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Design and Manufacturing of Flange Coupling using CNC Technology

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Abstract: *The basic concept of our project is to manufacture FLANGE COUPLING using Computer Numeric Control (CNC) Technology, which gives better quality products. The use of these machines in manufacturing industries has achieved realizable goals. Development of CNC machines is considered as an outstanding contribution to machine tool engineering, intelligent use of CNC machine tools can achieve complex machining tasks. Hence the process adopted for manufacturing is reliable.*

A rigid coupling is a unit of hardware used to join two shafts within a motor or mechanical system. It may be used to connect two separate systems, such as a motor and a generator, or to repair a connection within a single system. A rigid coupling may also be added between shafts to reduce shock and wear at the point where the shafts meet.

Flanged coupling is a type of rigid coupling in which two co-linear shafts are connected by the flanges. The coupling enables torque transmission between the shafts & prevents relative rotation between them.

In the project work a flanged coupling was made by local material available & CNC technology was also performed.

A coupling is a device used to connect two shafts together at their ends for the purpose of transmitting power. Couplings do not normally allow disconnection of shafts during operation. Flange coupling has two halves dissimilar in construction. The pins are rigidly fastened by nuts to one of the flange and kept loose on the other flange. This coupling is used to connect of shafts. Which is having a small parallel misalignment, angular misalignment or axial misalignment.

Keywords: CNC, Flange, CAD, CAM, Bench work,

I. INTRODUCTION

CNC machines, which gives better quality products. The use of these machines in manufacturing industries has achieved realizable goals. Development of CNC machines is considered as an outstanding contribution to machine tool engineering, intelligent use of CNC machine tools can achieve complex machining tasks. Hence the process adopted for manufacturing is reliable.

Computer Numeric Control (CNC) advance system is the automation of machine tools that are operated by precisely programmed commands encoded on a storage medium (computer command module, usually located on the device) as opposed to controlled manually by hand wheels or levers, or mechanically automated by cams alone. Most NC today is computer (or computerized) numerical control (CNC), in which computers play an integral part of the control.

In modern CNC systems, end-to-end component design is highly automated using computer-aided design (CAD) and computer-aided-manufacturing

(CAM) programs. The programs produce a computer file that is interpreted to extract the commands needed to operate a particular machine by use of a post processor, and then loaded into the CNC machines for production. Since any particular component might require the use of a number of different tools – drills, saws, etc. – modern machines often combine multiple tools into a single "cell". In other installations, a number of different machines are used with an external controller and human or robotic operators that move the component from machine to machine. In either case, the series of steps needed to produce any part is highly automated and produces a part that closely matches the original CAD design.

A. Coupling

A coupling is a device used to connect two shafts together at their ends for the purpose of transmitting power. Couplings do not normally allow disconnection of shafts during operation, however there are torque limiting couplings which can slip or disconnect when some torque limit is exceeded.

The primary purpose of couplings is to join two pieces of rotating equipment while permitting some degree of misalignment or end movement or both. By careful selection, installation and maintenance of couplings, substantial savings can be made in reduced maintenance costs and downtime.

Couplings are used to connect two shafts for torque transmission in varied applications. It may be to connect two units such as a motor and a generator or it may be to form along line shaft by connecting shafts of standard lengths say 6-8m by couplings.

Coupling may be rigid or they may provide flexibility and compensate for misalignment. They may also reduce shock loading and vibration. A wide variety of commercial shaft couplings are available ranging from a simple keyed coupling to one which requires a complex design procedure using gears or fluid drives etc.

However there are two main types of couplings

1) **Rigid Coupling** : Rigid Couplings are mainly used in areas where the two shafts are coaxial to each other. There are many types of couplings that fall under the rigid couplings category. They are:

Rigid Sleeve (or) Muff Couplings - This is the basic type of coupling. This consists of a pipe whose bore is finished to the required tolerance based on the shaft size. Based on the usage of the coupling a keyway is made in the bore in order to transmit the torque by means of the key. Two threaded holes are provided in order to lock the coupling in position. The photo shows a type of the rigid sleeve or muff coupling.



Fig.1.1: Muff coupling

2) **Flexible Coupling**: Flexible couplings are used to transmit torque from one shaft to another when the two shafts are slightly misaligned. Flexible couplings can accommodate varying degrees of misalignment up to 3° and some parallel misalignment. In addition, they can also be used for vibration damping or noise reduction. The material used to manufacture the beam coupling also affects its performance and suitability for specific applications such as food, medical and aerospace. Materials are typically aluminum alloy and stainless steel, but they can also be made in acetel, maraging steel and titanium. The most common applications are attaching encoders to shafts and motion control for robotics.

