Session 14 – Cable Support Systems
Cable Support Systems in the IEC World

A new IEC Standard, IEC61537-2001 has been developed...

If full details of the cabling layout are available then the likely cable load can be calculated using either manufacturer's published information or the tables of Cable Weights and Diameters which are given below. However it is often necessary to select a tray or ladder design in the absence of accurate information on the likely cable load. To assist this selection process a useful approach can be to choose a likely size of tray or ladder and then to estimate the maximum cable weight which is capable of being contained within it. This estimate may be arrived at using the following guide:-

Max. cabling capacity (kg/m) = Cable laying area (m2) x 2800
Multicore cables on racks or trays may be bunched in a maximum of two layers.

HV and LV single core cables shall be laid in trefoil groups with 150 mm clear spacing between trefoils.

On trays or racks HV cables shall be segregated from the LV cables. Individual cables emerging from floors or soil shall be protected against mechanical damage by means of galvanized steel pipes or rigid PVC pipes. Single core cables emerging from floors or soil shall be protected by rigid PVC pipes. These pipes shall extend at least 100 mm above ground or floor level.

Grouped cables emerging from floors or soil shall be protected collectively by a properly designed metal shield or duct in such a way that heat dissipation of the sustained load carrying cables is not hampered. The propagation of fire from one space to the other shall be prevented by proper sealing of openings around cables.

Cables or cable supports shall not be fixed directly or indirectly to plant, equipment or process piping which may require removal or replacement. Cables shall be laid on racks or trays strictly in accordance with the laying patterns stated on the layout drawings. Metal parts of the cable racks and trays shall be bonded and connected to the common earthing grid.

All cabling support materials, i.e. ladders, trays and relevant fixing materials, used throughout the plant shall be hot-dip galvanized unless the environment is considered to be particularly saliferous or sulphurous, such as to justify the use of materials offering a higher degree of corrosion resistance. In the latter case specific plants or areas shall utilize stainless steel (grade 304). Stainless steel (grade 316) shall be used offshore.
Bends and corners in the cable racks, trays or ladders shall take account of the minimum cable bending radii. Cable racks and trays shall be closed by removable top covers, allowing adequate ventilation, in situations where:
- mechanical damage of the cables is likely to occur during plant maintenance activities,
- oil or chemical spillages on the trays can be expected,
- sun shielding is required against direct solar radiation.

Vertical cable rack risers shall not be installed in front of, or over, pipe risers.

Flexible cabling

The application of flexible cables in industrial plants and installations shall be limited to:
- welding cables;
- trailing cables, e.g. for movable equipment, hand tools, hand lamps;
- winches, hoists, soot blowers, and electric motors, if connected by means of a nearby intermediate junction box.

An earth continuity conductor, equal in cross-sectional area to the largest phase conductor, shall be provided. This requirement applies even when the cable is armored.

Wires in conduit

Wires in conduit systems shall be applied only for lighting, communication and convenience outlets in closed buildings in non-hazardous areas. Conduit installations shall be made using rigid PVC conduit and non-metallic conduit boxes. Conduit box covers shall remain accessible. Where local regulations permit, unarmored round installation cable can be used in cable ducts. Tee or straight-through joints shall be made in connection boxes.
Cable marking/numbering

Cable numbers shall be marked on the cables along their routes and at both termination points. For underground cabling, the spacing between cable numbers along the route should not exceed 5 m, and for above ground cabling, 25 m. Cables shall also be numbered where they branch off from a main route.

For underground cable marking purposes non-corroding strips shall be used, each having ample length to be wrapped twice around the cable and in which the cable number has been imprinted by means of letter/cipher punches. For above ground cabling, plastic markers resistant to the site conditions shall be strapped round the cables.

For underground cabling, above ground route markers shall also be provided at every change of direction in the routing and at both sides of road or pipeline crossings, except when cable routing is already indicated by colored concrete pavement.
Cable Tray Wiring

More use of protection by location than is typical in US installations. The use of basket tray is typical for light weight last meter cable runs in onshore applications. The use of ventilated cable tray is common for heavier weight cables and offers more protection in offshore applications.

Cable ladder is typically used in feeder applications for longer runs of multiple cables or of higher ampacity and weight.
Cable Support Systems in the IEC World

Typical Cable Weight Information...

