# Design and Manufacturing of Paint Mixture Equipment in Core Manufacturing Industry.

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*Abstract:* Our Sponsored Company requirement of Paint mixer Equipment. We have provided ideas ofdesign of mixer Equipment. Core Paint production is an important process which has wide applications in several fields in Casting Manufacturing Processes. The aim of the project is to develop a small-scale paint mixer Equipment. The design of the paint mixer Equipment is feasible, sustainable and cost effective and they are maintaining the viscosity of paint. This work is intended to study the cycle time and existing method of different work stations and suggesting improved method for the same so as to reduce the cycle time and to improve productivity at Company. The importance of this work is directly related to the reduction of the inefficient time and increasing the productivity. The new approach of studying the operations by video work study techniques. The advantages of this project used in the improvement of the productivity by reducing the cycle time, smooth flow of components for assembly, reducing the worker fatigue, suggesting new methods and installing it. This project highlights the advantages of adopting such an efficient process.

***IndexTerms* -Work Study, Method Study, Stop Watch Etc.**

## I. Introduction

Aim of the project is company requirement is of Paint mixer equipment. We have provided ideas ofdesign of mixer equipment. Paint production is an important process which has wide applicationsin several fields. The aim of the project is to develop a small-scale paint mixer equipment. The design of the paint mixer machine is feasible, sustainable and cost effective and they are maintaining the viscosity of paint.

Mixing equipment must be designed for mechanical and process operation. Although mixer design begins with a focus on process requirements, the mechanical design is essential for successful operation. Usually, a competent manufacturer of mixing equipment will take responsibility for the mechanical design. However, process conditions, such as impeller operation near a liquid surface, can impose severe mechanical loads. Similarly, the process environment will influence the selection of a motor enclosure. In many ways the process requirements can have a direct impact on the mechanical design. In other ways, such as the natural frequency of a mixer shaft, appropriate mechanical design must be determined by the equipment designer.

Although normally viewed as a single piece of equipment, like a pump, the typical mixer is composed of several individual components, such as a motor, gear reducer, seal, shaft, impellers, and tank, which is often designed and purchased separately. Although highly customized for many applications, most mixers are a combination of standard components, sometimes with modifications, and often with unique characteristics, such as shaft length. Generalizations, especially for mixers, can misrepresent individual situations, but some features are common to the largest number of mixers built worldwide. The most common motive force for a mixer is an electric motor, so a knowledge of standard motor characteristics is useful. Most mixers operate at or below typical motor speeds, so some type of speed reduction is common. Speed reduction can be accomplished with several different types of gears, usually in enclosed housings, or with belts and sheaves.

Besides speed reduction, antifriction bearings are found in all types of rotating equipment. Some type of seal around the rotating shaft is required for closed-tank operation and the type depends on degree of seal required, operating pressure, and operating temperature. The shaft for a mixer, especially a large one, involves significant mechanical design, partly because of the myriad of shaft lengths, impeller sizes, and operating speeds, and partly because both strength and rigidity are necessary for a successful design. The combination of custom process and mechanical design necessary for mixers is unique for chemical process equipment. Mechanical design does not end with the shaft, since strength and practical issues remain for the impeller. Another part of mixer design is the tank in which the mixer is used, since tank dimensions' influence mixer features, especially shaft length. Conversely, a mixer requires tank features, such as baffles, support strength, and other tank internals. Materials of construction, although most commonly metal alloys for mixers, depend on process chemistry and operational requirements. The second step in design sequence is mechanical design of mixer components. The fundamental approach is straightforward, design for power (torque and speed), then shaft loads, and finally mixer dynamics. For larger systems above 100 HP it may be prudent to perform a mixer system modal analysis (FEA) to avoid unexpected interactions. General test procedure and design methodology are based on the assumption that the loading on themixer and vessel components are geometrically symmetric and temporally invariant- a condition that is not often met.

## II PROBLEM STATEMENT

Due to manual core paint mixing operation, they have not get required viscosity for the core painting. Due to change in viscosity depend it may be lead rejection in casting due to core defect. Due to this reason near about 0.3% of core rejection observed in the company. So, we have to decide to reduce rejection level below 0.1%, So we have taken Project study.

