بسم الله الرحمن الرحيم

DESIGN AND BUILDING MACHINE FOR MULTIUSE GRAPES JUICE

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Abstract

Grape squeeze machines used in Palestine facing many problems that effect on the juice output quality , this project will solve the problems related to squeezing process, and use anew mechanical and electrical design of pressing grapes that adopt batch press method with multi stage filtration.

الملخص:

تواجه ماكينات عصر العنب في فلسطين مشاكل عدة والتي تؤثر بدورها على جودة المنتج الذي يعتمد على عصير العنب، وهذا المشروع سوف يعمل على حل المشاكل المتعلقة بعملية عصر العنب وسوف يستخدم في هذا المشروع تصميم ميكانيكي وكهربائي حديثين لعصر العنب والذي يعتمد على طريقة الكبس و استخدام وحدة تنقية متعددة.

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Symbols	Title
A	Mean Cross sectional area
A_t	Cross sectional area of the plastic tube
A_p	Piston area
A_m	Machine area
D	Mean Diameter
D_{cy}	Cylinder diameter
D_{rod}	Cylinder rod diameter
D_t	Plastic tube diameter
D_m	Diameter of the machine.
$\mathcal{L}$	Tolerance grade for hole
P	The Pressure
P_i	Inner pressure
P_{air}	air pressure inside the pneumatic piston
P_g	pressure exerted and needed to press the grapes
F_p	piston force (force exerted by piston)
F_g	force needed to press the grapes
r_i	Machine cylinder inner radius
r_o	Machine cylinder outer radius
V	Volume
V_{max}	Volume of tube
V_{min}	Volume after pressing
L_s:	Piston stroke (The length of stroke applied at the grape by the piston)
L_r:	Residual length after pressing
L_m:	Length of the press machine
δ	fundamental deviation
Sf	Scale factor
C	Compression ratio
$S_y(S_{yt})$	yield strength of stainless steel 304

t	Thickness of cylinder
d	Notch diameter
w	width
σ_t	Tangential stress
σ_r	Radial stress
σl	longitudinal stress
M	Moment at the gate pivot
n	Factor of safety
σ'	***von Mises stress(shear-energy theory)***
h	Distance of the spring from the pivot
K_t	Concentration factor
K	Stiffness of the spring
δ	Deformation of the spring

Chapter One

Introduction

Contents:

1.1 General Outlook

Food productions such as treacle (dibs) that depend on grape juice are spcared widely for a long time in many regions and it is play an important role in Palestinian economical and social life. Many process and methods applied in Palestine to squeeze grapes, one of the most methods used in Palestine is the continuous method which generally used the screw to squeeze grapes.

From field studies of the machine designs many, problems associated to these systems such as crushing the grape seeds and bough, which reduce the grape juice quality .This project will solve the problems associate with the grape squeezing, by choose a new design that adopt the batch method which use the pneumatic press and multistage filtration, so high juice quality will be achieved.

1.2 Project Goal

The main purpose of this project is to look for a new grape press machine design, which more efficient and requires less effort and time needed to operate it. Also high output grape juice quality due to provide the new press machine with a multi stage filter. This machine will take into account the quantities of grapes that produced into Palestine per year, and the quantities needed for food products such as treacle (Dibs).

1.3 Methodology of work

During our Planning and designing of this project, project passes through schedule and program that contains sequence of steps start with:

(1) Field visits to the grape squeezing places that operated by the municipalities such as Alkader in Bethlehem, All of that in order to identify principle of operation and design details of available machines. During several visits, we have appointment the negative aspects of these machines; also we have developed general look about appropriate design takes into account the size and economic feasibility our machine.

(2) We studied and reviewed the previous studies for the grapes quantities of and there various distribution in Palestine and the West Bank, by access to official documents through various institutions such as Palestinian grape board and the Palestinian Ministry of Agriculture in Hebron, as well as access to Bachelors message of some students at Hebron University. [3]

(3) Study the different designs of squeezing machines and evaluation the alternatives operational process in squeezing grape. In addition to a previous project made by students from Palestine polytechnic University. This project used screw method in grape press. [4]

(4) Evaluate and calculate the production amount of grapes in the West Bank, and determine the quantities of production in areas where the food products industry such as (Dibs, milban) is important in that areas especially in Hebron and Bethlehem, Based on these quantities we were determine the size of the machine and method of work, which will adopt the batch method. Because it is more efficient and do not affect on the product largely, also it use pneumatic press which is clean and do not need much power to press grapes. Also it has multi filtration units which increase the grape juice quality.

(5) Economic feasibility was calculated of this project. Also we studied the project effect on the agricultural economy in terms of land reclamation for agriculture, this will lead to increase the grape production quantity, and achieve a good income return to farmer families.

(6) An actual experiment was conducted, in order to determine the pressure needed to press the grape completely, and to determine the size and the dimension of the machine.

1.4 Factors for the project importance

1- Improvement and enhancement the agricultural industry sector, by looking for a new designs that solve problems that affect on the production quality.

2 – The surplus quantities from the grape crop in Hebron and Bethlehem, which may be subjected to damage due to the lack of sufficient demand from the domestic market and the difficulty of exporting.[9]

3 - Food products (such as Dibs and milban, jam) making are depend on manual and primary methods; this methods require time and effort. These methods would delay the appropriate time of squeezing grapes, thereby this will reduce the quality of output product.

4 – Available demand on the domestic market for processed food products derived from grapes and grape juice, this will lead to disposal of the food products in the local market throughout the year.

5 - The availability of press machines will work to increase the employment opportunities at both the agricultural and industrial economic income and will

increase the farmer's income of in particular, and increase the farmer's interest in grape cultivation.

7 - The need for home-made food products to compete and to be substitute for Israel products. This will increases the economic income of Palestinian families, through sale the crop at appropriate price in the difficult economic situation.

The building of such a machine will lead to the promotion of a large part of farmers to grow grapes and thus increase the cultivated area with grape, also this will lead to the reclamation of land, choosing the grape types that appropriate to food products manufacture such as (al-dbapoqee) and to improve the farming methods adopted.

On the other hand, increase the cultivated land will preserve land from desert extent, also the possibility of using the solid material after squeezing to feed animal and the possible use of waste in the manufacture of fertilizers, and seeds of grapes are also used, which is used for the medical and cosmetic purposes, furthermore, it will help to conserve one of the important cultural and social aspects of Palestine people life.

1.5 Data collection and analyses

Grapes are occupy an important role in the economic and social life of the Palestinian people and take a place beside the olive in the agricultural sector throne, And it is one of the main sources of agricultural income, as it value contribute up to approximately (9.5% to 12.3%) of the agricultural production. Thus it occupied the second place after the olive culture in Palestine in terms of cultivated area and in terms of quantity of production.[2]

Grapes are cultivating in Palestine widely especially in Hebron and Bethlehem cities, with an annual cultivated area in these regions about 78904 Donuum. With an 43774 Donuum of planted area in Hebron, which its rate is close to 55.4% of cultivated land in the West Bank, and it produce approximately 35692 Ton of grapes with an average about Tone per Donuum.[2] The grape quality in these regions is considered the highest in the world because of the high percentage of sugar in it and its high resistance to disease.

Grape farmers suffer in both regions (Hebron, Bethlehem) from many problems, notably the increased quantities of grapes which remain without pick down from its trees until the end of squeezing season this quantities called surplus quantities as the total annual excesses (surplus) grape quantity in the West Bank about 811.142 ton, due to several factors, including problems of internal and external marketing because of Israeli control, isolation of the West Bank and obstruct the export.

1.6Areas planted with grapes in the west bank

Hebron and Bethlehem areas is Considered the most productive of the grape Crops in the West Bank, and there are more than 15 villages in both regions, the cultivated area with grape in this two regions forming the most planted area in comparison with the other planted fruit. Table (1-1) represents the planted area and production quantity of grapes in Hebron city and its village in 2005.

Table (1-1): planted area distribution in Hebron in 2005

Village in Hebron district	Planted Area (Donuums)
Hebron	14212
Halhul	5705
Tafoeh	162
Beit Omer	5420
Saieer	1015
Yatta	1903
ALsheoq	1225
Edna	1465
Bani-noem	865
Tarqomia	1285

Source: 1- Palestine ministry of agriculture. 2- Palestinian grape Board.

Also grapes grow with varying percentages in all regions of the West Bank, and Table (1-2) show the distribution of cultivated areas and production quantity per year, quantities of grapes needed for Dibs. [2]

Table (1-2) Planted area and the amount of production of each country in 2005.

Country \Area	Total planted area	Total amount of producti on	Percent of/total planted area	Fresh grapes (ton)	Dibs product (ton)	Export to\Israel factories (ton)	surplus amount (ton)
Total area	٧٨٩٠٤	٧٨٢١٧	١٠٠	٥٢٦٤٠.٠٤	٥٩٧١.٧٩٢	١٠٣٧٩.٨	٩٢٢٥.٣٦٣
West bank	٧٤٧٩٥	٧٤٨٣١	٩٤.٨	٥٠٣٦١.٢٧	٥٩٧١.٧٩٢	١٠٣٧٩.٨	٨١١٨.١٤٢
Jenen	٤٢٥٧	١٥٤٩٦	٥.٤	١٠٤٢٨.٨١	٠	٠	٥٠٦٧.١٩
Topas	١٤	١١	-	٧.٤٠٣	٠	٠	٣.٥٩٧
Tolekarem	٦٦	٦٧	-	٤٥.٠٩١	٠	٠	٢٠.٩٠٩
Nablus	١٢٢١	٨٧٨	١.٥	٥٩٠.٨٩٤	٠	٠	٢٨٧.١٠٦
Qlqelia	٥٠	٤٨	-	٣٢.٣٠٤	٠	٠	١٥.٦٩٦
Salfieet	١٠٨٠	٨٩٤	١.٣	٦٠١.٦٦٢	٠	٠	٢٩٢.٣٣٨
Ramallh	٢٥٣٤	١٣٥٦	٣.٢	٩١٢.٥٨٨	٠	٠	٤٤٣.٤١٢
Jericho	٧٤٨	١١٨٥	١	٧٩٧.٥٠٥	٠	٠	٣٨٧.٤٩٥
Jerusalem	٢٨١٢	١٩٩٤	٣.٥	١٣٤١.٩٦٢	٢٥٣.٢٣٨	١٩٩.٤	١٩٩.٤
Bethlehem	١٩٢٣٩	١٧٢١٠	٢٤	١١٥٨٢.٣٣	٢١٨٥.٦٧	٣٠٤٢	٤٠٠
Hebron	٤٣٧٧٤	٣٥٩٩٢	٥٥.٤	٢٤٠٢٠.٧٢	٣٥٣٢.٨٨٤	٧١٣٨.٤	١٠٠٠

Gaza strip	٤١٠٩	٣٣٨٦	٥,٢	٢٢٧٨,٧٧	٠	٠	١١٠٧,٢٢ ٢
North/Gaza	٥٠٠	٣٩٢		٢٦٣,٨١٦	٠	٠	١٢٨,١٨٤
Country \Area	Total planted area	Total amount of producti on	Percent of/total planted area	Fresh grapes (ton)	Dibs product (ton)	Export to\Israel factories (ton)	surplus amount (ton)
Gaza	٢٨٦٣	٢٢٧٤		١٥٣٠,٤٠٢	٠	٠	٧٤٣,٥٩٨
Derbalah	٦٥٠	٦٥٠		٤٣٧,٤٥	٠	٠	٢١٢,٥٥
Kanyouns	٥٦	٥٢		٣٤,٩٩٦	٠	٠	١٧,٠٠٤
Rafah	٤٠	١٨		١٢,١١٤	٠	٠	٥,٨٨٦

Source: 1- Palestine ministry of agriculture. 2- Palestinian grape Board.

And the chart (1-3) below shows the varying distribution of production in Palestine in 2005.

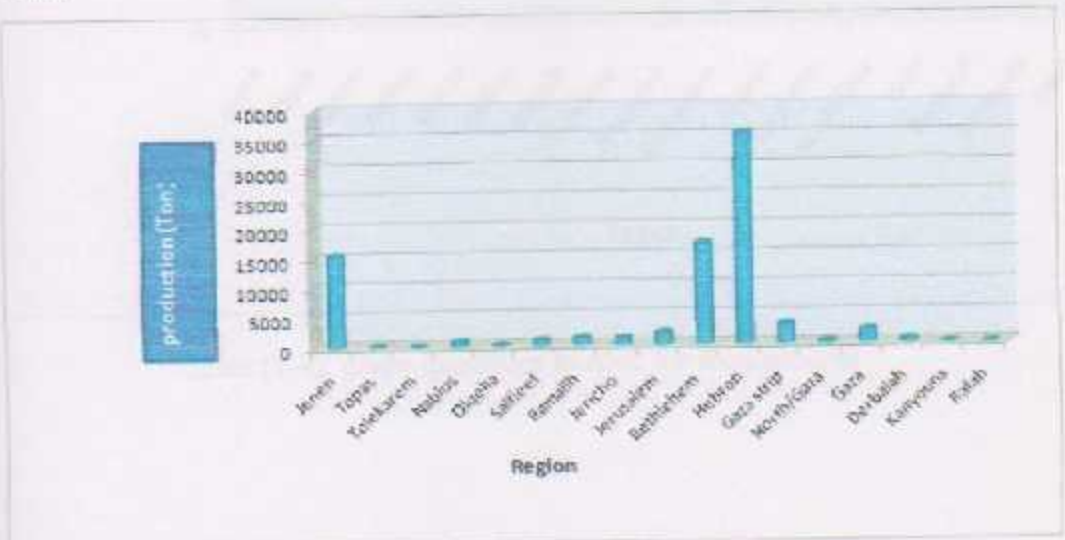


chart (1-3) Grape quantities distribution in Palestine.

It Seen from the tables above, that the most of the cultivation of the grapes are heavily concentrated in the areas of Hebron and Bethlehem, and they are forming 79.4% from the total area in the West Bank, and they produce a rate of 71,123% from the total production in the West Bank.

People in these regions produce the traditional food products such as Dibs and Almilban that need the grape juice as shown in the chart (1-4) for commercial purpose, this products done through a simple and primitive methods. First collecting the mature grape and then it cleaned, after that it squeezed by hand by putting it into Sackcloth pocket and then it pressed by hand, or by available machines that most of them use screw.

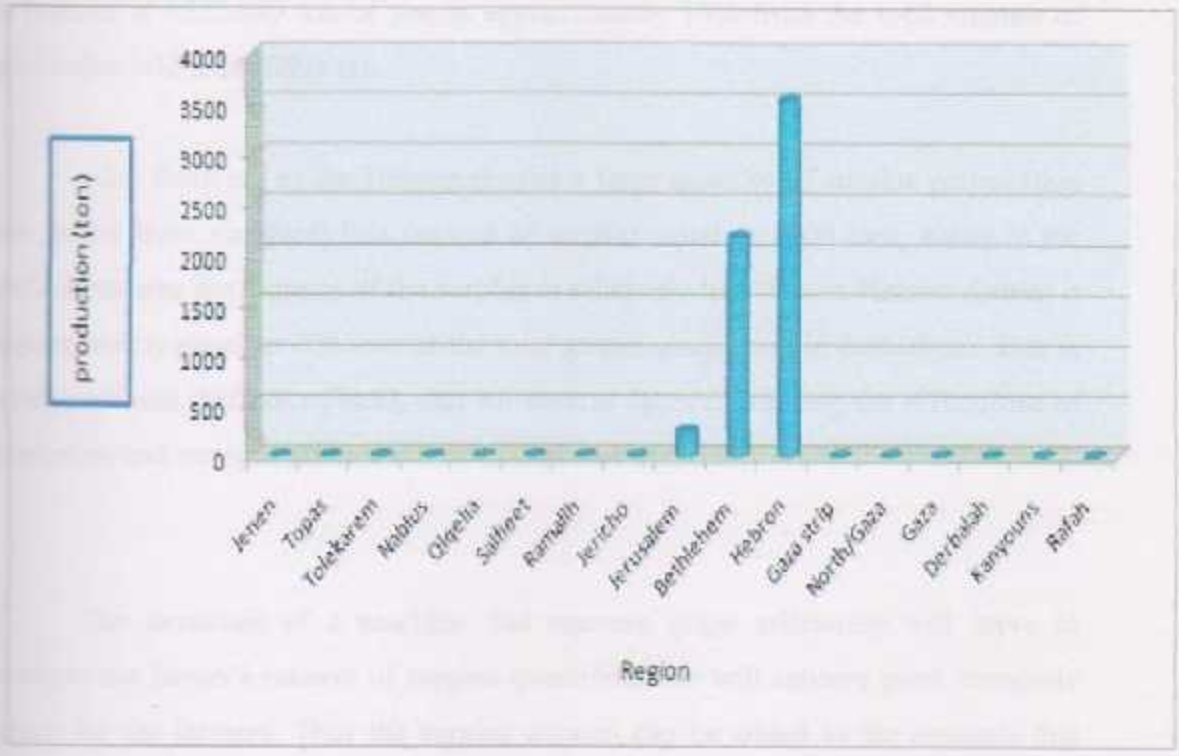


Chart (1-4): grape quantities needed for food product

From the chart above all food products made widely in Hebron and Bethlehem which make them the major cities that use squeezing machine for that purpose only, from our field studying These methods have negative sides on the product in terms of need time and effort to do the work and the reduction of product quality, also lack of efficient filtration and accuracy of squeezing grapes in these methods.

1.7 Food products quantities analysis

The amount of grapes needed to manufacture the food products such as Dibs in Hebron is 3532.889 ton of grapes approximately 10% from the total amount of production which is 35692 ton.

Also there are in the Hebron district a large quantity of surplus grapes (that not picked from vineyard) this amount of surplus equal to 1000 tons, either in the Bethlehem area the amount of the surplus is relatively less than in Hebron district it approximately equal to 400 tons of the total grapes production in Bethlehem. This is a large amount that not utilized, that for several factors including the difficulties of marketing and transportation and lack of care and attention.

The existence of a machine that squeeze grape efficiently will serve to increase the farmer's interest of surplus quantities, this will achieve good economic return for the farmers. Thus the surplus amount can be added to the amounts that going to make food products such as Dibs.

So the percent and the amount of grape go to treacle (Dibs) will become as follow:

Hebron district:

$$new\ amount = the\ real\ amount\ of\ grapes\ needed\ to\ be\ squeezed + surplus\ in\ amount\ in\ hebron$$

$$= 3532.844 + 1000 = 4532.844\ ton$$

The new percentage of grapes needed to make food products from the total production of grape in Hebron

$$= \frac{4532.844\ ton}{35692\ ton} * 100\ \% = 12.7\ \%$$

The total area in the West Bank, nearly 74795 Donuum and the total amount of production is 74831 tons. So the rate of production per Donuum is:

$$= \frac{74831}{74759} = 1.0009\ ton/donuum$$

$\frac{74831}{74759} = 1.0009$ ton / Donuum.

So the production rate of the West Bank and its various regions is approximately ton/Donuum. Table (1-5) below shows the distribution of grape production in Hebron villages and the grape amounts of food products in major cities and their villages.

Table (1-5): Grape quantities distribution in Hebron district.

Area	Followed villages	Area planted donuum	Quantity of grape production per year/(ton)	Total quantity production (ton)	Grapes need to produce dibs from total quantity in Hebron (* 12.5%) (ton)
Al smoeh	Alsamoeh Wad alamayra amnezl	٢٢٥ ٨٥ ٦٠	٢٢٥ ٨٥ ٦٠	٣٧٠	٣٧٠*12.5%=46.25
Yata	yata alhela alrehea zeef Alboeb Bet amra alkarmel	٤٠٠ ٨٩ ٢٣٦ ١٦٨ ٩٦ ٧٥٩ ١٠٥	٤٠٠ ٨٩ ٢٣٦ ١٦٨ ٩٦ ٧٥٩ ١٠٥	١٩٠٣	٢٣٧.٨٧٥
Aldahrea	Aldahrea Altawany Meen Enab alkabera	٣١٥ ٨٠ ٨٨ ٥	٣١٥ ٨٠ ٨٨ ٥	٤٨٨	٦١.٠٠
Banynoaem	Banynoaem	٨٦٥	٨٦٥	٨٦٥	١٠٨.١٢٥
Taffoh	Taffoh	١٦٢	١٦٢	١٦٢	٢٠.٢٥
Tarqomea	Tarqomea	١٢٨٥	١٢٨٥	١٢٨٥	١٦٠.٦٢٥
Alsheok	alsheok	١٢٢٥	١٢٢٥	١٢٢٥	١٥٣.١٢٥
Sueer	Sueer Hamrosh Am albutm	530 ٢٤٠ ٢٤٥	530 ٢٤٠ ٢٤٥	١٠١٥	١٢٦.٨٧٥
Halhool	Halhool	٥٧٠٥	٥٧٠٥	٥٧٠٥	٧١٣.١٢٥
Betomer	Betomer Jala	٤٩٢٠ ٥٠٠	٤٩٢٠ ٥٠٠	٥٤٢٠	٦٧٧.٥٠
Alaroob	Alaroob Shouokh alaroob	٧٥٤ ١٣٣	٧٥٤ ١٣٣	٨٨٧	١١٠.٨٧٥
Edna	edna heta	٤٥٩ ٩٧٠	٤٥٠ ٩٧٠	١٤٦٥	١٨٣.١٢٥

Sureff	sureff	٢٢٨	٢٢٨	٢٢٨	٢٨.٥٠
Hebron	Hebron	٥٨٩٧	٥٨٩٧	١٤٢١٢	١٧٧٦.٥٠
	Kharas	٨٧	٨٧		
	Nuba	١١٥	١٥٥		
	Betaula	٣٢٥	٣٢٥		
	Betkahel	٣٧٠	٣٧٠		
	Bet enun	١٥٠٠	١٥٠٠		
	Qlae	٧٥٠	٧٥٠		
	zeta	١٠٨٠	١٠٨٠		
	Albaqaa	١٧٦٦	١٧٦٦		
	Albuara	١٢٨٠	١٢٨٠		
	Khalh aldar	١٠٤٠	١٠٤٠		
	qlqes				

Source: ministry of agricultural/ Hebron district.[5]

Grape season is almost take two months between September and October months in Hebron and Bethlehem areas; if we have delete the holidays in two months there will be almost 48 day for appropriate grape squeezing season.

The average grape production in the season (48 day) in Hebron city only is:

$$\frac{1776.5}{48} = 37.01 \text{ ton per day.}$$

And if the machine works 8 hour per day, the average production per hour is:

$$\frac{37.01}{8} = 4.627 \text{ ton per our.}$$

The machine that will be designed must be capable to finish pressing these quantities at the appropriate time with more efficient and low effort without any effect on the production quality.

1.8 Economical Feasibility

In this topic we determine the economical feasibility of the press machine, taking the calculation in Bethlehem especially in Alkader village (because we visit squeezing place in its municipality and take the necessary information about coasts of squeezing).

First cost

The first coast calculates the money cash to build the machine, all the part we will used is stainless steel metal, the first coast is:

- Structure body 150 N.S.
- Electrical components 1000 N.S.
- Pneumatic cylinders 2400 N.S.

Useful life estimated for the machine is over 10 year.

Income:

- (0.15) N.S Cost of kg to be squeezed (determined by municipality of al_khader).

Total income during useful life of the machine, taking the village that have the average product of grapes that needed to be squeezed which is (al Aroob) village in order to have a grape products.

The average production of grapes need to be pressed in the total season period which is two months (48 days of work) is 110.875 Ton (2.2 ton in the season), so the average production per day is:

$$\frac{110.875\ ton}{48\ day} = 2.31\ ton\ /day.$$

Total income during the season is:

- 110.875 ton *1000 kg *0.15 N.S shekel =16631.25 N.S

Salvage cost: this term estimate the sell price of the machine after 10 year,[6] and it estimated 2000 N.S.

Maintenance cost:

One employments works at the press machine:

- 1 *2500 *(2 months) = 5000 N.S

The income in the present worth value is:

PW = - first cost+ total income (P/A, 10%, 10)- maintains (P/A, 10%, 10)+salvage value (P/F, 10%, 10).....[6]

PW = - (150+2400+1000) + 16631.25 (P/A, 10%, 10) - 5000(P/A, 10%, 10) +2000(P/F, 10%, 10)

= - 5000 +16631.5 (6.145) -5000(6.145) +2500(0.3855)..

= - 5000 + 102199.34 - 30725 + 963.75

= 67437.8 shekel /10 year

PW = 6743.78 shekel /year

This value is the total income from pressing this quantity in Bethlehem, and by using one press machine in all Bethlehem, this positive value means project is very economic.

In large grpe production that would be used in grape products, we can use more the on machine, or resize the the machine capacity to coape with quantities produced.

1.9 Literature Review

During human sought to improve grape squeezing methods, he invite different methods of press, knowing that the most common methods followed is:

- Continuous pressing.
- Batch pressing.

The continues press is used to large grape quantities, this method has many disadvantages because it crush the grape seeds at high screw rotation, this will affect on the products that need grape juice, where it is used in Palestine region widely farmers and food product makers calling for a new methods that more efficient and do not need large time, and effort, have no affect on the output grape juice. Batch press is one of the methods that have many advantages in terms of product quality and very appropriate for the available grape quantities in Palestine, and it is the same principle of operation that we will adopt in our project.

The fig (1.1) below shows the old stone press, where the people used their foot to press grapes which demand large effort and time.

Fig (1.1): old press stone in almajdle/palestine.

1- Simple method to pressing grapes:

A porous cloth laid out on a square frame is filled by feet the grapes are formed by folding up the cloth like a diaper fig (1-2) describes the principle.

Fig (1-2) simple method to pressing grapes

This method is oldest and more than easy and not expensive so the farmers are used it in this area. This method is not best because it is not healthy, unclean juice; this method is need large time and effort.

Beside to the poverty of high quality of the juice that produced from squeezing the fresh grapes. And it not used for commercial production, and it use primitive ways to filtration. So it is not recommending using it.

2- Manual mechanical press machine:

A hand powered mechanical advantage system that moves the piston down a central screw, fig (1-3) describe how pressed grapes.

Fig (1-3) Manual mechanical press machine

The pressing is done by a downward moving piston. A very cheap and very slow process that yields clean, low phenolic content juice. A typical unit can handle 400-500 pounds per filling, yielding about 120 gallons per ton, with very clean, low solids juice.

While some easier to load versions have been developed, this system is still generally used for pressing grapes. The rack and grapes press lacks an important capability for apple pressing that of moving and rearranging the squeezed mass, or breaking up the cake, to increase the juice yield. [4]

3- Motorized Crusher

In this press machine grapes are loaded into the top bin where the powered screw feed continually pushes grapes towards the rollers fig (1-3) shows the machine.

Fig (1-4) Motorized Crusher

Grapes are gently crushed by the rubber rollers and then fall into the destemming chamber. The destemming chamber features a removable basket with a bunch of circular holes in it and rotating destemming shaft. Grapes fall through the holes into your bucket. Stems get rotated through the basket by the destemming shaft until they exit at the end of the machine where they fall onto the ground or an awaiting bucket.

4- Mori press

Motorized hydraulic press with extractable cages. Adjustable pressure and automatic start/stop. Constructed in two sizes, 700mm and 800mm with extractable cages in wood on trolley for easy loading and unloading of fruit. Drain plates and ram plate in stainless steel on all models. Entire press is on wheels for ease of movement. Fig (1-5) shows the press.

Fig (1-5) Mori press

5- Horizontal bladder press machine

Also in the 1970s, the Willmes bladder press came into favor, with a full wrap slotted stainless steel screen replacing the wooden basket containment juice separation system. The bladder, a thick rubber tube about a foot and a half in diameter, runs down the center and is sealed to the ends of the press, compressed air

is then pumped in to inflate, fig (1-6) show component of this machine. Grapes are loaded in through hatches to surround the bladder.

With operating pressures ranging from 3 psi to 60 psi, the phenolic load in the tail of the pressing cycle can be very high.