<table>
<thead>
<tr>
<th>Nom. Area of Conductor, mm²</th>
<th>2 core</th>
<th>3 core</th>
<th>4 core</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg/m</td>
<td>D mm</td>
<td>kg/m</td>
<td>D</td>
</tr>
<tr>
<td>25</td>
<td>0.7</td>
<td>18.4</td>
<td>1.0</td>
</tr>
<tr>
<td>35</td>
<td>0.9</td>
<td>20.0</td>
<td>1.3</td>
</tr>
<tr>
<td>50</td>
<td>1.2</td>
<td>22.2</td>
<td>1.7</td>
</tr>
<tr>
<td>70</td>
<td>1.7</td>
<td>24.6</td>
<td>2.4</td>
</tr>
<tr>
<td>95</td>
<td>2.3</td>
<td>28.2</td>
<td>3.3</td>
</tr>
<tr>
<td>120</td>
<td>2.8</td>
<td>30.9</td>
<td>4.0</td>
</tr>
<tr>
<td>150</td>
<td>3.5</td>
<td>34.1</td>
<td>4.9</td>
</tr>
<tr>
<td>185</td>
<td>4.2</td>
<td>37.8</td>
<td>6.1</td>
</tr>
<tr>
<td>240</td>
<td>5.5</td>
<td>43.2</td>
<td>8.0</td>
</tr>
<tr>
<td>300</td>
<td>7.0</td>
<td>47.2</td>
<td>9.7</td>
</tr>
<tr>
<td>400</td>
<td>8.5</td>
<td>53.2</td>
<td>12.6</td>
</tr>
</tbody>
</table>
Cable Support Systems in the IEC World

Support of cable tray and ladder is typically done in the same fashion as US installations but generally has fewer restrictions as to loading design. Calculations for loading of cable into tray is based upon manufacturers cable data compared to loading data for tray manufacturer.
It is not uncommon to use either the cable tray or ladder to be used as a means to directly mount lighting fixtures to the support structure. Special bracketry is designed for various brands of products to be supported in this fashion. Examples of these types of installations are shown here.

Stretch preventors are typically used to relieve strain on the cable as the enter light fittings.
Cable Support Systems in the IEC World - Typical

Channel 49x49x4 mm
AISI 316
1.5 m Art. no.: 82342
Cut to right length
UNO channel
U-41-1 Art. no. 1371859
3 m length

UNO angle
D 41 Art. no.: 1371898

Locking bolt
M10x20 Art. no.: 1371983

Tray hook
SPB-TH Art. no.: 89577

Structure SP2214
includes
Bolt M10x20 Art. no.: 1371325
Washer Art. no.: 1371352
UNO M10 nut M-3110 Art. no.: 1371874

Carbon steel
Stainless steel
Cable Support Systems in the IEC World - Typical

1.5 - 2m

80 x 80 mm
90 x 90
100 x 100
120 x 120
140 x 140
150 x 150
180 x 180
200 x 200

Carbon steel

See detail next page
Cable Support Systems in the IEC World - Typical

SS TYPES

OE Flexi Riser, how to use:
A unique flexibility simplifies installation whatever obstacle you encounter.

OE Flexi Riser
Type - Width  |  Art. no.
OE 125-FR-150 |  80336
OE 125-FR-300 |  80337
OE 125-FR-600 |  80339
OE 125-FR-900 |  80341

Fixed Crosses and T-pieces see page 9

FR2 for R = 450
OE 125-FR2-150 |  80250
OE 125-FR2-300 |  80251
OE 125-FR2-600 |  80253
OE 125-FR2-900 |  80255

FR3 for R = 600
OE 125-FR3-150 |  80256
OE 125-FR3-300 |  80257
OE 125-FR3-600 |  80259
OE 125-FR3-900 |  80261

FR4 for R = 900
OE 125-FR4-150 |  80262
OE 125-FR4-300 |  80263
OE 125-FR4-600 |  80265
OE 125-FR4-900 |  80267

Directional adjustor
O49-57B bracket
Art. no.: 84168

Directional adjustor
O49-57 bracket
Art. no.: 1371702

Support close to reducer

Splice connector
Art. no.: 83600

Reducer
Type (Type - width)  |  Art. no.
OE 125-R-150 |  80298
OE 125-R-300 |  80299
OE 125-R-450 |  80300
OE 125-R-600 |  80301
OE 125-R-750 |  80302
Cable Support Systems in the IEC World - Typical
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- **Hand rail**
- **SS TYPES**
  - Armature tray type SPB-RF 40-100.
  - The tray system gives free cable support to and from the armature.
- **Option:**
- **SPB-KR Combil-Riser**
  - Art. no.: 81546
- **Beam clamp**
  - Type MKJ 14 26/6
  - Art. no.: SP2066
- **Pressure sleeve**
- **Beam clamp**
  - Type MK70 10/10B
  - Art. no.: SP2106
- **Bolt M10x50**
  - Art. no.: 1371330
  - Flange Nut
  - Art. no.: 1371973

- **Bracket for lighting installation on hand rails.**
  - Art. no.: 83614
- **Stretch preventors and Cable protectors for Light support trays, see page 10.**

**SS**
- All material in stainless steel
- Safety factor = 2
- Bolts required M10x20 1371983
- Bolts required M10x30 1371300
- Nuts required M10 1371310
- Max load each M10 2000 kg
- Bolts required M6x12 1371681
- Max load each M6 1000 kg
- IEC Ex
- CE
Cable Support Systems in the IEC World - Typical

SS TYPES

- Tag sign Art. no.: SP2024 (not included in SP2117)
- Preslotted holes for Tag sign
- Hand rail
- Lighting pole
  - Structure Art. no.: SP2117
  - Chalmit 36W-1 armature
  - Smart Box junction box
  - Junction box plate (included in art. no. SP 2117)
  - Welding bracket for lighting pole Art. no.: SP1974 (not included in SP2117)
Cable Support Systems in the IEC World - Typical

**SS TYPES**

Prepared to fix Loud speakers, Gas detectors and Flash lights.

