SINCE 1962

Cooling Tower

LFC-N

FANLESS COOLING TOWER

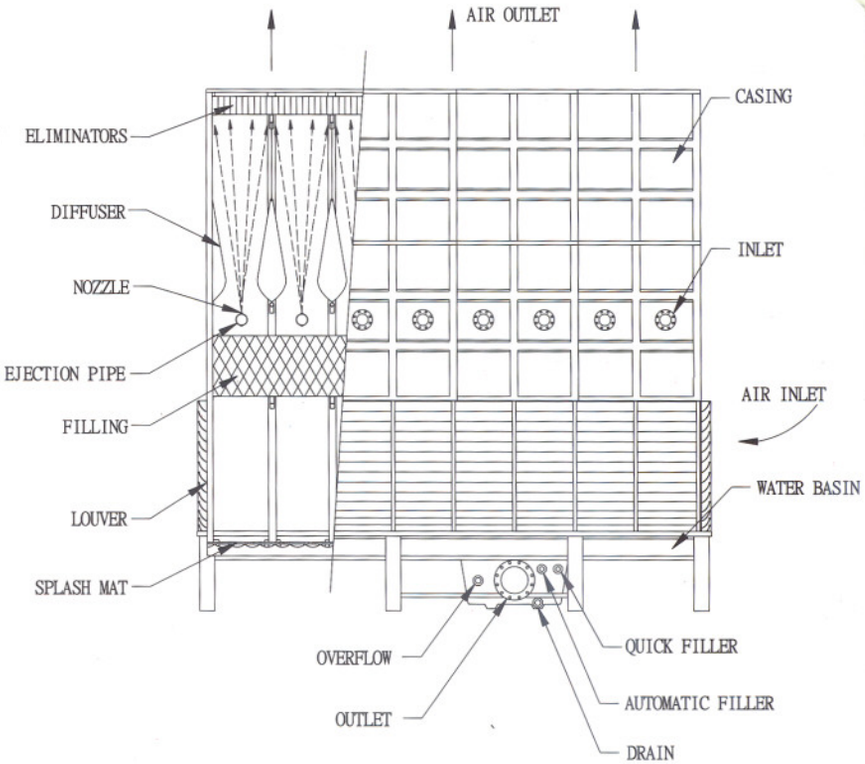


LFC-N FANLESS COOLING TOWER

Theories & Merits

LFC-N is taking advantage of the water pressure of circulation pump forming the water screen through special ejection pipe nozzles; Meanwhile, the pressure differential inside and outside is generated by the flowing speed of water screen and further inhaling the ambient air into the cooling tower.

The effectiveness of cooling down the water is achieved through the precise diffusers that can regulate the ambient air sucked in passing through the filling. Thus, the circulation water is fully in contact with the ambient air during water ejection and falling processes, and the heat can be rejected outside.



The ambient air of fanless cooling tower is naturally entering the cooling tower due to the pressure differential caused by ejection water screen so that there are no mechanical fan drive and transmission equipments. This breakthrough, creative and revolutionary design can, once for all, eliminate the problems of mechanical noises, vibration and maintenance brought by fanned cooling tower. This is the best choice for the pursuits of safety, efficiency, environmental and conveniences.

Products Profile

a. Casings: made of F.R.P. materials that is having fine and weather-proof exterior.
b. Water Basins: inside is light steel that can withstand impact while outside is made of FRP material.
c. Inlet Louver: made of PVC material that is weather-proof and corrosion-resistant. Designed with long arc shape that can regulate the airflow effectively and function the prevention of the drift loss.
d. Splash Mat: made of Nylon that is having fiber-intertwined structure and big gap with good water porosity for reducing the water dripping noises effectively.
e. Fillings: made of vacuum-formed PVC sheet that is having 60mm pitch after being glued and not easy at clogging, and provides good heat rejection with design of tilted contour waves.
f. Diffusers: designed according to fluid dynamic theory and can increase the air exhaust efficiency and water distribution effectively; made of vacuum-formed P.S. that is sturdy after being formed.
g. Ejection Pipe Ass'y: made of protruded Aluminum Alloy that is not easily deformed; the applied ejection nozzles is made from good friction-proof ABS material.
h. Drift Eliminators: applied with five-pass design that can minimize the drift loss and save the water resource effectively; made of weather-proof PP material.

