

MODEL DETAILED PROJECT REPORT

ON

PRIMARY PROCESSING PROJECT FOR ORANGES

**[PACKHOUSE-SORTING, GRADING & WAXING LINE(8TPH), PRECOOLING
(6MT Batch) & COLD STORAGE (25MTX2 NO.)]**



PREPARED BY

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HIGHLIGHTS OF THE PROJECT

1. GENERAL

Name and address	
Project Site	
Name and designation of authorized signatory	
Constitution	
Nature of Industry	Primary Processing Project for Oranges- Packhouse-Sorting, grading & waxing line(8TPH), Precooling(6MT Batch) & cold storage(25MTx 2Nos.)
Capacity Utilization	100 Percent from 4th year onward
Raw material	Oranges & other citrus fruits etc.

2. PROJECT COST & MEANS OF FINANCE

Sr.No.	Particulars	Amount (Rs. In Lakh)
1	Land	Available
2	Buildings	199.21
3	Plant and Machinery	199.14
4	Miscellaneous fixed asset	4.64
5	Preli. And Preoperative Expenses	13.10
6	Contingencies	6.11
7	Working capital Margin	21.14
	TOTAL	443.33

Means of Finance

Sr.No.	Source	Amount (Rs. In Lakh)
1	Member contribution (15%)	66.50
2	Term Loan(39.89%)	176.83
3	State Government grant/subsidy(45.11%)	200.00
	TOTAL	443.33

C. PROJECT PROFILE (FINANCE)

Particulars	Unit	First Year	Fourth Year
Estimated net WC requirement	Rs	84.56	84.13
Estimated annual sales realization	Lakh	2025.24	2893.24
Profit After Tax (PAT)		64.77	117.96
Employment potential (Factory + Admin.Staff)		5 No.	
Debt service coverage ratio (DSCR)	Average DSCR	2.57	
	Maximum DSCR	4.33	
	Minimum DSCR	1.74	
Payback period	2 years 5 months		
Internal rate of return (IRR)	37.28 %		
Expected period of implementation from the date of sanction of loan	10 Months		

CHAPTER 1

INTRODUCTION

Mandarin is a group name for a class of oranges with thin, loose peel. These are treated as members of a distinct species, *Citrus reticulata* Blanco. The name "tangerine" could be applied as an alternate name to the whole group, but in the trade, it is usually confined to the types with red-orange skin. Mandarins include a diverse group of citrus fruits that are characterized by bright coloured peel and pulp, excellent flavor, easy-to-peel rind and segments that separate easily



The exact location of origin of Mandarin fruits is not clearly identified. It is believed that Mandarins is a native of southeastern Asia and the Philippines. The spread of Mandarins from Asia to Europe was slow. First, it was taken to North Africa and then probably by the fall of the Roman Empire, it entered the South of Europe, where it flourished in the Middle Ages. It is also believed that Mandarins were brought to America by the Spaniards (Columbus took seeds of citrus fruits with him in his second trip) and then by the Portuguese in their exploration trips of the New World, around year 1500. In Asia, it is most abundantly grown in Japan, southern China, and India.

Mandarin is very important fruit crop, second only to banana. It is usually consumed in raw form or in fruit salads as well as juice. The fruit consists of three layers.

1. The outer yellow/orange peel is with oil glands which exude the essential oils, producing the typical orange odor.
2. The whitish thread like mesocarp.
3. The endocarp consisting of 8 - 10 segments filled with juice sacs (vesicles).

Mandarins are rich in Ascorbic acid (13 – 54 mg per 100 g of edible portion) and Calcium (25 – 46 mg per 100 g of edible portion). They are a great source of Vitamin C. One orange actually has all the Vitamin C that one needs for the day. The water content in the fruit is nearly 80 per cent to 90 per cent of edible portion. The chemical composition of the Mandarin is as under.

Table No. 1 -Chemical Composition of Mandarin

(Per 100 g of edible portion)

Moisture	82.6-90.2 g
Protein	0.61-0.215 g
Fat	0.05-0.32 g
Fiber	0.3-0.7 g
Ash	0.29-0.54 g
Calcium	25.0-46.8 mg
Phosphorus	11.7-23.4 mg
Iron	0.17-0.62 mg
Carotene	0.013-0.175 mg
Thiamine	0.048-0.128 mg
Riboflavin	0.014-0.041 mg
Niacin	0.199-0.38 mg
Ascorbic Acid	13.3-54.4 mg

Source: Morton, J. 1987. Mandarin, Fruits of warm climates. Julia F. Morton, Miami, FL.

1.0 Comparative composition of Mandarins of different places:

The composition of Mandarins may differ, depending upon the place of growing, A comparative statement of composition of mature Mandarins, grown at different places, is given in table No. 2

Table No. 2 - Composition of mature Mandarin

Composition	Nagpur Mandarins		Coorg Mandarins		Kinnow	
	Mrig bahar	Ambia bahar	Main crop	Monsoon crop	Outer fruit	Inner fruit
Average weight of fruit (g.)	100	125	101	97	145	189
Peel (g.)	27	20	2.62	2.67	0.46	0.45
Juice(g)	45	55	49.5	54.0	38.6	40.2
Pomace (g.)	28	25	-	-	42.0	39.3
TSS (^o Brix)	11-14	8-10	11.5	10.0	9.5	9.0
Acidity (as anhydrous citric acid) (%)	0.3	0.5	0.87	1.1	0.77	0.64
Essential oil (%) (v/w)	2.2	3.1	-	-	-	-
Pectin (%) (fresh wt. basis)	4.5	3.5	-	-	-	-
Ascorbic acid (mg/100 ml juice)	35.0	33.6	40.2	41.6	18.8	18.7

Source: Mandarin in India- CFTRI, Mysore

1.1 MORE THAN VITAMIN C:

Citrus is most commonly thought of as a good source of vitamin C. However, fruits also contain an impressive list of other essential nutrients, including both glycaemic and non-glycaemic carbohydrate (sugars and fibre), potassium, folate, calcium, thiamin, niacin, vitamin B₆, phosphorus, magnesium, copper, riboflavin, pantothenic acid and a variety of phytochemicals. Citrus contains no fat or sodium. The average energy value of fresh citrus is also low, which can be very important for consumers concerned about putting on excess body weight. A medium orange contains 60 to 80 kcal, a grapefruit 90 kcal and a tablespoon (15 ml) of lemon juice only 4 kcal (Whitney and Rolfes, 1999).

Table no 3. - Nutritional facts about citrus fruit

	Orange	Grapefruit	Tangerine
Weight (g)	131	236	84
Energy (kcal)	62	78	37
Fibre content (g)	3.1	2.5	1.7
Ascorbic acid (mg)	70	79	26
Folate (mcg)	40	24	17
Potassium (mg)	237	350	132

Source: Guthrie and Picciano, 1995.

1.2 Economic Importance:

Mandarins are rich in vitamin A, B, C and phosphorus, which are consumed fresh or in the form of juice, jam, squash and syrup. It is one of the main source of peel oil and citric acid.

CHAPTER 2

PRODUCTION OF ORANGES

Table 1 - Indian Production of MANDARIN(M.ORANG,KINNOW,ORANGE) (000 Tonnes)

S. No.	State	2021-22		2020-21		2019-20	
		Production	% share	Production	% share	Production	% share
1	M.P.	2060.55	32.89	2208.18	35.50	2169.76	35.36
2	Punjab	1177.54	18.80	1177.54	18.93	1329.00	21.66
3	M.S.	987.47	15.76	940.65	15.12	899.60	14.66
4	Rajasthan	653.90	10.44	618.95	9.95	562.47	9.17
5	Haryana	602.37	9.62	517.83	8.33	484.40	7.89
6	Assam	209.34	3.34	185.02	2.97	203.80	3.32
7	Karnataka	185.55	2.96	180.15	2.90	107.54	1.75
8	Arunachal Pradesh	67.74	1.08	67.74	1.09	67.74	1.10
9	Mizoram	54.17	0.86	54.17	0.87	54.17	0.88
10	Manipur	47.53	0.76	47.53	0.76	44.28	0.72
	Total	6046.16		5997.77		5922.76	

Source- National Horticulture Board(NHB)

Table 2- Indian Production of SWEET ORANGE (MALTA , MOSAMBI)

(000 Tonnes)

S.No	State	2021-22		2020-21		2019-20	
		Production	% share	Production	% share	Production	% share
1	A.P	2700.57	69.35	2663.28	66.78	2663.28	65.92
2	Maharashtra	515.19	13.23	611.54	15.33	659.65	16.33
3	Telangana	511.65	13.14	517.03	12.96	510.04	12.62
4	M.P.	91.35	2.35	120.74	3.03	113.80	2.82
5	Punjab	24.18	0.62	24.18	0.61	26.92	0.67
6	Karnataka	14.89	0.38	14.45	0.36	14.94	0.37
7	Jammu & Kashmir	6.15	0.16	6.15	0.15	11.66	0.29
8	Mizoram	4.94	0.13	4.94	0.12	10.87	0.27
9	Bihar	4.68	0.12	4.68	0.12	6.18	0.15
10	Rajasthan	4.50	0.12	4.12	0.10	4.94	0.12
	Total	3878.10		3971.11		4022.28	

Source- National Horticulture Board(NHB)

Table 3. Indian Production of Lime/ Lemon

(000 Tonnes)

S.No.	State	2021-22		2020-21		2019-20	
		Production	% share	Production	% share	Production	% share
1	A.P.	693.87	19.73	688.70	19.41	688.70	18.68
2	Gujarat	625.83	17.80	625.83	17.64	636.02	17.25
3	Maharashtra	346.32	9.85	358.70	10.11	415.02	11.26
4	Karnataka	340.39	9.68	330.47	9.31	360.19	9.77
5	M.P.	302.77	8.61	324.70	9.15	340.35	9.23
6	Orissa	288.03	8.19	288.03	8.12	267.83	7.26
7	Assam	157.32	4.47	156.87	4.42	243.48	6.60
8	Telangana	150.55	4.28	150.72	4.25	155.08	4.21
9	Bihar	114.96	3.27	114.96	3.24	115.31	3.13
10	West Bengal	94.92	2.70	102.22	2.88	94.78	2.57
	Total	3114.96		3141.20		3316.76	

Source- National Horticulture Board(NHB)

Table 4. Orange Cultivation in Vidarbha in year 2021

S.No.	District	Total land under Cultivation(Ha)	Land under Orange (Ha)	% land under Oranges	Irrigated land under Oranges, Ha
1	Amravati	761513	74,575	69.75	74,575
2	Nagpur	540107	20,442	19.12	20,316
3	Wardha	389772.4	3677.37	3.42	3338.39
4	Buldhana	750457	4011	3.75	4011
5	Yavatmal	863707	1725	1.61	1725
6	Akola	420037	1686	1.57	1535
7	Washim	407056	659	0.61	659
8	Chandrapur	470834.21	73.84	0.06	58.63
9	Bhandara	182249.17	36.42	0.03	31.90
10	Gondia	167267	12	0.01	01
11	Gadchiroli	205892.30	4.63	0.004	0.00
	Total	5158892.08	106906.26	100%	106250.92

(District Socio-Economic Survey –All Vidarbha District -2021)

From Table 4, it may be seen that Amravati and Nagpur districts are the main belt for growing oranges. There is ample scope for improving productivity, Post-Harvest Management and processing of In particular and citrus fruits in general. Keeping this view in mind, Maharashtra Govt. wants that the private Entrepreneurs, Farmer Producer Companies, APMC should come forward for putting the Pack house projects with sorting, grading and waxing line and precooling and cold storage project and also processing of oranges in to value added products like RTS, Squash, Nectar, Jam/jellies and marmalade etc.

CHAPTER 3

POSTHARVEST MANAGEMENT

Post-harvest management is the technology of handling of an agricultural produce after harvest to prolong the shelf life, freshness and an attractive appearance. Nearly, 20-25 per cent of fruits are wasted due to faulty Post-harvest management during harvesting, packaging, storage, grading and transportation etc. Proper scientific post-harvest management can minimize these losses. Like post-harvest management, the proper pre-harvest steps such as use of proper harvesting tools and assessment of maturity also improve the shelf life of the fruits and reduce the post-harvest losses to a great extent.

3.1 Pre-harvest factors influencing the post-harvest management:

Once the fruits are harvested, then the overall quality of fresh fruits can hardly be improved. The final market value of the produce depends upon the grower's ability to apply best available pre-harvest technology and subsequent harvesting and then post-harvest technology.

The pre-harvest technology, like use of fertilizers, pest control, growth regulators, climatic conditions like wet and windy weather and tree conditions, influences the fruit potentiality for storage by modifying physiology, chemical composition and morphology of fruits. In pre-harvest treatment, if the spray (10 ppm) of Gibberellic acid is done at colour break stage, it delays colour development, maintain firmness, thereby allows to extend harvesting period. Similarly, the use of potassium fertilizers extends the shelf life of the fruits.

3.2 Maturity – (Harvest maturity and Physiological maturity):

3.2.1 Harvest maturity:

A critical time for producers is the assessment of right maturity, as to when to harvest a crop. Normally, any type of fresh produce is ready for harvest when it has developed all ideal conditions for consumption. This condition is usually referred to a harvest maturity. Harvest maturity of horticultural produce depends mostly on the purpose and distance of market for which they are harvested. The deciding factors of harvest maturity are appearance (colour, size, and shape), texture, glossiness, hardness, pulpiness, smell (aroma or odour), and tastes (sweetness, sourness, bitterness).

3.2.2 Physiological maturity:

In physiological sense, however, maturity refers to attainment of final stage of biological function by a plant part or plant as a whole. Thus the physiological maturity differs from harvest maturity

The maturity of harvested fruits has an important role on shelf life, quality and market price. Hence, certain standards of maturity must be kept in mind while harvesting the fruits. However, the most commonly used measures to access maturity for harvesting the Mandarin is peel colour.

Fruits are considered mature, if they have a yellow orange colour on 25% or more of the fruit surface. Fruit quality for harvesting depends upon SS (soluble solids contents, sugar) and acidity of the juice. The juice should have a SS of 8.5% or higher. SS content is determined by squeezing a few drops of juice on a hand-held refractometer.

3.3 Harvesting:

Mandarins are mostly hand plucked, using ladders rested on bamboo support, to prevent the tearing of branches bearing fruits. The quality of the produce is greatly affected by the damages/injuries during the harvesting. Therefore, great care should be taken during harvesting/plucking the fruits.

The plucking of fruits should not be carried out during wet weather or early morning when fruits are turgid and can easily be bruised, leading to decay during subsequent handling. Mandarin fruit tend to "plug" when snapped from the tree, i.e., a piece of the peel from the fruit remains attached to the stalk. It is preferable to use clippers to clip the fruit from the tree to avoid damage. The other cause of deterioration in the fruit quality is harvesting of immature or over mature fruits. Similarly, fruits are spoiled when they are harvested by pulling the fruit, causing rupturing of the peel of loose skin of the fruits. Harvested fruits need careful handling, till they reach the consumers.

3.3.1 Harvesting stage:

Generally, the Mandarins are harvested in 32-36 weeks after the fruit is set. In Coorg district, the fruits are harvested in 36-38 weeks; otherwise there is every possibility of shriveling of fruits and heavy drops. The colour of the rind also indicates the time of harvesting of the fruits. The criteria, depending on colour of rind for assessing the fruit maturity in some of the states are as under.

Sr.No.	Place	Colour of rind
i)	West Bengal	Greenish tinge
	High altitude	Orange yellow
	Low altitude	
ii)	Arunachal Pradesh	Colour changes from green to orange
iii)	Haryana	Colour changes from green to dark yellow
iv)	Meghalaya	Colour changes from green to deep orange
v)	Punjab	Yellow
vi)	Madhya Pradesh	Colour changes from green to orange
vii)	Maharashtra	Colour changes from green to orange

3.3.2 Harvesting technique:

Suitable application of harvesting technique is very important to prevent the losses during post-harvest handling. Fruits should be clipped in such a way that the button remains intact with the fruits. Sometimes, longer stalk portion of the clipped fruits left during harvesting, pierces into other fruits and causes injuries in them that paves the way for attack of wound pathogen. Therefore, while clipping the stalk should be cut close to the fruit, so as to preclude it from puncturing the rind of other fruit during harvest and handling.

3.3.3 Precautions during harvesting:

Harvesting is considered to be the most important factor, governing the post- harvest management. Therefore, following precaution should be taken during harvesting.

- i) Harvesting should be done by using appropriate instruments like clippers or by carefully twisting and pulling the fruit from the tree.
- ii) The harvesting under wet conditions should be avoided, since wet fruits are more susceptible to microbial growth and soil particles may cling to wet crops, exposing them to soil-borne rot organisms.
- iii) Harvesting of fruits is best done in the late morning, because in the early morning the oil glands of the fruits are full and cause immediate discolouration.
- iv) Care should be taken at the time of plucking the fruit that the button remains attached to the fruit.
- v) Stalk left on the fruit should be cut off close to fruit because they can puncture other fruit, causing injury and fruit spoilage.
- vi) The tree should never be shaken to harvest the fruits. Do not allow the fruit to fall on the soil, as the impact leads to mechanical injury, that makes fruit more prone to decay.
- vii) After harvesting, fruits should never be left in direct sunlight and must be kept in the shade
- viii) To avoid contact with the soil, the harvested fruits should be carefully put into padded field crates, well-ventilated plastic containers, or picking bags.
- ix) Picking bags made with a quick-opening bottom, should be either strapped around the waist or put over the shoulder of the picker.
- x) Picking bags should be so designed to empty from the bottom so that fruits can roll out of the sack onto the bottom of a larger field container or atop fruits already present.

The state-wise season of harvesting and method of harvesting of Mandarin is given in Table No. 1

Table No. 1 - Season and method of harvesting

Sr.No.	State	Start of season	End of season	Method of harvesting
1	2	3	4	5
1.	Assam	October	February	Use of clippers and twisting
2.	Haryana	November	March	Hand plucking
3.	Karnataka Summer Monsoon	December June	February August	Twisting angularly or using a pair of clippers
4.	Madhya Pradesh I II	January November	February December	Hand plucking
5.	Maharashtra III	October February	January end Mid May	Hand plucking
6.	Meghalaya	November	February	Hand plucking
7.	Mizoram	November	January	Hand plucking
8.	Nagaland	November	January	Traditional hand plucking
9.	Punjab	November	March	Hand plucking, cutting with scissors
10.	Rajasthan	January	April	Hand plucking
11.	Tamil Nadu Kodai Hills Main season Off season Shevray Hills Main season Off season Nilgiris Main season Off season	November 15 July November 15 July November July	January 15 September January 15 September February September	Hand plucking
12.	Tripura I II	November December	January February	Hand plucking
13.	West Bengal	November	January	Hand plucking

Source: DMI survey

It is evident from the table No 1, that in the states like Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu and Tripura, the harvesting of Mandarin is undertaken twice a year. In Karnataka, the season of harvesting is December to February (summer crop), and June to August (Monsoon) crop. While in Madhya Pradesh, both the harvesting seasons are of very short duration i.e., November to December (I season) and January to February (II season). In Maharashtra, the first harvesting commences in October and lasts till the

end of January/February (Ambia season), the period of second harvesting is from February to mid-May (Mrug Bahar). Similarly, in Tamil Nadu, the main season commences in November and lasts up to January / February, the period of second season namely 'off season' is from July to September. In Tripura the duration of first season is from November to January and second season is from December to February.

In rest of the Mandarin producing states, the harvesting of fruits is done only once in a year, as in Assam (October to February), Haryana and Punjab (November to march), Meghalaya (November to February), Mizoram (November to January), Nagaland and West Bengal (November to January) and Rajasthan (January to April).

Regarding method of harvesting, the traditional method i.e., hand plucking method is generally used in all the Mandarin growing states. In this traditional method, the fruits are twisted angularly and plucked. In the states like Assam and Karnataka, the clippers are also used for plucking of the fruits.

3.4 Post Harvest operations:

The adoption of best post-harvest management technique can extend shelf-life and quality of the fruits. Curing and washing, degreening, grading, packaging, storage, transportation and marketing etc., are the main post harvest operations.

3.4.1 Curing and washing:

During the curing, field heat of the fruit is brought down, this helps in stabilizing the metabolic process. The fruits are spread on the floor in orchard's yard, having the cushion of paddy straw for nearly 24 hrs and then washed to remove the dirt. By washing the original colour and luster of the fruits is also recovered.

The application of food grade wax, kaolin or similar coating, can also be used to enhance the appearance and minimize water loss. To prevent the fungal growth, proper fungicide in prescribed quantity is used while giving wax treatment.

The post packing treatment like fumigation and gamma-ray irradiation are generally practiced for high priced fruits.

3.4.2 Degreening:

Degreening constitutes conversion of chlorophyll of the peel without influencing the internal quality of the fruit.

In de-greening, the yellow-orange fruits with green spots could be de-greened in 48 hours at 26-28⁰ C and 90-95 RH at nearly 5 ppm ethylene concentration.

3.4.3 Grading:

Grading is one of the most important procedures to be followed in post harvest handling, as it determines the quality, shelf life and price of the fruit. During grading, the produce is sorted according to the fixed grade standard, taking into consideration various quality factors to make a homogenous lot.

Post-harvest grading of Mandarin is rarely practiced at the producer's level. At the most, the fruits are sorted out, based on physical characteristics like weight, size, colour, shape and degree of damage on fruits. This type of grading is done by hand in small

operations.

In pack houses handling large volume of the produce, semi- automatic grading machines are also used, wherein the fruits are passed down on a slow moving conveyor. This semi automatically grading is very efficient with respect to time, space and quantity. The N.R.C.C., Nagpur has developed a machine for mechanical sorting, washing, waxing and sizing operations.

Sometimes, hand-held rings called “Fruit Sizer” of different diameters are used to check the different size categories and help in packing of same size fruits in the one container.

It is a common experience, the traders generally place best quality fruits at the top of containers, but this practice neither helps the growers nor traders. Therefore, the grading of fruits as per accepted quality standards helps farmers, marketing functionaries, processors, traders and consumers in efficient marketing.

Table- Grading Parameters used for grading of Mandarins in Maharashtra State

Sr.No.	State	Agency	Parameters used for grading	Quantity graded (%)
1	Maharashtra	Producers	Size and colour	-
		Wholesalers	Size and colour	80-85
		Commission agents	Size and colour	80
		Exporters	Size and colour	100

It is common practice in almost all the Mandarin producing states that the producers sell the orchards to the pre harvest contractors before commencement of the harvesting season. These merchants harvest the fruits and carry them to different markets without undertaking any grading, for sale. In the markets, the grading is generally done on the basis of colour, shape and size.

3.5 Advantages of Grading and standardization:

1. Grading is beneficial to the farmers, traders as well as to the consumers, as it provides common standard to all.
2. Grading of the produce before sale enables farmers to get better price for their produce.
3. Grading assists the producers and other intermediaries in preparing fresh produce for market with appropriate labeling.
4. Grading helps the consumers to get standard quality produce at fair price.
5. It facilitates the consumer to compare the prices of different qualities of a produce in the market.
6. It assures the quality of the produce and also reduces the cost of the marketing and transportation.
7. Produce of similar grade can be stored in bulk.
8. Market values are better understood.
9. Commodities can be bought and sold without inspection, through e-trading.
10. Grading provides an authentic and scientific basis in promoting and managing the marketing system.

11. It serves as a realistic and common basis for market intelligence and reporting.
12. It facilitates the settlement of quality disputes between buyers and sellers.

