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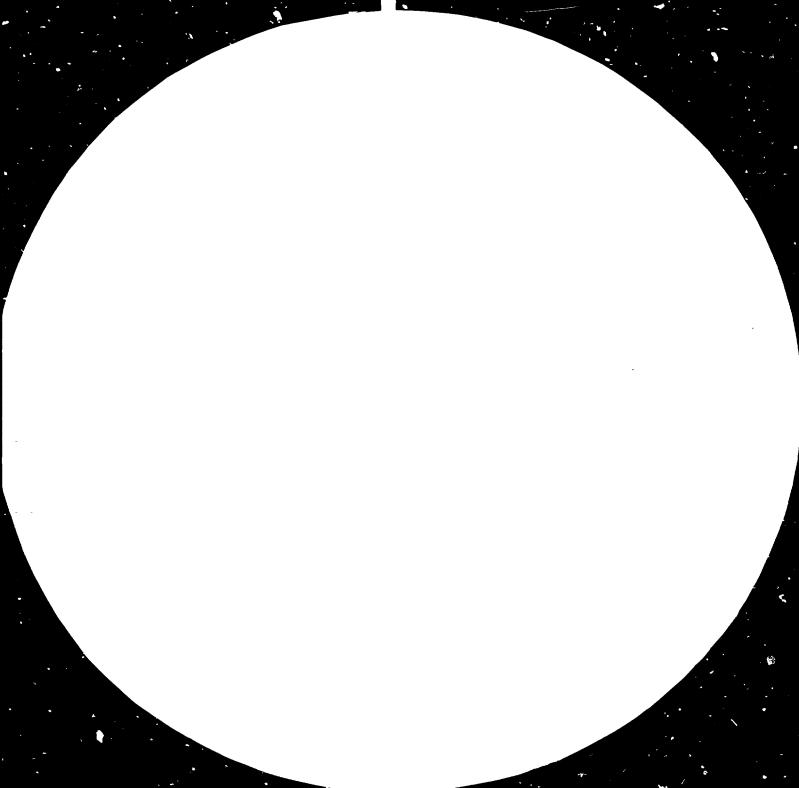
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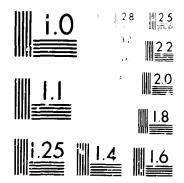
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MERCIER REPORTED FOR THE

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<u>UNIDO-Czechoslovakia Joint Programme</u> for International Co-operation in the Field of Ceremics, Building Materials and Non-metallic Minerals Based Industries in Pilsen - Czechoslovakia

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PROFILES OF BRICK PLANTE .

EY: JAH DŘEVO

Special Consultant:

-- ZDENIK ENGELTHALER

1.

November 1979

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I. INTRODUCTION

While the Profiles of Manufacturing Establishments, volumes I - III, published by UNIDO are concerned predominantly with economical parameters of industrial plants having been in operation for some years inclusive of brick plants, and the Brickmaking Plant - Industry Profile, published by UNIDO within the Development and Transfer of Technology Series is dealing with the technology of brickmaking supplemented with a review of investment and manufacturing costs as well as sales revenues, the submitted paper is focused on a series of mechanized brickworks suitable for potential deliveries to developing countries. It should give the reader a more detailed view of the extent of manufacturing equipment, degree of mechanization and technical parameters of the brick plants and advise him on how to proceed with the preparation of such a project.

Explanatory Notes

Informative prices of machinery refer to quotations in November 1979. References to tons are in metric tons.

II. BRIEF TECHNOLOGIES OF BRICK PLANTS DESCRIBED IN THE PROFIL'SS

Technologies of brick manufacture in general

The technology of brick manufacture may be subdivided into partial technologies related to particular phases of the production process consisting of body preparation, shaping, drying and firing. The applied technologies may se summarized as follows:

Body preparation	 wet preparation process dry preparation process
Sh apin g	- soft mud extrusion process - stiff mud extrusion process - semi-ary pressing - soft mud making process - vibration-compaction process
Drying	- artificial drying - natural drying

Firing	- continuous firing process
	- intermittent firing process

- 2 -

The series of the described brick plants comprises the following capacities:

Yearly output of a brick plant	Type of kila
32 mill. bricks	Tunnel kiln oil-fired
20 mill, bricks	Annular kiln cil-fired
10 mill. bricks	Anrular kiln oil-fired
5 mill. bricks	Annular kiln oil-fired
20 mill, bricks	Annular kiln coal-fired
10 mill. bricks	Annular kiln coal-fir vd
5 mill. bricks	Annular kiln coal-fired

2-3 mill. bricks Annular kiln coal-fired

All the described brick plants use the wet process in the phase of body preparation and the soft extrusion process in the phase of shaping.

The brick plants of yearly output of 32, 20 and 10 millions of tons per year include artificial driers while in the plants producing 5 and 2-3 millions of bricks natural drying is applied. The continuous firing process takes place in all the described plants. If specified, it is the moving ware continuous process conducted in the tunnel kiln in the variant of 32 millions of bricks per year and the noving fire continuous process in the annular kilns in the other cases.

In general, however, the applied technologies depend on the type of brickware to be produced (solid brick, cored bricks, blocks, tiles) and on the properties of available clays (soft clays slaking in water, non-slakable clays, harmful incretions).

- 4 -

Technology of brickworks producing 32 millions

of bricks per year (Table No. 2) Preparation shop and moulding shop

The raw mate ial from the storage dump is conveyed into the box feeder. Hence an inclined belt conveyer feeds it into the edge runner mill where the raw material is disintegrated, wetted by adding water, partly homogenized and forced through the openings in the grinding path into a plate mixer under the mill.

The raw material discharged from the plate mizer is conveyed by means of an apron conveyer with closed pans into a fine-grinding round mill. After being ground, the fine-grained material falls onto a short reversing belt conveyer which feeds either of the two large-capacity box feeders before two shaping lines by means of link-up inclined apron conveyers with closed pans. The feeders serve as a reserve before the shaping lines proper as well.

From every feeder the raw material is transported by an inclined apron conveyer with closed pans into a doubleshaft mixer with steaming through, where it is plasticated, homogeniced and the shaping consistency is rinally corrected. The processed raw material then falls into the feed hopper of the vacuum auger machine. Here it is compacted and shaped into a column from which bricks are out by means of a cutter. The further transport of green moulded bricks is provided by an automatic line setting them on metallic laths and loading them onto a column storage receiver on the wet side of the drier.

Drying

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From the storage receiver the bricks on laths are withdrawn by four-column finger trucks which again, after being transferred by electrical transfer +-bles to artificial driers, set them on ledges in drying chambers.

In every compartment, there are provided two aisles. The circulation of the drying medium is secured by means of rotomixers travelling between the aisles. The drying medium is the hot air generated in the heat exchanger by firing fuel oil and adding waste heat from the kiln. The mixture is delivered to particular compartments by a fan through distribution piping.

The anticipated drying cycle of a double-compartment should be 48 hours. Dried bricks are removed from the drier by means of four-column trucks on electrical transfer tables and are stored in the column storage receivers on the dry side of the drier. After being reloaded on conveyer and after automatic release of laths, dry bricks are conveyed by means of apron conveyers with closed pans to loading places where they are loaded by hand onto kiln cars.

- 6 -

Firing

The dried bricks are fired in a tunnel kiln. They are set on kiln cars in packs so that they may be easily withdrawn by means of a high-lift truck after firing. The successive final drying and heating of dried pieces in the kiln is carried out by hot air which can be transferred from the kiln cooling zone.

It is necessary to charge the kiln with dried bricks of good quality only (i.e. free of cracks and other mechanical defects), lest unnecessary burning losses should occur. Dried pieces of poor quality should be separated and returned to the raw material storage.

The assumed firing cycle takes 40 hours.

Dispatching

Burnt products are taken from the kiln cars by mer 3 of a fork-lift truck and stored in the finished product store.

Rail transport

The motion of kiln trucks both with dry bricks to the kiln and with burnt bricks from the kiln to unloading places as well as the circulation of empty kiln trucks is provided for by means of a rechanized rail transport system.

- 7 -

Kiln truck repair shop

Defects on kiln trucks are removed on a storage siding in the kiln truck repair shop.

0il system

The oil system equipment provides for continuous supply of fuel oil. It concists of storage tanks, pumps, distribution pipings and safety devices. A reserve for approximately 28 days of operation is stored in the tanks.

Emergency generator

The emergency generator provides for electric power supply to those units where serious damages could occur due to failure in power supply.

Technology of brick plants producing 20 and 10 millions of bricks per year (Table Nos. 3, 4 and 6,7)

This brief technology description applies both to the plants producing 10 and 20 millions of bricks per year, the manufacturing process being identical. The machinery equipment of the both variants is the same in the phases of body preparation and moulding. The double output is achieved by the larger plant running two shifts per day while the smaller one works 1 shift per day. In the phase of $dryir_6$ and firing there are two drives and two kilns to achieve the yearly output of 20 mill. bricks.

Preparation shop

The raw material from the storage dump is conveyed into the box feeder and then uniformly fed to the edgerunner mill by means of an inclined belt conveyer. In this mill the raw material is disintegrated, wetted by addition of water, partly homogenized, then forced through the holes in the edge-runner pan into a plate-type mixer located under the mill. From this mixer the raw material is conveyed into a roller mill for fine grinding. It is then conveyed by a steep conveyer into a box feeder, which serves for feeding uniformly the auger brick machine.

Brick moulding shop

From the box feeder the raw material falls into the charging hopper of the auger where the final correction of humidity, homogenization and density of the body takes place.

The auger extrudes a column which is cut by a circular cutter into bricks which are set automatically on laths and into a single-column loader. The columns are then pushed into a six-column storage receiver.

Drying

From the storage receiver always four columns are released by a column truck and transported on an electrically driven transfer table into artificial driers with impulse drying. The drier consists of particular chambers. Circulation of drying medium is ensured by rotomixers travelling between the aisles in the chambers. The drying medium is the hot air, heated in the oil-fired heat exchanger. Also the waste heat from the kiln is utillized. The hot air is delivered into individual chambers by means of a fan and distribution piping.

The drying cycle is assumed to be 48 hours. Dry bricks are withdrawn from the drier by the four-column

- 10 -

truck on an electrically driven transfer table and set in a six-column storage receiver on the dry side of the line.

