

SNCF RÉSEAU

INDUSTRIAL & ENGINEERING SERVICES

OVERHEAD CONTACT LINE PRODUCTS



2020 EDITION



EDITORIAL

Overhead contact lines are a vital feature of the railway landscape and are part of the magic that goes into supplying trains with electrical power.

As a symbol of sustainable development, modernity and sheer infrastructure power, overhead lines must be constantly available, reliable, discreet and robust in delivering power to the pantographs with which they interact.

For over a century, French railways have been designing and maintaining DC current overhead lines. For more than 60 years they have been working with AC current overhead lines.

The team at the DGII-TE Division, which is the current repository of this wealth of know-how and experience, is proud to introduce this catalogue. Together with their maintenance colleagues, they are responsible for the complete lifecycle of one of rail's major assets, using high-capacity digital tools and test platforms for the purpose.

The DGII-TE Division is resolutely future-oriented in its approach and its products are adapted to cater to all French national rail network requirements.

Products are designed to meet stringent interoperability, safety, security and maintainability standards and for maximum train performance and cost-effectiveness.

It goes without saying this catalogue will evolve over time to keep pace with product development and include new designs able to cater to ever more demanding project standards.

I hope you will find it useful and enlightening.



Christian COURTOIS

Head of the Electric Traction Department

ELECTRIC TRACTION DEPARTMENT

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ELECTRIC TRACTION DEPARTMENT

PROPOSING TOP QUALITY
OCL PRODUCTS



CONSTRUCTING THE FUTURE

A CENTURY OF PARTNERSHIP

For over a century, the French national rail network (RFN) has constantly been a work in progress.

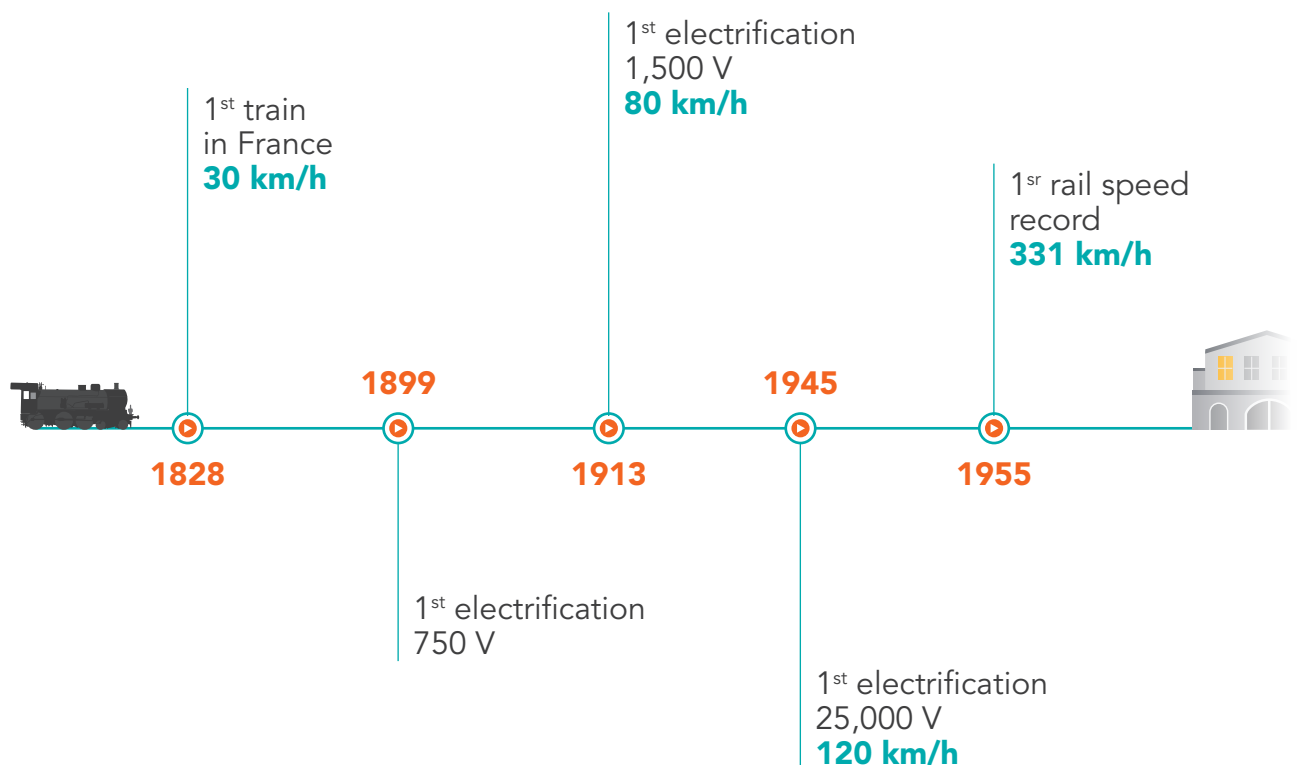
Within SNCF Réseau's Industrial & Engineering Headquarter, the Fixed Electric Traction Installation Division spearheads electrification system design and development operations.

They set the benchmark for overhead lines in France, where they enjoy the benefits of more than 100 years of experience with 750 V and 1,500 V systems, 60 years of experience with 25,000 V and 35 years of experience with 2 x 25,000 V.

The skills of the teams and the quality of their overhead line systems have been amply demonstrated by the 4 world speed records chalked up over the years.



From the very first, SNCF has always wanted to share its products and services with its European and international partners and clients.



WORLD RAIL SPEED RECORDS

On 3 April 2007, TGV trainset V150 beat the world rail speed record when it reached 574.8 km/h, i.e. 159.7 m/s.

Over the 12 weeks of tests and 2 weeks of demonstration runs, the trainset covered 2,400 km at over 400 km/h, including 1,000 km at over 500 km/h.

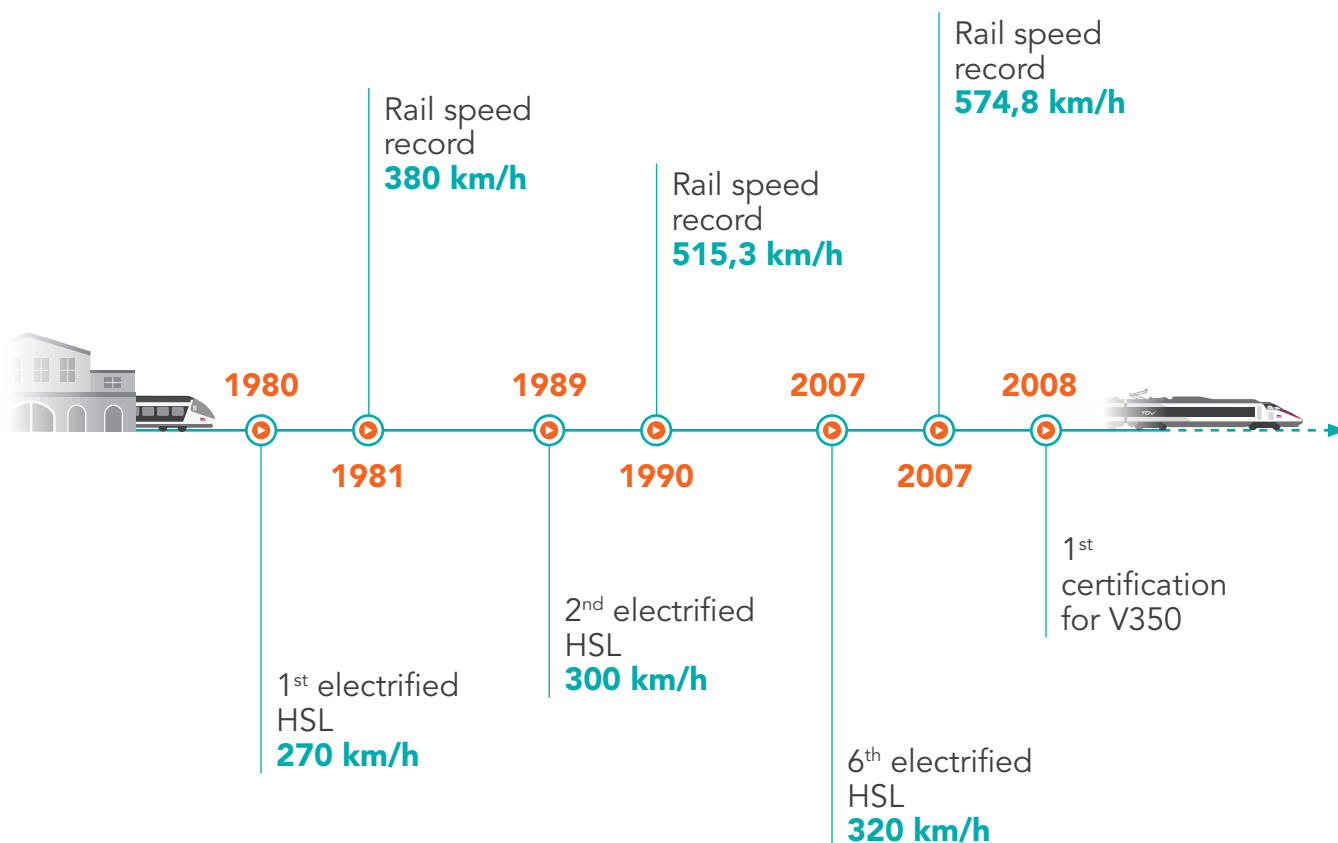
This technical feat was achieved using a V350 overhead line with voltage temporarily boosted to 30 kV and mechanical tension to 4 tons.

