CONCEPT DRAWING FOR OIL DRAINING MACHINE FOR VTU WITH NUMERICAL ANALYSIS

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Abstract:

The aim of this Project is to Manufacture and design Oil Draining unit for Vary Touch Unit (VTU) to overcome the current problem of the industry and to make the efficient unit to increase the productivity and reduce the human fatigue. The proposed machine will be automated and will work with the help of PLC program. The machine will be compact as compared to the existing unit and it will be easy for the maintenance work whether it is mechanical or electrical or instrumental side as all the components on the machine will be easily approachable.

Keywords: The machine will be completely automated and will work on the PLC program.

1. Introduction:

Introduction Of Current System

The VARY TOUCH UNIT (VTU) is a part of TRACTOR which is use to hold the Plough. The VTU contains hydraulic oil due to which it can hold the weight of around 800kg firmly After Load testing of Vary Touch Unit in the process the parts which pass all the criteria are ready for the dispatch for final use before introduction of these parts in to the market the oil which it contains it must be drained out completely The current unit which is use for draining purpose has some limitations due to which the productivity of the plant is decreased and the plant is under maintenance for more time due to MECHANICAL and ELECTRICAL break downs. The problem which the industries are currently facing with current unit are listed below

1) Frequent breakage of hinges used in structure.
2) It is not PLC based.
3) OIL draining Problem.
4) Collection of drain Oil is also difficult
5) Cycle time req. for draining oil is more
6) The conveyor on which the VTU draining is done is not properly aligned with the before and after conveyor
7) After lifting and tilting the VTU for Oil draining it touches the VTU which lies behind it.
8) The clamping mechanism which is available for holding the VTU while lifting and tilting is manual.
9) The position of lifting cylinder is in the pit and the drain oil is deposited in the pit so that the floor is become slippery which may cause accident.

2. Proposed System:-

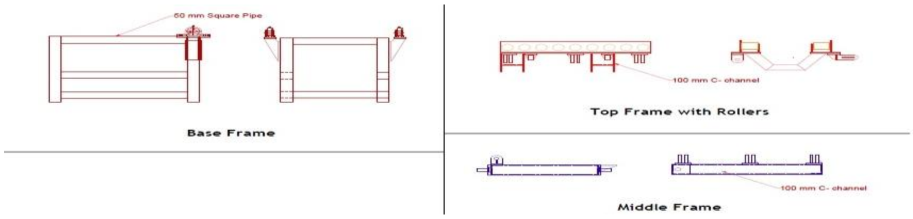
The proposed system will overcome the entire problem which is associated with the current system in terms of productivity and function ability; the proposed system will comprise the following characteristics

1. The hinges which will be used are machined hinges.
2. The entire unit will be PLC based.
3. Try to reduced maximum use of Hinges and instead of Hinges at few points will use Plummer Block for proper and smooth motion
4. For draining purpose there will be a drain tank on unit itself and it will contain the drain tap at the base so that the collected oil will be transferred easily to oil tank.
5. The unit will at the height of the before and after conveyor so that it will be align properly with the existing conveyor.
6. After lifting and tilting of VTU for Oil draining it will not touch the VTU which lies behind it.
7. The clamping will be automated in our unit and it will be hydraulically operated so that the it will hold the VTU firmly
8. The position of lifting cylinder will be on the structure itself and it will avoid the saturation of oil on the floor

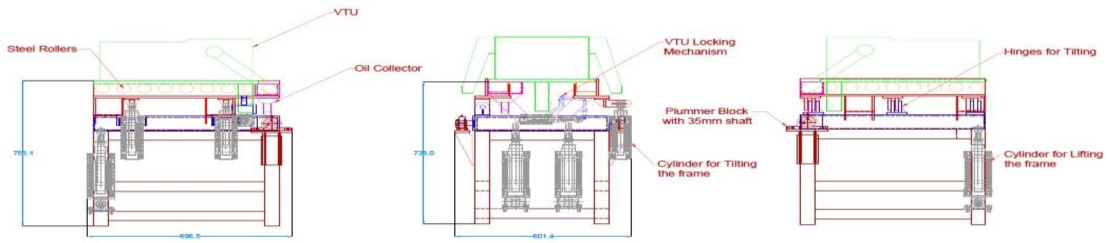
With this unit we will try to make the best draining unit and it will increase the productivity and the number of VTU dispatch per day will increase as the chances of breakdown of the unit will reduced. The unit which we are introducing will try to couple with the vacuum pump also so that the strain mark of the oil **or** the oil which will present in the oil chamber of VTU will be sucked completely. As soon as the draining cycle will complete the Vacuum pump will get actuated and it will be connected with the PLC itself.