Here the laths are released and the dry bricks are conveyed on a belt conveyer to three loading points. At these loading points the dry bricks are arranged by hand into preks and transported by high-lift trucks to the moving fire continuous kiln.

Firing

Dried bricks are fired in the moving fire continuous kiln of Hoffmann type. The kiln is situated in such a way that the transport moutes are as short as possible. The kiln has 22 chambers, each of capacity 48 cu.m. The chambers are charged with packs of dry bricks by means of high-ligt trucks. The packs are set on elevated supports arranged in such a way as to ensure the required pattern of setting.

The residual moisture content of dried bricks is up to 3%. The kinn should be charged only with dried bricks without cracks and other mechanical defects to avoid unnecessary losses during firing.

The principle of the moving fire is well known. At any time dried bricks are set in a chamber and fired bricks drawn from another chamber, while fuel is fed

- 11 -

to the firing zone. The combustion gases pass through the pre-heat zone warming up the unfired bricks before being exhausted to the stack. The heat recovered by cooling the fired products is utilized for preheating the combustion air and for the drier.

Fired bricks are withdrawn by means of high-lift trucks provided with hydraulic tongs.

Dispatch

The withdrawn products are deposited in the storage yard and then dispatched as required.

Note: Alternatives of brick plants with oil-fired and coal-fired kilns differ in some items in the chapters III, IV, V and VII of the Table

- 12 -

Technology of wrick plants producing 5 millions

of bricks per year (Table Hos. 5 and 8)

Preparation shop and pressing shop

The rew material extracted in a clay pit is delivered into 3 box feeder dosing it uniformly ento an inclined conveyer belt. The belt conveys the rew material to the toothed rolls where it is disintegrated. The dreased rew material is transported by an apron conveyer with closed pans into a two-shaft mixer. A further inclined conveyer serves to transport the mixture to fine rolls where it is ground to the size of 1.5 to 2 mm and passed by means of an inclined conveyer into a box feeder before a worm press. The final homogenization and compacting of the mixture are carried out in the worm press(= the auger).

The column leaving the press is cut-off by a wire cutter into bricks of required lengths which are transported to the column loaders on a horizontal conveyer belt. The moulded bricks are manually unloaded from the belt and are loaded on laths into the column loaders.

Drying

Loulded bricks on laths are unloaded from the column loaders by column trucks and transported on transfer tables to through-pass natural driers.

Dried bricks are removed from the driers by means of column trucks and are loaded on the column loaders located on the opposite side of the driers.

Pried bricks with laths are lowered in the loaders on the bentam-wheeled trucks with swivelling platforms intended for the transport of dried pieces to the kiln

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for firing. After the dried bricks have been set in the kiln the laths are transported back to the loaders for further loading.

Firing

Dried bricks are fired in the moving fire continuous kiln. The kiln is situated so that the transport routes are as short as possible. The kiln consists of 14 chambers of 38 cu.m. capacity each. The total capacity of the kiln amounts to 532 cu.m. When designing the kiln capacity the average batch of 235 pcs/cu.m., i.e. approx. 658 kg/cu.m. has been taken into account.

Bricks of 4 to 5% of residual moisture content are charged into the kiln. Slow after-drying and heating the dried bricks in the kiln is effected by hot air which can be supplied from the kiln cooling zone. For this purpose a set of piping with a connection to the transfer channel in the kiln body is installed on the kiln.

In order to avoid unnecessary losses during the firing only high-quality dried bricks are to be charged into the kiln, i.e. without cracks and other mechanical defects. Low-quality dried pieces must be separated and returned back to the raw material stockyard.

The stacking of products in the round kiln is carried out manually. The stacks must allow an easy passage of combustion products and gases generated during the ware firing in the kiln. Carefully stacked bricks secure a continuous and smooth firing process in the kiln.

After the whole chamber has been filled the filling hole is to be closed by two walls of bricks laid on clay mortar. Both the walls must be provided with clay plaster, too. The walls are mutually separated by an air gap of approx. 20 cm which improves the insulation against the external atmosphere.

Special care must be paid to the entire firing process and the operation of the kiln because this technological section is of the maximum effect on the final quality of products.

Temperature in the kiln burning zone will be checked by an optical pyrometer as required.

Note: Alternatives of brick plants with oil-fired and coal-fired bricks differ in some items in the chapters III, IV, V and VII of the Tables.

Technology of brick plants producing 2 - 3 millions

of bricks per year

(Table No. 9)

The manually extracted raw material loaded on tractor tipping trailers is delivered to the plant, where it is filled into a box feeder. Discharged by the feeder it is conveyed by an inclined belt conveyer to idle toothed rollers. Here the raw material is crushed to the fineness of 10 - 15 mm and then transported by means of another belt conveyer to a fine roller mill, where it is ground with the gap between runners being approximately 2 mm. The raw material is then transported by means of a further belt conveyer to a two-shaft through-type mixer, where it is wetted and mixed with water thoroughly. It falls then into the charging hopper of an auger machine.

From the auger the raw material is extruded through the mouth in the form of a moulded column which is cut into bricks by means of a cutter. These wet bricks are transferred by hand onto platform trucks and conveyed to the drying area. The area must be flat, with a solid surface and rain water drainage. If the bricks are too soft, it is necessary to set them flat at first, after their partial drying and getting harder, bricks are stacked and dried.

Dry bricks are loaded on platform trucks and charged into the annular kiln. In the kiln bricks are arranged in patterns with gaps in between and fired.

The bricks are then transported to the stockyard or directly to the transport vehicles for dispatching.

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III. PROFILES OF BRICK PLANTS

The Profiles comprise reviews of processing machinery based on actual projects, technical parameters, labour requirements, areas required for production premises and informative prices of machinery. The presented plants are mechanized and represent a rational manufacturing process. Nevertheless, the extent of machinery can be substantially reduced if e. G. labour is cheap and abundant in the respective country. Such a reduction. after a thorough economic calculation, may be applicable especially in the internal transport of materials and semi-products. There may be another case where the artificial drier may be excluded from a delivery to an arid country. On the contrary, an enterpreneur in a country with long-lesting periods of high air humidity will hardly dispense with such a drier.

The particular variants of brick plants with selected production factors are summarized in Table No. 1. The separation of plants with oil-fired kilns from those ones with coal-fired kilns in Table Nos. 1 to 9 was done intentionally. Although there are differences only in some items of parts III, IV, V and VII of the Tables with regard to this arrangement a clear survey from this point of view is obtained for parties interested either in fuel oil or coal basis. There is no doubt that with rising fuel oil prices there will be many developing countries unable to afford to fire bricks with fuel oil.

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The Later La

SELECTED PRODUCTION FACTORS OF MECHANIZED BRICK PLANTS

	Raw material consumption	Fired bricks gross output	Specific drying heat per kg of	Specific firing heat per kg of	Tota speci const
			fired products +	fired products	per in <u>1:</u> prod
	ton/year	ton/year	MJ/kg	MJ/kg	IJ,
	143,000	93,100	0.945	1.464 _	2.4
20 <u>1111</u> Ericks 2 oli <u>- 175</u> 1 arnul <u>er Firs</u>	92,140	59,572	1.230	1.172	2.
10 <u>milli</u> , bricks Mil-siirri Annulli, film	45,690	29,786	1.230	1.172	2
3 million (miloza 011-cilmed 011-cilmed 011-cilmed	22,900	14,900	natural drier	1,172	1.1
20 milli, bricks 2 coal-tirei compute files	92,140	59 , 572	1.237	1.339	1.2 1.3
10 mill. bricks Coal-tortic gamment film	45,690	29,786	1.237	1.339	1.2
5 minne irricks Contection Andulir ille	22,900	14,900		1.339	1.3
2-3 millio iricka Coal-: annula	15,000	9,670	- natural dric:	1.465	1.4

+ Specific heat data are calculated per 1 kg of kiln gross output. The net yearly out and a of rejects in the annular kilns. Nowever, the actual percentage of rejects we discuplize.

SECTION 1

.75 Electric Total fuel Electric Technol. Water for Total water total consumption power power total social 2t specific installed consumption consumption conveniences consumed heat per year per kg of input per year per year consumption ia + fired per year products GJ/year cu.m/year ton/year k₩ MJ/kg cu.m./jear 29,300 5,700 1,464 11,340 2.409 1,450 heating oil 3,636 489 4,455 17,000 1,075 2.402 heating oil 8,500 2.402 1,818 454 3,240 700 heating oil 203 1,544 4,100 1,050 1.172 444 heating oil h,oil 17,000 1.237 1.339 3,663 1,872 454 1,075 5,014 coal h.oil 936 424 2,585 8,500 700 1.237 2,507 1.339 coal h.oil 852 4,100 1,050 113 1,254 1.339 coal h.oil 950 150 486 1,800 846 1.465 coal

yearly outputs are calculated on approx. 4% of rejects in the tunnel kiln of rejects will depend on the quality of used clay and on the technological

SECTION 2

				·····		
					•	
ic total ption ar	Technol. water total consumption per year	Water for social conveniences consumption per year	Direct production workers total	Required area of production premises	Estimated price of machinery free Euro- pean ports	T A B L E
ar	cu.m/year	cu.m./year	number	sq.m.	000 US 🛱	
{O	29,800	1,450 ·	58	10,000	3,552	2
55	17,000	1,075	43	6,400	1 9-548	3
.;0	8,500	700	28	4,000	986	4
;4	4,100	1 , 050	42	2,400	459	5
63	17,000	1,075	43	6, 40°)	l,445	6
.35	8,500	700	28	4,000	932	7
,,,,,,,, .	4,100	1,050	42	2,400	391	8
	1,800	950	38	1,000	192	9
,,			1	1	•	

e in the tunnel kiln by the technological



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Explanatory notes to perticular variants

a) <u>Variant of 32 mill.</u> bricks with oil-fired tunnel kiln - Table No. 2

bution system.

Ad part III: The transport process of green moulded bricks between the extruder and the column storage receiver on the wet side of the drier as well as the transport of dry green bricks between the column storage receiver on the dry side of the drier and the laths releasing and bricks transleading station are automated.

