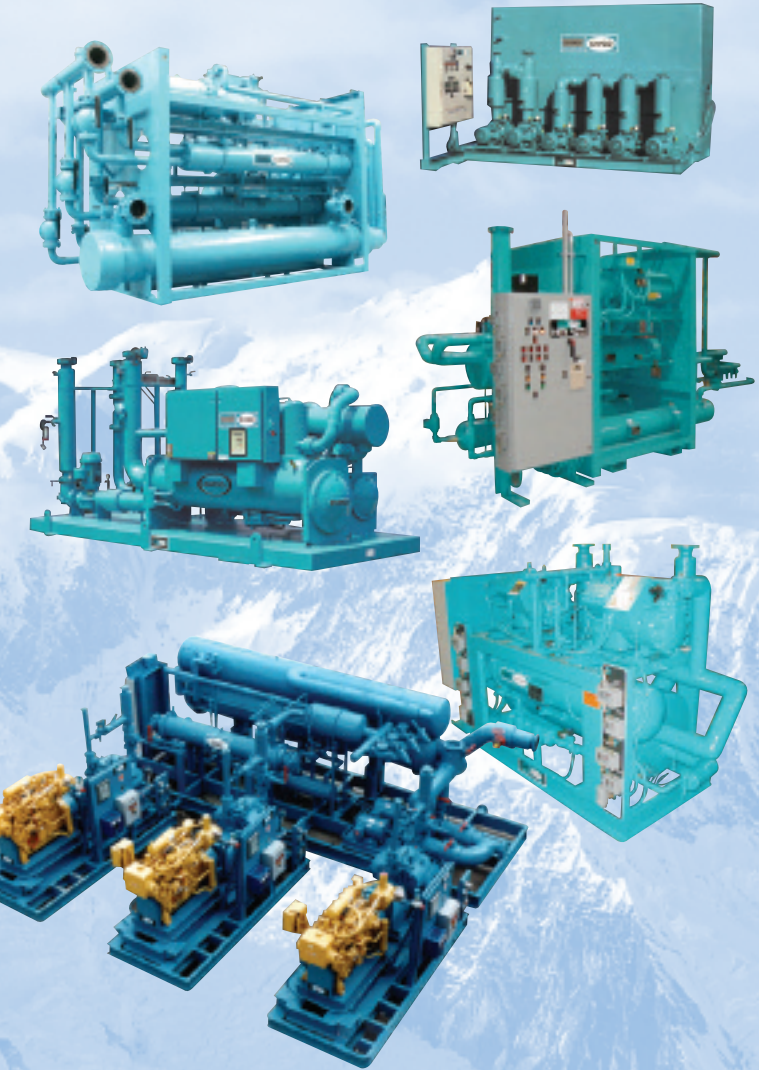


Design Formulae



Reference Card

TOROMONT

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INJECTION MOLDING	
MATERIAL	LBS./HR PER 1 TON
HDPE	30
LDPE	35
ACRYLIC	35
PP	35
PPO	40
NYLON 6, 66	40
POLYURETHANE	40
PET	40
PS	50
ABS	50
PC	50
CELCON	50
ACETAL	50
PVC	75

EXTRUSION – PIPE PROFILE	
MATERIAL	LBS./HR PER 1 TON
HDPE	50
LDPE	50
PP	50
PET	50
ABS	60
PVC	65
PS	75
EXTRUSION – TROUGH, BATH, CHILL ROLL	
POLYSTYRENE	60
ABS	60

BLOW MOLDING	
MATERIAL	LBS./HR PER 1 TON
HDPE	40
PET	40
PVC	70

VACUUM FORMING	
MATERIAL	LBS./HR PER 1 TON
HDPE	70
LDPE	70
PP	70
PS	200
PVC	250

BLOWN FILM		
1.14 TONS	100 CFM @ 40 F AIR	33 F GLYCOL
1.05 TONS	100 CFM @ 45 F AIR	35 F GLYCOL
0.85 TONS	100 CFM @ 50 F AIR	40 F WATER
INCOMING AIR	90 F D.B./78 F W.B. INCLUDES FAN MOTOR HEAT	