LFC-N

Product Features

- **Operation Vibration Noises**

  The noises of traditional cooling tower are generated by operating fan and motors. The body vibration induced by transmission equipments is reinforcing the noise resonance and can be effectively reduced by installing vibration isolators and channel base. The LFC-N cooling towers are fanless due to different cooling methods so there are no troublesome noises and vibrations.

- **Water Saving and Pollution Free**

  LFC-N fanless technological tower is applying transferring device of high efficient fluid dynamic energy to substitute fan motors. Although increasing pump heads are required due to design requirement, the average total power consumption is equivalent between fanless and fanned towers. The air exhaust system is applying none-reduction design so that the air exhaust velocity can be 60% more lower than fanned one.

  With the use of five-pass drift eliminators, depending on the ejection pressure, the drift loss can be controlled between 0.001% and 0.009% that is lower than fanned towers and truly can save the significant water resource. The specially designed eliminators are used for rendering the slight water volume of drifting drop below 50μm, that is suspending in the air and vanish suddenly without generating second pollution.

- **Low Maintenance Cost**

  This product has no mechanical equipments of Motor, Speed Reducer and transmission unit; i.e. whole tower consists of non-moving parts. Under the normal water quality, except the flow valve assembly, just need to keep the circulation water clean and then there will be no troubles of unexpected shutdown and operation maintenance.

- **Modular Structure**

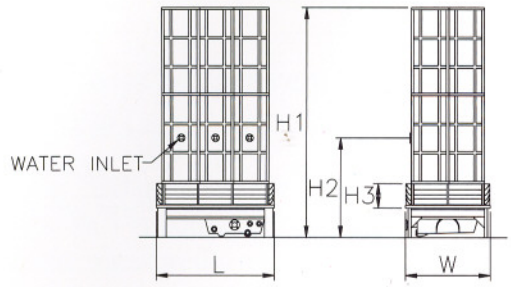
  Whole LFC-N tower is making use of modular design. All components are manufactured with moulds to insure the stable performance and provide the flexible erection arrangement based on site space of end user. Also LFC-N tower can be easily and conveniently dismantled for re-erection or capacity upgrade at will.

  For the factory operation, the modular components can be easily piled up and stored so that the warehouse occupancy is reduced. Convenient and quick inventory check can save the manpower and material preparation.

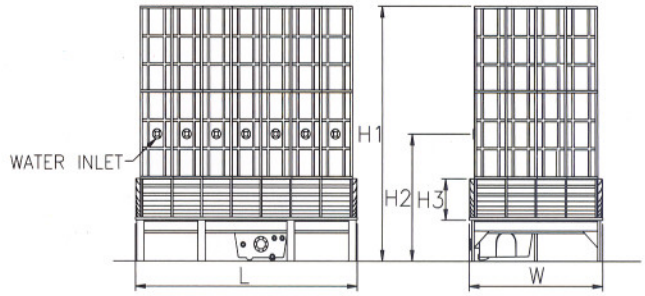
- **Safety, Splendor and Compliance with Environmental Protection**

  The fanless tower body is sturdy and firm, and has no electrical wiring around so that the cooling tower can be randomly positioned without safety concerns. The tower shell color can be changed at will according to environmental background, so splendid and no conflicting. No mechanical noise, dust proof, no drift loss and most of the components can be recyclable for re-use. Thus, this is the product that meets the environmental requirements of 21st century.

