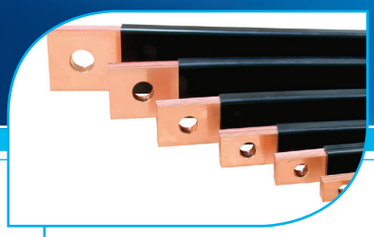


INTERNATIONAL WIRE Group

# FLEXIBLE ELEMENTS

## Concept and design

The FORISSIER flexible elements are manufactured with an assembly of copper strips (Cu ETP), protected by a PVC extrusion wich offers an electrical insulation as well the flexible element is twisted or used in different environments (humidity, high temperature or agressive ambience).

## Scope of application

*100 % EXTRUDED*
*NEW PVC UL APPROVED*

All application linked to power transportation, to replace: Cables, Rigid bars
Electrical appliances (Switchboard, Circuit breaker and converter).
Transformer (connections between the transformer and the bars)

## The range

- Standard Length: 2000 mm and 3000 mm (other dimensions upon request).
- Strip thickness: 0.5 mm up to 1 mm.
- Number of strips: 2 up to 12.

**Options**

- Tinned copper or aluminium.
- Flexible connections.
- Halogen free.
- High température insulation – 125 °C.

## Advantages

The sole electrical connection system wich compiles all duties: shaping – connectors – conductor insulation and insulated support.

The manufacturing cost of the connection is reduced by using a sole component compared to the price of cables + supports + connectors.

**With reference to rigid bars :**

- AIncreasing of electrical performance with improvement of safety (higher current density with insulation for a same section of copper).
- Gain of volume by closeness implantation of insulated flexible elements.
- Easy shaping thanks to the flexibility of the strips in comparison with rigid bars.

**With reference to cables :**

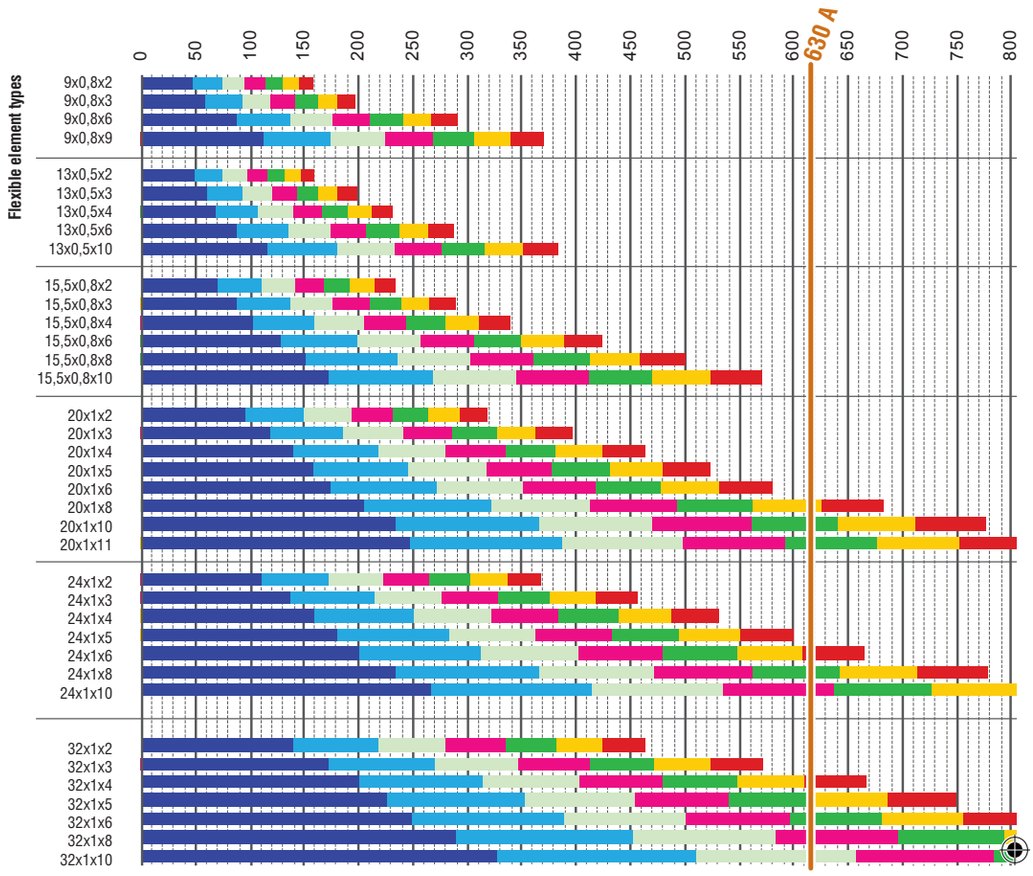
- Time saving by the simplicity of connection manufacturing using no added connectors.
- Suppression of the contact resistance between the cable and the connector.
- Gain of volume with the folding in comparison with the compulsory curvature of a cable.
- Suppression of the supports or glands.

