HEATING

SECTION UIP 3

EXPLANATION

The following costs are averages of typical installations, including cost of unit, miscellaneous materials and labor included in installation, cost of roughing in necessary utilities and vents, and a pro rata share of contractor's profit and overhead through a general contractor.

Heating and cooling costs per square foot of floor area are included in the Calculator and Segregated Cost Sections.

FLOOR AND WALL FURNACES

Costs are for gas-fired units. Add $95 to $145 per thermostat. Add $105 to $160 for electric ignition. Add $105 to $150 for circulating fan. For direct vent thru-wall or freestanding units, add $70 to $190.

RATED CAPACITY	FLOOR FURNACES		WALL FURNACES	
	SINGLE	DUAL	SINGLE	DUAL
25,000 B.T.U.	$720	-----	$620	$700
35,000	785	$ 950	670	745
45,000	845	1,010	725	800
55,000	890	1,095	785	860
65,000	920	1,155	855	925
75,000	-----	1,245	-----	-----

FORCED-AIR AND GRAVITY FURNACES

Average cost of installed gas-fired units with electric ignition including thermostat. Gravity and upflow furnaces will typically be at the lower end of the cost range while downflow (counterflow), horizontal and electric furnaces will be at the higher end. For high-efficiency models use higher side of the range, adding an additional $235 for deluxe low-$NO_x$ emission high-efficiency condensing furnaces. Add $150 to $210 per outlet for ducts, registers and grills. Deduct $130 to $175 for standing pilot ignition systems. Add 10% for oil-fired or stoker-fired units plus cost for a storage tank below. For dual chamber wood-burning units, add 100%; for outdoor wood-burning units, add 110% to 130%, larger units cost $23.00 to $27.00 per 1,000 B.T.U.s. See Section UIP 12 for chimneys.

RATED CAPACITY	COST RANGE		RATED CAPACITY	COST RANGE	
65,000 B.T.U.	$1,275 –	$1,825	125,000 B.T.U.	$1,600 –	$2,225
75,000	1,325 –	1,900	150,000	1,725 –	2,450
85,000	1,375 –	2,000	200,000	2,075 –	3,000
100,000	1,425 –	2,125	300,000	3,025 –	4,375
For storage tanks, add:					
275 gallons	600 –	775	1,000 gallons	1,525 –	1,900
550	1,000 –	1,275	1,500	2,075 –	2,575

CLOCK THERMOSTATS

Single setback thermostats will range in cost from $120 to $150 plus $6 for each additional setback. Multistage programmable thermostats, used to automatically raise or lower temperature at preselected times, cost from $235 to $360. Hazardous location thermostats for controlling heating systems in explosive environments cost $190 to $295.

AUTOMATIC VENT DAMPERS

Automatic vent dampers cost $200 to $270 installed.

VENTILATION

For roof ventilators and blowers, see Section UIP 4.

SPACE HEATERS – SUSPENDED

Costs are for each gas-fired unit complete with propeller-type fans, including installation. High-efficiency, power-vented units are at the high end of the range. Add $235 for blower-type operation. For poly-tube adapter, add $120. Add $150 to $235 for electric ignition. Add $60 for propane-powered units. For oil-fired units, add 150%. For steam heat costs, use Section SEG 3 or 4.

RATED CAPACITY	COST RANGE		RATED CAPACITY	COST RANGE	
35,000 B.T.U.	$ 800 –	$1,175	150,000 B.T.U.	$1,300 –	$1,725
50,000	900 –	1,275	175,000	1,325 –	1,900
60,000	925 –	1,300	200,000	1,425 –	2,025
75,000	975 –	1,400	250,000	1,725 –	2,400
100,000	1,025 –	1,525	300,000	2,000 –	2,775
125,000	1,125 –	1,625	400,000	2,775 –	3,950

SPACE HEATERS – FLOOR

Costs are for oil-fired industrial heaters complete with fans, filters, controls, limited ductwork, storage and piping.

RATED CAPACITY	COST EACH	RATED CAPACITY	COST EACH
100,000 B.T.U.	$3,025	400,000 B.T.U.	$ 7,950
150,000	3,825	500,000	9,575
200,000	4,625	750,000	13,575
300,000	6,300	1,000,000	17,875

RADIANT HEATERS – SUSPENDED

Costs are for gas-fired units complete with piping and controls. Continuous pipe loop systems with reflectors and vacuum pump are at the high end of the range.

RATED CAPACITY	COST RANGE		RATED CAPACITY	COST RANGE	
15,000 B.T.U.	$1,025 –	$1,175	75,000 B.T.U.	$1,825 –	$2,150
30,000	1,175 –	1,400	100,000	2,025 –	2,450
45,000	1,325 –	1,625	125,000	2,575 –	3,075
50,000	1,400 –	1,700	150,000	3,025 –	3,525

FANJET DISTRIBUTION

Costs are for suspended fanjets including housing. Add $235 for motorized shutters.

FANJETS SIZE	FANJETS COST (EACH)	POLYTUBE DUCTING COST RANGE (PER LINEAR FOOT)
12"	$550	$ .42 – $ .53
18"	650	.46 – .58
24"	825	.54 – .69
30"	975	.59 – .76

VENTILATION FANS – WALL

Costs are for each fan unit complete with square or slant-wall housing. Automatic wall shutters are included at the high end of the range.

SIZE	COST RANGE		SIZE	COST RANGE	
24"	$ 825 –	$1,125	42"	$1,175 –	$1,600
30"	900 –	1,200	48"	1,375 –	1,850
36"	1,075 –	1,450	54"	1,650 –	2,200

HEATING

SECTION UIP 3

SOLAR HEATING SYSTEMS

The following costs are averages, including all ducting and ancillary equipment necessary for space heating either by use of liquid transfer-type or direct air-type collector systems.

The costs for individual installations can vary greatly and every application must be examined for its own special design costs, locational considerations, varying capacity, type of absorption, medium and storage facilities employed. Any conventional backup system must be priced separately. For large commercial applications use the complete system costs only, where 5,000 to 10,000 square feet of collector area will fall within the Good cost range and 50,000 square feet and over will normally fit the Low-cost range for pricing purposes.

LIQUID SYSTEM	LOW	AVG.	GOOD
Complete system based on square feet of collector area	$ 42.35	$ 67.70	$ 108.65
Cost of individual component items:			
Collectors, per sq. ft.	21.50	34.00	53.70
Storage tank, per gal./capacity	2.85	3.45	4.20
Pipe loops, heat exchangers, ducts and controls, complete	5,525	8,700	13,575
Insulation, tank and pipes	1,025	1,725	2,925

AIR SYSTEM	LOW	AVG.	GOOD
Complete system based on square foot of collector area	$ 39.40	$ 63.00	$ 100.25
Cost of individual component items:			
Collectors, per sq. ft.	19.95	31.35	48.95
Pebble bed storage container with gravel, 200 – 400 sq. ft., each	1,275	2,075	3,375
Air handler, ducts, blowers and controls, complete	6,100	9,550	14,925
Insulation, tank and pipes	825	1,425	2,450

HEAT-RECOVERY SYSTEMS

The following costs are rough averages for complete air to air heat-recovery systems. The costs for individual design systems can vary greatly due to the many variables involved.

SIZE	COST– CFM
2,500 – 5,000 CFM	$4,600 – $5,775
5,000 – 15,000	2,500 – 4,700
15,000 – 20,000	1,750 – 3,225
20,000 – 30,000	1,025 – 1,800

HOT WATER BOILERS

Cost are for small natural gas- or propane-fired cast-iron boilers or generators with insulated jackets and standard controls and include pumps and gauges. For oil-fired, add 10% to 20%; electric hydronic boilers, add 25% to 40%. Deduct $130 to $190 for standing pilot ignition systems. For thru-wall power venting, add $330. Costs do not include piping or electric wiring. For large commercial and industrial boilers, see Section UIP 12. Add for expansion tank below.

RATED CAPACITY	COST RANGE
33,000 B.T.U.	$1,725 – $2,225
60,000	1,850 – 2,450
75,000	1,900 – 2,575
100,000	2,025 – 2,750
125,000	2,125 – 2,950
150,000	2,225 – 3,125
175,000	2,375 – 3,350

HYDRONIC EXPANSION TANKS

Costs are for high-temperature steel expansion tanks installed with a maximum working pressure of 100 to 125 PSI.

2-gallon	$110 – $155	10-gallon	$230 – $335
5	155 – 220	15	305 – 440
7	185 – 265	20	380 – 555

HYDRONIC BASEBOARD HEATERS

Costs are for installed 7" high heaters used in hot-water systems with boilers and include tubing, panels, end caps and pivot-mounted dampers to regulate heat flow. Add $7.75 to $12.00 ($30 to $50 for 1-1/4" tube) for each corner application. For two-tier 1-1/4" tube assembly, add 50%; for three-tier, add 75%. For electric-heated hydronic, use electric baseboard costs from Page 3.

Length	1/2" Tube Cost Range	3/4" Tube Cost Range	1-1/4" Tube Cost Range
2'	$ 39 – $ 47	$ 47 – $ 59	$ 67 – $ 83
3'	45 – 57	57 – 72	84 – 103
4'	52 – 67	65 – 83	100 – 124
6'	67 – 84	84 – 105	134 – 167
7'	76 – 97	96 – 121	152 – 188
8'	98 – 122	122 – 153	168 – 209
9'	105 – 130	131 – 164	185 – 230
10'	110 – 140	138 – 173	202 – 252

HEATING

SECTION UIP 3

ELECTRIC WALL FURNACES

Costs are for wall- or recess-mounted counterflow electric wall furnace and includes thermostat switches and installation. For rear package that directs some of the heated air to an adjoining room, add $75 to $130.

RATED CAPACITY	COST RANGE	RATED CAPACITY	COST RANGE
2,000 watts	$360 – $505	6,000 watts	$565 – $ 895
4,000	480 – 690	8,000	655 – 1,105

RADIANT CABLE IN WALLS, FLOOR OR CEILING

Costs are for installed system and include cables, switches, controls and thermostats.

1,000 watts	$255 – $350	4,000 watts	$690 – $ 985
2,000	390 – 565	5,000	835 – 1,165
3,000	540 – 715	6,000	955 – 1,375

RADIANT CEILING PANELS

Costs are for suspended or surface-mounted panel including controls.