3.5.1 Grading at producers' level:

Though there is no grading of Mandarin at producers level, but there is an increasing recognition to the fact that producers need to be assisted in grading their produce before sale so that they may get better price. For securing adequate returns to the producer/seller, the scheme of "Grading at Producers' Level" was introduced in 1962-63 by Directorate of Marketing and Inspection. The main objective of this scheme is to subject the produce to simple test and assign a grade before it is offered for sale. After grading, the producers get prices commensurate with the quality of the produce.

3.6 Packaging:

The packaging of fruits is required for efficient handling and marketing, better eye appeal and better shelf life by reducing mechanical damage and water loss. The proper packaging protects the fruits from pilferage, dirt, physiological and pathological deterioration during further handling. Efficient packaging of horticultural produce in uniform size reduces the need for repeated weighing and can facilitate handling, stacking, loading, unloading, better storage, long transportation, transshipment and marketing.

The use of traditional baskets, sacks, boxes and trays to carry the produce to the market is very much common, as a packaging material. These are locally fabricated, low cost and made out of cane and bamboo, dried grass, palm leaves and teak leaves. Though, they serve the purpose of carrying fresh produce to short distances, they cannot be used for long distance transportation. Large quantities of produce need better packaging to minimize the losses and achieve the most economical use of conveyance. During the packing, the immature, overripe, damaged and diseased fruits should be sorted out, only sound fruits should be packed.

While selecting and opting out for specific packaging material for a particular produce, precaution should be taken to prevent transit hazards caused by the packaging material. Nature of such damages is cut or punctures, shock/impact, compression, vibration, heat damage, chilling or freezing damage and chemical contamination.

The different types of packaging material that can be used for packing fresh horticultural produce comprises of

1. Natural materials (traditional containers made of cane and bamboo, straw, and palm leaves etc.
2. Wooden boxes,
3. Corrugated fiber board boxes,
4. Molded plastics sacks or bags made out of natural or synthetic fibers (e.g. jute, sisal, polypropylene polyethylene) and
5. Paper or plastic films.

Recyclable boxes molded from Higher Density Polythene (HDP) are widely used for transporting of produce. These can be specially designed and fabricated to meet the specific requirements of transport. They are strong, rigid, smooth, easily cleaned and stacked to conserve space. Paper or plastic films is often used for lining of packing boxes in order to reduce transportation loss and prevent friction damage. Plastic-film bags or wraps are widely used in marketing of fruit, especially in consumer size packs. Packaging operations may be done manually or mechanically using various methods viz; loose-fill jumble packing, multilayer pattern pack with size grading, multilayer size graded pack using separator trays and single layer pack for high value produce.

3.6.1 Type of packaging:

There are two types of packaging i.e. i) Conventional packages and ii) Modern packages. In conventional packages, wooden boxes, bamboo boxes and jute gunny bags are used.

In modern packaging card board boxes, plastic crates, poly bags, wire bags.

C.A.P. (Controlled Atmospheric Packaging) is generally used. C.A.P. allows certain gaseous components from atmosphere to replace the ones released by the produce or checks the gaseous exchange around fruit pack and thus enhances the shelf life.

It is seen that for the local markets, the Mandarins are packed in sacks, bags, bamboo baskets and wooden boxes. Sometimes, the Mandarins are also packed in telescopic cardboard boxes. The corrugated boxes, which are cost effective due to its reusability, are also being used as packaging material while transporting the fruits.

For export of Nagpur Mandarins usually 2 pieces, telescopic, corrugated fiberboard boxes of three ply or five ply are used. The size of the box may vary according to the requirement of the importing country. Normally a box size of 49.5 x29.5 x 17.5 cm having 10 kg capacity is recommended. The boxes must have 5% area punched as holes for ventilation. To immobilize the movement of fruits inside the box, three ply wax treated dividers having ventilation holes are used.

During the survey it is found that there are no standard parameters of any pack and may differ from place to place. Usually, the fruits are placed in layers one above the other, with a straw padding in-between.

The state-wise packaging material used, mode of packaging and their capacity, are furnished in table No 3.

Table No. 3. Mode of packaging for mandarins

S. No.	State	Agency	Mode of packaging	
			Type	Capacity (kg)
1	2	3	4	5
1	Assam	All functionaries	No packing	Loose
2	Haryana	Producers	No packing	Loose
		Wholesalers	Plastic crates	18-20
		Commission agents	Corrugated boxes	8-10
		Cooperatives		
		Processor	No packing	Loose
		Exporters	Wooden boxes	8-10
		Retailers	No packing	Loose
3	Karnataka	Producers	No packing	Loose
		Commission agents	Corrugated fiber board	24 fruits per pack
		Cooperatives		
4	Madhya Pradesh	Wholesalers	Basket	20-25 Kg.
		Commission agents	Basket	20-25 Kg.
		Cooperatives	Box	10-15 Kg.
		Producers	No packing	Loose
5	Maharashtra	Wholesalers	Wooden box and Plastic crates	20-25 Kg.
		Exporters	Carton box	10-15 Kg
		Retailers	Loose	Loose
6	Meghalaya	Producers	Bamboo baskets	30 Kg
		Wholesalers	Bamboo baskets	30 Kg
		Retailers	Bamboo baskets	8 Kg
7	Mizoram	Producers	Gunny bags	30 Kg
		Wholesalers	Gunny bags	50 Kg
8	Nagaland	All functionaries	No packing	Loose
9	Punjab	Producers	No packing	Loose
		Wholesalers	Plastic crates	18-20
		Commission agents	Corrugated boxes	8-10
		Cooperatives	Wooden boxes	25-27
		Processor	Plastic crates	10-15
		Exporters	Corrugated boxes	8-10
		Retailers	Jute bags	8-10
10	Rajasthan	Producers	Crates	20-22 Kg.
		Wholesalers	Wooden box	20-22 Kg.

		Commission agents	Wooden box	20-22 Kg.
		Cooperatives	Wooden box	20-22 Kg.
		Retailers	Loose	Loose
11	Tamil Nadu	Producers	Carton boxes, Bamboo baskets, Plastic crates boxes	5-10 Kg. 5-15 Kg. 20 Kg.
		Commission agents	Plastic crates/ boxes	10-20 Kg.
		Wholesalers	Plastic crates/ boxes Cartons, Loose	10-20 Kg. 10-15 Kg.
		Retailers	Plastic crates/ boxes, Bamboo baskets	10-20 Kg. 10-15 Kg.
12	Tripura	Producers	Bamboo baskets	100 Nos.
		Wholesalers	Bamboo baskets	100 Nos.
13	West Bengal	Producers	Bamboo baskets, Gunny bags, Polythene bags	15-20 Kg.
		Wholesalers	Wooden boxes	100-110 Nos.
		Commission Agents	Wooden boxes	100-110 Nos.

Source: DMI survey

The producers generally sell the orchards to pre-harvest contractors. The producers, who do not sell the produce to pre-harvest contractors, transport Mandarins in loose to the nearby markets. The packaging material like Bamboo baskets, Gunny bags, Poly woven bags Plastic crates, Cartons and Corrugated fiber board boxes etc. and sometimes wooden boxes are used in carrying the produce to the markets by the wholesalers and commission agents.

3.6.2 Parameters of packaging material

The size, type and capacity of the packaging material depend mostly upon the locally available raw material, distance of the markets and type of transport to be used. Generally, the packing material of different size made of bamboo boxes, corrugated fiber boxes, telescopic boxes, wooden boxes and plastic crates are used for packing of Mandarins.

The information regarding capacity of the packages, approximate weight per package used, number of layers and count of Mandarins kept in the packages, material used as packaging cushion etc, are given in table No.4

3.6.3 Qualities of packaging material:

Since, a package as a container offers accommodation to the contents for storage and transportation, therefore the packages must have the following basic qualities.

Table No. 4. Parameters of packaging material

Sr. No	State	Market	Type of packaging	Capacity of packaging			Shape	Packaging meant for
				Weight (Kg.)	Count (No.)	No. of layers		
1	2	3	4	5	6	7	8	9
1	Maharashtra	Achalpur	Wooden boxes	21-24	150 -250	4	Rectangular	Interstate / long distance
		Chandur Bazar	Wooden boxes	20-28	100-210	5-6	Rectangular	and export Local and small distances
			Plastic crates	20	120 - 165	3 - 4		
		Warud	Wooden boxes	20 - 25	150 - 225	4 - 5	Rectangular	Interstate / long distance
		Narkhed, Katol	Plastic crates, Wooden boxes	20 - 25	150 - 225	4 - 5	Rectangular	Interstate / long distance
Nagpur	Carton boxes	10 - 15	45 - 50	4 - 5	Rectangular	Interstate and export		

Source – DMI Survey

- i) It must protect quality and quantity.
- ii) It must prevent spoilage during transit and storage.
- iii) Labeling of package must indicate about quality, variety, date of packing, traceability, weight and price etc.
- iv) It must be convenient in handling operations.
- v) It must be convenient to stack.
- vi) It must be cheap, clean, hygienic and attractive.
- vii) It must be biodegradable
- viii) It must be free from adverse chemicals.
- ix) It should be reusable.
- x) It should immobilize the fruits placed inside.
- xi) Quality and hygienic cushioning material must be used to protect fruits from impact, injury and compression.
- xii) It should offer good ambient conditions to the fruits congenial for storage and transportation.
- xiii) It should meet optimum requirements of ventilation vis-à-vis temperature and relative humidity management.

3.6.4 Packaging material suggested by Market Planning and Design Center:

Market Planning & Design Centre of Directorate and Inspection has suggested the corrugated paper boxes for the packaging of Mandarins. It has the following advantages.

- 1) These packages can be arranged in the truck with minimal residual space.
- 2) The unit capacity is comfortable, compared with conventional wooden box.
- 3) The counts of each package can very well be presented in terms of unit dozen or multiple thereof, which will facilitate price negotiations and auction.
- 4) The weight of each package in terms of gross weight and net weight will be less than that of the conventional wooden box and hence the package is likely to be safe from various surges in the transit.
- 5) The handling cost at loading point will be comparable with the conventional wooden boxes.
- 6) The unit cost of transportation will be reduced, because of more space generated for the cargo in the load.

3.6.5 Precautions to be taken before packaging:

- i) Mandarins should be plucked at appropriate maturity, keeping in view the time span of the market.
- ii) Mandarins should be sorted and graded as per accepted quality standards, before packing. Only sound fruits should be packed.
- iii) Before packing, post-harvest treatment with wax and fungicides should be resorted to as a prophylactic measure against pathogenic invasion in transit.
- iv) For prevention of bruising/abrasion injuries, paper liners, pads, trays or tissue wraps may be used. As an alternative, cushioning with easily available paddy straw keeps the packing cost minimum. It will maintain a level of R.H. because of moisture absorbing tendency of the paddy straw and keep the temperature down.
- v) Careful placement of Mandarins in the cartons is necessary to avoid bruising. The use of telescopic boxes can overcome this problem very well.
- vi) For securing packages, use of adhesive tape (3 to 4 cm) may be used. The packages can also be secured with thin rope of coconut fiber, or polythene sutli, as an alternative.

3.6.6 Precautions during packing:

During packing, fruits should never be packed loosely in order to avoid shaking of fruits which leads to friction among fruits surface and thereby causing damage. In wooden boxes or cartons, filling should be done with little pressure so that during transit period when the volume of the fruits gets reduce due to dehydration and adjustment of space due to jerks in transit, the pack structure does not get loose.

It is also observed that during the packaging, sharp edges of the packing material damage the fruits. Therefore, care should be taken so that they do not come out of the containers, resulting in bruising, puncturing and damaging the fruits.

Similarly, there should not be too much ventilation which can affect the quality of fruits due to shrinkage, loss in weight, colour, etc.

3.7 Cool Chain:

Cool chain is essential during the transport of quality Mandarins all the way from the farm to the customer. This helps in maintaining the temperature inside the box at the same low level as in the cold storage.

The various stages of the cool chain are:

1. Pre- cooling and cold store at the farm.
2. Refrigerated truck from farm to the airport
3. Cold store at the airport.
4. Building up of the pallet in a cold store at the airport.
5. Loading the aircrafts directly from the cold store in a short time.
6. Cargo aircraft maintains cold store temperature in transit.
7. Off-loading direct into a cold store in the receiving country.
8. Refrigerated truck to the air cooled departmental stores.

3.8 Preparation for the Market:

During the survey, it was observed that producers do not carry out any special preparation for bringing Mandarins to the markets. At the most, Mandarins are washed and cleaned before carrying them to the markets. Moreover no chemical treatment is given for ripening of the fruits, as is done in case of other fruits like banana and mangoes.

3.9. Post -Harvest Losses:

3.9.1 Nature and Causes of Post-Harvest Losses:

Post-harvest losses of horticultural produce may occur due to a variety of reasons. Some of the common reasons for post-harvest losses are as under.

- (i) Mechanical injury:
- (ii) Injuries due to thermal shock;

- (iii) Disease and pest attack;
- (iv) Microbial attack; and
- (v) Physio-biochemical reasons.

Fresh fruits are inherently perishable. During the process of distribution and marketing, substantial losses are recorded which range from a slight loss of quality to total spoilage. Post harvest losses may occur at any point in the marketing process, from the initial harvesting, grading, packaging, transportation from the field to storage, storage to assembly point, during storage and distribution to the final consumer.

A large number of intermediaries play an important role in the system between farmer and the retailer like local retailer, transporter, wholesalers and distributor, etc, and at every step significant waste is noticed.

3.9.2 Shrink-wrapping:

This is a relatively new technique in which heat shrinkable poly film is used to wrap the individual fruit and over wrapping of trays. Polyethylene is the best for using it as wrapping, as it is least expensive and extend the shelf life by three weeks.

3.9.3 Storage:

The production of the fruit is seasonal, but its demand remains for a longer period. Therefore, storage is very essential for extending the consumption period of fruits, as well as for regulating their supply to the markets. The principal aim of storage is to ensure better returns to the growers.

The storage of Mandarins, at different markets, is given in table No.5

Table No 5. Storage of mandarins

Sl. No	State	Agency	Type of storage (ambient/cold storage)	Period of storage	Method of storage
1	Assam	Producers/All functionaries	Simple storage	N.A.	Loose
2	Haryana	Producers	Not in practice	-	-
		Wholesalers / Commission agents	Cold storage	30-60 days	In plastic crates
3	Karnataka	Producers/All functionaries	Simple storage	5-10 days	Corrugated boxes, Bamboo boxes, Loose
4	Madhya Pradesh	Producers/All functionaries	Simple storage	N.A.	Corrugated boxes, Bamboo boxes, Loose

5	Maharashtra	Producers/All functionaries	Simple storage	2-3	Wooden boxes, Plastic crates, Loose
		Processors	Cold storage	3-5	In boxes
6	Meghalaya	Producers	Simple storage	2-3 days	Gunny bags, bamboo baskets
		Wholesalers	Simple storage	2-3 days	
		Retailers	Simple storage	5-8 days	
7	Mizoram	Producers	Simple storage	2-3 days	Bamboo baskets
		Wholesalers	Simple storage	2-3 days	Gunny bags, bamboo baskets
		Retailers	Simple storage	4-7 days	Loose
8	Nagaland	Producers/All functionaries	Simple storage	2-3 days	Loose
9	Punjab	Wholesalers / Commission agents, Retailers	Cold storage	30-45 days 3-5 days	Plastic crates
10	Rajasthan	Producers/All functionaries	Simple storage	N.A.	Loose
11	Tamil Nadu	Wholesalers/	Cold Storage	4 -5- months	5,10 & 15 Kg.
12	Tripura	Retailers	Simple storage	5-20 days	Loose
13	West Bengal	All functionaries	No storage	N.A.	N.A.

Source: DMI survey

From the table No 5, it is revealed that the Mandarins are also kept in cold storage in states like Haryana, Maharashtra, Punjab and Tamil Nadu. In other states, the Mandarins are kept in ambient storage. In Haryana and Punjab, plastic crates are used for storing the Mandarins. In Maharashtra and Tamil Nadu, wooden boxes and plastic crates are in use for storing of the fruits. In North Eastern states, bamboo baskets, gunny bags are used for storing the fruits.

CHAPTER- 4

PROJECT CONCEPT AND JUSTIFICATION

It is proposed to set up a Pack house with grading line cum a small pre cooling and cold storage system of 50 MT capacities at various locations for Citrus fruits mainly Oranges.

Rationale of the Project

Post-harvest losses in our country have been estimated about 35 % and only about 2% of the total F & V are processed. Maharashtra State is the largest producer of F & V in India. Delay in the harvest takes away its freshness, palatability, appeal & nutritive value. Due to insufficient demand, weak infrastructure, poor transportation and perishable nature of crops the grower sustain substantial losses. During the glut, the loss is considerable.

Estimated post harvest losses for some fruits

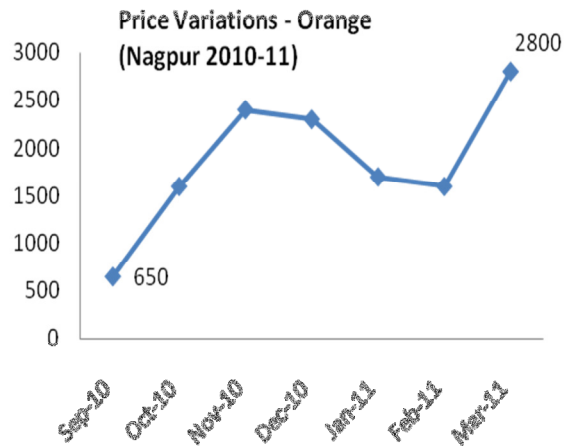
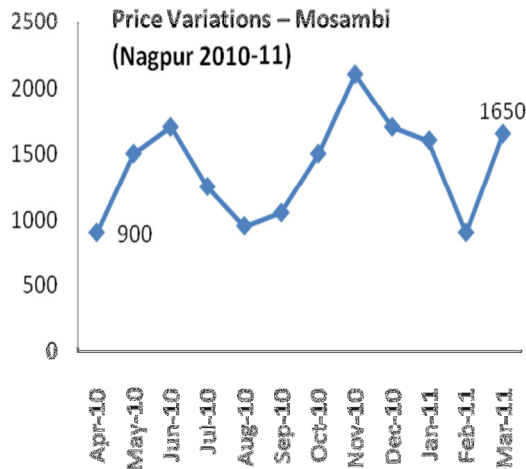
Sr.No.	Type of Fruits	Percent of Loss
1	Orange/ Mandarin	20-95
2	Lemon	20-85
3	Papaya	40-100
4	Banana	20-80

Careless and improper handling of agriculture produce reduces the market value and keeping quality, ultimately causing enormous losses and depriving rightful benefits to both growers and consumers. Besides these quantitative losses the loss suffered in quality before actual consumption can hardly be estimated. Although the R & D effort on the development of Post-harvest handling has helped in reducing the spoilage, considerable losses continue to occur. Moreover, most of the agricultural produce is seasonal, due to harvest glut the price falls drastically. This is applicable not only for F & V, but any type of agricultural produce.

The approach possible for solving the problem is the creation of cold storage facilities in the agriculture producing region as also in the major towns and urban consumption centres to ensure supply of agricultural produce round the year in the reasonable price

Problem of Price fluctuations & Benefits of Cold Storage System

The following Figures are based on the month wise average prices for sweet lime (mosambi) and oranges in the Nagpur APMC for the financial year 2010-11. The variation in prices is quite considerable.



High-level price fluctuation in Fruits and vegetables, spices, dry fruits has been calling for a satisfactory solution for quite some time now. One of the effective ways of addressing this problem is through setting up of more efficient and modern cold storage system. With better post-harvest management practices, better handling /storage practices, opportunities for quick and cost competitive transport plans and processing options the proposed cold storage system is well equipped to address this problem.

There is a need for better organization of orange trade with better post-harvest management practices and a scientific storage at low temperature, an efficient transportation and processing options.

STORAGE AT LOW TEMPERATURE FOR AGRICULTURAL PRODUCE

Fresh fruits and vegetables are perishable. Particularly high-breed varieties have a shorter shelf life than the organic produce. Due to green revolution, yield per acre and area under cultivation has increased. Most of fruits & vegetables are seasonal. The produce of all

farmers comes to market yard simultaneously as such their prices fall. There is a need to extend their shelf life. The bio-chemical and microbial changes are slow at low temperature. So refrigerated cold storages are used to prolong the shelf life of perishable produce.

Constraints faced by farming community during Post Harvest Management Technologies are:

- Lack of education about market awareness and prices round the year
- Fully dependent on merchant for marketing
- No cold chain and scientific storage facilities in the vicinity
- Lack of sufficient capital
- Improper guidance

Most of the produce is seasonal crops and F & V, spices are perishable in nature. In a good season there may be glut , because of insufficient transport facilities, lack of roads and poor availability of packing materials, the surplus particularly F & V, some spices cannot be taken to quickly enough to the market in the urban areas. Moreover, the surplus agriculture produce cannot be stored for sale in the off-season because of non-availability of cold storage facility nearby. Thus, the growers do not get a good price for their agricultural produce in the harvest glut and some of it is spoilt resulting in the complete loss.

JUSTIFICATION OF THE PROJECT

The existing structure of marketing of perishables especially oranges, and other citrus fruits do not address the problems of farmers; it has low marketing efficiency, high post-harvest losses and does not foster competitiveness. A modern system in respect of pack house with grading system and a small cold storage system reduce vested interest of a large intermediary chain to some extent, assures quality and raise income of actual farmer.

Objectives of the Proposed Project:

Following are the main objectives of the proposed project

- To provide additional agricultural marketing infrastructure for the oranges.
- To promote competitive alternative agricultural marketing infrastructure by inducement of latest technology that sustains incentives for quality and enhanced productivity thereby improving farmer's income.
- To promote direct marketing so as to increase market efficiency through reduction in intermediaries and handling channels thus enhancing farmer's income.
- To provide infrastructure facilities for grading, standardization and quality certification of agricultural produce so as to ensure price to the farmers commensurate with the quality of the produce.
- To promote grading, standardization and quality certification system for giving a major thrust for promotion of pledge financing and marketing credit, introduction of negotiable warehousing receipt system and promotion of forward and future markets so as to stabilize market system and increase farmer's income.
- To create general awareness and provide education and training to farmers, entrepreneurs and market functionaries on agricultural marketing including grading, standardization and quality certification.

The setting up of such units for the oranges will be useful for the farmers, traders and processors in the area and will reduce post-harvest losses, assure quality to consumers and improve the returns to the farming community.

CHAPTER-5

NHM GUIDELINES FOR CONSTRUCTION OF PACK HOUSE CUM COLD STORAGE

Construction Features:

The general convention of conventional construction is as follows:

Foundation:

Superstructure and Foundation (which may be conventional Footing Type, Pile Foundation, Raft Foundation etc.) to be designed by qualified & licensed structural / civil engineer. The design shall meet the BIS standards and relevant seismic zone norms for earthquake proof designs.

Cold Chamber:



Walls - However, in RCC structure insulated panel boards will be provided in place of masonry walls.

Roof - Truss Roof with G.S. / Pre-coated G.S. Sheet cover. .

In case of truss roof, provision to be made for fixing insulated panels on the ceiling & supporting of cooling units from the trusses (alternatively cooling units can be supported on the floor mounted frame structure on top floor).

Provision for FRP sheets for natural lighting to be made in roof sheeting at certain locations. For ventilation of attic, provision of ridge monitor or turbo ventilators (which require no electric power) can be made. The work to be handled by experienced agencies to ensure a trouble free roof structure. The roof may be kept walkable for maintenance.

