Common faults and solutions of air brake system

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ABSTRACT

Air brake system is a kind of brake system commonly used by large trucks, buses and other large vehicles. Air brake system structure is more precise, high frequency of use, so it is often prone to failure of a part. Once the air brake system fails, it is not only easy to affect the normal use of the vehicle, but also bring damage to the safety of the vehicle. Therefore, improving the reliability of the air brake system, reducing its failure rate and improving its troubleshooting level is an important principle to ensure its safe use. This paper mainly analyzes and discusses the common faults and solutions of air brake system, and sums up some common points effectively.

Keywords: Air brake system; common faults; solutions

1. INTRODUCTION

The failure of air brake system is one of the common faults of large vehicles. It will not only affect the normal use of the vehicle, but also bring damage to the safety of the vehicle. Therefore, it is necessary to analyze the types and causes of common faults of the air brake system, and summarize some practical solutions. We hope to bring some help to the normal use of the air brake system [1].

2. ANALYSIS OF THE WORKING PRINCIPLE OF AIR BRAKE SYSTEM

Automobile brake is divided into oil brake and air brake two kinds, the latter is what we call "air brake". And the brake of large vehicle mainly uses air brake. Due to the air brake system has the advantages of sensitive response and sufficient strength, it is more suitable for large trucks or large buses and other large vehicles,a schematic diagram of a typical double-circuit air brake system is shown in figure 1.

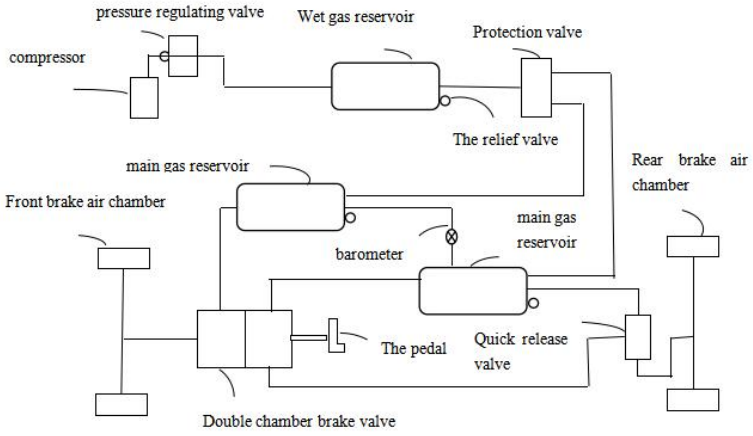

Figure 1. Schematic diagram of a typical double-circuit air brake system

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Seventh International Conference on Mechatronics and Intelligent Robotics (ICMIR 2023), edited by Srikanta Patnaik, Tao Shen, Proc. of SPIE Vol. 12779, 127792T · © 2023 SPIE · 0277-786X · Published under a Creative Commons Attribution CC-BY 3.0 License · doi: 10.1117/12.2689370

The main principle of the air brake system is: through the use of compressed air generated when the air pump works to drive the brake shoe, so as to achieve the brake.

Air brake is a commonly used brake device, its brake system is based on horseshoe brake, through the drum brake to brake. Because the air flow is large, the pressure is large, so the brake pump of the brake system will have a lot of travel.

3. ANALYSIS OF COMMON FAULTS AND MAINTENANCE SCHEME OF AIR BRAKE SYSTEM

Common faults of the air brake system include: failure to pump air, failure of the brake to return to its original position, failure of the brake -- although the brake has been started, the braking force has decreased.If you are not careful at this time, it can also cause a very serious accident.

So it is very necessary to carry out a thorough examination of the air brake system of the car. The domestic mainstream automobile brake system has been improved for many years, and there is basically no big change in structure. Only new parts such as ABS sensor and air dryer have high requirements for brake transmission system, which should also be paid attention to here[2].

Through the investigation of truck drivers and some traffic accidents, major accidents such as Trailer fire and brake failure were found, which were caused by the problems of the brake system. Some of it is because the system is not checked, or fake parts are used [3]. If it is under normal circumstances, it is easy to create an illusion and cause problems.

