PROCESS PLANT INSTALLATIONS AT SOUTH AFRICAN SUGAR FACTORIES

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Introduction

Major items of process plant have been listed and related to the tons of cane crushed per hour at each factory. Most of the plant details shown in the tables have been published previously but it was felt that a handier form of reference was required. The tables will make comparison of installed capacities quite simple. The intention was to include items in addition to those shown in the tables such as details of injection water and cooling tower installations, bagacillo screening and handling, actual steam and power usage, but insufficient data has come to hand. It is hoped to extend this list gradually and relate the plant items to the material handled rather than to the general coverage of cane throughput as we have done this year.

Some observations and comparison of average results obtained from the survey have been made using figures given by Hugot in his Handbook of Cane Sugar Engineering.

General

A few figures of the newer large cane knife installations are listed:

	hp/tch	*hp/tfh*
AK	3.3	21.8
JB	2.9	20.3
SZ	2.6	17.9

Hugot gives a figure of 15 hp/tfh per set but in South Africa the figures are generally higher than this. The results of an earlier survey gave an installed hp/tfh of 16.2 and the figures above are nearer 20. The estimated actual power consumption on the earlier survey was 8.7 hp/tfh.

Shredders are rated at 3 hp/tch or 20 hp/tfh and again looking at the hp/tfh at some of our bigger factories

AK	21.8	SZ	22.4
DL	17	UK	18.9
JB	23.7		

they compare fairly closely to this figure. From the total values obtained in Table 1 there is an installed hp/tfh for overall cane preparation of 56.29. Adding Hugot's figures of 30 hp for two sets of knives and 20 hp for shredders per tfh, this equals 50 hp/tfh and so the figures are about 12% heavier on power than his values.

Mill sizes and fibre throughput are given for comparative purposes, feeder roll volumes have not been included and so SZ figures, and to a lesser extent other mills with pressure feeders, TS, ME and UF, must be treated with this reservation.

The average fibre loading in lb/cu ft TRV = 46.6, lower than the last average figure from the Mutual Milling Control Project of 1967 which was = 52.5. UK has the highest mill loading with 62.3 lb/cu ft TRV (if one excludes SZ with its pressure fed mills).

The average installed hp/tfh = 125 and if to this is added 56 hp/tfh for preparation, i.e. 181, it compares closely with an Hawaiian published figure of 173 hp/tfh for milling and preparation.

If, as an approximation, the 125 hp is divided by 6 to estimate an individual milling unit power requirement, this then equals 21 installed hp/tfh/mill. On a longer train this is a little lower and the AK figures $= \frac{132}{7} = 18.85$ hp/tfh/mill.

The horsepower ratings of the old horizontal engines (there are still 28 in operation, driving 49 milling units) are not easily available now and have been unavoidably left out in the table. Where one engine drives more than one milling unit dotted lines have been extended to cover the columns representing the mill concerned. JB, EN, ME and GD have electric drives on all or some of their mills and there are 46 turbines and 19 vertical high speed steam engines used on mill drives in the industry.

A few basic features of the diffusers at present in operation are listed and it would appear that EN has some capacity in hand compared with the other three. The horsepower ratings/tfh (on the milling table) of these plants show a much lower figure than the conventional milling trains. UC is the highest of the group but was designed for double its existing throughput. Whether the diffuser itself is large enough to handle this throughput without substantial loss of performance remains doubtful.

Juice heaters, including the almost universally adopted pre-evaporator heaters, have a heating surface to tch ratio of 73.65. A new feature of heater design was seen lately with a dished end type door; it was neater in appearance and much lighter in construction.

The average installed filtering area per tch is 6.6 sq ft/tch compared with a 1941 Natal figure of 7.8 and Hugot's figure of exactly 6.6. Details of bagacillo screening area, cyclones and fans would help complete the picture of this section of the factory. Some details were sent in, but not enough to get good average figures. EN has the high figure of 9.62. Possibly not all of this is used as it is now a diffusion factory. The ML and UC figures reflect the fact that a large filter station is not required for a diffuser factory: ML = 3.86 and UC = 6.77 for double its present throughput. A figure of 3.38 would be a truer reflection.

Clarifier ratings are a little difficult to classify as they are dependent on the type of clarifier used and they can be rated on settling area as well as a volumetric basis. The listing has also been compli-

cated by the inclusion of Rabe clarifiers which are vacuum flotation units and a straight comparison on a volumetric or capacity basis is not realistic. At any rate, the average capacity of the non-Rabe clarifiers is about 140 cu ft/tch. Again, diffuser factories, ML at 75 and UC at $\frac{109}{2} = 54$, are low. Reference figures seem to indicate 80 or 90 cu ft tch, so it seems that a larger clarifier capacity is needed than is accepted overseas.

There are two new full Kestner evaporator units being installed at DL and FX and it will be most interesting to compare performances of these vessels with the semi-Kestner and Robert vessels now in use. The average figures given for quadruple effect evaporators are from 240-290 sq ft/tch, a generally accepted value for defecation factories being 275 sq. ft/tch. The average from Table 6 is 320 sq ft/tch. Only FX is lower than 275 with 258 and this includes its new full Kestner evaporator. PG are fortunate with 445 sq ft/tch and should therefore top the syrup Brix tables this season. Their exhaust pressure is, however, a little lower than general. Vapour cells are often used in series with older quads and the whole plant is operated in quintuple effect and therefore slightly higher average HS would be expected than with a quadruple effect.