Floor - The floor comprises of base concrete, in cold stores with suitably lower levels in cold chambers. The level difference between cold chambers and ante room to be equal to the thickness of floor insulation plus the layer of PCC or tremix finish.

Inter-floors The basic structure can be RCC columns & beams or steel columns & steel beams.

Grating - Wooden batten grating or steel grating using flats / square tubes etc. The inter-floors have to be designed for a product loading of 900 kg/m^2 min. Where AC units are located on top floor, the structure has to be suitable for the unit static & dynamic loads.

Ante Room - This should preferably be designed to accommodate staircase, electrical hoist cage and have wider doors. Provision for fire escape stair & exits to be made as per local norms. The inter-floors in ante room to have doors to each cold room on each floor.

Strip curtains for cold rooms and Air Curtains for external outlets / inlets –

Strip curtains are quite common for reducing infiltration of air during loading / unloading. Air curtains need power for operation but are more effective if properly installed.

Rodent proof civil structure and proper drainage of water to be ensured.

Rooms for machines, Electricals etc.

Dock - Loading & unloading dock shall be designed with RCC slab roof or sheet roofing. However the machine roof can have RCC slab roof to accommodate the evaporative condensers , pump sets, water tank, water softener etc. The dock area to accommodate suitably sized office & toilet for staff & labour.

Ancillaries - Underground fresh water storage, storage for firefighting , water supply & sanitary arrangements , compound wall / fencing , main gate, security , electrical sub-station & D.G.set platform , roads & parking place for vehicles etc. Green landscaping with benches for labourers is desirable.

Thermal Insulation: It is recommended that appropriate BIS standards are adopted for selection of design parameters (IS 661:2000) and method of application of thermal insulation (IS 661 & 13205) . Though fresh F& V are stored at + 0 C, it is recommended to design thermal insulation for (- 4 C to + 2 C) temperature condition to have lower heat

load. Material of extruded polystyrene is not recommended as yet by BIS, therefore, the committee is not recommending its application in cold storage for storing fresh fruits and vegetables or any other consumable item.

Materials of thermal insulation and its application.

Cold chambers have to be insulated on walls, ceilings / roofs and floors with proper insulating material of adequate thickness, with provision for vapour barrier on outer side & proper cladding / cover on inner side.

The commonly used insulation materials are:

- a) Expanded polystyrene
- b) Rigid Polyurethane foam
- c) Rigid phenolic foam
- d) Mineral wool / glass wool
- e) Extruded polystyrene

In case of Umred Project, the PUF panel for walls & ceiling and EPS for floor insulation have been considered.

The ancillary materials to be used include :

- a) Vapour barrier e.g. aluminum foil, polyurethane sheet, with bitumen / cold mastic adhesives
- b) Teakwood batten pegs, Tees etc.
- c) G.S.sheet runners (avoid wooden batten runners)
- d) Cladding of profiled / pre-coated G.S.sheets 0.5 / 0.6 mm thick / Fibre glass sheets of suitable thickness.

For Conventional Insulation

Walls & Ceiling

1. Primer Coat followed by two layers of bitumen.
2. Fixing aluminium foil min. 50 microns
3. Fixing wooden pegs at suitable intervals
4. Fixing two layers of insulation with staggered joints
5. Fixing G.S.sheet runners over the pegs in longitudinal & lateral directions

6. Fixing profiled and pre-coated g.s. sheets, 0.5 / 0.6 mm thick over the runners with proper finishing of joints. Alternatively FRP sheets can be used.

Floor

1. Laying of polythene sheet min.250 microns , as vapour barrier
2. Fixing insulation slabs in two layers with bitumen as adhesive for the first layer
3. Covering with tar felt
4. Laying PCC / tremix of 75 mm/ 100 mm thickness.

For Insulated Panel Structure

Walls & Ceiling

1. Perimeter of the plinth to be in level for panel installation
2. Panels to have cam lock or tongue / grove joints.
3. Sheet metal flashing to be provided on all concrete / wall ceiling joints internally & externally. PVC coving or concrete curbing to be provided on wall – floor joints.
4. Horizontal Tie bracings to be provided between vertical wall panels & external columns, to take care of wind loads.
5. Adequate numbers of Pressure relief ports to be provided on all chambers with electrical connection.
6. Insulated doors shall be suitable for panel mounting.



**MINIMUM INSULATION THICKNESS FOR VARIOUS INSULATION MATERIALS
BASED ON RECOMMENDED U VALUES FOR -4 TO +2 COLD STORAGE.**

Type of insulation	Material	Wall			Ceiling / roof U value =0.24 W / m k	Floor U value = 0.29 W / m k
		External U value = 0.27 W / m k		Floor U value = 0.58W / m k		
		K	Thickness mm	Thickness mm		
	15	0.036	150	75	150	125
	32	0.023	100	50	100	100
	50	0.026	100	50	125	100
	48	0.033	125	50	125	100
	32	0.033	125	50	125	100

Notes-

- K values from IS661:2000
- U values are the recommended heat transmission coefficients for cold storage temperature range -4 to 2⁰ C by IS661:2000
- All values rounded off in multiples of inch (25 mm)

5. Total refrigeration load – Heat load calculation

- Procedure for load calculation

Procedure laid out by ASHRAE Fundamentals and refrigeration handbooks may be followed. The current method prescribed by ASHRAE Fundamentals is RTS (Radiant time series) method in which room by room analysis for each hour is carried out. However, the assumptions used for the building envelope and the loads are very crucial. ASHRAE refrigeration handbook elaborates a more traditional approach. Thus, based on the overall impact/ sensitivity of important parameters, some estimates can be made. Designers also tend to take a safety factor of 5-10% on the estimated loads.

- Ambient conditions

0.4% annual design conditions of that location as per ASHRAE / ISHRAE data may be used for holding period. For the loading and pull down periods, 0.4% design conditions for those months may be taken.

- **Product incoming temperature**

It varies with location and harvesting time. However, average value may be taken as shown in Typical Designs enclosed.

- **Capacity during loading, pull down, holding and lean periods**

Refrigeration capacities should be calculated at various operating conditions and necessary arrangements for capacity control be included in the equipments to be provided.

6. Refrigeration system and equipment selection

Vapour compression systems are commonly used. However, absorption systems can also be used for cold storages, where heat is readily available instead of electricity e.g. solar, geothermal, waste heat, etc.

Refrigerant issues- eco-friendly, safety, energy efficiency

Ammonia seems to be the best refrigerant in terms of environment (being natural) and energy efficiency for this application. However, it is toxic and precautions should be taken in its handling. In case there is a restriction of using ammonia at certain locations, the refrigeration system can be designed to work on R 134a, R404A etc.

Type of system-



Direct expansion (in case of HFC and others), liquid overfeed and gravity with a surge drum

Liquid overfeed systems force excess liquid through the evaporator to improve the system efficiency and reduce the operating costs. It becomes more favorable as the number of

evaporators goes up. Details of a gravity feed system are included in details on subsequent pages with list of additional equipment for a liquid overfeed system.

Compressor- reciprocating / screw with capacity control

Multiple multi-cylinder reciprocating compressors or screw compressors with appropriate capacity control may be used. Typically the holding capacity may just be 50% of the peak capacity during loading. So, it may be suitable to go for two same sized compressors each suitable for holding capacity at peak loads. A third compressor as standby compressor is recommended. Compressors should be able to deliver the desired capacity at worst conditions not at rated conditions. VFD's can also be used for closer control in some cases. Capacity of compressor shall be confirmed by data-sheet of manufacturer.

Condenser- atmospheric, evaporative, water cooled

Condensers can be air cooled with water spray or with provision of precooling of condenser air or of evaporative type or shell and tube water cooled type shall be confirmed by data-sheet of manufacturer.

Cooling coils-ceiling/wall mounted

Delta T (difference between evaporating and air inlet temperatures) should be kept low for higher humidity in the chamber. Typical values shall be 4.4 or less during holding period and can go up to 6 during peak loading period. This shall be confirmed by data sheet of manufacturer. This increases the coil surface substantially. The coils selected are kept on the higher side to keep higher humidity levels even during loading / pull down periods. Ammonia coils are typically MS hot dip galvanized or SS / aluminium tubes with Aluminium fins. The cooling units for other refrigerants have coils with copper tubes and aluminium fins.

Capacity control of fans

Fans operation can be cycled to save power during part load operation. VFD's may also be used on the fans to get good savings.

Testing and charging the system

Installation, Testing and Commissioning should be carried out as per BIS (for standards available). ASHRAE standards may be referred to as guidelines but not mandatory.

Air purger (manual or automatic)

It is desirable to remove air and other non condensable gases from the refrigeration circuit to keep the compressor head pressures lower and also improve heat transfer coefficients.

Defrosting method-water/hot gas etc.

Water defrosting is a simple method and can be done manually or through a timer.

Humidification system

Although higher humidity levels of 85-90% can be achieved by keeping low delta T in the cooling coil. But during loading periods and for RH>90%, humidification system is a must.

Several techniques are available, but it should preferably

Be done using water mist with 2-10 micron and uniformly distributed all over the chamber ensuring that the product does not get wet.

Equipment derating at higher ambient

A designer should match the loads with the de-rated equipment capacity at higher ambient conditions.

GENERAL SPECIFICATIONS FOR REFRIGERATION SYSTEM

Brief Specifications for Equipment / Materials / Services

Refrigeration Compressors & Motors

Quantity	3 No. each of 50 % capacity (one preferred as standby)
Type	Reciprocating , multi cylinder complete with water cooled head / jackets, with accessories like oil separators, capacity control & unloaded start. Alternatively screw compressor, open type with accessories
Capacity at critical operating conditions	To be configured in kW
Estimated Motor rating	To be configured in kW, RPM, type of insulation, input AC power supply

ii. Evaporative Condenser

Coil section	Hot dip galvanized M.S. pipes CDW Boiler quality tubes or S.S. 304 tubes
Fan section	With 2/3 Axial Flow Fans with Cast Aluminium OR S.S. impellers, complete with TEFC Sq. cage motors, Class F insulation & IP-55 protection

Water sump tank	S.S 304 or M.S. epoxy coated with necessary connections
Other provisions	Water spray arrangement, air inlet grilles, eliminators of suitable design
Unit casing	With removable G.S sheet panels & inspections windows etc.
Estimated Heat rejection capacity at 38 C condensing & applicable WB temp	To be configured in KW
Suggested standard	ARI Std 490

III H.P Receiver

Horizontal ammonia receiver complete	With necessary connections, reflex type level gauge etc.
Capacity	To be configured
Material of construction	Boiler quality steel plates
Quantity	2 Nos. (Two nos. are suggested since some States regulations call for Pressure testing of high pressure vessels on a periodic basis)
Suggested standard	ANSI/ ARI 495

IV Air Cooling Units

a) Fined cooling coil	Coil design to be suitable for gravity feed/ pump circulation as per design
M.O.C.	Hot dip galvanized M.S. pipes CDW Boiler quality tubes OR S.S. 304 tubes & aluminium fins with proper bonding system
Fin spacing	6.25 to 8.5 mm (3-4 FPI)
b) Axial flow fans	With cast aluminium /S.S./ FRP impellers, with variable pitch, TEFC Squirrel cage motors with class F insulation, IP-55 protection
c) Accumulator	Vertical/ horizontal with necessary connections (in case of gravity feed units)
d) Unit casting	G.S sheet duly painted, pan of G.S./M.S. with epoxy paint

e) Defrosting arrangement	Water
Unit capacities	
Number per chamber	To be configured
Estimated capacity each at critical operating conditions	To be configured
Estimated coil surface area	To be configured
Estimated air flow capacity each	To be configured

For fruits & vegetables requiring higher humidity, lower delta T, higher flow rates of air and higher coil surface areas need to be used

For 1 No. F & V cold store	Generally 3 nos
Estimated capacity each at critical operating condition	To be configured
Estimated coil surface area	To be configured
Estimated air flow capacity each	To be configured
Suggested Standard	ARI Std. 420

Notes:

- a) Number of ACUs may vary from 2 to 4 per chamber, in which case the capacity parameters shall be increased or decreased proportionally.
- b) The ranges in capacities have been mentioned considering the possibility of higher cooling capacity requirement if incoming product temperatures are around 30⁰C, mostly in western & southern zones.

Refrigerant Piping, Fittings & Valves

Piping Interconnecting piping between compressor, condenser, receiver and cooling units	M.S. black piping conforming to IS-1239 Piping as per ANSI guidelines and pressure vessels as per BIS Code IS 2825). Reference to ASHRAE B-31.5 recommended.
--	---

Vi Water Piping, Fittings & Valves

Piping shall be used for	
<ul style="list-style-type: none"> a. Condenser water circulation b. Compressor cooling c. Defrosting d. Drain lines 	<p>Piping to be G.I.class B or sizes up to 65 NB & M.S. black pipe conforming to IS-1239.</p> <p>Valves up to 40 NB to be Gate / Globe type.</p> <p>Valves 50 NB / larger to be butterfly type.</p>

vii. Water Pump sets

Water flow capacity to take care of condenser water flow & compressor head / jacket cooling	2 nos. (one standby)
Capacity	To be configured

viii. Thermal insulation for refrigerant piping etc.

Material for insulation for refrigerant suction line, accumulators etc.	<p>EPS pipe section</p> <p>PUF pipe section with 0.6mm Aluminium or 0.5mm G.S.pre-coated sheet cladding</p> <p>Nitrile Rubber / EPDM / chemically cross linked polyethylene pipe section / other acceptable materials with woven glass cloth with UV treated pigmented epoxy coating.</p>
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Duct Mouth pieces

To be provided on each fan outlet for uniform distribution of air at the topmost level.	G.S. sheet deducting as per IS 655
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Ventilation for cold chambers

System to be designed for providing adequate air changes / day	<p>Axial flow / inline duct fans with cleanable inlet filters , G.S sheets / Aluminium / PVC ducting up to cold chambers and ducting for exhaust from cold chambers to outside.</p> <p>Heat exchanger with energy recovery wheel or heat pipe can be used for cooling the incoming air from the exhaust air. Typical efficiencies of heat exchangers are 70% or higher.</p>
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Humidification

External humidification for 90 to 95 %	Fogger type external humidification system with 2 to 10 micron particles with automatic regulation.
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Controls- One sensor per 100 ton of storage is suggested as good (Univ. of Idaho study)

Temperature control	Temp. Indicators cum controllers for individual chambers. Temperature scanners and a centralized temperature indication in machine room.
RH control	RH indicator & controller
CO	CO sensors for regulation of ventilation system
Refrigerant flow controls	Liquid level controls, solenoid valves etc.
PLC control systems	For overall control of various parameters.

xiii. Installation, Testing & Commissioning

Installation	The plant shall be installed, tested & commissioned as per IS 660 / ASHRAE. Std.15
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General Notes:

- a. The above design recommendations are based on Ammonia as refrigerant & the system designed for gravity feed for air cooling units. It is also possible to use pump circulation system (overfeed system) requiring following components:
- b. Centralized ammonia L.P. receiver.
- c. Ammonia pumps – 2nos.
- d. Refrigerant flow & safety controls.
- e. Interconnecting piping – both supply & return lines shall be insulated. In this case the individual accumulators for AC units & level controls etc. are not required.

ELECTRICAL INSTALLATIONS

- Power Factor – not less than 0.95.
- Transformer of minimum required capacity.

ELECTRICAL INSTALLATION

i. Substation

Substation with a rating of about 200kW	<ul style="list-style-type: none">a. Step down transformer suitable for incoming H.T.voltage / 433 V as per IS-2026 / other applicable standards.b. Two pole / four pole structure as per local requirements.c. Outdoor type metering cubicle with approved meter, CTs / PTs etc.d. Earthing station as per requirement.e. Switchyard fencing with gates as per Electrical Board requirements.
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ii. D.G. Set for standby power

D.G. set complete with accessories and with weather-proof and noise-proof canopy as per local pollution control norms.	Estimated Rating; as per design. One big for pull down period and one small for holding period may be used.
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iii. Main power distribution panel

Main power distribution panel with changeover facility for normal electric supply & D.G. set supply. With ongoing feeders for various electrical panels

iv. Electric panels

Electric panels for	<ul style="list-style-type: none">a. Refrigerationb. Lighting, Electric hoist, Fansc. APFC (automatic power factor correction) paneld. Water supply, firefighting etc.
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v. Power & Control cabling etc.

Power and control cabling, earthing etc. for various electrical circuits	Aluminium armoured conductors for main power lines & equipment lines & copper conductors for lighting , control wiring etc.
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vi. Lighting

Lighting in a. cold stores, ante room b. other areas c. outside areas	The light fittings (with non glass covering) should be energy efficient eg. CFL (with vapour proof casing) fittings for cold chambers. A central switch should be provided outside each chamber. Typical installations for lights may be 2 to 3 W / m of floor area. (IS 15111)
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vii. Electrical hoist

Electric hoist	With wire ropes, steel fabricated cage with guides & openable doors for material movement, product lifting.
Capacity	2 MT of product

9. Safety-

SAFETY MEASURES

Provision for handling accidental leakage of ammonia	Ammonia sensors in cold chambers near ACU & machine room Emergency ventilation for machine room Safety release of refrigerant to water sump Ammonia masks First aid kit Instructions for handling emergencies.
Fire protection	Fire sensors in cold chambers & machine room Dry & water based firefighting systems as per specs below Sprinklers for high pressure receivers.
Emergency lighting system	May be solar PV cells with batteries & controller
Emergency alarm system	To be provided with switches near all cold store doors and alarms located in common public areas.
Lightning arrestors for the building as per local regulations	

i Fire Fighting

a. Dry type

Firefighting equipment necessary for extinguishing liquid, solid and electrical fire:	<ul style="list-style-type: none">i. Dry chemical powder type 5.0 kg capacity with ISI Mark fire extinguisher complete with wall mounting bracketii Carbon dioxide (CO₂) type 4.5 kg capacity fire extinguisher complete with wall mounting bracketiii G.I. fire bucketsiv M.S. Stand for fire buckets
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b. Water based (mandatory if local code so prescribes)

System shall comprise of	<ul style="list-style-type: none">i 2 sets of water supply pumps.ii 2 sets firefighting pumpsiii G.I. piping, class C with necessary fittings and valvesiv rubber hose reelv canvas hose pipevi M.S. fabricated hose box with key
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- Provision of lifts/ material handling equipment - no. of doors (one on GF or on each floor)

Improper handling may cause injury to the potatoes. As labour is cheap in India and power is not reliable, lifts/ mechanized handling is not common but may be useful in some cases. Pelletization; wherever feasible and economical would maintain the quality of potato.

10. Conflict f performance (CoP) – Optimum energy efficiency should be determining criteria for CoP. However, for the instant type of cold storage CoP of minimum 3.6 at peak load condition, 3.3 for holding period and about 2.5 during lean period is recommended.

11. Operation and maintenance- Cold storage design must be accompanied by Operation and Maintenance Manual for cold storage operator which should cover following points in English as well as Hindi languages.

- No. of operating hours

- Training of operators

- Monitoring and control – temperature, humidity, CO₂
- Door seals- checking methods
- Maintenance of equipment / cold store
- Hygiene issues.

12. Variation/ amendment Clause

The standards prescribed above are not intended to prevent or discourage variations arising out of new concepts, innovations and R&D in building design and construction, thermal insulation and cooling and refrigeration technology etc. However, any variations or deviations from the above prescribed standards must be supported by scientific / technical details for prior approval of the competent authority, on the basis of merit who may decide the proposal in view of relevant technical details including critical storage requirements, energy efficiency (coefficient of performance), availability of Standards, environmental concerns, safety, etc. Similarly, periodic amendment of standards for general application may also be undertaken by the National Horticulture Board; in consultation with a committee of subject matter experts duly constituted for this purpose.

CHAPTER – 6
SPECIFICATION OF PACK HOUSE CUM COLD STORAGE PLANT

- A. Sorting, Grading & Waxing Line- Capacity 8 TPH, Mechanical Type placed in pack house**
- B. Precooling (6MT capacity), Cold Storage Unit- 25MTX 2Nos. Basic Cold Store Design Considerations**

i) Commodity Storage Requirements:-

Type of Commodities/Produce	Chamber 1	Chamber 2
Ideal / Recommended Storage Conditions		
<ul style="list-style-type: none"> - Temperature (DB in °C) - Humidity RH (%) Range - Air Circulation (CMH/MT of Produce) - Ventilation (Air Changes/Day) - CO₂ Range (PPM) - Produce Cooling Rate (°C/day) - Freezing Point °C - Others 	<p style="text-align: center;">2-4 85-90 10 2 Less than 3000 5 °C/day -2 to3 °C</p>	<p style="text-align: center;">2-4 85-90 10 2 Less than 3000 5 °C/day -2 to3 °C</p>
Cold Chamber Dry bulb (DB in °C)	2-4	2-4
Cold Chamber RH (%)	85-90	85-90
Max Storage period (months)	06	06
Max product temp (°C) at the time of loading	25	25
Daily loading rate (MT/day) in each cold chamber	Up to 5%	Up to 5%
Loading Period (months)	Round the year	Round the year
Pull down rate (°C / day)	5 °C/Day	5 °C/Day
Unloading Period (months)	Round the year	Round the year
Daily unloading rate (MT/day) – from each cold chamber	Up to 10%	Up to 10%
Ante Room Conditions (T °C & RH %)	+20 to 25 °C 50-60	+20 to 25 °C 50-60

Sorting & Grading Area (T °C & RH %)	+20 to 25 °C 50-60	+20 to 25 °C 50-60
Special Provisions CIPC treatment for Process Potatoes	NA	NA
Special Provisions – MA / Ethylene Control / Fumigation/ Fresh Air etc.	NA	NA

ii) Fresh Air / Ventilation System

Brief Description of CO ₂ Extraction / Ventilation System	NA
CO ₂ Concentration Control Range (PPM)	NA
Monitoring & Control Instrument – Type – Accuracy	TIC 0.1 Deg. C
Ventilation Capacity (Max Air Changes/Day)	Up to 2 Air Changes/Day (by Door Opening)
Design Considerations for Energy Recovery and Preventing Wetting of Produce	NA

iii) Cold Store Chamber Sizing and Capacity

– No. of chambers: 02

Details	CSC 1	CSC 2
Total Capacity of Each Cold Store Chamber (MT)	25	25
Internal Chamber Dimensions L x B x H (m)	10x8x4	10x8x4
No. of mezzanine floors X Height (m) per floor	NA	NA
Size & Weight of Bags or Boxes being stored	30 crates/pallet 20kg each	30 crates /pallet 20kg each
Total number of Bags/Boxes stored in each Cold Store Chamber	42 pallets	42 pallets

- Type: Palletized
- Max Height of Building ---- 4 Mtrs.