For their part, the supporting structures and overhead line components were neither strengthened, renewed nor specifically maintained.



574,8 km/h

World rail speed record



SNCF RÉSEAU IN FRANCE

KEY FIGURES

5,812 km of 1,500 V DC electrified overhead line

9,563 km of 25 kV AC electrified overhead line

120 km of 15 kV, 20 kV and 63 kV HT lines

For a total of **7.9 TWh/year** supplied to the railway operators

3 types of pantograph

100 years of experience

5,000 engineers and **15,000** network maintenance operators

EACH DAY

260 freight trains

330 Intercity trains

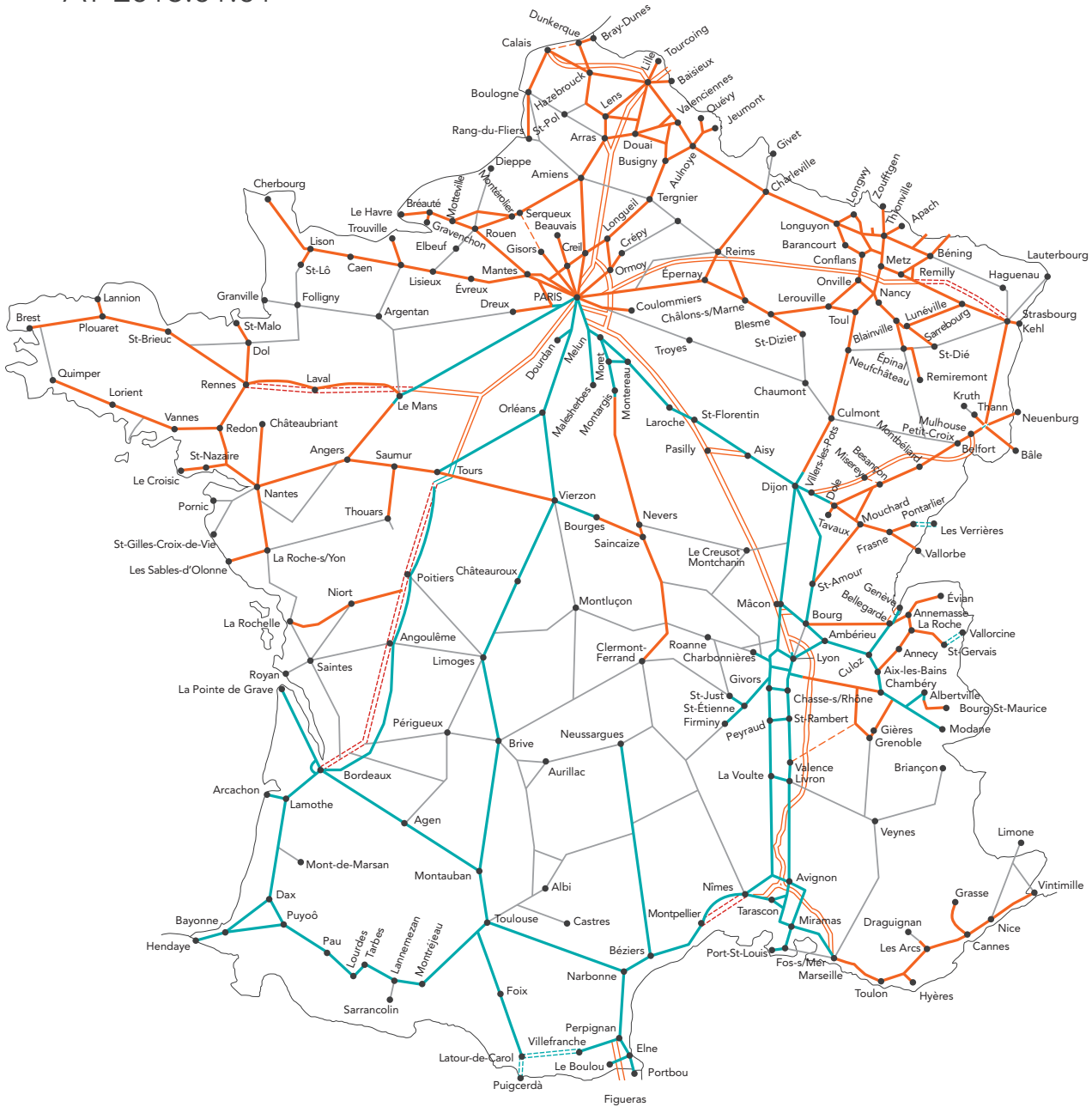
800 high-speed trains

5,700 regional express trains

6,000 Greater Paris suburban trains

ELECTRIFICATION OF THE FRENCH NATIONAL RAIL NETWORK

AT 2015.01.01



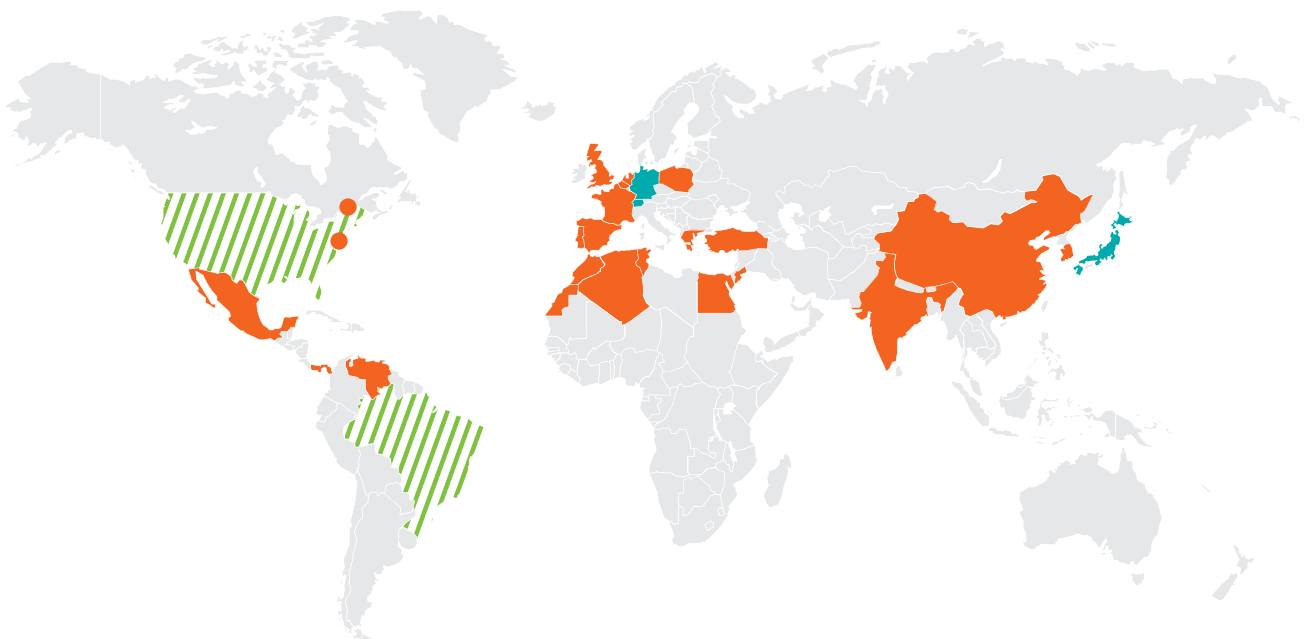
Key:

- Single-phase 25,000 V electric traction
- 1,500 V DC electric traction
- - - - - Other power supply systems in operation
- - - - - Single-phase 25,000 V electrification in progress
- - - - - 1,500 V electrification in progress
- Non-electrified main lines
- = = = = = 25,000 V high-speed lines
- = = = = = 1,500 V high-speed lines
- - - - - HSL 25,000 V electrification in progress

SNCF RÉSEAU OVERHEAD CONTACT LINES WORLDWIDE

CLIENT AND PARTNER PROJECTS IN MORE THAN 30 COUNTRIES

AT 2015.01.01



Key:

 Clients

 Partners

 Projects under study

REFERENCES



























LIFECYCLE MANAGEMENT

The overhead contact systems proposed in this catalogue have all been designed, erected, tested, operated and maintained by SNCF Réseau. It owes its position among the world's leading overhead contact system exponents to its holistic management approach, from design to renewal, from procurement to disposal of end-of-lifecycle products. This approach explains why SNCF Réseau can propose electrification solutions that are the most cost-effective in Europe.

