Operation control function by the outdoor unit control

Determination of compressor speed (frequency)

1) Maximum and minimum frequency under normal operating conditions

(rps)

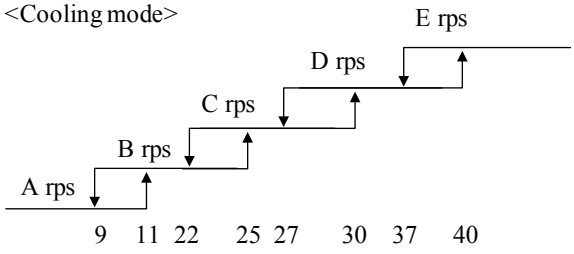
Model	FDCW60VNX-W	
Operation mode	Cooling	Heating
Maximum frequency	106	110
Mimimum frequency	12	12

2) Maximum required frequency under high outdoor air temperature condition
Maximum required frequency is limited according to the outdoor air temperature (Tho-A)

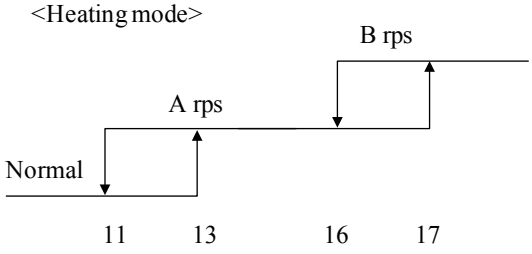
(rps)

Model		FDCW60VNX-W
Cooling mode	A rps	60
	B rps	75
	C rps	90
	D rps	Please see 3)
	E rps	95
Heating mode	A rps	90
	B rps	75

<Cooling mode>



<Heating mode>



3) Maximum frequency under high condensing saturated temperature (CST or Thi-L whichever higher) in heating mode.
Maximum frequency is limited according to the condensing saturated temperature.

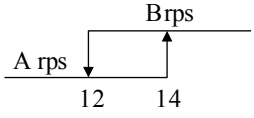
(rps)

Model		FDCW60VNX-W
Cooling mode	Outdoor air temperature	27℃ <Tho-A ≦ 40℃
	A rps	95
	B rps	-

(rps)

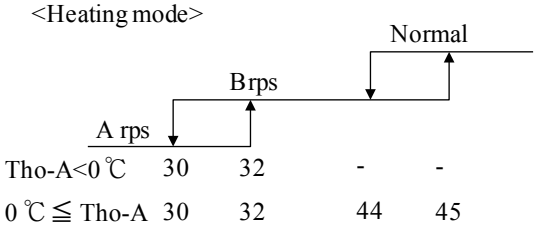
Model		FDCW60VNX-W	
Heating mode	Outdoor air temperature	Tho-A<0℃	0℃ ≦ Tho-A
	A rps	95	90
	B rps	Normal	100

