Unit 6

Pneumatic System

Text 1

Air Resource System

The composition of SS_{4G} locomotive compressed air system is shown in fig 6-1. It supplies clean, dry and stable compressed air for locomotives and trains to ensure the necessary compressed air for the train braking, air spring and so on. When it works properly, it supplies compressed air by a compressor sets 43. The compressed air enters air dryer 49 through check valve 47 and the purified dry compressed air is stored for future use in main reservoirs 91 and 92.

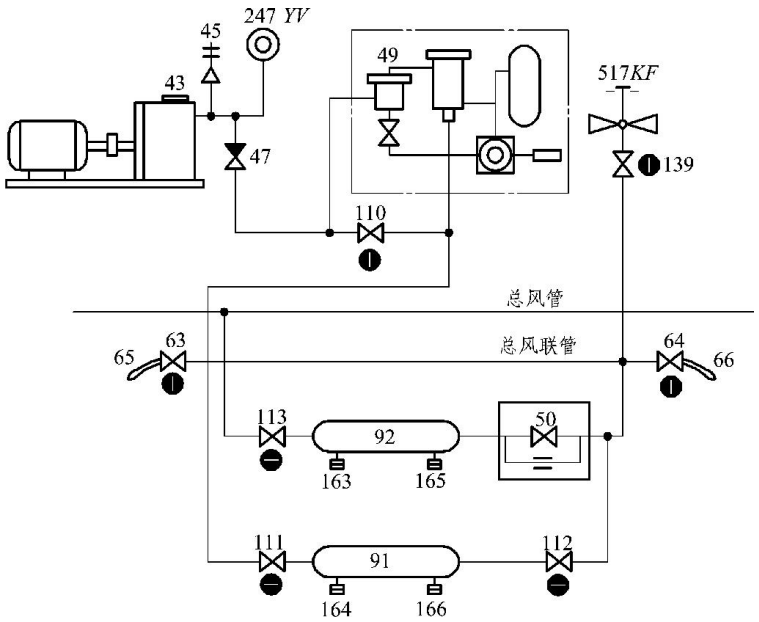

Fig 6-1 Compressed Air Pip System

43—air compressor; 49—air dryer; 45—high voltage safety valve; 247YV—air release electro-pneumatic valve for air release; 47—check valve; 110,111,112,113-cutting valve; 91,92—main reservoir; 63,64—angle cock; 50—backflow check valve; 517KF—pressure controller; 163~166—water drain valve

The air pressure in the main reservoir is controlled between 750~900 kPa by pressure controller 517 KF.

High voltage safety valves 45 is for limiting the highest pressure of compressed air in main reservoir and their set valve is 950 kPa. Check valves are for cutting the backflow of the compressed air in the main reservoir. Electro-pneumatic valve for air releasing 247YV is to ensure the no-load start of compressor.

Meanwhile, compressed air of 750 ~ 900 kPa is supplied for locomotives through the main air pipe at the end of locomotives. In order to prevent air resource in the whole reservoir from losing great when coupler breaking, there is a backflow check valve 50 between reservoirs 91 and 92. Even if coupler is breaking and the whole air pipe exhausts air directly, compressed air in reservoir 92 can be exhausted out to atmosphere slowly through the small backflow hole of radius 6 mm in the backflow check valve 50. In this case, compressed air in reservoir 92 can ensure the need for on emergency stop.

New Words and Expressions

compressed [kəm'prest] adj. 被压缩的；扁平的

reservoir ['rezəvwɑ: (r)] *n*. 水库；蓄水池

backflow ['bækfləu] *n*. 回流；逆流

exhaust [ig'zɔst] *vt*. 排出；耗尽；使精疲力尽；彻底探讨

vi. 排气

n. 排气；废气；排气装置

valve [vælv] *n*. 阀；真空管；活门

emergency [i'mə:dʒənsi] *n*. 紧急情况；突发事件；非常时刻

adj. 紧急的；备用的

prevent [pri'vent] *vt*. 预防，防止；阻止

vi. 妨碍，阻止

air dryer　空气干燥器

pressure controller　压力控制器

electro-pneumatic valve　电空阀

cutting valve　塞门

check valve　止回阀

water drain valve　排水塞门

in this case　在此种情况下

Notes

1. High voltage safety valves 45 are for limiting the highest pressure of compressed air in main reservoir and their set valve is 950 kPa. Check valves are for cutting the backflow of the compressed air in the main reservoir. Electro-pneumatic valve for air releasing 247YV is to ensure the no-load start of compressor.

