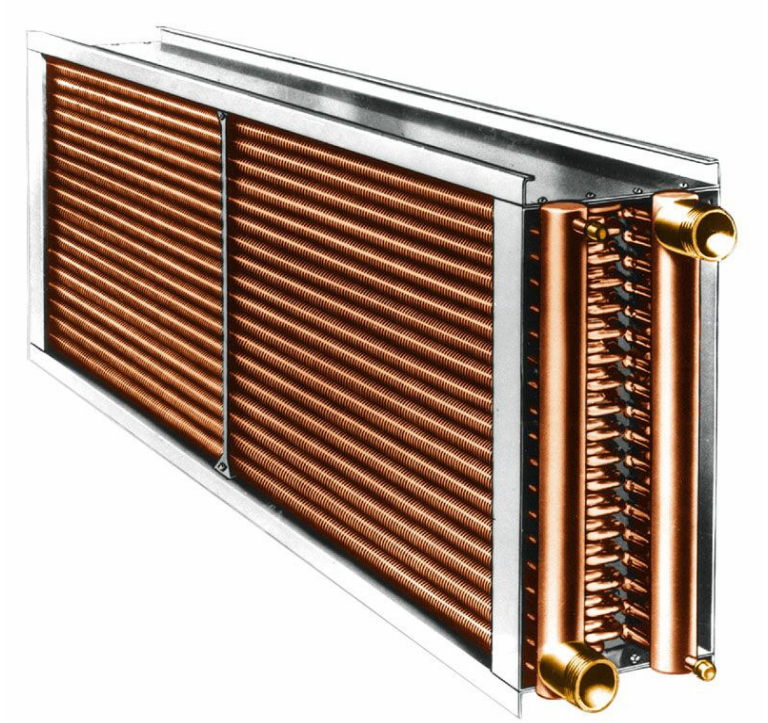
CA-194

PROTECTION OF WATER COILS

TO PREVENT FREEZING DAMAGE



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PROTECTION OF WATER COILS TO PREVENT FREEZING DAMAGE

This bulletin describes the method for removing the water from the coils or the method for supplying glycol to the coils to prevent freeze damage.

Installations that do not use permanent brine or do not have heating protection require that some measures be implemented for winter shutdown to prevent water coils from freezing. EVEN THOUGH COILS ARE DRAINED, ENOUGH WATER MAY REMAIN IN THEM TO CAUSE FREEZE DAMAGE. It should be remembered that the measure of any heating protection depends upon the continuity of heat supply and the reliability of automatic control. Where outside air is tempered by mixing with warm return air, stratification might occur and some of the air may be cold enough to freeze the water in the coils. If there is doubt as to whether a coil is safely protected, it is usually advisable to provide additional freeze protection measures.

This bulletin assumes that the coil piping connections include plugged tees. If some other arrangement is used, the serviceman may have to establish his own procedure, following in general the guidelines of this bulletin.

EQUIPMENT REQUIRED FOR BLOWING OUT COILS WITH AIR:

The blower recommended for this operation is a portable electric type of blower that should be selected to supply 150 cfm at a static pressure of around 45.0 inch of water. Such a blower is manufactured by - Gardner Denver Blower Division, 100 Gardner Park, Peachtree City, Ga. 30269, or Breezemaker Fan Co., 1608 N. 24th St., Tampa, FL. 33605, or ebm-papst Inc., 110 Hyde Rd., Farmington, CT. 06034.

An adapter is required to connect the blower outlet to the coil connection. This can be done by using a flexible rubber tube. If the blower has a rubber nozzle, connection can be made by cutting off this nozzle and pinning a pipe nipple to the outlet; this nipple may then be connected to the coil using a pipe union or threaded flange, as applicable.

Using air from a compressed air tank is not recommended, as more volume and more air pressure is required than can be supplied by compressed air tanks.

PROCEDURE USING AIR TO BLOW OUT COILS

1. Shut off the water supply.

2. Drain the coil, using vent and drain valves when provided. In Figures 1 and 2, this step requires opening of the header vent or removing the plug from the header tee, and opening all drains.

3. Connect the blower to the coil supply or return header (upper coil connection) at a point where there will be no reduction in pipe size from the blower to the coil. In Figure 1, the blower is shown connected to the header with top connection (return connection in most applications). Figure 2 shows the blower connected to the header at the top of the coil. Do not attempt to supply air to the coil by connecting the blower to the air vent or drain connection. They are too small and therefore sufficient air cannot be supplied to the coil.

4. Close all outlets on the header to which the blower is connected and remove the plug from the other header. See Figure 1 and 2 for plug location.

5. Operate the blower for at least one-half hour and then check coil for dryness. This check may be made by holding a mirror in front of the discharge from the coil. If water is still being removed, the mirror will become fogged. Continue to operate the blower until the coil is dry.

