

IMPROVEMENT OF LEAK TESTING MACHINE FOR ENGINE VALVE

Amit R. Mahale¹, Suraj R. Wable², Shrikant A. Kothavade³,

Ganesh V. Shelar⁴, Prof. D.S. Patil⁵

^{1,2,3,4,5}Mechanical Department, LoGMIEER (India)

ABSTRACT

Leak Testing Machine which is an Pneumatically Powered System used for Leak testing of an Engine Valve. The System consist of a Lever which forces valves against the Specially Designed Die Surface having absolutely high surface finishing in order to develop an air tight contact in between Die and valve surface. This done by introducing grippers and some pneumatic arms which is help to pick the engine valve from conveyor line and place properly in the die cavity. An air of certain pressure is maintained within die for checking leakages.

Keywords: CLU , DPU, FRL, MCU,

I.INTRODUCTION

In present condition the leak testing machine have more cycle time because they have to check valve dimension initially by using gauge and then selected valves are checked for leakage in leak testing machine. Also the operation was less safe because there are more chances of entrapment of operators hand in between die and lever and more difficult for operating in operators point of view. In present condition The leak detection machine for engine valve is pneumatically operated machine for engine valve.in which the engine valve checking for any manufacturing defect causing a valve to be leak. The machine consist of pressure die (female die) machine control unit, actuator, lever (male die).In which female die is placed on work table i.e. cylindrical die cavity and male die is placed vertically on the top surface of male die which is like pneumatic cylinder. when the engine valve is placed on into the die cavity by operator and when the switch is press then the pneumatically operated lever is comes down and press the valve against die cavity.at the time on the machine control unit shows the pressure inside the cavity and if leakage is available then indicate valve is leak or not.Then the accepted jobs again recover by the operator and placed in the trolley. If the engine valve is defective then machine control unit shows on its display the pressure of compressed air inside the die cavity is lower and indicate red signal for work piece is defective.But the main drawback is the operator fatigue and increases the cycle time of the process so there is the effect on the production quantity. The main purpose of our project is improved safety, reduced cycle time, study and development of leak testing machine for engine valve.

II. HEADINGS

1. Working principle of existing system.
2. Components of existing system.
 - 2.1 screw compressor, 2.2 direction control valve, 2.3 FRL unit, 2.4 Double acting reciprocating actuator, 2.5 Machine control unit. 2.6 one workstation. 2.7 Pressure die and gauge. 2.8 Solenoid Valve.
- 3 working of improved system.
4. Additional components of improved system.
 - 4.1 Cam operated Actuator, 4.2 Two workstation, 4.3 Proximity sensor, 4.4 New die design.
5. Die design.

III. INDENTATIONS AND EQUATIONS

3.1 Working of existing system

The machine consist of pressure die (female die) machine control unit, actuator, lever (male die). In which female die is placed on work table i.e. cylindrical die cavity and male die is placed vertically on the top surface of male die which is like pneumatic cylinder. when the engine valve is placed on into the die cavity by operator and when the switch is press then the pneumatically operated lever is comes down and press the valve against die cavity. at the time on the machine control unit shows the pressure inside the cavity and if leakage is available then indicate valve is leak or not. Then the accepted jobs again recover by the operator and placed in the trolley. If the engine valve is defective then machine control unit shows on its display the pressure of compressed air inside the die cavity is lower and indicate red signal for work piece is defective.

Screw compressor:

The capacity of Screw compressor is 100 PSI. Initial pressure required for the checking of valve is $11.3\text{psi} \pm 0.5\text{bar}$ and maximum pressure drop during the testing 0.5psi in 5 second.

Direction control valve:

The main function of Direction Control valve is to control the direction of flow of the Air which decides the direction of motion of Double acting reciprocating Actuator. In this system 4/2 DCV, 5/2 DCV, 2/2 DCV are used.

FRL unit:-

There are three main components in FRL unit as discussed below:

pneumatic filter is a device which removes contaminants from a compressed air stream. Pressure regulator: primary function is to match the flow of gas through the regulator to the demand for gas placed upon it, whilst maintaining a constant output pressure. pneumatic lubricator Injects an aerosolized stream of oil into an air line to provide lubrication to the internal working parts of pneumatic tools, and to other devices such as actuating cylinders, valves and motors.

