

1 - PURPOSE

1.1. - This specification governs the shapes, dimensions and tolerances to be complied with for the preparation for welding of the edges of rolled products made of plain carbon or low alloy steels with a tensile strength of less than 610 N/mm² used for the construction and repair of railway rolling stock for arc welding with coated electrodes and for semi-automatic arc welding.

It also defines the minimum conditions required for the abutment of the parts.

These regulations do not apply to automatic submerged arc welding, or to automatic gas-shielded welding.

1.2. - Classification

The shapes of the edges as prepared for welding are classified in relation to :

- the type of joint (butt or T joint),
- the shape of the weld symbolised on the drawing in accordance with the requirements of ISO international standard 2553,
- the thickness of the components to be welded,
- the position for welding :
 - flat,
 - vertically upwards (VM)
 - or vertically downwards (VD) (1)
 - horizontal vertical,
- the welding process :
 - with coated electrodes,
 - semi-automatic,

They are defined in Appendices 1 and 2 to this specification.

(1) Except for normal penetration electrodes.

2. CHARACTERISTICS

2.1. Physical characteristics

After preparation, the plate edges must have a uniform appearance with no trace of segregation or oxide inclusion and without laminations, laps or other defects or unevenness.

They must be free from grease deposits, paint or other coatings.

2.2. Geometrical characteristics

2.21. The dimensions to be given to the shapes of the edges for welding and to the gaps between parts as set up for welding shall be as those used for the classification (1.2.), in Appendices 1 and 2 attached to this specification.

2.22 In addition, the following tolerances shall be complied with when setting-up for welding:

2.221. - Butt joints

- Difference in vertical level of the bevelled plate edges : ≤ 1.5 mm.

In the case of a weld supported by a non-fusible metal backing bar, the tolerance on the dimension of the root gap shall be $\pm 20\%$ of the plate thickness, with a minimum of 0.5 mm and a maximum of 1.5 mm.

- Tolerance on the position of the root faces: ± 1 mm.

- In the case of a non-fusible metal backing bar being used during welding, there must be contact between the edges to be welded and the backing bar at all points.

2.222. - T joints

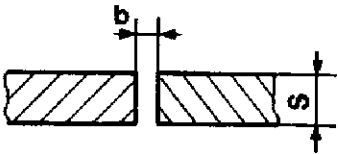

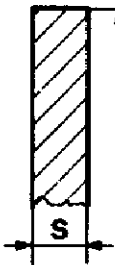
- Tolerance on the angles : $\pm 5^\circ$.

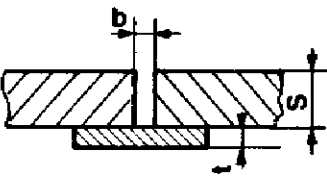
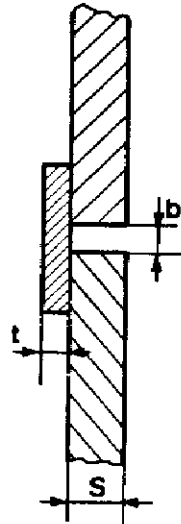
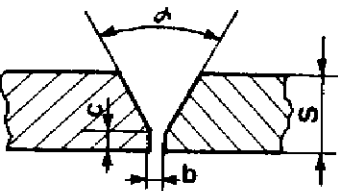
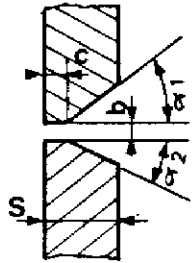
3. - EXECUTION

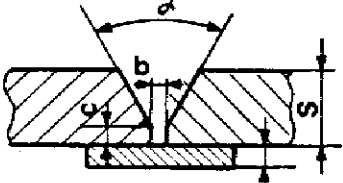
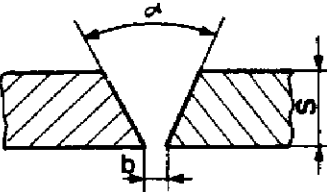
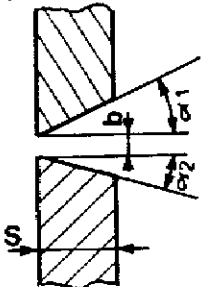
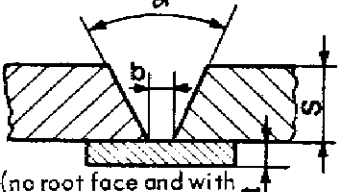
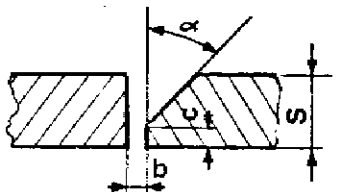
The process used for shaping the edges to be welded must be the subject of prior agreement between the factory and the purchasing Railway.