Fig (1-6) Horizontal bladder press machine

Today, modern control programs that can run lower pressures and perform frequent break-ups of the press cake, can improve the yield while holding down the phenolic load. Several manufacturers produce good knock offs of this system. With well trained, attentive operators, high quality juice extraction is, if not easy, at least regular. Many small user press use only the lower end of the pressing range, and never worry about separating use only the lower end of the pressing range, and never worry about separating "free run" from" fractions.

6- Continuous press machine

Historically very controversial and often felt to imply lack of concern for quality. Properly used, continuous grapes presses can be effective in juicing whites before pressing, or in pressing reds. In some small farmers these presses have been very successful in handling grapes. Some units have convenient ways to separate press fractions of increasing phenolic loading. in my opinion, this separation should be used, and made a part of the quality control effort, rather than regarded as proof of problems, in the fig(1-7) descript component of this press machine. [4]

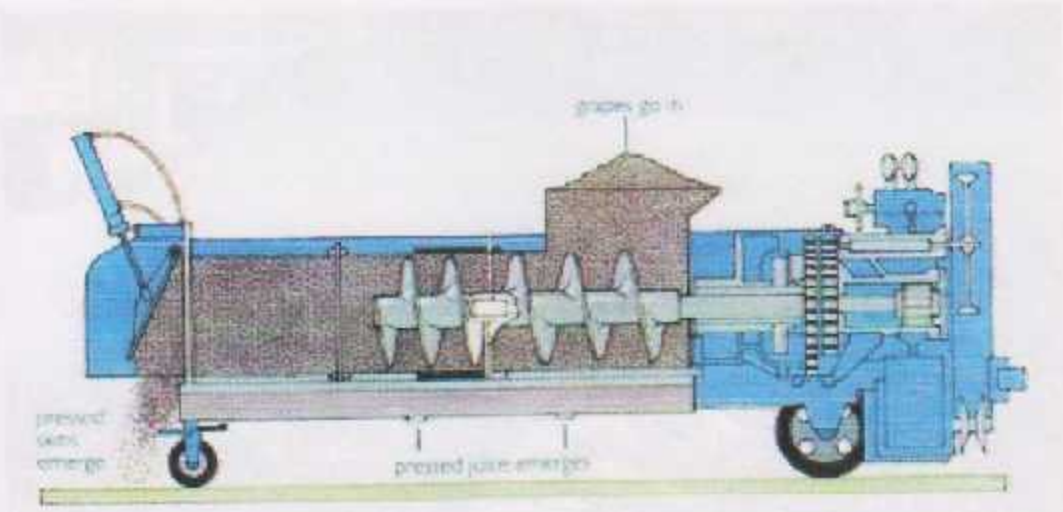


Fig (1-7) Continuous press machine

In the experimental stage since the early 1970s. The advantage of the continuous belt concept is just that. It is continuous and the dwell time in any part of the machine is short. The advantage is just that: the dwell time in the pressing part of the travel is usually too short. These machines are in use for some other fruits, but are still mostly experimental for grapes

7- Grape press machine

This machine is developed by students in Palestine polytechnic in 2002, its principle of work depend on continues method it used s screw to push the grapes into a chamber (grape press itself), fig (1-8) shows the main screw, and the pure juice is collect in the collecting tank. To get rid of the solid material they use control plate which is acted by the pressure of the compression springs. [4]

Fig (1-8): The screw used in continuous method.

1.10 Locally used technology

We have visit many towns in order to discuss and study grape squeezing process and its method, and the problems that farmers have been meeting in this process. Therefore, these are considered more important among the problems that farmers have been suffering in both processes concerning grapes Squeezing and purifying.

Because of the importance of these problems, we have decided to deal with grape problems in general and squeezing process in particular and do our best to solve this problem.

We went to Beit-Ommar town and met farmers and officials of grape squeezing machines and treacle (Dibs) production. There we talked about the problems that grape farmers face in squeezing process. They are told us about simple method of grape squeezing that use human foot; this is an old method, wasteful, exhausting and takes a lot of time. This suffering is due to not having squeezing machines which save time and labor. Also , farmers faced blemish disposal after squeezing and purifying , as they were using (hewwar) material in canvas sacks to purify grape juice.

So after discussing and displaying problems that farmers face in squeezing process, we were asked to put solutions for these problems.

Then, we went to Halhul and Al-Khader town and met farmers and officials of grape squeezing and treacle production. After talking about grape squeezing, we discussed the problems that farmers face in grape squeezing and purifying. Also farmers said that they used old methods in grape squeezing process. Besides, they always faced a lot of problems and wasted great time and effort and lack of good filtration output product even with the available machine press. Finally, after discussion of these problems, and in order o find solutions for farmers' suffering concerning grape squeezing. So we put a modified design that uses the batch method which has many advantages in terms of the output product quality, also we put a filtration unit that will purify the juice and dispose the blemish.

1.11 Project schedule

Table (1-6): project time- schedule

Process	Week														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Choosing project															
Collecting need data															
Study quantity analysis															
Literature review															
Determining the design															
Writing document															

Collecting data and study the distribution of quantities in Palestine was the important stage after choosing the project, specific details of the design will be mentioned in the second semester.

Table 1.2: Project time-schedule for second semester

Process	Week														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Grape pressing experiments															
Calculate and Assigning dimensions															
Mechanical and electrical design															
Building the press machine															
Testing the project															
Writing the documentation															

1.8 Project Budget

component	number	price(NIS)
Cylindrical body	1	100
Stainless steal plates	2	350
Pneumatic cylinders	3	2400
Relay	3	150
Timer	1	150
Magnetic sensor	1	100
switch	4	50
Pneumatic valves	1	400

1.12 Report content

This chapter represents the general idea of the project, in addition to the analysis of the grape production distribution in Palestine, methodology of work, economical feasibility, conduction the literature reviews of the previous studies about this project.

Chapter two presents a study about gapes in general, and the economical and medical values of gapes, also discussing the pre-harvest and post-harvest factories influencing on grape juice quality. And the type of grapes spread in Palestine.

Chapter three presents the machine design and its principle of operation, also the reasons and causes of choosing this project, and describes the mechanical and electrical components.

Chapter Two

Grapes

Content:

2.1 General Outlook

Grape is one of the most important fruit crops in terms of the value of food, medical and economical value, and the most corps prevalent in the world, it occupies the first place among the fruit trees in terms of area planted, production, and it is accounting for about 33% Of fruit production in the world. In the Arab world, grapes came in second place among the fruit trees in terms of area, production and contribute to the gross domestic product.

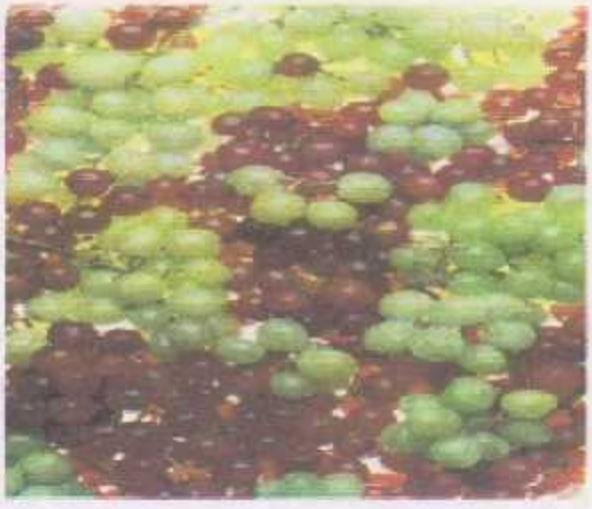


Fig 2.1: grapes.

Grapes exist in many colors, such as the green color, white and black and red as seen in fig (2.1), As grapes can be eaten fresh or juice, it used for traditional products (Dibs, malben), where are all useful ways of its consumption is useful and high nutritional value.[1] The cultivation of grapes from the oldest plants in Palestine is the most widespread and contributes to the national income. And for its big economic importance and high food value, pressing grapes and provide it as a product in the local markets will increase the use of the grapes juice product in all aspects.

2.2 The annual session for the Grapevine in Palestine

The life cycle of the grapevine is define as the period of time that the Grapevine lives in years and it is calculated as the age of a tree in years from its cultivated to the tree death. The annual session of the grapevine Characterized by two different stages they are:[1]

- Quiescence and dormancy period.
- Growth period.

There are various factors affecting the length of the growth which is the environmental factors surrounding them and the different kinds of the grape, also by service operations in place and the type of soil, moisture, and the method used in pruning and other factors and physiological and genetic, environmental influences and climatic conditions. Also Changes that occur in grapes during growth and maturation determine the quality of the juice.

The temperature (25°C - 30°C) degrees and relative humidity 60% is Considered as the optimal conditions for the maturity of the fruit, and when the low temperature of 20 degrees and relative humidity of 4%, the maturity of fruits affected completely. Increasing the temperature of 40 degrees lead the fruit to be wilt. And the maturity time of the fruits differs between varieties and kinds, maturity of grapes can be completed on the basis of the temperature prevailing in the Palestinian Territory into three groups. [1]

Accordingly grapes in the Palestine are complete its growth in a period that not exceed two months, from the beginning of September and end of October , this period is called the "squeezing season" and it is the best time for pressing juice and prepare the products, where the grapes is still having the good taste and high sugar percentage.

The following table represents the main stages of grape tree growth in Palestine.[1]

Table 2.1: Stages of annual growth in Palestine

Growth phase	Period of time
The preparing period of growth	The beginning of February-until mid March
Period of growth and bud burst, Clusters formation	Mid-March until the beginning of the month of May
completion of fruit growth	The beginning of June until mid-August
The completion of the maturity of fruits in the early maturing varieties	15 June until mid-August
Completion of the maturity of fruits in a medium-maturing varieties	20August until 20September
Completion of the of maturity fruits in the late maturing varieties	15 September until the end of the month of October

(1) Source: grape vine.[1]

2.3 Economical value of the grapes

The importance of grape trees in Palestine comes from the fact that it can adapt its cultivation in all kinds of soils, and the possibility to cultivate grape in areas that is not suitable for the fruit trees cultivation, and the quality of cultivation in the highlands and mountain valleys and rugged, territory, and land surface, tolerance for low fertility and steep terrain , deep soil in addition to grape tree low irrigation water tolerance.

While the lands in the west bank having this features and the grapes ability to adapt in this features, this will help to increase the planted area with grapes, resulting in increasing the economical income of the farmer families under the deteriorated economical situation, means that it will provide employment opportunities in the agricultural sector through farming lands and sale the corps and transport it to the marketing, This will reflects on land restoration and prevent drought lands to extend.

2.4 Food value of the grapes

Grapes is considered one of the most important in terms of food value, they contain a high proportion of water ranges between (85% -90%), and seven grams Glucose, 1 gram of fat, 16 grams carbohydrate, it also contains a high proportion of reducing sugars and many amino and organic acids, vitamins like Vit-B and Vit -G and fatty also it contains phenols and Baktin, fiber and minerals and Flavonoid antioxidants compounds. Glucose and fructose are the major sugars present in grape juice. The quality of grape juice largely depends upon sugar level, acid content and flavor constituents such as methyl anthranilate and other volatiles, tannins and color substances. In general, as fruit matures, the sugar and color increase and the pH and titratable acidity decrease.

2.5 Medical value of grape

The medical value of the grape is considered high due to the benefits of fresh juice content like protein and vitamins , amino acids ,enzymes , accurate nutrients minutes, and phenols, volatile oils and fatty acids and simple sugars which provides the body with energy and calories needed for the movement and activity and the critical interactions within the body. The grapes used in the treatment of diseases of the stomach, tuberculosis, jaundice and in dealing with cases of poor digestion and nutrition and strengthening the muscles, especially the heart muscle and strengthen the blood circulation and stimulate the kidneys and to address cases of chronic poisoning such as mercury, lead and help to get rid of excess sodium chloride in the body and helps to get rid of excess boric acid in the blood. Used as treatment effective against joint pain and rheumatism, Anakrs disease, as well as the reduction and regulation of blood pressure, while the baktin salts of potassium, it plays an important role in the process of blood clotting.[1] eating grapes after a period of flesh is more on the benefits of dealing with the body immediately after the cut.

2.6 Kind of grapes spread in Palestine

Grapes spread in Palestine is more than 50 kinds of grapes, all of it used as a table fresh grape and juice, also as grape products like (dibs and milben, dried grapes, jam). And the famous grape kinds in Palestine are: "al-daboqe" and "al-hamadani", "al-halaoani", "al-zete", "al-shami".

The table below(2.2) represent some of famous kinds and their colors, and the juice percentage to the total grape production of each kind.

Table (2-2) popular planted grapes/ alkader

Number	*Type of grape*	*color*	*Percentage of juice*
١	Al-daboqe	White	٨٧%
٢	Jandlee	White	٨٢%
٣	Marawe	White	٧٢%
٤	Halawany	Red	٧١%
٥	Balotey	Black	٨٠%
٦	Berote	White	٧٤%
٧	Zene (balade)	White	٨٨%
٨	Shame	Black	٦٣%
٩	Daraweshe	Black	٦٦%
١٠	With out seeds	White	٨٢%

Source: Palestinian grape board.[2]

And the white grape kinds that have the economic returns in the manufacture of grape are:

Al-daboqe class: It is the preferable grapes type than the other classes to the and farmers and used in the grape products industry, it is considered as one of the most popular separated in Palestine in terms of planted area, and most appropriate to

the environmental conditions also the weather situation, the most tolerant to drought conditions and the high proportion of lime in the soil; so that its trees so strong and heavy production, which has a relatively high proportion of sugar of all kinds.

There are two types to grow these kinds of grape in Palestine and they are the rain-fed method and water irrigation method, statistics show that only 7% of farmers using water irrigation in grape culturing in the summer season, while the rain-fed method is the main method used in grape culturing. Because of that this makes these kinds of growth is the most economical method used in our countries and areas because it depends in the rains water irrigation and no need to built channels to feed them.

Training system

Grape trees are planted in many forms[3], due to the kinds and lands nature. In Palestine they planted as follow:

- 66% mat (straw) train.
- 16% ground train + straw train.
- 10% ground train.
- 8% on V and T shape.

Fig 2.2: mat (straw) train.

Fig 2.3: V and T shape.

The following table shows the planted area with two types of growing grapes in Palestine.

Table (2.3): Planted area and the amount of production of each country in 2005

Total area	Productive				Not productive		Total quantity	Total production (ton)	Percentage of total area
	rain-fed	productivity	water irrigation	productivity	rain-fed	water irrigation			
West bank							74795		94.8
Jenen	3874	3874			383		4257	15496	5.4
Topas			7	1500	5	2	14	11	
Tolekarem	40	700	26	1500			66	67	
Nablus	1116	735	23	2500	80	2	1221	878	1.5
Qiqelia	48	1000			2		50	48	
Saifleet	1080	828					1080	894	1.3
Ramallh	2534	535					2534	1356	3.2
Jericho			596	1988		152	748	1185	1
Jerusalem	2812	709					2812	1994	3.5
Bethlehem	16839	976	250	3100	1150		19239	17210	24
Hebron	40978	871			2796		43774	35692	55.4

Source: 1- Palestine ministry of agriculture. 2- Palestinian grape Board.[2]

2.7 Pre-harvest and harvest, post-harvest factors influencing grape juice quality

2.7.1 Pre-harvest factors influencing grape juice quality

In order to have a good quality of grape juice we must study the influence factors on grapes during pre-harvest process, which are divided to the major factors: climate, soil, cultivar, and care of plant. Each of these factors exerts its own influence. But interactions among these factors are the most important for product quality.

2.7.1.1 Climate

The maximum, minimum and average temperatures as well as the daily pattern of heat accumulation and solar energy level have to be considered in looking at the overall site .Rainfall, clouds and fog and their distribution through the season are important along with other water and solar factors.

2.7.1.2 Soil

Loose soils with moderate fertility and excellent drainage characteristics are best. This ideal situation and all conditions that vary from the ideal require different vineyard management systems to obtain maximum juice quality.

2.7.1.3 Cultivar

Grape cultivar is widely kwon in Palestine with deep experience, the grape cultivar help to produce juice with a balance of sugars, acids, flavoring substances.

2.7.1.4 Care of plants

Fertilization, irrigation, and application of insecticide operations can influence juice quality. Maintaining an adequate and balanced mineral nutrition program is a major factor in producing high fruit yields and quality grapes. In order to have fresh quality and stored juice color stability; balanced fertilization program is important.

2.7.2 Harvest and postharvest factors influencing grape juice quality

That in harvest maturity, the flavor and sugar/acid ratio of grape juice was directly related to maturity, making harvest dates crucial determiners of juice quality. Most grapes used for juice are mechanically harvested. It was shown that mechanically harvested grapes are of better quality than hand-harvested grapes. Effects on the quality of machine-harvested grapes can be altered or influenced by six major factors:

- Type of machine
- Cultivar
- Production system
- Harvest temperature
- Interval between harvesting and processing
- Postharvest handling system.

2.8 Juice production

There are several options for juice extraction and subsequent treatment. Methods for commercial preparation of grape juice have undergone continuous change. In most commercial operations, the continuous pressing method is used. Batch pressing is appropriate for deeply pigmented grapes where maximum color extraction is desired. Whereas, the immediate or press procedure is necessary to maintain the initial color of grapes.

Our machine design will use press to extract grape juice for several design advantages, which will be mentioned in the next chapter.

Chapter Three

Press Machine Design

Content:

3.1 General Outlook

There are many specific ways to extract grape juice. Some are well-established, large-scale procedures for commercial production. Operations range from kitchen to industrial scale depending upon volume, end use and quantities. The goal in juice manufacture is to remove as much of the desirable components from the fruit as possible without also extracting the undesirables such seed and skin.

Continuous system in the two regions (Hebron, Bethlehem) is widely used; this method is not suitable to squeeze grapes, because it crushes seeds and lack for good filtration, and food products need high output quality. These problems encourage us to find solutions and other effective methods to increase the quality of juice; one of these solutions is the batch press with multi stage filter.

3.2 Causes of Design

1) The size of the produced quantities that needed to be squeezed, by this main factor the size and the design were chosen to deal with quantities produced at the harvest season in Palestine.

2) After field study and analysis the available squeezing machine designs, we find that the batch press design is better than the other designs in terms of high quality of output product without any undesirable flavor, and do not crash the grape bough and seeds, contrary in screw method the seeds can be crashed.

3) The new design is used multistage (strain and rough) filtration which contains strain and rough filtering (different degrees) of filtration.

4) This batch press is using the pneumatics press which clean and not expensive and not harmful and pollute to the output juice , while the hydraulic press which uses the oil suffer from oil leakage which can reached mix with juice also the food main festering prefer the pneumatic system for its operational characteristic.

5) Batch pressing that used pneumatic press which is more speed and efficient.

6) It can be used to press another product after finish the squeezing season with high press efficient such as tomato to make tomato paste.

7) High per hour output, easy to use controls and very simple maintenance.

8) Reduce the period of squeezing, and reduce the number of persons needed to squeeze the grapes, not expansive.

3.3 General Juice Manufacture Principle

There are a number of unit operations involved in converting whole grape to the desired juice fig (3-1) show the manufacture flow process, in order to get grape juice it must pass through three stages:

- Pre-process stage.
- Grape press stage.
- Post-process stage.

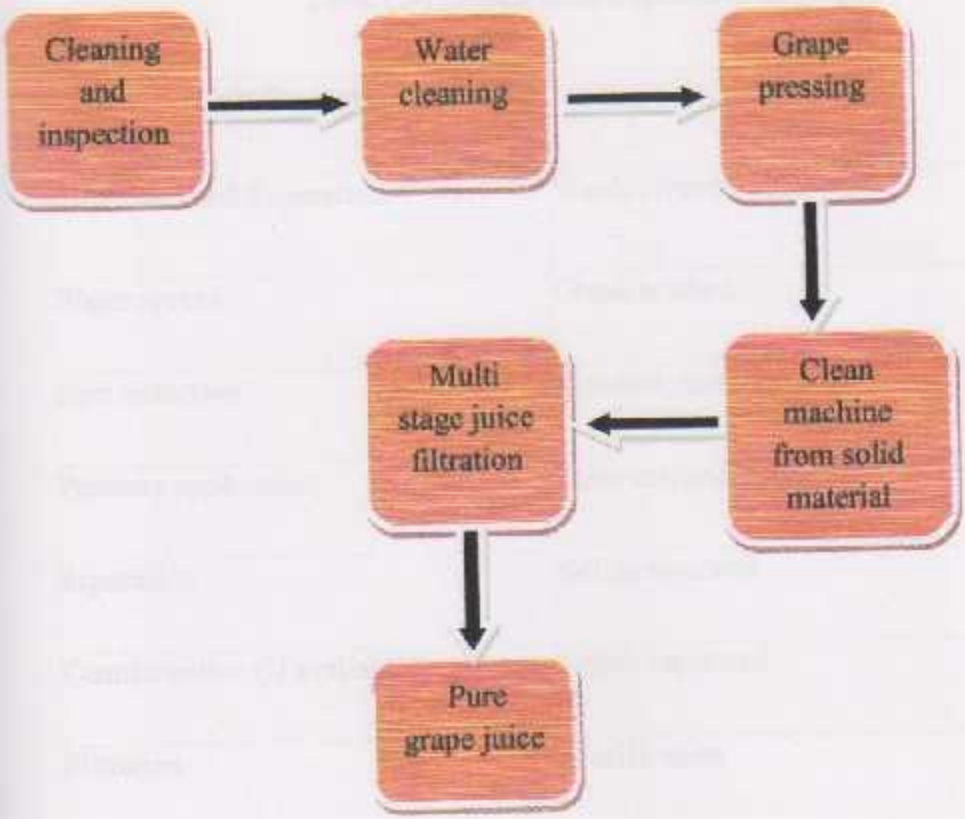


Fig (3.1): Manufacture flow process

Table (3-1) shows shortly the results of each unit operation that applied to the grape crop, beginning from picking grapes until juice extraction.

Table (3-1) result of unit operation on grapes

Unit Operation	Result
Inspection and Separation	Sized, cleaned
Water sprays	Grape washed
Size reduction	Crushed, comminuted
Pressure application	Juice extracted
Separation	Solids screened
Centrifugation (if available)	Solids separated
Filtration	Clarification
Fluid flow	Juice transferred, pumped, stored

3.3.1 Pre-process stage

This stage include Cleaning, sorting and inspection the grape crop fig (3-3) shows these steps, also remove of unwanted pieces of grape is very important, more bad piece of grapes can cause undesirable output juice, but when this defective pieces pressed it can end up contaminating an entire lot of juice. In the same context, a few pieces containing microbial pathogens or toxic chemicals can and do raise havoc when juiced.

Fig (3-2) Cleaning, sorting and inspection the grape.

Cleaning steps and water recycling may be required to remove dust, mud or transport-induced foreign matters and germs; this will insure that dirty fruit is not delivered for processing all of these steps is to insure sanitary quality of juice.

Inspection can be manual, contingent upon workers observing and removing defects or automatic, effected by computer controlled sensors to detect off color, shape or size of undesirable pieces. Sophisticated instrumentation operating at high speed is being increasingly employed in modern processing facilities, although the human eye, hand and mind still commonly make the final decision.

This process is done by using specific powered conveyer as shown in the schematic design, it divide for two section one for cleaning and the other for washing grapes; the inlet nozzle above the conveyer will have water sprays as the grape filled to the inlet nozzle. Conveyer will contain holes that water can pass through.

3.3.2 pressing

Pressing is the act of applying pressure to grapes in order to separate juice from grape skins, The pressing operation can also range from manual to mechanical with complete automated systems common in the juice industry. A small press machine are effective for small quantities, but for larger multi-kilogram amounts, continues system more appropriate, also continuous screw presses capable of handling many tones/hour of crushed fruit. Care must be taken not to subject the press cake to excessive shear; or else seeds and other solids will contribute undesirable components to the juice. However, press aids can present a disposal problem, may be expensive and unless well refined, can contribute off flavors.

Presses act by positioning the grapes or whole grape clusters between a rigid surface and a moveable piston and slowly decrease the volume between the two surfaces. Modern presses are able to follow a pressing program which dictates the duration and pressure at each press cycle, usually ramping from 0 Bar to 2.0 Bar. As the pressure increases on the grape skins so too much, the amount of martial in skins will extract into the juice.

3.3.3 Post-process Stage

This topic contains Juice clarification and there are many kinds of filtration one is centrifugal filtration and the other is density separation filtration. Extracted juice must be treated further. A settling step can help rapid methods such as centrifugation and filtration can produce a clear juice. A continuous or a decanting centrifuge with automatic dislodging to produce a clear or nearly clear juice is quite effective fig (3.3). A fine mesh shaker screen can further remove particulates Figure (3.4). A centrifuge is a very costly item; however, it greatly simplifies subsequent filtration steps and is an essential component in many juice processing operations.

Figure 3.3: Continuous centrifuges.

The juice stream should be cleaned up as much as possible to reduce treated volume and increase throughput. There are many filtration systems well suited to various juices. These range from plate and frame filters, fitted with porous cellulose pads, Figure (3.5) to plastic, ceramic, or metal membranes. Diatomaceous earth mixed with the liquid serves to greatly increase the surface area and porosity of the filter bed and hence the particulate absorbing capacity of the filter.

Figure 3.4: Shaker separating screen

Figure (3.5): Plate and frame and vacuum filter.

In the extreme case a filter can have small enough pores to physically remove microorganisms from the juice (sterile filtration) or even remove macromolecules such as proteins and carbohydrate polymers (ultra filtration). The production of a clear or brilliantly clear juice and the prevention of post filtration turbidity are the normal goals.

3.3.4 Capacity of machine:

Assuming this machine will work (8) hours in a day and for all the season time (48) day, the machine must cope to finish the produced quantity during the season period without any late from the specified time, because any late beyond this time will decrease the grape juice quality.

Taking the villages around Hebron that quantity of grapes needed to produce treacle (dips) and other grape production, that have smaller amount of grapes production per year from the total fresh grape quantity in same village.

Taking Yatta: total production of grapes is 1903 ton per year.

- Amount needed to produce grape juice

$$1903 * 12.5\ \% = 237.9\ ton\ /year.$$

- Average production during season

$$\frac{237.9}{48\ day} = 5.955\ ton/day.$$

- If the machine works in Yatta 8 hours, the average production per hour is:

$$\frac{5.955\ ton}{8\ hours} = 0.75\ ton/hours = 750\ \text{Kg/h}.$$

The machine must finish this quantity per hours each day for all the season without late.

The pressing process time is designed to give an enough times of the juice to liquidate out from the holes. So each press batch will take a time between 5-10 minute, from the beginning of filling until end the of pressing. The machine must finish 289 kg in one hour, so the machine capacity of each press batch is:

$$batch\ cpacity = \frac{750}{60} * 10 \text{ minute} \cong 125kg\ per\ 10\ min.$$

For Targomia:

Average production per hour is:

- 418.3 Kg /h

Capacity of the machine per hour is:

$$batch\ cpacity = \frac{418.3}{60} * 10 \text{ minute} \cong 137kg\ per\ 10\ min.$$

For each press batch should finish 137 kg per 10 min, this mean that the capacity of the machine should be 137 kg. Mentioning that in large cities that have high production we can use more than one machine in order to deal with the exists quantity.

Mentioning that in large cities that have high production we can use more than one machine, Or resize the machine capacity to deal with the quantities produced.

3.4 Mechanical components

The main mechanical components in the machine contain the conveyer and pneumatic system that exerts force on the grape by piston.

3.4.1 Pneumatics system

Pneumatics has long since played an important role as a technology in the performance of mechanical work. It is also used in the development of automation solutions.

The pneumatic cylinder has a significant role as a linear drive unit, due to its relatively, low cost, ease of installation, simple and robust construction and ready availability in various sizes and stroke lengths.

3.4.2 Advantages:

1) Widely available.

2) Clean, cheap and leakage does not cause contamination or electric shock.

3) Not pollute.

4) Simple to maintenance and Easy to store.

