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Modeling and Weight Optimization of Oil Pan by Analysis

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Abstract

In an internal combustion engine of the reciprocating type the oil pan is the housing of the crankshaft. The enclosure forms the largest cavity in the engine and is located below the cylinder(s) which in a multi cylinder engine are usually integrated in to one or several cylinder blocks. Oil pan is located at the bottom of engine. It is used to store the engine oil. Oil will be pumped to the engine from the oil pan when required. In this project modeling of oil pan used in Submarine engine will be done. The aim of the project is to model Oil pan using CAD software, Initially data will be collected to design mould tool and for the conditions of analysis. In next stage a model will be generated using pro-engineer for further study. Mould design calculations will be done to model the mould assembly. After mould preparation structural analysis will be conducted by comparing the suitable material selection for oil pan to optimize the die structure for weight reduction. Modeling, will be done using catia v5software.

Keywords— Oil pan, Manufacturing Methods, Cost Analysis, Design, Analysis

INTRODUCTION TO OIL-PAN

An oil pan is a component that typically seals the bottom side of four-stroke, internal combustion engines in automotive and other similar applications. While it is known as an oil pan in the U.S., other parts of the world may call it an oil sump. Its main purpose is to form the bottommost part of the crankcase and to contain the engine oil before and after it has been circulated through the engine. When an oil pan is removed, some components revealed usually include the crankshaft, oil pickup, and the bottom end of the dipstick. During normal engine operation, an oil pump

will draw oil from the pan and circulate it through the engine, where it is used to lubricate all the various components. After the oil has passed through the engine, it is allowed to return to the oil pan. In a wet sump system like this, the amount of oil that an engine can hold is directly related to the size of the oil pan. An engine can hold no more oil than can fit in the pan without reaching the crankshaft, since a submerged crankshaft will tend to aerate the oil, making it difficult or impossible for the oil pump to circulate it through the engine. The drain plug used to change the engine oil is typically located somewhere on the oil pan. An easy way to locate an oil drain plug is to find the pan and then look for its lowest point. The pan may be slanted, have a bulge on one end, or be at a slight angle due to the position of the engine. This low point is usually where the drain plug is located so that nearly all of the oil in the pan can be drained through it. Certain engines, such as those in race or high performance cars, may make use of what is known as a dry sump system. Instead of storing all the oil in the crank case, these engines have a divorced reservoir that it is pumped to and from. Oil pans on engines like these will typically be much smaller than those in wet sump systems, since the oil is returned to the reservoir after being used for lubrication.

Manufacturing Methods Of Oil-Pan

General Capabilities:

1. Deep & Shallow Draw Stamping
2. Plastic Injection Molding
3. Rubber Injection Molding
4. Die-cast, Sand cast and Gravity Casting
5. Chrome and Vacuum Metallization
6. Extrusion and CNC machining
7. Wiring and electronic components

Oil pan specific capabilities:

1. OEM replacement oil pans
2. Fabrication ready oil pan cores
3. Custom oil pump pick-ups and dipsticks.
4. Wet sump fabricated to specifications
5. Dry sump fabricated to specifications
6. Fabrication components
7. Custom finishes
8. Highly customized work for volume customers

Manufacturing method is completely depends on importance of the usage of component and engine capacity and conditions In this project we are designing OIL PAN for submarine engine

Methods Of Accumulating Costs In Records Of Account

The balance sheet lists the components of inventory as raw materials, work in process, and finished goods. These accounts reflect the cost of unsold production at various stages of completion.