With regard to pan floor capacity, the quantities of massecuite boiled per hour by each factory have been listed and from this the available times for the different boilings can be readily checked. The average pan capacity in cu ft/tch is 53.42. Non remelt capacities would be around 45 cu ft/tch and with remelt around 50 cu ft/tch. The Mauritius average is given at 54 cu ft/tch. Heating surface ratios can also be seen from the table.

Crystallizer capacities average 166 cu ft/tch and once again FX appear to be the lowest with 105 cu ft/tch.

It is of interest to see that the continuous centrifugal machine is being adopted not only as a "C" machine but also a "B" machine. There are now eight "B" machines, 33 "C" foreworkers and 26 "C" afterworkers. Development work is being carried out overseas on a machine suitable for "A" massecuites and it seems that continuous curing will soon eliminate one of the last batch operations in sugar processing. The screen area of a continuous machine is about one third that of a batch machine, so that screen areas from different factories must be checked bearing in mind the type of machines used at each plant.

Power plant and steam generation have shown a trend recently towards higher pressure and larger unit size, resulting in a much lower steam consumption rate and even in one case to an embarrassing surplus of bagasse. It is a trend of special benefit to those factories with refineries and irrigation loads that had been forced to use extraneous fuel. The higher pressure operation has brought home the necessity of adequate water treatment as the cleaning of large bent-tube boilers is neither easy nor inexpensive.

Boiler plant is shown in Table 10. AK have installed capacity of 1111 lb hr/tch which is 55½% steam on cane at present crushing rate. The four boilers with H.S of 6551 sq ft give a rating of 91 sq ft HS/tch against a figure in Hugot of 360 sq ft. The lb steam/H.S ratio $= \frac{80\ 000}{6\ 551} = 12.2$ lb/sq ft HS. This is provided with the assistance of a large air heater and economiser but provides a measure of progress from the older and more conservative ratings of 4 or 5 lb steam sq ft H.S. for straight tube boilers. There are installations of 125 000 lb/hr rating at 6 and 7 lb steam/sq ft HS and other boilers of a lower rating but with large reserve capacity. There are 9 accumulator installations mostly in larger factories, but more information is needed on these and on de-aerator and water treatment plants.

Power plant is in the final table and ML has the highest installed steam generating capacity at 92.75 kw/tch, carrying an irrigation load (4 Mw) and refinery. AK has a 27.78 kw/tch rating and JB 48.0 kw/tch including mill drives. PG and SZ have amongst the lowest installed ratings and both carry refineries. The new alternator plants working from 400/450 psi to a 15 psi back pressure have steam consumption figures of 18 lb/kw hr compared with some of the older 200 psi - 5 psi sets of 34 lb/kw hr. There is no average power or steam figure given, as refinery and irrigation demands at most factories would not show a meaningful overall average.

Conclusion

The author would like to thank the 13 factories which returned the questionnaire to supplement the information available in the Sugar Year Book. There are some omissions and it is hoped that they will be filled during the year. If there are discrepancies in individual plant items, e.g. plant no longer in use, rearrangement of heaters, evaporator vessels, etc., mills are requested to advise such alterations and so keep the inventory up to date, otherwise it loses much of its value.

Key to factories

AK	Amatikulu	ML	Malelane
DL	Darnall	MV	Melville
DK	Doornkop	ME	Mount Edgecombe
EM	Empangeni	PG	Pongola
EN	Entumeni	RN	Renishaw
FX	Felixton	SZ	Sezela
GH	Gledhow	TS	Tongaat
GD	Glendale	UF	Umfolozi
IL	Illovo	UK	Umzimkulu
JB	Jaagbaan	UC	Union Co-op, Dalton

TABLE 1

Cane preparation

Factory	Cane		Lower sets		Top set		Shredder		Total installed hp	Total installed hp/ton fibre/hr
	Ton cane per hour	Ton fibre per hour	hp	rpm	hp	rpm	hp	rpm		
ML	207	33.76	600	600	600	600	Nil	Nil	1,800	53.3
ML			600	600						
PG 1	60	8.0	180	488	180	488	Nil	Nil	360	45.0
PG 2	100	13.5	250	488	300	735	Nil	Nil	550	40.7
UF 1	182	23.42	375	585	450	495	500	980	1,325	56.57
UF 2	85	12.28	250	720	250	720	350	960	850	69.21
EM	208	37.79	850	300	850	300	Nil	Nil	1,700	44.98
FX 1	106	16.16	250	575	250	736	450	—	950	58.78
FX 2	75	11.84	200	575	250	736	350	—	800	67.56
EN	52	7.01	120	550	150	550	150	—	420	59.91
AK			250	585						
AK	288	43.50	950	720	950	570	950	1,000	3,100	71.26
DK	76	11.56	120	485	180	580	300	982	600	51.90
GD	48	7.05	200	488	120	475	150	1,000	470	66.67
DL	217	32.27	550	600	400	720	550	1,000	1,500	46.48
GH	235	38.36	600	490	450	490	650	1,000	1,700	44.31
MV	78	12.33	200	580	250	580	300	980	750	60.80
JB	208	29.52	600	593	600	593	700	984	1,900	64.36
UC	59	8.06	270	600	335	600	Nil	Nil	605	75.06
TS 1	177	28.32	450	560	400	730	450	960	1,300	45.90
TS 2	107	17.12	380	560	380	560	370	960	1,130	66.00
ME	194	31.22	375	590	420	495	600	—	1,395	44.68
IL	115	17.02	300	—	350	—	450	—	1,100	64.63
RN	78	13.80	150	590	250	590	300	925	700	50.7
SZ 1	69	10.48								
SZ 2	231	33.48	600	590	600	590	750	1,000	1,950	58.24
UK	165	23.80	300	580	300	580	450	—	1,050	44.12