200 watts	$145 – $170	800 watts	$305 – $335
400	200 – 225	1,000	360 – 380
600	255 – 280	1,200	415 – 435

INFRARED CEILING OR WALL HEATERS

Costs are for indoor heaters and include installation and prorated share of electrical circuits. For outdoor infrared installations add 10% to 20%.

500 watts	$185 – $265	3,000 watts	$430 – $ 600
1,000	255 – 350	5,000	560 – 790
2,000	335 – 470	7,000	860 – 1,220

ELECTRIC BASEBOARD HEATERS

Costs are for baseboard heaters mounted directly on finished floor and include installation. Add $15 to $90 for wall thermostat. Add $30 to $155 for each built-in thermostat.

WATTS	LENGTH	COST RANGE	WATTS	LENGTH	COST RANGE
500	2'	$110 – $295	2,000	8'	$200 – $560
750	3'	120 – 335	3,000	10'	240 – 660
1,000	4'	140 – 400	5,000	11'	280 – 765
1,500	6'	165 – 470	7,000	12'	310 – 860

BATHROOM HEATERS

Costs are for ceiling or wall heaters including installation. Small wattage is bulb type. For ceiling light unit, add $30 to $50. For floor or kickspace units, add $95 to $130.

WATTS	WITHOUT FAN	WITH FAN
250	$ 65 – $130	$ 95 – $165
500	85 – 155	115 – 185
750	100 – 165	130 – 205
1,000	120 – 200	160 – 240
1,500	165 – 230	215 – 320
2,000	200 – 265	255 – 400

ELECTRIC INDUSTRIAL HEATERS WITH FAN

Costs are for 60-Hz fan-forced, ceiling- or wall-mounted heaters used in industrial, commercial and farm applications, and include installation, summer fan switches and thermostats.

KW	COST RANGE	KW	COST RANGE
3	$ 625 – $ 900	15	$1,450 – $2,200
5	725 – 1,075	20	1,800 – 2,725
7.5	975 – 1,425	30	2,425 – 3,600
10	1,075 – 1,600	50	3,300 – 4,975

NOTE: For electric duct heaters with thermostat and relay, use above table deducting 25% to 40% from the cost range.

ELECTRIC CABINET UNIT HEATERS

Costs are for electric cabinet heaters with built-in thermostat and relays, and include installation, miscellaneous materials, connections and prorated share of electrical circuits. For recessed units, add 5% to 10%.

SURFACE MOUNTED

	LENGTH				
KW	3'	4'	5'	6'	7'
3	$1,750	-----	-----	-----	-----
4	-----	$1,800	-----	-----	-----
6	-----	1,875	-----	-----	-----
8	-----	1,950	$2,225	-----	-----
10	-----	2,025	2,400	$2,475	-----
12	-----	2,100	2,450	2,525	-----
16	-----	-----	2,500	2,625	-----
20	-----	-----	-----	2,725	$2,825
24	-----	-----	-----	-----	3,025

DUCTWORK

Costs are per linear foot of insulated, flexible, round polyester ducts and include supports, accessories and installation.

DIAM.	GRAY	METALIZED	DIAM.	GRAY	METALIZED
3"	$ 6.10	$ 6.45	12"	$12.10	$12.85
4"	6.25	6.70	13"	13.15	14.05
5"	6.70	7.10	14"	13.60	14.80
6"	7.00	7.50	15"	16.30	17.45
7"	8.40	8.90	16"	17.00	18.25
8"	8.85	9.35	17"	18.10	19.55
9"	9.20	9.85	18"	18.80	20.35
10"	9.35	9.95	19"	19.55	21.20
11"	11.90	12.60	20"	20.35	22.05

HEATING AND COOLING

SECTION UIP 3

REFRIGERATION

The rated horsepower of the motor is approximately equivalent to the number of tons of refrigeration. One ton of refrigeration equals 12,000 B.T.U.

WINDOW UNITS

CAPACITY	COST EACH	CAPACITY	COST EACH
1/2-Ton	$645 –$ 770	1-Ton	$1,010 – $1,195
3/4	770 – 1,045	2	1,525 – 1,885

For units installed in wall sleeves, the cost on new work is approximately the same. For remodeling, add cost of making hole and repairing. Add $220 for 220-volt units. Add 25% to 50% for reverse cycle (heat pump) window or wall units.

PACKAGE UNITS

Average cost includes single duct and outlet, or use of heating ducts. Add $170 per additional ducted outlet or intake.

CAPACITY	COST EACH	CAPACITY	COST EACH
2-Ton . . .	$2,925 – $3,250	7-1/2-Ton .	$10,150 – $11,375
3	4,275 – 4,825	10	13,300 – 15,050
5	6,925 – 7,750	15	19,550 – 22,050

COMPLETE COOLING SYSTEM

Costs are averages of engineered systems, including complete ductwork, zone controls, power, and electrical connections. Open buildings such as auditoriums, industrials, and markets will usually have a lower cost per ton than buildings requiring a larger number of temperature zones and intricate piping or ductwork such as good offices, hospitals, etc. The costs shown are medians in three cost ranges.

	COST PER TON OF CAPACITY		
CAPACITY	LOW	AVERAGE	GOOD
5-Ton . .	$2,200	$2,725	$3,350
10	2,100	2,575	3,200
15	2,025	2,475	3,075
25	1,950	2,425	3,000
50	1,850	2,300	2,775
75	1,800	2,200	2,725
100	1,750	2,125	2,675
150	1,700	2,075	2,525
250	1,675	2,000	2,475
400	1,600	1,900	2,400

EVAPORATIVE COOLERS

WINDOW UNITS

Cubic Feet per Minute	Cost per Unit	Cubic Feet per Minute	Cost per Unit
1,500	$370 – $480	4,500	$730 – $ 950
2,500	480 – 615	5,500	840 – 1,095
3,500	590 – 770	6,500	950 – 1,220

ROOF OR WALL UNITS

Costs include one outlet, add $160 per additional outlet. For farm application, deduct 15% to 25%.

Cubic Feet per Minute	Cost per Unit	Cubic Feet per Minute	Cost per Unit
3,000	$1,025 –$1,300	8,000	$1,875 – $2,450
4,000	1,175 – 1,450	9,000	2,025 – 2,675
5,000	1,375 – 1,700	12,000	2,575 – 3,300
6,000	1,600 – 1,900	14,000	3,050 – 3,875
7,000	1,800 – 2,300	16,000	3,625 – 4,550

AIR CURTAINS

Air curtains in place, including necessary connections, cost from $26.50 to $45.00 per square foot of entrance opening. Add 70% to 80% for particulate filtered units and 80% to 100% for heated units.

COMBINED HEATING AND COOLING

PACKAGE UNITS

Costs are averages per installation, with single-duct system and necessary vents, plumbing, power, and electrical connections for each unit. Costs are for commercial split systems of gas-fired, forced-air heating with gas or electric refrigerated cooling, and for heat pumps (reverse cycle refrigeration). Residential-type systems will cost 20% less for a 2-ton unit to 40% less for 5 tons.

Add $170 to $215 for each additional ducted outlet or intake, and $270 for each control to commercial systems only.

In cooler climates, heat pumps need supplemental heat. If supplemental electric coils are installed in ducts, add $405 for each coil. If a complete extra heating system is used, price separately.

RATED COOLING CAPACITY	SPLIT SYSTEM		HEAT PUMP	
2-Ton	$ 4,275 –	$ 4,600	$ 3,825 –	$ 4,175
3	6,225 –	6,700	5,600 –	6,100
5	9,925 –	10,800	9,100 –	9,925
7-1/2	14,550 –	15,900	13,350 –	14,550
10	18,900 –	20,525	17,525 –	19,225
15	27,375 –	30,025	25,725 –	28,150
20	35,575 –	39,075	33,800 –	37,100
25	43,725 –	48,050	41,800 –	45,900
30	51,675 –	56,950	49,700 –	54,675

HEATING AND COOLING

SECTION UIP 3

COMBINED HEATING AND COOLING

ENGINEERED SYSTEMS

Costs of these systems vary greatly with climate and degree of temperature control required. Buildings with large open areas and few controls need much less ductwork and fewer control items than buildings with many subdivided rooms with individual controls. In cooler climates larger heating units are involved, while costs are listed per ton of cooling capacity. Costs are smoothed medians of three cost ranges and include the complete unit, installation, power, connections, and all ancillary items.

The lowest-priced installation would normally be in a sheltered area in an industrial plant or market with few separate temperature zones. The highest-priced installation per ton would normally be found in good and excellent buildings with occupancies such as offices, hospitals, hotels, and others which require many temperature zones, in an open area experiencing severe wind chill.

To state the problem differently, the determining cost factors are the year-round ambient temperatures and the number of temperature controls, plus the quality of equipment and design of the complete system.

RATED CAPACITY (Tons)	COST PER TON LOW	AVERAGE	GOOD
10	$2,760	$4,055	$5,950
15	2,660	3,920	5,770
20	2,595	3,835	5,645
30	2,495	3,700	5,480
40	2,430	3,620	5,365
50	2,385	3,540	5,275
75	2,300	3,425	5,115
100	2,240	3,355	5,005
150	2,155	3,240	4,860
200	2,100	3,155	4,760
300	2,030	3,060	4,620
500	1,925	2,930	4,445
750	1,865	2,835	4,305
1,000	1,815	2,760	4,220
1,500	1,750	2,670	4,090

MISCELLANEOUS RESIDENTIAL ITEMS

Costs installed in place with necessary vents and/or connections.

	COST RANGE
Air purifier, electronic	$ 780 – $1,260
Air purifier, filtered air	365 – 625
Humidifier	340 – 645
Ceiling fan	100 – 280
add for lighting	40 – 350
Sauna heater, door unit	770 – 1,460
rock unit	1,315 – 2,240

Attic exhaust fans and ventilators, see Section UIP 4.

AIR TERMINAL UNITS

VARIABLE AIR VOLUME

Costs are each and include reheat coils, controls and installation.