> The main purpose of this automated section is to eliminate defects on green bricks that would otherwise be considerable in manual handling. The tunnel kilns are applied for larger outputs where they achieve a good fuel economy. They may be oil-fired or gas-fired. The uniform firing temperature in the cross-section of the kiln and the possibility of following the prescribed firing curve guarantee good quality of products and low percentage of rejects. Coal-firing is not applicable. The contracts for deliveries of larger plants with considerable consumption of electric power include as a rule electrical substation and power distri-

b) Variant of 20 mill, bricks with oil-fired

annular kiln - Table Ho, 3

Ad part III: Also in this case the transport of green bricks to and from the drier is partly automated for the purpose of a low rejects percentage. The two continuous annular kilos exhibit also a good fuel economy and the delivery is much cheaper in comparison with a tunnel kilo. In this variant an electrical substation and power distribution system are not included in the delivery.

c) Variant of 10 mill. bricks with oil-fired

annular kiln - Table No. 4

Ad part III: The transport of green bricks from and to the drier is partly automated for the purpose of a low rejects percentage. The kilm is of the same type and size as in the foregoing case. An electrical substation and power distribution system are not included in the delivery.

d) Variant of 5 mill. bricks with oil-fired annular kilp - Table No. 5

In this variant a natural drier is applied and, consequently, there is no oil required for the drying process. The kiln is sized adequately to the required output. An electrical substation and power distribution system are not included in the delivery.

e) Alternative variant of 20 mill. bricks with

coal-fired annular kiln - Table Nc. 6

Ad part III: The design of kilns is identical with oil-fired kilns. The main difference consists in the application of mechanized coal stokers instead of oil burners. The stokers feed ground coal through chutes in the top of kilns into the chambers of the firing zone. The oil-fired drier, however, requires also the oil system.

Ad parts III, IV: These parts include coal consumption for the kilns and fuel oil consumption for the driers.

1) <u>Alternative variant of 10 mill. bricks with coal-fired</u> <u>annular kiln - Table No. 7</u>

The same note as in the preceding paragraph applies to this variant.

g) <u>Alternative variant of 5 mill. bricks with coal-fired</u> <u>annular kiln - Table No. 3</u> Ad part III: The design of kiln is identical with the oil-fired kiln of the same size. Oil burners are replaced by mechanical coal stokers. Ad parts IV, V: With regard to the application of a

natural drier only coal for kiln firing is consumed.

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h) Variant of 2 - 3 mill. bricks with coal-fired annular kiln - Table No. 9 Ad parts I, IV, V: The plant can produce 2 - 3 millions of bricks per year. The epplied calculation is based on 3 millions of green moulded bricks representing 2 675 000 fired bricks in the final net output. Ad part III: The specification of machinery includes in this case also a transport equipment of raw material from the pit to the plant. Only the phase of body preparation and moulding is fully mechanized. The drying is carried out on a flat, solid surface with water drainage. Therefore no drier equipment is listed in the specification. Ad part VI: The manning table includes in this case also workers for clay winning and transport to the plant.

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Cable No. 2

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- 23 -PROFILES OF BRICK PLANTS

BRICKWORKS 32,000,000 bricks per year (with oil-fired tunnel kiln)

I. ALLICAL PRODUCTION CAPACITY 32,	,000,000	II. TECHNOLOGIC	L FEATURES		
fir	red bricks		Perforated bricks dimensions 240x115		
III. SFICIFICATION OF MACHINERY			l fired brick=2.8	ks	
- in technological sequence	_		Supposed clay of a properties absorbing of water of plasti	na 20	¥,5 •
Preveration and moulding shop Chree-compartment box feeder	Pcs l		losing 14% of dry in firing process		
Belt conveyer incl. iron particle	ĩ	Time capacities			
indicator Edge runner mill for wet grinding process	l	Number of Number of	working days working shifts	300/y 2/day	r _ `
Plate-type mixer	1		working time time except		/shift) hrs/year
Apron conveyer with closed pans Fine roller mill incl. 2 machines	1				_
for regrinding the rolls		Operation Operation) hrs /year) hrs /year
Reversing belt conveyer Apron conveyer with closed pans	1 2				
Box feeder with rubber belt	2 2 2 2 2	Tunnel kiln			Pcs
Apron conveyer with closed pans Two-shaft extrusion mixer	2	0il heated tunn			1
Vacuum auger machine with	2	gross output 93	-		
2 mouthpieces Automatic line providing		The delivery co			
transport of moulded bricks	2	steel accessori air handling eq			
free the brick cutter, setting		kiln ironing an	d auxiliary		-
of pricks on laths and loading onto column (orage receiver on		equipment, burn	er system, coats, measuring		
the wet side of the drier; un-		and control sys	tem, electrical		
loading dried bricks from the column storage receiver on the		installation, s			
dry side of the drier, separating		kiln.			
dried bricks from laths, reloading		Kiln cars incl.	lining materials	•	115
bricks for further transport and leths for recirculation.		Rail transport	-		
Electric transfer table incl.	2		type transfer tab]	e	2
four-column truck Belt conveyer	4	Drawing chein c	onve; er		3
freck for four-column	l set	Pressure chain- Hydraulic pushe			3 5
Lulti-stage crucks Track for electric transfer table	l set	Cable-type push	er i		5
Steel supporting structures and	l set	1	hanized rails		l set
platforms Steel chutes and feed hoppers	l set	Kiln car repair			
Metallic laths 50x30x1,540 mm as transport supports for moulded bricks during drying	44,800	hammer, compres	uck concrete mires		l set
Driers .		vibrator, pulle			
Not-air compartment type drier	2	<u>Oil system</u>			
incl. inlet fans, exhaust fan , cil-fired hot-air exchangers,	2	Fuel oil storag	e tank		2
interconnection and exhaust piping,		l of 125 cu.m vol Two-fiiter batt			2
steel structure of drier stages, rail tracks in drier compartments.		Colfecting sett	ing tank		1
drier gates, transport and hoisting		Fuel cil servic Horizontal gear			3 · · · · · · · · · · · · · · · · · · ·
trucks of drier gates incl. rail track, drawing rotomixers, drawn		distribution sy	ster		**
rotomizers, measuring and regula-		Distribution pi			sets
tion equipment, hot-air supply		: Auxiliary mater Insulation of s			set
piping from tunnel kiln to drier.		collecting sett of supply and c	ing tanks,	T	set
Both the drier compartments proper	•	piping			
and the mixing compartments built		Emergency gener			
of brick masonry are usually supplied by the buyer.		by oil engine	200 kVA driven ping and equipment	. 1	l set
	-	-			
		Electrical Inst	dilevion tion containing tw	10	1
		outdoor three-p transformers ea switchgear, two	hase oil-immersed ch of 800 kVA, one	!	*

Table No. 2 - continuation

PROFILES OF BRICK PLANTS

- 24 -

BRICKWORKS 32,000,000 bricks per year (with oil-fired tunnel kiln)

F		·			
+	IV. TECHNICAL CHARACTE	RISTICS OF MAJO	R UNITS	III. Continuation	Pes
	Moulding lines			Box-type subdistribution boards	s 10
	6 334 pcs/hour		Control desks and columns for machines on rail transport	10	
		8,334 pcs/hour (green moulded bricks)		Electrical installations from distribution boards to motors	l set
	Driers	ers		Electrical installation of the production premises	l set
	Gross throughput	35,000,000 pcs/ 7.200 hrs/year	year	<u>Tunnel kiln</u>	
	Working capacity Drying cycle	48 hours		Number of installed kilns	1
	Specific drying heat	•	1	•	I Gil-fired tunnel
	consumption per kg of fired products	U.74) MU/KE	1	Kiln design	kilr
	Fuel oil consumption	310.56 k;/hour	:	Firing temperature Fired ware	app ex. 1000°C Perforated bricks
		2,236 t/year		Fired ware	240x115x72 mm 1 brick=2.8 kg
	V. RAN MATERIALS AND I	<u>له ها خ خ کر پر پر در در</u>		Gross output	33,250,000 pcs/year 3,958 pcs/year
	Consumption of raw material in extracted condition	143,000 t/ye ar		Gross weight output	93,10C t/year
	Consumption of fuel oil	5,700 t/year		Kiln overall dimensions: - length - max. building width	143 m 5.60 m
	Installed electric power input	1,464 kW		- max. building height	3.60 =
	Electric power consumption	11,340 GJ/year		Furnace dimensions: - height above kiln car deck - width	1.93 m 3.60 m
	Consumption of technological water	29,800 cu.m/yea	ar	Kiln cer dimensions: - Length	2.60 m
ł		sumption of water 1,450 cu.m/year		- width	3.60 =
	for social conveniences			Gross volum? of storage	2 x 5.94 cu.m
	VI. LABOUR			Firing process: Firing cycle Number of burnt kiln cars/year	
	Production workers			/hour Required number of kiln cars	1.270 51 in tunnel kilm
	Shifts Preparation shop	<u>lst 2nd 3rd</u> 2 2 -	<u>4 4th</u>		54 sland-by for 42 hours
İ	Moulding shop + handling of laths	6 5 -	-	Burners	10 reserve 011-fired
	Drying incl. heat exchangers	2 2.2	2		ceiling mounted burners
	Firing	2+2 2 2	2	Power and fuel consumption:	1. 4 4
	Handling of products	6 6 -	-	Specific heat consumption per kg of fired products	1,464 110/23
	Transport of dried pieces and products	4 4 -	-	Calorific value of fuel oil Fuel oil consumption	39.35 IJ/kg 412.38 kg/hour
	Kiln car repair shop	2	-		3,464 t/year
	Oil system	1 1 -	-	Installed electric power input	160 k7
ļ		27 23 4	4	Electric power consumption	135 k.m/hour
	In the total of 58 wo duction workers are i maintenance workers (should be determined qualification in resp	rkers only dire ncluded. The nu electricians, f with megard to t	mber of itters) heir		
	VII. SUPPLEMENT	·		1	
	Required area for production preaises	10,000 sq.m			
	Informative price of machinery free European ports	3,552,000 US 🔏			

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- 35 -Profiles of Brick Playes

BRICKWORKS 20,000,000 bricks per year (with 2 oil-fired ennular kilns)