iv) Ante Room & Process Areas:-

Details	Length (m)	Width (m)	Height (m)
Ante Room	-	-	-
Sorting & Grading Area	31.5	20	4
Loading / Unloading dock	provided		

v) Machine Room & Utility Areas:-

Details	Length (m)	Width (m)	Height (m)
Machine Room	NA	NA	NA
Office Area	Provided		
Toilets & Changing rooms	Provided		
Any other/Packing Materials Stores	Provided	Provided	Provided

vi) Building & Construction Details:-

- **Type of construction :** Civil/ Pre-engineered Building

Type of External walls of cold chambers	PUF Panel
Type of Internal / Partition walls	PUF Panel
Type of Roof / Ceiling	GI SHEET/PUF Panel
Type of Internal structure / Racks	NA
Type of mezzanine grating	NA
Types of Lighting fixtures in cold Chambers	IP55 Grade CFL/LED
Types of Lighting fixtures in Process & Other Areas	IP55 Grade CFL/LED

vii) Insulation and Vapor Barrier

– **Type of Insulation :** Insulating Sheets / Metal Skin Composite panels

Type of Insulation	Wall		Ceiling / Roof	Floor
	External	Internal		
Type of material EPS / Metal Skin PUF Composite Panels / XPS/ PUR, Others	Civil	PUF	PUF	PUF
Relevant IS Code	IS- 11239	IS-11239	IS- 11239	IS-11239
Density (kg/m ³)	40± 2 Kg/M ³	40±2 Kg/M ³	40 ± 2 Kg/M ³	40 Kg/M ³ .
Thermal Conductivity at +10°C k value (W/m.Deg.K)	0.023 at 10°C	0.023 at 10°C	0.023 at 10°C	0.036 at 10°C
Thermal diffusivity m ² /h	2.5	2.5	2.5	2.5
Water vapour transmission rate, ng/Pa.sm, Max.	0.30	0.30	0.30	0.30
Water absorption after 24h immersion, percentage by mass.	0.30	0.30	0.30	0.30
Relevant IS Code of Practice for Thermal Insulation of Cold Store	IS-601 and IS-13205	IS-601 and IS-13205	IS-601 and IS-13205	IS-601 and IS- 13205
Total Insulation Thickness (mm)	80 MM	80 MM	80 MM	60 MM.
No. of layers & Thickness / layer (mm)	Single layer	Single layer	Single layer	Single layer
Type of vapor barrier & thickness (microns)	PUF Panel outer skin will be vapour barrier	PUF Panel outer skin will be vapour barrier	PUF Panel outer skin will be vapour barrier	Polythene sheet of 250 microns
Type of Bituminous/Sticking Compound	Chemical Sealant	Chemical Sealant	Chemical Sealant	85/25 Grade Bituminous
Type of Cladding / Covering/ External Finish	0.5 MM GS Sheets	0.5 MM GS Sheets	0.5 MM GS Sheets	With tar felt & 100 MM Trimix
Locking/Fixing & Sealing System in case of Metal Skin Composite Panels	N.A.			
Any other info	---	---	---	---

viii) Cold Store Doors & Air Curtains:-

Type of Insulation	Details
No. of Insulated doors	11 (5 double leaf, 3 single leaf & 3 swing type)
Type hinged / sliding	hinges
Insulation Material EPS / PUF / Others	PUF
Thickness of Insulation (mm)	8nos. 40mm thick, & 3nos., 80 mm thick
Type of cladding	GI Pre-coated
Size of door opening (mm)	1500 x 2100 (5nos.), 1200 x 2100 (6nos.)
Provision of Strip curtains – nos. & overlap %	11 Nos & 20% Overlap
Air curtains, if any	NA
Others	NA

ix) Material Handling

–**Proposed Practice** : Manual

Procedure	Brief Description
Material Handling Procedures & Equipment	- Hand Pallate Truck 1.0 MT
Cap of Electric Elevator Rating of motor (kW)	NA
Any other device	NA

x) Grading, Sorting Washing, waxing Line

– **Proposed Practice** : Manual / Semi Automated

Procedure	Brief Description
Process Line	
Total Connected Load (kW)	45 Kw

C. Heat Load Calculation of Cooling System – Summary

Ambient Conditions	Summer	Monsoon	Winter
Dry Bulb Temperature (°C)	48	32	13
Wet Bulb Temperature (°C)	25	26	9

Refrigeration Load		During Loading (kW)	During Pull Down (kW)	During Holding (kW)
Transmission Load		6.0	6.0	6.0
Product Load		6.0	6.0	2.0
Internal Load	Lighting load	3.0	1.0	1.0
	Occupancy load	3.0	1.0	1.0
Infiltration Load		3.0	1.0	1.0
Ventilation/ Fresh Air Load		6.0	1.0	1.0
Equipment Load - Fan motors etc.		5.0	5.0	5.0
Total Load (kW/24 hrs)		32.0	21.0	17.0

Compressor Operation Hours/Day	Loading Period	4.0
	Pull Down Period	14.0
	Holding period	6.0

Multipliers	Safety Factor	1.1
	Defrost Period	Off Cycle

Cold Store

Total Refrigeration Load	Peak Period	Holding Period	Lean Period
Total Load (KW)	16.0	6.0	2.0

Please attach detailed heat load calculation sheets of the proposed cold store unit in accordance to the prescribed Technical Standards and Guidelines duly approved by a Qualified Engineer.

D. Cooling System Design & Equipment Selection

i) Cooling System Configuration

Type of Refrigerant	Freon R404a
Type of System	DX Type
Type of compressor	Recei/Scroll
Type of capacity control	On/Off Type
Type of condenser	Air-Cooled
Cooling Towers (if applicable)	NA
Type of cooling coil	Ceiling suspended
Type of defrosting	Off Cycle
Humidification System & Control (Brief Description)	Ultrasonic steam humidifier.

ii) Compressor Detail:

Compressor Make & Model	Nos.	Comp. RPM	Operating Parameters Evap. SST. / Cond. Temp (°C)	Refrigeration Capacity (KW)	Motor Rating. (KW)	Total Electric Power. (BkW)	Remarks Working /Standby
Emerson	4	1440	-2 DegC/50 DegC	32.0	4.0	20.0	Working

iii) Secondary Brine System

Make & Model	Nos.	Operating Parameters inlet/outlet (°C) &flow (lps)	Chiller Capacity (kW)	Recirculation Pump Motor Rating (kW)	Total Electric Power (BkW)	Remarks Working /Standby
NA						

iv) Condenser Details

Condenser Make & Model	Nos.	Operating Parameters Cond.Temp.(SDT)/ in/out water temp(^o C) &flow (lps)	Condenser Capacity (kW)	Electric Fan /Pump Motor Rating (kW)	Total Electric Power (BkW)	Remarks Working /Standby
Carrier/Daikin	4	+50 DegC	10.0	4.0	16.0	Working

v) Cooling Tower Details (if applicable) (Each chamber)

Cooling Tower Make & Model	Nos.	Operating Parameters DB & WB Temp, in/out water temp(^o C)	Cooling Tower Capacity(KW)	Fan & Pump Capacity (CMH/LPS) & Motor (kW)	Total Electric Power (BkW)	Remarks Working /Standby
NA						

**vi) Condensing Unit Details – for HFC / HCFC
Proposed 01 No Condensing units Each Chambers**

Make & Model – condensing unit	Make & Model – compressor	Qty – condensin g unit (nos)	Qty – compres sor per cond unit (nos)	Operating Parameters Cond.Temp.(SDT)/ in/out water temp(^o C) &flow (lps)	Refrigeration capacity (kW)	Condenser Capacity (kW)
Carrier/ Daikin	Emerson	04	04	50 DegC	32.0	40.0

vii)

Electric Fan /Motors Kw 4.0	Compressor power consumption (kW) 16.0	Total Electric Power consumption (KW) 20.0
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viii) Air Cooling Units (ACU)

ACU Make & Model	Nos.	Operating Parameters Evap. (SST)/ inlet-outlet & TD* (^o C)	Cooling Capacity (kW)	Air Flow (CMH) & Face Velocity (M/S)	Material of Coil Tubes & Fins	Fin pitch (mm)	Total Fan Electric Power (BKW)
Carrier/ Daikin	04	-2/+50	8.0	4700	Cu & Al	4	1.0

(*) TD – Temperature difference between Evap. (SST) °C & Return Air (at coil inlet).

Please attach Detailed Technical Data Sheets of each equipment namely Compressors, Condensers, Cooling Towers, Air Cooling Units giving General Layout, Dimensions, Material of Construction, Rated Capacity, Operating Parameters and COP (please note that the Air Cooling Unit data sheet should include heat transfer area, fin spacing, no. of rows, air flow, face velocity, fan static, air throw, Fan Motor BKW/KW, fin spacing, etc) duly Certified by the respective equipment manufacturers with reference to the Relevant Codes & Standards. (AS PER DATA SHEET OF CA STORAGE)

ix) Electrical Installation

Total Connected load (kW)	20.0 KW
Estimated power requirement at Peak Load Period (BkW)	18.0 KW
Estimated power requirement at Holding Load Period (BkW)	14.0 KW
Estimated power requirement at Lean Load Period (BkW)	6.0 KW
Capacity of Transformer (KVA) (proposed)	160 KVA
Size of Capacitor for power factor correction & their operation	PF KVA
Make & Capacity of standby D.G. Set (KVA)	Kirloskar

x) Safety Provisions

Details of Fire Fighting equipment	Dry	1. ‘ABC’ (Multi-Purpose) Dry Powder Type stored pressure Fire Extinguisher complete with pressure indicator gauge. Squeeze grip lever type valve & wall fixing bracket extinguisher confirming to 15:13049 with ISI mark. 2. G.I. Fire Buckets with M.S. Stand confirming to IS:3594
	Water based	Will be considered if local authorities insists
Handling Refrigerants & Leaks	Leak Detection	
	Handling measures	(i) First Aid Kits (ii) Display of Instructions for Handling Emergencies.

Safety devices – LP/HP cutouts, safety valves, shut off valves etc.	Provided
Details of Emergency alarm system & push-button system in cold chambers	Emergency alarm in Common Public Area
Emergency lighting in Cold chambers & other areas	Battery operated electrical inverter /UPS
Lightening arrestors	As per local regulations
Any other safety provisions	Other safety measures as per code of Practice IS-3594

xi) Codes & Standards Followed

Building Design & Structure	As per NBC / NHB standards
Construction Materials	A class Building Material to be used.
Thermal Insulation & Application	As per IS Code- IS:661 and IS:13205
Refrigeration Equipment & Systems	As per Technical Standards
Electrical & Mechanical Systems	As per Technical Standard
Food Safety	As per Technical Standard
Others	

xii) Energy Saving Equipment & Measures

Details of Energy Saving devices	Brief Description & Savings
Light Fixtures CFL/LED	Low voltage tube/ CFL
Natural Lighting for general areas	Yes
VFD for fans / compressors	NA
Refrigerant Controls and Automation	Yes, Temperature Indicator cum controllers for individual chambers, centralized temperature indicator in machine room.
Air Purger	NA
Power Factor Controller	Power Factor Indicator and Controller to be installed
Energy recovery heat-exchanger for Ventilation System	NA

Renewable/ Solar Energy e.g. PV lighting	NA
PLC Control, & Data Acquisition	----, As per Technical Standard
Any other features e.g. water recycling, rain water harvesting ...	---

xiii) Operation & Maintenance

Description	Nos. / Details
Proposed staff for Operation & Maintenance	02 Persons
Proposed Annual Maintenance Contracts (if any)	To be provided
Training & Preventive Maintenance procedures	Will be done
Sanitation & Hygiene practice	Yes, Wash Room/Sanitary Arrangements shall be provided
Pollution Control	(Non polluting unit)

xiv) Estimated Performance Parameters of Proposed Cold Store

Parameters	Peak Period	Holding Period	Lean Period
Coefficient Of Performance (COP)of the Cold Store Unit	2.0	2.2	2.5
Power Consumption (KWH/Day)	300	200	150
Total Electricity Cost (Rs/Day)	3000	2000	1500
Electricity Cost towards Storage (Rs/ MT /Day)	16.0	25.0	33.0

ACCEPTABLE MAKES OF ELECTRICAL ITEMS

Sr. No.	Item description	Make
1	ACB conforming to IEC 60947-2 with 50 KA breaking capacity, Icu=Ics, Icw for 1 Sec., with microprocessor based LSIG protection.	L&T U Power with RS 2.5 G release. Siemens 3WT with ETU 37WT release.
2	MCCB D/O handle. Icu= Ics.	L&T D-sine / Siemens 3 VL / Schneider.
3	Automatic load transfer switch (ATS).	Asco Series 200 / Cummins OTPC Level 1.
4	Switch-fuse unit	L&T FNX / Siemens Super switch.
5	On load change over switch with switch fuse.	HPL.
6	Power & Aux. Contactors.	L&T / Siemens.
7	MCB with 10 KA breaking capacity.	Legrand Lexic.
8	RCCB HPI type.	Legrand.
9	MCB Distribution boards.	Legrand.
10	Load Manager with 1.0 class.	Conzerv EM 6400 with RS 485 port.
11	Ammeter & voltmeter digital type.	Conzerv.
12	Electronic type energy meters.	Conzerv.
13	CTs with 1.0 class.	AE / Eq.
14	Push buttons.	Teknic / Esbee / Eq.
15	Indicating lamps LED type.	Teknic / Esbee / Eq.
16	Selector switches.	Kaycee / Salzer / Eq.
17	Control fuses.	GE / C&S.
18	Terminals.	Elmex / Connectwell.
19	H.T Load Break Panel.	Crompton / Schneider / Eq.
20	APFC Panel.	ABB / Neptune / Meher.
21	LV Power & Control cables.	Finolex / Polycab / Rallison.
22	FRLS type copper wires.	Finolex / Polycab / L&T / RR.
23	PVC conduit / casing & capping.	Precision / Diamond.
24	Lighting switches.	Anchor Roma / Vinay Carol.
25	Lighting fixtures.	Wipro / Crompton / Philips.
26	Ceiling fans.	Crompton.
27	Exhaust fans.	Crompton / GE / Alstom.
28	Cable lugs	Dowells
29	Cable glands	Comet
30	Metal clad plug sockets.	Legrand Lexic.
31	DLP trunking.	Legrand.

Sr. No.	Item description	Make
32	RG 6 wire.	Finolex / Polycab / RR.
33	Cat 6 UTP cable.	D-link / Legrand.
34	Multi core copper flexible wires.	Finolex / Polycab / RR / Rallison.
35	Telephone wires.	Finolex / Polycab / RR.
36	Power Busbar.	Schneider Canalis / Legrand Zucchini.
37	Transformer.	Kirloskar / Crompton / Voltamp / Kamath / Vijay / Nissar / Mahati.
38	D.G. set with sound proof canopy as per CPCB norms.	Cummins / Kirloskar.
39	L.T. Panels.	Will be approved by Consultant based on set-up & quality.
40	Pipe in pipe earthing system.	Ashlok / UES / Fast track / Eq.
41	Passive infrared sensors for lighting control.	Blue Technologies. Email: bluesachin@gmail.com.
42	Early Streamer Emission Lightning protection system.	Stormaster / Eq.
43	Solid state Annunciator.	Minilec/Eq.
44	Servo Stabilizer.	Servomax / Power Integration.

CHAPTER – 7

PROJECT PREPAREDNESS AND IMPLEMENTATION SCHEDULE

NOC's/ Approvals/Permissions

List of NOC's/ Approvals/Permissions required and their status is indicated in the following table:

Management and administration

Beneficiary has to appoint an Architect for preparing civil estimate. A competent project team for developing and implementing the project will be deployed.

Technical and financial tie ups

The Board of Directors of a firm/Beneficiary will study the need of Packhouse with sorting, grading and waxing line and precooling and cold storage unit for the oranges. Consultants and experts will be appointed as and when required, during the development and implementation of this project. MSAMB will guide the beneficiary. Beneficiary will bring in the required equity through internal accruals. SAMP Pnc will guide beneficiary for availing term loan.

Project management

The project management for the proposed project will be under able leadership of Chairman/Directors of the beneficiary. The appointed experts, consultants and existing staff of the beneficiary will together work in tandem and develop/ implement this project.

Required man power will be appointed. Project monitoring/ management will work almost on daily basis and as per the final bar chart/ implementation schedule developed after ordering plant and machinery.

Project implementation

For implementation this project within the desired time and cost schedules, it is essential to undertake meticulous planning, right from the conceptual stages. Following aspects of the project implementation will be crucial.

Effecting timely project development activities, including securing approval for Govt. grant and NOC/approval for each component of the project.

Arranging required term loan from the Financial Institution(s), rendering required follow-up. MSAMB Project Advisor shall guide at every step.

Finalization of mode of project implementation package route, O & M contracts for individual

project components, along with strong team from the Beneficiary for effective monitoring of the implementation of the project as per schedule is recommended.

Manpower and resource mobilization at required time is needed.

Project schedule

The zero date of the project starts from the sanction of grant, and term loan sanctioned from FI and also financial closure. The total estimated period for erection and commissioning of plant is estimated 6 to 8 months. Appendix – gives the implementation schedule.

The detailed PERT/CPM networks for the project will have to be prepared by the time of achieving the financial closure. Normally the major activities include-

- Appointment of consultant, project architect
- Basic engineering and finalizing specifications
- Detailed design engineering and specifications
- Preparation of package bids, bidding, bid evaluation, recommendations and contracting for civil, mechanical/refrigeration, electrical and instrumentation components.
- Kick off meetings with individual vendors/contractors
- Vendor drawing review and approvals, inspection, expediting and delivery at site
- Site supervision for erection, testing and commissioning
- Bidding, contracting and signing OF, O and M contracts

CHAPTER-8

FINANCIAL VIABILITY

8.1 Introduction

This is a model project Report for the Primary Orange Processing Unit involving a Pack house with a sorting, grading and waxing line (8 TPH), a precooling (6 MT capacity per batch and a cold storage unit (25MT capacity each, 2nos.).

The financial viability of the said unit has been worked out. The details have been explained in following paras.

8.2 Project cost

The project cost estimates have been prepared on the assumptions that the plant & machinery as per standard specifications shall be purchased from the approved machinery suppliers in India, whereas the civil construction of various buildings and machinery foundation shall be carried out by the local contractors using locally available construction materials.

On the basis of present market price and anticipated escalations up to the scheduled date of commissioning, the capital cost of the proposed scheme will be Rs.443.33 lac .

8.2 Total cost of project

Sr. No.	Particulars	Amount (Rs. lac)
1	Land and Land Development	0.00
2	Building & other civil work	199.21
3	Plant and Machinery including Taxes & Duties	199.14
4	Misc. Fixed Assets	4.64
5	Preliminary & Pre-operative and contingency	19.21
6	Margin Money	21.14
	Total	443.33

8.2.1 Particulars of Land

Sr. No.	Particulars	Amount (Rs. lac)
1	Land (available)	0.00
	Total	0.00

8.2.2 Particulars of Civil Works To be Made

Sr. No.	Particulars	Amount (Rs Lac)
1	Civil & structural work, roads, fencing , GST	195.30
2	Architecture's Fees	3.91
	Total	199.21

8.2.3 Details of Plant and Machinery

Sr.No.	Particulars	Amount (Rs Lac)
A	Pack house, grading line, Precooling and Cold storage Plant	
1	Puff panels, doors & electricals etc	51.25
2	Refrigeration plant & machinery for hall, precooling and cold storage	53.65
3	Grading line (8TPH)	40.00
4	DG set (160KVA)	19.36
5	Transformer	4.50
	Total	168.76
	GST @ 18%	30.38
	Grand Total	199.14

8.2.4 Miscellaneous Fixed Assets

Sr No.	Particulars	Amount (Rs Lac)
1	Furniture, PC, Firefighting, weighing machine	4.64
	Total	4.64

8.2.5 Pre -operative Expenses

Sr No.	Particulars	Amount (Rs Lac)
1	Government clearance	0.50
2	Establishment expenses Fees	0.50
3	Stamp duty & legal Expenses	1.00
4	Travelling Expenses	0.60
5	Rent, rates & taxes	0.25
6	Printing, stationery , postage & telephone	0.25
7	Insurance during erection & Interest capitalization on Term Loan	10.00
	Total	13.10

8.2.6 Contingency Charges

Sr No.	Particulars	Amount (Rs Lac)
1	Building & Civil Works (in civil estimate considered)	0.00
2	Plant & Machineries @ 3%	5.97
3	Other Fixed assets @ 3%	0.14
	Total	6.11

8.2.7 Margin Money

Sr No.	Particulars	Amount (Rs Lac)
1	Margin Money	21.14
	Total	21.14

8.3 Means of Finance

The Pack house with grading and waxing line, precooling and cold storage unit will be beneficial for fetching better price for the oranges. The financing pattern of such proposal is 85% debts and 15 percent own equity. However, the beneficiary is likely to receive subsidy of Rs 200 Lacs. The debt percentage shall reduce to 39.89 %

The financing pattern for the model project of pack house is envisaged as under.

Sr.No.	Particulars	Percent	Amount, Rs lac
1	Own Equity	15.00%	66.50
2	Debt		
	Term loan	39.89 %	176.83
3	Subsidy under package	45.11%	200.00
	Total	100	443.33

8.4 Assumptions Underlying the Profitability Projections

The proposed orange processing Project of the Pack house with grading and waxing line and precooling & cold storage unit is expected to be completed by the end of Oct 2025 and commercial production will start probably from Nov 2025. The assumptions in regard to production of following products have been taken as under.

Sr.No.	Particulars	Year		
		I	II	III
1	Orange processing Pack house with sorting, grading & waxing, precooling & Cold storage unit	64 TPD	64 TPD	64 TPD
2	Capacity Utilization, Percent	70	80	90
3	Net working days	105	120	135
4	Total Oranges handled , MT/A	6720	7680	8640
5	Graded Oranges 80% of total, MT/A	5376	6144	6912
6	Oranges < 50MM size handled, MT/A	1344	1536	1728
7	Oranges in cold storage, 15cycles/A, MT /A	525	600	675

8.5 Scheme of Project Implementation

Estimated capital cost and the financial viability of the proposed orange pack house cum grading, waxing line, precooling & cold storage unit has been worked out on the assumption that the above project shall be completed by the end of October 2025.

8.6 Physical Targets

The financial viability and profitability projections along with funds flow statement for the next ten years are based on the following physical targets.

Sr.No.	Particulars	Unit	Value
1	Pack house with sorting & grading line(8TPH), Precooling (6MT) & Cold storage (50MT) plant,	MT/day	64
2	Capacity Utilization (from 4th year	%	100

	onward)		
3	Gross Working Day, Max.	Days/A	150
4	Oranges handled/A	MT/A	9600
5	Graded Oranges/A	MT/A	7680
6	Oranges < 50MM size handled/A	MT/A	1920
7	Oranges kept in cold storage,15 cycles/A	MT/A	750

8.7 Financial Projections

The projected financial forecast for the next 10 years for pack house, sorting cum grading and waxing line, precooling and cold storage unit have been worked out on the above physical targets at 100% capacity utilization and it is furnished at Annexure - I. The summarized results of the above-mentioned period are as under:

Sr.No.	Particulars	Amount, Rs lac
1	Net Sales	27196.08
2	Less: Operating Cost	25142.14
3	Profit/ loss before depreciation, Tax and interest	2053.94
4	Less: Rs Lac	
	a) Depreciation	303.37
	b) Interest on Term loan	77.81
	c) Interest on working Capital	69.49
	d) Income tax on profit	508.12
5	Profit/loss after depreciation, interest and tax on term loans & Working Capital	1095.15
6	Add back depreciation	303.37
7	Total Cash Accruals	1398.52

8.8 Basic Financial Parameters of Projected Profitability

While preparing the projected profitability, the following financial parameters have been assumed.

