# Working Manual: System for Measurement and Recording for Industrial Insulation Cladding

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# Working manual:
## System for measurement and recording for industrial insulation cladding

Contents

## 1. Scope and purpose

This manual is applicable for insulations of pipes, fittings, vessels and tanks in industrial installations. It creates a system of measurement for sheet-metal preparation and assembly.

The measuring system created in this document provides for recording all data required in a form equally as suitable for calculation, for sheet-metal preparation and assembly, and for accounting and documentation.

This measuring system dispenses with the possibility to devise symbols and tables for each and every conceivable case.

Complicated constructions and special cases can be recorded separately in the drawing spaced provided, or in the measuring sheet for special fittings.

## 2. Principles

The measuring system created in this manual comprises the recording of data in tabular form as well as the drawing rules. The main effort was applied to the tabular documentation. To meet this objective, measuring sheets have been designed for pipes, removable boxes, vessels and tanks.

Additionally, in the drawing space of the measuring sheet for pipes the opportunity is given to lay down the pipe system in isometric projection and – using symbols – the components listed in the tables. Special fittings can also be sketched in the drawing space in the measuring sheets.

The recording in tabular form is also the basis for the computerised data handling.

All measurements are to be given in mm.

## 3. Drawing rules

Plotting is carried out in the drawing spaces of the measuring sheets for pipes and removable boxes. However, it is principally restricted to the drawing of pipes and fittings. Plotting of removable boxes is needed only in special cases.

### 3.1 Plotting of pipe systems in isometric projection

#### 3.1.1 Co-ordinates

The direction of pipes is plotted in isometric projection in accordance with Figure 1. A scale drawing of the lengths of the pipes is not necessary.

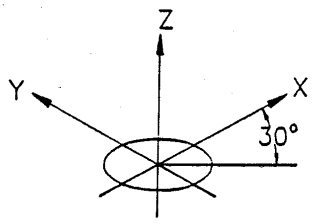



**Figure 1**

The co-ordinates X, Y, Z represent the three main axes; the planes defined by them are called the principal planes. If pipes run outside these principal directions, the planes must be hatched as shown in Figure 2 according to the following rules: The planes of the side and front perspective (Y,Z; X,Z) are hatched vertically and the plane of the horizontal perspective (X,Y) is hatched at an angle of 30°.

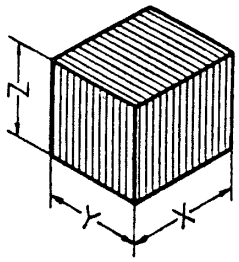



**Figure 2**

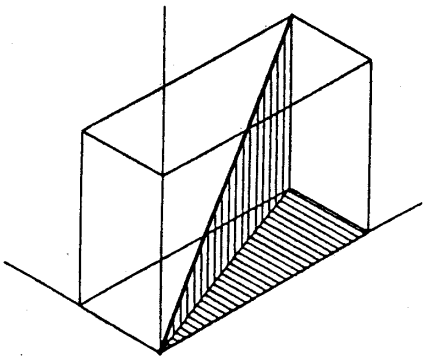


**Figure 3**

Figure 3 shows an example of a pipe running at angles to all three principal planes.

The definition of the angles for principal directions in relation to the direction of assembly is shown in Figure 4. For horizontal pipes, 0° always lies on top and the following angles run clockwise **looking in the direction of assembly** (marked with a double arrow-head). For vertical pipes (Z-axis), 0° is always in the Z,X-plane, the following angles run clockwise **looking against the Z-axis.**

These angles are used if in an isometric drawing the position for a fitting or the position of a seam are to be shown (see chapter 3.1.4).

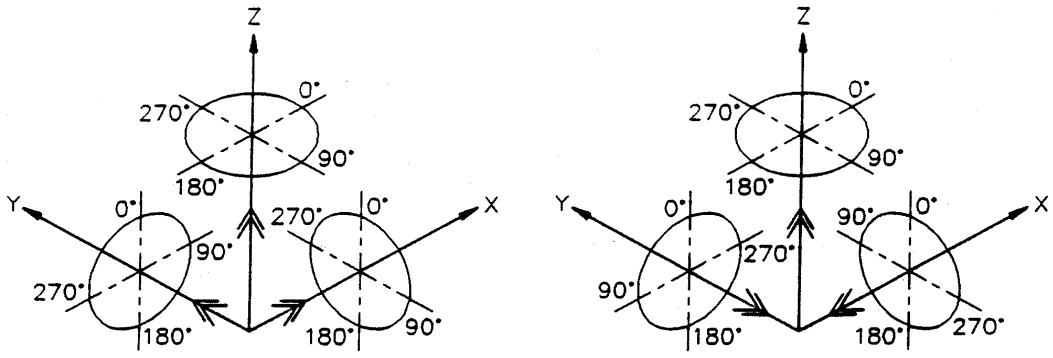



**Figure 4**

Figure 5 shows an example for the use of angles at a given piping system.

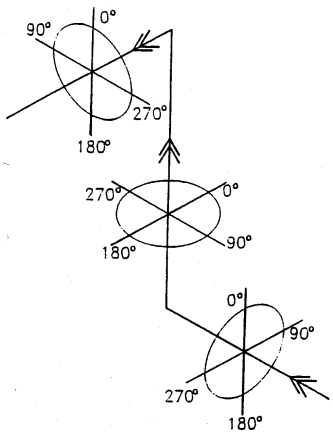



**Figure 5**

### 3.1.2 Symbols

Pipes and fittings are plotted using the symbols given in the Annex.

### 3.1.3 Direction of assembly

The direction of assembly and its changes can be specified using the symbols 1 and 2.

### 3.1.4 Longitudinal seams and cut-outs

It is possible to define the position of longitudinal seams and cut-outs. This is done using angles between 0° and 360° using the system shown in Figure 4 with the symbol 8 for the longitudinal seam and the symbols 10 or 11 for the cut-outs.

For the standard positions 0°, 90° etc., only the symbol without the angle is used.

It must be noted that when defining fitting positions in the tables, the angle as defined in chapter 4.1 must be used.

Examples for the position of longitudinal seams and cut-outs on pipes are shown in Figure 6. These displays are symbols and are, therefore, not in an isometric projection.

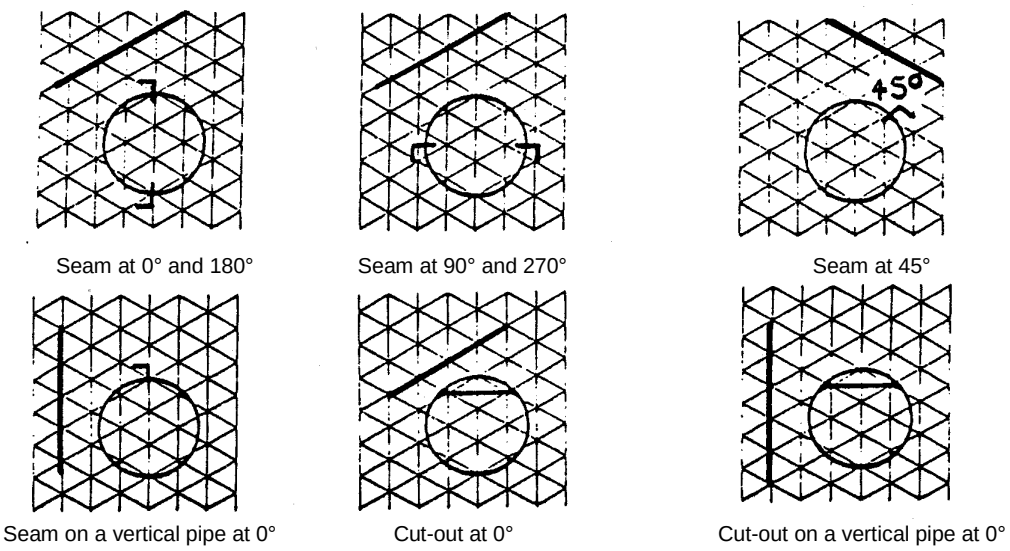



**Figure 6**

### 3.1.5 Pipe lengths between formed pieces and fittings

In the drawing space, the actual distances are being recorded, whilst in the table the measurements for fabrication are listed.

### 3.1.6 Distance between elbows and taps

The distances are taken from the axis of the pipe, as shown in Figure 7.

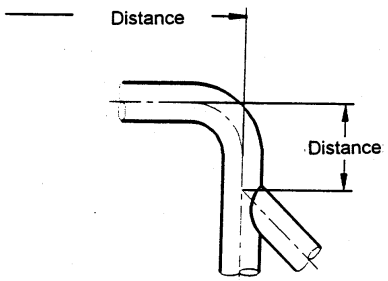



**Figure 7**

### 3.1.7 Distance between fittings

The distances from flanges and flanged fittings are taken from the middle of the flange, for welded fittings from the weld seam (Figure 8). The distance s must also be given.