6. Bump or jar the coil slightly during the blowing operation, if possible. This will free any water, that may be trapped and may also dislodge any dirt or scale which can trap water in the coil. TAKE CARE NOT TO DAMAGE THE COIL.

7. Allow the coil to stand for a few minutes after it is first blown out to give the moisture that adhered to the walls of the tube a chance to accumulate. Blow it out again, and if any water comes out, repeat the blowing operation.

8. Leave drains open and all plugs out until warm weather or until the coil is returned to service.

EQUIPMENT REQUIRED TO FLUSH COILS WITH ANTI-FREEZE

The portable equipment needed consists of a 1inch centrifugal pump operating at a speed of about 3500 rpm and having a capacity of about 25 gpm at a 35 ft. head pressure. The pump can be direct connected to a ½ Hp 3450 rpm motor. In addition to the pump, it is necessary to have one or two containers of sufficient capacity to transport the glycol and to act as sumps from which the solution can be pumped.

Glycol anti-freeze is recommended. Other freeze protecting solutions such as alcohol is not recommended. “Prestone™” or similar ethylene glycol anti-freeze solutions have been found to be satisfactory for flushing the coils. The necessary concentration of the solution will depend on the lowest temperature of the particular locality.

The use of Ethylene Glycol or Propylene Glycol without an inhibitor is satisfactory in protecting against freeze-up of water trapped in a drained coil. This solution will not cause corrosion in a cold system.

When adding glycol to a hot water system for protection of hot water pre-heater coils, use only the Prestone™ brand. The inhibitor contained in this solution will prevent corrosion for several months at elevated temperatures, occasional addition of small quantities of glycol fluid will strengthen the inhibitor.

Ethylene glycol has its lowest freezing point when it is in a solution of about 60% glycol and 40% water by volume. A stronger solution than this is not advisable because the freezing temperature will be increased. The strength of the solution can be checked with a hydrometer in the same way that the auto mechanic checks the anti-freeze solution in an automobile radiator. Refer to Tables below for estimating the volume of the coil and percentage of Ethylene glycol for maximum freeze protection.

PROPERTIES OF ETHYLENE GLYCOL AND WATER SOLUTION:

% OF ETHYLENE GLYCOL BY VOL.	SPECIFIC GRAVITY @ 60 DEG. F	FREEZING TEMP. DEG. F	% WATER BY VOL.
0	1.000	32	100
10	1.016	23	90
20	1.031	15	80
30	1.045	3	70
40	1.058	-15	60
50	1.070	-30	50
60	1.081	-55	40
70	1.092	-46	30
80	1.102	-43	20
90	1.110	-20	10
100	1.117	- 7	0

The following table indicates the estimated water holding capacity of the various water coils. These figures are only approximate and are intended to give a general idea of the size container and the amount of anti-freeze solution required; an additional amount of solution will be required for the pump and piping, with a small reserve for the container.