<Cooling mode>



CST or Thi-L whichever higher

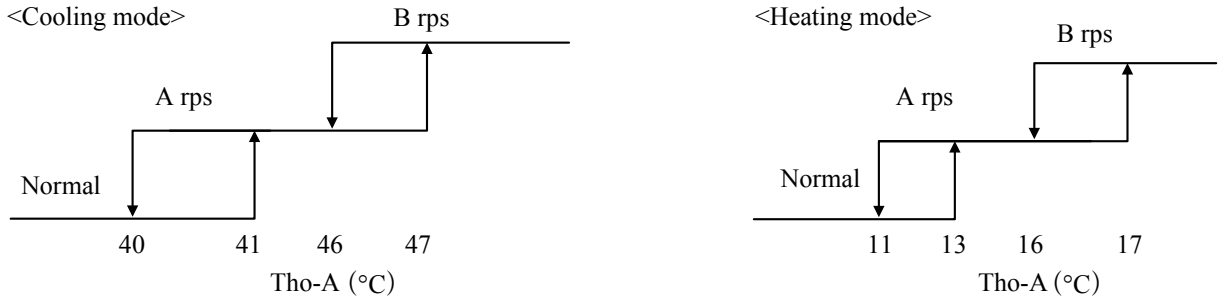
<Heating mode>



CST or Thi-L whichever higher

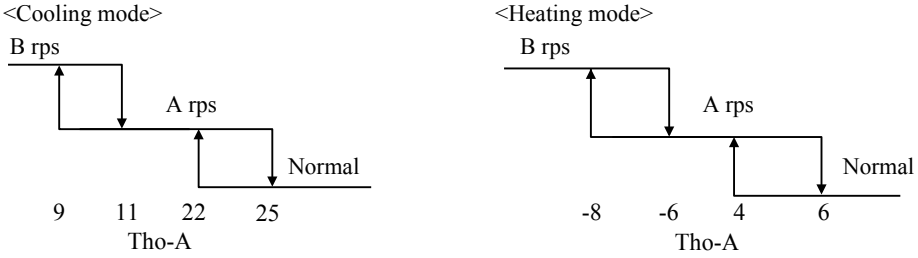
4) Minimum required frequency under high ambient temperature condition.
According to the outdoor air temperature (Tho-A) , minimum required frequency in cooling mode is changed as per A or B in below table.

Model		FDCW60VNX-W
Cooling mode	A rps	30
	B rps	40
Heating mode	A rps	30
	B rps	40



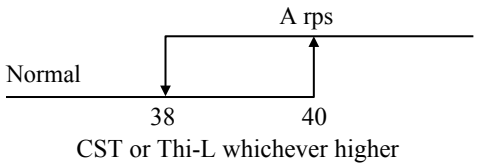
5) Minimum required frequency adjustment under low ambient temperature (Tho-A) condition
According to the outdoor air temperature, minimum required frequency is offset by as per below table.

Model		FDCW60VNX-W
Cooling mode	A rps	-
	B rps	45
Heating mode	A rps	35
	B rps	45



6) Minimum required frequency under high condensing saturated temperature (CST or Thi-L whichever higher) in heating mode.

Model		FDCW60VNX-W
Heating mode	A rps	41



7) When any of the controls from 1) - 6) above may duplicate, whichever the smallest value among duplicated controls is taken as the maximum required frequency, and whichever the biggest value is taken as the minimum required frequency.

Compressor start control

1) Compressor starts upon receipt of the thermostat ON signal from the indoor unit
2) However, at initial start-up after turning the power circuit breaker on, the compressor may enter the standby state for maximum 30 minutes in order to prevent from dry-up of oil in the compressor.

Compressor soft start control

1) The pattern 1

Normally, the outdoor unit starts a compressor with this control except the condition mentioned in (2) pattern 2.

- Firstly, compressor starts at 10rps up to the target speed "30rps", and it is acceralated by 5rps/s.
- Compressor acceleration
- The compressor upper limit speed is limited at "A", "B", and "C" rps for "T minutes after compressor starts" respectively.

			Duration from the starting compressor T (min)			
			T ≦ 5min	T ≦ 7min	T ≦ 9min	T ＞ 9min
			A rps	B rps	C rps	
FDCW60VNX-W	Cooling mode		120	120	120	-
	Heating mode	Tho-A ≧ 0℃	48	120	120	-
		Tho-A ＜ 0℃	48	56	75	-

“When the value in this table is higher than the global highest (Nmaxo) value,
it follows the global highest value.”
In case the pattern 1 condition and the pattern 3 condition are fulfilled at the same time, pattern 3 start-up will be done.

2) The pattern 2

① Control condition

Operation mode is “Heating” and all below condition a) and b) are fullfilled.
But any of 1) ~3) conditions is fulfilled, pattern 1 start-up will be done.

1) Operation mode is changed from “stop” to “Heating”
2) Restarting compressor after Defrost operation.
3) Restart from “Forced-Stop”

a) “Compressor Command” is turned from “OFF” to “ON”
b) When “Compressor commnad” is turned “ON”, Tho-A is less than 10 degree C.