DIMENSIONS AND STANDARD SPECIFICATIONS LFC-N



LFC-N-25~40,60(120W)



LFC-N-50,70~225(240W)

Model	Water Flow (LPM)			Dimensions (MM)					Weight (KG)		Water Flow for sizing pump
LFC-N-	37-32-27℃	37-32-28℃	37-32-29℃	L	W	H1	H2	H3	Dry	Operational	LPM
25	325	278	227	1480	1480	4020	1700	380	380	780	325
30	390	333	272	2080	1480	4020	1700	380	500	970	390
40	520	445	363	2080	1480	4020	1700	380	500	970	520
50	650	556	454	1480	2680	4020	1700	380	620	1190	650
60	780	667	545	3280	1480	4020	1700	380	770	1400	780
70	910	778	636	2080	2680	4340	2060	560	850	1770	910
80	1040	889	727	2080	2680	4340	2060	560	850	1770	1040
100	1300	1112	908	2680	2680	4340	2060	560	1000	2090	1300
125	1625	1390	1135	3280	2680	4340	2060	560	1250	2500	1625
150	1950	1668	1362	3880	2680	4520	2240	740	1460	2860	1950
175	2275	1946	1589	4480	2680	4520	2240	740	1660	3230	2275
200	2600	2224	1816	5080	2680	4520	2240	740	1840	3570	2600
225	2925	2502	2043	5680	2680	4520	2240	740	2040	3930	2925
250	3250	2780	2270	3300	5100	5180	2880	1340	2740	4900	3250
300	3900	3335	2724	3900	5100	5180	2880	1340	3110	5610	3900
350	4550	3891	3179	4500	5100	5180	2880	1340	3530	6380	4550
400	5200	4447	3633	5100	5100	5180	2880	1340	3890	7080	5200
450	5850	5003	4087	5700	5100	5180	2880	1340	4270	7810	5850
500	6500	5559	4541	6300	5100	5480	3180	1640	4810	8700	6500
600	7800	6671	5449	7500	5100	5480	3180	1640	5600	10610	7800
700	9100	7783	6357	8700	5100	5480	3180	1640	6400	12100	9100
800	10400	8895	7265	9900	5100	5480	3180	1640	7230	13610	10400
900	11700	10006	8173	11100	5100	5480	3180	1640	7960	15040	11700
1000	13000	11118	9081	12300	5100	5480	3180	1640	8760	16520	13000

a) Above cooling water flow rate listed is the circulation water flow rate of condenser or heat exchanger; inlet /outlet water temperature : 37℃/32℃

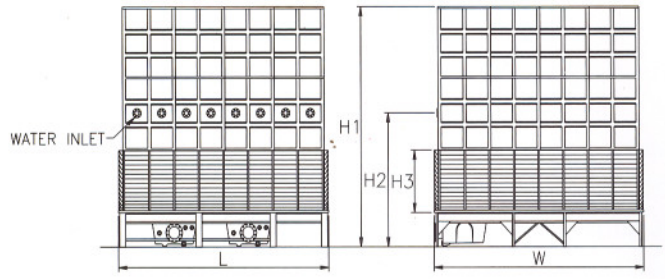
b)Please base on above list of water flow rate of sizing pump for deciding the water flow rate of pump.

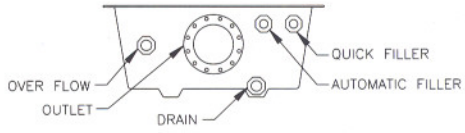
c) The total pump head for sizing pump is based on the resistance loss of piping and condenser, and also the list of above tower head.

d) The Y shape filters should be installed on hot water inlet and the diameter of filtering mesh hole should be smaller than 3mm.

e) The foundation should be leveled during construction.

LFC-N





LFC-N-250~1000(480W)