Double Acting Reciprocating Actuator:-

Double Acting Cylinders are equipped with two working ports-

one on the piston side and the other on the rod side. To achieve forward motion of the cylinder, compressed air is admitted on the piston side and the rod side is connected to exhaust. During return motion supply air is admitted at the rod side while the piston side volume is connected to the exhaust. Force is exerted by the piston both during forward and return motion of cylinder.

Machine Control Unit:-

The machine control unit (MCU) is a microcomputer that stores the program executes the commands into actions by the machine tool . The MCU consists of two main units : the data processing unit (DPU) and the control loops unit (CLU). The DPU software includes control system software, calculation algorithms, translation software that converts the part program into a usable format for the MCU, interpolation algorithm to achieve smooth motion of the cutter, editing of part program (in case of errors and changes) . The DPU processes the data from the part program and provides it to the CLU which operates the drives attached to the machine lead screws and receives feedback signals on the actual position and velocity of each one of the axes . A driver (dc motor) and a feedback device are attached to the lead screw. The CLU consists of the circuits for position and velocity control loops, deceleration and backlash take up, function controls such as spindle on/off . Machine Tool The machine tool could be one of the following : lathe, milling machine, laser, plasma, coordinate measuring machine etc . that a right-hand coordinate system is used to describe the motions of a machine tool . There are three linear axes (x,y,z), three rotational axes (i,j,k), and other axes such as tilt (θ) are possible . For example, a 5-axis machine implies any combination of x,y,z, i,j,k, and θ .

One Workstation:-

In an existing leak testing machine there is only one station to check the leakage of an engine valve. Also it has separate die and gauge units which consumes more time for checking the valve.

Pressure Die and Gauge:-

Pressure die is a female component in the leak testing system in which valves are placed for checking of leakages. In an initial stage valves are put into the gauge for checking the dimensions and then accurate valves are only given to the next stage of checking that is in die otherwise valve is rejected.

Solenoid Valve

The solenoid valve has the most simple working principle. The medium flows through a small orifice which can be closed off by a plunger with a rubber gasket on a bottom. A small spring holds the plunger down to close the valve. The plunger is made up of a ferromagnetic material.

