Wear-resistant materials

element®
Integrity in details
Wear-resistant plates and sheets

<table>
<thead>
<tr>
<th>Synthetic and composite lining</th>
<th>Metal lining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubber lining (RU)</td>
<td>WRSteel</td>
</tr>
<tr>
<td>RU (PU)-CER</td>
<td>Hybrid</td>
</tr>
<tr>
<td>Polyurethane plates and sheets</td>
<td>Polyethylene plates</td>
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<tr>
<td>Polyurethane plates</td>
<td>Ceramic plates</td>
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<tr>
<td>Polyethylene plates</td>
<td>Bimetallic plated HYBRID</td>
</tr>
<tr>
<td>Steel HYBRID</td>
<td></td>
</tr>
</tbody>
</table>

### Size
- **Standard smooth plates**
  - Thickness: 15 - 150 mm
  - Length: 1500, 3000 mm
- **Corrugated plates**
  - Thickness: 4-25 mm
  - Length: 1000, 2000 mm
- **Sheet rubber**
  - Thickness: 10, 20, 35, 64, 95 mm
  - Length: 250, 500 mm
- **Polyurethane plates**
  - Thickness: 5-30 mm
  - Length: 2000 mm
- **Polyethylene plates**
  - Thickness: 4-25 mm
  - Width: 1400, 1500 mm
  - Length: 3000, 10000 mm
- **Wear resistant steel plates**
  - Thickness: 3-60 mm
  - Width: 1400 mm
  - Length: 1400, 3400 mm
- **Bimetallic plated HYBRID**
  - Thickness: 6-45 mm
  - Width: 1400 mm
  - Length: 1400, 3400 mm

### Type of load
- **Impact**
  - Impact / Sliding friction
- **Impact**
  - Sliding friction
- **Impact / Sliding friction**
- **Impact / Sliding friction**
  - Sliding friction
  - Impact / Sliding friction
- **Impact / Sliding friction**
  - Impact / Sliding friction
- **Impact / Sliding friction**
- **Impact / Sliding friction**
  - Sliding friction
- **Impact / Sliding friction**
  - Impact / Sliding friction
- **Impact / Sliding friction**
  - Impact / Sliding friction

### Properties
- **1. Low- and heavy-duty**
  - Low- and heavy-duty
  - Shock absorption
  - Vibration dampening
  - Corrosion-free
- **2. Low- and tough duty with drop angle 10-50°**
  - Shock absorption
  - Vibration dampening
  - Corrosion-free
- **3. Medium- and tough duty with drop angle to the optimal value 90°**
  - Shock absorption
  - Vibration dampening
  - Corrosion-free
- **4. Low and Medium/heavy-duty**
  - Low friction coefficient for sticking prevention
  - Protection against sliding friction of fine particles
  - Protection against sliding friction of medium size particles

### Application
- **Hoppers**
  - Screens (wet screening)
  - Hoppers
  - Hoppers
  - Hoppers
- **Troughs**
  - Troughs
  - Troughs
- **Feeders**
  - Skips
  - Skips
  - Skips
- **Skips**
  - Surge bins
  - Surge bins
  - Surge bins
- **Transfer stations**
  - Transfer stations
  - Transfer stations
  - Transfer stations
- **Surge bins**
  - Surge bins
  - Surge bins
  - Surge bins
- **Silos**
  - Chutes
  - Chutes
  - Chutes
- **Chutes**
  - General wear protection
  - General wear protection
  - General wear protection

### Temperature conditions
- **-25°C to +70°C**
- **-60°C to +70°C**
- **-40°C to +70°C**
- **-60°C to +70°C**
- **60°C to +200°C**
- **up to +900°C**

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Rubber lining plates

Rubber plates possess good wear resistance and tear strength that makes them the standard solution for mining equipment protection. High resilience of rubber provides shock and vibration absorption protecting the equipment and reducing the noise level. The steel plate (optional) provides additional protection of equipment and tight lining by means of bolts or welded pins.

**Application:** primary and secondary crushing, zones with high sliding friction impact load in feed chutes, hoppers, storage bins, transfer points etc.

