

DVMS Training

Advance Service & Troubleshooting

Part I

Rev 2.1



DVM S Advance Service & Troubleshooting

Due to Samsung's policy of ongoing product development, specifications are subject to change without prior notice. Every effort has been made to insure that the information included in this presentation is as accurate as possible at the time of its publication.

This presentation is provided as a guide to help HVAC field technicians understand the most common service and diagnostic procedures for the Samsung DVMS VRF systems. This training module is not intended to replace Samsung service manuals, technical data books, installation/operation manuals or other factory documents.

Only properly trained, HVAC professionals should attempt to install and service any Samsung heating and air-conditioning system.

High Voltage Caution:

Extra care must be taken when working on or around DVM S equipment due to numerous high voltage components. Whether installing or servicing DVM S equipment in the field or while attending Samsung HVAC training classes which include powered simulators and equipment, be aware of the potential dangers of high voltage – use caution

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For technical support issues, always contact your Samsung equipment provider.

www.samsunghvac.com www.dvmdownload.com

Advance Service & Troubleshooting

TOPICS

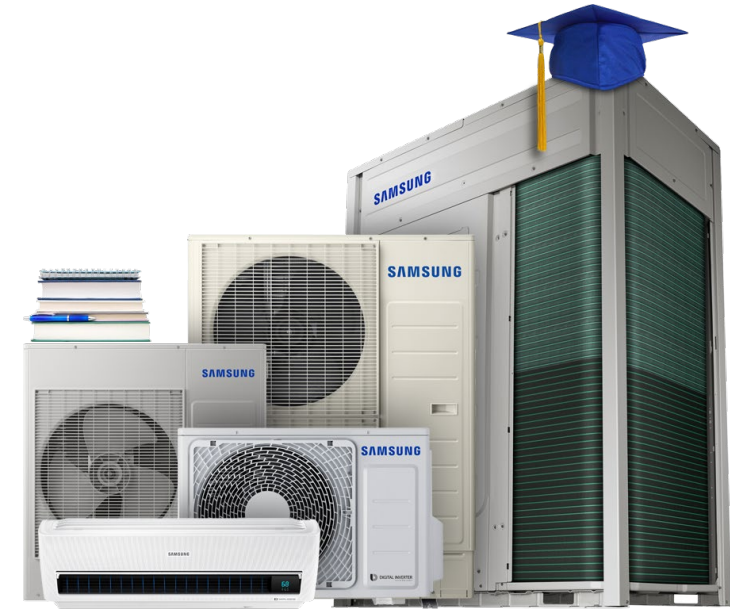
- Basic System Operation
- Heat Pump Introduction
- Heat Recovery Introduction
- Indoor Unit (IDU) Control
- Outdoor Unit (ODU) Control
 - Heat Pump Refrigerant Circuit
 - Heat Recovery Refrigerant Circuit

Samsung Business Academy

Samsung Business Academy (SBA)

SBA Account Sign Up Required:

- Register for future training classes/courses.
- Receive credit for this training class.
- Access completion certificates.
- Complete surveys/submit feedback.



List of Courses



Training Courses
Catalog



Visitor's Guide



Samsung Business
Academy Login



Samsung Business
Academy Registration

Samsung Business Academy (SBA)



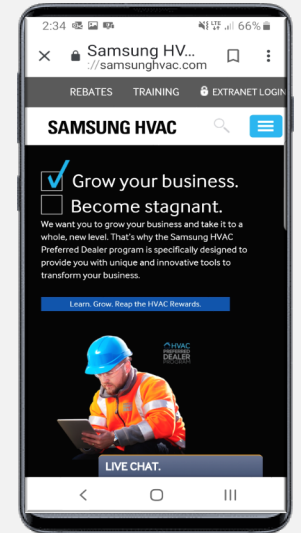
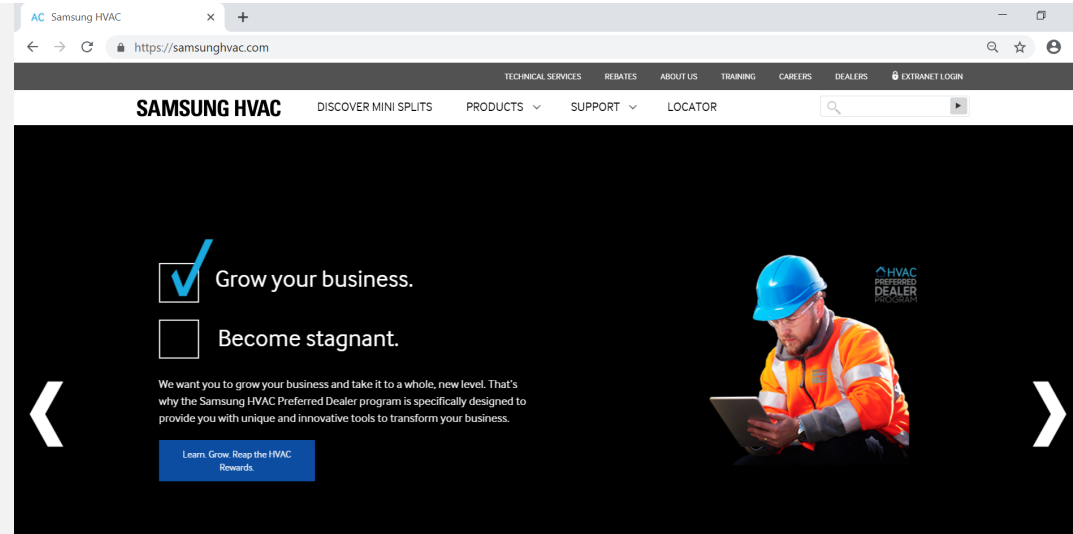
- 1. Sign up for a SBA Account**
 - Contractor
 - Distributor
- 2. View/print completion certificates**
- 3. Register for future training**
 - Instructor-Led Courses
 - Online Demand

1. Sign Up for a SBA Account

Go to:

www.samsunghvac.com*

*Disable popup blocker.



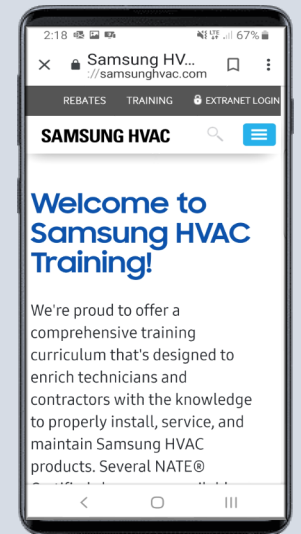
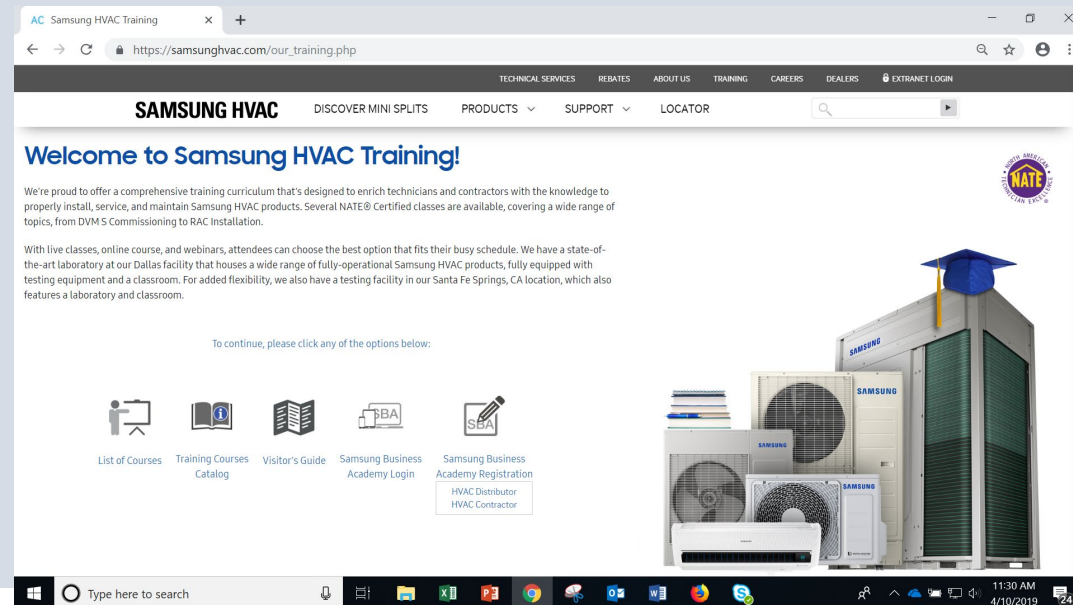
Hover over:



Samsung Business
Academy Registration

Choose either:

HVAC Distributor
HVAC Contractor



SAMSUNG

1. Sign Up for a SBA Account

HVAC Contractor

Complete all required fields designated by an asterisk (*).

* Required Field

For **Partner** field, please search for and choose your dealer code. If you cannot find your dealer name, please choose "Other" and provide the name in the text field below.

* First Name:

* Last Name:

* Email Address:

* Address Line 1:

Address Line 2:

* City:

State:

* Zip:

Phone:

* How did you learn about Samsung HVAC Training?

Click **Partner:** to add Distributor information.

Partner:

Company Name (if not found above)

* Who is your Partner Distributor?

* Job Title

SAMSUNG HVAC Dealer #

NATE ID #

Language:

1 Type Distributor Name

Search Partner

Title: ID:

Distributor Name

Title	ID	Parent

2 Click Search

Search Partner

Title: ID:

Title	ID	Parent
My Distributor	SHA362	Samsung HVAC (Parent)

3 Click your Distributors name to add to form.

Partner: YOUR DISTRIBUTOR

If your Distributor is not in the list,

1 Type **Other** in the ID: field.

Search Partner

Title: ID:

Title	ID	Parent
OTHER	SHVAC-OTHER	Samsung HVAC (Parent)

2 Click Search

3 Click OTHER to add to form.

Partner: OTHER

SAMSUNG

1. Sign Up for a SBA Account

Complete the rest of the Sign Up form.

4 Select “**Opt-In**” to receive training communications.

* Opt-In / Opt-Out of Training Promotion:

Select

* Passwords must contain alpha and numeric characters.

* Passwords cannot have three or more consecutive same characters.

* Passwords must be 8 - 20 characters.

* Passwords cannot have leading or trailing spaces.

* Passwords cannot be the same as the Username, User ID, or email address.

* Passwords must contain at least one special character.

* New password

* Confirm password

5

Create password using required format.

Already a user? [Login here](#)
Return to Browsing? [Click here](#)

Cancel

Submit

6

Click **Submit** to complete sign-up.

After account is setup...

01

Approval takes 1-2 business days.



Attendance is marked complete.

02

03

Certificate available in SBA.



SAMSUNG

1. Sign Up for a SBA Account

HVAC Distributor

Complete all required fields designated by an asterisk (*).

* Required Field

For **Partner:** click the icon to the right of the

Click the + icon next to SHVAC to find the **Distributor Partner** y

* First Name:

* Last Name:

* Email Address:

* Address Line 1:

Address Line 2:

* City:

State:

* Zip:

Phone:

Click **Partner:**  to add Distributor information.

Partner: 

* Job Title:

NATE ID #:

Language:

Sales
Marketing
Service
Engineering
Operations
Research & Development
Technical Support
Finance (incl. Controlling)
Human Resources & General Affairs
Information Technology
Logistics
Procurement
Legal & Compliance
Training
Product Application (Pre-Sales)
Warranty
Other

1 Type your Business Name

2 Click Search

Search Partner

Title: ID:

Title	ID	Parent
1 2 >>		

Search Partner

Title: ID:

Title	ID	Parent
My Distributor	SHA362	Samsung HVAC (Parent)

3 Click your Business name to add to form.

Partner: DISTRIBUTOR NAME  

If your Business is not in the list,

1 Type **Other** in the ID: field.

2 Click Search

Search Partner

Title: ID:

Title	ID	Parent
OTHER	SHVAC-OTHER	Samsung HVAC (Parent)

3 Click OTHER to add to form.

Partner: OTHER  

SAMSUNG

1. Sign Up for a SBA Account

Complete the rest of the Sign Up form.

4 Select “**Opt-In**” to receive training communications.

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Click **Submit** to complete sign-up.

After account is setup...

01

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Attendance is marked complete.

02

03

Certificate available in SBA.



SAMSUNG

2. View/Print Completion Certificates

① Go to [www. https://samsunghvac.com/our_training.php](https://samsunghvac.com/our_training.php)

② Click:  Samsung Business Academy Login

Login with Samsung Business Academy (SBA) username/password.

SAMSUNG
Welcome to SBA
Samsung Business Academy

English

ph.hutchins@samsunghvac.com

Login

☐ Remember me

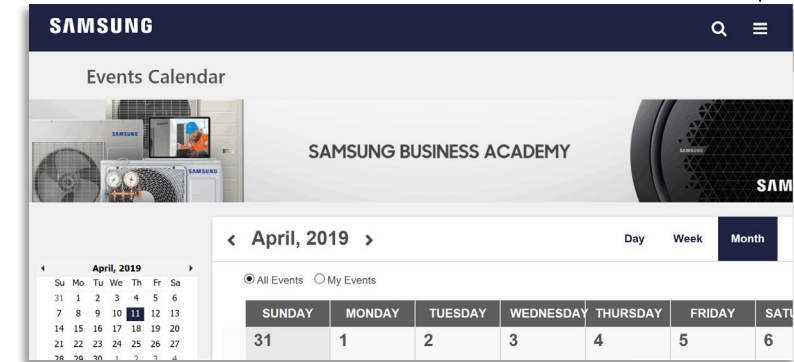
[Forgot your password?](#)

[Terms & Conditions and Privacy Policy](#)

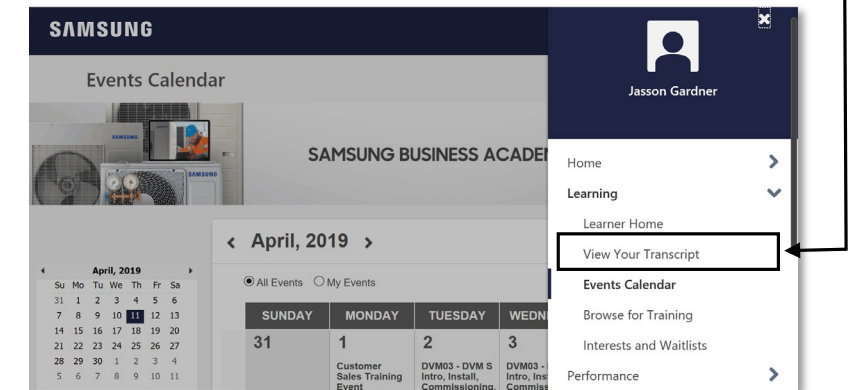
Registration

Welcome to
Samsung Business Academy

③ Open Menu. (☰)

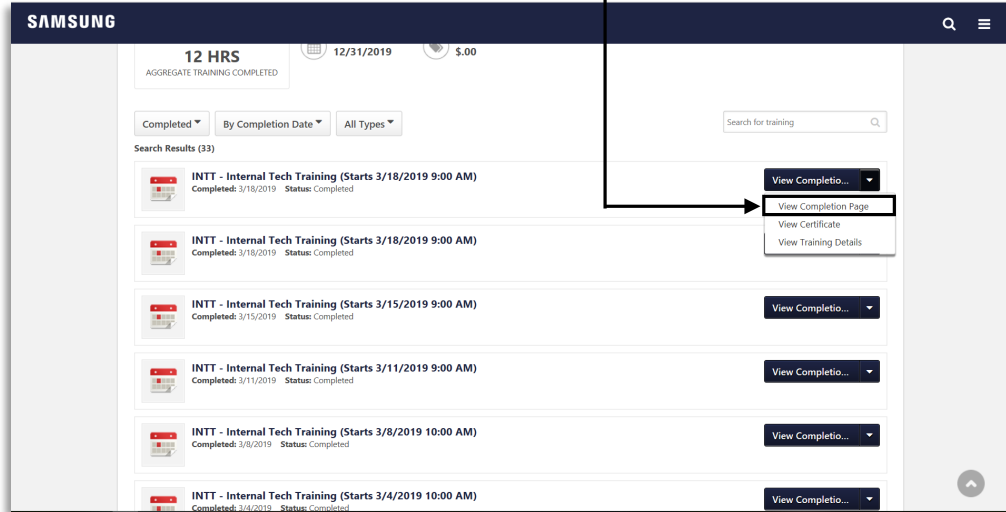


④ Click “View Your Transcript”.



2. View/Print Completion Certificates

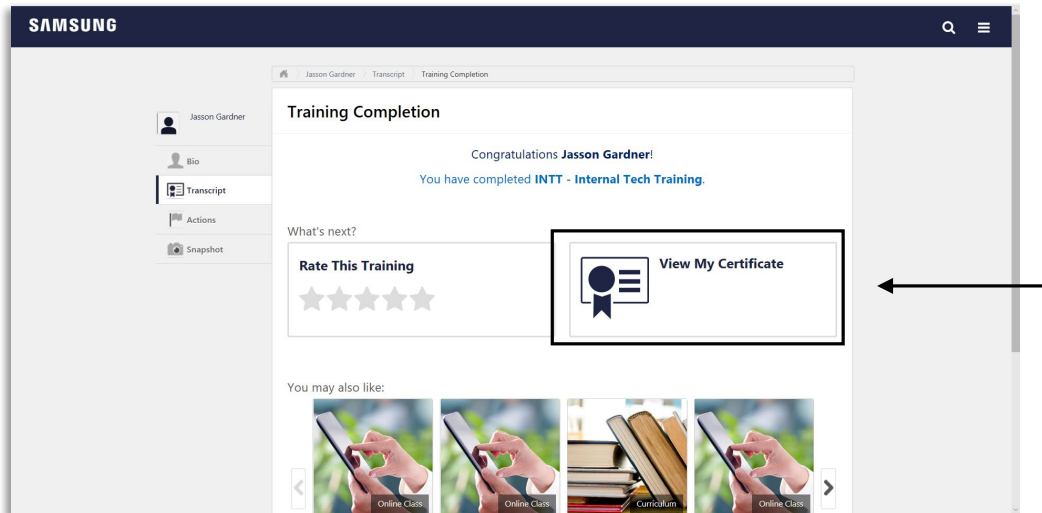
④ Click “View Completion Page”.



⑥ Select “Print” or “Save” option(s).



⑤ Click “View My Certificate”.



Note: Confirmation email will be sent with link to download certificate.

You recently attended a session of DVM03 - DVM S Intro, Install, Commissioning, & Config. This message is to confirm that your learning transcript has been marked complete, and your certificate of completion can now be viewed and printed.

Your Session Details:

Start Date: 4/3/2019

End Date: 4/4/2019

To view your certificate of completion:

- Navigate to your [Transcript](#) in the SAMSUNG BUSINESS ACADEMY portal
- Select Completed transcript from the drop-down selector
- Find DVM03 - DVM S Intro, Install, Commissioning, & Config on your completed transcript page and click the Print Certificate option on the right-hand side next to this training item. Your certificate will open in PDF form. You may print it and/or save the file to your local computer.

If you have questions, please submit them by replying to this message.

3. Register for Future Training



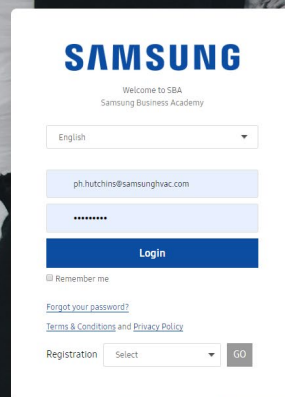
① Go to [www. https://samsunghvac.com/our_training.php](https://samsunghvac.com/our_training.php)

② Click:  Samsung Business Academy Login

③ Samsung Business Academy (SBA) displays.

- **Hover** - on class name to view class information.
- **Click** - on class name to open the class registration form.

Login with Samsung Business Academy (SBA) username/password.



SAMSUNG
Welcome to SBA
Samsung Business Academy

English

ph.hutchins@samsunghvac.com

Login

☐ Remember me

[Forgot your password?](#)

[Terms and Conditions and Privacy Policy](#)

Registration Select

Welcome to
Samsung Business Academy



Instructor - Led Training

SAMSUNG

Events Calendar

SAMSUNG BUSINESS ACADEMY

SAMSUNG

April, 2019

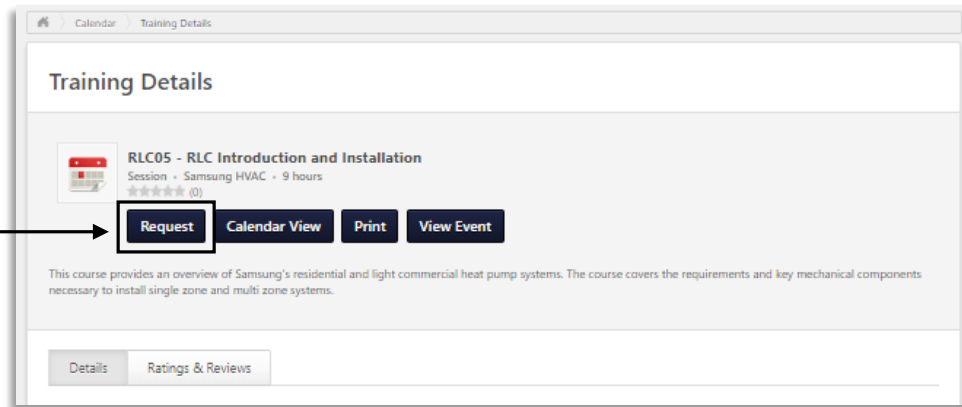
Day Week Month Agenda

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
31	1 Customer Sales Training Event 9:00 AM CST - Inverness - US CST	2 DVM03 - DVM 5 Intro, Install, Commissioning, & Config 7:00 AM CST - R-L Craig Company Inc. - Louisville, KY RLC06 - RLC Advanced Service Introduction 8:00 AM CST - NSC St Louis, MO DVM03 - DVM 5 Intro, Install, Commissioning, & Config 8:30 AM CST - Samsung HVAC Roanoke, TX DVM03 - DVM 5 Intro, Install, Commissioning, & Config 9:00 AM CST - Inverness - Chicago IL	3 DVM03 - DVM 5 Intro, Install, Commissioning, & Config 7:00 AM CST - R-L Craig Company Inc. - Louisville, KY RLC06 - RLC Advanced Service Introduction 8:00 AM CST - NSC St Louis, MO ECO 01 9:30 AM CST - SRS - Long Branch, NJ DVM03 - DVM 5 Intro, Install, Commissioning, & Config 9:30 AM CST - Samsung HVAC Roanoke, TX COM02 - DVM 5 NASA Controls Introduction 9:30 AM CST - Samsung HVAC Roanoke, TX DVM03 - DVM 5 Intro, Install, Commissioning, & Config 9:00 AM CST - Inverness - Chicago IL	4 RLC05 - RLC Introduction and Installation 7:00 AM CST - Binghamton, NY - BRS Supply ECO 01 9:00 AM CST - SRS - Long Branch, NJ RLC06 - RLC Advanced Service Introduction 9:30 AM CST - NSC St Louis, MO RLC06W webinar - RLC Introduction and Installation 9:30 AM CST - Webinar - US CST DVM04 - DVM 5 Advanced Service and Troubleshooting 9:30 AM CST - Samsung HVAC Roanoke, TX DVM 5 Water Introduction and Basic Installation 10:30 AM CST - Samsung HVAC Santa Fe Springs, CA DVM Chiller Introduction and Basic Installation 1:00 PM CST - Samsung HVAC Santa Fe Springs, CA	5 DVM04 - DVM 5 Advanced Service and Troubleshooting 8:30 AM CST - Samsung HVAC Roanoke, TX RLC06 - RLC Introduction and Installation 10:30 AM CST - ECCO Supply Ltd Burnaby, BC Weekly Webcast 10:30 AM CST - Webinar - US CST ECO 1.1 11:00 AM CST - Samsung HVAC Santa Fe Springs, CA	6
7	8	9	10	11	12	13

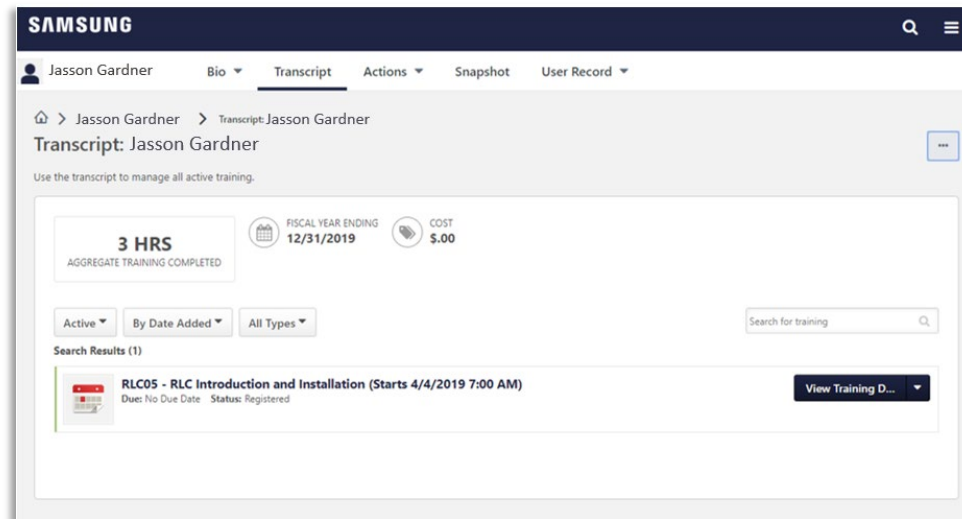
SAMSUNG

3. Register for Future Training

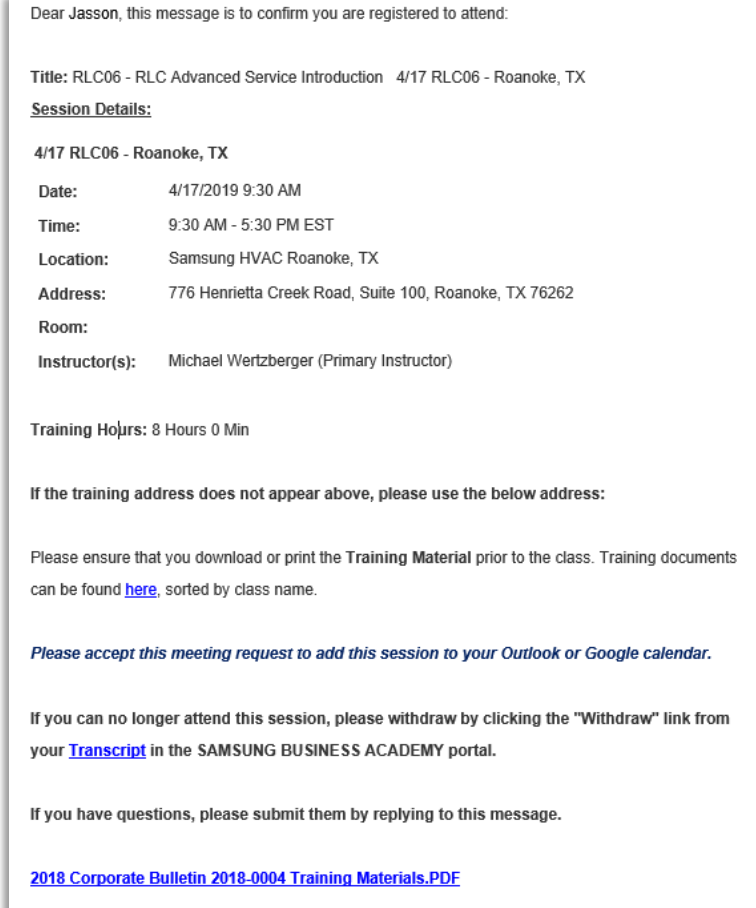
④ Click “Request”.