3.4.3 Disadvantage:

1) Pneumatic component is expensive.

2) High compressibility make the control of actuators is difficult.

The primary levels in a pneumatic system are:

- Energy supply
- Input elements (sensors)
- Processing elements (processors)
- Control elements
- Power components (actuators)

Control elements fig (3.6) control the actuating elements in accordance with the signals received from the processing elements. The elements in the system are represented by symbols which indicate the function of the element. [8]

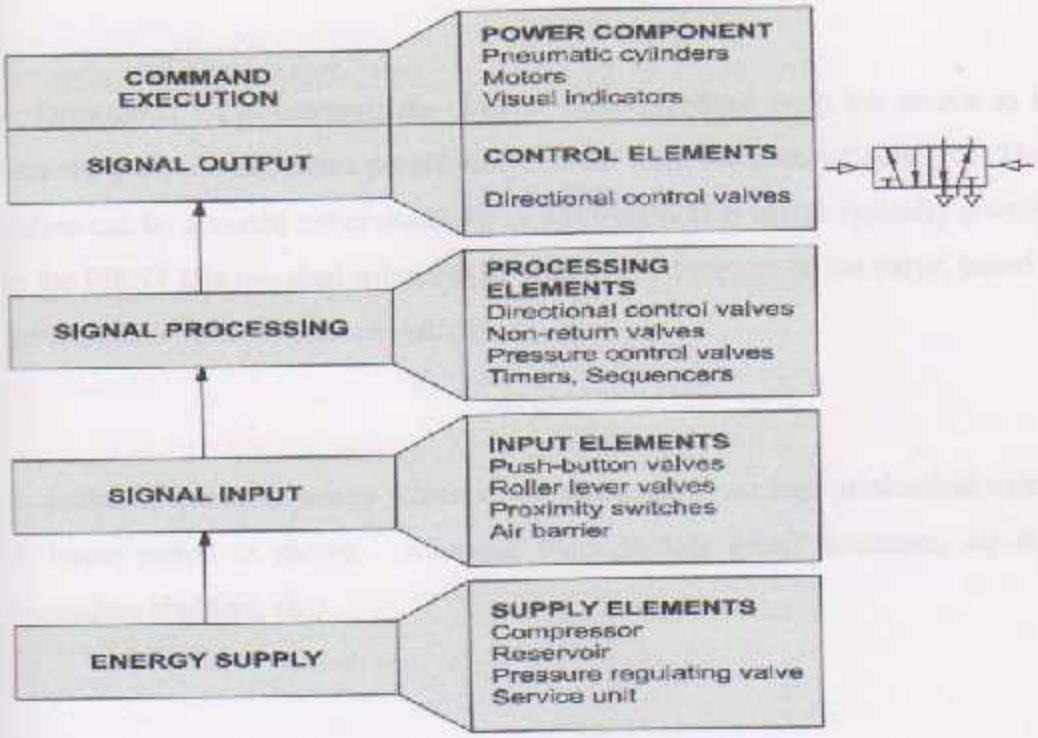


Figure (3.6): Pneumatic control system

3.4.5 Components of a pneumatic system:-

1. Compressor: a pump which compresses air, raising it to a higher pressure, and delivers it to the pneumatic system (sometimes, can also be used to generate a vacuum).

2. Check valve: one-way valve that allows pressurized air to enter the pneumatic system, but prevents backflow (and loss of pressure) into the compressor when it is stopped.

3. Accumulator: stores compressed air, preventing surges in pressure and relieving the duty cycle of the compressor.

4. Directional valve: controls the flow of pressurized air from the source to the selected port. Some valves permit free exhaust from the port not selected. These valves can be actuated either manually or electrically (the valves typically provided in the FIRST kits use dual solenoids to change the direction of the valve, based on input signals from the control system).

5. Actuator: converts energy stored in the compressed air into mechanical motion. A linear piston is shown. Alternate tools include rotary actuators, air tools, expanding bladders, etc

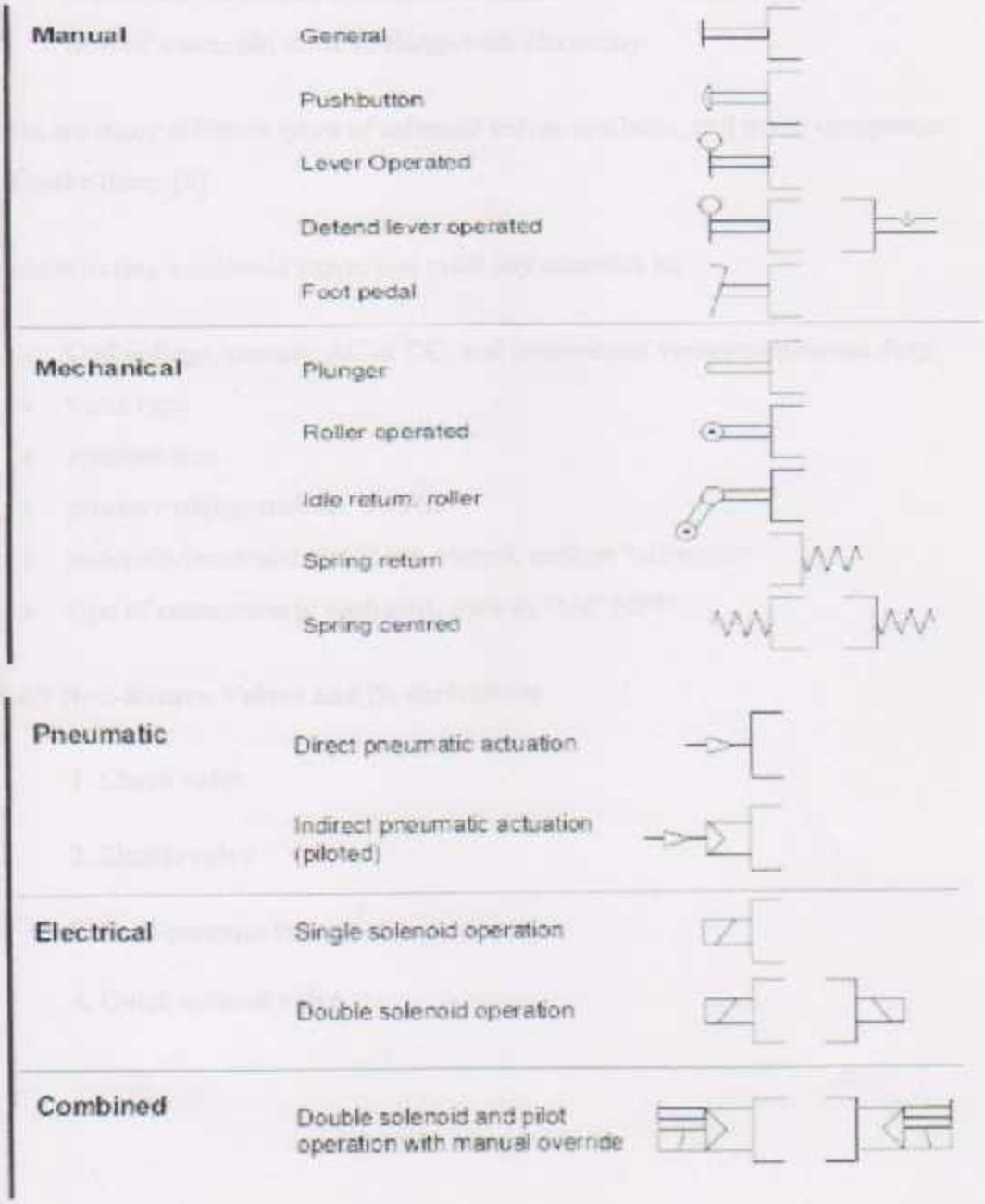
3.4.6 Valves:

The function of valves is to control the pressure or flow rate of pressure media. Depending on design, these can be divided into the following categories: [8]

- Directional control valves
  - Input/signaling elements
  - Processing elements
  - Control elements
- Non-return valves
- Flow control valves

- Pressure control valves
- Shut-off valves

3.4.7 Action Valves



3.4.8 Solenoid valve

- A solenoid is a coil of wire that becomes magnetized when electricity is run through it.
- Solenoids often have a hole in the middle and a protruding metal rod that is pushed or pulled by magnetism when power is applied.
- A solenoid valve uses a solenoid to actuate a valve. This lets you control the flow of water, air, or other things with electricity.

There are many different types of solenoid valves available, and many companies that make them. [8]

When selecting a solenoid valve, you must pay attention to:

- Coil voltage, current, AC or DC, and intermittent versus continuous duty.
- valve type
- aperture size
- pressure rating, such as "50 PSI"
- materials (medium) that it can control, such as "air/water"
- type of connection to each port, such as "1/4" NPT"

3.4.9 Non-Return Valves and its derivatives

1. Check valve
2. Shuttle valve
3. Dual-pressure valve
4. Quick exhaust valve.

Chapter Four

Mechanical Design

Content:

4.1 Description of machine work

The machine is used to press grape to bring the pure juice from grapes, and insulate it from the solid material by batch press system using pneumatic press. Fig (4.1) shows the press machine structure, and fig (4.2) shows its main component.

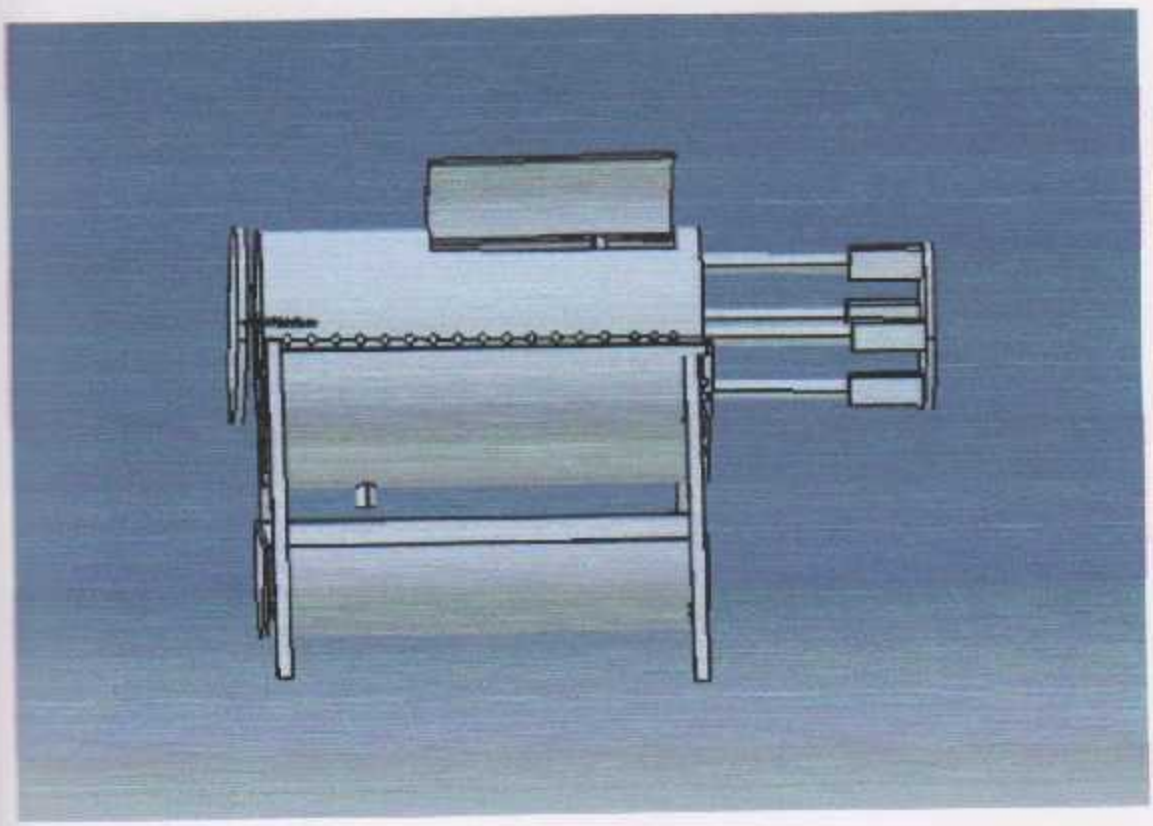


Fig (4.1): Machine press.

Adding springs to the movable gate, and using pneumatic cylinders to press the grapes; allow and permit to control the pressure value applied to the grape inside the press machine related to the types of the grape that would be pressed (different grape types will result in using different pressure values in order to make it capable to press the grape completely).

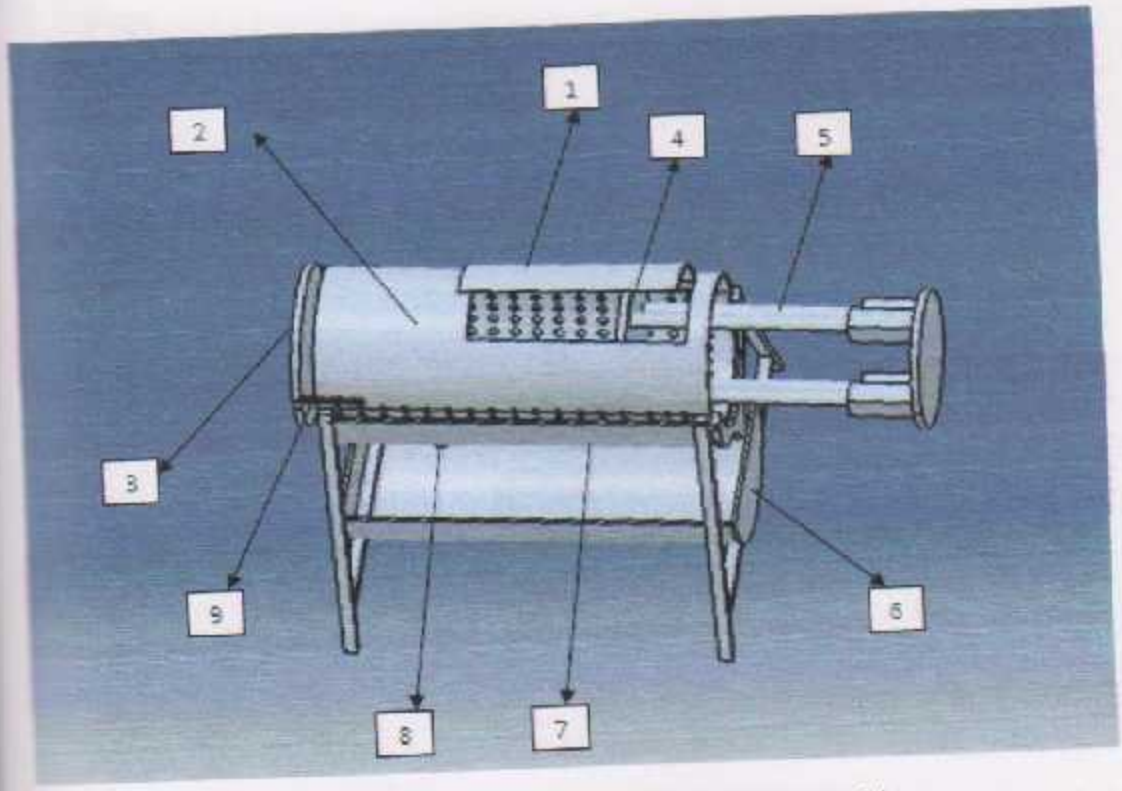


Fig (4.2): Side view with component of the machine.

4.1.1 Components of the grape press machine:

1) Machine door.

2) Machine structure body.

3) Movable gate.

4) Cylindrical shaft.

5) Pneumatic pistons.

6) Tank.

7) Juice collector.

8) Multi stage filter.

9) Springs.

10) Air compressor fig(4.3).

Fig (4.3): Air compressor.

There is an trough (tank) under the press machine , and around the holes where the juice will be flow out of them, and collected in tank before it through out the filter.

4.2 The operation steps of grape press machine:

1) Preparing and entering grapes process:

The grape are washed before entering inside the press chamber, this will remove the dust on grape, so increasing the output juice quality. And the grape will be distributed manually entire the press chamber and the machine door is closed.

2) While the grape placed inside the cylindrical chamber, the compressor is switched on, and the piston now is ready to press.

3) Pressing grape process:

The amount needed to be squeeze is now inside the main chamber, the piston after that will press the grapes, by effecting of the force that exerted by pneumatic force (compressed air).

4) Juice is now flow out from the holes in the machine body to the juice collector, and then goes to the multi stage filtration and then to tank.

5) Grape and solid material will be pressed repeatedly (because not all the grape pressed will be removed out from the chamber after pressed it), now the residuals while pressing will push out slightly the movable gate and goes out of the chamber.

(6) After shaft back and press end, springs that attached to the movable gate, will push back the movable gate to its original place.

4.3 Pressure calculation:

To determine the machine dimension; force and pressure applied to grapes will be calculated. Where there is not an available data about the needed pressure, this project will start by conducting an actual experiment was made, to obtain the required operating pressure.

In this experiment a pneumatic pressure is applied to the grape gradually from air compressor has 12 bar maximum pressure, By putting (1 Kg) of grapes in plastic tube has diameter (D =11cm) and a length (L=25 cm). And with increasing the air pressure slightly at the piston; the quantity of compressed air was controlled by a pneumatic throttle, with an operating pressure 9 bar. Fig (4.4) shows the component of the experiment, grapes begin (start) to squeeze, and grape juice leaks at approximately at 8 to 9 bar as shown in the pressure gage in fig (4.5).

Fig(4.4): Experiment component

Fig (4.5): pressure gage.

The piston used in the experiment has the following features in table (4-1):

Table (4-1): Basic cylinder dimension.

Bore size (mm)	Cylinder stroke (mm)	Rod diameter (mm)
26	100	10

Piston model: D5NN-26-100-PPV-A

Fig (4.6) shows the experiment dimension. The pressure and the force needed to squeeze grapes by this experiment can be calculated by using the equations [7]:

1) Force at retraction:

$$F_{th} = A_P * P_{air} \tag{4.1}$$

$$F_p = P_{air} * \frac{\pi}{4} * \left({D_{cy}}^2 - {D_{rod}}^2 \right) \tag{4.2}$$

Where:

F_p: Force exerted by piston.

F_{th}: Theoretical force exerted at grape.

A_p: Piston area.

P_{air}: Air pressure inside the cylinder.

D_{cy}: Cylinder diameter.

D_{rod}: Cylinder rod diameter.

The force at retraction is:

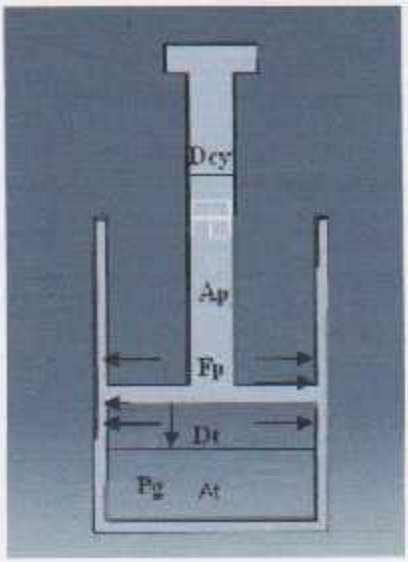


Fig (4.6): Experiment dimension

$$F_p = 9 * 10^5 * \frac{\pi}{4} * (26^2 - 10^2) * 10^{-6}, \quad (4.3)$$

$$F_p = 180.9\ N$$

2) Force at load [7]:

$$F_p = P_{air} * A_p, \quad (4.4)$$

F_p: Force exerted by the piston.

A_p: Piston area $= \frac{\pi}{4} * (D_{cy})^2$.

P_{air} : air pressure inside cylinder – 9 bar.

Where:

1 bar $\cong 101.3\ KPa$

So the force exerted by the piston is:

$$F_p = 9bar * \frac{\pi}{4} * (26\text{mm})^2. \quad (4.5)$$

$$F_p = 9 * 10^5 * \frac{\pi}{4} * (26)^2 * 10^{-6}. \quad (4.6)$$

$$F_p \cong 478\ N$$

Pressure exerted by the piston at grape inside the plastic tube :

In order to find the pressure at the grape, area of plastic tube must be founded by the equation:

$$A_t = \frac{\pi}{4} * (D_t)^2 \quad (4.7)$$

A_t: Area of the tube.

D_t: plastic tube diameter.

$$A_t = \frac{\pi}{4} * (11 * 10 *^{-2})^2 \quad (4.8)$$

$$A_t \cong 95 * 10\ ^{4} m^2$$

Now the pressure exerted and needed to press the grapes inside the cylindrical plastic tube is:

$$P_g = \frac{F_P}{A_t} = \frac{P_p * A_p}{A_t} \quad (4.9)$$

Where:

Pg: pressure exerted and needed to press the grapes.

$$P_g = \frac{478N}{95*10^{-4}m^2} = 0.503 * 10^5\ Pa. \quad (4.10)$$

$$P_g = 0.503\ bar$$

Where 0.503 bar is the pressure needed to press the grape at the start of press, after awhile of pressing process, the pressure exerted at the grape will increase slightly, because the contents inside the machine cylinder will become more compact and will produce a resistance on the opposite cylinder direction while pressing grapes, in this situation the resistance will vary from one to another due the grape type. So due to the change of the pressure; a design factor is considered when applying this pressure inside the press machine. For that a factor design will be taken in calculations, to ensure a complete pressing process for the different grape types. The design factor vary between minimum factor = 1.2 and maximum factor = 1.5. So the pressure that the machine body will designed at its value will become:

If we used a grape to press that is not used usually for producing food products (it have lower quantity of water, it means it more rigid and high solids), it cause the resistance to pressing grape will increase and the pressure needed will also increase, so we can use maximum factor 1.5 in this condition. In our experiment that was conducted, the grape used on experiment, is the grape that used in the food products (have a higher water quantity and lower solids), all of the grape inside tube was pressed totally at 0.51 bar, for more safe in the pressure that needed minimum factor 1.2 was selected.

So $P_g = P_d$, and $Pg = 0.61\ bar$.

4.4 Machine capacity:

In order to determine the capacity of the press machine to cope with the personal and commercial quantities, a field study was conducted to figure out the production quantities distribution over all the regions in Hebron and Bethlehem districts. Table (1-5) in chapter one, and with appendix A shows the food products quantities and how they are used.

The decision of the machine capacity was taken on the basis on the average production of grapes needed to be squeezed in the villages of Hebron and Bethlehem regions. Taking the village that have the average product of grapes that needed to be squeezed which is (al Aroob) village in order to have a grape products.

The average production of grapes need to be pressed in the total season period which is two months (48 days of work) is 110.875 Ton, so the average production per day is:

$$\frac{110.875\ ton}{48\ day} = 2.31\ ton\ /day.$$

And the average production per 8 hour working at one day is:

$$\frac{2.31}{8} = 0.289\ ton/hour\ \ = 289\ Kg/h.$$

The pressing process time is designed to give an enough times of the juice to liquidate out from the holes. So each press batch will take a time between 5-10 minute, from the beginning of filling until end the of pressing. The machine must finish 289 kg in one hour, so the machine capacity of each press batch is:

$$batch\ cpacity = \frac{289}{60} * 10\ \text{minute} \cong 50kg\ per\ 10\ min.$$

4.4.1 Determine the diameter of the press machine:

According to the batch capacity which is almost 50 kg, the volume of 50 kg that will displaced in the press machine can be founded, The volume of 15 kg of grapes was found experimentally, so the volume of 50 kg is:

Volume of 15 kg $\longrightarrow V_{15kg} = 0.03\ m^3$

Volume of 50 kg $\longrightarrow V_{50\,kg} = ?$

Volume of 50 kg $= 0.03 * \frac{50}{15} \cong 0.1\ m^3$

In order to determine the diameter of the machine, we must determine the scale factor between the volume of pressed grape in the experiment (volume of 1kg, that experiment was made to determine the pressure at grape) to the machine volume of 50 kg.

Volume of 15 kg $\longrightarrow V_{15kg} = 0.03\ m^3$

Volume of 1 kg $\longrightarrow V_{1\,kg} = ?$

Volume of 1 kg $= 0.03 * \frac{1}{15} \cong 0.002\ m^3$

So the scale factor (Sf) between the experiment volume to the machine volume is:

$$\text{Scale factor} = \frac{\text{volume of 50 kg}}{\text{volume of experiment}} = \frac{0.1\text{m}^3}{0.002\text{m}^3} = 50\,.$$

Fig (4.7) shows the scale factor and dimensions. To find the cylinder machine diameter, it can be determined by the equation (4.11) :

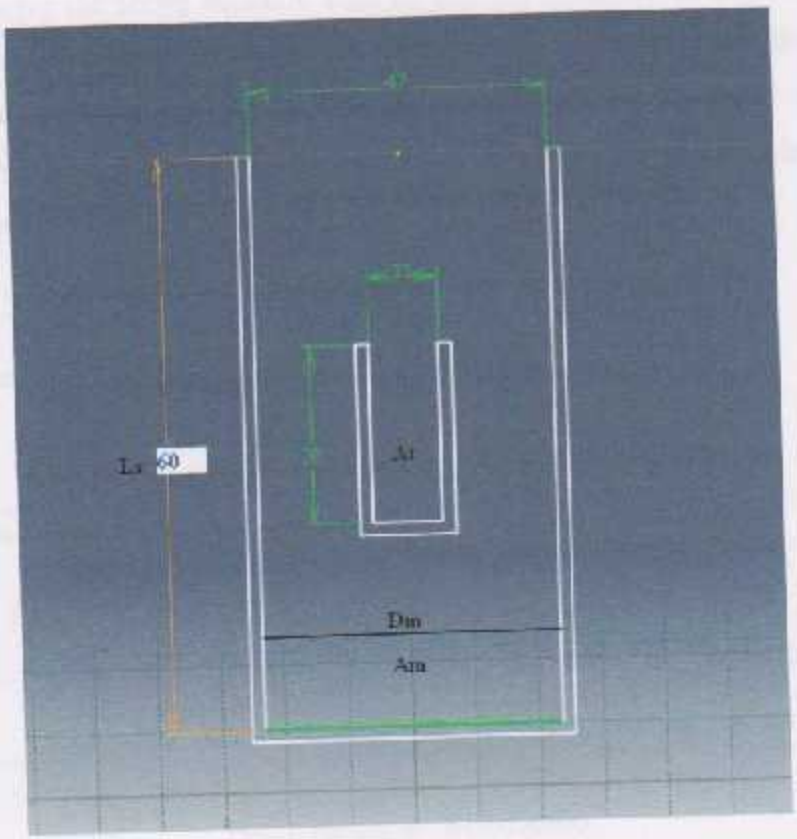


Fig (4.7): shows the scale factor and dimensions.

$$\frac{\pi}{4} * L_S * {D_m}^2 = Sf * 0.002\,. \qquad (4.11)$$

Where:

D_m: The diameter of the machine.

L_s: The length of stroke applied at the grape by the piston (piston stroke).

To solve the above equation with Ls and D_m variables, and making the two equation sides equivalent. We choose the available pneumatic cylinders that have the highest stroke in the local markets. Strokes available vary between(10.5 cm, 20,cm, 60 cm), in this project we are considered to use the highest stroke available due to the average grape quantity per batch.

Model of the piston used practically in the project:

Table (4-2): Basic cylinder dimension.

Bore size (mm)	Cylinder stroke (mm)	Rod diameter (mm)
63	600	20

Piston model is: SU63X600.

Accordingly, the equation (4.11) , with Ls = 60 cm, can be solved for D as:

$$\frac{\pi}{4} * 60 * 10^{-2} * {D_m}^2 = 50 * 0.002, \qquad (4.12)$$

$$D_m \cong 0.47m = 47cm$$

4.5 Force and the pressure inside the press machine:

To find the force exerted by the pneumatic piston that was selected, at 9 bar can be calculated by the equation:

$$F_p = A_p * P_P \,. \tag{4.13}$$

Where:

A_p: piston area.

P_p: pressure applied to the piston.

F_p: force exerted by the pneumatic piston.

