

Design of Angle Body Machining Fixture

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Abstract— KOSO group of company (valve division) is situated at Ambad is famous worldwide for their control valves. They are manufacturing many types of valves like globe valve, butterfly valve, and choke valve for many customers but recently they suffer from a problem of how to manufacture a valve body part which does not have a base for clamping and as we know it is essential to have a base for clamping to perform machining. Most importantly customers refuse to import those choke valves which has boss welded at the base of globe valve (boss was welded for clamping) and similarly due to increased losses in case of choke valves. So, we have decided to manufacture an angle body machining fixture for clamping and to provide easy of machining for choke valve body. There are two plates one is vertical and another is horizontal plate. They are welded to gather. It can be used to locating the body. On the horizontal plate two supporting plates are used to remove the vibration and it make the proper alignment by using nut and bolt. Clamping boss is used to clamp the fixture in Vertical Turret Lathe machine.

Key words: Valve, Chock Valve, Clamping

I. INTRODUCTION

Koso India Private Limited (Kentrol Control Valve Division) was acquired by Nihon Co., Ltd. Japan and is based in Nasik, India. Originally formed in 1989 under the name of Intro India Private Limited, it has seen various changes over the years. Each change has seen the company become much stronger and well positioned to meet the demands of a forever changing market place. We specialize in the supply of Standard Service Globe type Control Valves, Butterfly type control valves and Severe Service Control Valves. We have gained a reputation for supplying specially designed high quality valves for the most onerous service conditions. The group of companies specializes in the Controls and Process Automation Systems market.

The key products and services that we provide are Control Valves, High Technology Surface Choke Valves, Actuators and Instrumentation with operating facilities worldwide. The KKI Series 73 surface choke valve offers a unique solution for the majority of choke applications in the oil and gas industry.

They are manufacturing many types of valves like globe valve, butterfly valve, and choke valve. Recently they suffer from a problem of how to manufacture a valve body part which does not have a base for clamping and as we know it is essential to have a base for clamping to perform machining. Most importantly customers refuse to import those choke valves which has boss welded at the base of globe valve (boss was welded for clamping) and similarly due to increased losses in case of choke valves. So, we have decided to manufacture an angle body machining fixture for clamping and to provide easy of machining for choke valve body.

A. Problem Definition

Previously for machining a desired valve body component a solid structure like square or cylinder is welded by using gas metal arc welding to the opposite face of flange which is to

be machined. For this requirement of solid structure is mainly depends on the type of chuck to be used like 3 jaw chuck or 4 jaw chuck on the machines we are going to do machining or the operations to be performed. Most importantly it is noted that Kentrol which is associated with 3 or 4 jaw chuck so they have welded a boss.

Welding of boss is economical to company because the process includes additional efforts which are not feasible. Initially boss is welded for machining and after finishing the machining boss is cut down and finally work piece is grinded which most uneconomical aspect is for the company. After removing a boss hardness of material is affected and cracks are also generated which causes failure while functioning of valve thus it reduces a life span of valve hence customer refuses to import such boss welded valves and in case of 4 directional clamping, as we clamp work piece from all directions which is time consuming process and machining speed is also gets slower down.

There is possibility of slipping of work piece and most of the times chattering of job takes place it also increases setup time of job. Therefore there is need for an alternate solution for this problem. So we have decided to manufacture a fixture which can clamp as well as provide ease to access the machining to choke valve body.

B. Objectives

The objectives are as followed by:

- 1) To minimize the time required to place the valve body.
- 2) To improve clamping, balancing and alignment of job.
- 3) To improve production rate and product quality.
- 4) To improve use of measuring gauge.

C. Methodology

Fixture is a work holding device that holds supports and locates the work piece for a specific Operation but does not guide the cutting tool. It provides only a reference surface or a device. The main purpose of a fixture is to locate and in some cases hold a work piece during either a machining operation or some other industrial process. Fixtures should be securely clamped to the table of the machine upon which the work is done. Fixtures are specific tools used particularly in milling machine, shapers and slotting machine.

In Koso India Private Limited we are working on lathe or VTL machine, in which there is a production of chock valve". To mount the chock body there mounting problem occur. It required more time to mount the chock valve body. In angle body machining fixture uses two plates those are welded to each other at perpendicular section. Two supporting guide plate is used to support body. Clamping boss is used to balance the body. The shaft is used to clamp the valve body on fixture.