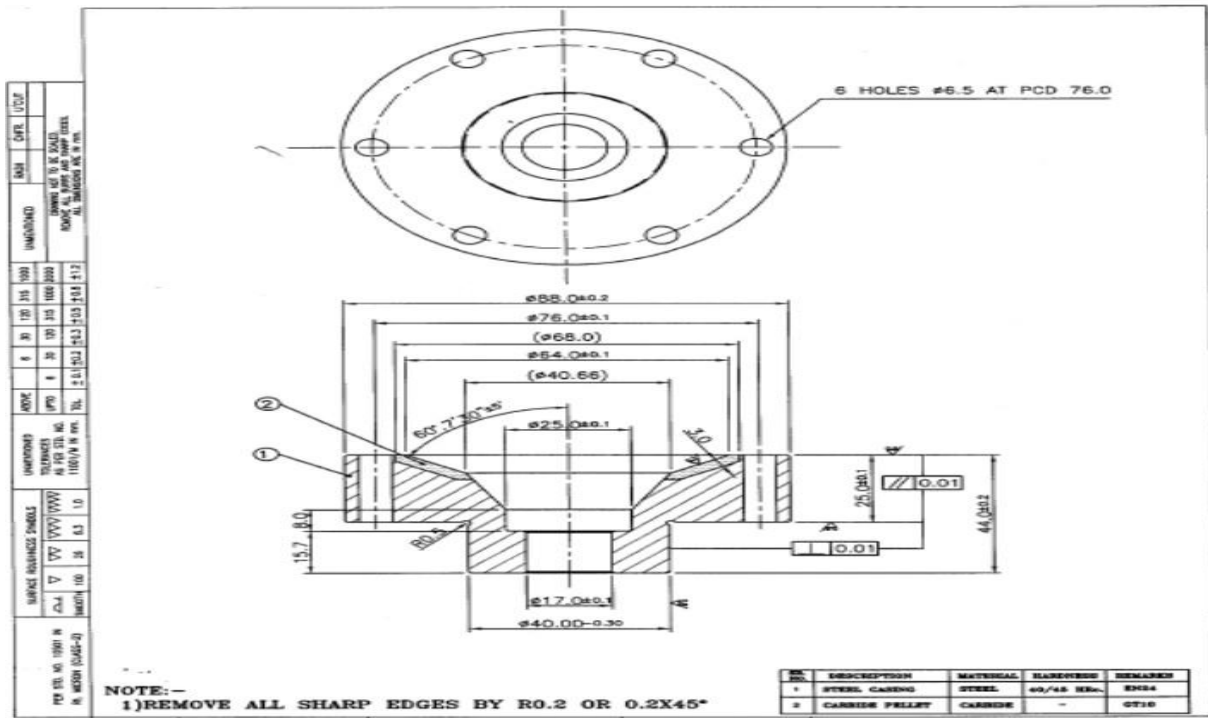


Fig 1. Existing system Die Design

3.2 Working of improved system

In improved Leak testing machine to increase the productivity of machine we use two stations instead of one. Also to increase the operator safety we replace the Reciprocating Double acting actuator with Cam operated Rotating actuator. In order to improve safety of operator we fix the Cam operated actuators on base of the machine instead of column and the push buttons should be simultaneously operated by operator to avoid accidents. Until the rejected valve is placed in a rejection box, next valve is not getting checked, so we can avoid the mixing of accepted and rejected valves.

IV ADDITIONAL COMPONENTS OF IMPROVED SYSTEM

4.1 Cam operated Actuator

Cam operated actuators are rotary actuators. Cam is used to generate a rotary motion to the lever of an actuator.

4.2 Two workstation

In improved design of leak testing machine we increase the number of stations for checking of valves which is helpful to increase the productivity of machine.

4.3 Proximity Sensor

A proximity sensor is a sensor able to detect the presence of nearby object without any physical contact. A proximity sensor emit a electromagnetic field or beam of electromagnetic radiation and looks for changes in field or return signal. In leak testing machine inductive proximity sensor is used.

4.4 New Die Design

In a new die design we don't have to check the valve by using the gauge initially that is valves which are within tolerance limits then and then it can fit into the die, otherwise it cannot fit into the die, so individual checking of dimension and leakages is avoided.