   高压空气阀来限制主风缸内的最高风压，设定在 950 kPa。止回阀用来阻止主风缸内的压缩空气逆流，启动电空阀用来确保压缩机空载启动。

2. Even if coupler is breaking and the whole air pipe exhausts air directly, compressed air in reservoir 92 can be exhausted out to atmosphere slowly through the small backflow hole of radius 6 mm in the backflow check valve 50. In this case, compressed air in reservoir 92 can ensure the need for on emergency stop.

   即使发生断钩，总风管里的空气全部流失，总风缸 92 里的压缩空气可以通过逆流止回阀 50 里 6 mm 半径的回流小孔慢慢放出，这样总风缸 92 里的压缩空气可以保证紧急制动所需的压缩空气。

   even if 即使，纵然，尽管，虽然。例：

   Even if we have achieved great success in our work, we should not be conceited.

即使我们在工作中取得了很大的成绩，也不应该自满。

Text 2

Control Pipe System

Pneumatic air pipe system, such as pantograph, main circuit breaker, high voltage changeover switch and electro-pneumatic contactor, etc. belongs to control pipe system. It supplies sufficient compressed air which the above mentioned devices need to ensure the proper operation of locomotive.

The composition of SS_{4G} locomotive control pipe system shown in fig 6-2. It can be divided into 3 working conditions according to its effect:

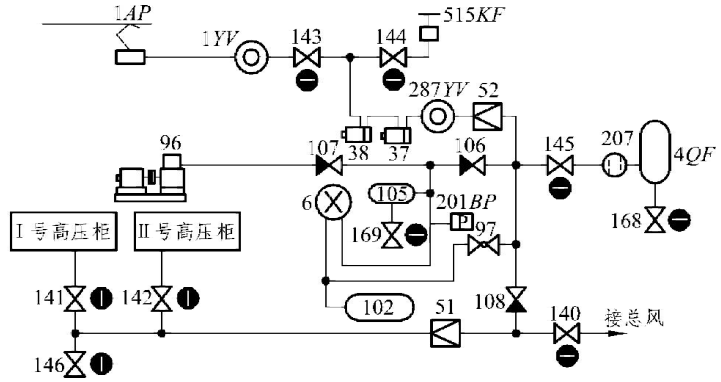

Fig 6-2 Control Pipe System

1YV—electro-pneumatic valve; 102—Control reservoir; 106、107，108—Check valve; 168,140~146—Cutting cock; 51，52—Pressure regulation valve; 105—Auxiliary reservoir; 6—Double needle pressure meter; 96—Auxiliary compressor; 207—Water dividing and air filtering machine

(1) Air supply of the main air reservoir during normal operation

During normal operation, the main reservoir feeds the control system.

The control reservoir 102 is set to stabilize the air pressure in control system if pressure fluctuates when the main circuit breaker switches on/off. Before stopping the locomotive, air pressure in control reservoir should be inflated to more than 900 kPa and then close the cock 97, for future use of raising pantograph and turning on switch.

Every time before crew start off the train, they should open the water exhaust cock 168 of reservoir in the main circuit breaker in order to drain out the water in reservoir to ensure the operation safety of the main circuit breaker.