So the force exerted by the pneumatic piston is:

$$= \frac{\pi}{4} * 6.3^2 * 10^{-4} * 9 * 10^5 \tag{4.14}$$

$$\text{Fp} = 2804\ N.$$

The force applied to the grape by one pneumatic piston at the machine diameter is:

$$F_g = A_m * P_g \tag{4.15}$$

Where:

A_m: Machine area.

P_g: The pressure needed to press the grape.

$$F_g = \frac{\pi}{4} * 46^2 * 10^{-4} * 0.61 * 10^5 \tag{4.16}$$

$$F_g = 10133.8\ N$$

We notice that the force needed to press the grapes available by one pneumatic piston is lower than the force that must be applied on the grape, So the force of the piston F_p must be greater or equal to the force needed to press the grape, in order to increase the force applied at the grapes by the force of the pneumatic cylinders(F_p), we increase the number of pistons acting on grapes by:

$$F_p * n \geq F_g \tag{4.17}$$

$$F_p * n \geq A_m * P_g \tag{4.18}$$

$$n = \frac{F_g}{F_p} = \frac{10133.8}{2804} \cong 3.65 \tag{4.19}$$

n: is the number of pistons that can be add to increase the force of F_p.

Here we can use four pistons in parallel to increase the force, a fourth piston can be add for more safety pressure that needed. So n = 4 pistons, and F_p becomes:

$$F_p * n \geq F_g = 4 * 2804 = 11216\,N > F_g \tag{4.20}$$

$$F_p = 11216\,N$$

F_p is the force that must be produced by the four pistons, to complete the pressing process.

4.5.1 Residual length after pressing

The compression ratio is ratio between the volumes of grapes after pressed, to the volume of machine chamber, an experiment was conducted to find the volume of residuals as:

$$C = V_{max}/V_{min} \tag{4.21}$$

Where:

C:compression ratio.

V_{max}: volume of tube.

V_{min} ;volume after pressing.

Calculation was made at the experiment to find the residually volume before press to the volume of pressed residual by:

$$V_t = \frac{\pi}{4} * Dt^2 * L_t \tag{4.22}$$

Where:

D_t: plastic tube diameter.

L_t: length of grape displaced in the tube before pressing.

So the volume V_t will be equal to the volume of 1kg before pressing = $0.002m^3$, so V_t will become:

And the volume after pressing (residual length was measured , L= 6 - 7 cm) is:

$$V_{min} = \frac{\pi}{4} * Dt^2 * Lr \quad (4.23)$$

Where:

L_r: the length of residual after pressing

$$V_{min} = \frac{\pi}{4} * (11 * 10^{-2})^2 * 6 * 10^{-2} \quad (4.24)$$

$$V_{min} \cong 0.00057\ m^3.$$

The compression ratio can be calculated by :

$$C = \frac{V_{max}}{V_{min}} \quad (4.25)$$

$$C = \frac{0.002}{0.00057} = 3.5$$

The residual of 60 cm of grape length in the press machine will become:

$$C = \frac{V_{max}}{V_{min}} = 3.5 = \frac{\frac{\pi}{4} * (47 * 10^{-2})^2 * 60 * 10^{-2}}{\frac{\pi}{4} * (47 * 10^{-2})^2 * Lr} \quad (4.26)$$

$L_r = 17$ cm.

Take length of residual (L =20 cm) for more safe in the residual length when dealing with different types of grapes (different types of grape will have different residual length). The total length of machine chamber adding the residual and adding 10 cm to the total length of the machine, to insure that the all quantity of residual grape will be pressed totally before it leaves the machine chamber fig (4.9) shows length distribution of the machine. So the total length of the machine is:

Where:

L_m: length of the press machine.

IMPORTANT NOTE:

In machine redesign the length of the residuals must be determined specifically, that in our experiment we press grape that is not used for the food products.

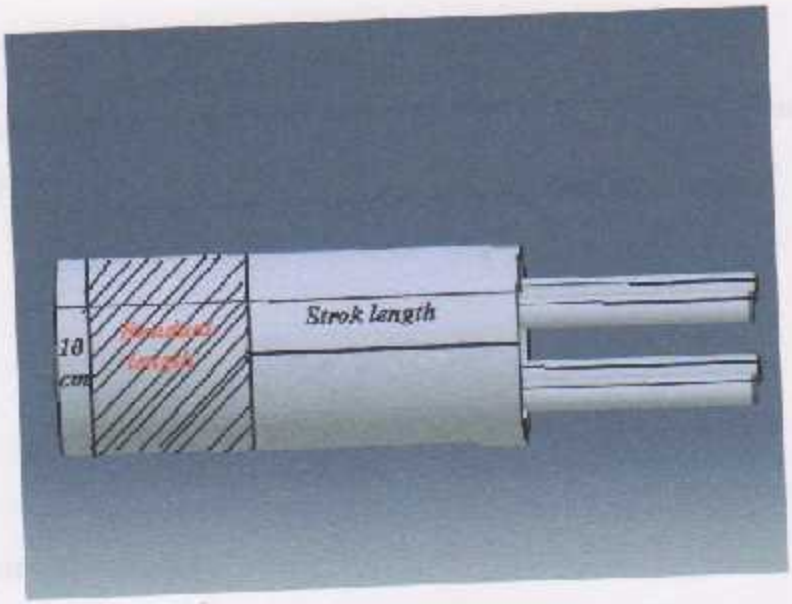


Fig (4.8): shows length distribution of the press machine.

4.5.2 Shaft diameter

In this type of commercial pressing, accuracy between machine hole and the shaft is not to be essential, accordingly from table (2-8) in appendix A, we choose loose running fit with symbol H_{11}/C_{11} , so the machine shaft dimension become:

From table (A-2), we select loose running fit, with ISO symbol is H_{11}/C_{11}.

And from table (A-11), we find the tolerance grade is (IT11) is $\Delta D = 0.36mm$ using the equation for the hole:

$$D_{max} = D_{min} + \Delta D. \quad (4.27)$$

Where:

D_{min} = press cylinder diameter $= 470mm$

ΔD = tolerance grade for hole.

For the shaft is designated as 470mm / c_{11} (for shafts with clearance fit c, d, f, g is used) from table (A-12), the fundamental deviation $\delta_f = -0.4\ mm.$

$$D_{min} = D + \delta_f \tag{4.28}$$

Where:

δ_f: Fundamental deviation.

$$D_{min} = 470 - 0.4 = 469.6mm$$

$$Dmax = D + \delta_f + \Delta D \tag{4.29}$$

$$D_{max} = 470 + (-0.4) - 0.36 = 469.24\ mm.$$

Dimension of machine cylindrical machine hole and the shaft will become:

For hole $D_{min} = 470mm$

For shaft $D_{max} = 469.24mm.$

Where in this project we will use seals around the shaft to prevent the residuals and the juice to leak from the clearance between the shaft and the cylindrical hole.

4.5.3 Thickness of machine cylinder

Thickness of the machine cylinder must tolerate the inner pressure that produced by the pressed grape at the wall, so that we choose the stainless steal material for the machine body, because of its widely commercial usage, and good industry properties, and its availability in the markets.

Pressure exerted at grape by the pneumatic cylinders will affect on the machine wall, by producing different stresses at the wall. So to insure that the machine wall thickness will tolerate the inside pressure and all the forces components(radial, tangential, and longitudinal stresses) produced by the inside pressure at machine wall, we choose the factor of safety n, with $1 \leq n \leq 3$ in designing the cylinder machine wall.

Data:

$P_i = 0.61bar = P_{design}$

$L_m = 90.$

S_y – 276 Mpa. For stainless steal.

Where:

$S_y(S_{yt})$: yield strength of stainless steel 304(Annealed).

In order to find the thickness of cylinder wall at the given inside pressure and by using the equations:

$$\sigma_t\, max = \frac{(di+t)}{2t} \tag{4.30}$$

$$\sigma_t = \frac{r_i^2 * P_i}{r_o^2 - r_i^2}\left[1 + \frac{r_o^2}{r_i^2}\right] \tag{4.31}$$

$$\sigma_l = \frac{Pi \cdot ri}{2t} \tag{4.32}$$

$$\sigma_r = -P_i \tag{4.33}$$

Fig (4.8) shows 3-D state of stress.

Where:

σ_t = Tangential stress.

σ_r = radial stress.

σ_l = longitudinal stress.

t = thickness of cylinder.

r_i = inner radius of the machine cylinder.

r_o = outer radius of the machine cylinder.

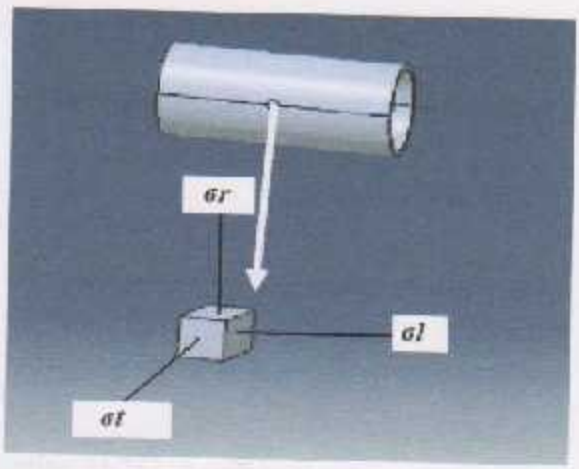


Fig (4.9): 3-D state of stress.

In determine the thickness of the cylinder wall, we will use the Distortion theory [11], because it gives more accurate thickness values, and it is not neglecting the σl(longitudinal stress), and uses for simple tension and compression, also the material is ductile. So we apply the distortion equations to find t as:

At r_o the radial stress (σ_r)=0.

The factor of safety n is considered to be $1 \leq n \leq 3$ [11]. Select n= 2.

$$n = \frac{S_y}{\sigma} \tag{4.34}$$

$$\sigma^{`} = \frac{276}{2} = 138Mpa$$

Where:

n = Factor of safety.

$\sigma^{`}$ = *von Mises stress.*

And by applying distortion theory with the *von Mises stress* equation:

$$\sigma^{`} = [(\sigma1 - \sigma2)^2 + (\sigma2 - \sigma3)^2 + (\sigma3 - \sigma1)^2]^{1/2} \quad (4.36)$$

Where:

$\sigma1 = \sigma_t max$, $\sigma_t\, max = \frac{(di+t)}{2t}$

$\sigma2 = \sigma_l$, $\sigma_l = \frac{P_i * r_i}{2t}$

$\sigma3 = \sigma_r = -P_i = -0.61 * 10^5 pa = 61\ kpa$

By substitute equations (4.31), (4.32), (4.33) in equation (4.36), it will becomes:

$$138\ Mpa = \left[\left(\frac{P_i(di+t)}{2t} - \frac{P_i * r_i}{2t}\right)^2 + \left(\frac{P_i * r_i}{2t} - (-P_i)\right)^2 + \left(-P_i - \frac{P_i(di+t)}{2t}\right)^2\right]^{1/2} \quad (4.36.a)$$

And by substitute the values of the variables of Pi and di in equation (4.37):

$$138\ Mpa = \left[\left(\frac{61*10^3(47*10^{-2}+t)}{2t} - \frac{61*10^3*23.5*10^{-2}}{2t}\right)^2 + \left(\frac{61*10^3*23.5*10^{-2}}{2t} + 61 * 10^3\right)^2 + \left(-61 * 10^3 - \frac{61*10^3(47*10^{-2}+t)}{2t}\right)^2\right]^{1/2} \quad (4.36.b)$$

$$138\ Mpa = \left[\left(\frac{1.44*10^4}{t} + 0.0305 * 10^6 pa - \frac{0.71675*10^4}{t}\right)^2 + \left(\frac{0.71675*10^4}{t} + \right. \quad (4.36.c)$$

$$0.061 * 10^6 pa\Big)^2 + \Big(-0.061 * 10^6 pa - \frac{1.44*10^4}{t} - 0.0305 * 10^6 pa\Big)^2 \Big]^{1/2}$$

$$138\ Mpa = \Big[\Big(\frac{0.72325*10^4}{t} + 0.0305 * 10^6 pa\Big)^2 + \Big(\frac{0.71675*10^4}{t} + 0.061 * 10^6 pa\Big)^2 + \Big(-0.0915 * 10^6 pa - \frac{1.44*10^4}{t}\Big)^2 \Big]^{1/2} \quad (4.36.d)$$

By solving the above equation (4.36.e), with $A^2 + 2AB + B^2$, for each boundary and it become:

$$138\ Mpa = \Big[\Big(\frac{0.53*10^8}{t^2} + \frac{0.044*10^{10}}{t} + 9.3025 * 10^8\Big) + \Big(\frac{0.52*10^8}{t^2} + \frac{0.088*10^{10}}{t} + 37.21 * 10^8\Big) + \Big(8.38 * 10^9 + \frac{0.26*10^{10}}{t} + \frac{2.0736*10^8}{t^2}\Big)\Big]^{1/2} \quad (4.36.e)$$

$$(138\ Mpa)^{*(2)} = \Big[\frac{3.12*10^8}{t^2} + \frac{0.392*10^{10}}{t} + 130.3 * 10^8\Big]^{1/2 *(2)} \quad (4.36.f)$$

$$19044 * 10^{12} = \frac{312*10^6 pa}{t^2} + \frac{2930*10^6 pa}{t} + 0.03 * 10^{12} pa \quad (4.36.g)$$

$$(19043.99 * 10^{12} pa) * t^2 = 312 * 10^6 pa + (2930 * 10^6 pa) * t \quad (4.36.h)$$

Dividing equation (4.36.h) by 10^6:

$$\frac{(19043.99*10^{12}pa)}{10^6} * t^2 - \frac{(2930*10^6pa)*t}{10^6} - \frac{312*10^6pa}{10^6} = 0 \qquad (4.36.k)$$

$$t = \frac{-(-2930)\pm\sqrt{(-2930)^2+4(5.942*10^{12})}}{2*(19043.99*10^6)}$$

$$t = \left|\frac{2930\pm4.88*10^6}{38087.98*10^6}\right| = \frac{4.88}{38087.98}\ t = 1.28 * 10^{-4}m$$

$$t = 1.28 * 10^{-4}m = 1.28 * 10^{-1}\ mm$$

By the equation $r_o = r_i + t$,we can find the outer radius:

$$r_o = 23.5cm + 0.0128cm = 23.5128\ \text{cm}.$$

We notice that the thickness should not be less than $0.0128cm$, so we used the standard thickness available in the markets, where it higher than $0.0128cm$. By substitute the value of t in equation (4.30), the stress will become:

$$(\sigma_t)\ max = \frac{P_i(di+t)}{2t}$$

$$(\sigma_t)\ max = \frac{0.61*10^5pa\left(47*10^{-2}m+1.28*10^{-4}m\right)}{2\left(1.28*10^{-4}\right)}$$

$$(\sigma_t)\ max = \frac{28.677808*10^3}{2.56*10^{-4}} = 112.1\ \text{Mpa}$$

$$(\sigma_t)\, max = 112.1 Mpa\,.$$

Also we find σ_l:

$$\sigma_l = \frac{P_i * d_i}{4t} \tag{4.37}$$

$$\sigma_l = \frac{0.61*10^5 pa*(47*10^{-2}m)}{4*(1.28*10^{-4})} = \frac{28.67*10^3}{5.12*10^{-4}} = 56\ Mpa.$$

$$\sigma_l = 56\ Mpa$$

The machine structure (body) have holes around (notches), this means there will be a stress concentration around this notches (in case of axial and shear loading) , so we must take Kt(concentration factor) into account, and added it to the calculation of stresses. From table (A-15-1, appendix A), find the value of K_t then stresses will become:

$$\sigma_t = \sigma_t * k_t \tag{4.38}$$

Where :

The diameter of notch is $d = 2mm$, and the distance between notches 2 cm, so w=1 cm, to find K_t we must find d/w, by using table (A-15-1), K_t is:

$$\frac{d}{w} = \frac{0.002\text{m}}{0.01\text{m}} = 0.2$$

$Kt = 2.5$, apply value of K_t in equation (4.38), σt and σl will become:

$$\sigma_t = \sigma_t * k_t = 112.1 Mpa * 2.5 \cong 280.25\ Mpa\,.$$

$$\sigma_l = \sigma_l * k_t = 56\ Mpa * 2.5 \cong 140\ Mpa\,.$$

Now with the new values of σ_t, the thickness of the machine can be founded by substitute its value instead of 138 Mpa in equation(4.36.f):

$$(280.25\ Mpa)^{*(2)} = \left[\frac{3.12*10^8}{t^2} + \frac{0.392*10^{10}}{t} + 130.3 * 10^8\right]^{1/2^{*(2)}}$$

So t will become:

$$t = \frac{-(-2930) \pm \sqrt{(-2930)^2 + 4(5.942*10^{12})}}{2*(78540*10^6)}$$

$$t = 3.2 * 10^{-5} m.$$

All dimensions of the machine press show clearly and specifically in the appendix A.

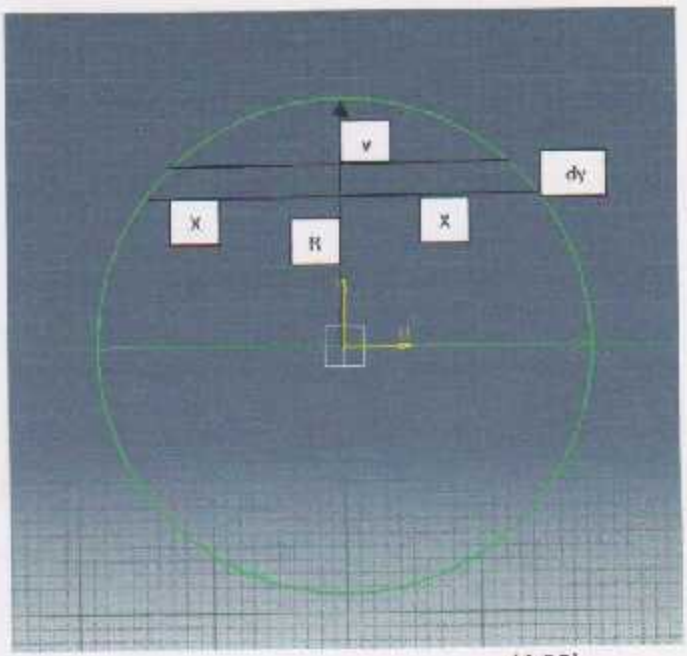
4.6 Stiffness of the springs

Adding a gate with mechanical spring, will achieve by it simplest and more economical design, and it will guaranty a continuous repeated pressing of the grapes, while the residual's slips out at each batch of chamber by the movable gate.

So the force (Fs) of the spring must be quietly larger than the force exerted by the pistons, before calculating the stiffness of the spring, the moment at gate pivot can be calculated, to find the stiffness of the spring.

Circle equation: $R = \sqrt{X^2 + Y^2}$, Where:

X−2b, $X = R^2 - Y^2$, b will become:



Force at the movable gate:

$$df = p * dA$$

$$df = P * b * dy.$$

The moment is:

$$M = \int_{-R}^{+R} (R - Y) * (b * dy) * P_i \quad (4.39)$$

$$M = P_i * \left(\int_{-R}^{+R} (R - Y) * \left(2\sqrt{(R^2 - Y^2)} \right) \right) \quad (4.40)$$

By using the polar coordinates, and assume:

$$Y = R * \cos\theta$$

$$Y^2 = R^2 * \cos^2\theta$$

$$R^2 - Y^2 = R^2 * (1 - \cos^2\theta)$$

$$R^2 - Y^2 = R^2 * \sin^2\theta. \quad (4.41)$$

Taking the root for the two sides in equation (4.41), it will become:

$$\sqrt{R^2 - Y^2} = R * \sin\theta \quad (4.42)$$

Where:

$$dy = -R * \sin\theta \ . d\theta \quad (4.43)$$

So the Moment when substitute equation (4.42), and (4.43) will become:

$$M = -2 * P_i \int (R - R * \cos\theta) * R * \sin\theta * R * \sin\theta \ . d\theta \quad (4.44)$$

$$= 2 * P_i * R^3 * \int (1 - \cos\theta) * \sin^2\theta \, . d\theta \quad (4.45)$$

$$= -2 * P_i * R^3 * \int \sin^2\theta \, . d\theta - \int \cos\theta * \sin^2\theta \, d\theta \quad (4.46)$$

Assume:

$u = \sin\theta$

$du = \cos\theta \, . d\theta$

And substitute in equation (4.46), the equation will become as:

The

$$= -2 * P_i * R^3 * \int \frac{1+\cos 2\theta}{2} . d\theta - \int \cos\theta * u . du \quad (4.47)$$

integration of equation (4.47) will be:

$$= -2 * P_i * R^3 * \left[\frac{1}{2} * \theta + \frac{\sin 2\theta}{4} - \frac{\sin^3\theta}{3}\right] \quad (4.48)$$

For the integration boundary :

$Y = R * \cos\theta$

$\cos\theta = \frac{Y}{R}$

$\theta = \cos^{-1}\theta * \frac{Y}{R}$.

So

$\theta\ at\ (Y = R) = \cos^{-1}\frac{R}{R} = \cos^{-1}(1) = 0$

$\theta\ at\ (Y = -R) = \cos^{-1}\frac{R}{R} = \cos^{-1}(-1) = \pi.$

Substitute the integration boundary in equation (4.47):

$$= -2 * P_i * R^3 * \left[\frac{1}{2} * \theta + \frac{\sin 2\theta}{4} - \frac{\sin^3\theta}{3}\right]\Big|_{\pi}^{0} \quad (4.49)$$

The equation (4.49) will become:

$$= 2 * P_i * R^3 * \left[\frac{1}{2} * \theta + \frac{\sin 2\theta}{4} - \frac{\sin^3\theta}{3}\right]\Big|_{0}^{\pi}$$

$$M = 2 * P_i * R^3 * \left(\left(\frac{1}{2} * \pi + 0\right) - \left(\frac{1}{2} * (0) + \frac{\sin 2(0)}{4} - \frac{\sin^3(0)}{3}\right)\right)$$

$$M = P_i * R^3 * \pi$$

$$= 0.61 * 10^5 * (23.5 * 10^{-2})^3 * 3.14 = 12977.9 * 0.2$$

$$M \cong 2596N.m$$

The moment is:

$$M = h * F \tag{4.50}$$

Where:

h: is the distance of the spring from the pivot (at the center).

$$F_S = \frac{M}{h} = \frac{2596}{23.5*10^{-2}} \cong 11047N$$

Also Fs is:

$$F_s = K * X \tag{4.51}$$

Where:

X = the distance that the movable gate will move.

K = stiffness of the spring.

But the spring in the middle of the gate, will move by a deformation distance δ, from the identical triangle made when the gate moves fig (9.10), the deformation of the spring δ is:

$$\frac{\delta}{10} = \frac{23.5}{47}$$

$$\delta = 5cm.$$

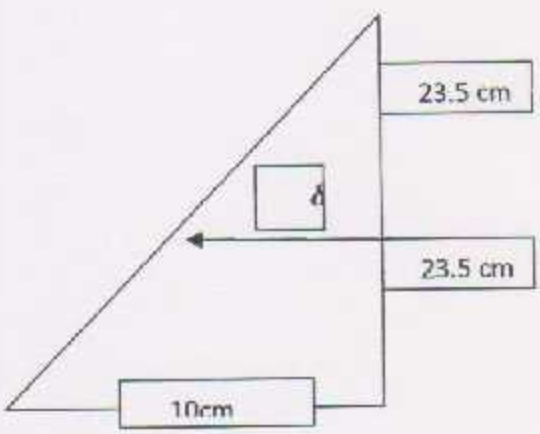


Fig (4 10): The identical triangle made when gate moves.

Where:

δ = deformation of the spring.

Designing the gate with two springs on parallel, K_{eq} will become for each spring:

$$K_{eq} = K1 + K2$$

Where $K1 = K2$. So K_{eq} will become:

$$K_{eq} = 2K$$

Equation (4.51) will become:

$$F = 2K * \delta$$

$$So\ K = \frac{F_s}{2*\delta} = \frac{11047}{2*(5*10^{-2})} = 110470$$

$$K = 110.47\ kN/m$$

4.7 Pneumatic component

Pneumatic cylinders are two kinds:

A- Single acting cylinders: works in single stroke the acting or return stroke by using pneumatic energy or external force.

B- Double acting cylinders: Its work in the tow storks the acting and return stroke using the pneumatic pressure, it's the most common and used in the pneumatic applications.

Fig (4.11) shows the hydraulic circuit of the project.

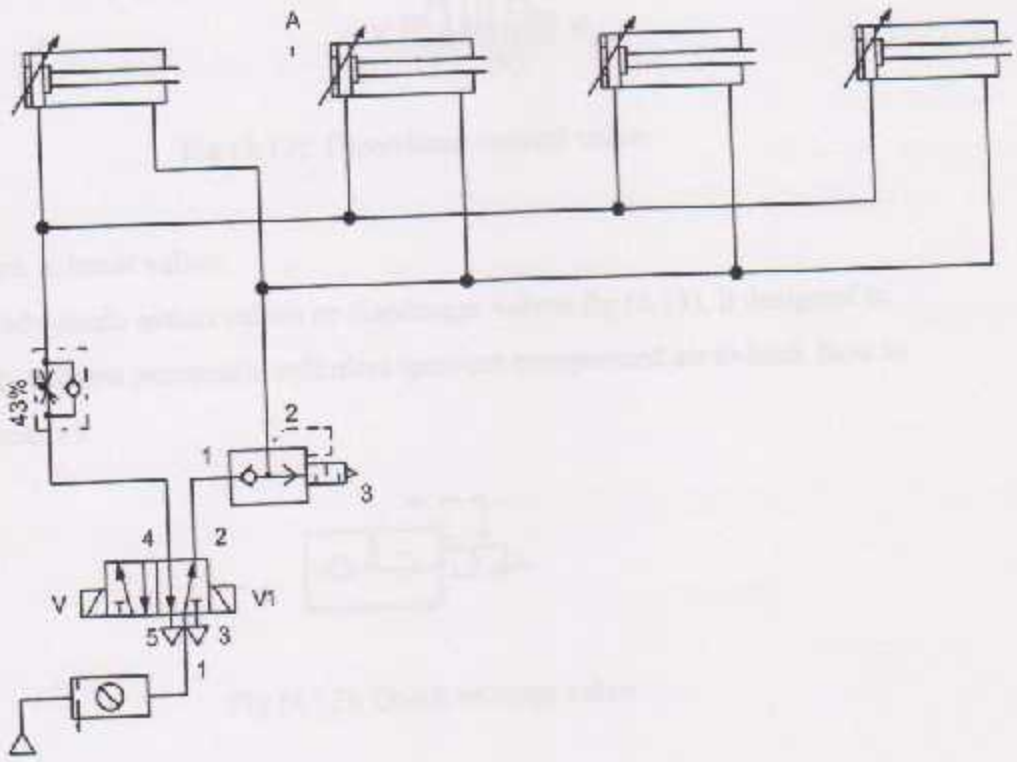


Figure (4.11): Project hydraulic circuit.

In this project, a double acting pneumatic cylinders with cylinder model SU600*63 is used, also a compressor producing maximum pressure 12 bar. And the valves that used are:

1. Directional control valve (electrical double solenoid):

Controls the flow of pressurized air from the source to the selected port fig (4.12). Some valves permit free exhaust from the port not selected. These valves can be actuated either manually or electrically (the valves typically provided in the FIRST kits use dual solenoids to change the direction of the valve, based on input signals from the control system).

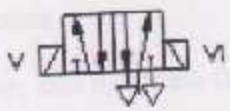


Fig (4.12): Directional control valve.

2. Quick exhaust valve:

Are ready-made piston valves or diaphragm valves fig (4.13), it designed to quickly exhaust pneumatic cylinders (prevent compressed air to back flow to compressor).

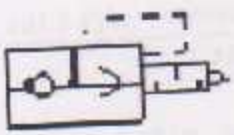


Fig (4.13): Quick exhaust valve.

3.One – way flow control valve:

Control the speed of the piston and the quantity of the flow enter to the piston, fig(4.14).