3.1 Common faults of air brake systems

3.1.1 Excessive moisture in the air brake system

This is a common fault cause of the air brake system. Too much moisture will damage the parts. For example, if there is too much moisture in the air tank, it will lead to corrosion at the connection of the pressure sensor and damage to the pressure sensor, resulting in the failure of the combination instrument without pressure[4]. At the same time, once the brake contains too much water, condensation will occur in the cold winter. Once it freezes, it may lead to the decline of braking effect. In serious cases, it will lead to braking failure, which will lead to the occurrence of traffic accidents.

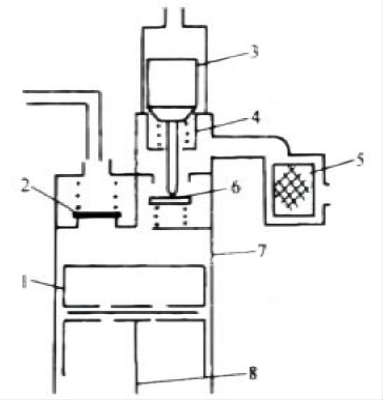
3.1.2 There is a leak in the line

Air brake system is another kind of more common fault. If there is air leakage in the pipeline, the braking effect of the air path brake will decrease or even fail.

3.2 Common faults and maintenance schemes of the air brake system

3.2.1 Serious oil leakage of air compressor will cause downstream faults

In daily use, when checking the vent of the pressure relief valve, pay attention to the oil pollution condition [5]. If there is serious oil pollution, the compressor must be repaired and replaced when necessary.Structure diagram of air compressor is shown in figure 2.



(1 piston 2 outlet valve 3 unloading plunger 4 plunger spring 5 air filter 6 intake valve 7 cylinder block 8 connecting rod)

Figure 2. Structure diagram of air compressor.

In particular, we should pay attention to the good lubrication of the oil line of the air compressor, the oil pipe can not be welded, and there is no difference in force and vibration after loading [5]. The rupture of the lubricating oil pipeline is easy to cause serious faults of the steam pump and engine.Under normal circumstances, such tubing should be reserved for replacement.

When starting in cold winter, you can't open too much throttle to raise the water temperature, otherwise it will cause lubrication problems of the air compressor, leading to strain and wear of the cylinder. Leading to oil leaks and carbon buildup on the cylinder head (air compressor).

3.2.2 Effect of high suction temperature on regeneration performance of dryer

From the appearance, the performance of the dryer is difficult to identify, because the dryer to carry out "water absorption - drainage" operation in a working cycle.

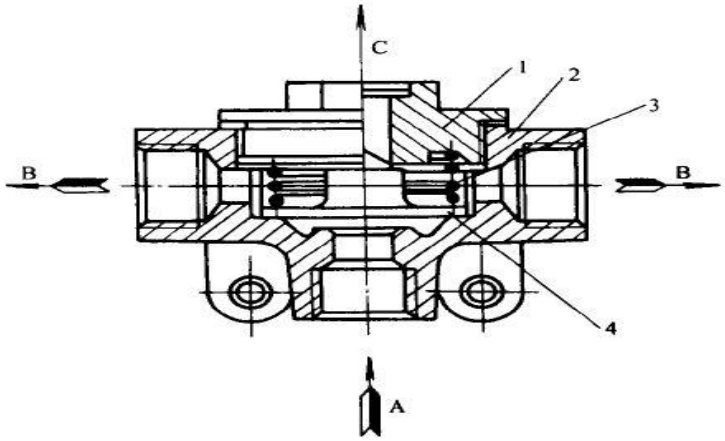
In the selection of high-quality drying equipment, but also pay attention to the operation of the system, such as under the exhaust pipe if there is a lot of oil, indicating that the molecular sieve dryer has been seriously polluted by oil. At this point it has completely lost its function and has not absorbed water.

The temperature test paper is used to detect the inlet temperature. When the temperature exceeds 65℃, the filtration capacity of the filter element will be reduced, and even failure will occur.

3.2.3 Check the two parts of active and passive circuit

3.2.3.1 Active return part

All aspects of the action of the active circuit are composed of the functions of multiple parts. Under enough pressure, the driver depresses the brake pedal and then quickly releases it. At this time, pay attention to observe the exhaust of relay operated and quick release valves. If the exhaust speed is slow, repair and replace it immediately.The quick release valve structure diagram is shown in figure 3.