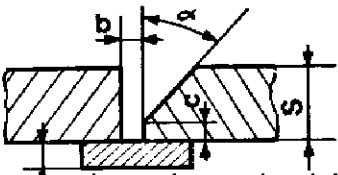
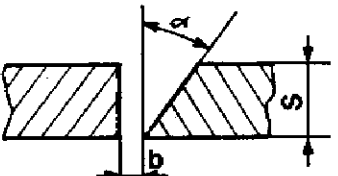
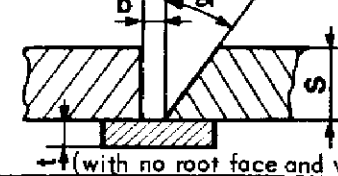
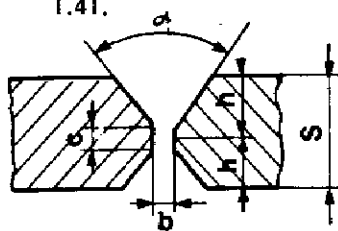
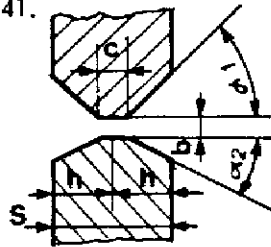
It may not be altered without the further agreement of the latter.

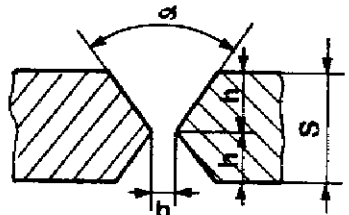
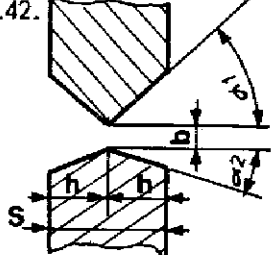
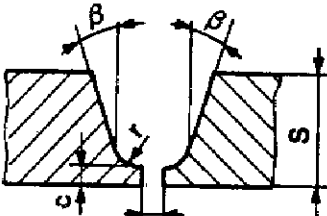
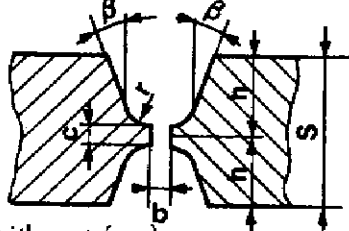
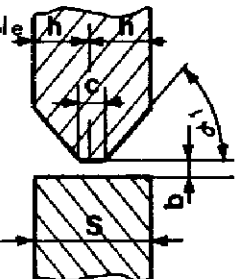
TYPES OF JOINT AND PREPARATION FOR MANUAL WELDING WITH NORMAL PENETRATION ELECTRODES

| Welding in the flat and vertically upwards positions | | | | | | | Welding in the horizontal-vertical position | | | | | | |
|---|----------|-----------------------------|---------|-----------------|----------------|---------------------------------|--|----------|-----------------------------|---------|-----------------|----------------|---------------------------------|
| 1. - BUTT JOINTS | | | | | | | | | | | | | |
| Type of weld | S mm | b mm | c mm | α (°) | β (°) | Remarks | Type of weld | S mm | b mm | d mm | α (°) | β (°) | Remarks |
| 1.1. open square butt 1.11. | | | | | | | 1.1. open square butt 1.11. | | | | | | |
|  | ≤ 3 | $s \pm 0,5$ | | | | For welding on one side only |  | ≤ 3 | $s \pm 0,5$ | | | | For welding on one side only |
| | ≤ 6 | $0 \text{ to } \frac{s}{2}$ | | | | For welding on both sides |  | ≤ 5 | $1 \text{ to } \frac{s}{2}$ | | | | For welding on both sides |

