12-211283 CO

Building Permit Application
City of Portland, Oregon - Bureau of Development Services
1900 SW 4th Avenue, Portland, Oregon 97201 • 503-823-7310 • TTY 503-823-6868 • www.portlandoregon.gov/bds

This permit application expires if a permit is not obtained within 180 days after it has been accepted as complete.

Type of work
☐ New construction ☑ Addition/alteration/replacement
☐ Demolition ☐ Other:

Category of construction
☐ 1 & 2 family dwelling ☑ Commercial/industrial ☐ Accessory building
☐ Multifamily ☐ Master builder ☐ Other:

Job site information and location
Job no.:	Job address: 101 SE 82ND AVE
City/State/ZIP: PORTLAND, OR	
Suite/bldg./apt. no.:	Project name: SAFEWAY 4342
Cross street/directions to job site:	
Subdivision:	Lot no. / Tax map/parcel no.

Description of work
INSTALLATION OF A REPLACEMENT COOLING TOWER. ROOF EXHAUST MODIFICATION. Structural upgrades to roof system for future mech. work

Provide RS Permit no.

☑ Property owner ☐ Tenant
Name: SAFEWAY, INC.	E-mail: DARLENE.PAHKOW@SAFEWAY.COM
Address: P.O. BOX 1564	
City/State/ZIP: CLACKAMAS, OR 97015	
Phone: 503.657.6343	FAX: 503-659-6496

Owner installation: This installation is being made on property that I own, which is not intended for sale, lease, rent, or exchange.

Owner signature: Darlene Pahkow Date: 10.16.12

☑ Contractor
Business name: KENDALL CONSTRUCTION	E-mail: JAIMEC@KENDALLCONSTRUCTION.COM
Address: P.O. BOX 550	
City/State/ZIP: TROUTDALE, OR 97060	
Phone: 503.665.5047	FAX: 503-661.3577
CCB lic. no. 29680	

Authorized signature:

Print name: JAIME CRAUN Date: 10-16-12

☐ Applicant ☐ Contact Person
Business name: SAME AS CONTRACTOR	
Contact name:	
Address:	
City/State/ZIP:	
Phone:	FAX:
E-mail:	

Authorized signature:

Print name: Date:

Office Use Only
Permit no:	
Date received:	
By:	

Required Data: One and Two Family Dwelling
Permit fees* are based on the value of the work performed. Indicate the value (rounded to the nearest dollar) of all equipment, materials, labor, overhead, and the profit for the work indicated on this application.

Valuation:	~~20,000~~
Number of bedrooms:	
Number of bathrooms:	
Total number of floors:	
New dwelling area:	square feet
Garage/carport area:	square feet
Covered porch area:	square feet
Deck area:	square feet
Other structure area:	square feet

Required Data: Commercial Use
Permit fees* are based on the value of the work performed. Indicate the value (rounded to the nearest dollar) of all equipment, materials, labor, overhead, and the profit for the work indicated on this application.

Valuation:	20,000
Existing building area:	square feet
New building area:	square feet
Number of stories:	
Type of construction:	
Occupancy groups	
Existing:	
New:	

Notice
All contractors and subcontractors are required to be licensed with the Oregon Construction Contractors Board under ORS 701 and may be required to be licensed in the jurisdiction in which work is being performed.

Statement of Fact: I certify that the facts and information set forth in this application are true and complete to the best of my knowledge. I understand that any falsification, misrepresentation or omission of fact (whether intentional or not) in this application or any other required document, as well as any misleading statement or omission, may be cause for revocation of permit and/or certificate of occupancy, regardless of how or when discovered.

I acknowledge that work related to this Building Permit Application may be subject to regulations governing the handling, removal and/or disposal of asbestos and/or lead-based paint. _____ (initials)

Building Permit Fees*
Please refer to fee schedule

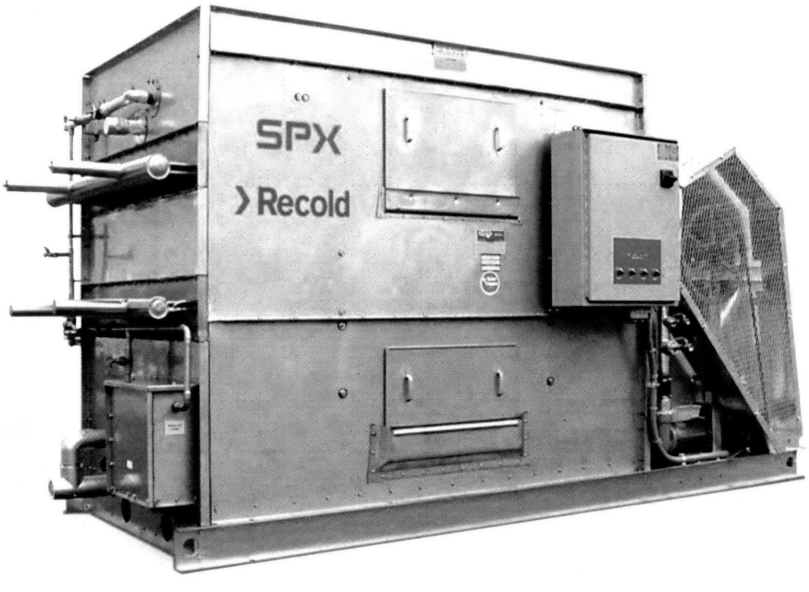
Fees due upon application	
Amount received	
Date received	

Residential Combo permit subcontractor submittals only can be faxed to 503-823-7693 or e-mailed to bdscombinspec@portlandoregon.gov.

SPX®

Recold JW Series

FLUID COOLER



City of Portland
REVIEWED FOR CODE
COMPLIANCE
DEC 04 2012
Permit Number

Recold®

2

12.211283 a

Construction 3
Schematic 4
Engineering Data 5
Freeze Protection 6
Selection Procedure 7
Load Factors 8
Rating Table 10
Pressure Drop 11
Accessories 12

Nomenclature

JW L 50 B

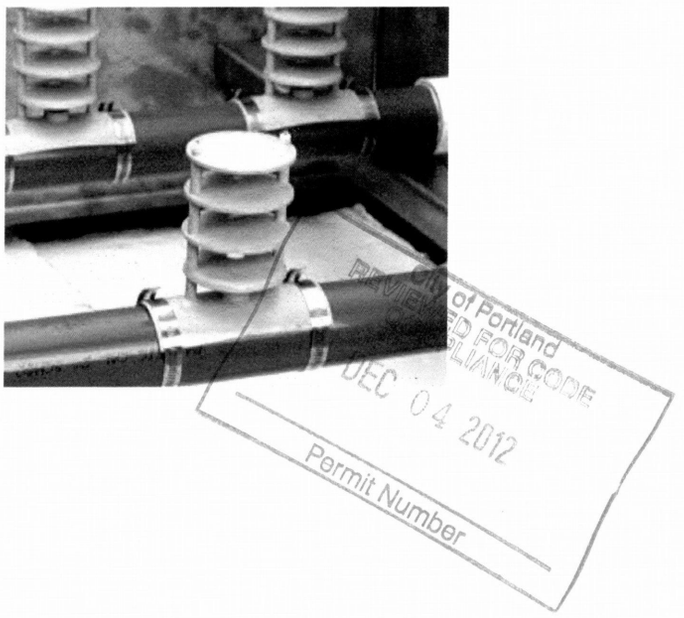
- JW — Design Series
- L — Optional GPM Range: L = Low Flow, H = High Flow
- 50 — Approximate Coil Face (area in sq ft)
- B — Unit Size

IMPORTANT

Since Recold heat exchange coils are copper, the coil can be drained without regard to internal corrosion. This must be considered with steel tubes that do not have internal protection.

RECOLD HYDROSPRAY

Recold engineering has developed an exclusive water distribution system called hydrospray. This unique system provides optimum water coverage of the heat transfer coil for maximum efficiency and virtual elimination of harmful scale problems that result from uneven water distribution. This process is accomplished through a limited number of large orifice non-clogging diffusers mounted on a heavy duty PVC pipe water header.



The JW Evaporative Fluid Cooler is a ruggedly built unit constructed to provide many years of durable, dependable service with minimal maintenance requirements. Quality materials and workmanship are a key factor in meeting this objective.

FAN MOTORS

Fan motors furnished as standard equipment are open drip-proof type suitable for outdoor service. Motors have a 1.15 service factor and are mounted on a heavy duty adjustable base located for easy access.

FAN GUARD SCREENS

All moving parts are protected with OSHA approved galvanized steel screens. Each guard is easily removed for access to the fan.

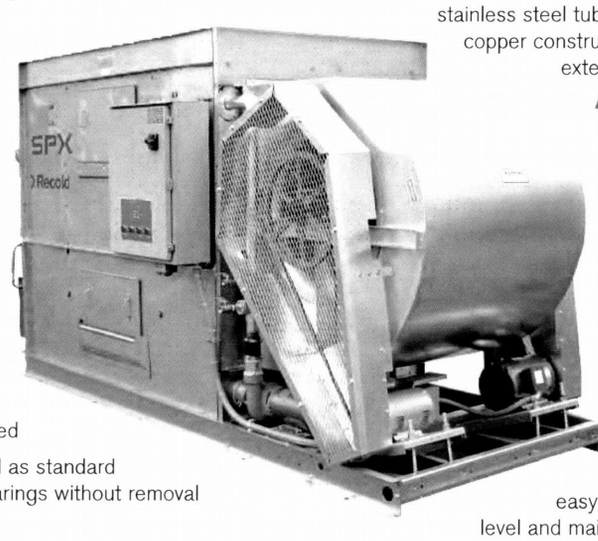
FAN SECTION

The centrifugal fan is forward curved, statically and dynamically balanced and constructed of galvanized steel. The fan housing has curved inlet rings for efficient air entry and discharge into the pan. Fans are mounted on a solid steel shaft coated to resist corrosion. Heavy duty, pillow block type, self-aligning ball bearings are located at each end of the fan shaft. No intermediate bearings are required

Extended lube lines are supplied as standard equipment to allow servicing bearings without removal of fan guard screens.

WATER CIRCULATION PUMP

The water circulation pump is a close coupled, bronze fitted centrifugal type with mechanical seal. Each pump is factory mounted and piped. Standard motor is open drip-proof suitable for outdoor service.



DRIFT ELIMINATORS

Eliminators are constructed of PVC assemblies in removable, easy to handle sections. Each section has a three break design allowing three changes in air flow and measure approximately 5 inches in depth. The use of durable PVC eliminates the corrosion problems associated with galvanized eliminators.

HEAT EXCHANGE COIL

Coil tube bundle is constructed of ⅝" copper tubing with stainless steel tube sheets and copper headers. The copper construction offers a noncorrosive coil for extended service life.