LATUCIAS PRODUCTION CAPACITY	20,000,000	II. TECENOLOGIC	IAL PLATURSS
	fired bricks	Assortment:	Perforated bricks (20, of volume dimensions 240x115x72 mm
111. BERETTERETER OF MARKENEY			1 brick=2.8 kg
- 11 technological sequence		Rew materials:	Supposed clay of average
EPERation chop	Pcs		proporties absorbing 20.4 of water of plasticity and
nx feeder	1		losing 14: of dry substance in firing process
lalt conveyer	i	Time capacities	
Idge mill for wet grinding	1		working days 300/year
Plate-type mixer	1	Rumber of	working shifts 2/day
Ire jh belt conveyer	1		working time 7 hrs/shift time except 4,200 hrs/year
Coller mill for fine grinding incl. 2 machines for regrinding the rolls	1	drier and Operation	
.pron conveyer	1		
Som feeder with rubber celt	1	Drier	
irougn belt conveyer	<u> </u>		fired excharge and kiln
Apporting structures and platform	is l set	waste heat)	-fired exchargers and kiln
lautes and charging hoppers	l set	1	Pes
uxiliary materials	l set	. Hot-air chamber	r drier 2
<u>Coulding shop</u> Vecuum auger with 3	1	are constlucted delivered in mo	r incl. mixing chember i of brick masonry and bat cases locally. The y includes inlet and
exchangeable mouthpieces	· .	emaust fans, h	hot-air exchangers,
lting roller bed	1	<pre>interconnectin; steel structure</pre>	; and exhaust piping, as of drier stages,
Sirculation chain-type cutter	1	' rails in chambe	ers, suspended insulated
Iransier table	1	<pre>/ Jates of Chambe / Jates. drawing</pre>	ers, trucks for hoisting rotomixers, drawn roto-
lutomatic setting machine	1	_ mixers, measur:	ing and control equipment,
ic ler bed	1	insulation of p	prbru?•
Peeder for the loader	1	Transship point	
-c-colur loader	1	_ Sngine-driven)	high-lift truck 4
Six-column storinge receiver for wat bricks	1	SHydraulic fork	incl. accessories 4
lleduric manufactore truck	1	<u>Annular kiln o:</u>	il-fired
licotric transfer table with Arm of le	1	kiln with block	p-fired barrel arch t courging, production 2
sin-estrum storage receiver For irles brieds	-	. The delivery of),001 bricks/year 6 machinery includes •
22 - column Jrunsloader	1		fittings, fans, suction pingo, 4 sets of
lotricule, spron conveyer solded with dry brick heveller		station, measured model	, complete oil piping ring instruments,
renoving and ary bricks to be well requipment	-	insulating mate sliding gate	erials and steel
allor concepts for transport	-		livery pipings to 2 sets
Lithe storage receiver	1	to the driers	ir from the kiln
<pre>lin; conveyer of released lins for recirculation</pre>	1	(building mater:	action of the Liln ials will be needed
Selt conveyer for further transport of dry pieces to loading point for kilns	1	bricks, cement stone, srom tir	d by the buyer: fired , like, sand, parry mber, reinforcint al steel elements.
Metallic laths 50x30x1,540 mm	33,000	1	erials are included
		Cil system Fuel oil stora Gear pumps for Two-rilter bat Collecting set Distribution p Auxiliary mate	re tank 3 oil pumping 10 tery 2 ting tank 1 ipin; 1 set



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2. Idineniid ge,eee,eee triet ger geur (eine een-sies) arruber Mines

	<u></u>		
Houlding Line		Concumption of reversements in extracted condition	92,100 . /year
Capacity 22, 141, 00 ; 5, 543 558/20		Denourgation of furl off	S. C. C. Symmetry
(creen mould	iad brusko)	Installei electria	SUD WY COM
Lriers		20 0. märt	-
Number of installed	2	Plactuic cower consumption	the state of the second se
urlers	-	Contemption of technological	. 17,000 10,00,00
Gross throughput	22,471,000 dried tricus/year	••••	
Charjing capacity Working capacity Drying cycle	150,000 pcs 7,200 hrs/year /a.brs	Concurytion of whiler for coold outpenionces	29972 taen/2012
Specific drying heat consumption per kg	1.230 NJ/kg		
of fired products Fuel oil consumption		Freducción unriera	
-	1,852 t/year	Jailto	lut kan gra
<u>Oil-fired annular kiln</u>	_	Preparation shop	2 4
Number of installed kilns	2	Houlding shos +	•
Further data refer to one kiln only.		lethe Pandling	3 ·
Kiln design	.loving fire	Dryin finol heat exonencer	
naan ucoabn	and the second sec		2+1 3-2 1
	arch kiln with block	Eamiling of products	
Fired ware	Performled bricks	iminarity of dried pieces and products	
	240miljx72 mm 1 brick=2.6 kg	Cll system	<u> </u>
Gross output Gross weight output	10,633,000 pcs/year 29,726 t/year 3.54 t/acur		
Kiln dimensions:	3+34 6/ 10 LT	In the total of 49 workers a	nip i or protoco
Number of chambers	22	In the total of 45 workers of workers are included, 200 m workers (electricians, little	
Width of channel Chamber volume	4.0 m 45 cu.m	- GOTERNIA NATA PLACES I TO T.	
Kiln volume	1.056 cu.m	in respective countries.	
Charge Values:			
Charge of a chamber			
Charge of hiln Average density of charge	219,548 ros 562 k;/cu.m.of sotting	- Jamed area of production - presiden	6 : 1.
Piring process:		informative price a	1,540,0 Mar
Cire reversing the	160 tours 350 ays/y sr 50 cumir - pear	ne linery fros luropect ports	
5	+ t moport in.		
	10 (mero, 1.5)		
			•
	- ¹¹ 80 kij/kour 11 Jynar 40 kij		
1. 1. T. S. S.	94. ik 101		
and the second	on noth a nitter. :		
Gross output	2., 76,000 nes/year		
	55.5 2 t/year		
pecific a st consumption Fuel bit done imption	211.20 kg/ 1.774 t/yea:		

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- 7 -Badrillis of triod Places

EXIGNIONNE 10,000,000 bricks per year (with oil-fired annular biln)

	fired bricks			
		ascortment:	Ferinantel bricks (21, of volum
111. DINCREICATION CONCULTINY			dimensions 240mll5m 1 brich = 2.6 kg	72 mm
in technological sequence	;	Raw materials:	Jupposed clay of av. properties abcorbin.	7 20.
<u>legenentio: shop</u>	Pca		of water of pleatic losing 14% of dry s	ity and ubstance
Bom feeder	1	Time capacities	in firing process	
lilt conveyer	1			00/****
Lige mill for wet grinding	1	lumber of		00/year /day
llate-type mixer	1	Difective Coordian	working time T	hrs/shift
Trough belt conveyer	1	dritr and	kiln ²	,100 hrs/yea
woller mill for fine grinding field to the solution of the sol	l	Operation Operation		,200 hrs/yea ,400 hrs/yea
lpron conveyer	1	<u>Drier</u>		Pcs
Bon fødder	1	(neated by oil- and kiln waste		
Prough belt conveyer	l	Hot-air chanter	-	1
Supporting structures and platfor	ms l set		n incl. mixing chambe	-
Chutes and hoppers	l set	are constructed	iron brick maconry	
Adultiony materials	l sét		In most cases locally	•
<u> nling shop</u>	ł	and exhaust far interconnecting	nery includes inlet is, het-air exchanger ; and exhaust piping,	2
Vacuum - suger with 3 Inchangeable mouthpieces	<u> </u>	rails in chambe ting gates of a	s of drier stages, rs, cuspended insula manaers, truck for	_
Pilting roller bed	1	hoisting gates,	draming and drawn Surin; and control	
direulation chain-type cutter	<u>1</u>	equipment, incu	lation of piping.	
Iransport table	<u>-</u>	Grancolin point		
sitematic setting machine	1		i igh-lift truckth	3
coller bed	1	accescories		-
Reeder for the loader	1	Bydraulic fork	with hocessories	3
ele-oclum loader	l	inular hiln of	l'_rin⊶a	
<pre>http://www.storageliedeiver for wet bricks</pre>			-lir i barrel arch -lir i barrel arch	1
lestric multi-stage sruck	-	canasity 10,000	,000 orioks/year	-
Contril transfer table with one table	-	- All necessary i	machinery includes Nittings, Pars, custi-	on
Dix-volumn storaje receiver Res arled Dricks	-	otipico, eres, comple inclorations include	pinge, 4 seet of mobi the oil piping a stic runger of insulating	1e F,
One-column vronslosder	1	materials, stee	il cluiing gates.	
Sistri. Sompron Soveptar provides with dig some lovell€r	2	l custior and del 1211 - nir Irc	liver piping to draw a the kill to the	l set
fatus rop <mark>ving and dr_e pieces</mark> Factorian d evic e) aler Se ephones ale		
Self convelor for transport of ladio	- -	telliveret et a conort, itra, c	alo lire neodea do be le buyur: fired brich land, quarry stone, s	aim
Laura storr to receiver			circ Jars, structura	
testing conveyor of release inclusion recirculation	2	ouralling anto	erinlo are ucually ler's delivery.	
helt on over for further managed any places to losaing point of the kinn		<u></u>	·	
Mechlic lashs	15,500	level oil plarma	ju talik	2
540 mm	-	Gear pumps for No-filter batt	oil jumping	3
		Collecting set:	ing tank	1
		Distribution pi	lpin;	l sct 1 set
		سرتيا فالجردورو التي متيف تحسيم تساوه ما ا		وتات فيقد سد

Table No. 4 - continuation

- 2 -PROPILIO OF BAULI SLANDS

LATCHWORAD 10,000,000 prices per your (sing bil-sings findersing)

