

## Toughened Glass

PRODUCT CODE	: 94107
QUALITY AND STANDARDS	: IS 2553:1971 IS 6180:1971 IS 6640:1972
PRODUCTION CAPACITY	: Quantity: 4,80,000 sq.ft. Value : Rs.2,40,00,000
MONTH AND YEAR OF PREPARATION	: March, 2003
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### INTRODUCTION

Toughened glass acquires a degree of strength for excess of the strength of normal glass sheet or plate glass, which if broken shatters into small and comparatively harmless pieces. It is claimed that the resistance to mechanical shock of toughened plate glass is 4 to 5 times more than that of ordinary plate glass. A toughened glass has better resistance to the vibration, mechanical shock and abrasion.

Toughend Glass has to pass the following important tests:

- i. Transfer strength test on sheets on simply supported (Modules of rupture and electricity)
- ii. Impact test: By following weight on sheets supported on two wooden battens
- iii. Impact by falling weight on sheet evenly bedded (on putty)

- iv. Impact by falling weight on edge of sheet
- v. Repeated twisting tests
- vi. Sand blast abrasion
- vii. Thermal tests

Because of the strength and other specific physical properties mentioned above, it finds applications in the following fields:

- i. Automobile industry : Cars, trucks, buses, tempos etc.
- ii. Railways : Coaches
- iii. Defence : Fleets, vehicles factory
- iv. Commercial : Hotels, shops complex
- v. Air ports : Doors

### MARKET POTENTIAL

With increased transportation facilities the demand of the product is increasing at a steady pace specially in the automobile

industry, railways, ships building both for production and replacement.

## BASIS AND PRESUMPTIONS

The project is based on single shift of 8 hours with 300 working days.

## IMPLEMENTATION SCHEDULE

Sl. No.	Activity	Period (in months)
1.	Project preparation and acquirement of shed, provisional registration etc.	2
2.	Procurement of machinery and raw materials	6
3.	Installation of machinery and equipment, appointment of labours etc.	2
4.	Procurement of raw materials and starting trial production	1
	Total	11

## TECHNICAL ASPECTS

### Process of Manufacture

The glass plate is heated to a temperature above its softening point and then subjected to rapid cooling. The glass is suddenly chilled and in this process contracts towards the core. It stretches until it has solidified and is no longer able to contract further at this stage the core is still soft. It contracts against restrained exercise by the solidified upper layer of the glass. This compression is responsible for the strength of the glass sheet, which is limited to about 20,000 lb/sq.inch. Thus it is highly stressed and the resultant force is able to nullify the external impact.

The intensity of the stresses depends on the rate of cooling, co-efficient of expansion, thermal conductivity of the glass, its specific heat, elasticity, and certain other physical properties.

### *Toughening Process*

The raw plate glass sheet which is free from waviness, distortion etc., is cut to required size and shape and then all the edges are ground and polished as per end use of the product. This is called edge grinding and polishing and is very important for toughening because it will lead to breakages during process. No glass sheet can be toughened without edge grinding and polishing.

### *Washing and Drying*

After the edge grinding and polishing the glass sheets are washed manually or by machine and then dried. The glass sheets are fed into the furnace (Electrically operated). The sheets are kept in the furnace above its softening point, which varies according to the composition of glass. After attaining required temperature the glass sheets are removed out of the furnace and placed in the air blowing quenching boxes for 20 to 25 seconds. After quenching glass sheet is toughened. For bend glass toughening, the glass sheets passes through a set of dies (as per shape) after furnace and then to the quenching boxes.

### *Testing*

After toughening all the sheet glasses are passed through the polariscope inspection.

### Quality Control and Standards

IS 2553:1971

IS 6180:1971

IS 6640:1972

## FINANCIAL ASPECTS

### A. Fixed Capital

(i) Land and Building		(Rs.)
Land	About 3000 sq.mtrs. @ Rs.300	9,00,000
Built up area	Work shed = 400 mtrs @ 1800	7,20,000
	Building, workshop 100mtrs @ 2200	2,20,000
	Laboratory block 40 mtrs.	88,000
	Boundry wall	50,000
	Water Tank	50,000
	<b>Total</b>	<b>20,28,000</b>

