

<b>fig. 2-1 - Cable trench cross-sections</b>	<b>12</b>
<ul style="list-style-type: none"> <li>cable protective casing</li> <li>HV cable</li> <li>mechanical protection</li> <li>warning foil</li> <li>cable protective casing</li> <li>sand bed</li> <li>LV cable</li> <li>warning PVC slab</li> <li>excavation material</li> <li>surrounding terrain</li> </ul>	
<b>fig. 2-2 - Picture to the table 2-1a.</b>	<b>16</b>
<ul style="list-style-type: none"> <li>opto tube</li> <li>HV cable core diameter</li> <li>LV core diameter</li> <li>inner diameter of the cable protective casing</li> </ul>	
<b>fig. 2-6 – Example of a method of sealing with a lid with a shrink tube</b>	<b>22</b>
<ul style="list-style-type: none"> <li>clamping nuts</li> <li>shrink tube</li> <li>cable</li> <li>system cover</li> <li>slip ring and o-ring</li> <li>concrete wall</li> <li>X = wall thickness</li> <li>Plug</li> </ul>	
<b>fig. 2-7 – Example of cable passage through a wall with a fire seal</b>	<b>23</b>
<ul style="list-style-type: none"> <li>wall</li> <li>fire resistant sealant</li> <li>cable</li> </ul>	
<b>fig. 2-8 – Example of passage for multiple cables through a wall with a fire seal</b>	<b>23</b>
<ul style="list-style-type: none"> <li>fire resistant sealant</li> <li>wall</li> <li>cable</li> </ul>	
<b>fig. 3-1 – Example of EHV cable cross-section</b>	<b>28</b>
<ul style="list-style-type: none"> <li>core Cu (Al)</li> <li>semiconducting water blocking tape</li> <li>inner semiconducting layer</li> <li>XLPE insulation</li> <li>outer semiconducting layer</li> </ul>	

semiconducting water blocking tape  
copper shielding  
copper shielding tape  
semiconducting water blocking tape  
aluminium foils  
outer sheath

**fig. 3-2 - Both end bonding systems**

**30**

cable heads  
metal sheath of the cable  
conductor  
metal shielding  
direct bonding  
direct grounding  
induced voltage in the cable shield

**fig. 3-3 - Single point bonding systems**

**31**

cable heads  
sheath of the cable  
conductor  
shielding  
surge protector  
parallel earth conductor  
direct bonding  
direct grounding  
induced voltage in the cable shield

**fig. 3-4 - Cross-bonding transposition**

**32**

cable heads  
coupling  
conductor  
separate shielding  
shielding  
cross- bonding  
parallel earth conductor  
surge protector  
direct grounding  
cross- bonding  
direct grounding  
minority part  
minority part  
minority part  
majority part

induced voltage in the cable shield

**fig. 3-5 - Laying the cable in the normal route in a triangular EHV formation** **34**

warning foil  
concrete slab  
sand bed  
opto tube  
warning foil  
concrete slabs  
sand bed with cemented stabilization 1:14  
grounding tape 2x FeZn 30x4  
levelling concrete layer

**fig. 3-6 - Laying of EHV cable in normal route in planar formation** **35**

opto tube  
concrete slab  
sand bed with cemented stabilization 1:14

**fig. 3-7 - Laying the cable in an under-drill with external cable protective casing** **36**

outer cable protective casing with a diameter of 600mm

**fig. 3-10 - Location of the optical cable outside the sheath of the EHV power cable** **37**

cable tie for fastening the optical cable  
optical cable for temperature sensing  
HV cable  
Fastening detail  
single phase clamp  
EHV cable  
cable tie for fastening the optical cable  
optical cable for temperature sensing  
sheath  
steel tube  
reinforced wires  
optical fibre

**fig. 3-11 - Example of DTS system connection** **38**

optical connection cable  
power cable with integrated optical fibre  
monitoring unit

**fig. 3-12 - Sensor heating measurement** **38**

Pt100 evaluation unit

earthing point  
reference electrode in the ground  
3x2 Pt100 sensors located on the power cable  
manual measuring unit

**fig. 3-13 - View of the passage to the EHV cable into the dug route** 41

kWN cable passages into the dug route

**fig. 3-15 - Detail of fastening the bundle to the footbridge and bundling in a horizontal path** 42

a) fastening to the structure b) intermediate fastening

**fig. B 1-1 - Laying of opto tubes, LV and HV cable in a sand bed** 46

warning foil  
mechanical protection  
HV-LV cable  
LV cable  
Opto tube  
Sand bed  
LV cable or opto tube  
warning PVC slab  
excavation material  
surrounding terrain

**fig. B 1-2 - Laying of the HV cable in a cable protective casing with backfill and concreting** 46

concrete  
sand layer

**fig. B 1-3 - Laying of LV cables in the cable trench** 47

excavation material  
warning foil  
sifted soil  
LV cable  
cable trench  
levelling layer

