Cost Correlations for Equipment

All prices refer to North American prices for mid 1970 corresponding to a Marshall-Stevens index of 300. Most prices are for carbon steel (c/s) equipment although some are quoted for stainless steel (s/s) construction.

More details are given by Woods (1974).

Single high efficiency c/s: FOB Multi: FOB	99	~apacity, 10 ³ scfm "pacity, 10 ³ scfm	m (2)	1 – 80 1 – 150	0.56	ž 3
Deactators: Vacuum type: FOB	200	capacity, US gpm	8.8	50 - 1000	0.43	 - -
	Size	Unit	Cost 10³ \$	Range	и	Error %
Forced draft type: FOB Dialysis: Installed Digester: anaerobic: Installed Distillation tower; complete tower-trays: Installed	100 3 (10) (300)	capacity, US gpm membrane area, 10 ³ ft ² volume, 10 ³ ft ³ (actual) (fced, 1b/yr) ^{0.65} (trays)	5.4 32 (37 (480	50 - 800 0.5 - 60 1 - 35 35 - 600 300 - 30,000	0.45 0.79 0.41 0.97	79
Drives: Gear unit: FOB excl motor	(40) (500)	drive, nominal 0.5 hp at reduction 1800 ratio	0.58 [3.6	4 - 150 150 - 2000 2 - 30	0.45 0.75 0.88	
V best and pulley: FOB Sprockets and roller chain: FOB	10	drive, hp drive, hp	0.055	$\frac{2-50}{2-10}$	0.21	
Drycis: Cone, jacketed vacuum s/s: FOB incl auxil Drum, atmos c/s: FOB excl. motor Fluidized bed, direct fired c/s: FOB incl auxil	0 0 0 0 0	working capacity, It's surface area, fi^2 (diam.) (fluidizing \int_{0}^{0} (relocity, ft/sec)	2.7 22)°.35 45	3 – 26	0.52	40
Rotary, indirect fired c/s: FOB incl motors Rotary, direct fired c/s: FOB incl auxil Installed Rotary, steam tube c/s: FOB incl motor Rotary, vacuum c/s: FOB incl auxil Roto-louvre, atmos c/s: FOB incl auxil Sand bed, for sludge: Installed Shelf, vacuum c/s: FOB excl trays, vac. equip Spray ~150°C c/s: FOB	4 4 100 100 100 2 2 2 (200) (200) 5 5 5	peripheral area, 10 ² ft ² peripheral area, 10 ² ft ² solid waste, ton/d heating area, 10 ² ft ² peripheral area, 10 ² ft ² peripheral area, 10 ² ft ² surface area, 10 ³ ft ² tray area, 10 ² ft ² water evap/hr, 10 ³ lb	28 18 150 150 33 33 35 220 5.1 150	1 - 20 1 - 40 40 - 600 4 - 70 0.2 - 10 0.5 - 10 5 - 43 43 - 1000 0.15 - 10	0.88 0.88 0.84 0.71 0.63 0.63 0.63 0.63	20 20 20 20 20 20 20 20 20 20 20 20 20 2

	Size	Ceit	Cost	Range	*	Error %
Tray-Truck eis: FOB excl trays	-	tern star 102 ft3				
Turnel of the Control of the control	- ·	11 - A CA C	4	0.20 - 15	0.37	
The state of the s	4	heated surface, 102 ft ²	\$	1.5 – 15	0.93	20
Transported bed c/s: FOB incl auxil	-	water evap/hr, 103 1b	9	0.60 - 20	0.42	; <u>s</u>
turbo c/s: Del incl motors		drying area, 101 ft²	48	0.20 - 20	0.66	3
Ejectors:						
Single stage; 100 psig steam; FOB ejector	m	(lb/hr air)/(ann He abe)	0.80	0.7	6	ş
Two stage: FOR incl condenser nining	-	Clarific and Company of the Company	3	25 - 4.0	2	2
Marking and the COS and the control of the control of the cost of	- :	(16/hr att)/(mm Hg abs.)	<u>-</u>	0.2 - 10	0.43	င္က
entimestage: rob inci condenser, piping Electrodialysis:	9	(lb/hr air}/(mm Hg abs.)	2.0	0.5 - 100	0.26	6
Membranes, spacers, electrodes: FOB	9	area, 103 ft 2	400	20 - 80	0.0	
Unit for 4000 ppm feed; Installed		capacity, 10s US gal/d	1.600	0.02 100	0.83	
Electrostatic pre-initatore C.S FOR	<u> </u>		(23	0.I - 8	0.39	Ġ.