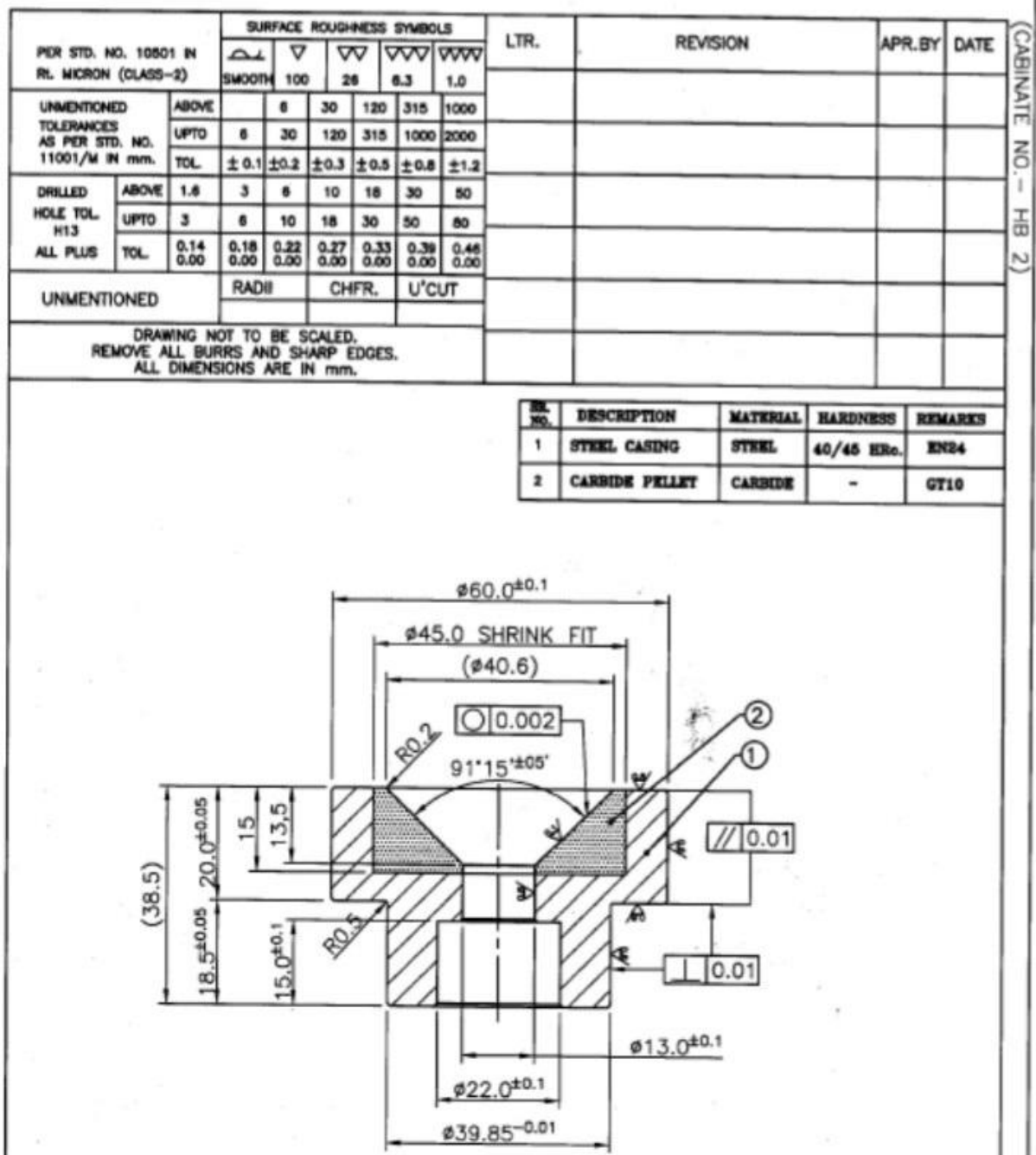


Fig. 2 New Die Design

IV.FIGURES AND TABLES

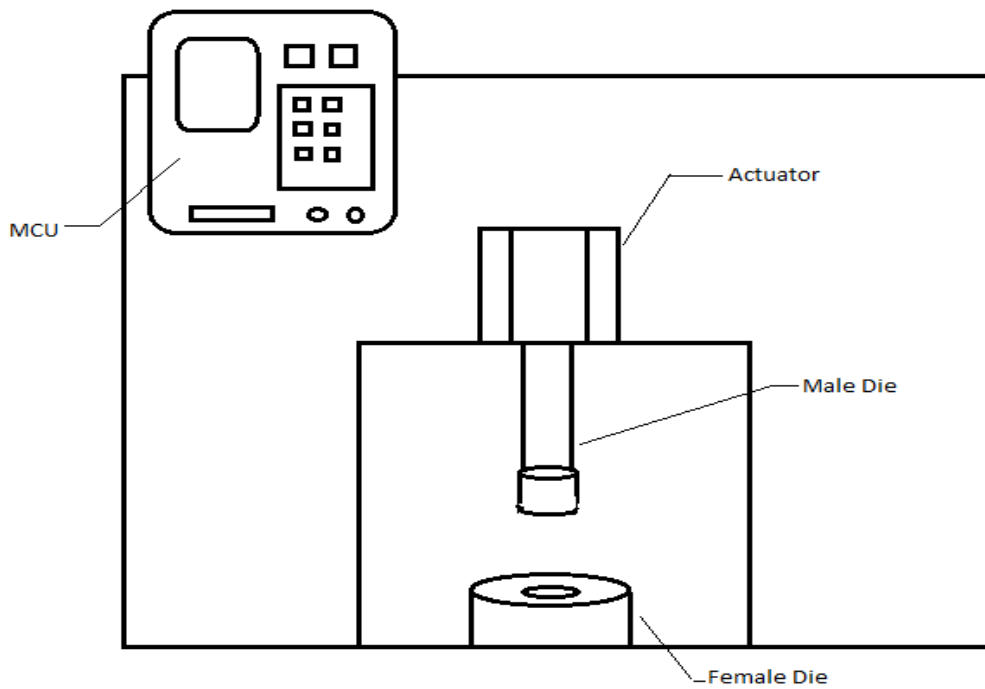


Fig. 3 Line Diagram of Existing Leak Testing Machine

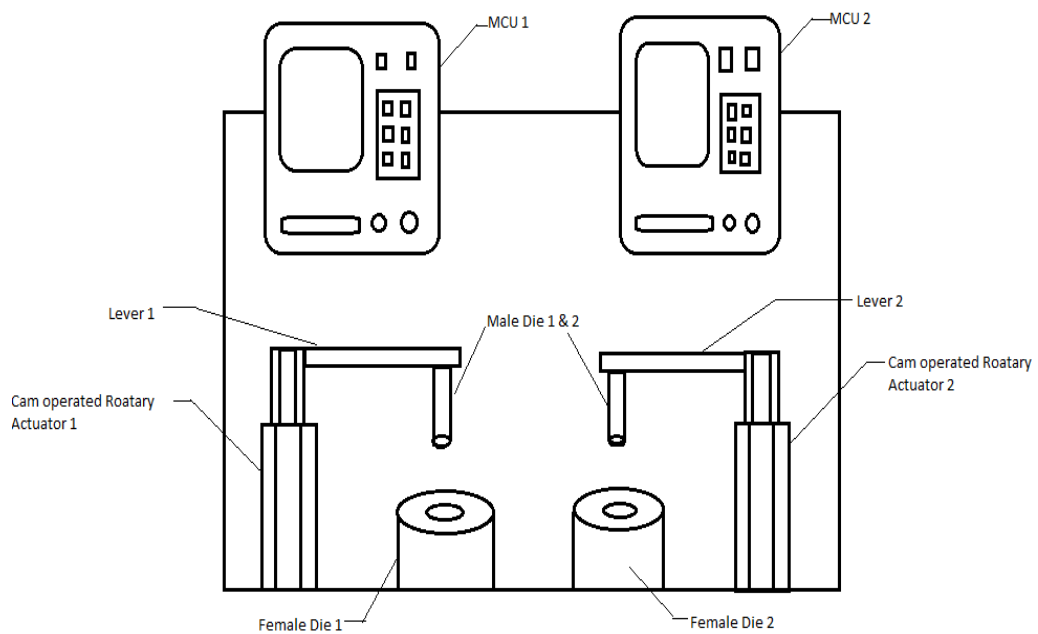


Fig. 4 Line Diagram of Improved Leak Testing Machine

Table: Result of Existing and New System

Parameters	Existing System	Improved System
Number of Valves Checked at a time	1	2
Clamping Time	1 sec	1 sec
Testing Time	2 sec	2 sec
Exhaust Time	0.5 sec	0.5 sec

V.CONCLUSION

We conclude that New Improved Leak Testing Machine have more productivity as compare to the existing leak testing machine and it is much more safer than the existing leak testing machine because in this system there are two push buttons which must be operated simultaneously then the operation can be done. Hence there is no chances of accidents. Also no possibility of accepting the faulty valves. But the limitation is the increase in cost of the system because of increase in number of components. This machine is very useful for precise checking of an engine valves.

REFERENCES

- [1]Mr.Yuvraj K Lavhale¹, Prof. Jeevan Salunke had been done research on “Overview of failure trend of inlet and exhaust valve”,In International Journal of Mechanical Engineering and Technology (IJMET), ISSN 0976 – 6340(Print), And technology(IJMET) ON MARCH 2014,VOLUME 5, ISSUE 3.
