

**Dear Experts and Colleagues,**

Greetings!

I am from **Beijing Xinchuang Chunshu Rectifier Co., Ltd.**, serving as the **Chairman and General Manager**. I have been engaged in the research, development, production, and application of power semiconductor devices for **38 years**. Our products are widely used in **power generation, transmission, and transformation, locomotive traction, steel production, electrochemical industries, and military applications**.

Today, we are here with great excitement to **celebrate the 25th anniversary of the Russian Railway Research Institute**. On behalf of **Beijing Xinchuang Chunshu Rectifier Co., Ltd.**, I would like to extend my sincerest greetings and heartfelt gratitude to **Director Viktor** and all our friends who have supported and trusted us over the years. Now, I would like to briefly share with you a **historical overview of China's railway locomotive development**.

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## **1. The Development of Locomotives after the Founding of the People's Republic of China**

Since the **reform and opening-up**, China's railway transportation has experienced rapid growth, with locomotive technology evolving from **scratch to sophistication**, from **simple to complex**, and from **extensive to**

refined.

In the early days, we mainly relied on **diesel locomotives** for railway traction. Starting with the **Dongfeng (DF) and Dongfanghong (DFH) series diesel locomotives**, they played a crucial role in railway transportation. Despite the technological limitations at the time, our engineers overcame numerous design and manufacturing challenges, laying a solid foundation for dieselization in China's railway system.



东风 4 型内燃机车 (DF4)



东方红 2 型内燃机车 (DFH 2)

## **2. The Gradual Electrification of Railways to Meet Increasing Transport Demands**

As railway transport demands grew, China **gradually transitioned to electric locomotives**, with the **Shaoshan (SS) series** representing this progress. From **SS1 to SS11**, these locomotives not only **improved traction capabilities and energy efficiency** but also **achieved significant technological advancements**.

Notably, during the development of the Shaoshan series, Chinese engineers incorporated **structural elements from Russian locomotives** while also **adopting design concepts from France**, leading to **optimized structures and enhanced equipment selection**.

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## **3. Advantages and Applications of High-Power Thyristors in Electric Locomotives**

The application of **high-power components** has played a crucial role in the continuous development of electric locomotives. Our company has accumulated extensive experience in **rectifier components**, particularly in **replacing low-power thyristors with high-voltage, high-current press-pack thyristors**, achieving remarkable results.

Compared to traditional low-power thyristors, high-power thyristors offer the following advantages:

- **Enhanced reliability:** Reduces voltage/current balancing issues and

lowers failure risk, improving overall system reliability.

- **Simplified circuit design:** Minimizes external compensation components and trigger control complexity.
- **Increased efficiency:** Reduces power loss and optimizes heat dissipation for stable long-term performance.
- **Space-saving:** Fewer components and simplified mechanical structure reduce equipment footprint.
- **Cost reduction:** Decreases auxiliary components and maintenance costs while improving production efficiency.
- **Improved dynamic performance:** Faster response speed and better parameter consistency ensure stable operation under various conditions.
- **Ideal for retrofitting old locomotives:** Provides a **modernization solution** for aging locomotives, extending their lifespan.



**Diagram of Railway Components After Replacing Low-Power with High-Power Components**

## Upgraded SS3B Thyristor Rectifier System Case Study

In the original SS3B locomotive rectifier system, multiple low-power thyristors and rectifier diodes worked in series-parallel to convert AC from the traction transformer into DC for traction motors.

However, the large number of components led to voltage/current balancing issues, increasing failure risks and maintenance costs.

- Before the upgrade:

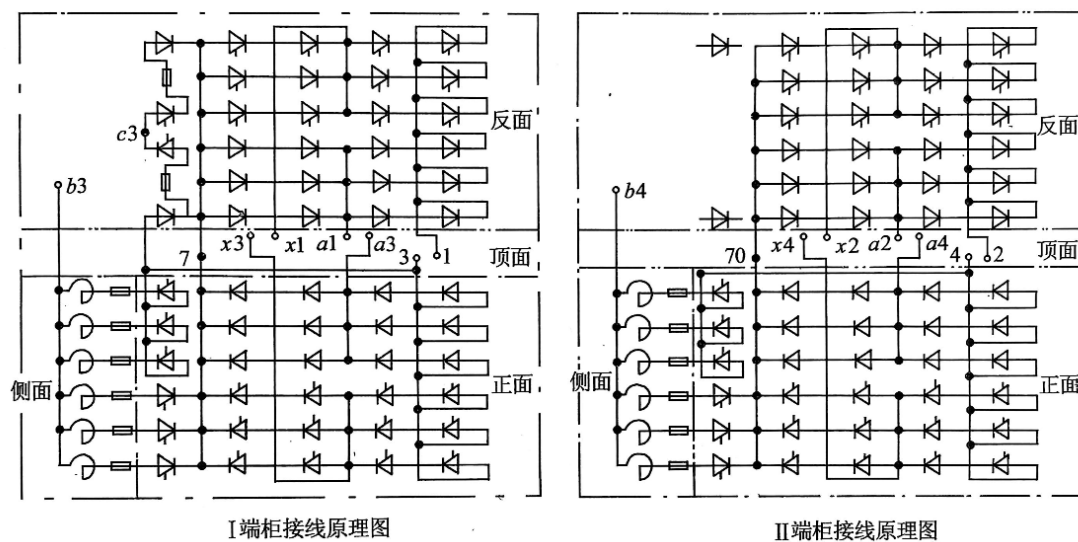


图 4-68 整流柜接线原理图

## Circuit Schematic of Rectifier Cabinets I and II of SS3B Electric Locomotive



### **Actual Photos of the Rectifier Cabinet of SS3B Electric Locomotive**

- Rectifier Cabinet I: 32 thyristors, 26 rectifier diodes
- Rectifier Cabinet II: 30 thyristors, 24 rectifier diodes
- **Total: 112 components, single cabinet weight: 800 kg**
- **Thyristor model: KP600A/2800V**
- **Rectifier diode model: ZP800A/3000V**
- **After the upgrade (using high-power press-pack thyristors):**
  - Rectifier Cabinet I: 12 thyristors, 8 rectifier diodes
  - Rectifier Cabinet II: 10 thyristors, 8 rectifier diodes
  - **Total: 38 components, single cabinet weight reduced to 380 kg**

- **Thyristor model:** KP3600A/3000V
- **Rectifier diode model:** ZP4600A/3000V

### **Upgrade Benefits:**

✓ Improved reliability: Fewer components, reduced voltage balancing issues, increased system stability.

✓ Optimized structure: Fewer parallel components, making the system more efficient.

✓ Reduced weight: **Over 50% weight reduction**, saving space and reducing mechanical stress.

✓ Higher efficiency: **Lower power loss**, better heat dissipation.

✓ Lower maintenance costs: **Fewer auxiliary circuits and easier maintenance.**

This upgrade significantly improved the **overall performance of the SS3B rectifier system**, serving as a successful example of **modernizing old locomotives.**

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## **4. China's High-Speed Rail Development in the Past 20 Years**

Over the past two decades, China has **transitioned from technology importation to independent innovation** in high-speed rail development.

Today, China boasts the **largest and fastest high-speed rail network in the world.**

From **CRH trains to the Fuxing series**, China's high-speed rail industry

has overcome numerous technological challenges in **traction, braking, and intelligent control.**

Notable developments:

- **CRH380A:** China's first independently developed high-speed train, reaching speeds of **380 km/h**, with outstanding **stability and comfort.**



**CRH380A**

- **CRH6:** Primarily used for intercity railways and short-distance transportation, this model features flexible train formation and efficient operation, meeting the commuting needs between urban clusters.



**CRH6**

- **Fuxing CR400AF and CR400BF:** As iconic models of China's high-speed rail, the Fuxing trains not only achieve world-leading speeds but also represent significant improvements in energy efficiency, environmental sustainability, and intelligent control systems.



**CR400AF**



**CR400BF**

Recent breakthroughs:

- **450 km/h high-speed trains for the Beijing-Shanghai route.**
- **600 km/h vacuum tube trains** (Chinese Academy of Sciences).
- **1,000 km/h maglev train** (China Aerospace Science and Industry Corp).
- **1,500 km/h hyperloop project** (Southwest Jiaotong University and Dongfang Electric).

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## **5. Cooperation Between Xinchuang Chunshu and the Russian Railway Research Institute**

I have known **Director Viktor** for many years, and we have had numerous

discussions on **rectifier cabinet technology for electric locomotives**. Our **T353-800-3600 components** have **successfully passed operational tests in the Russian Railway Research Institute's electric locomotives**.

Next, we will collaborate on **replacing low-power thyristors with high-power alternatives**. With our **extensive experience in modernizing Chinese electric locomotives**, we believe our knowledge will provide valuable insights for **Russian locomotive upgrades**, facilitating technological advancements. We look forward to **expanding our cooperation in more areas in the future**.

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Dear guests, the development of the railway industry requires **continuous learning and innovation**. On behalf of **Beijing Xinchuang Chunshu Rectifier Co., Ltd.**, I reaffirm our **commitment to technological exchange and win-win cooperation**.

Let us **work together** to create a brighter future for railway technology, bringing prosperity to both **China and Russia!**

**Thank you!**