8.9.1 Sales Realization

Sr.No.	Particulars	Unit	Value
1	Graded Oranges	Rs/ MT	34000
2	Oranges < 50MM size	Rs/Ton	10000
3	Additional price fetched due to cold stored Oranges	Rs/ Ton	12000

8.9.2 Cost of purchase of Oranges per MT

It is considered Rs 15000 per MT

8.9.3 Cost of Utilities

It is given in Annexure 10. The utilities cost is estimated as Rs 18Lakh at 100% capacity utilization

8.9.4 Salary and Wages

The calculation of salary and wages is considered in Annexure 9. The estimated cost of direct salary and wages shall be Rs 7.12 lakh per annum

8.9.5 Repairs & Maintenance

The percentage of repairs and maintenance on Building and fixed assets as 1% and Plant & Machinery is considered 1.5 % from 1st year onwards.

8.9.6 Insurance

The insurance charges on building ,plant & machinery and fixed assets cost & on stock @ 0.5 % has been considered.

8.9.7 Depreciation

The depreciation has been calculated as per provisions of the Companies Act, 2013 on straight-line method on total plant.

8.9.8 Interest on Term Loan

It has been assumed in the projections that the total term loan of FI amount of Rs.176.83 lac will be repaid in 14 equal (half yearly) installments with one-year moratorium period after completion of the project. Interest rate has been assumed at the rate of 11 % per annum.

8.9.9 Arrangement of Working Capital

Rate of interest on working capital loan is assumed @ 11% per annum.

8.10 Projected balance sheet:

The projected balance sheet for the next 10 years after completion of the proposed scheme of the project is enclosed.

8.11 Financial Parameters

Sr. No.	Particulars	Average DSCR	BEP at 100% installed Capacity	Pay Back Period (PBP)	Internal Rate of Return (IRR)
1	Base Case: Orange purchase price 15000/MT, Graded Oranges sale price as Rs 34000/MT, Reject oranges(<50MM size) Rs 10000/MT and additional price	2.57	26.38	2Yr 5Months	37.28

	due to keeping in cold storage as 12000/MT				
2	If Orange price is increased by Rs 500/MT i.e. Rs 15500/MT, sale price as above	2.02	33.15	3Yr	33.54
3	If Sale price of graded oranges decreased by Rs 500/MT i.e. Rs 33500/MT	2.13	31.50	2Yr 10 Months	34.43

8.11.1 The Projected Funds Flow Statement

From the projected funds flow statement placed at Schedule-D, it is apparent that the factory will start repayment of term loan installments from the second year after commissioning of the project and the total amount of Bank term loan including interest thereon will be repaid fully in 8th year after completion of the scheme

8.11.2 Sensitivity Analysis

It has been carried out and financial parameters have been given in 11.1

8.11.3 Important Financial Indicators

The important financial indicators for the project are as follows-

Sr.No.	Particulars	Value
1	Internal Rate of Return (IRR)	37.28 %
2	Break Even Point (BEP)	26.38 %
3	Pay Back Period (PBP)	2 years 5 Months
4	Debt Service Coverage Ratio (DSCR)	
	Average	2.57
	Maximum	4.33
	Minimum	1.74

The project is financially viable based on the above financial parameters which are favorable.

CHAPTER – 9

CONCLUSION AND RECOMMENDATION

SWOT ANALYSIS

Strengths

- Amravati and Nagpur districts are known for best quality of **Oranges**.
- Government of Maharashtra is encouraging APMC, FPO, Co-operatives and Entrepreneurs for such Orange value addition projects.
- The various sites proposed are in the orange growing area and **near to the main cities** such as Amravati, Nagpur. Therefore, well connected by air, rail and road network.
- **Required manpower** is available in around the project.
- The **farmers shall be benefited** and will get better price for their produce mainly citrus fruits(Oranges, Sweet lime and lemon).

Weakness

- Availability of raw materials can be subject to **the vagaries of climate**.
- Agriculture in the region has remained primitive with very **little standardization**.
- **Awareness among the farmers** regarding the use of latest technology of sorting, grading and waxing and cold storage Technology may require some time.

Opportunities

- Tremendous demand for the Oranges in the domestic and International markets countries like Bangala desh and adjoining Asian countries and Arebian countries.
- Increasing trend in the consumers to use the Orange based products.
- Direct marketing to end-user is possible through retail network.
- Rural regions of the state would have greater exposure towards national and International markets and various income generation avenues.

Threats

- Delay in the installation of the project may cause loss to the orange growing farming community.
- Delay in developing the project may increase the project cost.

Key Management Features

- Appointment of project team, required experts and consultants right from beginning.
- Securing all required permissions/NOC's/approvals quickly.
- Selection of right technology and equipments suppliers for the proposed project.
- Effective project management for timely execution.

CONCLUSION AND RECOMMENDATION

The captioned project is technically feasible and commercially of immense importance to farming community in particular. The project is recommended for immediate implementation. The backward and forward linkages of the project as well as socio-economic benefits to the farming community in the operational area of Vidarbha region make this a win-win project to all stakeholders.

SCHEDULES

(Rs.In Lakhs)

SCHEDULE- A

ESTIMATED COST OF THE PROJECT

Sr. No.	PARTICULARS	Annexure	AMOUNT
1	Building	1	199.21
2	Plant and Machinery	2	199.14
3	Misc. Fixed Assets	3	4.64
4	Preoperative & Preliminary Expenses	4	13.10
5	Contingency Provision	5	6.11
6	Margin Money for Working Capital	6	21.14
	TOTAL		443.33

MEANS OF FINANCE

(Rs.In Lakhs)

Sr. No.	PARTICULARS	AMOUNT
1	Promoter's contribution 15.00%	66.50
2	Govt. Subsidy(200Lakh) 45.11%	200.00
3	Term Loan from FI 39.89%	176.83
	TOTAL 100%	443.33

SCHEDULE - B

PROJECTED PROFITABILITY STATEMENT

(Rs.In Lakhs)

Sr.No.	PARTICULARS	Operating years									
		1	2	3	4	5	6	7	8	9	10
1	No. of working days/Annum	150	150	150	150	150	150	150	150	150	150
2	Capacity Utilization	70%	80%	90%	100%	100%	100%	100%	100%	100%	100%
3	Sales Realization	2025.24	2314.56	2603.88	2893.20	2893.20	2893.20	2893.20	2893.20	2893.20	2893.20
4	Production Cost										
	a) Raw Material	1845.31	2108.93	2372.54	2636.16	2636.16	2636.16	2636.16	2636.16	2636.16	2636.16
	b) Wages & Salaries	6.45	7.05	7.11	7.12	7.12	7.12	7.12	7.12	7.12	7.12
	c) Consumables & Packaging	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	d) Utilities	12.60	14.40	16.20	18.00	18.00	18.00	18.00	18.00	18.00	18.00
	e) Repaires and maintenance	5.03	5.03	5.03	5.03	5.03	5.03	5.03	5.03	5.03	5.03
	f) Other manufacturing expenses	6.56	6.71	6.86	7.01	7.16	7.31	7.46	7.61	7.76	7.91
	TOTAL Production Cost	1875.95	2142.11	2407.74	2673.31	2673.46	2673.61	2673.76	2673.91	2674.06	2674.21
5	Gross Profit (EBIDT)	149.29	172.45	196.14	219.89	219.74	219.59	219.44	219.29	219.14	218.99
	b) Interest on Working capital	6.98	6.97	6.95	6.94	6.94	6.94	6.94	6.94	6.94	6.94
	c) Interest on Term Loan	19.45	16.67	13.89	11.12	8.34	5.56	2.78	0.00	0.00	0.00
	d) Interest of O/S loan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	6) Income Before Depreciation	122.86	148.80	175.29	201.83	204.46	207.09	209.72	212.35	212.20	212.05
	a) Depreciation (SLM)	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34
7	7) Operating profit (PBT)	92.53	118.47	144.95	171.49	174.12	176.75	179.38	182.01	181.86	181.71
8	8) Tax @ 30%	27.76	36.30	44.94	53.53	54.89	56.16	57.44	58.67	59.05	59.37
9	9) Net Profit (PAT)	64.77	82.17	100.02	117.96	119.23	120.59	121.94	123.34	122.80	122.34

SCHEDULE-C

DEBT SERVICE COVERAGE RATIO (DSCR)

(Rs.In Lakhs)

PARTICULARS	Operating years									
	1	2	3	4	5	6	7	8	9	10
Profit After Tax	64.77	82.17	100.02	117.96	119.23	120.59	121.94	123.34	122.80	122.34
Depreciation	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34
Interest on term loan	19.45	16.67	13.89	11.12	8.34	5.56	2.78	0.00	0.00	0.00
Interest of O/S loan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total inflow	114.56	129.18	144.25	159.42	157.90	156.48	155.06	153.68	153.14	152.68
Interest on term loan	19.45	16.67	13.89	11.12	8.34	5.56	2.78	0.00	0.00	0.00
Installments term loan	0.00	25.26	25.26	25.26	25.26	25.26	25.26	25.26	0.00	0.00
Interest on working capital	6.98	6.97	6.95	6.94	6.94	6.94	6.94	6.94	6.94	6.94
Installment of O/S loan	0.00	25.26	25.26	25.26	25.26	25.26	25.26	25.26	0.00	0.00
Total outflow	26.43	74.17	71.37	68.58	65.80	63.02	60.24	57.46	6.94	6.94
Annual DSCR	4.33	1.74	2.02	2.32	2.40	2.48	2.57	2.67	0.00	0.00
Average DSCR	2.57									
Maximum DSCR	4.33									
Minimum DSCR	1.74									

SCHEDULE- D											
PROJECTED CASH FLOW STATEMENT											
											(Rs.In Lakhs)
PARTICULARS	Operating years										
	YR.OF IMM.	1	2	3	4	5	6	7	8	9	10
A) Source of Funds											
a) Share Capital	66.50	.----	.----	.----	.----	.----	.----	.----	.----	.----	.----
b) Govt Subsidy	200.00										
c) Long Term Loan	176.83	.----	.----	.----	.----	.----	.----	.----	.----	.----	.----
d) Profit aft.Int. & Depn. & Taxation		64.77	82.17	100.02	117.96	119.23	120.59	121.94	123.34	122.80	122.34
e) Depreciation		30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34
f) Working Capital Loan		21.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	443.33	116.25	112.50	130.35	148.30	149.57	150.93	152.28	153.68	153.14	152.68
B) Application of Funds											
a) Capital Expenditure	402.98	.----	.----	.----	.----	.----	.----	.----	.----	.----	.----
b) Repayment of Term Loan		0.00	25.26	25.26	25.26	25.26	25.26	25.26	25.26	0.00	0.00
c) Repayment of O/S Loan		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d) Increase in Working Cap.		63.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	402.98	63.42	25.26	25.26	25.26	25.26	25.26	25.26	25.26	0.00	0.00
C) Opening Cash and bank balance		40.35	93.18	180.42	285.51	408.55	532.86	658.52	785.54	913.95	1067.09
D) Current Bank Credits	40.35	52.83	87.24	105.09	123.04	124.31	125.66	127.02	128.41	153.14	152.68
E) Closing Cash & Bank balance	40.35	93.18	180.42	285.51	408.55	532.86	658.52	785.54	913.95	1067.09	1219.77

SCHEDULE-E

PROJECTED BALANCE SHEET

(Rs.In Lakhs)

PARTICULARS	Operating years										
	YR.OF IMM.	1	2	3	4	5	6	7	8	9	10
A) LIABILITIES											
a) Share Cap.(Promoter)	66.50	66.50	66.50	66.50	66.50	66.50	66.50	66.50	66.50	66.50	66.50
b) Govt. Subsidy	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00	200.00
c) Profit & Reserve		64.77	146.93	246.95	364.91	484.14	604.73	726.67	850.01	972.81	1095.15
d) Term Loan	176.83	176.83	151.57	126.31	101.05	75.78	50.52	25.26	0.00	0.00	0.00
e) Loan O/S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
f) Working Cap. Loan		21.14	21.14	21.14	21.14	21.14	21.14	21.14	21.14	21.14	21.14
TOTAL	443.33	529.24	586.14	660.90	753.60	847.57	942.89	1039.57	1137.65	1260.45	1382.79
B) ASSETS											
a) Fixed Assets (Net Of Depreciation)	402.98	372.64	342.30	311.97	281.63	251.29	220.95	190.62	160.28	129.94	99.60
b) Initial Wkg.Cap.Ass.		63.42	63.42	63.42	63.42	63.42	63.42	63.42	63.42	63.42	63.42
c) Addl.Cur. Assets	40.35	93.18	180.42	285.51	408.55	532.86	658.52	785.54	913.95	1067.09	1219.77
TOTAL	443.33	529.24	586.14	660.90	753.60	847.57	942.89	1039.57	1137.65	1260.45	1382.79

SCHEDULE- F
BREAK EVEN ANALYSIS

(Rs.In Lakhs)

Sr.No.	Particulars	Operating Years									
		1	2	3	4	5	6	7	8	9	10
I	Sales	2025.24	2314.56	2603.88	2893.20	2893.20	2893.20	2893.20	2893.20	2893.20	2893.20
II	Variable Expenses										
	1. Raw Material	1845.31	2108.93	2372.54	2636.16	2636.16	2636.16	2636.16	2636.16	2636.16	2636.16
	2. Wages and salaries	1.61	1.76	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78
	3. Consumables and packaging	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4. Utilities	6.30	7.20	8.10	9.00	9.00	9.00	9.00	9.00	9.00	9.00
	5. Other manufacturing expenses	3.28	3.35	3.43	3.50	3.58	3.65	3.73	3.80	3.88	3.95
	6. Interest on working Capital	5.23	5.23	5.22	5.21	5.21	5.21	5.21	5.21	5.21	5.21
	Total variable cost	1861.74	2126.47	2391.07	2655.65	2655.72	2655.80	2655.87	2655.95	2656.02	2656.10
III	Contribution (I-II)	163.50	188.09	212.81	237.55	237.48	237.40	237.33	237.25	237.18	237.10
IV	Fixed Expenses										
	1. Salary & Wages	4.84	5.29	5.33	5.34	5.34	5.34	5.34	5.34	5.34	5.34
	2. Utilities	6.30	7.20	8.10	9.00	9.00	9.00	9.00	9.00	9.00	9.00
	3. Other manufacturing expenses	3.28	3.35	3.43	3.50	3.58	3.65	3.73	3.80	3.88	3.95
	4. Interest on Term Loan	19.45	16.67	13.89	11.12	8.34	5.56	2.78	0.00	0.00	0.00
	5. Interest on working capital	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74
	6. Depreciation (S.L.M.)	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34
V	Total fixed expenses	65.95	64.60	62.83	61.03	58.33	55.62	52.92	50.22	50.29	50.37
VI	Profit Volume Ratio %	8.07	8.13	8.17	8.21	8.21	8.21	8.20	8.20	8.20	8.20
VII	B.E.P Sales	816.91	794.90	768.80	743.31	710.61	677.89	645.14	612.37	613.48	614.59
VIII	B.E.P. Capacity %	40.34	34.34	29.53	25.69	24.56	23.43	22.30	21.17	21.20	21.24
	BEP at installed capacity	26.38									

SCHEDULE- G

PAYBACK PERIOD

(Rs.In Lakhs)

Particulars	Operating Years										
		1	2	3	4	5	6	7	8	9	10
Cash Outflow	-443.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subsidy		200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Profit after Tax		64.77	82.17	100.02	117.96	119.23	120.59	121.94	123.34	122.80	122.34
Depreciation (SLM)		30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34
Less: Prelim. Expenses		13.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cash inflow		282.01	112.50	130.35	148.30	149.57	150.93	152.28	153.68	153.14	152.68
Net Cash inflow		-161.32	-48.82	81.53	229.83	379.40	530.32	682.60	836.28	989.42	1142.10
The payback period is between		2years	5 Months								

SCHEDULE- H

INTERNAL RATE OF RETURN

(Rs.In Lakhs)

Particulars	Operating Years										
		1	2	3	4	5	6	7	8	9	10
Total outflow	443.33										
Subsidy		200.00									
Net profit after tax		64.77	82.17	100.02	117.96	119.23	120.59	121.94	123.34	122.80	122.34
Depriciation		30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34
Interest on term loan		19.45	16.67	13.89	11.12	8.34	5.56	2.78	0.00	0.00	0.00
Interest on O/S balance		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on Working Capital		6.98	6.97	6.95	6.94	6.94	6.94	6.94	6.94	6.94	6.94
NET CASHFLOW		321.53	136.15	151.20	166.36	164.84	163.42	162.00	160.62	160.08	159.62
INTERNAL RATE OF RETURN		37.28	%								

ANNEXURES

ANNEXURE - 1
PARTICULARS OF PROPOSED BUILDING

(Rs.In Lakhs)

Sr. No.	PARTICULARS	AMOUNT
1	Construction Cost inclusive of, Contingency, roads , Fencing & GST	195.30
2	Architect 2 %	3.91
	Total	199.21

ANNEXURE - 2

ESTIMATED COST OF PLANT & MACHINERY

(Rs lakh)

Sr. No.	PARTICULARS	Quantity	Unit	Unit Rate	Amount
	Puff Panels & doors & eletricals etc	Lot			
1	for process hall, Precooling & cold storage		1	51.25	51.25
2	Refrigeration Machinery for hall, precooling & cold storage	lot	1	53.65	53.65
3	Grading Line (8TPH)	Lot	1	40.00	40.00
4	DG set(160KVA)	lot	1	19.36	19.36
5	Transformer	Lot	1	4.50	4.50
6	Grand Total				168.76
7	GST (18%)				30.38
	Total				199.14

ANNEXURE - 3
MISCELLANEOUS FIXED ASSETS

(Rs. Lakhs)

Sr. No.	Particulars	Estimated Cost	P & F, Insurance @ 3%	Total Cost
1	Furniture, fixtures with computer	1.50	0.05	1.55
2	Weighing Machine	0.50	0.02	0.52
3	Firefighting System (Dry & Wet)	2.50	0.08	2.58
	Total	4.50	0.14	4.64

ANNEXURE - 4
PREOPERATIVE EXPENSES

(Rs. In Lakhs)

Sr. No	ITEMS	AMOUNT
1	Government Clearances	0.50
2	Establishment Expenses	0.50
3	Stamp duties & legal charges	1.00
4	Rent, Rates & Taxes	0.25
5	Travelling Exp.	0.60
6	Printing, Stationary, Postage & Telephone etc.	0.25
7	Miscellaneous Expenses	
	a) Insurance during Construction period	1
	b) Interest during Erection Period	12
	TOTAL	13.10

**ANNEXURE - 5
CONTINGENCY PROVISIONS**

(Rs.In Lakhs)

Sr.No.	Particulars	Percent	Cost	Amount
1	Building & Civil Works (In civil estimate)	0.00%	199.21	0.00
2	Plant & Machineries	3.00%	199.14	5.97
3	Other Assets @	3.00%	4.64	0.14
	TOTAL			6.11

**ANNEXURE - 6
MARGIN MONEY FOR WORKING CAPITAL**

(Rs.Lakhs)

Sr. No.	Particulars	Stocking level	Operating Years									
		Days	1	2	3	4	5	6	7	8	9	10
1	Raw Material	4	70.30	70.30	70.30	70.30	70.30	70.30	70.30	70.30	70.30	70.30
2	Consumables and Packing	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Salaries and Wages	30	1.84	1.76	1.58	1.42	1.42	1.42	1.42	1.42	1.42	1.42
4	Utilities	30	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60
5	Work- in- progress	1	8.82	8.82	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81
6	Net Working Capital		84.56	84.48	84.29	84.13	84.13	84.13	84.13	84.13	84.13	84.13
7	Margin Money	25%	21.14	21.12	21.07	21.03	21.03	21.03	21.03	21.03	21.03	21.03
8	Bank Borrowings	75%	63.42	63.36	63.22	63.10	63.10	63.10	63.10	63.10	63.10	63.10
9	Interest on Bank loan	11%	6.98	6.97	6.95	6.94	6.94	6.94	6.94	6.94	6.94	6.94

**ANNEXURE-7
PRODUCTION AND SALES**

(Rs.In Lakhs)

Particulars	Unit	Operating Years									
		1	2	3	4	5	6	7	8	9	10
A)Grading, waxing, packing & Transportation											
1. Orange fruit handling/day(8TPH) 8hrs working	MT/Day	64	64	64	64	64	64	64	64	64	64
2.Workiing days /Annum	Days/A	150	150	150	150	150	150	150	150	150	150
3. Capacity Utilization	Percent	70	80	90	100	100	100	100	100	100	100
4. Total oranges handled in MT/A	MT/A	6720	7680	8640	9600	9600	9600	9600	9600	9600	9600
5. Graded Oranges 80% of the total, MT/A	MT/A	5376	6144	6912	7680	7680	7680	7680	7680	7680	7680
6.Oranges less than 50 MM size handled, MT/A	MT/A	1344	1536	1728	1920	1920	1920	1920	1920	1920	1920
B) Cold storage Used											
1. Cold storage (25 MTx2Nos.), 15Cycles /Season	MT/A	525	600	675	750	750	750	750	750	750	750
C. Sales Revenue (Rs lakh)											
1. Grated Orange Sales @ Rs 34000/MT	34000	1827.8	2088.96	2350.08	2611.2	2611.2	2611.2	2611.2	2611.2	2611.2	2611.2
2. Oranges less than 50MM sales @ Rs 10000/MT	10000	134.4	153.6	172.8	192	192	192	192	192	192	192
3. Cold stored oranges , additional value @ Rs 12000/MT	12000	63	72	81	90	90	90	90	90	90	90
Total		2025.2	2314.56	2603.88	2893.2	2893.2	2893.2	2893.2	2893.2	2893.2	2893.2

ANNEXURE - 8

RAW MATERIAL & Processing (Grading , waxing & Cold storage use)

(Rs.In Lakhs)

Sr.No	PARTICULARS	Unit	Operating Years									
			1	2	3	4	5	6	7	8	9	10
A	Grading , Waxing, packaging & Transport											
1	Orange fruit handling per day (8TPH), 8hrs working	TPD	64	64	64	64	64	64	64	64	64	64
2	working days per annum (5months/A)	Days/A	150	150	150	150	150	150	150	150	150	150
3	Capacity utilization	percent	70%	80%	90%	100%	100%	100%	100%	100%	100%	100%
4	Total Oranges handled in MT	MT/A	6720	7680	8640	9600	9600	9600	9600	9600	9600	9600
5	Graded Oranges 80% of total, MT/A	MT/A	5376	6144	6912	7680	7680	7680	7680	7680	7680	7680
6	Crates for graded Oranges (Cap 25Kg), nos./Annum	Lakh nos.	2.15	2.46	2.76	3.07	3.07	3.07	3.07	3.07	3.07	3.07
7	Oranges less than 50 MM size handled , MT/A	MT/A	1344	1536	1728	1920	1920	1920	1920	1920	1920	1920
B	Cold storage used											
7	Cold storage (25MT*2 nos.), 15cycles per Annum	MT/A	525	600	675	750	750	750	750	750	750	750
C	Raw material , Processing Cost											
1	Orange as raw material value @Rs 15000/MT	15000	1008.00	1152.00	1296.00	1440.00	1440.00	1440.00	1440.00	1440.00	1440.00	1440.00
2	Harvesting & Transport to pack house @Rs1500/MT	1500	100.80	115.20	129.60	144.00	144.00	144.00	144.00	144.00	144.00	144.00
3	Unloading, waxing, packing & loading@ Rs 3500/MT	3500	188.16	215.04	241.92	268.80	268.80	268.80	268.80	268.80	268.80	268.80
4	Crates for graded Oranges (Cap 25Kg), @ Rs 105/no.	105	225.79	258.05	290.30	322.56	322.56	322.56	322.56	322.56	322.56	322.56
5	Transport cost ,Average Rs 6000/MT	6000	322.56	368.64	414.72	460.80	460.80	460.80	460.80	460.80	460.80	460.80
	Total		1845.31	2108.93	2372.54	2636.16	2636.16	2636.16	2636.16	2636.16	2636.16	2636.16