Note: Average t.c.h. for mills with two tandems: PG-148 UF-261 FX-180 TS-284 SZ-299

TABLE 2

Mills

Factory	Mills: Roll Dimensions given in Inches 1	2	3	4	5	6	7	T.R.V. /cu ft	Lbs. Fibre/hr. /cu ft T.R.V.	Prime Movers (Mills)' E—Electrical T—Turbine V—Vertical H—Horizontal 1	2	3	4	5	6	7	Total Instal. hp	Instal. hp/ton Fibre
ML	84×42*	Diffuser			84×42*			—	—	750 T	Diffuser			750 T			1,500	44.4
PG 1	66×34‡	66×34	66×34	66×34	66×34	66×34		589	27.16	—350 H—		—350 H—		—350 H—			1,050	131.2
PG 2	66×34	66×34	66×34	66×34	66×34	66×34		624	43.26	300 H	—400 H—		—400 H—		300 H		1,400	103.7
UF 1	84×40	84×40	84×40	84×40	84×40	84×40	84×40*	1,283	36.5	450 V	450 V	450 V	450 V	450 V	450 V	600 T	3,300	140.9
UF 2	66×34	66×34	66×34	66×34	66×34	66×34	66×34	728	33.7	H	—H—		H	H	—500 T—		—	—
EM	84×44½	84×44½	Diffuser		84×44½	84×44½		—	—	550 T	550 T	Diffuser		550 T	550 T		2,200	58.2
FX 1	72½×35½†	66×36½	66×36½	66×36½	66×36½	66×36½	66×36½	874	36.97	—H—		—H—		—H—			—	—
FX 2	60×33	60×33	60×33	60×33	60×33	60×33		534	44.34	H	—— H ——			—H—			—	—
EN	52×28	Diffuser			52×28	52×28		—	—	175 E	Diffuser			—300 E—			475	67.7
AK	84×45	84×45	84×45	84×55	84×55	84×55	84×45	1,623	53.6	950 T	800 T	800 T	800 T	800 T	800 T	800 T	5,750	132.0
DK	66×35	54×27	54×27	54×27	54×27	66×35		435	53	550 T	—550 T—		—550 T—				2,200	190.0
GD	60×30	48×24	48×24	48×24	56×28			246	57.3	200 V	— 400 H —			150 E			750	106.3
DL	84×42	84×42	84×42	84×42	84×42	84×42		1,212	53.24	600 V	600 V	600 V	600 V	600 V	600 V		3,600	111.5
GH	84×44	84×43	84×43	84×43	84×43	84×43		1,279	59.98	650 T	650 T	650 T	650 T	650 T	650 T		3,900	101.6
MV	72×36	66×33	66×33	72×34	72×34			550	44.8	450 T	—550 H—		—550 H—				1,550	125.7
JB	84×46	84×46	84×46	84×46	84×46	84×44½		1,439	41.02	870 E	870 E	870 E	870 E	870 E	870 E		5,220	176.8
UC	78×36	Diffuser			60×30	60×30		—	—	375 T	Diffuser			275 T	275 T		925	114.7
TS 1	84×38*	84×38	84×38	84×38	84×38	84×38	84×38*	1,158	48.9	750 T	450 V	450 V	450 V	450 V	450 V	600 T	3,600	127.1
TS 2	84×42*	66×34	66×34	66×34	66×34	66×34		722	47.42	750 T	—450 T—		350 H	—375 V—			1,925	112.4
ME	84×41	84×38	83×38	84×38	84×38	84×38	84×40*	1,202	51.9	600 T	420 E	420 E	420 E	420 E	420 E	600 T	3,300	105.7
IL	84×40	72×36	72×36	72×36	72×36	72×35		812	41.92	—H—		—H—		—H—			—	—
RN	66×36	66×36	66×36	60×31	60×31			507	54.4	350 T	—620 T—		—275 H—				1,245	90.2
SZ 1	66×34	66×34	66×34	66×34	66×34			520	40.3	H	—H—		—H—				—	—
SZ 2	84×42*	84×42*	84×42*	84×42*	84×42*			1,010	66.28*	750 T	750 T	750 T	750 T	750 T			3,750	112
UK	72×36	72×36	72×36	72×36	72×36	72×36		764	62.3	550 T	550 T	550 T	550 T	550 T			3,300	138