On the strength of several decades of accumulated skills and knowledge, the solutions developed are guaranteed reliable, resilient and robust.



The Electric Traction Department in the SNCF Réseau Industrial & Engineering Headquarter can offer you the services of its

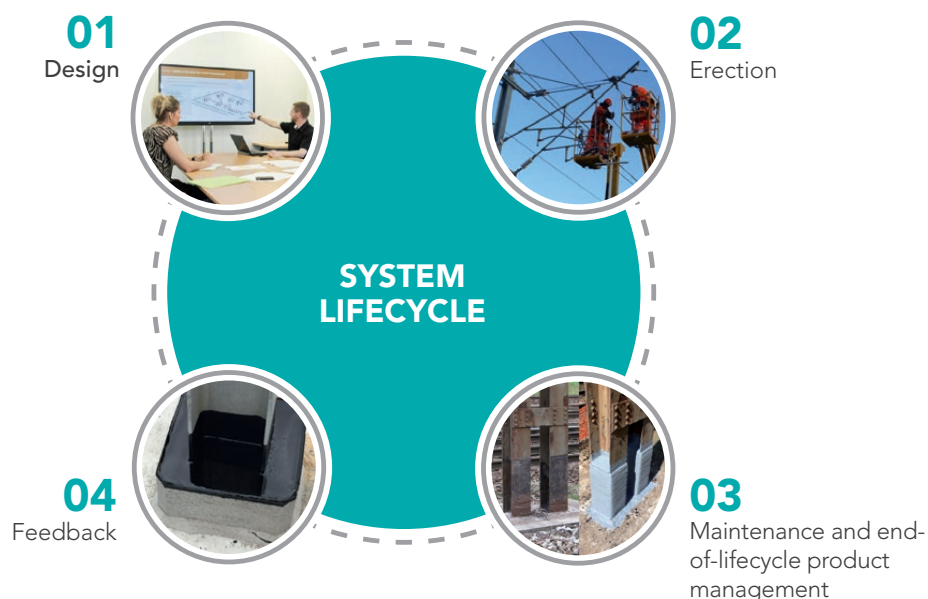
140 strong team of skilled, dynamic and forward-looking engineers and technicians.

COMPREHENSIVE SOLUTIONS

Through solid working relationships with its clients, SNCF Réseau can partner them throughout their product lifecycle, from the start of the project and the technical options selected, to OCL erection, operation and maintenance, replacement and management of end-of-lifecycle disposal.

The Electric Traction Department (DGII-TE) will be happy to work with you on your projects, whatever their scale, in producing functional diagrams, procuring high-quality components and handling project management.

With DGII-TE taking charge of the overall design process, it can adapt its procedures to the specific needs of your projects at all times.



INNOVATION APPLIED TO YOUR PROJECTS

PROCESS CONTROL

The Electric Traction Department of the SNCF Réseau Industrial & Engineering Headquarter invests about 10% of its annual budget on research and innovation in a bid to ensure the continuous development of its fixed electric traction equipment products.

Innovation is one of the Department's major strengths and for this, it can count on the support of its 120-strong workforce and their know-how and technical capabilities combined with the latest simulation methods.

Innovation focuses on improving technical performance, boosting infrastructure availability and keeping lifecycle costs under control



SNCF Réseau patents its different inventions, thereby **contributing to progress within the railway community as a whole.**

CONTINUOUS IMPROVEMENT FOR ENHANCED SUSTAINABILITY

Research, development and innovation are the watchwords at DGII-TE and the team is constantly proposing upgrades to its OCL products to keep down erection and maintenance costs and extend product lifecycles.

EXAMPLES

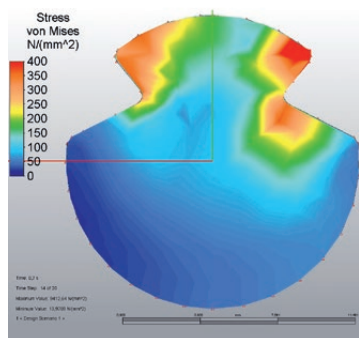
- Adaptable overhead lines capable of migrating from 1,500 V DC to 25,000 V AC and vice versa
- Stitch wire-free suspensions for simple high-performance systems
- Reduced maintenance: boltless structures
- Innovative solutions for protecting the base of embedded masts

Some
10%
of the Department's budget is earmarked for Research & Development.

INNOVATIVE TECHNOLOGIES FOR THE FINEST MODERN DESIGNS

To exploit the possibilities offered by the latest digital technologies, SNCF Réseau has started using and developing sophisticated digital tools in the design of its top quality overhead contact lines.

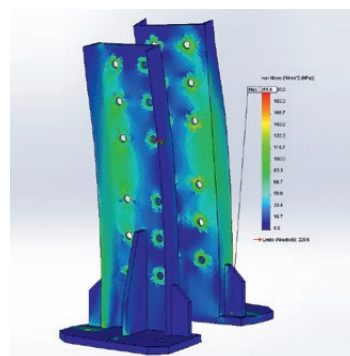
These are recalibrated via line tests to provide reliable and robust results.



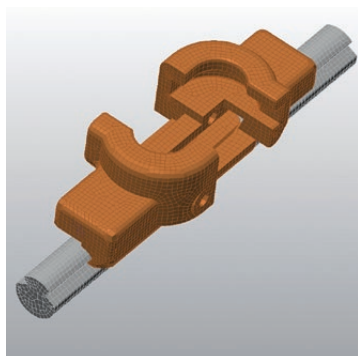
Analysis of mechanical stress in the contact wire following tightening of the clamp



3D model of a pantograph for the study of pantograph/OCL interaction



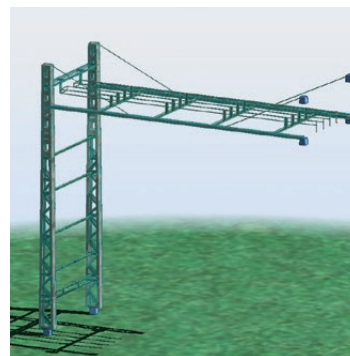
Finite element calculation of the mechanical behaviour of a mast base



3D model of a contact wire clamp



3D model of a catenary wire suspension



Calculation of the mechanical dimensions of power supply frames



ELECTRIFICATION AND COMPLETE RENEWAL

DEVELOPING SOLUTIONS
SPECIFIC TO YOUR NEEDS



A SOLUTION FOR EVERY NEED

WIDE RANGE OF ADAPTABLE OPTIONS

DGII-TE can offer overhead contact line systems for a wide range of speeds that can be adapted to:

- the type of power supply:
 - ▶ 25,000 V (or 15,000 V) AC with or without “negative” feeder
 - ▶ 1,500 V (or 3,000 V, 750 V) DC with or without “positive” feeder(s)
- specific electrification requirements (new lines, maintenance and replacement of existing lines, service tracks)
- particular contexts (urban, suburban, regional, high speeds).

All these designs are carefully calculated to keep down the number and dimensions of the different components and achieve the requisite performance standards at the most economical lifecycle cost.

In addition, system design makes allowance for the different electric traction system lifecycles (Planning, Erection, Operation, Maintenance and Recycling).



Solutions are designed to adapt to all possible line configurations

(tunnels, viaducts, underpasses, etc.)

TSI APPROVED OVERHEAD CONTACT LINES

The overhead line systems proposed in this catalogue are compliant with the criteria set by the European Union in its Technical Specifications for Interoperability (TSI). They are designed, in particular, to allow for track maintenance margins and erection tolerances.

Certification has been obtained in relation to the following versions of the Energy TSI:

- 2008 : ENE TSI High speeds - Regulation 2008/284/EC
- 2011 : ENE TSI Conventional lines - Regulation 2011/274/EU
- 2014 : ENE TSI Energy subsystem- Regulation 1301/2014

OVERHEAD CONTACT LINE DESIGN APPLICATIONS

TYPE	MAXIMUM SPEED												
	60	80	100	120	160	...	200	220	...	300	...	340	
25,000 V AC	V350 ✔												
	V300 ○												
	V200 ✔												
	V160 ✔												
1,500 V DC	CSRR ✔												
	CLRég ○												
Aerial contact (LAC) / MASS TRANSIT	LAC												

Key :

- ✔ TSI certified
- TSI certification pending
- Optimum range of use

OVERHEAD LINES FOR SERVICE TRACKS FOR 25,000 V AC or 1,500 V DC POWER SUPPLIES

DGII-TE offers a range of overhead contact lines specifically designed for service tracks:

- ▶ Single contact wires with or without mechanical tensioning for 25,000 V AC
- ▶ Single or double contact wires for 1,500 V DC (non-tensioned)
- ▶ Reinforced double contact wires for 1,500 V DC (non-tensioned)

To find the best solution for your needs, contact the I&P-TE teams.