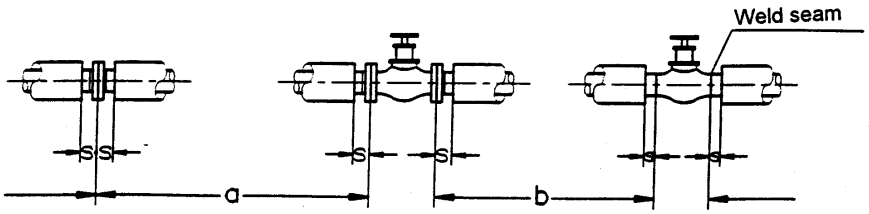



**Figure 8**

## 4. Display in tabular form

The measured data are being recorded on the sheets.

**Measuring sheet for pipes**
**Measuring sheet for removable boxes**
**Measuring sheet for vessels and tanks**

The measurements for fabrication must always include the swages (see Figure 9).

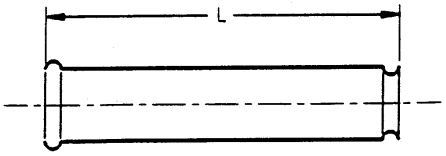



**Figure 9**

Additional information, e. g. for accounting, special pieces, additional longitudinal or circumferential seams, must be entered under “additional notes”.

The measuring sheets for pipes and removable boxes are explained on their respective instruction sheets.

### 4.1 Measuring sheet for pipes

The dimensions of formed pieces are listed in the table. The identification of formed pieces is entered in column 2 **Identification** using the following abbreviations:

| | |
|---|---|
| P | straight piping |
| E1 – E4 | elbows |
| T1 – T4 | taps |
| A1 – A4 | cut-outs |
| RE | reducer |
| WA | water deflector |
| K | end cap |
| S | extremity |
| KA | removable box |

In addition to the abbreviation K for end cap and S for extremity, the number of components must be given, e. g. K1 for a one-piece end cap, S2 for an extremity of two pieces.

For identification of the desired swages, four squares showing standard swages have been provided at the bottom left-hand corner.

In squares 3 and 4 enter the distance X between the swage and the end of the piece also. In square 5 special forms can be defined, if necessary. In square 6 enter the overlap of the longitudinal seam.

The identifying numbers of the swages for individual pieces are put in the columns 6 and 10 of the table.

For the formed pieces mentioned, all data must be put into the columns. Columns not needed for individual formed pieces have been crossed out in the instructions below.

### 4.1.1 Straight piping

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Pre-fabrication | Amount |
| | | | | | | X | | X | | X | X | X | | |

**Column 2: Identification**
**P**

**Column 3: Pipe diameter**
Outer diameter of the pipe without insulation

**Column 4: Insulation thickness**
Nominal thickness of fitted insulation layer s

**Column 5: D**
Diameter of the casing
This consists of the pipe diameter plus twice the insulation thickness. For insulation systems with an air space, twice the air space thickness must also be added. Fabrication tolerances, i. e. for radiused and bevelled legs, must be taken into consideration.

**Columns 6 and 10: Swages**
Insert the number of the desired swages from squares 1 to 5 of the swage squares. In column 6 the left swage, in column 10 the right swage as you look on the longitudinal seam.

**Column 8: Length**
Fabrication dimension of an element of casing. For standard lengths equal to coil-width [ / ] is to be inserted. Width of coil to be given under “Remarks”.

**Column 14: Pre-fabrication**
The developed circumference of the casing, to include additions for overlappings at seams and for the swages. If the swage is known, entry by measuring crew on the site, if not, entry in pre-fabrication shop.

### 4.1.2 Elbow

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Pre-fabrication | Amount |
| | | | | | | | | | | | | | | |

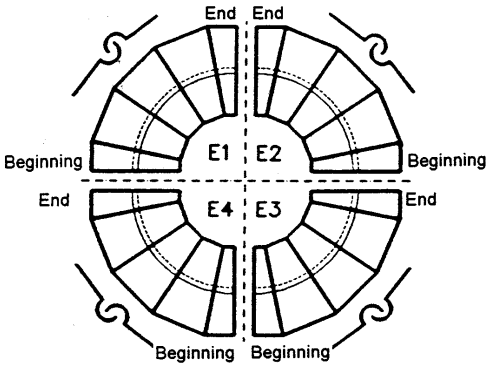



**Figure 10**

**Column 10: Identification**
**E1 – E4**
Four types of elbows exist which are to be identified according to Figure 10 as E1 to E4. The type required is put into column 1 “Identification”.
The four types of elbows have:

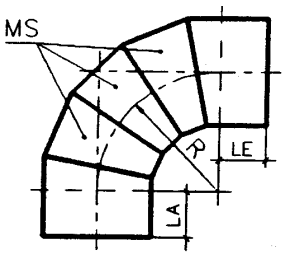
- circumferential and longitudinal seams positioned to ensure that water is kept out,
- the longitudinal seam at the front (standard pattern).

Note: If, for instance, a standing elbow type E2 is selected instead of type E1, the implication is that the longitudinal seam is at the back.

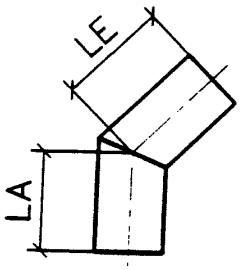
**Columns 3 to 5:**
See chapter 4.1.1

**Columns 6 and 10: Swages**
Select according to the squares 1 to 5 in the space for swage identification; the swage for the beginning in column 6, the swage for the end in column 10.
The beginnings and ends of the four types of elbows are shown in Figure 10.

**Columns 7 and 9: Elongation of the start piece LA and of the end piece LE**
The definition of LA and LE is shown in Figure 11. The difference between elbow and long radius bend must be noted.



Elbow



Long radius bend

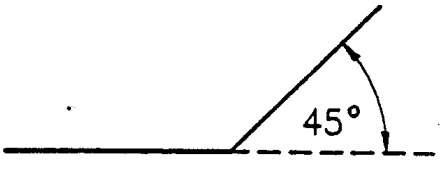
**Figure 11**

**Column 8: Number of segments MS**
Ms is the number of segments not counting the start and end pieces.
For a long radius bend [ / ] is to be inserted.

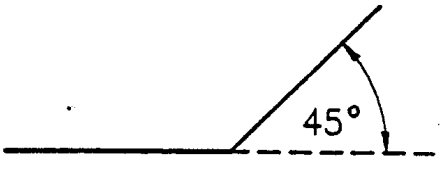
**Column 11: Radius**
The radius of the elbow is the radius of curvature of the axis of the pipe.
For a long radius bend [ / ] is to be inserted.

**Column 12: Angle**
The angle of the elbow W is the angle of change of direction of the straight-running pipe (0° < W < 180°).

Example:



45° elbow



110° elbow

**Figure 12**

**Column 13: Position of seam**
For standard type, the seam is at the front side on the centre line. In this case, “0” is to be inserted.
Deviations from the standard type are identified by giving an appropriate angle:
0° to 260°: clockwise looking into the elbow from its start.

**Column 14: Pre-fabrication**
See chapter 4.1.1

### 4.1.3 Taps

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Pre-fabrication | Amount |
| | | | | | X | | | X | | X | | | | |

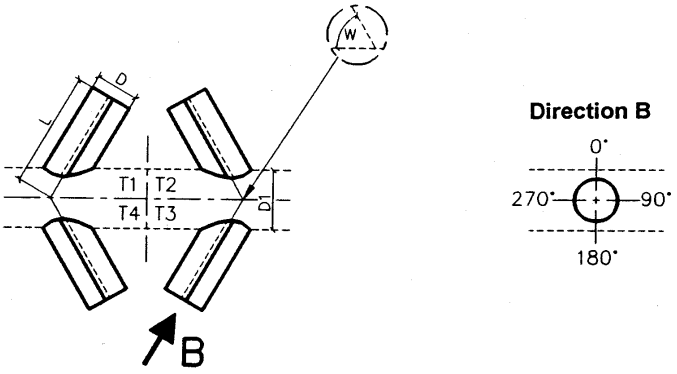



**Figure 13**

**Column 2: Identification**
**T1 – T4**
Four types of taps are to be identified as T1 to T4 as shown in Figure 13. The type selected is entered in column 2 “Identification”.
For the types of taps have:
- the longitudinal overlap positioned so that water is kept out,
- the longitudinal overlap at the front.

For types at right angles, T1 to T4 is entered according to the desired seam overlap.

**Columns 3 to 5**
See chapter 4.1.1. The dimensions of the tap are to be entered.

**Column 7: D1**
Diameter of the casing of the running pipe insulation.

**Column 8: L**
Length of the tap as shown in Figure 13 (note deviation from Figure 9)

**Column 10: Swage**
Information regarding the swage at the end of the tap. The number of the swage selected is entered according to the squares 1 to 5 from the swage identification block.