CAPACITY (CFM)	COST RANGE
100 – 200	$ 565 – $ 790
200 – 350	590 – 830
350 – 500	645 – 900
500 – 750	660 – 965
750 – 1,000	725 – 1,030
1,000 – 1,250	775 – 1,095
1,250 – 1,500	830 – 1,155
1,500 – 2,500	1,060 – 1,490
2,500 – 5,000	1,525 – 2,155

AIR TERMINAL UNITS

CONSTANT VOLUME

Costs are for single-duct units and include reheat coils, controls and installation. Double-row reheat coils cost $160 to $355 per square foot.

CAPACITY (CFM)	COST RANGE
100	$ 480 – $ 660
300	525 – 725
500	555 – 790
750	585 – 830
1,000	680 – 965
1,250	715 – 995
1,500	750 – 1,060
2,000	975 – 1,360
2,500	1,220 – 1,725
3,000	1,360 – 1,920
4,000	1,590 – 2,250

DEHUMIDIFIERS

Costs are for residential dehumidifiers with built-in frost and overflow controls and automatic humidistat to maintain selected humidity. Add $20 to $50 dollars for separate hose connection and drip tray.

CAPACITY PINTS/24 HRS.	COST RANGE
15	$360 – $550
25	415 – 635
30	470 – 690
40	550 – 770
50	660 – 910

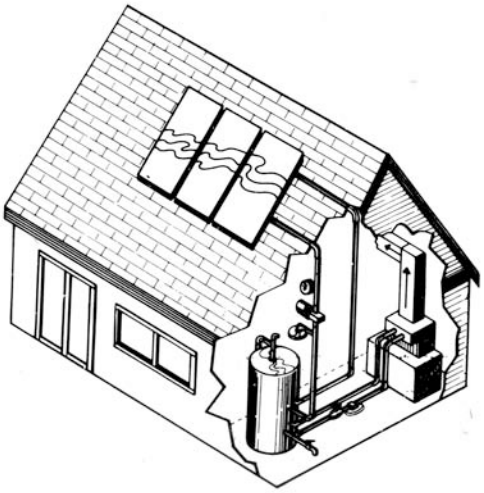
HEATING, COOLING AND VENTILATING

SECTION UIP 3

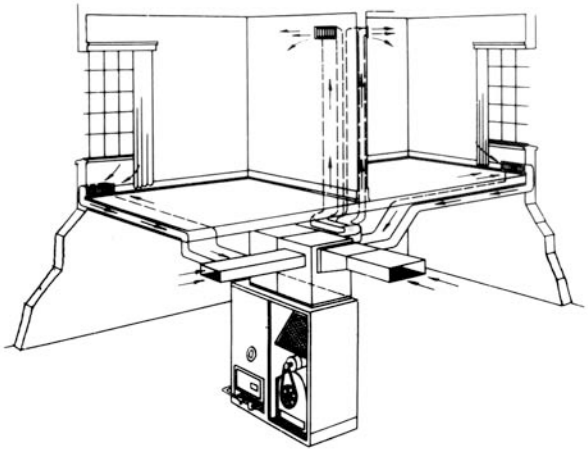
AIR-CONDITIONING REQUIREMENTS

Air-conditioning requirements are greatly dependent on the occupancy of the structure. The following figures give typical quantities by occupancy in square feet per ton of cooling capacity, except as otherwise stated. Figures do not include cooling for ice making, cold storage, etc. The range of areas includes approximately 80% of all cases.

OCCUPANCY	SQUARE FEET/ TON
Fast food restaurants, small bars and taverns	100 – 225
Lounges and restaurants	125 – 275
Radio & TV stations, laboratories, barbershops, drug stores	150 – 300
Luxury high-value residential occupancies	150 – 450
Hospitals	180 – 280
Specialty retail shops, dental offices	200 – 300
Churches, auditoriums, theaters	200 – 375
Fraternal buildings, governmental, clubhouses, country clubs	225 – 400
Colleges, banks, department stores, libraries, museums	250 – 450
Schools, light industrials, offices, medical offices, telephone	275 – 500
Mortuaries, veterinary hospitals	300 – 475
Bowling alleys, retail stores, shopping centers	300 – 500
Hotels, motels, post offices	280 – 450
Discount stores, loft buildings, nursing homes	350 – 500
Dormitories, food markets	280 – 550
Vocational schools, jails	400 – 600
Residential occupancies	400 – 750
Fire stations and service garages	550 – 750
Food markets with energy recovery systems	600 – 750
Auditoriums	1 ton per each 15 to 25 seats
Theaters	1 ton per each 10 to 20 seats
Bars and taverns	1 ton per each 7 to 12 seats



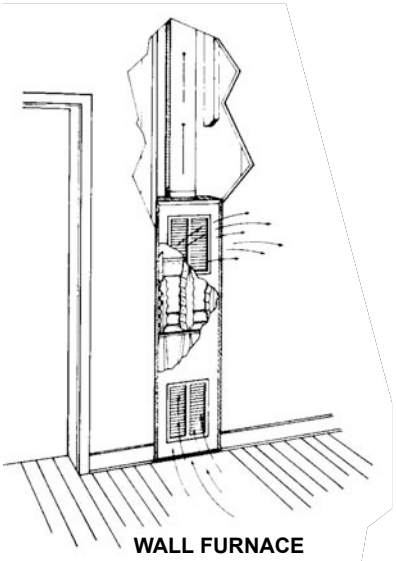
SOLAR HEATING SYSTEM



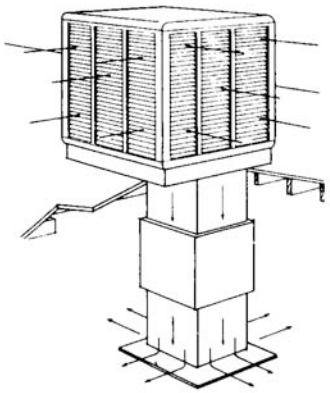
FORCED-AIR FURNACE

HEATING, COOLING AND VENTILATING

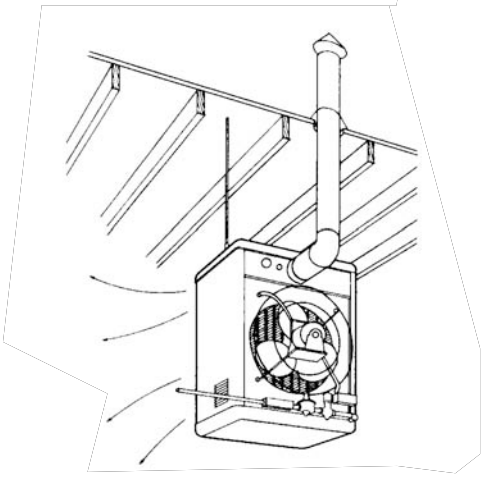
SECTION UIP 3



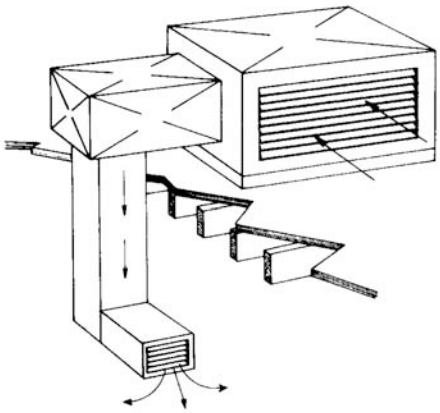
WALL FURNACE



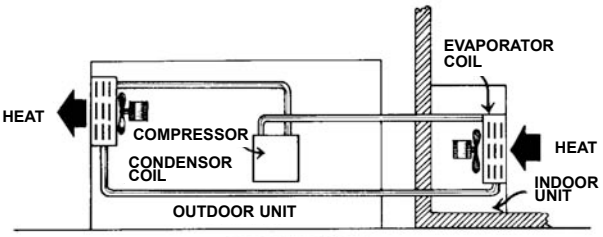
EVAPORATIVE COOLER



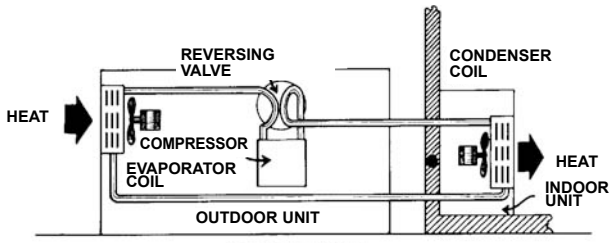
SPACE HEATERS (SUSPENDED)



PACKAGE AIR CONDITIONING

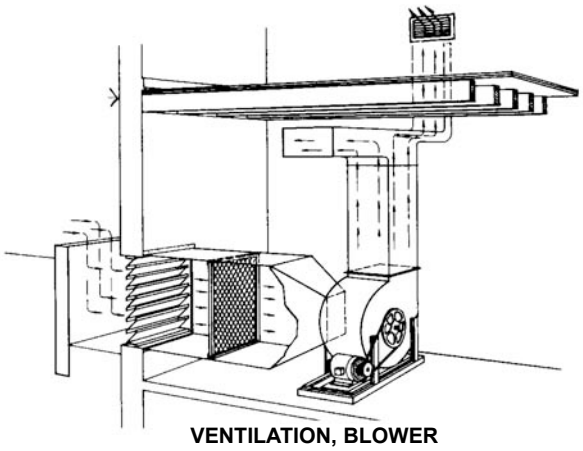


COOLING CYCLE

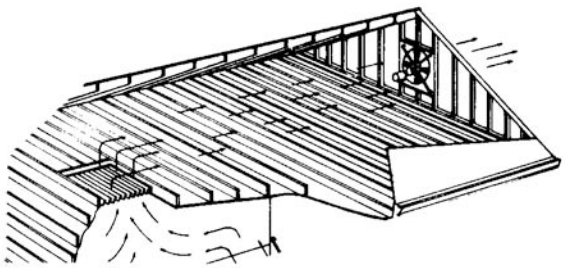


HEATING CYCLE

HEAT PUMP



VENTILATION, BLOWER



VENTILATION, FAN ONLY

MECHANICAL COSTS

SECTION UIP 3

PERCENTAGE OF TOTAL COST

The following table records the results of studies of many recently completed buildings, by occupancy, giving the percentage of total contract cost spent on the mechanical items, exclusive of elevators and sprinklers. The average used is the median, and the high and low percentages which are given do not include extremes, but are computed to include approximately 90 percent of all cases within the given range (45% each side of the median). For electrical percentages, see Page 17.

