In underground construction

reliability and security of all components are very important. Especially in shaft and route lines which can extend to kilometres, a long service duration of pipes is demanded in this field. All operational equipment must resist extreme loads and every premature failure costs time and money, regardless of safety-relevant aspects. Maintenance work shall be carried out only within the planned revision time periods; therefore the availability of the conveying line system must be secure. We consider these influence variables already in the planning stage and in the preparation of the quotation. Special circumstances require individual solutions. Therefore not only elbows, pipes and reducers are a part of a conveying line, but also compensators and bracket pipes for mounting in pithead buildings.

Our conveying lines are designed for static and dynamic loading and protected against corrosion for the planned life-span and the environment.

Our products have already been in used with great success for decades in all areas of the underground construction field.
In industrial applications

abrasive materials are conveyed in pneumatic or hydraulic way. The wear is determined by the form, hardness, and the flow rate of the pumped material, (as well as the type of support.)

Therefore all the relevant factors has to be observed at the planning stage of a pipeline:
• High wear resistance of pipeline components
• Planned service life of pipeline
• Operational Safety
• Ability to plan inspection times
• Dimensionally accurate line geometry
• Static
• Line course
• Special surface treatments

Our products are (also) used in industrial applications that require the highest possible purity and integrity of the materials to be conveyed.
Together with our customers we develop professional solutions. ESSER PIPES are successful for many years in the processing industries. They transport fibre reinforced plastic granules, hard plastic powder and flakes, glass, supplementary fuels, slag residues, as well as many other abrasives.
For the highest requirements we recommend our TWIN PIPE series. In comparison with standard ST52 (S355) pipes usual on the market, higher service-lifes can be achieved. Up to five times with quality ESSER 700, even up to ten times with quality ESSER 900, are possible.

### ESSER 160 (ST52)

**Material**  
Single Layer Unhardened

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Diameter (DN)</td>
<td>[mm] 65 ≤ DN ≤ 350 in 2,56 ≤ DN ≤ 13,78</td>
</tr>
<tr>
<td>Wall Thickness (W)</td>
<td>[mm] 4 ≤ W ≤ 12,5 in 0,16 ≤ W ≤ 0,49</td>
</tr>
<tr>
<td>Working Pressure (P)</td>
<td>[bar] 0 ≤ P ≤ 200 [psi] 0 ≤ P ≤ 2900</td>
</tr>
<tr>
<td>Service Life Factor</td>
<td>1 *</td>
</tr>
</tbody>
</table>

### ESSER 400

**Material**  
Single Layer Hardened

- Hardness (acc. Rockwell) up to 45 HRC

<table>
<thead>
<tr>
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<th>Range</th>
</tr>
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<td>Nominal Diameter (DN)</td>
<td>[mm] 65 ≤ DN ≤ 350 in 2,56 ≤ DN ≤ 13,78</td>
</tr>
<tr>
<td>Wall Thickness (W)</td>
<td>[mm] 4 ≤ W ≤ 12,5 in 0,16 ≤ W ≤ 0,49</td>
</tr>
<tr>
<td>Working Pressure (P)</td>
<td>[bar] 0 ≤ P ≤ 130 [psi] 0 ≤ P ≤ 1885</td>
</tr>
<tr>
<td>Service Life Factor</td>
<td>2-3 *</td>
</tr>
</tbody>
</table>

### ESSER 700

**Material**  
Double Layer Hardened inner pipe, pressure resistant outer pipe

- Hardness (acc. Rockwell) up to 63 HRC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Diameter (DN)</td>
<td>[mm] 80 ≤ DN ≤ 150 in 3,15 ≤ DN ≤ 5,90</td>
</tr>
<tr>
<td>Wall Thickness (a+b)</td>
<td>[mm] 4 ≤ a+b ≤ 13 in 0,16 ≤ a+b ≤ 0,51</td>
</tr>
<tr>
<td>Working Pressure (P)</td>
<td>[bar] 0 ≤ P ≤ 200 [psi] 0 ≤ P ≤ 2900</td>
</tr>
<tr>
<td>Service Life Factor</td>
<td>5 *</td>
</tr>
</tbody>
</table>

### ESSER 900

**Material**  
Double Layer Hardened inner pipe, pressure resistant outer pipe

- Hardness (acc. Rockwell) up to 67 HRC

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Diameter (DN)</td>
<td>[mm] 112 ≤ DN ≤ 200 in 4,4 ≤ DN ≤ 7,80</td>
</tr>
<tr>
<td>Wall Thickness (a+b)</td>
<td>[mm] 3,5 ≤ a+b ≤ 13 in 0,14 ≤ a+b ≤ 0,51</td>
</tr>
<tr>
<td>Working Pressure (P)</td>
<td>[bar] 0 ≤ P ≤ 200 [psi] 0 ≤ P ≤ 2900</td>
</tr>
<tr>
<td>Service Life Factor</td>
<td>10 *</td>
</tr>
</tbody>
</table>

Other diameters, wall thicknesses and operating pressures on request. Not all combinations of diameter, wall thickness and operating pressure are possible.

