Overhead contact lines for tramway

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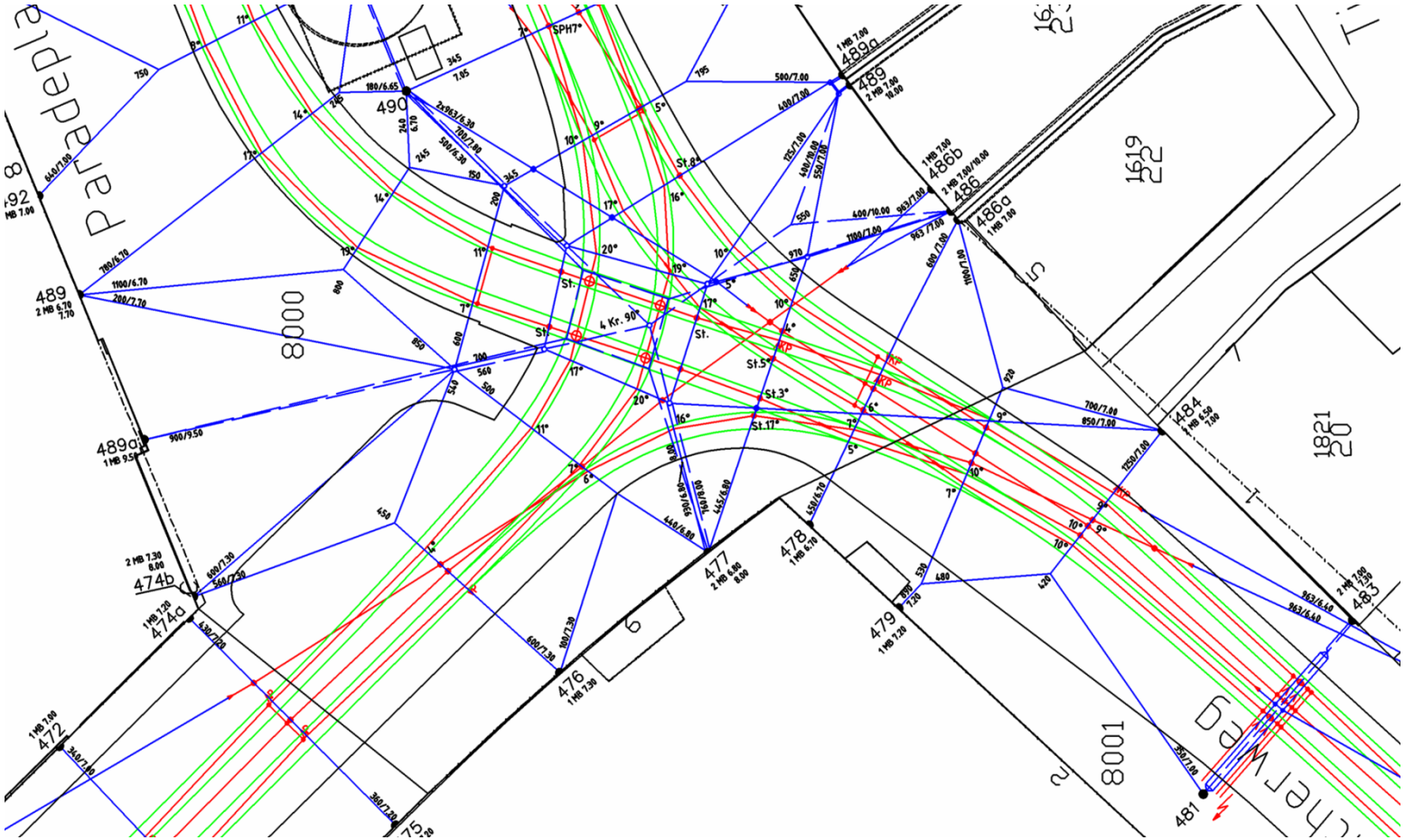
Overhead contact lines layout



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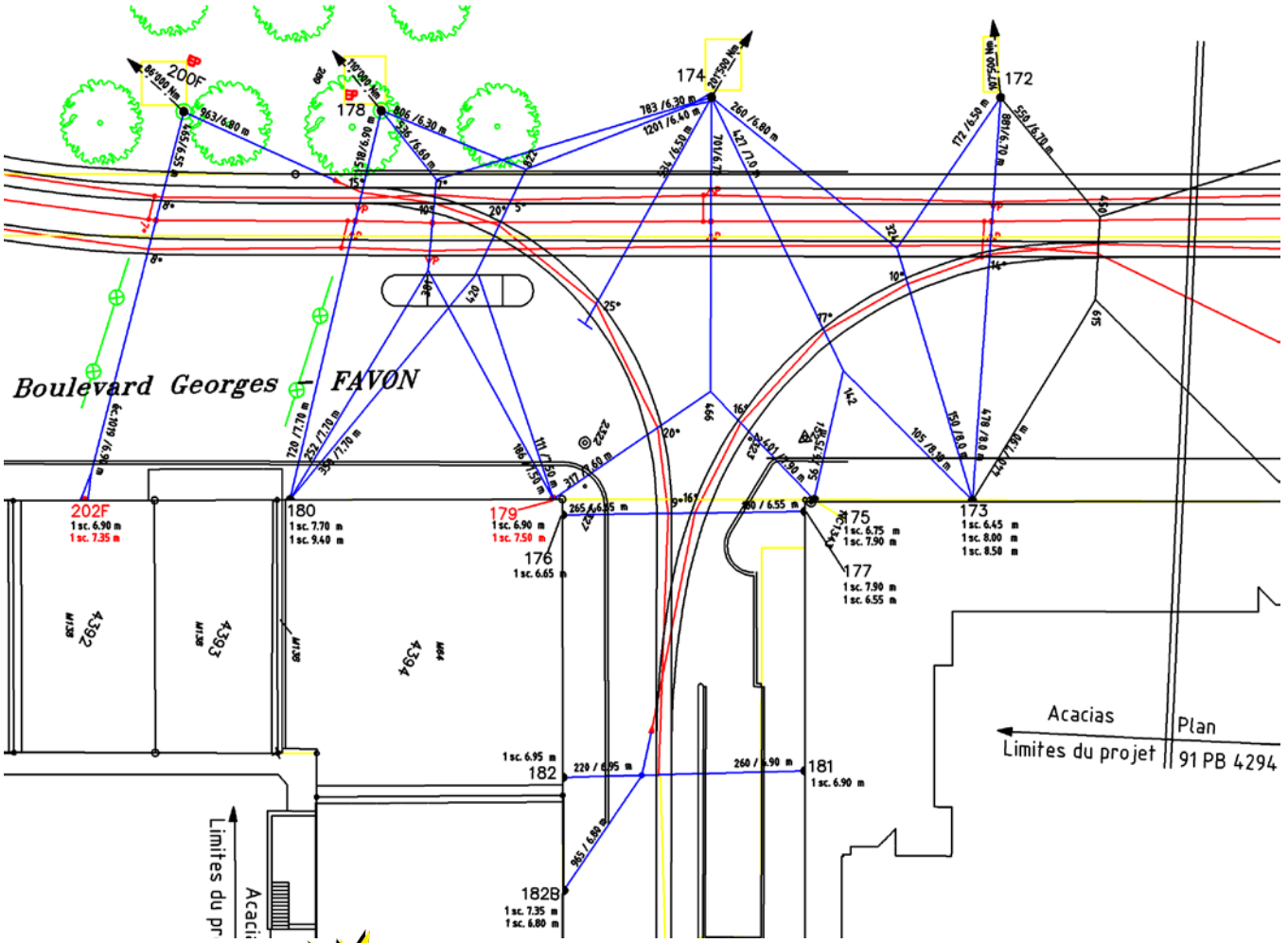
Overhead contact lines layout



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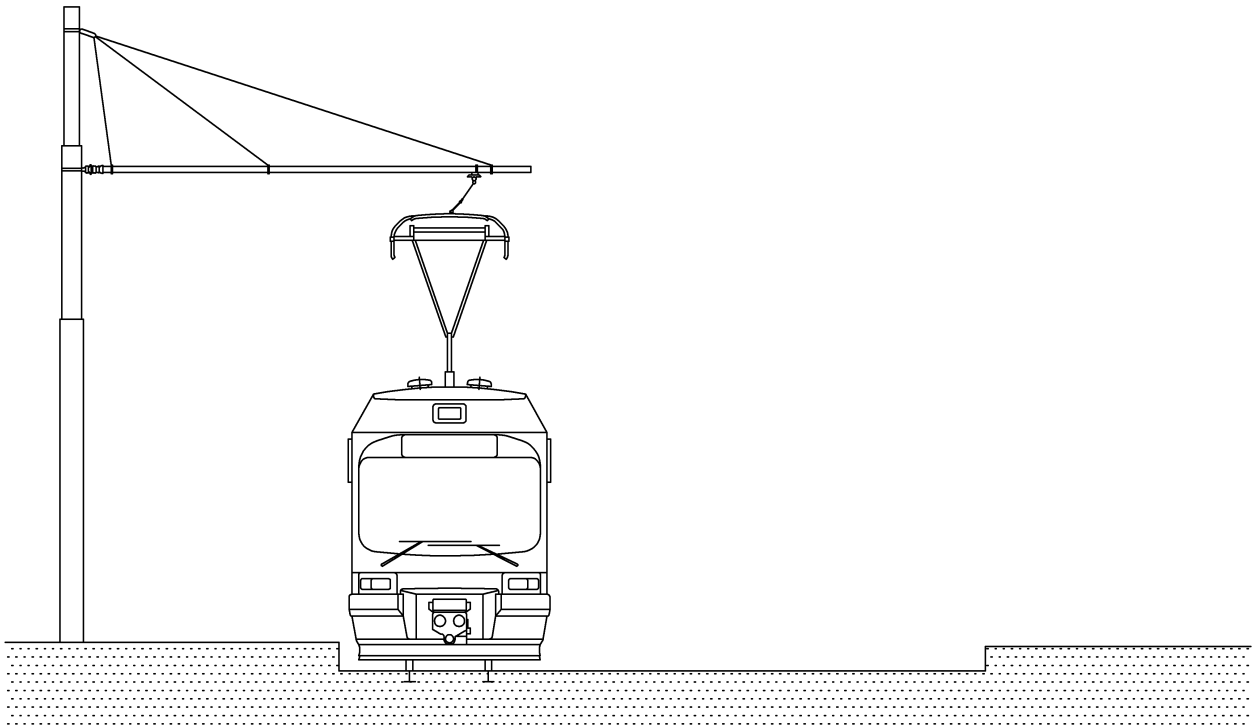
Structures for tramway, 1-track