OCCUPANCY	HEATING ONLY			HEATING & COOLING			PLUMBING		
	LOW	MEDIAN	HIGH	LOW	MEDIAN	HIGH	LOW	MEDIAN	HIGH
Apartments, Classes A and B	3.7	5.9	8.9	6.1	8.5	11.5	7.2	8.5	10.5
Apartments, Classes C and D	2.6	4.0	7.7	6.4	8.6	12.3	7.5	10.9	15.3
Auditoriums and theaters	-----	-----	-----	7.6	11.5	18.1	3.0	5.5	10.6
Banks	-----	-----	-----	4.5	7.4	12.6	2.3	4.3	7.0
Bowling alleys	-----	-----	-----	8.6	12.3	17.5	2.5	4.6	7.6
Clubhouses and meeting halls	3.5	6.0	10.2	8.2	10.4	14.0	5.0	7.2	11.9
Convalescent hospitals and nursing homes	4.1	6.1	8.7	7.8	11.4	17.3	8.1	10.6	13.6
Department stores	-----	-----	-----	9.1	11.8	14.9	2.8	4.0	5.8
Discount stores	3.4	5.4	9.3	8.3	10.7	13.4	2.3	4.3	7.3
Dormitories	4.7	7.1	10.6	7.0	10.1	13.8	6.6	8.4	10.9
Fraternal buildings and community centers	-----	-----	-----	8.4	12.1	17.6	4.7	7.0	10.5
Homes for the elderly	2.8	4.8	8.6	5.9	8.4	12.5	8.1	10.2	12.5
Hospitals	-----	-----	-----	11.3	16.8	22.9	7.9	10.8	15.1
Industrials	3.1*	6.2*	12.3*	11.5	16.0	23.0	3.8	6.4	11.5
Libraries and museums	4.4	6.1	8.5	8.3	12.1	17.4	3.1	5.3	7.8
Markets	-----	-----	-----	7.1	10.0	14.2	4.2	6.1	9.2
Medical office buildings and clinics	-----	-----	-----	6.2	9.7	16.4	4.6	8.5	13.0
Motels and hotels	-----	-----	-----	4.6	8.7	14.8	6.6	10.2	13.5
Office buildings	4.3	6.5	9.5	6.6	10.2	17.5	2.6	4.7	8.5
Restaurants	-----	-----	-----	8.0	12.2	15.6	5.3	9.8	13.7
Retail stores and shops	3.7	4.8	6.1	6.1	8.9	12.6	2.2	4.6	8.8
Telephone buildings	-----	-----	-----	9.5	14.0	19.2	3.7	5.5	8.0
Warehouses	1.9*	4.3*	9.1*	5.9	9.4	14.9	2.0	4.0	7.2

*With office cooling

PLUMBING

SECTION UIP 3

EXPLANATION

In the Segregated Cost Sections, plumbing is priced on the basis of floor area or average cost per fixture. Many times, it is desirable to give a more detailed breakdown, especially in industrial occupancies. These tables will enable the assessor to detail his plumbing costs by type of fixture.

The costs listed here include cost of the fixture, labor, miscellaneous materials for rough and finish, and contractor's profit and overhead. Average amounts of water, gas, and waste lines within the building are included but not exterior sewer or utility lines or meters.

Industrial plumbing may be priced from this page, but long pipe and sewer runs must be added. Including all items, industrial and warehouse costs range from $1,825 to $5,225 per fixture; therefore, it is recommended that if they are priced from the following table, add for pipe and sewer runs of over 25' per fixture. This should normally give a reasonable answer. Store and office fixtures have a normal range from $1,550 to $2,750 per fixture and may be priced from the table in a like manner. Toilet partitions and restroom accessory costs are found in Section UIP 2.

WATER HEATERS

Residential type:	20 Gal.	30 Gal.	40 Gal.	50 Gal.	70 Gal.
Minimum, competitive	$510	$530	$555	$605	-----
Average, 5-year guarantee	605	650	700	750	-----
Good, 10- to 15-year guarantee	-----	765	840	945	$1,145

For hot-water recovery expansion chamber, add $295.
Insulation jacket, add $32.
Point-of-use water heaters cost $160 – $260.

Commercial heater:

100 GPH recovery	$1,925 – $2,700	150 GPH recovery	$2,225 – $3,000
Storage tank, lined		Recirculating pumps	
120 gallons	1,600 – 2,225	1 inch	300 – 525
240	2,225 – 2,975	2	500 – 700
360	3,025 – 3,625	3	700 – 1,200

SOLAR HOT WATER HEATERS

Liquid-heat collectors (two to three panels), 80- to 120-gallon water tank with heat exchanger and pump. Where system is integrated with space heat, reduce cost by 50%.

Cost is in addition to conventional hot-water system:	$4,275 – $5,975
Hot-water collector, tank combination, single unit:	1,500 – 2,175

WATER SOFTENERS

Average cost of automatic units completely installed with necessary fittings. Rated capacity is in grains of hardness converted per week. Commercial, per regeneration, add 100%.

RATED CAPACITY	COST RANGE	RATED CAPACITY	COST RANGE
20,000	$1,100 – $1,250	60,000	$1,250 – $1,475
30,000	1,150 – 1,275	100,000	1,300 – 1,575
40,000	1,175 – 1,325	200,000	2,050 – 2,500

WATER FILTRATION Residential type:
complete treatment system (filter, clarify, soften, refine) . . . . . $2,700 – $6,125

FIXTURES

	LOW	AVG.	GOOD	HIGH
Average for residential fixtures	$ 505	$ 780	$ 1,200	$ 1,840
high value	1,875	2,345	2,985	3,775
Bathtub	520	840	1,350	2,190
handicapped, walk-in door	3,600	4,220	4,950	5,800
fiberglass tub-shower	965	1,290	1,710	2,290
handicapped unit	1,275	2,125	3,515	5,865
deluxe or whirlpool	2,300	3,350	4,925	7,275
environmental encl.	20,525	23,425	26,650	30,175
Bidet	620	870	1,220	1,710
deluxe	1,825	2,250	2,825	3,575
Drinking fountain	490	595	715	870
Refrigerated water coolers	905	1,070	1,260	1,480
Water coolers, hot/cold water	-----	1,105	1,350	1,675
Floor drain	260	345	465	615
large sinks	615	705	825	935
Gas piping, res., per unit	200	250	315	400
Hose bib	70	100	140	190
Hydrant, commercial wall	205	320	510	805
Laundry tray, single	310	405	530	690
double	380	510	680	905
Lavatory	320	485	730	1,105
deluxe (handpainted, gold trim, etc.)	1,325	1,800	2,325	3,025
gold plated	1,550	2,175	3,075	4,275
polished metals (brass, copper, etc.)	1,325	1,850	2,450	3,300
marble or granite	1,575	2,175	2,950	3,950
pedestal mount	1,005	1,130	1,260	1,415
deluxe (hand painted, gold trim, etc.)	1,725	2,175	2,650	3,250
gold plated	2,325	3,075	3,975	5,225
carved marble/granite	4,050	6,000	8,950	13,225
Roof drain	255	375	540	785
Shower, stall*	520	680	870	1,130
prefabricated unit	720	965	1,290	1,710
metal cabinet	235	295	375	470
deluxe (add steam below)	1,725	2,500	3,575	5,150
environmental encl.	13,500	18,450	25,475	34,850
handicapped unit	1,225	1,965	3,195	5,155
shower base only	235	320	440	615
deluxe	705	850	1,055	1,290
Shower over tub or extra hard.	145	190	255	340
deluxe hardware sets, each	370	520	745	1,030
Sink, kitchen, single	400	500	620	775
multibowl	485	670	920	1,275
deluxe bowls	1,800	2,450	3,400	4,675
undersink, hot water disp.	175	215	255	310
water purification, faucet	280	375	510	690
Sink, service (janitor)	530	685	885	1,145
Steam generators, res. baths	1,205	1,390	1,580	1,805
Sump pump 1/3 to 1/2 hp, 1-1/4" outlet	345	425	525	645
Urinal	685	965	1,350	1,935
Water closet	535	775	1,110	1,615
deluxe	1,725	2,325	3,075	4,125
handicapped	615	760	935	1,160
air compressor, add	825	965	1,145	1,345
electric, incinerator type	1,625	1,825	2,025	2,250
composting	1,750	2,050	2,400	2,825
Wet bar	435	510	600	710
deluxe	870	1,260	1,805	2,580
Rough-in only, for fixture	280	330	400	485
Clean outs	85	125	170	235
Vent, dryer or appliance	100	130	175	240
Add for gold-plated hardware, per set (not gold finish)	65	130	265	550

*Tile, glass doors, and enclosures are included under Interior Construction in the Segregated Cost Sections. If separate costs for these items are desired, tile showers cost $565 to $1,000; tile floor only, $130 to $190; shower doors, $140 to $505; tile tub surround, $320 to $530; and tub enclosure, $185 to $645. Custom shower or tub enclosures will cost from $1,145 to $10,250. Grab bars, see Section UIP 2.

PLUMBING AND WELL DRILLING

SECTION UIP 3

INDUSTRIAL WASH SINKS

Enameled cast iron, rectangular, 30" wide:	COST RANGE
4 feet long, four faucets	$1,475 – $1,900
8 feet long, eight faucets	2,450 – 3,225

Add 20% for stainless steel.

Circular wash fountains:	36"		54"	
Polished cement (granite chips)	$2,175 –	$2,775	$2,475 –	$3,200
Terrazzo (marble chips)	2,250 –	2,900	2,600 –	3,300
Enameled steel	2,475 –	3,200	2,775 –	3,575
Stainless steel	2,675 –	3,425	3,075 –	3,925
Semicircular wash fountains:				
Polished cement (granite chips)	1,875 –	2,450	2,175 –	2,800
Terrazzo (marble chips)	1,950 –	2,600	2,325 –	3,000
Enameled steel	2,225 –	2,825	2,500 –	3,250
Stainless steel	2,450 –	3,125	2,800 –	3,550
Two-person wash fountains:				
Enameled steel			950 –	1,325
Stainless steel			1,175 –	1,575
For infrared control, add			650 –	1,275

INSTALLED PIPE

In large buildings with few fixtures, some consideration must be given to the length of pipe runs from the fixture to the point where the pipe is stubbed out of the building. Cost of runs longer than an average of approximately 25' per fixture should be added from Section UIP 12, or the following abbreviated table. Costs are per linear foot of run including fittings and valves.