Fig (4.14). One – way flow control valve.

4.8 Air consumption and compressor

For the preparation of the air, and to obtain facts concerning power costs, it is important to know the air consumption of the system. The air consumption is specified in liters of air drawn in per minute. For a particular operating pressure, piston diameter, stroke and stroke number, the air consumption is calculated by:

Air consumption = Compression ratio • Piston surface • Stroke • Stroke number per minute.

$$Compression\ ratio = \frac{101.3\ Kpa + Operating\ pressure\ (in\ kPa)}{101.3\ Kpa}$$

$$Compression\ ratio = \frac{101.3 + 900\ Kpa}{101.3}$$

$$Compression\ ratio = 9.9$$

Air consumption can be calculated by using the fig (4.15), as:

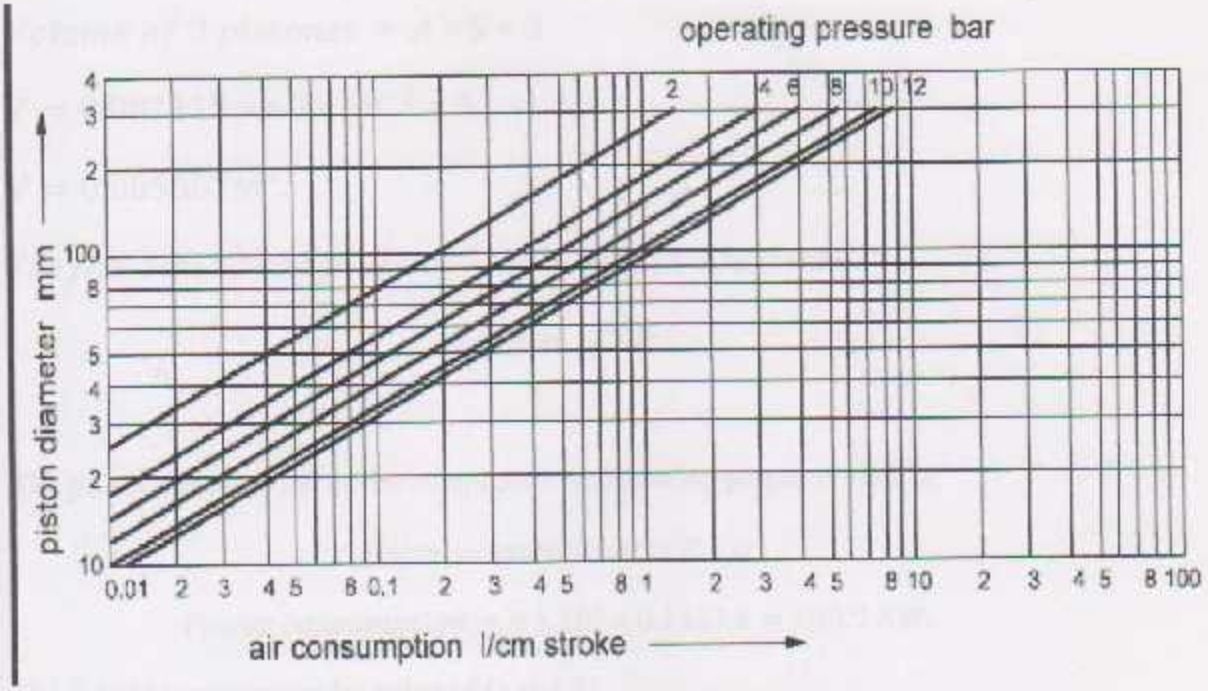


Fig (4.15) : Air consumption chart

$Air\ consumption\ per\ strok = q_h \cong 34.5\ l\ per\ cm\ strok$

For double acting cylinders, the air consumption in liter per minute is given by:

$$q_B = 2 * s * n * q_H$$

Where:

q_B : Air consumption (l/min)

S: stroke (cm)

n: number of strokes per minute (1/min) = 0.1 stroke per minute.

q_h : Air consumption per cm of strokes(l/cm)

So q_B will become:

$$q_B = 2 * s * n * q_H$$

$$q_B = 2 * 0.1 * 60\ cm * 34.5$$

$q_B = 414\ l\ per\ min$

$Volume\ of\ 3\ pistones = A * S * 3$

$V = 0.003115 * 60 * 10^{-2} * 3$

$V = 0.005607 m^3.$

$The\ flow\ rate\ of\ compressor = \frac{V}{n} * 2 = 0.11214\ m^3 per\ min$

$$Q = 3.96\ SCFM$$

The power consumption of the compressor at operating pressure 9 bar is:

$$power\ consumption = P * Q$$

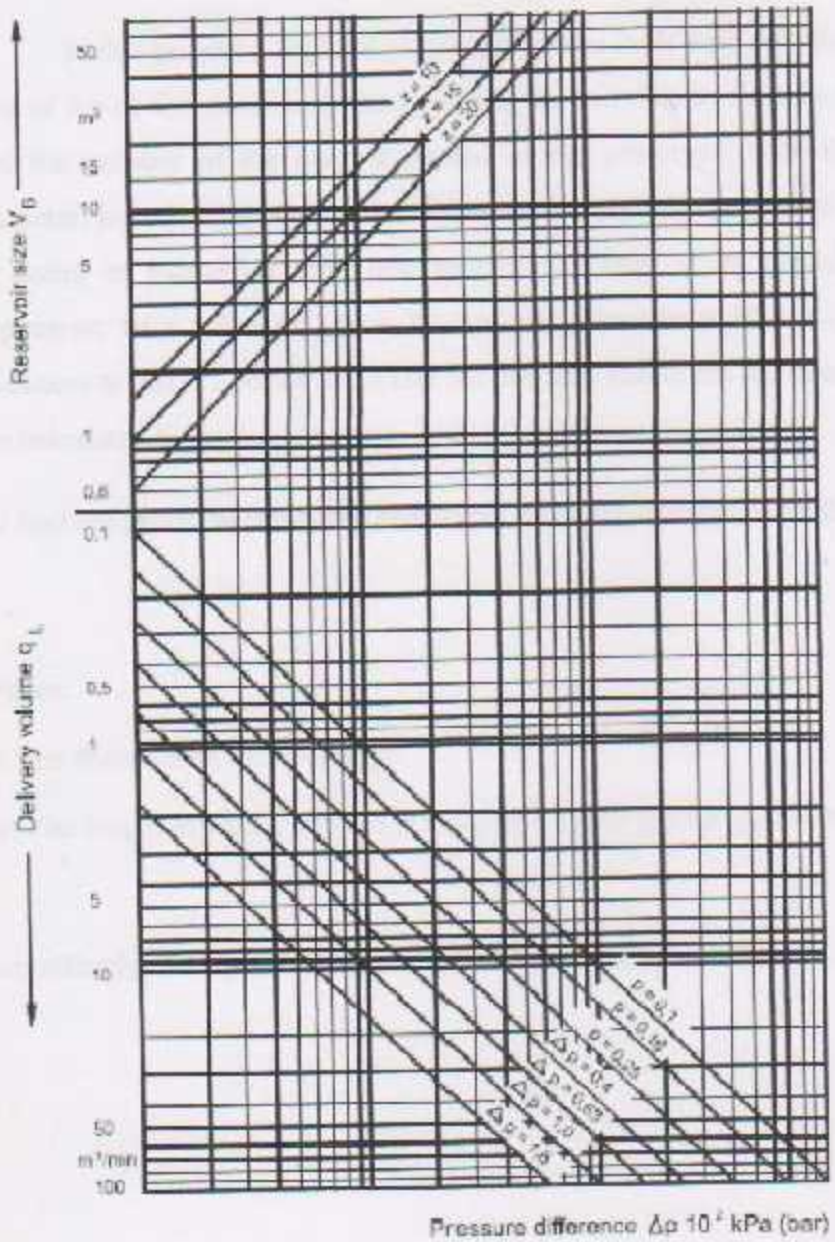
$$Power\ consumption = 9 * 10^5 * 0.11214 = 100.9\ KW.$$

The suitable compressor by value of Q and P:

Type	Capacity in scfm	Horsepower	Cooling medium	Lubrication
Single-stage, lubricated rotary	14 to 3,000	5 to 700	Air or water	Yes

The reservoir volume:

To determine the reservoir volume can be founded by fig below:



Fig(4.16): reservoir size.

Deferential pressure ΔP = 3 bar (operating pressure between 9 and 12 bar).

Z: cycling per hour = 6 cycle per hour. And with q = 15 m³ per min.

So the reservoir size = $15m^3$.

Prototype project information:

In this project a realized prototype will be built with downing (enlarging) the size of the of the machine (calculate with the real data to find the forces by pistons and the number of the pistons needed in the prototype, with the real prototype diameter, in order to preserve the values of the pressure needed to press the grape), by using an cylindrical cast iron material because of its availability and lowest expensive, with a length Lm = 70 cm, and diameter = 38 cm (available), and a thickness $\cong 3mm$. So the force and the pressure inside the diameter of the prototype are calculated by:

To find the piston stroke in the prototype, it can be determined by the equation:

Where:

D: The diameter of the Prototype.

Ls: The length of stroke applied at the grape by the piston (piston stroke).

Accordingly, the equation (1), with D = 38 cm, can be solved for Ls as:

Strokes available in the markets is 30 cm, so the piston model that will be used in the prototype is:

Piston model is: DNC 60*300.

Bore size (mm)	Cylinder stroke (mm)
60	300

Table (4-3): Basic prototype piston dimension.

Force exerted by the piston is:

$$Fp = Ap * Pp = \frac{\pi}{4} * (6)^2 * 10^{-4} * 9 * 10^5$$

$$Fp = 2544\ N.$$

Fp: force exerted by the pneumatic piston.

The force applied to the grape by one pneumatic piston at the prototype diameter is:

$$Fg = Ap * Pg$$

Where:

Ap: Prototype Area.

Pg: The pressure needed to press the grape = $0.61 * 10^5\ bar$.

$$Fg = \frac{\pi}{4} * 38^2 * 10^{-4} * 0.61 * 10^5$$

$$Fg \cong 6915\ N.$$

We notice that the force needed to press the grapes available by one pneumatic piston is lower than the force that must be applied on the grape, so the force of the piston Fp must be greater or equal to the force needed to press the grape.

$$Fp * n \geq Fg$$

$$Fp * n \geq Am * Pg$$

$$n = \frac{Fg}{Fp} = \frac{6915}{2544} \cong 2.7 .$$

n: is the number of pistons that can be add to increase the force of Fp.

Here n = 3 pistons, so we can use in the prototype project 3 pistons in parallel because. So n = 3 pistons in the prototype, and Fp becomes:

$$Fp = 3 * 2544 = 7632\ N$$

We notice that Fp is now large than the wanted force needed to press the grape, which mean that using 3 pistons in the prototype is capable and enough to accomplish pressing process.

Chapter Five

Electrical Design

Content:

5.1 Introduction:

Electrical components are a key element in the machine, through which control the instrument and protect it from any defect that might occur during the work, and these elements fuse, which works to protect the circuit from any increase in the current course of action, the separation of the Chamber of the source of electricity, and also emergency be the key to the color red.

When a power failure or malfunction mechanical the group by pressing on this key and the machine is separated from the electrical source and put in the immediate area so that the Group access it easily in the event of any electrical or mechanical malfunction.

The door switch opened and placed at the introduction of grapes into the machine to the agent for not working, but this key Safety be closed in order to squeeze the grapes are good, either the security key is used to prepare the machine to work before pressing the power key, The key is used to run most potent when it is pressed from the by the Group in order to start the process of pressing grapes.

It contains a set of relay which works to control the movement of pistons, either timer would delay the return process is cylinders to age well.

5.2 Flow Chart:

This figure shows (5.1) flow chart the project and determine how the work of God, where has this plan on the terms until the work of God well, and built if there is any defect in this attempt, and how to return to the starting point for the machine to work well.

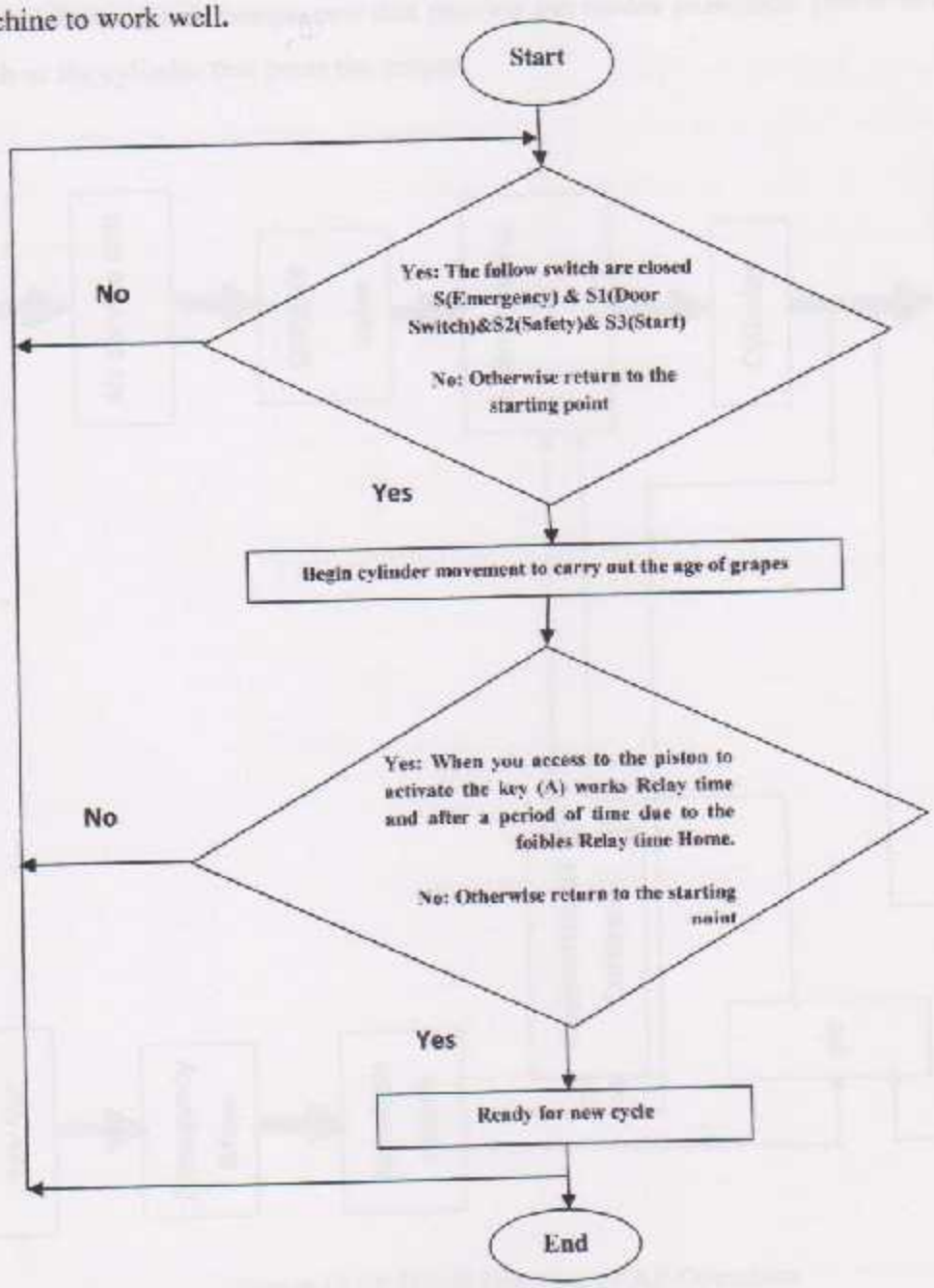


Figure (5.1):Flow chart

5.3 Control block diagram

This figure show the block diagram for electrical circuit for the machine that contain the protection circuit, air pressure control unit ,voltage source ,and low voltage. This figure show two modes of control, conventional and PLC control, the figure shows the air compressor that provide the modes pneumatic power to drive , such as the cylinder that press the grapes.

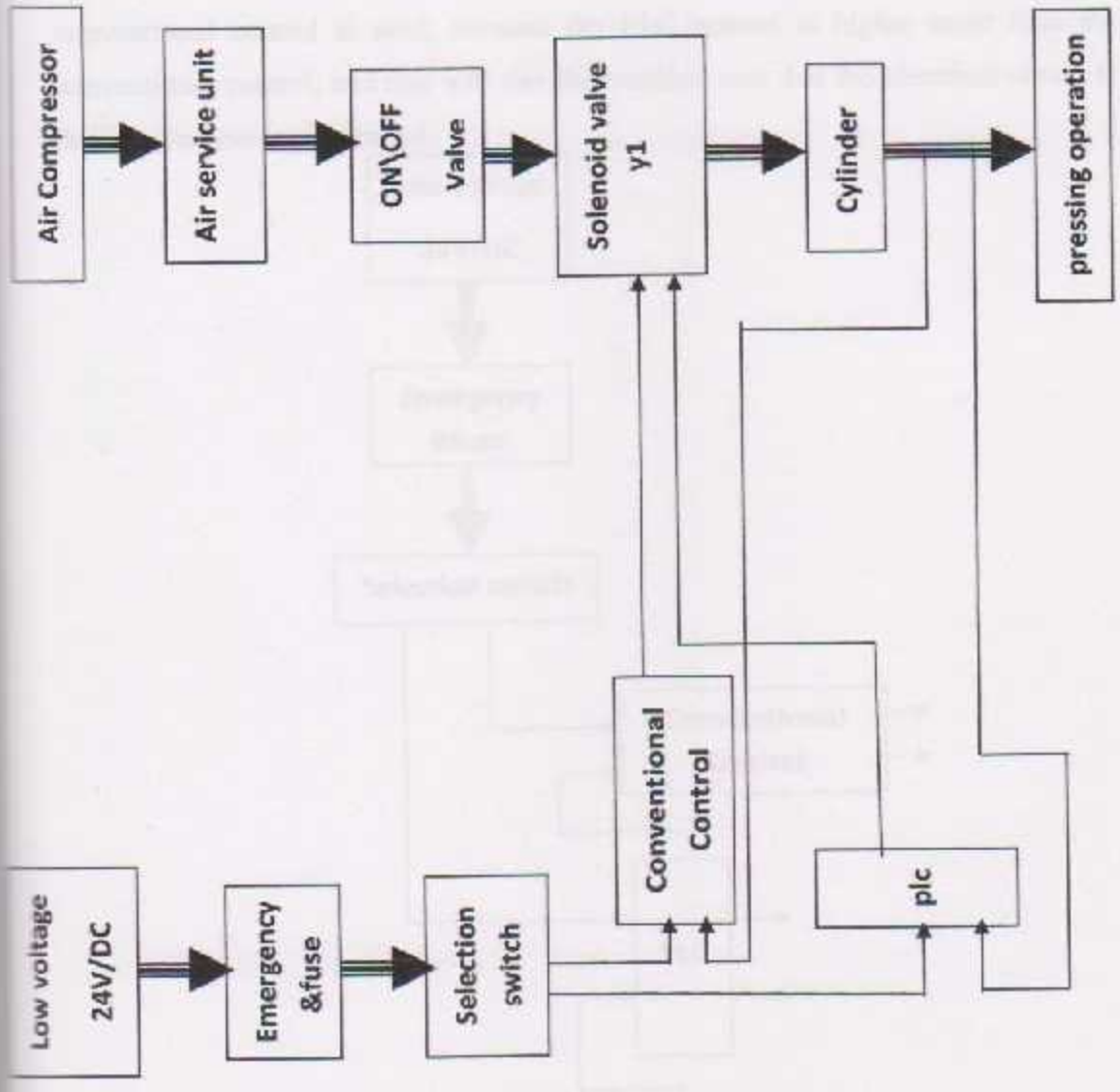


Figure (5.2): Block Diagram of All Operation

Figure (5.3) show the low voltage source (24V) that is used in control circuit, the control circuit contains connecting wires and relays, the relays supplied with 24 volt, and low current, the relay contain a magnetic coil that connect and disconnect the contactors, this contactors control by the machine depending on the control programmer.

This figure show two modes of control conventional and PLC control .The control style is chosen by a special button, in the prototype machine the conventional control is used, because the PLC control is higher coast than the conventional control, and that will rise the machine cost .but the electrical circuit is designed to accept plc control.

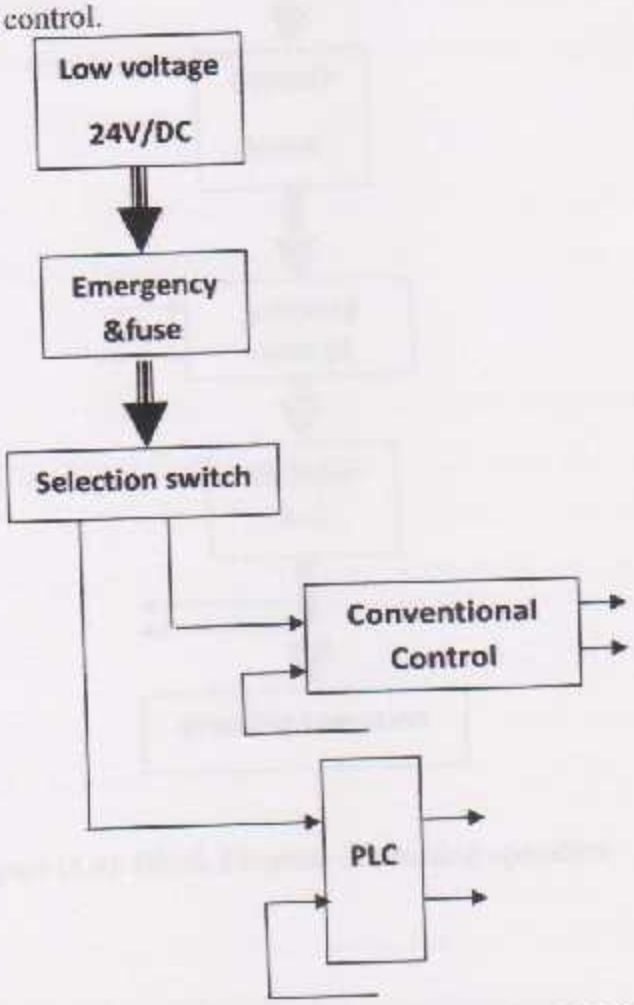


Figure (5.3): Block Diagram of control conventional and PLC control.

Figure (5.4)shows the air compressor that provide the power for cylinder by to press the derive power at grapes the pressing operation. This figure show the service unit, the service unite contain the pressure regulator, lubricator, air filter, and the pressing cylinder.

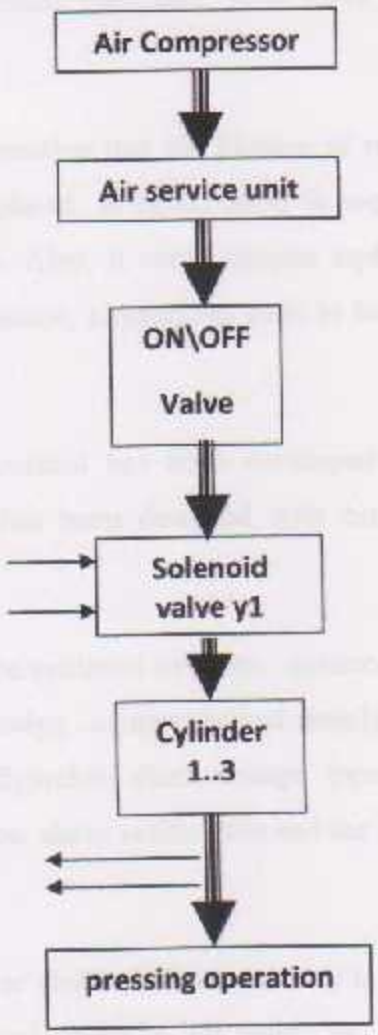


Figure (5.4): Block Diagram of pressing operation

5.4 Conventional control :

This type of control is introduced at the outset of industrial revolution, since sixties and it is used to operate automated machines, it is simple to build using relays interconnected using wires inside the control panel. But to discover an error in the system much time was needed especially with more complex process control systems.

It is important to mention that the lifetime of relay contacts is limited, so some relays need to be replaced. If replacement is required, machine had to be stopped and production too. Also, it could happen replacement is needed during operation. As far as maintenance, electricians need to be very skillful with finding errors.

The conventional control has been developed to provide a simple and reliable operation, also it has been designed with both installer and end users requirements in mind.

A quick design can be achieved by users, enhanced feature set and advanced programming that allows design to quickly and simply meet the demands of end user. Equipped with configurable class change inputs, coincidence detection, programmable delays to allow alarm verification and the facility to interface to larger house alarm systems.

For end users, clear visible indications, easy to operate functions and a red key to activate the control buttons, are used to make for simple and unambiguous operation.

Engineered and built to the same high standard as all control panels, machines control systems contains the essential part of any safety solution.

Figure (5.5) shows the control circuit of in this project that works to control the cylinder motion in the press of grapes. This department consists of the keys to protection, and also includes a number of relay to assist in the control cylinders and contains the coil time to delay the movement of the cylinders when a link to the end of the half, that is, when the key(A)and that to the press of grape is well. And also contains the two coil arc by them to give a signal to the valves to control the movement of cylinder.

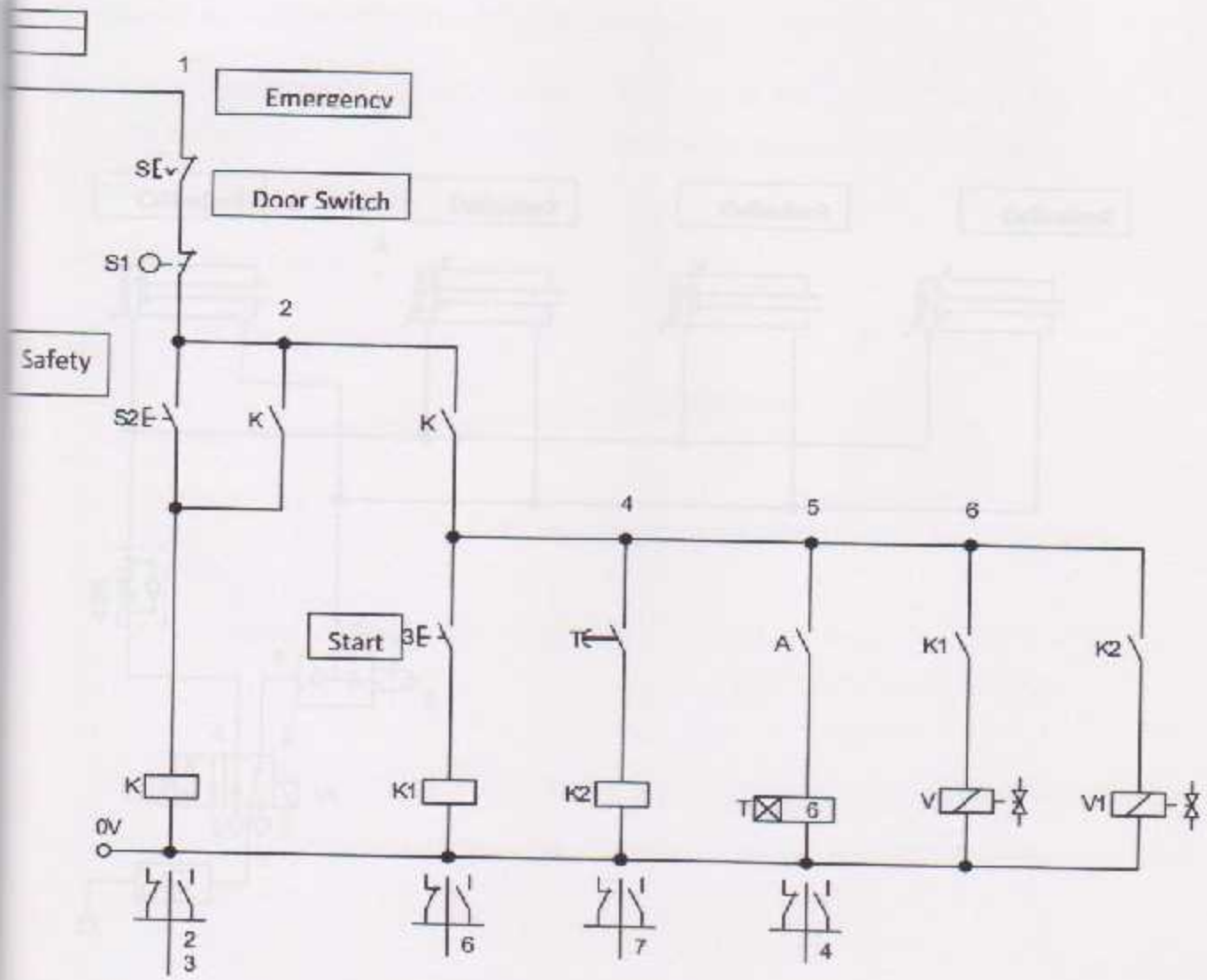


Figure (5.5): Electric scheme of the Service

The following figure (5.6)shows the pneumatic part of the project which consists of four cylinders and the cylinder this process press grapes, and contains a valve that contains two coil to find the reference of a control circuit to control the motion cylinder, and air service unit and the air pump, which lies also contains a quick exhaust valve, a help to get the air faster when return cylinder, and also contain one way flow control valve that controls the cylinder speed when the rinsing process grapes.