**Column 12: Angle**
Angle of the tap: angle between the tap and the running pipe ($0° < W \leq 90°$)

**Column 13: Position of seam**
The standard position is at 0°. This is at the front side at the centre line as shown in Figure 13. In this case, “0” is entered.
Deviations from the standard position are indicated using an angle:
0! to 360°: clockwise looking into the tap (direction B, Figure 13).

**Column 14: Pre-fabrication**
See chapter 4.1.1

### 4.1.4 Double elbow

Double elbows following each other in a pipe system in so short a distance that they are measured as one piece for practical reasons must be sketched in the drawing space.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Pre-fabrication | Amount |
| 1.1 | | | | | | | | X | X | | | | | |
| 1.2 | ZT | X | X | X | X | X | | X | X | X | | | X | |
| 1.3 | | X | X | X | X | X | | | | | | | | |

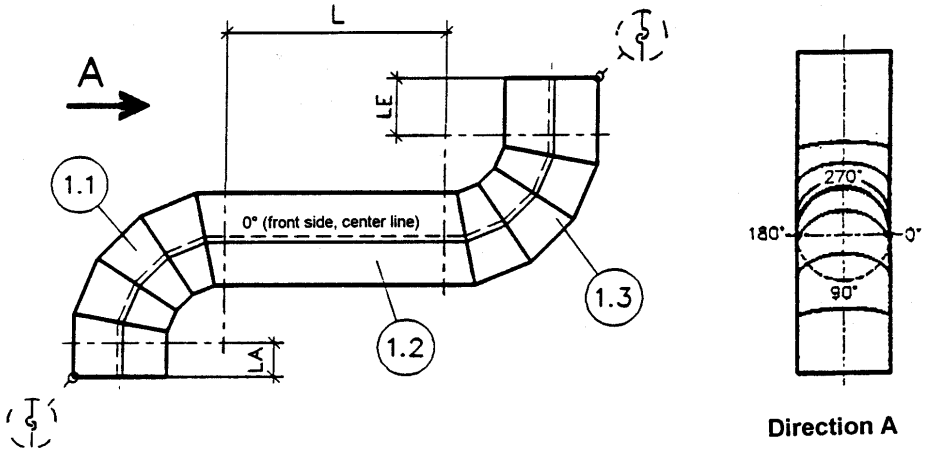



**Figure 14**

**Column 1: Position**
For each part of the combination one line is to be used. First line for the first part in direction of assembly. Each line is marked with a double digit, e. g. 1.1, 1.2, 1.3.

**Column 2: Identification**
**E1 – E4**
**ZT** for middle section

**Columns 3 to 15**
See chapter 4.1.2 for elbows;
see chapter 4.1.1 for straight parts ZT.

**Peculiarities** (explained using example positions 1.1 – 1.3)

**Position 1.1** (commending elbow)
**Columns 9 and 10:** no entries

**Position 1.2** (middle section)
**Columns 3 to 7:** no entries
**Column 8: Length of the middle section ZT**
As shown in Figure 14 (note deviation from Figure 9)
**Columns 9 to 11:** no entries
**Column 12: Angle mounting position**
Insert the angle of the mounting position (direction of departure) of the departing elbow. The position of zero is defined by the centre line on the front side of the commencing elbow.
**Column 13: Position of seam**
Insert the position of the seam of the middle section ZT. Position of 0! as in column 12.

**Position 1.3** (departing elbow)
**Columns 3 to 7:** no entries

### 4.1.5 Cut-out

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Pre-fabrication | Amount |
| | | | | | | | | | | | | | X | |

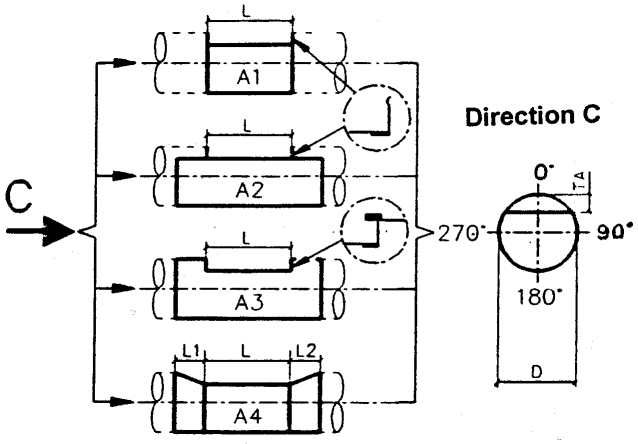



**Figure 15**

**Column 2: Identification**
**A1 – A4**
The different types of cut-outs A1 to A4 as shown in Figure 15 are entered.

**Columns 3 to 5**
See chapter 4.1.1

**Columns 6 and 10: Swage**
Enter the number of the swage according to the swage identification block for those swages which are needed at the connection to the cylindrical part. For cut-outs of type A4, the swage on the side of L1 is entered in column 6, the swage on the side of L2 in column 10.

**Column 7: L1**
Length of the first transition piece for cut-outs of type A4

**Column 8: L**
Length of the cut-out as shown in Figure 15

**Column 9: L2**
Length of the second transition piece in the direction of assembly for cut-outs of the type A4

**Column 11: TA**
Depth of the cut-out as shown in Figure 15

**Column 12: Mounting position**
For vertical pipes, the position is indicated using the space-oriented system of co-ordinates as given in Figure 4.
For vertical pipes, “S” is inserted.
Figure 16 shows as an example the mounting position of a horizontal cut-out, at an angle of 60°.

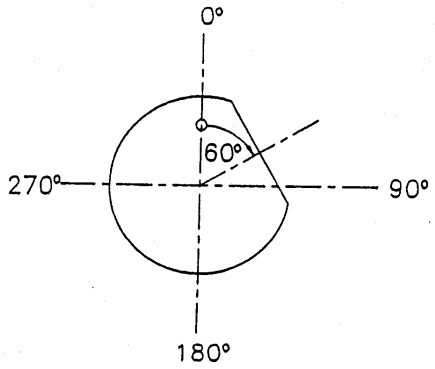



**Figure 16**

**Column 13: Position of seam**
The position of the seam is given as an angle respective of the pre-fabricated piece. The angle is between the cut-out and the seam. This angle is measured clockwise in direction “C” (Figure 15).
Figure 17 shows as example the seam at 80° from the cut-out at a mounting position angle of 30!.

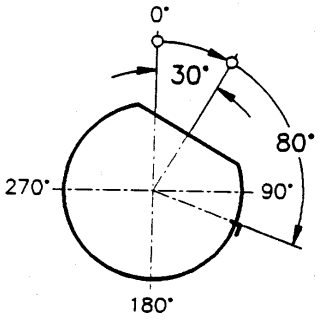
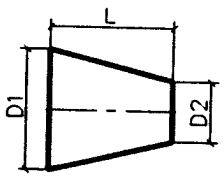


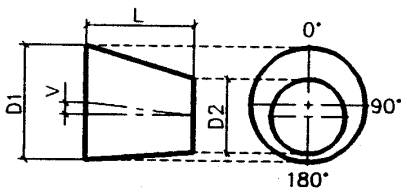

**Figure 17**

### 4.1.6 Reducer

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Pre-fabrication | Amount |
| | | ✕ | ✕ | ✕ | | | | | | | | | ✕ | |



concentric reducer



eccentric reducer

**Figure 18**

**Column 2: Identification**
**RE**

**Columns 6 and 10: Swages**
Enter the number of the swages according to the swage identification block: in column 6 the swage for the end with the bigger diameter, in column 10 the swage for the end with the smaller diameter.
Note: For vertical reducers, the identification of the swage also indicates which of the two ends is the upper and which the lower, respectively.

**Column 7: D1**
The larger diameter of the casing
See also description of column 5 in chapter 4.1.1

**Column 8: L**
Length of the reducer as shown in Figure 18

**Column 9: D2**
Smaller diameter of the casing
See also description of column 5 in chapter 4.1.1

**Column 11: Offset**
Distance V between the two pipe axes (see Figure 18)
For concentric reducers, [ / ] is inserted

**Column 12: Mounting position**
Only for eccentric reducers; for concentric reducers, [ / ] is inserted
For horizontal pipes, the position of the largest longitudinal line of the reducer is indicated using the space-oriented system of co-ordinates as given in Figure 4.
For vertical pipes, “S” is inserted.
Figure 19 shows an example for a mounting position of 40°.

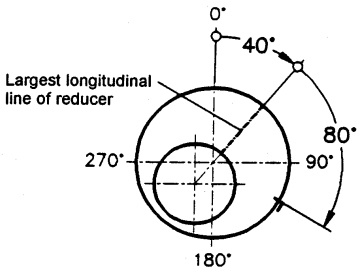



**Figure 19**

**Column 13: Position of seam**
Only for eccentric reducers; for concentric reducers, [ / ] is inserted
The position of the seam is indicated using an angle between the largest longitudinal line of the reducer and the seam (Figure 20). The angle is measured clockwise looking from the larger diameter into the reducer.