**fig. B 1-4 - Laying of HV cables in the cable trench** 47

excavation material  
sifted soil  
levelling layer

**fig. B 1-5 - Laying of LV cables in a multi-chamber cable protective casing** 48

excavation material  
sifted soil

multi-chamber cable protective casing  
LV cable  
levelling layer

**fig. B 1-6 - Laying of cables in a sand bed - concurrence of HV and LV**

48

cable  
excavation material  
Mechanical protection  
1-4 the end bricks are laid along the entire length of the cable route  
2 bricks separate HV and LV cables along their entire length  
3 bricks separating the LV cables are laid every 5 m  
5 covering bricks  
6 bricks indicating the place of marking of the cable  
Sand  
LV cable  
HV cable  
LV cables  
warning foil

**fig. B 1-7a - Combination of low voltage, high voltage cables, communication cables, first part**

49

micro tube  
**HV cable**  
**Combined power cable with micro tubes**  
**LV cables with energy opto tube**  
Opto tube  
**LV cable with an integrated energy microtube**  
LV cable with an integrated microtube  
sand bed  
warning foil or warning slab  
excavation material  
surrounding terrain

**fig. B 1-8b - Combination of low voltage, high voltage cables, communication cables, second part**

49

concrete  
cable protective casing  
**HV cable and opto tube under a road or roadside**  
**Cable and opto tube**  
LV

Opto tube  
HV  
**HV Cable and opto tube**

opto tube

**fig. B 1-9 - Cable bollard for marking cable networks** 50

HV Cable

**fig. B 1-10 - Height marking of the breaking point of a railway crossing** 50

white

red

FeZn tube Ø32

terrain

Concrete

**fig. B 2-2 - Example of a terminal with direct earthing of the EHV shield** 57

EHV cable

lockable earthing box for direct grounding

main grounding

grounding cable

**fig. B 2-3 - Example of a coupling with cross-bonding and EHV surge protector** 58

EHV cable

coaxial cable

lockable earthing box with cross bonding and surge protector

grounding network

EHV cable

coupling with lead-out shield

**fig. B 2-4 - Example of an optimal solution of a connection box for EHV cables + a coupling behind each other** 59

**Description**

pavement construction

compacted backfill

warning foil

concrete slab coverage

fine sand 0-4mm

wall – concrete blocks

coupling 110kV

concrete slab 150mm thick with a net

position for the cross-bonding box

**fig. B 2-5 - Example of an optimal solution of a connection box for cables + a coupling next to each other** 60

## **Description**

pavement construction  
compacted backfill  
warning foil  
concrete slab coverage  
fine sand 0-4mm  
wall – concrete blocks  
coupling 110kV  
concrete slab 150mm thick with a net  
position for the cross-bonding box

### **fig. B 2-6 - Laying of the EHV cable in the communication transition in a triangular formation 61**

cable protective casing Ø 110 (160) mm and opto tube  
4x PVC (PE)  
Concrete the cable protective casings

### **fig. B 2-7 - Laying of the EHV cable in the communication transition in a planar formation 61**

warning foil  
cable protective casing Ø 110 (160) mm and opto tube  
4x PVC (PE)  
Concrete the cable protective casings

### **fig. B 2-8 - Laying of EHV cable with protection in cable trench in planar formation 62**

laying into separated cable trenches

### **fig. B 2-9 - Laying of EHV cable with protection in a common cable trench in a triangle 62**

warning foil  
concrete trench for opto tube  
concrete trench for opto tube

### **fig. B 2-10 - Crossing of EHV cables under pipes (gas, water, sewage) 63**

warning foil  
4xPVC Ø232  
piping  
warning foil  
concrete  
EHV cable

### **fig. B 2-11 - Crossing of EHV cables under pipes (gas, water, sewage) 64**

piping  
warning foil  
4xPVC Ø232

warning foil  
concrete  
EHV cable

**fig. B 2-12 - Crossing of EHV cables with hot water pipes**

**65**

hot water pipes  
warning foil  
concreted cable protective casings  
EHV cable 4xPVC Ø232

hot water pipes  
warning foil  
concrete  
EHV cable

**fig. B 2-13 - Crossing of EHV cables with hot water pipes**

**66**

warning foil  
concreted cable protective casings  
EHV cable 4xPVC Ø232  
hot water pipes

warning foil  
concrete  
EHV cable  
hot water pipes

**fig. B 2-14 - Crossing of EHV cables with railway tracks by under-drilling**

**67**

starting pit (block the pit)  
back pressure  
target pit (block the pit)

Cross-section A  
non-magnetic material fiberglass (PE) from Ø 200mm

Cross-section B  
1x steel tube Ø 508mm  
1x (for EHV 3xPE Ø 200mm)

**fig. B 2-15 - Not recommended laying method for EHV cable lines** 67

concrete  
warning foil  
EHV cable