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Review paper on geometrical dimension and tolerances of ss316 material during face milling operation of rupture disk

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Abstract- **In the chemical and petrochemical industries pressure relief devices specially rupture disks or Burst disks protects the vessels and pipes against overpressure. In this precisely opening and working of rupture disk (known as burst disk also) becomes necessity. The opening of a rupture disk is stochastic process, depending on the manufacturing process of the disk. Generally this area cannot be predicted precisely. For typical industrial rupture disk vent line systems, significant errors can be made by applying current sizing methods. Sizing method also needs to evaluate its gd&t parameters. Rupture disk surface flatness and surface roughness performs great deal of its success. So there is strong need for experimental data reliable validated sizing method of rupture disk.**

Index Terms- **vertical milling centre, flatness, surface roughness, face milling,**

I. INTRODUCTION

A rupture disc, also known as a pressure safety disc, burst disc, bursting disc, or burst diaphragm, is a non-reclosing pressure relief device that, in most uses, protects a pressure vessel, equipment or system from over pressurization or potentially damaging vacuum conditions.

Rupture disks are made of many materials and different sizing as per

Fig1 : Rupture disk[12]

Rupture disks are made of many materials and different sizing as per pressure operating requirements. Like, aluminum alloys, graphite, rubber etc. But most commonly stainless steel material rupture disks are used.

II. WORKING PRINCIPAL OF OPERATION

A. Principal of operation

A rupture disk is a sensitive relief device designed to rupture at a pre-determined pressure and temperature. It is a means of providing protection for personnel and equipment. As such, it must be a fail-safe device. Rupture disks are used where instantaneous and full opening of a pressure relief device is required. These devices are also utilized where "zero" leak-age is required of a relief device. These devices can also be used in series as “Quick opening valves”.

When the system pressure over reaches the rupture disk yield strength(which is specified on rupture disk tag by the manufacturer) rupture takes place on the disk, and the substance carried by the system released the pressure.

B. Importance of dimensions and tolerances in rupture disk

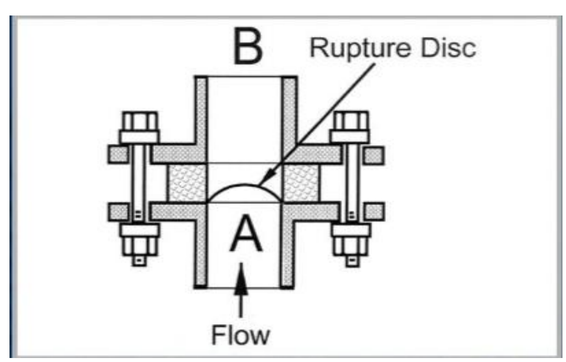

Fig 2: Rupture disk working principle [11]

Rupture disc essentially joins between the two flanges, with the help of preassembly screw, augment pin, and hook. It should be properly installed between the flanges, if not than leakage occurred, which results in heavy loss of substance, machinery and cost. It might also leads towards the unnecessary accidents, which even hazardous for human lives.
In this scenario, proper dimensions and tolerances important, if the tolerances are not match with the limit, failure of rupture disk might happen, or could say that rupture might not take place instantaneous at desired pressure.
So, the proper dimension and tolerances are the most essentiaty for rupture disc.

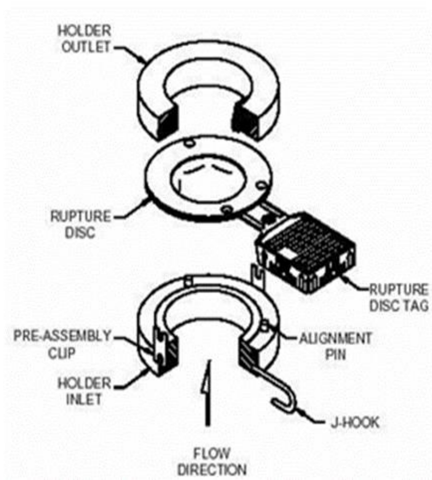

Fig 3: Rupture disk and parts schematic drawing

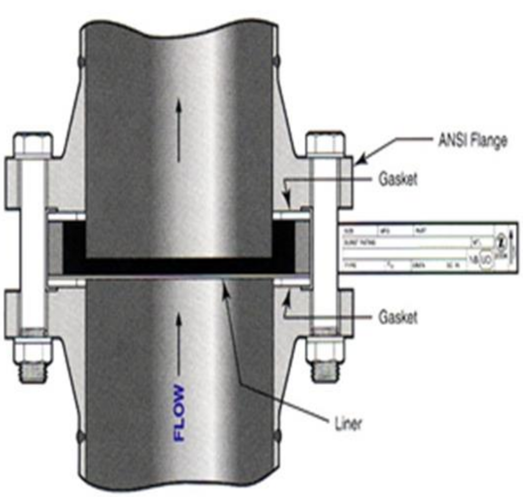

Fig4: Installed rupture disk[13]

III. FACE MILLING OPERATION

Face milling operation is used widely in the industry. In the case of rupture disk, face milling operation is used to get best surface quality and further finishing work.
In the rupture disk smoothened surfaces are necessary, for leak proof installation. To obtain this good surface quality face milling operation is used to carried out on the rupture disk.