**Temperature range of effective use:** from -25°C to +70°C

**Key Features:**

1. Protect equipment against wear due to high shock absorbing properties
2. Reduce ore disintegration during transportation
3. Reduce noise and vibration levels compared to steel lining
4. Light-weight solution
5. Resistant to corrosion and temperature gradients
6. Easy to cut and bend for mounting

**Standard smooth plates**

- **Rubber hardness:** 60 Shore A
- **Material drop angle:** 500
- **Material:** Carbon structural steel
- **Standard range, mm:**
  - thickness: 15-150
  - width: 500, 600, 750
  - length: 1500, 3000

**Corrugated rubber plates**

- **Rubber hardness:** 60 Shore A
- **Material drop angle:** 100
- **Material:** Carbon structural steel
- **Standard range, mm:**
  - thickness: 50, 75, 100, 125
  - width: 500, 600, 750
  - length: 1000, 1500

**Sheet rubber**

- **Rubber hardness:** 40/60 Shore A
- **Material drop angle:** 0
- **Material:** Without steel substrate
- **Standard range, mm:**
  - thickness: 4-25
  - width: 1400, 1500
  - length: 3000, 10000

---

**Shape-cutting and mounting:**

<table>
<thead>
<tr>
<th>Plate thickness, mm</th>
<th>Max. recommended bend radius, mm</th>
<th>Max. recommended bend angle, (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 25</td>
<td>400</td>
<td>0-45</td>
</tr>
<tr>
<td>25-40</td>
<td>500</td>
<td>0-45</td>
</tr>
<tr>
<td>40-75</td>
<td>600</td>
<td>0-45</td>
</tr>
<tr>
<td>Over 75</td>
<td>Individual recommendations</td>
<td></td>
</tr>
</tbody>
</table>

**Fastening:**

- **No coding**
- **CL** — with contact glue layer
- **VW** — through hole with washer
- **W** — welded pin
- **H** — through hole for bolting

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* Steel thickness can be variable within 3-10 mm for reliable prevention of lining plate delamination or damage
Rubber-ceramic and polyurethane-ceramic plates

Due to the high resilience of rubber (or Polyurethane) in combination with the high hardness and wear resistance of aluminum oxide ceramics the composite lining plates possess extremely long life. Metal sheet base is also used for installation.

Application: feeders, troughs, discharge chutes of screens, transfer stations in conveyors, systems, in materials of chutes and screening troughs.

Rubber-ceramic plates

Temperature range of effective use: from -35°C to +90°C

Key Features:
1. Several times longer lifetime than steel lining
2. Noise reduction and occupational safety improvement
3. Good performance in severe conditions (high volume of material with different size)

Polyurethane-ceramic plates

Temperature range of effective use: from -60°C to +80°C

Key Features:
1. Several times longer lifetime than steel lining
2. Resistant to oil and some solvents
3. For wet and dry conditions

Standard range

<table>
<thead>
<tr>
<th>Material</th>
<th>Total thickness, mm</th>
<th>Patterns</th>
<th>Height of ceramic inserts, mm</th>
<th>Thickness of steel substrate, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC</td>
<td>8</td>
<td>S20, H24, C20</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>RC</td>
<td>10</td>
<td>S20, H24, C20</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>RC</td>
<td>20</td>
<td>S20, H24, C20</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>RC, UC</td>
<td>35</td>
<td>S40, R100, C20, H24</td>
<td>20</td>
<td>5 (3)</td>
</tr>
<tr>
<td>RC, UC</td>
<td>50</td>
<td>R100, R150</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>RC</td>
<td>64</td>
<td>R150</td>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>RC</td>
<td>95</td>
<td>R150 (120)</td>
<td>50 (70)</td>
<td>5</td>
</tr>
</tbody>
</table>

Reference code:

RC35 C20x10 500x500-5W

Material:
RC — rubber-ceramic
UC — polyurethane-ceramic

No coding
W — welded pin
WB — welded bolt
WN — welded nut
G — plate without steel substrate for gluing
H — through hole for bolting

* Other dimensions of plates under request
Polyurethane lining plates

Polyurethane (PU) – is the most versatile polymer possessing a wide variety of physical-mechanical properties depending on the formulation and application. PU has a number of advantages compared to metal, rubber and some other plastics: high abrasion resistance, tear and impact strength, wide hardness range and other useful properties. Due to its versatility and diversity of properties PU belongs to the most valuable and advanced synthetic materials used in mining industry.

Due to its properties, polyurethane is one of the most promising and advanced modern synthetic materials used in the mining industry.

Application: feeding troughs, hoppers, accumulator reservoirs for sticky, hygroscopic and abrasive materials, especially for Also suitable for convex and concave surfaces.

Temperature range of effective use: from -40°C to +70°C

Key Features:

1. Better wear resistance than rubber lining
2. High tear and tensile strength
3. Wide hardness range
4. Prevent sticking and improve material flow
5. Good resistance to low temperatures
6. Allow to line curved surfaces

Polyurethane plates

Material:
- 70 Shore A – blue color
- 80 Shore A – yellow color
- 90 Shore A – green color

Thickness: 5-30
Width x Length: 1000x2000

Polyurethane plates with steel reinforcement

Material:
- 70/80/90 Shore A
- Steel substrate* - carbon structural steel Cr3

Thickness: 5-30
Width x Length: 1000x2000

*Steel thickness can be variable within 3-10 mm for reliable caused by excessive load.