V350 STI UP TO 350 KM/H

SECOND GENERATION OF HIGH-SPEED LINE OVERHEAD CONTACT SYSTEMS

The most recent world rail speed record of 574.8 km/h was achieved using a V350 overhead contact line.

These overhead power supply systems are suitable for revenue speeds of 350 km/h and were designed to contain lifecycle costs and guarantee high standards of performance. The design benefitted from 35 years of feedback from working with the V300 overhead line.

Nominal contact wire height is theoretically 5.08 metres to keep down the cost of civil works but this can be increased up to as much as 5.30 metres at the client's request.

The V350 overhead contact line has been certified TSI certification by an independent body.



East European HSL Phase 2
(Paris-Strasbourg)

Brittany Pays de Loire HSL
(Le Mans-Rennes)

Nimes Montpellier bypass
HSL

South Europe Atlantic HSL
(Tours-Bordeaux)



Tangiers-Kénitra HSL
~200 km – under development

V350 TSI OVERHEAD CONTACT LINE TECHNICAL FACTSHEET

ELECTRICAL POWER	25,000 V AC - 50 Hz (or 15,000 V AC – 16.7 Hz)
MAXIMUM SPEED	350 km/h
TSI ENE CERTIFICATION VERSION	2008 and 2014
PANTOGRAPHS ACCEPTED	1,450 mm – 1,600 mm – 1,950 mm ⁽¹⁾
PANTOGRAPH SPACING	Compliant Types A, B, C of Table 4.2.13 of the TSI
TENSION LENGTH	1,400 m
MAXIMUM SPAN LENGTH	63 m (for curves > R = 20,000 m)
MINIMUM LINE CURVE RADIUS	1,000 m
TENSION REGULATION RANGE	80 °C
NORMAL SYSTEM HEIGHT AT SUSPENSION POINTS	1,400 m
CATENARY WIRE MATERIAL	Bz 116 mm ²
CATENARY WIRE MECHANICAL TENSION	2,000 daN
CONTACT WIRE MATERIAL	Cu 150 mm ² , copper alloy
CONTACT WIRE MECHANICAL TENSION	2,600 daN
NOMINAL CONTACT WIRE HEIGHT	5.08 m (constant)
CLEARANCE REQUIRED UNDER CIVIL WORKS STRUCTURES	6 m
AERIAL EARTH CABLE	Yes
“NEGATIVE” FEEDER	Yes (depending on traction return current mode)
DEICING LOOP	Optional
STANDARD COPPER CROSS SECTION	203.7 mm ²

Nominal values applicable at requirement review stage. For detailed design phases, see functional drawings

(1) Subject to adaptation



V300 OVERHEAD CONTACT LINE UP TO 300 KM/H

ROBUST MULTIPURPOSE OVERHEAD CONTACT LINE FOR HIGH SPEEDS

As the first SNCF overhead contact line specifically designed for high-speed operations, the V300 was used during the world record breaking run of 515 km/h in 1990.

35 years of experience with this system on a heavily-trafficked network have provided ample opportunity to demonstrate its reliability and design quality. The number of components has been decreased with the removal of the stitch wire. This and other successive enhancements have made system calibration easier.



Paris South East HSL
(Paris-Lyon)
Atlantic HSL (Paris-Tours)
Mediterranean HSL
(Lyon-Marseille)
North HSL (Paris-Lille)



Korea Train Express
(Séoul-Busan)
412 km



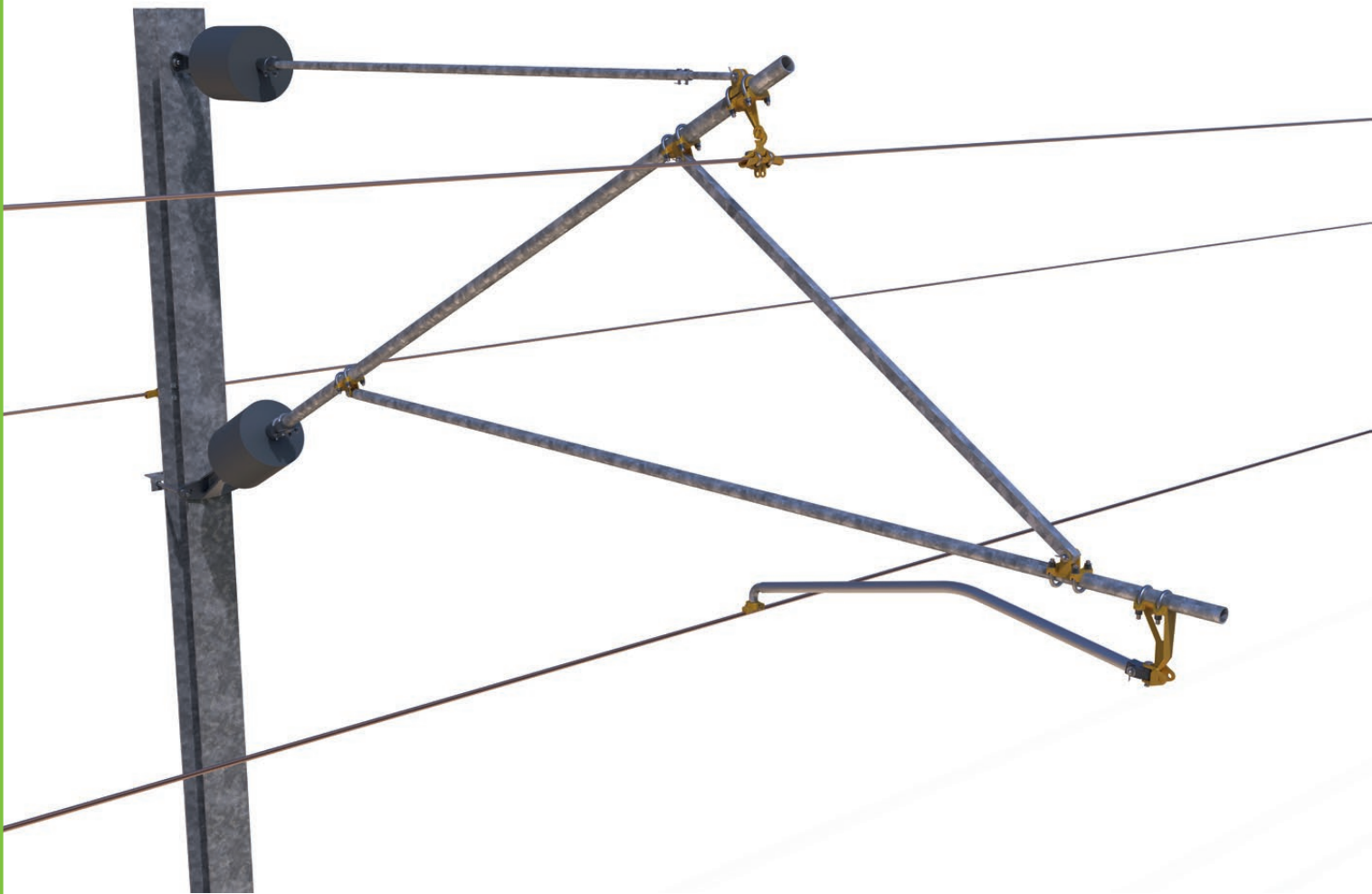
Channel Tunnel Rail Link
(108 km)

V300 OVERHEAD CONTACT LINE TECHNICAL FACTSHEET

ELECTRICAL POWER	25,000 V AC - 50 Hz (or 15,000 V AC - 16,7 Hz)
MAXIMUM SPEED	300 km/h
TSI ENE CERTIFICATION VERSION	2014 (pending)
PANTOGRAPHS ACCEPTED	1,600 mm – 1,450 mm – 1,950 mm ⁽¹⁾
PANTOGRAPH SPACING	Compliant Types A, B, C of Table 4.2.13 of the TSI
TENSION LENGTH	1,400 m
MAXIMUM SPAN LENGTH	63 m (for curves > R = 20,000 m)
MINIMUM LINE CURVE RADIUS	1,200 m
TENSION REGULATION RANGE	80 °C
NORMAL SYSTEM HEIGHT AT SUSPENSION POINTS	1,400 m
CATENARY WIRE MATERIAL	Bz 65 mm ²
CATENARY WIRE MECHANICAL TENSION	1,400 daN
CONTACT WIRE MATERIAL	Cu 150 mm ² , hard drawn copper
CONTACT WIRE MECHANICAL TENSION	2,000 daN
NOMINAL CONTACT WIRE HEIGHT	5,08 m (constant)
CLEARANCE REQUIRED UNDER CIVIL WORKS STRUCTURES	6 m
AERIAL EARTH CABLE	Yes
"NEGATIVE" FEEDER	Yes (depending on traction return current mode)
DEICING LOOP	Optional
STANDARD COPPER CROSS SECTION	186.3 mm ²

Nominal values applicable at requirement review stage. For detailed design phases, see functional drawings

(1) Subject to adaptation



V200 TSI OVERHEAD CONTACT LINE FOR SPEEDS UP TO 200 KM/H

OVERHEAD CONTACT LINE FOR HIGH SPEEDS

The V200 overhead contact line is in widespread use on the French national rail network. It was based on the Type 85 design which was further developed in the 1980ties to herald a breakthrough in overhead line system performance. This is the standard system used on the national conventional rail network.