3. CONCEPT DRAWING

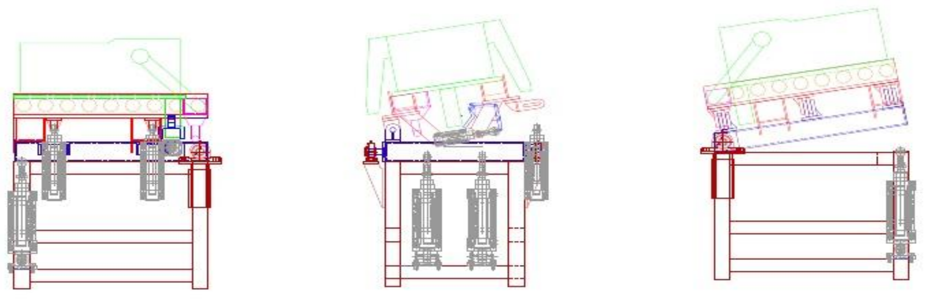
a) Part Drawing



b) Assembly Drawing



4. Proposed Working Condition



Original Position　Tilting Condition Final　Lifting Condition Final

5. Proposed Sequence of Operation

1. Operator will press the start cycle button.
2. System will sense the presence of VTU on the drain unit and will start only if there is VTU present.
3. Lock cylinder between incoming VTU and drain unit will be actuated.
4. Next locking clamp cylinder for VTU locking on drain unit will be activated.
5. After 1 sec delay the first platform cylinder will be actuated and simultaneously a connection to vacuum pump will actuate to start the vacuum pump.
6. After delay of 3-5 sec, second platform's tilting cylinder will be actuated.
7. System will remain in tilted position for 30 Seconds (Can be set as required).
8. After cycle completion both tilting and lifting cylinders will be deactivated and system will come to its home position.
9. Next VTU will be unlocked by deactivating respective clamp cylinder
10. Lock cylinder will be deactivated after a delay of 5 second so that operator will get time to unload the VTU.

5.5 Numerical Calculation:-

Load of the object = 130Kg

Weight of Top Frame = 60Kg

Weight of Middle Frame = 60Kg

Total Weight = 250Kg

For Design Consideration

Assume Total Weight = 300Kg

a) Initial Condition

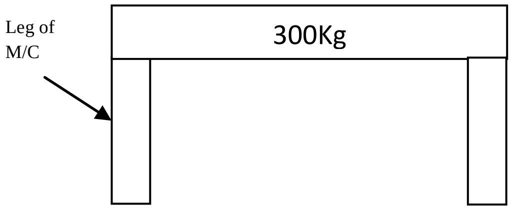
When the part is loaded on the machine and the machine is in **ideal** condition

Б = F/A

= (300*9.81)/100

= **29.43 N/mm^2**

Б (for Single leg) = **7.35N/mm^2**

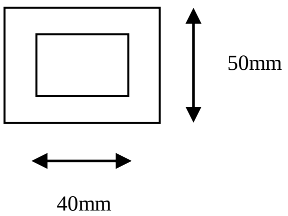


Bending Moment:-

$R_A + R_B$ = 300*9.81

$R_A + R_B$ = 2943 N

$\Sigma M_A = 0$

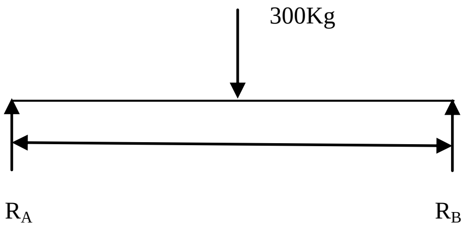


R_B * 0.56 = 2943 * 0.28

R_B = 1471.5 N-m

&

R_A = 1471.5 N-m



0.56m

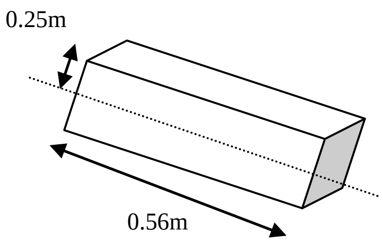
Bending Moment at C

$\Sigma M_c = 0$

1471.5*0.25 = R_c

R_c = 412.02 N-m

Bending Stress



M / I = F/ Y = E/R

M= Max. Bending Moment

I = Moment of Inertia

F = Bending Stress

Y = Distance of Neutral Axis

Y = 0.25m

M = 412.02 * 10^3 N-mm

I = (BD^3 / 12 – bd^3 / 12)