GALLONS REQUIRED PER COIL WITH 5/8" OD TUBES

	12 TUBE FACE				18 TUBE FACE				24 TUBE FACE				30 TUBE FACE			
	ROWS				ROWS				ROWS				ROWS			
TUBE LENGTH	2	4	6	8	2	4	6	8	2	4	6	8	2	4	6	8
2'-0"	1.14	1.85	2.49	3.17	1.72	2.71	3.72	4.71	2.27	3.61	4.97	6.32	3.44	5.42	7.44	9.42
2'-6"	1.29	2.18	2.95	3.78	1.94	3.17	4.41	5.65	2.57	4.22	5.87	7.52	3.88	6.34	8.82	11.30
3'-0"	1.44	2.46	3.40	4.38	2.17	3.62	5.07	6.52	2.88	4.82	6.78	8.73	4.34	7.24	10.14	13.04
3'-6"	1.60	2.77	3.85	4.98	2.40	4.07	5.76	7.43	3.18	5.43	7.59	9.93	4.80	8.14	11.52	14.86
4'-0"	1.75	3.07	4.31	5.59	3.63	4.53	6.45	8.33	3.48	6.03	8.59	1.14	7.26	9.06	12.90	16.66
4'-6"	1.90	3.37	4.76	6.19	2.85	4.98	7.13	9.24	3.78	6.64	9.50	12.35	5.70	9.60	14.26	18.48
5'-0"	2.05	3.67	5.21	6.79	3.08	5.44	7.81	10.15	4.09	7.25	10.41	3.55	6.16	10.88	15.62	20.30
5'-6"	2.20	3.98	5.67	7.41	3.31	5.89	8.49	11.05	4.39	7.86	11.32	4.76	6.62	11.78	16.98	22.10
6'-0"	2.35	4.28	6.12	8.01	3.53	6.34	9.17	11.96	4.69	8.46	12.22	15.96	7.06	12.68	18.34	23.92
6'-6"	2.50	4.58	6.58	8.62	3.76	6.79	9.86	12.86	5.00	9.07	13.14	7.17	7.52	13.48	19.71	25.72
7'-0"	2.65	4.88	7.03	9.22	3.99	7.24	10.54	13.76	5.30	9.67	14.05	18.38	7.98	14.28	21.08	27.52
7'-6"	2.81	5.19	7.49	9.83	4.22	7.70	11.20	14.67	5.60	10.28	14.96	19.58	7.43	15.30	22.40	29.34
8'-0"	2.96	5.49	7.94	10.43	4.44	8.16	11.86	15.58	5.90	10.88	15.87	20.78	8.88	16.32	23.72	31.16
8'-6"	3.11	5.80	8.40	11.04	4.67	8.63	12.56	16.48	6.21	11.48	16.77	21.99	9.34	17.25	25.12	32.96
9'-0"	3.26	6.10	8.85	11.65	4.90	9.09	13.26	17.38	6.51	12.08	17.67	23.19	9.80	18.18	26.52	34.76
9'-6"	3.41	6.41	9.31	12.26	5.13	9.54	13.96	18.29	6.81	12.72	18.57	24.39	10.25	19.07	27.92	36.58
10'-0"	3.56	6.71	9.76	12.86	5.35	9.98	14.66	19.20	7.11	13.36	19.47	25.59	10.70	19.96	29.32	38.40
10'-6"	3.74	7.05	10.25	13.50	5.62	10.48	15.39	20.16	7.47	14.03	20.45	26.87	11.24	20.96	30.79	40.32
11'-0"	3.92	7.39	10.74	14.14	5.89	10.98	16.12	21.12	7.83	14.70	21.42	28.15	11.78	21.96	32.26	42.24
11'-6"	4.10	7.73	11.23	14.78	5.13	11.48	16.85	22.08	8.19	15.37	22.39	29.43	12.32	22.96	33.73	44.16
12'-0"	4.28	8.06	11.72	15.43	5.35	11.98	17.59	23.04	8.54	16.04	23.37	30.71	12.85	23.96	35.19	46.08

PROCEDURE USING ANTI-FREEZE SOLUTION

1. Shut off the water supply.

2. Open the drains and vents provided and allow the coils to drain as completely as possible.

3. Isolate the coil or group of coils in order to limit the flushing circuit and decrease the amount of anti-freeze solution required.

4. Complete piping connections to the coil as shown in Figure 3.

5. With throttling valve and drain valves closed, start the solution pump and operate until air is vented from coil.

6. Close air vent and open throttling valve about halfway.

7. Circulate solution about fifteen minutes and then check the glycol solution strength.

8. If the solution is too weak, add anti-freeze solution to bring it up to desired strength and again circulate through the coil for about fifteen minutes.

9. When the concentration of solution returning from the coils is found satisfactory, shut down the pump and drain anti-freeze from the coil.