1

Soulding line		Concernt est of the material	1 45, 6, 0 t/gest
Capacity 11,220,000 pos/year		in exchanter condition	
	pos/hour	Concurption of fuel off	1,813 t/rear
(green moulded trisks)		Inculled electric power	15. X.
<u>)rier</u> G r oss throughput	11,220,000 pcs/year	Alestric power consumption	
1000 s.mong.rpas	(green dried bricks)	Concerption of technologies	
Charging capacity	75,000 pes	ater	- 29,00 0.2.4 <u>0</u>
Working capacity	7,200 hrs/year	Sone contion of weger	700 million/pear
Drying cycle Specific drying heat	48 hours 1.230 MJ/kg	for spaint conveniences	
consumption per kg of fired products			······································
Fuel oil consumption	129.30 kc/hour 931 t/year	Induction morkers	
Dil-Tired annular		Chifts	lot 2nd Jra 4th
<u>kiln</u> :	Versie - dit	Preparation shop	2
Kiln design	Moving fire top-fired barrel arch kiln	loulding shop + Laths hendling	3
Fired ware	Perforated bricks 240x115x72 mm	- irving incl. heat Sonohanger	1 1 1 1
	1 brick=2.8 kg	, Firing,	2+2 2 2 2
Gross output	10,638,000 pcs/year	landling of products	4
Gross weight output	29,767 t/year 3.54 t/hour	Transport of dry pieces and products	4
Kiln dimensions: Number of chembers Width of channel Chamber volume	22 4.0 m 48 cu.m	Gil system	· · · · ·
		·	15 3 3 5
Kiln volume	1,056 cu.m	In the total of 28 workers	only lirect
Charge values: Charge of chamber	9,984 pcs	production workers are inc	
Charje of kiln Average density	580 20/00 0	f of maintenance wonders (el	•
of charge		choula be determined with jualification in respection	
Firing process: Fire reversing rate		1 •	
Number of working days		VII. DUPPL.CLWF	
Number of kiln turnings	50 turnin js/yea.	Required area of production 4,000 cost	
Burners	4 transportable burner sets	Triormative price of	565,000 to //
Number of burners	12 ourners/set	Machinery free Suropean polis	• • • •
Puel and power consum Crucitic bast	nption: 1.172 MJ/KA		
Specific heat consumption Fuel all calorific	39.35 MJ/kg		
value			
Fuel oil concumption Installed electric	105.60 hj/hour,567 t/ 46 ki yaar		
power input Disctric power concumption per hour	34 Kita		
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Pable No. 5

- 29-FAOFILIS OF BAIDK PLANDS

ERICINCENS 5,000,000 bricks per year (with oil-fired annular Liln)

<u></u>	5,000,000 fired bricks	II. TECHIOLOGIDIL PLATUR 3	(200° or molect)		
III. (PROIPICTION OF MACHINERY		Assortmen Perforated bricks dimensions 240x115			
		1 brick = 2.8 km			
- in technological sequence		, , , , , , , , , , , , , , , , , , ,			
Preparation shop	Pes	Raw materials: Supposed clay of a			
Box feeder	l	properties ebsorbi	-		
Bult conveyer	1	of water of plasti			
lile toothed rolls	- -	losing 14% of dry	substance		
	l	in firing process			
ivo-shait miner	l	Time capacities:			
Apron conveyer	l	Number of working days	300/year		
High speed rolls incl. roll grin	der l	lumber of working shifts	l/day		
Loron conveyer	1	Effective working time	7 hours/shift		
lom desder	l	Operation time except	2.100 222 (200		
Supporting structures and platfo	orms 1 set	drier and kiln	2,100 hrs/yea		
Chutes and charging hoppers	l set	Operation time of kiln	8,400 hrs/yea		
Auxiliary materials	l set	•			
Toulding shop		Annular kiln oil-fired	Pcs		
	1	Noving fire top-fired barrel arch kiln of production capacity	l		
Sirculation chain-type cutter	l	5,000,000 bricks/year			
kelt conveyer	1	The delivery of machinery includes			
Floor-type column loader	2	all necessary fittings, fans, suction			
Ploor-type column transloader	2	and exhaust piping, 4 sets of mobile			
Dicetric transfer table	4	burners, complete oil pumping station,			
One-column manually operated	4 •	insulating material.			
vruch car Natural drier		Steering car on bantam wheels for kiln charging	l		
Truck for transfer tables on the charging size of the driver	2 1	Steering platform car on tyres For the construction of the kiln	1		
Track for transfor tables	•		-		
amain for transfor tables on the discharging side of the d	irier -	to be delivered by the buyer: fin			
Pract for salti-stage core	1	<pre>// be delivered by the buyer; if // bricks, cement, lime, sand, quary</pre>			
in drier choles	1	stone, sawn timber, reinforeing	J		
Steel structures made of solid is sections and plates	l set	bars, structural steel elements.			
Vertien Laths /carriers of pieces/	24,300	Refractory materials are included , in seller's delivery.	i		
(cize 40x60x1540 mm)		1			
Tratective netting of troller line	1	1 Od.1 syrtem			
		Puel oil storage tank	1		
··		Gear pumps for oil pumping,	4		
in the second	oć a	lwo-filter battery	1		
iulding natorials for driver and much any timber, fastening and a	nchering	Collecting setting tank	1		
material, stepl galvanized corr	ujated	Distribution piping	1 set		
shew, and galvalized tinsmith's as will is wooden laths are usual		Auxiliary materials	l set		
uvlivered locally.	-	Insulation	l set		
		1			
"Buyer's delivery.					

BRICHMUNHUS 5,000,000 pricks per year (with oil-dir i sumular kiln)

<u> goula Turper</u>		- Sindia tith of me leavenin in knowedder sondi, kn	2. 2.,50, t/y at		
Capacity	5,007,000 por/year	in antractic bondialan Dimension of data oil	···· •/:		
	2,670 pos/licuz	inaliei eleatria momer			
	(green moulde: bricks)				
	or1323)	- Electric promission contraption			
latural_drier	5,607,000 pos/gear	- Jone option 61 technologie - water	ni - Jill cust inte		
fross throughput	(green úried	Consumption of water for	1,050 au.m/yea		
	bricks)	zreitl convenienze:			
)il-finad onnulan kiln					
		<u>Ireduction workers</u>			
Kiln de s ign	Noving fire top-fired barrel arch kiln		<u></u>		
Pired ware	Perforated bricks				
	240mlljm72 mm		2 1		
Gross output	1 brick = 2.6 kg 5,320,000 gcs/year		·· 6		
aross onebre	pcs/hour وَرَوَهُ	·	·+2 · 2 · .		
Gross output by weight	14,900 t/year 1.170 t/hour	Products handling	8		
المتعالم المعالية المعالم المع	Tello flynny		6 2 2 L		
(iln dimensions:		: ا	•		
lumber of chembers	1;	 In the total of 42 workers	only direct		
Width of channel Chamber volume	ン• フ 皿	production workers are inc	•		
Kiln volume		of maintenance workers (el	lectriciana, litt.		
Charge values:		should be determined with regard to vice a			
Charge of chamber Charge of kiln	125,000 pcs 658 kg/cu.m	qualification in respectiv	re countries.		
Average density of charge		<u>.</u>			
	ol setting				
Firing process:		l . Required area of productio	an 2,400 aq.m		
Fire reversing rate Number of working days	165 hrs=1 week 350 davs/year	premises	··· ·· ·· · · · · · · · · · · · · · ·		
Number of working hours Number of kiln surnings	8,400 hours/year 50 turnin_s/year	' Informative price of			
Surners	4 vranuportuble) machinery free Europown 9 ports			
llumber of burners	sets 12 burners/set				
Fuel and power consumption: Specific h at consumption					
Calorific A at consumption Calorific value of fuel oil	1.172 MJ/kg 39.35 MJ/kg	1			
Ui_ consumption	92.66 kg/hour 444 t/year				
Installed electric	24 Z3				
power input Diectric power	17 200	i .			
consumption per hour		, , ;			
	•				
) 	•		
		1			

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- 31 -Moyillis of Brick Films

Daronneum 20,000,000 pricks per year (with coal-filted annular kinn)

20,00	0,000 bricks	II. 200.500LOGICAL P.ACULLO	
	——————————————————————————————————————	Assortment: Perforated bricks (10%, of volume)	
TIL GRUDINES CON CONTINUES		l dimensions 2:0rll5r72 mm l brick = 2.8 kt	
- in technological securnce			
<u>Technalisa skop</u>	Fol	law materiels: Supposed clay of average prope absorbing 20% of water alphast and losing 14% of dry substanc	icity
Dom floeder	1	in firing process	-
Beit conveyer	1	Time capacities:	
Dive mill for wet grinding	1	Tumber of working days 300/year	
Elaie-type miner	1	Number of working shifts 2/day Effective working time 7 hrs/shift	
Traugh balt conveyer	1	Operation time except .,200 hrs/selft	-
Holler mill for fine grinding incl. 1 modines for regrinning the rolls	1	drier and kiln Operation time of drier 7,200 hrs/yea Operation time of kiln 8,400 hrs/yea	r
Apron conveyer	1		
Box Teeder with rubber belt	1	Drier (heated by oil-fired exchangers and	
Prough belt conveyer	1	kiln waste heat)	
Supporting structures and platforms	l set	l de la construcción de la constru	Pcs
-	l set	Hot air chamber dritr	2
	l set	Chambers proper incl. mixing chember are constructed of brick masonry and delivered in most cases locally. The	
<u>Loulding shop</u>		drier machinery includes inlet and exhaust fans, hot-air exchangers, inter- connecting and exhaust piping, steel	
Vacuum auger with 3 enchangeable mouthpieces	1	structures of diver stages, rails in chambers, suspended insulated mates of	
Tilting roller bei	1	chambers, trucks for hoisting gates, drawing rotominers, drawn rotomixers,	
Circulation chain-type cutter	1	measuring and control equipment.	
Irensier table	1	inculation of piping	
Lucomatic setting machine	1	Fransship point	
Lollor Lyd	1	Lagine driven high-lift truck	4
Peeler for the loader	-	Nydraulio fork incl. accessories	Ļ
Che-column londer	1		
Dix-coluum otoraje receiver for Wet moulded bricks	Ì	<u>larular kiln coal-fired</u> Howing fire top-fired arch kiln with	
. leotrie multi-stage truck	-	block charging, preduction capacity 10,000,000 bricks per year	2
l otric transfer table with curntable	÷,	The delivery of machinery includes all	-
chi-ooluum storage receiver for article bricks	1	chaust pipings, coal stokers with	
une-colum transloader	ì	Losecories, control equipment, mensuring increments, insulation material, steel	
Syron as weger provided with dry but a levellor	1	sliding gates.	
latic reliving and dry bricks training equipment	l	1 .0, dif 110. She will to the driers	set:
holls conveyer for treleport of laths	: 1	for the construction of the kiln building	
Laum roprage receiver	2	by he bayer: fired bricks, combat, lime,	
leling conveyer of Levhs for recirculation	1	f said, quarry stone, sawn timber, rein- foreing bars, strug aral steel elements.	
Delt serverer for further transport of dry pleases to loadily points for kills	l	, Moiractory material: are included i in seller s delivery.	
Devilli Str	33,000	<u>Vil system</u>	~
Jongoul, - Politik	JJ,(00	Fuel oil storage tank Jear pumps for oil pumping Double filter battery Collecting sedimentation tank	noort
		 Jistribution piping Juxiliary material 1 	. set . set