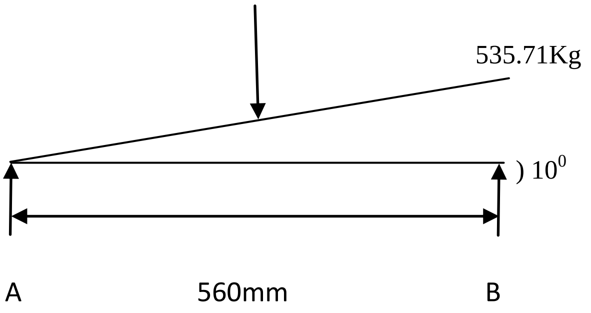
= (50^4/12 – 40^4/12)

= **307500 mm^4**

412.02*10^3/307500 = F/25

F = 33.49 N/mm^2

b) Lifting Condition:-



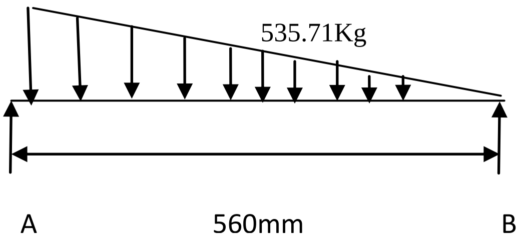
c

300Kg/0.56m = X/1m

X = 535.71Kg

W = ½ *(535.71*9.81)*0.56

= 1471.4N



$R_A + R_B$ = 1471.4N

$\Sigma M_A = 0$

0.56*R_B = 1471.4*0.186

R_B = 1471.4*0.186/0.56

R_B = 488.5N

R_A = 982.4N

A = π*D*W

= π*25*5.4

A = 424.11mm^2

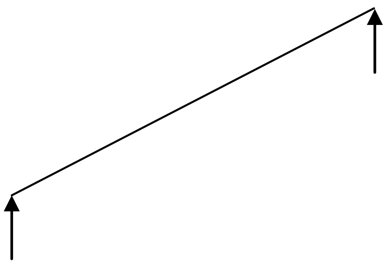
Б = F/A

= 5255/424.11

Б = 12.39N/mm^2

B

c) Tilting Condition:-



Weight of frame: - 240Kg

134.4*9.81 = 1318 N

A

F = 1318 N

$R_A + R_B$ = 1318 N

$\Sigma M_A = 0$

$.56\ R_B = 1318*.28$

$\mathbf{R_B = 659\ N}$

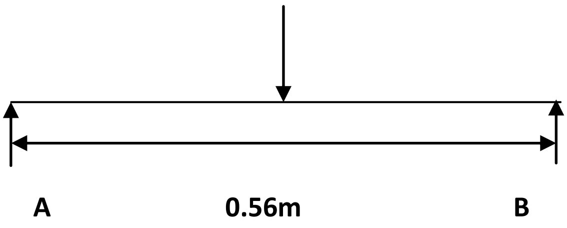
$R_A = 659\ N$ 240*.56 = 134.4Kg

B.M. at A = 0

B=0

C = 659*.28

C = 184.52 N



Bending Stress

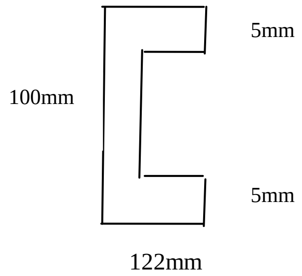
M / I = F/ Y = E/R

M= Max. Bending Moment

I = Moment of Inertia

F = Bending Stress

Y = Distance of Neutral Axis



M = WL/4

= 134.4*.56/4

= 18.8 N-M

$\mathbf{M = 18.8 * 10^3\ N\text{-}MM}$

$I_{XX\ 1} = 122 * 5^3 / 12 + (122*5 *50^2)$

$\mathbf{I_{XX\ 1} = 1.56 * 10^6}$

$I_{XX\ 2} = 5*90^3 / 12$

$= 3.03*10^5$

$\mathbf{I_{XX\ 2} = 3.03*10^5}$

$I_{XX\ 3} = 122*5^3 / 12 + (122*5*47.5^2)$

$= 1.3*10^6$

$\mathbf{I_{XX\ 3} = 1.3*10^6}$

$I_{XX} = I_{XX\ 1} + I_{XX\ 2} + I_{XX\ 3}$

$= 1.56 * 10^6 + 3.03*10^5 + 1.3*10^6$

$\mathbf{= 3.16 * 10^3}$

$F = M*L / I_{xx}$

$= 18.8 * 10^3 * 50 / 3.16*10^6$

$= .290\ N / M^2$

$\mathbf{F = 2.90\ N / MM^2}$

Bending Stress = 2.90 N / MM^2

References

[1] Design data book by **B.D.Shivalkar**
[2] Auto CAD Software
[3] Machine Design by **R. K. Bansal**
[4] Machine Design by **Khurmi Gupta**