

## **Integration of Two Pokayoke's for O-ring Detection & Nozzle Projection**

Sagar H. Atram<sup>1</sup>, Ganesh G. Gaikwad<sup>2</sup>, Tejas S. Joshi<sup>3</sup> & A.R.Kaushik<sup>4</sup>  
<sup>1,2,3,4</sup>(Department of E&TC, KVNNIEER, SPPU, Nasik, India)

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**Abstract :** *The injector is likely to be said as an heart of any engine which contributes in injecting fuel with desired specification. The injector manufacturing involves various discrete processes. Within view to recent customer complaints of o-ring missing and inaccurate nozzle projection possessing an error percentage of two percent for which the traditional manufacturing processes misses the mark/comes to grief thereby in order to prevail over these drawbacks system integration is proposed, wherein o-ring detection and nozzle projection is done in one process cycle, which not only detects o-ring but also computes exact nozzle projection of required specification with respect to thresholds preset. The system integration minimizes human errors if any as it does not allow any bypass of faulty product.*

**Keywords:** *Injector, engine. Threshold.*

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### **I. Introduction**

The injector injects fuel into the engine with required specification. Precise amount of fuel with accurate pressure needs to be sprayed into engine in order to obtain maximum efficiency. The injector must be properly manufactured to serve this purpose. Within view to recent customer complaints such as oring missing and inaccurate nozzle projection for the injector.

The traditional manufacturing processes of injector that comes to grief to keep up with customer requirements thereby the system integration is proposed. The system design involves integration of two pokayoke's namely oring detection and nozzle projection that utilizes Japanese working principle of continuous improvement named Kaizen. The error proofing technique called pokayoke is employed to successfully meet the customer requirements.[1]

#### **1.1 What is Kaizen**

Kaizen is the Japanese philosophy for "continuous improvement", which is based on "5S" concept,[2,3]

- a) Seiri (organization)
- b) Seito (order)
- c) Seiso (cleanliness)
- d) Seiketsu (consolidation)
- e) Shitsuke (discipline)

Kaizen plays a vital role to achieve the company's objectives such increase in productivity, obtain competitive advantage and to raise the overall business performance on a tough competitive market over the globe.[2,3]

#### **1.2 What is Pokayoke**

Pokayoke is Japanese technique which means "resistance to errors"(mistake-proofing). Various pokayoke devices are employed so as to influence and promote the quality of product without any deviation. Pokayoke is based on principle of 'reduction in variability', which deals with the identification and elimination of causes for deviations in relation to target values and tolerance limits. This is an important principle because it is interconnected with production management principles. The manifestations of variability in practice range from delays in schedule to dimensional errors in product. Whenever a process is subject to variability, all other performance aspects of that process will vary as well. Even slight variations in quality can influence the customer's perception of the overall quality.[4,5]

#### **1.3 Objective of System Integration**

The functional objectives of system design are,

1. No bypass of faulty injector part

2. Controlled fuel flow
3. Guaranteed delivery with desired specifications

#### 1.4 Benefits of System Design Proposed

There are two significant improvement

1. No or minimization in human errors due to automation
2. Greater horizon of accuracy and efficiency

### II. System Integration

The system integration involves oring detection and nozzle projection of injector manufacturing process.

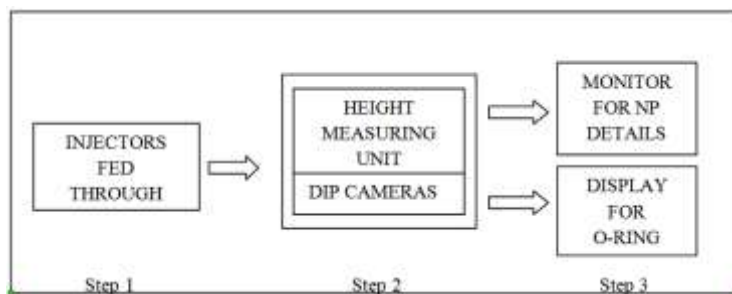


Fig 1: Block Diagram for System Integration

#### 2.1 Procedure for implementation

Step1). The injectors are fed through the conveyor belt to system integration.