The costs in work in process and finished goods are accumulated or tabulated in the record of accounts according to one of two methods: The Job-Order Cost Method When orders are placed in the factory for specific jobs or lots of product, which can be identified through all manufacturing processes, a job cost system is appropriate. This method has certain characteristics. A manufacturing order often corresponds to a customer’s order, though sometimes a manufacturing order may be for stock. The customer’s order may be obtained on the basis of a bid price computed from an estimated cost for the job. The goods in each order are kept physically separate from those of other jobs. The costs of a manufacturing order are entered on a job cost sheet which shows the total cost of the job upon completion of the order. This cost is compared with the estimated cost and with the price which the customer agreed to pay. The Process Cost Method When production proceeds in a continuous low, when units of product are not separately identifiable, and when there are no specific jobs or lots of product, a process cost system is appropriate, for it has certain characteristics: work is ordered through the plant for a specific time period until the raw materials on hand have all been processed or until a specified quantity has been produced; goods are sold from the stock of finished goods on hand since a customer’s order is not separately processed in the factory; the cost of production sheet is a record of the costs incurred in operating the process or a series of processes for a period of time. It shows the quantity produced in pounds, tons, gallons, or other units, and the cost per unit is obtained by dividing the total costs of the period by the total units produced. Performance is indicated by comparing the quantity produced and the cost per unit of the current period with similar figures of other periods or with standard cost figures.

Elements Of Costs

The main items of costs shown on the income statement are factory costs which include direct materials, direct labor and factory overhead and selling and administrative expenses. Materials The cost of materials purchased is recorded from purchase invoices. When the materials are used in the factory, an assumption must be made as to cost flow, that is, whether to charge them to operations at average prices, at costs based on the first-in, first-out method of costing, or at costs based on the last-in, first-out method of costing. Each method will lead to a different cost figure, depending on how prices change. Each situation must be studied individually to determine which practice will give a maximum of accuracy in cost figures with a minimum of accounting and clerical effort. Once the choice has been made, records must be set up to charge materials to operations based on requisitions. Indirect material

LITERATURE REVIEW

The first mathematical formulation of the FMS loading problem was given by Stecke Grouping and loading are formulated as non-linear 0-1 mixed integer programs. Allocate the operations and associated cutting tools of a selected set of part types among the machine groups subject to the technological and capacity constraints of the FMS and according to some loading objective. These problems are formulated in all detail as nonlinear mixed integer programs (the nonlinear terms are products of 0-1 integer variables).

Vidyarthi, at all proposed [3] a fuzzy-based methodology to solve the machine- loading problem in an FMS. The job-ordering determination before loading is carried out by evaluating the membership contribution of each job to its characteristics, such as batch size, essential operation processing time, and optional operation processing time. The operation–machine allocation decisions are made based on the evaluation of the membership contribution of an operation– machine allocation vector.

Several heuristic solution based methods for the machine loading have been developed. M. K. Tiwari, at all [4] developed a heuristic solution

OIL-PAN & MODELLING

is a versatile process for producing engineered metal parts by forcing molten metal under high pressure into reusable steel molds. These molds, called dies, can be designed to produce complex shapes with a high degree of accuracy and repeatability. Parts can be sharply defined, with smooth or textured surfaces, and are suitable for a wide variety of attractive and serviceable finishes.

Die castings are among the highest volume, mass-produced items manufactured by the metalworking industry, and they can be found in thousands of consumer, commercial and industrial products. Die cast parts are important components of products ranging from automobiles to toys. Parts can be as simple as a sink faucet or as complex as a connector housing The Future Refinements continue in both the alloys used in OIL-PAN and the process itself, expanding OIL-PAN applications into almost every known market. Once limited to simple lead type, today's die casters can produce castings in a

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variety of sizes, shapes and wall thicknesses that are strong, durable and dimensionally precise.

METHODS

OIL-PAN is a method of producing alloy castings by injecting molten metal into metallic mold under pressure. OIL-PAN process can be classified into

a) Hot Chamber Process

b) Cold Chamber Process

Material for `

The materials used for OIL-PAN are

1) Aluminum alloys

2) Zinc alloys

3) Magnesium alloys

4) Copper alloys

5) Lead alloys

Shrinkage Table for OIL-PAN alloys

Table 3.2 injection pressure

	Al/mg allo	**Zn alloy**	**Cu alloys**
Standard part	400	100-20	300-400
Engineering pa	400-600	200-30	400-500
Pressure tight p	800-1000	250-40	800-1000