ACCESS DOORS

Large rectangular access doors are strategically located to provide access to both upper water distribution system and lower pan basin. The patented doors provide a complete air and water tight seal without the use of gaskets or fasteners

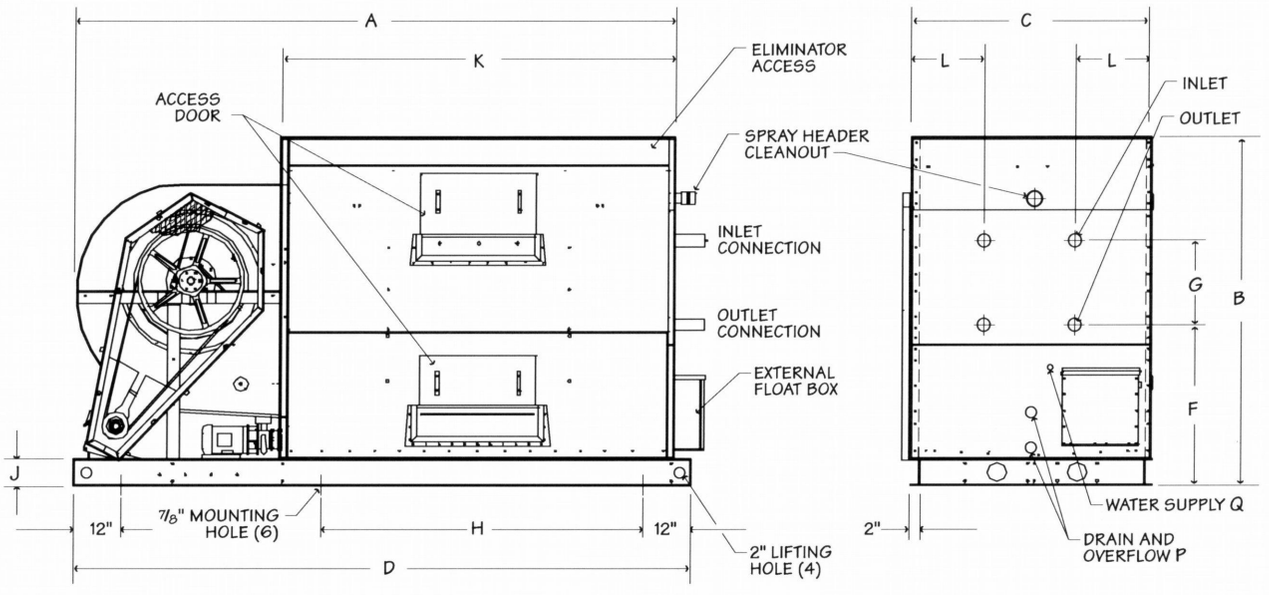
WATER MAKE-UP

Water make-up is provided by a solid brass float valve with arm and float ball installed in an external float box. This allows easy observation of the water operating level and maintenance of the valve with unit in operation.

CONSTRUCTION: The Evaporative Fluid Cooler sump pan is constructed of 300 stainless steel and casing panels are constructed of heavy gauge, G-235 galvanized steel. The sump pan and casing panels are flanged outward so that all the connecting fasteners are located outside the flooded section of the unit to help prevent leaks in the unit and provides a more permanent watertight joint. To provide further protection from corrosion, no welded joints are located below the water line. The unit is designed for a 30 psf on any projected area and ships in one piece on a minimum 6" high stainless steel channel base to help in handling and installation of the unit.

City of Portland
REVIEWED FOR CODE COMPLIANCE
DEC 04 2012
Permit Number

Recold JW Series Fluid Cooler – Schematic



MODEL	DIMENSIONS										ACCESS DOORS				OVERFLOW DRAIN FPT	WATER SUPPLY FPT
											FAR SIDE		NEAR SIDE			
	A	B	C	D	F	G	H	J	K	L	TOP	BOTTOM	TOP	BOTTOM	P	Q
JW10	80"	76"	31"	84"	32½"	19½"	–	6"	53"	13½"	1	1	–	–	2½"	½"
JW15	96"	76"	37"	102"	31½"	19½"	–	6"	65"	16	1	1	–	–	2½"	½"
JW25	115¾"	77"	45¼"	124"	34"	19½"	51¼"	6	76¾"	20½"	1	1	1	1 note 3	2½"	½"
JW35	139½"	80¼"	55½"	144"	38"	19½"	51"	6"	92"	14½"	1	1	1	1 note 3	2½"	¾"
JW50	172¼"	92½"	66⅞"	180¼"	41"	19½"	71¾"	6"	115"	17⅜"	2	1	2	1 note 3	2½"	1"
JW70	184¼"	98½"	93¼"	192"	47"	19½"	84½"	8"	115"	note 4	2	1	2	1 note 3	3"	1¼"
JW85	208"	98½"	93⅜"	217"	47"	19½"	96½"	8"	139¼"	note 4	2	1	2	1 note 3	3"	1¼"
JW100	221"	118½"	100½"	225"	67"	19½"	80"	10"	139½"	note 4	2	2	2	2 note 3	4"	1¼"
JW115	245½"	118½"	100½"	249"	67"	19½"	104"	10"	164½"	note 4	2	2	2	2 note 3	4"	1¼"
JW130	269"	118½"	100½"	273"	67"	19½"	128"	10"	188"	note 4	2	2	2	2 note 3	4"	1¼"

Note

1 Use this bulletin for preliminary layouts only. Obtain current drawing from your Recold sales representative.

2 If required add 6" for positive closure dampers. If required add 6" for booster coil section.

3 An additional bottom access door is installed on the connection end.

4. Consult Recold for coil connection locations.

5 If supporting the unit on beams, refer to the Recold suggested supporting steel drawing for required mounting hole location.

City of Portland
REVIEWED FOR CODE COMPLIANCE
DEC 04 2012
Permit Number

MODEL	FAN MOTOR hp*	AIR VOLUME cfm	FAN RPM	STANDARD FAN MOTOR FRAME	PUMP MOTOR hp	SPRAY WATER GPM	SUMP HEATER kW	APPROXIMATE WEIGHT lb	
								SHIPPING	OPERATING
JW10A	2	5280	689	145T	½	40	2.0	910	1400
JW10B	2	5150	706	145T	½	40	2.0	955	1400
JW10C	3	5450	825	182T	½	40	2.0	1005	1500
JW15B	5	8500	729	184T	½	50	2.0	1365	2000
JW15C	5	8300	740	184T	½	50	2.0	1435	2400
JW25A	5	11700	500	184T	¾	70	4.0	1850	2800
JW25B	5	11800	523	184T	¾	70	4.0	1955	2900
JW25C	7½	13000	614	213T	¾	70	4.0	2075	3200
JW35A	7½	19000	413	213T	1	110	4.0	2955	4300
JW35B	10	20000	462	215T	1	110	4.0	3140	4600
JW35C	10	19500	476	215T	1	110	4.0	3305	5000
JW50A	15	30200	385	254T	2	150	6.0	4380	6700
JW50B	15	29200	397	254T	2	150	6.0	4635	7200
JW50C	15	28400	385	254T	2	150	6.0	4885	7600
JW70B	20	37200	385	256T	3	250	8.0	6685	10200
JW70C	25	39000	415	284T	3	250	8.0	7085	10900
JW85B	30	52300	415	286T	3	325	11.0	7725	11900
JW85C	30	50000	430	286T	3	325	11.0	8185	12900
JW100B	30	58300	270	286T	5	375	11.0	9170	16870
JW100C	30	61000	280	286T	5	365	11.0	9675	17775
JW115B	40	66000	280	324T	5	400	14.0	10080	19050
JW115C	40	69000	290	324T	5	400	14.0	10670	20170
JW130B	50	76500	300	326T	5	450	16.0	11025	21425
JW130C	50	80000	305	326T	5	450	16.0	11720	22620

* For static pressure from ¼ to ½ ESP use next size larger motor

MODEL	JWL		SUMP CAPACITY	JW		COIL VOLUME	JWH		COIL FACE AREA
	CIRCUITS	CONNECTION OD	gal	CIRCUITS	CONNECTION OD	gal	CIRCUITS	CONNECTION OD	sq ft
JW10A	10	2 @ 2 5/8"	43	21	2 @ 2 5/8"	16	–	–	9.7
JW10B	21	2 @ 2 5/8"	43	42	2 @ 2 5/8"	20	–	–	9.7
JW10C	21	2 @ 2 5/8"	43	42	2 @ 2 5/8"	24	–	–	9.7
JW15B	26	2 @ 3 1/8"	64	52	2 @ 3 1/8"	31	–	–	14.5
JW15C	26	2 @ 3 1/8"	64	52	2 @ 3 1/8"	37	–	–	14.5
JW25A	33	2 @ 3 1/8"	95	66	2 @ 3 1/8"	37	–	–	21.6
JW25B	33	2 @ 3 1/8"	95	66	2 @ 3 1/8"	47	–	–	21.6
JW25C	33	2 @ 3 1/8"	95	66	2 @ 3 1/8"	57	–	–	21.6
JW35A	41	2 @ 3 1/8"	163	82	2 @ 3 1/8"	54	–	–	32.5
JW35B	41	2 @ 3 1/8"	163	82	2 @ 3 1/8"	70	164	4 @ 3 1/8"	32.5
JW35C	41	2 @ 3 1/8"	163	82	2 @ 3 1/8"	86	205	4 @ 3 1/8"	32.5
JW50A	50	2 @ 3 1/8"	248	100	2 @ 3 1/8"	82	–	–	49.6
JW50B	50	2 @ 3 1/8"	248	100	2 @ 3 1/8"	106	200	4 @ 3 1/8"	49.6
JW50C	50	2 @ 3 1/8"	248	100	2 @ 3 1/8"	130	250	4 @ 3 1/8"	49.6
JW70B	70	4 @ 3 1/8"	374	140	4 @ 3 1/8"	146	280	8 @ 3 1/8"	70.4
JW70C	70	4 @ 3 1/8"	374	140	4 @ 3 1/8"	182	350	8 @ 3 1/8"	70.4
JW85B	70	4 @ 3 1/8"	454	140	4 @ 3 1/8"	177	280	8 @ 3 1/8"	85.5
JW85C	70	4 @ 3 1/8"	454	140	4 @ 3 1/8"	200	350	8 @ 3 1/8"	85.5
JW100B	76	4 @ 3 1/8"	748	152	4 @ 3 1/8"	212	304	8 @ 3 1/8"	92.5
JW100C	76	4 @ 3 1/8"	748	152	4 @ 3 1/8"	262	380	8 @ 3 1/8"	92.5
JW115B	76	4 @ 3 1/8"	880	152	4 @ 3 1/8"	247	304	8 @ 3 1/8"	108.9
JW115C	76	4 @ 3 1/8"	880	152	4 @ 3 1/8"	305	380	8 @ 3 1/8"	108.9
JW130B	76	4 @ 3 1/8"	1012	152	4 @ 3 1/8"	305	304	8 @ 3 1/8"	125.2
JW130C	76	4 @ 3 1/8"	1012	152	4 @ 3 1/8"	349	380	8 @ 3 1/8"	125.2

City of Portland
REVIEWED FOR CODE COMPLIANCE
DEC 04 2012
Permit Number

Note

Inlet and outlet connection sizes shown are standard copper OD and are sized for nominal flow rates. Actual sizes should be specified to conform to job requirements. If special connections are required, such as flanges or threaded fittings, consult your Recold sales representative. Connection quantity is total of in and out connections

For the most part, evaporative closed circuit coolers will be installed for operation on a year-round basis. Units installed in a cold climate must be provided with adequate freeze protection for both the recirculating water and the heat exchange coil for proper equipment operation and maintenance.

RECIRCULATING WATER

The operation of evaporative cooled equipment under approximately full load conditions will prevent freezing of the recirculated water. However, during periods of very little or no heat load when fans and pumps are shut down, some form of freeze protection must be used.

A simple form of freeze protection commonly used is a remote sump tank inside a heated building below the evaporative cooled equipment. The water circulation pump is located at the remote tank circulating water through the evaporative cooler during load conditions. When the unit is shut down, the water drains down into the remote sump tank which is in a heated atmosphere.

The remote sump installation may be unacceptable in some cases due to unit location or space limitations. For these applications, pan water freeze protection may be attained by means of an optional electric heater located inside the unit pan. Electric pan heaters are designed to prevent pan water freezing during unit shut down with fans and pumps idle.

Water lines to and from the unit, pump, pump discharge and drain lines must be wrapped with a heat-tracing element and insulated to protect them from freezing.