| TECHNICAL CHARACTERISTICS | | | |
|---|---|---|---|
| **PVC - POLYVINYLCHLORIDE** | | | |
| Density | 1.31 | NFT 51-063 | Calorimetrique conductivity:3 to 4 10-4 cal/s/cm/°C |
| Hardness Shore | 85 A | NFT 51-109 | Dielectric strength:20 KV/mm |
| Maximum tensile strength | 19,6 MPa | NFT 51-034 | Fire request: Class FV 0 ep: 2 mm UL 94v0 |
| Maximum elongation | 365 % | NFT 51-034 | |
| Recycling | Yes | | |
| **STRIPS** | | | |
| **Copper classification** | Compliance with NF A 51-050 | | |
| | Designation | | Cu-ETP state 0 |
| | Mini copper | | 99.9 % |
| | Resistivity maximum at 20°C | | 1.7241 µW.cm ( 100%I ACS ) |
| **Copper characteristics** | Compliance with NF A 51-100 ( exception vickers hardness ) | | |
| | Tensile strength | | 200 MPa minimum |
| | Elongation | | 30 % minimum |
| | Vickers hardness | | < 55 HV |
| **FLEXIBLE ELEMENTS** | | | |
| Maximum voltages | 1000 Volts | | |
| Operating temperature | -40° C à +105°C | | |
| PVC thickness | 2.0mm | | |
| Dielectric strength | Average of 20 KV/mm | | Compliance to NFC 32-201-1 |
| Fire reaction | | | Compliance to NFC 32-070 C2 |

| DESIGNATION | | | | | |
|---|---|---|---|---|---|
| ES | 24 | X | 1 | X | 8 |
| Flexible element | Width | | thickness | | quantity |
| | strip(mm) | | strip(mm) | | strip |

# FLEXIBLE ELEMENTS

## Allowable current in relation to the flexible elements overheating for an ambient temperature of 35°C




### Selection :

The bar chart enables the selection of flexible elements according to the different parameters:

- Operating cabinet temperature of 35°C.
- Current (amps) requested.
- Acceptable rise in temperature.

### Selection's example :

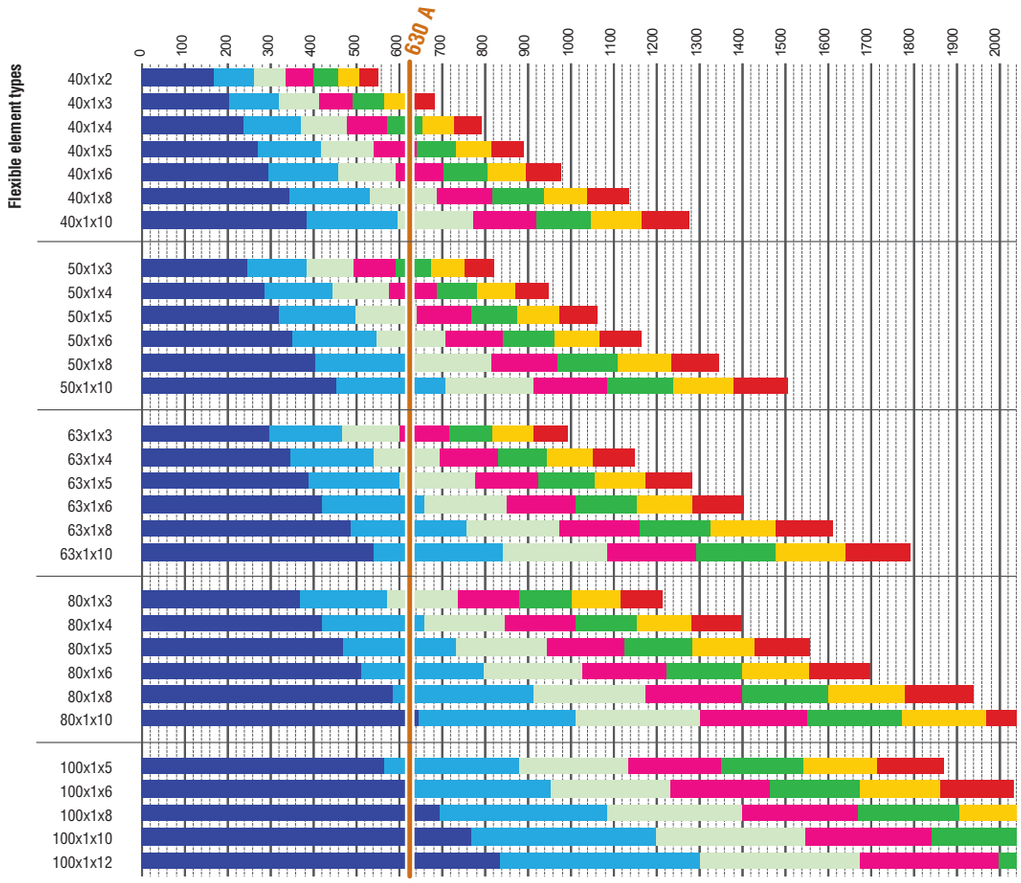
Our example concerns a current flow capacity of 630 A, and a maximum temperature of 85°C:

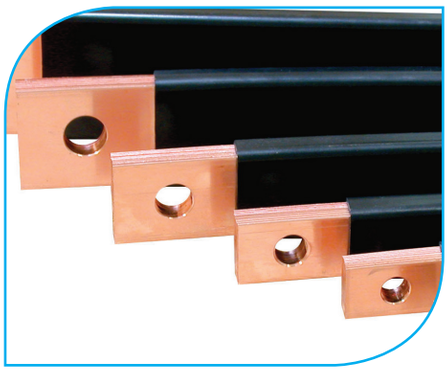
- Operating cabinet temperature is 35°C (fixed)
- The acceptable rise in temperature is (85°C – 35°C = 50°C). (See the orange line)

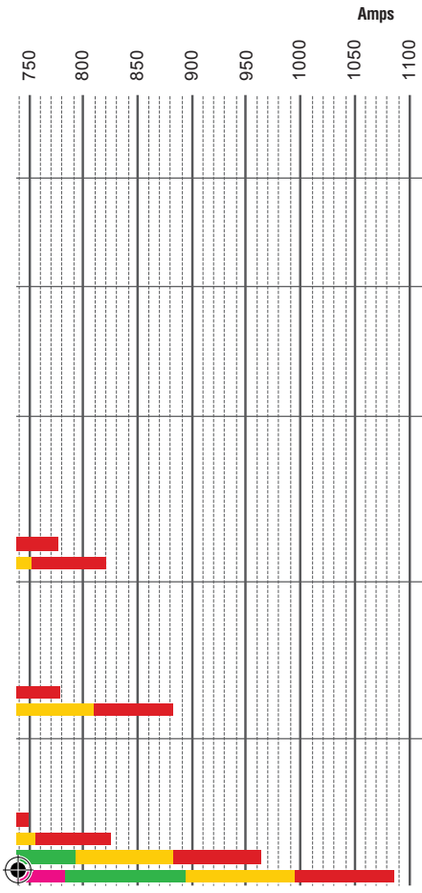
The possibilities are: (Intersection across the orange line and the green scale)