OIL PAN DESIGN CALCULATIONS

(Mould setup calculations for tonnage with that only we can choose the plate size)

a = cavity area (top) = 6,39,037 mm2

a1 = cavity area (left) = 263346 x 2 = 5,26,692 mm2

a2 = cavity area (right) = 87785 x 2 = 1,75,570.4 mm2

v = volume of component = 90,56,532 mm3

Density of material (cast iron) = 7.81 g/cc

W= weight of the component = 9.050e-3 x 70.73 kgi = 70730 gm's

L/t = 0 to 100(for mealy thick wall)

100 to 200 (most part's)

200 to 300(thin walls)

300 and above (difficult to mould special equipment)

Shot weight calculations

15% of component air flow = 10,609.5 gm's

20% of component air flow = 14,146 gm's

Total shot weight:

Wt. of composite + wt. of over flow + wt. of runner

70730 + 10609.5 + 14146 = 95,485.5 = 95.5 kg's

0.0602 min for material filling

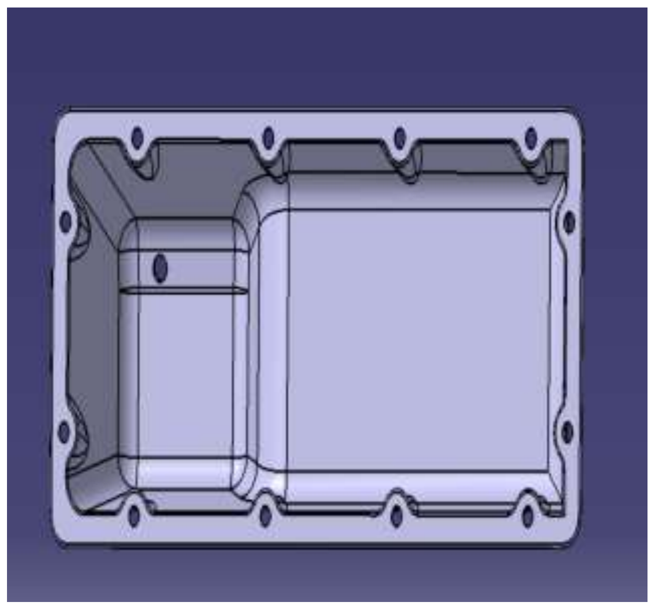
0.5 min for cooling (coolant passage)

0.5 min for mould opening & closing

Total = 1.0602 min

Therefore, 60 / 1.0602 = 56.59 56 comp/hr

H-180Alxv = 180 ton



OIL PAN 3Design

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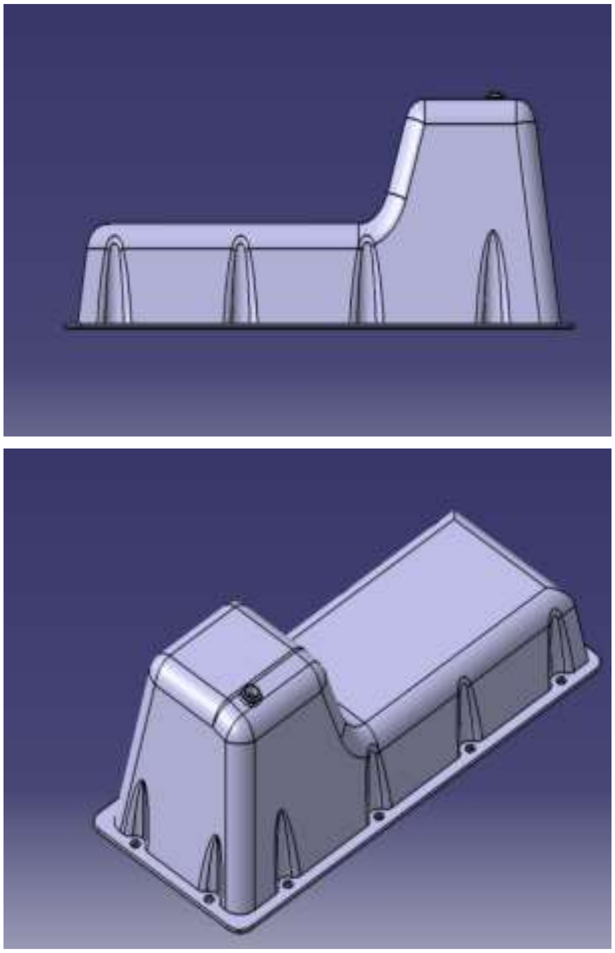
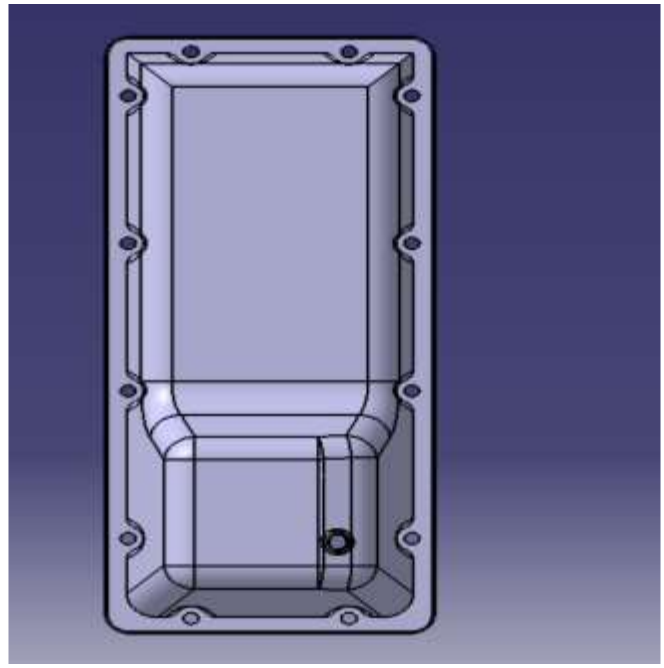