* Compared to unhardened ST52 pipes with equal wall thickness usual on the market. Conveyed material concrete.
The material to be conveyed always aims to retain its straight course. The geometry of elbows forces the conveyed material to change the flow direction. This movement causes a collision of the conveyed material with the outer radius of the inner wall from the elbow, so that it becomes a weak point of the delivery line. This matter requires a higher wear-resistance of the elbows compared to the straight pipes. Therefore our elbows are made in twin-layer design. For highest wear loads we recommend ESSER 900 elbows with inner layers made out of a special, high wear resistant cast alloy. Elbows can be produced in each angle between 5° and 90°.

ESSER-WERKE recommends generally using two-layer elbows from a higher quality.

<table>
<thead>
<tr>
<th>Material</th>
<th>Double Layer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hardened inner elbow</td>
<td>Pressure resistant outer elbow</td>
</tr>
<tr>
<td>Hardness (acc. Rockwell) up to 63 HRC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal Diameter (DN)</td>
<td>[mm] 80 ≤ DN ≤ 200</td>
<td>[in] 3.15 ≤ DN ≤ 7.80</td>
</tr>
<tr>
<td>Wall Thickness (a+b)</td>
<td>[mm] 4 ≤ a+b ≤ 10</td>
<td>[in] 0.16 ≤ a+b ≤ 0.39</td>
</tr>
<tr>
<td>Working Pressure (P)</td>
<td>[bar] 0 ≤ P ≤ 200</td>
<td>[psi] 0 ≤ P ≤ 2900</td>
</tr>
<tr>
<td>Service Life Factor</td>
<td>5 *</td>
<td></td>
</tr>
</tbody>
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Other diameters, wall thicknesses and operating pressures on request.
Not all combinations of diameter, wall thickness and operating pressure are possible.

* Compared to unhardened ST52 elbows with equal wall thickness usual on the market. Conveyed material concrete.
Abrasive wear properties of ESSER Pipes

GRADE OF WEAR in different pipe qualities
Medium: concrete C20/25

The above chart shows the analysis of test series for a very aggressive medium. Outlined in the diagram is the real wear of the pipe inner wall in proportion to the pumped concrete grade C20/25. The concrete was produced with unbroken natural aggregates. The measurements show that a conveying pipe in quality ESSER 900 has a 10-times longer service life than a ST52.

The specific values can be set approximately in proportion to similar transported materials.
Every case of application has to be analyzed and will be analysed by our engineers. After that we will discuss the next steps with our customer e.g. laboratory tests or field tests.
ESSER Pipes in diameters between DN 65 and DN 200 can be fitted with weld ends for coupling connections in Victaulic style. According to the application smooth weld ends or centred weld ends are in usage. Centred connections are able to compensate pressures up to 200 bar (≈2900 psi).

The most wear load is at the area of the connections. Wear resistant hardened steel rings or extreme wear resistant rings made of a special cast alloy increase this area.

These connection types enable a very quick mounting of the conveying line. Drop-forged couplings, saved by splint pins or screw joints, connect two conveying components.
ESSER Pipes can be fitted with almost all flange connections usual on the market. In addition to standard connections (e.g. DIN ISO), pipe connections according to customer’s specifications can be manufactured as well. Smooth (force-fit) and centred (force- and form-fit) connection types are possible.

Offsets and gaps between pipes cause turbulences which result in premature wear. Therefore it is possible that a premature failure happens sooner as calculated.

ESSER flange connections have a centring to prevent an offset between both pipes. Furthermore the centring simplifies the mounting of the single pipeline components.
Hydraulic Conveying

1. **High pressure conveying pipe 200 bar (2900 psi)**
   Due to the higher pressure a higher wall thickness is needed. Double layer pipes are used. They are economical and reliable. These pipes have a multiple lifetime compared to standard onelayer steel pipes (ST 52).