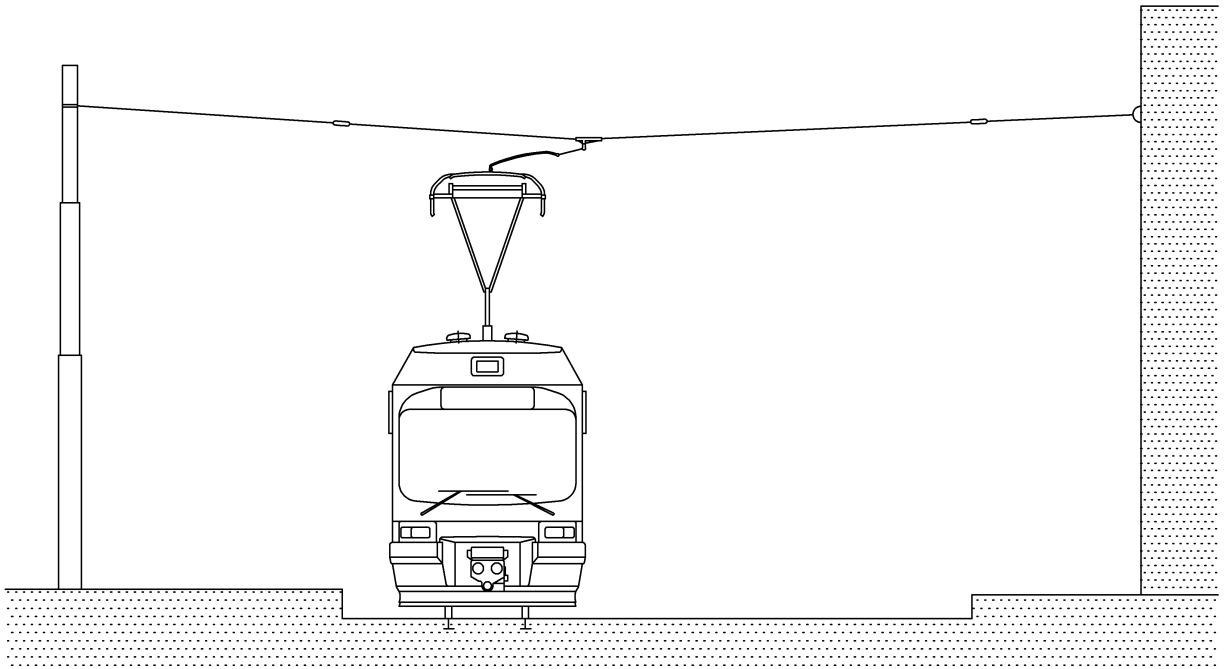


In tangent,

pole on the left or on the right

- With pipes and double top ties
- Pendulum suspension elastic

Structures for tramway, 1-track

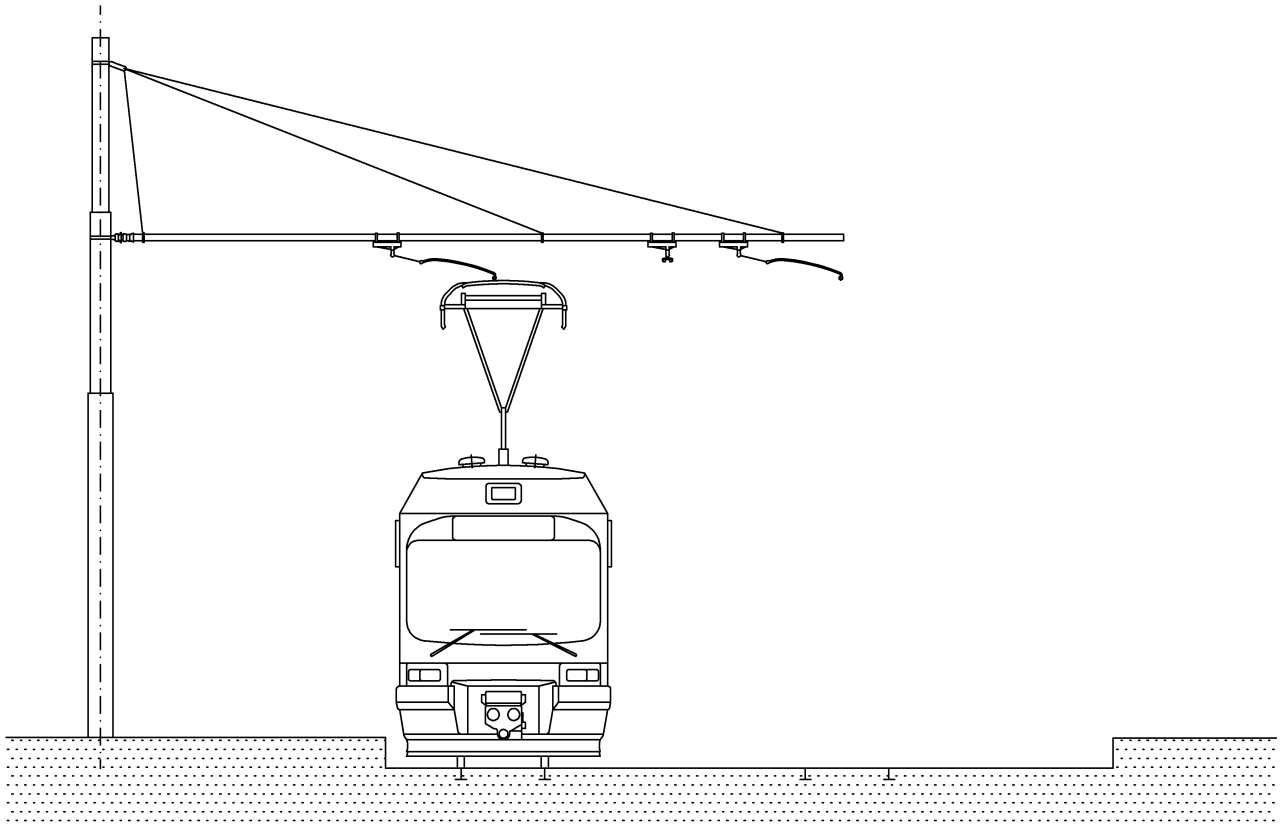


In curves,

poles or buildings

- With cross-span
- Suspensions elastic with steady arms

Structures for tramway, 2-track

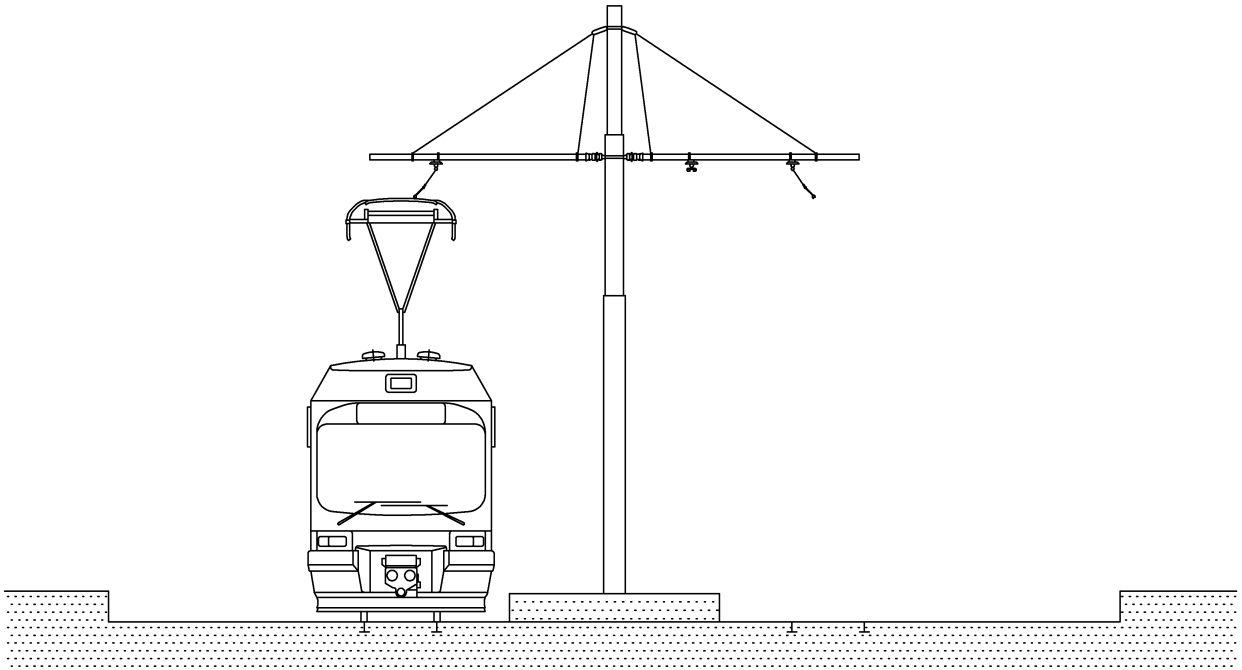


In curves,

poles outside the curve

- With pipes and double top ties
- Suspensions elastic with steady arms
- Feeder cable suspension rigid for 2 feeder conductors