OIL PAN 3Design side view



OIL PAN 3Design back view

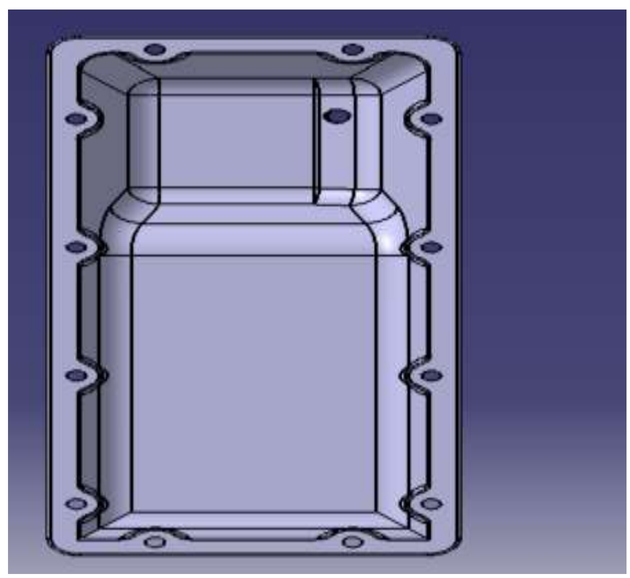


Table 4.4 aluminium (a360)

Density	2.68 g/cc
Tensile strength ultim	317 MPa
Tensile strength yiel	195 MPa
Modulus of elasticit	71.0 gpa