) (2)	gas now, 10" cm at 40"C	1115	8-100	200	\$ 5
Electrostatic separators: Del incl motor	2	caracity, 103 lb/hr	2	200		7
Elevators, bucket: Del exclandor	2	franchister of the second	4 1	N - 7	9.0	,
Founds oscoline #OD	2 8	(south) (sengur, 11)	*1	101 - 5 × [03	0.46	35
Figures, gasoning, FOB	400	drive, hp	Š	30 - 7000	0.82	70
Evaporators: Natural circulation c/s: FOB	2	healing area, ft2	õ	20 - 200	0,50	
Forced external circulation c/s: FOB	 	heating area, 103 ft?	65	0.2 - 5	0.74	\$
Internal circulation, horizontal tube c/s: FOB	v	heating area, 101 ft2	20	06 -	0.17	×
vertical basket c/s: FOB	٠,	henting area, 102 ftz	21	09 - 1	0.55	8
Vertical fong tube; rising/falling film c/s: FOB	2	heating area, 102 ft2	23	001 - 1000	0.68	5
Vertical agitated film 316 sfs: FOB	(0.05)	heating area 101 62) 10	0.01 ~ 0.18	0.36	30
	= `	The state of the s	[45	0.18 - 2.5	0,62	욙
Jackeled glass lined vessel; FOB	-	volume, 102 US gal	16	0.5 10	81.0	
Extractors: Porthighlar conditional; the	€.	CHING IS SOM	215	4 15	0.37	
	(2 <u>5</u>	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	(2)	55 - 40	0.78	
Rotaling disc, c/s: 17cl	? 0	(height, ft)(diam., ft)1.3	3.5	3 ~ 2000	0.84	9
Vertical agilated, s/s: Del incl motor	105	(height, ft)(diam., ft)	4 3	1 - 5000	0.81	

			Cost			Error
	Sizc	Unit	103 \$	Kange	=	•
	for	havin acco 62	30	15 - 600	0.67	æ
Horizontal mixer-settler unit, Rubber lined: 1	<u>.</u>	DOLL alca, 11	-	2 - 200	0.59	9
Extruders, c/s: FOB incl variable speed drive	2 9	arresponent, 1147	2.3	3 – 200	0.84	9
Fans; Centrifugal radial: Del exel motor	₹ 5	Capacily, 10- series	4.5	3 - 100	0.92	40
incl motor	₹;	and the section of the section	5.2	4 - 40	0,65	8
Vane axial: FOB excl motor	2 '	capacity, 10° 20111	6.0	1 - 10	0.35	9
incl molar	າເ	Sapacity, 103 sofm	0.50	1 - 160	0.40	\$6
Propeller: FOB package incl motor	3				;	
Feeders:	2	201000	7	3 - 10	0.06	
S, rotary star; Del exel molor	<u> </u>	(ton/hr)(length, ft)6. 55	13	50 - 5000	0.70	
Apron: Del exet nopper, mater	1				,	
Filters:	•	effective area, 102 ft ²	<u>r.</u>	0.1 - 10	0.55	;
Plate and frame c/s: Del		effective area 102 ft2	5.1	0.3 - 15	0.57	R :
Pressure leaf, vertical c/s: Del	. •	officiality area 102 ft2	7.1	0.3 - 15	0.51	9
horizontal c/s: Del		effective area 102 ft 2	61	0.1 - 15	0.48	8
Vacuum rotary drum c/s: FOB incl motor		effective ages 103 ft 2	9	0.4 - 10	0.68	
Vacuum rotary disk c/s: FOB incl motor	4	Checking area, 10	3.2	1 – 10	0.62	
Horizontal plate, c/s: Def filter	n r	elictrive entry, it	32	0.1 - 45	0.33	