(1- Bonnet 2- body 3- spring 4- valve A- air inlet B- air outlet C- air outlet)

Figure 3. The quick release valve structure diagram

Most valve body damage is due to oil and water problems. Therefore, the dryer needs to be carefully checked.

3.2.3.2 Passive return part

The passive return part refers to all kinds of parts inside the brake disc. The tension spring of the shoe return position should be moved up and down with a pry bar to check. If there is no elasticity and fatigue elongation, it should be replaced in time. Prevent the lower shoe from effectively returning in a long time, resulting in interference and friction between the brake disc and the lower shoe, resulting in temperature rise and astringent illusion of brake clearance adjustment.

3.2.3.2.1 Influence of the quality of the brake hub on the braking performance

People often neglect the quality of the brake hub, which in fact has a great impact on the performance of the brake. For example, the friction of the imitated brake hub is less than 40% of that of the original factory. In this way, once the brake temperature is too high, the brake hub is easy to be scrapped prematurely [6]. The riveting of the brake hub must be completed by special machinery. Manual riveting or bolt fixing shall not be adopted, otherwise loosening may occur.

The longer the brake hub is used, the easier it is for the rim to stand up. The brake hub body is free of cracks and smooth inside, and can be used within 3 mm. The excess grooves are ground flat with a grinder, and the thickened brake hub can be replaced to continue to be used, which saves the cost.

When the inner diameter of the brake is worn greatly, the method of "camshaft enlarging roller" can be adopted to restore the braking force, but after replacement, the brake motion curve will also change, resulting in the brake return position is not smooth.Especially when the brake pad clearance is too large.

During daily use, the brake clearance shall be adjusted in time. If the passive return pull spring of the shoe is not effective, the return spring of the slave cylinder shall be added.

3.2.3.2.2 High and low pressure of the air brake system

This is mainly due to the pressure regulating valve of the rated pressure regulation is not correct and caused. By adjusting the bolt on the valve. By turning the adjusting bolt downward, the working pressure can be increased, otherwise it will be reduced.

3.2.3.2.3 The pressure regulating and unloading function of the pressure regulating valve fails

The closing pressure of the pressure regulating valve is small, which is caused by the long unloading time of the air compressor [7]. This is still due to the failure of the pressure regulator caused by the effect of decline or even failure. Under normal circumstances, should check the vent check valve is faulty, and there are no impurities between the seat, check valve cone spring support ring has not jumped out; Pay attention to check whether the ventilation hole on the upper cover of the regulating valve is blocked by dirt, and whether the exhaust pipe hole of the housing is contaminated by dirt.

3.2.3.2.4 Automatic drain valve does not work properly

The main reason for this failure is that the entire drain is clogged with oil.In such cases, simply disassemble the valve for disassembly and cleaning before assembly.In addition, the leakage of the seal ring on the piston of the sewage valve can also lead to the failure of the air brake system [8]. For example, in the clutch, this kind of failure will be evident.Sewage valve control line whether there is no pressure output condition, this can be used to test loose control pipe connection. If the automatic drain valve fails to work normally, check whether the control pipe or connection is blocked by foreign matters, or whether the auxiliary button valve of the clutch has problems. Even if there is a problem with the key valve, it may also be caused by the problem of clutch power.

3.2.3.2.5 A condition in which the dryer cannot recoil and exhaust

When this happens, there is usually a problem with the pressure regulator. Whether the external pressure control valve, or the internal pressure control valve, in this situation must be removed to check the pressure control valve [9]. The exhaust valve of the dryer is prone to leakage fault, and this fault is usually because there is a problem with the sealing of the drainage valve, or there are impurities between the valve and the seat, resulting in lax sealing.

3.2.3.2.6 One of the four pipes cannot be inflated

The four-line protective valve divides the whole vehicle into four pipelines, namely front brake, hand brake, middle brake and auxiliary gas pipeline.

This system for the air brake system to provide protection is the vehicle in normal driving safety protection equipment. When the vehicle is in operation, four valves are fully open, consisting of a total of one air inlet and four exports. In fact, the four valves at this time only one "five" function, the whole car and gas road are connected. Only when one of the pipelines breaks or leaks, the pipeline valve will be closed and disconnected from the other pipelines after reaching a certain degree. This can ensure the normal operation and normal inflation of other pipelines.