Lifecycle costs are fully under control thanks to more than 35 years of feedback with this system, which is much appreciated for its reliability, efficiency and adaptability. It offers excellent value for money, in particular for regional traffic. It is also used by high-speed trains worked at 220 km/h to ensure continuity with HSL for regular performance across the network and to drive down infrastructure costs.



French national rail network



Luxembourg Railways

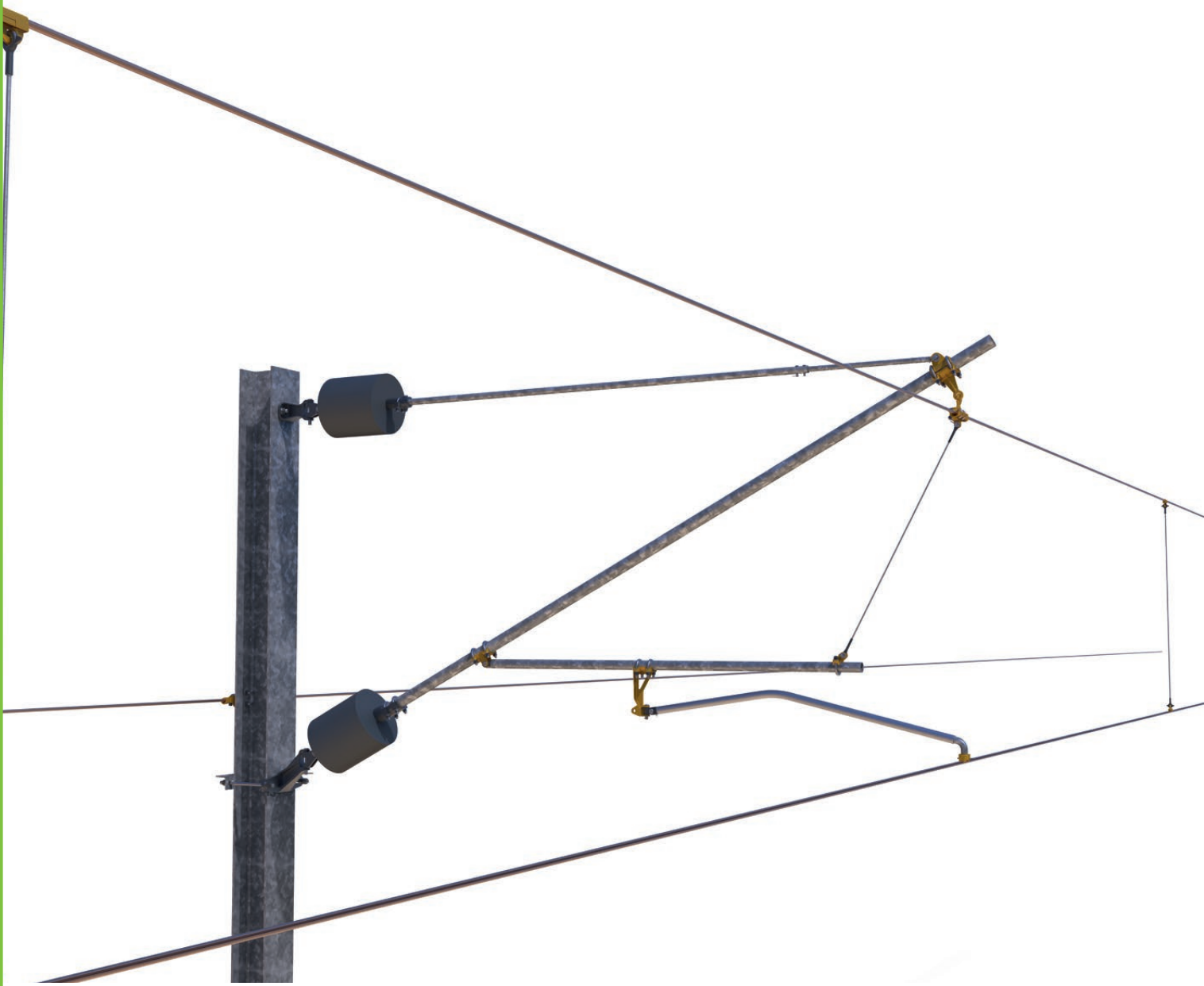


Electrification work in progress on the Tunis rapid transit rail network.

V200 TSI OVERHEAD CONTACT LINE TECHNICAL FACTSHEET

ELECTRICAL POWER	25,000 V AC - 50 Hz (or 15,000 V AC – 16.7 Hz)
MAXIMUM SPEED	200 km/h
TSI ENE CERTIFICATION VERSION	2011
PANTOGRAPHS ACCEPTED	1,450 mm – 1,600 mm
PANTOGRAPH SPACING	Compliant Types A, B, C of Table 4.2.13 of the TSI
TENSION LENGTH	1,400 m
MAXIMUM SPAN LENGTH	63 m (for curves > R = 20,000 m)
MINIMUM LINE CURVE RADIUS	300 m
TENSION REGULATION RANGE	70 °C
NORMAL SYSTEM HEIGHT AT SUSPENSION POINTS	1,250 m
CATENARY WIRE MATERIAL	Bz 65 mm ²
CATENARY WIRE MECHANICAL TENSION	1,200 daN
CONTACT WIRE MATERIAL	Cu 107 mm ² , hard drawn copper
CONTACT WIRE MECHANICAL TENSION	1,200 daN
NOMINAL CONTACT WIRE HEIGHT	5,50 m
CLEARANCE REQUIRED UNDER CIVIL WORKS STRUCTURES	6 m
AERIAL EARTH CABLE	Yes
“NEGATIVE” FEEDER	Yes (depending on traction return current mode)
DEICING LOOP	Optional
STANDARD COPPER CROSS SECTION	144.1 mm ²

Nominal values applicable at requirement review stage. For detailed design phases, see functional drawings



V160 TSI OVERHEAD CONTACT LINE UP TO 160 KM/H

FOR USE IN OCL UPGRADING OPERATIONS

The V160 overhead contact line was designed and developed for use in upgrading the first 25,000 V electrification systems installed in France, the so-called "North-East" systems. The aim was to be able to keep the existing supporting structures and limit the costs of achieving TSI compliance.

The V160 is particularly suitable for overhead line renewal projects in that the same foundations and metal structures can be used. Its recent design enjoys the benefits of more than 70 years of experience and its components have been tried and tested for optimum lifecycle costs.

The performance of this interoperable constituent is guaranteed by its TSI certification.

V160 TSI OVERHEAD CONTACT LINE TECHNICAL FACTSHEET

ELECTRICAL POWER	25,000 V AC - 50 Hz (or 15,000 V AC - 16,7 Hz)
MAXIMUM SPEED	160 km/h
TSI ENE CERTIFICATION VERSION	2014
PANTOGRAPHS ACCEPTED	1,400 mm – 1,600 mm
PANTOGRAPH SPACING	Compliant Types A, B, C of Table 4.2.13 of the TSI
TENSION LENGTH	1,400 m
MAXIMUM SPAN LENGTH	63 m (for curves > R = 20,000 m)
MINIMUM LINE CURVE RADIUS	300 m
TENSION REGULATION RANGE	70 °C
NORMAL SYSTEM HEIGHT AT SUSPENSION POINTS	1,250 m or 1,400 m
CATENARY WIRE MATERIAL	Bz 65 mm ²
CATENARY WIRE MECHANICAL TENSION	1,000 daN
CONTACT WIRE MATERIAL	Cu 107 mm ² , hard drawn copper
CONTACT WIRE MECHANICAL TENSION	1,000 daN
NOMINAL CONTACT WIRE HEIGHT	5.50 m
CLEARANCE REQUIRED UNDER CIVIL WORKS STRUCTURES	6 m
AERIAL EARTH CABLE	Yes
"NEGATIVE" FEEDER	Yes (depending on traction return current mode)
DEICING LOOP	Optional
STANDARD COPPER CROSS SECTION	144.1 mm ²

Nominal values applicable at requirement review stage. For detailed design phases, see functional drawings



CSRR TSI OVERHEAD CONTACT LINE

SIMPLE REINFORCED TENSIONED OVERHEAD CONTACT LINE

This new generation 1,500 V DC TSI overhead contact system replaces the so-called “normal” overhead line (CN). It has been carefully designed to offer excellent standards of performance at two different operating speeds (V160 and V220) depending on local conditions and/or line configuration.