				Duration from the starting compressor T (min)		
				T ≦ 1min	T ≦ 5min	T ≦ 5min
				A rps	B rps	C rps
FDCW60VNX-W	Heating mode	TAi<35℃	Tho-A ≧ -5℃	40	32	-
			Tho-A ＜ -5℃	45	32	-
		TAi>35℃	-	48	48	-

※ TAi; Inlet water temperature

3) The pattern 3

① Control condition

In case all of the following conditions are fulfilled when the operation mode is not "Stop"

i) Inverter command changes from "STOP" to "RUN".
ii) Target compressor speed is less than A rps.

② Control contents

Compressor lower speed limit is limited at Arps for "a" minites.

	Mode	A rps	a min
FDCW60VNX-W	Cooling	40	3
	Heating	41	3

If the operation is duplicate the pattern 2 and the pattern 3, the pattern 2 execution is priority.

Outdoor fan control

1) Relations between Fan speeds and revolutions

			Fan speed (rpm)							
			1st	2nd	3rd	4th	5th	6th	7th	8th
FDCW60VNX-W	Revolutions	Cooling	150	225	485	520	570	685	740	850
		Heating	150	225	485	520	570	685	800	850

2) Control of fan motor speed

(a) Starting fanmotor speed is fixed by the fanmotor speed excepted below case (i)

(i) Operation mode is "cooling" and Tho-A ＜ 22℃

	Fan speed	Control duration
11℃ ≦ Tho-A ＜ 22℃	2nd	30second after "Compressor ON"
Tho-A ＜ 11℃	1st	30second after "Compressor ON"

If Tho-A changed the condition during 30second, Fan speed does not change.

(ii) Other than case (i)

Follow the table (2).(b)

(b) Control of the fan motor speed in normal mode

		Fan speed (rpm)								
		OFF	1st	2nd	3rd	4th	5th	6th	7th	8th
Compreassor speed (rps)	Cooling	0	-	-	-	0-22	22-30	30-58	58-80	80-
	Heating	0	-	-	-	0-30	30-38	38-78	78-90	90-

※ Fan motor speed down actually delays 60 second from the time that the each change command occurs.
Once the increase command is active even if it is within the above 60 seconds,the fan speed is increased promptly.

※※ When fan motor speed command "OFF" is active, fan motor speed is controlled 0 rpm promptly without delay.

3) Stop fanspeed control.

Fan stop control shows as follows.

① Fan motor stops after fan 6th speed is operated T minutes.

	T (minutes)
Cooling	1min
Heating	1min

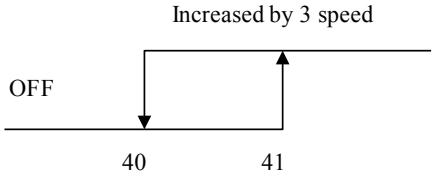
4) Fan speed control during cooling operation

a) Ambient air temperature (Tho-A) is below 25℃ .

Fan motor speed operates theUp-Down control according to heat exchanger temperature (Tho-R).

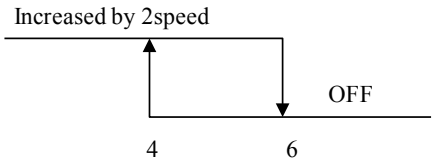
Tho-R	Fan speed
Tho-R ≦ 21℃	Decreased by 1 speed
21℃ <Tho-R ≦ 38℃	Retained
38℃ <Tho-R	Increased by 1speed

b) Ambient air temperature (Tho-A) is above 41℃ .
Fan motor speed operates the Up control according to ambient air temperature (Tho-A).



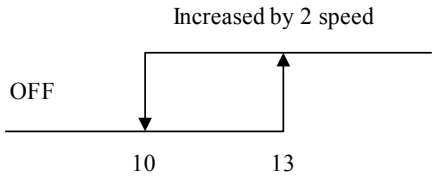
Ambient air temperature Tho-A(℃)

5) Fan speed control during normal heating operation
a) Ambient air temperature (Tho-A) is below 4℃ .
Fan motor speed operates the Up control according to ambient air temperature (Tho-A).