Structures for tramway, 2-track

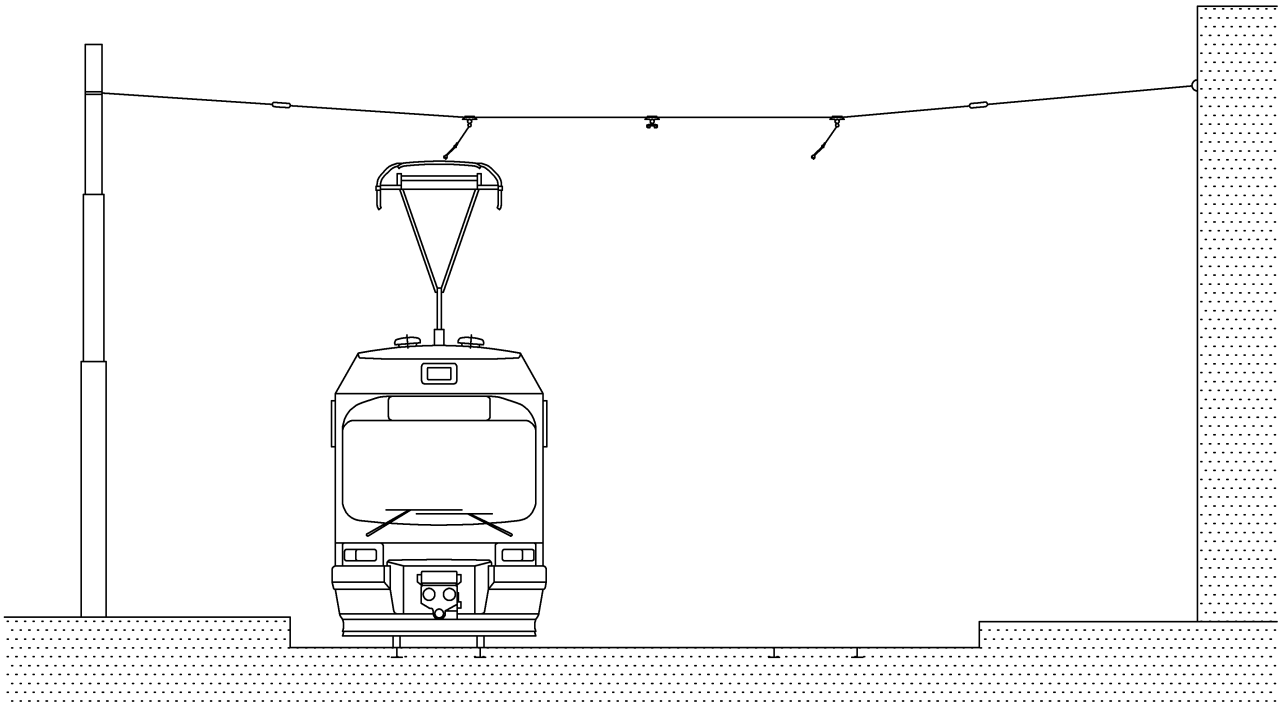


In tangent,

centre pole

- With pipes and single top tie
- Pendulum suspensions elastic
- Feeder cable suspension rigid for 2 feeder conductors

Structures for tramway, 2-track



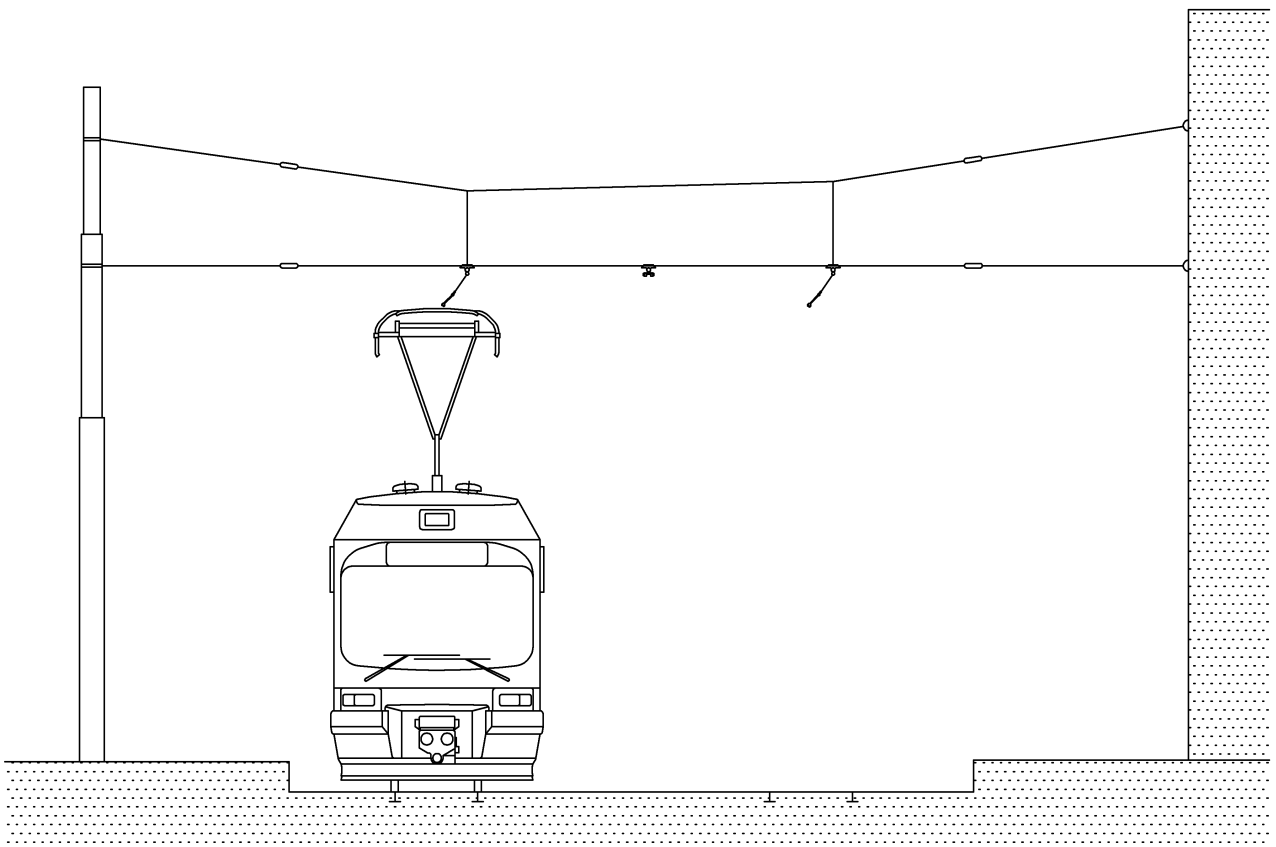
In tangent,

poles or buildings

- With cross-span
- Pendulum suspensions elastic
- Feeder cable suspension rigid for

  2 feeder conductors

Structures for tramway, 2-track



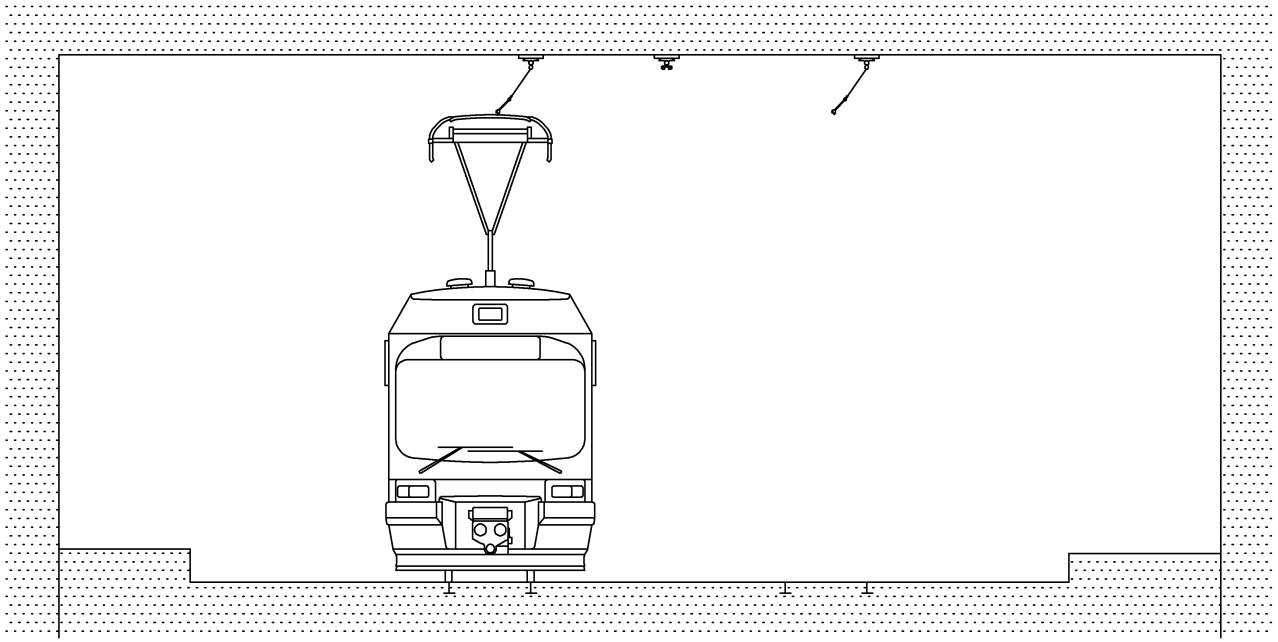
In tangent,

poles or buildings

- With head-span
- Pendulum suspensions elastic
- Feeder cable suspension rigid for