The line is mechanically tensioned throughout its length and therefore can withstand temperature variations over a pre-set temperature range.

Electrical power to the line can be adapted to network operating constraints by adding up to a maximum of three feeders.

The triangular support structure design (components and insulators) is very similar to that of the 25 kV AC systems, which facilitates migration to alternating current.

CSRR TSI OVERHEAD CONTACT LINE TECHNICAL FACTSHEET

ELECTRICAL POWER	1,500 V DC (or 3,000 V DC)
MAXIMUM SPEED	160 or 220 km/h
TSI ENE CERTIFICATION VERSION	2014
PANTOGRAPHS ACCEPTED	1,600 mm – 1,950 mm
PANTOGRAPH SPACING	Compliant Types A, B, C of Table 4.2.13 of the TSI
TENSION LENGTH	1,400 m
MAXIMUM SPAN LENGTH	V160: 63 m for curves R > 10,000 m V220: 63 m for curves R > 3,000 m
MINIMUM LINE CURVE RADIUS	300 m for V160
TENSION REGULATION RANGE	1,000 m for V220
NORMAL SYSTEM HEIGHT AT SUSPENSION POINTS	70 °C
CATENARY WIRE MATERIAL	1,250 m
CATENARY WIRE MECHANICAL TENSION	Bz 116 mm ²
CONTACT WIRE MATERIAL	1,800 daN
CONTACT WIRE MECHANICAL TENSION	2 x Cu 150 mm ² , hard drawn copper
NOMINAL CONTACT WIRE HEIGHT	2 x 1,000 daN for V160 2 x 1,400 daN for V220
CLEARANCE REQUIRED UNDER CIVIL WORKS STRUCTURES	5.50 m
AERIAL EARTH CABLE	5.80 m
“NEGATIVE” FEEDER	Possible
DEICING LOOP	Optional
STANDARD COPPER CROSS SECTION	378 mm ² (CSRR without feeder)

Nominal values applicable at requirement review stage. For detailed design phases, see functional drawings



CL-REG OVERHEAD CONTACT LINE

LIGHT TENSIONED OVERHEAD CONTACT LINE

This new generation 1,500 V overhead contact line is the logical successor to the lightweight copper overhead line (CL Cu). It is mechanically tensioned throughout its length and can be used in association with the CSSR at junctions, turnouts and in lightly-trafficked sections (secondary lines).

The line has a single contact wire to keep down maintenance costs.

The triangular support structure design (components and insulators) is very similar to that of the 25 kV AC systems, which facilitates migration to alternating current.

CL REG OVERHEAD CONTACT LINE TECHNICAL FACTSHEET

ELECTRICAL POWER	1,500 V DC (or 3,000 V DC)
MAXIMUM SPEED	100 km/h
TSI ENE CERTIFICATION VERSION	2014 (pending)
PANTOGRAPHS ACCEPTED	1,600 mm – 1,950 mm
PANTOGRAPH SPACING	Compliant Types A, B, C of Table 4.2.13 of the TSI
TENSION LENGTH	1,400 m
MAXIMUM SPAN LENGTH	63 m
MINIMUM LINE CURVE RADIUS	300 m
TENSION REGULATION RANGE	70 °C
NORMAL SYSTEM HEIGHT AT SUSPENSION POINTS	1,250 m
CATENARY WIRE MATERIAL	Bz 65 mm ²
CATENARY WIRE MECHANICAL TENSION	1,000 daN
CONTACT WIRE MATERIAL	Cu 107 mm ² , hard drawn copper
CONTACT WIRE MECHANICAL TENSION	1,000 daN
NOMINAL CONTACT WIRE HEIGHT	5.50 m
CLEARANCE REQUIRED UNDER CIVIL WORKS STRUCTURES	5.80 m
AERIAL EARTH CABLE	Yes
“NEGATIVE” FEEDER	Possible
DEICING LOOP	Optional
STANDARD COPPER CROSS SECTION	143.9 mm ² (CL Reg without feeder)

Nominal values applicable at requirement review stage. For detailed design phases, see functional drawings



MASS TRANSIT OVERHEAD CONTACT LINE (LAC)

This lightweight overhead contact line (LAC) is particularly suited for use in mass transit situations (trams or tram-trains). In the event of special architectural requirements, more elegant versions of the system may be proposed.

There are three power supply-speed combinations:

- ▶ 25,000 V AC - 120 km/h (tram-train)
- ▶ 1,500 V DC - 100 km/h
- ▶ 750 V DC - 70 km/h (tram)

Since the mechanical and geometrical characteristics are adaptable, the following three technical factsheets correspond to three examples of use, one for each different power supply systems.

MASS TRANSIT OVERHEAD CONTACT LINE – LAC 25,000 V AC TECHNICAL FACTSHEET

PROJECT	North Light Tangent
PROPOSED SPEED	100 km/h
TSI ENE CERTIFICATION VERSION	Not relevant
PANTOGRAPHS ACCEPTED ON THE LINE	1,600 mm
TENSION LENGTH	1,400 m
MAXIMUM SPAN LENGTH	45 m
MINIMUM LINE CURVE RADIUS	150 m
TENSION REGULATION RANGE	70 °C
SYSTEM HEIGHT (ENCUMBRANCE) (WITH DELTA SUSPENSIONS)	0.365 m
CONTACT WIRE MATERIAL	Cu 150 mm ² , hard drawn copper
CONTACT WIRE MECHANICAL TENSION	1,800 daN
CONTACT WIRE HEIGHT	From 5.50 m to 6.30 m
AERIAL EARTH CABLE	Yes
STANDARD COPPER CROSS SECTION	147 mm ²



NORTH LIGHT TANGENT

Paris

MASS TRANSIT OVERHEAD CONTACT LINE – LAC 1,500 V DC TECHNICAL FACTSHEET

PROJECT	Lyon West
PROPOSED SPEED	100 km/h
TSI ENE CERTIFICATION VERSION	Not relevant
PANTOGRAPHS ACCEPTED	1,960 mm
TENSION LENGTH	1,400 m
MAXIMUM SPAN LENGTH	50 m
MINIMUM LINE CURVE RADIUS	150 m
TENSION REGULATION RANGE	70 °C
SYSTEM HEIGHT (ENCUMBRANCE) (WITH DELTA SUSPENSIONS)	0.365 m
CONTACT WIRE MATERIAL	2 x Cu 150 mm ² , hard drawn copper
CONTACT WIRE MECHANICAL TENSION	1,500 daN
CONTACT WIRE HEIGHT	From 5.50 m to 6.30 m
AERIAL EARTH CABLE	Only in stations
“NEGATIVE” FEEDER	No
STANDARD COPPER CROSS SECTION	291 mm ²



TRAM-TRAIN DE L'OUEST LYONNAIS

MASS TRANSIT OVERHEAD CONTACT LINE - LAC 750 V DC TECHNICAL FACTSHEET

PROJECT	Mulhouse – Thur Valley
PROPOSED SPEED	70 km/h
TSI ENE CERTIFICATION VERSION	Not relevant
PANTOGRAPHS ACCEPTED	1,580 mm
TENSION LENGTH	1,400 m
MAXIMUM SPAN LENGTH	50 m
MINIMUM LINE CURVE RADIUS	150 m
TENSION REGULATION RANGE	70 °C
SYSTEM HEIGHT (ENCUMBRANCE) (WITH DELTA SUSPENSIONS)	0.365 m
CONTACT WIRE MATERIAL	Cu 150 mm ² - hard drawn copper
CONTACT WIRE MECHANICAL TENSION	1,500 daN
CONTACT WIRE HEIGHT	From 5.30 m to 6.30 m
AERIAL EARTH CABLE	No
“NEGATIVE” FEEDER	No
STANDARD COPPER CROSS SECTION	147 mm ²



MULHOUSE – THUR VALLEY TRAM-TRAIN

Lutterbach to Mulhouse section

CUSTOMISED OVERHEAD CONTACT LINES

DGII-TE possesses the skills and knowledge to handle all aspects of vital primary overhead line component design.