Registration status screen displays.



⑤ Confirmation email will be sent.

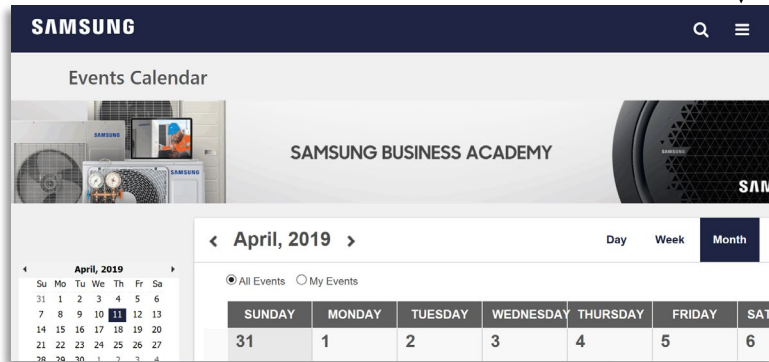


Note: If you do not receive with email within 15 minutes, check your Junk/Spam folder. Add [*@samsunghvac.com](mailto: *@samsunghvac.com) to trusted sites.

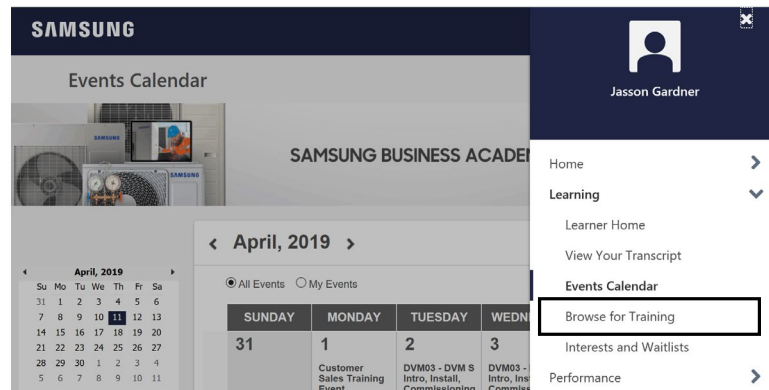
3. Register for Future Training

On - Demand Training

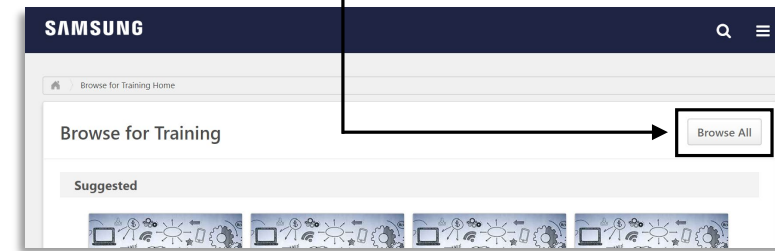
① Open Menu. (☰)



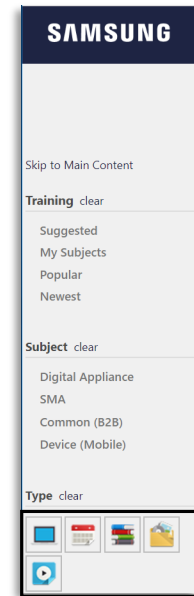
② Click “Browse for Training”.



③ Click “Browse All”.

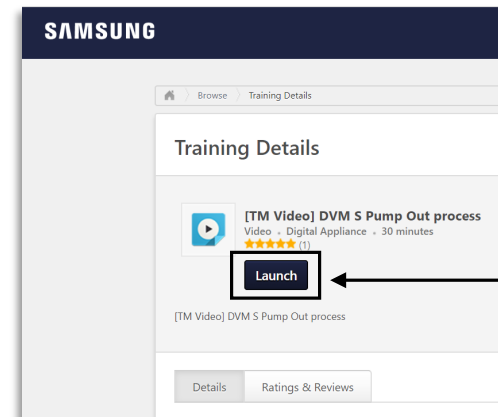


④ Click “Type”*.



*Online, Video and Materials.

⑤ Select course and click “Launch”.



**Thank You for setting up
your account in class!**



SAMSUNG *DVM S*

Basic System Operation

Basic System Operation

Indoor Unit Control – On/Off

ODU Status

IDU Status

RC Status



ON

Refrigerant flowing



ON

F3/F4 comm.



ON

Turn on
Thermo on



OFF

Refrigerant stop



ON

F3/F4 comm.



ON

Turn on
Thermo off



OFF

Refrigerant stop



OFF

F3/F4 comm.

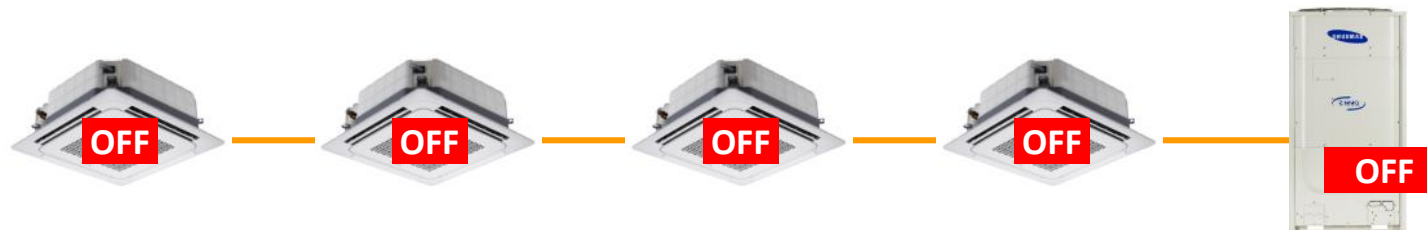


OFF

Turn off

Basic System Operation

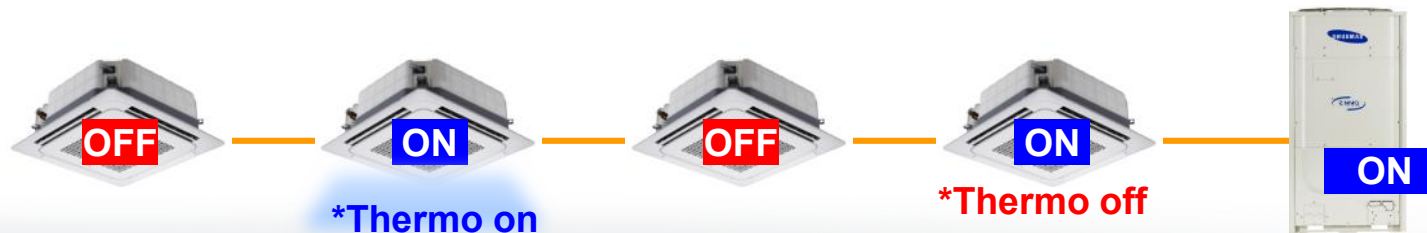
Outdoor Unit Control – On/Off



- Any indoor unit in a "thermo on" condition will start the outdoor unit

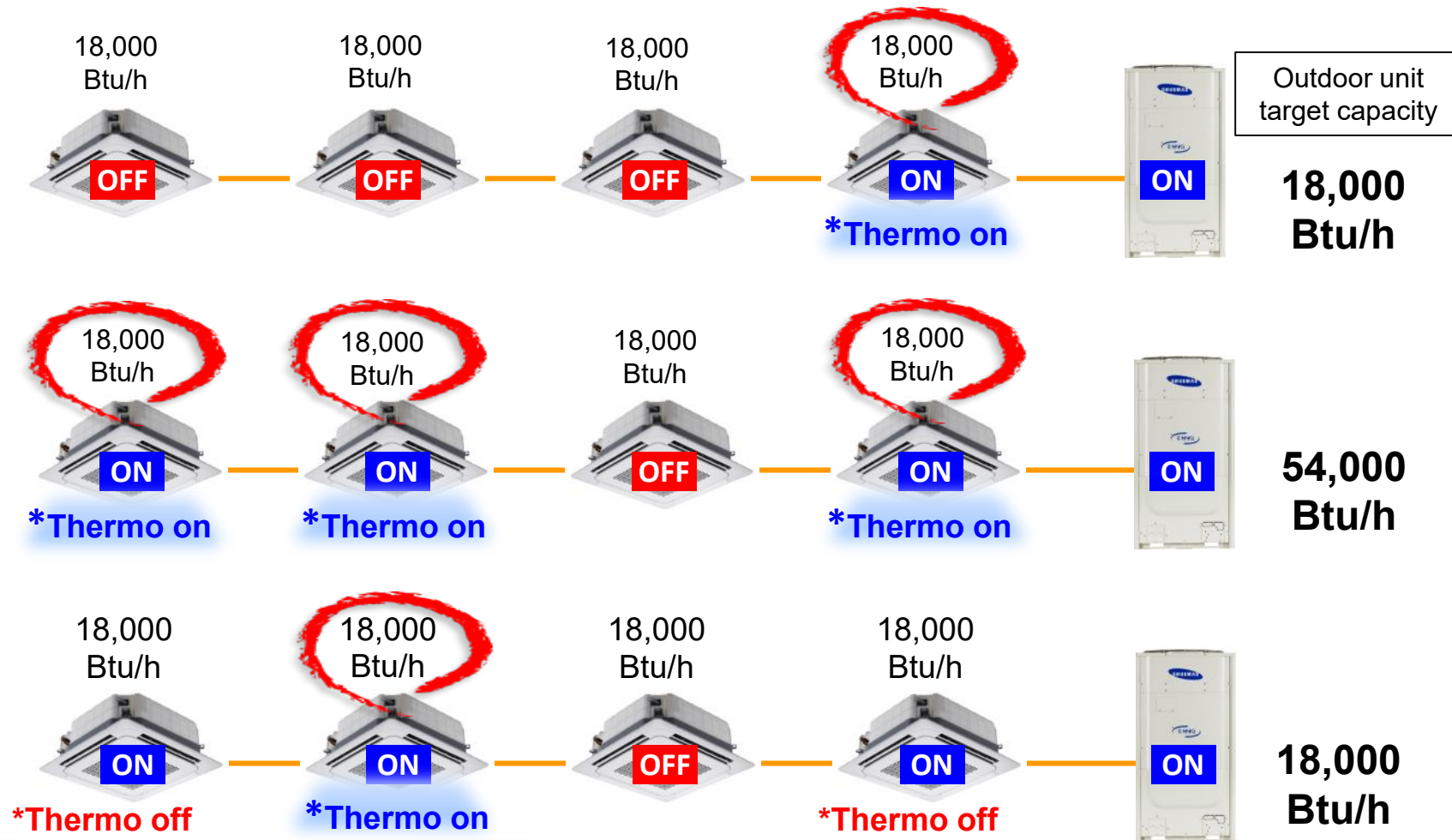


- Example: IDU is ON but the EEV is closed (Thermo Off) – ODU is OFF



Basic System Operation

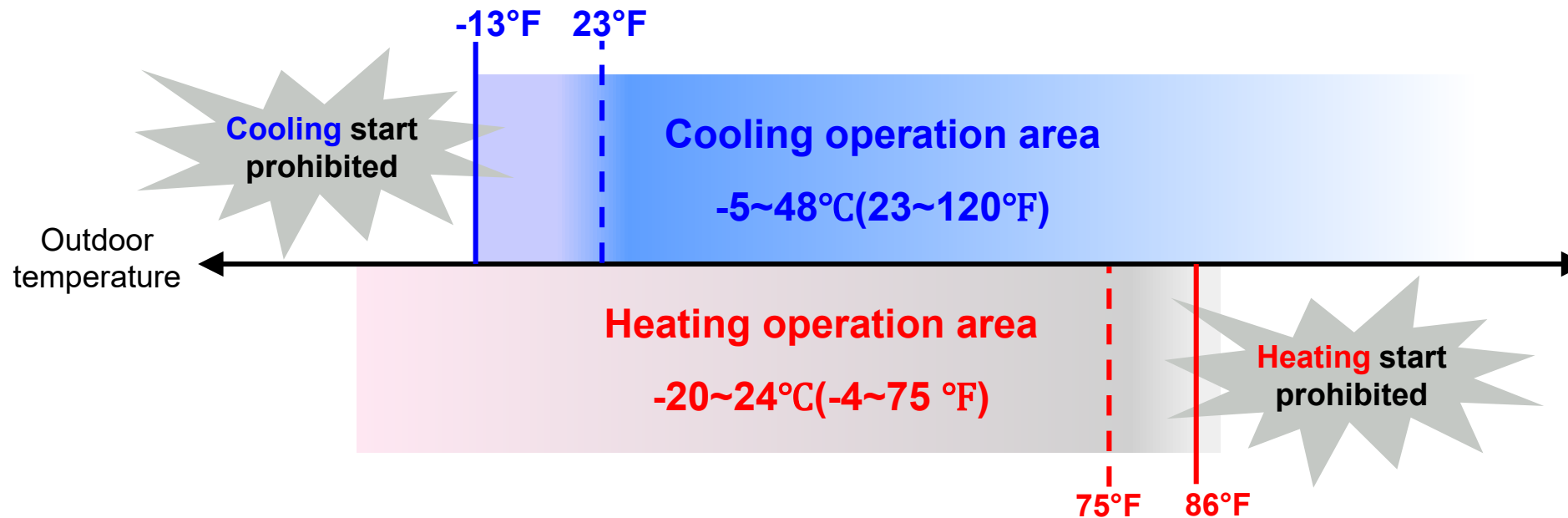
Outdoor Unit Capacity Control

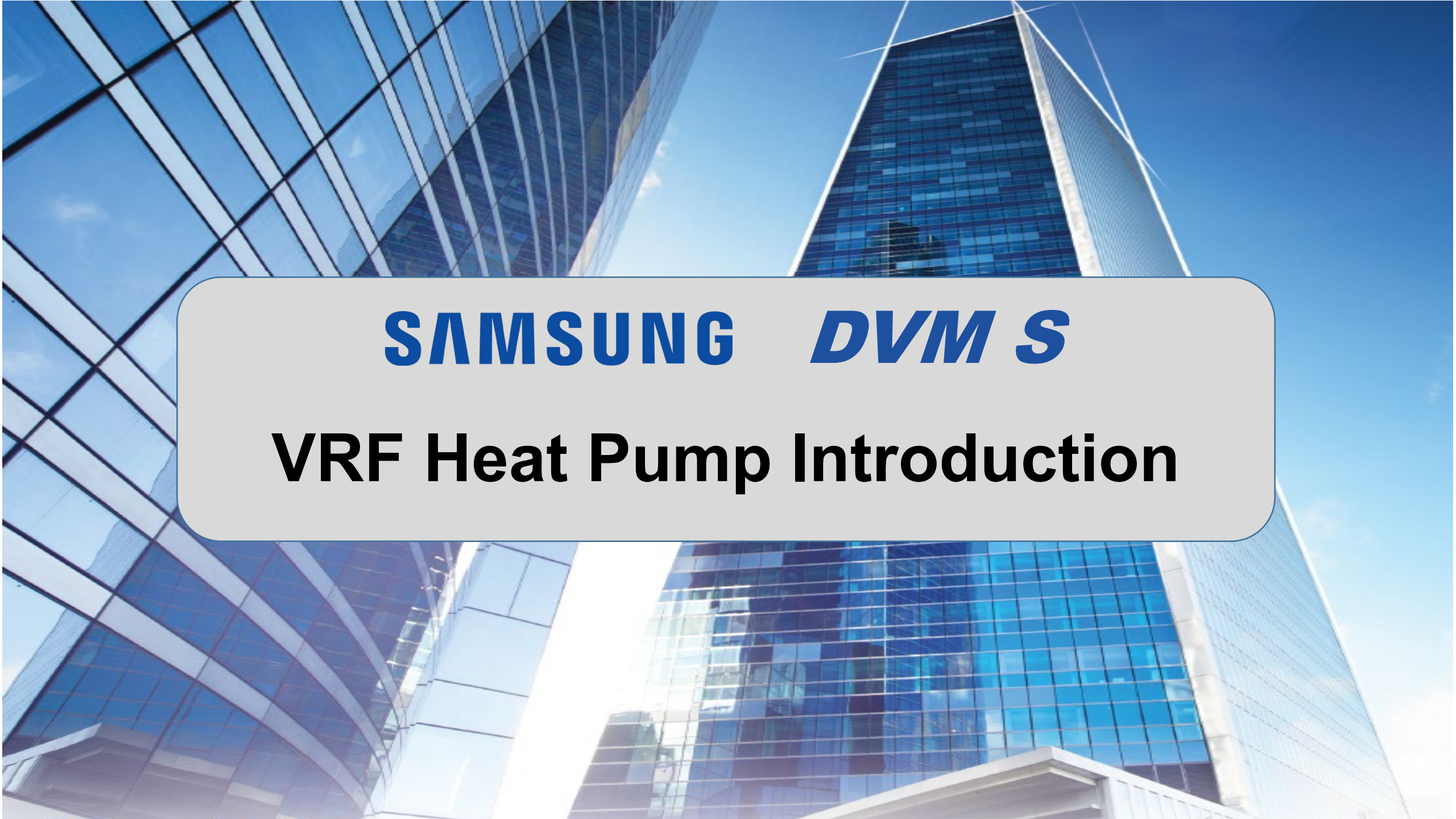


Basic System Operation

Operating Temperature Range For Outdoor Unit Start

- When ambient temperature is out of range, the system will not start and generates error
 - E440 – Prevention of heat operation
 - E441 – Prevention of cool operation
- System checks ambient temperature condition only on outdoor unit (compressor) start up
- The DVM S outdoor units will operate when ambient temperatures are exceeded however capacity and efficiency will decrease accordingly



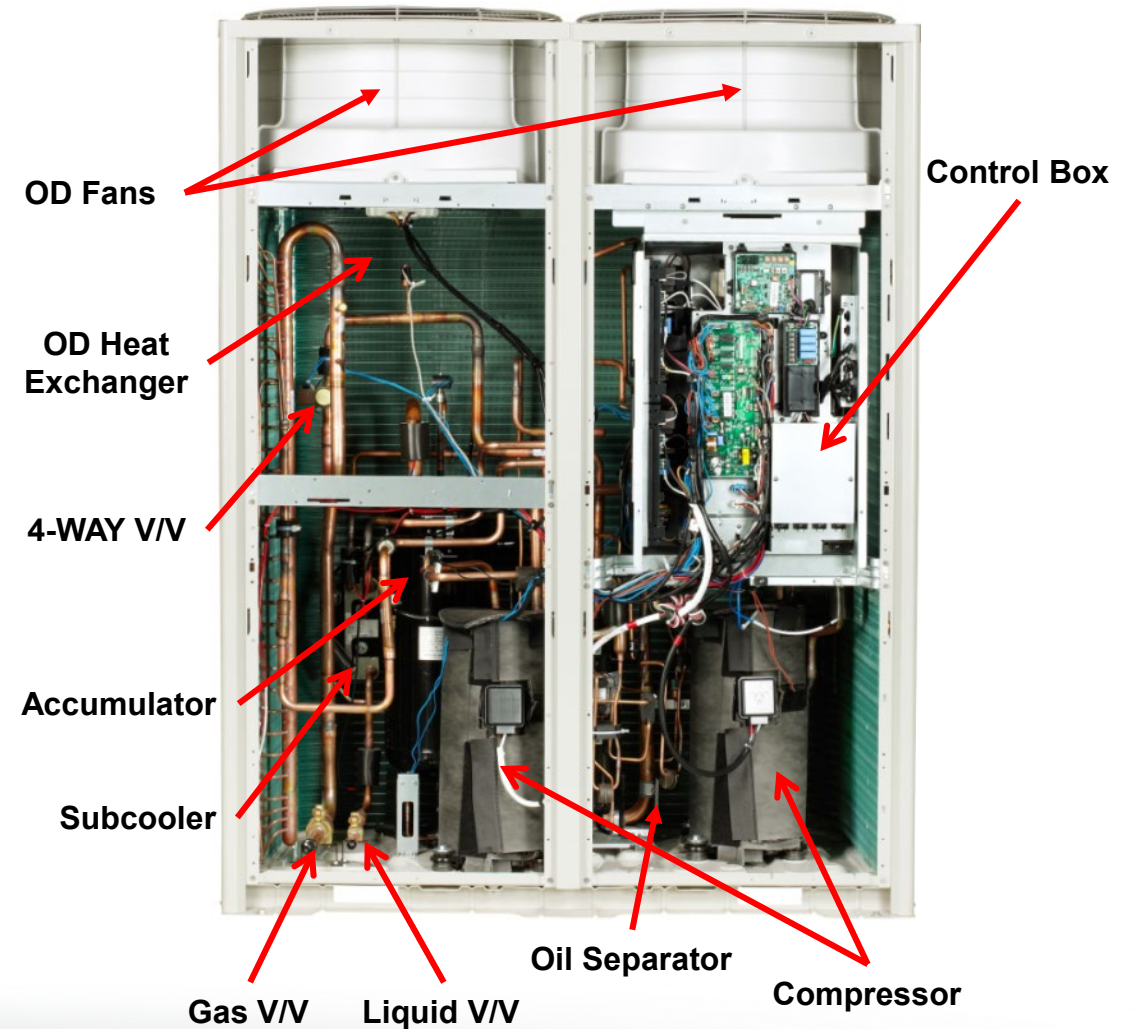
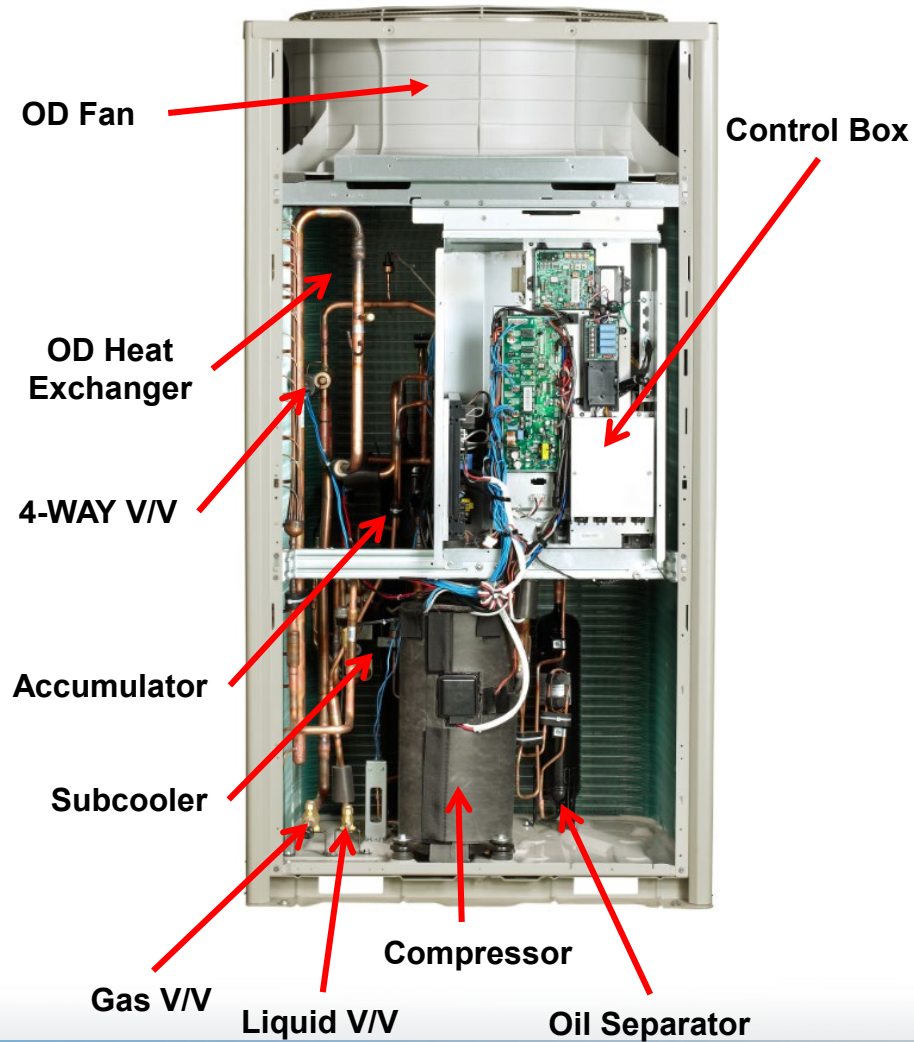