TABLE 1 Glycol Flow Correction Factors

UNIT MODEL JW/JWL	ETHYLENE GLYCOL BY VOLUME	DESIGN FLOW GPM								
		40	50	70	90	100	125	150	175	ABOVE
10A thru 35C	20%	1.07	1.05	1.02	1.00	1.00	1.00	1.00	1.00	1.00
	30%	1.10	1.07	1.02	1.01	1.00	1.00	1.00	1.00	1.00
	40%	1.14	1.11	1.05	1.01	1.00	1.00	1.00	1.00	1.00
	50%	1.16	1.13	1.06	1.01	1.00	1.00	1.00	1.00	1.00
50A thru 50C	20%	1.12	1.09	1.05	1.03	1.02	1.00	1.00	1.00	1.00
	30%	1.16	1.12	1.07	1.04	1.02	1.00	1.00	1.00	1.00
	40%	1.19	1.16	1.11	1.06	1.04	1.01	1.00	1.00	1.00
	50%	1.23	1.21	1.14	1.08	1.05	1.01	1.00	1.00	1.00
70B thru 130C	20%	1.15	1.11	1.09	1.06	1.04	1.03	1.01	1.00	1.00
	30%	–	1.18	1.11	1.07	1.05	1.03	1.01	1.00	1.00
	40%	–	1.20	1.15	1.10	1.07	1.05	1.03	1.00	1.00
	50%	–	1.23	1.20	1.11	1.11	1.07	1.04	1.00	1.00

HEAT EXCHANGE COIL PROTECTION

The best means of heat exchanger coil freeze protection is to circulate an ethylene glycol water solution. The solution freeze points with respective ethylene glycol by volume are given in Table 11 below. This method will allow freeze protection irrespective of heat load or unit shut down.

Some applications will not permit the use of an ethylene glycol solution. Under these circumstances, other means of freeze protections must be used and the following rules strictly adhered to.

1. Maintain full flow through the coil
2. Maintain heat load on the coil at all time so that the leaving water temperature does not drop below +50°F

Full flow alone will not protect the coil. Temperature of +50°F must also be maintained.

Methods of maintaining the recommended fluid temperature may vary with system design and operation. A simple means of preventing heat loss may be to locate the unit indoors allowing a heated atmosphere. Adequate space and ductwork must be provided for proper operation.

Units operating in low ambient conditions with a heat load which becomes very low or drops off completely may require the addition of an artificial load to maintain safe fluid temperature. The amount of artificial load required may be reduced by means of discharge positive closure dampers. The addition of the dampers will prevent induced air circulation or the chimney effect which may occur during unit shut down.

The above methods of coil freeze protection, when properly applied and maintained will provide good equipment protection. All methods, other than those using an adequate antifreeze solution, should provide a means of emergency coil draining. It is recommended that automatic drain valves and air vents with vacuum breakers be installed on each coil circuit. Adequately size drains with heat-tracing tape and insulation should be provided for free drainage. Should the circulating pump fail or the water temperature leaving the coil drop below 50°F for any reason, the coil will automatically drain preventing freeze damage.

City of Portland
REVIEWED FOR CODE
COMPLIANCE
DEC 04 2012
Permit Number

FREEZE POINT °F	ETHYLENE GLYCOL (by volume)			
	20%	30%	40%	50%
	14	3	-14	-38

Closed circuit cooler selections can easily be made by using the information on pages 6 through 11. The examples below demonstrate proper procedures for water and ethylene glycol solutions. Other fluids can be cooled, but since their heat transfer and flow characteristics may vary, please contact your local Recold sales representative for assistance.

WATER SELECTION EXAMPLE

Select a unit to cool 225 GPM of water from 102°F to 90°F at 76°F wet bulb temperature.

1. **Determine Range:**

   102°F - 90°F = 12°F Range

2. **Determine Approach:**

   90°F - 76°F = 14°F Approach

3. **Select Load Factor** – Enter Unit Load Factor Table 2 for 76°F wet bulb. Select load factor based on 12°F range and 14°F approach. Load factor in this example equals 3.3. When wet bulb temperature is an odd number interpolate between appropriate tables to determine the load factor.

4. **Select Unit Model** – Table 3, the load factor determined in step 3 falls between 3.0 and 3.5. Enter the 3.0 column and read down to the smallest unit flow rating which is greater than or equal to 225 GPM. For the Model JWL35B, interpolate between 245 and 190 GPM to determine the flow rating at the 3.3 load factor. Interpolation gives a rating of 212 GPM which is less than the design requirement. Select a Model JWL35C and again interpolate between load factor columns to determine flow rating. The second selection provides a flow rating of 245 GPM which exceeds the design requirement. The correct unit size is, therefore, a Model 35C.

5. **Determine Flow Limitations** – Enter Table 3 at unit size determined in Step 4 to select a JWL low flow or JW standard flow unit. The Model 35C with 225 GPM design flow falls within the standard coil flow limitations. The correct unit selection is, therefore, a JW35C.

6. **Determine Coil Pressure Drop** – Enter the Coil Pressure Drop Table at 225 GPM and read across to the unit model column to select pressure drop reading. In this example, pressure drop equals 4.8 PSI.

ETHYLENE GLYCOL EXAMPLE

Select a unit to cool 75 GPM of 40% by volume ethylene glycol from 107°F to 85°F with 78°F wet bulb.

1. **Determine Range:**

   107°F - 85°F = 22°F Range

2. **Determine Approach:**

   85°F - 78°F = 7°F Approach

3. **Select Load Factor** – Enter Table 2 for 78°F wet bulb and select load factor at design range and approach. Select 6.0 factor.

4. **Select Test Unit Model** – Enter the Unit Rating Table 3 at the 6.0 load factor and read down to the smallest unit flow rating greater than or equal to the design 75 GPM. Select the test model JWL35C.

5. **Correct Flow for Ethylene Glycol** – The flow correction factor obtained from Table 1 is 1.04. 75 GPM x 1.04 = 78 GPM.

6. **Adjust Model Selection** – Re-enter Table 3 at the 6.0 load factor and make selection based on corrected flow of 78 GPM. The adjusted unit selection is the Model JWL50A indicating an 80 GPM rating.

7. **Determine Flow Limitations** – Enter Table 3 at unit size determined in Step 6 to select a JWL low flow or JW standard flow unit. The Model 50A with 75 GPM design flow falls within the low flow coil limitations. The correct unit selection is, therefore, a JWL50A.

8. **Determine Coil Pressure Drop** – For ethylene glycol pressure drop calculation, the conversion factor from Table 5 must be applied to design flow before entering Table 4. 75 GPM x 1.05 = 79 GPM.
   The coil pressure drop for 79 GPM is 2.4 PSI.

City of Portland
REVIEWED FOR CODE
COMPLIANCE
DEC 04 2012
Permit Number

DEFINITIONS

Range: the difference between the entering and leaving water temperatures (WT in – WT out).

Approach: the difference between the leaving water temperature and the web bulb temperature (WT out – WB).

Load BTUH =

GPM x 500 x Sp. Gr. x Sp. Ht. x ($T^1 - T^2$) where

Sp. Gr. = specific gravity at average temperature

Sp. Ht. = specific heat at average temperature

T^1 = entering temperature

T^2 = leaving temperature

TABLE NO. 2

60° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7				6.0	6.4	6.7	7.2	7.3	7.5	7.7	7.9	8.0	8.2					
8				5.6	6.0	6.4	6.7	6.9	7.1	7.3	7.5	7.6	7.8	7.9	8.0			
9		4.3	4.8	5.3	5.7	6.0	6.3	6.5	6.8	6.9	7.1	7.3	7.4	7.6	7.7	7.8	7.9	8.0
10		4.0	4.5	5.0	5.4	5.7	6.0	6.2	6.4	6.6	6.8	6.9	7.1	7.3	7.4	7.5	7.6	7.8
11		3.8	4.3	4.7	5.0	5.3	5.6	5.9	6.1	6.3	6.5	6.6	6.8	6.9	7.0	7.2	7.3	7.4
12	2.9	3.5	4.0	4.5	4.8	5.1	5.4	5.6	5.8	6.0	6.2	6.4	6.5	6.6	6.8	6.9	7.0	7.2
13	2.8	3.2	3.8	4.2	4.5	4.9	5.1	5.4	5.6	5.8	5.9	6.2	6.3	6.4	6.5	6.7	6.8	6.9
14	2.5	3.1	3.6	4.0	4.3	4.6	4.9	5.1	5.3	5.5	5.7	5.9	6.0	6.2	6.3	6.4	6.6	6.8
15	2.4	3.0	3.5	3.9	4.1	4.5	4.7	4.9	5.2	5.4	5.5	5.7	5.8	6.0	6.1	6.3	6.4	6.6
16	2.3	2.8	3.3	3.7	4.0	4.3	4.6	4.8	4.9	5.1	5.3	5.5	5.6	5.7	5.9	6.1	6.3	6.4
17	2.2	2.7	3.2	3.6	3.9	4.1	4.4	4.6	4.8	4.9	5.1	5.3	5.4	5.7	5.8	5.9	6.0	6.2
18	2.1	2.6	3.0	3.6	3.8	4.0	4.2	4.4	4.6	4.8	4.9	5.1	5.3	5.4	5.6	5.8	5.9	6.0
19	2.0	2.5	2.9	3.3	3.6	3.9	4.1	4.3	4.5	4.7	4.8	4.9	5.2	5.3	5.4	5.6	5.8	5.9
20	1.9	2.4	2.8	3.2	3.4	3.7	3.9	4.2	4.3	4.5	4.7	4.8	4.9	5.1	5.3	5.4	5.6	5.7
21	1.9	2.4	2.7	3.1	3.4	3.6	3.9	4.1	4.2	4.4	4.6	4.7	4.9	5.0	5.3	5.3	5.4	5.6
22	1.8	2.3	2.6	3.0	3.2	3.5	3.7	3.9	4.1	4.3	4.4	4.6	4.7	4.9	5.0	5.2	5.3	5.4
23	1.8	2.3	2.6	3.0	3.2	3.5	3.7	3.9	4.1	4.3	4.4	4.6	4.7	4.8	5.0	5.2	5.3	5.4
24	1.7	2.1	2.5	2.8	3.1	3.3	3.5	3.7	3.9	4.1	4.3	4.4	4.5	4.6	4.8	4.9	5.1	5.2
25	1.6	2.1	2.4	2.7	3.0	3.2	3.4	3.6	3.8	3.9	4.1	4.2	4.4	4.6	4.7	4.8	4.9	5.1
26	1.6	2.0	2.3	2.6	2.9	3.2	3.3	3.5	3.7	3.9	4.0	4.1	4.3	4.4	4.6	4.7	4.8	4.9
27	1.5	2.0	2.3	2.6	2.8	3.1	3.3	3.4	3.6	3.8	3.9	4.1	4.2	4.3	4.4	4.6	4.7	4.8
28	1.5	1.9	2.2	2.5	2.8	3.0	3.2	3.4	3.5	3.7	3.8	4.0	4.1	4.2	4.3	4.4	4.6	4.7
29	1.4	1.8	2.1	2.4	2.7	2.9	3.1	3.3	3.4	3.6	3.7	3.9	4.0	4.1	4.2	4.4	4.5	4.6
30	1.4	1.8	2.1	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.0	4.1	4.3	4.4	4.5

62° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7				5.8	6.3	6.6	6.9	7.1	7.3	7.5	7.7	7.9	7.9	8.1				
8			4.9	5.4	5.8	6.2	6.5	6.7	6.9	7.1	7.3	7.4	7.6	7.8	7.9	8.0	8.1	
9		4.1	4.6	5.0	5.4	5.8	6.0	6.4	6.5	6.7	6.9	7.0	7.2	7.3	7.5	7.6	7.8	7.9
10		3.8	4.3	4.8	5.1	5.5	5.8	6.0	6.2	6.4	6.6	6.8	6.9	7.0	7.2	7.3	7.4	7.6
11	3.0	3.6	4.2	4.6	4.9	5.2	5.5	5.7	6.0	6.2	6.3	6.5	6.7	6.8	7.0	7.1	7.2	7.3
12	2.8	3.5	4.0	4.4	4.7	5.0	5.3	5.5	5.7	5.9	6.1	6.3	6.4	6.5	6.7	6.8	7.0	7.1
13	2.7	3.3	3.7	4.1	4.5	4.8	5.1	5.3	5.5	5.7	5.9	6.0	6.2	6.3	6.5	6.6	6.8	6.9
14	2.5	3.1	3.5	3.9	4.3	4.6	4.8	5.0	5.2	5.5	5.6	5.8	5.9	6.1	6.2	6.3	6.5	6.7
15	2.2	2.9	3.3	3.7	4.1	4.3	4.6	4.8	5.0	5.2	5.4	5.5	5.7	5.8	6.0	6.1	6.3	6.4
16	2.2	2.8	3.0	3.6	3.9	4.2	4.4	4.6	4.8	5.1	5.2	5.4	5.5	5.7	5.8	6.0	6.1	6.3
17	2.1	2.7	3.1	3.5	3.8	4.1	4.3	4.5	4.7	4.9	5.0	5.2	5.4	5.5	5.7	5.8	6.0	6.1
18	2.1	2.5	3.0	3.4	3.7	3.9	4.2	4.4	4.5	4.7	4.9	5.0	5.2	5.3	5.5	5.6	5.8	5.9
19	2.0	2.4	2.9	3.2	3.5	3.8	4.0	4.2	4.4	4.6	4.7	4.9	5.0	5.2	5.3	5.4	5.6	5.8
20	1.9	2.3	2.8	3.1	3.4	3.6	3.9	4.1	4.2	4.4	4.6	4.7	4.9	5.0	5.2	5.3	5.5	5.6
21	1.8	2.3	2.7	3.0	3.3	3.5	3.8	4.0	4.1	4.3	4.5	4.6	4.8	4.9	5.1	5.2	5.3	5.5
22	1.8	2.2	2.6	2.9	3.2	3.4	3.7	3.9	4.0	4.2	4.4	4.5	4.7	4.8	4.9	5.1	5.2	5.4
23	1.7	2.1	2.5	2.8	3.1	3.3	3.5	3.7	3.9	4.1	4.3	4.4	4.5	4.7	4.8	4.9	5.1	5.2
24	1.6	2.1	2.5	2.7	3.0	3.2	3.4	3.6	3.8	4.0	4.1	4.3	4.4	4.6	4.7	4.8	5.0	5.1
25	1.6	2.0	2.4	2.6	2.9	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.5	4.6	4.7	4.8	5.0
26	1.5	2.0	2.3	2.6	2.8	3.1	3.3	3.4	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.6	4.7	4.9
27	1.5	1.9	2.2	2.5	2.8	3.0	3.2	3.4	3.6	3.7	3.8	4.0	4.1	4.3	4.4	4.5	4.6	4.7
28	1.5	1.8	2.2	2.4	2.7	2.9	3.1	3.3	3.5	3.6	3.7	3.9	4.0	4.2	4.3	4.4	4.5	4.6
29	1.4	1.8	2.1	2.3	2.6	2.8	3.0	3.2	3.4	3.5	3.6	3.8	3.9	4.1	4.2	4.3	4.4	4.5
30	1.4	1.7	2.0	2.3	2.5	2.8	3.0	3.1	3.3	3.4	3.5	3.7	3.8	4.0	4.1	4.2	4.3	4.4

64° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7				5.6	6.1	6.4	6.7	7.0	7.1	7.4	7.5	7.7	7.8	8.0				
8			4.8	5.3	5.6	6.0	6.3	6.6	6.8	7.0	7.1	7.3	7.5	7.6	7.7	7.8	7.9	8.0
9		3.9	4.5	4.9	5.3	5.6	5.9	6.2	6.4	6.6	6.7	6.9	7.1	7.2	7.3	7.5	7.6	7.7
10		3.7	4.3	4.7	5.0	5.3	5.6	5.9	6.1	6.3	6.5	6.6	6.8	6.9	7.0	7.1	7.3	7.5
11	2.9	3.5	4.1	4.5	4.9	5.1	5.4	5.6	5.8	6.0	6.2	6.3	6.5	6.7	6.8	6.9	7.0	7.2
12	2.7	3.4	3.9	4.3	4.6	4.9	5.1	5.4	5.6	5.8	6.0	6.1	6.3	6.4	6.6	6.7	6.8	7.0
13	2.6	3.2	3.6	4.0	4.4	4.6	4.9	5.2	5.4	5.5	5.7	5.9	6.0	6.2	6.3	6.5	6.6	6.8
14	2.4	3.0	3.4	3.8	4.2	4.4	4.7	4.9	5.1	5.3	5.5	5.7	5.8	5.9	6.1	6.2	6.4	6.6
15	2.2	2.8	3.2	3.6	4.0	4.2	4.5	4.7	4.9	5.0	5.2	5.4	5.6	5.7	5.9	6.0	6.1	6.3
16	2.1	2.7	3.1	3.5	3.8	4.1	4.3	4.5	4.7	4.9	5.1	5.3	5.4	5.5	5.7	5.9	6.0	6.1
17	2.1	2.6	3.0	3.4	3.7	4.0	4.2	4.4	4.6	4.7	4.9	5.1	5.3	5.4	5.6	5.7	5.8	6.0
18	2.0	2.5	2.9	3.3	3.6	3.8	4.1	4.3	4.4	4.6	4.8	4.9	5.1	5.2	5.4	5.5	5.7	5.8
19	1.9	2.4	2.8	3.1	3.4	3.7	3.9	4.1	4.3	4.5	4.6	4.8	4.9	5.1	5.2	5.3	5.5	5.7
20	1.8	2.3	2.7	3.0	3.3	3.5	3.8	4.0	4.1	4.3	4.5	4.6	4.8	4.9	5.1	5.2	5.4	5.5
21	1.8	2.2	2.6	2.9	3.2	3.4	3.7	3.9	4.0	4.2	4.4	4.5	4.7	4.8	5.0	5.1	5.2	5.4
22	1.8	2.1	2.5	2.8	3.1	3.3	3.6	3.8	3.9	4.1	4.3	4.4	4.6	4.7	4.8	5.0	5.1	5.3
23	1.7	2.1	2.4	2.7	3.0	3.3	3.4	3.6	3.8	4.0	4.1	4.3	4.4	4.6	4.7	4.8	5.0	5.1
24	1.6	2.0	2.4	2.7	2.9	3.2	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.5	4.6	4.7	4.9	5.0
25	1.6	1.9	2.3	2.6	2.8	3.1	3.2	3.4	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.6	4.7	4.9
26	1.5	1.9	2.2	2.5	2.7	3.0	3.2	3.3	3.5	3.7	3.8	4.0	4.1	4.3	4.4	4.5	4.6	4.8
27	1.5	1.8	2.1	2.4	2.7	2.9	3.1	3.3	3.5	3.6	3.7	3.9	4.0	4.2	4.3	4.4	4.5	4.6
28	1.4	1.8	2.1	2.3	2.6	2.8	3.0	3.2	3.4	3.5	3.6	3.8	3.9	4.1	4.2	4.3	4.4	4.5
29	1.4	1.7	2.0	2.3	2.5	2.8	2.9	3.1	3.3	3.4	3.5	3.7	3.8	4.0	4.1	4.2	4.3	4.4
30	1.3	1.6	1.9	2.2	2.4	2.7	2.9	3.0	3.2	3.3	3.4	3.6	3.7	3.9	4.0	4.1	4.2	4.3

66° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7			5.0	5.5	5.9	6.3	6.5	6.8	7.0	7.2	7.4	7.5	7.6	7.8	7.9	8.0		
8			4.7	5.1	5.5	5.9	6.2	6.4	6.7	6.8	7.0	7.1	7.3	7.4	7.5	7.7	7.8	7.9
9		3.8	4.4	4.8	5.2	5.5	5.8	6.0	6.3	6.4	6.6	6.8	6.9	7.0	7.2	7.3	7.4	7.6
10	3.0	3.6	4.1	4.5	4.9	5.2	5.4	5.7	5.9	6.1	6.3	6.4	6.6	6.8	6.9	7.0	7.1	7.3
11	2.8	3.4	3.9	4.3	4.7	5.0	5.2	5.5	5.7	5.9	6.1	6.2	6.3	6.5	6.6	6.8	6.9	7.1
12	2.7	3.2	3.7	4.1	4.5	4.8	5.0	5.2	5.4	5.6	5.8	6.0	6.1	6.3	6.4	6.5	6.7	6.9
13	2.5	3.1	3.5	3.9	4.3	4.5	4.8	5.0	5.2	5.4	5.6	5.7	5.9	6.0	6.2	6.3	6.5	6.6
14	2.3	2.9	3.4	3.7	4.1	4.3	4.6	4.8	5.0	5.2	5.3	5.5	5.7	5.8	6.0	6.1	6.2	6.4
15	2.2	2.7	3.2	3.5	3.9	4.1	4.4	4.6	4.8	4.9	5.1	5.3	5.4	5.6	5.7	5.9	6.0	6.2
16	2.1	2.6	3.1	3.4	3.7	4.0	4.2	4.4	4.6	4.8	4.9	5.1	5.3	5.4	5.6	5.7	5.8	6.0
17	2.0	2.5	3.0	3.3	3.6	3.9	4.1	4.3	4.5	4.6	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9
18	1.9	2.4	2.8	3.2	3.5	3.7	4.0	4.2	4.4	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.5	5.7
19	1.8	2.3	2.7	3.0	3.4	3.6	3.8	4.0	4.2	4.4	4.5	4.7	4.8	5.0	5.1	5.2	5.4	5.5
20	1.8	2.2	2.6	2.9	3.2	3.5	3.7	3.9	4.1	4.2	4.4	4.5	4.7	4.8	5.0	5.1	5.2	5.4
21	1.7	2.2	2.5	2.8	3.1	3.4	3.6	3.8	4.0	4.1	4.3	4.4	4.6	4.7	4.9	5.0	5.1	5.2
22	1.7	2.1	2.5	2.8	3.0	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.5	4.6	4.7	4.8	5.0	5.1
23	1.6	2.0	2.4	2.7	3.0	3.2	3.4	3.6	3.7	3.9	4.0	4.2	4.3	4.5	4.6	4.7	4.9	5.0
24	1.6	1.9	2.3	2.6	2.9	3.1	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.6	4.7	4.9
25	1.5	1.9	2.2	2.5	2.8	3.0	3.2	3.4	3.5	3.7	3.8	3.9	4.1	4.3	4.4	4.5	4.6	4.7
26	1.5	1.8	2.2	2.4	2.7	2.9	3.1	3.2	3.4	3.6	3.7	3.9	4.0	4.2	4.3	4.4	4.5	4.6
27	1.4	1.8	2.1	2.4	2.6	2.9	3.0	3.2	3.4	3.5	3.6	3.8	3.9	4.0	4.2	4.3	4.4	4.5
28	1.4	1.7	2.0	2.3	2.5	2.8	2.9	3.1	3.3	3.4	3.6	3.7	3.8	4.0	4.1	4.2	4.3	4.4
29	1.3	1.6	1.9	2.2	2.4	2.7	2.9	3.0	3.2	3.4	3.5	3.6	3.7	3.9	4.0	4.1	4.2	4.3
30	1.3	1.6	1.9	2.1	2.3	2.6	2.8	2.9	3.1	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.1	4.2

68° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7		4.4	4.9	5.1	5.7	6.1	6.4	6.6	6.9	7.0	7.2	7.4	7.5	7.6	7.8	7.9		
8		4.0	4.6	5.0	5.4	5.7	6.0	6.2	6.5	6.6	6.8	7.0	7.1	7.2	7.4	7.5	7.6	7.7
9		3.7	4.3	4.7	5.1	5.4	5.6	5.9	6.1	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.3	7.5
10	2.9	3.5	4.0	4.4	4.8	5.1	5.3	5.6	5.7	6.0	6.1	6.3	6.5	6.6	6.7	6.8	7.0	7.1
11	2.7	3.3	3.8	4.2	4.6	4.9	5.1	5.4	5.5	5.7	5.9	6.1	6.2	6.4	6.5	6.7	6.8	6.9
12	2.6	3.1	3.6	4.0	4.4	4.7	4.9	5.1	5.3	5.5	5.7	5.8	6.0	6.1	6.3	6.4	6.6	6.7
13	2.4	3.0	3.4	3.8	4.2	4.4	4.7	4.9	5.1	5.3	5.4	5.6	5.8	5.9	6.1	6.2	6.4	6.5
14	2.2	2.8	3.3	3.6	4.0	4.2	4.5	4.7	4.9	5.1	5.2	5.4	5.6	5.7	5.8	6.0	6.1	6.3
15	2.1	2.6	3.1	3.4	3.8	4.0	4.3	4.5	4.7	4.8	5.0	5.1	5.3	5.5	5.6	5.8	5.9	6.1
16	2.0	2.5	3.0	3.3	3.6	3.9	4.1	4.3	4.5	4.7	4.8	5.0	5.2	5.3	5.5	5.6	5.8	5.9
17	1.9	2.4	2.9	3.2	3.5	3.8	4.0	4.2	4.4	4.5	4.7	4.8	5.0	5.2	5.3	5.5	5.6	5.8
18	1.9	2.3	2.7	3.1	3.4	3.6	3.9	4.1	4.3	4.4	4.6	4.7	4.9	5.0	5.2	5.3	5.4	5.6
19	1.8	2.2	2.6	2.9	3.3	3.5	3.7	3.9	4.1	4.3	4.4	4.6	4.7	4.9	5.0	5.1	5.3	5.4
20	1.7	2.1	2.5	2.8	3.1	3.4	3.6	3.8	4.0	4.1	4.3	4.4	4.6	4.7	4.9	5.0	5.1	5.3
21	1.7	2.1	2.4	2.7	3.0	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.5	4.6	4.8	4.9	5.0	5.1
22	1.6	2.0	2.4	2.7	2.9	3.2	3.4	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.6	4.7	4.9	5.0
23	1.6	1.9	2.3	2.6	2.9	3.1	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.6	4.7	4.9
24	1.5	1.9	2.2	2.5	2.8	3.0	3.2	3.4	3.5	3.7	3.8	4.0	4.1	4.3	4.4	4.5	4.6	4.8
25	1.5	1.8	2.1	2.4	2.7	2.9	3.1	3.3	3.4	3.6	3.7	3.9	4.0	4.2	4.3	4.4	4.5	4.6
26	1.4	1.8	2.1	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.3	4.4	4.5
27	1.4	1.7	2.0	2.3	2.5	2.8	2.9	3.1	3.3	3.4	3.5	3.8	3.8	4.0	4.1	4.2	4.3	4.4
28	1.3	1.6	1.9	2.2	2.4	2.7	2.8	3.0	3.2	3.3	3.5	3.6	3.7	3.9	4.0	4.1	4.2	4.3
29	1.3	1.6	1.9	2.0	2.4	2.6	2.8	2.9	3.1	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.1	4.2
30	1.2	1.5	1.8	2.1	2.3	2.5	2.7	2.8	3.0	3.2	3.3	3.4	3.5	3.7	3.8	3.9	4.0	4.1

70° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7		4.2	4.8	5.2	5.6	6.0	6.3	6.5	6.7	6.9	7.1	7.2	7.4	7.5	7.7	7.8	7.9	8.0
8	3.2	3.9	4.4	4.9	5.3	5.6	5.9	6.1	6.3	6.5	6.7	6.9	7.0	7.1	7.3	7.4	7.5	7.6
9	3.0	3.6	4.2	4.6	4.9	5.2	5.5	5.8	5.9	6.2	6.3	6.5	6.6	6.8	6.9	7.0	7.2	7.3
10	2.8	3.4	3.9	4.3	4.6	4.9	5.2	5.4	5.6	5.8	6.0	6.2	6.3	6.4	6.6	6.7	6.9	7.0
11	2.6	3.2	3.7	4.1	4.4	4.7	5.0	5.2	5.4	5.6	5.8	5.9	6.1	6.2	6.4	6.5	6.7	6.8
12	2.5	3.0	3.5	3.9	4.2	4.5	4.8	5.0	5.2	5.4	5.6	5.7	5.9	6.0	6.1	6.3	6.4	6.6
13	2.3	2.9	3.3	3.7	4.1	4.3	4.6	4.8	5.0	5.2	5.3	5.5	5.6	5.8	5.9	6.1	6.2	6.4
14	2.2	2.7	3.2	3.5	3.9	4.1	4.4	4.6	4.7	4.9	5.1	5.2	5.4	5.5	5.7	5.8	6.0	6.2
15	2.0	2.5	3.0	3.3	3.7	3.9	4.2	4.4	4.5	4.7	4.9	5.0	5.2	5.3	5.5	5.6	5.8	6.0
16	2.0	2.4	2.9	3.2	3.6	3.8	4.0	4.2	4.4	4.6	4.7	4.9	5.0	5.2	5.3	5.5	5.6	5.8
17	1.9	2.3	2.8	3.1	3.4	3.7	3.9	4.1	4.3	4.4	4.6	4.7	4.9	5.0	5.2	5.3	5.5	5.7
18	1.8	2.3	2.7	3.0	3.3	3.6	3.8	4.0	4.1	4.3	4.5	4.6	4.8	4.9	5.1	5.2	5.3	5.5
19	1.7	2.2	2.6	2.9	3.2	3.4	3.7	3.8	4.0	4.2	4.3	4.5	4.6	4.8	4.9	5.0	5.2	5.3
20	1.7	2.1	2.5	2.8	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.5	4.6	4.8	4.9	5.0	5.2
21	1.6	2.0	2.1	2.7	3.0	3.2	3.4	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.6	4.8	4.9	5.0
22	1.6	2.0	2.3	2.6	2.9	3.1	3.3	3.5	3.7	3.8	4.0	4.1	4.3	4.4	4.5	4.6	4.8	4.9
23	1.5	1.9	2.2	2.5	2.8	3.0	3.2	3.4	3.6	3.7	3.9	4.0	4.1	4.3	4.4	4.5	4.6	4.8
24	1.5	1.8	2.2	2.5	2.7	2.9	3.1	3.3	3.5	3.6	3.5	3.9	4.0	4.1	4.3	4.4	4.5	4.6
25	1.4	1.8	2.1	2.4	2.6	2.8	3.0	3.2	3.4	3.5	3.7	3.8	3.9	4.0	4.1	4.3	4.4	4.5
26	1.4	1.7	2.0	2.3	2.5	2.7	2.9	3.1	3.3	3.4	3.6	3.7	3.8	3.9	4.0	4.2	4.3.	4.4
27	1.3	1.7	2.0	2.2	2.5	2.7	2.9	3.0	3.2	3.3	3.5	3.6	3.7	3.8	4.0	4.1	4.2	.4.3
28	1.3	1.6	1.9	2.2	2.4	2.6	2.8	3.0	3.1	3.3	3.4	3.5	3.7	3.8	3.9	4.0	4.1	4.2
29	1.2	1.5	1.8	2.1	2.3	2.5	2.7	2.9	3.0	3.2	3.3	3.4	3.6	3.7	3.8	3.9	4.0	4.1
30	1.2	1.5	1.8	2.0	2.2	2.4	2.6	2.8	2.9	3.1	3.2	3.3	3.5	3.6	3.7	3.8	3.9	4.0

City of Portland
REVIEWED FOR CODE COMPLIANCE
DEC 04 2012
Permit Number

TABLE NO. 2

72° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7		4.1	4.7	5.1	5.5	5.9	6.1	6.4	6.6	6.8	7.0	7.1	7.3	7.4	7.6	7.7	7.8	7.9
8	3.1	3.8	4.3	4.8	5.1	5.5	5.7	6.0	6.2	6.4	6.6	6.7	6.9	7.0	7.1	7.3	7.4	7.5
9	2.9	3.5	4.1	4.4	4.8	5.1	5.4	5.6	5.8	6.0	6.1	6.4	6.5	6.6	6.7	6.9	7.0	7.1
10	2.7	3.3	3.8	4.2	4.5	4.8	5.1	5.3	5.5	5.7	5.9	6.0	6.2	6.3	6.5	66	6.7	6.9
11	2.5	3.1	3.6	4.0	4.3	4.6	4.9	5.1	5.3	5.5	5.7	5.8	6.0	6.1	6.3	6.4	6.5	6.7
12	2.4	2.9	3.4	3.8	4.1	4.4	4.7	4.9	5.1	5.3	5.5	5.6	5.7	5.8	6.0	6.2	6.3	6.5
13	2.3	2.8	3.2	3.6	4.0	4.2	4.5	4.7	4.9	5.1	5.2	5.4	5.5	5.7	5.8	5.9	6.1	6.3
14	2.1	2.6	3.1	3.4	3.8	4.0	4.3	4.5	4.6	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	6.1
15	2.0	2.5	2.9	3.2	3.6	3.8	4.1	4.3	4.4	4.6	4.8	4.9	5.1	5.2	5.4	5.5	5.7	5.9
16	1.9	2.4	2.8	3.1	3.5	3.7	3.9	4.1	4.3	4.5	4.6	4.8	4.9	5.1	5.2	5.4	5.5	5.7
17	1.9	2.3	2.7	3.0	3.3	3.6	3.8	4.0	4.2	4.3	4.5	4.7	4.8	4.9	5.1	5.2	5.4	5.6
18	1.8	2.2	2.6	2.9	3.2	3.5	3.7	3.9	4.0	4.2	4.4	4.5	4.7	4.8	5.0	5.1	5.2	5.4
19	1.7	2.1	2.5	2.8	3.1	3.3	3.6	3.7	3.9	4.1	4.2	4.4	4.5	4.7	4.8	4.9	5.1	5.2
20	1.6	2.0	2.4	2.7	3.0	3.2	3.4	3.6	3.8	3.9	4.1	4.2	4.4	4.5	4.7	4.8	4.9	5.1
21	1.6	2.0	2.3	2.6	2.9	3.1	3.2	3.5	3.7	3.8	4.0	4.1	4.3	4.4	4.5	4.7	4.8	4.9
22	1.5	1.9	2.2	2.5	2.8	3.0	3.2	3.4	3.6	3.7	3.9	4.0	4.2	4.3	4.4	4.5	4.7	4.8
23	1.4	1.8	2.2	2.4	2.7	2.9	3.1	3.3	3.5	3.7	3.8	3.9	4.1	4.2	4.3	4.4	4.5	4.7
24	1.4	1.8	2.1	2.4	2.6	2.8	3.0	3.2	3.4	3.5	3.7	3.8	3.9	4.0	4.2	4.3	4.4	4.5
25	1.3	1.7	2.0	2.3	2.5	2.7	2.9	3.1	3.3	3.4	3.6	3.7	3.8	3.9	4.0	4.2	4.3	4.4
26	1.3	1.7	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.6	3.7	3.8	3.9	4.1	4.2	4.3
27	1.2	1.6	1.9	2.1	2.4	2.6	2.8	2.9	3.1	3.2	3.4	3.5	3.6	3.7	3.9	4.0	4.1	4.2
28	1.2	1.5	1.8	2.1	2.3	2.5	2.7	2.9	3.0	3.2	3.3	3.4	3.6	3.7	3.8	3.9	4.0	4.1
29	1.2	1.5	1.7	2.0	2.2	2.4	2.6	2.8	2.9	3.1	3.2	3.3	3.5	3.6	3.7	3.8	3.9	4.0
30	1.1	1.4	1.7	1.9	2.1	2.3	2.5	2.6	2.8	3.0	3.1	3.2	3.4	3.5	3.6	3.7	3.8	3.9

74° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7		4.0	4.5	5.0	5.4	5.7	6.0	6.3	6.4	6.7	6.8	7.0	7.2	7.3	7.4	7.5	7.7	7.8
8	3.0	3.7	4.2	4.7	5.0	5.3	5.6	5.8	6.0	6.2	6.4	6.6	6.7	6.8	6.9	7.1	7.3	7.4
9	2.8	3.4	3.9	4.3	4.7	4.9	5.2	5.4	5.6	5.9	6.0	6.2	6.4	6.5	6.6	6.8	6.9	7.0
10	2.6	3.1	3.7	4.1	4.4	4.7	4.9	5.1	5.4	5.6	5.8	5.9	6.0	6.2	6.3	6.4	6.6	6.8
11	2.5	3.0	3.5	3.9	4.2	4.5	4.7	4.9	5.2	5.4	5.5	5.7	5.8	6.0	6.1	6.2	6.4	6.6
12	2.3	2.9	3.3	3.7	4.0	4.3	4.5	4.7	4.9	5.1	5.3	5.4	5.6	5.7	5.9	6.0	6.2	6.4
13	2.2	2.7	3.2	3.5	3.8	4.1	4.3	4.6	4.7	4.9	5.1	5.2	5.4	5.5	5.7	5.8	6.0	6.1
14	2.1	2.6	3.0	3.4	3.7	3.9	4.1	4.4	4.5	4.7	4.9	5.0	5.2	5.3	5.5	5.6	5.8	5.9
15	2.0	2.4	2.8	3.2	3.5	3.7	3.9	4.2	4.3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7
16	1.9	2.3	2.7	3.1	3.4	3.6	3.8	4.0	4.2	4.3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6
17	1.8	2.2	2.6	3.0	3.2	3.5	3.7	3.9	4.1	4.2	4.4	4.5	4.7	4.8	5.0	5.1	5.3	5.4
18	1.7	2.2	2.5	2.8	3.1	3.4	3.6	3.8	4.0	4.1	4.3	4.4	4.6	4.7	4.8	5.0	5.1	5.2
19	1.7	2.1	2.4	2.7	3.0	3.2	3.5	3.7	3.8	4.0	4.1	4.3	4.4	4.6	4.7	4.8	4.9	5.1
20	1.6	2.0	2.3	2.6	2.9	3.1	3.3	3.5	3.7	3.8	4.0	4.1	4.3	4.4	4.5	4.7	4.8	4.9
21	1.5	1.9	2.3	2.5	2.8	3.0	3.2	3.4	3.6	3.7	3.9	4.0	4.2	4.3	4.4	4.6	4.7	4.8
22	1.5	1.9	2.2	2.5	2.7	2.9	3.1	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.3	4.4	4.5	4.6
23	1.4	1.8	2.1	2.4	2.6	2.9	3.1	3.2	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.3	4.4	4.5
24	1.3	1.7	2.0	2.3	2.5	2.8	3.0	3.1	3.3	3.4	3.6	3.7	3.8	3.9	4.1	4.2	4.3	4.4
25	1.3	1.7	2.0	2.2	2.4	2.7	2.9	3.0	3.2	3.3	3.5	3.6	3.7	3.8	3.9	4.1	4.2	4.3
26	1.2	1.6	1.9	2.2	2.4	2.6	2.8	2.9	3.1	3.2	3.4	3.5	3.6	3.7	3.8	4.0	4.1	4.2
27	1.2	1.6	1.8	2.1	2.3	2.5	2.7	2.9	3.0	3.1	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.1
28	1.2	1.5	1.8	2.0	2.2	2.4	2.6	2.8	2.9	3.1	3.2	3.3	3.5	3.6	3.7	3.8	3.9	4.0
29	1.1	1.4	1.7	1.9	2.1	2.4	2.5	2.7	2.9	3.0	3.1	3.3	3.4	3.5	3.6	3.7	3.8	3.9
30	1.1	1.4	1.6	1.9	2.1	2.3	2.4	2.6	2.8	2.9	3.0	3.2	3.3	3.4	3.5	3.6	3.7	3.8

76° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7		3.8	4.3	4.8	5.2	5.5	5.6	6.1	6.2	6.5	6.6	6.8	7.0	7.1	7.2	7.3	7.5	7.6
8	2.9	3.5	4.0	4.5	4.8	5.1	5.4	5.6	5.8	6.0	6.2	6.4	6.5	6.6	6.7	6.9	7.0	7.2
9	2.7	3.3	3.8	4.2	4.5	4.8	5.1	5.3	5.5	5.7	5.9	6.0	6.2	6.3	6.5	6.6	6.8	6.9
10	2.5	3.0	3.5	4.0	4.2	4.6	4.8	5.0	5.2	5.4	5.6	5.7	5.9	6.0	6.2	6.3	6.5	6.6
11	2.4	2.9	3.4	3.8	4.1	4.4	4.6	4.8	5.0	5.2	5.4	5.5	5.7	5.8	6.0	6.1	6.3	6.4
12	2.2	2.8	3.2	3.6	3.9	4.2	4.4	4.6	4.8	5.0	5.2	5.3	5.5	5.6	5.8	5.9	6.1	6.2
13	2.1	2.6	3.1	3.4	3.7	4.0	4.2	4.5	4.6	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	6.0
14	2.0	2.5	2.9	3.3	3.6	3.8	4.0	4.3	4.4	4.6	4.8	4.9	5.1	5.2	5.4	5.5	5.7	5.8
15	1.8	2.3	2.7	3.1	3.4	3.6	3.8	4.1	4.2	4.4	4.6	4.7	4.9	5.0	5.2	5.3	5.5	5.6
16	1.8	2.2	2.6	3.0	3.3	3.5	3.7	3.9	4.1	4.2	4.4	4.6	4.7	4.9	5.0	5.2	5.3	5.4
17	1.7	2.1	2.5	2.9	3.1	3.4	3.6	3.8	4.0	4.1	4.3	4.4	4.6	4.7	4.9	5.0	5.2	5.3
18	1.6	2.1	2.4	2.7	3.0	3.3	3.5	3.7	3.8	4.0	4.2	4.3	4.5	4.6	4.7	4.9	5.0	5.1
19	1.6	2.0	2.3	2.6	2.9	3.1	3.4	3.6	3.7	3.9	4.0	4.2	4.3	4.5	4.6	4.7	4.8	4.9
20	1.5	1.9	2.2	2.5	2.8	3.0	3.2	3.4	3.6	3.7	3.9	4.0	4.2	4.3	4.4	4.6	4.7	4.8
21	1.5	1.8	2.2	2.4	2.7	2.9	3.1	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.3	4.5	4.6	4.7
22	1.4	1.8	2.1	2.4	2.6	2.8	3.0	3.2	3.4	3.5	3.7	3.8	4.0	4.1	4.2	4.3	4.4	4.5
23	1.4	1.7	2.0	2.3	2.5	2.8	3.0	3.1	3.3	3.4	3.6	3.7	3.8	4.0	4.1	4.2	4.3	4.4
24	1.3	1.6	1.9	2.2	2.4	2.7	2.9	3.0	3.2	3.3	3.5	3.6	3.7	3.8	4.0	4.1	4.2	4.3
25	1.3	1.6	1.9	2.1	2.3	2.6	2.8	2.9	3.1	3.2	3.4	3.5	3.6	3.7	3.8	4.0	4.1	4.2
26	1.2	1.5	1.8	2.1	2.3	2.5	2.7	2.8	3.0	3.1	3.3	3.4	3.5	3.6	3.7	3.9	4.0	4.1
27	1.2	1.5	1.8	2.0	2.2	2.4	2.6	2.8	2.9	3.1	3.2	3.3	3.4	3.5	3.7	3.8	3.9	4.0
28	1.2	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.8	3.0	3.1	3.2	3.4	3.5	3.6	3.7	3.8	3.9
29	1.1	1.4	1.6	1.8	2.1	2.3	2.1	2.6	2.8	2.9	3.0	3.2	3.3	3.4	3.5	3.6	3.7	3.8
30	1.1	1.4	1.6	1.8	2.0	2.2	2.4	2.5	2.7	2.8	2.9	3.1	3.2	3.3	3.4	3.5	3.6	3.7

78° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7	3.0	3.6	4.2	4.6	5.0	5.3	5.6	5.9	6.0	6.3	6.4	6.6	6.8	6.9	7.0	7.1	7.3	7.4
8	2.8	3.4	3.9	4.3	4.6	4.9	5.2	5.4	5.6	5.8	6.0	6.2	6.3	6.5	6.6	6.7	6.9	7.0
9	2.6	3.1	3.6	4.0	4.4	4.7	4.9	5.1	5.3	5.5	5.7	5.9	6.0	6.2	6.3	6.5	6.6	6.8
10	2.4	2.9	3.4	3.8	4.1	4.4	4.7	4.9	5.1	5.3	5.4	5.6	5.7	5.9	6.0	6.2	6.3	6.5
11	2.3	2.8	3.3	3.7	4.0	4.2	4.5	4.7	4.9	5.1	5.2	5.4	5.5	5.7	5.8	6.0	6.1	6.3
12	2.2	2.6	3.1	3.5	3.8	4.0	4.3	4.5	4.7	4.9	5.0	5.2	5.3	5.5	5.6	5.8	5.9	6.1
13	2.0	2.5	3.0	3.3	3.6	3.9	4.1	4.3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9
14	1.9	2.4	2.8	3.2	3.4	3.7	3.9	4.1	4.3	4.5	4.6	4.8	4.9	5.1	5.2	5.4	5.5	5.7
15	1.8	2.3	2.7	3.0	3.3	3.5	3.7	3.9	4.1	4.3	4.4	4.6	4.7	4.9	5.0	5.2	5.3	5.5
16	1.7	2.2	2.6	2.9	3.2	3.4	3.6	3.8	4.0	4.1	4.3	4.4	4.6	4.7	4.9	5.0	5.2	5.3
17	1.7	2.1	2.5	2.8	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.4	4.6	4.7	4.9	5.0	5.1
18	1.6	2.0	2.4	2.7	2.9	3.2	3.4	3.6	3.7	3.9	4.1	4.2	4.3	4.5	4.6	4.7	4.8	5.0
19	1.5	1.9	2.3	2.6	2.8	.31	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.3	4.5	4.6	4.7	4.8
20	1.5	1.8	2.2	2.5	2.7	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.0	4.2	4.3	4.4	4.5	4.6
21	1.4	1.8	2.1	2.4	2.6	2.9	3.1	3.2	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.3	4.4	4.5
22	1.4	1.7	2.0	2.3	2.5	2.8	3.0	3.1	3.3	3.4	3.6	3.7	3.8	4.0	4.1	4.2	4.3	4.4
23	1.3	1.6	2.0	2.2	2.5	2.7	2.9	3.0	3.2	3.4	3.5	3.6	3.7	3.8	4.0	4.1	4.2	4.3
24	1.3	1.6	1.9	2.2	2.4	2.6	2.8	2.9	3.1	3.3	3.4	3.5	3.6	3.7	3.9	4.0	4.1	4.1
25	1.2	1.5	1.8	2.1	2.3	2.5	2.7	2.8	3.0	3.2	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.0
26	1.2	1.5	1.8	2.0	2.2	2.4	2.6	2.8	2.9	3.1	3.2	3.3	3.4	3.5	3.7	3.8	3.9	3.9
27	1.1	1.4	1.7	1.9	2.2	2.4	2.5	2.7	2.9	3.0	3.1	3.2	3.3	3.4	3.6	3.7	3.8	3.8
28	1.1	1.4	1.6	1.9	2.1	2.3	2.5	2.6	2.8	2.9	3.0	3.1	3.3	3.4	3.5	3.6	3.7	3.8
29	1.1	1.4	1.6	1.8	2.0	2.2	.24	2.5	2.7	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
30	1.0	1.3	1.5	1.7	2.0	2.1	2.3	2.5	2.6	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6

80° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7	2.9	3.5	4.1	4.5	4.8	5.1	5.4	5.7	5.9	6.1	6.2	6.4	6.6	6.7	6.8	7.0	7.1	7.2
8	2.7	3.3	3.8	4.2	4.5	4.8	5.1	5.3	5.5	5.7	5.9	6.1	6.2	6.4	6.5	6.6	6.8	6.9
9	2.5	3.0	3.5	3.9	4.3	4.5	4.8	5.0	5.2	5.4	5.6	5.7	5.9	6.1	6.2	6.3	6.5	6.6
10	2.3	2.8	3.3	3.7	4.0	4.3	4.5	4.8	4.9	5.1	5.3	5.5	5.6	5.8	5.9	6.1	6.2	6.4
11	2.2	2.7	3.2	3.6	3.9	4.1	4.4	4.5	4.7	4.9	5.1	5.3	5.4	5.6	5.7	5.9	6.0	6.2
12	2.1	2.6	3.0	3.4	3.7	3.9	4.2	4.4	4.6	4.7	4.9	5.1	5.2	5.4	5.5	5.7	5.8	6.0
13	2.0	2.4	2.9	3.2	3.5	3.8	4.0	4.2	4.4	4.6	4.7	4.9	5.0	5.2	5.3	5.5	5.6	5.8
14	1.9	2.3	2.7	3.1	3.3	3.6	3.8	4.0	4.2	4.4	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6
15	1.8	2.2	2.6	2.9	3.2	3.4	3.6	3.8	4.0	4.2	4.3	4.5	4.6	4.8	4.9	5.1	5.2	5.4
16	1.7	2.1	2.5	2.8	3.1	3.3	3.5	3.7	3.9	4.0	4.2	4.3	4.5	4.6	4.8	4.9	5.1	5.2
17	1.6	2.0	2.4	2.7	3.0	3.2	3.4	3.6	3.8	3.9	4.1	4.2	4.3	4.5	4.6	4.8	4.9	5.0
18	1.6	1.9	2.3	2.6	2.8	3.1	3.3	3.5	3.6	3.8	4.0	4.1	4.2	4.4	4.5	4.6	4.7	4.9
19	1.5	1.9	2.2	2.5	2.7	3.0	3.2	3.4	3.5	3.7	3.8	4.0	4.1	4.2	4.4	4.5	4.6	4.7
20	1.4	1.8	2.1	2.4	2.6	2.9	3.1	3.2	3.4	3.5	3.7	3.8	3.9	4.1	4.2	4.3	4.4	4.5
21	1.4	1.7	2.0	2.3	2.5	2.8	3.0	3.1	3.3	3.4	3.6	3.7	3.8	4.0	4.1	4.2	4.3	4.4
22	1.3	1.7	1.9	2.2	2.4	2.7	2.9	3.0	3.2	3.3	3.5	3.6	3.7	3.9	4.0	4.1	4.3	4.3
23	1.3	1.6	1.9	2.1	2.4	2.6	2.8	2.9	3.1	3.3	3.4	3.5	3.6	3.7	3.9	4.0	4.1	4.2
24	1.2	1.5	1.8	2.1	2.3	2.5	2.7	2.8	3.0	3.2	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.0
25	1.2	1.5	1.7	2.0	2.2	2.4	2.6	2.8	2.9	3.1	3.2	3.3	3.4	3.5	3.7	3.8	3.9	3.9
26	1.1	1.4	1.7	1.9	2.1	2.3	2.5	2.7	2.8	3.0	3.1	3.2	3.3	3.4	3.6	3.7	3.8	3.8
27	1.1	1.4	1.6	1.9	2.1	2.3	2.4	2.6	2.8	2.9	3.0	3.1	3.2	3.3	3.5	3.6	3.7	3.7
28	1.1	1.3	1.6	1.8	2.0	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.2	3.3	3.4	3.5	3.6	3.7
29	1.0	1.3	1.5	1.7	1.9	2.1	2.3	2.4	2.6	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6
30	1.0	1.2	1.5	1.7	1.9	2.1	2.2	2.4	2.5	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5

82° WET BULB

	RANGE																	
APPROACH	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
7	2.8	3.4	3.9	4.3	4.7	5.0	5.3	5.5	5.7	5.9	6.1	6.3	6.4	6.5	6.7	6.8	6.9	7.1
8	2.6	3.2	3.6	4.0	4.4	4.7	4.9	5.2	5.4	5.6	5.8	5.9	6.1	6.2	6.4	6.5	6.6	6.8
9	2.4	2.9	3.4	3.8	4.1	4.4	4.7	4.8	5.0	5.3	5.4	5.6	5.8	5.9	6.2	6.4	6.5	6.6
10	2.2	2.7	3.2	3.6	3.9	4.2	4.4	4.6	4.8	5.0	5.1	5.3	5.5	5.6	5.8	5.9	6.1	6.2
11	2.1	2.6	3.0	3.4	3.7	4.0	4.2	4.4	4.6	4.8	4.9	5.1	5.3	5.4	5.6	5.7	5.9	6.0
12	2.0	2.5	2.9	3.3	3.6	3.8	4.1	4.2	4.4	4.6	4.8	4.9	5.1	5.2	5.4	5.5	5.7	5.8
13	1.9	2.4	2.8	3.1	3.4	3.7	3.9	4.1	4.3	4.4	4.6	4.7	4.9	5.1	5.2	5.3	5.5	5.6
14	1.8	2.2	2.7	3.0	3.2	3.5	3.7	3.9	4.1	4.2	4.4	4.5	4.7	4.9	5.0	5.1	5.3	5.4
15	1.7	2.1	2.5	2.8	3.1	3.3	3.6	3.7	3.9	4.1	4.2	4.4	4.5	4.7	4.8	4.9	5.1	5.2
16	1.7	2.0	2.4	2.7	3.0	3.2	3.5	3.6	3.8	4.0	4.1	4.2	4.4	4.5	4.6	4.8	4.9	5.1
17	1.6	2.0	2.3	2.6	2.9	3.1	3.3	3.5	3.7	3.8	4.0	4.1	4.2	4.4	4.5	4.6	4.8	4.9
18	1.5	1.9	2.2	2.5	2.7	3.0	3.2	3.4	3.6	3.7	3.8	4.0	4.1	4.3	4.4	4.5	4.6	4.7
19	1.4	1.8	2.1	2.4	2.6	2.9	3.1	3.3	3.4	3.6	3.7	3.9	4.0	4.1	4.2	4.3	4.5	4.6
20	1.4	1.7	2.0	2.3	2.5	2.8	3.0	3.2	3.3	3.5	3.6	3.7	3.8	4.0	4.1	4.2	4.3	4.4
21	1.3	1.7	2.0	2.2	.24	2.7	2.9	3.1	3.2	3.4	3.5	3.6	3.7	3.9	4.0	4.1	4.2	4.3
22	1.3	1.6	1.9	2.1	2.4	2.6	2.8	3.0	3.1	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.1	4.2
23	1.2	1.5	1.8	2.1	2.3	2.5	2.7	2.9	3.0	3.2	3.3	3.4	3.5	3.6	3.8	3.9	4.0	4.1
24	1.2	1.5	1.7	2.0	2.2	2.4	2.6	2.8	2.9	3.1	3.2	3.3	3.4	3.5	3.7	3.8	3.9	3.9
25	1.1	1.4	1.7	1.9	2.1	2.3	2.5	2.7	2.8	3.0	3.1	3.2	3.3	3.4	3.6	3.7	3.8	3.8
26	1.1	1.4	1.6	1.9	2.1	2.3	2.5	2.6	2.7	2.9	3.0	3.1	3.2	3.3	3.5	3.6	3.7	3.7
27	1.0	1.3	1.6	1.8	2.0	2.2	2.4	2.5	2.7	2.8	2.9	3.1	3.2	3.3	3.4	3.5	3.6	3.6
28	1.0	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.6	2.7	2.8	3.0	3.1	3.2	3.3	3.4	3.5	3.6
29	1.0	1.2	1.5	1.7	1.9	2.1	2.2	2.4	2.5	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5
30	0.9	1.2	1.4	1.6	1.8	2.0	2.2	2.3	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4

City of Portland
REVIEWED FOR CODE COMPLIANCE
Permit Number

TABLE NO. 3: Selection Parameters

Do not exceed the minimum and maximum flow rates given for each unit in column 2. Model JWH high flow rate units available only for models shown. Extrapolation of flow rating should not exceed the flow range printed for each unit.

MODEL NO.		GPM Min-Max	UNIT LOAD FACTORS															
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.2	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0
10A	JWL JW	10-35 36-126		140	96	70	53	41	34	32	28	24	21	18	16	15	14	13
10B	JWL JW	21-62 63-252	241	174	115	83	63	49	39	36	32	27	23	21				
10C	JWL JW	21-62 63-252	260	181	127	93	69	54	43	40	35	29	25	22	20			
15B	JWL JW	26-77 78-312	325	210	145	105	78	60	48	44	39	32	28	24				
15C	JWL JW	26-77 78-312	355	245	175	126	94	73	57	53	46	37	31	27	23			
25A	JWL JW	33-94 95-396	382	274	200	149	113	87	68	63	55	45	37	31				
25B	JWL JW	33-94 95-396	420	305	222	169	131	102	82	76	66	54	44	37	31			
25C	JWL JW	33-94 95-396	482	355	265	200	156	123	98	90	79	65	54	45	38	33		
35A	JWL JW	41-119 120-492	610	452	340	259	197	155	122	112	98	79	65	54	45	39		
35B	JWL JW JWH	41-119 120-425 426-550		535	410	315	245	190	150	138	120	96	79	65	55	47	41	
35C	JWL JW JWH	41-119 120-425 426-550		610	470	365	282	221	174	161	140	113	92	76	64	55	48	42
50A	JWL JW	50-149 150-550		685	515	390	300	235	185	170	147	118	97	80	68	58	51	45
50B	JWL JW JWH	50-149 150-425 426-650		720	550	425	330	260	209	192	167	135	110	92	77	66	57	50
50C	JWL JW JWH	50-149 150-425 426-650		760	585	455	355	281	225	207	181	147	121	101	85	72	63	55
70B	JWL JW JWH	70-209 210-690 691-850		880	705	550	430	340	270	248	215	175	143	118	100	85	74	65
70C	JWL JW JWH	70-209 210-575 576-850		1005	825	645	505	400	318	293	256	208	170	140	118	101	88	78
85B	JWL JW JWH	100-209 210-590 591-1000		1090	900	740	565	445	360	332	290	240	200	165	140	119	105	92
85C	JWL JW JWH	100-209 210-590 591-1000			1080	805	640	510	430	398	350	285	240	202	170	142	125	107
100B	JWL JW JWH	100-249 250-650 651-1700	1701	1405	1080	850	660	540	445	408	370	300	250	205	176	147	131	110
100C	JWL JW JWH	100-200 201-559 600-1700	1805	1505	1170	910	710	590	485	443	400	330	263	222	185	154	144	122
115B	JWL JW JWH	100-202 203-600 601-1700	1895	1580	1250	995	775	640	530	482	440	360	299	245	202	170	159	136
115C	JWL JW JWH	100-185 186-500 501-1700		1700	1370	1060	840	695	570	525	470	390	320	265	220	185	172	149
130B	JWL JW JWH	100-190 191-550 551-1700		1780	1470	1150	905	745	615	560	505	415	340	280	230	190	177	154
130C	JWL JW JWH	100-199 200-500 501-1700		1890	1600	1250	980	805	665	607	545	445	370	300	250	200	188	165

