# A Review on Design and Calculation of Handle for Aluminum Door

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***Abstract* - Doors are the most essential hardware used by human beings daily. Doors are used for sense of security to ourselves. To operate the door we need door handle and it's the most important part in door. Door handles are used for opening and closing of a door with minimum effort. The handle is manufactured by die casting process. The die casting is a metal casting process that is characterized by forcing molten metal under high pressure into a mold cavity. The mold cavity is created using two hardened tool steel dies which have been machined into shape and work similarly to an injection mold during the process. Most die castings are made from non-ferrous metals, specifically zinc, copper, aluminum, magnesium, lead, powder, and tin-based alloys. Depending on the type of metal being cast, a hot- or cold-chamber machine is used. During the use of round shaped aluminum door handles it is observed that when opening the door whole load is concentrated on two screws which results in tearing the area where handle is fastened, it is also observed that once the fastened tear. It can't be repaired and looks odd. I have redesigned the handle maintaining its aesthetic appearance and design to overcome the said identified problem.**

***Index Terms* - Door handle, Design, Shape, Easy to use, comfort style.**

## INTRODUCTION

1. Die casting 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.
2. 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.
3. Die casting is a manufacturing process for producing accurately dimensioned, sharply defined, smooth or textured-surface metal parts. It is accomplished by forcing molten metal under high pressure into reusable metal dies. The process is often described as the shortest distance between raw material and finished product. The term "die casting" is also used to describe the finished part.
4. Die casting equipment was invented in 1838 for the purpose of producing movable type for the printing industry. The first die casting-related patent was granted in 1849 for a small hand-operated machine for the purpose of mechanized printing type production. In 1885 Otto Mergenthaler invented the Linotype machine, which cast an entire line of type as a single unit, using a die casting process. It nearly completely replaced setting type by hand in the publishing industry. The Soss die-casting machine, manufactured in Brooklyn, NY, was the first machine to be sold in the open market in North America.[2] Other applications grew rapidly, with die casting facilitating the growth of consumer goods, and appliances, by greatly reducing the production cost of intricate parts in high volumes.[3] In 1966,[4] General Motors released the Accured process.

## METHODOLOGY

The complete study of Design and analysis of Handel will be done through the CAD Software Solid Works 18 & CATIA

1. Study of component: Study of component is required to design the core cavity, to decide the

ejection surface and parting surface, drafts, hole , ribs and undercuts.

2. Design Parameters consideration: The design parameters which exert a significant influence on the quality of die castings comprise: the geometrical design of the product, die and the feed system and temperature.
3. Geometrical dimensional consideration: Some of the of geometric features to be considered when creating a parametric model of the component of a die casting:
   a. Holes require special consideration while designing dies because the accuracy in perimeters of these features will be difficult to achieve, and also for rectangular pockets it grips to the die steel during solidification. To overcome this effect, Shrinkage allowance should be added, and proper draft should be provided to pocket features.
   b. Parting Lines: Parting line represents the point at which two different sides of a mould come together. The location of the parting line defines which side of the die is fixed half and which one is moving half.
4. Modelling using software: For designing of dies it is required to first make parametric model of component, which is then used to create core and cavity of the dies. After core and cavity extraction further elements are designed like ejector pins, ejector plates, back plate, sprue spreader (Diffuser) etc.
5. After completion of designing of dies its production drawing must be released to start the manufacturing of die components, production drawing also helps to define the manufacturing process planning.

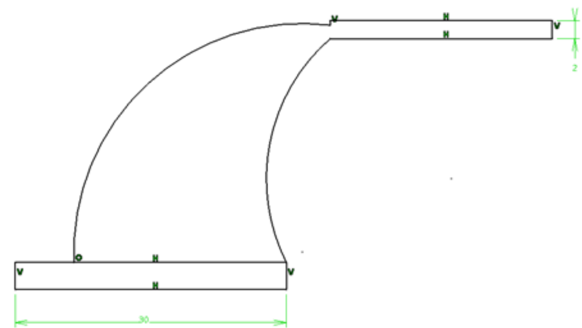
## OBJECTIVE

1. Change of design to achieve equally distributed load.
2. To design a suitable door handle which is user oriented
3. Reduction of material.
4. To maintain aesthetic appearance good.
5. To reduce the cross-sectional area.