II. DESIGN OF MECHANISM

A. Construction of Machining Fixture

In that industry they make a chock valve body product. In this industry the job in manufacturing glob valve, chock valve,

ball valve, vector valve in angle body so we make two plates they joint in perpendicular direction each other by using welding process. These two plates are vertical and horizontal plate. The vertical plate is use to locating body ID by using mounting boss. On this vertical plate job is mount or fixed by using horizontal shaft. In that industry they make a chock valve body product. In this industry the job is manufacturing in angle section (T slot) so we make two plates they joint in perpendicular direction each other by using welding process.

These two plates are vertical and horizontal plate. The vertical plate is use to beating body ID by using mounting boss. On this vertical plate job is mount or fixed by using horizontal shaft. In horizontal plate stud, supporting guide plate, nut and bold are mounted. The stud is use to support the job at center and supporting guide plates are remove the vibration and it make the proper aligned by using nut and bolt. In this horizontal plate at bottom side clamping boss is placed and this clamping boss is clamp by jaw on VTL and lathe machine.

B. Description of Components

1) Plates

The two mild steel plates are used in fixture. These two plates are perpendicular joint to each other by welding process. One is horizontal plate and second is vertical plate. These two plates are used clamp the supporting parts of fixture like mounting boss, stud, supporting guide plate, nut and bolt are mounted, clamping boss etc. The vertical plate is use to locating body ID by using mounting boss. On this vertical plate job is mount or fixed by using horizontal shaft.

2) Supporting Guide Plate

The two mild steel Supporting guide plates are used in fixture. Supporting guide plates are also balanced the fixture because of left side is one plate is mount and another plate is mount right side from center of stud.

C. Clamping Boss

In that fixture the balancing is necessary without balancing of fixture working is not proper. Then, the clamping boss is placed at center of stud because of center of gravity or the weight is more apply at the center point.

D. Mounting Boss

To allow the moment of stud through the boss and vertical plate the central hole of boss and vertical plate should be internally threaded. Therefore, the unwanted vibrations will be restricted.

E. Stud

To keep the central stud in its appropriate position it must be constraint in a single motion which is in-out with the help of threads. So the corrective action is to provide the threading on its ends so that it can easily get assembled and disassembled by just rotating it in clockwise and anti-clockwise direction.

F. Shaft

The shaft is used to locating the body ID by using mounting boss. The one end of shaft is fixed in the mounting boss and another is fixed to body by using nut. It can be remove the clamping and balancing problem.

III. DESIGN SPECIFICATIONS

A. Design of Supporter or Vibration Restrictors

During machining due to yawing motion torsional shear stress is generated on the boss. To minimize the stress and yawing motion supporters are provided which is mounted on a base plate. For mounting of vibration restrictor on the base plate gas metal arc welding is used. Supports from both sides are provided to the work piece with the help of threaded bolts at the sufficient height.

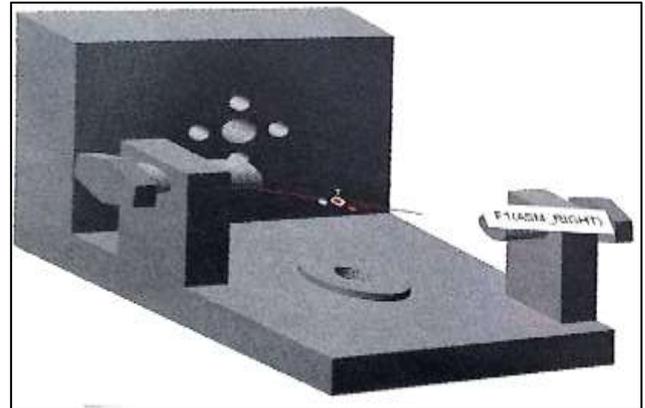


Fig. 1: Design of Supporter or Vibration Restrictors

B. Designs for Welding

Welding is a process of permanently joining metallic parts together by heating to a plastic or semi-molten state with or without the application of pressure and filler material. Welded joints can be used as an alternative to riveted or bolted joints, while welded structures can be used as an alternative to casting or forging, there are large numbers of welding processes used currently in the industrial applications. A few of them are:

1) Between Vertical Plate and Horizontal Plate

Rectangular plates welded together at right angle because the component we are going to machine is a angle body.