Secondary parts (masts, insulators, mechanical-tensioning equipment, etc.) can be adapted to specific project requirements (operating conditions, maintenance, costs, etc.), while always upholding the same overall product performance levels.

The table below shows the main options that are available with each of the overhead contact lines proposed.

The teams at DGII-TE are happy to partner clients before and during their projects to adapt the technologies used to their specific needs.

OPTIONS/ALTERNATIVES		V350	V300	V200	V160	CSRR	CLRÉG	LAC
MASTS	Embedded H beam	●	●	●	●	●	●	○
	H beam with metal base fixture	○	○	○	○	○	○	○
	Concrete	○	○	○	○	○	○	○
	Steel lattice	○	○	○	○	○	○	○
	Architectural design	○	○	○	○	○	○	●
FOUNDATIONS	Excavation, concrete, mast erection	●	●	●	●	●	●	○
	Piles/Micropiles	○	○	○	○	○	○	○
	Anchor rods	○	○	○	○	○	○	●
TENSIONING EQUIPMENT	With counterweights	●	●	●	●	●	●	●
	With springs	○	○	○	○	○	○	●
	Gas-operated	○	○	○	○	○	○	○
COUNTER-WEIGHTS	Cast-iron weights	○	○	●	●	●	●	○
	Single unit	●	●	○	○	○	○	—
INSULATORS	Composite	●	●	●	●	●	●	●
	Glass	●	●	●	●	●	●	○
	Porcelain	○	○	○	○	○	○	○
DROPPERS	Simple	○	●	○	●	—	—	—
	Articulated	●	○	●	○	●	●	—
	Non-articulated	○	○	○	○	○	○	—
ALIGNMENT AND CENTRING PINS		●	●	●	●	●	●	●
"NEGATIVE" FEEDER	Suspended	●	●	●	●	—	—	—
	Fixed to masthead	○	○	○	○	—	—	—
"POSITIVE" FEEDER REINFORCEMENT		○	○	○	○	●	●	○

Key:

● Nominal solution on RFN ○ Available — Not available

CUSTOMISED OVERHEAD CONTACT LINES

MAIN OPTIONS



Concrete-embedded mast



Mast with bolted support



Suspended negative feeder



Negative feeder fixed to masthead



HE mast



"Design" mast



Lattice-frame mast



Concrete mast



Gas-operated tensioning device



Spring-operated tensioning device



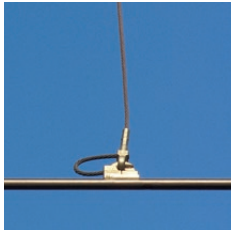
Counterweight system



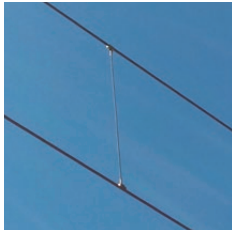
Individual counterweights



Simple dropper



Articulated dropper



Non articulated dropper



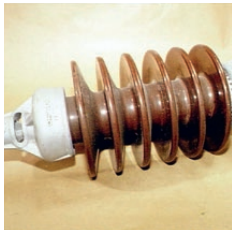
Monobloc counterweight



Composite insulator



Glass insulator



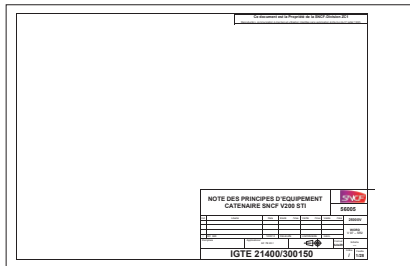
Porcelain insulator



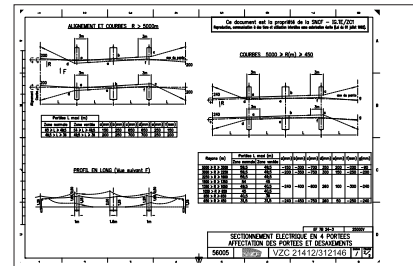
Centring pin

OVERHEAD LINE PLANS & DIAGRAMS

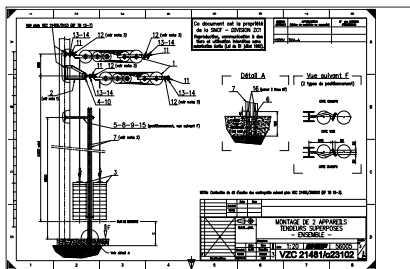
For the design of each of these overhead line types there exists a series of functional diagrams produced by the Design Department in accordance with its quality assurance procedures.



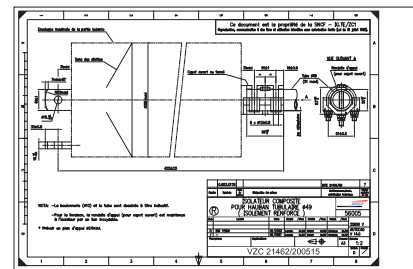
1. Functional references



2. Functional diagram of parts



3. Overall equipment diagram



4. Detailed parts diagram. Technical and general specifications

A COLLECTION OF PLANS COMPRISES...

- ◉ A system TSI-validated in the design phase.
- ◉ The possibility of support:
 - ▶ during the technical implementation phase,
 - ▶ in obtaining sub-system TSI certification in the implementation phase,
 - ▶ with the new technical developments to be applied as part of a project.
- ◉ Adaptable technical solutions that can reap the benefits of all the feedback acquired by the French rail infrastructure manager.
- ◉ A set of overhead line components designed in accordance with the European standards in force, with a wide choice of potential suppliers (few exclusive suppliers).
- ◉ The guarantee of simple implementation studies for greater project efficiency.
- ◉ Guaranteed performance standards.
- ◉ Guaranteed longevity.
- ◉ Possibility of combining all this with a nomenclature (list of parts and their characteristics). Also, possibility of support in the product type approval process and qualification of production sites.



MAINTENANCE AND PARTIAL REPLACEMENT

MAINTAINING THE EXISTING
OVERHEAD LINE NETWORK



ATTENTION
DANGER
DE FORT

ETF

11

www

GBL

RIV F-NOVA 3 Sgss
MANGIARE E BERE DURANTE IL LAVORO
BELADENE WAGEN SIND VORSICHTIG ZU BEHAND.
MANIARRE IL CARRO CARICATO CON PRECAUZIONI

THE FRENCH NATIONAL RAIL NETWORK TODAY

For more than a century, the French rail network has been the birthplace of new and emerging electric traction technologies.

Today the network totals 16,000 km of electrified lines, 90% of which are double track, and can boast some 70 different types of overhead contact line.

EXPERIENCE AND FEEDBACK

All these different technical solutions add up to an extraordinary collection of assets that, combined with a solid experience of maintenance and new design technologies, make infrastructure manager SNCF Réseau a past master in continuous product enhancement:

- ▶ Optimising and standardising components in the design phase,
- ▶ Driving down procurement and erection costs,
- ▶ Optimising preventive maintenance cycles,
- ▶ Suitably adapted product replacement (and or recycling) solutions



Optimised lifecycle costs (LCC)

MAINTENANCE POLICY

The catalogue sets out details of the major and minor replacement and renewal operations that correspond to the condition of the particular assets and the target performance standards (speeds, traffic volumes).

These operations are designed to maintain overall quality and comply with predefined principles and equipment standards.

RENEWAL OF THE LOWER PART OF A 25,000 V OVERHEAD LINE STRUCTURE

For 25 kV AC, the process consists of replacing the lower part of the overhead line supporting structures to bring them up to TSI performance levels.

This is particularly useful solution on lines where performance needs to be improved but where the condition of the structures does not justify complete OCL renewal.