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**iii.OBJECTIVES**

- The objective of paint mixing using a mixer is to achieve a uniform distribution of paint.
- To reduce Man power.
- To maintain the required viscosity.
- Reducing casting rejection due to core painting.
- Uniformly mixed paint gives low flow ability.

***IV.* DESIGN CALCULATIONS**

**Core production calculation**

core produce in 1 hr.

2.57 min cycle time = 177 sec per Core

**Production shift wise daily**

1 shift working hour 8 hr 30 min = 510 min

One shift production = 510 /2.57 min = 172 cycles

**In one Cycle per pattern two cores is Produced.**

172×2 =344 core Production work piece of 4 machine

= 344 × 4 = 1376

【1376 core in 1 shift 】

**Three shifts in one day**

Production in 3 shift one day =1376 × 3= 4128 core

【Daily production core is 4128 for all three shift 】

**A) Core paint calculation**

1 core = 64ml and 1 ml = 0.001 liter

4128 × 64= 264192 ml

264192 ×0.001 = 264 liter

【264 liter paint use in daily 】

**No of shift in company =3**

Shift wise paint use = 264 / 3= 88

【1 shift 88 liter paint use 】

**Mixing paint in mixing chamber of 2-time one shift**

88-liter paint use in one shift time mixing cycle = 88 / 2= 44 liter

【44 liter paint use in one mixing cycle 】

**Design Calculation of Mixing Chamber**

Quantity of fluid to be mixed had to be decided before doing further calculations as vessel dimensions have a huge impact on impeller design, forces acting on the shaft andthe setup as a whole. Also, the design of an impeller and its location in the tank primarilydepends on the tank diameter and height. Thus, first the effects of vessel dimensions onthe design were studied before selecting the tank dimensions.

After due considerations, the dimensions were selected which are stated belowGiven data:

Height of mixing chamber = 24 inch = 609.6 mm

We know that,

1 inch = 25.4 mm

Diameter of mixing chamber =24 inch = 609.6 mm

1.Area of mixing chamber = $\pi r^2$

= $\pi$ $(304.8)^2$ = = $291.8635\times10^3$ $mm^2$

**Area of mixing chamber is $291.8635\times10^3$ $mm^2$**

2.Volume of cylinder tank = $\pi r^2 h$

= $\pi$ $(304.8)^2 \times 609.6$

= 177.92 liter

The volume of mixing fluid was found to be 177.92 liters due to shape of the tank. Hence capacity of tank was found to be approximately 180 liters.