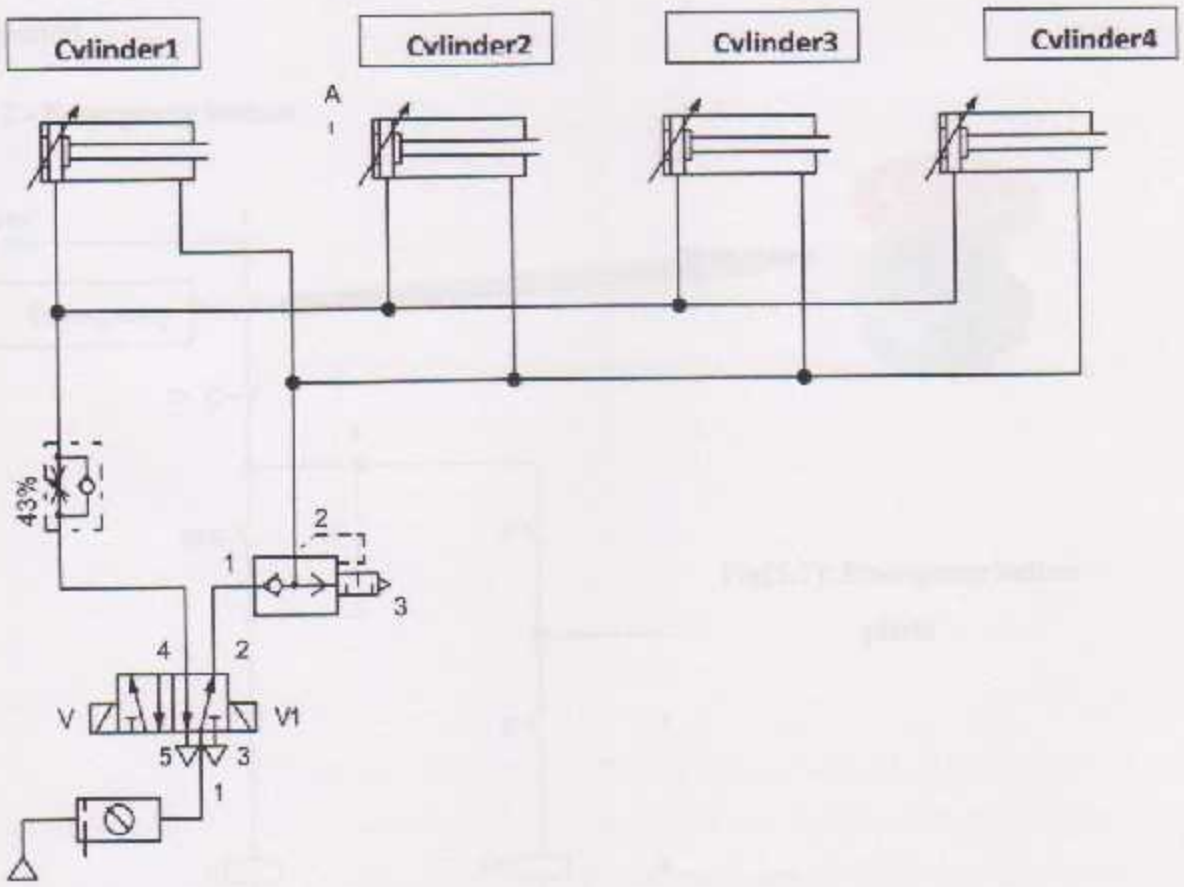


Figure (5.6):Circle of Mechanical Project

5.5 Protection

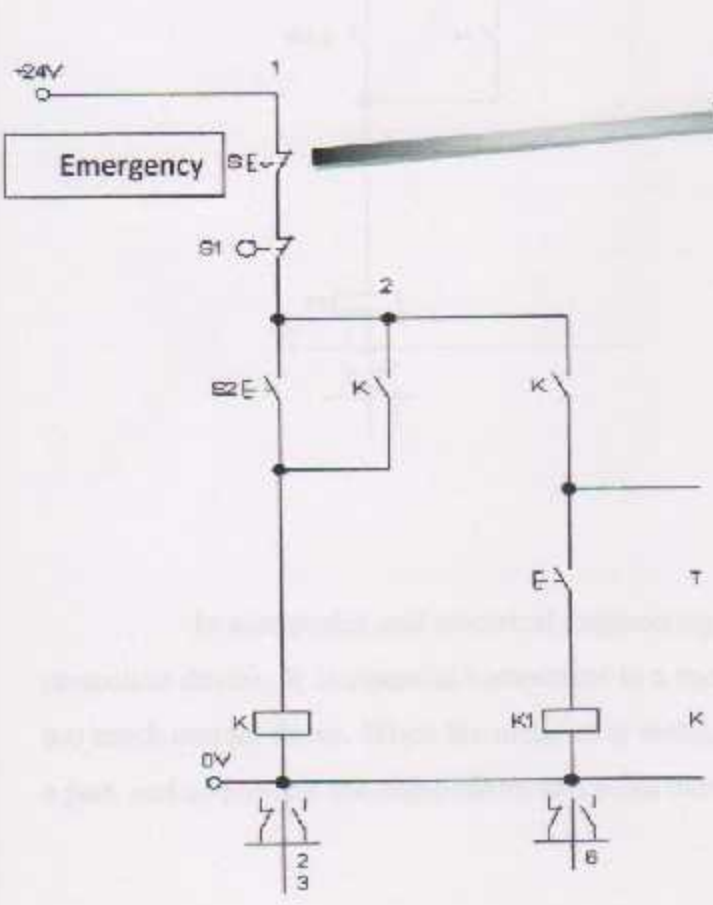
1 - Introduction

The power circuit of an automatic control system must perform the function of isolation, safety control, function control and electrical protection, which detected overloads and short circuit.

Protection device must be used in electrical control circuit detect any electrical and mechanical problems, which can occur in the load.

Any protection device must allow the motor to start but also protect the motor by preventing its operation when an over current occurs for too long a time period.

2 - Emergency button



Fig(5.7): Emergency button photo

Emergency button used to stop the machine when the worker push it in dangerous situations, its color is red ,usually put in easy to reach place on the machine body figure (5.7) show emergency button photo.

3-Fuse

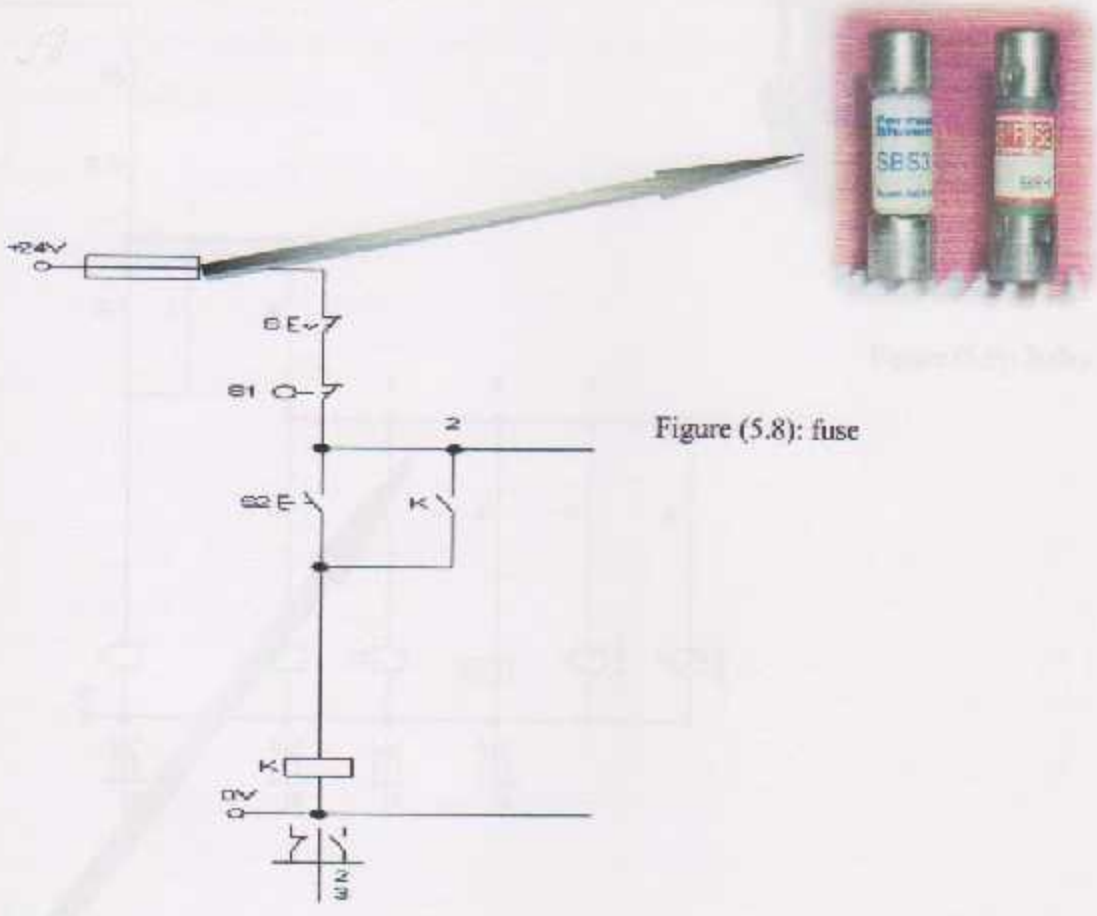


Figure (5.8): fuse

In electronics and electrical engineering a fuse is a type of over current protection device. It is essential component is a metal wire or strip that melts when too much current flows. When the metal strip melts, it opens the circuit of which it's a part, and so protects the circuit from excessive current.

4- Relay

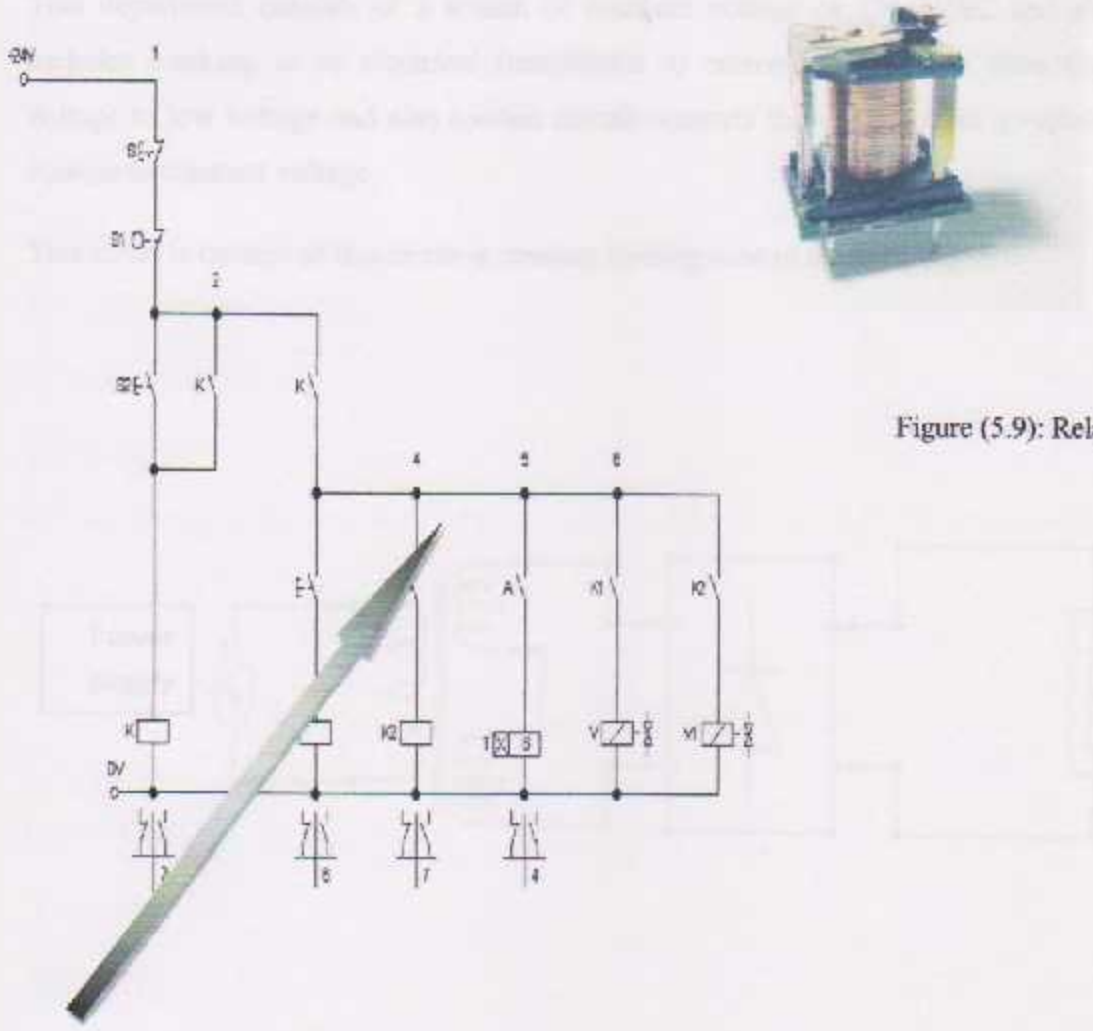


Figure (5.9): Relay

A relay is an electrical switch that opens and closes under the Control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. Because a relay is able to control an output circuit of higher power than the input circuit, it can be considered to be, in abroad sense, a form of an electrical amplifier.

5.6 Electric of load calculation:

This figure (5.9) shows the Department of Nutrition, which endeavors to provide the source voltage control circuit variable amount of 24V/ DC. This department consists of a source of constant voltage of 220 V/AC and also includes working at an electrical transformer to convert the voltage from high voltage to low voltage and also contain circuit converts the voltage from a variable voltage to constant voltage.

This effort is outside of this circle is running feeding control circuit.

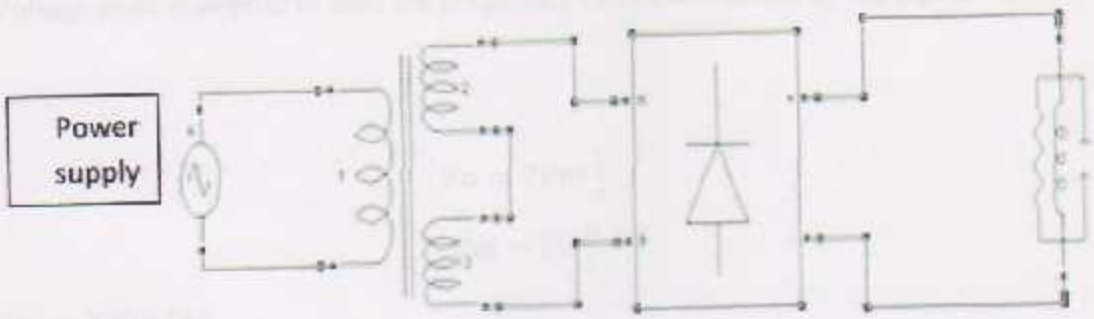


Figure (5.9): Department of Nutrition.

The components of the circuit:

Vin: Input voltage (AC).

Vm: Output voltage (AC).

Vo: Output voltage (DC).

Il : Current of Relay .

It : Total Current.

P : Power Transformer .

K: Factor for saved current.

N: Number of relays.

Calculation:

Voltage from converter to feed the pregnancy can be calculated by the equation(5.3):

$$Vo = 2Vm\frac{2}{\pi} \quad (5.2)$$

$$Vm = Vo\frac{\pi}{2} \quad (5.3)$$

$Vin = 220V/AC$.

$Vo = 24V/DC$

$Vm = 24\frac{\pi}{2}$.

$= 37.68V/AC.$

Current pregnancy, which can be calculated by the following equation(5.1):

$$It = I1 * K \quad (5.1)$$

$IL = 200mA.$

$K = 0.7.$

$It = N * 200mA$.

$= 6 * 200mA = 1200mA$ ... ... $1.2A$.

$It = IL * K$.

$= 1.2A * 0.7 = 0.84A$

Po

$$P = It * Vo \tag{5.4}$$

Where consumed by the load can be calculated by the equation(5.4):

$= 0.84A * 224V.$

$= 20.16W.$

Chapter Six

Contents:

Chapter Six

Conclusion and Recommendations

6.1 Conclusion

1. This type of press machine is very useful and with high efficient for the local society markets, in order to improve and develop the agricultural industry.

2. This project attract the attention of many people and agricultural association, that work in the agricultural field and grape industry.

3. The press machine was designed to be used personally and commercially considering the grape quantities needed to produced food products.

4. The design process adapted by design the machine that work by using press batch is an good alternative than the machines used in the local market with considering the economical factor.

5.The study of the production quantities the market of the grape and its food products, revealed a high potential for more works and jobs in the agricultural industry.

6.2 Recommendations

After studying the quantities and its distribution, and studying the press machines available in the market, which they was have low efficiency. Heavy seeking needed to improve the press machine worked at markets. From this principle this project is worked out.

After completing this project, the team has the following recommendations:

1. Use a particular automated conveyer, to fill the grape in the machine automatically.
2. Added water sprays on the conveyer to clean and wash the grapes that want to be pressed.
3. Use one pneumatic cylinder, that have the force needed to press the grape instead of four pistons for more machine compact, and more ease to control, and lower components are needed.
4. Use a hydraulic automated gate (to get rid of the residuals) instead of the gate depend on the stiffness of the springs.

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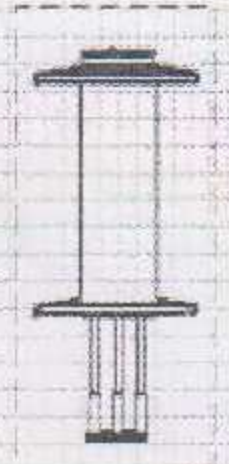
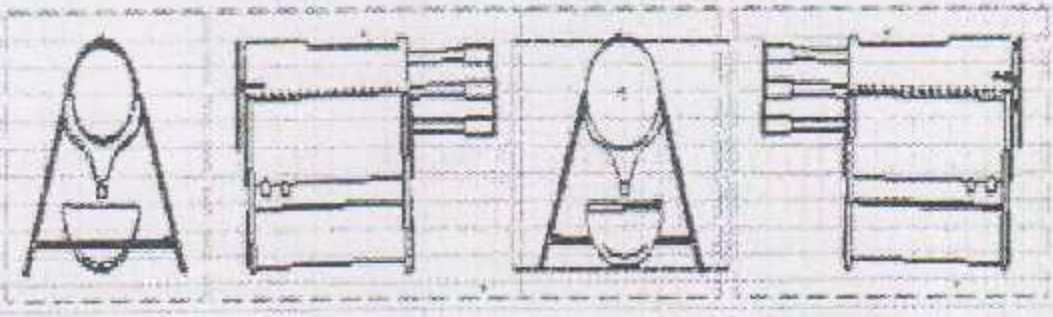
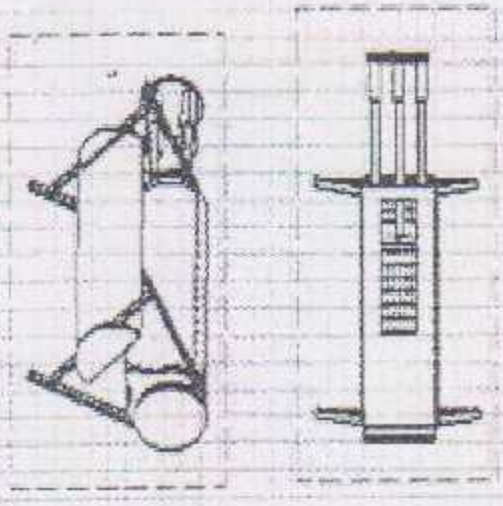
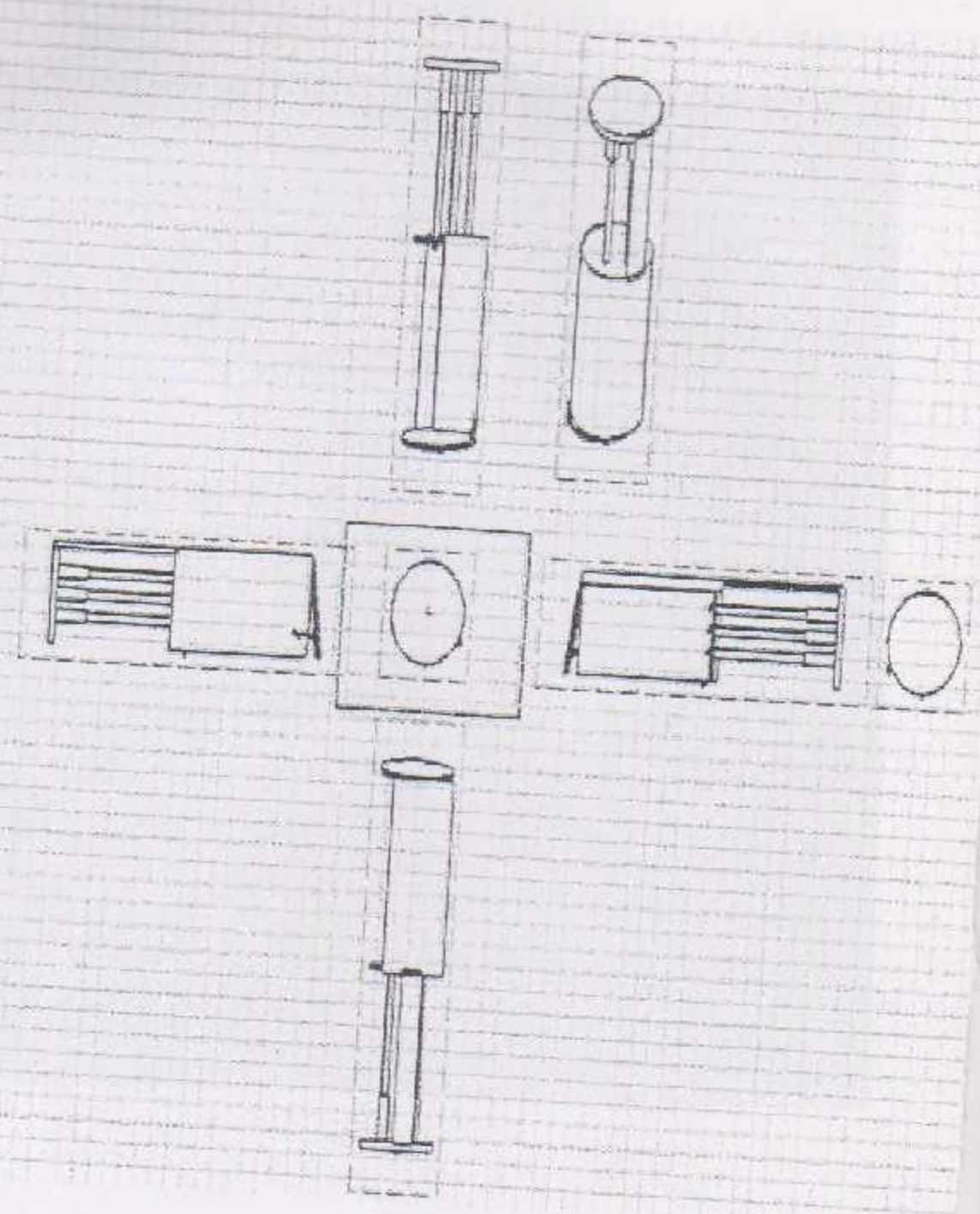
[11] Joseph E. shigley, Charles R. Miscke, Mechanical Design Engineering 7th ed , McGrow-Hill, New York, 2004.