* Pressure fed mill
Pressure rollers not included in T.R.V.
† Double two roll crusher
‡ Two roll crusher

TABLE 3

Diffusers

Factory	Diffuser Type	Diffuser Effective screen area sq feet	Diffuser Lbs cane/ sq feet effect area/hr	Diffuser Lbs fibre/ sq feet effect area/hr	Diffuser heaters sq. ft. h.s. Inter stage	Recirc.	Scalding	Press water	Total	Total /tch
Malelane	De Smet	1,725	240	39.14		2,500	5,000	5,000	12,500	60.38
Empangeni	BMA	1,990	209	37.97	1,570	5,380		2,120	9,070	43.6
Etumeni	De Smet	686	152	20.43	5 x 86	2 x 540	2 x 540	2 x 540	3,670	70.57
Dalton	BMA	518	228	31.11	160	1,340		730	2,230	37.7

TABLE 4

Juice heaters and filters

Factory	Juice heaters sq ft H.S. Primary	Secondary	Pre-evap.	Total	Total/ tch	Rotary filters (8 ft diameter) No. and type	Length ft	Combined area sq ft	No. and type	Length ft	Combined area sq ft	Total area sq ft	Total area sq ft/tch
ML	5×2,500		2×2,500	17,500	84.5	2×E	16	800				800*	3.86
PG	9×1,000			9,000	60.8	2×OC	16	800				800	5.4
UF	4×1,500	2×2,500 3=6,600	2×1,800	21,200	81.5	3×OC	12	900	2×E	12	600	1,500	5.77
EM	4×2,125		4×1,060	12,740	61.25	3×OC	16	1,200	1×E	16	400	1,600*	7.69
FX													
EN	1×1,200	1×1,200	1×1,000	3,400	65.38	1×OC	12	300	1×E	8	200	500*	9.62
AK	6×2,200		3×2,200	19,800	68.75	4×OC	16	1,600				1,600	5.55
DK	2×1,000	1×1,800	1×2,000	5,800	76.31	2×OC	9	450	1×OC	8	200	650	8.55
GD	2×1,000 2× 500			3,000	62.50	1×E	12	300				300	6.25
DL	6=11,087		2×2,000	15,807	69.50	4×OC	12	1,200				1,200	5.52
GH	10×2,000		2×2,250	24,500	104.25	4×OC	16	1,600				1,600	6.80
MV	3×1,000 1×1,500			4,500	57.6	2×OC	12	600				600	7.7
JB	3×2,500	3×2,500	2×2,500	20,000	96.15	1×OC	14 ft diam × 16 ft	700	1×OC	16	400	1,100	5.28
UC	2×1,000		1×1,000	3,000	50.8	1×E	16	400				400*	6.77
TS	3×2,000	4×2,000	4×2,000	22,000	77.46	5×OC	12	1,500	1×E	12	300	1,800	6.33
ME						4×OC	16	1,600				1,600	8.2
IL						2×OC	16	800				800	6.9
RN	1×2,200 3×1,500 2×1,600			9,900	126.9	1×OC	14	350	1×OC	9	225	575	7.37
SZ	7×2,200			15,400	51.5	4×OC	16	1,600				1,600	5.35
UK	4×1,200 2×2,300			9,400	56.96								

Where distribution is not available, heaters are shown under 'Primary'.

*Diffusion factory

TABLE 5

Clarifiers

Factory	No. and type ***	Diameter ft	Capacity cu ft	No. and type	Diameter ft	Capacity cu ft	Total capacity cu ft	Total/cap cu ft/tch
ML	1-G	32	15,602				15,602	75.3*
PG	2-D	20	10,312				18,101	122.3
	1-R	22	7,789					
UF	1-R	24	9,272	1-B	22	5,376	29,663	114.0
	1-R	26	10,875	1-B	20	4,140		
EM	1-D	20	4,815	1-R	36	20,842	34,929	167.9*
	1-R	24	9,272					
FX								
EN	1-R	20	6,426				6,426	123.5*
AK	4-R	24	37,088				37,088	128.7
DK	1-G	20	—				—	
	2-R	18	10,420					
GD	1-B	16	2,367				8,793	183.2
	1-R	20	6,426					
DL	2-RB		—				—	
	4-MW	20	22,470					
GH	1-R	28	12,585	1-RB	—	—	—	
	2-D	24	15,000					
MV	2-D	18	10,400				—	
	1-RB	12	—					
JB	2-R	32	32,945				32,945	156.9
UC	1-BMA	13	—	Press Water Clarifier			—	
	1-R	20	6,426				6,426	108.9*
TS	4-B	22	21,504				40,048	141.0
	2-R	24	18,544					
ME	3-R	24	27,816				27,816	143.3
IL	1-D	22	6,279				15,551	135.2
	1-R	24	9,272					
RN	1-D	20	5,156				9,271	118.8
	1-R	16	4,115					
SZ	1-RB	17	—	1-R	30	14,469	—	
	2-D	22	12,558					
UK	1-RB	12	—				—	
	2-B	14	3,466					

* Diffuser Factories

*** G-Graver
D-Dorr Multifeed
R-Rapidorr
RB-Rabe
MW-Mirrlees Watson
BMA-B.M.A.
B-Bach

TABLE 6

Evaporators sq ft H.S.