**Design calculation of supporting plate**

Length of plate =609.6 mm   Area of plate = $(side)^2$

= $(609.6)^2$
= 371.61 $*10^3$ $mm^2$

**2) Weight of plate and thickness of plate**

Weight of plate =$((side)/1000)^2 \times T \times$ density

Stainless steel (Grade SS 316) density is 7.93 $g/cm^3$

Weight of plate = $((609.6)/1000)^2\times10\times7.93$ = 29.46 kg

**Weight of plate = 29.46 kg**

Volume of plate = weight / density

Weight of plate = 29.46 ×1000 = 29468.844 gram

Volume of plate =29468/ 7.93 = 3716.12 $mm^3$

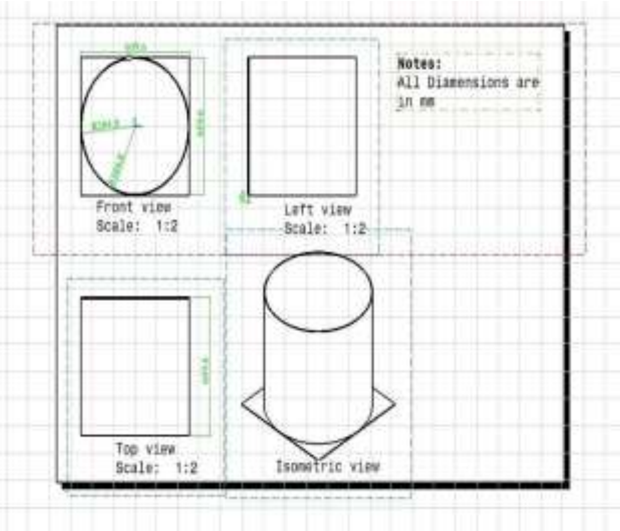
Volume of plate is 3716.12 $mm^3$

Thickness of plate = volume / area =3122.32/ 312.25 = 10.00 mm

**Thickness of plate is 10.00 mm**

**V.CAD MODELING**

## Mixing Chamber



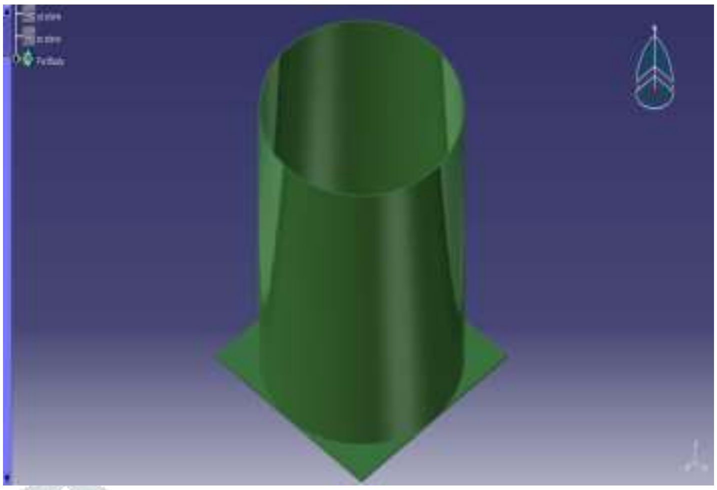



Fig.01. mixing chamber with base plate drawing Fig.02 mixing chamber 3D model

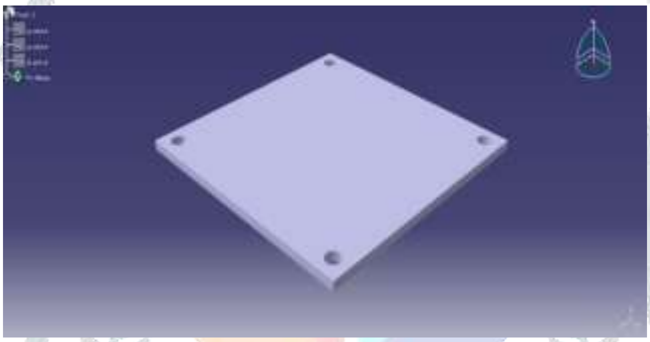
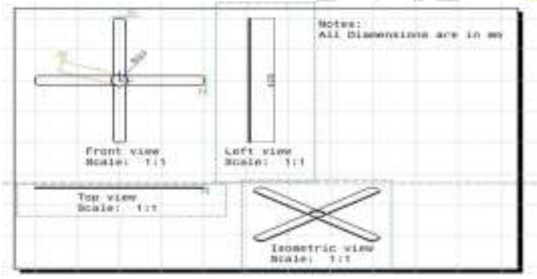