SAMSUNG *DVM S*

VRF Heat Pump Introduction

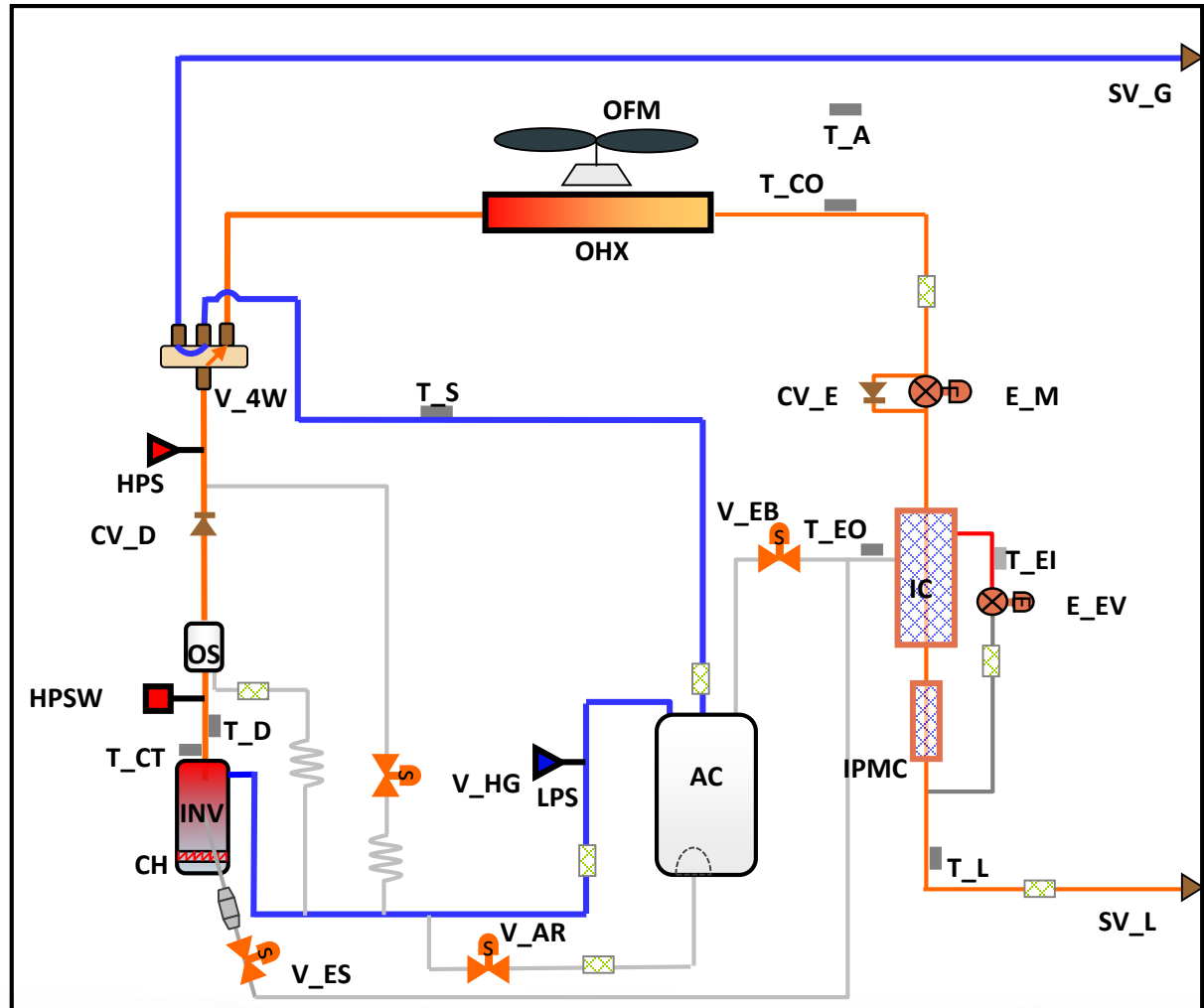
Heat Pump Introduction

Heat Pump Outdoor Unit



Heat Pump Introduction

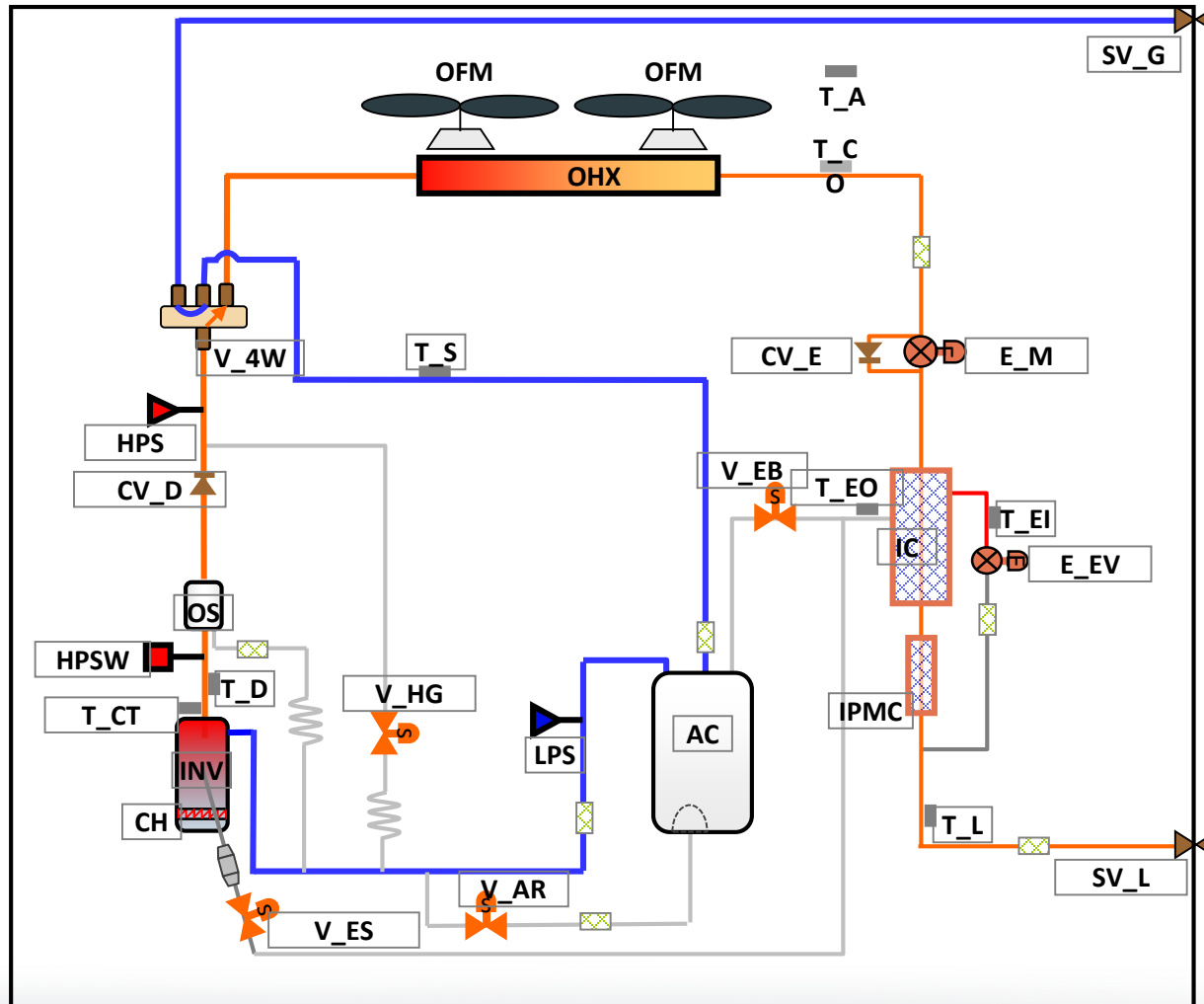
Heat Pump Refrigerant Circuit – Single Fan 1 compressor unit



	Name
INV	Inverter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
T_D	Discharge Temp. Sensor
T_S	Suction Temp. Sensor
T_CO	Cond Out Temp. Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Tube Temp. Sensor
T_CT	Comp. Top Temp. Sensor
T_A	Ambient Temp. Sensor
SV_G	Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

Heat Pump Introduction

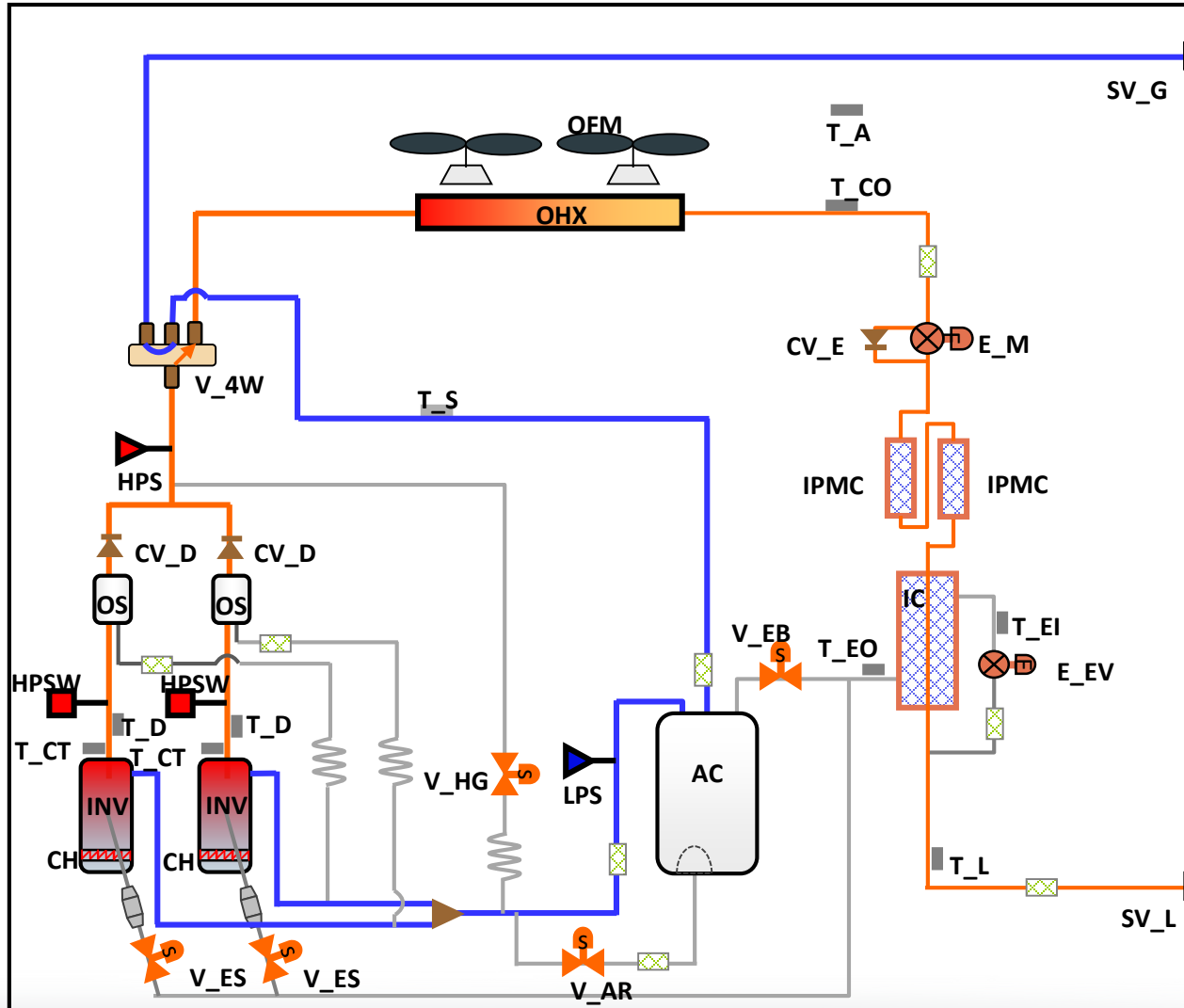
Heat Pump Refrigerant Circuit – Dual Fan 1 compressor unit



	Name
INV	Inverter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
T_D	Discharge Temp. Sensor
T_S	Suction Temp. Sensor
T_CO	Cond Out Temp. Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Tube Temp. Sensor
T_CT	Comp. Top Temp. Sensor
T_A	Ambient Temp. Sensor
SV_G	Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

Heat Pump Introduction

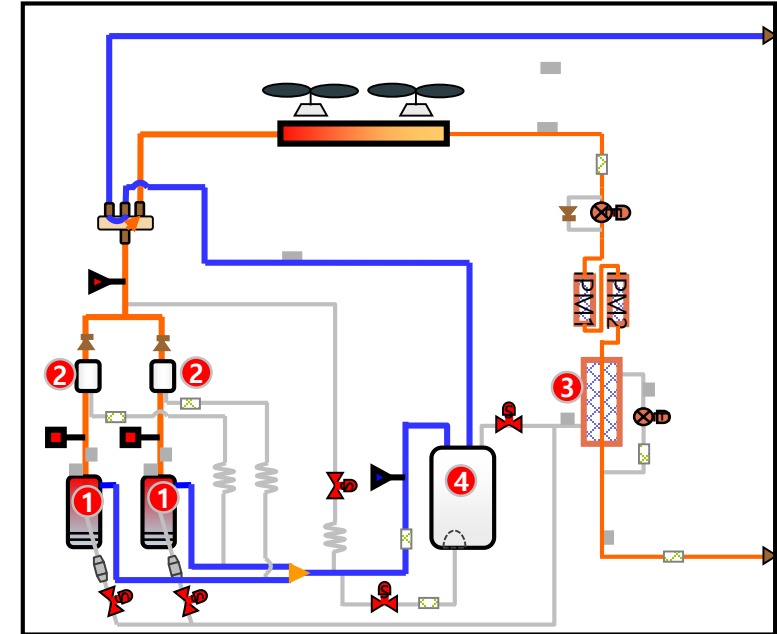
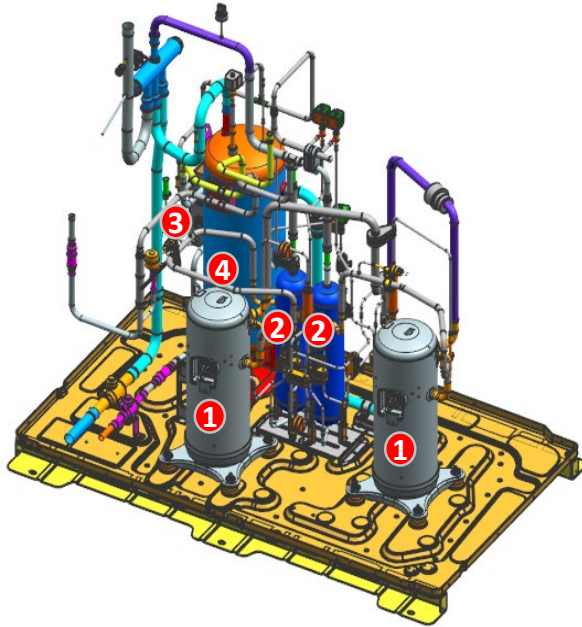
Heat Pump Refrigerant Circuit – Dual Fan 2 compressor unit



	Name
INV	Inverter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC	Accumulator
OS	Oil Separator
IC	Intercooler
IPMC	IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M	Main EEV
E_EV	EVI EEV
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG	Hot Gas Bypass Valve
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
T_D	Discharge Temp. Sensor
T_S	Suction Temp. Sensor
T_CO	Cond Out Temp. Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Tube Temp. Sensor
T_CT	Comp. Top Temp. Sensor
T_A	Ambient Temp. Sensor
SV_G	Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

Heat Pump Introduction

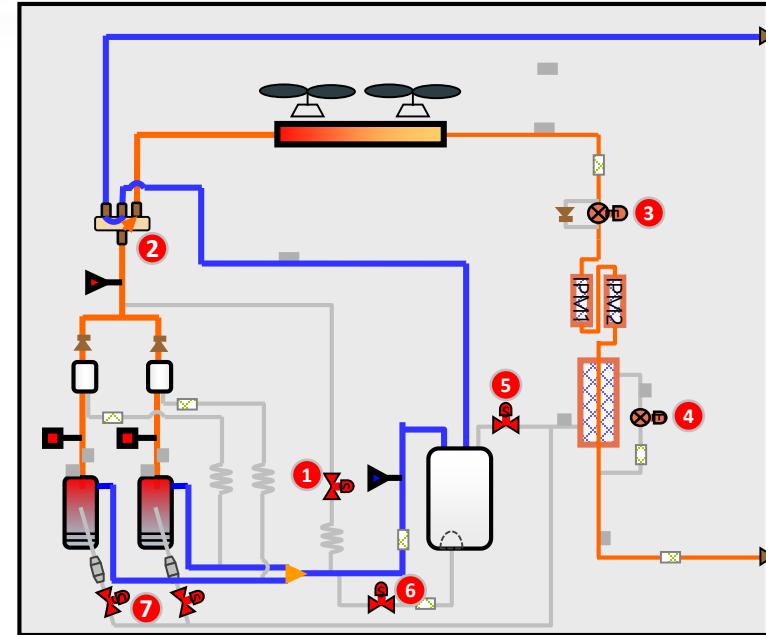
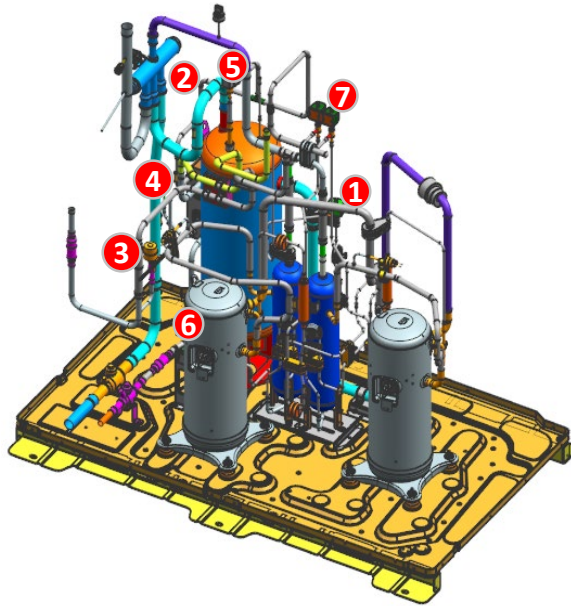
Part Introduction – Major Components



Name	Description
Compressors ①	■ 2 types of inverter compressors ■ Vapor injection compressor & Flash injection compressor
Oil separator ②	When compressor operates, oil is discharged from the compressors. To maintain proper compressor oil level.
Intercooler ③	1. To secure sub-cooling, 2. Vapor injection
Accumulator ④	To protect the compressor from liquid flood back operation, the accumulator collects liquid refrigerant and allows only the gas to enter the compressor.

Heat Pump Introduction

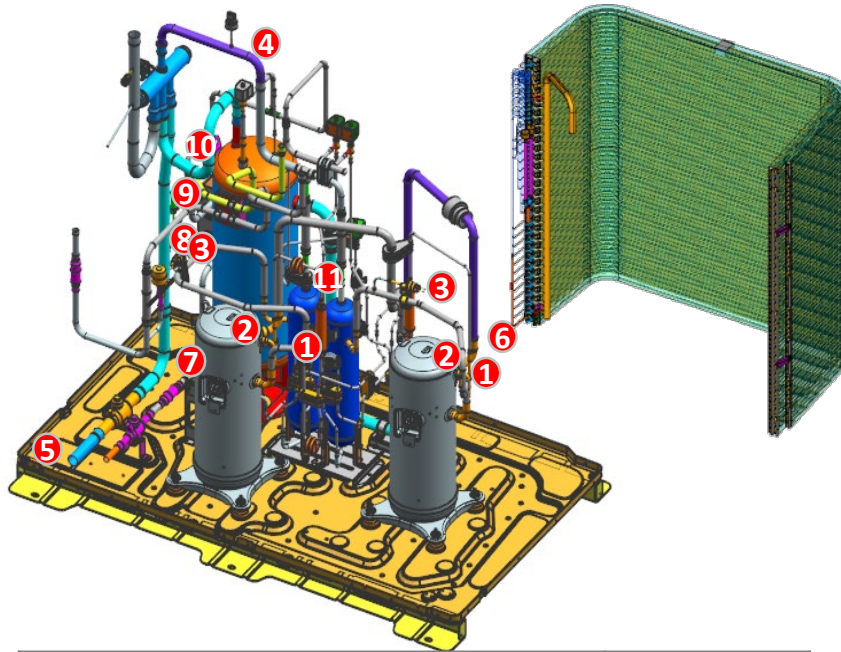
Part Introduction – Valve & EEV



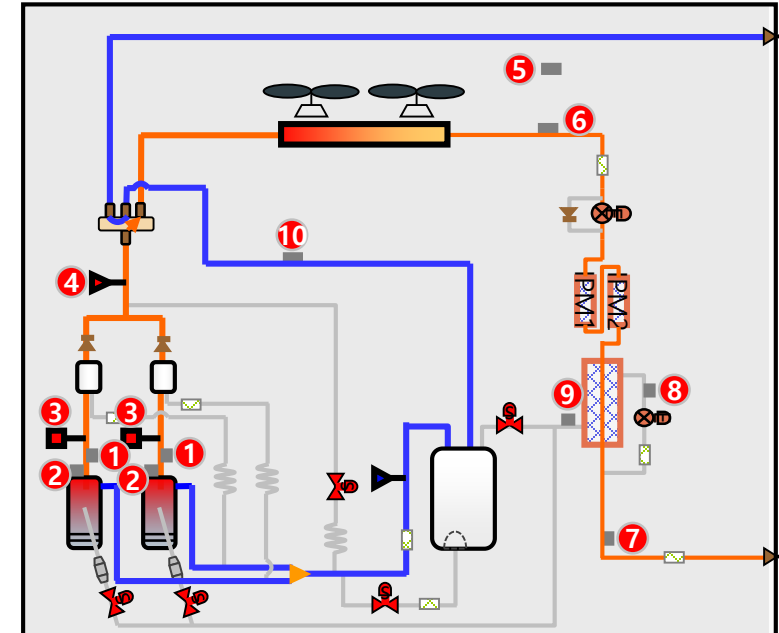
Name	Type	Function
Hot gas bypass valve ①	Solenoid	To compensate severe low pressure drop.
4way valve ②	Solenoid	To change operation mode of cooling and heating operation.
Main EEV ③	Stepper Motor	To control refrigerant flow rate in heating operation.
EVI EEV ④	Stepper Motor	To control refrigerant flow rate for sub-cooling.
EVI bypass valve ⑤	Solenoid	To supply vapor refrigerant to compressor suction.
Accumulator Oil Return Valve ⑥	Solenoid	To recover oil from accumulator.
EVI Sol valve ⑦	Solenoid	To inject vapor into the compressor scroll.

Heat Pump Introduction

Part Introduction – Sensor & Switch



Name		Type
Discharge temp. sensor	①	200K ohm
Top temp. sensor	②	200K ohm
High pressure switch	③	-
High pressure sensor	④	-
Ambient air temp. sensor	⑤	10K ohm
Cond. out temp. sensor	⑥	10K ohm



Name		Type
Tube temp. sensor	⑦	10K ohm
EVI in sensor	⑧	10K ohm
EVI out sensor	⑨	10K ohm
Suction temp. sensor	⑩	10K ohm
Low pressure sensor	⑪	-

Heat Pump Introduction

Part Introduction – Sensor & Switch

Name	Type	Description
Discharge temp. sensor	200K ohm	To sense compressor discharge gas temperature
Ambient temp. sensor	10K ohm	To sense outside ambient temperature
Cond_out temp. sensor	10K ohm	To sense condensing outlet temperature.
EVI in/out temp. sensor	10K ohm	To sense the temperature of vapor injection refrigerant
Liquid tube temp. sensor	10K ohm	To sense the sub-cooled refrigerant temperature.
Suction temp. sensor	10K ohm	To Sense compressor suction gas temperature

Name	Description	Output
High pressure sensor	To sense high pressure. To control fan RPM in cooling operation. To control compressor capacity in heating operation.	DC voltage 0 ~4.5V
Low pressure sensor	To sense low pressure temperature To control compressor capacity in cooling operation To control fan RPM in heating operation	DC voltage 0 ~4.5V

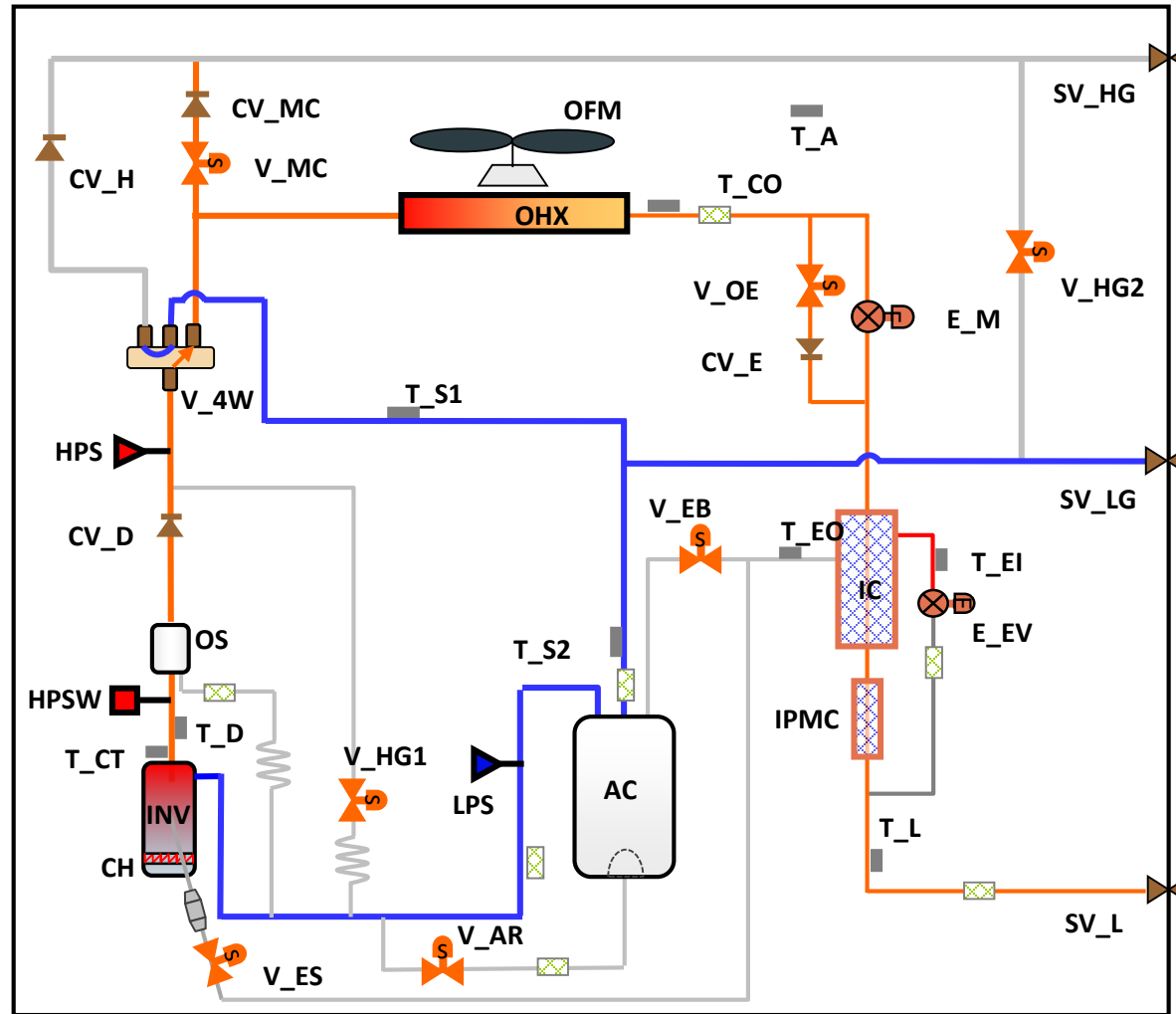


SAMSUNG *DVM S*

VRF Heat Recovery Introduction

Heat Recovery Introduction

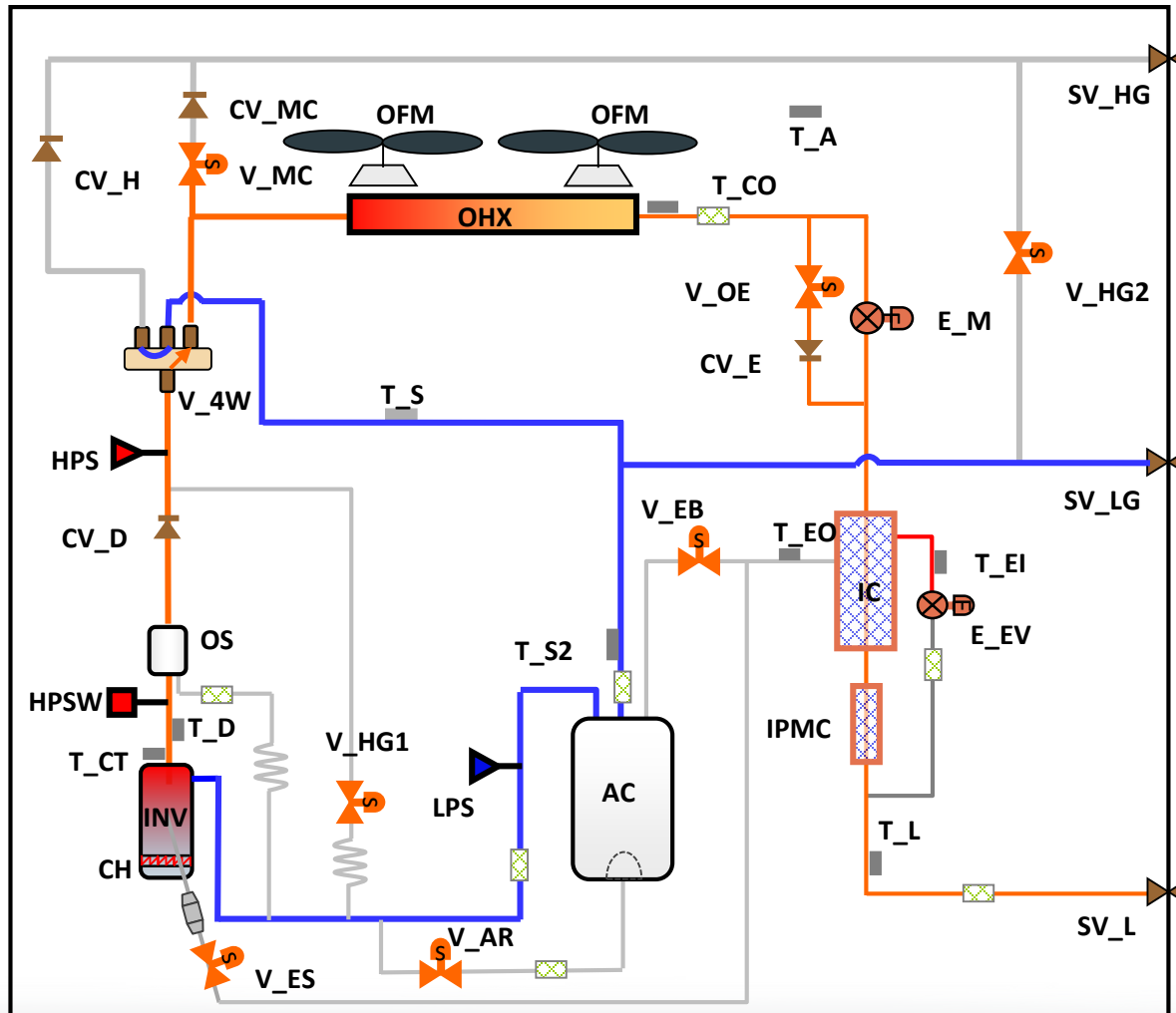
Heat Recovery Refrigerant Circuit – 1 Fan 1 compressor unit