Reference code:

PU—Cor—SH70 50x1000x1200—5W—Blue

Material:
- PU – polyurethane
- Cor – corrugated

Hardness

Overall dimensions, thickness-width-length, mm

Thickness of steel sheet

Fastening method

Color coding according to hardness

Shape-cutting and mounting:

Prevent sticking and improve material flow

<table>
<thead>
<tr>
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<td>600</td>
<td>0-45</td>
</tr>
<tr>
<td>Over 75</td>
<td>Individual recommendations</td>
<td></td>
</tr>
</tbody>
</table>

Standard pattern of fastening holes:

With L and W over 1000 mm additional intermediate holes required

Fastening:

No coding
- VW — through hole with washer
- W — welded pin

Material 70 Shore A — blue color
Material 80 Shore A — yellow color
Material 90 Shore A — green color

Standard range, mm Thickness: 5-30
Width x Length: 1000x2000

Material 70/80/90 Shore A
Steel substrate* - carbon structural steel Cr3

Thickness: 5-30
Width x Length: 1000x2000
Polyethylene lining plates

Ultra-high molecular weight polyethylene (UHMWPE) plates possess extremely low of sliding friction and extremely high impact strength. Due to its unique mechanical properties, the UHMWPE plates are used when sliding friction and impact of particles falling down with a small angle is the major factor of wear.

Application: feed trough, storage hopper for dry substances, accumulating reservoir, transportation chute.

Temperature range of effective use: from -60°C to +70°C

Key Features:

1. High abrasion resistance due to low coefficient of friction
2. Prevention of material sticking on the surface
3. Lightweight construction compared to steel and easy relining

Reference code:

Material:
UHMWPE — polyethylene

Grade:
UHMWPE-9000 (Mw 9 mln g/mol)
UHMWPE-1000 (Mw 4-6 mln g/mol)
3. Regenerated

Standard range, mm:
thickness: 5-80
width: 1220
length: 3015, 3050

Electrical properties:
A/S — antistatic

Fastening:

H — through hole for bolting
Bolted joint
Weld through washer

Steel wear-resistant lining plates

Wear-resistant steel linings are characterized by high hardness, strength and good impact resistance. In production, we use a method of metallurgical cleaning of steel and a unique quenching technology. As a result, the linings acquire uniform hardness and strength.

Application: bodies of trommels, cement mixers, buckets, blades of feeders, wagons, screw conveyors of mining and digging machines

Temperature range of effective use: from -60°C to +200°C

Key Features:

1. General purpose plates, resistant to wear, abrasion and cracking
2. Combine high strength with good bendability and weldability
3. Increase useful load on products and structures

Reference code:

Material:
WRSteel — wear-resistant steel

Grade:
WRSteel 450HB

Hardness

Overall dimensions, thickness-width-length, mm:

Standard range, mm:

Thickness: 4-75
Dimensions of sheets: 2000X6000, 2000x8000

Fastening:

H — through hole for bolting
W — welded pin
Weld connections
Bimetal lining plates

High wear-resistant properties of HYBRID plates ensure long service life while reducing maintenance costs. We use conventional low-carbon or heat-resistant steel as the base of HYBRID plates. With the help of automated surfacing, a special wear-resistant coating is applied to the base. We produce HYBRID plates with a uniform chemical composition and hardness thanks to an automated production method and quality control.

**Application:** lining of dump truck bodies, excavator buckets, crushers, feed funnels, hoppers, troughs, mixers

**Temperature range of effective use:** up to +900°C

**Advantages:**
1. Uniformity of built-up layer in terms of hardness and chemical composition
2. Perfect welding ability thanks to low-alloy steel base
3. Possibility of cold-state deformation. Min. deformation diameter 250 mm

**Properties of HYBRID plates:**

- **Chemical composition:** Plates are produced by build-up welding of one or more wear-resistant layers on a base plate of low-carbon steel with medium or low carbon content. Alloy contains a large amount of solid particles of the chromium carbide.

- **Microstructure:** Volume fraction of chromium carbide (Sg7sz) exceeds 50%.

- **Hardness:** Solid particles of chromium carbide are uniformly distributed throughout the layer. This creates a robust microstructure. Hardness is HRC58-65 depending on layer thickness.

- **Wear resistance:** Wear resistance of HYBRID is 16 times higher than that of low-carbon steel and 5 times higher than that of heat-treated steel.