  2 feeder conductors

Structures for tramway, 2-track

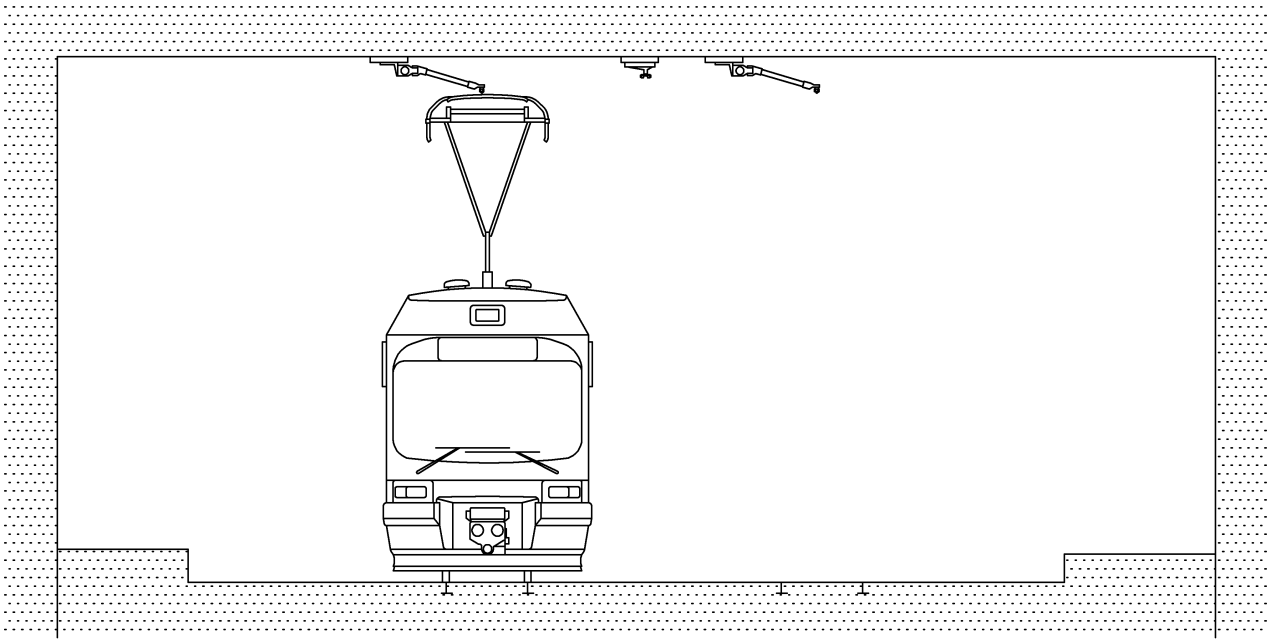


In tangent,

tunnel profile flat

- Attachment to the tunnel soffit
- Pendulum suspensions elastic
- Feeder cable suspension rigid for 2 feeder conductors

Structures for tramway, 2-track

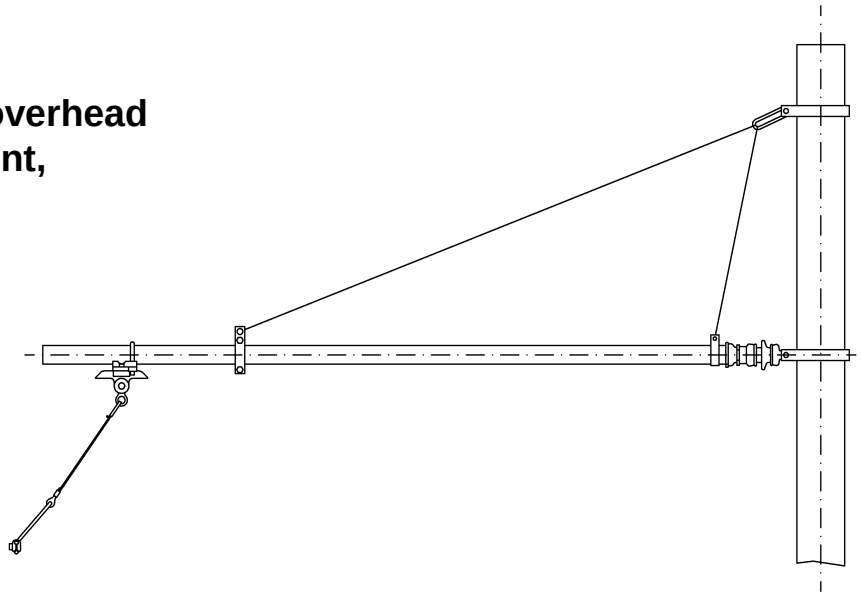


In tangent or curves, tunnel profile flat

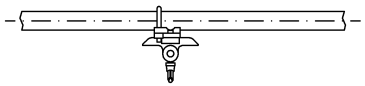
- Attachment to the tunnel soffit
- Elastic contact wire suspension with reduced installation height
- Feeder cable suspension rigid for 2 feeder conductors

Structures for tramway, in tangent

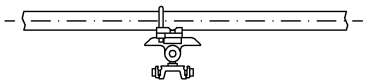
Fully elastic simple overhead contact wire in tangent, poles with cantilever



Contact wire suspension rigid in tangent



Feeder cable suspension rigid in tangent



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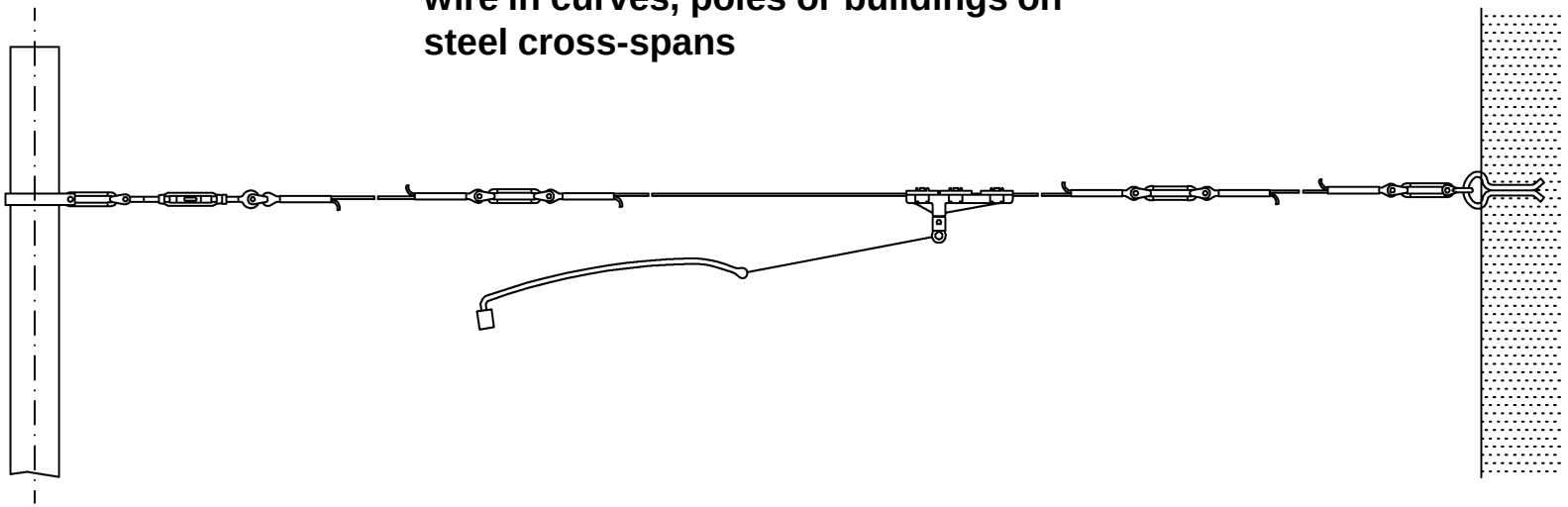
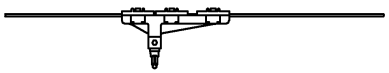
Structures for tramway, in curves