	GALVANIZED	COPPER	CAST IRON	PLASTIC
1/2"	$ 6.90	$ 7.25	-----	-----
3/4"	8.40	8.70	-----	-----
1"	11.50	10.90	-----	-----
1-1/2"	15.00	16.35	$11.75	$ 7.45
2"	18.55	21.10	15.35	8.45
3"	26.45	36.50	18.20	11.45
4"	35.95	59.95	21.55	14.70
6"	68.65	111.20	29.60	22.15
8"	-----	-----	45.90	-----
10"	-----	-----	66.25	-----

WATER-SUPPLY METERS

Installed costs do not include piping.

TYPE	SIZE	CAPACITY	COST RANGE
Bronze, screwed	3/4"	30 gpm	$ 165 – $ 220
	1"	50	220 – 280
	1-1/2"	100	380 – 495
	2"	160	670 – 840
Bronze, flanged	3"	360	2,100 – 2,510
	4"	500	3,130 – 3,610

INDUSTRIAL SHOWERS

Average cost-in-place including rough and finish plumbing.

	ENAMELED STEEL	STAINLESS STEEL	ADD FOR RECEPTORS
Column showers:			
Circular, 5 person	$2,025	$2,800	$1,575
Semicircular, 3 person	1,600	2,200	1,225
Corner, 2 person	1,550	1,950	1,275
Multi-stall showers:			
Circular, 5 person	4,750	6,150	1,725
Semicircular, 3 person	3,725	5,075	1,500
Corner, 2 person	3,225	4,350	1,325
Emergency shower	900	1,225	
Multi-nozzle, up to 12 spray	1,525	2,225	
decontamination	3,850	4,725	
Add for eye wash	460	640	

For exterior foot and body shower towers, see Section UIP 16, Page 4.

GREASE INTERCEPTORS

As found in restaurants and meat-packing houses. Installed costs do not include piping.

SIZE, GPM	CAPACITY, LB	COST RANGE
CAST IRON		
7	14	$ 725 – $1,200
15	30	1,175 – 1,950
50	100	2,500 – 4,025
FABRICATED STEEL		
100	200	$ 4,725 – $ 6,150
250	500	9,000 – 11,250
500	1,000	14,500 – 17,725

SEWAGE DISPOSAL

SEPTIC TANK Average costs installed and connected in normal soil.

750 gallon	$ 675 –$1,075	2,000 gallon	$ 1,875 – $ 2,650
1,000	950 – 1,400	4,000	4,175 – 5,275
1,250	1,225 – 1,700	6,000	6,300 – 7,850
1,500	1,500 – 2,025	10,000	10,550 – 13,225

Drainfields will typically cost 1 to 1.5 times the tank cost. Add 10% to 15% for elevated fields (for fill, see Section UIP 1) plus $3,825 to $8,725 for a grinder pump system.

Leaching lines, tile, per linear foot	$6.75 – $10.85
plastic pipe, per linear foot	4.10 – 6.75
add for gravel or stone backfill, per cubic foot	.34 – 1.04

Cesspools, $530 plus $20.75 per linear foot of depth.

WATER WELLS

Average costs of water wells, 100 to 1,000 feet deep. Costs include drilling, casings, gravel pack, setup, testing, and miscellaneous costs up to point of actual operation excluding pumps. Costs of vertical turbine pumps are listed in Volume I, page 267. The low and high costs do not represent the minimum or maximum possible, but the centers of low and high cost ranges.

	COST PER FOOT OF DEPTH		
SIZE	LOW	AVERAGE	HIGH
4" – 6"	$16	$ 24	$ 31
8" – 10"	28	36	48
12" – 14"	40	51	64
16" – 18"	52	64	80
20" – 22"	63	77	97
24" – 26"	75	93	114
28" – 30"	88	106	130

FIRE PROTECTION

SECTION UIP 3

FIRE PUMP EQUIPMENT

HORIZONTAL SHAFT (CENTRIFUGAL, 100 PSI)

Prices include installation costs, coupling and motor or engine on a steel base, plus relief valve and waste cone. Controller must be added for electric units. Diesel engine costs include battery, trickle charger, coupling and automatic controller. Electric motors are 230/460 volt, 3 phase, 60 Hz.

GPM	HP	RPM	ELECTRIC	DIESEL
500	60	1800	$18,750	$58,750
750	75	1800	23,500	63,750
1000	100	1800	27,750	67,250
1500	125	1800	35,000	73,000
2000	150	1800	41,250	77,000
2500	200	1800	46,750	80,750

VERTICAL SHAFT (TURBINE, MULTISTAGE)

The following prices include a vertical electric motor with thrust bearing. Costs for diesel engines include a right-angle drive, coupler, metal skid, fuel tank, battery, trickle charger and automatic controller.

GPM	HP	RPM	PUMP ONLY	ADD FOR ELECTRIC	ADD FOR DIESEL
500	50	1800	$23,750	$ 3,000	$38,250
750	75	1800	26,750	3,750	42,500
1000	100	1800	29,750	5,000	46,250
1500	125	1800	35,250	7,000	52,000
2000	150	1800	41,500	9,000	57,000
2500	200	1800	47,250	11,500	61,000

PUMP DRIVERS

Diesel engines with coupling, skid, battery, fuel tank and battery charger. For horizontal drive.

For 1000-gal., 100-psi pump	$24,250
For 2000-gal., 100-psi pump	30,250

Electric motors (squirrel-cage induction, 3-phase, 60-cycle, drip-proof).

VOLTAGE	RPM	HORSEPOWER					
		30	50	75	100	150	200
230 – 460	1800	$1,200	$2,000	$3,075	$4,050	$6,100	$8,175

ELECTRIC DRIVE CONTROLLERS

Combined Manual and Automatic, Across-the-Line

VOLTS	AMP*	HORSEPOWER					
		30	50	75	100	150	200
220	30,000	$ 7,000	$ 8,750	$11,750	$15,500	-----	-----
	75,000	13,000	14,250	15,250	16,250	$19,250	$23,250
440	25,000	6,500	7,250	8,250	8,750	9,500	10,250
	60,000	12,750	14,000	15,000	15,500	16,250	17,000

*Circuit breaker interrupting capacity.

Combined Manual and Automatic, Reduced Voltage

VOLTS	AMP*	HORSEPOWER					
		30	50	75	100	150	200
220	30,000	$ 8,750	$10,250	$12,750	-----	-----	-----
	75,000	15,000	16,000	18,250	$20,000	$25,000	$31,250
440	25,000	7,000	9,000	11,500	13,000	16,000	18,750
	60,000	13,000	15,750	18,250	19,250	21,750	24,500

DIESEL DRIVE CONTROLLERS . . . . . $6,450 – $6,725

FLOW METERS

PUMP SIZE	COST RANGE	PUMP SIZE	COST RANGE
500 gpm . .	$1,025 – $1,800	2000 gpm .	$1,475 – $3,625
750	1,100 – 2,125	3000	1,800 – 4,275
1000	1,175 – 2,475	4000	2,225 – 5,100
1500	1,300 – 3,075		

AUXILIARY LIGHT PACKS

Average cost in place for emergency lighting, including ancillary connections. Low end of range applies to lead acid batteries and the high end to nickel cadmium batteries.

Single	$380 – $600
Double	$390 – $625
Multipacks	$490 – $790

SPRINKLER SYSTEMS

Costs per square foot may be found in the Segregated Cost Sections. Refer to the section applicable to the type of building under consideration (see discussion in SEG INTRO).

COST PER HEAD			
LOW	AVERAGE	GOOD	HIGH COST
$155	$200	$265	$345

SMOKE- AND HEAT-ACTUATED ALARM SYSTEMS

Most commercial installations are leased. The costs below represent the installation costs charged to the user. For in-place costs see independent detectors under Fire Alarm Systems costs on next page. For duct-type detectors use the Control Panel connected system cost range.

Commercial base cost $1,050.00 plus $ .33 per square foot of protected areas.

Residential ionization smoke detectors cost $70.00 to $140.00 installed. Residential gas detectors-carbon monoxide, radon, etc., cost $40.00 to $70.00 installed.

FIRE PROTECTION

SECTION UIP 3

FIRE ALARM SYSTEMS

Buildings under 75' height.	COST RANGE
Control panel at lobby	$ 805 – $1,010
Add for each zone	170 – 235
Pull station	230 – 385
Smoke detector	305 – 460
Water leak detector	320 – 380
*Pull station with horn or bell alarm	105 – 130
*Pull stations	65 – 75
*Rate of rise, heat detectors	80 – 140
*Smoke-actuated door controls	180 – 260
*Smoke detectors	85 – 155
*Water leak detectors	175 – 240

*Use same costs for independent stations and detectors in buildings over 75' high.

Buildings 75' and above.

Control panel at fire control room (with street access for fire dept.) 75 zones	$9,074 – $13,761
Speakers connected with mike at control panel	105 – 125
Emergency telephone, 5 jacks	220 – 365
Sprinkler water flow detector	125 – 285
Time, date, location printer	6,150 – 8,800
Battery standby system	6,450 – 9,375

STANDPIPE

Costs per story, installed with necessary fittings. Add for hydrants below.

	2"	4"	6"	8"
Outside installation	$495	$1,070	$1,645	$2,190
Add for 1st-story Siamese connection	615	870	1,130	2,355
Inside wet standpipe	645	1,325	1,965	2,610

HYDRANTS

1-1/2" hose connection	$185	2-1/2" hose connection	$ 310
1-1/2" gate valve	305	2-1/2" gate valve	360
2-way Siamese 4" connection	840	2-way Siamese 6" connection	1,105

Inside fire hydrants including 75' of 1-1/2" hose, valve, rack nozzle, installed without cabinet, cost $495 to $705.