As ladder and tray console in combination with equipment support

**STUB**

Art. no.: 84169
Material 3mm

The STUB can be fixed directly onto RHS with U-bolts.

**U-Bolts for RHS ordering list**

<table>
<thead>
<tr>
<th>Type</th>
<th>M10 x M10</th>
<th>Bolt</th>
<th>Art. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-bolts RHS</td>
<td>80x80</td>
<td>M10</td>
<td>SP2188</td>
</tr>
<tr>
<td>U-bolts RHS</td>
<td>100x100</td>
<td>M10</td>
<td>SP2188</td>
</tr>
<tr>
<td>U-bolts RHS</td>
<td>80x80</td>
<td>M10</td>
<td>SP2186</td>
</tr>
<tr>
<td>U-bolts RHS</td>
<td>100x100</td>
<td>M10</td>
<td>SP2186</td>
</tr>
</tbody>
</table>
SS TYPES

For Tag plate
Protection roof
Art. no. 81372

Assembly of Equipment plate and Protection roof
Bracket for welding
Art. no.

Bracket for welding
Floor OER-BP
Art. no.

OE ladder
OE 150-150
Art. no. 79806
Equipment plate
Art. no.

Distance bracket
= Light bracket
for ladder widths
150 mm
Art. no. 84139

Screws
4 x M6 x 12
Art. no. 76236

Channel
MK 48-3
Art. no. 84139

Press clamp
KB-M10
Art. no. 84139

All materials in stainless steel
Support Systems Installation Examples
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Cable Cleats Trefoils for Single Core Cables

Power cables under short-circuit conditions (especially three-phase, single conductor cable arrangements) are subject to significant forces as a result of induced magnetic fields. For three-phase, single conductor cables, these forces cause violent thrashing of the individual conductors, frequently resulting in inadequately supported cables jumping out of their cable tray or raceway systems. Such unrestrained cable movement can cause cable damage, damage to surrounding equipment and possible injury.

A European Standard now exists – EN 50368:2003, Cable Cleats for Electrical Installations. This Standard was approved by CENELEC (the European Committee for Electrotechnical Standardization) in September 2003 and published in October 2003. EN 50368:2003 has the status of an approved British Standard.
Cable Cleats Trefoils for Single Core Cables

Good engineering practice for the use of single core cables without the use of conduit systems is to use cable cleats to minimize downtime and potential dramatic destruction of the cable systems and surrounding environment.
### Typical Installation of single core cable

<table>
<thead>
<tr>
<th>Method of installation in Table 3</th>
<th>Number of trays</th>
<th>Number of three-phase circuits (note 4)</th>
<th>Use as a multiplier to rating for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perforated trays</td>
<td>31</td>
<td>1: 0.98, 2: 0.96, 3: 0.95</td>
<td>Three cables in horizontal formation</td>
</tr>
<tr>
<td>Vertical perforated trays</td>
<td>31</td>
<td>1: 0.86, 2: 0.86</td>
<td>Three cables in vertical formation</td>
</tr>
<tr>
<td>Ladder supports, cleats, etc.</td>
<td>32, 33, 34</td>
<td>1: 1.00, 2: 0.98, 3: 0.97</td>
<td>Three cables in horizontal formation</td>
</tr>
<tr>
<td>Perforated trays</td>
<td>31</td>
<td>1: 1.00, 2: 0.97, 3: 0.92</td>
<td>Three cables in trefoil formation</td>
</tr>
<tr>
<td>Vertical perforated trays</td>
<td>31</td>
<td>1: 1.00, 2: 1.00</td>
<td>Three cables in trefoil formation</td>
</tr>
<tr>
<td>Ladder supports, cleats, etc.</td>
<td>32, 33, 34</td>
<td>1: 1.00, 2: 0.97, 3: 0.94</td>
<td>Three cables in trefoil formation</td>
</tr>
</tbody>
</table>

**NOTE 1** Factors are given for single layers of cables (or trefoil groups) as shown in the table and do not apply when cables are installed in more than one layer touching each other. Values for such installations may be significantly lower and must be determined by an appropriate method.

**NOTE 2** Values are given for vertical spacings between trays of 300 mm. For closer spacing the factors should be reduced.

**NOTE 3** Values are given for horizontal spacing between trays of 225 mm with trays mounted back to back and at least 20 mm between the tray and any wall. For closer spacing the factors should be reduced.

**NOTE 4** For circuits having more than one cable in parallel per phase, each three phase set of conductors should be considered as a circuit for the purpose of this table.