City of Portland
REVIEWED FOR CODE
COMPLIANCE
DEC 04 2012
Permit Number

TABLE NO. 4: Pressure Drop in PSI

For feet of head, multiply by 2.31

GPM	MODEL JW - JWL - JWH																							
	10A	10B	10C	15B	15C	25A	25B	25C	35A	35B	35C	50A	50B	50C	70B	70C	85B	85C	100B	100C	115B	115C	130B	130C
10	1.1																							
20	3.5	0.7	0.9																					
25	5.2	1.1	1.3	0.8	1.0																			
30	6.9	1.5	1.8	1.1	1.3	0.7	0.8	1.1																
35	9.1	1.0	2.3	1.5	1.8	0.9	1.0	1.4	0.7	0.9	1.1													
40	1.7	2.4	2.9	1.8	2.2	1.1	1.4	1.7	0.9	1.1	1.3	0.7	1.0	1.2										
45	2.1	3.0	3.6	2.3	2.8	1.4	1.8	2.1	1.0	1.3	1.6	0.9	1.2	1.5										
50	2.5	3.6	4.3	2.7	3.3	1.6	2.1	2.6	1.2	1.6	1.9	1.1	1.4	1.8										
55	3.0	4.3	5.0	3.2	3.9	1.9	2.5	3.0	1.5	1.9	2.3	1.3	1.7	2.1										
60	3.6	5.0	5.9	3.7	4.6	2.2	4.8	3.4	1.7	2.3	2.7	1.5	1.9	2.4										
65	4.0	1.0	1.3	4.3	5.2	2.6	3.4	4.1	1.9	2.6	3.1	1.7	2.2	2.8										
70	4.5	1.2	1.4	4.7	5.8	2.9	3.7	4.5	2.2	2.9	3.5	1.9	2.6	3.1	1.5	1.8								
75	5.0	1.4	1.6	5.4	6.5	3.3	4.2	5.2	2.5	3.4	4.0	2.2	2.9	3.5	1.7	2.1								
80	5.6	1.5	1.8	1.1	1.3	3.7	4.8	5.9	2.8	4.7	4.3	2.5	3.2	4.0	1.8	2.3								
85	6.3	1.7	2.0	1.2	1.4	4.2	5.4	6.5	3.2	4.2	5.0	2.8	3.6	4.5	2.0	2.5								
90	6.9	1.9	2.2	1.3	1.6	4.5	5.8	6.9	3.5	4.6	5.4	3.0	3.9	4.8	2.2	2.8								
95	7.7	2.1	2.4	1.5	1.7	0.8	1.0	1.3	3.8	5.0	6.1	3.3	4.3	5.4	2.4	3.1								
100	8.5	2.2	2.7	1.6	1.9	0.9	1.1	1.4	4.2	5.4	6.5	3.6	4.8	5.8	2.6	3.3	3.0	3.7	1.7	2.4	2.1	2.9	2.6	3.4
110	10.0	2.8	3.2	1.9	2.2	1.1	1.3	1.6	4.8	6.3	7.8	4.3	5.6	6.9	3.1	3.8	3.5	4.3	2.1	2.8	2.4	3.5	3.0	4.1
120	11.8	3.3	3.8	2.2	2.6	1.2	1.6	1.9	1.1	1.3	1.6	5.0	6.5	8.0	3.5	4.5	4.0	5.0	2.4	3.3	2.7	4.0	3.5	4.7
130	13.5	3.8	4.3	2.6	3.0	1.4	1.8	2.2	1.2	1.5	1.8	5.6	7.4	9.1	4.2	5.2	4.6	5.7	2.7	3.8	3.0	4.6	4.0	5.4
140		4.3	4.9	2.9	3.4	1.6	2.0	2.5	1.4	1.7	2.1	6.5	8.3	10.4	4.6	5.8	5.2	6.4	3.1	4.3	3.7	5.2	4.6	6.1
150		4.8	5.6	3.2	3.8	1.8	2.3	2.8	1.6	1.9	2.3	1.4	1.7	2.1	5.1	6.5	5.9	7.2	3.5	4.9	4.4	5.8	5.2	6.9
160		5.4	6.3	3.7	4.3	2.1	2.6	3.2	1.8	2.2	2.6	1.6	1.9	2.3	5.7	7.3	6.5	8.0	4.0	5.4	4.9	6.5	5.8	7.7
170		6.1	7.1	4.1	4.8	2.3	2.9	3.5	2.0	2.5	2.9	1.8	2.2	2.6	6.3	8.1	7.1	8.9	4.4	6.0	5.4	7.3	6.5	8.6
180		6.7	7.8	4.5	5.3	2.5	3.2	3.9	2.2	2.7	3.2	1.9	2.4	2.8	7.0	8.9	7.8	9.8	4.9	6.6	6.0	8.0	7.1	9.4
190		7.4	8.5	5.0	5.9	2.8	3.5	4.2	2.4	3.0	3.5	2.2	2.6	3.2	7.6	9.8	8.6	10.7	5.3	7.3	6.5	1.3	7.8	10.3
200		8.0	9.3	5.4	6.4	3.1	3.9	4.6	2.6	3.2	3.9	2.4	2.9	3.5	8.2	10.5	9.4	11.7	5.7	7.9	7.0	1.7	1.4	1.8
225		10.1	11.6	6.7	7.9	3.8	4.8	5.8	3.2	4.0	4.8	3.0	3.6	4.3	2.0	2.4	1.9	2.0	7.1	1.8	1.7	2.1	1.8	2.3
250		12.1	13.9	8.2	9.5	4.5	5.8	6.9	3.9	4.8	5.8	3.5	4.3	5.2	2.3	2.9	2.3	2.6	1.9	2.2	2.2	2.6	2.2	2.8
275				9.9	11.3	5.4	6.8	8.2	4.7	5.7	6.8	4.2	5.2	6.2	2.8	3.4	2.7	3.1	2.3	2.7	2.6	3.2	2.7	3.4
300				11.5	13.0	6.4	7.8	9.5	5.4	6.7	7.8	4.9	6.1	7.2	3.3	3.9	3.1	3.6	2.7	3.2	3.1	3.8	3.2	4.1
350				15.6	17.7	8.4	10.4	12.6	7.3	8.3	10.4	6.5	7.9	9.5	3.8	4.6	4.0	4.7	3.5	4.3	3.9	4.9	4.3	5.2
400						10.6	13.0	15.6	9.2	9.4	2.8	6.8	8.5	10.3	4.3	5.3	5.1	5.9	4.4	5.4	5.1	6.2	5.4	6.5
450									11.6	2.3	3.3	8.3	2.0	3.1	5.2	6.4	6.2	7.1	5.8	6.6	6.1	7.5	6.6	8.1
500									14.3	2.7	4.0	9.9	2.3	3.7	6.3	7.7	7.4	8.5	6.4	8.1	7.4	9.1	8.1	9.6
550										3.1	4.6	12.0	2.7	4.3	7.5	9.2	8.7	10.0	7.5	9.4	8.7	11.2	9.4	11.4
600													3.1	5.0	8.6	2.5	1.7	2.9	8.8	1.2	9.9	1.4	1.9	1.7
650													3.6	5.7	9.9	2.8	2.0	3.3	9.9	1.4	1.9	1.6	1.2	1.9
700															1.9	3.2	2.2	3.7	2.0	1.6	2.2	1.8	2.5	2.1
750															2.1	3.6	2.5	4.2	2.3	1.8	2.5	2.0	2.8	2.4
800															2.4	4.0	2.8	4.7	2.5	2.0	2.7	2.3	3.1	2.7
850															2.7	4.4	3.1	5.2	2.7	2.3	3.1	2.6	3.5	3.0
900																	3.4	6.0	3.1	2.5	3.5	2.9	3.9	3.3
950																	3.8	6.4	3.4	2.8	3.7	3.1	4.3	3.6
1000																	4.1	7.0	3.7	3.0	4.2	3.4	4.7	4.0
1100																			4.5	3.6	5.1	4.1	5.5	4.6
1200																			5.2	4.3	5.8	4.8	6.6	5.4
1300																			6.1	5.0	6.7	5.5	7.4	6.0
1400																			6.9	5.5	7.7	6.4	8.5	7.0
1500																			7.9	6.4	8.6	7.2	9.6	8.0
1600																			8.8	7.0	9.5	8.0	11.1	9.0
1700																			9.8	8.0	10.8	9.0	12.1	10.0

ONTARIO BUILDING CODE
REVIEWED FOR CODE
COMPLIANCE
Permit Number:

TABLE NO. 5: Ethylene Glycol Flow conversion

FACTOR	ETHYLENE GLYCOL % BY VOLUME			
	20%	30%	40%	50%
	1.04	1.05	1.05	1.06

Note For ethylene glycol pressure drop calculation, the conversion factor from TABLE 5 must be applied to design flow before entering TABLE 4.

CAPACITY CONTROLS

Dual Fan Motors—The dual fan motor package is available as a proven energy saving capacity control option. It consists of furnishing a high efficiency motor, a 1200 RPM, low speed motor, two sets of drives and belts, extended fan shaft and motor bases on opposite sides of the blower. A UL control-starter panel is available as a completely wired package for one point connection.

Variable Speed Drive—A Variable Speed Drive automatically minimize the tower's noise level during periods of reduced load and/or reduced ambient temperature without sacrificing the system's ability to maintain a constant cold water temperature. This is a relatively inexpensive solution, and can pay for itself quickly in reduced energy costs.

Electric Damper Controls—An electric damper control package is available as an accessory for modulating the internal damper system. A proportional solid state actuator is factory mounted below the fan scroll and attached to the damper shaft by connecting linkage. A sensing bulb connected to the actuator by a capillary tube is normally mounted in the unit pan water basin for monitoring the system. However, when specified, a pressure control may be supplied for field mounting to allow direct head pressure control. An end switch located inside the motor actuator may be adjusted to cycle the fan motor on for pressure rise and off when dampers close.

COIL CASING INSULATION

In order to further reduce the heat loss from the unit coil, insulation factory installed on exterior coil panels is available. A protective coat of paint is applied to the insulation for protection from the weather elements.

POSITIVE CLOSURE DAMPERS

Many times during unit shutdown with fan and pump off, it is desirable to conserve the amount of heat loss from the process fluid. For those applications, closure dampers are available for this installation at the air discharge of the fluid cooler. The damper package is designed to prevent convective air flow through the idle unit thus minimizing the heat loss. Installation of the closure dampers requires all wiring to be completed in the field. An electric actuator is factory mounted, however controls are to be supplied by others. The damper actuator should be wired into the field control system to allow the dampers to fully open when the fan cycles on and close when the fan cycles off. The actuator requires a 115V power supply

ELECTRONIC WATER LEVEL CONTROL

The electronic water level control package provides a constant and accurate means of monitoring water level in the unit. For this reason, it is often recommended for those installations which require year round operation in low ambient conditions.

The complete package includes an electric float switch with stilling chamber which is factory installed in the pan section of the unit. An electric solenoid valve for water make-up is shipped loose for remote installation. All wiring must be provided in the field by others.

PUMP STRAINER

Pump intake extension and a cleanable non-ferrous pump strainer in an easy access location is available.

MODIFICATIONS TO WATER DISTRIBUTION SYSTEM

Various package are available to provide manual or automatic change-over as a backup system in the event of a spray pump failure

PAN HEATER

The use of a remote sump tank located indoors is a common form of pan water freeze protection for evaporative cooling equipment. However, for those installations which will not allow this type of system, freeze protection may be provided by electric immersion heaters or steam or hot water coils installed in the pan.

The electric heater package consists of immersion heaters installed in the pan to provide efficient even heat distribution. Standard heaters are selected to provide approximately 40°F pan water at -10°F ambient temperature. A low water cutout switch is supplied to prevent heater operation when the elements are not completely submerged. The heaters are monitored by a sump thermostat with remote sensing bulb located in the pan water. All heaters and controls are factory installed for field wiring by others.

NOTE: Pan heater packages are designed to prevent pan water freezing during unit shutdown with fans and pump idle.

City of Portland
REVIEWED FOR CODE COMPLIANCE
DEC 04 2012
Permit Number

CAPACITY BOOSTER COIL

A finned coil mounted on top of the eliminator section is available primarily for applications with high entering fluid temperatures or for applications where dry operation under low entering air temperatures is anticipated. Copper tube with aluminum or copper fin coils are available.

VIBRATION ISOLATORS

Spring type vibration isolator rails may be supplied for field installation, most units will require an intermediate rigid steel framework between the isolators and the base of the unit to provide adequate structural support for the unit. Consult Recold sales representative for recommendations on any vibration isolation application.

STAINLESS STEEL CONSTRUCTION

300 stainless steel construction is offered as an option for sump pan and upper casing panels.

SPX COOLING TECHNOLOGIES, INC.
550 W MERCURY LANE
BREA, CALIFORNIA 92821 USA
P: 714 529 6080
F: 714 529 3603
spxcooling@spx.com
spxcooling.com

In the interest of technological progress, all products are subject to design and/or material change without notice.

ISSUED 2/2012 RECOLD JW-TECH-08

COPYRIGHT © 2012 SPX Corporation