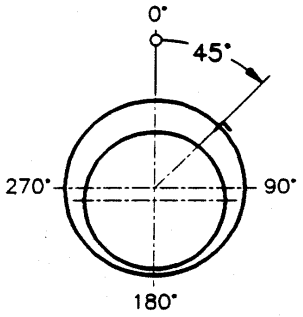



**Figure 20**

### 4.1.7 Water deflector (rain deflector; deflector)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Pre-fabrication | Amount |
| | | X | X | X | | | | | | X | X | X | X | |

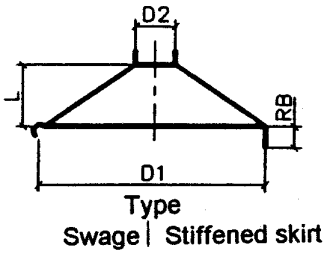



**Figure 21**

**Column 2: Identification**
**WA**

**Columns 6 and 10: Swages**
The number of the desired swages are inserted according to squares 1 to 5 of the swage identification block. If a stiffened skirt or an edge is wanted instead of the swage, the square number 5 is used to denote, for example:

RB = 15 (15 mm stiffened skirt) or
SF = 18(18 mm edge)

**Column 7: D1**
Larger diameter of the water deflector

**Column 8: L**
Height of the water deflector

**Column 9: D2**
Smaller diameter of the water deflector
Note: The water deflector is edged onto the given diameter.

### 4.1.8 Extremity

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Pre-fabrication | Amount |
| | | X | X | | | | X | X | X | X | X | X | X | |

**Column 2: Identification**
**S..**
After S, the number of parts is entered, e. g.
S1, for a one-piece extremity,
S2, for a two-piece extremity

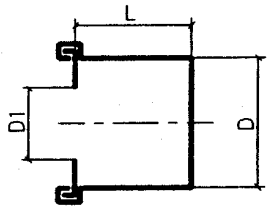
**Column 5: D**
Diameter of the casing according to chapter 4.1.1

**Column 6: Swage**
If the extremity is swaged, insert “1”. Otherwise, [ / ] .

**Column 7: D1**
The diameter of the cut-out (inner diameter)
In case the extremity is without a cut-out, [ / ] is to be inserted.

### 4.1.9 End cap

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Pre-fabrication | Amount |
| | | X | X | | X | | | X | X | X | X | X | X | |




**Column 2: Identification**
**K..**
After K, the number of parts of the cylindrical part is entered, e. g.
K2, for a two-piece end cap,
K3, for a three-piece end cap.

**Column 5: D**
Diameter of the casing according to chapter 4.1.1

**Column 7: D1**
The diameter of the cut-out (inner diameter)
In case the extremity is without a cut-out, [ / ] is to be inserted.

**Column 8: L**
Length of the end cap

### 4.1.10 Removable boxes

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Pre-fabrication | Amount |
| | | X | X | X | X | X | X | X | X | X | X | X | X | |

**Column 2: Identification**
**KA**
No further information is given since there is a special measuring sheet for removable boxes.

### 4.2 Measuring sheet for removable boxes

The shape of the removable boxes is given using the letters A to G, the joint line is given using the figures 1 to 7 according to Figure 23.

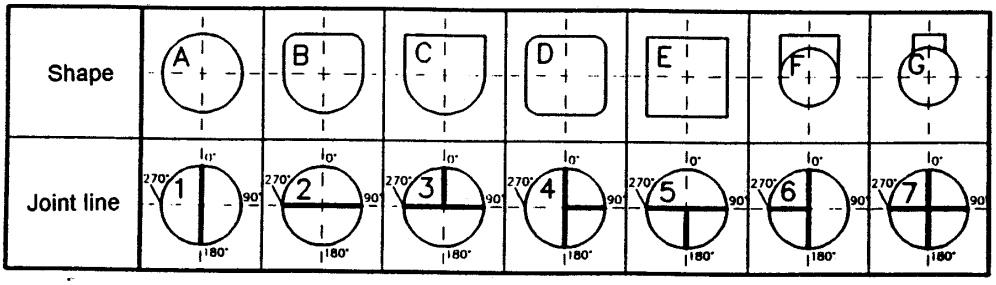



**Figure 23**

Example: Removable flange box with two longitudinal joints at top and bottom: A1

**Column 3: Method**
Enter information regarding the insulation of the removable box and its fastening

Type:

1… removable box without pins
2… removable box with pins, but without insulation and information regarding the insulation thickness
3… removable box with insulation and information regarding the insulation thickness

Fastening:

| | |
|---|---|
| S… | fastening by screws |
| BK… | fastening by bands and toggle clips |
| K… | fastening by toggle clips |

Example: Removable box with insulation and 100 mm thickness, fastening by bands and toggle clips = 3 BK 100

**Column 4: Type of longitudinal seam**
Tick the desired type of the longitudinal seam with or without edging.

**Columns 5 to 10: Dimensions A, B, C, D1, D2, L**
Dimensions according to Figure 24
The length L is measured overall

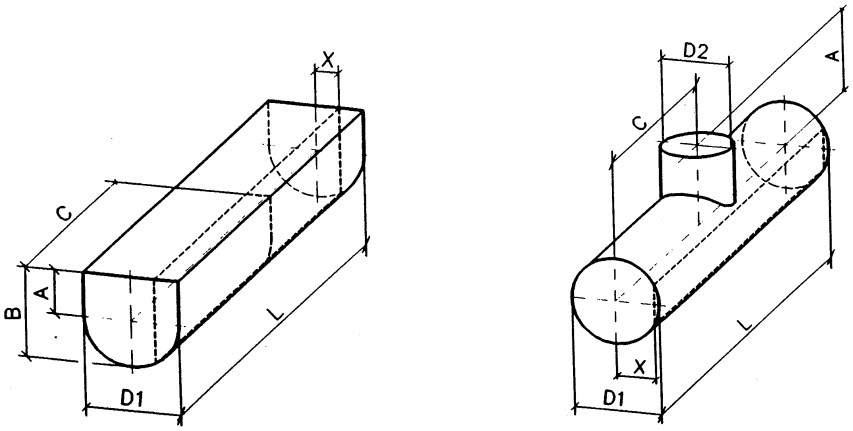
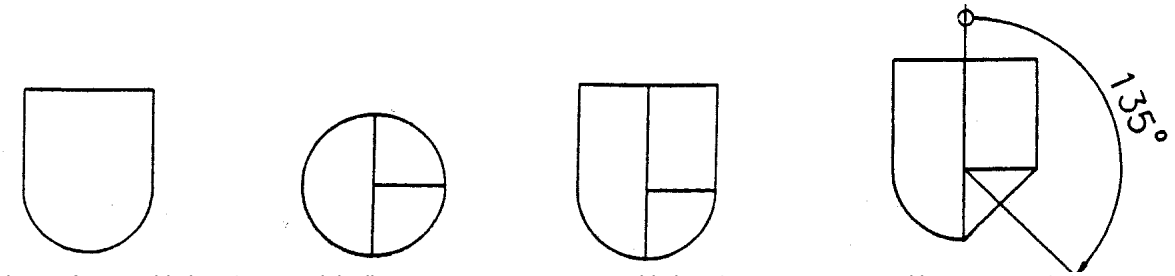



**Figure 24**

**Column 11: Cut-out**
The position of the cut-out is given as an angle relative to the removable box, using the co-ordinate system of Figure 23 for the joint lines 1 to 7 (example, see Figure 25)
Use the direction of the dimension “C” according to Figure 24
If there is no cut-out in the removable box, [/] is to be inserted.
The dimension X is defined in Figure 24. Unlike cut-outs on pipes, it is the “remaining distance” and not the “reduced distance”.




shape of removable box C | joint line No. 4 | removable box C 4 | with cut-out at 135°

**Figure 25**
Figure 27 shows the example of a prefabricated box with the mounting position 180° and a position of the cut-out of 135°.

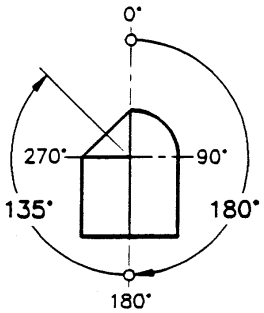



**Figure 27**

Column 13: Positioning, horizontal / vertical

Information whether it is a horizontal or a vertical prefabricated box. Tick the appropriate column.

Column 14: Rigidised cover

To be ticked if a rigidised cover is required for a vertical spindle box.

If no rigidised cover is required, insert |/|.