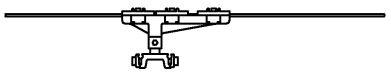
Fully elastic simple overhead contact wire in curves, poles or buildings on steel cross-spans



Contact wire suspension rigid in curves



Feeder cable suspension rigid in curves



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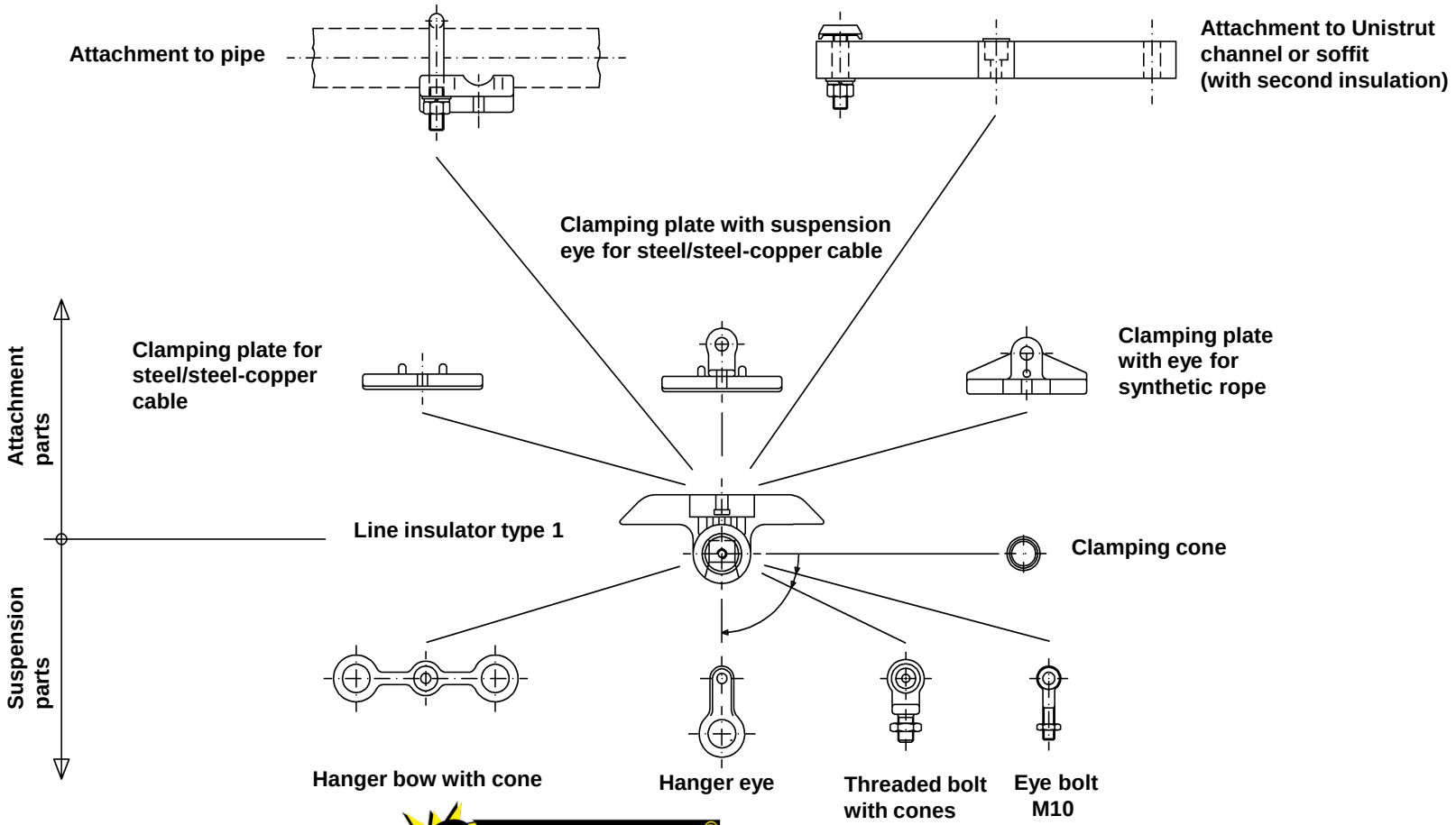
Overhead contact line suspensions for tramway

- Modular parts for line insulator type 1



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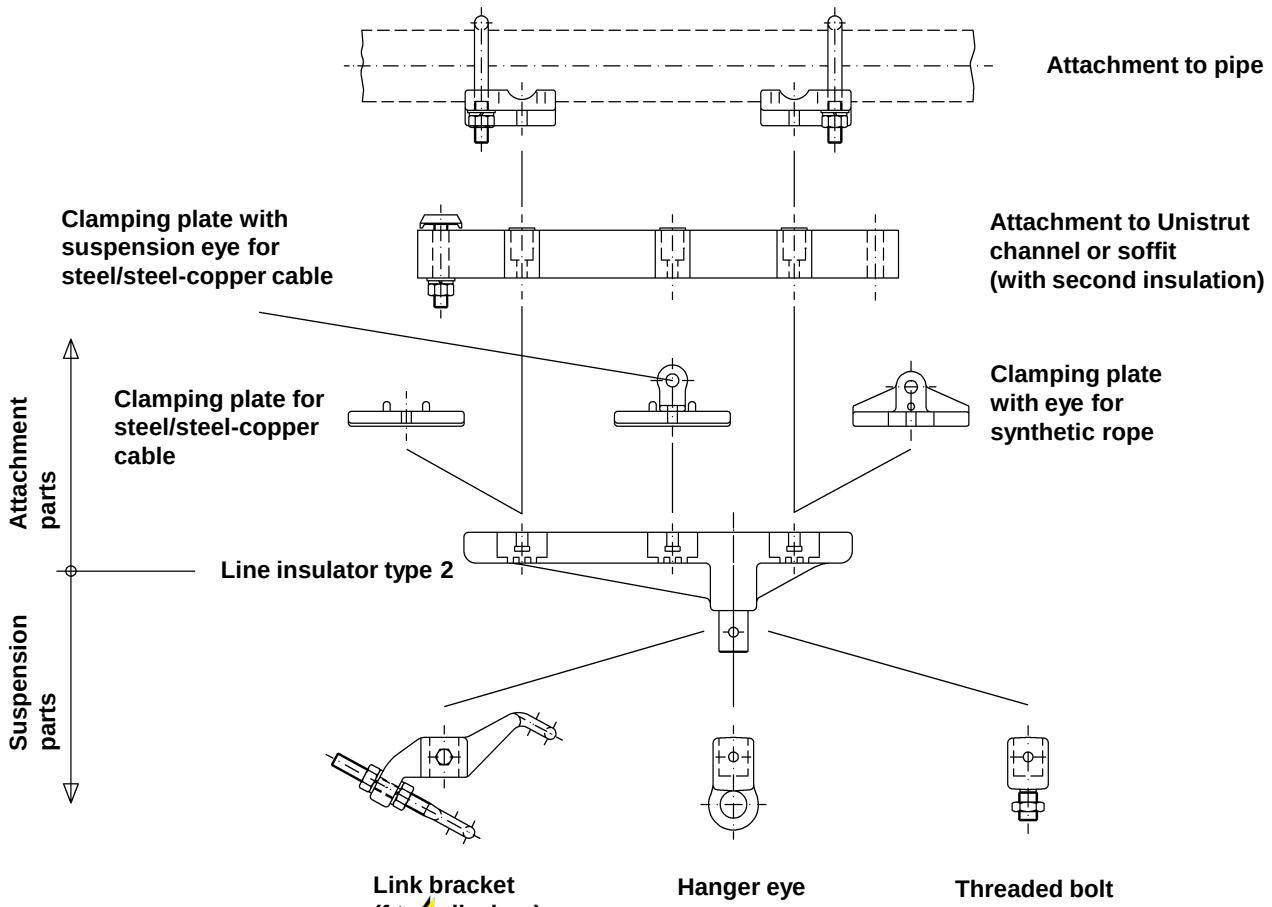
Overhead contact line suspensions for tramway

- Modular parts for line insulator type 2



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Overhead contact line suspensions for tramway

Our product range meet your demanding requirements

- Suitable for use for both trolleybus and tramway
- Compact and aesthetic design
- Self-insulating
- The newly developed suspension is fully compatible with existing systems
- Complete system incl. peripheral components
- Can be used for a range of catenaries systems:
  - rigid / semi-elastic / fully elastic pendulum system
- 2 suspension types: type 1 for tangent and type 2 for curves
- Defined insulating point, for greater safety

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Overhead contact line suspensions for tramway