- ES 20 X 1 X 10
- ES 24 X 1 X 8
- ES 32 X 1 X 6
- ES 40 X 1 X 4
- ES 50 X 1 X 3

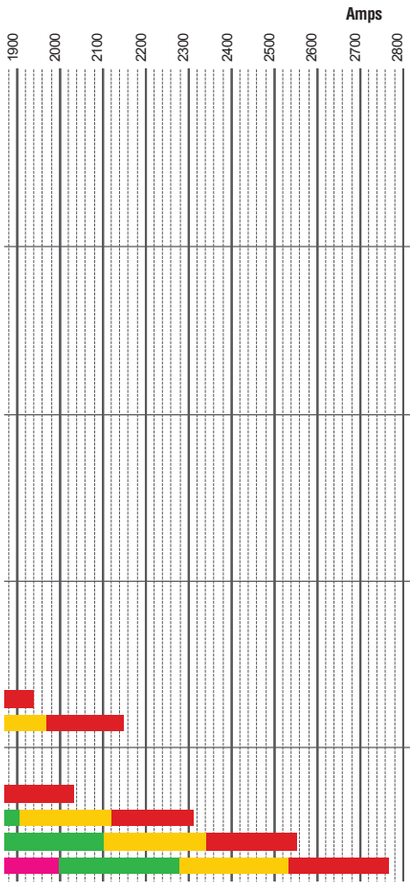
Depends on the clamp of the circuit breaker, you have to choose the correct width of the flexible element.






| Qantity strip | Width x thickness | Cross section area Sqmm | Designation ES | OVERHEATING 10° | 20° | 30° | 40° | 50° | 60° | 70° |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 9 x 0,8 | 14,4 | 9 x 0,8 x 2 | 47 | 74 | 95 | 114 | 130 | 144 | 157 |
| 3 | 9 x 0,8 | 21,6 | 9 x 0,8 x 3 | 59 | 92 | 119 | 141 | 162 | 180 | 196 |
| 6 | 9 x 0,8 | 43,2 | 9 x 0,8 x 6 | 88 | 137 | 176 | 210 | 240 | 266 | 291 |
| 9 | 9 x 0,8 | 64,8 | 9 x 0,8 x 9 | 112 | 174 | 225 | 268 | 306 | 340 | 371 |
| 2 | 13 x 0,5 | 13 | 13 x 0,5 x 2 | 48 | 75 | 97 | 116 | 132 | 147 | 160 |
| 3 | 13 x 0,5 | 19,5 | 13 x 0,5 x 3 | 60 | 93 | 120 | 143 | 163 | 181 | 198 |
| 4 | 13 x 0,5 | 26 | 13 x 0,5 x 4 | 69 | 108 | 140 | 166 | 190 | 211 | 231 |
| 6 | 13 x 0,5 | 39 | 13 x 0,5 x 6 | 87 | 135 | 174 | 207 | 237 | 263 | 288 |
| 10 | 13 x 0,5 | 65 | 13 x 0,5 x 10 | 115 | 180 | 232 | 276 | 316 | 351 | 383 |
| 2 | 15,5 x 0,8 | 24,8 | 15,5 x 0,8 x 2 | 70 | 110 | 141 | 168 | 192 | 214 | 234 |
| 3 | 15,5 x 0,8 | 37,2 | 15,5 x 0,8 x 3 | 87 | 136 | 175 | 209 | 239 | 265 | 290 |
| 4 | 15,5 x 0,8 | 49,6 | 15,5 x 0,8 x 4 | 102 | 159 | 205 | 244 | 279 | 310 | 339 |
| 6 | 15,5 x 0,8 | 74,4 | 15,5 x 0,8 x 6 | 128 | 199 | 257 | 306 | 350 | 389 | 424 |
| 8 | 15,5 x 0,8 | 99,2 | 15,5 x 0,8 x 8 | 151 | 235 | 303 | 361 | 412 | 458 | 501 |
| 10 | 15,5 x 0,8 | 124 | 15,5 x 0,8 x 10 | 172 | 268 | 345 | 411 | 470 | 523 | 571 |
| 2 | 20 x 1 | 40 | 20x1 x 2 | 96 | 150 | 193 | 230 | 263 | 292 | 319 |
| 3 | 20 x 1 | 60 | 20x1 x 3 | 119 | 186 | 240 | 286 | 326 | 363 | 396 |
| 4 | 20 x 1 | 80 | 20x1 x 4 | 139 | 217 | 280 | 334 | 381 | 424 | 463 |
| 5 | 20 x 1 | 100 | 20x1 x 5 | 158 | 246 | 317 | 377 | 431 | 479 | 523 |
| 6 | 20 x 1 | 120 | 20x1 x 6 | 174 | 272 | 351 | 418 | 477 | 531 | 580 |
| 8 | 20 x 1 | 160 | 20x1 x 8 | 205 | 321 | 413 | 492 | 562 | 625 | 683 |
| 10 | 20 x 1 | 200 | 20x1 x 10 | 234 | 365 | 470 | 560 | 640 | 711 | 777 |
| 11 | 20 x 1 | 220 | 20x1 x 11 | 247 | 386 | 497 | 592 | 676 | 752 | 821 |
| 2 | 24 x 1 | 48 | 24x1 x 2 | 111 | 173 | 223 | 265 | 303 | 337 | 368 |
| 3 | 24 x 1 | 72 | 24x1 x 3 | 137 | 214 | 276 | 329 | 375 | 417 | 456 |
| 4 | 24 x 1 | 96 | 24x1 x 4 | 160 | 250 | 322 | 383 | 438 | 487 | 532 |
| 5 | 24 x 1 | 120 | 24x1 x 5 | 181 | 282 | 363 | 433 | 494 | 550 | 600 |
| 6 | 24 x 1 | 144 | 24x1 x 6 | 200 | 312 | 402 | 479 | 547 | 608 | 664 |
| 8 | 24 x 1 | 192 | 24x1 x 8 | 234 | 366 | 471 | 562 | 641 | 713 | 779 |
| 10 | 24 x 1 | 240 | 24x1 x 10 | 266 | 415 | 534 | 637 | 727 | 809 | 883 |
| 2 | 32 x 1 | 64 | 32x1 x 2 | 139 | 218 | 280 | 334 | 382 | 424 | 463 |
| 3 | 32 x 1 | 96 | 32x1 x 3 | 172 | 269 | 346 | 413 | 471 | 524 | 572 |
| 4 | 32 x 1 | 128 | 32x1 x 4 | 200 | 313 | 403 | 480 | 548 | 610 | 666 |
| 5 | 32 x 1 | 160 | 32x1 x 5 | 226 | 352 | 453 | 540 | 617 | 686 | 749 |
| 6 | 32 x 1 | 192 | 32x1 x 6 | 249 | 388 | 500 | 596 | 680 | 756 | 826 |
| 8 | 32 x 1 | 256 | 32x1 x 8 | 290 | 452 | 583 | 695 | 793 | 882 | 963 |
| 10 | 32 x 1 | 320 | 32x1 x 10 | 327 | 510 | 657 | 783 | 894 | 995 | 1086 |




| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 40 x 1 | 80 | 40x1 x 2 | 167 | 261 | 337 | 401 | 458 | 510 | 556 |
| 3 | 40 x 1 | 120 | 40x1 x 3 | 206 | 322 | 415 | 494 | 565 | 628 | 686 |
| 4 | 40 x 1 | 160 | 40x1 x 4 | 240 | 374 | 481 | 574 | 655 | 729 | 796 |
| 5 | 40 x 1 | 200 | 40x1 x 5 | 269 | 420 | 541 | 644 | 736 | 818 | 894 |
| 6 | 40 x 1 | 240 | 40x1 x 6 | 296 | 461 | 594 | 708 | 809 | 900 | 982 |
| 8 | 40 x 1 | 320 | 40x1 x 8 | 343 | 535 | 690 | 822 | 939 | 1044 | 1140 |
| 10 | 40 x 1 | 400 | 40x1 x 10 | 385 | 601 | 774 | 922 | 1053 | 1171 | 1279 |
| 3 | 50 x 1 | 150 | 50 x 1 x 3 | 248 | 387 | 498 | 594 | 679 | 755 | 824 |
| 4 | 50 x 1 | 200 | 50 x 1 x 4 | 287 | 448 | 577 | 688 | 786 | 874 | 954 |
| 5 | 50 x 1 | 250 | 50 x 1 x 5 | 322 | 502 | 646 | 770 | 880 | 978 | 1068 |
| 6 | 50 x 1 | 300 | 50 x 1 x 6 | 352 | 550 | 709 | 844 | 965 | 1073 | 1171 |
| 8 | 50 x 1 | 400 | 50 x 1 x 8 | 407 | 635 | 818 | 975 | 1114 | 1238 | 1352 |
| 10 | 50 x 1 | 500 | 50 x 1 x 10 | 455 | 709 | 914 | 1089 | 1244 | 1383 | 1510 |
| 3 | 63 x 1 | 189 | 63 x 1 x 3 | 301 | 469 | 604 | 720 | 823 | 915 | 999 |
| 4 | 63 x 1 | 252 | 63 x 1 x 4 | 347 | 542 | 698 | 832 | 950 | 1056 | 1153 |
| 5 | 63 x 1 | 315 | 63 x 1 x 5 | 388 | 605 | 779 | 929 | 1061 | 1179 | 1288 |
| 6 | 63 x 1 | 378 | 63 x 1 x 6 | 424 | 661 | 852 | 1015 | 1159 | 1289 | 1408 |
| 8 | 63 x 1 | 504 | 63 x 1 x 8 | 487 | 759 | 978 | 1166 | 1332 | 1481 | 1617 |
| 10 | 63 x 1 | 630 | 63 x 1 x 10 | 541 | 844 | 1088 | 1296 | 1481 | 1646 | 1798 |
| 3 | 80 x 1 | 240 | 80 x 1 x 3 | 368 | 574 | 739 | 881 | 1006 | 1119 | 1221 |
| 4 | 80 x 1 | 320 | 80 x 1 x 4 | 423 | 660 | 851 | 1014 | 1158 | 1287 | 1406 |
| 5 | 80 x 1 | 400 | 80 x 1 x 5 | 471 | 735 | 947 | 1128 | 1289 | 1433 | 1565 |
| 6 | 80 x 1 | 480 | 80 x 1 x 6 | 513 | 801 | 1032 | 1229 | 1404 | 1562 | 1705 |
| 8 | 80 x 1 | 640 | 80 x 1 x 8 | 586 | 915 | 1179 | 1405 | 1604 | 1784 | 1948 |
| 10 | 80 x 1 | 800 | 80 x 1 x 10 | 649 | 1013 | 1305 | 1556 | 1777 | 1976 | 2157 |
| 5 | 100 x 1 | 500 | 100 x 1 x 5 | 565 | 882 | 1136 | 1354 | 1546 | 1720 | 1878 |
| 6 | 100 x 1 | 600 | 100 x 1 x 6 | 614 | 958 | 1235 | 1471 | 1681 | 1869 | 2041 |
| 8 | 100 x 1 | 800 | 100 x 1 x 8 | 699 | 1090 | 1404 | 1674 | 1912 | 2126 | 2321 |
| 10 | 100 x 1 | 1000 | 100 x 1 x 10 | 771 | 1203 | 1550 | 1848 | 2110 | 2347 | 2562 |
| 12 | 100 x 1 | 1200 | 100 x 1 x 12 | 836 | 1304 | 1680 | 2003 | 2287 | 2543 | 2777 |