## DESIGN CALCULATIONS

Volume of Component – 1.126 e-005 Cu M

Area of Component – 12000 sq mm



01. Calculation of opening force

$$\text{Opening force (Fo)} = \frac{Ac \times Pc}{100}$$

Where:

Ac = Area of component X 1.45 sq cm

1.45 = Area of feed system x Area of overflows

Pc = Cavity pressure/Technical Part

It will be considered as 400 bar to 600 bar

Ac = 12000 x 1.45

17400 sq mm

174 sq cm

$$(Fo) = \frac{174 \times 60}{100}$$

Fo = 1044 Ton

02. Calculation of Closing Force

Closing Force = Factor of safety + Opening force

$$\text{Closing Force} = \frac{20 \times 1044}{100} + 1044$$

$$= 1252.8 \text{ Tons}$$

From machine specification, machine will be selected by projected area of component,

Our component projected area is 174 scum which is under machine area range.

03. Calculation of Gate area

Where:

Qg = Discharge of material through gate

Vg= Gate Speed

$$Qg = \frac{\text{Volume of component} \times 1.30}{\text{Filling time}}$$

The filling time is taken as average value

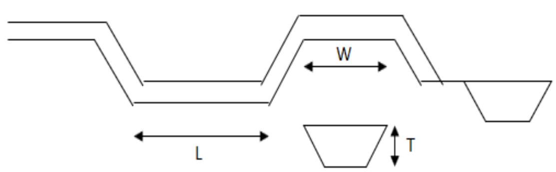
$$Qg = \frac{0.0000126 \times 1.30}{0.1}$$

Qg= 0.00014638 cu m
Qg= 146.38 cu cm/sec
Vg= 50 m/sec
Vg= 5000 cm/sec

$$Ag = \frac{146.38}{5000}$$

= 0.0292 mm
= 0.0292 x 100
= 2.92 sq mm
Round of 3 sq mm

4. Thickness of gate = S/3
Tg = 2/3
Tg =0.667mm
Tg = 1 mm
Where,
S= Area of wall Thickness




05. Width of Gate, Wg = Ag/Tg
Where,
Ag= Area of gate.
Tg= Thickness of gate.
Wg = 3/1
= 3 mm

06. Length of Gate Tg = 2 to 3 times of Wg
= 2 x 3
Tg= 6mm

07. Area of Runner, Ar = 1.25 x Ag
= 1.25 x 3
= 3.75
Ar = 4 mm

08. Runner depth, Tr $= \sqrt{Ar/1.6}$

$= \sqrt{4/1.6}$
= 1.58mm
= 2mm

09. Width of runner, Wr= Ar/Tr
= 4/2
= 2mm

10. Length of Runner, Lr = 2 x Wr
= 2 x 2
= 4 mm

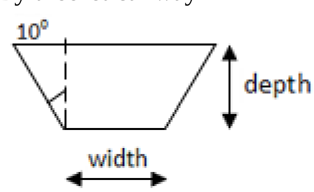
11. Ejector pin calculation
Ejector area = 4% of component area
Ac= 1200 x 4/ 100
Ac= 480 sqmm

Consider ejector pin dia as 8mm
Area, A (Ejection pin) = $\pi r^2$
= $\pi \times 4^2$
= 50.26 sqmm

No. of ejection pin = Area (ejection)/ Area (ejection pin)
= 480/50.26
= 9.55
= 10 pins