- [2]Mr. Rahul Pulkurte, had done reaserch on topic “Cycle time reduction in assembly line through layout improvement, ergonomics analysis and lean principles”.In Journal of Applied Sciences and Engineering Research, Vol. 3, No. 2,on February 2014
- [3]Mr.Rajiv.K.S1,et.al had been focus on, “Optimization of Governor Cover Leakage Testing Process to Reduce the Rejection Rate at the Customer End”. In IJSRD, “International Journal for Scientific Research & Development”, Vol. 2, Issue 05, 2014 | ISSN (online): 2321-0613.reserved by www.ijrsrd.com 582
- [4]Mr. Rehan ahmad et.al had been done research on had been focus on, “Automatic Leak Detection and Numbering System for Automobile Industry”,In IJCTA Vol 3 (3), 1285-1288 on MAY-JUNE 2012 / 1285 ISSN:2229-6093.
- [5]Mr.Donald T. Soncrant at elhad been focus on leak detection test machine In “International Journal of Engineering Research and General Science”, on April-May,2014 Volume 2, Issue 3, ISSN 2091-273053

Books:

- [1] S.R. Majumdar , Oil Hydraulic System Principles and Maintenance, McGraw Hill- 2001.
- [2] Anthony Esposito, Fluid Power with Applications, sixth Edition- 2003.
- [3] V.B. Bhandari, Design of Machine Element, McGraw Hill, third Edition- 2010.
- [4] R.K. Jain, Machine Design, Khanna publication- 2013.