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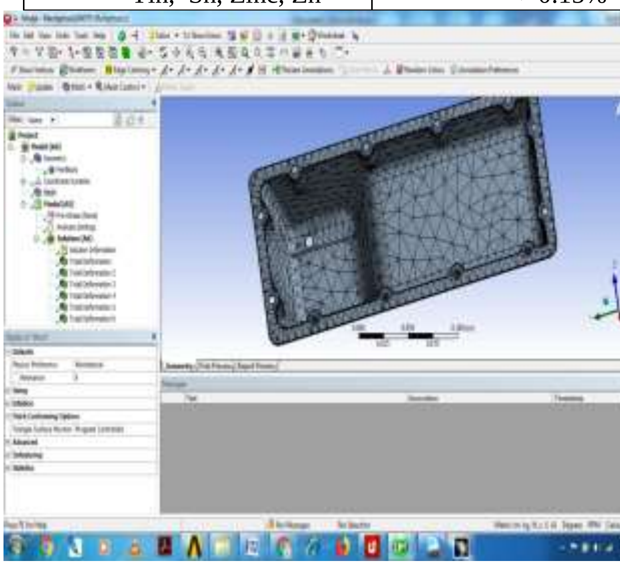
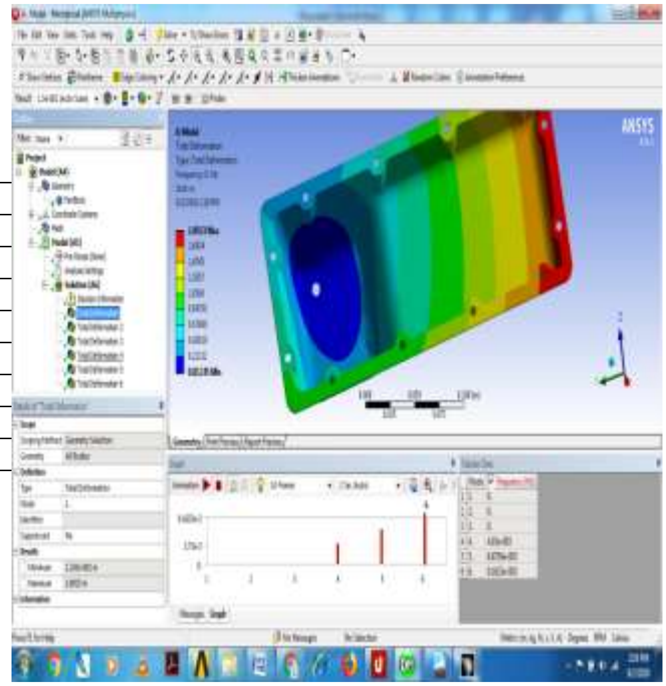
Poisson' s ratio	0.33

Table 4.5 composition

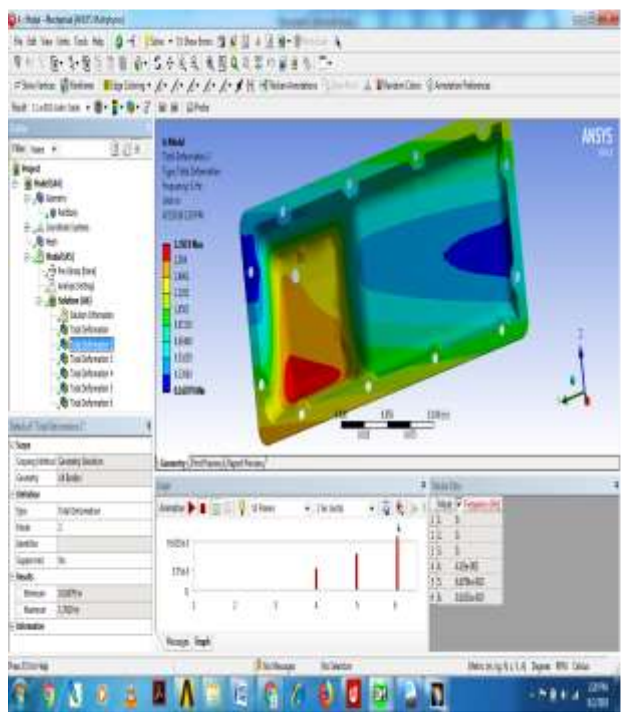
Aluminium, Al	85.8-90.6%
Copper, Cu	<=0.60%
Iron. Fe	<=1.3%
Magnesium,Mg	0.40-0.60%
Manganese,Mn	c<=0.35%
Nickel, Ni	<=0.50%
Other, Si	<=0.25%
Silicon, Si	9.0-10%
Tin, Sn, Zinc, Zn	<=0.15%