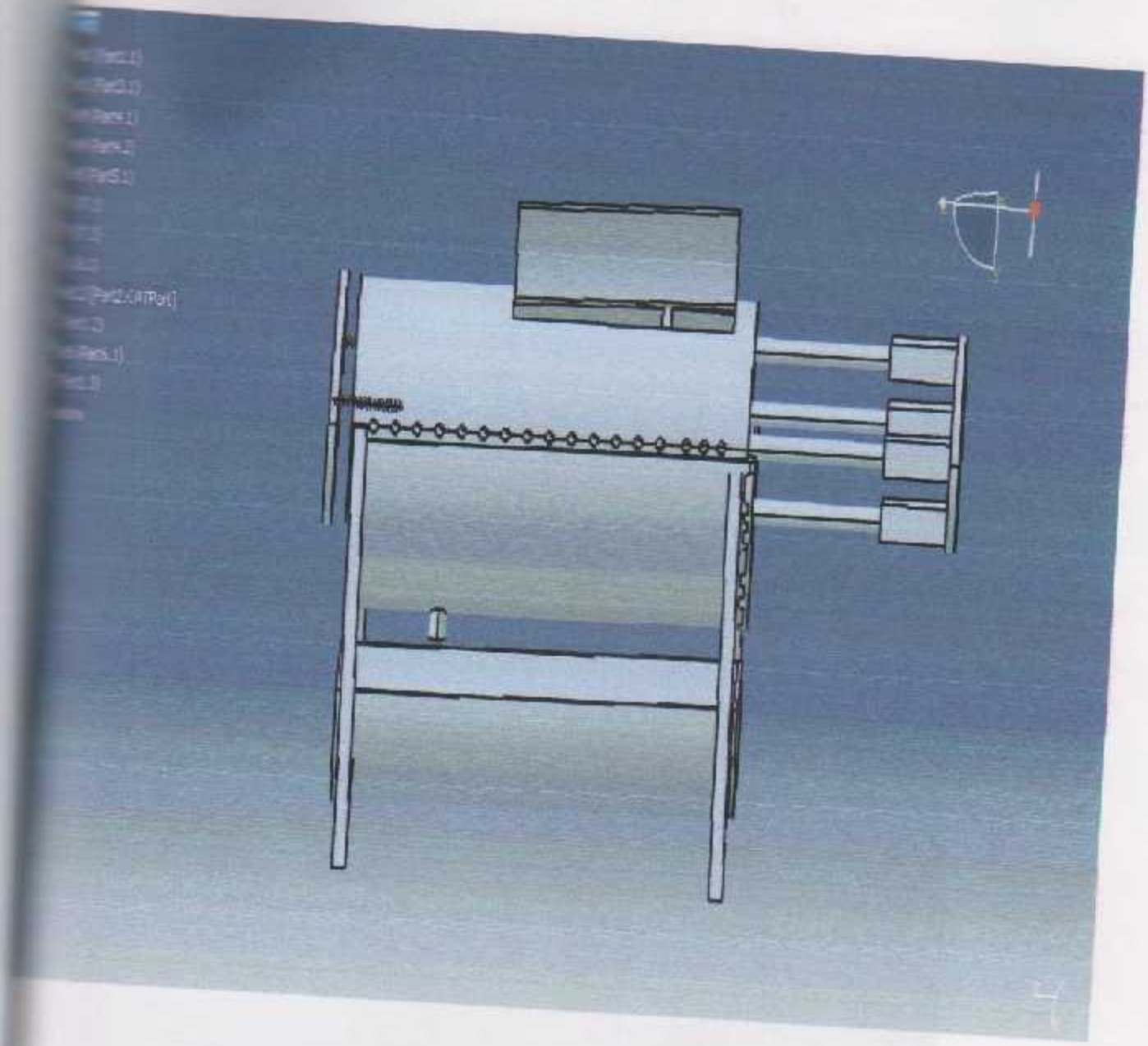
Appendix A

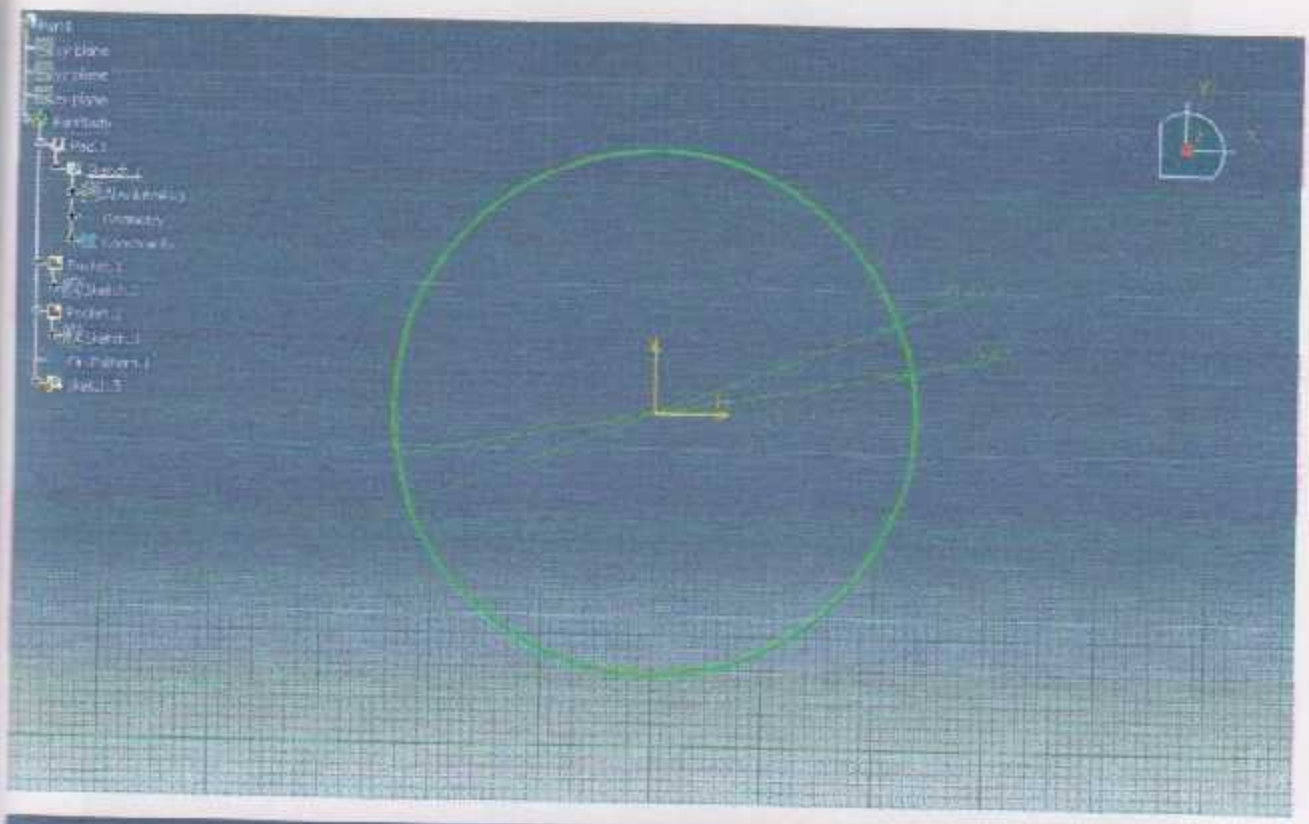


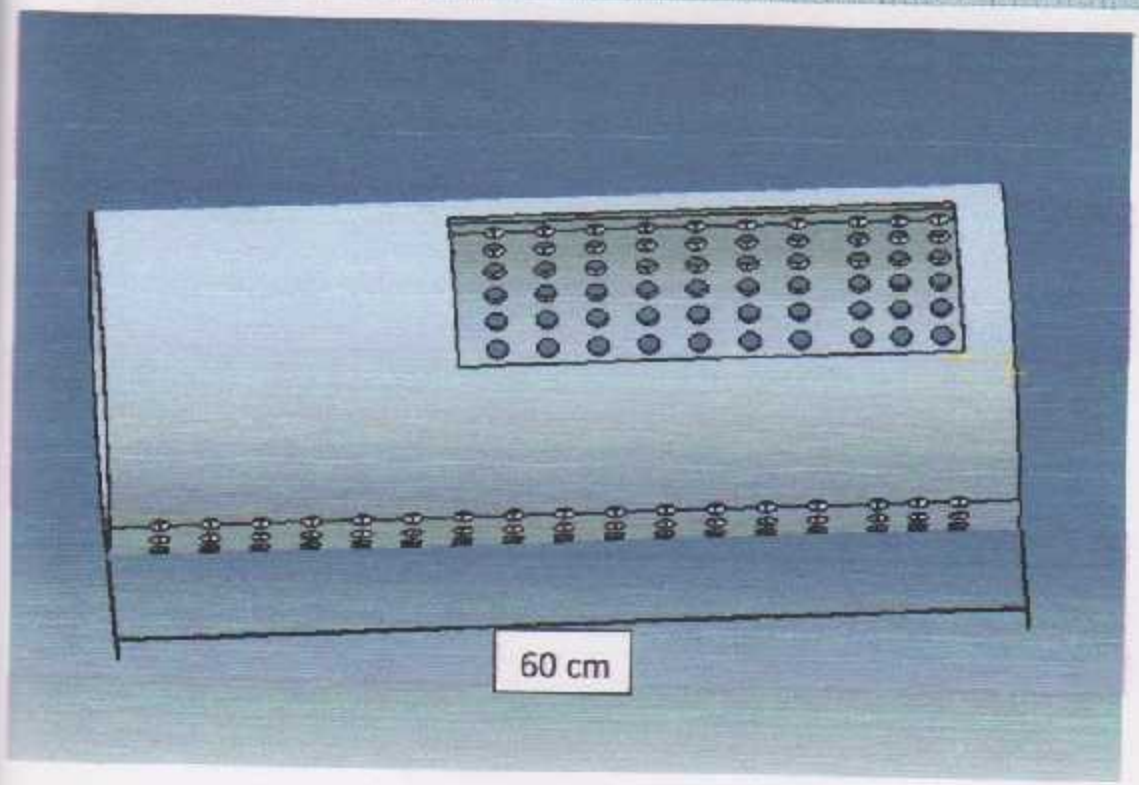


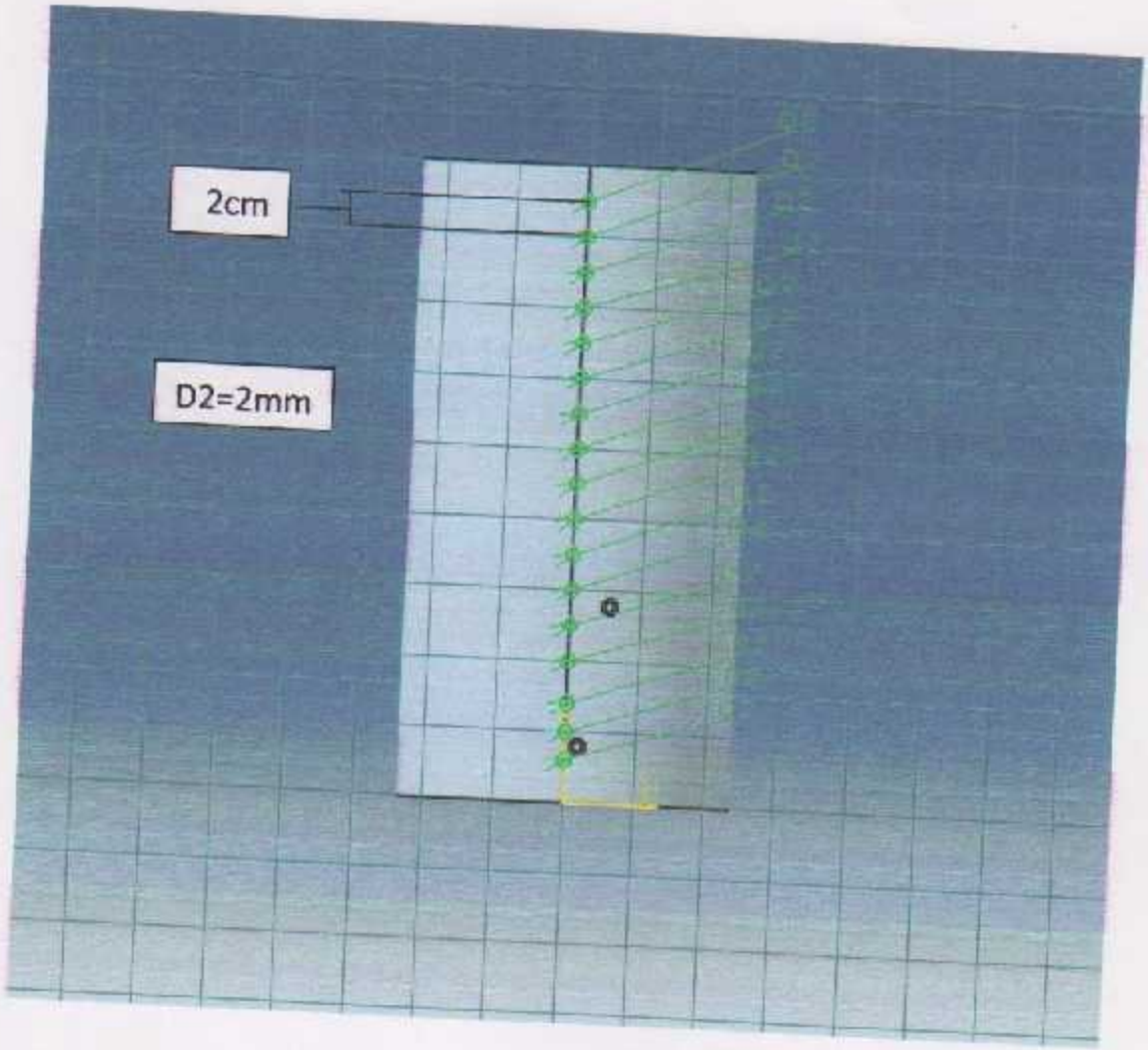


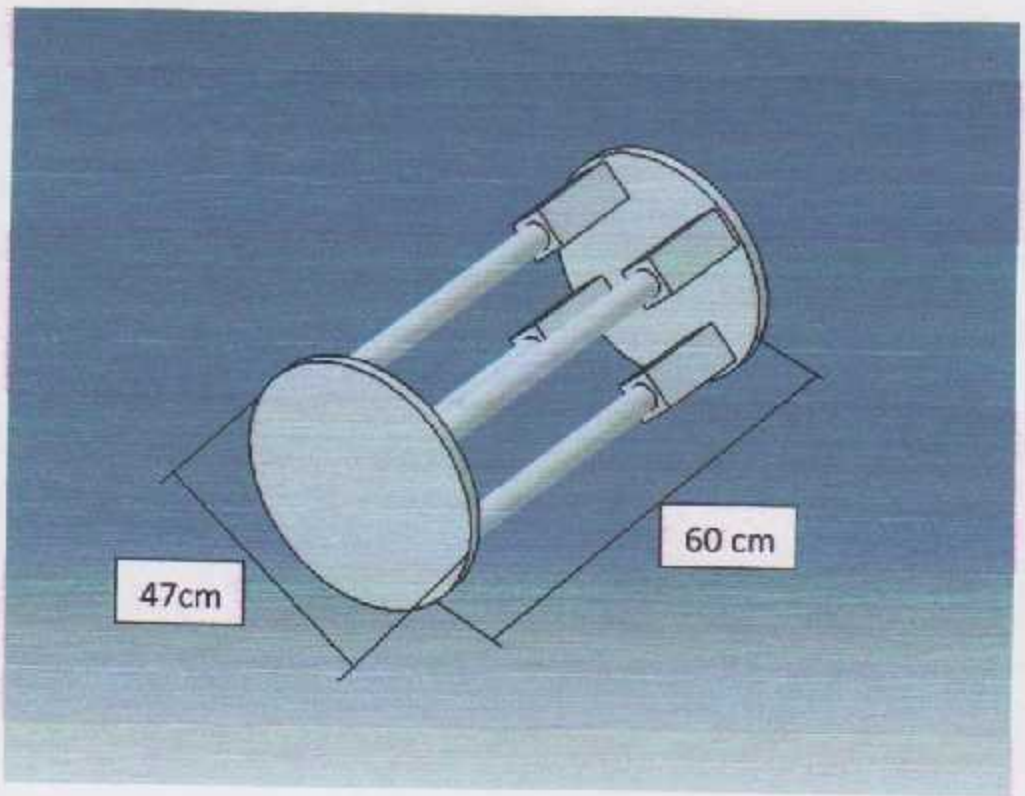


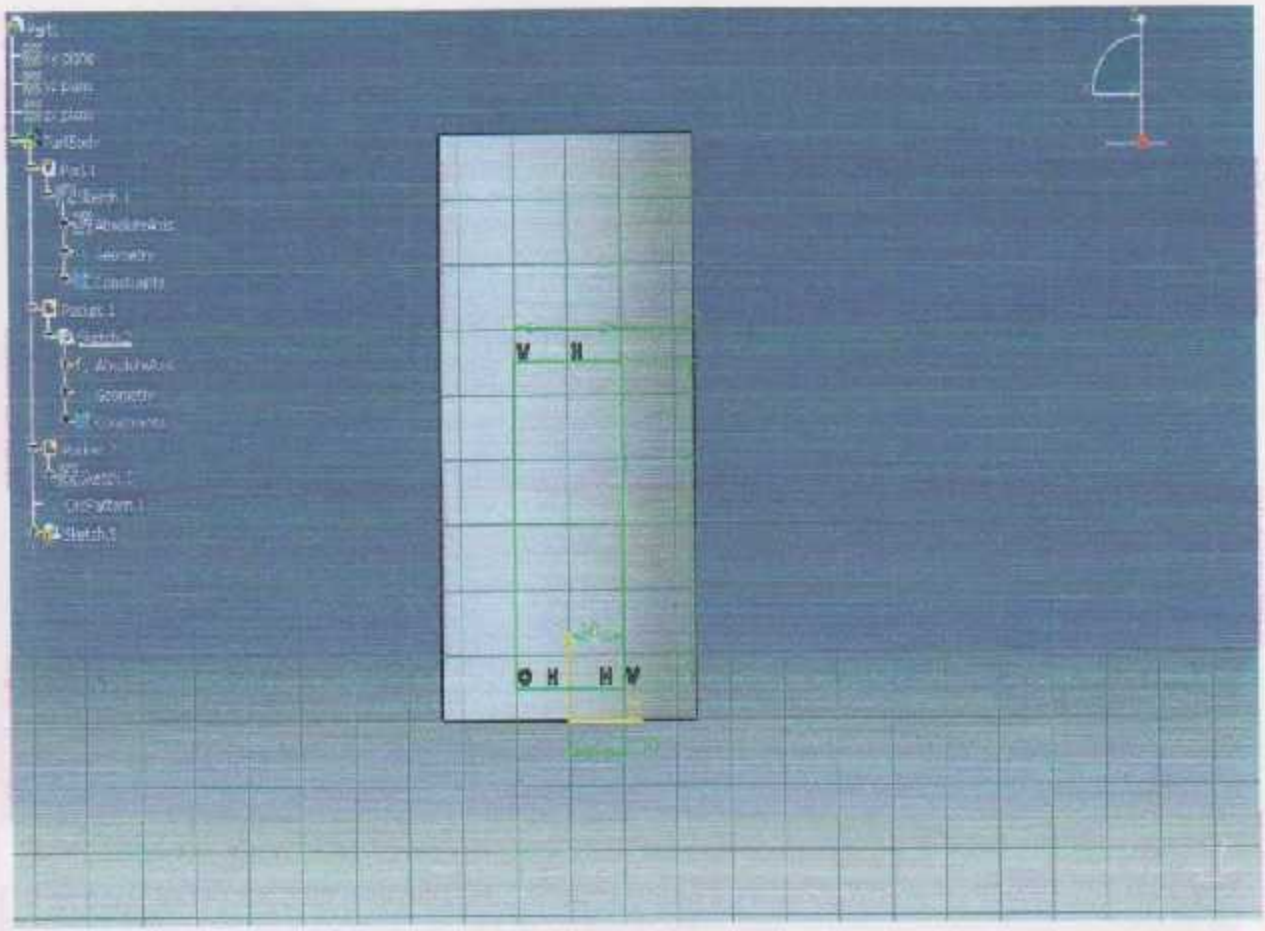


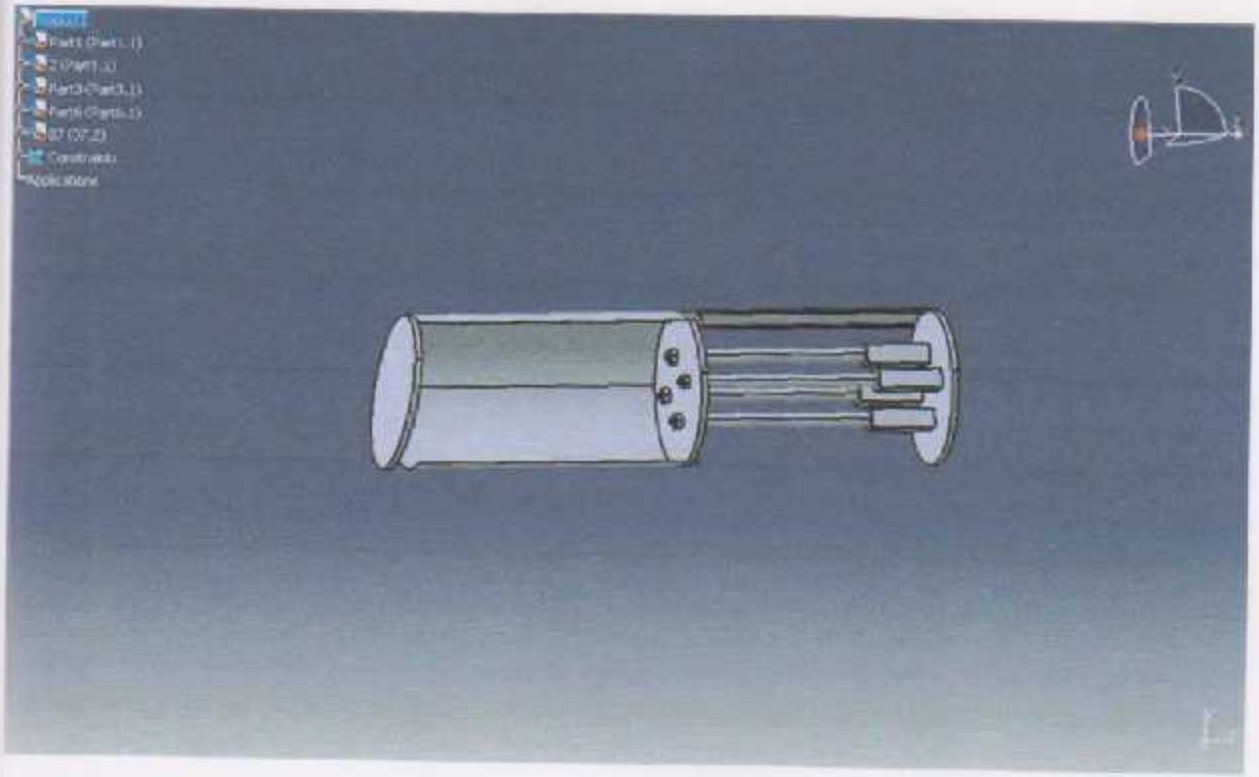


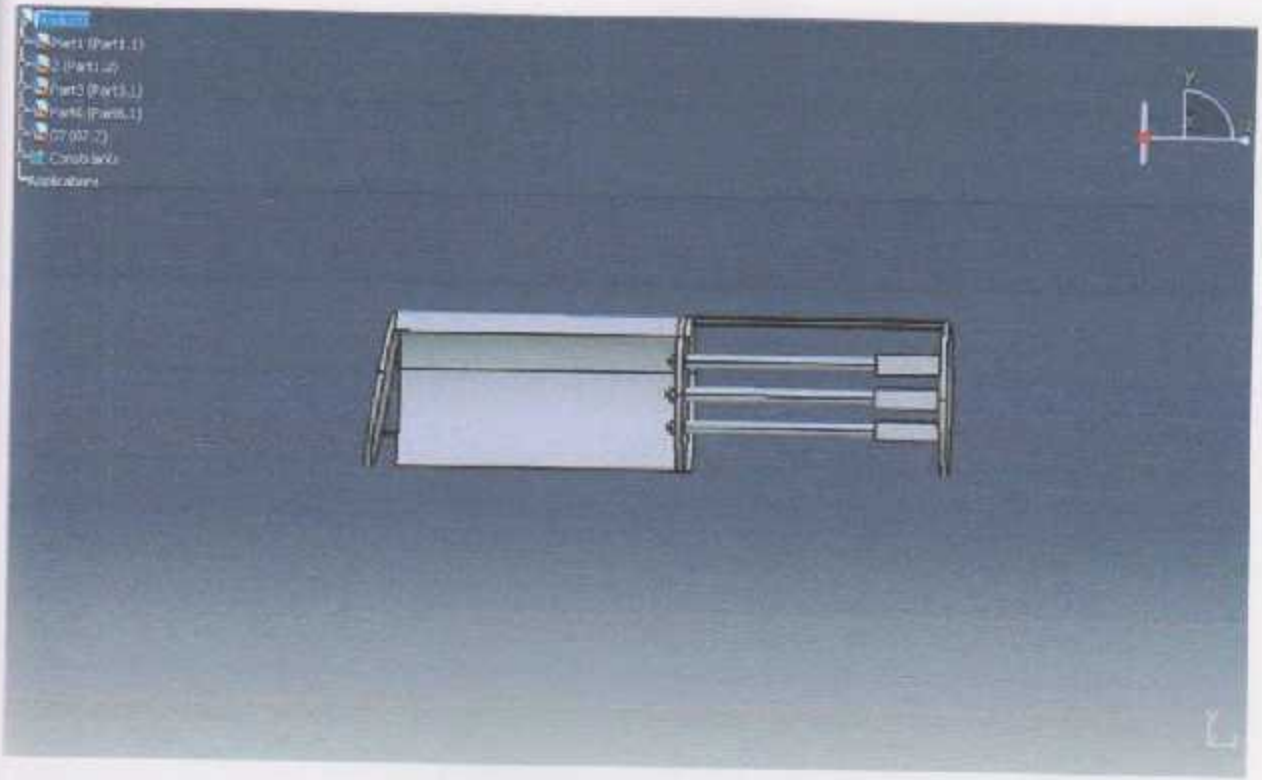

60 cm

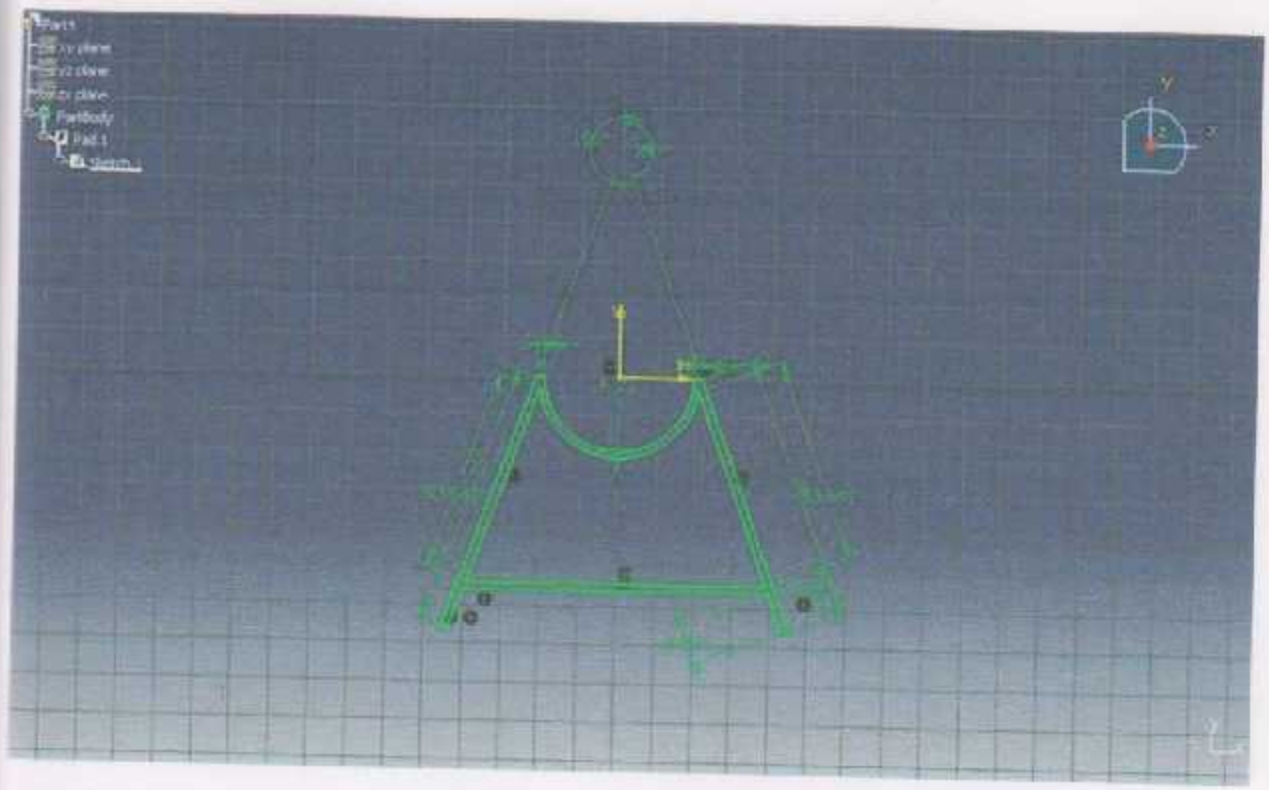

2cm
D2=2mm

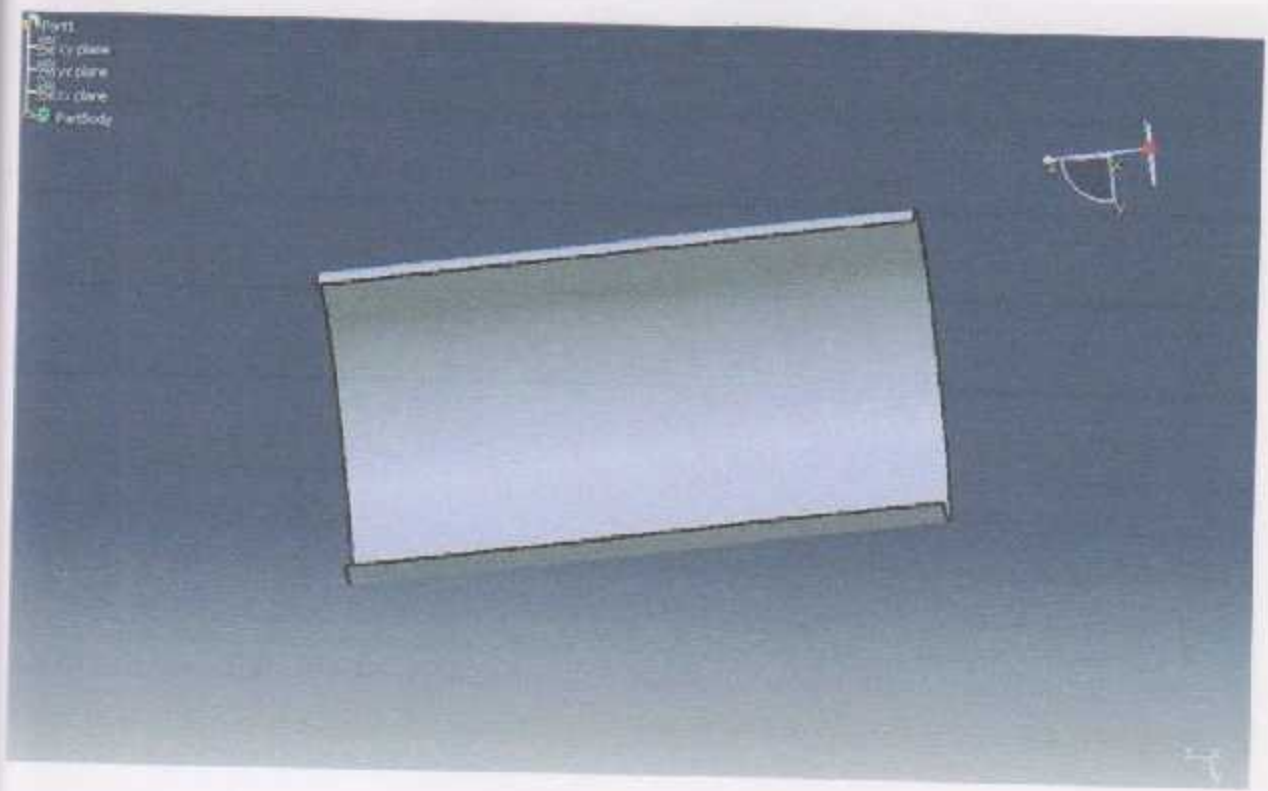

47cm
60 cm

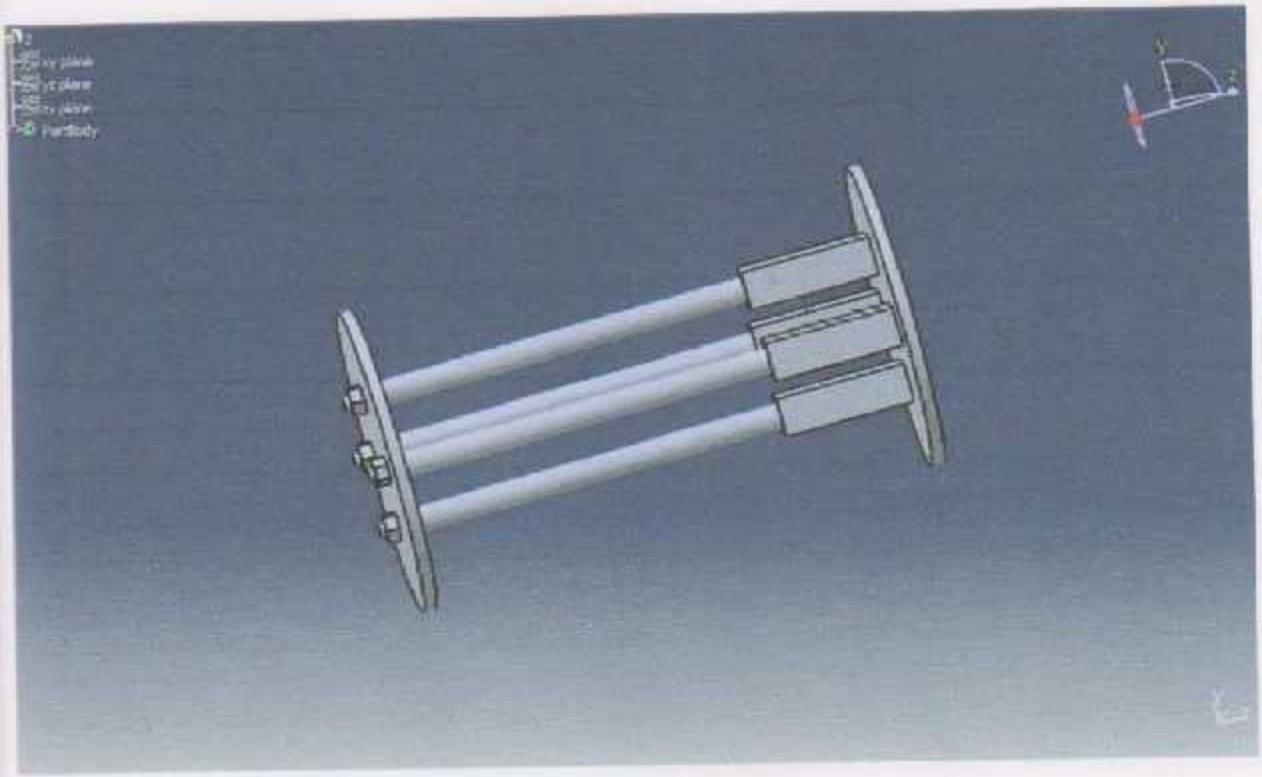


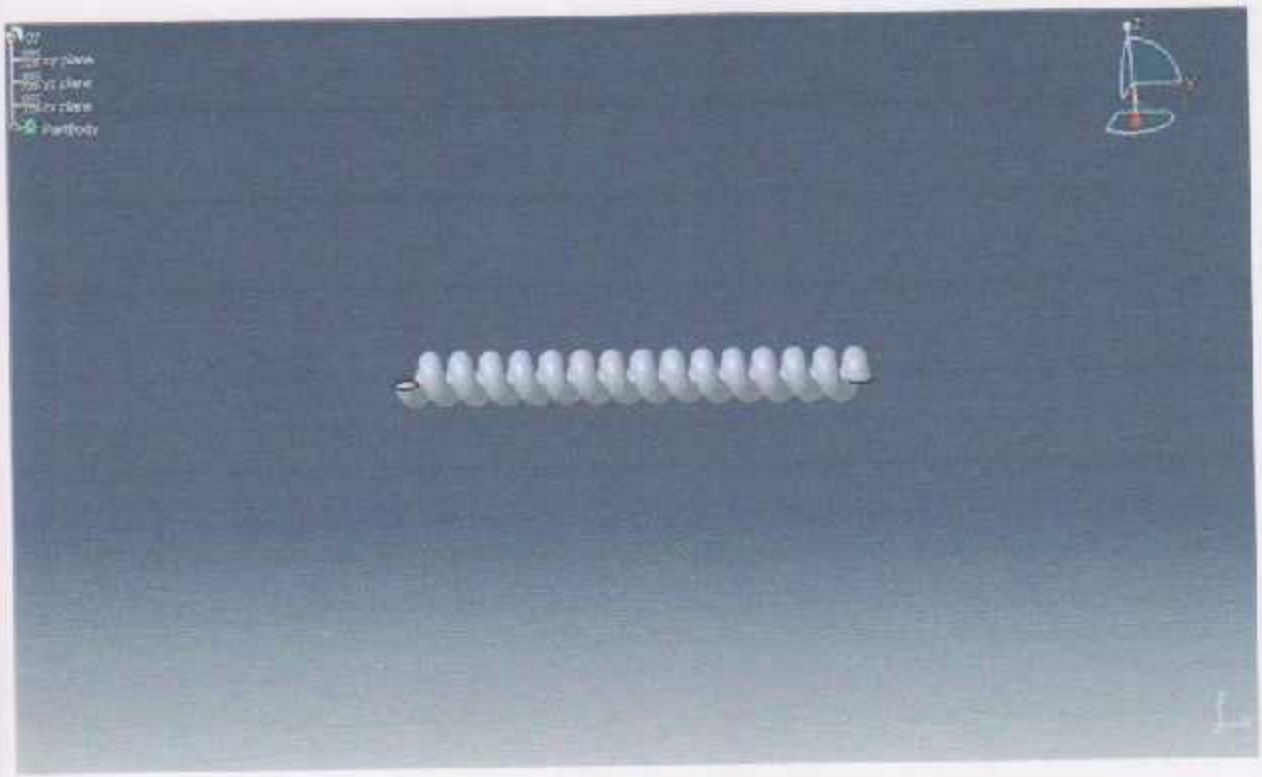












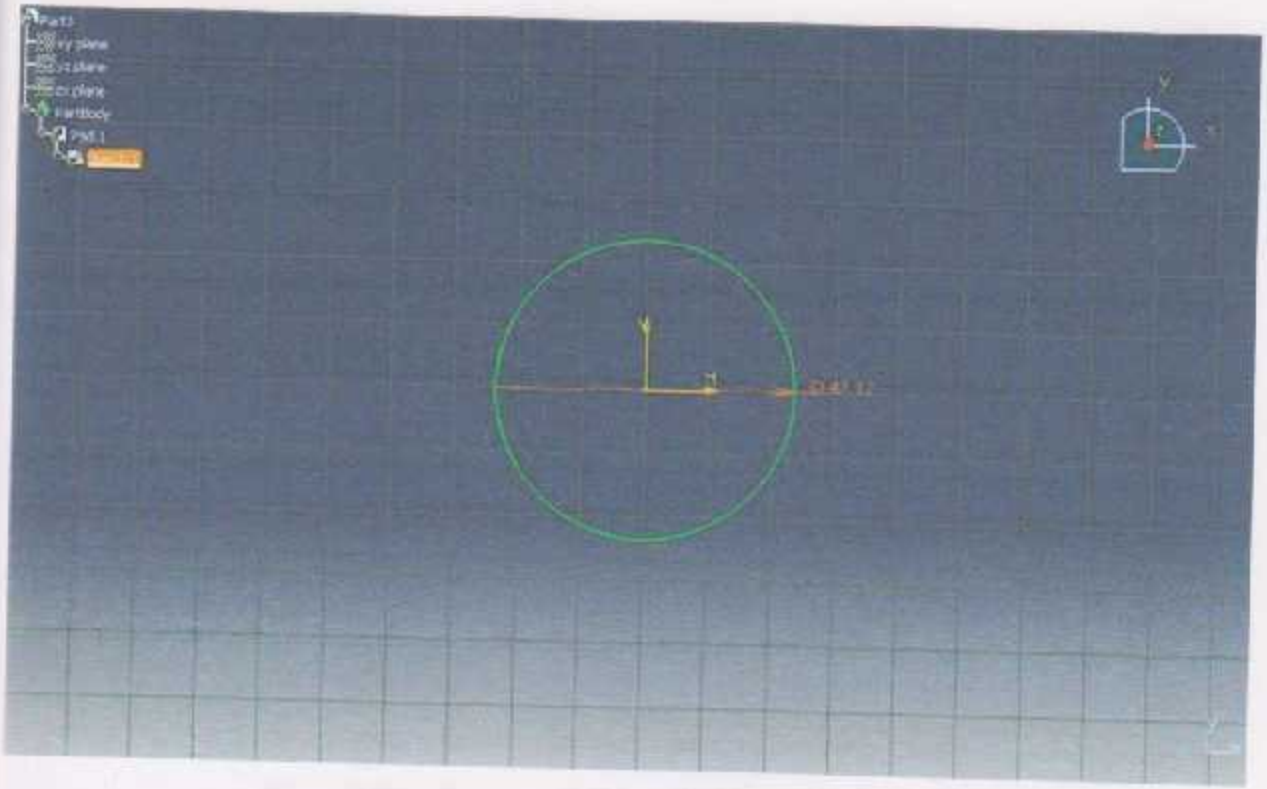

Part1
xy plane
yz plane
zx plane
PartBody
Pad.1

Table A–22

Results of Tensile Tests of Some Metals* Source: J. Orner, "Solid Materials," chap. 7 in Joseph E. Shigley and Charles R. Mischke (eds-in-chief), Standard Handbook of Machine Design, 2nd ed., McGraw-Hill, New York, 1996, pp. 7.67–7.70.

			Strength (Tensile)					
Number	Material	Condition	Yield S_y, MPa (kpsi)	Ultimate S_u, MPa (kpsi)	Fracture, S_f, MPa (kpsi)	Coefficient σ_0, MPa (kpsi)	Strain Strength, Exponent m	Fracture Strain ε_f
1018	Steel	Annealed	220 (32.0)	341 (49.5)	628 (91.1)†	620 (90.0)	0.25	1.05
1144	Steel	Annealed	358 (52.0)	646 (93.7)	898 (130)†	992 (144)	0.14	0.49
1212	Steel	HR	193 (28.0)	424 (61.5)	729 (106)†	758 (110)	0.24	0.85
1045	Steel	Q&T 600°F	1520 (220)	1580 (230)	2380 (345)	1680 (273)†	0.041	0.81
4142	Steel	Q&T 600°F	1720 (250)	1930 (210)	2340 (340)	1760 (255)†	0.048	0.43
303	Stainless steel	Annealed	241 (35.0)	601 (87.3)	1520 (221)†	1410 (205)	0.51	1.16
304	Stainless steel	Annealed	276 (40.0)	568 (82.4)	1600 (233)†	1270 (185)	0.45	1.67
2011	Aluminum alloy	T6	169 (24.5)	324 (47.0)	325 (47.2)†	629 (90)	0.28	0.10
2024	Aluminum alloy	T4	296 (43.0)	446 (64.8)	533 (77.3)†	689 (100)	0.15	0.18
7075	Aluminum alloy	T6	542 (78.6)	593 (86.0)	706 (102)†	882 (128)	0.13	0.18

*Values from one or two heats and believed to be obtainable using proper purchase specifications. Tensile properties may vary as much as 100 percent.
†Barrel value.

Table A–10

Cumulative Distribution Function of Normal (Gaussian) Distribution (Continued)

z_a	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
3	0.00135	0.0^3968	0.0^3687	0.0^3483	0.0^3337	0.0^3233	0.0^3159	0.0^3108	0.0^4723	0.0^4481
4	0.0^4317	0.0^4207	0.0^4133	0.0^5854	0.0^5541	0.0^5340	0.0^5211	0.0^5130	0.0^6793	0.0^6479
5	0.0^6287	0.0^6170	0.0^7996	0.0^7579	0.0^7333	0.0^7190	0.0^7107	0.0^8599	0.0^8332	0.0^8182
6	0.0^9987	0.0^9530	0.0^9282	0.0^9149	$0.0^{10}777$	$0.0^{10}402$	$0.0^{10}206$	$0.0^{10}104$	$0.0^{11}523$	$0.0^{11}260$
z_a	−1.282	−1.643	−1.960	−2.326	−2.576	−3.090	−3.291	−3.891	−4.417	
$F(z_a)$	0.10	0.05	0.025	0.010	0.005	0.001	0.0005	0.00005	0.000005	
$R(z_a)$	0.90	0.95	0.975	0.999	0.995	0.999	0.9995	0.9999	0.999995	

Table A–11

A Selection of International Tolerance Grades—Metric Series (Size Ranges Are for Over the lower limit and Including the Upper Limit. All Values Are in Millimeters)

Source: Preferred Metric Limits and Fits, ANSI B4.2-1978. See also BSI 4500.

Basic Sizes	Tolerance Grades					
	IT6	IT7	IT8	IT9	IT10	IT11
0–3	0.006	0.010	0.014	0.025	0.040	0.060
3–6	0.008	0.012	0.018	0.030	0.048	0.075
6–10	0.009	0.015	0.022	0.036	0.058	0.090
10–18	0.011	0.018	0.027	0.043	0.070	0.110
18–30	0.013	0.021	0.033	0.052	0.084	0.130
30–50	0.016	0.025	0.039	0.062	0.100	0.160
50–80	0.019	0.030	0.046	0.074	0.120	0.190
80–120	0.022	0.035	0.054	0.087	0.140	0.220
120–180	0.025	0.040	0.063	0.100	0.160	0.250
180–250	0.029	0.046	0.072	0.115	0.185	0.290
250–315	0.032	0.052	0.081	0.130	0.210	0.320
315–400	0.036	0.057	0.089	0.140	0.230	0.360

Table A–15

Charts of Theoretical Stress-Concentration Factors K_t

Figure A–15–1

Bar in tension or simple compression with a transverse hole. $\sigma_0 = F/A$, where $A = (w - d)t$ and t is the thickness.

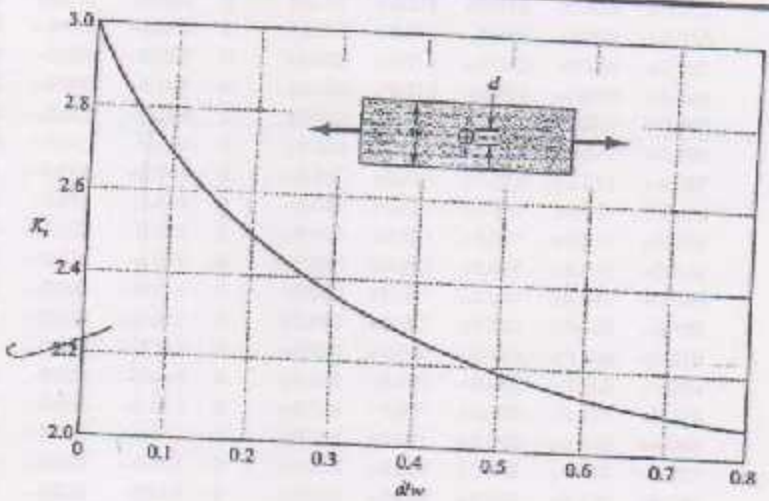


Figure A–15–2

Rectangular bar with a transverse hole in bending. $\sigma_0 = Mc/I$, where $I = (w - d)h^3/12$.

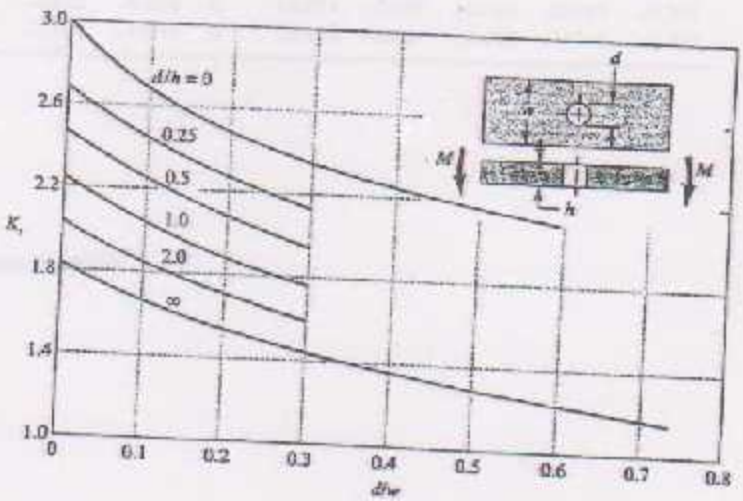


Figure A–15–3

Notched rectangular bar in tension or simple compression. $\sigma_0 = F/A$, where $A = dt$ and t is the thickness.

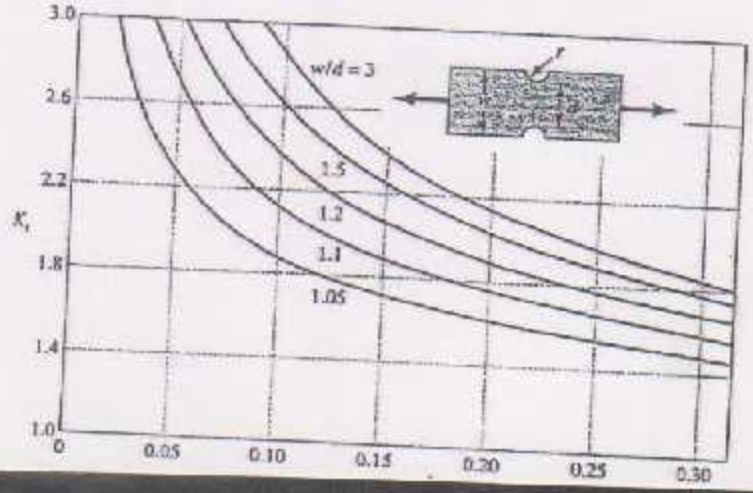


Table A–12

Fundamental Deviations for Shafts—Metric Series

(Size Ranges Are for Over the Lower Limit and Including the Upper Limit. All Values Are in Millimeters)

Source: Preferred Metric Limits and Fits, ANSI B4.2-1978. See also BSI 4500.

