

# Study on Oil Free Design of Railway Vehicle Air Supply System

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**Abstract:** With the development of science and technology, a breakthrough has been achieved in some key technologies, such as oil free lubrication material, high temperature resistance grease and hard anodizing. Oil free design of railway vehicle air supply system is available based on those advanced technologies.

**Keywords:** Heat control; Hard anodizing for cylinder; Roughness; Oil free

## 1. Introduction

Compressor in the air supply system will produce a lot of heat during working. In order to ensure the normal running of the device, a cooling system is requested. Oil cooling as a traditional cooling system has its defects. For example, it is very difficult to completely separate the oil and air. The proportion of oil and air will increase faster when the compressor runs to a specified time. The air mixed with oil will cause damage to the downstream products like air dryer and air valves. It may even col-

lapse the whole system. Lubricating air supply system is widely used in the railway vehicles.

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## 2. Description of Structure and Working Principle

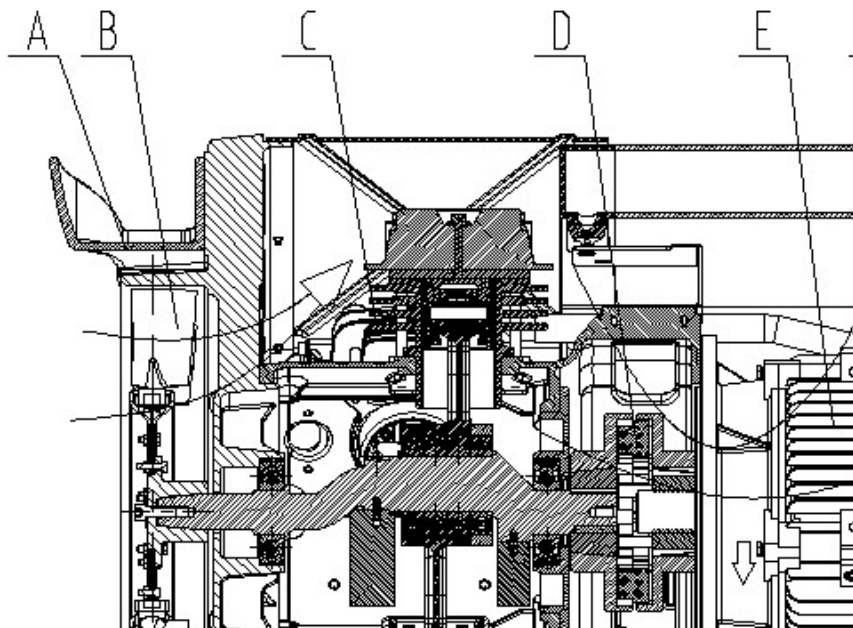


Figure 1. Structure Diagram

A. Fan structure. B. fan. C. compressor main body. D. elastic coupling. E. motor. F. cooler(inter cooler F1 and after cooler F2). G. motor structure. H. elastic damper. I.

purge valve. J. rod. K. cooling air flow and other pipes and shields.

Fan structure A connects to compressor main body D by bolts, fan B installs in the cavity of fan structure A.

Fan B is mounted on the crankshaft of compressor main body by means of taper fitting and screw tightening. Tightening the compressor main body C and motor E by some screws.

In order to transmit torque, connecting Compressor main body to motor E by an elastic coupling D, D could be a soft start device.

Connecting motor E to motor structure by some bolts. One side of cooler F is fixed on motor structure G by some bolts, another side is fixed on compressor main body G by some U bolts.

4 elastic dampers H are installed on the fan structure A and motor structure G.

To connect the compressor to car body by 4 elastic dampers H.

The purge valve I is installed in the bottom of inter cooler F1 and after cooler F2.

Tightening motor structure G and compressor main body by some rod J.

Fan B sucks in cooling fan K to cool the components.

Working principle: Sucking in air from atmosphere and then goes through the air filter to reach to the 3 first stage compress cylinders, the compressed air goes through the inter cooler to reach to the second stage compress cylinder, finally the air flow goes through the after cooler and output the compressed air to the downstream devices. Fan continuously runs with oil free cooling.

### 3. Research and Development Process

Difficulty 1.selection and test of oil free lubricating material. Piston ring and guide ring are made of PTFE derivatives and it should be modified according to our specific characteristic. Through the continuous adjustment of the additional elements and their proportion, we find a material meet our demand after more than 10 times` test. Difficulty 2.heat control. Lack of oil cooling, the compressor will produce a lot of heat during working. The biggest influence of heat is the grease(inside the bear-

ings)which relates closely to the life of compressor. To control the temperature of cylinder, cylinder head, piston pin and bearings in an acceptable rang by means of heat insulation design and sufficient cooling fan. In the meanwhile, we choose high temperature resistance grease for bearings.

Difficulty 3.Piston actions design. Cylinder bore has a fast relative friction actions with piston ring and guide ring. Define the material of piston ring and guide ring. The roughness, hardness, oxidation film thickness of cylinder bore influence the pump efficiency of compressor. The cylinder is designed to meet the requirements by the best machining and hard oxidation.

### 4. Conclusion

The successfully research on oil free air supply system of railway vehicle and the realization of installing on board solve the risk of delivering air mixed with oil and relieve the serious threat to the collapse of the braking system. At the same time, it is cleaner and economic than traditional air supply system as there is no need to replace oil during maintenance. Products have been recognized by the major customers, creating a great economic benefits.

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