Rolling Stocks Adaptation to Climate change

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UNIFE represents the European Rail (Supply) Industry

- Based in Brussels since 1992
- 22 permanent employees
- A trusted partner of the European institutions in all matters related to rail and transport

- Full members: 76 of the largest and medium-sized companies in the rail supply sector
- Associated members: 16 National Associations, representing almost 1,000 suppliers of railway equipment + EFRTC and UNISIG
- UNIFE members have an 80% market share in Europe and supply more than 50% of the worldwide production of rail equipment and services.
Different weather conditions met:

- Nordic conditions: low temperatures, snow falls, frost (Sweden, Finland, China, Russia…)
- Desert conditions: high temperatures, sun radiation, sands (Dubai, southern parts of Italy and Spain, Morocco, Iraq, Iran…)
- High humidity, salty environment, swift temperature variations (Eurostar, Singapore, India…)
- Strong winds (Japan, Southern France…)

Main issues:

- Reliability and availability
- Safety
- Passengers’comfort
- Maintenance
Rolling stock issues – reliability and availability

Snow and frost

- Blocking of systems (doors and steps, coupling, pantograph),
- Priming of the power system
- Disruption of cooling system (clogging of filters)
- Difficult channeling

Low temperatures

- Deterioration of the performance of the electronic components
- Capacity loss of the batteries
Rolling stock issues - reliability and availability

**High temperature**
- Reliability of the electronic and the electric components

**Sand and dust**
- Disruption of the equipments’ cooling unit
- Deterioration of the working systems (rotation and platforms)

**Humidity and salt**
- Disruption of the power systems especially in the event of swift weather variations
- Corrosion
Rolling stock issues - Safety

- **Bogie and brake system**: blocking and suspension of the braking system
- **Windshield**: limited visibility and windshield wipers deterioration
- **Fall of passengers** due to the presence of ice in the access area to the trains
- Disruption of high-speed trains’ **stability** by strong winds
- Impact on materials’ **mechanical resilience**
- Big weather variations create differential **dilatations’ problems**
Extreme weather conditions – main tested problems

Relevance of different climatic conditions for different components

Failure rate of different components

Source: Climatic Wind Tunnel Vienna – Article from Dipl. – Ing. G. Haller
Adaptation of the Rolling stocks to the Nordic conditions: Exemples

- Roof air supply and installation of the body-shell under pressure
- Protection of the mechanical components: bellow suspensions
- Protection of the cabling
- Reinforcement of the isolation and the heating systems
- Heating of the door steps, the hydraulic system and the windshield...
Modular Brake System for extreme climate conditions

Advantages:
- Designed to operate between -50 °C and +70 °C
- Knorr-Bremse distributor valve for 1520 mm gauge
- Flexible design for different installation spaces
- High availability through back-up levels
- High precision and high power relay valve (BP Compact)
- Intelligent self-diagnostic system
- Optimized overhaul period of at least 6 years
Adaptation of the Rolling stocks to desertic conditions: Exemples

- Sanding equipment
  - Cyclonic filters, blades, bellow
  - Roof air supply for extreme events (same for snow)

- Resizing of the electric and the electronic equipment
  - Temperature of functioning of the standardized interface equipments
  - Cooling of the power supply system, power converter, engine

- Reinforcement of the thermal isolation (car shell, window) and installation of window-blinds

- Reinforcement of the air-conditioning system and its autonomy in extreme weather conditions
Adaptation of the Rolling Stock to hot and humid conditions: examples

- Condensation protection
- Management of air-flow
- Protection of the electronic control panel
- Installation of condensers in the machines’ area
Conclusion

Adaptation to the extreme weather conditions:

Constraints .......

and solutions
Conclusion

Climate change adaptation of Rolling stocks:

• Weather forecast + 10 / + 20/ +30 years

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In New Rolling stocks, refurbishment activities, Technologies development….

• Modular solutions