Basic Sizes	Upper-Deviation Letter					Lower-Deviation Letter				
	c	d	f	g	h	k	n	p	s	v
0–3	−0.060	−0.020	−0.006	−0.002	0	0	+0.004	+0.006	+0.014	+0.018
3–6	−0.070	−0.030	−0.010	−0.004	0	+0.001	+0.008	+0.012	+0.019	+0.023
6–10	−0.080	−0.040	−0.013	−0.005	0	+0.001	+0.010	+0.015	+0.023	+0.028
10–14	−0.095	−0.050	−0.016	−0.006	0	+0.001	+0.012	+0.018	+0.028	+0.033
14–18	−0.095	−0.050	−0.016	−0.006	0	+0.001	+0.012	+0.018	+0.028	+0.033
18–24	−0.110	−0.065	−0.020	−0.007	0	+0.002	+0.015	+0.022	+0.035	+0.041
24–30	−0.110	−0.065	−0.020	−0.007	0	+0.002	+0.015	+0.022	+0.035	+0.048
30–40	−0.120	−0.080	−0.025	−0.009	0	+0.002	+0.017	+0.026	+0.043	+0.060
40–50	−0.130	−0.080	−0.025	−0.009	0	+0.002	+0.017	+0.026	+0.043	+0.070
50–65	−0.140	−0.100	−0.030	−0.010	0	+0.002	+0.020	+0.032	+0.053	+0.087
65–80	−0.150	−0.100	−0.030	−0.010	0	+0.002	+0.020	+0.032	+0.059	+0.102
80–100	−0.170	−0.120	−0.036	−0.012	0	+0.003	+0.023	+0.037	+0.071	+0.124
100–120	−0.180	−0.120	−0.036	−0.012	0	+0.003	+0.023	+0.037	+0.079	+0.144
120–140	−0.200	−0.145	−0.043	−0.014	0	+0.003	+0.027	+0.043	+0.092	+0.170
140–160	−0.210	−0.145	−0.043	−0.014	0	+0.003	+0.027	+0.043	+0.100	+0.190
160–180	−0.230	−0.145	−0.043	−0.014	0	+0.003	+0.027	+0.043	+0.108	+0.210
180–200	−0.240	−0.170	−0.050	−0.015	0	+0.004	+0.031	+0.050	+0.122	+0.236
200–225	−0.260	−0.170	−0.050	−0.015	0	+0.004	+0.031	+0.050	+0.130	+0.258
225–250	−0.280	−0.170	−0.050	−0.015	0	+0.004	+0.031	+0.050	+0.140	+0.284
250–280	−0.300	−0.190	−0.056	−0.017	0	+0.004	+0.034	+0.056	+0.158	+0.315
280–315	−0.330	−0.190	−0.056	−0.017	0	+0.004	+0.034	+0.056	+0.170	+0.350
315–355	−0.360	−0.210	−0.062	−0.018	0	+0.004	+0.037	+0.062	+0.190	+0.390
355–400	−0.400	−0.210	−0.062	−0.018	0	+0.004	+0.037	+0.062	+0.208	+0.435

Appendix B

إلى من يهمه الأمر

جدول رقم (2):توزع ومساحة العنب على المحافظات والمناطق(المساحة: دونم ، الإنتاج: طن العنب لانتاج الدبس :طن العنب الطازج :طن العنب للعصير في المصانع الاسرائيلية :طن والفاقد :طن).

الطازج من 12/20-4/15 والعصير والدبس في الفترة من 11/20-9/20

المحافظة / المنطقة	المساحه المجموع الكلي	الإنتاج الكلي	النسبة المئوية من المساحة الكلية	عنب طازج/طن	دبس/طن	للمصانع الاسرائيلة/طن	الفاقد/طن
المساحة الكلية	78904	78217	100	52640.04	5971.792	10379.8	9225.368
الضفة الغربية	74795	74831	94.8	50361.27	5971.792	10379.8	8118.142
جنين	4257	15496	5.4	10428.81	0	0	5067.19
طوباس	14	11	-	7.403	0	0	3.597
طولكرم	66	67	-	45.091	0	0	20.909
نابلس	1221	878	1.5	590.894	0	0	287.106
قلقيلية	50	48	-	32.304	0	0	15.696
سلفيت	1080	894	1.3	601.662	0	0	292.338
رام الله والبيرة	2534	1356	3.2	912.588	0	0	443.412
أريحا	748	1185	1	797.505	0	0	387.495
القدس	2812	1994	3.5	1341.962	253.238	199.4	199.4
بيت لحم	19239	17210	24	11582.33	2185.67	3042	400
الخليل	43774	35692	55.4	24020.72	3532.884	7138.4	1000
قطاع غزه	4109	3386	5.2	2278.778	0	0	1107.222
شمال غزه	500	392		263.816	0	0	128.184
غزه	2863	2274		1530.402	0	0	743.598
دير البلح	650	650		437.45	0	0	212.55
خان يونس	56	52		34.996	0	0	17.004
رفح	40	18		12.114	0	0	5.886

م.يوسف صلاح

رئيس مجلس العنب الفلسطيني

إلى من يهمه الأمر

جدول رقم (1):توزع ومساحة العنب على المحافظات والمناطق(المساحة: دونم، الإنتاجية: كغم/دونم، الإنتاج: طن عام 2005 (وزارة الزراعة، 2005).

المحافظة / المنطقة	مثمر				غير مثمر		المجموع الكلي	الإنتاج الكلي	النسبة المئوية من المساحة الكلية
	بعلي	الإنتاجية	مروي	الإنتاجية	بعلي	مروي			
المساحة الكلية	73296	1038	973	2215	4443	192	78904	78217	100
الضفة الغربية							74795		94.8
جنين	3874	4000	-	-	383	-	4257	15496	5.4
طوباس	-	-	7	1500	5	2	14	11	-
طولكرم	40	700	26	1500	-	-	66	67	-
نابلس	1116	735	23	2500	80	2	1221	878	1.5
قلقيلية	48	1000	-	-	2	-	50	48	-
سلفيت	1080	828	-	-	-	-	1080	894	1.3
رام الله والبيرة	2534	535	-	-	-	-	2534	1356	3.2
أريحا	-	-	596	1988	-	152	748	1185	1
القدس	2812	709	-	-	-	-	2812	1994	3.5
بيت لحم	16839	976	250	3100	1150	-	19239	17210	24
الخليل	40978	871	-	-	2796	-	43774	35692	55.4
قطاع غزه							4109	3386	5.2
شمال غزه	482	800	7	943	7	4	500	392	
غزه	2843	800	-	-	20	-	2863	2274	
دير البلح	650	1000	-	-	-	-	650	650	
خان يونس	-	-	52	1000	-	4	56	52	
رفح	-	-	12	1500	-	28	40	18	

م.يوسف صلاح

رئيس مجلس العنب الفلسطيني

إلى من يهمه الأمر

نتيجة نسبة العصير في معصرة جمعية إنتاج وتسويق العنب في الخضر في شهري تشرين الأول وتشرين الثاني لعام 2008م فقد كانت نتائج عصر أصناف العنب المختلفة حسب الجدول التالي:

#	الصنف	اللون	نسبة العصير
1	دابوقي	ابيض	%87
2	جندلي	ابيض	%83
3	مراوي	ابيض	%72
4	حلواني	احمر	%71
5	بيتوني (بلوطي)	اسود	%80
6	بيروتي	ابيض	%74
7	زيني بلدي	ابيض	%88
8	شامي	اسود	%63
9	شيوخي (دراويشي)	اسود	%66
10	بدون بذور	ابيض	%83

م.يوسف صلاح

رئيس مجلس العنب الفلسطيني