lable No. 6 - continuation

- 11 -Filo IIAS CONSILATIS

IV. THOIRICAL CHARACTERIZITI	<u>33 67 1502 0017a</u>		10121
<u>Loulding line</u>		Contemption of restancesial	
Capacity: 22,441,000 pcs/y		i in attracted condition	32,140 t/jear
5,343 pcs/hour	juricks)	Convergence el chel oil for sile driere	1,010 t/year
<u>Driers</u>	2	Consultion of coal for The kilns	5,01: 7/7022
Number of installed driers Gross throughput	2 22,441,000 áricá bricks/year	<pre>/ inc alle i gloctric power / input</pre>	454 M/year
Charging capacity	150,000 yes	Consumption of electric gover	3,663 GC/mar
Working capacity	7,200 hrs/year	Consumption of technological	
Drying cycle	46 hours	, hater	17,000 cu.m/rc
Specific drying heat consumption per kg of fired products	1.237 IJ/kg	Communition of water for spoint conveniences	1,075 cu.m/yer
Fuel oil consumption	260 kc/hour 1,872 t/year		
Coal-fired annular kiln		Frediction workers	
Number of installed kilns	2		0-3 Test 14
Further data refer to one			****************
kiln only.		Preparation shop 2	2
Kiln design	lloving fire top-fired barrel	Houlding chop + laths hondling 3	3
	arch kiln with block charging	Drying incl. heat exchanger	
Fired ware	Perforated bricks	Firing 2+2	
	240x115x72 mm 1 brick = 2.8 kg	Handling of products 4	
Gross output	10,638,000 pcs/yes 1,266 pcs/hour		
Gross weight output	29,786 tons/year 3.54 tons/hour	Cil system 1	
Kiln dimensions:		20721 19	15 5 3
lumber of chambers	22	In the total of 43 workers onl	e dincor en-
Width of channel Chamber volume	4.0 m 48 cu.m.	duction workers are included.	The number of
Kiln volume	1,056 cu.m.	maintenance workers (electrici should be determined with rege	in their
Charge values:		qualification in respective of	· · · · ·
Charge of a chamber Charge of kiln	9,984 pcs 219,648 pcs		······································
Average density of charge	582 kg/cu.m.		
Firing process:	of setting	Required area of production promises	6,400 sjeme
Fire reversing rate Number of working days Number of kiln turnings Burners	168 hours 350 days/year 50 turnings/year 54 coal stokers	Informative price of machinery free European ports	1,445,000 VC 🖌
Fuel and power consumption: Specific heat consumption Calorific value of coal Coal consumption	1.339 20/25 15.91 20/25 298.45 kg/20ur 2,507 t/year		
Installed electric power input	48 ¥ii		
Electric power consumption per hour	34 kWh		
Summer of selected data for both the kilns:			
	21,276,000 pcs/year 59,572 t/year		
Coal consumption	596.50 kg/hour 5.014 t/year		

BRICHTORRE 20,000,000 bricks pur your (with cont-dired canalar Wilm)

Table IS. 7

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.

DRIGHNOWNO 10,000,000 briens per er er ende stal-sidet under kild)

I. ANULL PRODUCTION C.P. TIPY	10,000,000	
	fired bricks	
II. SPECIFICATION OF LACENDAY.		aimensions launilin'i 1 Vriek = 2.2 kt
- in technological sequence		has motoriale: Supposed play of average properties activities at all
Prenaration shop	Teo	Willy of play loty and losin; 11,007 ary cultures in arying trocess
lox feeder	-	
Belt conveyer	1	Cime cupacities:
Zage mill for wet grinding	1	Runber of working laye (1.1/year Runber of working chifts (1/say
Plate-type mixer	1	lumbar of working allits lyday Liteotive working time 7 lumyallit
Trough belt conveyer	1	contraction time enders
Roller mill for fine grinding incl. 2 machines for regrinding the rolls	1	Cremation time of kiln (400 km///////////////////////////////////
Apron conveyer	1	
Box feeder	1	<pre>'Spice (heated by oil-fired exchanger and hill whate heat)</pre>
Trough belt conveyer ·	1	·
Supporting structures and platforms	l set	Chembers proper incl. mining okceler
Chutes and hoppers	l set	, are con tructed from brick marcury , and delivered in most cases locally.
Auxiliary materials	l set '	, the driver machinery includer inlat
		and ended denotes include the second states of the second states and ended states, and ended states such as second states and ended states such as suc
Loulding shep) sucel structures of drier longes, rails in chumbers, sucpended
Vacuum auger with 3 exchangeable mouthpieces	· ì	pincularing dates of chlubers, truch for heisting dates, drawing and pincen rotominers, helseuring and
Tilting roller bed	1	- control equipment, inculation of
Circulation chain-type cutter	1	piping.
Transport table	1	Erengelig roint
Automatic setting machine	1	- <u>hermanistani</u> Sheine-driven high-lift truck - 3
Roller bed	1	with accessories
Peeder for the loader	1	Nydraulie fork with accessories
One-column loader	1	<u> an la kiln sal-titu</u>
Six-column storage receiver for wet bricks	1	living line sor-fined terrol and a l hilm with block clargely grouterion
Electric multi-stage truck	1	capacity 10,000,000 Smicht, year
Electric transfer table with turn table	l	The delivery of machinery includes
Six-column storage receiver	1	and emicust pipings, coal atticut with a converse equipment, measuring inverse ments, inculation material, otcel
Gne-column transloader	l	ulian (1990). Ulian (1990)
Distributing apron conveyor provided with dry brick level or	1	Subtion and couldwary withing to cross off too-oir from one with to the ariser 1 c
Laths removing and dry pieces transloading device	÷	for the construction of the kild of the second states of the second second second second second second second s
Loller conveyer for the transport of laths	1	no do deliversi by the buyer, first brish, solod, line, sand, suarr
Litha storaje receiver	1	robnu, kona alkoer, rahiloroing biro, porasi, rah asaal elemento,
Peeding conveyer of released laths for recirculation	1	astrojory noswials are included in Seller's delivery.
		<u>ell moter</u> (for heating the drier)
Belt conveyor for further transport of dry pieces to loading point for the kiln	-	e The second sec
Metallic laths 50x30x1,540 mm	26,300	<pre>/// Liter Litery Litery / Litery Litery in teach / Litery Litery in teach / Litery Litery Instead also / Litery Instead also / Litery Instead also / Litery Instead also / Litery L</pre>
1		الله الله المعني الم المعني المعني

Table No. 7 - continuation - PROFILES OF BAION PLANTS

DAIGRNCHUS 10,000,000 bricks per year (with cool-fired annular kiln)

Loulding line		Consumption of rew mate	rial			
Capacity 11,220,000 pcs/year (green moulded bricks)		in extracted condition Consumption of fuel oil		45,690 t/year		
		for the drier		9 3 6 :	t/year	
<u>Drior</u> Gross throughput 11,220,00° pos/year (green dried bricks)		Consumption of coal for the kiln		2.50	7 t/yea	17
		Installed electric power input	er	-24 1		
Charging capabity	75,000 pes	Electric power consumpt	tion	2,58	5 GJ	
Working capacity	7,200 hrs/year	Jonsumption of technolo	ogical	0 50	.	
Drying cycle	40 hours	water Consumption of water		8,500) cu.m	/je
Specific drying heat consumption per kg of fired products	1.237 IJ/kg	for solial converiences	3	700 0	cu.m/ye	ear
Itel oil consumption	130 kg/hour 936 t/year	VI. L.BOIR				
		Production workers				
<u>Coal-fired annular kiln</u>		Shifts	7	<u> </u>	3-3	
Kiln design	Moving fire top-fired barrel arch kiln with	0.11.78	1st	2nd	3rd	4
	block charging	Preparation shop	2	-	-	
Tired ware	Perforated pricks 240x115x72 mm 1 brick = 2.8 kg	Noulding shop + laths handling	3	-	-	
Gross output	10,638,000 pcs/year	Drying incl. heat erchanger	1	-	1	
	1, 55 pes/hour	Firing	2+2	2	2	
Groce weight outpu	29,787 t/year 3.54 t/hour	Handling of products	4	-	_	
····		Transport of dry	_			
Hilm dimensions: Number of chambers	22	pieces and products	4			
lith of channel Charler volume	4.0 m 48 cu.m.	Oil system	÷			
Nilm volume	1,056 cu.m.		1:	3	3	
rje values:		In the total of CD work		1. dim.	~ ~ +	
	9,984 pcs 219,648 pcs	production workers are		-		مد ن
raje density of	562 kg/cu.m. of	of maintenance workers				
5.2000 	setting	should be determined w:	-			
<u>Firit : process</u> : Fire reversing rate	168 hours	qualification in respec	-			
Such r of working days Sumber of kiln turnings	350 dam /year 50 tominic/year	VII. SUZPLENSUT				
Burners	54 coal stokers			,	n -	
<pre>. : L and power</pre>		Required area of product premises	stion	4,000	0 sq., m	
optific heat	°.•339 ∷5/23	Informative price of machinery free Euro- a	-	620 /	000 US	"
Salouilic value of coal	15.91	ports	•	اوعور	000 03	14
Dal consumption	298.45 kJ/hour 2.507 J/year					
inutallud lectric power input	24 XV					
Diserrie pewer concumption per hour	17 kWh					
1						

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Intle DF 8

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PROFILIS OF BRICK PLANDS

BAIGNAGAND 5,000,000 bricks per year (with coal-fired annular kiln)