In the process of operation, the pipe often does not inflate. A common condition is the four-pipe protection valve, which is stuck and cannot be opened. In winter, because the residual water in the pipeline will freeze the pipeline valve, leading to the pipeline cannot be inflated, resulting in the pipeline cannot be inflated. After a long time of parking, the valve core of a pipeline of the vehicle will rust and stick to open, and the pipeline can not be inflated. When the above fault occurs, check the four-pipe protective valve. If it is stuck, clean it and then assemble it. If the valve is damaged, repair tools are usually used to replace the damaged part.

4. AIR BRAKE SYSTEM MAINTENANCE

No matter what kind of brake, the final brake is either the brake pad (disc) or the brake shoe (drum wheel) to achieve the braking. So often check the brake block or brake shoe thickness. If it is found to be close to or below the manufacturer's minimum thickness, it should be replaced immediately. At the same time of checking the brake pad, we should also pay attention to whether the brake disc or brake drum has wear, if there is a pit to timely disc or light drum, to ensure that the brake with the brake block contact area, and increase the braking force.

For the air brake, the water in the pipeline should be cleaned regularly and the dryer should be replaced regularly. Moisture in the air passages can eat into the pipes and affect the brakes. In severe cases, it can cause a failure of the braking system. In addition, the operation of the oil pump and the wear of the conveyor belt should be checked regularly. If there is a problem, replace it immediately[10].

Especially for heavy trucks, because of the heavy load, inertia is also large, brake brake pad force is larger, more heat generation, brake pad is easier to wear. Excessive wear brake pads will reduce the brake effect or even failure, so should check the wear of brake pads every 6 months, replace the brake pads in time. In addition, the dry pot should be replaced once a year. Because the air brake of the heavy truck pushes the compressed air to brake, and the air contains certain moisture, the drying tank is used to filter the water vapor in the compressed air in the air path system, the purpose is to prevent the corrosion of the air storage cylinder and all kinds of pump valves. Therefore, whether the drying tank can work properly directly affects the performance of the brake. So when maintaining the brake system, do not forget to replace the drying tank in time. In most cases, it is replaced once a year. Try to avoid choosing the low-cost drying tank. Also, try not to use the water cooling device. Large water tanks can still be seen on some heavy trucks, leaving two long watermarks on the long downhill road, which are devices to cool the hub of the car when braking. Once in the autumn and winter, the road surface water stains icing easy to cause after the car skidding, and by drenching to cool the car hub will also damage its life. At present, in cylinder braking has been added to some national 6 vehicles in the market. For example, the engine in-cylinder braking system of SAIC Hongyan heavy truck equipped with Kosso engine is conducive to reducing the frequency of hub braking. Prevent hub overheating, no water cooling, reduce traffic hazards, improve brake pad life, but also reduce the weight of the vehicle, thereby improving the payload.In addition, if the retarder is added, the braking effect will be more reliable, even for long downhill sections.

Pay attention to good braking habits. For example, before entering the long downhill, there will be a road sign to remind, at this time you can prepare in advance, pull the handle into low speed gear, need to control the speed, if the front is not too close to the vehicle, it can control the speed through the engine auxiliary braking, as far as possible to reduce the loss of driving brake. See Table 1 for common maintenance programs of air brake system.

Table 1. Common maintenance scheme of air brake system

Maintenance project	Brake pads and shoes	Air brake	heavy truck
Maintenance plan	Check thickness frequently	Always clean the accumulated water in the pipeline	Check the wear of brake pads every 6 months
Matters needing attention	Note if the brake disc or drum is worn	Check the running condition of the pump and wear of the conveyor belt regularly	The drying tank shall be replaced once a year

5. CONCLUSION

Air brake system is widely used in large vehicles. However, the failure of the air brake system is also a more common fault of large vehicles. It is not only easy to lead to brake failure, but also easy to affect the driving safety when it is serious. Therefore, appropriate measures should be taken to strengthen the fault repair and daily maintenance of the air brake system, so as to effectively reduce the failure rate of the air brake system, in order to ensure the normal use of the air brake system to the maximum extent.

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