ANNEXURE - 9

MANPOWER REQUIREMENT & EXPENSES

(Rs.In Lakhs)

Sr.No.	PARTICULARS	Salary per annum (Rs.)	Operating Years									
			1	2	3	4	5	6	7	8	9	10
A	Supervisory/Mamt. Staff											
1	Manager	240000	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
		1										
2	Operator(Seasonal 5months)	90000	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
		1										
3	Accountant(seasonal 6months)	120000	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
		1										
4	Electrician cum Mechanics(seasonal 6months)	72000	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
		1										
	Sub-total (A)	4	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22
	Increment @ 10%	10%		0.52	0.57	0.58	0.58	0.58	0.58	0.58	0.58	0.58
	Welfare	15%	0.783	0.86	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
	Total (A)		6.00	6.60	6.66	6.67	6.67	6.67	6.67	6.67	6.67	6.67
5	Office boy (1)	45000	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
		1										
	Total direct wages/salaries		6.45	7.05	7.11	7.12	7.12	7.12	7.12	7.12	7.12	7.12

A N N E X U R E - 10
PARTICULARS OF UTILITIES

(Rs.In Lakhs)

Sr. No.	PARTICULARS	Unit	Operating years									
			1	2	3	4	5	6	7	8	9	10
1	Orange handling /day(max 12hr)	MT/day	64	64	64	64	64	64	64	64	64	64
2	working days /Annum(5Months/A)	days/A	150	150	150	150	150	150	150	150	150	150
3	Capacity utilization		70%	80%	90%	100%	100%	100%	100%	100%	100%	100%
4	Electrical load @100Kw/hr for 12hr/d	Lakh Units	1.3	1.4	1.6	1.8	1.8	1.8	1.8	1.8	1.8	1.8
5	Electrical cost @Rs 10/unit	10	12.6	14.4	16.2	18.0	18.0	18.0	18.0	18.0	18.0	18.0
	Total		12.6	14.4	16.2	18.0	18.0	18.0	18.0	18.0	18.0	18.0

A N N E X U R E - 11
PARTICULARS OF REPAIRS AND MAINTENANCE

(Rs.In Lakhs)

Sr. No.	PARTICULARS	Percent	Operating years									
			1	2	3	4	5	6	7	8	9	10
1	On building	1.0	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99	1.99
2	On Plant and Machinery	1.5	2.99	2.99	2.99	2.99	2.99	2.99	2.99	2.99	2.99	2.99
3	On Other Fixed Assets	1.0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Total		5.03	5.03	5.03	5.03	5.03	5.03	5.03	5.03	5.03	5.03

A N N E X U R E - 12
PARTICULARS OF OTHER MANUFACTURING EXPENSES

(Rs.In Lakhs)

Sr.No.	PARTICULARS	Percent	Operating years									
			I	II	III	IV	V	VI	VII	VIII	IX	X
1	Printing & Stationary		0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95
2	Postage & Telephone		0.50	0.55	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95
3	Travelling & Conveyance		0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10	1.15	1.20
4	Insurance on Building, Plant & Machinery & Fixed Assets	0.50%	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11
5	Insurance on Stocks	0.50%	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70	2.70
	Total		6.56	6.71	6.86	7.01	7.16	7.31	7.46	7.61	7.76	7.91

ANNEXURE - 13

REPAYMENT OF TERM LOAN AND CALCULATION OF INTEREST

(Rs.In Lakhs)

PARTICULARS	Operating years									
	1	2	3	4	5	6	7	8	9	10
Term Loan from Bank O/S Balance	176.83	151.57	126.31	101.05	75.78	50.52	25.26	0.00	0.00	0.00
Yearly Installment	0.00	25.26	25.26	25.26	25.26	25.26	25.26	25.26	0.00	0.00
Interest @ 11%	19.45	16.67	13.89	11.12	8.34	5.56	2.78	0.00	0.00	0.00
Loan O/S Balance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yearly Installment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Debt Service	19.45	41.93	39.16	36.38	33.60	30.82	28.04	25.26	0.00	0.00

ANNEXURE - 14

CALCULATION OF DEPRECIATION (SLM & WDV)

(Rs.In Lakhs)

PARTICULARS	Operating years									
	1	2	3	4	5	6	7	8	9	10
Building @ 5%	9.96	9.46	8.99	8.54	8.11	7.71	7.32	6.96	6.61	6.28
199.21	189.25	179.78	170.79	162.25	154.14	146.43	139.11	132.16	125.55	119.27
0.00	9.96									
199.21										
Plant & Machinery 10%	19.91	17.92	16.13	14.52	13.07	11.76	10.58	9.52	8.57	7.71
199.14	179.22	161.30	145.17	130.65	117.59	105.83	95.25	85.72	77.15	69.43
0.00	19.91									
199.14										
Misce. Fixed Assets 10%	0.46	0.42	0.38	0.34	0.30	0.41	0.35	0.30	0.17	0.15
4.64	4.17	3.75	3.38	3.04	2.74	2.33	1.98	1.68	1.51	1.36
0.00	0.46									
4.64										
TOTAL Dep. (W.D.V.)	30.34	27.80	25.49	23.39	21.48	19.88	18.25	16.78	15.35	14.14
TOTAL Dep. Cost	372.64	344.84	319.34	295.95	274.47	254.59	236.34	219.56	204.21	190.07
TOTAL Dep. Cost (S.L.M.)	30.34									

ANNEXURE - 15
PROVISION FOR TAXATION

(Rs.In Lakhs)

Particulars	Operating Years									
	1	2	3	4	5	6	7	8	9	10
Profit before tax but after depreciation (SLM) & interest	92.53	118.47	144.95	171.49	174.12	176.75	179.38	182.01	181.86	181.71
Add depreciation in SLM	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34	30.34
Less : dep. in WDV method	30.34	27.80	25.49	23.39	21.48	19.88	18.25	16.78	15.35	14.14
Profits after dep. on W.D.V.	92.53	121.00	149.80	178.44	182.98	187.21	191.46	195.57	196.85	197.90
Taxable income	92.53	121.00	149.80	178.44	182.98	187.21	191.46	195.57	196.85	197.90
INCOME TAX @ 30 %	27.76	36.30	44.94	53.53	54.89	56.16	57.44	58.67	59.05	59.37

CIVIL ESTIMATES AND PLAN

Name of Work - Orange Packhouse & Cold Storage

RECAPITULATION SHEET

Sr.No	Description	Amount
A	Work Portion	
1	Cost for Civil Work	13757112.00
2	chain link fencing	990260.34
3	Concrete Road (12m, l=61.15m)	1303109.00
	TOTAL (A)	16050481.34
6	GST On A 18%	2889086.64
		18939567.98
B	Civil Work Royalty/testing	
	Add For Material Testing	70918.26
	Add For Royalty Charges	77154.46
4	Chain link fencing	
	Add For Material Testing	7325.00
	Add For Royalty Charges	3009.38
5	Concrete Road	
	Add For Material Testing	17045.00
	Add For Royalty Charges	48144.72
6	Bituminous Road	
	Add For Material Testing	121185.00
	Add For Royalty Charges	85113.57
	TOTAL (B)	429895.39
7	Add 1% Labour Insurance	160504.81
	Total :	19529968.18
8	Architect Fee 2%	390599.36
	GRAND TOTAL :	19920568.00

General Notes :

- Estimate is prepared on assumption of strata and for structural steel standard weight is considered for estimate purpose. As per actual design weight may vary.
- Estimate is prepared on the basic Rates of PWD SSR 2022-23 (As current SSR for 2023-24 and 2024-25 was not published)
- Lead charges and contingencies are not considered for Estimate.
- Additional % on SSR rates for municipal area is not Considered
- If proposed facility area is in tribal/naxelite area then additional 10% and 30 % Rates on basic ssr rates will increase respectively.
- For proposed facility site, If strata is Black Cotton Soil then cost will increase

ABSTRACT

Main Building

S.N.	SSR Item No.	Description	Quantity	Unit	Rate	Amount
1	21.02	Excavation for foundation in earth, soils of all types, sand, gravel and soft murum , including removing the excavated material upto a distance of 50 m. beyond the building area and stacking or spreading as directed, preparing the bed for the foundation and necessary back filling, ramming, watering, including shoring and strutting as necessary complete.				
		Lift Up to 1.5 M	401.340	Cu.M	215.30	86408.5
2	21.12	Excavation for foundation in hard murum including removing the excavated material upto distance of 50 mete Rs. beyond the building area and stacking or spreading as directed, preparing the bed for the foundation and necessary back filling, ramming, watering including shoring and strutting etc. complete.				
		Lift from 1.5 M to 3.0M	67.62	Cu.M	324.50	21943
3	21.36/679	Filling in plinth and floors with approved excavated materials in 15 cm. to 20 cm. layers including watering and compaction complete.	47.334	Cu.M	124.80	5907
4	21.37/680	Filling in plinth and floors with contractors approved material / murum / stone dust in 15cm. to 20cm. layers including watering and compaction complete.	853.224	Cu.M	826.80	705446
5	21.4/683	Providing soling using 80 mm size granite / quartzite / gneiss / trap metal in 15 cm. layer including hand packing filling voids with sand / grit, ramming, watering etc complete.	303.040	Cu.M	1512.20	458257
6	24.01/756	Providing and laying Cast in situ/Ready Mix cement concrete in M-10 of trap/ granite/ quartzite/ gneiss metal for foundation and bedding including bailing out water, Steel centering, formwork, laying/pumping, compacting, roughening them if special finish is to be provided, finishing if required and curing complete, with fully automatic micro processor based PLC with SCADA enabled reversible Drum Type mixer/concrete Batch mix plant (Pan mixer) etc. complete. With fine aggregate (Natural Sand / Crushed sand V	22.755	Cu.M	5938.40	135129
7	24.04/757	Providing and laying Cast in situ/Ready Mix cement concrete in M-15 of trap/ granite/ quartzite/ gneiss metal for foundation and bedding including bailing out water, Steel centering, formwork, laying/pumping, compacting, roughening them if special finish is to be provided, finishing if required and curing complete, with fully automatic micro processor based PLC with SCADA enabled reversible Drum Type mixer/concrete Batch mix plant (Pan mixer) etc. complete. With fine aggregate (Natural Sand / Crushed sand	216.148	Cu.M	6488.60	1402499

S.N.	SSR Item No.	Description	Quantity	Unit	Rate	Amount
		V				
8	25.11\765	Providing and laying in situ /Ready Mix cement concrete M-20 of trap / granite /quartzite/ gneiss metal for R.C.C. work in foundations like raft, strip foundations, grillage and footings of R.C.C. columns and steel stanchions etc. including bailing out water, Steel centering formwork, laying/pumping cover blocks, compaction and curing roughening the surface if special finish is to be provided (Excluding reinforcement and structural steel) etc. complete, with fully automatic micro processor based PLC with SCADA enabled reversible Drum Type mixer/ concrete Batch mix plant (Pan mixer) etc. complete. With fine aggregate (Natural Sand / Crushed sand VSI Grade finely washed etc)	113.400	Cu.M	7263.40	823670
9	25.31\770	Providing and casting in situ cement concrete of required grade of trap / granite /quartzite/ gneiss metal for R.C.C. columns as per detailed design and drawings or as directed, including steel centering, plywood/steel formwork, compaction, finishing uneven and honeycombed surface with C.M. 1:3 of sufficient minimum thickness to give a smooth and even surface or roughening the surface if special finish is to be provided and curing etc. complete. Including use of plastisizer wherever necessary as directed by Engineer (Excluding reinforcement, including cover block) . The Cement Mortar 1:3 plaster is considered for rendering uneven and honeycombed surface only. Newly laid concrete shall be covered by gunny bag, plastic, tarpaulin etc. (Wooden centering will not be allowed)	21.609	Cu.M	14209.50	307053

S.N.	SSR Item No.	Description	Quantity	Unit	Rate	Amount
10	25.5/772	Providing and casting in situ cement concrete of required grade of trap / granite /quartzite /gneiss metal for R.C.C. beams and lintels as per detailed design and drawings or as directed,including steel centering, plywood/steel formwork steel props, compaction, finishing uneven and honeycombed surface with C.M.1:3 of sufficient minimum thickness to give a smooth and even surface or roughening if special finish is to be provided and curing etc. complete. Including use of plastisizer wherever necessary as directed by Engineer-In-charge (Excluding reinforcement, including cover block) . The Cement Mortar 1:3 plaster is considered for rendering uneven and honeycombed surface only. Newly laid concrete shall be covered by gunny bag, plastic, tarpaulin etc. (Wooden centering will not be allowed)	63.017	Cu.M	12872.77	811208
11	33.3/945	Providing and laying in situ cement concrete M20 with tremix treatment for 100 mm thickness for flooring with groove cutting of 4mm wide and 20mm deep with necessary refilling with bitumen etc. complete.	1128.219	Sq.M	703.00	793138
12	26.33/797	Providing and fixing in position TMT - FE - 500 bar reinforcement of various diameters for R.C.C. pile caps, footings, foundations, slabs, beams columns, canopies, staircase, newels, chajjas, lintels pardis, copings, fins, arches etc. as per detailed designs, drawings and schedules. including cutting, bending, hooking the bars, binding with wires or tack welding and supporting as required complete.	29.846	MT	93291.10	2784378
13	27.12/878	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:6 in foundations and plinth of inner walls/ in plinth external walls including bailing out water manually , striking joints on unexposed faces, raking out joints on exposed faces and watering etc. Complete.	62.265	Cu.M	8065.20	502180
14	32.11/891	Providing sand faced plaster for external portion in cement mortar using Kharsalia / Kasaba or similar type of sand, in all positions including base coat of 15 mm. Thick in C.M. 1:4 using water proofing compound at 1 kg per cement bag, curing the same for not less than 3 days and keeping the surface of the base coat rough to receive the sand faced treatment 6 to 8 mm thick in C.M. 1:4 finishing the surface by taking out grains, making grooves and curing for fourteen days scaffolding etc. complete.	225.270	Sq.M	660.90	148881

S.N.	SSR Item No.	Description	Quantity	Unit	Rate	Amount
15	35.26/1076	Providing and applying two coats of exterior weather shield paint of approved manufacture and of approved colour to the plastered surfaces including cleaning, preparing the plaster surface ,applying primer coat ,scaffolding if necessary, and watering the surface for two days etc complete.	270.324	Sq.M	306.80	82935
16	21.22	Providing pre constructional anti termite treatment as per I.S. 6313 (Part-II) by treating the bottom surface and sides of excavation at the rate of 5 litres of emulsion concentrate of 1.0 percent of chlorophyrifos per square meter of surface area covering 10 years guarantee on bond paper.	1229.998	Sq.M	111.30	136899
17	21.24	Providing preconstructional antitermite treatment as per I.S. 6313 (Part-II) by treating the top surface of plinth filling at the rate of 5 litres of emulsion concentrate at 1.0 percent of clorophyrifos per square metre of surface area covering ten years guarantee on bond paper.	1016.914	Sq.M	112.30	114199
18	39.25	Providing and fixing rolling steel shutters fabricated from 18/20 guage steel laths with slide guides, bottom rail, brackets, door suspension shaft, housing box at the top including mechanical gear operation arrangement and one coat of red lead primer etc. complete.	13.750	Sq.M	5520.30	75904
19	23.04	Providing structural steel work in trusses, other similar trussed purlins and members with all bracing, gusset plates etc. as per detailed designs and drawings or as directed including cutting, fabricating, hoisting, erecting fixing in position, Making riveted/ bolted/ welded connection and one coat of anticorrosive paint and over it 2 coats of oil painting approved quality and shade etc. complete.	23.513	MT	124237.40	2921244
20	38.04	Providing and fixing corrugated galvanised iron sheets of 0.63mm thick (24 B.W.G.) for roofing without wind tiles including fastening with galvanised iron screws and bolts, lead and bitumen washers as per drawing etc. complete.(Weight of 5.5 Kilogram/sq.m.).	1032.15	SQM	904.80	933889
21	31.05	Providing water proof bedding for flooring of Bath and WC 25 mm thick in C.M. 1:3 including using approved water proofing compound in specified proportion as per manufacturers specifications for per bag of cement including leveling, curing and covering 10 years guarantee on court fee stamp paper of Rs.500/- including ponding test etc. complete.As directed by Engineer in charge. (S. S. R. I. No. 31.05 & Page No. 256) For Flooring At Toilet Blocks	14.25	SQM	447.20	6373

S.N.	SSR Item No.	Description	Quantity	Unit	Rate	Amount
22	43.05	Providing and fixing on walls/ ceiling/ floor 40 mm dia. CPVC pipe with necessary fittings, remaking good the demolished portion etc. complete. Including removing existing pipe line if necessary and conveying and stacking the same in PWD chowky or as directed etc.complete	100.00	RMT	663.50	66350
23	42.55	Providing and fixing on walls/ ceiling/ floor 15 mm dia. CPVC pipe with necessary fittings, remaking good the demolished portion etc. complete. Including removing existing pipe line if necessary and conveying and stacking the same in PWD chowky or as directed etc. complete	75	RMT	276.60	20745
24	41.4	Providing and fixing 15 mm dia screw down bib / stop tap of brass including necessary socket, union, nut, testing etc. complete (Prior approval of sample & brand by Architect is necessary before use)	4	NOS.	697.80	2791
25	41.47	Providing and fixing screw down 40mm dia meter wheeled stop tap of brass including necessary sockets/union nut complete.	2	NOS.	1217.80	2436
26	42.86	Providing and fixing European type wall-hung white water closet of Paryware/Hindware with push valve concealed type with cover plate 32mm size of JAQUAR MAKE SERIES FLV-1095 including soil pipe ,vent pipe up to outside face of wall ,100mm dia. G.I. plug bend inlet pipe all fittings, cutting & making good walls, floors etc. complete.	4	NOS.	15627.00	62508
27	43.37	Providing and fixing 15 mm diameter PVC Aqua kraft type Supreme make or equivalent make super jet spray with flange 2 in 1 faucet 1.50 metre long including all accessories etc complete	4	NOS.	486.70	1947
28	41.66	Providing and fixing colour glazed earthenware Wash Hand Basin of 55cm x 40cm size including pillar tap brackets, rubber plugs and brass chain, stop tap and necessary pipe connection including UPVC waste pipe and trap upto the outside face of the wall. Making good damaged surface testing etc. complete. With UPVC Bottle trap.	4	NOS.	6225.40	24902
29	41.8	Providing and fixing 10cm C.I. Nahani Trap including C.I. grating bend and piece of C.I. pipe upto the outside face of the wall complete	6	NOS.	1172.10	7033
30	42.02	Providing and fixing 15cm x 10cm salt glazed stoneware gully trap in cement concrete 1:4:8 outside the building including cast iron grating in the sink, connecting glazed stoneware pipe, brick masonry chamber with cast iron lid and cast iron grating for the gully trap.	2	NOS.	1694.20	3388

S.N.	SSR Item No.	Description	Quantity	Unit	Rate	Amount
31	42.16	Providing and constructing Brick Masonry Inspection Chamber 60cm x 45cm including 1:4:8 cement concrete foundation 1:2:4 cement concrete channels half round G.S.W. pipes, Brick masonry, plastering from inside and air tight 75 mm thick RCC cover etc. complete.	2	NOS.	10361.50	20723
32	42.28	Providing, laying and fixing P.V.C. pipe of 110 mm. dia. with fittings such as bends, tees, reducers, clamps, etc. including necessary excavation, trench filling etc. complete. Including removing existing pipe line if necessary and conveying and stacking the same in PWD chowky or as directed etc. complete.	100	RMT	617.80	61780
33	42.54	Providing and fixing H.D.P container Syntex or alike one piecen moulded water tank made out of low density polythylar and built corrugation including of delivery up to destination hoisting and fixing of accessories such as inlet, outlet overflow of all tanks capacity above 1000 to 20,000 litres	5000	Litre	11.40	57000
34	41.6	Providing and fixing White Glazed Earthenware Lipped Flat Back / Corner Type Urinal with PVC 5 liters flushing cistern with fittings, inlet pipe with stop tap, brackets for fixing the cistern, 32 mm diameter P.V.C. flush pipe with fitting including lead soil pipe, lead trap and soil pipe connection up to the outside face of wall. Spec. No. Bd.V. 26 Page No. 564. (S. S. R. I. No. 41.60 & Page No. 347)	4	NOS.	4979.50	19918
35	48.46	RWH-Shallow Percolation Pit providing, constructing 2.0m deep shallow depth percolation pit comprising of 1.0m dia pre-cast RCC rings, 300mm thick side filling around outside of RCC rings (annular space)with 40mm size boulders including filling of percolation pit upto 0.5m depth (from bottom up)with 25-75mm clean washed gravels followed by 0.5m depth of 10-25mm of clean washed stones followed by 0.5m of washed river fine aggregate (natural sand/crushed sand VSI grade finely washed etc.)including netlon mesh between each gravel/fine aggregate (natural sand/crushed sand VSI grade finely washed etc.)media layer including covering with RCC slab, manhole frame & cover, PVC rungs etc. including arrangement for inlet & outlet pipe, excavation & back filling as shown in the drawing. The rate shall be inclusive of all labour, material, wastage, scaffolding, transportation, taxes, including all leads, lifts at all levels. All material should be of approved make. All works complete as per the drawing, technical specification and	2	NOS.	53560.00	107120

S.N.	SSR Item No.	Description	Quantity	Unit	Rate	Amount
		direction of the Architect in charge				
36	42.18	Providing and fixing hume pipe septic tank 900mm diameter with vent pipe and cap including necessary (including excavation and laying)	2	NOS.	17395.00	34790
37	42.19	Providing soak pit of size 120cm x 120cm x 120cm including excavating and filling with brick-bats.	2	NOS.	3070.10	6140
					G.TOTAL	13757112

Name of Work - chain link fencing

S.N.	SSR Item No.	Description	Quantity	Unit	Rate	Amount
1	21.02	Excavation for foundation in earth, soils of all types, sand, gravel and soft murum , including removing the excavated material upto a distance of 50 m. beyond the building area and stacking or spreading as directed, preparing the bed for the foundation and necessary back filling, ramming, watering, including shoring and strutting as necessary complete.				
		Lift Up to 1.5 M	110.544	Cu.M	215.30	23800.1232
2	21.4/683	Providing soling using 80 mm size granite / quartzite / gneiss / trap metal in 15 cm. layer including hand packing filling voids with sand / grit, ramming, watering etc complete.	13.818	Cu.M	1512.20	20895.58
3	24.01/756	Providing and laying Cast in situ/Ready Mix cement concrete in M-10 of trap/ granite/ quartzite/ gneiss metal for foundation and bedding including bailing out water, Steel centering, formwork, laying/pumping, compacting, roughening them if special finish is to be provided, finishing if required and curing complete, with fully automatic micro processor based PLC with SCADA enabled reversible Drum Type mixer/concrete Batch mix plant (Pan mixer) etc. complete. With fine aggregate (Natural Sand / Crushed sand V	6.909	Cu.M	5938.40	41028.406
4	27.12/878	Providing second class Burnt Brick masonry with conventional/ I.S. type bricks in cement mortar 1:6 in foundations and plinth of inner walls/ in plinth external walls including bailing out water manually , striking joints on unexposed faces, raking out joints on exposed faces and watering etc. Complete.	23.836	Cu.M	8065.20	192242.5105
5	32.11/891	Providing sand faced plaster for external portion in cement mortar using Kharsalia / Kasaba or similar type of sand, in all positions including base coat of 15 mm. Thick in C.M. 1:4 using water proofing compound at 1 kg per cement bag, curing the same for not less than 3 days and keeping the surface of the base coat rough to receive the sand faced treatment 6 to 8 mm thick in C.M. 1:4 finishing the surface by taking out grains, making grooves and curing for fourteen days scaffolding etc. complete.	103.635	Sq.M	660.90	68492.37
6	35.21	Providing and applying priming coat on concrete/ masonry/ Asbestos Cement plastered surfaces including scaffolding if necessary, preparing the surface by thoroughly cleaning oil, grease, dirt and other foreign matter and sand papering as required etc. complete.	103.635	Sq.M	37.40	3875.95