Our product range meet your demanding requirements

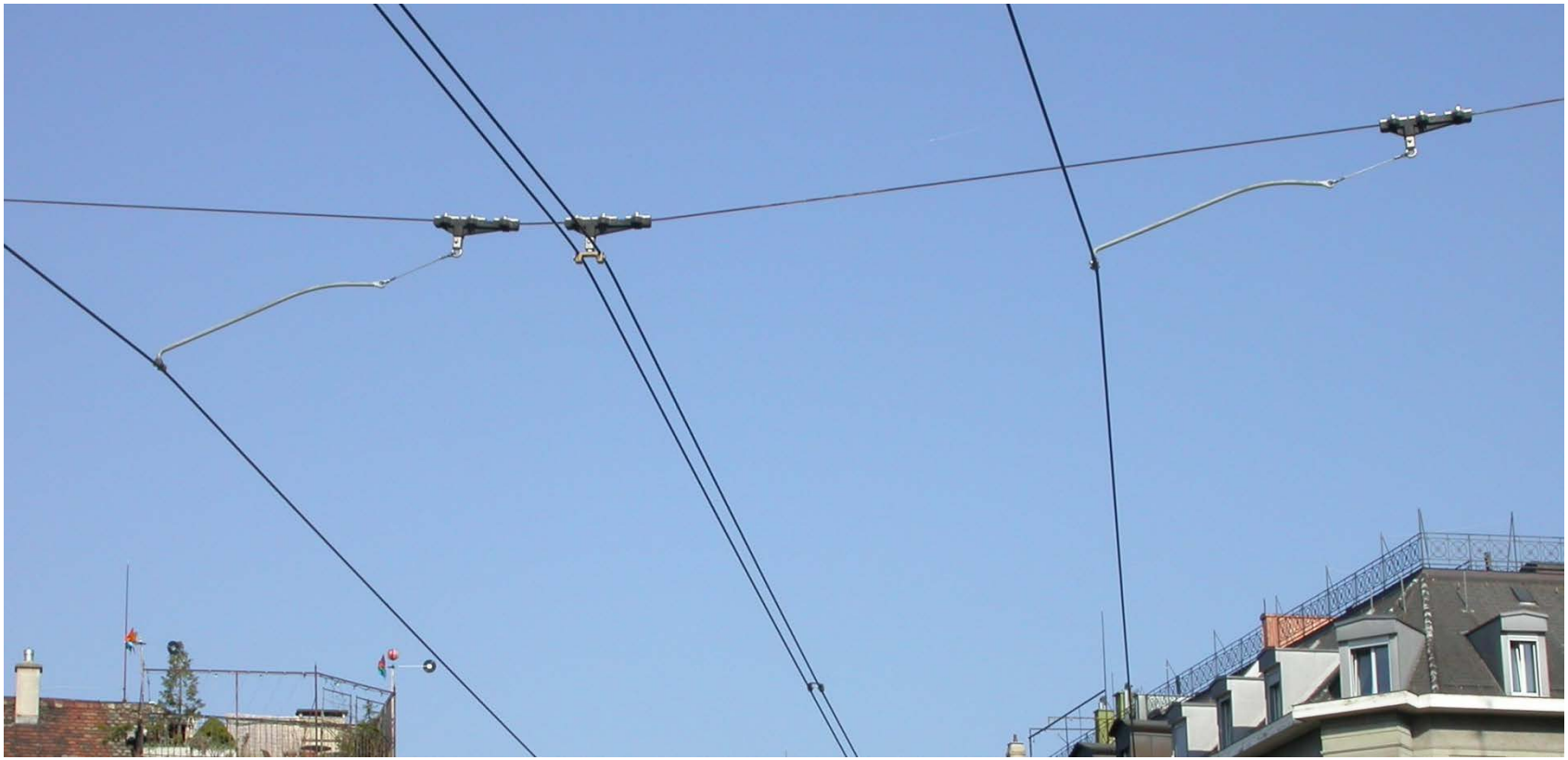
- All parts corrosion-resistant
- Suitable for suspension from:
  - steel/steel-copper cable 25-50 mm2
  - synthetic rope ø 11 and 13.5 mm
  - cantilever (steel or synthetic) ø 1.5-2.5” and ø 45-75 mm
  - soffit
- Suitable for use with 2/0 or 4/0 contact wires 80-120 mm2
- Adjustable inclination of the contact wire clamps

Overhead contact line suspensions for tramway

- 2-track, with line insulator type 1 in tangent

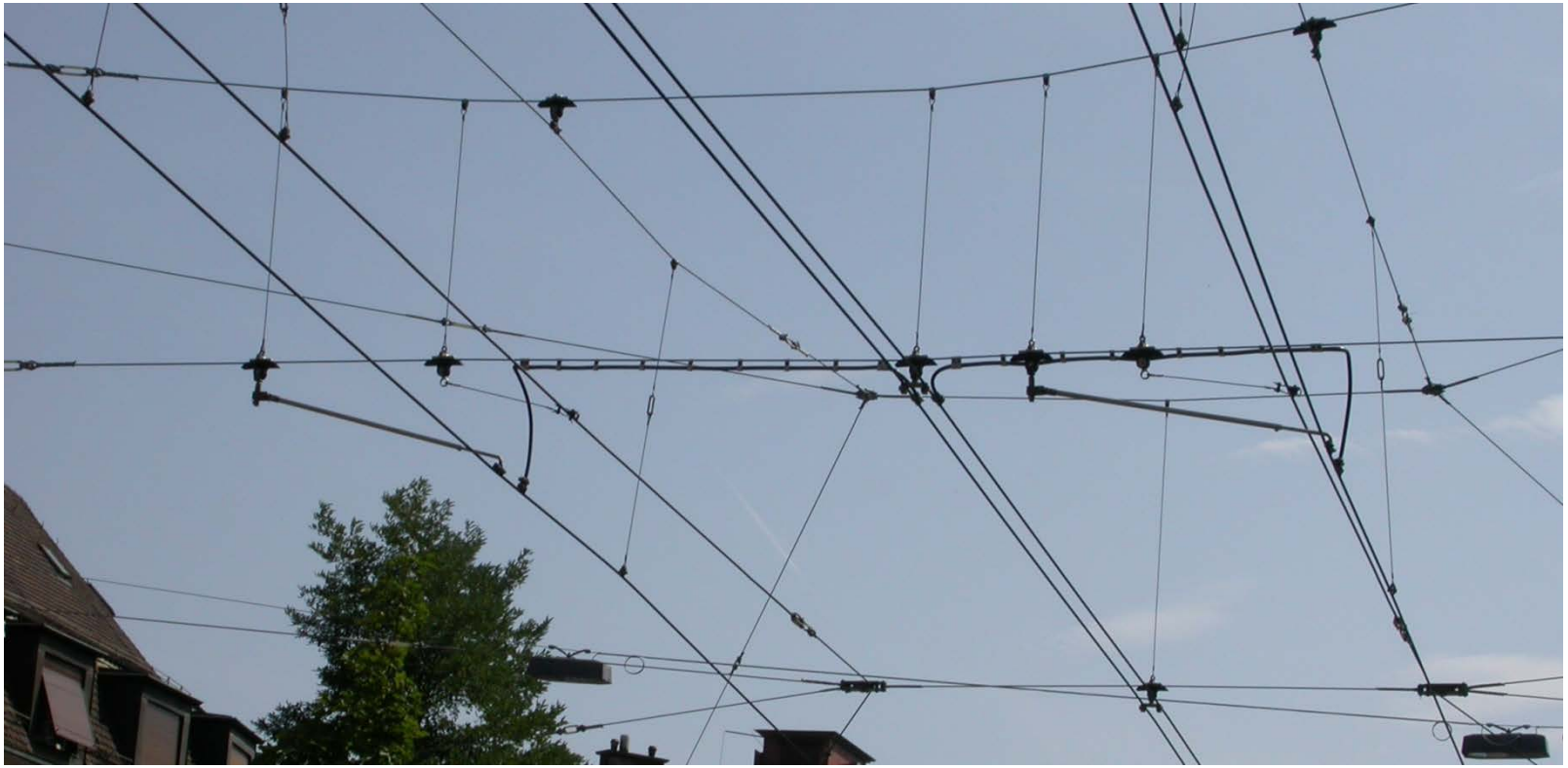
Overhead contact line suspensions for tramway

- 2-track, with line insulator type 2 in curves



Overhead contact line suspensions for tramway

- 2-track, with line insulator type 1 in tangent
  in auto-tensioned sections



Overhead contact line suspensions for tramway

With line insulator type 1

in tangent

- Pendulum (elastic)
- Suitable for suspension from:
  - Steel/steel-copper cable 25-50 mm2
  - Synthetic rope Ø 11 and 13,5 mm
  - Cantilever Ø 1.5-2.5”
    and 45-75 mm (steel or synthetic)
  - Soffit
- Operating tension: max. 1500 V
- Line insulator GRP/SST/Al
- Accessories SST
- Contact wire clamps Cu

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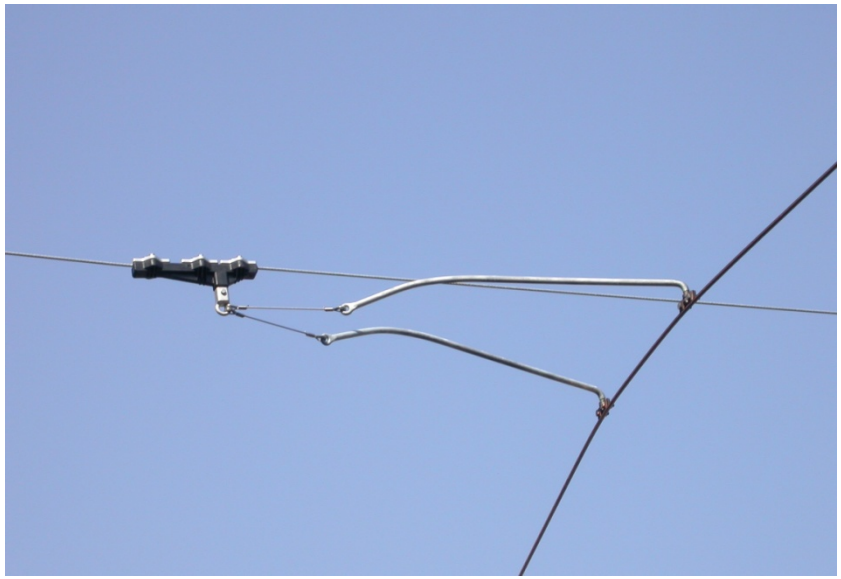
Overhead contact line suspensions for tramway