*Fig.03. base plate 3D model*




## Impeller

*Fig.04 impeller drawing* *Fig.05. Impeller 3D model*

## Shaft

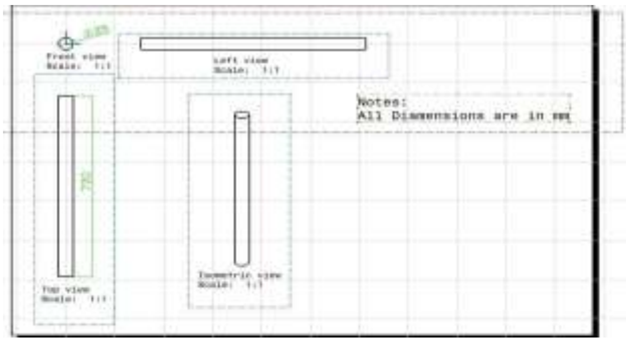



*Fig.06.shaft drawing* *Fig.07.shaft 3D model*

## Motor

Fig.08. 3D model of motor

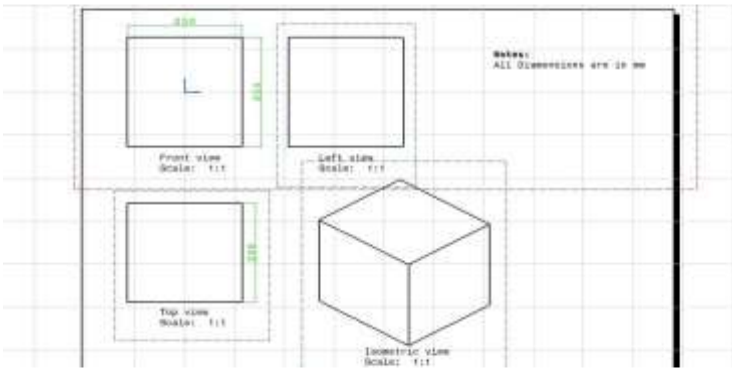



Fig.09. Motor stand

## Complete assembly

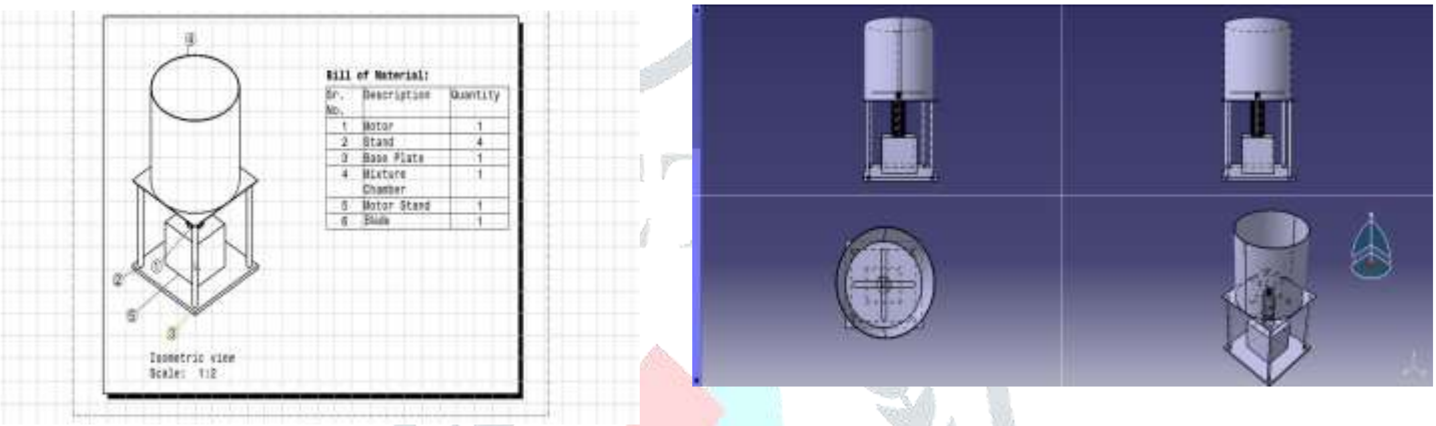



Fig.10. Complete assembly of paint mixture

**RESULTS**

Table 01. viscosity: its result and effects

| Sr. no. | Viscosity | Results | Effect |
|---|---|---|---|
| 1. | 0.33 | More viscosityThickness more | A layers of paint forms on the core and paint peels off . |
| 2. | 0.28 | Viscosity maintains | Proper paint applied on core |
| 3. | 0.22 | Less viscosityLess thickness | Paint flow quicklyand not maintain paint layer on core . |

| **Particulars** | **core save per year** | **Profit per year** |
|---|---|---|
| Core rejection per year(0.1%) after paint mixture use | 2148 | 2,54,217 |
| Salary due of one person after use ofmixture | -- | 1,08,000 |
| Company total profit | | 3,62,217 |

Table.02.for saving of cores per year and increase in company total profit.

**By using work study, we saved the cost of accurate core shop by 3,62,217 per year**