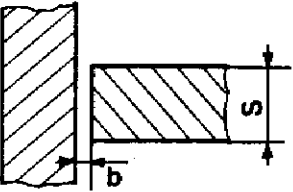
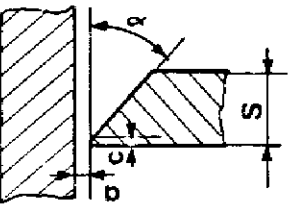
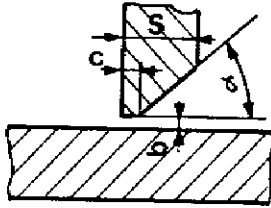
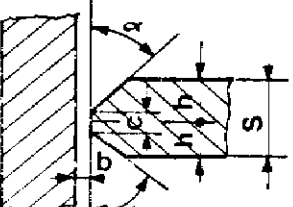
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|--|-------------------------------|---------------|-----------------------------|--|--|--|--|----------------------------------|--|-----------------------------|--|--|--|
| <p>1.12. open square butt (with backing bar)</p>  | <p>< 3</p> | <p>0 to 3</p> | | | | <p>$t \geq 5$</p> | <p>1.12. open square butt (with backing bar)</p>  | <p>$1 - < 3$</p> | <p>$S \begin{matrix} +1 \\ -0 \end{matrix}$</p> | | | | <p>$t \geq b$</p> |
| <p>1.2. single V (with root face) 1.21.</p>  | <p>$6 < 10$</p> | <p>0 - 2</p> | <p>2 ± 1</p> | <p>$70^{\circ} \begin{matrix} +0^{\circ} \\ -10^{\circ} \end{matrix}$</p> | | <p>gouging and rewelding on the reverse side</p> | <p>1.2. Single V 1.21.</p>  | <p>$> 10 - 25$</p> | <p>0 - 2</p> | <p>2 ± 1</p> | <p>$\alpha 1 = \begin{matrix} 45^{\circ} +5^{\circ} \\ -0^{\circ} \end{matrix}$ $\alpha 2 = \begin{matrix} 15^{\circ} +5^{\circ} \\ -0^{\circ} \end{matrix}$</p> | | <p>gouging and rewelding on the reverse side possible.</p> |