	Name
INV	Inverter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC / OS	Accumulator / Oil Separator
IC / IPMC	Intercooler / IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M / E_EV	Main EEV / EVI EEV
V_MC	Main Cooling Valve
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG1	Hot Gas Bypass Valve 1
V_HG2	Hot Gas Bypass Valve 2
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
V_OE	Outdoor EEV Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
CV_H	HR Check valve
CV_MC	Main Cooling Check Valve
T_D	Discharge Temp. Sensor
T_S1	Suction Temp. Sensor 1
T_S2	Suction Temp. Sensor 2
T_CO	Cond Out Temp. Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Tube Temp. Sensor
T_CT	Comp. Top Temp. Sensor
T_A	Ambient Temp. Sensor
SV_HG	High Gas Pipe Service Valve
SV_LG	Low Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

Heat Recovery Introduction

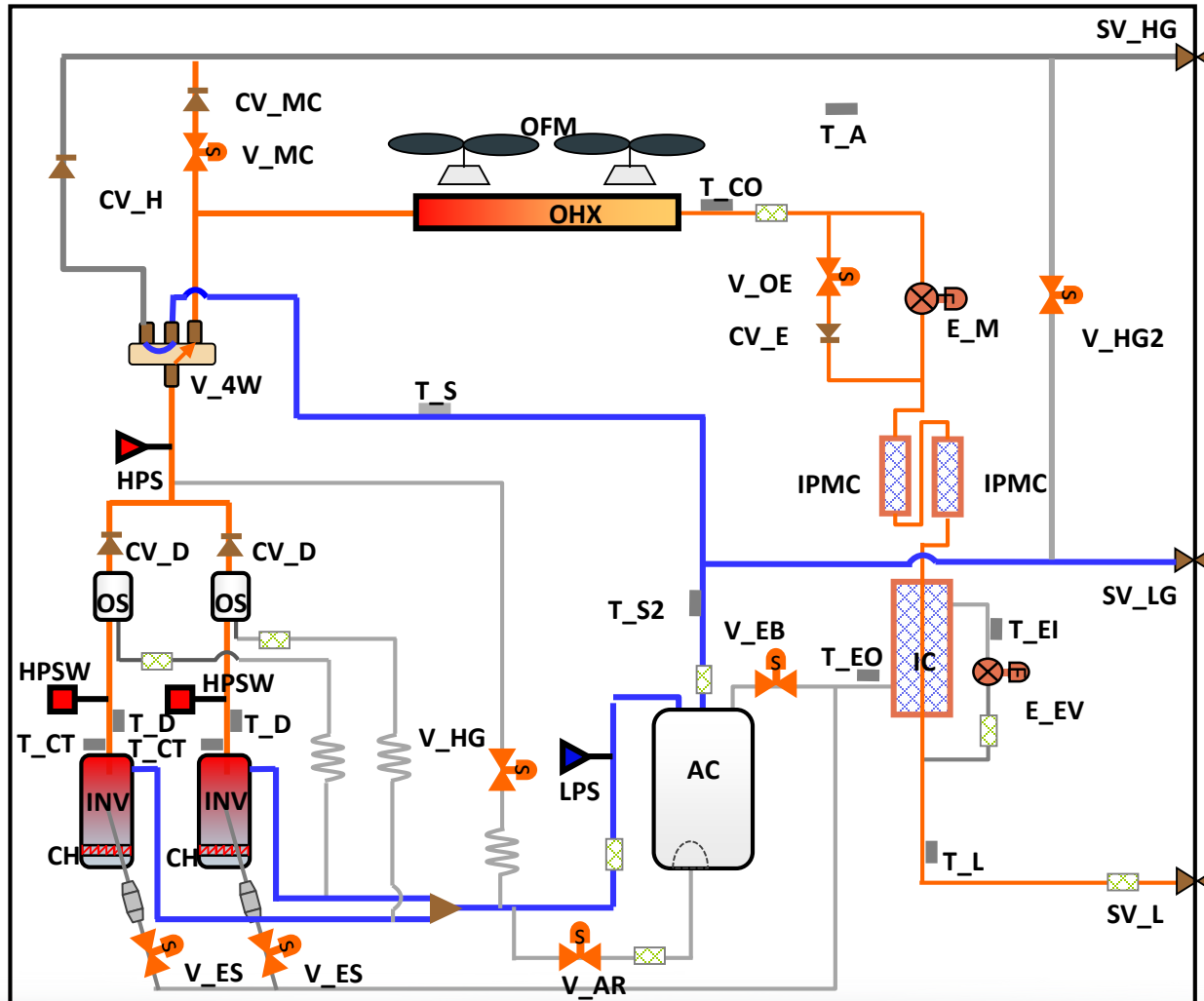
Heat Recovery Refrigerant Circuit – 2 Fan 1 compressor unit



	Name
INV	Inverter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC / OS	Accumulator / Oil Separator
IC / IPMC	Intercooler / IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M / E_EV	Main EEV / EVI EEV
V_MC	Main Cooling Valve
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG1	Hot Gas Bypass Valve 1
V_HG2	Hot Gas Bypass Valve 2
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
V_OE	Outdoor EEV Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
CV_H	HR Check valve
CV_MC	Main Cooling Check Valve
T_D	Discharge Temp. Sensor
T_S1	Suction Temp. Sensor 1
T_S2	Suction Temp. Sensor 2
T_CO	Cond Out Temp. Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Tube Temp. Sensor
T_CT	Comp. Top Temp. Sensor
T_A	Ambient Temp. Sensor
SV_HG	High Gas Pipe Service Valve
SV_LG	Low Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

Heat Recovery Introduction

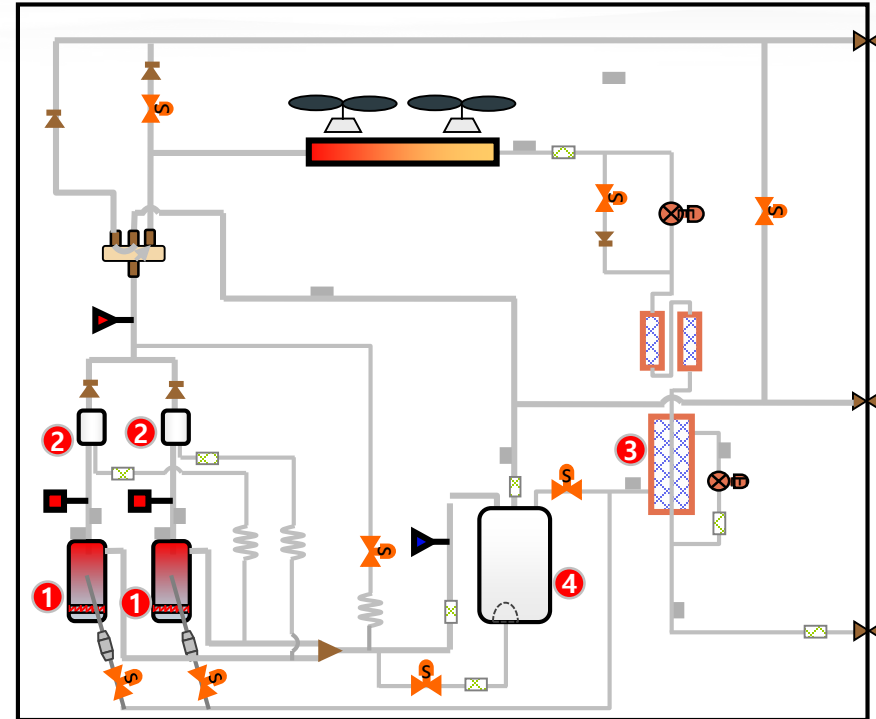
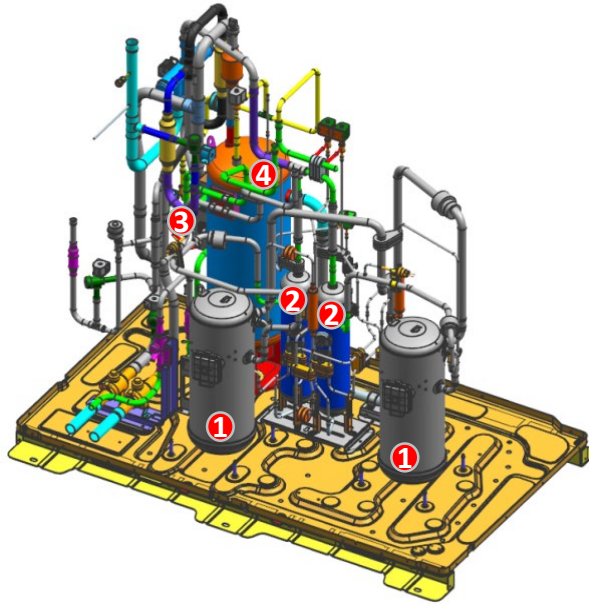
Heat Recovery Refrigerant Circuit – Dual Fan 2 compressor unit



	Name
INV	Inverter Compressor
OFM	Outdoor Fan Motor
OHX	Outdoor Heat Exchanger
AC / OS	Accumulator / Oil Separator
IC / IPMC	Intercooler / IPM Cooler
CH	Crank Case Heater
HPS	High Pressure Sensor
LPS	Low Pressure Sensor
HPSW	High Pressure Switch
E_M / E_EV	Main EEV / EVI EEV
V_MC	Main Cooling Valve
V_ES	EVI Sol. Valve
V_EB	EVI Bypass Valve
V_HG1	Hot Gas Bypass Valve 1
V_HG2	Hot Gas Bypass Valve 2
V_4W	4Way Valve
V_AR	Accumulator Oil Return Valve
V_OE	Outdoor EEV Valve
CV_E	EEV Bypass Check Valve
CV_D	Discharge Check Valve
CV_H	HR Check valve
CV_MC	Main Cooling Check Valve
T_D	Discharge Temp. Sensor
T_S1	Suction Temp. Sensor 1
T_S2	Suction Temp. Sensor 2
T_CO	Cond Out Temp. Sensor
T_EI	EVI In Temp. Sensor
T_EO	EVI Out Temp. Sensor
T_L	Liquid Tube Temp. Sensor
T_CT	Comp. Top Temp. Sensor
T_A	Ambient Temp. Sensor
SV_HG	High Gas Pipe Service Valve
SV_LG	Low Gas Pipe Service Valve
SV_L	Liquid Pipe Service Valve

Heat Recovery Introduction

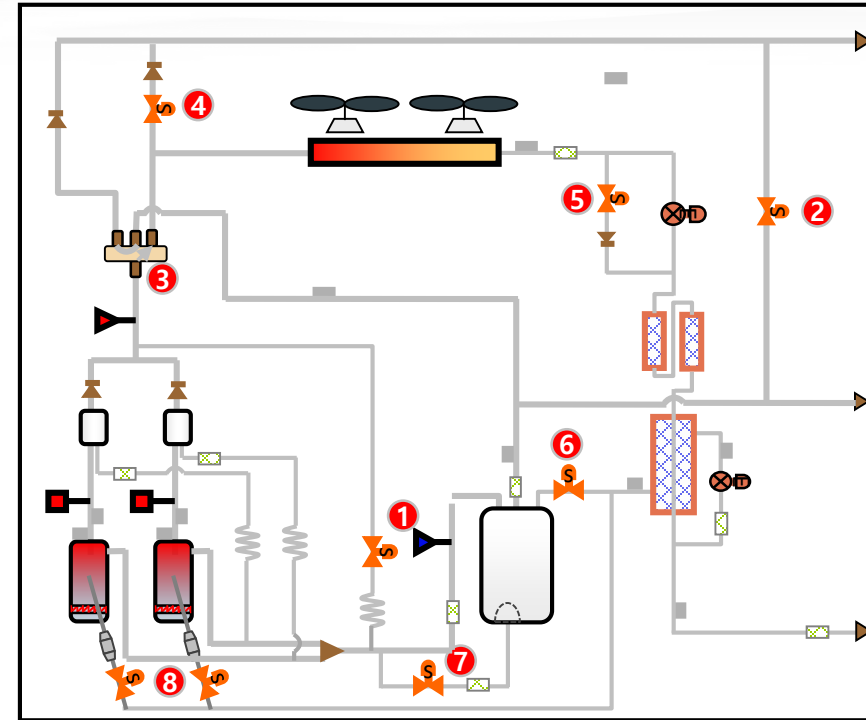
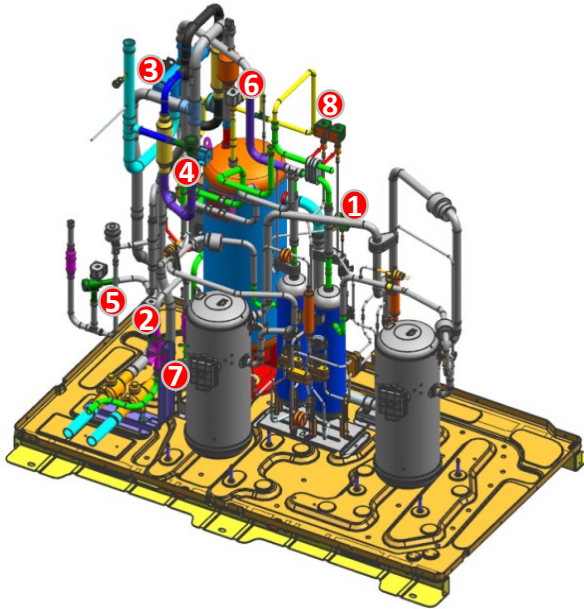
Part Introduction – Major Components



Name	Description
Compressors ①	■ 2 types of inverter compressors ■ Vapor injection compressor & Flash injection compressor
Oil separator ②	When compressor operates, oil is discharged from the compressors. To maintain proper compressor oil level.
Intercooler ③	1. To secure sub-cooling, 2. Vapor injection
Accumulator ④	To protect the compressor from liquid flood back operation, the accumulator collects liquid refrigerant and allows only the gas to enter the compressor.

Heat Recovery Introduction

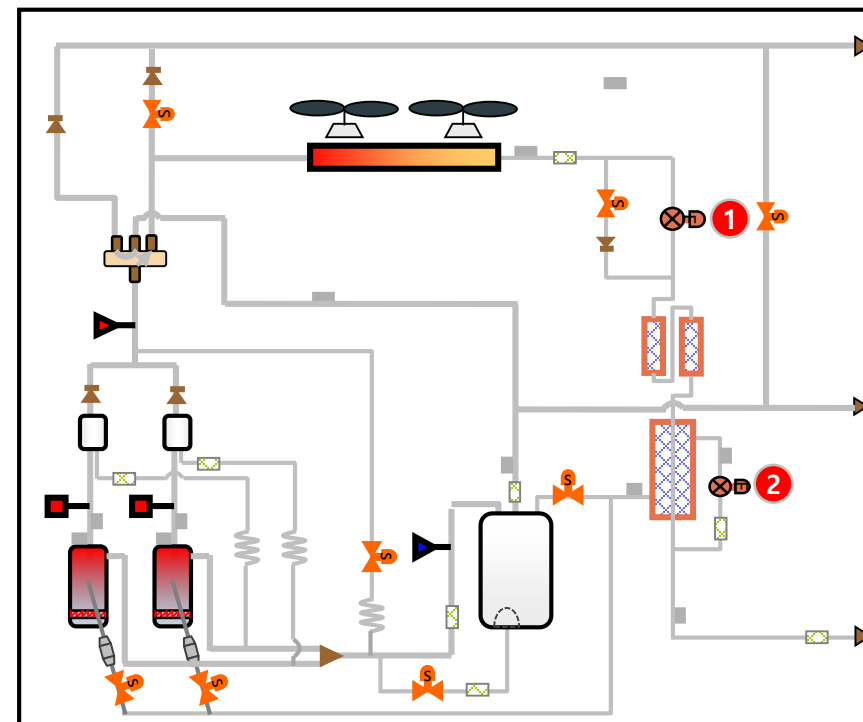
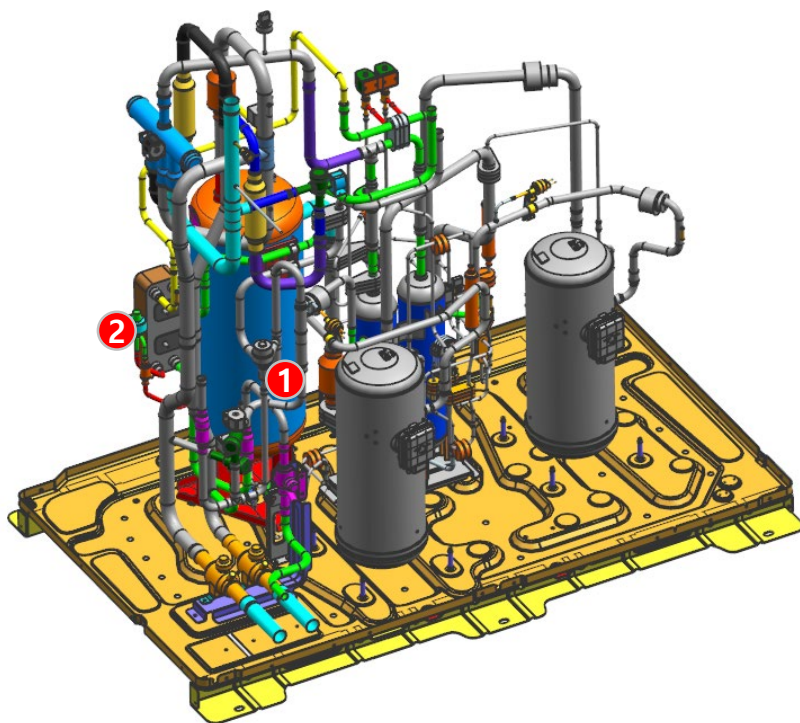
Part Introduction – Valve & EEV



Name	Type	Function
Hot gas bypass valve 1	1 Solenoid	To compensate severe low pressure drop.
Hot gas bypass valve 2	2 Solenoid	To equalize high & low pressure on unit stop
4way valve	3 Solenoid	To change Heat/Cool operation mode – Energizes for heat operation.
Main cooling valve	4 Solenoid	To supply refrigerant to heating indoor unit in main cooling operation.
Outdoor EEV valve	5 Stepper Motor	To control refrigerant flow rate in main cooling operation.
EVI bypass valve	6 Solenoid	To supply vapor refrigerant to compressor suction.
Accumulator Oil Return Valve	7 Solenoid	To recover oil from accumulator.
EVI Sol valve	8 Solenoid	To inject vapor to scroll.

Heat Recovery Introduction

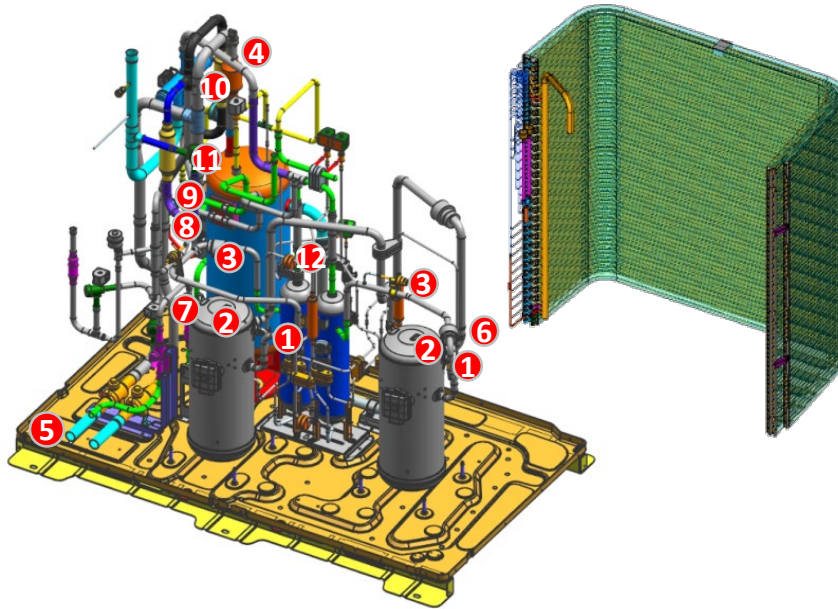
Part Introduction – Valve & EEV



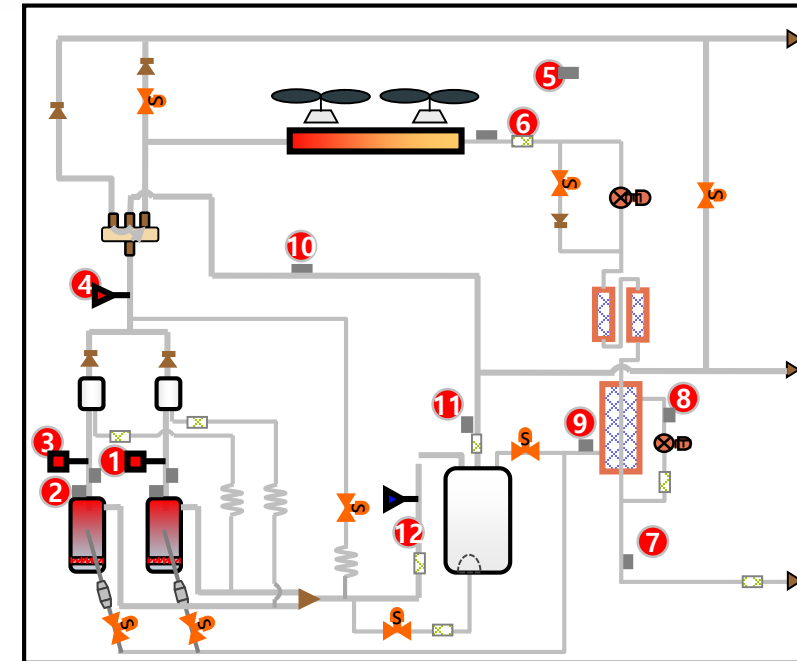
Name	Type	Function
Outdoor main EEV	① Stepper Motor	To control refrigerant flow rate in heating operation.
EVI EEV	② Stepper Motor	To control refrigerant flow rate for sub-cooling.

