3 |
| 1163     | 2124     | Н      | 264                   | 363  | 254               | 339  | 1,5           | 3,5  |
| АК4-1ч   | 2618А    | Н      | 242                   | 387  | 234               | 356  | 1,9           | 4,5  |
| АД33     | 6061     | М      | -                     | 145  | -                 | -    | -             | 20   |
| АД1      | 1150А    | М      | 60                    | 80   | -                 | -    | 30            | 50   |
| АД1      | 1150А    | Н      | 130                   | 160  | -                 | -    | 4             | 7,5  |
| АМц      | 3003     | М      | 90                    | 120  | -                 | -    | 20            | 40   |
| АМц      | 3003     | Н      | 185                   | 200  | -                 | -    | 3             | 7    |