#### (ii) Plant and Machinery

Description	Imp./ Ind.	Qty	Value (Rs.)
Electric toughening furnace complete with refractory lining, heating elements, thermo-couples, recorders, operating panel board, oil circuit breaker, temperature controller etc. to heat the sheet glass at its softening point as per following specifications:  Maximum kW: 185  Maximum temp. 800°C  No. of zone: 6  Maximum sheet glass size: 84" x 36" (7'x 3')  Electric supply: 400/440V, 3 phase	Ind.	1	20,00,000
Air quenching blower with motor dia 1450 mm, motor 175 HP for cooling heated glass	Ind.	1	4,75,000
Super structure and ducting (Fabricated locally)	Ind.	1	2,50,000
Hydraulic equipment for curved sheets	Ind.	1	5,00,000
Blowing boxes and moulds for curved sheets	Ind.	1 set	50,000
Edge working machine for edge arising with motor, starter, grinding wheel, water tough and V belt	Ind.	2 sets	1,00,000
Vertical notching machine complete with motor, starter, V belt etc., for edge working	Ind.	1	50,000
Vertical grinding machine complete with motor, starter, V belt etc., for edge working	Ind.	1	50,000
Vertical polishing machine with motor, starter, V belt etc.	Ind.	1	50,000
Drilling machine for drilling holes in the sheet glass for shaping suitable drilling 1" bore with 3" x 2" cast iron table with 10"/12" drilling centre	Ind.	1	1,00,000

Description	Imp./ Ind.	Qty	Value (Rs.)
Cutting machine with arm table, cutting rail and swivel cutting head for shaping	Ind.	1	1,00,000
Drying and washing machine with blower, starter, heater conveyor, roller etc., for washing and drying the sheets	Ind.	1	2,00,000
Testing equipments	Ind.		
Rectification machine to detect surface scratch	Ind.	1	35,000
Polariscope inspection line with polaroid sheet, light etc., for testing the strain/in the glass	Ind.	1	35,000
Other testing equipments for testing	Ind.	1	25,000
<i>Maintenance and workshop machines</i>			
Lathe machine complete with accessories	Ind.	1	1,00,000
Pillar drilling machine	Ind.	1	20,500
Power saw machine 10"	Ind.	1	20,000
Hand drill 25 mm size	Ind.	1 set	10,000
Hand grinder 6" size	Ind.	1	10,000
Tools for die making	Ind.	LS	10,000
Bench vice	Ind.	2 sets	5,000
Compressor	Ind.	1	50,000
Pumps for water supply	Ind.	2	30,000
	Total		42,75,500
<i>Electric Sub-station</i>			
LT panel			
Electricals like busbar, distribution board, main switch, cables etc.			10,00,000
Taxes, freight octroi, transit expenses and handling including transformer 10%			3,00,000
Erection and commissioning such as unit construction, steel structures etc., and supervisory charges 7%			2,25,000
Electrification charges 7%			2,25,000
Contingencies and price escalation 5%			1,50,000
Misc. equipments such as trolleys, glass cutting tables etc.			25,000
Office equipment like typewriter,almirah, furniture, trolleys for carrying sheet glass etc.	LS		50,000
(iii) Pre-operative Expenses			25,000
	Total		62,75,500

## B. Working Capital (Per Month)

### (i) Staff and Labour (per month)

Designation	Nos.	Salary (Rs.)	Total (Rs.)
Production-cum-Factory Manager	1	10,000	10,000
Administrative officer-cum-Accountant	1	5,000	5,000
Marketing executive	1	10,000	10,000
Production supervisor	1	5,000	5,000
Foreman	2	4,000	8,000
Furnace operator	1	2,500	2,500
Edge working operator	3	1,800	5,400
Glass cutter	1	1,800	1,800
Packing-cum-despatch clerk	1	1,800	1,800
Steno-typist	1	3,500	3,500
Clerk	1	3,000	3,000
Security staff	2	1,800	3,600
Fitters	3	2,200	4,400
Peon	1	1,200	1,200
<i>Factory staff</i>			
Skilled labour	2	2,500	5,000
Unskilled labour	2	1,800	3,600
		Total	73,800
		+ Perquisites @ 15% on salary	11,070
		Total	84,870

### (ii) Raw Materials (per month) (75% Production in the year)

	(Rs.)
Sheet glass 32,000 sq.ft. @ Rs.22 per sq.ft.	7,04,000
Packing materials LS	46,000
Total	7,50,000

### (iii) Other Contingent Expenses (per month) (Rs.)

Postage and stationery	2,000
Telephone expenses	2,000
Consumable stores	3,000
Repairs and maintenance	5,000
Transportation charges	5,000

### Other Contingent Expenses (per month) (Rs.)

Advertisement and publicity	5,000
Insurance	2,000
Sales expenses	5,000
Misc. expenses	1,000
Total	30,000

### (iv) Utilities (per month)

Power 50,000 kWh units @ Rs.3.00 per unit cost	1,50,000
Water LS	10,000
Total	1,60,000

(v) Total Recurring Expenditure  
(per month) (i + ii + iii + iv) 10,24,870

(iv) Total Working Capital  
for 3 Months 30,74,610

## C. Total Capital Investment

Land and building	Rs. 20,28,000
Machinery and Equipment	Rs. 62,75,500
Working capital	Rs. 30,74,610
Total	Rs. 1,13,78,110

## MACHINERY UTILISATION

75% utilisation of machinery and manpower has been taken into consideration.