Model	Tower Head for sizing pump (M)			Hot Water Inlet (Size of Ejection Pipe)			Cold Water Outlet	Drain pipe	Overflow pipe	Auto Makeup	Manual Makeup
LFC-N	WB=27℃	WB=28℃	WB=29℃	Type	Dia.	Q'ty					
25	14	15	16	120W	2B	2	2B(50A)x1	1B(25A)x1	2B(50A)x1	3/4B(20A)x1	3/4B(20A)x1
30	14	15	16	120W	2B	3	2 1/2B(65A)×1	1B(25A)x1	2B(50A)x1	3/4B(20A)x1	3/4B(20A)x1
40	14	15	16	120W	2B	3	2 1/2B(65A)×1	1B(25A)x1	2B(50A)x1	3/4B(20A)x1	3/4B(20A)x1
50	15	16	17	240W	3B	2	3B(80A)x1	1B(25A)x1	2B(50A)x1	3/4B(20A)x1	3/4B(20A)x1
60	14	15	16	120W	2B	5	4B(100A)x1	1B(25A)x1	2B(50A)x1	3/4B(20A)x1	3/4B(20A)x1
70	16	17	18	240W	3B	3	4B(100A)x1	1 1/2B(40A)x1	2B(50A)x1	1B(25A)x1	1B(25A)x1
80	16	17	18	240W	3B	3	4B(100A)x1	1 1/2B(40A)x1	2B(50A)x1	1B(25A)x1	1B(25A)x1
100	16	17	18	240W	3B	4	4B(100A)x1	1 1/2B(40A)x1	2B(50A)x1	1B(25A)x1	1B(25A)x1
125	16	17	18	240W	3B	5	5B(125A)x1	1 1/2B(40A)x1	2B(50A)x1	1B(25A)x1	1B(25A)x1
150	16	17	18	240W	3B	6	5B(125A)x1	1 1/2B(40A)x1	2B(50A)x1	1B(25A)x1	1B(25A)x1
175	16	17	18	240W	3B	7	6B(150A)x1	1 1/2B(40A)x1	2B(50A)x1	1B(25A)x1	1B(25A)x1
200	16	17	18	240W	3B	8	6B(150A)x1	1 1/2B(40A)x1	2B(50A)x1	1B(25A)x1	1B(25A)x1
225	16	17	18	240W	3B	9	6B(150A)x1	1 1/2B(40A)x1	2B(50A)x1	1B(25A)x1	1B(25A)x1
250	17	18	19	480W	4B	5	8B(200A)x1	2B(50A)x1	2B(50A)x1	1 1/4B(32A)x1	1 1/4B(32A)x1
300	17	18	19	480W	4B	6	8B(200A)x1	2B(50A)x1	2B(50A)x1	1 1/4B(32A)x1	1 1/4B(32A)x1
350	17	18	19	480W	4B	7	8B(200A)x1	2B(50A)x1	2B(50A)x1	1 1/4B(32A)x1	1 1/4B(32A)x1
400	17	18	19	480W	4B	8	8B(200A)x2	2B(50A)x2	2B(50A)x2	1 1/4B(32A)x2	1 1/4B(32A)x2
450	17	18	19	480W	4B	9	8B(200A)x2	2B(50A)x2	2B(50A)x2	1 1/4B(32A)x2	1 1/4B(32A)x2
500	18	19	20	480W	4B	10	8B(200A)x2	2B(50A)x2	2B(50A)x2	1 1/4B(32A)x2	1 1/4B(32A)x2
600	18	19	20	480W	4B	12	8B(200A)x2	2B(50A)x2	2B(50A)x2	1 1/4B(32A)x2	1 1/4B(32A)x2
700	18	19	20	480W	4B	14	8B(200A)x2	2B(50A)x2	2B(50A)x2	1 1/4B(32A)x2	1 1/4B(32A)x2
800	18	19	20	480W	4B	16	8B(200A)x3	2B(50A)x3	2B(50A)x3	1 1/4B(32A)x3	1 1/4B(32A)x3
900	18	19	20	480W	4B	18	8B(200A)x3	2B(50A)x3	2B(50A)x3	1 1/4B(32A)x3	1 1/4B(32A)x3
1000	18	19	20	480W	4B	20	8B(200A)x3	2B(50A)x3	2B(50A)x3	1 1/4B(32A)x3	1 1/4B(32A)x3

f) Manual makeup of 1 /4B(32A) shall go with the external connecting nozzle of 1 1/2B(40A)

g) Pressure gauge shall be installed on the inlet pipe of each cell to detect if the pump head of ejection pipe is sufficient or not; according to various design wet bulb temp.(D.W.B.) the pump head values are required as below:

1. If DWB is at 27℃, the ejection pipe pump head of 120W type is 12M, that of 240W type is 13M and 480W type is 14M。
2. If DWB is at 28℃, the ejection pipe pump head of 120W type is 13M, that of 240W type is 14M and 480W type is 15M。
3. If DWB is at 29℃,the ejection pipe pump head of 120W type is 14M, that of 240W type is 15M and 480W type is 16M。

h). The data of above table are subject to change without prior notice due to frequent technical upgrades

Method of Noise Measurement & Noise Table

a) The 45 deg. distance S at the measuring point 4 is equivalent to the width of tower measured from the top edge of cooling tower. If the equipment width is less than 1.5m, the distance is still considered 1.5m.

b)The ?accuracy of noises measured is not interfered by ambient environments (such as background noise)

c)Unit of sound level is dB(A) in which "A" stands for the measured values on A **location ?**on noise gauge.

e) Dynamic Characteristic: In principle, fast char. is applied for the selection of dynamic char. on noises gauge.

f) According to the noise control standards of Environmental Protection Administration, Executive Yuan. The update of background sound volume: All sound volumes, except the sound source to be measured, are considered background sound volume. The background sound volume at measuring site better be different from sound source for over 10dB(A) and if not, it should be rectified based on the table below.

UNIT: dB(A)

Model	Measuring Points							
LFC-N-	1	1'	2	2'	3	3'	4	S
25	58	58	54.5	54	51	51	60	1.5
30	58	59	54.5	55.5	51	51	60	1.5
40	58	59	54.5	55.5	51	51	60	1.5
50	60	59	56	55.5	51	51	61	2.4
60	58.5	59	54.5	55.5	51	52	60	1.5
70	60.5	60	56	55.5	52	53	62	2.4
80	60.5	60	56	55.5	52	53	62	2.4
100	61	61	56	56	53	53	62	2.4
125	61	61.5	56	56.5	53	53	63	2.4
150	61	61.5	56	57	53	54	63	2.4
175	61	62	56.5	57	53	54	64	2.4
200	61	63	56.5	57	53	54	64	2.4
225	61	63	56.5	57	53	54	64	2.4
250	63	62.5	57.5	57.5	55	55	64	4.8
300	63	62.5	57.5	57.5	55	55	64	4.8
350	63	63	57.5	57.5	55	55	65	4.8
400	63	63	57.5	57.5	55	55	65	4.8
450	63	64	57.5	58	55	56	65	4.8
500	63	64.5	58	59	56	56.5	65	4.8
600	63	65	58	59	56	56.5	65	4.8
700	63	65.5	58	59	56	57	65	4.8
800	63	66	58	59	56	57	66	4.8
900	63	66.5	58	60	56.5	57.5	66	4.8
1000	63	66.5	58	60	56.5	57.5	66	4.8

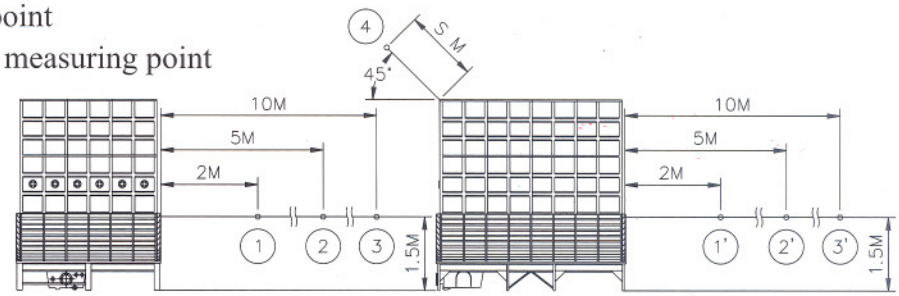
The permitted tolerance of noise values listed is within ±3dB(A)