COOLING TOWER LOAD FACTORS	
BARREL	1 TON PER INCH OF SCREW DIA.
SCREW	2 TONS (NOMINAL)
THROAT	1 TON FOR SCREWS UP TO 3" DIA. 2 TONS FOR SCREWS FROM 4" – 6" DIA.
GEAR DRIVE	0.1 TON PER HP
HYDRAULICS	0.1 TON PER HP (< 5 SEC CYCLE TIME) 0.15 TONS PER HP (> 5 SEC CYCLE TIME)
SPOT WELDERS	15,000 BTUH PER 100 KVA
VACUUM PUMP	0.1 TON PER HP
AIR COMP. (NO DRYER)	0.15 TONS PER HP
AIR COMP. (WITH DRYER)	0.2 TONS PER HP

GENERAL FORMULAE	
TONS:	$(\text{GPM} \times \text{DELTA WATER TEMP}) / 24$
AIR-SENSIBLE HEAT (BTUH)	$\text{CFM} \times 1.085 \times (\text{DRY BULB 1} - \text{DRY BULB 2})$
AIR-LATENT HEAT (BTUH)	$\text{CFM} \times 0.68 \times (\text{GRAINS 1} - \text{GRAINS 2})$
AIR-TOTAL HEAT (BTUH)	$\text{CFM} \times 4.5 \times (\text{ENTHALPY 1} - \text{ENTHALPY 2})$
AIR-MOLD ROOM HVAC	80 SQ FT PER TON
HP- PUMP MOTORS	$(\text{US GPM} \times \text{FT HD}) / (3960 \times \text{PUMP EFFICIENCY})$
HP – FAN MOTOR	$(\text{CFM} \times \text{INCHES S.P.}) / (6356 \times \text{STATIC EFFICIENCY})$
TCUs	LOAD + (0.5 TONS PER 3/4 HP ZONE)
RECTIFIERS	$\text{AMPS} \times \text{VOLTS} \times 3.414 = \text{BTUH}$
PRINTING – WEB COOLING	$\text{WEB WIDTH (")} \times (0.000252 \times \text{WEB SPEED (FPM)})$ $\times \text{STOCK WEIGHT (LBS.)} \times \text{DELTA WEB TEMP (DEG F)}$ $\times \text{SPEC HEAT (0.342)} \times 60 \text{ MINUTES} = \text{BTUH}$
PRINTING – FOLDER AIR	1 TON PER 125 CFM
PRINTING – VIBRATORS	1 TO 12 TONS PER PRINTING UNIT



PUMP OPERATION AT 50 HZ

60 HERTZ	50 HERTZ OPERATION
GPM	X 0.829 (17%)
HEAD	X 0.687 (31%)
B.H.P.	X 0.569 (43%)
3,500 RPM	2,900 RPM
1,750 RPM	1,450 RPM

ENERGY & TEMPERATURE

1 TON	12,000 BTUH (TRUE CONVERSION)
	15,000 BTUH (NOMINAL "TOWER" TON)
1 BTU	0.293 WATTS
	252 CALORIES
	0.252 KG-CAL
TEMPERATURE	(DEG F -32) / 1.8 = DEG C
	(DEG C X 1.8) + 32 = DEG F

POWER

1 HP	2,545 BTUH
	746 WATTS

PRESSURE

1 PSI	2.31 FT HD
	0.068947 BAR
	6.8947 KILOPASCALS
	2.036 INCHES OF MERCURY

FLOW

1 US GPM	3.785 LITRES / MINUTE
	227.1 LITRES / HOUR
	0.2271 CU METRES / HOUR

VOLUME

1 CU FT	7.481 U.S. GALLONS
	0.0283 CU METRES
1 CU METRE	35.314 CU FEET
	264.2 U.S. GALLONS
1 U.S. GALLON	8.34 POUNDS OF WATER
	3.785 LITRES
	0.833 IMPERIAL GALLONS

AREA / MISC.