### 4.3 Measuring sheet for vessels and tanks

Dimensions and data for vessels and tanks are inserted in the measuring sheet for vessels and tanks. For each vessel, an individual sheet must be used. For the top and bottom ends, the DIN standards according to the explanation sheet should be inserted where appropriate.

The dimensions of the ends are given in the tables, e. g. vessel with two ends: 1st line: top of left end of vessel; 2nd line: bottom or right end of vessel.

For information regarding the cylindrical part, the squares "profile of the cylindrical part" and "position of longitudinal seams" are to be used.

Numbered swaged connections are given in the measuring sheet for vessels and tanks. The numbers of the desired swaged connections are to be inserted in columns 3, 14, 15 and 16.

Table

| 1 | 2 | 3 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Shape | Vessel End swages | | Vessel diameter | Insulation thickness | D1 | D2 | R | r | H1 | H2 | H3 | Number | | Prefabrication seam | Assembly seam | End connection | Amount |
| | | horizontal | vertical | | | | | | | | | | segments | parts | | | | |
| | | | | | | | | | | | | | | | | | | |

Column 2: Shape

Form of the ends:

| | |
|---|---|
| E | flat end |
| T | cone end |
| K | dome end without knuckle radius |
| Z | dome end with knuckle radius |

Column 3: Vessel horizontal / vertical

Information whether it is a horizontal or vertical vessel and information on the shape of end seam required (connection to the cylindrical part).

For a horizontal vessel, the desired number of the swage is inserted under "horizontal", for a vertical vessel under "vertical".

If no swage is desired, |/| must be inserted.

Column 4: Diameter of the vessel

Diameter of the vessel without insulation.

Column 5: Insulation thickness

The thickness of the insulation is inserted (see also column 4 in chapter 4.1.1).

Columns 6 to 12: Dimensions D 1, D 2, R, r, H 1, H 2, H 3

Dimensions of the insulation cladding

| | |
|---|---|
| D 1 | diameter of the cladding |
| D 2 | diameter of the opening |
| R | the spherical radius for domed ends |
| r | the knuckle radius for domed ends |
| H 1 | projected extension of the end |
| H 2 | height of the dome |
| H 3 | height to the opening |

Column 13: Number of segments / prefabricated pieces

Enter the number of segments of the complete end and the number of pre-assembled pieces in which the end is to be delivered to the erection site.

Column 14: Prefabricated seam

Enter the required connection for those segments which are pre-assembled in the workshop, using the appropriate number from the swage squares.

Column 15: Assembly seam

Enter the required connection for the joining of the pre-assembled pieces on site, using the appropriate number from the swage squares.

Column 16: Top and bottom connection (flat end; for coned and domed ends, the connection from H 1 to H 2)

Connection between top / bottom and body.

Enter 9 for open lock-seam or 10 if stiffened skirt is to be used.

Square "Profile of cylindrical cladding"

Here, information regarding the cladding is given, such as the number of cylindrical pieces, overlap, connection, direction of assembly as shown in Figure 29.

For vertical vessels, the upper part is on the left-hand side of the diagram.

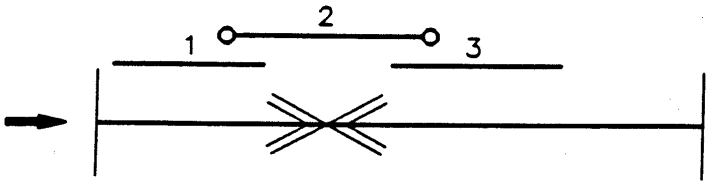



**Figure 28**

Square "Position of longitudinal seams"

The position of the longitudinal seams for the parts given in "profile of the cylindrical cladding" should be indicated. Examples for three parts of a vessel are given in Figure 29.

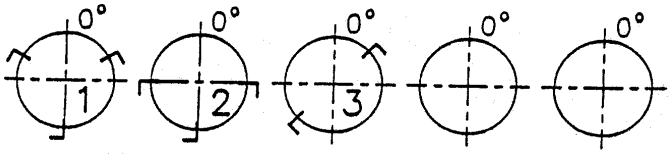
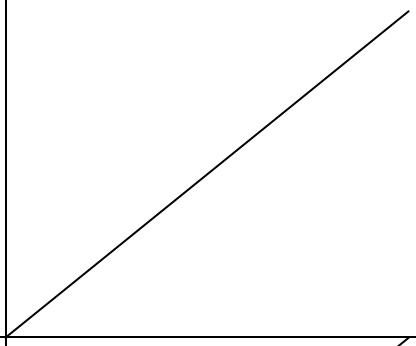
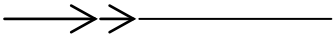
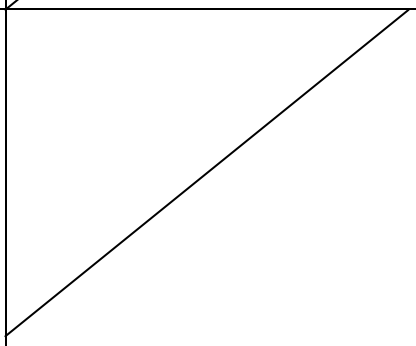
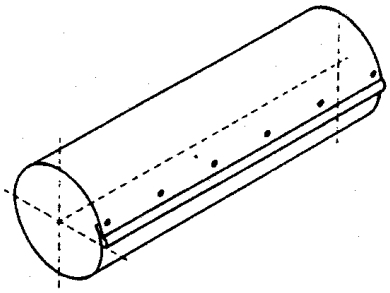
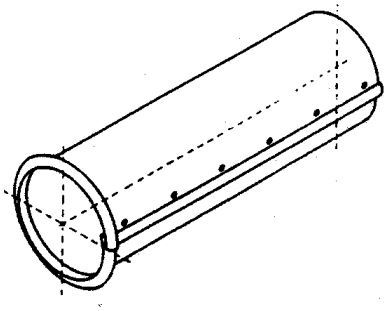
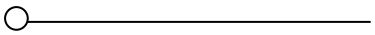
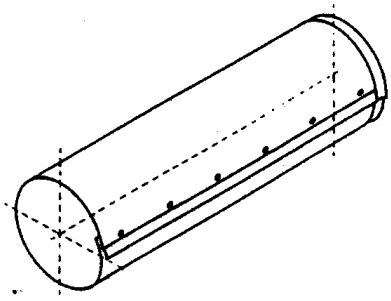


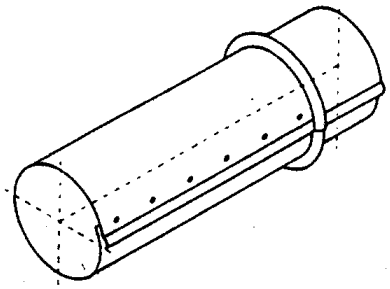
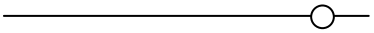
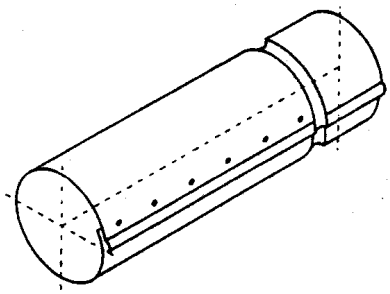
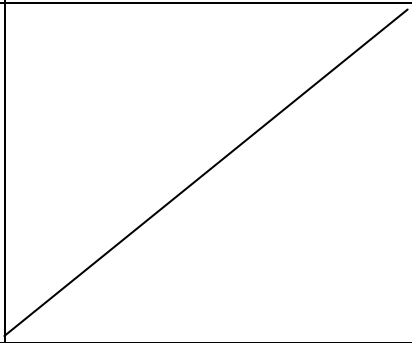
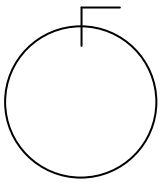
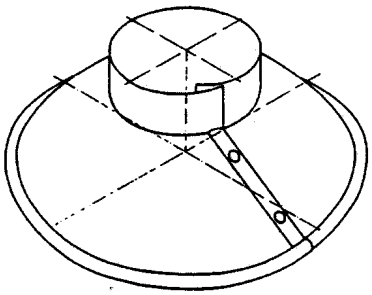
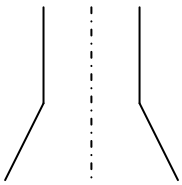
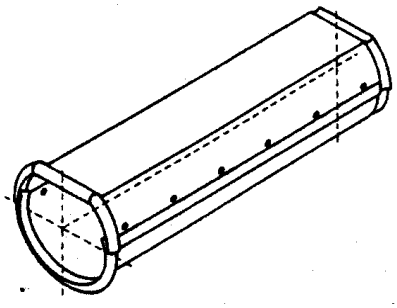
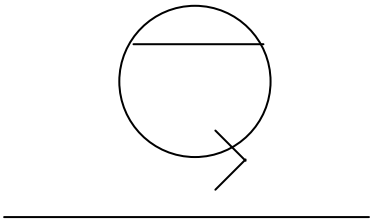