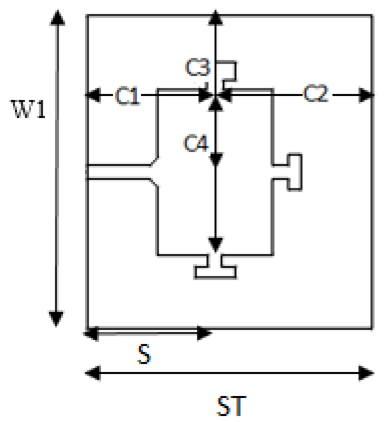
12. Overflow calculation: -
Taken as 30% of component volume = 30 x 14.63/100
= 4.389
= 5 cucm
Consider overflow = 3
lume of single overflow = 5/3
= 1.66 cucm
= 1.66 x 1000
=1666.66 cumm

By theoretical way




Depth = 3 x thickness
= 3 x 2
= 6 mm
Width = 2 x depth
= 2 x 6
= 12 mm
Length = 2 x width
= 2 x 12
= 24 mm

CAVITY INSERT

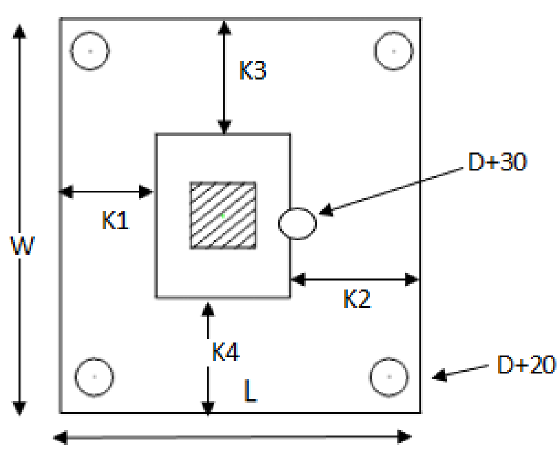



Take, where,
C1=30, Distance from center line

C2=30, Distance from center line
C3=50, Distance from center line
C4=50, Distance from center line

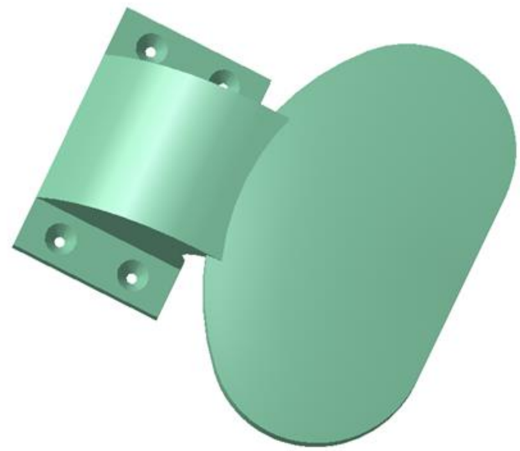
S = C1+75
= 30+75
= 105 mm
W1 = C3+C4+120
= 50+50+120
= 220 mm
ST = S+C2+60
= 105+30+60

CORE INSERT




Take,
K1 = 80 , K3 = 100
K2 = 80 , K4 = 100
L = K1+S1+K2
L = 80+95+80
L = 255 mm
W = K3+W1+K4
W = 100+220+100
W = 420 mm n