<u>I. ANTUAL PRODUCTION CAPACITY</u> 5,000 Sired	,000 Dricks	Assortment: Perforated bricks (20) of volume)
		dimensions 240x115x72 mm,
IL. SPUGIPICATION OF MACHINERY		1 brick = 2.8 kg
- in technological sequence	-	
- TH recumoroficar sednewce		Raw materials: Supposed clay of average
Preparation shop	Pes	properties absorbing 20%
Lom feeder	l	of water of plasticity and
lon leeder Delt conveyer	1	losing 14% of dry substance
Idle toothed rolls	1	in firing process
	÷.	
Apron conveyer Iwo-shalt mixer	⊥ ר	Time capacities:
	÷ 7	· ·
Apria conveyer	1	Number of working days 300/year
Nick speed rolls incl. roll grinder	1	Humber of working shifts 1/day
Apron conveyer	<u>_</u>	Effective working time 7 hours/shift
Box feeder	1	Operation time except drier and kiln 2.100 hrs/year
Supporting structures and platforms	l set	Operation time of kiln 5,400 hrs/year
Chutes and charging hoppers	l set	
Auxiliary materials	l set	}
•••••		Annular kiln coal-fired Pcs
<u>Noulding chop</u>		Noving fire top-fired barrel 1
Luger with 2 exchangeable mouthpieses	1	arch kiln of production capacity 5,000,000 bricks/year
irculation chain-type cutter	1	The delivery of machinery includes
lelt conveyer	1	all necessary fans, fittings, suction
Floor-type column loader	2	and exhaust piping, coal stokers with
Ploor-type column transloader	2	accessories and control equipment, "
Diectric sfer table	÷	measuring instruments, insulation
One-co? ually operated	4	caterial.
truck		1
lavural arjer		Steering car on bartom wheels 1 for kiln charging
Track for pranuler tables on the pharping class of the driver	l	Steering platform car on tyres l
irisk for transfer table on	l	, For the construction of the kiln
the dirator jing side of the drier	-	building materials vill be needed
frack for multi-stage caru in drier aloles	1	to be delivered by the buyer: fired
Steel structures made of	l set	bricks, cement, line, sand, quarry
rolled section and plates	_ ~~ ~	stone, sawn timber, reinforcing bars,
Tooden Latus Carriers of	24,600	structurel steel clonents.
pressed pieces)	- · ,	Refractory materials are included in
hize 40n50x1540 mm		seller's delivery.
*Protective netting of troley line	l	
		With regard to the applied natural
.		drier there is no need of fuel oil
Note:	• ` -	and oil distribution.
Duildin; material for drier sheds su		1
timber, fastening and anchoring mate	-	
galvanized corrugated sheet and galv		
tinsmith's sheet are not included in	the	
delivery.		
+ - • • • • •		•
+ Buyer's delivery		

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- 55 -Pable No. 6 - continuation Recolled of Labor Million

BRIGHTAN WE 5,00 .000 bricks per year (with coal-lived annuar Mile)

<u>Loulding Line</u>		- Concurstion of survivates		22	0 1/3	
<u>noduli, unio</u>		in entres el sensition			-	
Capacity	5,607,000 pec/year	- Janus mpolanu al Goal		1,254 t/year '		·
	(green moulded	¹ Installe, elus mis porez inpit	113 X.			
bricks)		Elsotric power concumption		852 i	U/yeel	
Natural drier		Constantion of testmolog	jical	4.10) ou.m/	تبينا كانيا
Gross throughput	5,607,000 pcs/year (green dried bricks)	Consumption of water for costal conveniences	•) cu.m	
Coal-fired annular kiln	,					
Kiln design	Loving fire ton-fired barrel	Production workers				
	arch kiln	Shifta	lst	2r.d	3rd	4 7 2
Fired were	dare Perforated bricks 240x115x72 mm					
	1 brick = 2.3 kg	Proparation shop Moulding shop	2 ·	-	-	-
Gross output	5,320,000 pcs/year	لولاده معنی معموم معنوم المعنی معنی معنی معنی م المعنی معنی معنی المعنی معنی معنی م	 6		_	_
	633 pcs/hour	i Firing	7+2		2	
Gross output by weight:	14,500 t/year 1.770 t/hour	llaniling of products	3			
	•		οć	' _	2	2
Kiln dimensions:						_
Number of chambers Width of channel	14 3.5 m	In the total of 42 workers only direct production workers are included. The number				
Chamber volume Kiln volume	38 cu.m 532 cu.m	of maintenance workers				
		should be determined with				,
Charge velues:	0.130	qualification in respect				
Charge of chamber Successories of kiln	8,930 pcs 125,000 pcs					
directing density of directory	658 kg/ou.m. of	VII. SUPPLEMENT				
Firing process:	setting	Required area of product	tion			
Fire reversing rate	168 hours = 1 week	prémiecs				
Humber of working days Humber of working hours Humber of kiln turnings	350 days/year 8,400 hours/year 50 turnings/year	Informative price of machinery		392,	655 55	e' N
Burners	30 stokers	free European ports				
Fuel and power and consumption:	•					
Specific heat consumption	1.339 LJ/kg					
Calorific value '	15.01 113/kg					
Consumption of coal	149,28 km/hour 1,254 t/jear					
Installed elect ric power input	12 kű					
Bleesrie power consumption per hour	9 XWA					

- 37 -PROPILES OF BRICK PLUTS

MICHAULE 2 - 3 millions of bricks (with coal- or wood-fired agnular kiln)

	2,675,000	IL. THOMMODOLICAL P	10.90.23	
	lirea bricks	Assortment	Solid and/or	perforated bricks
(illouintions refer to this am of not production)	ount		dimensions 24 w.ight 3.4/2.	0ml15x72 mm
	·	- Can materials	Supposed clay	corbing 20%
- in traincle pleas requeste			losing 140 of	plasticity and Cary substance
the second of the tite		Line capacities:	in firing pro	poess
	1	Imper of work	cinc devs	250/weer
		/Ucasonal oper approx. 9 mor	ation -	
1 . 10:102	1	Mumber of work	circ shifts	1/day 6 krs/shift
l l converce Lui trance rolls	1	Operation time drier and kill	e except	1,500 hrs/year
	1 F	Operation time		6,636 hrs/year
Colling Sur Bells	*	IV. TECHNICAL CHARM	C 777759708 0	בסדיקן רחיניי ב
- Luit miner	1		<u></u>	
		<u>Noulding line</u> Capacity	3.00	0.000 pcs/year
in algorit track a contraint prationes	20 1 set	Japasz .	ີ (ສ	reen moulded pricks
lights and histors	l cet l set		-	0 pcs/hour
line or one-live emular kiln		Conl-fired annular		na Pino tan Pinat
مريسه ومسمع بروسين ومريد ومرار مسريد		Kiln design		ng fire top -fired el arch kiln
uth of production capacity 1 - 5 mille pricimper year	1	Fired ware		ks 115x72 mm ick = 3.4 kg
The delivery of machinery include control lan, act-air fan, like fans control, all necessary fittings, p	s ., .iping.	Gross output	2,84	4,000 pcs/year 00 bricks/week
for the concurration of the kilm	5	Gross output by we	icht 9,67	0 t/year
b alding misorials will be needed by delivered locally: coment, can three bricks, lime, guarry stone, and there, reinforcing bars, and there are elements.	.ú.,	Kiln dimensions: Number of chambers Width of channel Height in the vaul central line Length of 1 chamber	2.0 t 2.5 r 5.2	reade and and and
	idel	Chamber volume Kilm volume		cu.m
		_ Fuel consumption: Specific heat cons	unption 1.46	
		Calorific value of	coal 15.7	products 47 LU/kg
		Cosl consumption	227. E46	49 kg/hour t/year
		<u></u>	N DINROY INP	
		Concernation of year		15,000 t/year
	 	in entracted condi- longue tion of coa provalles electric	1	846 t/year 150 %
en e		ingu Cleschie power con Concomption of Sec		426 GJ/yeer 1,000 cu.m/yeer
an a		Univer Concumption of Wat cosin1 convenience		950 cu.m/year
i a a irrino irri to itin 1		·····		
			escuestion -	- 1,000 sq.m
		section.		_
35 2	1 1	Informative price free Suropean port		192,000 US #
·		_ <u></u>		

IV. THE PROCESS OF ESTABLISHMENT OF A BRICK PLANT

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The technological equipment of which various variants have been described in the preceding chapter is only one production factor. It forms together with engineering works, raw and auxiliary materials, energies, labour and managing staff the physical substance of a brick plant. The preparation of the establishment of a plant is an exacting process consisting of many activities planned within the framework of a project.

Successive phases of a project

- A. Activities aiming at decision-making
 - Geological research
 - Preliminary testing of raw materials
 - Pre-feasibility study
 - Laboratory testing of 19W materials
 - Pilot plant testing of raw materials
 - Elaboration of technology
 - Peasibility study

B. Project engineering

- Engineering design and preparation of books of tender for equipment
- Evaluation of tenders for equipment
- Preparation of books of tender for civil engineering works
- Evaluation of tenders from civil engineering contractors
- Co-ordination of construction, equipment delivery, erection and supervision

- Supervision during construction
- Supervision of start-up and commissioning

Geological research

In most cases there will be no extensive prospecting for clay necessary. There are visible and time saving ways how to find clays for brick-making.

The investigation should start with a visit to the Geological Survey of the respective country. There would be few reports in the library dealing with clays but there may be more reports on prospecting for coal, oil, metals, etc. These reports often contain hints to clays in the upper layers of the overburden. The pits exploited by the existing handicraft brick producers are also a promising; guide to clay deposits. Contractors of road building are sure to possess information on clay occurances as well.

The geologist looking for aley suitable for brick manufacture should be assisted by a brick plant technologist. The identification of size of deposit, calculation of reserves, whickness of overburden, taking of representative samples and proposal of the mining method should be their job.

The extent of the taking of mamples depends on the purpose for which they are needed (preliminary, laboratory, pilot plant tests) and on the required quantity of olay in the deposit. Drilling sinking shafts into the ground and taking samples from olay outprops are the applied pathods. If the homogenity of the deposit has not been sufficiently investigated in the initial phases an adequately intensive drilling should be repeated before opening the pit.

Conclusion:

The samples taken successively in particular phases are delivered to a testing institute for preliminary, laboratory and pilot plant tests.

Preliminary testing of raw materials

The objective of the preliminary tests is the identification of the tested raw material by ascertaining its basic properties. The preliminary tests should provide for the basic information regarding the application in a certain product. They are carried out in the following sequence:

- Description of samples
- Experimental firing and assessment of fired corpuscles
- Preparation of laboratory briquettes
- Determination of water of plasticity
- Drying shrinkage
- Firing shrinkage at three firing temperatures
- Water absorption
- Bending strength
- Assessment of colour and appearance of fired laboratory briquettes

Conclusion:

If the preliminary tests are positive, a preliminary technology may be drafted within and for the purpose of a pre-feasibility study.