Horizontal tilting pan c/s: FOB	(Checkly dates, 19	8	100 ~ 350	0.58	
Belt filter: s/s: FOB	3 :	Clicative July, it-	300	003 - 100	Ð.84	
Microstrainer c/s: Installed	2 5	capacity, to Co gainst	72	000 nz - 1	0.63	
Deep bed: Installed	3	11011C. Attas				
Fiotation:		b/leg CD viscous	35	0.1 - 10	0.47	
Dissolved air for LS: Installed	- (and the second s	(1.6	0.21 - 1	0.37	
latter Section 1	<u>.</u>	capacity, 100 ft?	3.6	E - 3	0.74	
Induced graff for 55: the	[7·	106 11S call (d)	36	0.25 - 5	0,80	
Foam separators for waste water: Installed	-	capacity, iv. to ben't			1	9
Furnaces:	90	heat absorbed, 106 Btu/h	ጁ	10 - 400	0.73	÷ 5
Box type direct fixed c/s: Del vertical evlinder direct fixed c/s: FOB	2 °	heat absorbed, 10s Btu/h	430	0,5 - 100 0.15 - 4	0.59	3
Multiple hearth c/s: Installed]	capacity, 10" 10/4				

Fluid bed incinerated: Installed Generalors: turbine drive: FOB incl drive Grit chamber for waste water: Installed Grit chamber for waste water: Installed Heat Exchangers: Shell-tube, floating beat c/s: Del Fixed tube × 0.87; Wettle × 1.35 Shell-tube—finned tube Roating head c/s: Del Air cooled, finned c/s: FOB Air cooled, finned c/s: FOB Plate coil c/s serpentine type: Del Cascade, cast iton: Del Cascade, cast iton: Del Double pipe, c/s internal finned: Del Spiral plate (Rosenblad) c/s: Del	capacity, 103 lb/h power output, kW surface area, ft² surface area, 103 ft² total area, 103 ft² bare tube area, 103 ft² surface area, ft²	(270 (900 600 18 6.5 (15 26 26 2033	0.4 - 1 1 - 9 3000 - 50,000 50 - 1500 0.02 - 20 0.7 - 3 3 - 10 5 - 15 5 - 15 15 - 40	0.53 0.73 0.37 0.59 0.59 0.59 0.59 0.50 0.78	26 4 22
kettle × 1.35 d c/s: Del (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10)	oower output, kW utface area, ft ² utface area, 10 ² ft ² otal area, 10 ² ft ² otal area, 10 ² ft ² urface area, ft ² urface area, 10 ² ft ²	600 600 6.5 6.5 (1.5 26 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5	3000 - 59 3000 - 50,000 50 - 1500 6.02 - 20 0.7 - 3 3 - 10 5 - 15 5 - 15 15 - 40	0.73 0.37 0.59 0.57 0.18 0.16	5 6 6 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
kettle × 1.35 d c/s: Del (6) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10) (10)	nurface area, ft² nurface area, ft² otal area, f0³ ft² sare tube area, f0² ft² nurface area, ft² nurface area, ft²	6.5 6.5 (6.7 (1.5 (0.033	2002 - 200 50 - 1500 6.02 - 20 0.7 - 3 3 - 10 5 - 15 15 - 40	0.37 0.59 0.57 0.38 0.36 0.78	388 4 488