HOSE CABINETS

Steel	$230 – $320	Aluminum	$260 – $385
Stainless Steel	$420 – $615		

PLAYPIPES (Each)

Short, 15"	$85	Long, 30"	$165

HOSES (Per linear foot)

1-1/2"	$1.75 – $2.20	2-1/2"	$2.55 – $3.45

HOSEHOUSES

Steel . . . . . $945 – $1,130 Aluminum . . . $1,260 – $1,550

Add 50% for miscellaneous hosehouse equipment.

EXTINGUISHER CABINETS

Steel . . . . . $165 – $250 Aluminum . . . $185 – $295

Stainless Steel . . . $310 – $500

EXTINGUISHERS

	COST EACH		COST EACH
Portable, 2-1/2 gal. (pressurized) antifreeze	$175	water	$ 130
Carbon dioxide, with hose and horn, 2-1/2#	130	20#	320
5#	155	*50#	1,160
10#	190	*100#	2,235
Dry chemical, regular types 2-1/2#	60	30#	300
5#	85	*45#	1,170
10#	135	*150#	2,015
20#	200	*350#	3,080

*Costs include wheeled carts.

For all-purpose dry chemical types, add 5% to 10%. For halon type, add 100%.

CARBON DIOXIDE SYSTEMS

Flooding Systems, cost per cubic foot.

TANK SIZE	SMALL (500 cu. ft.)	MEDIUM (3,000 cu. ft.)	LARGE (30,000 cu. ft.)
Standard hazards	$2.80	$2.05	$1.35
Electric hazards	3.65	2.60	1.45
Fur vaults	4.90	3.30	1.65

Local Application, cost per square foot.

	SMALL (25 sq. ft.)	MEDIUM (250 sq. ft.)	LARGE (1,000 sq. ft.)
Coated surfaces	$105	$64	$46
Liquid surfaces	138	94	66

AIR FOAM SYSTEMS

High Expansion, cubic feet per minute.

5,000 cfm	$3,925	10,000 cfm.	$5,350
15,000 cfm	$7,450		

Low Expansion, (protein), cost per tank.

TANK SIZE	FUEL OIL	GASOLINE
500 sq. ft.	$ 7,300	$ 7,850
1,000	8,250	9,100
1,500	9,350	10,575
2,000	10,600	12,225
2,500	11,975	14,175
3,000	13,575	16,425

HALON 1301 SYSTEMS

Cost-in-place per cubic foot including ionization detection with approximately 6% total flooding of electrical hazards. Recharging of system may or may not be viable, since costs may double. Acceptable substitutes, such as FM200, will currently cost about 10% more, while Inergen systems will cost 10% to 20% less than costs listed below.

1,000 cu. ft.	$6.50 – $8.25	3,000 cu. ft.	$3.75 – $5.00
30,000 cu. ft.	$1.75 – $2.75		

DRY CHEMICAL SYSTEMS

Restaurant Hood/Duct	LOW	AVERAGE	HIGH COST
Cost per nozzle	$355	$490	$680

ELECTRICAL

SECTION UIP 3

SERVICE ENTRANCE EQUIPMENT

SINGLE PHASE, 120/240 V

Includes combination meter socket and circuit-breaker panel, circuit breakers, riser conduit cables, weatherhead, ground rod, clamp, cable and fittings. For group meters, add $125 to $190 per meter. Add $65 for each ground fault interrupter breaker. For underground service, deduct 5% to 10%.

CAPACITY	LOW	AVG.	GOOD
30 amperes	$ 265	$ 325	$ 385
60	385	465	550
100	590	690	805
200	1,035	1,190	1,390

3-PHASE, 120/208 V

Cost includes meter socket, main breaker or switch, riser conduit, cable, entrance cap, ground rod, clamp, cable and fittings.

60 amperes	$ 950	$ 1,025	$ 1,150
100	1,325	1,425	1,525
200	2,250	2,400	2,650
400	4,125	4,425	4,800
600	5,975	6,400	7,000
800	7,875	8,425	9,175
1000	9,725	10,400	11,325
1200	11,600	12,400	13,525

GROUNDING SYSTEMS

Grounding rod, complete,			
up to 10' conductor cable	$ 115.00	$ 160.00	$ 205.00
water pipe clamp system	65.00	80.00	110.00
foundation connector system	165.00	300.00	585.00
add for lightning terminal points	70.00	80.00	100.00
add for each add'l. foot of cable	.75	1.95	4.20
add for arrestor, 175 V to 650 V	100.00	130.00	190.00
Electrolytic tube system, complete	850.00	1,375.00	2,150.00
add for ground resistance tester	3,225.00	3,825.00	4,500.00

SAFETY SWITCHES

Fused, single-throw, 3-pole, 600-V, NEMA #1, indoor type. For weatherproof boxes, add 20% to 40%; dustproof, add 100% to 200%; explosionproof, add 300% to 400%.

SIZE	COST RANGE	SIZE	COST RANGE
30 amperes	$180 – $215	400 amperes	$1,525 – $1,850
60	265 – 305	600	2,425 – 2,975
100	430 – 520	800	4,175 – 4,850
200	715 – 860	1,200	5,500 – 6,425

SWITCHGEAR

Listed costs are typical cost ranges of standard types and styles of switch and panelboard equipment and vary with voltage, number of circuits, number of wires and phases of current, and safety features. Add costs of circuit breakers.

SERVICE SWITCHGEAR COST RANGE

AMPS	RESIDENTIAL Light Commercial		COMMERCIAL Light Industrial		INDUSTRIAL Institutional	
100	$ 240 –	$ 375	-----	-----	-----	-----
200	450 –	655	-----	-----	-----	-----
225	1,650 –	2,050	$ 2,725 –	$ 3,050	-----	-----
400	2,800 –	3,325	4,275 –	4,750	-----	-----
600	4,100 –	4,775	5,800 –	6,450	$15,075 –	$20,800
800	5,325 –	6,100	7,225 –	8,075	18,575 –	25,325
1000	6,575 –	7,400	8,500 –	9,550	21,900 –	29,500
1200	7,775 –	8,675	9,775 –	10,950	25,025 –	33,475
1600	-----	-----	12,175 –	13,675	30,850 –	40,800
2000	-----	-----	14,400 –	16,225	36,325 –	47,625
2500	-----	-----	-----	-----	42,775 –	55,500
3000	-----	-----	-----	-----	48,850 –	62,925
4000	-----	-----	-----	-----	60,300 –	76,725

DISTRIBUTION SWITCHGEAR (Light, Heat or Power Centers)

AMPS						
100	$ 575	$ 800	-----	-----	-----	-----
150	775	950	$ 975	$1,325	-----	-----
225	925	1,275	1,375	1,750	$ 2,550	$ 3,400
400	1,325	1,775	1,950	2,600	3,850	5,050
600	1,700	2,300	2,650	3,400	5,050	6,700
800	2,000	2,700	3,225	4,125	6,150	8,200
1200	2,550	3,500	4,300	5,475	8,175	10,875
1600	-----	-----	5,225	6,675	10,000	13,525
2000	-----	-----	-----	-----	11,700	15,475

CIRCUIT BREAKERS FOR SWITCHGEAR

AMPS	120 VOLTS		240 – 480 VOLTS		600 VOLTS	
20 – 60	$ 50 –	$140	$ 155 –	$ 285	$ 195 –	$ 425
70 – 100	130 –	300	280 –	475	375 –	715
125 – 225	410 –	650	520 –	830	735 –	1,190
400 – 600	-----	-----	1,515 –	1,870	1,695 –	2,345
700 – 800	-----	-----	2,085 –	2,805	2,415 –	3,350

CIRCUIT BREAKERS FOR METALCLAD SWITCHGEAR

600 VOLTS			
AMPS		AMPS	
800	$ 6,500 – $11,000	3,000	$32,250 – $48,500
1,600	12,750 – $21,500	4,000	51,750 – 74,000
2,000	18,000 – $28,250		

ELECTRICAL

SECTION UIP 3

TRANSFORMERS

DRY TYPE Single phase, 240/480 V primary, 120/240 secondary		OIL FILLED Three phase or Y, 5 KV or 15 KV with taps 277/480 V secondary	
SIZE	COST RANGE	SIZE	COST RANGE
3 KVA	$ 525 – $ 575	150 KVA	$14,250 – $17,000
5	700 – 825	300	20,750 – 24,250
7.5	900 – 1,025	500	27,250 – 32,250
10	1,100 – 1,250	750	34,250 – 40,250
15	1,400 – 1,625	1000	39,750 – 47,250
25	1,925 – 2,250	1500	49,750 – 58,500
37.5	2,525 – 2,925	2000	58,250 – 68,500
50	3,000 – 3,500	2500	65,750 – 77,750
75	3,875 – 4,500	3000	72,500 – 85,500

SUBSTATIONS

High-voltage unit substations, complete with transformers, breakers and grounding, cost from $60 to $235 per KVA.

EXAMPLES

RATING	COST	COST/ KVA	RATING	COST	COST/ KVA
150 KVA	$38,750	$255	1,000 KVA	$ 93,000	$95
500	67,500	130	2,000	127,750	65

POWER WIRING

The following tables may be used in lieu of actual costs. It will be necessary to spend time in the building analyzing the power distribution arrangement – possibly making a rough sketch and obtaining specifications from the plant engineering department or electrical maintenance foreman.

The tables indicate an estimate of the average costs installed-in-place. They include (where applicable) wire, fittings, hangers, bends, termination, and contractor's overhead and profit. Costs are based on a maximum height above the floor of 12'.

Power wiring for motors and motor costs are found in Section UIP12, Page 6.

RIGID CONDUIT AND WIRING (EXPOSED)

Costs include three conductors of the maximum wire size in each size conduit. They also include: tees, ells, junction boxes, bends, hangers and fittings.

SIZE	COST/FOOT	SIZE	COST/FOOT
1/2"	$ 7.25	2"	$17.50
3/4"	8.60	2-1/2"	24.80
1"	10.05	3"	34.10
1-1/4"	11.75	3-1/2"	47.65
1-1/2"	13.90	4"	66.70

WIREWAY GUTTERS

(Per linear foot, without wires)

4" x 4" .....$18.50 6" x 6" .....$25.00 8" x 8" $38.25

BUS DUCT, 3-PHASE, 600-VOLT

Cost per linear foot for indoor plug-in type, including typical fittings, but not disconnect or circuit breaker-type switches to machines. For weatherproof duct, add 15% – 25%.