2. **High pressure elbow 90° 200 bar (2900 psi)**
   The change of the flow direction of the transported material in the elbow stresses the outer radius of the inner layer. ESSER 900 elbows are designed with a thicker ultra wear and impact resistant cast insert which are able to resist this strain of impact and abrasion.

3. **High pressure discharge pipe 200 bar (2900 psi)**
   The change of flow direction in the elbow causes higher abrasion in the inlet of the following pipe. Therefore extreme wear resistant ESSER 900 material for the inner layer will be used to reinforce this section.

4. **High pressure elbow 30° 200 bar (2900 psi)**
   The change of the flow direction of the transported material in the elbow stresses the outer radius of the inner layer. ESSER 900 elbows are designed with a thicker ultra-wear and impact resistant cast insert which are able to resist this strain of impact and abrasion.

5. **Conveying pipe 85 bar (1233 psi)**
   After normalising the pressure in the pipeline, two layer pipes with a smaller total wall thickness are used. They are economical and reliable. These pipes have a multiple lifetime compared to standard steel pipes (ST 52).

**Technical features**
- Two-layer pipes with an extreme wear resistant inner layer for high pressure applications.

**Surface preparation**
- Surface preparation (e.g. rust removal, corrosion protection, primer, top coat, etc.) can be done in accord to customer’s parameters and requirements.
- Coating: Airless spraying method according to newest standards and regulations.

**Structural analysis**
- We are able to create verifiable statical calculations of the pipeline components.

**Material standard tests**
- If required, the following standard tests can be made:
  1. Pressure test acc. to customer’s specifications
  2. Non-destructive testing of welds - Magnetic particle testing of welds acc. to DIN EN 1290 MT 2
  3. Non-destructive examination of fusion welds - Visual examination acc. to DIN EN 970 VT 2

**Alternative components (single layer pipes)**
- We are able to offer single layer pipe components for low delivery volumes and materials with low abrasion.

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**Centring connection with wedge coupling**

(for high pressure applications)
- The connection has a centring (male/ female) which simplifies the mounting and prevent an offset between both pipes.
- An O-ring prevents leakage of transported material. These special kinds of connections are designed for pressure up to 200 bars.
Pneumatic Conveying

1 Bracket pipe
There are delivery lines which are mounted free hanging or others mounted free standing in the mining shaft. The delivery line will be stabilised and carried by bracket pipes. The position of these pipes are based on a structural calculation. The bracket pipe is the beginning of every section of the shaft pipeline.

2 Extension pipe with stuffing box
Extension pipes are mounted in every section to compensate thermal expansions or contractions. These special pipes consist of two interlocking pipes with different diameters. The upper small pipe interlocks in the lower pipe with the larger diameter. A stuffing box prevents leakage of transported material.

3 Reducer
The nominal diameter has changed due to the greater outlet of the stuffing box. The reducer returns the diameter to the normal dimension of the pipeline. The pressure on the inner layer of this pipe increases as a result of the reduction of the diameter. ESSER 900 Reducers are able to compensate these pressure differences due to construction and the processed materials.

4 Discharge pipe
The high pressure at the end of the reducer has an effect on the following pipe. Abrasion is caused in the first part (inlet side). Therefore extreme wear resistant ESSER 900 material is used to reinforce this section.

5 Straight conveying pipe
After normalising the pressure in the pipeline two layer pipes with smaller wall thickness are used. They are economical, reliable and have a multiple lifetime compared to standard steel pipes (ST 52).

6 Elbow
The transported material crashes on the outer radius of the inner layer. Additionally the change of flow direction stresses the inner elbow in a higher grade. ESSER elbows are designed with a thicker ultra-wear and impact resistant cast insert which are able to resist this strain of impact and abrasion.

Technical features
Double Layer Pipes with an extreme wear resistant inner layer. Standard flanges, with or without centring, or customised flange connections are possible.

Surface preparation
Surface preparation (e.g. rust removal, corrosion protection, primer, top coat, etc.) can be done in accord to customer’s parameters and requirements.
Coating: Airless spraying method according to newest standards and regulations.

Structural analysis
We are able to create verifiable statical calculations of the pipeline components.

Material standard tests
If required, the following standard tests can be made:
1. Pressure test acc. to customer’s specifications
2. Non-destructive testing of welds - Magnetic particle testing of welds acc. to DIN EN 1290 MT 2
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