IV. LITERATURE REVIEW

Ajay et al [1] investigated the effect of milling parameters such as feed(50,275,500)mm/min, spindle speed(700,1350,2000)rpm, depth of cut(0.1,0.3,0.5)mm on surface roughness and material removal rate errors in milling of EN45(steel alloy) using end mill cutter. Their results shows that , optimal combination of milling parameters such as feed of 275mm/min, spindle speed of 1350rpm, depth of 0.30mm for required maximum material removal rate and minimum surface roughness.
Madiri Samuel sukumar et al [2] analysis of multi responses in the face milling with the help of taguchi method with process parameters such as coolant (dry, kerosene, soluble oil), feed mm/rev (315,500,800), spindle speed (900, 1120, 1400) depth of cut (0.8, 1.0, 1.2) and concludes that coolant is moderately, speed mostly, feed rate very least and depth of cut least affected on the surface roughness.
K nadolny et al [3] concludes that flatness could not be achieved before smoothing the surface on austenitic stainless steel work piece. He carried out milling, grinding and smoothing operations on the austenitic stainless steel, and concludes that milling operation gives less flatness deviations and most smoothing surface.
Than tun aung et al [4] carried out conventional machining and high speed machining operations with the radial and axial depth of cut and concludes that high speed machining with high axial depth of cut, cutting speed and feed rate should be used to ensure better surface quality and maximize production.
A.B. Abdulla et al [5] studied to develop analytical based surface roughness technique, and concludes that feed rate is the most important cutting parameter for determining the machined surface roughness, when end milling aluminum plate. This is followed by the cutting speed and depth of cut. The sensitivity result

was verified by experimental analysis, which was showing that percentage deviation in analytical and experimental method is less than 10%.

Alpesh et al [6] The goal is the prediction of surface roughness by ANN (Artificial nueral network) wirh studying feed rate, cutting speed and depth of cut. And identifies minimum surface roughness value 0.18, while feed is 0.03 mm/tooth, cutting speed is 140 m/min and 0.1 depth of cut. Concludes that surface roughness increases as the feed rate increases.

Phillip et al [7] taguchi optimization method was applied to find the optimal process parameter, which minimizes the surface roughness. The results shows that feed rate 51.84%, cutting speed 41.99% and cutting speed 1.66% affects on the surface roughness. This results clearly indicates that feed and cutting speed are the most influential parameters for surface roughness. While the depth of cut is least affects on the surface finish.

Rajendra et al [8] studied the parameter cutting speed, feed rate, axial depth of cut, radial depth of cut, for investigating the effects of these parameters on the surface roughness. And obtained results from experiments are minimal surface roughness is 0.640µm at 190 m/min cutting speed, 0.10 rev/min feed rate, 0.1mm axial depth of cut and 0.12mm radial depth of cut. Author compare the experimental results with the MRA (multi-regression analysis) and ANN (artificial neural network). The results of experimental and ANN gives the minimal surface roughness for the same parameter range.

Saurin et al [9] investigated the milling parameters such as speed (500,1200,850)rpm, feed (150,300,225)mm/rev, depth of cut (0.1,0.5,0.3)mm, on surface roughness and flatness error in milling of (WCB) Wrought cast steel using 3-axis CHIRON FZ 16 L/CNC milling machine with miracle coated VP15TF insert. Their results shows that the max error by regression model to predict flatness is 7.06% and average error is 5.17% while predicting the surface roughness the maximum error is 10.98% and average error is 6.86%. The controversy in depth of cut leads to multi objective optimization but the influence of depth of cut is very less on both the responses. So, to achieve the desire quality more focus should be made in the right selection of spindle speed and feed.

Pravin saini et al [10] studied the parameter spindle speed, depth of cut, and feed rate for optimizing surface roughness. The minimal surface roughness obtained are at maximum spindle speed 2500 rpm, moderate feed rate 200 mm/min, and at depth of cut of 0.3mm.

V. CONCLUSION

From the study of different literature, it seems that depth of cut, spindle speed and feed rate are the most essential parameters to obtain good surface quality. Further, flatness deviation could be reduced as increase the surface quality.

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