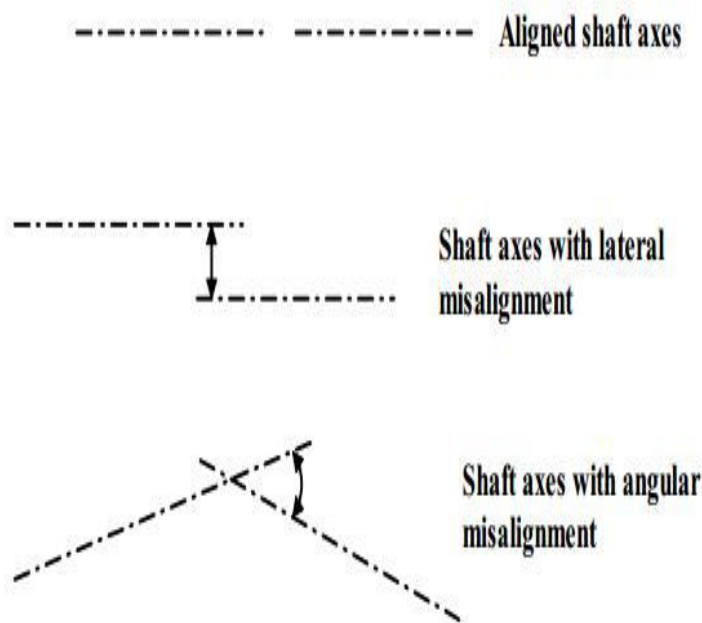


Fig.1.2 Types of misalignments in shafts

3) **Flange Coupling**: It is a very widely used rigid coupling and consists of two flanges keyed to the shafts and bolted.

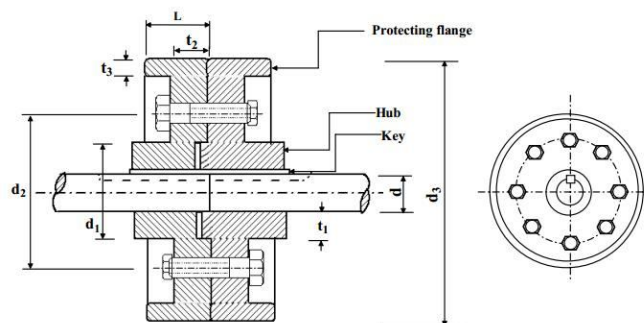


Fig.1.3A typical flange coupling

II. MATERIAL

Basically large variety of materials are been used but the largely used is EN36 and combinations of carbon steel based on its applications. Flange 1 and 2 both are made up of EN36 material.

ASTM EN36 is usually available in the following forms:

A. Rectangle Bar

- 1) Square bar
- 2) Circular rod
- 3) Steel shapes such as channels, angles, H-beams and I-beams.

Chemical composition

Carbon	0.12-0.18%
Silicon	0.10-0.35%
Manganese	0.30-0.60%
Sulphur	0.050 Max
Phosphorus	0.050 Max
Chromium	0.60-1.10%
Molybdenum	—
Nickel	3.00-3.75%

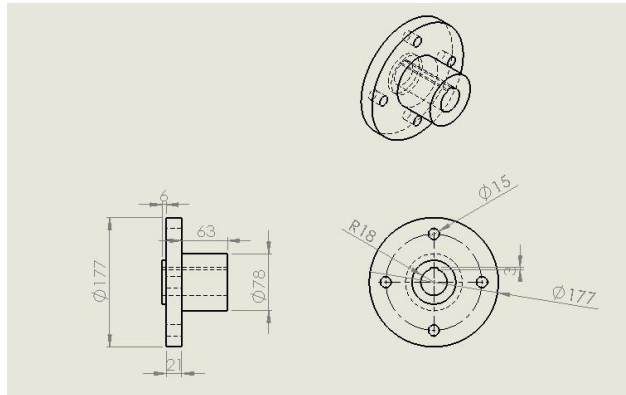
B. Applications

ASTM A36 steel has the following applications:

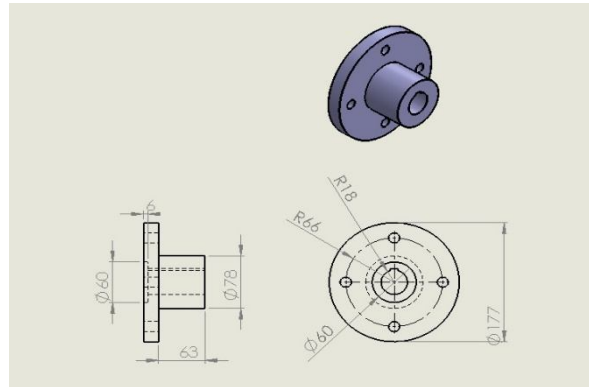
- 1) It is used in bolted, riveted or welded construction of bridges, buildings and oil rigs.
- 2) It is used in forming tanks, bins, bearing plates, fixtures, rings, templates, jigs, sprockets, cams, gears, base plates, forgings, ornamental works, stakes, brackets, automotive and agricultural equipment, frames, machinery parts.
- 3) It is used for various parts obtained by flame cutting such as in parking garages, walkways, boat landing ramps and trenches.