Heat Recovery Introduction

Part Introduction – Sensor & Switch



Name		Type
Discharge temp. sensor	①	200K ohm
Top temp. sensor	②	200K ohm
High pressure switch	③	-
High pressure sensor	④	-
Ambient air temp. sensor	⑤	10K ohm
Cond. out temp. sensor	⑥	10K ohm



Name		Type
Tube temp. sensor	⑦	10K ohm
EVI in sensor	⑧	10K ohm
EVI out sensor	⑨	10K ohm
Suction temp. sensor 1	⑩	10K ohm
Suction temp. sensor 2	⑪	10K ohm
Low pressure sensor	⑫	-

Heat Recovery Introduction

Part Introduction – Sensor & Switch

Name	Type	Description
Discharge temp. sensor	200K ohm	To sense compressor discharged gas temperature
Ambient temp. sensor	10K ohm	To sense outdoor ambient temperature
Cond_out temp. sensor	10K ohm	To sense condenser outlet temperature.
EVI in/out temp. sensor	10K ohm	To sense vapor injection refrigerant temperature
Liquid tube temp. sensor	10K ohm	To sense sub-cooled refrigerant temperature
Suction temp. sensor	10K ohm	To sense compressor suction gas temperature

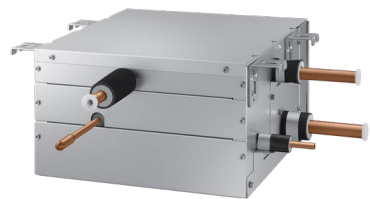
Name	Description	Output
High pressure sensor	To sense high pressure. To control fan RPM in cooling operation. To control compressor capacity in heating operation.	DC voltage 0 ~4.5V
Low pressure sensor	To sense low pressure To control compressor capacity in cooling operation To control fan RPM in heating operation	DC voltage 0 ~4.5V

Heat Recovery Introduction

Mode Change Units – S*NEK

Heat Recovery – MCU Mode Change Unit

- 1,2,4&6 port models (max. 8 indoor units per port)
- Brazed pipe connections
- Main 3-pipe connection on both sides of MCU for series installation
 - Excl. S1NEK single port MCU – right side connection only
- **No condensate drain**
- Auto addressing



S1NEK1N



S2NEK2N



S4NEK3N

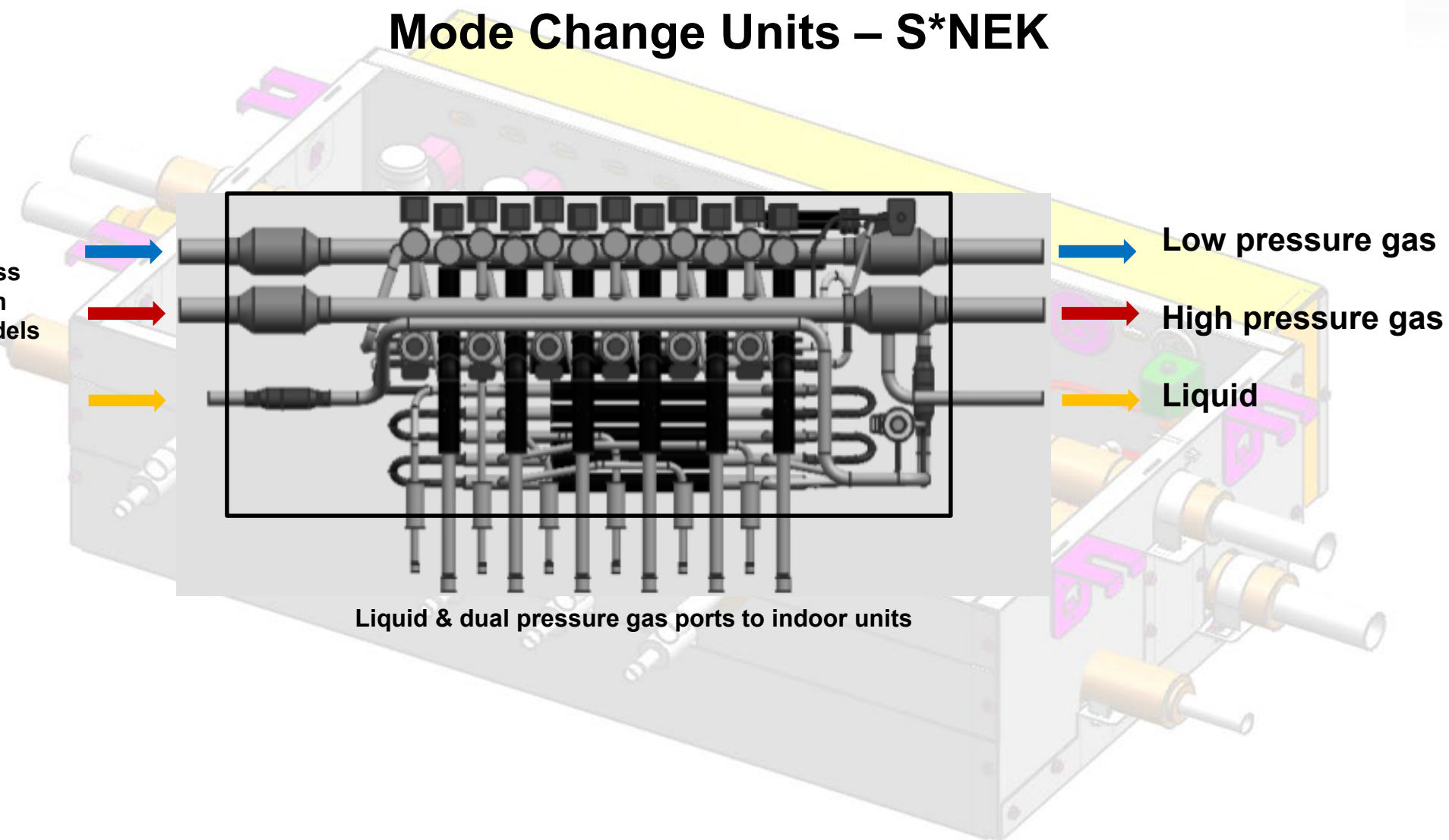


S6NEK2N

Heat Recovery Introduction

Mode Change Units – S*NEK

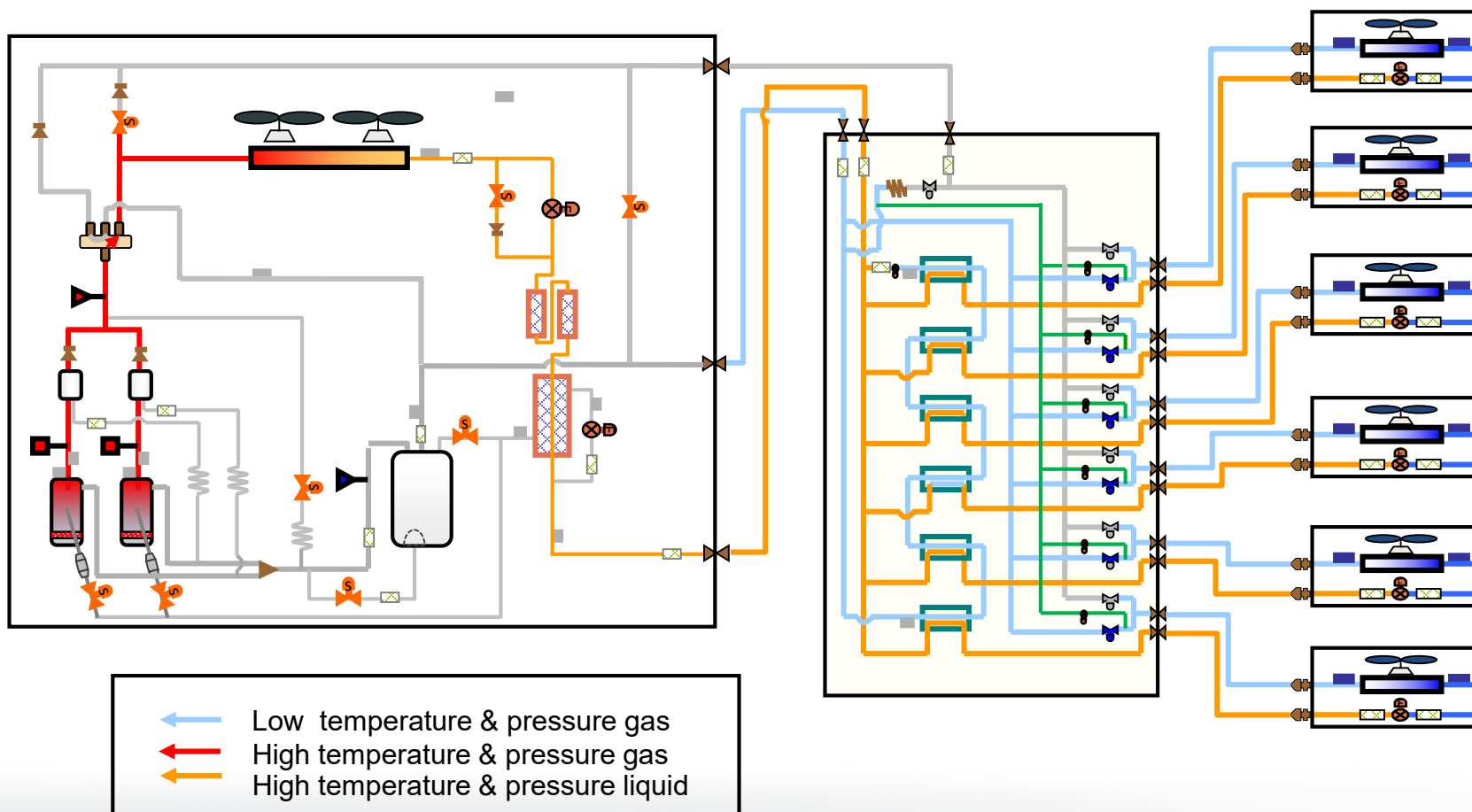
Refrigerant pass
through design
2,4&6 port models



Heat Recovery Introduction

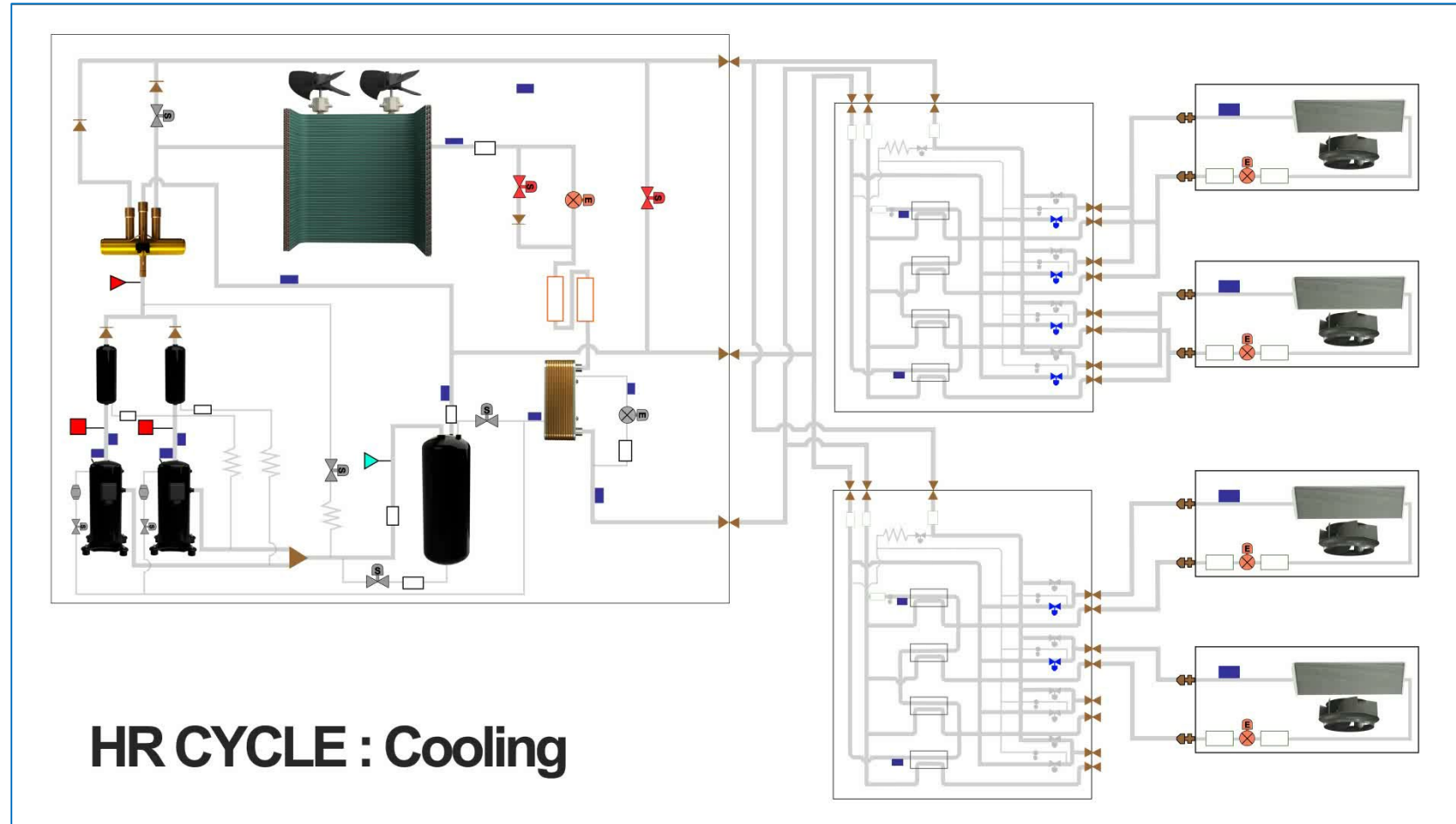
Cooling Operation

- Hot gas bypass valve 2 open condition
 - 20 mins. In cooling
 - Cooling oil recovery
 - System stop in 2 mins. 30 sec. 30 sec. open then close (pressure equalization)