**Figure 29**

### 4.4 Measuring sheet for special fittings

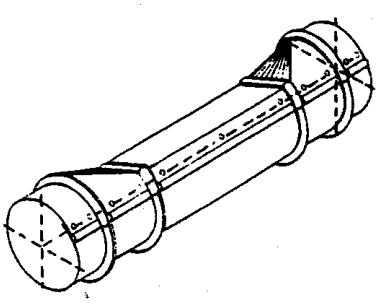
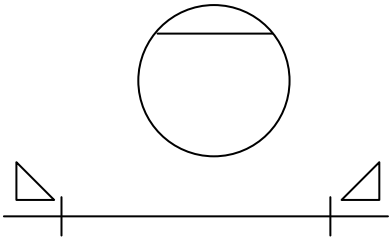
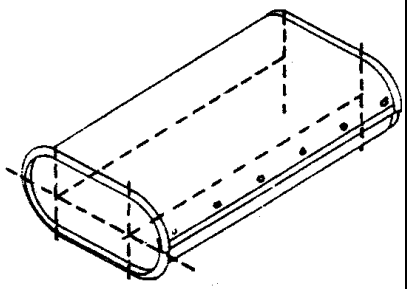
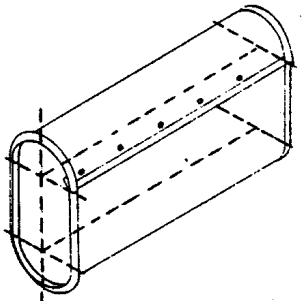
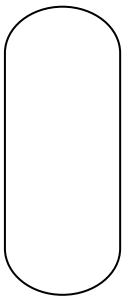
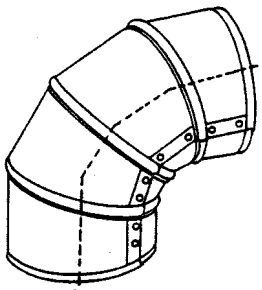
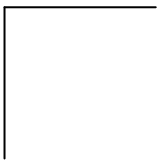
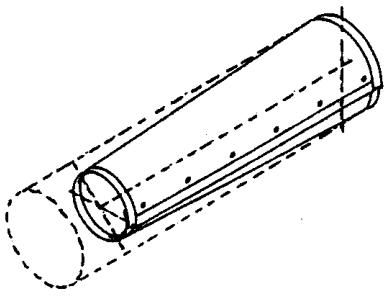
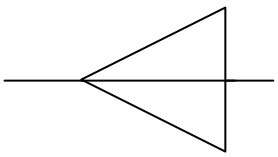
For special fittings, e. g. Y-pieces, tap-elbows, flattened elbows, transition pieces, the measuring sheet for special fittings is to be used.

| SYMBOLS | | | I |
|---|---|---|---|
| No. | Drawing | Symbol | Explanation |
| 1 |  |  | Direction of assembly |
| 2 |  |  | Change in direction of assembly |
| 3 |  |  | Pipe without circumferen-tial swage |
| 4 |  |  | Pipe with male swage at one end |
| 5 |  |  | Pipe with female swage at one end |

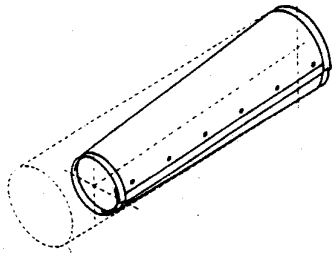
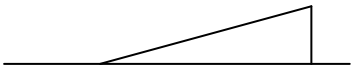
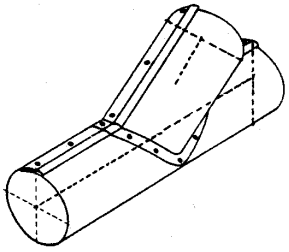
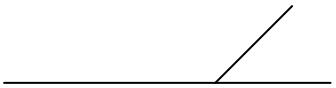
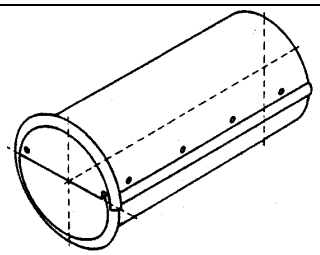
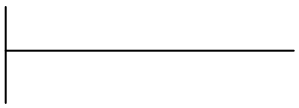
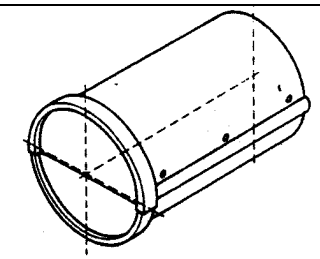
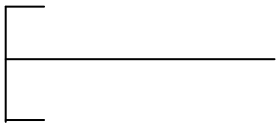
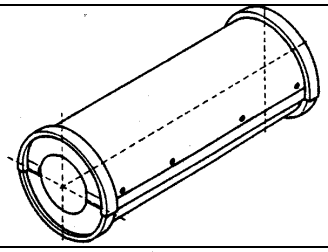
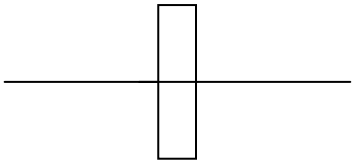
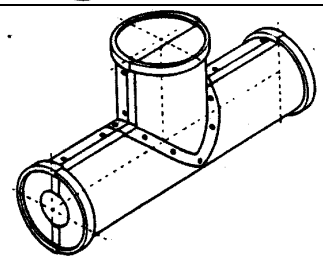
Note: If a piece is without a longitudinal swage, this must be stated.

| SYMBOLS | | | II |
|---|---|---|---|
| No. | Drawing | Symbol | Explanation |
| 6 |  |  | Pipe with inset male swage |
| 7 |  |  | Pipe with inset female swage |
| 8 |  |  | Position of longitudinal seam, also indicating the direction of overlap [1)] |
| 9 |  |  | Water deflector |
| 10 |  |  | Pipe with cut-out and swaged longitudinal seam |

[1)] Where needed, including the angle dimension.

| SYMBOLS | | | III |
|---|---|---|---|
| No. | Drawing | Symbol | Explanation |
| 11 |  |  | Reduction with two triangles [1]<br>(Type A 4) |
| 12 |  |  | Pipe cluster<br>Pipes lying alongside each other |
| 13 |  |  | Pipe cluster<br>Pipes on top of each other |
| 14 |  |  | Elbow [2] |
| 15 |  |  | Concentric reducer |

[1] If needed, including angle dimension.
[2] The term "elbow" is also used for "radial protractor" and "long-radius bend".

| SYMBOLS | | | IV |
|---|---|---|---|
| No. | Drawing | Symbol | Explanation |
| 16 |  |  | Eccentric reducer |
| 17 |  |  | Tap |
| 18 |  |  | Extremity |
| 19 |  |  | End cap |
| 20 |  |  | Removable box for flanges |
| 21 |  |  | Removable box for fittings |

| | | | |
|---|---|---|---|
| | **Measuring sheet for pipes** | Auftrags-Nr.: | Datum: |
| | Baustelle: | Zeichnungs-Nr.: | Blatt-Nr.: |
| | Aufmaßnehmer: | Rohrleitungs-Nr.: | Liefertermin: |

**Bundesfachabteilung Wärme-, Kälte-, Schall- und Brandschutz beim Hauptverband der Deutschen Bauindustrie e.V.**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Bezeich-nung | Rohrleitungsdurch-messer | Isolierschick-tdicke | D | Sicke | LA D1 L1 | MS L | LE D2 L2 | Sicke | Radius TA Versatz | Winkel Einbaul-age | Nahtlag e | Zuschnit t | Stück |
| | | | | | | | | | | | | | | |
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FOR MISSING TRANSLATION, SEE PAGE 8

| | | | | | |
|---|---|---|---|---|---|
| Blechwerkstoff: | | | Kontrolle Werkstatt: | | Bemerkungen: |
| Blechdicke: | | | Kontrolle Baustelle: | | |
| 1 | 2 | 3 | 4 | 5 | 6 Überlappung Längsnaht ..... mm |

**Entries required in the measuring sheet for pipes**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Prefabrication | Amount |
| **Straight piping** | P | | | | | | | | | | | | | | |
| **Elbows** | E 1 – E 4 | | | | | | | | | | | | | | |
| **Tap** | T 1 – T 4 | | | | | | | | | | | | | | |
| **Double elbow** | .1 | | | | | | | | | | | | | | |
| | .2 | ZT | | | | | | | | | | | | | |
| | .3 | | | | | | | | | | | | | | |
| **Cut-out** | A1 – A 4 | | | | | | | | | | | | | | |
| **Reducer** | RE | | | | | | | | | | | | | | |
| **Water deflector (rain deflector; deflector)** | WA | | | | | | | | | | | | | | |
| **Extremity** | S. | | | | | | | | | | | | | | |
| **End cap** | K. | | | | | | | | | | | | | | |
| **Removable box** | KA | | | | | | | | | | | | | | |