Step2). In one system cycle two processes are done i.e.;

(2.a). *Oring Detection*-it is done using digital image processing technique.

(2.b). *Nozzle projection*-It is computed using height measuring unit.

Step3). Monitors displays the results of nozzle projection as well as oring detection.

#### 2.2. Oring Detection

For the oring detection process DIP cameras are employed. The image processing is done depending upon the real time image captured which is compared on brightness with the reference image fed primarily with the threshold level. The threshold is set to 60% and above it injector part is accepted. The image comparison results are displayed over monitor. If the brightness is found to be 60% or more then the oring is present and is of desired specification else it is rejected.

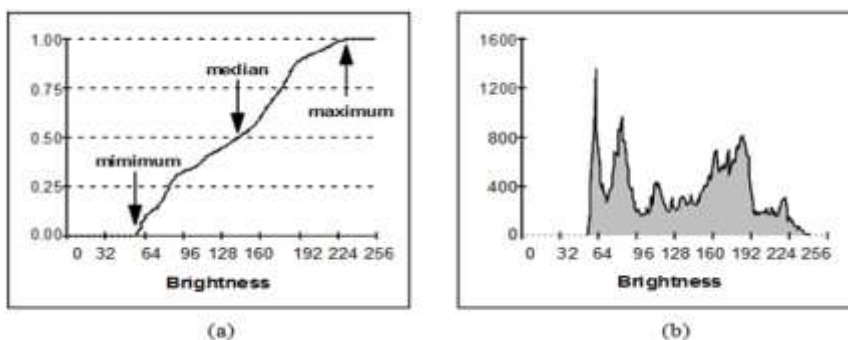


Fig 2: Brightness comparison result

#### 2.3 Nozzle Projection

The height measuring unit is used to compute the nozzle projection. Threshold reading of injector is fed depending upon the required specification. The results are then computed using this threshold reading and the obtained computed measurements of the nozzle of injector.

**2.4 Working**

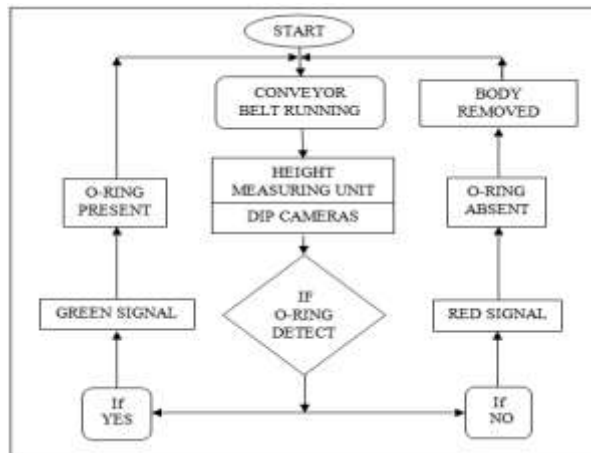


Fig 3: Flow diagram

**2.5 Result and Analysis**

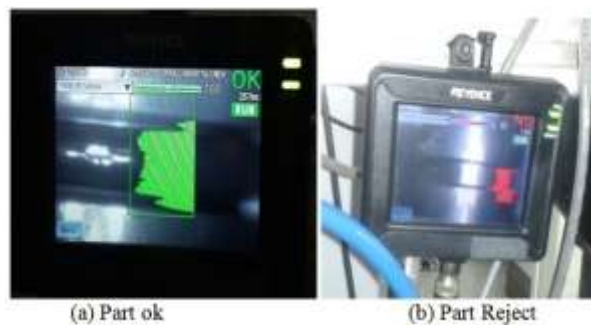


Fig 4: Results for oring

**III. Conclusion**

On implementation of Integration of two pokayokes for oring detection and nozzle projection

1. Minimizes human errors
2. To meet the customer requirements i.e. guaranteed delivery with desired specifications.
3. Proper fuel injection.

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