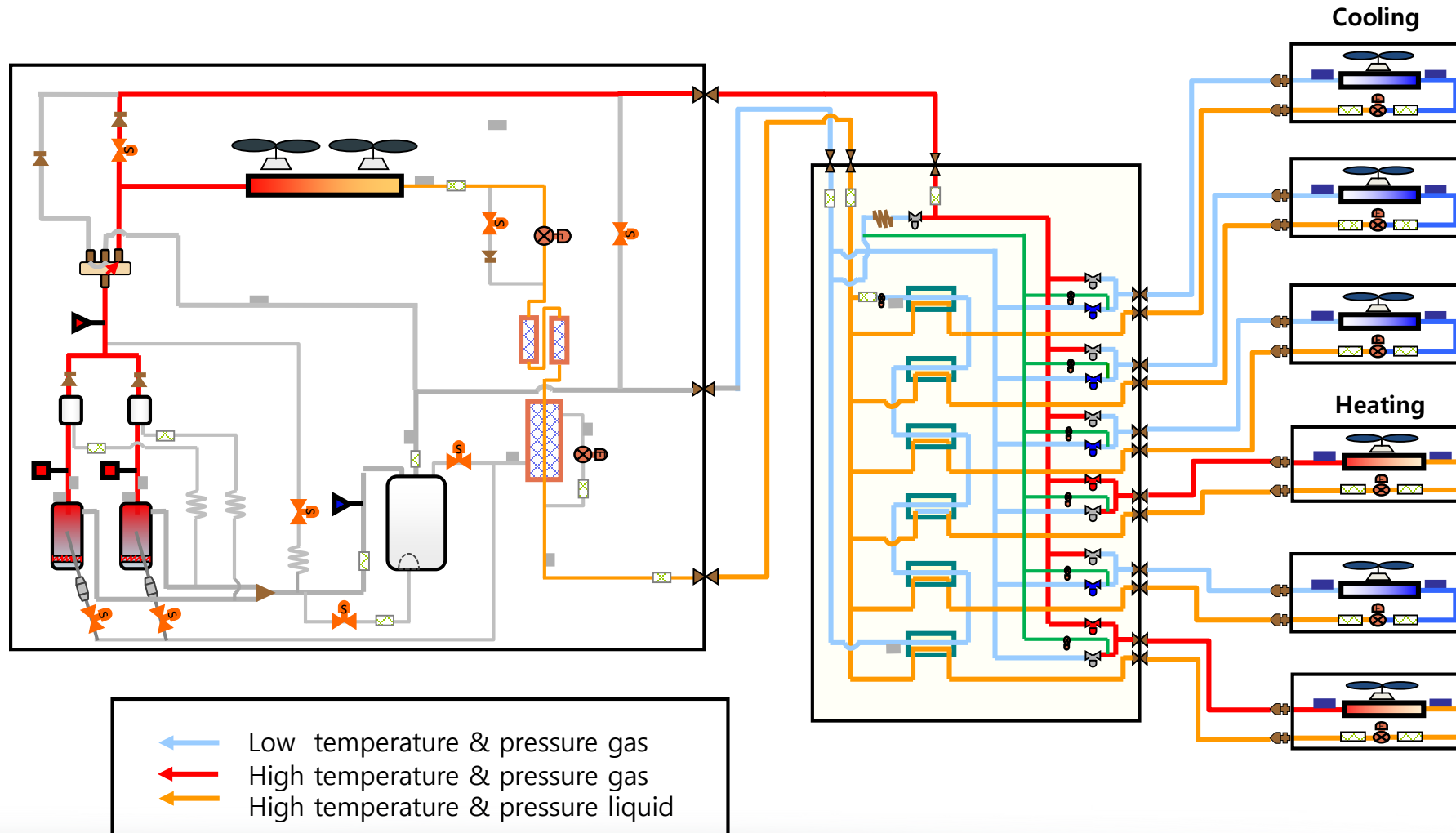
Heat Recovery Introduction

Video



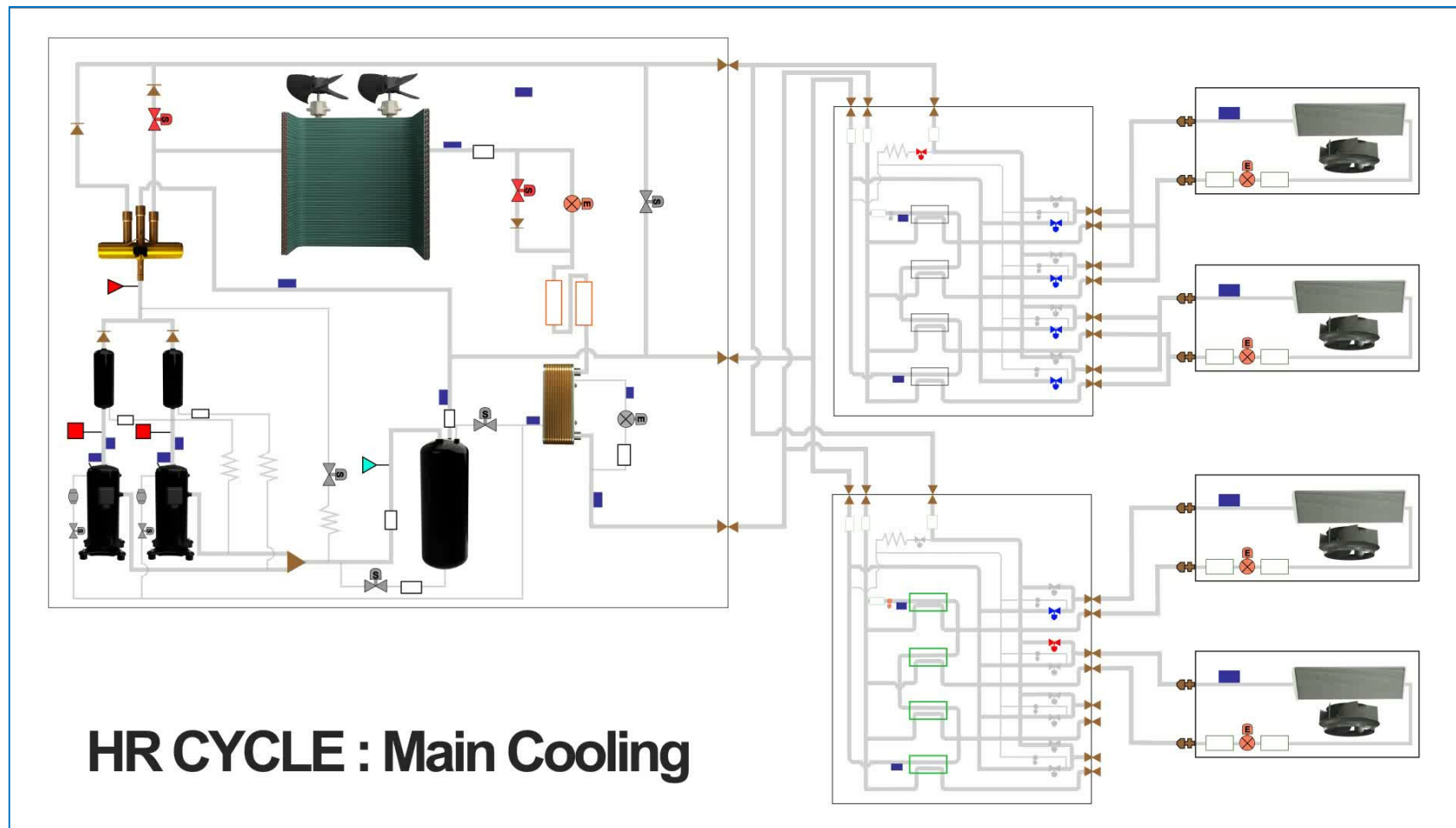
Heat Recovery Introduction

Main Cooling Operation



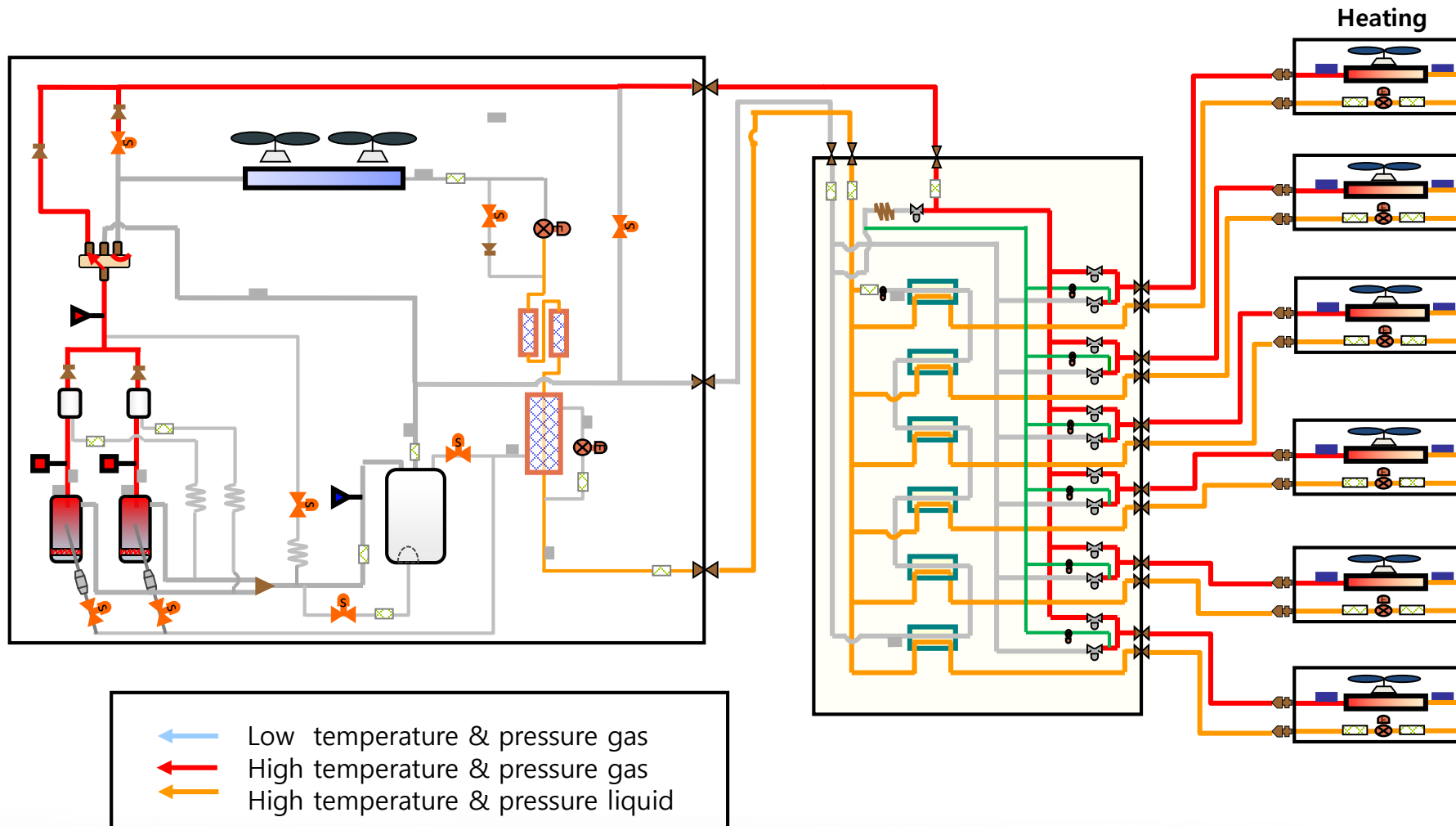
Heat Recovery Introduction

Video



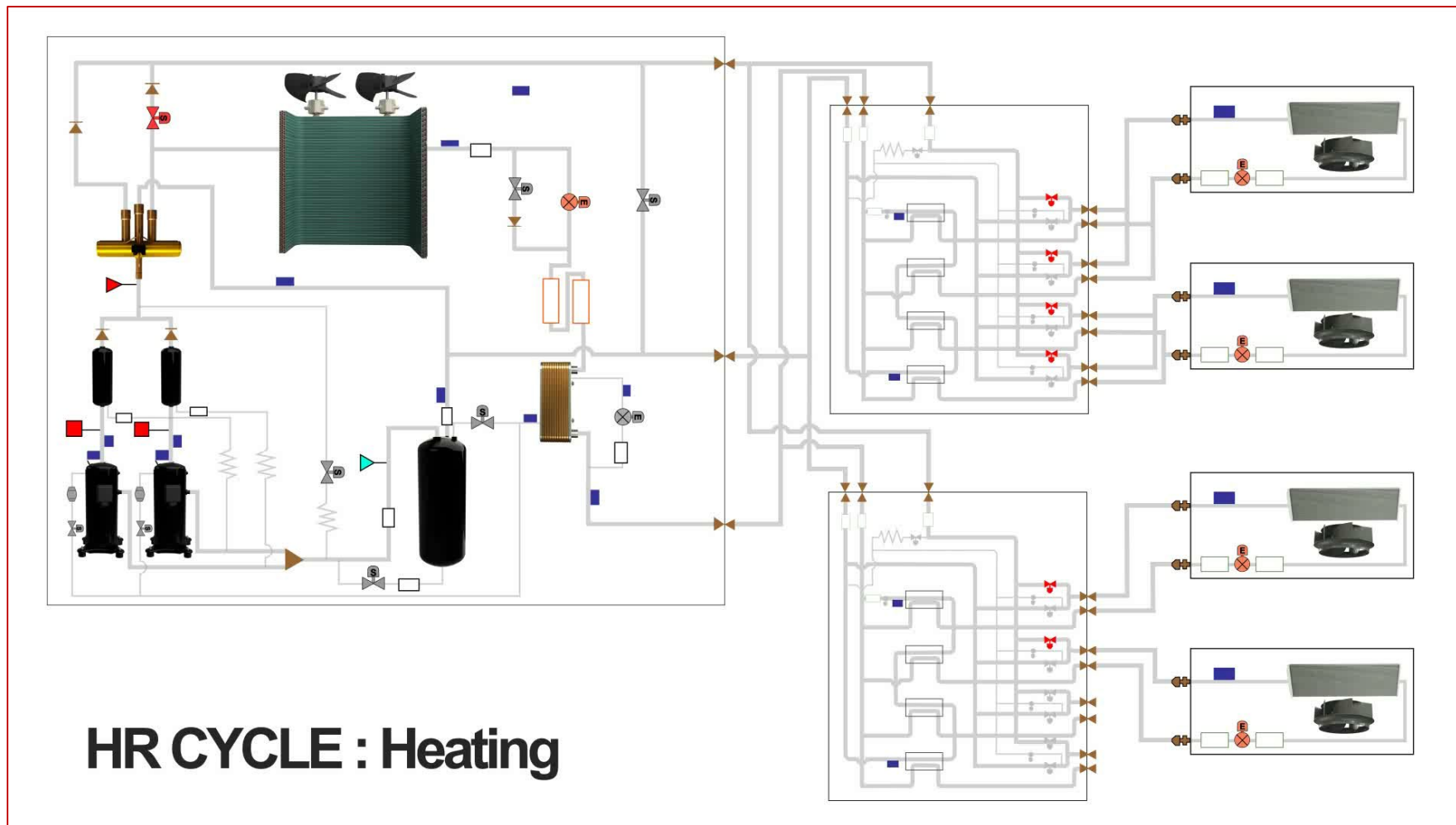
Heat Recovery Introduction

Heating Operation



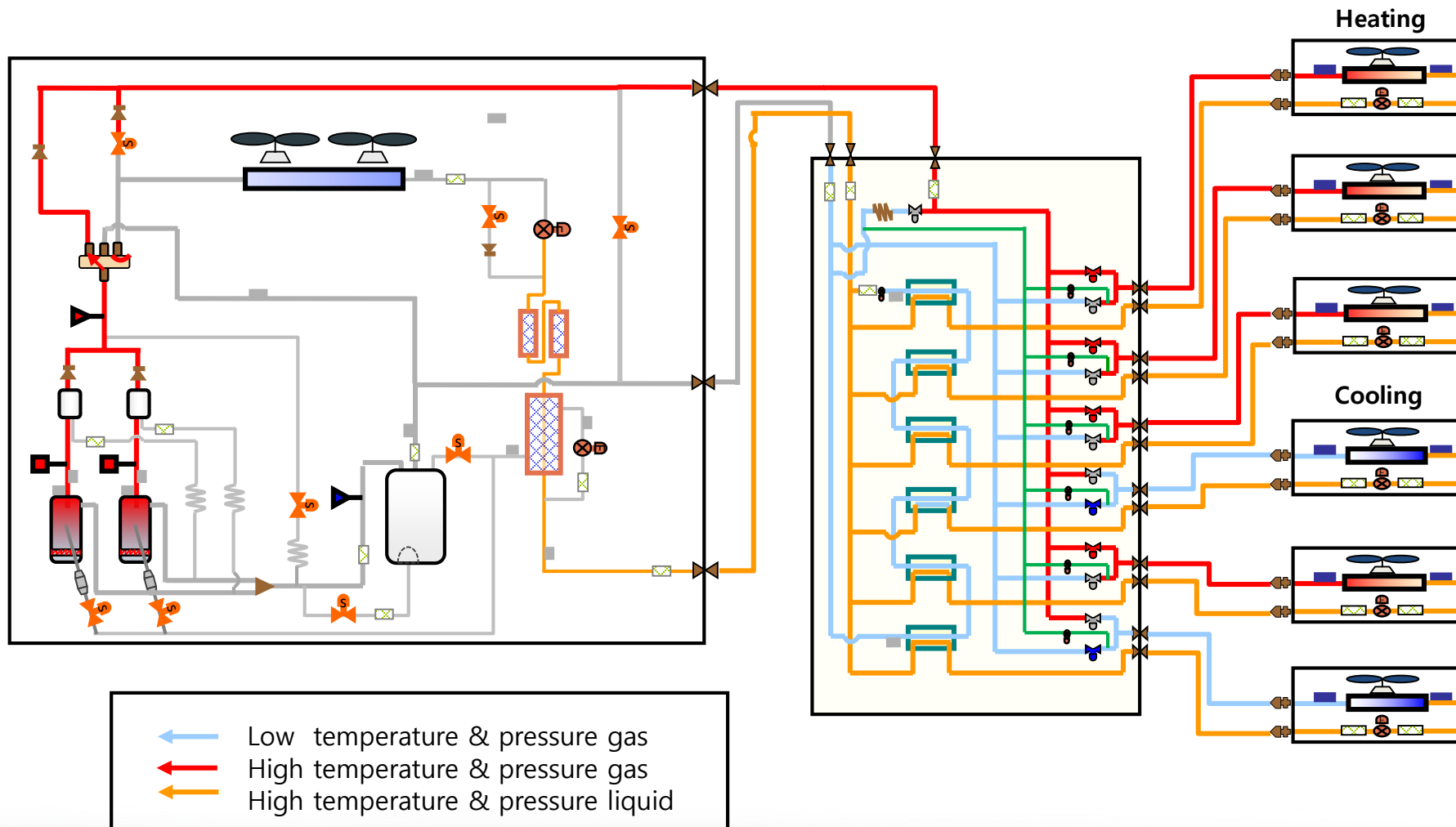
Heat Recovery Introduction

Video



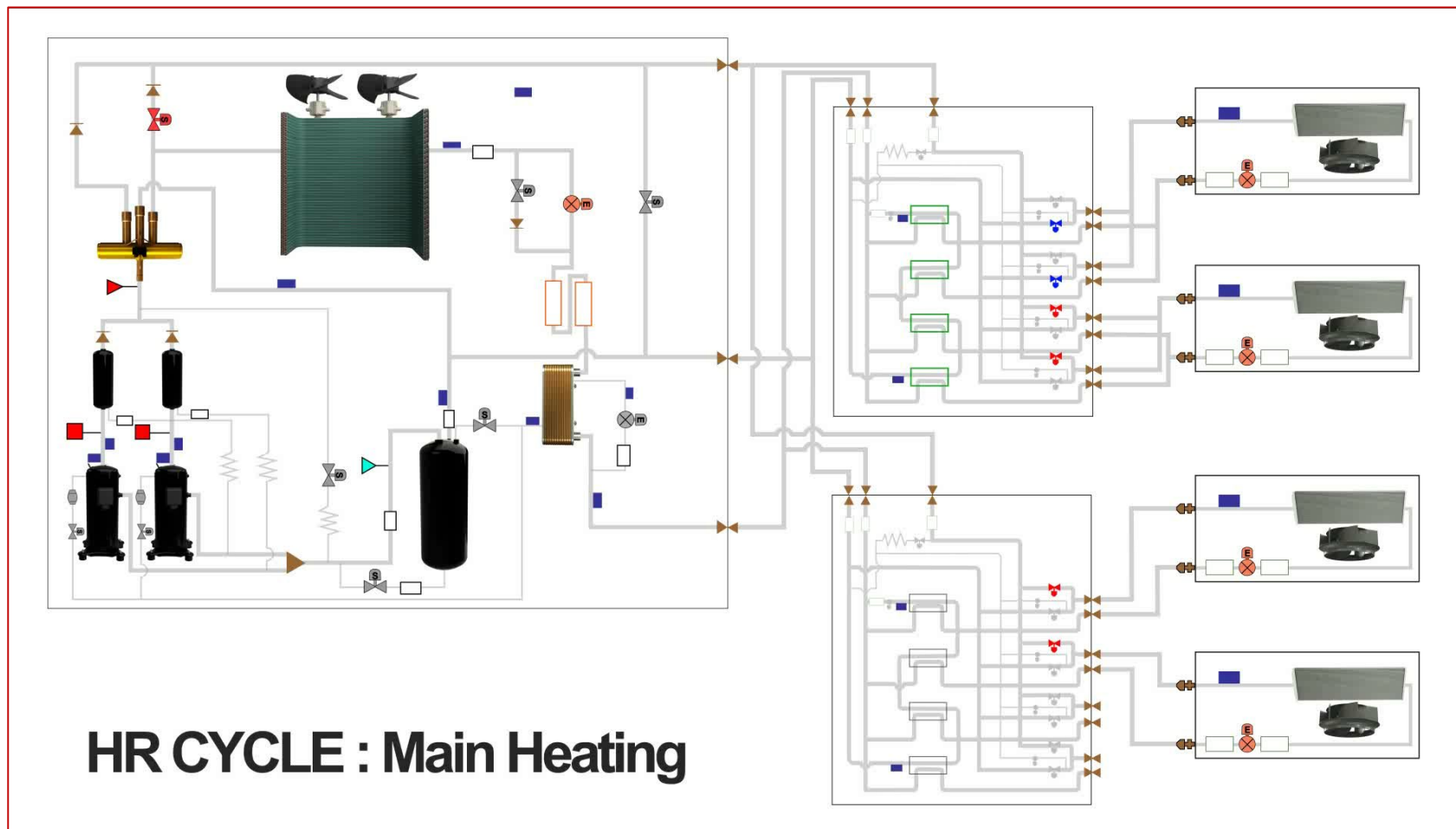
Heat Recovery Introduction

Main Heating Operation



Heat Recovery Introduction

Video





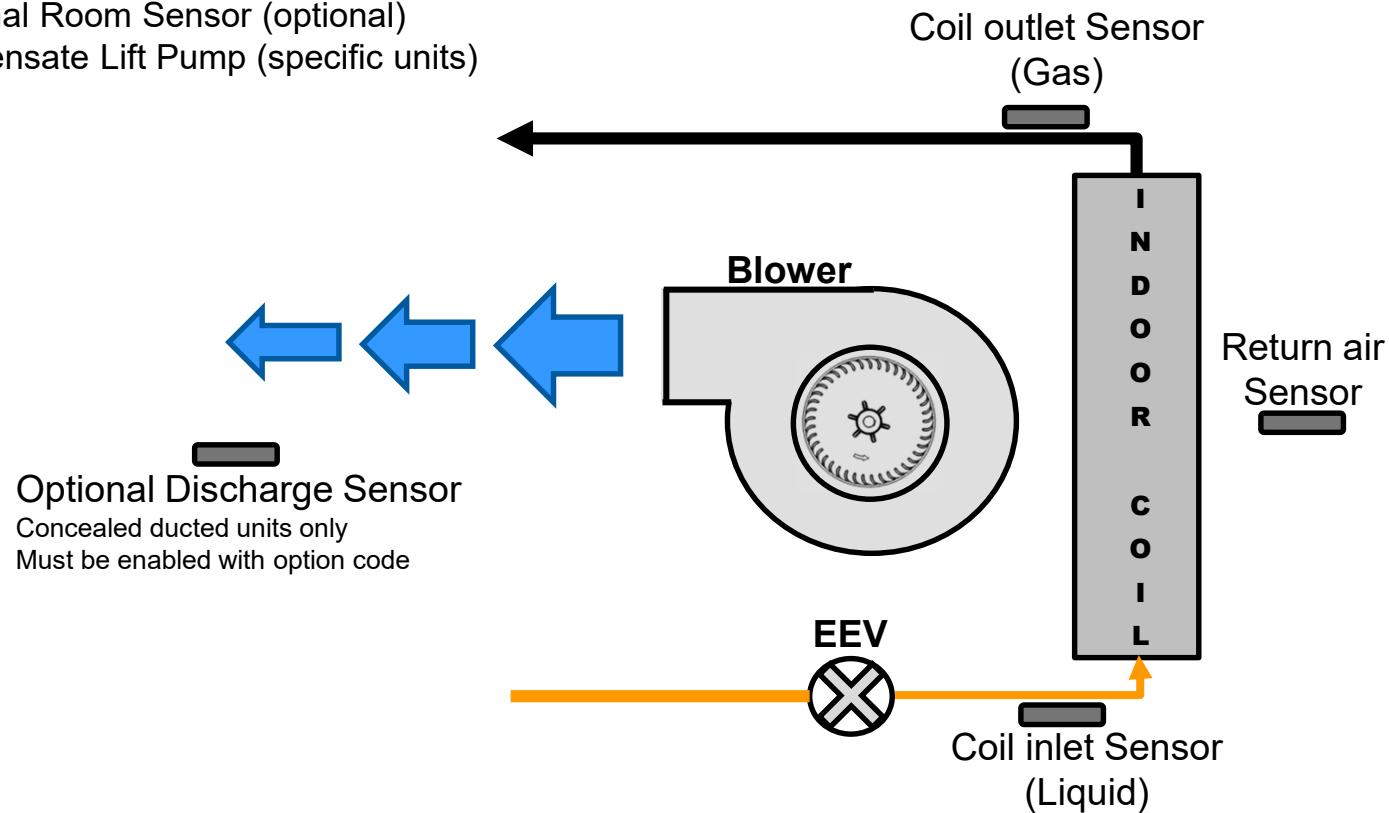
SAMSUNG *DVM S*

Indoor Unit Control

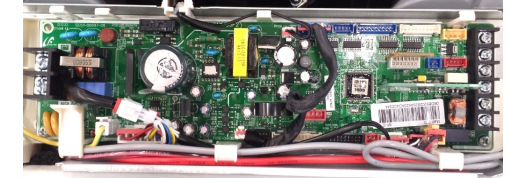
Indoor Unit Control

Indoor Fan Coil Basic Operation

- Indoor unit component diagram
 - Control components
 - Control PCB
 - Electronic Expansion Valve (EEV)
 - Wired Remote Controller w/built-in sensor (optional)
 - External Room Sensor (optional)
 - Condensate Lift Pump (specific units)



Example: 4-Way Cassette PCB



Example:
MWR-WE11(13)N



Room Sensor



MWR-TA
External Room Sensor

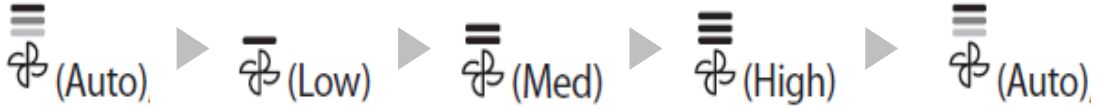


(Actual product appearance may vary)

Indoor Unit Control

Fan Speed Control

■ Fan speed control step

User control	
System control	- Ultra Low: minimum step(* non feedback type : 5 step + Low step x 0.25) - Low Low: Low – 1 step (* 1step : about 20rpm) - High High: High + 1 step - Ultra High: High + 2 step

■ Quiet Mode reduces the sound level from the fan motor during cooling or heating operation

- Fan feedback indoor unit (ex. RAC, 1way, 2way, 4way) - Current Fan speed -1 step (1step = about 20 rpm)
- Fan non feedback indoor unit (ex. duct) - H → M , M → L , L → L

Indoor Unit Control

Fan On/Off Control – Thermo-off Condition

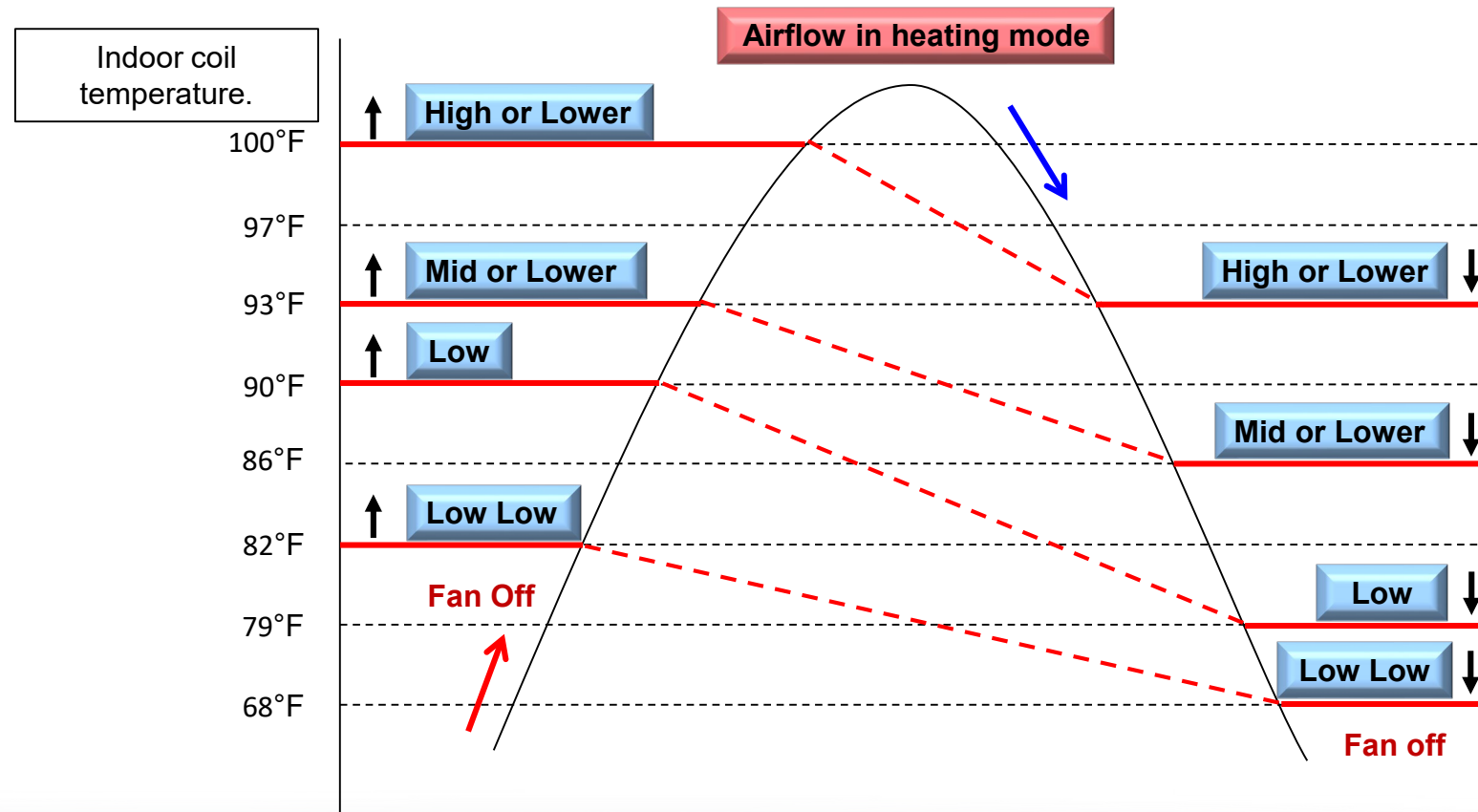
Mode	Thermo	EEV	Fan	“02” SEG4 setting
Cooling	ON	Open	On	0,1,2,3
	OFF	Closed (0 or 35)	On	0,1,2,3
			Off	4,5,6,7
Heating	ON	Open	On	0
	OFF	Open 120 step	Off & On(20°F↑)	0,4
			Off & On (20°F↑, 20sec on every 5mins)	2,6
			Off	1,3,5,7

“02” SEG 4	External room s/s	Minimizing fan operation
0	Disuse	Disuse
1	Use	Disuse
2	Disuse	Use-Heating
3	Use	Use-Heating
4	Disuse	Use-Cooling
5	Use	Use-Cooling
6	Disuse	Use-Both
7	Use	Use-Both

Indoor Unit Control

Fan Speed Control – Cold Air Prevention (Heat Mode)

- On a heat thermo-On, the fan operation is delayed until the indoor coil reaches 82°F
- This is a default function and cannot be deactivated



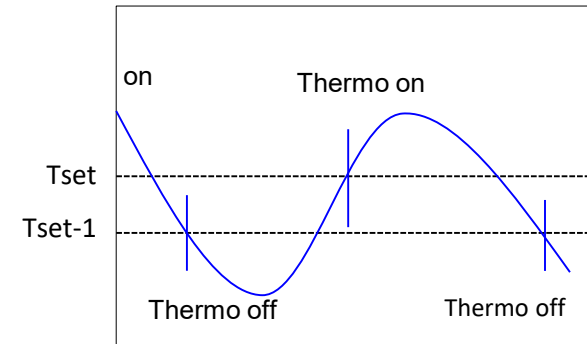
Indoor Unit Control

Cool & Heat Thermo On & Off Operation

■ Cooling Operation

Thermo on : Room temp. $\geq$ Set temp.

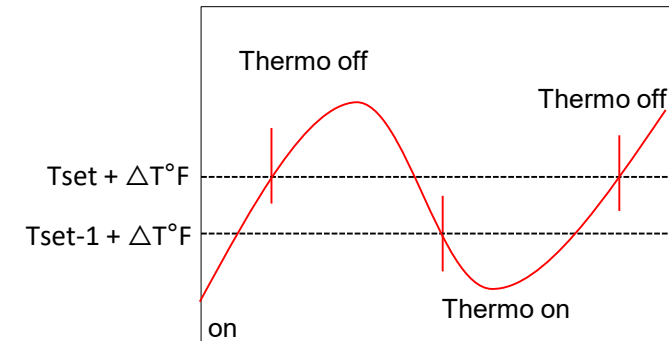
Thermo off : Room temp. $\leq$ Set temp. -1



■ Heating Operation

Thermo on : Room temp. $\leq$ Set temp. - 1 + $\Delta T^{\circ}F$

Thermo off : Room temp. $\geq$ Set temp. + $\Delta T^{\circ}F$



Indoor Unit Control

Heating Compensation Temperature

- $\Delta T^{\circ}\text{C}$ = Heating compensation temperature
 - Factory default (product code SEG6)
 - 4-Way type: $\Delta T^{\circ}\text{C}$ = 9°F
 - Others: $\Delta T^{\circ}\text{C}$ = 3.6°F

- Installation Setting (option code SEG21)

SEG21 Setting	ΔT
0	Factory default
1	3.6°F
2	9°F

- When using remote controller built-in room sensor – Installation option: SEG4=1
 - $\Delta T^{\circ}\text{C}$ = 0°F
- When wired R/C built-in sensor is set as “use” then $\Delta T^{\circ}\text{C}$ = 0°F regardless of SEG4 setting
- **Priority:** Wired R/C built-in sensor use = Ext. Room Sensor setting > Installation Option > Product Option
 - If higher priority setting is applied, lower will be ignored



Indoor Unit Control

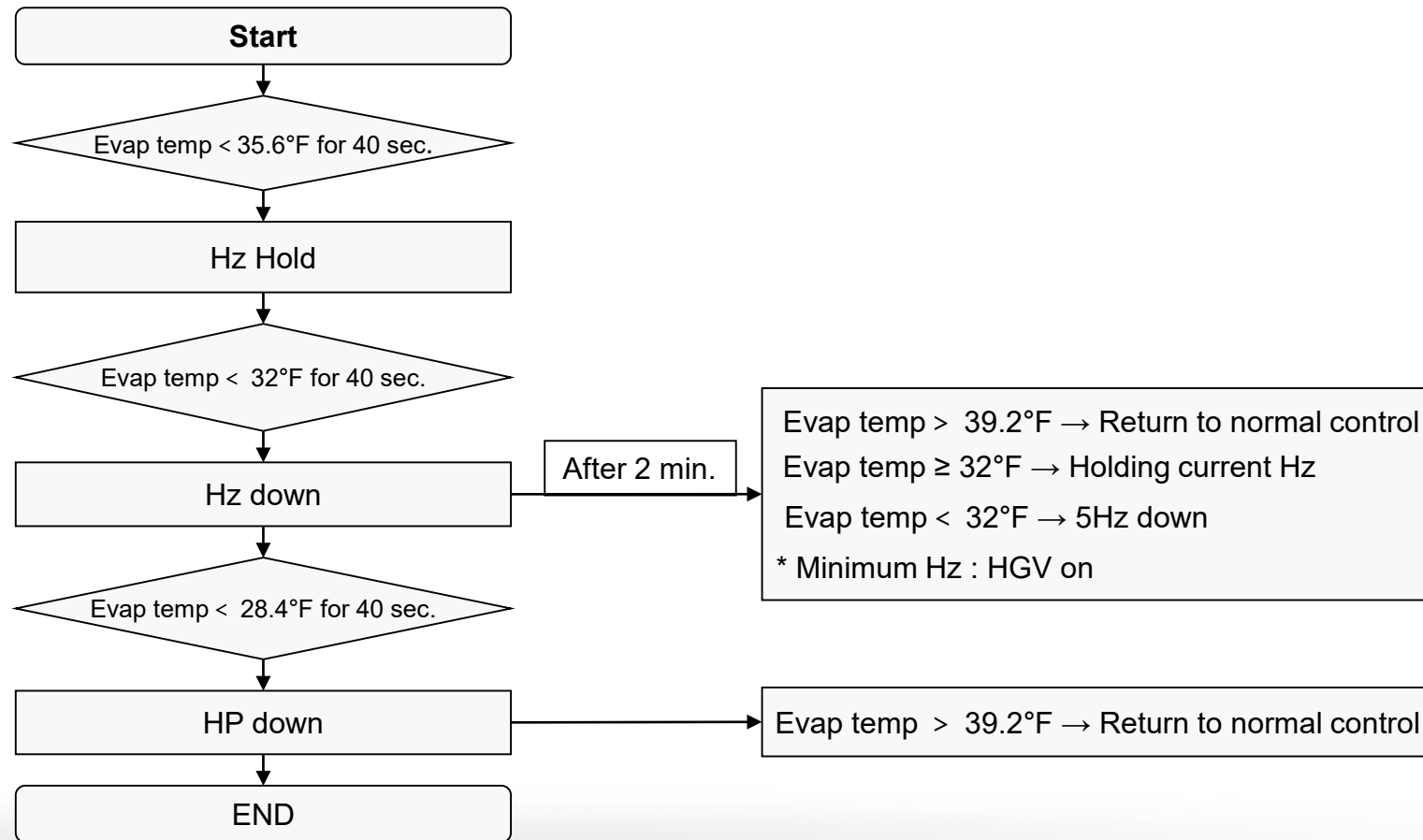
Indoor Unit Operation Mode

Mode	Fan speed	EEV	Setting temp. range	Remark
Auto mode	Fixed – Auto Difference between Set temp. & Room temp.) Low: 1°F ≤ Mid ≤ 3°F : High	Control	18~30°C (65~86°F)	User selection
Cooling mode	User input (Low, Mid, High, Auto)	Control	18~30°C (65~86°F)	User selection
Dry mode	Fixed - Auto (Low / Low Low)	Control	18~30°C (65~86°F)	User selection
Heating mode	User input (Low, Mid, High, Auto)	Control	16~30°C (61~86°F)	User selection
Turbo mode (while Cooling/Heating)	Fixed – High or Turbo	Control	Unable	Operating for 30mins then return to previous
Fan mode	User input (Low, Mid, High)	Fixed (Close)	-	User selection
Defrost	Stop	Fixed (Open)	-	System
Oil recovery	Turn on: User selected Turn off: Stop	Control	-	System

Indoor Unit Control

Indoor Coil Freeze Protection Control

- Purpose: To prevent indoor coil freeze up due to abnormally low coil temperature
- Process: Hz Hold → Hz Down → HP Down (no error code for freeze protection)



Indoor Unit Control

Auto Mode - Default

- Initial operation mode determination

If Room Temp. $\geq$ Set Temp. $- 1^{\circ}\text{F}$	If Room Temp. $<$ Set Temp. $- 1^{\circ}\text{F}$
→ Auto cooling mode	→ Auto heating mode

- Thermo-On/Off

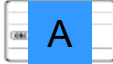
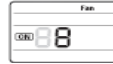
- Thermo-On/Off is same in cooling & heating mode

- When mode change is carried out

Model	Heat pump	Heat recovery
Condition	1 & 2 & 3	1 or 2 or 3
Detail	1. Thermo off for 30 mins 2. Only 1 IDU is turned on. 3. IDU product option change "Seg 5 current + 2" ex) 014046-194XXX → 014066-194XXX * If more than 2 IDUs are turned on, IDU mode will follow the ODU operation mode.	1. Thermo off for 30 mins 2. IDU Set temp. change 3. Follow the installation option setting * refer to the next page for "3"

Indoor Unit Control

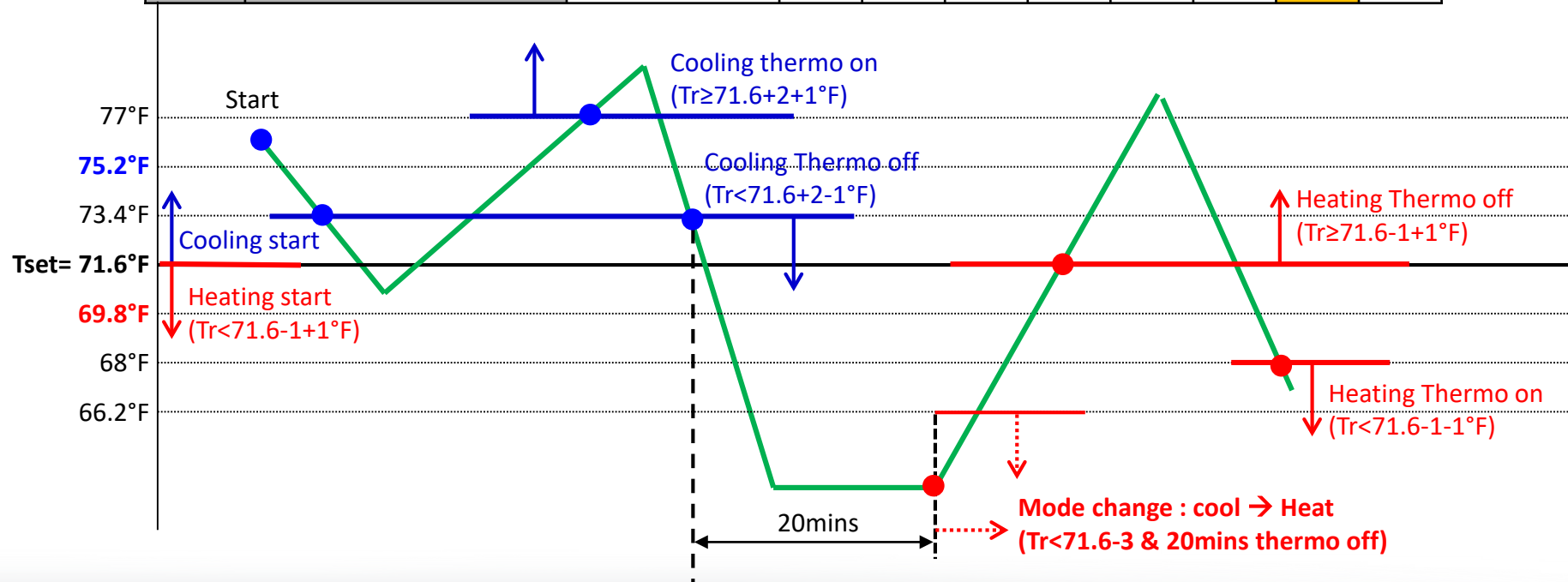
Auto Mode – Auto Changeover Setting For Heat Recovery

Option	SEG1		SEG2		SEG3		SEG4		SEG5		SEG6	
Explanation	PAGE		MODE		Use of Auto Change Over for HR only in Auto mode		(When setting SEG3) Standard heating temp. Offset		(When setting SEG3) Standard cooling temp. Offset		(When setting SEG3) Standard for mode change Heating → Cooling	
Remote Controller Display												
Indication and Details	Indication	Details	Indication	Details	Indication	Details	Indication	Details	Indication	Details	Indication	Details
	0		5		0	Follow product option	0	0	0	0	0	1
					1	Use Auto Change Over for HR only	1	0.5	1	0.5	1	1.5
							2	1	2	1	2	2
							3	1.5	3	1.5	3	2.5
							4	2	4	2	4	3
							5	2.5	5	2.5	5	3.5
6	3	6	3	6	4							
7	3.5	7	3.5	7	4.5							
Option	SEG7		SEG8		SEG9		SEG10		SEG11		SEG12	
Explanation	PAGE		(When setting SEG3) Standard for mode change Cooling → Heating		(When setting SEG3) Time required for mode change		Compensation option for Long pipe or height difference between indoor units					
Remote Controller Display												
Indication and Details	Indication	Details	Indication	Details	Indication	Details	Indication	Details				
	1		0	1	0	5 min.	0	Use default value	1	1) Height difference ¹⁾ is more than 30m or 2) Distance ²⁾ is longer than 110m		
			1	1.5	1	7 min.	2	1) Height difference ¹⁾ is 15~30m or 2) Distance ²⁾ is 50~110m				
			2	2	2	9 min.						
			3	2.5	3	11 min.	2					
			4	3	4	13 min.						
			5	3.5	5	15 min.						
			6	4	6	20 min.						
7	4.5	7	30 min.									