OVERHEAD LINE DESIGN

TECHNICAL CHARACTERISTICS

	TYPE	TSI	SPEED				TARGET
			50	150	250	350	
25,000 V AC	Type 98		50-150				V160 TSI
	North-East		50-150				V160 TSI
	Type 82		50-200				V200 TSI
	Type 85	✓ 2011/274/EU	50-200				V200 TSI
1,500 V DC	Ex-Midi		50-150				CSRR TSI
	CN	○	50-200				CSRR TSI or CN TSI
	LGVA (Ex-Tours bypass)		50-200				-

Key: ✓ Certified ○ Certification pending

TYPE 98 OCL

25,000 V AC



ELECTRICAL POWER	25,000 V AC 50 Hz
------------------	----------------------

MAXIMUM SPEED	140 km/h
---------------	----------

1ST COMMISSIONING DATE	1998
------------------------	------

USE	Conventional lines
-----	--------------------

PANTOGRAPHS ACCEPTED	1,450/1,600 mm
----------------------	----------------

TENSION REGULATION RANGE	70 °C
--------------------------	-------

TSI	No
-----	----

NORTH-EAST OCL

25,000 V AC



ELECTRICAL POWER	25,000 V AC 50 Hz
------------------	----------------------

MAXIMUM SPEED	160 km/h
---------------	----------

1ST COMMISSIONING DATE	1952
------------------------	------

USE	Conventional lines
-----	--------------------

PANTOGRAPHS ACCEPTED	1,450/1,600 mm
----------------------	----------------

TENSION REGULATION RANGE	70 °C
--------------------------	-------

TSI	Yes, post upgrading
-----	---------------------

TYPE 85 OCL

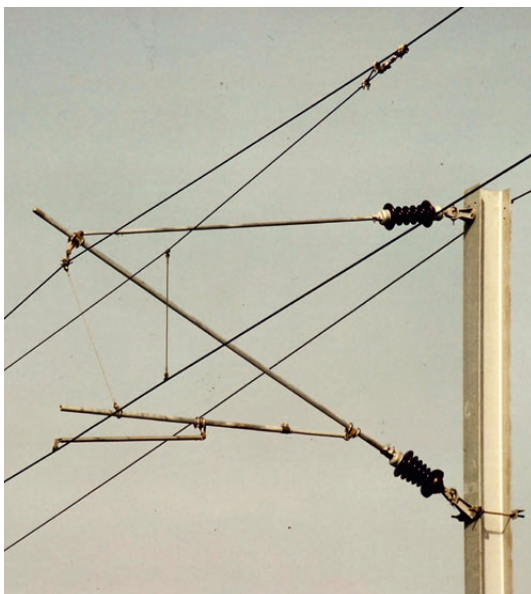
25,000 V AC



ELECTRICAL POWER	25,000 V AC 50 Hz
MAXIMUM SPEED	200 km/h 220 km/h for TGV
1ST COMMISSIONING DATE	1985
USE	Conventional lines
PANTOGRAPH ACCEPTED	1450/1600 mm
TENSION REGULATION RANGE	80 °C
TSI	Yes

TYPE 82 OCL

25,000 V AC



ELECTRICAL POWER	25,000 V AC
MAXIMUM SPEED	200 km/h 220 km/h for TGV
1ST COMMISSIONING DATE	1982
USE	Conventional lines
PANTOGRAPHS ACCEPTED	1,450/1,650 mm
TENSION REGULATION RANGE	80°C
TSI	Yes, post renewal

EX-MIDI OCL

1500 V DC



ELECTRICAL POWER 1,500 V DC

MAXIMUM SPEED 160 km/h

1ST COMMISSIONING DATE 1922

USE Conventional lines

PANTOGRAPHS ACCEPTED 1,950 mm

TENSION REGULATION RANGE Not relevant

TSI No

COMPOUND OCL

1500 V DC



ELECTRICAL POWER 1,500 V DC

MAXIMUM SPEED 200 km/h
220 km/h for TGV

1ST COMMISSIONING DATE 1924

USE Conventional lines

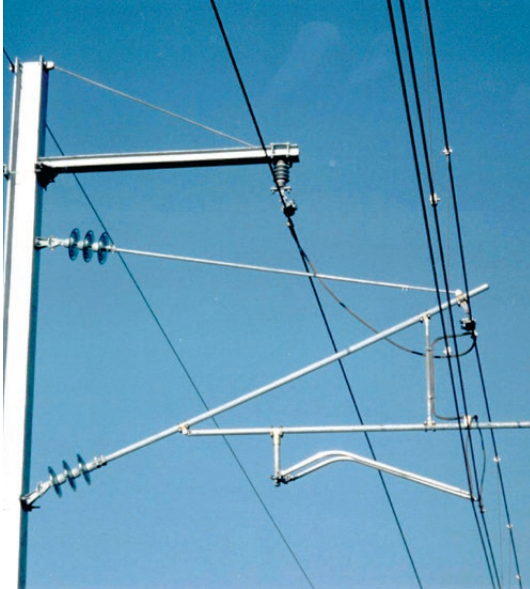
PANTOGRAPH ACCEPTED 1,600/1,950 mm

TENSION REGULATION RANGE 45 °C

TSI pending

LGVA OCL

1500 V DC



ELECTRICAL POWER 1,500 V DC

MAXIMUM SPEED 270 km/h

1ST COMMISSIONING DATE 1990

USE HSL connecting lines

PANTOGRAPHS 1950 mm

ACCEPTED 1,950 mm

TENSION REGULATION RANGE 80 °C

TSI No

CERTIFIED SKILLS & ABILITIES

I&P maintains and enhances the skills and abilities of its all staff in order to achieve excellence. The results of these efforts have been certified by an independent body.



Approbation de Système Qualité Constituant d'Interopérabilité

Réf. : 0942/4/CH/2011/NRJ/FR/8154/0003 éd. 2

Conformément :

- à la Directive 2008/57/CE du Parlement Européen et du Conseil relative à l'interopérabilité du système ferroviaire au sein de la Communauté,
- à la Décision 2011/274/UE concernant une spécification technique d'interopérabilité relative au sous-système «Energie» du système ferroviaire transeuropéen conventionnel,
- à la Décision 2008/284/UE concernant une spécification technique d'interopérabilité relative au sous-système «Energie» du système ferroviaire transeuropéen à grande vitesse,
- au règlement 1301/2014/UE concernant les spécifications techniques d'interopérabilité relatives au sous-système «énergie» du système ferroviaire de l'Union,

Le Système de Gestion de la Qualité du demandeur :

SNCF PSIGT-TE
6 Avenue François Mitterrand
F-93574 La Plaine Saint Denis cedex

a été évalué par :

CERTIFER
1, Place de Boussu- B.P. 70141
F- 59416 ANZIN, FRANCE

afin de vérifier la conformité aux exigences applicables des directives et STI citées ci-dessus.

L'évaluation a montré que le Système de Gestion de la Qualité appliqué aux constituants ci-dessous est conforme (comme détaillé dans les rapports d'audits):

Lignes aériennes de contact

Phases évaluées : Conception Fabrication Tests en usine

Cette approbation est valide sous condition d'entretien continu et de surveillance du Système de Gestion de la Qualité en conformité avec les exigences des Directives et STI citées ci-dessus.

Les rapports d'audits ECI8154/0003 version 1 et ECI_8644_0003_01 détaillent les audits réalisés et leurs résultats.

L'évaluation (de la phase conception uniquement) a été réalisée dans le cadre des modules H1, H2, CH et CH1.

Date de certification initiale: 28/07/2011

Date de fin de validité : 19/01/2017



NOTIFICATION 0942



Délivré le 20/01/2015 à Anzin par
Le Directeur Général Délégué



Pierre KADZIOLA

Formulaire 55601/4

Agence de Certification Ferroviaire
Siège social : 1, place de Boussu - B.P. 70141 - F 59416 Anzin Cedex
Tél. : +33 (0)3 27 28 35 00 - Fax : +33 (0)3 27 28 35 09 - www.certifer.eu
Association suivant loi du 1^{er} juillet 1901 - TVA/SIRET : FR 73 411 047 285 / 00035 - Code NAF : 9499Z

GLOSSARY

AT	: Tensioning equipment
CN	: “Normal” overhead contact line
CSRR	: Simple reinforced and tensioned overhead contact line
CSS	: Central Sub-station
DGII-TE	: SNCF RESEAU’s Industrial & Engineering Headquarter, Electric Traction Department
EF	: Finite elements
LAC	: Aerial contact line
LCSR	: Single tensioned contact wire
LGVA	: Atlantic high-speed line
OCL	: Overhead Contact Line
RFN	: French National Rail Network
TSI	: Technical Specifications for Interoperability

CONTACT

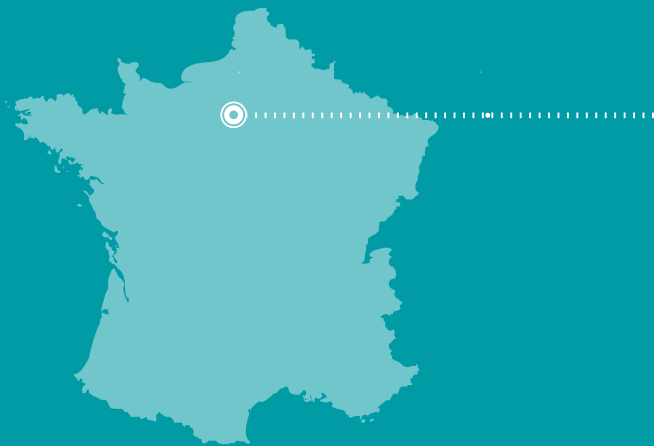
SNCF RÉSEAU

INDUSTRIAL & ENGINEERING SERVICES

FIXED ELECTRIC TRACTION EQUIPMENT DEPARTMENT

TEL.: +33 (0)1 41 62 05 77

E-MAIL: contact.te@reseau.sncf.fr



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