kattle × 1.35 d c/s: Del (6) 3 (10) (10) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130) (130)	nitface area, 10° ft ² otal area, 10° ft ² vare tube area, 10° ft ² nitface area, ft ² urface area, 10² ft ²	6.5 6.5 115 26 10.033	0.02 - 20 0.7 - 3 0.7 - 3 3 - 10 5 - 15 15 - 40	0.59 0.57 0.78 0.36 0.78	2 2 2 2 2
acting head c/s: Del 1 0.85; U-tube × 0.87; kettle × 1.35 nned tube floating head c/s: Del {6} nned c/s: FOB 3 serpentine type: Del {10} c/s internal finned: Del {15} Los lia) c/s: Del {15} tosenblad) c/s: Del {16} 1 1 1 1 1 1 1 1 1 1 1 1 1	nuclace area, 10 ³ ft ² otal area, 10 ³ ft ² vare tube area, 10 ³ ft ² nuclace area, ft ² urface area, 10 ² ft ²	6.5 (6.7 (1.5 26 (0.033	0.02 - 20 0.7 - 3 3 - 10 0.2 - 20 5 - 15 15 - 40	0.59 0.57 0.78 0.36 0.36	3 2 2 2
read c/s: Del {2} 3 4 {30} 6 {30} 10 10 10 10 10 10 10 10 10 10 10 10 10	otal arca, 10º ft² sure tube arca, 10º ft² nurface arca, ft² nurface arca, ft²	(6.7 (1.5 26 (0.033	0.7 - 3 3 - 10 0.2 - 20 5 - 15 15 - 40	0.57 0.78 0.36 0.36	222
Del 36 2 36 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	out area, to- 10° pare tube area, 10° f1° parface area, f1° parface area, 10° f1°	(115 26 70.033	3 - 10 0.2 - 20 5 - 15 15 - 40	0.78 0.8 0.36 0.78	22
Det (30)	pare tube area, 103 ft² nurface area, ft² nurface area, 102 ft²	26 50.033	0.2 - 20 5 - 15 15 - 40	0.8 0.36 0.78	30
Det (30)	iurface arca, fi ² iurface arca, 10 ² fi ²	0.033	5 - 15 15 - 40	0.36	
Del 399 399 399 399 399 399 399 399 399 39	urface area, 102 ft²		15-40	0.78	
Del (28) 28 - 29 - 29 - 29 - 29 - 29 - 29 - 29 -	unface area, 102 lt2	con'n)	V		
Del		0.40	7.41	0	2
23.00 23.00 23.00 23.00 23.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 24.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00 26.00	total area, ft²	0.40	3 – 250	0.14	20
(350) (700) (13) (13)		5.5	100 200	0.65	
. 186 . 286 . 286	surface area, ft²	413.C	200 - 200	0.65	
m <u>- m</u> c		122.0	200 - 1000	0,90	
	surface area, ft ²	3.0		8.	8
é c		1.4	0.4 - 2	0.27	
(3)	surface area, 10º ft²	42.2	2-4	0.48	
		(3.7	4-7	0.72	
Spiral tube cite 10el	Coll area fit	(0.12	2.5 - 7.5	0.43	
() () () () () () () () () () () () () (-11 63.65	(0.47	7.5 - 60	0.83	
Tank suction header c/s: FOB	surface area, 104 ft²	I.3	0.3 - 20	6.58	
•••	surface area, ft2	0.14	1-6	0.35	S
Mandrel wound Al: FOB	Surface area, 103 ft2	180	10 - 20	0,76	•
Cubic; graphite: FOB 30 surface	surface area, fl²	1.7	10 ~ 200	0.46	
OB excl tank 30	surface area, ft²	0.29	1 - 300	0.33	
Thermal serew c/s: FOB excl motor	turface area, 102 ft2	01	0.1 - 4	0.78	40
Electric immersion c/s: FOB socresy,	encrgy, kW	0.70	10 - 200	0.87	