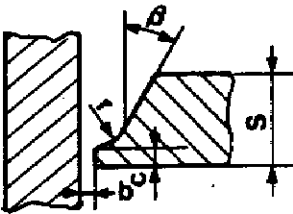
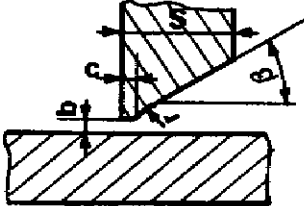
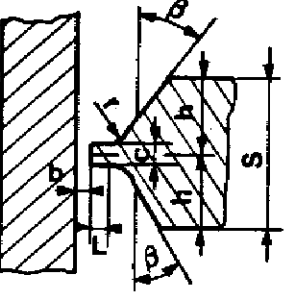
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| <p>1.22.</p>  <p>(with backing bar)</p> | <p>6- <math>\leq 12</math></p> | <p>3 $\begin{matrix} +2 \\ -0 \end{matrix}$</p> | <p>2 $\begin{matrix} +0 \\ -1 \end{matrix}$</p> | <p>55° $\begin{matrix} +5^\circ \\ -0^\circ \end{matrix}$</p> | <p>* 70° $\begin{matrix} +0^\circ \\ -10^\circ \end{matrix}$ for vertically upwards welding</p> | <p>1.22.</p> | | | | | | | | |
| <p>1.23.</p>  <p>(no root face)</p> | <p>3- <math>\leq 10</math></p> | <p>2 $\begin{matrix} +1 \\ -0 \end{matrix}$</p> | <p>70° $\begin{matrix} +0^\circ \\ -10^\circ \end{matrix}$</p> | <p>gouging and re-welding on the reverse side impossible.</p> | <p>1.23.</p>  | <p>3- <math>\leq 10</math></p> | <p>2 $\begin{matrix} +1 \\ -0 \end{matrix}$</p> | <p>$\alpha 1 = 45^\circ \begin{matrix} +5^\circ \\ -0^\circ \end{matrix}$ $\alpha 2 = 0^\circ$</p> | | | | | | |
| <p>1.24.</p>  <p>(no root face and with backing bar)</p> | <p>3- <math>\leq 12</math></p> | <p>3 $\begin{matrix} +2 \\ -0 \end{matrix}$</p> | <p>55° $\begin{matrix} +5^\circ \\ -0^\circ \end{matrix}$</p> | <p>* 70° $\begin{matrix} +0^\circ \\ -10^\circ \end{matrix}$ for vertically upwards welding</p> | <p>1.24.</p> | <p>3- <math>\leq 10</math></p> | <p>2 $\begin{matrix} +1 \\ -0 \end{matrix}$</p> | <p>$\alpha 1 = 45^\circ \begin{matrix} +5^\circ \\ -0^\circ \end{matrix}$ $\alpha 2 = 15^\circ \begin{matrix} +5^\circ \\ -0^\circ \end{matrix}$</p> | | | | | | |
| <p>1.3. single bevel (with root face) 1.31.</p>  | <p>6- <math>\leq 10</math></p> | <p>2 ± 1</p> | <p>2 $\begin{matrix} +0 \\ -1 \end{matrix}$</p> | <p>55° $\begin{matrix} +5^\circ \\ -0^\circ \end{matrix}$</p> | <p>* 45° $\begin{matrix} +5^\circ \\ -0^\circ \end{matrix}$ for vertically upwards welding, gouging and re-welding on the reverse side</p> | <p>1.3. Single bevel (with root face) 1.31</p> | | | | | | | | |
| | <p>>10-25</p> | <p>5 $\begin{matrix} +3 \\ -0 \end{matrix}$</p> | <p>2 $\begin{matrix} +0 \\ -1 \end{matrix}$</p> | <p>55° $\begin{matrix} +5^\circ \\ -0^\circ \end{matrix}$</p> | <p>gouging and re-welding on the reverse side possible.</p> | <p>>10-20</p> | <p>2 $\begin{matrix} +1 \\ -0 \end{matrix}$</p> | | | | | | | |
| | <p>3- <math>\leq 20</math></p> | <p>0-3</p> | <p>60° $\begin{matrix} +5^\circ \\ -0^\circ \end{matrix}$</p> | <p>gouging and re-welding on the reverse side possible.</p> | | | | | | | | | | |
| | <p>>12-25</p> | <p>5 $\begin{matrix} +3 \\ -0 \end{matrix}$</p> | <p>55° $\begin{matrix} +5^\circ \\ -0^\circ \end{matrix}$</p> | | | | | | | | | | | |
| | <p>>10-25</p> | <p>3 ± 1</p> | <p>2 $\begin{matrix} +0 \\ -1 \end{matrix}$</p> | <p>45° $\begin{matrix} +5^\circ \\ -0^\circ \end{matrix}$</p> | <p>gouging and re-welding on the reverse side</p> | | | | | | | | | |

| | | | | | | | | | | | | |
|--|-------------------|------------------------------------|------------------------------------|--|---|---|----------------|------------------------------------|------------------------------------|--|--|--|
| <p>1.32.</p>  <p>with root face and with backing bar)</p> | <p>6 < 12</p> | <p>5⁺²_{.0}</p> | <p>2⁺⁰_{.1}</p> | <p>55^{+5°}_{-0°}</p> | <p>* 45^{+5°}_{-0°} for vertically upwards t > b</p> | <p>1.32.</p> | | | | | | |
| <p>1.33.</p>  <p>(with no root face)</p> | <p>3 < 10</p> | <p>2⁺¹_{.0}</p> | | <p>55^{+5°}_{-0°}</p> | <p>gouging and re-welding on the reverse side impossible</p> | <p>1.33.</p> | | | | | | |
| <p>1.34.</p>  <p>(with no root face and with backing bar)</p> | <p>3 < 12</p> | <p>5⁺²_{.0}</p> | | <p>55^{+5°}_{-0°}</p> | | <p>1.34.</p> | | | | | | |
| <p>1.4. Double V 1.41.</p>  <p>(with root face)</p> | <p>> 13-25</p> | <p>3 ± 1</p> | <p>2 ± 1</p> | <p>70^{+0°}_{-10°}</p> | <p>h = S/2 (symmetrical)</p> | <p>1.4. Double V 1.41.</p>  <p>h = $\frac{S}{2}$ (symmetrical) If complete penetration is required, it is necessary to take special measures,</p> | <p>> 20</p> | <p>2⁺¹₋₀</p> | <p>2⁺⁰_{.1}</p> | <p>alpha 1 = 45^{+5°}_{-0°} alpha 2 = 15^{+5°}_{-0°}</p> | | |