Tolerance table for background sound volume：

L1-L2	3	4	5	6	7	8	9
Tolerance values	-3	-2		-1			

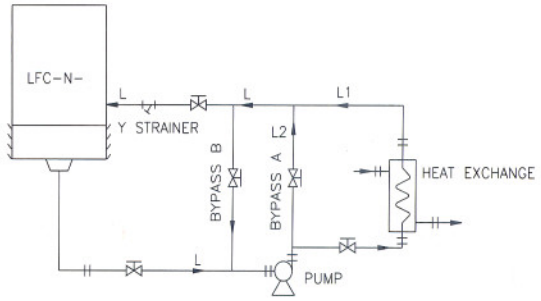
＊L1：sound volume at measuring point

＊L2：background sound volume at measuring point



Circulation Pump Sizing

1. Fanless technology tower is using nozzles to spray upwards the circulation water. The sprayed hot water is mixed with air becoming air-water compounds to enter diffusers. Then, the air and liquid will be separated by drift eliminators allowing the circulation water to fall into the water basin for completion of heat exchange.
2. To keep the ratio of air-water compounds mixed by the sprayed-up hot water and air, the circulation water of cooling tower should be constant to insure the best conditions of cooling tower. In other words, the minimum circulation water flow rate should be remained at 13LPM per RT
3. The water flow rate of air conditioning system is the condenser's RT by 13LPM or 3GPM because the selection of cooling tower should also consider the fluctuation of Wet Bulb Temperature.
   When the design Wet Bulb Temp. is blow 27℃, the selection of cooling tower's RT will be lower than condenser's RT. Thus, cooling tower water flow rate will be condenser's RT by 13LPM or 3GPM.
   When the design Wet Bulb Temp. is above 27℃, the selection of cooling tower's RT will be larger than condenser's RT. Thus, the cooling tower water flow rate will be cooling tower's RT by 13LPM.
   Abovementioned are based on the design hot water temp. at 37℃ and cold water temp. at 32℃.
4. Based on above essential points please refer to the following two methods for deciding the water flow rate of circulation pump:
   (a) The water flow rate of circulation pump is condenser's RT by 13LPM when the design Wet Bulb Temperature is lower than 27℃.
   (b) The water flow rate of circulation pump is cooling tower's RT by 13LPM when Design Wet Bulb Temperature is larger than 27℃. In this case, the water flow rate needed for condenser or heat exchanger will be lower than that of circulation pump. Please install bypass pipe A for extra water flow rate that will be led into cooling tower by this bypass. (as illustrated by the arrangement of circulation water pipes below)



THE ARRANGEMENT OF CIRCULATION WATER PIPES

5. The function for the arrangement of the bypass pipes:
   (1) The purpose for the arrangement of bypass pipe A is to increase the water flow rate entering cooling tower.
   (2) The purpose for the arrangement of bypass pipe B is to decrease the water flow rate entering cooling tower. This is to lower the application pressure to avoid that cold water temperature is too low.
6. Assuming that there is a 200RT condenser with outlet temperature at 37℃, inlet temperature at 32℃ and Wet Bulb temperature at 28℃, (a) What is the size of cooling tower ? (b) What is the water flow rate for circulation pump and bypass pipe water flow? (c) What is the tower head for sizing the circulation pump?
   Answer:
   (1) Condenser's water flow rate is 2600LPM (=200 x 3) and the cooling tower selected is LFC-N-250.
   (2) The water flow rate for circulation pump is 3250LPM(=250 x 13). The bypass water flow rate is 650LPM (L-L1 = 3250 – 2600 = L2)
   (3) Cooling Tower Pump Head is 18M.

7. Assuming that there is a 300RT condenser with outlet temperature at 37℃, inlet temperature at 32℃ and Wet Bulb temperature at 29℃, (a)What is the size of cooling tower ? (b) What is the water flow rate for circulation pump and bypass pipe water flow? (c) What is the tower head for deciding circulation pump?

   Answer:

   (4) Condenser's water flow rate is 3900LPM (=300 x 13) and the cooling tower selected is LFC-N-450.

   (5) The water flow rate for circulation pump is 5850LPM (=450 x 13). The bypass water flow rate is 1950LPM (L-L1 = 5850 – 3900 = L2)

   (6) Cooling Tower Pump Head is 19M.

5. The Fanless technology cooling tower is making use of constant cooling tower water flow that is ejected by fixed number of spray nozzles for creating the constant sprayed water pressure and then forming the pressure differential inside and outside the tower that brings the cold air into the cooling tower to cool the circulation water.

