Mechanical Equipment - Course 430.1

AIR SYSTEM

Compressed air is a major source of industrial power with many advantages. It is relatively safe, economical, easily transmitted and adaptable. Its adaptability is evidenced by the many applications of compressed air in NGS.

There are four main air systems. For your convenience, a chart has been prepared describing each air system. As shown in the Table 1, each system demands its' own discharge pressures and special requirements.

TABLE 1

SYSTEM	DISCHARGE PRESSURE	SPECIAL REQUIREMENTS	COMPRESSOR TYPE
1. Breathing Air	0.6 mPa(g) (80 psig)	oil free	screw, liquid ring.
2. Service Air	0.9 mPa(g) (130 psig)	-	Reciprocating piston.
3. Instrument Air			
H.P.	1.0 mPa(g) (140 psig)	oil free	PNGS - Self lubricated Reciprocating piston.
L.P.	0.6 mPa(g) (80 psig)	dry	BNGS - Lubricated Reciprocating piston with oil filter after compressor.
4. Switchyard Air	6.8 mPa(g) (1000 psig)	oil free very dry	Self-Lubricated Reciprocating piston.

AIR SYSTEM - SCHEMATIC

Producing compressed air involves a number of devices. A typical air system with the major components appears in Figure 1. A description of each follows:

(1) Filter/Silencer - The main function of the filter is to ensure dirt particles do not enter the compressor. This prevents excessive sludge buildup which would lead to equipment failure.

(2) Unloader Valve - Controls compressor capacity.

(3) Compressor - Manufactures compressed air.

(4) Intercooler - A heat exchanger that reduces the temperature of air after the first stage that reduces power required.

(5) Aftercooler - Another heat exchanger, water cooled, which reduces temperature of compressed air to:

(a) condense excessive moisture.
(b) decrease volume of air to increase storage of air in air receiver.

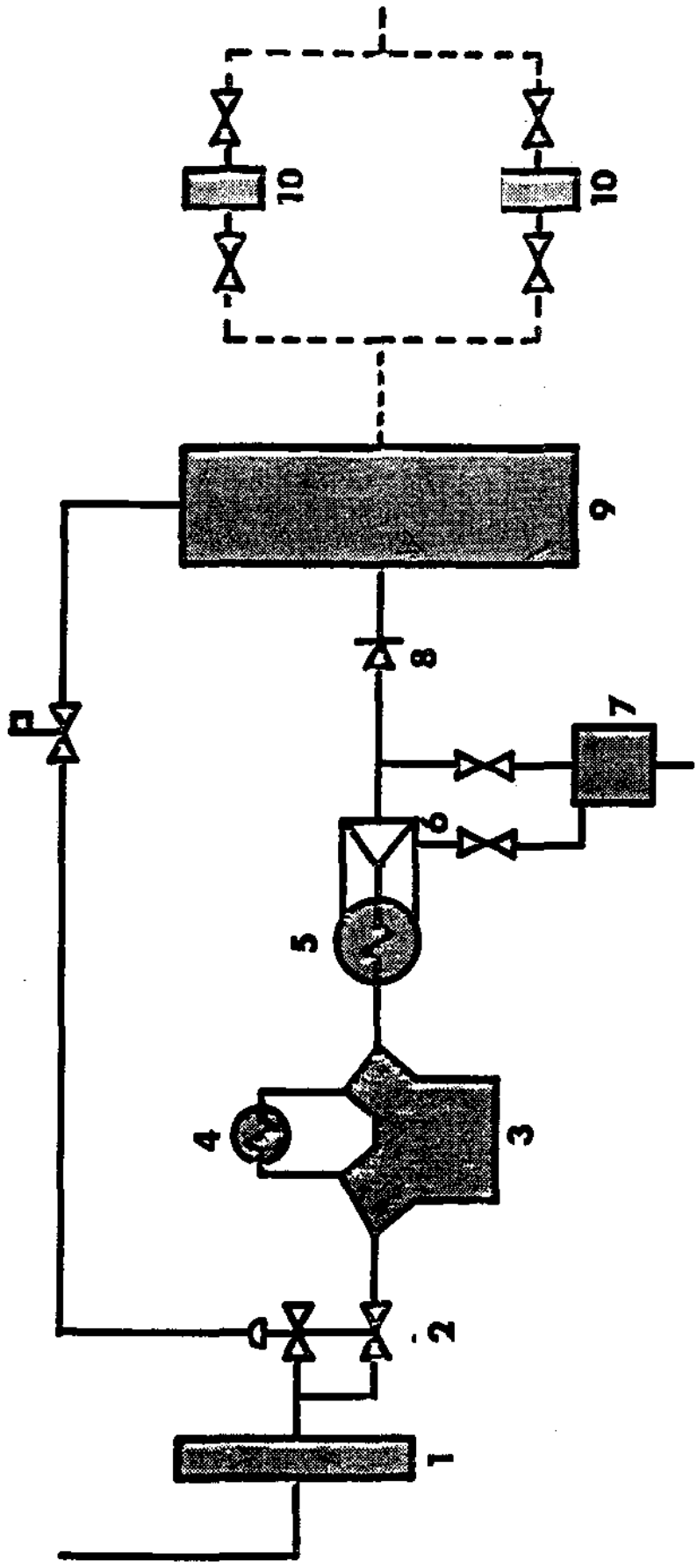
(6) Separator - A device which separates moisture from the compressed air.

(7) Trap - Allows moisture to drain from separator without compressed air leakage.

(8) Non-Return Valve - Prevents the escape of compressed air from air receiver through a stopped compressor.

(9) Receiver - A storage vessel for compressed air.

(10) Air Driers - Are used to produce very dry air. Most air driers are molecular sieve types.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COMPRESSOR CONTROL

Most of NGS air systems have varying demand characteristics. Occasionally, loads are heavy for only short time periods. Quite often, air system demand can be spread over longer time periods by use of receivers. In these circumstances, compressors may not be needed continuously.

Since capacity requirements do vary, some method of compressor control is essential. The method of control used by NGS is **automatic dual control** - a combination of unloading and ON/OFF process.

Unloading describes a process in which the compressor is operating but not compressing. There are three methods used in NGS to unload the compressors.

(1) Free Air Unloading
- with free air unloading, inlet valves are held open so that air discharge from the cylinder passes back into intake passages.
- usually found on 7" stroke compressors.

(2) Clearance Unloading
- used on compressors greater than 7" stroke.
- with clearance pocket unloading, the air is compressed into a clearance pocket when the piston travels in one direction and air returns to cylinder on the return stroke. Currently not used in NGS.

(3) Throttling Suction Air
- in this process, the air delivery is effected by throttling the inlet air whereby air delivery is completely stopped. Air present within compressor is then released to atmosphere.

The method of control used depends upon the type of compressor used. At Bruce NGS, for instance, throttling is used with screw type compressors, and free air unloading is employed in the instrument air - reciprocating piston compressors.

STARTING PROCEDURES

All compressors are unloaded before starting. Starting unloaded:

(1) reduces starting torque requirements. Since there is no compression at starting, power demands of the motor are reduced.

(2) enables the lubrication system to operate effectively before compression.

(3) enables the cooling water systems to operate effectively before compression.

ASSIGNMENT

1. Name the four air systems in NGS and describe the requirements of each.

2. Draw a typical air system showing the main components.

3. What method of compressor control is used in NGS?

4. Name and describe three methods of unloading.

5. How are compressors started? Why?

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