- **Flatness tolerance:** Flatness tolerance is ±3 mm / m

- **Thickness tolerance:** Uniform built-up thickness with a tolerance within 0-0.5 mm.

**Reference code:**

HYBRID—CR 6+3 9x1300x2800—H

**Material:**
HYBRID — bimetal

**Surface:**
CR — abrasion-resistant
HCR — high-strength and abrasion-resistant
IR — high-strength and impact-resistant
HR — heat-resistant, up to 900 °C
SP — special plates

**Thickness of main layer**

**Thickness of built-up layer**

**Overall dimensions, thickness—width—length, mm**

**Fastening method**

**Classification:**

**Surfaces**

- CR: C: 3.0-4.5%, Cr: 15-27%, 58-65HRC
- HCR: C: 3.5-5.5%, Cr: 27%-40%, surface wear-resistant layer up to 25 mm thick
- IR: High-strength and impact-resistant plate
- HR: Heat-resistant plate, up to 900 °C
- SP: Special plates with addition of Mo, Nb, Ni, W, V

**Variant of thicknesses (base layer + built-up layer)**

<table>
<thead>
<tr>
<th>Base layer</th>
<th>Built-up layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>3+3 / 4+4</td>
<td>5+5</td>
</tr>
<tr>
<td>6+4 / 6+5</td>
<td>6+6 / 6+8</td>
</tr>
<tr>
<td>8+4 / 8+5</td>
<td>8+6 / 8+7</td>
</tr>
<tr>
<td>10+4 / 10+5</td>
<td>10+6 / 10+7</td>
</tr>
<tr>
<td>12+4 / 12+5</td>
<td>12+6 / 12+7 / 12+8 / 12+10 / 12+11 / 12+12 / 12+18 / 12+20</td>
</tr>
<tr>
<td>14+6 / 14+8</td>
<td>14+10</td>
</tr>
<tr>
<td>16+6 / 16+8</td>
<td>16+10</td>
</tr>
<tr>
<td>18+6 / 18+8 / 18+10</td>
<td></td>
</tr>
<tr>
<td>20+5 / 20+6 / 20+8 / 20+10 / 30+10 / 40+10 / 20+20 / 20+25</td>
<td></td>
</tr>
</tbody>
</table>

**Fastening:**

- H — through hole for bolting
- W — welded pin
- Electric rivet
- Weld connections

* We can produce plates of various sizes and thicknesses, cut and bend wear plates into specific shapes and details depending on the customer’s drawings.
ETO — Engineering-to-order. Customized selection and erection supervision for linings

ETO or “engineering-to-order” is a full-fledged engineering work on the selection and installation of lining materials for the characteristics of the customer’s equipment.

Advantages:

1. Ready for installation
   - The set is ready for installation and does not need additional fitting-up and fastening
2. All inclusive
   - The cost of the lining set includes services for its preparation and erection supervision
3. Guarantee of efficiency
   - We guarantee the cost effectiveness. We provide a justification for the payback period

We undertake for all engineering work

Our service specialists will come to you, collect preliminary information, perform all necessary measurements. Our engineering Department will select the necessary types of plates, prepare layout and mounting patterns and necessary drawings.

Cost and payment procedure for project work

You can pay for the project in parts — the frequency and amount of payment will be equal to the cost of the customer for the current lining materials. The cost of the lining set includes services for its preparation and erection supervision.

Project example:

Problem:
The replacement interval of steel linings on the trapezoidal hopper is 1 month, which does not satisfy the Customer.

Solution:
We selected the types and calculated the thickness of lining materials, taking into account the service of individual elements of the hopper. We performed shape-cutting of materials.

Result:
Unit service life was increased by 6 times. Economic effect - decrease of unit operation unit cost by 11.5%.

Steps for cooperation:

Request
Customer’s need to reduce operating costs of equipment

Visit of service engineer
We take the measurements of unit, investigate wear characteristics and service hours of currently used materials

Preparation of technical-economic solution
We prepare layouts and fastening patterns, material budget, feasibility study

Approval by Customer
Assessment of technical solution and economic effect

Manufacturing of the set
We make up the set, cut the material, prepare the fasteners

Erection supervision
We visit Customer’s site and provide technical support for installation

| Rubber-ceramic standard plates 500x500 mm for side walls in combination with non-standard plates adapted to the size of the hopper walls |
| Rubber plates of customized sizes for lining the corners of the hopper |
| Lining of hopper upper edges with HYBRID bimetal plates |
Element Group of Companies

For ordering wear-resistant plates or individual projects email to service@element.global

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