S.N.	SSR Item No.	Description	Quantity	Unit	Rate	Amount
7	35.26/1076	Providing and applying two coats of exterior weather shield paint of approved manufacture and of approved colour to the plastered surfaces including cleaning ,preparing the plaster surface ,applying primer coat ,scaffolding if necessary, and watering the surface for two days etc complete.	103.635	Sq.M	306.80	31795.22
8	46.39	Providing and erecting chain link fencing 1.6 M. height with G.I. chain link of size 50 x 50 mm, 8 gauge thick and fixed 75 mm above ground level on vertical M.S. Angles of 40 x 40 x 6 mm size, including excavating pits for foundation and embedded in C.C. block of 1:4:8 mix of size 450 x 450 x 670 mm. at 1.75 M. c/c with iron bar 16mm dia as hold fast including welding link with angle frame at 30 cm c/c with nuts and bolts and horizontal M.S. Angles at top and bottom of 25 x 25 x 5 mm size and vertical M.S. flat 35 x 5 mm and 25 x 5 mm horizontal including cross support of 40 x 40 x 6 mm angles both side at every corner or bend embedded in concrete blocks of 1:4:8 of size 450 x 450 x 670 mm including 3 coats of oil painting etc. complete.	230.3	RMT	2640.60	608130.18
					G.TOTAL	990260

Site Development & Concrete Road Work

S.N	SSR Item No.	Description	Quantity	Unit	Rate	Amount
1	2.11/27	Excavation for roadway in earth, soil of all sorts, sand, gravel or soft murum including dressing section to the required grade, camber and side slopes and conveying the excavated materials with all lifts upto a lead of 50m. and spreading for embankment or stacking as directed. By Mechanical Means.	330.21	Cu.M	123.80	40880.00
2	2.29b/29	Supplying hard murum/ kankar at the road site, including conveying and stacking complete.	220.14	Cu.M	621.90	136905.00
3	2.3/29	Spreading hard murum for side width etc. complete	220.14	Cu.M	82.20	18096.00
4	2.31/29	Compacting the hard murum side widths including laying in layers on each side with power roller including artificial watering etc. complete.	733.8	Sq.M	21.80	15997.00
5	3.18/33	Providing, laying, spreading and compacting stone aggregates of specific sizes to water bound macadam specification including spreading in uniform thickness, hand packing to proper grade and camber, applying and brooming requisite type of screening/ binding Materials to fill up the interstices of coarse aggregate, watering and compacting with Intelligent Compactor with compaction analyzer and V-Sat attachment. to the required density. Grading I (Using Screening Type A (13.2) mm Aggregate)	146.76	Cu.M	2319.20	340366.00
6	3.2	Providing, laying, spreading and compacting stone aggregates of specific sizes to water bound macadam specification including spreading in uniform thickness, hand packing to proper grade and camber, applying and brooming requisite type of screening/ binding Materials to fill up the interstices of coarse aggregate, watering and compacting with vibratory roller to the required density. By Mechanical Means - Grading II (Using Screening Type B (11.2 mm) Aggregate)	8.25	Cu.M	2279.70	18808.00
7	39.47	Providing and fixing heavy duty interlocking concrete Rubber mould glossy paving blocks of 80mm thickness of having a strength of 400kg/Sq.cm.of approved quality and shape on a bed of crushed sand of 25to30mm thick including skirting joints and cleaning etc.complete.(using 100% crushed sand)	50	Sq.mt	1457.00	72850.00

S.N	SSR Item No.	Description	Quantity	Unit	Rate	Amount
8	7.01	Providing and casting insitu or precast tapering R.C.C.M-20 Barrier type Kerb without gutter (asper RC 861983) embedded 125mm below ground level overM-10PCC finished neatly with C.M.1:2, setting the same in C.M.1:2, including the required excavation in any strata and removing the excavated stuff anywhere in city and redoing the surface as specified and directed by Engineering In-charge. Using Concrete Batching and Mixing Plant	68	RMt	576.20	39182.00
9	24.01/756	Providing and laying Cast in situ/Ready Mix cement concrete in M-10 of trap/ granite/ quartzite/ gneiss metal for foundation and bedding including bailing out water, Steel centering, formwork, laying/pumping, compacting, roughening them if special finish is to be provided, finishing if required and curing complete, with fully automatic microprocessor based PLC with SCADA enabled reversible Drum Type mixer/concrete Batch mix plant (Pan mixer) etc. complete. With fine aggregate (Natural Sand / Crushed sand V	5.5	Cu.M	6063.20	33348.00
8	3/22.14	Planting small & medium size ornamental flowering plant:-Digging pit with size 0.6 x 0.6 x 0.6 meter. Removing & conveying unwanted stuff of a required distance as directed filling the pit with fresh garden soil & farm yard minor upto a height of 0.6 meter in 3:1 proportion mixing the soil & minor levelling, watering on previous night. Planting (one year or two year old) healthy plant sapling as per specification mainaining till well established by watering, weeding, sturring of soil replacing of casualities etc. complete.	50	Nos.	404.00	20200.00
9	33.3	Providing and laying in situ cement concrete M20 with tremix treatment for 100 mm thickness for flooring with groove cutting of 4mm wide and 20mm deep with necessary refilling with bitumen etc. complete.	805.8	SQM	703.00	566477.00
					TOTAL	1303109

MATERIAL TESTING
Main Building

No	Material Testing	Name Of Test Required	QTY.	Frequency For Testing As Per VQCC Spec	UNIT	NO.OF TEST REQ.	Say Test Required	RATE	TOTAL
A	Cement	Basic Test on Cement	176 MT	1 Test for 150 MT(3000 Bags)	Bags	1	2	3770	7540
B	Sand	a) FM,Silt,& Clay	219.00	At Beginning & when source changes	CUM	1	1	1,380.00	1,380.00
		b) Silt Factor	219.00		CUM	0	0	850.00	0.00
C	Aggregate	Water Absorption ,sp,Impact/crushing Value	326.00	1 Test per 200 Cum	CUM	1.5	1	2,600.00	3,900.00
		Seive Analysis	326.00		CUM	1.5	1	690.00	1,035.00
		Flakyness Index & Elongation	326.00		CUM	1.5	1	850.00	1,275.00
		Abrassion	326.00		CUM	1.5	1	1,170.00	1,755.00
		Soundness	326.00		CUM	1.5	1	2,495.00	3,742.50
D	Bricks	Crushing Strength & Water Absorption	54481.00	As per set of 15 bricks for each 50000	NO.	1	1	2,175.00	2,175.00
E	CC Cubes M20	Comp Strength	187.00	1 for 5 cum	Cu.M	37.4	37.4	690.00	25,806.00
F	Mix Design	All Test			No	1	1	13,755.0	13,755.00
G	Steel	All Test	24.00	1 for 5 MT	MT	5	5	1,595.00	7,975.00
H	Murum	Seive Analysis	56.70	1 for 400 cum	Cum	0.14175	0.14175	690.00	97.81
		Liquid & Plastic Limit	56.70	2 for 400 cum	Cum	0.14175	0.14175	1,170.00	165.85
		Mechanical Analysis	56.70	3 for 400 cum	Cum	0.14175	0.14175	2230	316.10
TOTAL									70918.2575

Royalty Main Building

No.	Description	Qty	Unit	Rate	Amount
1	Sand	281.93	Cum	237.37	66921.80
2	Murum	47.33	Cum	216.18	10232.66
Total :					77154.46

MATERIAL TESTING
Chain Link Fencing

NO.	Material Testing	Name Of Test Required	QTY.	Frequency For Testing As Per VQCC Spec	UNIT	NO.OF TEST REQ.	Say Test Required	RATE	TOTAL
A	Cement	Basic Test on Cement	176 MT	1 Test for 150 MT(3000 Bags)	Bags	1	1	3770.00	3770.00
B	Sand	a) FM,Silt,& Clay	219.00	At Beginning & when source changes	CUM	1	1	1,380.00	1,380.00
C	Bricks	Crushing Strength & Water Absorption	11918.00	As per set of 15 bricks for each 50000	NO.	1	1	2,175.00	2,175.00
TOTAL									7325.00

Royalty Chain Link Fencing

No.	Description	Qty	Unit	Rate	Amount
1	Sand	12.67	Cum	237.37	3009.00
Total :					3009.00

MATERIAL TESTING
Concrete Road

SR.NO.	Material Testing	Name Of Test Required	QTY.	Frequency For Testing As Per VQCC Spec	UNIT	NO.OF TEST REQ.	Say Test Required	RATE	TOTAL
A	Cement	Basic Test on Cement	24.20	1 Test for 150 MT(3000) Bags	Bags	0.024	1	3,770.00	3,770.00
B	Sand	a) FM,Silt,& Clay	2.34	At Beginning & when source changes	CUM	0.002	1	1,380.00	1,380.00
C	Aggregate	Water Absorption ,sp,Impact/crushing Value	4.68	1 Test per 200 Cum	CUM	0.023	1	2,600.00	2,600.00
		Seive Analysis	0.00		CUM	0.000	1	690.00	690.00
		Flakyness Index & Elongation	10.20		CUM	0.051	1	850.00	850.00
		Abrassion	10.20		CUM	0.051	1	1,170.00	1,170.00
		Soundness	10.20		CUM	0.051	1	2,495.00	2,495.00
									-
H	Murum	Seive Analysis	0.00	1 for 400 cum	Cum	0.000	1	690.00	690.00
		Liquid & Plastic Limit	220.14	2 for 400 cum	Cum	0.550	1	1,170.00	1,170.00
		Mechanical Analysis	220.14	3 for 400 cum	Cum	0.550	1	2,230.00	2,230.00
TOTAL									17,045.00

Royalty Concrete Road

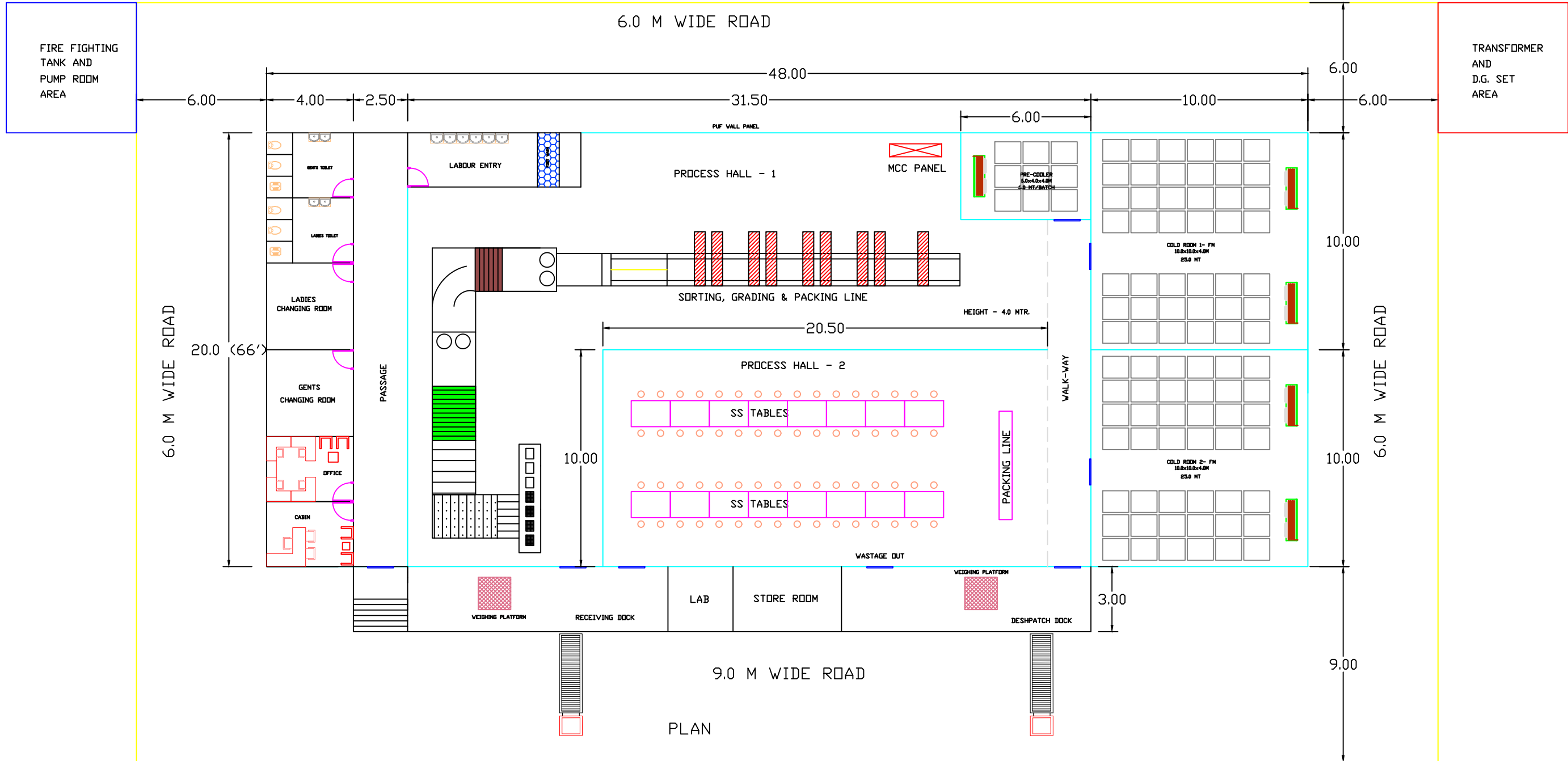
No.	Description	Qty	Unit	Rate	Amount
1	Sand	2.33	Cum	237.37	554.85
2.	Murum	220.14	Cum	216.18	47589.87
Total :					48144.72

MATERIAL TESTING
Bituminous Road

No.	Description	Qty	Unit	Rate	Amount
	MIX DESIGN.				
14	Wet Mix Macadam Mix Design (S. S. R. I. No. 9 & P. No. 587)	1.00	Per Test	16250.00	16250.00
	Concrete Paver Block				
15	Compressive Strength Water Absorption (Set Of 8 Block), Flexural Test (Set Of 8 Block), Resistance Test (Set Of 8 Block) (S. S. R. I. No. 26 & P. No. 588)	1.00	Per Test	2495.00	2495.00
	SOIL / MURUM				
16	Sieve Analysis. (S. S. R. I. No. 29 & P. No. 589)	2.00	Per Test	690.00	1380.00
17	Liquid limit & plastic Limit. (S. S. R. I. No. 30 & P. No. 589)	2.00	Per Test	1170.00	2340.00
18	Compaction Test (Proctor Density). (S. S. R. I. No. 31 & P. No. 589)	2.00	Per Test	1860.00	3720.00
19	C.B.R. Test (Lab) With compaction test. (S. S. R. I. No. 32 & P. No. 589)	2.00	Per Test	6905.00	13810.00
20	C.B.R. Test (Field Determination Test) Excluding Transportation. As per IS 2720 Part XXXI (S. S. R. I. No. 33 & P. No. 589)	2.00	Per Test	2300.00	4600.00
	BITUMEN				
21	Penetration, Softening Point, Flash & Fire Point, Specific Gravity (S. S. R. I. No. 41 & P. No. 589)	2.00	Per Test	3135.00	6270.00
22	Viscosity. (S. S. R. I. No. 42 & P. No. 589)	2.00	Per Test	1910.00	3820.00
23	Ducility / Elastic Recovery (S. S. R. I. No. 43 & P. No. 589)	2.00	Per Test	905.00	1810.00
24	Extraction Test. (OGC) Ducility / Elastic Recovery (S. S. R. I. No. 44 & P. No. 589)	2.00	Per Test	2500.00	5000.00
25	Extraction & Sieve Analysis of Bituminous mix (For BM/DBM/AC) (2 Samples Of Extraction For One Sieve Analysis Including Extraction) (S. S. R. I. No. 45 & P. No. 589)	2.00	Per Test	3930.00	7860.00
26	Marshall Stability & Flow measurement. (Set of 3 moulds) (S. S. R. I. No. 46 & P. No. 589)	2.00	Per Test	1115.00	2230.00
27	Job Mix Design with all Tests on aggregate (Excluding Bitumen) For DBM/SDBC/AC. (S. S. R. I. No. 47 & P. No. 589)	2.00	1 Mix Design	16250.00	32500.00
28	B. M. Mix Design With All Tests On Aggregate (Excluding Bitumen) (S. S. R. I. No. 48 & P. No. 589)	2.00	1 Mix Design	7490.00	14980.00
	BITUMINOUS EMULSION				
29	% Residue Test By Evaporation / Sieve Test (S. S. R. I. No. 55 & P. No. 590)	2.00	Per Test	635.00	1270.00
30	Partical Charge Test (S. S. R. I. No. 56 & P. No. 590)	2.00	Per Test	425.00	850.00
				TOTAL	121185.00

Royalty Bituminous Road

No.	Description	Qty	Unit	Rate	Amount
1.	Metal 40 mm Above / Soling Royalty Quantity As Per Royalty Statement	209.166	Cum	216.18	45217.55
2.	Murum Royalty Quantity As Per Royalty Statement	184.550	Cum	216.18	39896.02
	Total :				85113.57



PLAN

ALL DIMENSION ARE IN METER

TECHNOPAWAN ENGINEERING			
PROJECT - PACK HOUSE			
TITLE -PACKHOUSE LAYOUT PLAN			
DRG BY - AGD	CKD BY	REV	DATE
DRG NO.-302/24-25	AVI	2	25-05-24

AREA - 960 SQM (10350 SQFT)

Ref.: BBG/TE/308-24/25.

Date: 29.05.2024

To,

Shri. B.B. Gunjal
Pune

Subject: Offer for supply & installation of PUF panel for Precooler, Cold Room & Packhouse.

Dear Sir,

This refers to our discussion; we are giving Offer for complete scope as mentioned below.

Basis of Design:**1) Process Hall 1 & 2 :**

Size - As per Drawings.

2) Pre-Cooler Room 1:

Product - Citrus Fruits

Room Size - 6.0 x 4.0 x 4.0 (H) Mtr. - 1 No.

Storage Product Capacity - 6.0 MT/ Batch

Product Incoming Temp : +25 DegC.

Room Temp : +2 DegC.

2) Cold Room

Product - Citrus Fruits

Room Size - 10.0 x 8.0 x 4.0 (H) Mtr. - 02 Nos.

Storage Product Capacity - 25.0 MT/ Chamber

Product Incoming Temp : +4 DegC.

Room Temp : +4 DegC.

SR NO	DESCRIPTION	QTY	UNIT	UNIT RATE	AMOUNT
A)	PUF PANEL SUPPLY & INSTALLATION:				
	PROCESS HALL, PRE-COOLER & COLD ROOM :				
1	PUF panel & Doors: Make - Kingspan Jindal & Metaflex PUF Panel/Slab Insulation –PUF Panel Cladded with 0.4mm thk Precoated GI Sheet, 38 +/-2 kg/Cum PUF density a) Wall 80 mm thk PUF Panel - 760 SqM b) Ceiling 80 mm thk PUF Panel - 840 SqM c) Flooring 60 mm thk PUF Slab with Polythene Sheet - 225 SqM	1	Lot	51,25,000	51,25,000
2	PUF Panel Accessories : Flashing, Silicon, Liquid PUF, Rivets etc - 01 Lot				
3	a) Double Leaf Type Insulated Door-1500(W)x2100(H)x40 thk mm - 05 Nos. PUF Insulated Panel Cladded with both side precoated GI sheet, Complete with frame, Kock Plate & all accessories like locks & hinges. b) Single Leaf Type Insulated Door-1200(W)x2100(H)x40 thk mm - 03 Nos. PUF Insulated Panel Cladded with both side precoated GI sheet, Complete with frame, Kock Plate & all accessories like locks & hinges. c) Swing Type Insulated Door-1200(W)x2100(H)x80 thk mm - 03 Nos. PUF Insulated Panel Cladded with both side precoated GI sheet, Complete with frame, Kock Plate & all accessories like locks & hinges.				
4	PUF Panel Installation - 1825 SqM				
5	Strip Curtain - 06 Nos.				
6	Transport - 01 Job				
7	Internal Electrical Light Fitting & Wiring - 01 Job				
	SUB-TOTAL (A)				51,25,000

B)	REFRIGERATION EQUIPMENT SUPPLY & INSTALLATION:				
8	PROCESS HALL 1 & 2 : Make- Daikin/Carrier i) Evaporators of Ceiling Suspended type ii) Aircooled Condensing unit Refrigeration Capacity (R404a) - 12.0 kW, 3 Phase @ Evaporation Temp. +10 DegC & Condensing Temp. : 50 DegC iii) Supply & Installatio of above system.	8	Set	2,95,000	23,60,000
9	COLD ROOM 1 & 2 : Make- Daikin/Carrier i) Evaporators of Ceiling Suspended type ii) Aircooled Condensing unit Refrigeration Capacity (R404a) - 8.0 kW, 3 Phase @ Evaporation Temp. -2 DegC & Condensing Temp. : 50 DegC iii) Supply & Installatio of above system.	4	Set	2,95,000	11,80,000
10	PRE-COOLER ROOM : Make- Daikin/Carrier/Starcooler i) Evaporators of Ceiling Suspended type ii) Aircooled Condensing unit Refrigeration Capacity (R404a) - 55.0 kW, 3 Phase @ Evaporation Temp. -2 DegC & Condensing Temp. : 50 DegC iii) Supply & Installatio of above system.	1	Set	14,75,000	14,75,000
11	Electrical Panel & Related Cabling of Refrigeration System.	1	Job	3,50,000	3,50,000
SUB-TOTAL (B)					53,65,000
GRAND-TOTAL (A + B)					1,04,90,000

Taxes :

1) GST Extra @ 18%

Payment Terms:

1) 90% Advance along with purchase order.
10% against Commissioning of Work

Exclusion:

- 1) Civil work (PCC/Tiles) for floor of Cold room insulation etc.
- 2) Termination of Power supply cables to our compressor control Panels.
- 3) Water and electricity for erection and commissioning.
- 4) Any Civil/Structural Supporting Work for PUF Panel , IDU & ODU.
- 5) Main Ele. Power required at Main Electrical Panel
- 6) Fabricated Shed.

Delivery:

Supply of Equipments & PUF Panel – 2 to 3 weeks
For Installation and commissioning 4 to 6 week from supply & site clearance.

Validity:

This offer for 30 days from the date of offer.

Warranty:

Equipment warranty & Guarantee are effective for period of 12 months from the date of start-up of units or 15 months from the date of We trust the above is in line with your requirement and look forward to receive your valuable order.

Yours Truly,

For **"Technopawan Engineering"**

Avinash Dalvi (98505 00275)

Commercial Grading-Packing Line for **Santras**

(capacity 7 -8 Tons / Hr.)