## Shaping

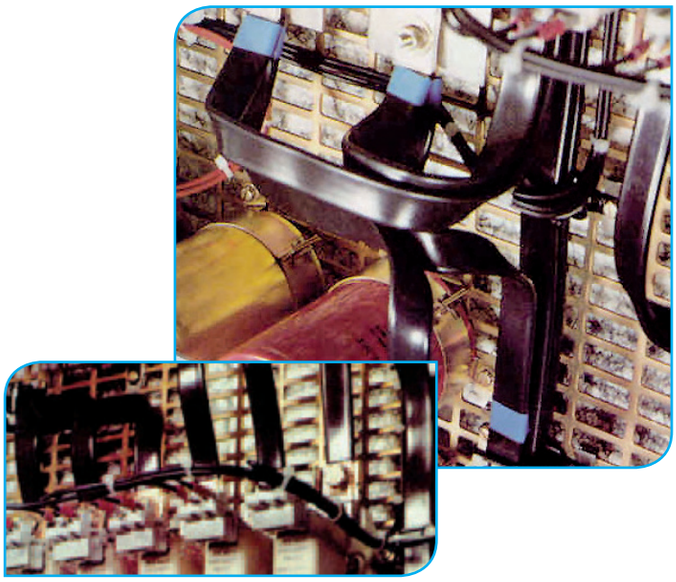
1.Cut the total length of the flexible element + 50 mm for the shaping.

2. Shaped the element:
   That operation must be done before the final cutting, the stripping and the punching.

3. Stripping:
   The stripping must be done with a knife or a stripper.

4. Punching or drilling
   Punching or drilling used to create a bump. To guarantee a correct contact between the clamp and the flexible element, please make sure that you punch or drill from the surface on contact with the clamp.

5. Assembling:
   Use a washer under the head of bolt to apply a pressure on the width of the flexible element.
   For flexible elements made with more than 4 strips, use « BELLEVILLE » washer plus iron bolt. Otherwise, use a bolt coated with zinc.



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