Ambient air temperature Tho-A(℃)

b) Heat exchanger temperature (Tho-R) is above 13℃ .
Fan motor speed operates the Down control according to heat exchanger temperature (Tho-R).



Ambient air temperature Tho-A(℃)

Silent mode

When outdoor unit receives silent mode signal from indoor unit, silent mode operation starts.

[Control contents]

a) Fan speed upper limits are restricted according to the following table.

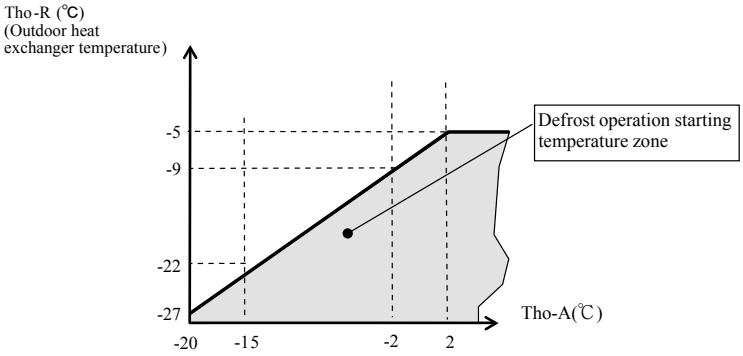
Model	Operation mode	Max speed (rpm)
FDCW60VNX-W	Heating / Cooling	570

∗ Compressor speed limits are also restricted by indoor unit control command.

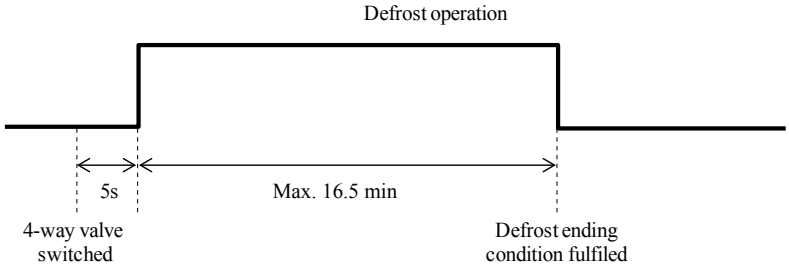
∗ In case of some conditions which enter protection control, the restriction of silent mode is cancelled.

Defrost operation

1) Defrost starting conditions
Defrost operation can be started only when all of the following condition are satisfied.
a) After start of heat operation
When it elapsed 35 minutes.(Accumulated compressor operating time)
b) After end of defrost operation
When it elapsed 35 minutes.(Accumulated compressor operation time)
c) Outdoor heat exchanger sensor (Tho-R) temperature
When the temperature has been below -5 ℃ for 3 minutes continuously.
d) The difference between the outdoor air temperature sensor and the outdoor heat exchanger temperature sensor (Tho-A - Tho-R) fulfils the following condition.
・ Tho-A - Tho-R ≧ 7℃

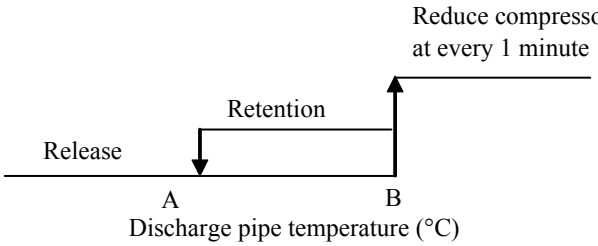


2) Defrost ending conditions
Defrost ending condition is fullfiled when either one of the following is satisfied.
a) Outdoor heat exchanger temperature sensor (Tho-R):10℃ or higher
b) Control operation time of defrost operation→When 16 minutes 35 seconds has passed since 4-way valve is switched.



