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Design and Development of Safety Valve Testing Equipment

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Abstract: Safety valves are widely used as the safety device in pressure systems, such as medical oxygen tanks , boilers and pressure pipes, to ensure the safe operation of pressure systems. At present, the inspection of safety valves is mainly carried out by manual operation or semi-automatic operation, and it requires a lot of manpower operation costs. Moreover, the measurement of different pressure ranges is performed using only a single pressure sensor such that the test precision is insufficient. In this study, a high-precision safety valve test with four testing channels(socket) was proposed, and an manual man made testing system was developed. In this system, the user can define the test specifications through parameter setting. The system can manually execute the complete test control process and judge whether the test was passed based on the measured data. In this project for the low, middle, and high test pressures, the safety valves of four different states were tested respectively and the test reports were parameter noted . Finally, it statistically analyzed the test results for the diagnosis of the safety valve failure. Therefore, the results of this research may effectively solve the problems of current safety valve testing and improve its operational efficiency and test quality.All materials used in the fabrication of this machine are of standard specification and locally sourced. The equipment also eliminated dependency on the 3rd party, reducing testing valve cost. This machine eliminates the problems and limitations to a greater extent. In this way the production rate increases, time saving as compared to dependency on 3 rd party.

1. INTRODUCTION

Safety valves are widely used as the safety device in pressure systems, such as boilers and pressure pipes, to ensure the safe operation of pressure systems. At present, the inspection of safety valves is mainly carried out by manual operation or semi-automatic operation, and it requires a lot of manpower operation costs. Moreover, the measurement of different pressure ranges is performed using only a single pressure sensor such that the test precision is insufficient. In this study, a high-precision safety valve test architecture with three testing channels was proposed, and an automated testing system was developed. In this system, the user can define the test specifications through parameter setting. The system can automatically execute the complete test control process and judge whether the test was passed based on the measured data. In this article, for the low, middle, and high test pressures, the safety valves of four different states were tested respectively and the test reports were automatically generated. Finally, it statistically analyzed the test results for the diagnosis of the safety valve failure. Therefore, the results of this research may effectively solve the problems of current safety valve testing and improve its operational efficiency and test quality.In every industry safety

valve are use for equipment safety for machine ,human & pipeline.The purpose of the performance test of the safety valve is to determine the characteristics of the valve before operation.A safety valve is a valve that acts as a fail-safe. An example of safety valve is a pressure relief valve (PRV), which automatically releases a substance from a boiler, pressure vessel, or other system, when the pressure or temperature exceeds preset limits. Pilot-operated relief valves are a specialized type of pressure safety valve. A leak tight, lower cost, single emergency use option would be a rupture disk.

Safety valves were first developed for use on steam boilers during the Industrial Revolution. Early boilers operating without them were prone to explosion unless carefully operated.
Vacuum safety valves (or combined pressure/vacuum safety valves) are used to prevent a tank from collapsing while it is being emptied, or when cold rinse water is used after hot CIP (clean-in-place) or SIP (sterilization-in-place) procedures. When sizing a vacuum safety valve, the calculation method is not defined in any norm, particularly in the hot CIP / cold water scenario, but some manufacturers [1] have developed sizing simulations.

Any pressurized system requires safety devices to protect people, processes and property. This details situations when over pressure may occur, the wide and often confusing types of device on offer, how such devices operate and the many codes, standards and approval authorities to note.

PROBLEM DEFINATION
Identifying problems with safety valve equipment involves thorough inspection and testing for issues like leaks, corrosion, mechanical damage, and improper operation. Common problems include inadequate sealing, overpressure, or failure to open/close properly. Regular maintenance and testing protocols help detect and address these issues to ensure the safety valves function effectively when needed.

OBJECTIVE
To reduce safety valve testing time.

To improve working capacity of process.

To increase plant efficiency.

Decrease the maintenance of safety valve.

To reduce human hazard & healthy enviorment for work.

Describe manual testing procedure for safety valves.

To reduce plant breakdown time.

BLOCK DIAGRAM

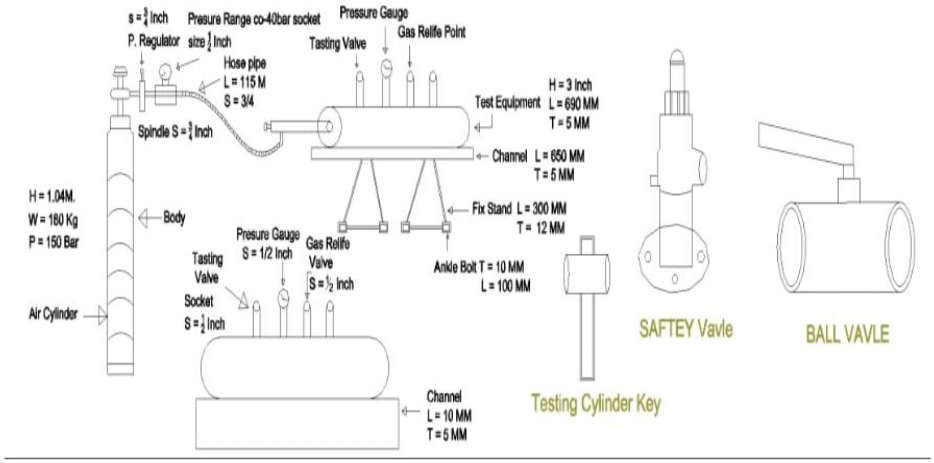

Fig. Safety valve testing equipment

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Fig 1-Block diagram of safety valve testing equipment

Block diagram description: Pressure Source: A pressure source, often a pump or compressed gas cylinder, is used to generate the test pressure.

2. Pressure Gauge: A pressure gauge is connected to the pressure source to measure the test pressure accurately.

3. Valve Under Test: The safety valve being tested is connected to the testing device.

4. Control Valves: These valves are used to control the flow of fluid into the safety valve during the test.

5. Data Recorder: A data recorder may be included to record the test results, including test pressure and valve performance.

ADVANTAGES

The primary advantage of safety valve testing is that it helps ensure the safe & reliable operation of pressure vessels and pipeline.
Operator can help prevent equipment failures, leak and other potentially hazardous incidence.
Fuel cost and testing time reduce as during valve test no need to over pressurize the boiler/system.
Valve seat erosion will be reduce.
Economical beneficial due to reduce maintainance cost & increase working efficiency.

DISADVANTAGES

One disadvantage of safety valve testing equipment could be its initial cost. High-quality testing equipment can be expensive to purchase and maintain, which might be a barrier for some companies. Additionally, depending on the complexity of the equipment, it could require specialized training for personnel to operate effectively, adding to the overall cost.

APPLICATION

In steam system safety valve typically use for boiler,over pressure,protection and other application such as downstream of pressure reducing controls.
It is also use process operation to prevent product damage due to excess pressure.
To control or limit surges of pressure within pipelines, acting as protection for the system & defending against instrument failure.

2. REFERENCE

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