COMPONENT DESIGN-



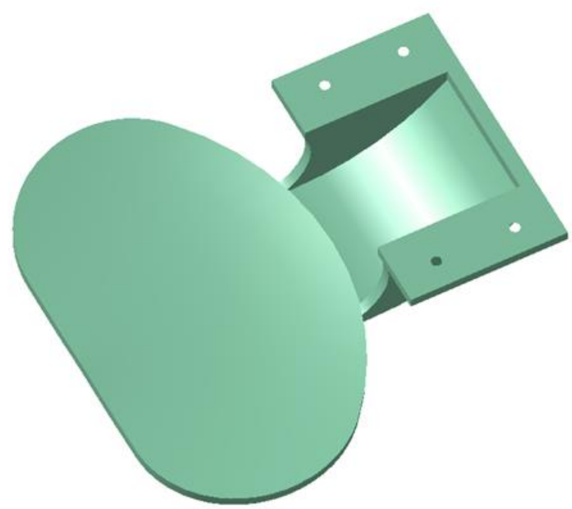
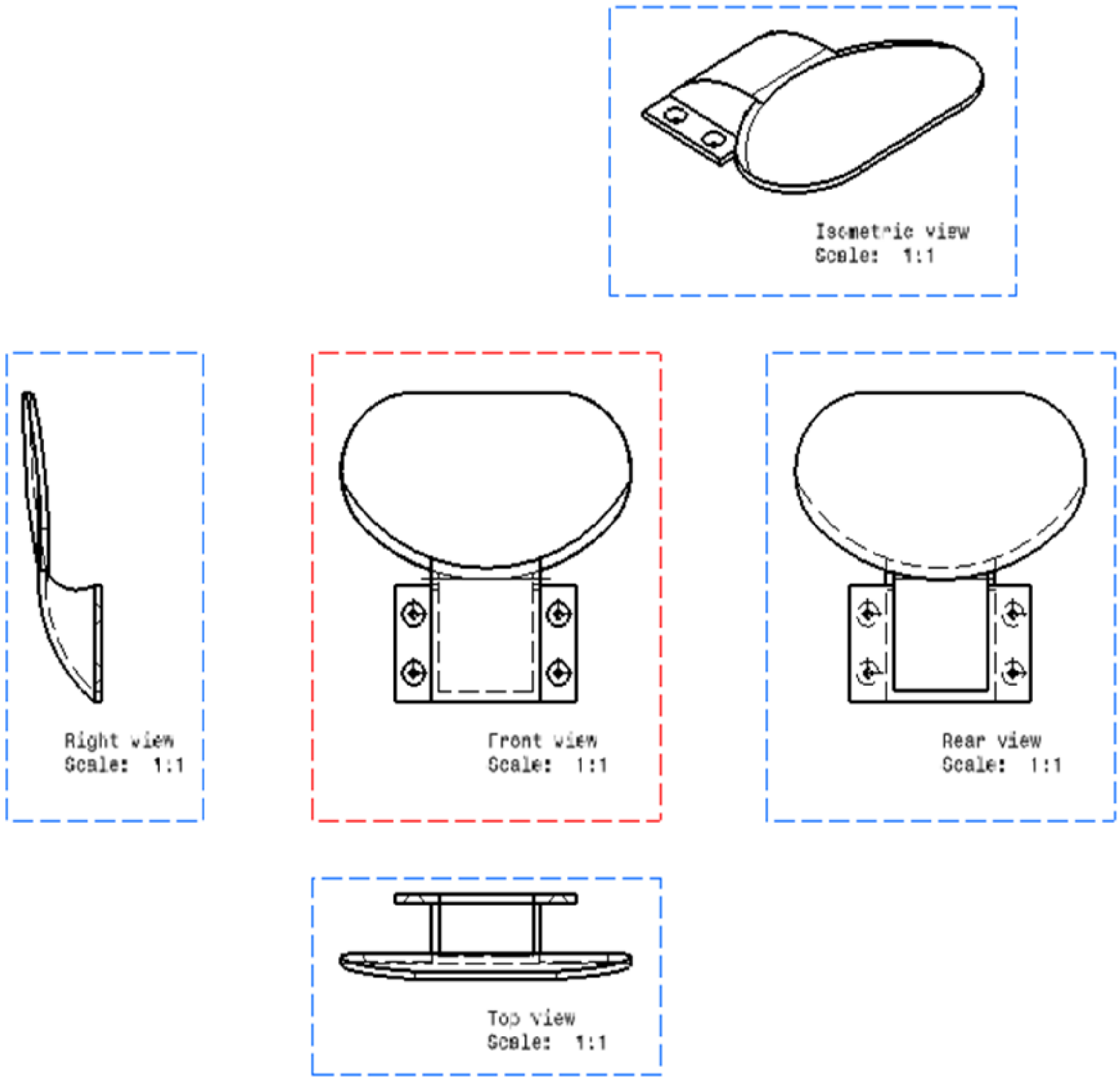
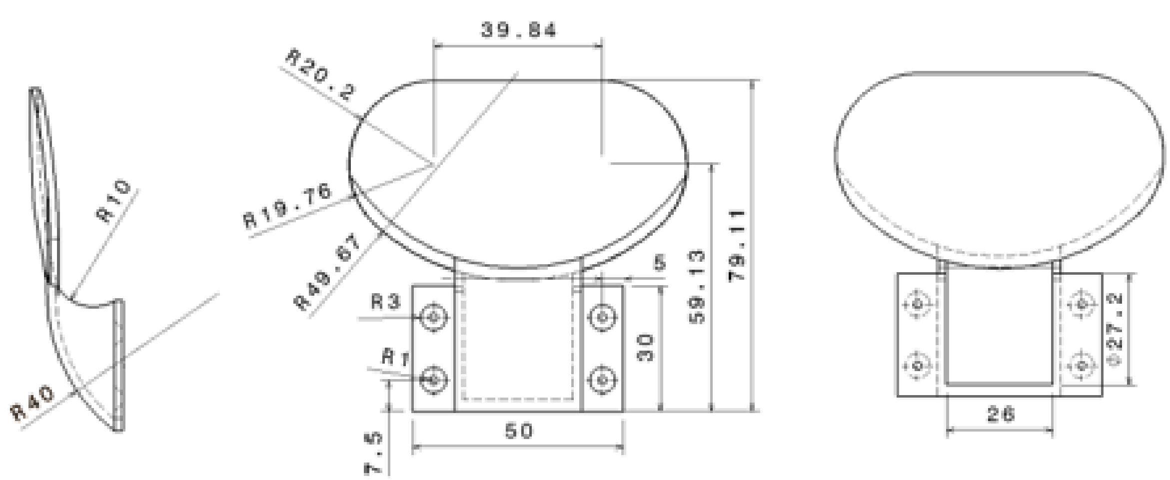