Indoor Unit Control

Auto Mode – Auto Changeover Setting For Heat Recovery

Setting		Value	0	1	2	3	4	5	6	7
A	Heating offset	SEG4	0	0.5	1	1.5	2	2.5	3	3.5
B	Cooling offset	SEG5	0	0.5	1	1.5	2	2.5	3	3.5
C	Heat → cool	SEG6	1	1.5	2	2.5	3	3.5	4	4.5
D	Cool → heat	SEG8	1	1.5	2	2.5	3	3.5	4	4.5
T	Time	SEG9	5	7	9	11	13	15	20	30

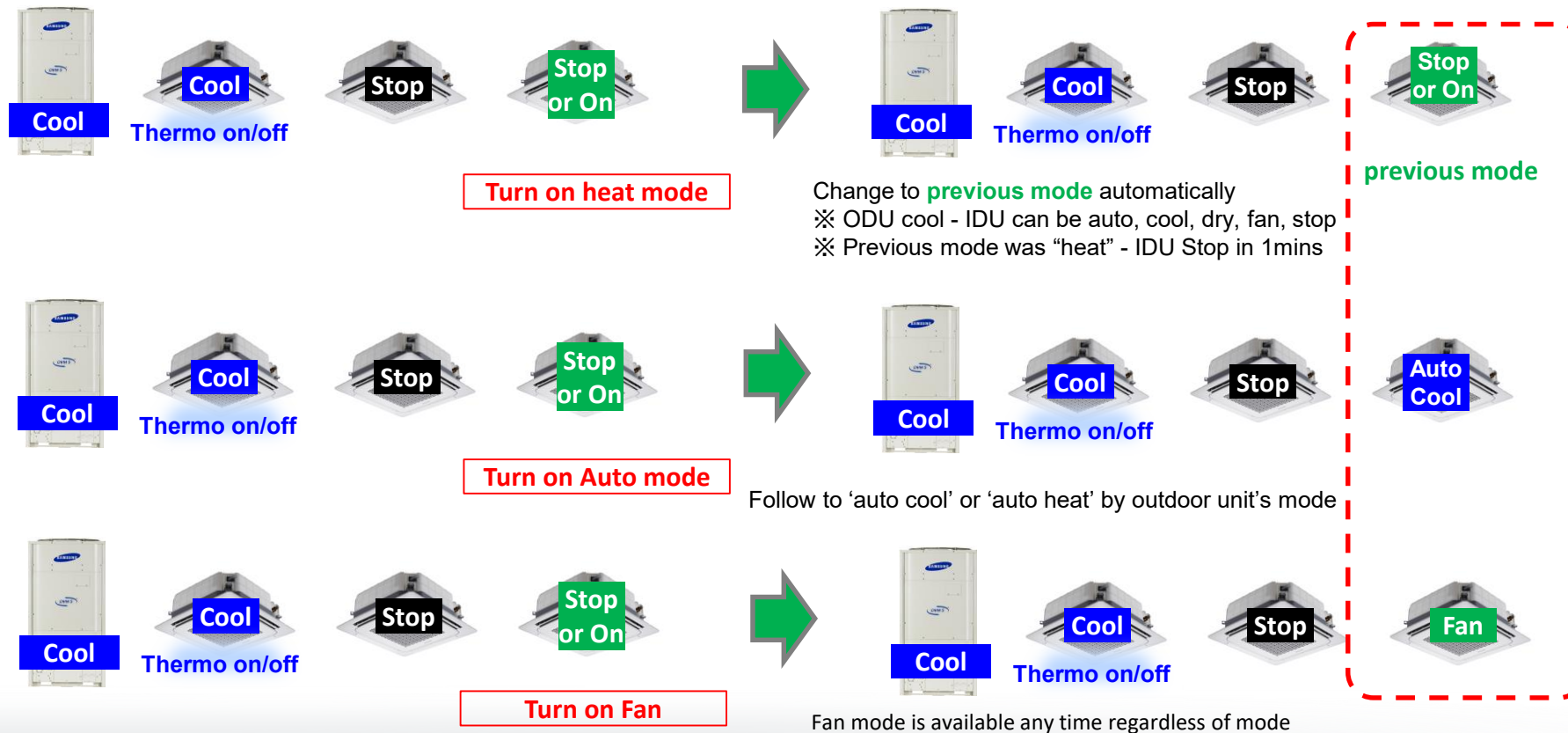


Indoor Unit Control

Mixed Operation Prevention – Heat Pump only

Mixed operation prevention in wired remote controller

- Operation mode restriction by outdoor unit's mode in Heat Pump
- If the wireless remote controller is in the opposite mode, the signal will be ignored

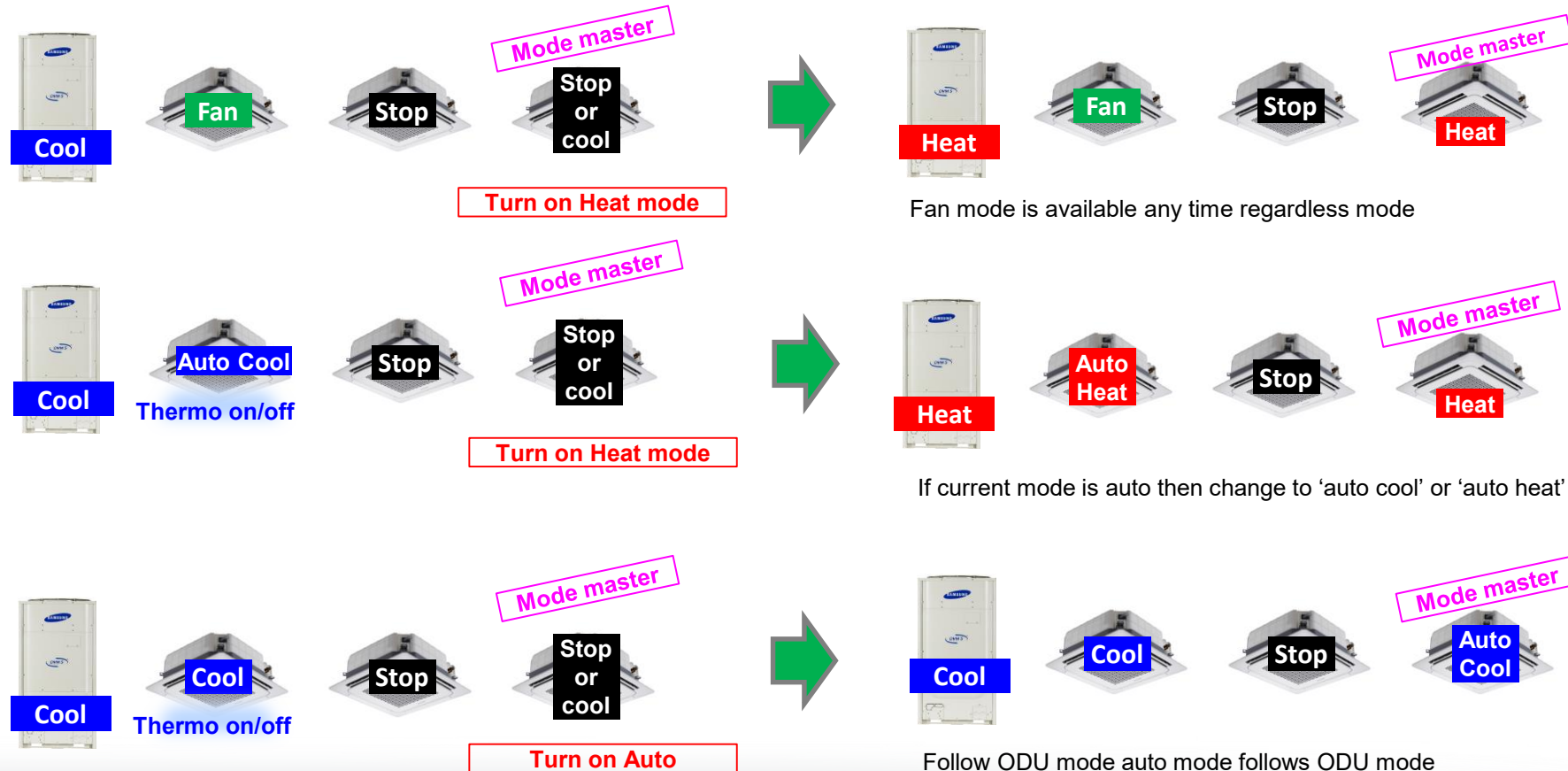


Indoor Unit Control

Mixed Operation Prevention – Heat Pump only

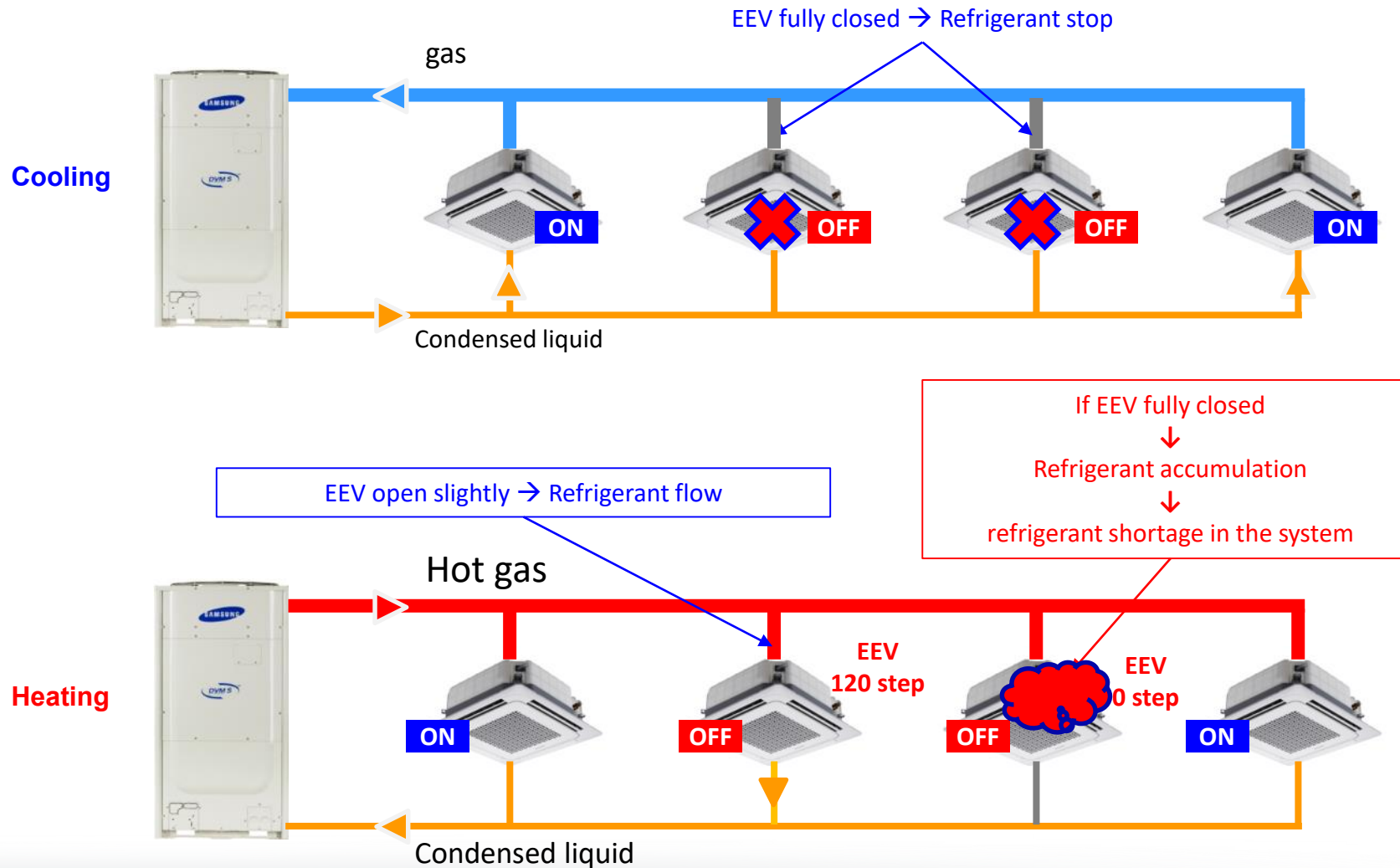
Mode master in wired remote controller

- Operation mode restriction by “Mode master indoor unit” even when the unit is stop
- If IDU is On or mode changed then mode will be determined by “mixed operation prevention”



Indoor Unit Control

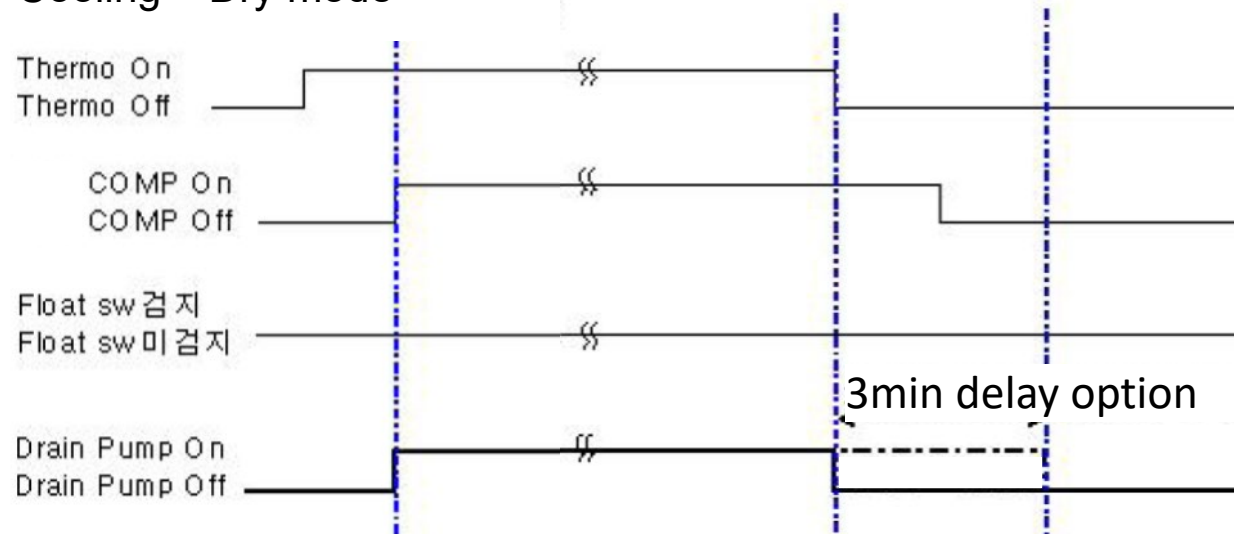
Electronic Expansion Valve Control



Indoor Unit Control

Condensate Lift Pump

■ Cooling – Dry mode



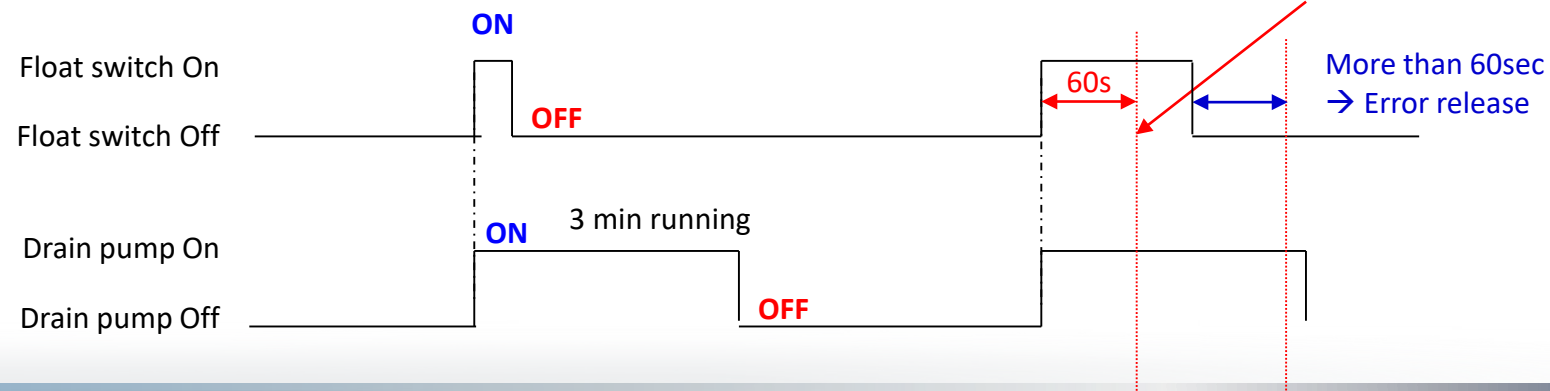
Installation option 02

SEG8

Use of drain pump

Indication	Details
0	Disuse
1	Use
2	Use+3min delay

■ Other mode



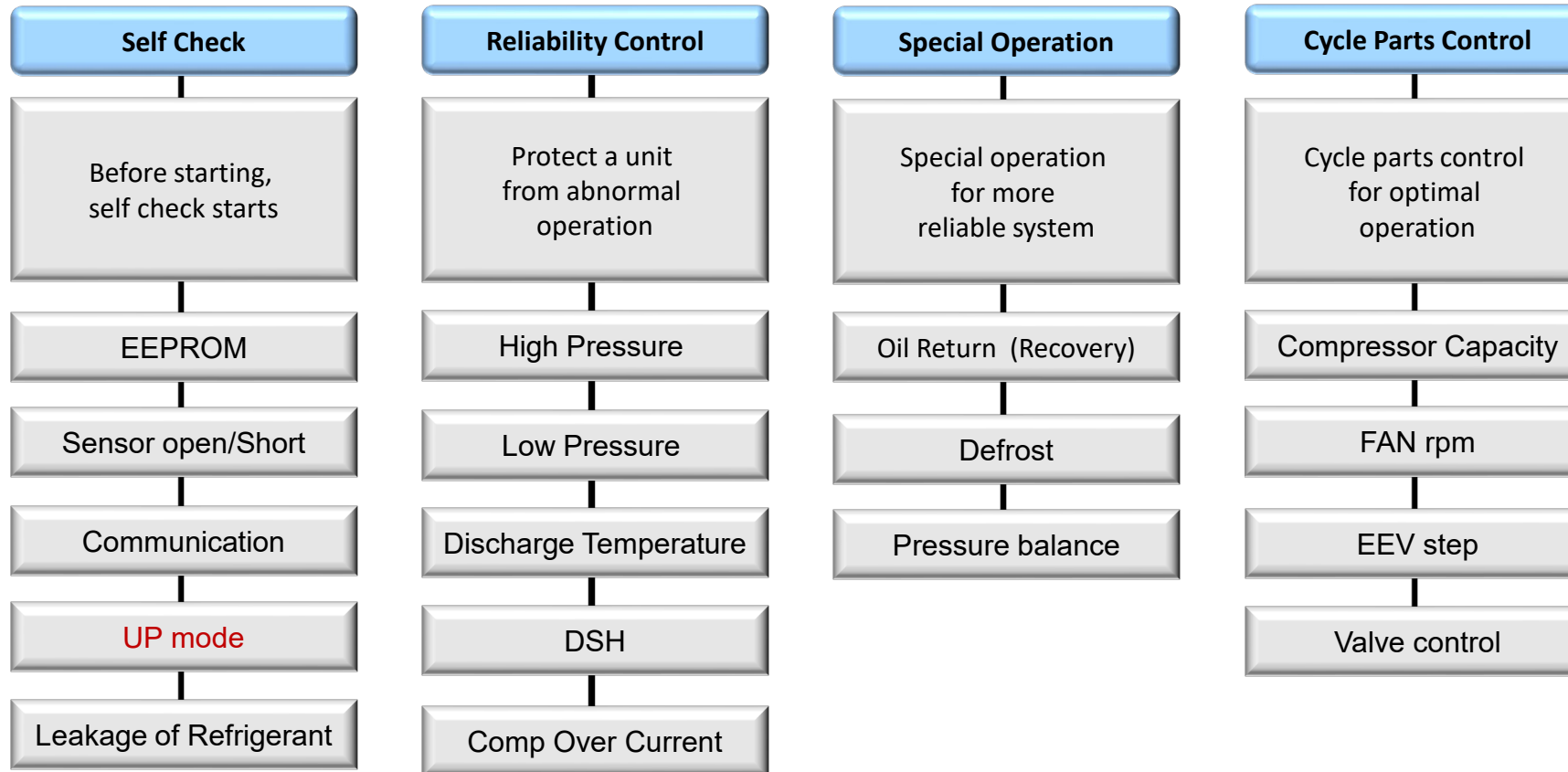


SAMSUNG *DVM S*

Outdoor Unit Control

Outdoor Unit Control

Control Logic Configuration



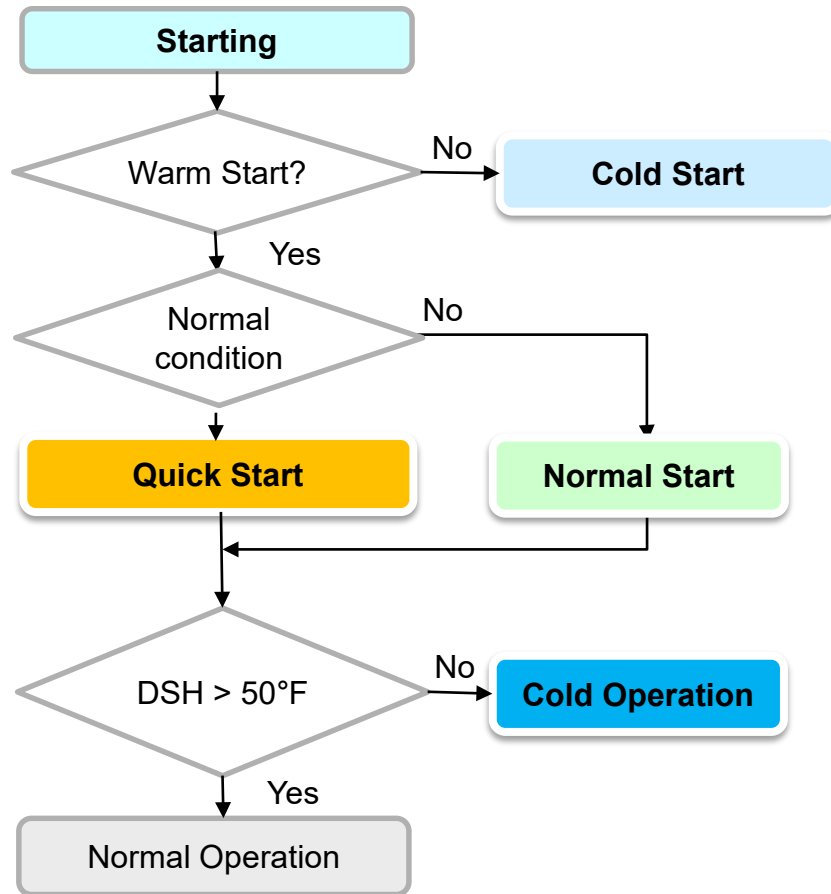
Outdoor Unit Control

Basic Control Logic

Mode	Main Part	Output	Factor	Target
Cooling	INV Comp	FREQUENCY	Low pressure (current-target)	Target low pressure
	OD FAN	FAN STEP	High pressure (current-target)	Target high pressure
	EVI EEV	EEV STEP	Sub-cool (current SC-target SC)	Target SC/Td
Heating	INV Comp	FREQUENCY	High pressure (current-target)	Target high pressure
	OD FAN	FAN STEP	Low pressure (current-target)	Target low pressure
	Main EEV	EEV STEP	SH(Suc-Tst_LP), DSH, Balance, etc.	Target SH
	EVI EEV	EEV STEP	SH(EVI out-EVI in)	Target SH/Td

Outdoor Unit Control

Compressor Safety Starting Pattern



Crankcase Heater (CCH)

- CCH must be energized for 6 hours before initial compressor start to avoid damage due to liquid refrigerant forming in the compressor oil

Starting pattern

- **Cold Start**
 - If the compressor temperature is low, a low start-up frequency is applied to protect the compressor from potential liquid compression and poor lubrication due to oil foaming
- **Cold operation**
 - If the DSH is low, the compressor frequency speed is decreased to protect the compressor from liquid compression
- **Quick start**
 - All compressors start at the same time if required
- **Normal start**
 - Compressors start one after the other in sequence

DSH = Discharge Super Heat: Comp discharge temp minus high press saturated temp

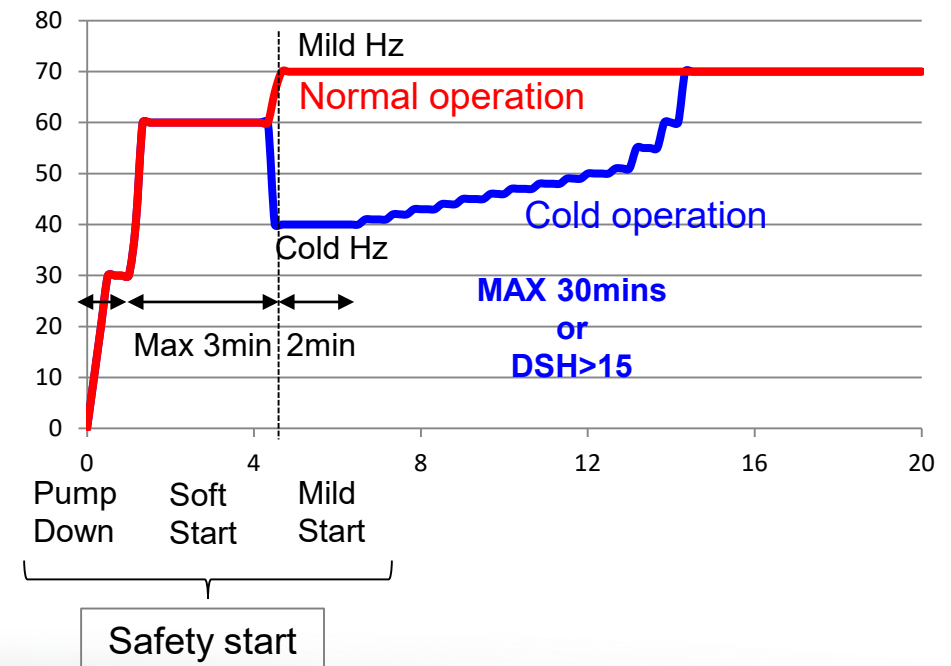
Outdoor Unit Control

Normal & Cold Operation

- Limitation of max. frequency & frequency increasing speed until min. DSH is reached
 - Low frequency operation
 - Prevent accumulator liquid flooding
- DSH (Discharge Super Heat) = Compressor discharge temp. – High pressure saturated temperature