3-POLE COST RANGE			4-POLE COST RANGE		
AMPS	ALUMINUM	COPPER	AMPS	ALUMINUM	COPPER
225	$ 56 – $ 72	$ 80 – $109	225	$ 68 – $ 90	$117 – $161
400	78 – 97	121 – 155	400	94 – 119	162 – 210
600	106 – 126	168 – 209	600	125 – 155	210 – 265
800	130 – 160	215 – 265	800	155 – 185	260 – 325
1000	165 – 180	265 – 315	1000	190 – 215	305 – 375
1350	205 – 235	350 – 410	1350	240 – 275	395 – 475
1600	240 – 265	410 – 475	1600	280 – 315	460 – 545
2000	290 – 325	505 – 585	2000	345 – 375	560 – 655
2500	360 – 390	620 – 715	2500	420 – 465	685 – 800
3000	425 – 465	740 – 855	3000	495 – 545	805 – 930

UNDERGROUND WIRING

Average costs per linear foot in place, in trench. Includes three conductors of the maximum wire size and terminations for each size of conduit, trenching not included.

Excavation, backfill and compaction for the trench, assuming average soil conditions, use $ .60 per cubic foot.

PLASTIC DUCT		TRANSITE DUCT		GALVANIZED RIGID CONDUIT	
SIZE	COST	SIZE	COST	SIZE	COST
2"	$11.35	2"	$11.30	2"	$15.60
3"	23.45	3"	23.20	3"	31.25
3-1/2"	33.65	3-1/2"	33.15	3-1/2"	43.80
4"	48.20	4"	47.40	4"	62.15

POWER POLE

40' high $845.00

5' wood cross arm with insulators and hardware ....$230.00 each

TRANSFER SWITCHES

(Automatic, single phase, 3 pole, 600 V, or indoor type.)

AMPS	COST	AMPS	COST
30	$ 2,600	600	$15,250
60	3,400	800	18,000
100	4,450	1000	22,250
150	5,800	1200	25,500
225	8,450	1600	30,500
400	12,250	2000	34,500

ELECTRICAL

SECTION UIP 3

GENERATORS

Costs of home generator sets including connection. Lower end of range is with rope starter. Upper end is with battery and automatic starter.

	COST RANGE
1,000 watts	$ 650 – $ 875
1,500	900 – 1,175
2,000	1,100 – 1,450
3,000	1,475 – 2,500
4,000	1,825 – 3,050
5,000	2,175 – 3,600
7,000	3,000 – 4,800

STANDBY POWER

Emergency generators for institutional, commercial and other buildings, complete with controls for immediate operation in the event of loss of the primary power source, cost from $255 to $1,050 per KW. The costs vary with the size and type of driver. 120-volt battery systems cost $1,450 to $2,175 per kilowatt.

EXAMPLES

RATING	GAS/ GASOLINE DRIVE	COST/ KW	RATING	DIESEL DRIVE	COST/ KW
10 KW	$10,525	$1,050	30 KW	$ 23,000	$770
15	13,500	900	100	48,250	480
30	20,550	685	150	62,750	420
100	43,050	430	300	97,500	325
150	54,775	365	500	133,500	265
			750	191,500	255
			1,000	255,250	255

ELECTRICAL OUTLETS

The following costs may be used to arrive at a more detailed estimate of electrical costs than is obtained by using the costs per square foot of floor area that are given in the Segregated Cost Sections. The following costs apply to convenience and lighting outlets only, not to power wiring for equipment or heating. Cost per outlet includes allowance for service, but not for fixtures, panelboards, safety switches or circuit breakers.

Normal residential wiring will usually be in the low and average ranges, and commercial and public buildings in the average to high ranges. Large industrial buildings and warehouses with relatively few outlets and long, heavy wiring runs may run much higher on a cost-per-outlet basis. Explosionproof receptacles can run 300% to 400% more.

COST PER OUTLET

TYPE	LOW	AVG.	GOOD	HIGH
Nonmetallic sheathed cable (Romex)	$37.00	$45.25	$ 54.75	$ 66.75
Armored cable (BX)	42.75	52.50	64.50	79.75
Flexible conduit	55.25	69.00	85.75	107.00
Thinwall conduit (EMT)	62.75	79.00	99.00	124.00
Rigid conduit	71.50	89.00	111.25	138.50
Low-voltage, telephone, TV, sound	24.00	26.25	28.25	30.75
Coaxial cable or fiber optic	27.25	31.25	36.00	41.25

For ground fault interrupter outlets, add . . . $5.50 – $11.00 each.

OTHER CIRCUITS (NONMETALLIC)

	LOW	AVG.	GOOD
Garbage disposer (includes switch and receptacle)	$ 94.00	$116.00	$145.25
Dishwasher	87.25	110.25	139.25
Dryer	142.50	162.75	187.75
Range and oven	168.25	202.25	244.25
Room air conditioner	169.75	188.25	210.25
Water heater	133.00	161.00	195.75

For flex conduit – add 20% to 40% to above circuits.
For EMT – add 30% to 50%.

LIGHTING FIXTURES

TYPE	LOW	AVG.	GOOD
Incandescent, surface	$ 44	$ 93	$ 267 up
open commercial, standard	57	73	96
recessed or adjustable	75	136	244
pendant	33	58	109
vaportight	105	160	230
explosion-proof	255	445	775
illuminated exit	80	140	240
add for battery backup	165	190	230
Chandeliers	235	925	3,245
high value*	6,750	13,250	25,500 up
Fluorescent, surface or pendant			
Strip, 1 lamp	68	102	155
2 lamps	73	110	167
4 lamps	100	155	230
6 lamps	230	275	325
8 lamps	325	365	415
recessed, troffer or diffused			
2 – 4 lamps	100	165	255
6 – 8 lamps	355	425	520
add for air-handling type	55	65	80
add for emerg. lighting ballast	235	255	280
High-intensity discharge			
mercury vapor, recessed	325	475	710
pendant, vaportight	385	445	520
explosionproof	710	860	1,035
high bay	585	775	1,065
high-pressure sodium, low bay	645	720	805
high bay	835	1,090	1,415
pendant, vaportight	545	605	680
explosion-proof	870	930	995
metal halide, low bay	520	620	740
high bay	710	970	1,285
add for twin bay	100	125	170
add for bay wire guards	35	60	100
Occupancy sensors, photoelectric cell	215	255	315
daylighting, automatic dimming system	1,255	1,580	2,060
each extra sensor, add	280	305	355
auto switch sensors, manual dimmer	69	125	232

*__NOTE:__ Chandelier costs will vary greatly due to the materials, finish and intricacy of design. Fixtures classified by age or beauty as having antique or historical value, or designed by name artists, must be valued as art objects by the fine arts specialists, where the costs can easily run seven to ten times the listed costs.

For emergency lighting fixtures, see Page 11. For outdoor lighting, see Sections UIP 16 and 17.

SECURITY PROTECTION

SECTION UIP 3

SECURITY ALARM SYSTEMS

SENSORS:	RESIDENTIAL COST RANGE		COMMERCIAL COST RANGE	
Point-area detectors (per opening)				
Alarm glass (wired)	$ 70.00 –	$ 140.00	$140.00 –	$ 420.00
Screen (burglarproof, wired)	70.00 –	280.00	280.00 –	550.00
Capacitance proximity detectors	-----	-----	420.00 –	2,095.00
Photoelectric, beam interrupt	305.00 –	700.00	700.00 –	2,095.00
Field-of-view changes	11.00 –	69.00	11.00 –	69.00
Stress detectors, floor	95.00 –	215.00	280.00 –	700.00
pressure mat	70.00 –	280.00	-----	-----
Trip or pull switches (wire trap)	11.00 –	33.00	-----	-----
Switch sensors, magnetic, (per switch)	75.00 –	155.00	75.00 –	420.00
mercury	75.00 –	155.00	80.00 –	155.00
self-contained (battery)	37.00 –	71.00	-----	-----
Vibration detectors	45.00 –	105.00	75.00 –	280.00
Volume detectors				
Motion detectors, infrared	80.00 –	305.00	140.00 –	550.00
microwave	80.00 –	305.00	140.00 –	550.00
ultrasonic	80.00 –	305.00	140.00 –	550.00
self-contained (battery)	80.00 –	280.00		
Sound detectors, sensing units	80.00 –	305.00	140.00 –	550.00
rem. monitoring	655.00 –	3,485.00	655.00 –	3,485.00
ANNUNCIATORS:				
Alarms, local				
Bells	$ 70.00 –	$140.00	$215.00 –	$ 420.00
Buzzers	11.00 –	15.00	11.00 –	15.00
Horns	70.00 –	140.00	215.00 –	420.00
Sirens	70.00 –	140.00	215.00 –	1,390.00
Lights	70.00 –	140.00	215.00 –	420.00
CONTROL UNITS (TRANSMISSION–DISPLAY):				
Control panel	$215.00 –	$420.00	$675.00 –	$1,400.00
Remote annunciator	140.00 –	420.00	275.00 –	835.00
add for:				
event recorders	-----	-----	205.00 –	710.00
transponders	-----	-----	345.00 –	1,390.00
electrical switch locks	105.00 –	420.00	345.00 –	700.00
remote transmitters, ea.	38.75 –	54.00	-----	-----
standby power, battery	15.00 –	135.00	105.00 –	2,770.00
PERSONNEL/ID VERIFICATION SYSTEMS:				
Coded badge/card access	-----	-----	$400.00 –	$8,075.00

CCTV SYSTEM

	COST RANGE	
Base system, one camera/one monitor	$1,400.00 –	$9,100.00
each extra camera	1,375.00 –	4,425.00
each simulated or dummy camera	60.00 –	230.00
each miniature covert camera	825.00 –	1,625.00
each extra monitor	375.00 –	775.00
video recorder	2,150.00 –	6,925.00
zoom lens control	1,950.00 –	7,075.00

COMPLETE RESIDENTIAL UNITS

(Includes sensors, annunciators and controls)

Hardwired	$1,900.00 –	$5,175.00
Wireless	675.00 –	3,350.00

HOME AUTOMATION SYSTEMS

Home automation base system, one monitor and control panel for temperature, lighting, appliances and water heater control	$ 2,175.00 –	$ 4,350.00
Custom system, including security (20 – 40 zones), no camera		
base, up to 5 add'l. temp. zones	8,250.00 –	11,500.00
two monitors, up to 20 temp. zones	15,750.00 –	21,750.00

BUILDING AUTOMATION SYSTEMS

Commercial energy management or building automation system costs can vary greatly depending on the amount and sophistication of the monitoring and control equipment involved for H.V.A,C., lighting, automation and life safety control, and energy management capabilities.