Quote : Q / SF / May / 02 Dated 25th May 24

Client : Mr. Gunjal , Consultant MSAMB

FROM : Stayfresh, Mumbai 25th May 2024

ANNEXURE - I

1. Crate Tilter with hopper	5000 x 350
2. Small Size Eliminator	3000 x 500
3. Belt Conveyor (underneath)	2500 x 1920
4. Sorting Inspection	2500 x 1920
5. Washer Unit	2500 x 2020
6. Pre-Dryer Unit	6000 x 1920
7. Waxer Unit	1250 x 2020
8. Dryer Unit	8500 x 1920
9. 90 degree Belt conveyor	3000 x 600
10. Belt Singulator 2 lanes	2500 x 700
11. Electronic Grader, 2 lanes	12000 x 700
12. Take-Out Cross Belts 9 nos.	2500 x 300
13. Electrical Panel with cabling.	1500

U shape Layt-Out

(1) Crate Tilter with Hopper

- M.O.C. M.S. Powder coated
- Length 5000 mtrs.
- Width 500 mm.
- Tilting mechanism Mechanical
- Powered by 1.0 H.P. Geared motor
- Speed Control By VFD, Delta make or equivalent

- **FUNCTION :**

- To facilitate conveying crates on a chain conveyor
- To automatic tilt the filled crates to empty santras gently on hopper
- The gap between the pipes of hopper allows the leaves, stems, twigs to drop below.

-

(2) Small Size Eliminator

- M.O.C. M.S. Powder coated
- Length 2500 mm
- Width 1920 mm
- Rollers SS 304 / Aluminum
- Powered by .25 H.P. Geared Motor

• **FUNCTION :**

- To eliminate the small size below 45 to 50 mm

(3) Belt Conveyor (underneath)

- M.O.C. M.S. Powder coated
- Length 2500 mm
- Width 1920 mm
- Belt endless, PVC food grade
- Powered by .5 H.P. Geared Motor

FUNCTION :

- To divert the santras to Sorting inspection conveyor, after eliminating the small size santras

(4) Sorting Inspection Feeder

- M.O.C. M.S. Powder coated
- Length 2500 mm
- Width 1920 mm
- Rollers SS 304 or aluminum
- Side pockets 2 nos. for rejects
- Powered by .25 H.P. Geared Motor

- **FUNCTION :**

- To sort the Santras manually for quality and eliminate rejects.

(5) Washer Unit

- M.O.C. S.S. 304
- Length 2500 mm
- Width 1920 mm
- Washing Brushes 20, Nylon bristles
- Rotation of brushes Controlled by VFD, Delta make or equi.
- Water nozzles SS 304, 3 + 2 + 3 = 8 nos.
- Water Pump .5 H.P. mono-block
- Powered by 1.0 H.P. Geared Motor
- Clean-Out Bar .25 H.P. Geared Motor

FUNCTION :

- To clean the santras using fresh sanitized water .
- Motorized Clean-Out bar system SS 304 to remove the santras at the end of the run.

(6) Pre-Dryer Unit

- M.O.C. M.S. Powder coated
- Length 6000 mm
- Width 1920 mm
- Rollers SS 304 / Aluminum,
- Powered by .33 H.P. Geared Motor
- Blowers 1.0 H.P. 2 Nos
- Heaters Finned, 9 nos. 1 KW each. Optional
- Gas Burner Included. (MS Piping to connect to LPG cylinders client scope.)

FUNCTION :

- To dry the water on to the santras before it goes into waxing section.

(7) **Waxer Unit**

- M.O.C. S.S. 304
- Length 1250 mm
- Width 1920 mm
- Waxing Brushes 10 nos. Horsehair
- Powered by 1.0 H.P. Geared Motor
- Clean-Out Bar .25 H.P. Geared Motor
- Waxing nozzle Air atomizing
- Waxing Pump Electronic, with Flow control.
- Compressor with double head, 1 H.P.

FUNCTION :

- To wax the fruit using air atomizing nozzle and compressor, with Electronic Pump
- Motorised Clean-Out bar system to remove the fruits at the end of the run.

(8) **Dryer Unit**

- M.O.C. M.S. Powder coated
- Length 8500 mm
- Width 1920 mm
- Rollers SS 304 / Alluminum,
- Powered by .50 H.P. Geared Motor
- Blowers 2.0 H.P. 2 Nos,
- Heaters 9 KW, (optional)
- Gas Burner Included. (Piping connection to LPG cylinders will be client scope.)

FUNCTION :

- To dry the wax coating on fruits without increasing the pulp temp. substantially.

(9) **90 degree Belt conveyer**

- M.O.C. M.S. powder coated
- Length 3000 mm
- Width 700 mm
- Belt PVC Food Grade
- Powered by .5 H.P. Geared Motor
-

- **FUNCTION**

- To divert fruits from 90 degree in to Belt Singulator

(10) **Belt Singulator Unit**

- M.O.C. M.S. Powder coated
- Length 2500 mm
- Width 700 mm
- Belts PVC, endless
- Powered by 1.0 H.P. Geared Motors, 1no.

FUNCTION

- To singulate fruits in to 2 rows to feed in to 2 rows of Electronic Grader.

(11) **Electronic Diameter Grader**

- M.O.C. - M.S. powder coated
- Length 12000 mm
- Width 700 mm
- Cups HDPE
- No. of Lanes Two
- No. of sizes Eight + 1
- Powered by 5.0 H.P. Geared motor
- Load cells Dynamic, two nos.
- Vision system computer controlled PLC Delta or equiv.
- Touch screen Yes
- Scada system Yes
- Software Included to control all parameters and report Printing. Ink jet printer included.

FUNCTION :

- To size the Fruits according to diameter / weight in to 8+1 sizes

(12) **Take-Out Cross Belts**

- M.O.C. M.S. Powder coated
- Length X width 2500 mm X 300 mm , 9 Nos.
- Belt PVC, Food grade, endless
- Powered by .25 H.P. Geared Motors, 9 Nos.

FUNCTION :

To take away the sized fruits on Packing Table.

(13) **Electrical Panel complete with cabling**

ANNEXURE - II

PRICE: Ex-Works Navi Mumbai –

Rs. 35 to 40 Lakhs , 10 m. tons / Hr. for Mechanical grader

Rs. 80 to 90 Lakhs 10 m. tons/ Hr. with Electronic grader

Quote : Q / SF / May / 02 Dated 15th May 24

Client : Consultant, MSAMB

FROM : Stayfresh, Mumbai 15th May 2024

- Sales Tax - 18 % GST extra
- **Transport Three truck loads to Vidarbha**
- Erection – commissioning Rs. 1.5 Lakh

• **Payment Terms :**

- 40 % advance
- 55 % against inspection & trials at Navi Mumbai
- 5 % after commissioning

Delivery – Minimum 60 to 75 days , from date of 1st advance, linked to agreed payment terms.

- Additional for SS 304 rollers, instead of Aluminum.

Makes of following

- Motors - Hindustan or equivalent
- Gearboxes Bonfiglioli
- Aluminum rollers Hindalco
- PVC Belt Forbo (European make)
- Switchgears L & T or equivalent
- Brushes Bristles Nylon 6 material
- Cameras Cognex or equivalent
- PLC Delta / Siemens or equivalent

Civil works required 5000 to 6000 sq. ft. 50 to 60 Lakhs

Power consumption 25 H.P. + 18 KW if run on heaters

LPG burners .5 H.P.

Water Consumption 1000 liters per Hr. 1 paise / Kg of fruit

Chemicals/sanitizer 2-3 paise / kg of fruit

Wax Consumption 20-25 paise / Kg of fruit

Labour	Unloading	2
	Feeding	2
	Grader	8
	Loading	2
	Packers	20

Operating cost for running a packhouse

- Power	6
- Water	1
- Chemicals	1
- Wax coatings	20
- Labour	6
- Packers	?
-	-----
-	35 paise / Kg. of fruit

Spares Inventory to be kept

- Solenoids	2 - 3
- Cups	30-40
- Aluminum Rollers	10
- Spkts	10
- Flange Motors	.25, .50, 1.0, 2.0 each
- Brushes	Nylon – 2, Horsehair - 1
- Electricals	Push buttons 2 each, green and red
- MCBs	4 poles 1 each 6,10 and 16 amp.
- Relays	one each

-

-
-
-



Static ELECTRICALS PUNE

No Light-up your world.....

MANUFACTURES OF POWER & DISTRIBUTION TRANSFORMERS

Ref. No.: SEP/AR/24-25/3359

Date: 29.05.2024

To,
M/s. Global Consultants & Services
Pune

Kind Attn: - Mr. Vishwas Patil

QUOTATION FOR TRANSFORMER

We thank you for your valued inquiry and have pleasure in submitting our offer for supply of Distribution Transformer. Our offer is subject to the terms and conditions of Sale as per enclosed schedules

The Transformer shall be manufactured and tested as per IS: 1180 & as per MSEDCL Specifications.

SCHEDULE: A

PRICE AND TECHNICAL DETAILS OF TRANSFORMERS

Make: - Static Electricals Pune

Rating (KVA): - 200

Voltage Ratio : - 11000/433

Type: - Indoor / Outdoor

Quantity (Nos.): - 01

No. of Phases: - 03

Frequency: - 50 Hz

Core: - CRGO

Winding: - Copper

Cooling: - ONAN

Vector Symbol: - Dyn – 11

H.V.:- Delta connected

L.V.:- Star connected

Tapping on H. V. for % H. V. variation of + 5 % to – 10 % in equal steps of 2.5 % **Off circuit tap changer**

Rate : - 200 KVA, 11000/433 V: - 3,00,000/-

Cont.

S. No. 229/2/2, Behind Rajiv Gandhi Infotech Park, Phase 1, Hinjawadi, Pune 411057

Tel.: 020 - 22933018 Telefax : 020 - 22933059

E-mail : staticelectricalspune@rediffmail.com www.staticelectricals.com



Static ELECTRICALS PUNE

We Light-up your world.....

MANUFACTURES OF POWER & DISTRIBUTION TRANSFORMERS

SCHEDULE-B

COMMERCIAL TERMS & CONDITIONS

PRICE	<ul style="list-style-type: none">• C.GST @ 9.00%:- Exclusive• S.GST @ 9.00%:- Exclusive• Transportation: - Exclusive• Unloading at Site: - Done By Purchaser• Prices are subject to IEEMA price variation clause.
DELIVERY PERIOD	<ul style="list-style-type: none">• Completing within 10 Days from the receipt of your technically and commercially written order along-with advance payment and all MSEDCL documents
PAYMENT	<ul style="list-style-type: none">• 40 % Advance payment while placing the order and 60 % balance shall be released against Performa Invoice prior to dispatch after successfully inspection at our works.
INSPECTION	<ul style="list-style-type: none">• All Transformers are tested by us & MSEDCL Engineers before dispatch.
GUARANTEE	<ul style="list-style-type: none">• In case Transformer supplied by us is under 1.3 % supervision scheme will be guaranteed as per M.S.E.D.C.L. rules i.e. for 60 Months from the date of dispatch.• This Guarantee subject to the installation, commissioning, operation and maintenance of the transformer as per IS: 10026.
VALIDITY	<ul style="list-style-type: none">• Our offer is valid for the period of Fifteen Days from the date of offer, subject our confirmation if any, thereafter.

For STATIC ELECTRICALS PUNE

ABHIJEET RAJE (9823230236)

S. No. 229/2/2, Behind Rajiv Gandhi Infotech Park, Phase 1, Hinjawadi, Pune 411057

Tel.: 020 - 22933018 Telefax : 020 - 22933059

E-mail : staticelectricalspune@rediffmail.com www.staticelectricals.com

Corporate Office

Plot #A 37, H Block,
MIDC Pimpri, Pune-411019.
Maharashtra, India.

Manufacturing Units

Gat No 392/1/2,
Mahalunge Ingle,
Chakan-Talegaon Road,
Tal-Khed, Pune-410501.

Annexure A: Technical Specification/Scope of Supply

Annexure B: Specification of Kirloskar Acoustic Enclosure

Annexure C: Commercial Terms & Conditions



KALA GENSET PVT LTD
Toll Free No:- 1800 123 0018
www.kalabiz.com



Ref No - QTN/24-25/07002111

29-May-2024

To
Technopawan Engineering
Manchar Pune.

Kindly Att:- Mr. Avinash Sir

Sub : Offer for the Supply of 160 kVA Three Phase Kirloskar DG Set confirming to CPCB IV+ regulations.

Dear Sir,

We thank you for your valued enquiry and the interest shown in Kirloskar Genset.

'Kirloskar' is the world's leading and most preferred Genset brand in India offering the widest range of power ratings. Kirloskar Group has a strong lineage of over 133 years of rich engineering history. Today the group has a net worth of over INR 6000 Crs having its presence in various parts of the world.

Kirloskar Diesel Engines are used as prime movers in different applications such as D.G.Set, Earth Moving, Tractors, Industrial Pumpset, Fire Fighting Pumpset, Cold Storages, Rice Mills and many other applications.

Kirloskar is a major player globally, specialized in both Air-Cooled and Water-Cooled Engines, Petrol Generating sets with power output from 2.8 kW to 4 kW and diesel generating sets with power output from 3.5 kVA to 2000kVA.

Over 50,000 establishments/businesses from different sectors such as Manufacturing, Service, Software, Construction and Infrastructure are powered by 'Kirloskar' Gensets annually.

Kirloskar provides reliable and high-quality products at a competitive pricing.

Kirloskar has the widest service network with more than 360 service outlets across the country backed with trained and efficient service engineers. We offer single window service for the entire Genset (Engine, Alternator, Canopy and Control Panel) and also offer Customized AMCs & CMCs to suit our esteemed Customer requirements.

KALA GENSET Source of Power



We KALA Genset Pvt Ltd is the leading Authorized GOEM of Kirloskar Oil Engines Ltd. for the sale of Kirloskar DG sets in the range of 2.8 kVA to 2000 kVA in a single configuration and in multiple sets configuration for higher Power requirements.

We offer end to end power solutions to our valued customers that include:

- 1) Pre-sales counseling on Genset selection, Genset Sizing, Site Selection, Load Analysis.
- 2) Assessment of optimal power needs.
- 3) Delivery, on site Installation and Commissioning.
- 4) Assistance for compliance with Statutory requirements.
- 5) Onsite training for operation & maintenance.

We also undertake supply of multiple Gensets in Synchronization and turnkey projects for higher power requirements. We offer need specific customized need Control Panels for operating Gensets in AMF, Synchronizing, Grid Power Synchronizing and Distribution.

We also supply mobile DG sets, Gensets operating on alternate fuels such as Bio Diesel, Bio gas and Natural gas.

We are pleased to enclose herewith our detailed Techno - Commercial offer of "Kirloskar DG set" and brochure for your persuasion & consideration with following annexure:

- Annexure A: Technical Specifications/Scope of Supply
Annexure B: Specification of Kirloskar Acoustic Enclosure
Annexure C: Commercial Terms & Conditions

We trust you would find the same in line with your requirements. We welcome any clarification sought pertaining to the subject. We look forward to establish a long term business association with you and await your favorable response.

Thanking you and assuring you of our best attention at all times.

Yours sincerely,

Ajit Jadhav
For KALA GENSET PVT.LTD.
Mobile : 9545556185
Mail ID : ajit.jadhav@kalabiz.com
www.kalabiz.com

ANNEXURE "A"**TECHNICAL SPECIFICATION OF 160 kVA THREE PHASE KIRLOSKAR DIESEL GENERATING SET****A) DIESEL ENGINE:-**

KIRLOSKAR Make Diesel Engine Model 6K1080ETA 4G1 ,CRDi Six Cylinders Inline, Liquid Cooled, Turbocharged with After Cooled, Developing 200 bhp @ 1500 RPM. Engine is with Electric Start, Compression Ignition, 4 Stroke Cycle, Designed to run continuously at 1500 RPM . It conforms to IS 10002, ISO-3046, BS 5514 standards. All Diesel Engines are comply with latest CPCB norms. The Diesel Engines are comprising of followings: -

- Radiator with Fan
- Fuel Injection equipment with Electronic Governor
- Dry type Air Cleaner
- Exhaust Silencer
- Lube Oil filter (Spin On Type)
- Fuel Oil filter (Spin On Type)
- 12V Electric starting system
- Battery charging alternator
- Stop Solenoid
- Lube Oil pressure Gauge
- Water Temperature Gauge
- Lube Oil temperature Gauge
- Battery Voltage
- K - Cool Super Plus coolant
- First Fill Lube Oil

B) ALTERNATOR:-

KIRLOSKAR make Alternator, suitable for continuous duty operations rated at 1500 RPM 415 V, 0.8 PF, 50Hz, 3Ph. in SPDP Enclosure, Self- Excited & Self- regulated, Brush less, 'H' class Insulation, Floor mounted with anti friction Shielded Ball Bearing on end. The alternator conforms to IS: 4722, BS EN 60034-1 suitable for tropical conditions.

C) BASE FRAME:-

Suitable to couple above Engine & Alternator made from steel sheet metal.

D) FUEL TANK:-

8 Hrs Capacity for continuous running, with Diesel fuel Inlet & Outlet, Air Vent & Drain plug arrangements.

E) BATTERY:-

1 No.12 V Battery with Leads

F) STANDARD GENSET CONTROLLER UNIT WITH CONTROL PANEL:-

Kirloskar Genset Controller unit with totally enclosed, Steel Construction Control Panel suitable for indoor floor / wall mounting installation having following safeties and display parameters: -

Gen-set Display Parameters	Engine Display Parameters	Electrical Safeties (along with Display)	Mechanical Safeties (along with Display)
Phase Voltage	Lube Oil Pressure	Genset Under/Over voltage	Phase Voltage
Line current	Engine Temperature	Under/Over Battery voltage	Low Lube oil pressure
Frequency	Fuel Level Status	Under/Over Frequency	High Lube oil Temperature
Average Voltage	Engine speed	Phase Failure	High engine coolant temperature
Average Current	Battery Voltage, Minimum Battery Voltage	Phase sequence reverse	Low coolant level
Phase kW & Total kW	Lube Oil Temperature	Over Current	Low Fuel Level
kWH	Engine Hours	Over kW	Start/Stop fail
kVA	No. of Starts		Battery Charging Alternator fail
kVAR			
PF			

G) Kirloskar

Kirloskar India's only digital power back-up solution, designed for the users of tomorrow. KOEL promise world class performance, robust design , digitally connected, ultimate convenient, smart user interface, superior looks and one-stop solution for its customers.

ANNEXURE "B"

TECHNICAL SPECIFICATION OF KIRLOSKAR ACOUSTIC ENCLOSURE CONSTRUCTION

Followings are some technical features of Acoustic Enclosure:-

- 1) The Enclosure is modular in construction.
- 2) Base Frame is made of Sheet metal.
- 3) Durable industrial locking system is provided on Doors.
- 4) Door Gaskets are made in high quality EPDM material.

CORROSION RESISTANCE:-

To make the Enclosure weather proof:-

- 1) All sheet metal parts/components are hot dipped in seven tanks process, Pretreated and Passivated.
- 2) Sheet metal components are with Pretreated and Passivated Base Powder Coated.
- 3) Base Frame is Epoxy Coated/Powder Coated.
- 4) Zinc Passivated Hardwares are used to avoid rusting.

ACOUSTIC INSULATION:-

- 1) Sound proofing of the Enclosure is done with Quality Foam confirming to IS: 7888 Standard.
- 2) Acoustic foam shall be fire retardant and fire resistant.
- 3) Attenuates are provided to control sound at entry and exit of container.
- 4) Specially designed Residential Silencer is provided.

VENTILATION AND AIR CIRCULATION:-

Exhaust pipe inside Enclosure is thoroughly insulated by Cladding of Rock wool and Sheet.

ELECTRICAL:-

Neutral Body Earthing points at the sides of enclosure are isolated through Moulded compound.

SAFETIES:-

Emergency Push button to Stop the DG set from outside, Low Fuel oil level, Low Lube oil pressure, Low Coolant Level, High Engine Temperature.

R&D:-

Our R & D department is constantly engaged in the Product Development for keeping pace with world's latest technology to give customers value for money in form of improvements. The canopies being offered are for output of Noise Level ≤ 75 dbA at a distance of 1-meter average, as per the CPCB Latest Norms.

ANNEXURE "C"

No	Description	Qty	Unit Price (Rs.)	Amount
1	<p>Diesel Generating Set 160 kVA 3 Phase comprising of "KIRLOSKAR" make Engine , Model 6K1080ETA 4G1 Water cooled producing 200 BHP @ 1500 RPM coupled with "KIRLOSKAR" make Alternator , mounted on a Base Frame.</p> <p>Along with:-</p> <ul style="list-style-type: none"> > STD Control Panel > Fuel tank > Battery with leads > First fill of oil > Engine safeties & protections > Anti vibration mounting pads <p>Acoustic Enclosure suitable for 160.00 kVA DG Set. CPCB IV+ Norms.</p>	1.00	1,800,000.00	1,800,000.00
2	Auto Panel	1.00	130,000.00	130,000.00
3	Transportation charges			6,000.00
4	Total Amount			1,936,000.00
5	GST @18%			348,480.00
6	Grand Total			2,284,480.00

COMMERCIAL TERMS & CONDITIONS

GST :-

GST Included

FREIGHT :-

Transportation Included

TRANSIT INSURANCE :-

Customer shall arrange the transit insurance of the equipment from our works up to the destination.

GOVT. LEVIES :-

Any entry tax or any such Govt. charges, levy applicable at the entry point of the destination will be to your account & paid by you directly.

VALIDITY :-

Our offer shall remain valid for 7 days from the date of issue and would be subject to our confirmation in writing thereafter.

DELIVERY :-

Within 4 to 6 weeks from the date of receipt of your Techno-commercially clear & firm Purchase Order along with advance for Standard Genset Only, subject to Force Majeure condition and unforeseen delay beyond our / suppliers control.

PAYMENT :-

30 % advance along with the Purchase Order & balance 70 % against our Performa Invoice before dispatch.

WARRANTY:-

The warranty is for 24 months or 5000 hours of operation whichever is earlier from the date of commissioning, subject to use of Kirloskar K Oil Super, Kirloskar genuine filters, K cool super plus and services sourced through KOEL authorized Service Dealer. This warranty shall be governed by Kirloskar Oil Engines warranty Policy. Other terms & conditions for warranty shall be as per our Company Standard Warranty Policy.

ORDER PLACEMENT :-

For Supply of Genset Purchase Order to be released in favor of Kala Genset Pvt Ltd., where as for all Installation Jobs (Supply of Installation Materials and Labor Job both) Purchase order to be released in favor of Kala Genset Pvt. Ltd.

OTHER TERMS & CONDITIONS

- 1) All orders are subject to our Order Acceptance in writing.
- 2) All offers and orders are subject to the General Terms & condition of sale.
- 3) Any amount received as advance from the Customer / Purchaser is for mobilization of the order & will not attract any interest there on.
- 4) All disputes and / or differences arising out of the order / Contract against our Offer shall be referred to Arbitration under Arbitration & Conciliation ACT 1996 And/or any statutory modification in force thereof and such Arbitration are Subject to Pune Jurisdiction.
- 5) Cancellation Charges: If purchase order is cancel by the customer, cancellation Charges will be applicable @ 15% of the basic order price for all items of 15KVA to 250KVA. For all items of ratings above 251 KVA, it will be @ 1% of the order price.

ESTEEMED CUSTOMERS