(2) Air supply of control air reservoir after depot stop

Air supply of control reservoir after depot stop is lower than 450 kPa and the stored air

pressure in control reservoir 102 is higher than 700 kPa before it's put into a new operation. Cock 97 can be opened to raise pantograph and turn on switch directly. While raising pantograph and turning on switch, the air pressure in control reservoir will drop greatly. So, the main compressor must be inflated immediately to restore the normal working conditions under which air is supplied by the main reservoir.

(3) Air supply of auxiliary compressor after depot stop

When locomotive will run into operation again after a long time of stop, if the air pressure in the main reservoir is lower than 450 kPa and that stored in control reservoir 102 is lower than 450 kPa, only the auxiliary compressor set can be started to inflate air.

In order to shorten inflation time of the auxiliary compressor 96, the cock 97 should be closed to cut control reservoir 102 before starting auxiliary compressor. When the pressure in auxiliary reservoir 105 is higher than 600 kPa, while the pantograph can be raised and are turning on switches, and the main compressor set should be started at once for inflation to restore normal working conditions under which air is supplied by the main reservoir. Don't stop the operation of auxiliary compressor until the pressure in the main reservoir is higher than 450 kPa, to ensure the reliability of the operation of raising pantograph and turning on switches. The pressure can be indicated by the double needle pressure meter 6 which is set in electro-pneumatic braking cabinet.

The set of auxiliary reservoir 105 has two such effects: on one hand, to stabilize and store compressed air; on the other hand, to cool the compressed air produced by auxiliary compressor, so every time after using the auxiliary compressor, water drainage cock 169 under auxiliary reservoir should be opened to drain out the water.

New Words and Expressions

pantograph ['pæntəgræf] *n.* 受电弓

contactor ['kɔntæktə] *n.* 开关；电流接触器

reservoir ['rezəvwɑ: (r)] *n.* 水库；蓄水池

inflation [in'fleiʃ(ə)n] *n.* 膨胀；通货膨胀；夸张；自命不凡

compressor [kəm'presə] *n.* 压缩机；压缩物

changeover switch 转换开关

control pipe system　控制管路系统

compressed air　压缩空气

air reservoir　风缸

electro-pneumatic braking　电空制动阀

water drainage cock　排水塞门

Notes

1. While raising pantograph and turning on switch, the air pressure in control reservoir will drop greatly, so the main compressor must be inflated immediately to restore the normal working conditions under which air is supplied by the main reservoir.

   当升弓合闸后，控制风缸风压会急剧下降，所以，应立即启动压缩机组打风，尽快恢复正常运行工况，由总风缸供风。

2. When locomotive will run into operation again after a long time of stop, if the air pressure in the main reservoir is lower than 450 kPa and that stored in control reservoir 102 is lower than 450 kPa, only the auxiliary compressor set can be started to inflate air.

   机车库停放很长一段时间后，再次投入使用时，如果总风缸内风压因泄漏而已低于主断路器分合闸所需最低工作压力 450 kPa，而控制风缸 102 内储存风压大于 450 kPa，则需要启动辅助压缩机组打风。

Text 3

Auxiliary Pipe System

Auxiliary pipe system in SS_{4G} locomotive is mainly composed of sander, air horn, wiper

and its auxiliary pipes，as the fig 6-3 shows. The air of auxiliary equipment is directly supplied by main reservoir. When some equipment has malfunction or needs repair, its corresponding air supply cock can be closed to cut off air supply.

In order to increase the adhesion between rails, sanding equipment is set in SS_{4G} locomotives. Its four sand boxes are placed in side sill of the bogies. Each box has a volume of 100 L. The sanding equipment can not only accept the control by driver, but also co-operate with brake, anti-slide and broken coupler protection device. The pedal switch 35SA set under the driver's desk can directly control the sand valve at its end.