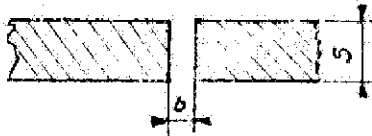
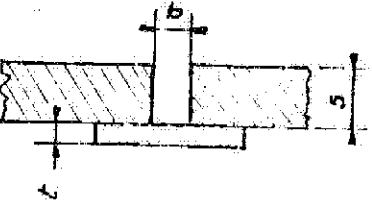
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| <p>1.42.</p>  <p>(with no root face)</p> | <p>>13 20</p> | <p>3 ± 1</p> | | <p>70°^{+0°} -10°</p> | <p>$h = \frac{S}{2}$ (symmetrical)</p> | <p>1.42.</p>  | <p>>20</p> | <p>2⁺¹ -0</p> | <p>$\alpha 1 =$ 45°^{+5°} -0°</p> <p>$\alpha 2 =$ 15°^{+5°} -0°</p> | <p>$h = \frac{S}{2}$ (symmetrical)</p> <p>If complete penetration is required, it is necessary to take special measures.</p> |
| <p>1.5. Single U</p> <p>1.51.</p>  <p>(with root face)</p> | <p>> 20</p> | <p>2 ± 1</p> | <p>3 ± 1</p> | <p>15° ± 5°</p> | <p>$R = 5 \begin{matrix} +2 \\ -0 \end{matrix}$</p> | <p>1.5. Single U</p> | | | | |
| <p>1.6. Double U</p> <p>1.61.</p>  <p>(with root face)</p> | <p>> 30</p> | <p>2 ± 1</p> | <p>3 ± 1</p> | <p>15°^{+5°} -0°</p> | <p>$h = \frac{S}{2}$ (symmetrical)</p> <p>$R = 5 \begin{matrix} +2 \\ -0 \end{matrix}$</p> | <p>1.6. Double U</p> | | | | |
| | | | | | | <p>1.7. Double bevel</p> <p>1.71.</p>  | <p>10 < 20</p> | <p>2⁺¹ -0</p> | <p>$\alpha 1 =$ 45°^{+5°} -0°</p> | <p>$h = \frac{S}{2}$ (symmetrical)</p> <p>If complete penetration is required, it is necessary to take special measures.</p> |
| | | | | | | <p>> 20</p> | <p>2⁺¹ -0</p> | <p>2⁺⁰ -1</p> | <p>$\alpha 1 =$ 45°^{+5°} -0°</p> | |

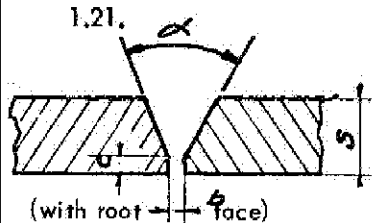
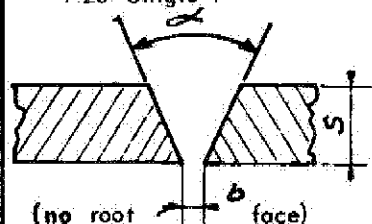
2. - T JOINTS

| Section | S mm | b mm | c mm | α (°) | β (°) | Remarks | Section | S mm | b mm | c mm | α (°) | β (°) | Remarks |
|--|-----------------|-----------------------|-----------|------------------------------|-------------|---------------------------------|---|-------------|-------------------|--------|------------------------------|-------------|--|
| 2.1 open square T 2.11.  | all thicknesses | 0 to 5S with 2mm max. | | | | | 2.1 open square T | | | | | | If complete penetration is required, special measures must be taken : (gap, back gauging, welding bead, etc...) |
| 2.2 Single bevel 2.21.  (with root face) | $5 \leq 20$ | 0 to 3 | 1 max. | $55^\circ +5^\circ -0^\circ$ | | | 2.2 Single bevel 2.21.  | $5 \leq 20$ | $\frac{S+1}{S-0}$ | 1 max. | $55^\circ +5^\circ -0^\circ$ | | If complete penetration is required, special measures must be taken : (gap, back gauging, welding bead, etc...) |
| 2.3 Double bevel 2.31.  (with root face) | $>13-25$ | 0 to 3 | $2 +0 -1$ | $55^\circ +5^\circ -0^\circ$ | | $h = \frac{S}{2}$ (symmetrical) | 2.3 Double bevel | | | | | | $h = \frac{S}{2}$ (symmetrical) if complete penetration is required, special measures must be taken : (gap, back gauging, welding bead, etc...) |