OIL PAN meshing file



OIL PAN stress file



OIL PAN total dfr 1

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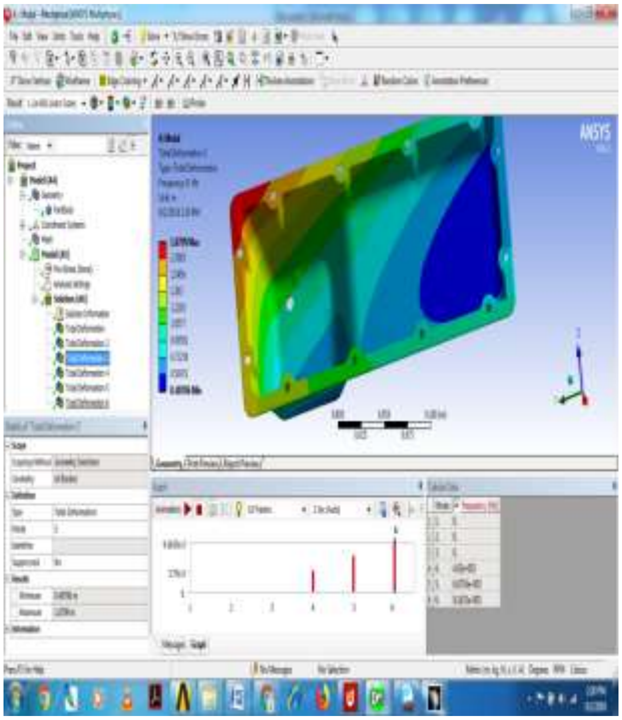
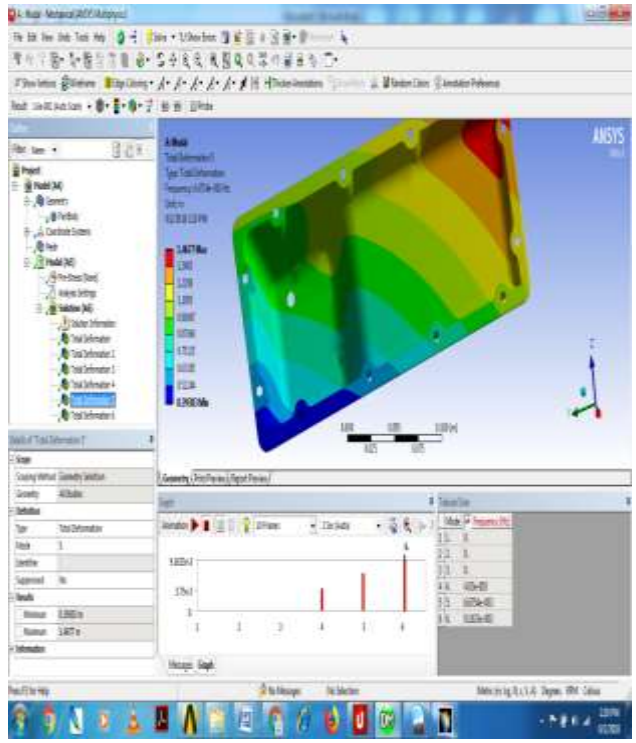
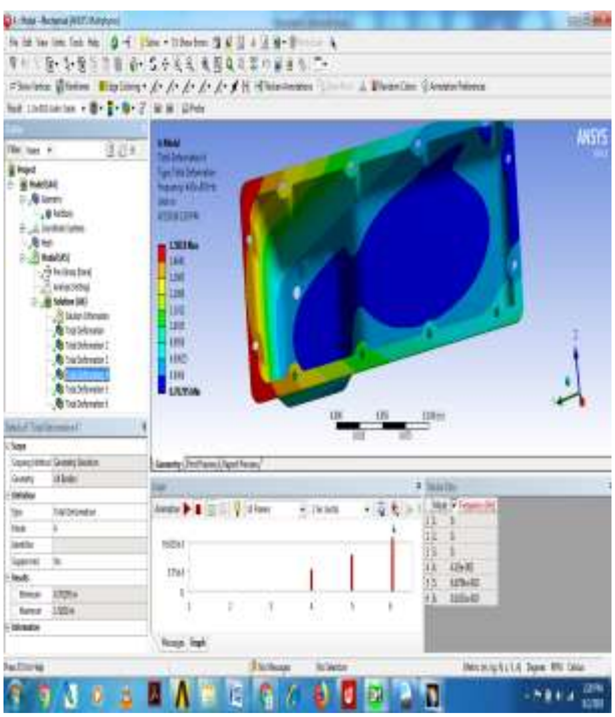


