

## Factory standard for cold-formed pipe elbows and pipe elbows (SC-WN)

### 1. Purpose

It must be ensured that pipe elbows and pipe bends which are not manufactured and tested according to official standards, customer requirements or other tolerance specifications are still within certain limits of tolerance and meet consistent quality criteria.

### 2. Scope of application

This factory standard applies to all pipe elbows and pipe bends for which drawings or orders do not contain any indication of tolerances which are to be complied with unless other agreements have been explicitly made in the offer or order confirmation.

This factory standard applies to all materials and bending procedures which are manufactured or sold by the two companies specified above.

### 3. Overall dimensions

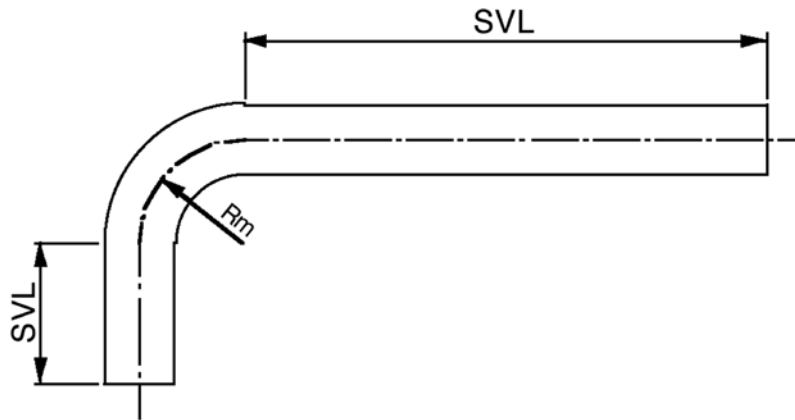
Term: SC-WN = Schuster factory standard

All dimensions are in mm

Pipe bends and pipe elbows

| Nominal dimension | ≤ 50    | ≥ 51<br>... 100 | ≥ 101<br>... 250 | ≥ 251<br>... 500 | ≥ 501<br>... 1000 | ≥ 1001<br>... 3000 | ≥ 3001  |
|-------------------|---------|-----------------|------------------|------------------|-------------------|--------------------|---------|
|                   | +/- 1,0 | +/- 1,5         | +/- 2,0          | +/- 3,0          | +/- 4,0           | +/- 6,0            | +/- 8,0 |

Overall dimension = average bending radius (Rm) + leg extension (SVL)



#### 3.1 Radius tolerance for pipe elbows 180°

| Nominal dimension | ≤ 50    | ≥ 51<br>... 100 | ≥ 101<br>... 250 | ≥ 251<br>... 500 | ≥ 501   |
|-------------------|---------|-----------------|------------------|------------------|---------|
| Tolerance         | +/- 1,5 | +/- 2,0         | +/- 3,0          | +/- 4,0          | +/- 5,0 |

#### 3.2 Radius tolerance for pipe elbows < 180°

| Nominal dimension | ≤ 50    | ≥ 51<br>... 100 | ≥ 101<br>... 500 | ≥ 501<br>... 1000 | ≥ 1001                      |
|-------------------|---------|-----------------|------------------|-------------------|-----------------------------|
| Tolerances        | +/- 2,0 | +/- 3,0         | +/- 5,0          | +/- 20,0          | 2 % of the specified radius |

## 4. Bending angle tolerances for pipe elbows and pipe bends

Degree of accuracy f: +/- 0,5°

Degree of accuracy m: +/- 1,0°

Degree of accuracy g: +/- 2,0°

If no degree of accuracy is indicated, degree of accuracy m applies.

## 5. Formation of ripples

If possible, the formation of ripples should be prevented provided that this is possible based on the raw material or a possibly suboptimal ratio of radius and wall thickness.

Flat ripples are admissible if the average ripple height ( $h_m$ ) does not exceed 3% of the outside diameter ( $da_1$ ) of the liner pipe and the distance between the ripples is  $>15 \times$  the average ripple height ( $h_m$ ).

The average ripple height is calculated using the following formula:

$$h_m = \frac{(da_2 + da_4)}{2} - da_3$$

$h_m$  = average ripple height

$da_1$  = outside diameter

$da_2$  = height of the largest ripple

$da_3$  = height of the valley between  $da_2$  and  $da_4$  (diameter)

$da_4$  = height of the ripple adjacent to  $da_2$  (diameter)

## 6. Ovality in the bending area

The measured ovality can be calculated using the following formula:

$$\text{Ovality in \%} = 2 \times \frac{D_{\max} - D_{\min}}{D_{\max} + D_{\min}} \times 100$$

Unless otherwise provided for, admissible ovality is:

$Rm = \leq 4 \times d_a$  up to 10%

$Rm = > 4 \times d_a$  max. 5%

$$O_{\text{adm}} = \frac{20}{Rm / d_a}$$

$O_{\text{adm}}$  = admissible ovality

$d_{\text{max}}$  = maximum measured outside diameter

$d_{\text{min}}$  = minimum measured outside diameter

$Rm$  = medium bending radius

$d_a$  = outside diameter

## 7. Wall thickness

The reduction in wall thickness of pipe elbows and pipe bends depends on the ratio of diameter and radius and the required or admissible ovality. If a minimum wall thickness is required it must be indicated on the request for proposal.

## 8. Surfaces

Slight horizontal or vertical draw marks due to the production procedure and more or less deep and visible grooves produced on the surface by the tools are admissible. Draw marks resulting from the mandrel forming process are admissible as well.

Higher surface requirements regarding the inner and outer surface inconsistent with or exceeding the SC-WN must be specified during the offer phase.

Unless requested otherwise, bending parts are delivered without surface finishing such as dipping, blasting, grinding or polishing.

## 9. Lubricants

For the lubrication of mandrels commercially available vegetable oil or soap based lubricants or minimum mineral oil based lubrication are used. Pipe elbows and pipe bends are pre-cleaned but they are not absolutely free of grease or drawing compound.

Special requirements inconsistent with or exceeding the SC-WN must be indicated on the request for proposal.