| | | | | | | | | | | | |
|---|----------------|---------------|------------------------------------|--|---|---|----------------|---------------|------------------------------------|--------------------------|--|
| <p>2.4 Single J 2.41.</p>  <p>(with root face)</p> | <p>> 16</p> | <p>0 to 3</p> | <p>2⁺¹₋₀</p> | <p>20°^{+5°}_{-0°}</p> | <p>R = 8 min. If complete penetration is required, special measures must be taken : (gap, back gouging, welding bead, etc..)</p> | <p>2.4 Single J 2.41.</p>  | <p>> 16</p> | <p>0 to 3</p> | <p>2⁺¹₋₀</p> | <p>20°^{+5°}</p> | |
| <p>2.5 Double J (with root face)</p>  | <p>> 30</p> | <p>0 to 3</p> | <p>2⁺¹₋₀</p> | <p>15°^{+5°}_{-0°}</p> | <p>$h = \frac{S}{2}$ (symmetrical) R = 8 min. $L = 3 + \frac{2}{-1}$ If complete penetration is required, special measures must be taken : (gap, back gouging, welding bead, etc..)</p> | <p>2.5 Double J</p> | | | | | |

**TYPES OF JOINT AND PREPARATION
FOR SEMI-AUTOMATIC GAS-SHIELDED WELDING
WITH SOLID WIRE ELECTRODES**

| ALL POSITIONS | | | | | | |
|---|---------|--------------|---------|-----------------|----------------|--------------------------------------|
| 1. BUTT JOINT | | | | | | |
| Section | S mm | b mm | c mm | α (°) | β (°) | Remarks |
| 1.1 Open square butt 1.11. | | | | | | |
|  | 1-5 | $S+1$ 2-0 | | | | For weld- ing on one side only |
| | 3-6 | $2+1$ -0 | | | | For weld- ing on both sides |
| 1.12. Open square butt (with backing bar) | | | | | | |
|  | 1 | $2+1$ -2 | | | | $t \geq b, 8 \text{ mm}$ max. |
| | 2-5 | $S+1$ -0 | | | | |

| | | | | | | |
|--|-------------|------------------|------------------|------------------------|--|---|
| 1.2. Single V | $6 \leq 10$ | 2^{+1} -2 | 2^{+0} -1 | $50^\circ \pm 5^\circ$ | | |
|  | ≥ 10 | 2^{+1} -2 | 2^{+0} -1 | $45^\circ \pm 5^\circ$ | | gouging and rewelding on reverse side |
| 1.22. | | | | | | |
| 1.23. Single V | $5 \leq 10$ | 2^{+1} -0 | 1 max. | $50^\circ \pm 5^\circ$ | | |
|  | > 10 | 2^{+1} -0 | 1 max. | $45^\circ \pm 5^\circ$ | | gouging and rewelding on reverse side impossible |
| 1.24. | | | | | | |

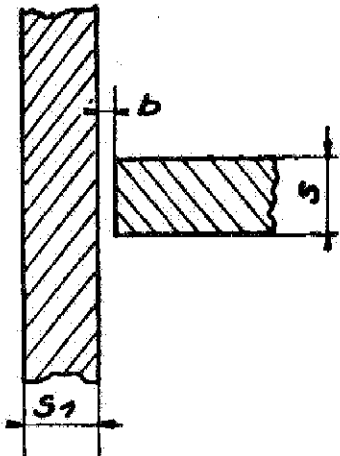
| | | | | | | |
|--------------------|--|-----------------|--|-----------|------------------------|--------------------------------------|
| 1.3. Single bevel | | | | | | |
| 1.31. | | $6 < \sqrt{10}$ | 2 ± 1 | 2 ± 1 | $45^\circ \pm 5^\circ$ | welding on the reverse side possible |
| | | > 10 | 3 ± 1 | 2 ± 1 | $45^\circ \pm 5^\circ$ | |
| 1.32. | | | | | | |
| 1.33. Single bevel | | | | | | |
| | | $6 < \sqrt{10}$ | $2 \begin{smallmatrix} +1 \\ -0 \end{smallmatrix}$ | 1 max. | $45^\circ \pm 5^\circ$ | welding on the reverse side possible |
| | | > 10 | $2 \begin{smallmatrix} +1 \\ -0 \end{smallmatrix}$ | 1 max. | $45^\circ \pm 5^\circ$ | |
| 1.34. | | | | | | |

| | | | | | | |
|---------------|--|--------|-----------|-----------|------------------------|------------------------------------|
| 1.4. Double V | | | | | | |
| 1.41. | | > 12 | 3 ± 1 | 3 ± 1 | $50^\circ \pm 5^\circ$ | $h = \frac{s}{2}$ (symmetrical) |
| 1.42. | | | | | | |
| | | > 12 | 3 ± 1 | 1 max. | $50^\circ \pm 5^\circ$ | $h = \frac{s}{2}$ (symmetrical) |

