

J" Type / "S" Type Overhead Contact Lines

The "J"/"S" type overhead contact lines represent a versatile system, with its tradition dating back to the early electrification efforts of Czechoslovak railway lines in the 1950s. The "S" type overhead contact lines are intended for alternating current systems AC 25 kV 50 Hz and AC 15 kV 16.7 Hz; the "J" type overhead contact lines are designed for 3 kV DC system. Both designs comprise standard vertical catenary, as well as inclined



catenary and simple overhead contact lines. Therefore, they allow effective electrification of main railway lines and station tracks, as well as side tracks, local railway lines, depots, and hold yards. Elektrizace železnic Praha a.s. is engaged in the development of new OCL components and assemblies, and it provides comprehensive services at all stages of the process – i.e. design, construction, production, and installation. This facilitates quick and effective implementation of turnkey projects and fulfillment of various nonstandard requirements and needs of customers.



Basic characteristics of the "J"/"S" type overhead contact lines

- Variability based on customer's needs and wishes (type of supporting structure, foundation, tensioning equipment, insulators);
- Variability based on line type and running speed (vertical catenary, inclined catenary, simple contact lines);
- Low maintenance requirements;

- Well-proven and reliable system;
- Available for speeds of up to 250 km/h (or 260 km/h for "S" type);
- Typical service life of the entire system is 50 years;
- Compliance with European standards and Technical Specification for Interoperability (TSI ENE);
- Includes standard solutions for other equipment located on overhead contact line masts, such as lighting, suspended fibre-optic cables, small transformer stations.



Basic parameters of "J"/"S" type overhead contact lines with vertical catenary

OCL type	J250	J main track	J side track	S260	S main track	S side track
Catenary cable	Cu 120 mm ² , 15 kN	Cu 120 mm ² , 15 kN	Bz 50 mm ² , 10 kN	Bz 50 mm ² , 13 kN	Bz 50 mm ² , 10 kN	Bz 50 mm ² , 8 kN
Contact wire	Cu 150 mm ² , 20 kN	Cu 150 mm ² , 15 kN	Cu 100 mm ² , 10 kN	Cu 120 mm ² , 15 kN	Cu 100 mm ² , 10 kN	Cu 80 mm ² , 8 kN
Stitch wire	Bz 50 mm ² , 14 m	Bz 50 mm ² , 12 m	---	Bz 50 mm ² , 16 m	Bz 50 mm ² , 12 m	---
Construction speed	250 km/h	160 km/h	80 km/h	260 km/h	160 km/h	80 km/h
Variation in elasticity	< 16 %	< 20 %	< 45 %	< 13 %	< 20 %	< 45 %
Propagation velocity of mechanical waves	434 km/h	402 km/h	440 km/h	489 km/h	440 km/h	423 km/h

Construction of "J"/"S" type overhead contact lines

Foundations

Standard supporting foundations are cast on-site of C 12/15 concrete (lower part below the frost line) and C25/30 concrete (upper foundation part), in the form of prism-shaped trenches. Masts are fixed to foundations with screw bolts that serve as the concrete reinforcement and also allow fine adjustments of the mast tilt. With regard to tensioning

masts, sidebearing foundations are used, featuring widened lower sections in order to ensure sufficient bearing capacity upon horizontal loading from tensioning equipment. Some foundations feature additional reinforcement based on the relevant documentation and additional concrete tensile load. If required by customers, it is possible to use other types of foundations, e.g. precast foundations or pile foundations (in areas with high groundwater levels or sandy/clay soil).



Supporting structures

The overhead contact line conductors are fixed to masts and crossbeams, as appropriate. Standard masts for "J"/"S" type overhead contact lines are as follows:

- Flat steel masts DS;
- Tubular masts TS and their derivations;
- Lattice steel masts BP.

The specific mast type depends on customer's preferences; however, flat steel masts DS are generally the most suitable solutions for open lines due to their low weight and lower production costs. With their significant carrying capacity, BP masts are used for the following installations: contact line conductor's tensioning, supporting of feeder head spans, and suspension of long crossbars. Other types of masts may be used for specific conditions, such as reinforced concrete masts or "H"-section steel masts.



Crossbeams for "J"/"S" type overhead contact lines represent specific structures that allow cost-effective and reliable suspension of contact line conductors over several tracks. Each crossbeam features two masts and a crossbar, which together form a rigid frame. Longer crossbars are suspended on adequately extended masts. The advantage of this type of crossbeams – compared to self-supporting crossbeams of competing types of overhead contact lines – mainly consists in significantly smaller dimensions of foundations (perpendicular to tracks, the foundation acts a joint), low weight and crossbar dimensions (crossbar height is only 26 or 35 cm, as appropriate) and – last but not least – aesthetic appearance of the structure.

