

Research and development of EMU for extremely cold or sandstorm area

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Part 2 Technical Challenge

Part 3 Research Route

Part 4 Vehicle Information





Basic situation of climate/railway lines in China





Ha-Da high speed railway

- Start & End station: Haerbin-Dalian, 23 stops
- Line length : 921 km
- Design velocity : 350km/h
- Service time : December 2012
- Lowest temperature : -38.3°C(Feb.2001)
- Snow situation : average 30 snow days/year Maximum snow thickness 27.1cm





Lan-Xin high speed railway

The first high speed railway in the blown sand environment in northwest area

- Start & End station : Lanzhou-Wulumuqi , 22 stops
- Line length : 1776 km
- Design velocity : 250km/h
- Service time : December 2014





Lan-Xin high speed railway

- Lowest temperature : -41.5°C in historical records
- Highest temperature : +47.7°C in historical records
- Altitude : 1500~3000m(50.6%) , max 3600
- wind & sand : 5 wind regions , 56.6m/s in historical records

grit diameter 0.075~0.5mm

■ Ultraviolet : Maximum radiation intensity level 5

radiation quantity $\geq 30 \text{w/m}^2$ UV index ≥ 10

■ Long journey : 1776km





可靠性Structure reliability

- ductile-brittle transition temperature
- reliable installation
- reliability of valves/sensors
- Iubricant / lipid
- rubber



brittle fracture

ductile fracture





动力学Vehicle dynamic performance

- suspension parameters for low temperature
- cross-wind stability
- wheel-rail wear







空气动力学Aerodynamic performance

700 200					
540 175 1000 1000		wind velocity (m/s)	25	30	>33
		EMU Max speed (km/h)	200	160	outage
			é.		
Original flow field	Optimized flow field	fairing			



低温适应性Low temperature adaptability

- condensate
- heat tracing
- sealing











高海拔/强风沙适应性Attitude/wind adaptability

- impact on high voltage components
- impact on traction/pneumatic devices
- anti-sand hit ability
- preventing & clearing sand









舒适性 Comfort

- Heat transfer coefficient K (1.1~1.2W/m²k)
- Air conditioner

-40~+40°C outside, 22~25°C inside







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Research Route

•comprehensive survey, identify key technical issues

- simulation and experiment (components, EMU)
- make special documents
- •auxiliary measurements

动车组冬季运用执行文件				
序号	文件名称	版本年份		
1	动车组冬季运营机务部门操作注意事项	2015年		
2	动车组冰雪天气检修重点注意事项	2015年		
3	CRH380BG/CRH5型动车组融冰除雪操作规范及出库标准	2015年		
4	CRH380BG型动车组制动盘异常磨耗情况下单轴切除办法	2015年		
5	关于动车组冰雪天气限速的建议	2015年		
6	CRH5型动车组齐齐哈尔地区冬季库外停放建议	2015年		



Contrast before and after

using anti-snow coating





CRH380BG



Design velocity	350 km/h
Formation type	8-car formation 4M4T
EUM length/width/height	~203 m/3257 mm/3890 mm
Seating capacity	556 passengers
Traction power	9200 kW
Axle load	17 t
Average acceleration (0~200km/h)	≮0.4 m/s ²
Environment temperature	-40°C \rightarrow $+40^{\circ}\text{C}$
Altitude	≤1,500 m
Wind speed	15m/s commonly (occasionally 33m/s)





Design velocity	250 km/h
Formation type	8-car formation 5M3T
EUM length/width/height	~211 m/3300 mm/3900 mm
Seating capacity	613 passengers
Traction power	5500 kW
Axle load	17 t
Average acceleration (0~120km/h)	≮0.3 m/s ²
Environment temperature	-40° C \sim + 40°C
Altitude	≤3,600 m
Wind speed	15m/s commonly (occasionally 33m/s, suitable for Lan-xin railway line)

CRH5G





Design velocity	250 km/h
Formation type	8-car formation 4M4T
EUM length/width/height	~200 m/3300 mm/3860 mm
Seating capacity	613 passengers
Traction power	4800 kW
Axle load	15 t
Average acceleration (0~120km/h)	≮0.3 m/s ²
Environment temperature	-40° C \sim + 40° C
Altitude	≤3,600 m
Wind speed	15m/s commonly (occasionally 33m/s, suitable for Lan-xin railway line)

CRH2G