The following cost ranges are in some cases based on only a few projects and should be considered as very rough guides at best. We would suggest that whenever possible, survey, bid or contract costs should be obtained.

Small buildings, under 10,000 sq. ft., total cost		
Single function, *no computer	$ 550.00 –	$ 6,550.00
Medium buildings, under 50,000 sq. ft., total cost		
multifunction, stand-alone (microprocessor)	3,000.00 –	12,000.00
*add for computer monitoring	8,250.00 –	27,250.00
Large buildings, over 50,000 sq. ft.,		
fully distributed multifunction and central station		
cost per point, HVAC only	175.00 –	975.00
lighting only	75.00 –	500.00
integrated, energy, fire, security	1,250.00 –	2,775.00

NOTE: For fire alarm systems, see Page 12.
For security gates and fencing, see Section UIP 5. For security grilles and shutters, see Section UIP 5.

PHOTOVOLTAIC

SECTION UIP 3

PHOTOVOLTAIC POWER SUPPLY

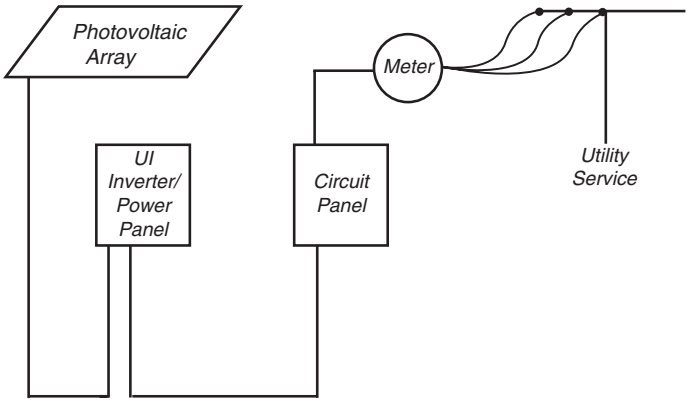
These solar power systems run from basic direct current systems, which consist of a simple solar module directly running DC equipment to Utility Inter-tie (UI) systems incorporating inverters, control panels and meters. The UI system allows the user to use the utility rather than a battery bank for storage. The excess power is sold back to the utility at a rate determined by the utility or credited to the user through the use of additional utility meters.

PRE-ENGINEERED RESIDENTIAL UTILITY INTER-TIE SYSTEM

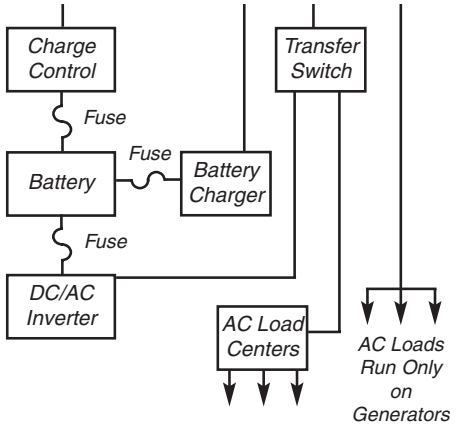
Includes solar modules, inverter, panel and meter. The number of panels required is determined by several factors including power demand, percentage of solar supplementation, and available square footage. For battery backup, additional components to be added from below.

	COST RANGE
12 – 24 module system, installed, per module	$1,250 – $1,450
36 – 48	1,065 – 1,200
72 – 96	955 – 1,035
Unit Costs:	
Solar Modules, 10 watt – 30 watt	$ 140 – $ 315
40 watt – 60 watt	260 – 425
75 watt – 120 watt	470 – 785
285 watt – 300 watt	1,825 – 2,025
Module mounts, top-of-pole, 1 – 6 panels, per panel	55 – 165
8 – 16 panels	50 – 100
side-of-pole, 1 – 4 panels	100 – 195
ground/roof mounts, 1 – 6 panels	85 – 145
low - profile	70 – 135
two-tier, 6 – 12 panels	45 – 80
Automatic tracker, 4 – 12 panels, per panel	170 – 275
Power panel, includes inverter, DC disconnect, bypass switch, 1500 watt – 3000 watt	2,575 – 4,775
3600 watt – 4800 watt	3,325 – 6,600
7200 watt – 8000 watt	6,275 – 11,975

Unit Costs continued:	COST RANGE
Inverters, true sine wave, 125 watt	$ 295 – $ 390
250 watt	535 – 620
600 watt	785 – 850
1100 watt	980 – 1,245
modified sine wave, 500 watt	525 – 655
1500 watt	1,275 – 1,375
2400 watt	1,775 – 1,900
3600 watt	2,025 – 2,150
grid inter-tie only, 1000 watt	2,350 – 2,475
1500 watt	2,875 – 3,000
2000 watt	2,900 – 3,075
2500 watt	3,525 – 3,650
true sine wave grid-tie, 4000 watt – 5500 watt	4,575 – 5,225
Industrial inverter, three-phase, grid-tie, 10000 watt – 20000 watt	8,875 – 18,475
30000 watt – 50000 watt	22,850 – 39,450
100000 watt – 150000 watt	75,750 – 102,000
225000 watt – 300000 watt	117,750 – 136,250
Standard deep-cycle battery, 6 volt	100 – 220
12 volt	195 – 260
industrial deep-cycle battery packs, 12 volt	1,950 – 2,750
24 volt	3,650 – 5,225
48 volt	6,900 – 9,950
Charge controllers, 12, 24, or 48 volt, 12 – 20 amps	75 – 220
30 amp – 35 amp	125 – 285
40 amp – 60 amp	190 – 490
Battery charger, 30 amp – 40 amp	165 – 275
75 amp	355 – 435
Transfer switch, 120 amp	85 – 110
240 amp	135 – 275
Meters	255 – 325



UTILITY INTER-TIE BASIC COMBINATION



PHOTOVOLTAIC ARRAY / GENERATOR COMBINATION

ELECTRICAL

SECTION UIP 3

PERCENTAGE OF TOTAL COST

The following table records the results of studies of many recently completed buildings, by occupancy, giving the percentage of total contract cost spent on the electrical items. The average used is the median, and the high and low percentages which are given do not include extremes, but are computed to include approximately 90 percent of all cases within the given range (45% each side of the median).

OCCUPANCY	TOTAL ELECTRICAL			SERVICE & DISTRIBUTION			LIGHTING & CONTROL			SPECIAL SYSTEMS		
	LOW	MED.	HIGH	LOW	MED.	HIGH	LOW	MED.	HIGH	FIRE ALARM & DETEC-TION MEDIAN	STANDBY POWER MEDIAN	OTHER* MEDIAN
Apartments, Class A & B	6.6	8.9	11.9	4.1	5.2	6.8	1.5	1.9	2.7	.5	.4	.9
Apartments, Class C & D	5.3	7.5	10.6	3.1	4.3	6.3	1.7	2.1	2.9	.5		.6
Auditoriums and theaters	6.1	9.1	13.5	2.6	4.2	7.1	2.2	2.9	4.1	.4	.7	.9
Banks	8.0	11.2	16.2	3.0	4.0	6.1	2.2	3.3	5.6	.8	.4	2.7
Bowling alleys	7.9	10.6	13.9	4.7	6.2	8.3	2.5	3.2	4.2	.5		.7
Clubhouses and parish halls	6.3	9.3	13.5	3.1	4.2	6.1	2.6	3.9	5.9	.6		.6
Convalescent hospitals and nursing homes	8.4	11.3	15.7	3.3	4.8	7.3	2.9	3.9	5.4	.7	.6	1.3
Department stores	9.4	12.3	16.6	5.1	6.9	9.7	3.4	4.1	5.3	.6	.5	.2
Discount stores	6.0	8.8	13.2	3.1	4.5	7.0	2.5	3.4	4.8	.4		.5
Dormitories	7.0	8.6	10.8	3.8	4.0	4.6	2.0	2.8	3.9	.6		1.2
Fraternal buildings	6.2	8.9	12.7	3.0	4.1	5.9	2.6	3.5	5.0	.6		.7
Homes for the elderly	7.4	9.4	13.8	4.2	5.6	8.0	1.5	1.7	2.5	.7		1.4
Hospitals	9.8	13.5	17.9	5.6	7.4	10.0	2.6	3.5	5.0	.3	.8	1.5
Industrials†	7.3	10.9	16.9	3.7	5.4	7.8	3.2	4.6	6.2	.4		.5
Markets	9.9	13.3	16.9	6.2	7.8	10.0	2.9	3.6	4.9	.4	.7	.8
Medical office buildings and clinics	7.4	10.4	13.9	4.0	5.2	7.0	2.4	3.2	4.6	.5	.6	.9
Motels and hotels	4.9	8.4	11.0	2.8	4.2	6.4	1.8	2.6	3.8	.3	.4	.9
Office buildings	6.7	10.0	15.6	3.1	4.6	7.2	2.6	4.0	6.4	.4	.5	.5
Restaurants	8.0	11.8	15.7	5.4	7.3	9.0	2.3	3.9	5.8	.3		.3
Retail stores and shops	7.1	10.0	15.5	4.0	6.0	9.4	3.0	3.8	5.1			.2
Telephone buildings	8.2	12.3	16.6	3.4	5.3	8.6	.9	1.2	1.9	.9	4.7	.2
Warehouses	4.5	7.5	13.0	2.2	4.3	8.6	2.0	2.7	3.8	.5		

†Lighting and utility outlet only, without power wiring.

*Other special systems include intercom, sound, TV cabling, security, etc.