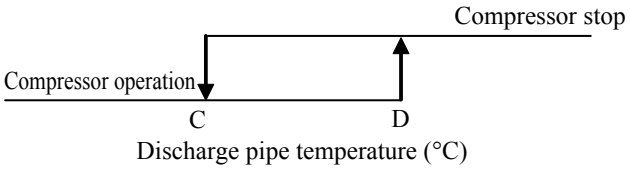
Protective control/ anomalous stop control by compressor speed (frequency)

1) Compressor discharge pipe temperature protection
   a) Protective control
   If the discharge pipe temperature (detected with Tho-D) exceed the setting value, the compressor speed (frequency) is controlled in order to suppress the rise of discharge pipe temperature.



Model	A℃	B℃
FDCW60VNX-W	95	105

   b) Anomalous stop control
      i) If the discharge pipe temperature (detected with Tho-D) exceed the setting value, the compressor stops.
      ii) When the discharge pipe temperature anomaly is detected 2 times within 60 minutes or 60 minutes continuously including the time of compressor stopping, discharge pipe temperature error is displayed and E36 is recorded in Error Log and it enters the anomalous stop mode.



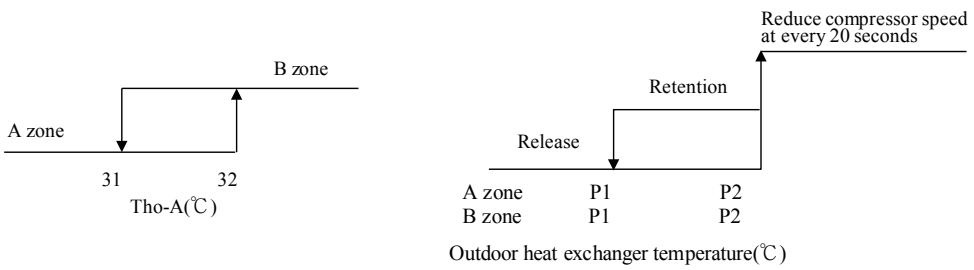
Model	C℃	D℃
FDCW60VNX-W	95	115

   c) Reset of anomalous stop mode
   When the discharge pipe temperature drops to the reset value of E°C or lower for F minutes continuously, it becomes possible to restart from control.

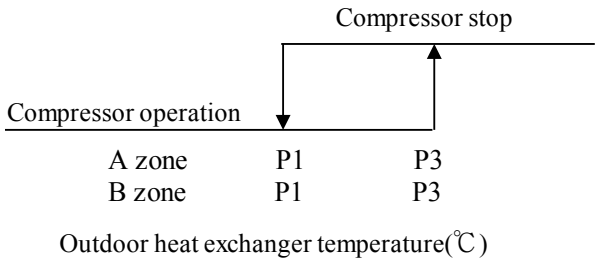
Model	FDCW60VNX-W
E ℃	95
F minutes	Immediately

2) Cooling high pressure protection
   a) Protective control
      i) When the outdoor heat exchanger temperature (Tho-R) exceeds setting value that be changed by outdoor air temperature,the compressor speed (frequency) is controlled in order to suppress the rise of high pressure.

Model		FDCW60VNX-W	
		A zone	B zone
Cooling mode	P1	51	53
	P2	53	58
	P3	56	63

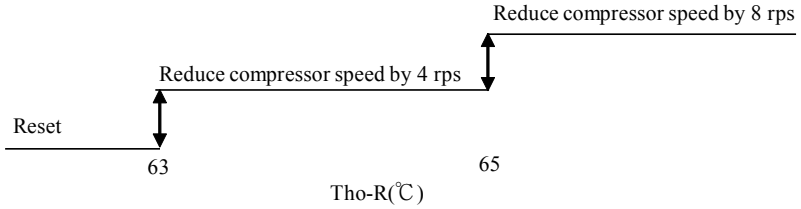


b) Anomalous stop control
   i) If the outdoor heat exchanger temperature (Tho-R) exceeds the setting value, the compressor stop.
   ii) Whe n the outdoor heat exchanger temperature anomaly is detected 5times within 60 minutes, or 60 minutes continuously including the time of compressor stopping, coolinf overload error is displayed and E35 is recorded in the Error Log and it enters the anomalous stop mode.



c) Reset of anomalous stop mode
   When the outdoor heat exchanger temperature drops to the reset value P3 ℃ or lower, it becomes possible to restart from the control.