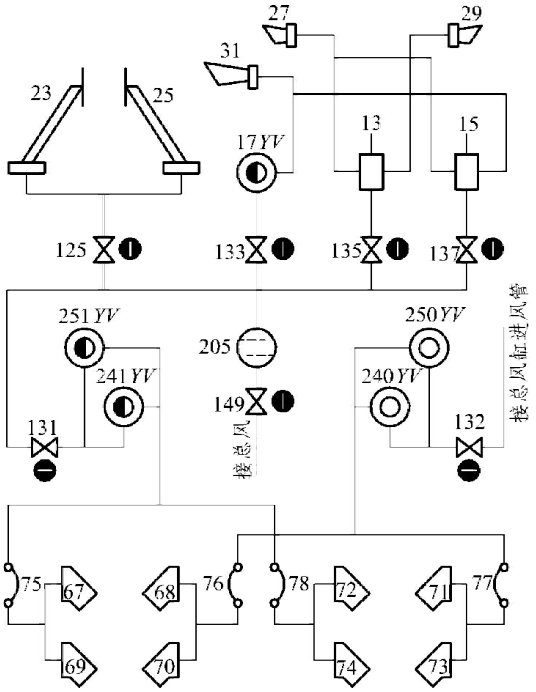

Fig 6-3　Auxiliary Pipe System

There are three air horns at the top of SS_{4G} locomotive's driver cab: one is forward high pitch speaker 27; one is backward high pitch speaker 29; the other is forward low pitch speaker 31. They are controlled by manual horn control valve 13 and 15 on the main and assistant-driver's desks and pedal switch 33SA under the driver's desk. When the control valve 13 on the main driver's desk is pushed forward, the forward high pitch speaker 27 will make noise; when backward, the backward high pitch speaker 29 will make noise. When the manual control valve 15 on the assistant-driver's desk is pushed forward, the forward high pitch speaker 27 will make noise; when backward, the forward low pitch speaker 31 will make noise.

If pedal switch 33SA is used, electro-pneumatic valve 17YV will be electrified, the total air will directly enter forward low pitch speaker and make noise.

There are wipers on the forward windows, and the wipers is divided into the left side and

right side. The right windscreen wiper is on the side of driver; the left windscreen wiper is on the side of assistant driver. The control valve which is mounted on the drivers desk is used to switch on and off wipers.

New Words and Expressions

sander ['sændə] *n*. 磨沙机；撒沙者

wiper ['waipə] *n*. 擦拭之物；刮水器

malfunction [mæl'fʌŋ(k)ʃ(ə)n] *vi*. 发生故障；不起作用

n. 故障；失灵；疾病

pedal ['ped(ə)l] *vi*. 踩踏板；骑车

n. 踏板；脚蹬子

manual ['mænjʊ(ə)l] *adj*. 手工的；体力的

n. 手册，指南

windscreen ['win(d)skri: n] *n*. 汽车挡风玻璃

air horn 气笛；扬声器

pedal switch 踏板开关

assistant driver 副司机

Notes

1. Auxiliary pipe system in SS_{4G} locomotive is mainly composed of sander, air horn, wiper and its auxiliary pipes.

   SS_4 改型电力机车的辅助管路系统由撒砂器，风喇叭，刮雨器和它们的辅助管路组成。

2. The sanding equipment can not only accept the control by driver, but also co-operate with brake, anti-slide and broken coupler protection device.

撒砂装置不仅受司机控制，而且也能与制动机，防空转滑行及断钩保护装置配合作用。

“not only …but also…”，“不但……而且……”。

Exercise 1

1. Answer the following questions according to the passage.

(1) According to its effect，how many working conditions can be divided of the SS_{4G} locomotive control pipe system ?

(2) What’s the air pressure in the main reservoir?

(3) Please describe the work path of the main reservoir under normal conditions.

2. Translate the following sentences into English.

（1）机车停放后，重新投入使用时，如果总风缸内风压因泄漏而已低于主断路器分合闸所需最低工作压力 450 kPa，而控制风缸 102 内储存风压大于 700 kPa。

（2）每次使用辅助压缩机后，应打开辅助风缸下方排水塞门排放积水。

（3）风源系统为电力机车和列车提供洁净、干燥、稳定的压缩空气，以确保列车制动和空气弹簧等有足够的压缩空气。