Factory	Vapour cell	Vapour cell	1st effect	2nd effect	3rd effect	4th effect	Total sq ft x 1,000	Total sq ft /tch
			Where distribution is not available all HS is listed under 1st (or 2nd) effect					
ML		17,000*	11,000+11,000	11,000 + 11,000	8,000	8,000	77	372
PG	12,000	19,000	5,000 3,750	5,000 3,750	5,000 3,750	5,000 3,750	66	445
UF	20,000*	9,000*	10,000 12,500	6,000 7,000	6,000 7,000	6,000 (7,000 spare) 7,000	90.6	348
EM		10,900 9,130	7,640 5,940	7,640 3,690	7,640 3,690	7,640 3,690	67.5	324
FX		17,000**	8,500	7,000	7,000	7,000	46.5	258
EN		8,000*	2,500	2,500	3,500	3,500	20	384
AK			8,000+ 8,000 8,000+ 8,000	8,000 8,000	8,000 8,000	8,000 8,000	80	277
DK			4,500 3,000	10,500 —— 4,600 ——			22.6	297
GD			4,000+ 1,250	3,000	2,500	1,250 + 1,250	13.3	277
DL		30,000**	8,000	8,000	8,000	8,000	62.0	286
GH			15 000 15,000	10 000 10,000	7,000 4,000 + 4,000	7,000 4,000 + 4,000	80	340
MV		9,358	2,329 1,950	2,329 1,950	2,329 1,950	3,494 3,494	29.2	374
JB			15,000+15,000	13,000	13,000	13,000	69	331
UC			9,000*	3,000	3,000	3,000	18	305
TS	10,000	+10,000	15,000 —— 6,000 6,000	6,000 6,000	6,000 6,000	6,000 6,000	83	292
ME		27,000	10,000	8,000	8,000	8,000	61	314
IL			27,500 —— 9,000 ——				36.5	317
RN			3,750 2,000	3,750 2,000	3,750 2,000	3,750 2,000	23	294
SZ	15,000	+3 x 10,000	7,000 3,750	7,000 3,750	7,000 3,750	7,000 3,750	88	294
UK			20,000 —— 27,000 ——				47	284

* Semi Kestner
** Full Kestner

TABLE 7

Vacuum pans

Factory	Cu ft A mass /hr	Cu ft B mass /hr	Cu ft C mass /hr	Storage tanks**			A pans				B pans		C pans				Total pan cap. cu ft	Total pan cap. cu ft/ tch	Strike receivers magma mixers cap. cu ft
				Syrup cu ft	A mol. cu ft	B mol. cu ft	Cap. cu ft	H.S. sq ft	Cap. cu ft	H.S. sq ft	Cap. cu ft	H.S. sq ft	Cap. cu ft	H.S. sq ft	Cap. cu ft	H.S. sq ft			
ML	1,413	432	311	4,815	3,210	3,210	3×1,500	2,550			*1,500	1,950	1,500	2,250			12,000	57.9	6× 700
							*1,500	1,950			1,500	2,250	1,500						
PG	683	278	193	9,200	3,600	4,000	1,200	2,300			1,100	2,120	1,100	2,120	700	932	6,700	45.2	600
							1,100	2,120					800	1,218	700 B/C	932			800
UF	1,166	422	345	4,914	2,340	1,872	2×1,600 A/B	—	2×1,300	—	1,600 B/C	—	800	—			13,700	52.6	
							800 A/B				1,500 B/C	—	2×1,600	—					
EM	806	369	318	8,690	3,680	3,680	1,500	2,710	1,800	3,100	1,800	3,250	800	1,450	1,500	2,330	10,700	51.4	1,000
							1,800	3,500					1,500	2,400					2× 900
FX	730	216	213	6,420													7,400	41.1	
EN	235	113	73				700	1,700			900	1,650	*450	750			2,890	55.5	2× 150
							540	850					300	500					2× 300
AK	1,220	431	353	3,780	3,024	3,024	4×1,500	2,700			2×1,500	2,700	2×1,500	2,250			12,000	41.6	3×1,700
DK	327	111	94	3,000	2,000	1,200	750	1,200	550 A/B	775	550	775	1,100	1,650			4,400	57.9	2× 500
							700	1,450	750 A/B	1,800									
GD	148	96	61	1,440	2,160	2,592	720				3× 320	B/C	See B	—			2,480	51.7	300
							800												450
DL	886	247	289	9,700			1,500	2,660	1,000	1,880	1,000	1,200	1,000	1,900	1,000	1,500	9,500	43.8	1,500
							2,000	2,880			1,000	1,900	1,000	1,800					2× 800
GH	821	420	332	7,320	5,000	3,100	2×2,000	4,000			4×1,300		3×1,300				14,400	61.3	
							1×1,300												
MV	388	137	100	2,200	2,200	2,200	1,200		600		1,200		1,200				4,800	61.5	6× 450
							600												
JB	439	162	149	7,124	6,370	6,370	4×1,500	2,700			2×1,500		2×1,500	2,250			12,000	57.6	
UC	257	119	91	2,304	1,536	1,152	2× 900	1,575			900	1,575	900	1,575			3,600	61.0	2× 900
TS	1,057	520	386	3,480	2,319	1,944	6×1,000				3×1,000	—	3×1,000	—			12,000	42.2	700
											One Stirrer								
ME	HTM			10,914													12,700	65.5	
IL	704	198	189	—			2×1,000		2×1,100	A/B	1,100	—	1,100		600		8,200	71.3	
													1,200						
RN	238	140	102	—			2× 880	1,200	750	1,000	800	1,200	880	1,200			4,190	53.7	350
SZ	1,194	645	473	11,200	5,600	8,400	4×1,500	2,400			See A		3×1,000	1,700	1,100	2,000	12,100	40.46	1×1,200
							A/B						2×1,000	1,700					1×1,500
UK	772	211	192	12,000													9,100	55.15	