1 SQ FT	0.0929 SQ METRES
AREA OF A CIRCLE	(DIA X DIA) X 0.7854
CIRCUM OF A CYLINDER	DIA X 3.142
VOLUME OF A CYLINDER	(DIA X DIA) X 0.7854 X LENGTH

DISTANCE

1 INCH	2.54 CM
1 FOOT	30.48 CM
1 YARD	0.9144 METRES
1 MILE	1.609 KILOMETRES

PRESSURE DROP ACROSS CONTROL VALVES

$$\text{PSI PRESS DROP} = (\text{DESIGN GPM} / \text{VALVE CV})^2$$

ELEVATION ABOVE SEA LEVEL

DERATE CONDENSER BY

2,000 FT	0.95
4,000 FT	0.90
6,000 FT	0.87
8,000 FT	0.83

PIPE SIZING GUIDE					
PIPE SIZE	PROCESS PIPING			TOWER RETURNS	
	FLOW	LOSSES PER 100FT	WATER VELOCITY	FLOW	WATER VELOCITY
1/2"	2 GPM	4.8 FT HD	2.2 FPS		
3/4"	4 GPM	4.2 FT HD	2.4 FPS		
1"	7 GPM	3.6 FT HD	2.6 FPS		
1 1/4"	15 GPM	3.8 FT HD	3.3 FPS		
1 1/2"	23 GPM	3.9 FT HD	3.2 FPS		
2"	45 GPM	3.9 FT HD	4.3 FPS		
2 1/2"	73 GPM	3.9 FT HD	4.9 FPS		
3"	131 GPM	3.9 FT HD	5.7 FPS	90 GPM	<4 FPS
4"	270 GPM	4.0 FT HD	6.8 FPS	155 GPM	<4 FPS
6"	796 GPM	4.0 FT HD	8.9 FPS	360 GPM	<4 FPS
8"	1,530 GPM	3.6 FT HD	10.0 FPS	620 GPM	<4 FPS
10"	2,450 GPM	2.8 FT HD	10.0 FPS	975 GPM	<4 FPS
12"	3,500 GPM	2.3 FT HD	10.0 FPS	1,400 GPM	<4 FPS
14"	4,200 GPM	2.0 FT HD	10.0 FPS	1,680 GPM	<4 FPS
16"	5,500 GPM	1.7 FT HD	10.0 FPS	2,200 GPM	<4 FPS

FITTINGS ADD FRICTIONAL LOSS IN EQUIVALENT LENGTH OF PIPE					
PIPE SIZE	ELBOW	TEE STRAIGHT THRU	CHECK VALVE	BALL VALVE REDUCED PORT	GATE VALVE
1/2"	3.6	2.4	8.0	3.5	0.7
3/4"	4.4	3.2	8.8	4.5	0.9
1"	5.2	4.6	11.0	3.0	1.0
1 1/4"	6.6	5.6	13.0	6.5	1.5
1 1/2"	7.4	7.7	15.0	4.5	1.8
2"	8.5	9.3	19.0	9.0	2.3
2 1/2"	9.3	2.2	22.0	3.5	2.8
3"	4.4	2.8	27.0	5.0	3.2
4"	5.9	3.3	38.0	19.0	4.5
6"	8.9	3.8	50.0		7.0
8"	12.0	4.7	63.0		9.0
10"	14.0	5.2	90.0		12.0
12"	17.0	6.0	120.0		13.0
14"	18.0	6.4	140.0		15.0
16"	21.0	7.2	150.0		17.0

ETHYLENE GLYCOL			PROPYLENE GLYCOL		
PERCENT VOLUME	FREEZE POINT	SPECIFIC HEAT	PERCENT VOLUME	FREEZE POINT	SPECIFIC HEAT
10%	25 F	0.938	10%	26 F	0.958
20%	17 F	0.894	20%	18 F	0.935
30%	5 F	0.847	30%	8 F	0.897
40%	-12 F	0.792	40%	-7 F	0.852
50%	-35 F	0.732	50%	-28 F	0.796

COMMONLY USED TOWER CITY-WATER MAKE-UP CALCULATIONS	
EVAP. RATE = 2 GPM	PER 1,000,000 BTUH
EVAP. RATE = 3 GPM	PER 100 TOWER TONS
{(TOTAL BTUH) / 960 BTU PER LB. / 8.33 LBS. PER GAL / 60 MINUTES PER HOUR}	
X 2 (= BLEED-OFF RATE FACTOR) = GPM MAKE-UP	



*Cimco-
Expect the
best*

TOROMONT



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