**Entries required in the measuring sheet for pipes**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pos. | Identification | Pipe diameter | Insulation thickness | D | Swage | LA D1 L1 | MS L | LE D2 L2 | Swage | Radius TA offset | Angle mounting position | Position of seam | Prefabrication | Amount |
| **Straight piping** | P | | | | | | X | | X | | X | X | X | | |
| **Elbows** | E 1 – E 4 | | | | | | | | | | | | | | |
| **Tap** | T 1 – T 4 | | | | | X | | | X | | X | | | | |
| **Double elbow** | .1 | | | | | | | | X | X | | | | | |
| | .2 | ZT | X | X | X | X | X | | X | X | X | | | X | |
| | .3 | | X | X | X | X | X | | | | | | | | |
| **Cut-out** | A1 – A 4 | | | | | | | | | | | | | X | |
| **Reducer** | RE | | X | X | X | | | | | | | | | X | |
| **Water deflector (rain deflector; deflector)** | WA | | X | X | X | | | | | | X | X | X | X | |
| **Extremity** | S. | | X | X | | | | X | X | X | X | X | X | X | |
| **End cap** | K. | | X | X | | X | | | X | X | X | X | X | X | |
| **Removable box** | KA | | X | X | X | X | X | X | X | X | X | X | X | X | |

| | | | |
|---|---|---|---|
| **Measuring sheet for removable boxes** | Auftrags-Nr.: | Datum: | **Bundesfachabteilung Wärme-, Kälte-, Schall- und Brandschutz beim Hauptverband der Deutschen Bauindustrie e.V.** |
| Baustelle: | Zeichnungs-Nr.: | Blatt-Nr.: | |
| Aufmaßnehmer: | Rohrleitungs-Nr.: | Liefertermin: | |

| 1 | 2 | 3 | 4 | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | 12 | | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Bezeich-nung | Ausführung | Längenahtausführung | | A | B | C | D1 | D2 | L | Abflachung | | Einbaulage (Spindel) | | Anordnung | Riffelbord | Stück |
| | | | | | | | | | | | bei Grad | x | li. | st. | | | |
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FOR MISSING TRANSLATION, SEE PAGE 33

| | | |
|---|---|---|
| Blechwerkstoff: | Kontrolle Werkstatt: | Bemerkungen: |
| Blechdicke: | Kontrolle Baustelle: | |

| | | | |
|---|---|---|---|
| | **Measuring sheet for vessels and tanks** | Auftrags-Nr.: | Datum: |
| | Baustelle: | Zeichnungs-Nr.: | Blatt-Nr.: |
| | Aufmaßnehmer: | Rohrleitungs-Nr.: | Liefertermin: |

**Bundesfachabteilung Wärme-, Kälte-, Schall- und Brandschutz beim Hauptverband der Deutschen Bauindustrie e.V.**

| 1 | 2 | 3 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Form | Behältersicke li. | Behältersicke st. | Behälter-durchmesser | Isolierschicht-dicke | D1 | D2 | R | r | H1 | H2 | H3 | Anzahl Segmente | Anzahl Bauteile | Werkstattnaht | Baustellennaht | Stirnseitenverbindung | Stück |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
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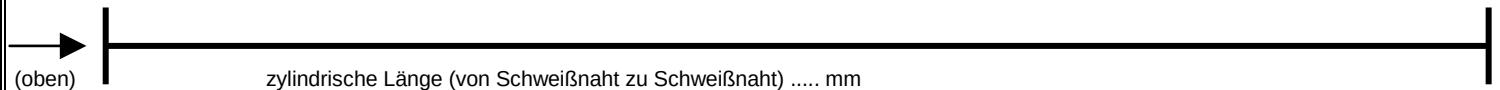
Längsschnitt zylindrische Ummantelung Rundnahtüberlappung ..... mm

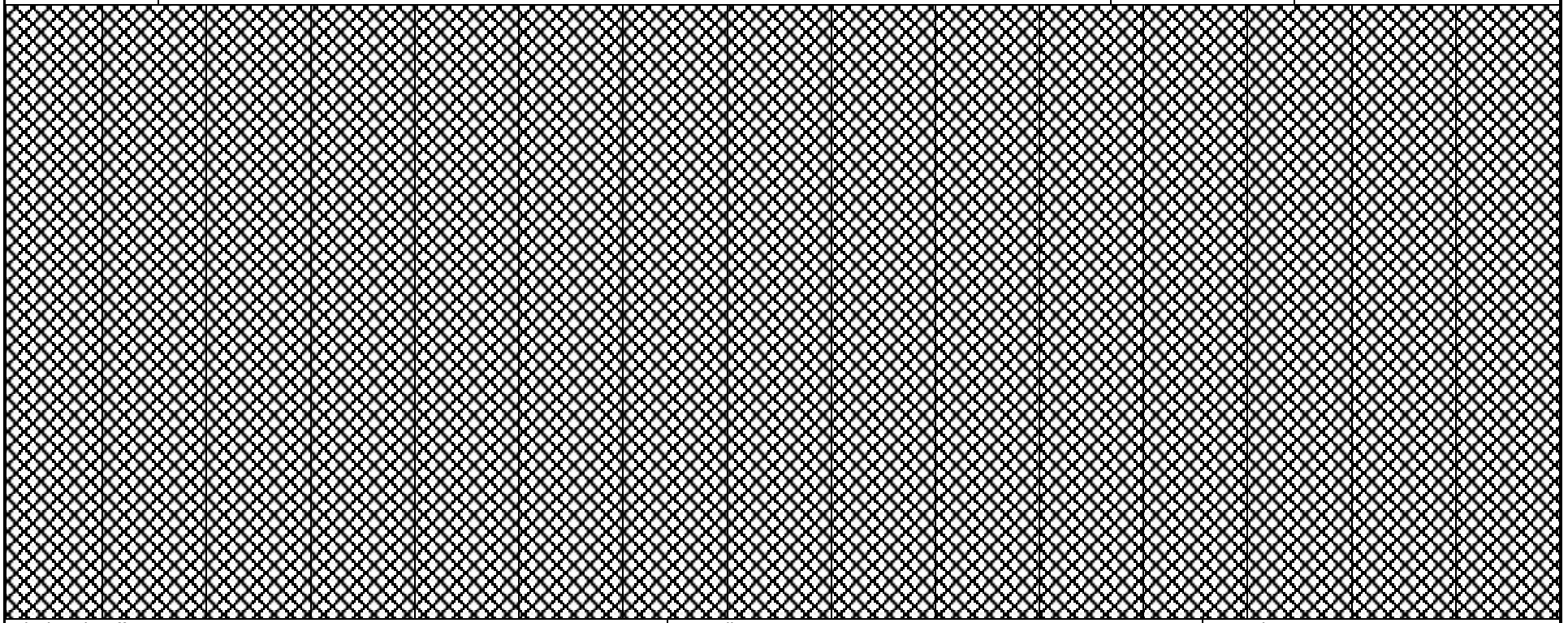



zylindrische Länge (von Schweißnaht zu Schweißnaht) ..... mm

Lage der Längsnähte Überlappung ..... mm

| Blechwerkstoff: | | | Blechdicke: | | | Kontrolle Werkstatt: | | Kontrolle Baustelle: | | | Bemerkungen: |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | |

| | Instructions for Measuring Sheet for Pipes | | Bundesfachabteilung<br>Wärme-, Kälte-, Schall-<br>und Brandschutz<br>beim Hauptverband der<br>Deutschen Bauindustrie e.V. |
|---|---|---|---|

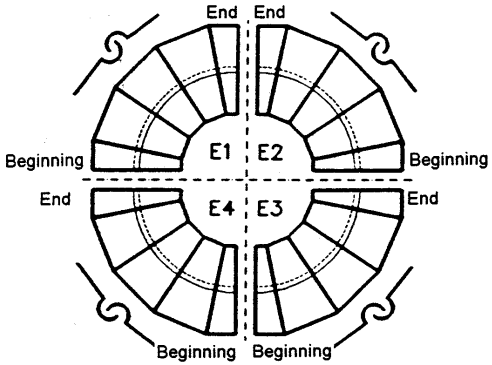


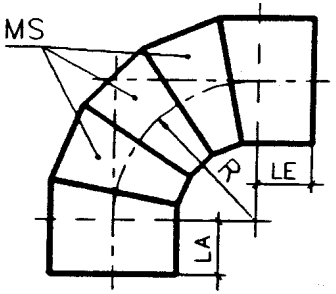
| Blechwerkstoff: | | | Kontrolle<br>Werkstatt: | | | Bemerkungen: |
|---|---|---|---|---|---|---|
| Blechdicke: | | | Kontrolle<br>Baustelle: | | | |
| 1 | 2 | 3 | 4 | 5 | 6<br>Überlappung<br>Längsnaht<br>..... mm | |