OIL PAN total dfr

OIL PAN strain



OIL PAN total deformation



ANALYSIS RESULTS

Table 6.5 Analysis results

Material	Displacement(mm)	Strain	Von-misses stress (N/mm^2)
Mild steel F26	0.24694	0.0069591	133.38
Aluminium A360	0.66136	0.0018799	132.43

Factor of safety for M.S. F26 is 200/91.486= 2.186

Factor of safety for Aluminum A360 is 195/91.56= 2.12

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WEIGHTAND COSTTABLEFOR EXISTINGMODEL

Table 6.3 Weight and Cost Table for existing model

INDEX	MATERIAL NAME	QUANTITY & PRICE	COST
1	C22 carbon steel alloy for bolts	1.516KG X275 Rs	416
2	MS	2062.35KG X74 Rs	1,52,614
3	Hard And Steel	6942.9 X 268 Rs	18,60,697
4	Ohns	7.508 X 325 Rs	2,460
5	Guide Sleeves	6NOS X 500 Rs	3,000
6	Guide Pillers	6 X 1300 Rs	7,800
7	Water Inlet Knobs	72 X50 Rs	3,600
	TOTAL	9,260 KG'S	20,30,587.00/-

WEIGHT AND COST TABLE FOR MODIFIED

Table 6.4 Weight and cost table for Modified model

INDEX	MATERIAL NAME	QUANTITY & PRICE	COST
1	C22	1.606 x 416 Rs	669.00 /-
2	MS	3805.5 x 74 Rs	2,81,607.00 /-
3	Hard And Steel	5411.48 x 268 Rs	14,50,277.00 /-
4	Ohns	7.56 x 325 Rs	2,457.00 /-
5	Guide Sleeves	6 x 500 Rs	3,000.00 /-
6	Guide Pillers	6 x 1300 Rs	7,800.00 /-
7	Water Inlet Knobs	48 x 8 Rs	2,400.00 /-
	TOTAL	9,226 KG'S	17,48,210.00/-

CONCLUSIONS

In this venture the enhancement of oil container utilizing experimentation technique is finished. This undertaking decreases the sum and time. In the initial step the overview is led on oil skillet, its assembling and cost estimation techniques. In the following stage oil skillet demonstrate is readied utilizing expert/e programming for assembling and cost estimation reason. In the subsequent stage the form computations are done and arranged shape apparatus with existing and improved kick the bucket parts models. In the subsequent stage basic investigation is led on part utilizing customary material M.S F26 and new material Aluminum A360 kick the bucket cast compound. According to the examination results Aluminum A360 is the correct decision to make the oil container. As in the current form plan the hard steel was utilized for the center and hole parts of the bite the dust to withstand the high level of material temperature at the purpose of liquid metal pouring to such an extent this incorporates the material cost and assembling time for the pass on to utilize the whole strong square of center part with hard steel. So amid the improvement and changes for this kick the bucket shape it is chosen to part the center part into two pieces like center embed and center plate. With the end goal that center embed will be fabricate by hard steel and the center plate will be produce by mellow steel so it will diminish the material cost for the center embed and the machining time required for it and it will likewise facilitate the get together technique. As though it is required to supplant the center embed just in future. In this advancement just the parts those are conveying a high material cost and assembling time are streamlined yet other shape get together parts are not adjusted as those are gathered according to get together necessity. In this outline enhancement and changes it is demonstrated that the correlation for the assembling time required and the material costs required when improvement and how it will be valuable for the shape anufacturer from the time and cost perspective. It tends to be presumed that utilizing enhanced shape planning is more preferences in cost astute and time compelling. By utilizing improved form we can spare around 68 long periods of machining time and almost Rs.3,00,000. In the event that shape maker makes oil container with

Aluminum can lessen part cost almost 40%. Aluminum A360 is likewise have the closest qualities when contrasted with M.S. F26 so better to utilize Aluminum rather than customary material so organization can spare time and endeavors by doing in chilly chamber heater rather than hot chamber.

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