   Thus, the water flow rate entering the cooling tower should be kept constant (and will not be affected by design wet bulb) and the layout of circulation water pipes has to be completed based on above illustration to maintain the thermal performance of cooling tower.

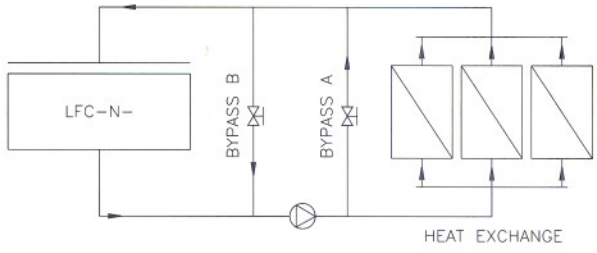
Layout Example

1. Multi-condensers are in operation with single cooling tower with one circulation pump.

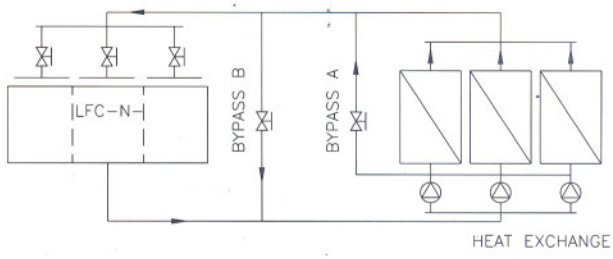
   If the condenser is not in operation and the cooling water is also not circulating, then

   the flow control vale of bypass pipe A should be properly opened to keep cooling tower circulation

   water and pump head unchanged to make sure that the thermal performance of cooling tower will not decrease.



2. Multi-condensers are in operation with single cooling tower with multi-circulation pumps. In this case, the water header will be applied for separating the cooling tower so that all condensers can be independently operating through the control valves.



   If flow control valves are all open with single pump operation, it is possible that the water flow rate and pump head decrease so that the cooling tower thermal performance is insufficient.(as illustrated in the drawing below)

LFC-N COMPARISONS BETWEEN FANLESS AND FANNED COOLING TOWERS

LFC-N type technology cooling tower is the hi-tech patented products. The Patent Status is as below:

Item \ Type	LFC-N fanless cooling tower	Fanned cooling tower
Silent Design	Without fan motor, reducer and moving parts and noise level is lower than super low noise type of cooling tower.	With fan motor, reducer, and mechanical transmission; higher noise and vibration.
Cooling method	The dynamically sprayed cooling water is applied for exhausting the air so that mechanical driving forces are not requited.	Fan, motor and reducer are applied for cooling and air exhausting.
Vibration isolation	Vibration free so that vibration isolators are not needed.	High vibration during operation. Vibration isolators are needed.
Drift Loss and Dust Proof	Five-pass type eliminators on the top of tower is for splitting air and water; besides dust proof, the drift loss is kept between 0.001% and 0.009% (depending on ejection pressure). Its Drift loss is 90% less than traditional tower so that the contagion of Legionnaire Symptom can be decreased.	There is no eliminators on the tower roof so that dusts can enter easily. The reducing type air outlet brings larger exhausting air so that the drift loss is high and the second pollution can be caused easier.
Structure	Modular design is applied to insure stable performance. Air conditioning towers are using FRP casings and HDGS structure for resisting corrosion and erosions in a long run and can endure. Also, it can go with integral building plan for tidiness and beauty.	Made of FRP and none modular design.
Power consumption	Fan is not needed but higher pump head is required. The total power consumption is equivalent to traditional tower.	Fan is needed and the total pump head is lower.
Operation and Maintenance cost	Whole tower are of non-moving parts that are anti-corrosive material so there are no consumable parts. Thus, the maintenance costs are low.	Whole tower is using mechanical transmission with components of electrical motor so there are consumable parts. Thus, the maintenance cost is high.

(1) Republic Of China, Taiwan: Patent No. 117483
(2) Mainland China: Patent No. 95238193.1
(3) United Stated of America: Patent No. 5639286

The patent registrations in other countries are still under processing.

SINCE 1962

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