10. This same solution may be used for flushing additional coils, providing its concentration is maintained.

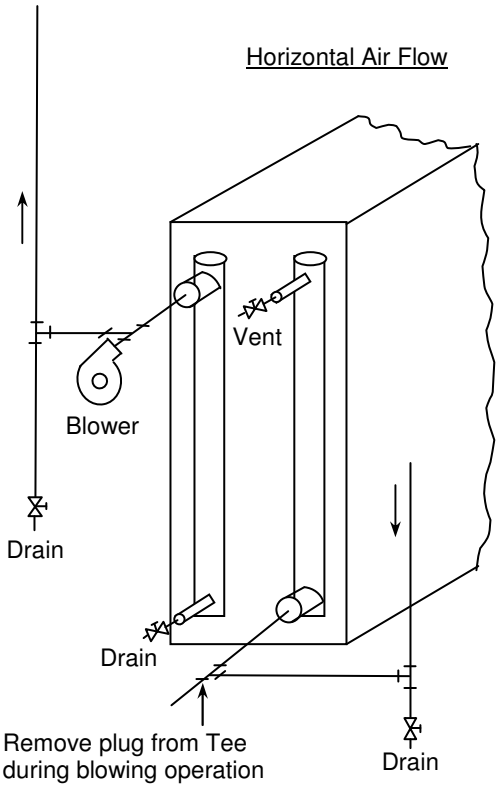

Fig. 1
Horizontal air flow coil
Blower connection

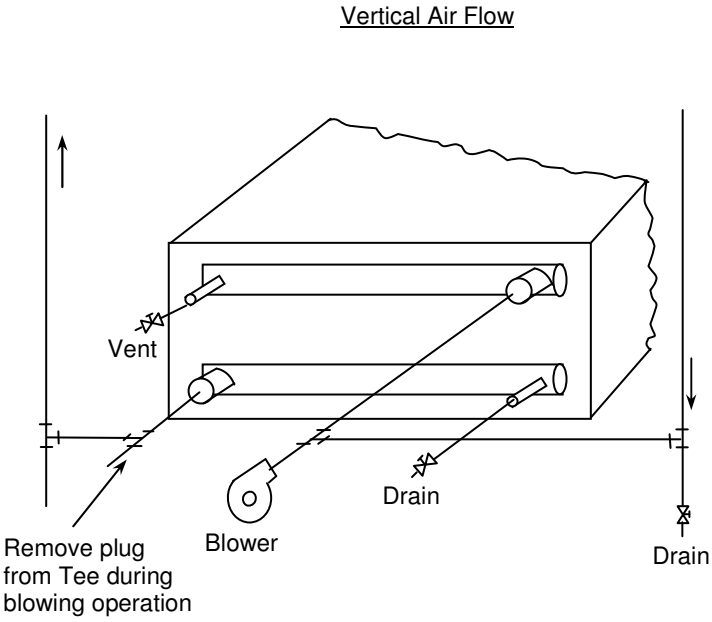

Fig. 2
Vertical air flow coil
Blower connection

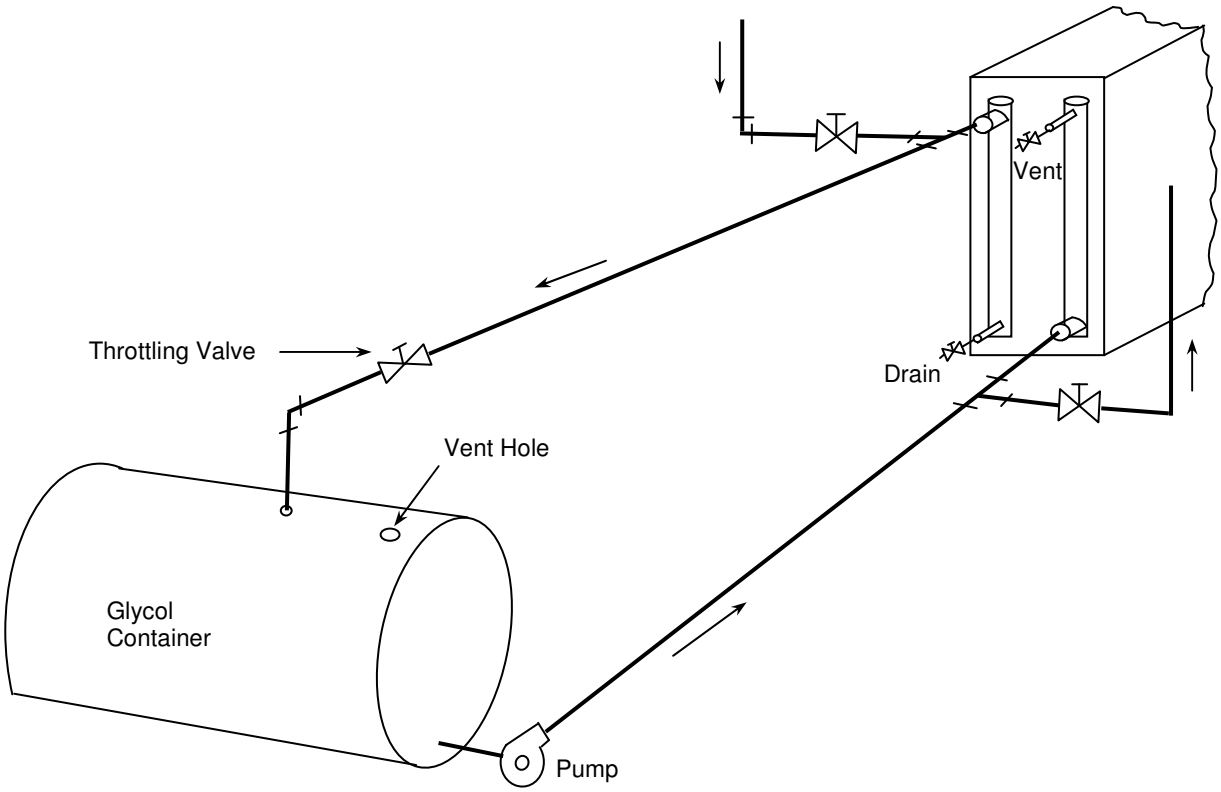

Fig. 3
Piping Schematic for Flushing Coil with Glycol