Maximum span of crossbeams ranges from approximately 30 m for the lower crossbar type and 40 m for the higher crossbar type.

Surface treatments of supporting structures fully reflect customer's wishes; it is possible to use Lankwitzer paint coating system, hot-dip galvanization, or ZnAl metallization (for TS masts). In order to facilitate transportation or due to limited dimensions of the galvanization bath, crossbars may be divided into two or three pieces and subsequently screwed together on-site.



Conductor's suspension

For open tracks, transversal tubular insulated cantilevers are commonly used. As standard, it is possible to use hot-dip galvanized steel cantilever or aluminum cantilever. All types make it possible to adjust heights and stagger of the catenary cable and contact wire.

In stations, traditional suspensions with one or two cross-span registration wires or suspensions on vertical insulated

SIK cantilevers are used for crossbeams. Suspensions on registration wires facilitate installations for complicated station heads with many switches. On the other hand, SIK cantilevers ensure full mechanical separation of overhead contact lines for individual tracks, thereby preventing the spreading of potential defects. Compared to transversal cantilevers on drop tubes, as used in competing types of overhead contact lines, SIK cantilevers put a lower loading on the crossbeam and are mainly suitable for open lines with three or more tracks.



Tensioning of conductors

In order to tension contact line conductors, it is possible to use traditional idle pulleys with ratio of 1:2, pulleys with ratio of 1:3 and 1:4 developed in EŽ Praha, as well as compact (mono block) pulleys with ratchet or cable brake and ratio of 1:3. Tensioning equipment may be located on BP masts without counter-

anchoring, if sufficiently sized foundations are available, or on TS/DS masts with counter-anchoring for cost-effective solutions. It is also possible to use special spring tensioning equipment.



Other components of contact lines

Integral parts of overhead contact lines include feeding and reinforcing conductors, disconnectors with optional remote controls, protection from hazardous touch voltage and overvoltage, protection from stray current, and return

circuit and grounding. The "J"/"S" type overhead contact lines comprise standard solutions for all these assemblies that meet most customer's needs and comply with requirements set down by European standards.

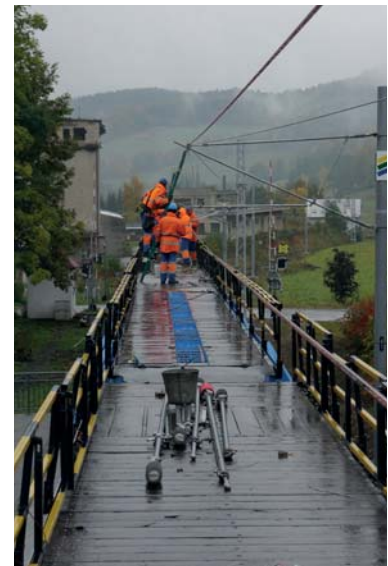


Development, production, and installation

The company Elektrizace železnic Praha is committed to continuous improvement in quality and features of its products. Higher running speeds, new materials, new legislation and standards all require continuous development for the "J"/"S" type overhead contact lines. For this purpose, the company has an in-house development and design center that also deals with any customization requirements of our customers. Our own accredited testing lab performs prototype testing and sample tests for our production and outsourced supplies.

The whole portfolio of masts and most components for overhead contact lines are produced within in-house production facilities of Elektrizace železnic Praha. The production and pre-assembly services are closely linked to design, material specifications, and warehouse logistics, utilizing internal database systems.

With regard to installation and assembly works, the company Elektrizace železnic Praha uses its own machinery; it is thus able to carry out any and all works required for construction of overhead contact lines from tracks. This mainly includes internally produced mobile concrete plants and crane wagons, assembly wagons with suspension crane cages, and measuring carriages. However, our team comprising experienced site managers and installers, centralized within two installation centers in the Czech Republic and one installation center in Slovakia, is also very important. Many of our employees also have experience with international projects, e.g. in Montenegro, Estonia or Poland.



References

In the Czech Republic, contact line type "J"/"S" is being used in the majority of railway reconstruction and electrification projects. Foreign applications can be found as well. Following table shows selection from important references:

Railway line/station	Section length (km)	Put into operation
Brno – Česká Třebová	91	1998
Praha – Ústí nad Labem	100	2003
Přerov – Česká Třebová	108	2005
Prague main station, New Connection Prague	35	2008
Railway test ring VÚŽ Velim	13	2010
Plzeň – Cheb	106	2011
Tallinn – Vasalemma, Keila – Paldiski (Estonia)	62	2013
Přerov junction	44	2014
Olomouc main station	39	2016



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