Fig. Alluminium Door Handle


Isometric view
Scale: 1:1
Right view
Scale: 1:1
Front view
Scale: 1:1
Rear view
Scale: 1:1
Top view
Scale: 1:1


39.84
R20.2
R19.76
R49.67
R10
R40
R3
R1
7.5
50
5
30
59.13
79.11
27.2
26

## CONCLUSION

In this research we successfully study the design parameter and analyzed for the purpose of determination the design component is safe, strong and easy to use. This design component is easy to handle and comfort style.

## REFERENCES


[1] "The Production of Alluminium Die Castings using a Fan Gate"Transactions, Society of Die Casting Engineers, (now NADCA) 1975, Paper G-T75-122 A. J. Davis and P. M. Robinson.

[2] "The Significance of Metal Pressure in Hot Chamber Die Casting" Parts I, II and III Transactions, Society of Die Casting Engineers, (now NADCA) 1977. A. J. Davis and H. Siauw.

[3] "Rationale of the SDCE Gating Equation "Proceedings, Australian Die Casting Association, 1989 E. A. Herman.

[4] "A Fast Die Design Technique"Proceedings, Australian Die Casting Association, 1993 Graham Wilson.

[5] "The Effect of Operating Conditions & Gate Design on the Fill of 4mm Thick Flat Plate Castings" - Parts 1,2 and 3. Proceedings, Society of Die casting Engineers of Australia (now ADCA), 1980 A Davis, H. Siauw, M. Murray.

[6] "Zinc Pressure Die Casting - the Metal Flow System" Australian Zinc Development Association M. A. Cope.

[7] "Venting Design in Die Casting: An Analytical Approach" Transactions, North American Die Casting Association, 1991 Yiftah Karni.

[8] "Implementing Activity Based Costing" Transactions, North American Die Casting Association, 1991 Graham Wilson.

[9] "The Role of Pressure in High Pressure Die Casting" Transactions, North American Die Casting Association, 2001 G. Savage, M. Gershenzon, K.J.Rogers.

[10] "Improvements in Zinc Die Casting Using Hot Sprue Technology" Transactions, North American Die Casting Association, 2001 Graham Wilson