3) Heating high pressure protection
   a) Protective control
   If the liquid line temperature of water heat exchanger (BT15=Thi-L) or the condensing saturated temperature (CST), whichever the higher.
   Exceeds the setting value, the compressor speed (frequency) is controlled at every 10 seconds to suppress the rise of high pressure.



4) Overcurrent protection

When the inverter primary current (CT current) reaches following value, the compressor speed is reduced until it gets to the cancellation value.

Operation mode	Current (A)
Cooling	11.5
Heating	13.5

5) Anomalous power transistor current

a) If the current value of power transistor exceeds the setting value, the compressor stops in order to prevent from overcurrent of inverter.

6) Anti-freeze control by the compressor frequency control

It depends on the command from indoor unit.

7) Broken wire detection on temperature sensor and low pressure sensor

a) Outdoor heat exchanger temperature sensor, outdoor air temperature sensor

If the following is detected for 5 seconds continuously within 2 minutes to 2 minutes 20 seconds after the compressor ON, the compressor stops. After a delay of 3 minutes, the compressor restarts but if the same anomaly is detected repeatedly 3 times within 40 minutes, the compressor stops with the anomalous stop mode.

・Outdoor heat exchanger temperature sensor (Tho-R): -50°C or lower

・Outdoor air temperature sensor (Tho-A): -30°C or lower

Note : During defrost operation and for 3 minutes after the end of defrost operation, this control is not performed.

b) Discharge pipe temperature sensor

If the following is detected for 5 seconds continuously within 10 minutes to 10 minutes 20 seconds after the compressor ON, the compressor stops. After a delay of 3 minutes, the compressor restarts but if the same anomaly is detected repeatedly 3 times within 40 minutes, the compressor stops with the anomalous stop mode.

・Discharge pipe temperature sensor (Tho-D): -10°C or lower

Note : During defrost operation and for 3 minutes after the end of defrost operation, this control is not performed.

8) Fan motor error

a) If the outdoor fan speed is detected A rpm or lower for 30 seconds continuously under the outdoor fan control mode, the compressor stops.

b) When the outdoor fan speed drops to A rpm or lower 3 times and the compressor stops, Fan alarm is displayed and E48 is recorded in the Error Log.

Model	FDCW60VNX-W
A rpm	75

9) Anomalous stop by the compressor start/stop

a) When it fails to shift to the rotor position detection operation of compressor DC motor during 5 seconds after establishing the compressor start condition, the compressor stops temporarily and restarts 3 minutes later.

Pump-down control

It is possible to recover the refrigerant on the piping into the outdoor unit by this function.

Pump down operation can only be started when operation mode is set to addition heat only on menu 4.2. When this operating mode is activated pump down is available on service menu 5.11.

Menu number	Setting	Alternatives	Default	Other
5.11.X.1	Pump down	Yes/No	No	Menu only displayed in “Addition heat only” mode
5.11.X.2	Start pump down	Yes/No	No	Activates compressor operation. Above menu has to set “Yes” to display this menu.

Once the function has been activated:

- Compressor starts cooling operation with 2 minutes delay time.
- Target compressor speed will be 56 rps.
- Circulation pump runs at 100% when compressor starts.

Pump down stops automatically when one of the following conditions is fulfilled:

- Pressure at BP4 gets lower more than 0.087MPa for more than 5 seconds.
- More than 5 minutes have passed.
- An alarm stops the compressor operation.

When pump down is stopped:

- Circulation pump runs at it normal operation.
- Pump down changes to “No”.
- Start pump down changes to “No”.