2. T-JOINTS

2.1. Open square

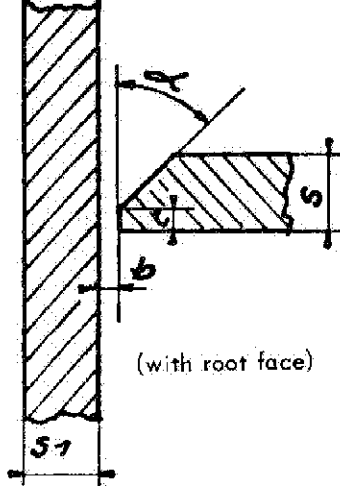
2.11.



all thick-
nesses
0 to $\frac{S}{6}$
with
2 mm
max.

2.2. Single bevel

2.21.

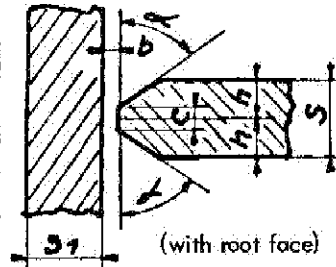


≥ 5 3 ± 1 3 ± 1 $45^\circ \pm 5^\circ$

welding on
the reverse
side in the
form of a fillet
weld.

2.3 Double bevel

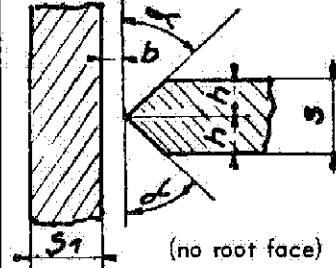
2.31.



≥ 6 3 ± 1 2 ± 1 $45^\circ \pm 5^\circ$

$h = \frac{S}{2}$
(symmetrical)

2.32.



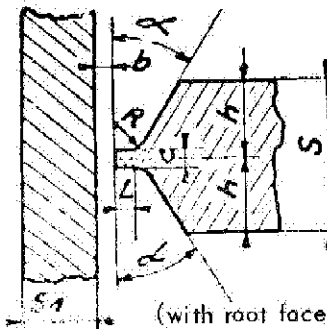
≥ 6 $2 \begin{matrix} +1 \\ -2 \end{matrix}$ 1 max.

$45^\circ \pm 5^\circ$ $h = \frac{S}{2}$
(symmetrical)

2.4 Single J

(with root face)

2.5 Double J



≥ 30 $2 \begin{matrix} +1 \\ -2 \end{matrix}$ 3 ± 1 $25^\circ \pm 5^\circ$

$h = \frac{S}{2}$
(symmetrical)
 $R = 8 \text{ mm}$
 $L = 3 \begin{matrix} +2 \\ -1 \end{matrix}$

APPLICATION

As from 1 July 1979.

All Railways belonging to the Union. An unlimited derogation is, however, granted to the ÖBB.

RECORD REFERENCES

Headings under which the question has been dealt with :

- Standardisation of welding materials (electrodes).
(Sub-Committee for Specifications : Paris, January, 1974).

(1-7-80)

- Question 5/S/27 - Standardisation of welding materials
III) Amendments to existing leaflets.
(Sub-Committee for Specifications : Paris, January 1977).

- Question 5/Sa/Fic - Revision of Leaflet 897-9 «Preparation, for welding, of the edges of rolled products made of plain carbon or low alloy steels with a tensile strength of less than 610 N/mm², for arc welding with coated electrodes and for semi-automatic arc welding».

(Sub-Committee for Specifications : Paris, January 1979).

- Question 5/Sa/Fic - Examination of observations made by Railways on UIC Leaflet 897-9 «Preparation, for welding, of the edges of rolled products made of plain carbon or low alloy steels with a tensile strength of less than 610 N/mm², for arc welding with coated electrodes and for semi-automatic arc welding».

(Sub-Committee for Specifications : Paris, January 1980).