With line insulator type 2

in curves

- With 1 or 2 steady arm (elastic)
- Suitable for suspension from :
  - Steel/steel-copper cable 25-50 mm2
  - Cantilever Ø 1.5-2.5”
    and 45-75 mm (steel or synthetic)
  - Soffit
- Operating tension: max. 1500 V
- Line insulator GRP/SST/Al
- Steady arm SST
- Accessories SST
- Contact wire clamp CuNiSi

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Overhead contact line suspensions for tramway

With line insulator type 1

in tangent

- In auto-tensioned sections
- Suitable for suspension from :

  - Steel/steel-copper cable 25-50 mm2
- Operating tension: max. 1500 V
- Line insulator GRP/SST/Al
- Steady arm SST
- Accessories SST
- Contact wire clamp CuNiSi

Overhead contact line suspensions for tramway

With line insulator type 1

in tangent

- Suspension of feeder conductor
- Suitable for suspension from:
  - Steel/steel-copper cable 25-50 mm2
  - Synthetic rope Ø 11 and 13,5 mm
  - Cantilever Ø 1.5-2.5”
    and 45-75 mm (steel or synthetic)
  - Soffit
- Operating tension: max. 1500 V
- Line insulator GRP/SST/Al
- Accessories SST
- Feeder clamp CuAl

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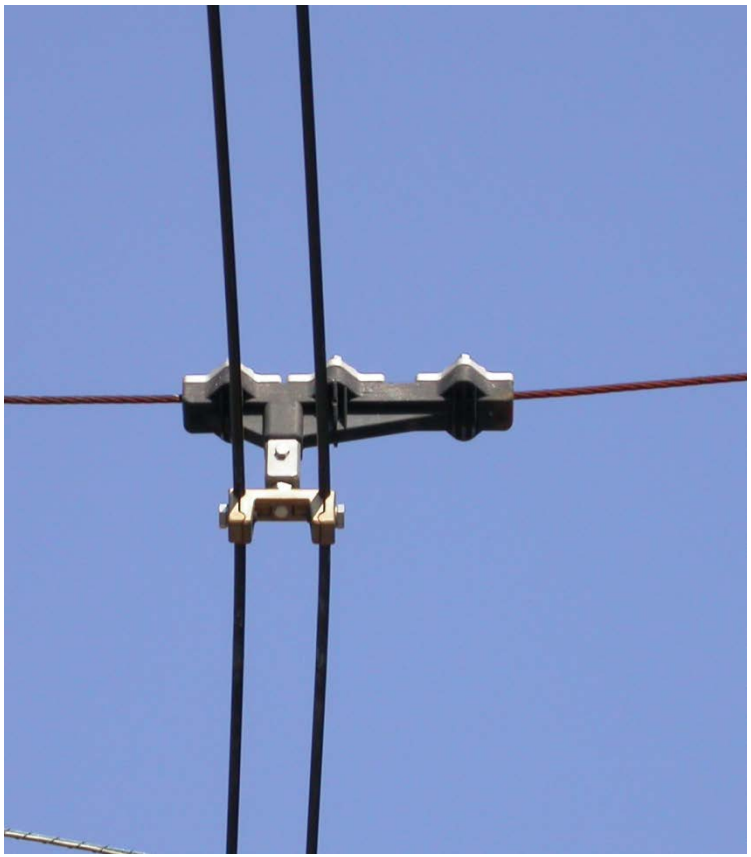
Overhead contact line suspensions for tramway



With line insulator type 2

in curves

- Suspension of feeder conductor
- Suitable for suspension from:
  - Steel/steel-copper cable 25-50 mm2
  - Cantilever Ø 1.5-2.5”
    and 45-75 mm (steel or synthetic)
  - Soffit
- Operating tension: max. 1500 V
- Line insulator GRP/SST/Al
- Accessories SST
- Feeder clamp CuAl

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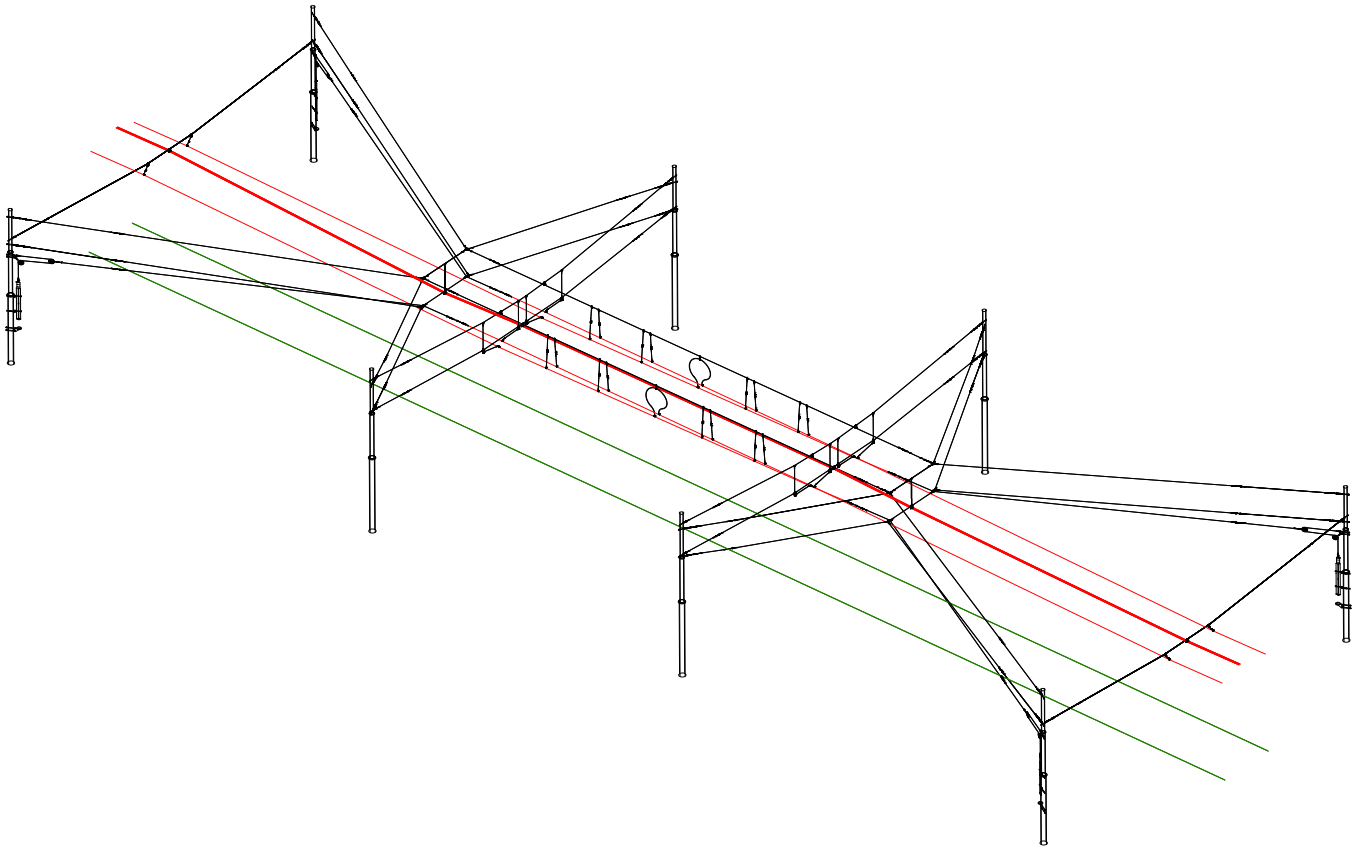
Overhead contact line suspensions for tramway

- Overhead wiring for tramway operation in auto-tensioned sections
  2-track, with head-spans, flexible, double