* Stirrer equipped pans
** 10,000 galls = 1,605 cu ft

TABLE 8

Crystallizers

Factory	A Cap. cu ft	B Cap. cu ft	C Cap. cu ft	Total capacity × 1,000 cu ft	Total capacity cu ft/tch
ML	6 × 1,500	4 × 1,500 W	12 × 1,500 W	33.0	159
PG	6 × 600	7 × 600	20 × 600 W	26.4	178
	2 × 1,100		4 × 1,100 W		
UF	25 × 350/900 A/B		4 × 1,600 W	—	—
	1 × 1,600				
EM	12 × 1,090	16 × 1,090	20 × 875	48.0	230
FX	4,500	4,800	9,600 W	18.9	105
EN	2 × 700	5 × 300 2 × 400	7 × 450 W	7.95	152
	1 × 600	1 × 500			
AK	12 × 1,636	8 × 1,565 W	16 × 1,565 W	57.2	198
DK	3,200	3,300	5,500 W	12.0	157
GD	3 × 720	4 × 350	4 × 350	6.4	133
			4 × 350 W		
DL	5 × 1,000	10 × 1,000	20 × 1,000	35.0	161
GH	6 × 2,000	12 × 1,300	18 × 1,300	46.2	196
MV	8 × 600 W	2 × 1,200 W	4 × 1,200 W	13.2	169
		2 × 600 W			
JB	4 × 1,500	8 × 1,500 W	18 × 1,500 W	45.0	216
UC	2 × 900	3 × 900	5 × 900 W	9.0	152
TS	5 × 1,000	7 × 1,000	18 × 1,000 W	30.0	105
ME	14 × 900	4 × 900	20 × 1,000	45.0	231
		11 × 800			
IL	4 × 1,200	4 × 1,200	8 × 1,200 W	21.6	187
			2 × 1,200		
RN	3 × 850	5 × 850	7 × 850	12.75	163
SZ	8 × 1,500 W	8 × 1,500 W	30 × 1,000 W	54.0	180
UK	3 × 1,500	3 × 1,500	7 × 1,500 W	21.1	127
	2 × 800				