2) The Chuck Piece welded to Base Plate

Instead of welding in overhead position better way horizontal or flat surface of the base plate in bottom side is welded. Welding method used is same which GMAW because of flexible and economical.

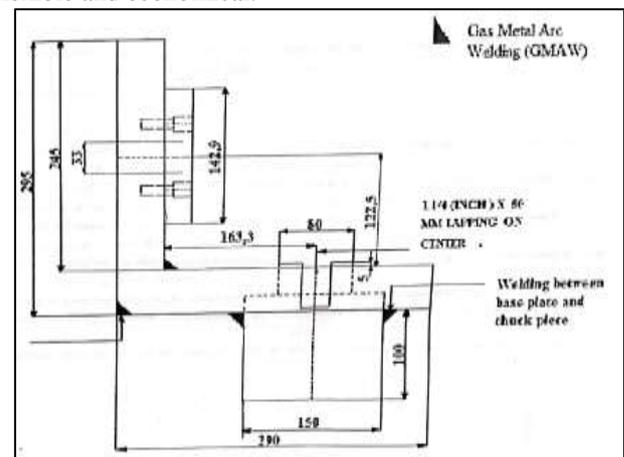


Fig. 2: The Chuck Piece welded to Base Plate

C. Material Selection

To design a fixture, initially we go for a material selection by considering the market availability and machining convenience so considering all the important aspects we have selected mild steel material for the fixture.

Reason for selection of MS material:

- 1) Mild steel is a very popular grade of through of hardening medium carbon steel.
- 2) Which is readily machine able in any condition.
- 3) MS is suitable for the manufacture of parts such as general purpose axles, Shafts, gear, bolt and studs.
- 4) Maximum stress which it can sustain is $700\text{-}850\text{ N/mm}^2$
- 5) Yield stress as 465 N/mm^2 .

IV. ASSEMBLY OF THE MECHANISM

The following is the assembly of the screw jack consisting of only five parts. The 3D Solid model of the same product is designed in Creo with the same Dimensions.

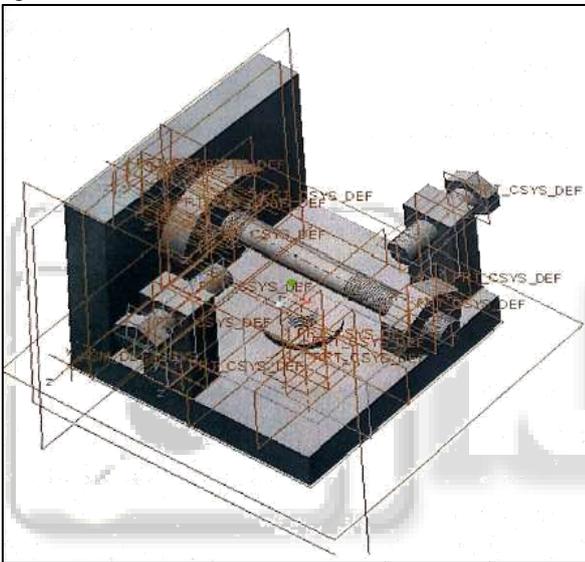


Fig. 3: The 3D Solid model

A. Advantages

- 1) To avoid a Worker effort and difficulties when job is manufacture.
- 2) Reduce setting time and lathe machine.
- 3) The work piece and tool are relatively located at their exact positions before the operation automatically within negligible time. So it reduces product cycle time.
- 4) It reduces the production cycle time so increases production capacity.

B. Disadvantages

- 1) It will be wear out.
- 2) Fixture are heavier in construction.

V. CONCLUSION

In the traditional process for manufacturing job, the job had clamped on each machine individually .This led to Increase in lead time, resulting in decrease in production rate.

From our project and new design of the fixture assembly manufactured has reduced complication increasing in manufacturing of product, this design in preferable for mass Production as it has reduced lead time along with the

reduction of worker fatigue which indirectly increases the efficiency the efficiency of worker there by increasing plant efficiency.

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