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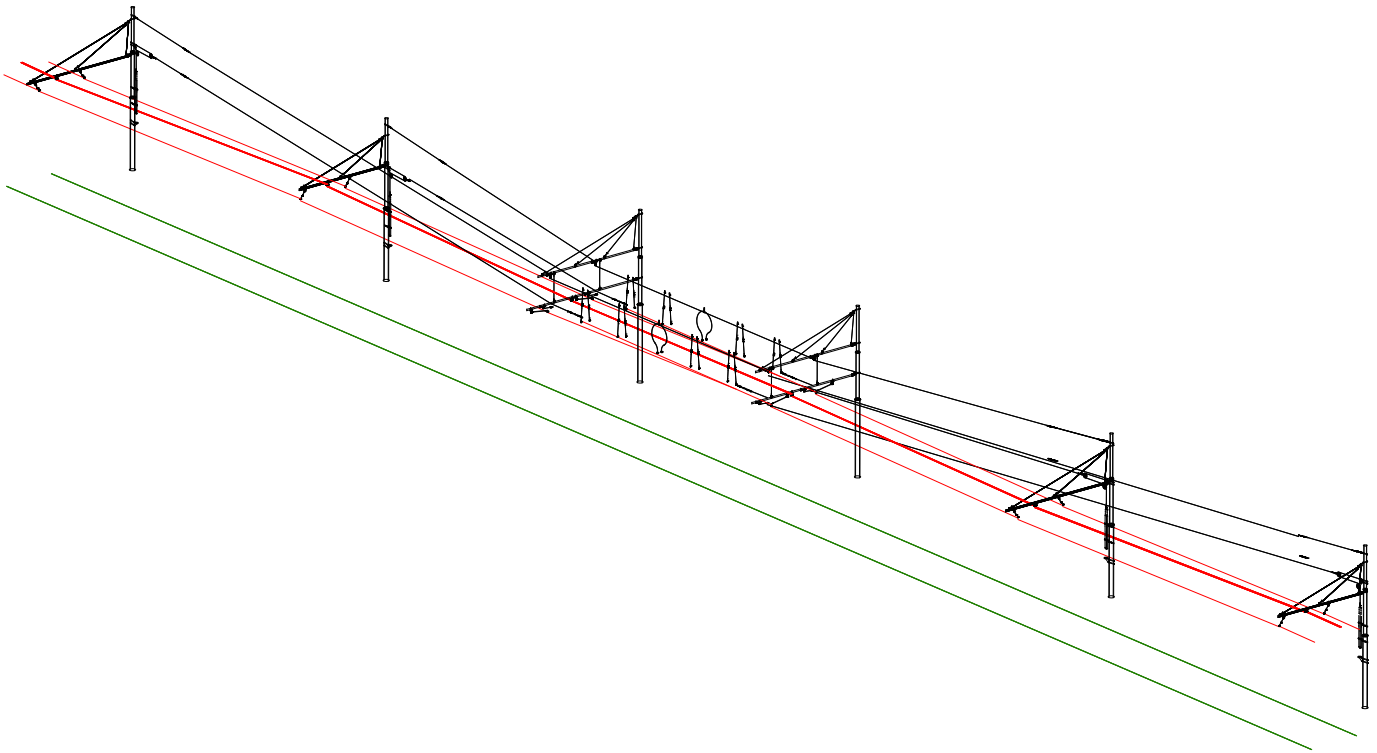
Overhead contact line suspensions for tramway

- Overhead wiring for tramway operation in auto-tensioned sections
  2-track, cantilever track, flexible, double



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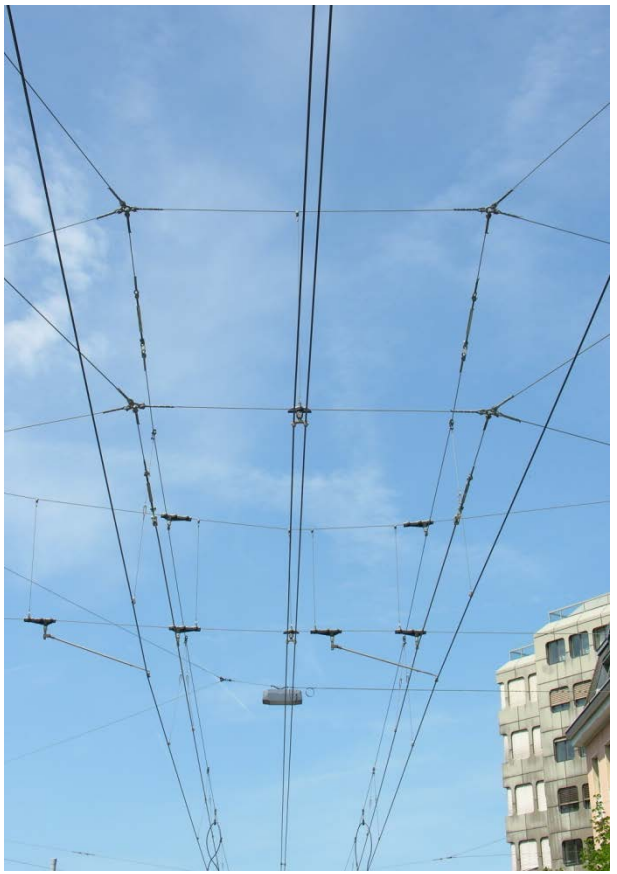
Overhead contact line suspensions for tramway

- Overhead wiring for tramway operation in auto-tensioned sections



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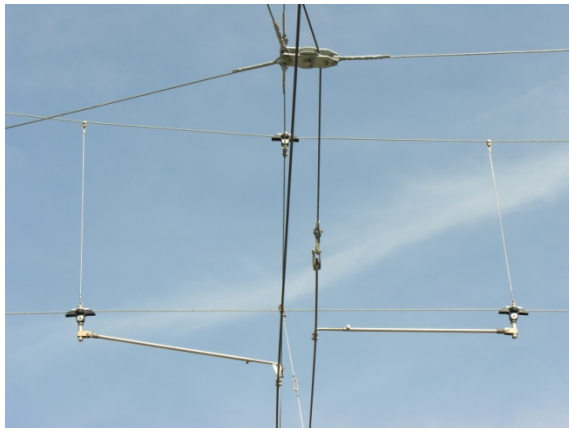
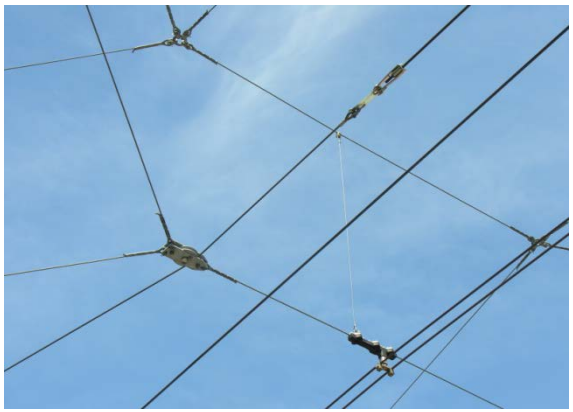
Overhead contact line suspensions for tramway

- Overhead wiring for tramway operation in auto-tensioned sections





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Overhead contact line suspensions for tramway

Crossing KUMAX

- Crossing tramway - tramway, adjustable
- For use with flat and bowed pantographs
- Adjustable range from 55° to 90°

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Overhead contact line suspensions for tramway

- Overhead wiring for tramway operation feedings

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Overhead contact line suspensions for tramway

- Overhead wiring for tramway operation feedings, Knife-blade disconnect switches

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Overhead contact line suspensions for tramway

- Overhead wiring for tramway operation section insulators with feeding

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Overhead contact line suspensions for tramway

- Overhead wiring for tramway operation, Geneva (TPG), Switzerland

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Overhead contact line suspensions for tramway

- Overhead wiring for tramway operation, Geneva (TPG), Switzerland

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Overhead contact line suspensions for tramway

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Overhead contact line suspensions for tramway

- Overhead wiring for tramway operation, Zurich (VBZ), Switzerland

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- Overhead wiring for tramway operation, Berne (Bernmobil), Switzerland

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Overhead contact line suspensions for tramway

- Contact wire comparison

	Single Cu 1 x 107 mm^2	Single Cu 1 x 150 mm^2	High-strength CuMg 1 x 120 mm^2	Double Cu 2 x 107 to 2 x 120 mm^2
+	- elastic - minor wear - easy installation - minor forces on cantilevers and poles - little visual impact	- higher current flow - in case of low frequencies possibly no feeder required	- bigger span length possible	- higher current flow - possibly no feeder required
-	- less current flow - more feeding points required - more current connectors required	- less elastic - higher wear - heavier for installation - higher forces on cantilevers and poles	- price - range of suppliers limited - no experience in Switzerland	- demanding adjustment - uneven wear of both contact wires - higher forces on cantilevers and poles - permanent pantograph contact with both contact wires not guaranteed - higher total wear

Overhead contact line suspensions for tramway

- Comparison of support systems

	Single suspension rigid	Single suspension with pendulum	Single suspension with Delta	Multiple suspension with messenger wire
+	- reduced number of components - little visual impact	- highly elastic, light - little visual impact - partial length adjustment through subsidence slope of pendulum - less wear of contact wire - durability min 30 years	- pole spacing up to 35 m - ideal length adjustment with auto-tensioned contact line	- pole spacing up to max 60 m - minimum wear of contact wire - minimum wear of carbon - highly elastic - no additional feeder required messenger wire = feeder - durability min 30 years
-	- hard spot in suspension ends in higher wear of contact wire and carbon - lower speeds - possibly additional feeder required - contact loss of current collector at the point of suspension possible - length compensation of contact wire just badly possible	- pole spacing max 32 m - possibly additional feeder required - more bonding required	- wear of contact wire little higher - due to wind additional steady arm required - possibly additional feeder required - limited durability of synthetic ropes	- higher visual impact - pole size and forces higher

Overhead contact line suspensions for tramway

A summary of the benefits

- Corrosion resistant
- Functional form
- Greater acceptance due to compact and aesthetically appealing design
- Simpler management of spare parts, since
  - the system is extremely versatile, due to its modular make-up
  - the same basic components can be used for electric trolleybus and tramway
- Compatible with previous systems
- Simplified assembly
- Pre-assembly possible in workshop

Overhead contact line suspensions for tramway

Standards

- Basically by standards according
  ISO 9001, IEC / EN - Standards
  (e.g. DIN EN 50124-1, IEC 60383) and specifications
- Tests of the single components
  - mechanical
  - electric
  - ecological
    (UV, salt spray etc.)

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