Pre-feasibility study

The pre-feasibility study comprises the investigation of raw materials as per preliminary tests, the market possibilities and a draft of the establishment of a brick plant inclusive of its location with estimates of capital requirements, investment costs, production programme, sales and revenues, production costs and profitability.

The pre-feasibility study should say, in this early stage, before further steps are made and further costs incurred, whether 'he venture is economically viable.

Conclusion:

If the result of the pre-feasibility study is positive laboratory and pilot plant tests may follow.

Laboratory testing of raw materials

First of all the preliminary tests are repeated on a larger amount of samples representing the pattern of homogenity of the deposit. Technological tests are extended by drying sensitivity (by Bigot), extrusion test, bulk density, cold crushing and bending strength tests. Further important laboratory tests are sieve grading, chemical analysis, X-ray analysis or thermal analysis. <u>Conclusion</u>: See next paragraph

Pilot plent tests

Pilot plant tests are selected laboratory tests applied on raw materials, semiproducts and fired bricks manufactured on industrial scale. They reflect harder conditions of the industrial brick manufacturing process in comparison to laboratory conditions. The results of pilot plant rests should be in compliance with respective national standards.

Conclusion:

If laboratory and pilot plant tects are positive the definite technology of brick manufacture can be elaborated.

Elaboration of technology

Based on the laboratory and pilot plant tests and with regard to the outlined production programme as estimated in the pre-feasibility study, the production technology is devised. Operations and outputs in particular phases are described so as to give a sufficient back-ground for choosing suitable machinery. If the brick plant includes the clay pit as well the mining technology is to be elaborated.

Conclusion:

The technology is completed for its application in further steps of the project.

Peasibility study

The structures of a pre-fiasibility study and a feasibility study are identical. However, the background is more precise and more detailed in the latter case. While the pre-feasibility study was based on preliminary tests of raw materials and estimates of market and economic data the feasibility study takes into account the results of laboratory and pilot plant tests and the devised technology. It comprises a deep market research with verified prices, instead of estimates of inmestment costs price lists and offers from producers of equipment and from contractors of civil engineering work are at hand. Also production costs are corrected on the basis of the definite technology.

The results of the feasibility study are expressed in terms of profitability, internal rate of return of equity, break-even point of sales and costs related to production volume and further economic parameters as requested by the entrepreneur, the bank or the government

authorities.

The feasibility study is conducted by an industrial economist and a market expert.

Conclusion:

If the results of the feasibility study are accepted the implementation of the project may be started.

Engineering design and preparation of books

of tender for equipment

On the basis of the feasibility report the over-all design of equipment and the books of tender are prepared. The latter serve as a background information for the tenders of equipment suppliers. The objective of this procedure is to receive comparative offers which can be easily evaluated. The over-all engineering design as well as detailed designs in further stages should be elaborated by a designer experienced in brick manufacturing equipment.

Conclusion:

The books of tender are sent out to potential suppliers of equipment.

Evaluation of tenders for equipment

The received tenders are compared and evaluated. Technical characteristics of equipment, completeness, required over-all dimensions of production premises, delivery period, price, supplier's credit and guarantees are taken into account. The most suitable tender is selected and the supplier contacted for the purpose of concluding a contract. The contents of a model contract for delivery of equipment are enclosed. (See Appendix No. 1)

An entrepreneur unexperienced in brick manufacture should prefer contracting the delivery and erection of the whole production equipment with guaranteed output (as per contract) and quality of products. Still more secure is a turn-key contract comprising the delivery and erection of equipment as well as the construction of civil engineering works.

The preparation of books of tender for equipment as well as the evaluation of tenders should be entrusted to an expert in brick manufacturing equipment and technology.

Conclusion:

After the conclusion of the contract (or concurrently) books of tender for civil engineering works may be prepared.

Preparation of books of tender for civil engineering

First a detailed lay-out of manufacturing equipment should be elaborated by the client (if not contracted to be delivered by the supplier of equipment) where not only the foundations of machines but also participation of civil engineering contractors in the construction of production equipment is specified (e.g. brickwork of driers and kilns). A specimen of bills of quantities for such a purpose is enclosed (See Appendix N_0 . 2). The above background information should be included in the books of tender for civil engineering works. They should include required types and parameters of production premises, administrative buildings and other civil engineering works such as power, water and severage lines, roads, fencing, etc.

Conclusion:

Books of tender for civil engineering are sent out to potential contractors.

Evaluation of the tenders for civil engineering work.

The received tenders are compared and evaluated and the most suitable one is accepted. It is the matter of the contract whether the detailed designs and lay-outs will be elaborated by the client, the contractor or an architect. After the conclusion of the contract preliminary measures are taken for meeting local regulations and ensuring a smooth start-up of realization.

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The preparation of the books of tenders for civil engineering works and the evaluation of tenders is an assignment of a team of specialists in various professions.

Conclusion:

After evaluation of the most suitable tender a contract is concluded between the entrepreneur and the building contractor.

<u>Co-ordination of construction, equipment delivery,</u> erection and supervision

For the purpose of organizing the pre-investment and investment activities the entrepreneur should establish an independent group consisting at least of a managing director, secretary and cashier-bookkeeper. The counterpart engineer, manufacturing foreman, clay pit foreman, chief of quality control and tests, draughtsman and warehouse clerk should be assigned since the start-up of construction. This staff may become a permanent one after the completion of the brick plant construction.

A master chart is prepared indicating the schedule of construction, equipment delivery and erection as well as trial runs as stimulated in the contract. The supervision is organized and the deadlines of contracted obligations are to be regularly checked.

Conclusion:

After the successful completion of this phase the start-up and manufacture commissioning follows.

Supervision during construction

The objective of the supervision of civil engineering construction is to check the process of construction of buildings and installation of power, water and sewerage lines.

The supervision of manufacturing equipment includes deliveries of equipment, erection and connection.

The construction of civil engineering works is mostly supervised by specialists in various trades who participated in the evaluation of the tender. The manufacturing equipment and its erection is supervised by the counterpart engineer or by an invited expert.

Supervision of start-up and comissioning

In compliance with the guarantees stipulated in the contract functional tests of particular machines are performed by a representative of the equipment supplier and under the supervision of the counterpart engineer. If the tests are satisfactory the whole plant is commissioned and its guaranteed output as well as performances of particular sections are tested. As a rule also the quality of products is guaranteed and checked. The testing results are summarized in take-over protocols and signed by both parties.

Use of the presented publication

An entrepreneur considering to establish a brick plant may be well experienced in brick manufacture and will probably know how to proceed with the establishment of a new brick plant. He will probably read with interest the Profiles of Brick Plants and compare the referred data with his owns He may be also interested in some of the described plants and require the information from the sellers.

To an entrepreneur who is not yet familiar with this line of manufacture this booklet should be more useful. He will follow the sequence of activities in Chapter No. IV and invite consultants accordingly. If he is not sure about the extent of demand for bricks and if there is nc previous information evailable about the quality of the clay deposit to be exploited he will satisfy himself by ordering preliminary tests of raw materials, the review of which he finds in the same chapter, along with the elaboration of a pre-feasibility study to obtain the primary technical and economical orientation. In this phase the Chapter Nos, II and III should be of a considerable use, giving the information on technologies. technological equipment, consumption of raw materials, fuels, water, labour requirements and informative prices of equipment delivery. The indicated extent of the required production area is a basis for a preliminary price estimate of the production premises. If the size of none of the referred brick plants compares with the size of brickworks considered by the entrepreneur. th required data may be calculated by extrapolation. In case the mechanisation of the plant is to be substituted partly by manual labour the data must be recalculated accordingly

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and equipment sellers contacted if need be.

If the conclusions of the pre-feasibility study show good prospects the laboratory and pilot plant tests referred to in Chapter No. IV should follow. The next step then is the feasibility study which again may apply some data and technologies from the Chapter Nos. II and III.

If a previous information on quality of the deposit is available and the scope of demand for brick products is warranted, the pré-feasibility study may be ommitted. The laboratory and pilot plant tests are made successively and the feasibility study follows.

In the further phases of the project dealing with project engineering the booklet will not only be a guide. Its technologies and parameters may be applied in the preparation of books of tender for equipment and the Contents of a model contract for a brick plant equipment may serve for checking the completeness of a contract.

Appendix No. 1

Contents of a model contract for a brick plant equipment

Section I	Introductory provision
Section II	Object of contract
Section III	Purchase price
Section IV	Transport insurance
Section V	Delivery terms
Section VI	Technical and quality conditions of the delivery
Section VII	Packing and marking
Section VIII	Shipping instructions
Section IX	Advice
Section X	Inspection of quality
Section XI	Guarantees and take-over protocols
Section XII	Delivery terms and transfer of risks
Section XIII	Payment conditions
Section XIV	Force majeure
Section XV	Consequences of delayed fulfilment of sellers obligations
Section XVI	Consequences of delayed fulfilment of buyers obligations
Section IVII	Erection of equipment
Section XVIII	Service
Section XIX	Patent rights
Section XX	Arbitration
Section XXI	General provisions
Enclosure I	Technical specification of delivery
Appendix 1	Electrical Conditions and Requirements
Appendix 2	Conditions and Requirements for Dust and Noise
Appendix 3	Tender

Enclosure IIGuarantee on the part of the sellerEnclosure IIIGuarantee on the part of the buyerEnclosure IVTechnical documentation to be
dalivered by sellerEnclosure VTechnical documentation to be
delivered by the buyerEnclosure VConditions for works conductéd
on site

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Appendix No. 2

List of building materials for brick plant kilns

(usually delivered locally by buyers)

Item	Naterial	Unit	Required quantities for annular kilns producing per year					
••			10 mill. bricke	5 mill. bricks	2-3 mill, bricks			
1	Solid bricks compressive strength P 150, 250/120/65 mm	рсв	617,000	373 ,0 00	320 ,000			
2	Two-capity bricks compressive strength 2 25 290/14D/65 mm	pca	21,000	13,000	-			
3	Pertland cement 325	t	193	63	60			
4	Slaked lime	. t.	- 41	31	28			
5	River send	cu.m	368	213	224			
6	Gravel send	cu.m	380	251	210			
7	Quarry stone for foundations	Qu.m	180	110	105			
8	Sieved clinker without organic admixtures	ou.m	890	392	250			
9	Auxiliary save timber	cu.m	11	6	-			
10	Reinforcing bars	t	2.5	1				
11	Structural steel	t	5	3	3			

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