III. EXPERIMENTAL PROCEDURE

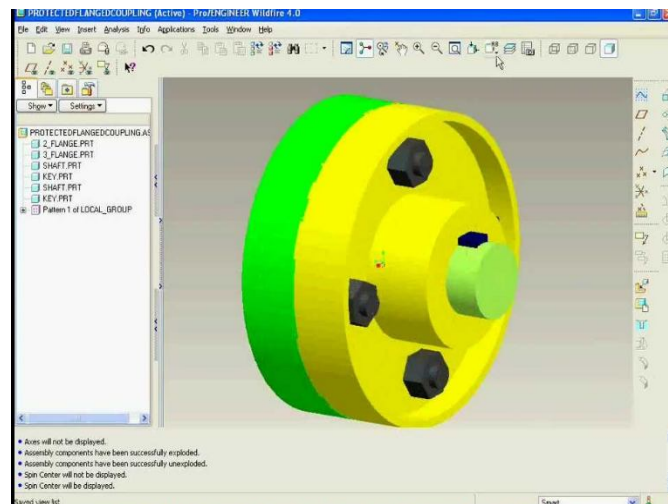
A. Our Design Dimensions (Male Part 1)



B. Female Part 2



C. Auto CAD Designing



We have designed a protected type flange coupling using Auto CAD software and some professional teaching staff with reference to steps.

After designing process is completed save the file as a new document. We can give the designed file as an input to CNC system using some external disk.

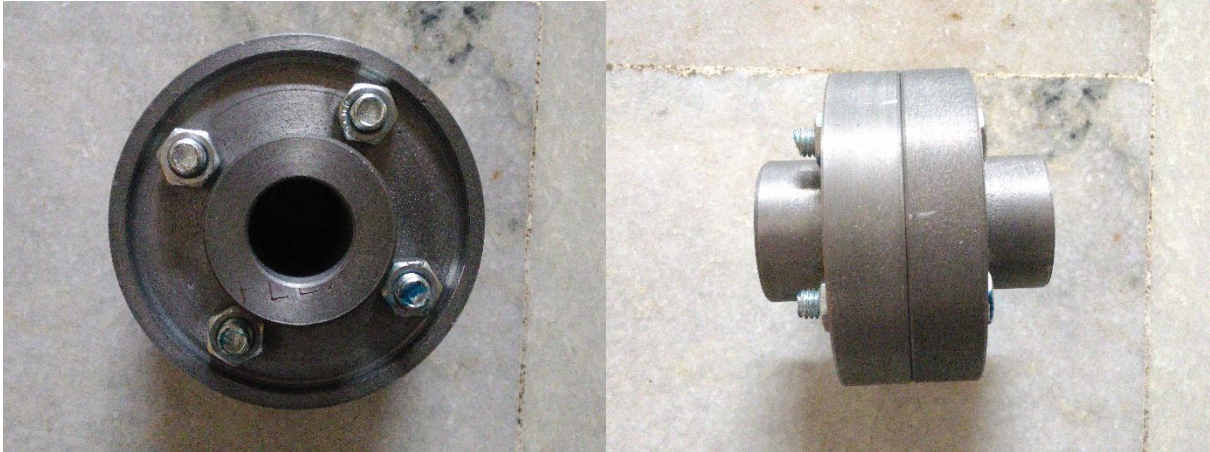
Note: In some cases file should be converted into particular controlling file i.e in our case it is a FAUNIC controlling system.

IV. METHODOLOGY

As we designed flange coupling using CAD software it automatically binds the design into CAM software package. We just need to set the raw EN36 material in CNC machine. Various Machining process were used for several machining are:-

- A. CNC Lathe machine was used for facing, turning, boring, chamfering.
- B. CNC Drilling machine was used for drilling & boring.
- C. CNC Milling machine was used for surface finishing..
- D. CNC Machine for Internal die & External die was used for internal thread cutting of nuts & external thread cutting of bolts.

1) Output:



Front view of coupling

Top view of coupling

V. CONCLUSION

In a step wise manner using all the process the flange coupling is manufactured on CNC Machine.

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