S.E. MECH.-APPLIED THERMODYNAMICS

CAPACITY CONTROL OF COMPRESSORS (PART OF UNIT 6)

COMPILED BY PROF. S. V. JOSHI

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In most installations, the demand for air is irregular and therefor some means of controlling the output of the compressor is necessary. The choice of control depends upon the character of the air load.

Practically all compressors have unloading devices, as these control devices are usually termed. They are actuated by the pressure on the discharge side of the compressor. A falling pressure indicates that air is being used faster than produced and more air is required. A rising pressure indicates that more air is being produced than is being used and therefore less air is required.

An air receiver is used to store high pressure air from the compressor. Its volume reduces pressure fluctuations arising from changes in load and from compressor switching.

Air coming from the compressor will be warm and the large surface area of the receiver dissipates this heat to the surrounding atmosphere. Any moisture left in the air from the compressor will condense out in the receiver, so outgoing air should be taken from the receiver top.

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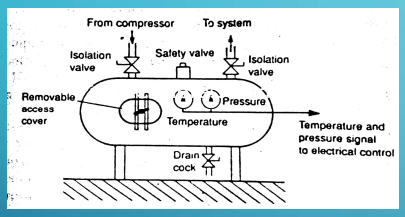

Fig. 1 Compressed air receiver

Fig. 1 shows essential features of a receiver. They are usually of cylindrical construction for strength, and have a safety relief valve to guard against high pressures arising from failure of the pressure control system. Pressure indication and usually temperature indication are provided, with pressure switches for control of pressure and high temperature switches for remote alarms.

A drain cock allows removal of condensed water, and access via a manhole allows cleaning. Obviously, removal of a manhole cover is hazardous with a pressurized receiver, and safety routines must be defined and followed to prevent accidents.

Air receiver size is determined by load requirements, compressor capacity and allowable pressure deviations in the receiver. Control of the compressor is necessary to maintain pressure in the receiver.

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Compressor capacity can be controlled by any of the below three methods –

1. Automatic start and stop control
2. Intake regulation
3. Exhaust regulation

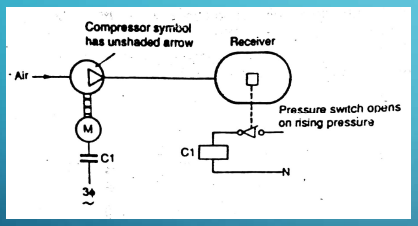

Fig. 2 Automatic start and stop control

Automatic start and stop control – Refer Fig. 2

In this method, the compressor is started when receiver pressure falls to some minimum pressure and stopped when receiver pressure rises to a satisfactory level again. A pressure switch is connected to the air receiver and as soon as the pressure in the receiver exceeds a pre-determined pressure, the electrical contact of the pressure switch is broken from the motor and the compressor stops working. But as the air pressure in the receiver goes down, the switch contacts to the motor are re-established and the compressor starts again. Air supply to the pressure switch is ensured by a separate pipe from the receiver.

This method of capacity control is used when the demand for compressed air is intermittent, i.e. when the compressor has significant spare capacity.

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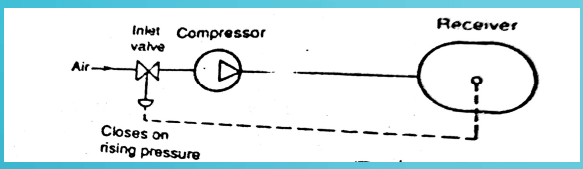

Fig. 3 Intake regulation

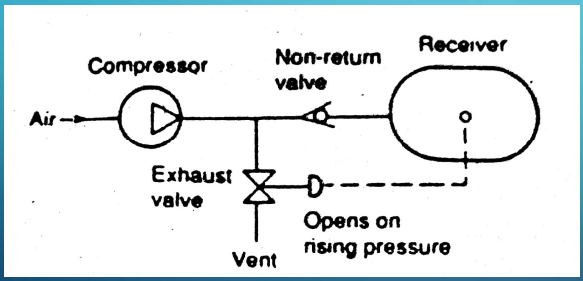

Fig. 4 Exhaust regulation

Intake regulation – Refer Fig. 3
In this method, an inlet valve is held open to allow the compressor to operate, and is closed when the air receiver has reached the desired pressure. The compressor then forms a near vacuum on its inlet side.

Exhaust regulation – Refer Fig. 4
In this method, the compressor runs continuously and an exhaust valve is fitted to the compressor outlet. This valve opens when the required pressure is reached. A non-return valve prevents air returning from the receiver.

Intake regulation or exhaust regulation is used when the demand for compressed air is fairly constant, i.e. when the compressor capacity and load requirements are closely matched.

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