## FINANCIAL ANALYSIS

### (1) Cost of Production (per year) (Rs.)

Total Recurring Cost	1,22,98,440
Depreciation on building @ 5%	56,400
Depreciation on machinery and equipment @ 10%	4,27,550
Depreciation on furnace 20%	4,00,000
Interest on investment @ 14%	15,92,935
Depreciation on other equipments and furniture @ 25%	18,000
Total	1,47,93,325

**(2) Turnover**

For calculation purposes, it is assumed that the unit shall manufacture flat toughened glass of size 5 to 6 mm. the average sale prices of which is taken at Rs.22 per sq.ft. total 3,84,000 sq.ft. (per year), after allowing rejection of 24,000 sq.ft., the saleable quantity will be 3,60,000 sq.ft., @ Rs.48/- per sq.ft.

**(3) Net Profit (per year)**

$$\begin{aligned} &= \text{Turnover} - \text{Cost of Production} \\ &= \text{Rs. } 1,72,80,000 - 1,47,93,325 \\ &= \text{Rs. } 24,86,675 \end{aligned}$$

**(4) Net Profit Ratio**

$$\begin{aligned} &= \frac{\text{Net profit per year} \times 100}{\text{Turn over per year}} \\ &= \frac{24,86,675 \times 100}{1,72,80,000} \\ &= 14.39\% \end{aligned}$$

**(5) Rate of Return**

$$\begin{aligned} &= \frac{\text{Net profit per year} \times 100}{\text{Total investment}} \\ &= \frac{24,86,675 \times 100}{1,13,78,110} \\ &= 21.85\% \end{aligned}$$

**(6) Break-even Point**

Fixed Cost	(Rs.)
Depreciation on Furnace @ 20%	4,00,000
Depreciation on office equipment and furniture	18,000
Depreciation on machinery and equipment	4,27,550
Depreciation on building	56,400
Interest on total investment	15,92,935
Insurance	24,000
40% of salaries and wages	4,07,376
40% of other contingent expenses + Utilities (excluding insurance)	9,02,400
<b>Total</b>	<b>38,28,661</b>

$$\begin{aligned} \text{B.E.P.} &= \frac{\text{FC} \times 100}{\text{FC} + \text{NP (per year)}} \\ &= \frac{38,28,661 \times 100}{38,28,661 + 24,86,675} \\ &= 60\% \end{aligned}$$

**Additional Information**

- Capacity utilisation has been assumed at 75% in the 1st year.
- The raw materials and sales prices have been taken at the prevailing market and sales prices have been considered ex-factory

**Addresses of Machinery Suppliers**

- M/s. Associated Erectors (Calcutta)  
14 A, S.N. Banerjee Road, Kolkata-700 013.
- M/s. Andrew Yule and Co. Ltd.  
Yule House, B. Civil Row, Kolkata-700 001.
- M/s. Punam Machine and Tools  
10, Ganesh Chandra Avenue, Kolkata - 700 013.
- M/s. Eastern Engineering Works  
7, Fancy Lane, II Floor, 4 A, Courz in House Street, Kolkata - 700 001.
- M/s. Supertuf Industries  
3/93, DB Gupta Road, Paharganj, New Delhi.

**Raw Material Suppliers**

- M/s. Shree Vallabha Glass Works  
Vallabha Vildyanagar, Via Anand, Dist. Kaira, (Gujarat)
- M/s. Hindusthan Pilkington Glass Works Ltd.  
Assansol, (West Bengal)

3. M/s. Triveni Sheet Glass Works Ltd.  
Bhurpur,  
Allahabad (UP).
4. M/s. Indo Asahi Glass Works Ltd.  
Hazaribag,  
(Bihar)
5. M/s. Haryana Sheet Glass Works Ltd.  
20th Mill Stone,  
P. S. Rai, Sonapat,  
(Haryana)
6. M/s. Saraikela Glass Works Ltd.  
Kandra, Singhbum, (Bihar)