W = Water Cooled

TABLE 9

Centrifugals

Factory	A Machines					B Machines					C Machines (Foreworkers)					C Machines (Afterworkers)					Total Screen Area sq ft	Total Screen Area sq ft Tch
	Type	No.	RPM	Size (Inches)	Screen Area sq ft	Type	No.	RPM	Size (Inches)	Screen Area sq ft	Type	No.	RPM	Size (Inches)	Screen Area sq ft	Type	No.	RPM	Size (Inches)	Screen Area sq ft		
ML	WS	5	1,000	54×40	235	W.S. Co	4	2,200	34×34°	38	W.S. Co	8	2,200	34×34°	76						349	1.68
PG	B	6	1,500	42×30	165		4	1,500	42×34	110	B	8	1,500	42×30	220	B	2	1,500	42×30	55.0	550	3.71
UF	WS	4	1,500	40×30	104.8	W.L.	5	1,500	42×22	100.5	W.L.	9	1,450	42×22	180.9	AC Co	4	2,200	2,750	28	539.8	2.07
											W.S.	4	1,500	48×30	125.6							
EM		8	1,000	48×30	251.2	BMA Co	4	2,200	K850	32.56		12		42×30	330	BMA Co	3	2,200	K850	24.42	638.2	3.06
FX	B	5		48×30	157		6		42×24	132	B	10		42×24	220	B	3		42×24	66	575	3.19
EN	B	2		42×30	55	B	2		42×30	55	B	2	1,100	42×24	44						181.5	3.49
											B	1		42×30	27.5							
AK	B	7	1,500	48×30	219.8	B	5	1,500	48×30	157	B	11	1,500	48×30	345.4	B	4	1,500	48×30	125.6	847.8	2.94
DK	WS	3	1,350	40×30	78.6	W.S.	2	1,350	40×30	52.4	W.S.	4	1,350	40×30	104.8	HL Co	2	2,200	23½×34°	10.2	246	3.24
GD	ASEA	1		48×30	31.4		1		48×30	31.4	W.S. Co.	2	2,200	34×34°	19						81.8	1.70
DL		4	1,500	48×30	125.6		4	1,500	48×30	125.6		6	1,500	48×24	150.8	BMA Co	4	2,200	K850	32.56	713.7	3.28
												7	1,500	42×24	154							
												6	1,500	40×24	125.4							
GH	B	7	1,000	48×30	219.8	B	5	1,500	48×30	157	B	18	1,500	42×24	396	W.S. Co.	3	2,200	34×34°	28.5	801.3	3.40
MV	B	3		42×30	82.5		3		42×30	82.5	B	3		42×24	66		2		42×24	44	312	4.00
											W.S. Co.	1	2,200	34×34°	9.5							
JB	BMA	6	1,450	48×30	188.4	BMA	6	1,450	48×30	188.4	BMA	11	1,720	48×30	345.4	BMA Co	3	1,750	K1,000	35.4	782	3.75
											BMA Co	3	2,200	K850	24.42							
UC	B	2	1,500	42×30	55	B	3		42×30	82.5	AC Co	4	2,200	2,750	28						165.5	2.80
TS	ASEA	8	1,300	48×30	251.2	PCW	12	1,500	40×24	250.8	BMA Co	10	2,200	K850	81.4	HL Co	5	2,200	23½×34°	25.5	608.9	2.14
ME		9		42×24	247.5		8		42×24	176.0		3	1,500	42×24	66		5	1,000	42×24	110	787.9	4.06
												6	1,700	48×30	188.4							
IL	PC	1		42×30	27.5	W.S.	4	1,400	40×30	104.8	ASEA	4	1,800	48×30	125.6	W.S. Co	2	2,200	34×34°	19	434.1	3.77
	WS	4	1,500	40×30	104.8						W.S.	2	1,700	40×30	52.4							
RN	B	4		42×30	110	B	3		42×30	82.5	B	3		42×30	82.5	B	1		42×30	27.5	302.5	3.87
SZ	B	4	1,500	48×30	125.6	B	5	1,500	48×30	157.0	B	14	1,500	42×24	308	B	5	1,000	42×24	110	738.2	2.47
	BMA	1	1,500	53×32½	37.6																	
UK	B	5		42×30	137.5	B	3		42×30	82.5		3		42×24	66						334.8	2.02
											AC Co	1	2,200	2,750	7							
											W.S. Co	2	2,200	34×34°	19							
											B Co	2	1,800	36×30°	22.8							

Co=Continuous Machines

TABLE 10

Steam generation plant

Factory	Rating No. lb/hr	H.S. sq ft	Work press. psig	Air heater sq ft	Econ. sq ft	Rating No. lb/hr	H.S. sq ft	Work press. sq ft	Air heater sq ft	Econ. sq ft	Accumulators No. cap/lb	Work press.	Deaerator lb/hr	Base exchange lb/hr	Instal. rating lb/hr ×1,000	Instal. rating lb/hr/ tch
ML	3×100,000	13,220	450	7,790	2,904								300,000	30,000	300	1,449*‡
PG	2× 50,000	6,250	200	4,350	—	4×25,000	5,500	160	3,850	—	2×25,000	160			200	1,351*
UF	1× 30,000		200			2×30,000	= 9,922	160								
	1×125,000	17,240	450	10,500	—	2×30,000	5,245	200			2×	160			465	1,788
	2× 55,000		200			2×40,000	7,322	160								
EM	1×100,000	9,080	450			4×30,000	7,322	160			50,000	160	150,000	10,000	340	1,634
	1× 50,000	8,080	165			1×70,000	11,080	200					300,000			
FX	1×100,000					1×	7,322								—	
	1×100,000					1×	4,000									
EN	1× 50,000		250												—	
	3=	8,980	180		8,800/3											
AK	4× 80,000	6,551	450	5,060	9,437						2×45,000	200		180,000 lb cycle	320	1,111
DK	3× 15,000	2,760	140			1×25,000	4,226	140							127	1,671
	1× 12,000	2,400	140			1×45,000	7,000	360								
GD	2× 15,000	3,654	150	3,300/2		1×30,000	5,346	200	4,300	2,500					60	1,250
DL	1×100,000	9,080	450	5,420	13,820	1×50,000	7,214	450			37,000		300,000		340	1,566
	1× 50,000	7,332	200			2×70,000	11,080	200								
GH	1×100,000	9,850	400	16,800	4,010	2×50,000		400			2×60,000				360	1,531*
	1×100,000	14,225	400			2×30,000		200								
MV	1× 9,000	2,531	100			4=34,000	9,081	160	13,770/5	—					140	1,794
	1× 37,500	3,335	160	4,860	7,320	1×60,000	6,250	250	7,875	—						
JB	3×100,000	19,129	450	12,650											300	1,442
UC	1× 50,000	8,396	250	4,168	2,112	3×18,000		160						5,000	104	1,762†
TS	2× 75,000	11,080	200			3×18,000	4,000	110			2×53,000				469	1,651‡
	3= 55,000	11,000	160			5×18,000	4,000	160								
	1× 60,000	7,500	210			1×60,000	7,500	220								
ME	6× 55,000	8,283	200	1,328		1×60,000	7,200	200			2=55,000	200	400,000	100,000	390	2,010‡
IL	5×	4,780	150			1×	8,600	450							—	
	2×	6,000	200													
RN	1× 50,000		160												125	1,602
	3× 25,000		160													
SZ	6× 35,000		180	6,930							75,000	160	Two	50,000	460	1,538*
	2×125,000	20,100	300	8,845	5,200											
UK	2×	5,100				1×	4,500								—	
	1×	12,690				1×	5,000									