**Instructions for measuring sheet for pipes**

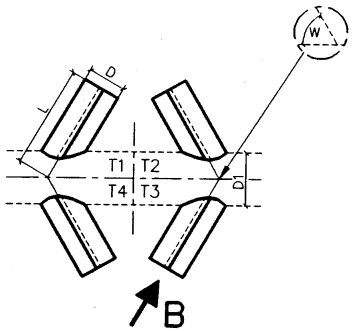
**Bundesfachabteilung Wärme-, Kälte-, Schall- und Brandschutz im Hauptverband der Deutschen Bauindustrie e.V.**

**Elbow E**

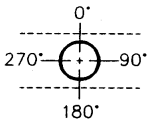


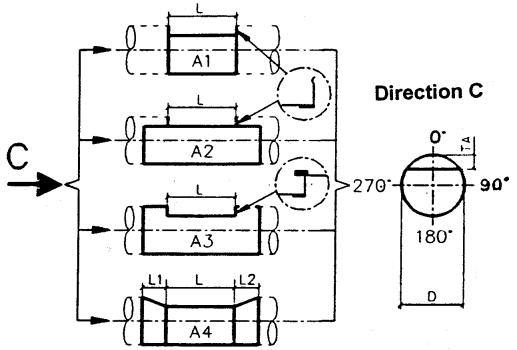

**Tap T**




**Direction B**

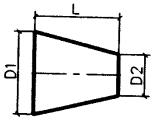



**Cut-out A**

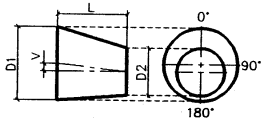



**Reducer RE**

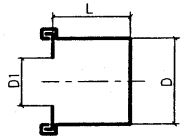
concentric reducer



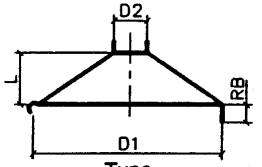

eccentric reducer




**End cap K**




**Water deflector WA**




Type

Swage | Stiffened skirt

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Cut-out (A1 – A4) | | Elbow (E1 – E4) | **MS** | Number of middle pieces | **RE** | Reducer | | Tap (T1 – T 4) |
| **D** | Diameter of the casing | **L** | length | **P** | straight piping | **K2** | End cap<br>Number indicates two-piece end cap | **V** | Offset in eccentric reducer |
| **D1** | larger diameter | **L1** | Length of the connecting piece | **R** | Radius of the elbow | **S1** | Extremity<br>Number indicates extremity in one piece | **W** | Angle |
| **D2** | smaller diameter | **L2** | Length of the connecting piece | **RB** | Stiffened skirt | **TA** | Depth of the cut-out | **WA** | Water deflector |

**Instructions for measuring sheet for removable boxes**

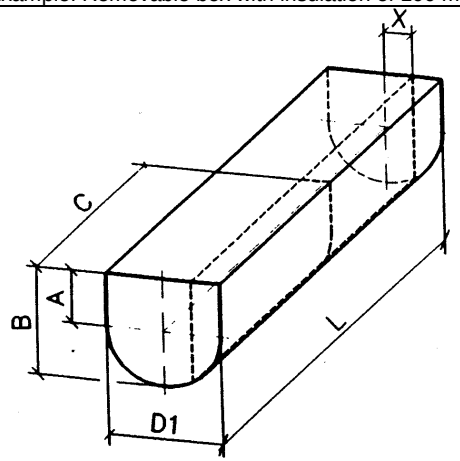
**Bundesfachabteilung**
**Wärme-, Kälte-, Schall-**
**und Brandschutz**
**im Hauptverband der**
**Deutschen Bauindustrie e.V.**

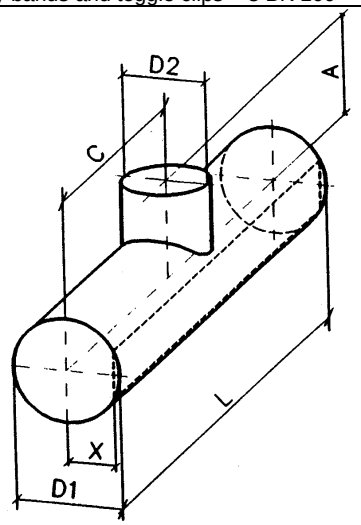
| Form | Partition |
|---|---|

1 = Removable box without pins
2 = Removable box with pins, but without insulation and information regarding the insulation thickness
3 = Information regarding the insulation thickness

S = Fastening by screws
K = Fastening by toggle clips
BK = Fastening by bands and toggle clips

Example: Removable box with insulation of 100 mm thickness, fastening by bands and toggle clips = 3 BK 100




Cut outs

Example: removable box A2 flat side at 90°

Mounting position

Example: upper spindle at 0°

To indicate the mounting position, the angle at which the spindle is lying is to be indicated.

| | | | |
|---|---|---|---|
| | **Explanations to measuring sheet for vessels and tanks** |  | **Bundesfachabteilung Wärme-, Kälte-, Schall- und Brandschutz im Hauptverband der Deutschen Bauindustrie e.V.** |

| | |
|---|---|
| Flat end | Cone end |
| Dome end without knuckle radius | Dome end with knuckle radius |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **E** | Flat end | | | | | | |
| **T** | Cone end | **H1** | Projected extension of the end | | | | |
| **K** | Dome end without knuckle radius | **H2** | Height of the dome | **R** | Spherical radius | **D1** | Diameter of the cladding |
| **Z** | Dome end with knuckle radius | **H3** | Height to the opening | **r** | Knuckle radius | **D2** | Diameter of the opening |

**Domed ends according DIN**
28011 (Klöpperform) and
28013 (Korbbogenform)

| | | | |
|---|---|---|---|
| **Measuring sheet for pipes** | Auftrags-Nr.: | Datum: | |
| Baustelle: | Zeichnungs-Nr.: | Blatt-Nr.: | |
| Aufmaßnehmer: | Rohrleitungs-Nr.: | Liefertermin: | |

**Bundesfachabteilung Wärme-, Kälte-, Schall- und Brandschutz beim Hauptverband der Deutschen Bauindustrie e.V.**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pos. | Bezeich-nung | Rohrleitungs-durch-messer | Isolier-schicht-dicke | D | Sicke | LA D1 L1 | MS L | LE D2 L2 | Sicke | Radius TA Versatz | Winkel-einbau lage | Naht-lage | Zuschnitt | Stück |
| 1 | RE | | | | 2 | 460 | 140 | 370 | 2 | / | 0 | 90 | | 1 |
| 2 | P | 219 | 120 | 460 | 2 | | / | | 1 | | | | 1495 | 1 |
| 3 | T1 | 168 | 100 | 370 | | 460 | 285 | 370 | 1 | | 90 | 0 | 1210 | 1 |
| 4 | P | 219 | 120 | 460 | 1 | | 715 | | 1 | | | | 1495 | 1 |
| 5 | S2 | | | 460 | 1 | 225 | | | | | | | | 5 |
| 6 | A1 | 219 | 120 | 460 | 2 | | 370 | | 2 | 50 | 90 | 180 | | 1 |
| 7 | P | 219 | 120 | 460 | 1 | | 705 | | 1 | | | | 1495 | 1 |
| 8 | KA | | | | | | | | | | | | | 1 |
| 9 | E4 | 219 | 120 | 460 | 1 | 235 | 4 | 420 | 2 | 300 | | | 1485 | 1 |
| 10 | P | 219 | 120 | 460 | 1 | | / | | 1 | | | | 1495 | 1 |
| 11 | KA | | | | | | | | | | | | | 1 |
| 12 | P | 219 | 120 | 460 | 1 | | / | | 2 | | | | 1495 | 1 |
| 13 | E2 | 219 | 120 | 460 | 1 | 710 | / | 395 | 2 | / | 45 | 0 | 1485 | 1 |
| 14 | P | 219 | 120 | 460 | 2 | | / | | 1 | | | | 1495 | 2 |
| 15 | E2 | 219 | 120 | 460 | 1 | 500 | 4 | 235 | 1 | 300 | 90 | 0 | 1485 | 1 |
| 16 | S2 | | | 370 | 1 | 172 | | | | | | | | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Blechwerkstoff: | Aluminium | | Kontrolle Werkstatt: | | | Bemerkungen: |
| Blechdicke: | 1,0 mm | | Kontrolle Baustelle: | | | Coil width: 1000 mm |
| 1 | 2 | 3<br><br>X = ..... mm | 4<br><br>X = ..... mm | 5 | 6<br>Überlappung Längsnaht 40 mm | |