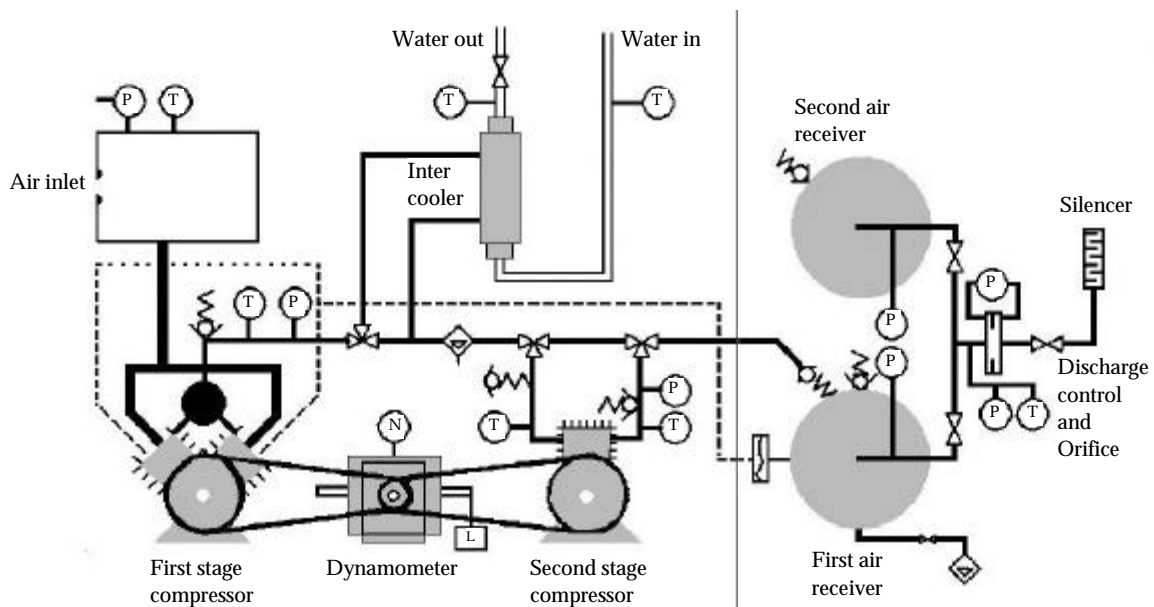


P9050 TWO STAGE RECIPROCATING AIR COMPRESSOR

INTRODUCTION.

Cussons P9050 Two Stage Reciprocating Air Compressor Test Set has been designed as a high quality educational test facility on which a wide range of controlled experiments can be undertaken on the performance of reciprocating air compressors and compressed air plant. The test set is a self contained unit comprising two main assemblies; an instrument and control console and a welded steel base frame which carries the dynamometer, air compressors and air receivers.

The two compressors are individually belt driven from a variable speed, swinging field DC dynamometer with torque measurement by strain gauge load cell. The drive system is arranged in such a way that the test set may be used as either a two stage machine or as a single stage machine with the second stage undriven and bypassed. The capacity of the delivery can be altered by connecting either one or both of the two air receivers whilst the delivered air flow can be varied over a wide range. Apart from its use for educational experiments, the test set may also be used in its single stage form as a compressed air supply for the laboratory.



DESCRIPTION

BEDPLATE ASSEMBLY

The bedplate is a welded steel structure on which is mounted the lower air receiver, dynamometer and the two compressor slide bases, while the bedplate itself is mounted on six flexible spring mounts which provide vibration isolation.

DYNAMOMETER

The dynamometer is a separately excited DC motor with the stator of the machine mounted in self aligning trunnion bearings. The dynamometer is fitted with torque arms, one of which connects to a strain gauge load cell for load measurement. A 100 tooth wheel is fitted at the non drive end of the machine where a magnetic pick-up feeds a pulse train signal to a "frequency to voltage" convertor for speed feedback/indication.

BELT DRIVE SYSTEM

Each compressor is mounted on an adjustable slide base allowing easy adjustment of belt tension. A single vee wedge belt is used to drive the compressor and the drive pulleys are mounted on the dynamometer shaft using 'taper lock' bushes. Three alternative second stage drive pulleys are available to enable different speed ratios to be achieved.

FIRST STAGE COMPRESSOR

The first stage compressor is an industrial twin-cylinder air-cooled machine with a bore of 70 mm and a stroke of 50 mm giving a capacity of 385 ml. The inlet valves are fitted with diaphragm-operated head unloaders which unload the compressor by holding the inlet valves open. The unloaders are connected to automatic pilot valves fitted to the lower air receiver which opens when the air pressure reaches a preset value. The delivery valve acts as a non return valve when the compressor is unloaded thus preventing discharge of the air receiver back through the compressor.

SECOND STAGE COMPRESSOR

The second stage compressor is a vertical single cylinder machine with a bore of 50 mm and a stroke of 70 mm giving a capacity of 137 ml.

WATER COOLED INTERCOOLER

A shell and tube heat exchanger is used in a counter flow configuration between the first and second stage compressors.

AIR RECEIVERS

Two horizontal air receivers each having a capacity of 250 litres are fitted each with a drain valve, safety relief valves, pressure gauge connection and delivery valve. The receivers are arranged so that the lower one is always used while the top one is available to double the system capacity when required.

INSTRUMENTATION AND CONTROL CONSOLE

The instrument and control console comprises a welded steel framework which supports a sloping desk at the front and two instrument/control panels. The following instrumentation is included:

Speed - digital with analogue trend
Torque - digital with analogue trend

Temperatures - 10 way digital indicator

- 1 Air inlet
- 2 First stage outlet
- 3 Second stage inlet
- 4 Second stage outlet
- 5 Discharge
- 6 Intercooler water inlet
- 7 Intercooler water outlet

Pressures - bourdon tube gauges

- 1 First stage discharge
- 2 Second stage discharge
- 3 Lower air receiver
- 4 Upper air receiver
- 5 Discharge

Air inlet flow rate - orifice plate and manometer

Discharge flow rate - orifice plate and manometer

EXPERIMENTAL CAPABILITIES

The twin cylinder first stage compressor is fitted with pressure operated off-loading devices on the inlet valves so that the performance of a single stage compressed air system with an air receiver and with variable demand can be fully investigated. By changing the compressor speed the relationship between the intake volume flow rate, the air receiver volume and delivery flow rate can be examined for various duty cycles. As a two stage system the effect of capacity ratio between the two stages on the inter stage pressure may be investigated by altering the second stage drive ratio. The effect of intercooling may also be examined.

The air delivery characteristics of an air compressor may be evaluated, in particular the variation of air delivery with pressure and compressor speed.

The compressors are provided with the necessary modifications and fittings for use with Cussons P4600 Electronic Engine Indicating & Combustion Analysis System for Gasoline & Diesel. The use of this equipment allows a full dynamic analysis of cylinder pressures including Pressure/Volume diagrams.

SERVICES

Cooling water:- 15 mm OD tube connection.

Electrical supply:- 380-415V/3ph/50 Hz rated 40 amps per phase. (Alternative voltages/frequencies can be supplied.)

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