* Refinery
† Wattle extract factory
‡ Irrigation

TABLE 11

Power plant

Factory	Steam alternators		Inlet press. psig	Exhaust press. psig	Diesel alternators		Gen. volts	Factory volts	Total instal. steam power kw	Instal. steam power kw/tch
	No. Rating kw	No. Rating kw			No. Rating kw	No. Rating kw				
ML	2 6,400		450	15			6,600		19,200	92.75*†
	1 6,400		450	15/Cond.						
PG	1 2,000	1 1,000	200	10	1× 425	2× 125	3,000	500	3,600	24.32*
	1 600		200	10						
UF	1 6,000		450	15					10,500	40.38
	1 2,500	2 1,000	200	15	1×1,000	3= 750	550	550		
EM	1 3,000		185	15			6,600	500	5,500	26.4
	1 1,000	2 750	150	15	1× 310	1× 350	500			
FX	1 4,000				1× 280	1× 150			7,000	38.89
	1 3,000									
EN	1 1,500		250	15	1× 100	1× 75			2,400	46.15
	1 450		180	15						
AK	2 4,000		450	15	2× 350		6,600		8,000	27.78
DK	1 1,000		360	15	1× 200		550	550	1,750	23.02
	1 750		140	15	1× 125					
GD	1 1,250		200	Cond.	2× 200		11,000	500	1,850	38.5 †
	2 300		140	6	1× 150 (Hydro-elec)		500			
DL	1 3,000	1 2,000	200	15	1× 600				7,000	32.2
	1 2,000		450	200						
GH	1 5,400		400	15/Cond.	1×3,000		3,300	550	9,650	41.06*†
	1 2,750	1 1,500	400	15			3,300			
MV	1 2,000		250	15	1× 212		500	500	3,035	38.9
	3=1,035		150	5						
JB	2 5,000		450	15			6,600		10,000	48.0
					2× 400	1× 100	500			
UC	1 1,500		250	12	1× 40		380	380	1,820	30.8
	1 320									
TS	3 1,500		160	10			550	550	10,500	36.9 †
	1 3,000		200	10			6,600			
	1 3,000		200	Cond.			6,600			
ME	4=9,680				1× 300				9,680	49.89 †
IL	1×1,500						500	550	5,000	43.47
	1 3,500		450				6,600			
RN	3 800		150	10	1× 150		550		2,400	30.76
SZ	3 1,000		180	15	1× 800		3,300	500	6,750	22.57*
	1 3,750		300	15						
UK	1 2,000	1 1,100			1× 200	1× 125			3,100	18.78

* Refinery
† Irrigation

Discussion

Mr. Hulett (in the chair): A word of warning should be given about using statistics such as these when new plant is being designed.

At Gledhow, the evaporator, which has not been changed, is now producing a higher brix than previously but with 16,000 square feet less heating surface.

When milling tandems are being compared, in my opinion the underfeed rollers should be included in the Total Roller Volume. Both Sezela and Amatikulu are designed for the same capacity and yet Sezela apparently has a T.R.V. of only 1,000 compared to the 1,600 for Amatikulu. But at Sezela for every three rollers there are two pressure feed rollers, which are not reflected in the T.R.V.

Mr. Buchanan: Feeder rollers are ignored just as they were in the Mutual Milling Control Project. But their effect is shown by a difference in the specific feed rate whereas if feed rollers are included the specific feed rate is consistent, which may obscure the advantage of having a feeder roller.

We have not, and do not, recommend that this information be used for design purposes.

Mr. Kramer: When the questionnaire was sent out to gather information for this paper factories should have been asked how much of the equipment was actually being used.

At Amatikulu, for instance, three clarifiers only are used, the fourth being very seldom required.

Mr. Allan: This was mentioned in connection with power plant.

However, to encourage factories to reply, the questionnaire was kept as short as possible, but further details can be added later.

I do not like comparing centrifugal screen area against tons cane—I think the comparison should be with cubic feet of massecuite.

If actual power and actual steam could be quoted, the tables would be more useful for design purposes.

Mr. Cranswick: I do not agree with questionnaires being sent out at all. It arrives on the manager's desk and from there is passed on in succession to the chief engineer, the second engineer and the planning officer, who, after having it for four weeks gets the clerk to complete it from cards that are out of date.

The only way is for someone to visit each mill and buttonhole the chief engineer and process manager and complete the form. At the same time he could find out how much of the installed equipment was being used.

Mr. Robinson: We have mentioned installed capacity that might not be in use but far more interesting might be non-installed capacity we would like to use.

Mr. Moor: These comparative figures might be helpful in the design of capacity of vacuum pumps for pans and evaporators.

What is the CFM required, for instance, for a vacuum pan operating at 26 inches of vacuum?

Mr. Allan: In the questionnaire only two factories admitted having vacuum pumps!

We will be pleased to help you from basic design principles as we have supplied this information in the past to other factories.