Cold Operation condition (A B)	
A	DSH <50°F
B	Max (T top, T dis) < 122°F
* Judge when "Soft Start" finish	

Cold Start release (A B)	
A	Max 30 mins
B	DSH >59°F



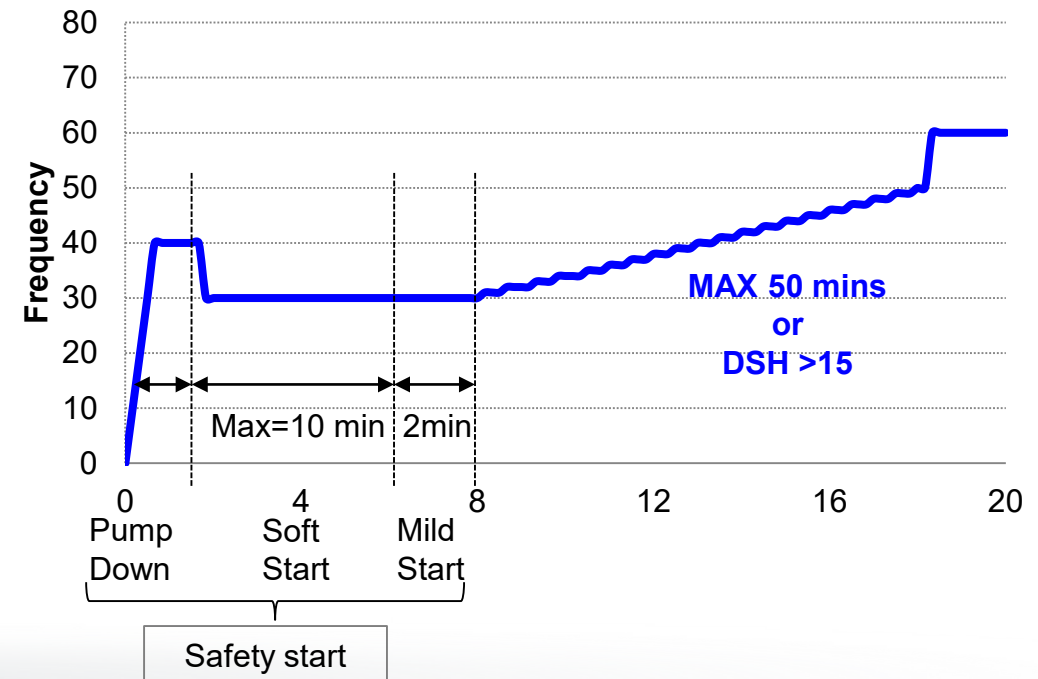
Outdoor Unit Control

Cold Start

- Limitation of max. frequency & frequency increasing speed until min. DSH is reached
 - Low frequency operation
 - Oil forming prevention
 - Secure compressor oil level
- DSH (Discharge Super Heat) = Compressor discharge temp. – High pressure saturated temp

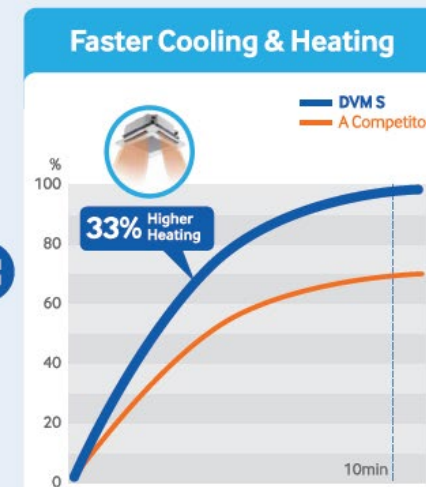
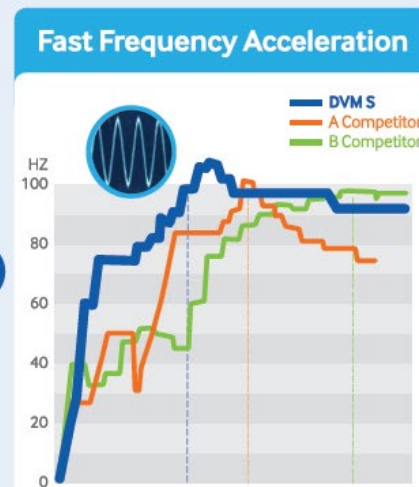
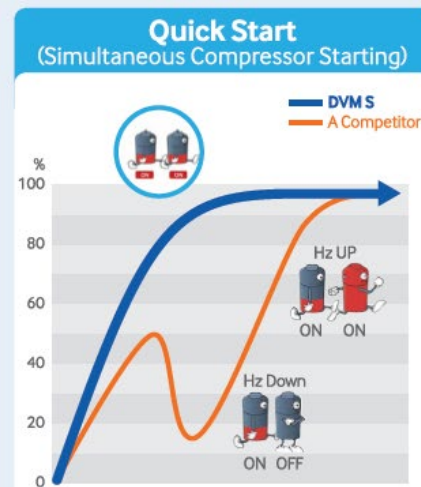
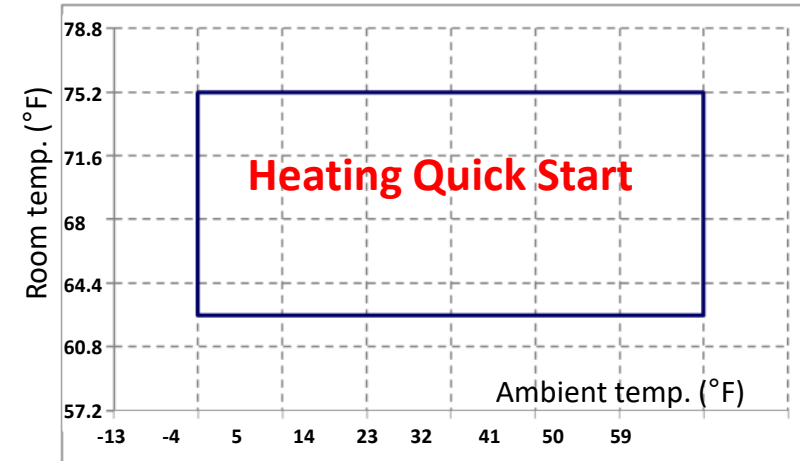
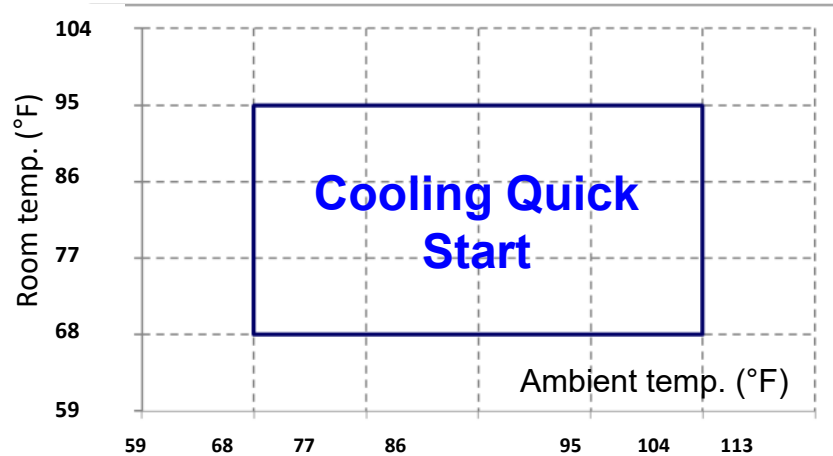
Cold Start condition (A B) x C x D	
A	Max (T top, T dis) – T air < 59°F
B	Max (T top, T dis) < 122°F
C	Less than 12 hours after the power supply
D	Ambient temp. < 86°F (Cooling) Ambient temp. < 68°F (Heating)

Cold Start release (A B)	
A	Max 50mins
B	DSH > 59°F



Outdoor Unit Control

Quick Start ($\geq 30\%$ Indoor Unit Capacity Required)



Outdoor Unit Control

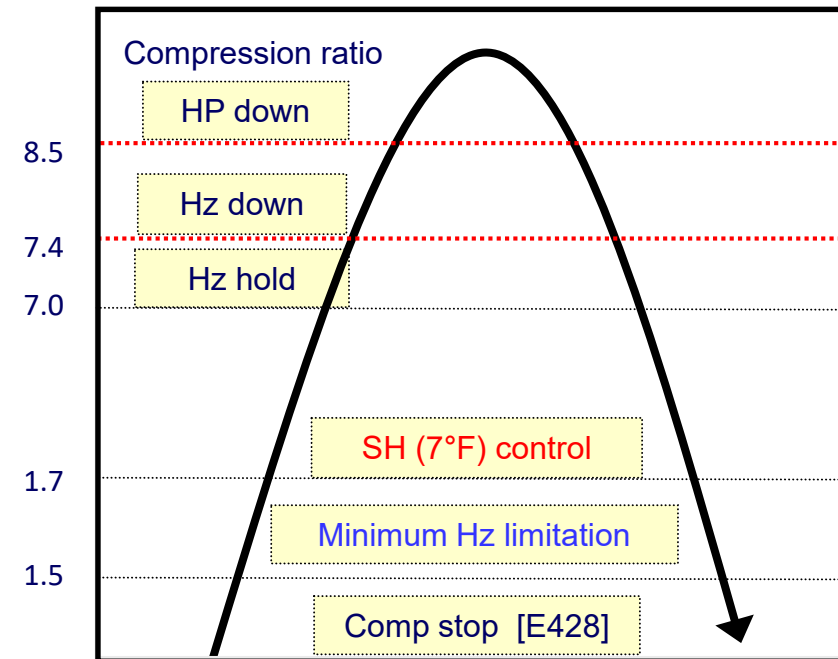
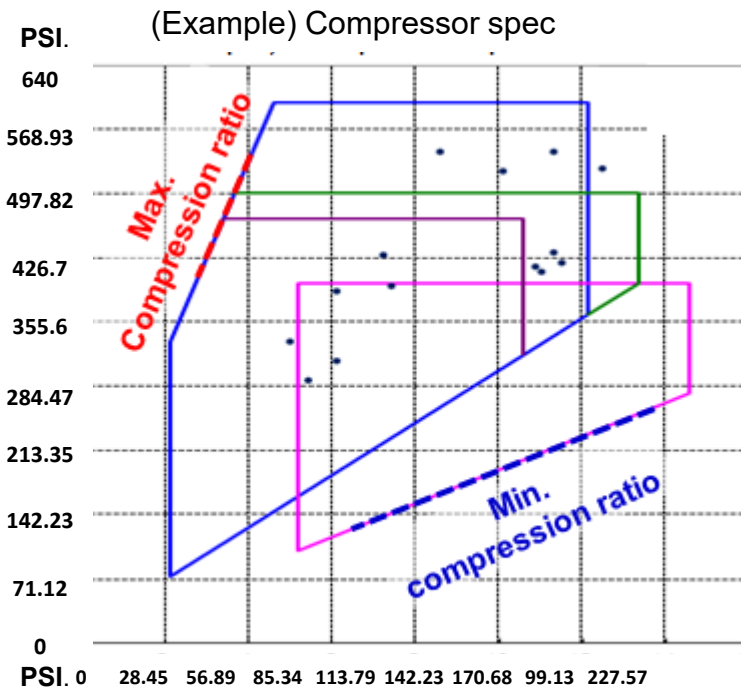
Compression Ratio Control

- Purpose: Protect the compressor from abnormal operation
- Process: Hz Hold → Hz Down → HP Down Compressor stop (E428)
 - Max. compression ratio: to limit capacity
 - Min. compression ratio: to maintain lubrication

- Compression Ratio

$$= (\text{High pressure} + 14.7\text{psi}) / (\text{Low pressure} + 14.7\text{psi})$$

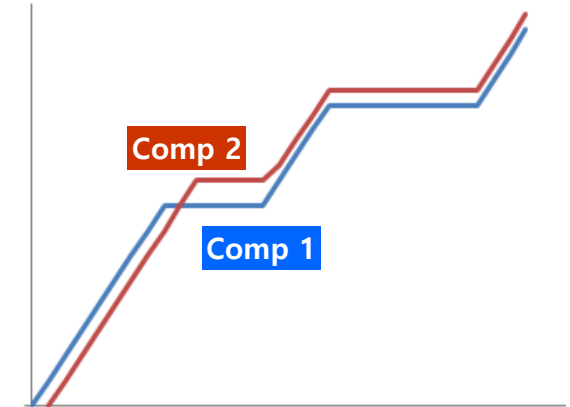
$$(\text{Absolute pressure} = \text{Gauge pressure} + 14.7\text{psi})$$



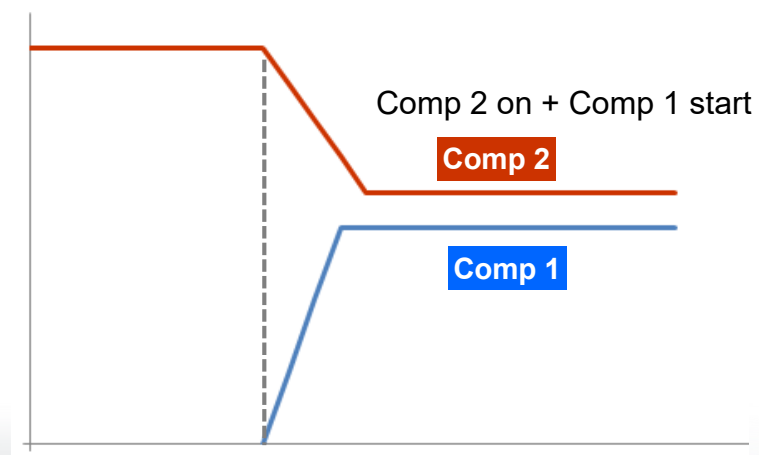
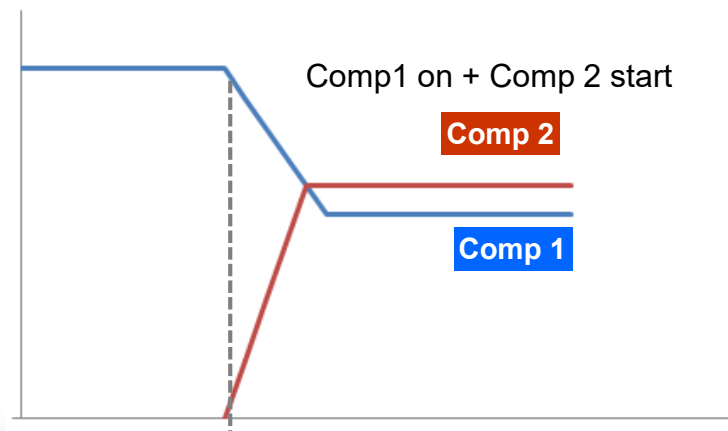
Outdoor Unit Control

Control Logic – Dual Compressors Starting

- Comp 2: $\text{Hz} = \text{Comp 1} + \text{offset}$
- Offset: Max. 10 Hz
- Major condition for next compressor starting (1or2)
 - Comp. Hz > 76Hz
 - Comp. Hz > 60 Hz for 3 mins. Without unit stop
 - Comp. Hz > 70 Hz for 3 mins. When unit stop



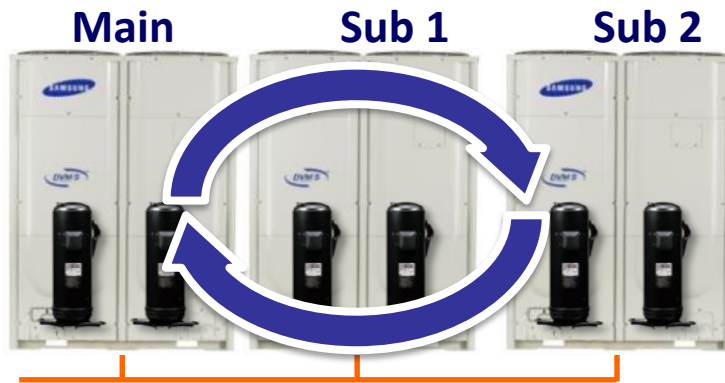
Control Logic – Additional Compressor Starting



Outdoor Unit Control

Operating Priority

Modular System
2 or 3 ODU's connected
together on the same
refrigerant network



- **Master unit priority**
 - At initial starting from power supply
 - ODU address setting (Main - Sub1 - Sub2)
- **Master unit rotation**
 - 1- After defrost / oil recovery / all unit off
(Master unit operates more than 60mins)
 - 2 - Any unit is stopped over 40 min.

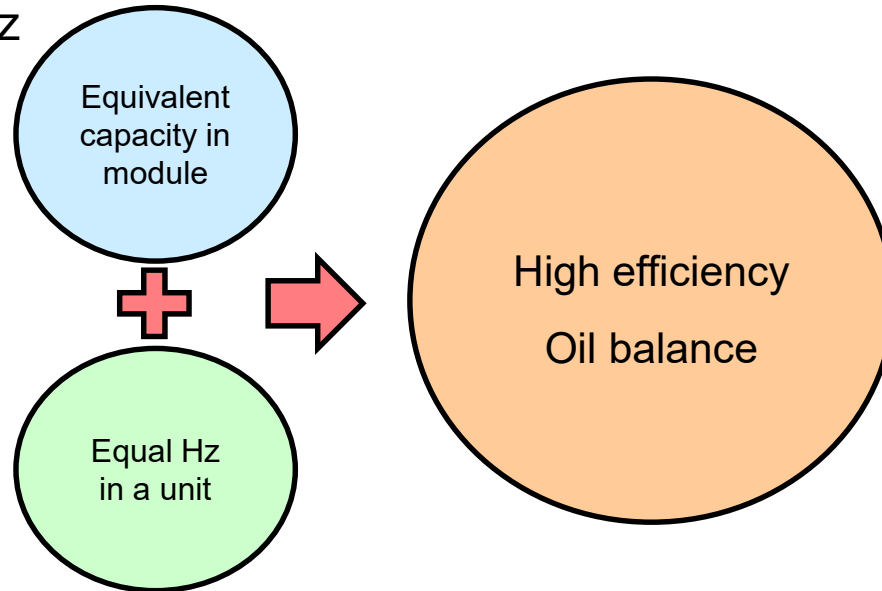
Main	Sub1	Sub2
Master	Sub1	Sub2
Sub2	Master	Sub1
Sub1	Sub2	Master

- **Compressor priority in a unit**
 - Which one is off longer
 - INV1 at initial starting from power supply
- **Additional compressor starting condition**
 - Over 60Hz & over 3mins operation
 - Over 76Hz operation
- **Efficiency of 30~80Hz is better than higher frequency**
- **Each unit will decide individually**

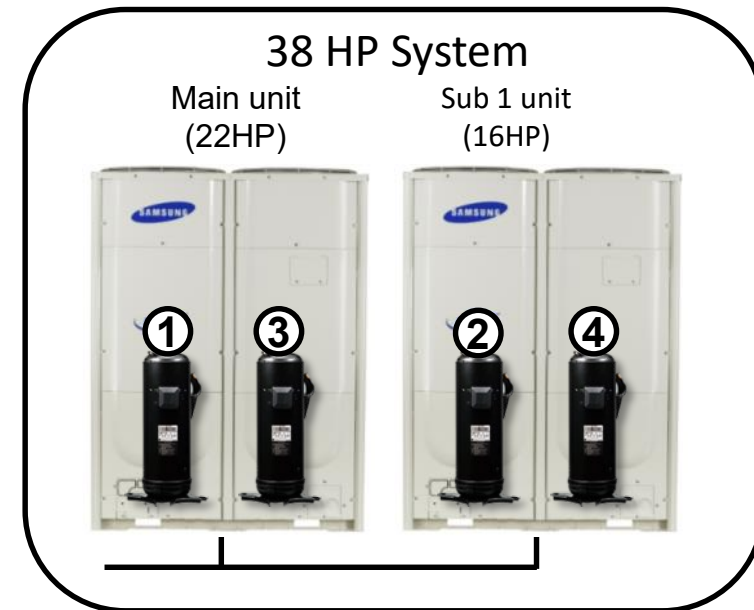
Outdoor Unit Control

Compressor Capacity Control

- Equal frequency in a unit: max. 10Hz difference
- Equal capacity in a module: Capacity division by unit capacity, control all compressor frequency difference within 20Hz



Example) Required capacity = 273,000 Btu/h



	Main unit		Sub 1 unit	
Compressor	Comp 1 (64cc)	Comp 2 (64cc)	Comp 1 (52cc)	Comp 2 (52cc)
Module Capacity [Btu/h]	273,000: * <u>22</u> /38 = 158,000		273,000: * <u>16</u> /38 = 115,000	
Comp Capacity [Btu/h]	79,000	79,000	57,500	57,500
Frequency	70 Hz	70 Hz + α	62 Hz	62 Hz + α

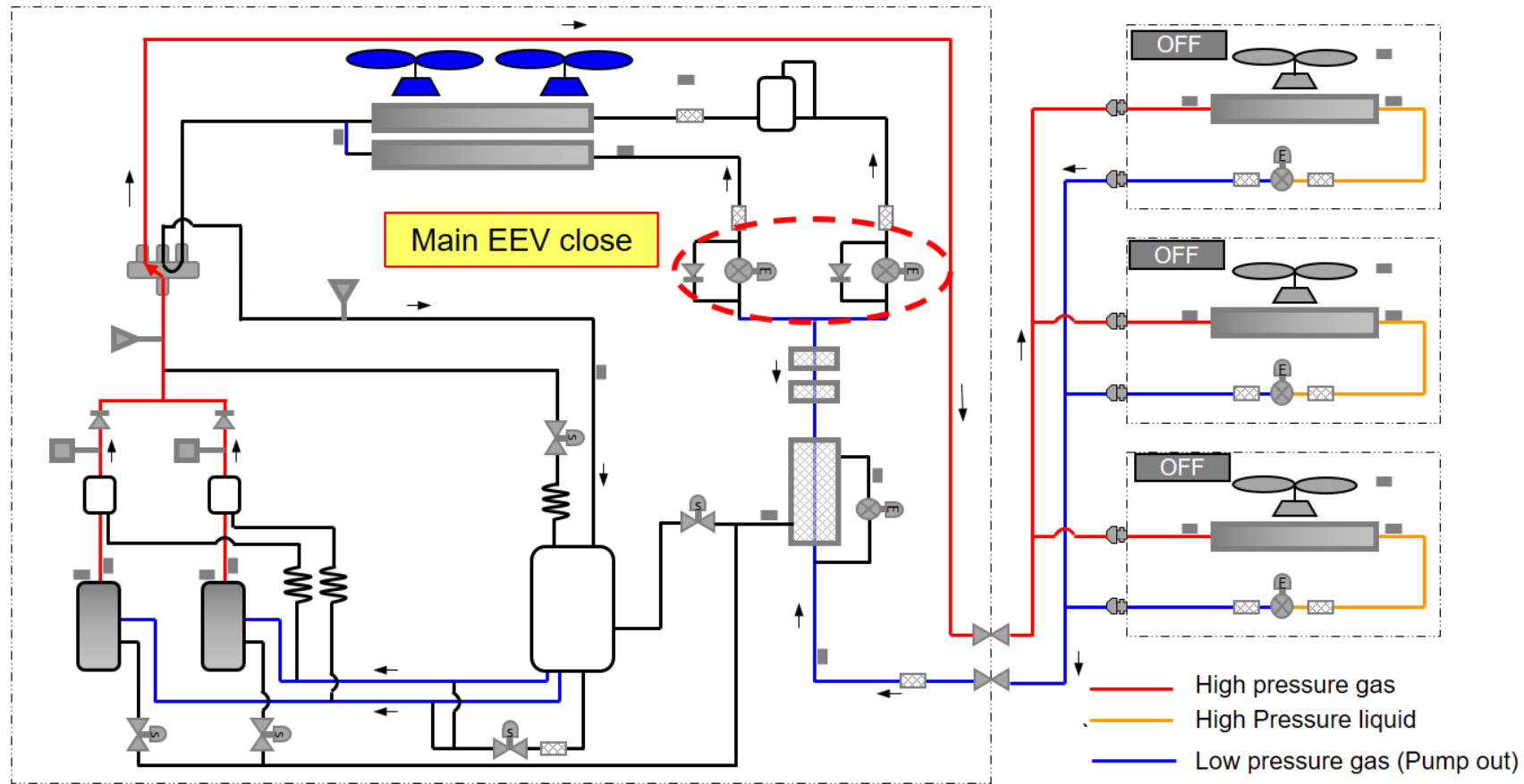
To minimize liquid flood back in the system on next start, pump down or pump out is initiated after ODU stop



Outdoor Unit Control

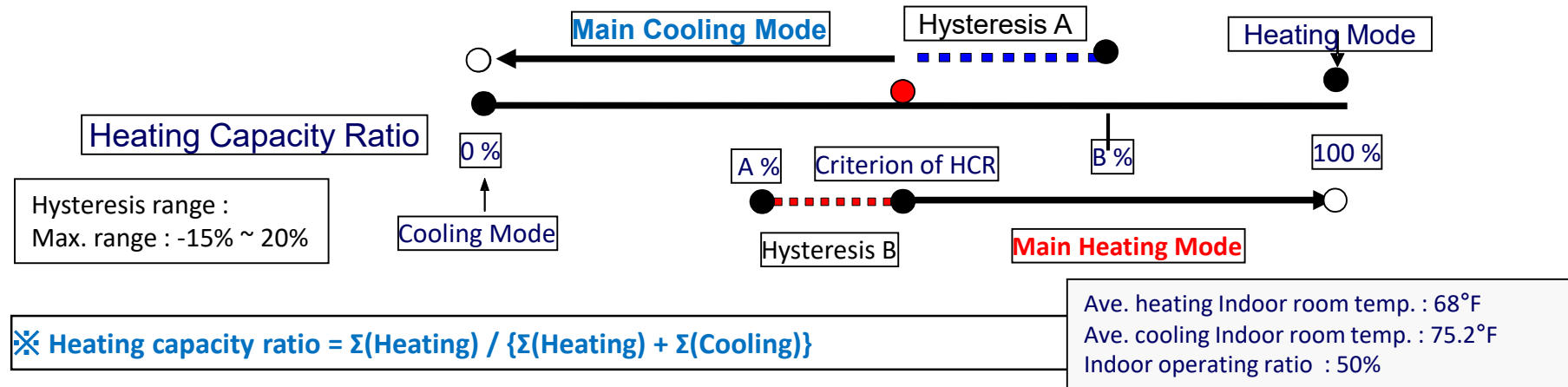
System Pump Out – **Heating** (Heat Pump)

To minimize liquid flood back in the system on next start, pump down or pump out is initiated after ODU stop



Outdoor Unit Control

Heat Recovery – Operating Mode Determination

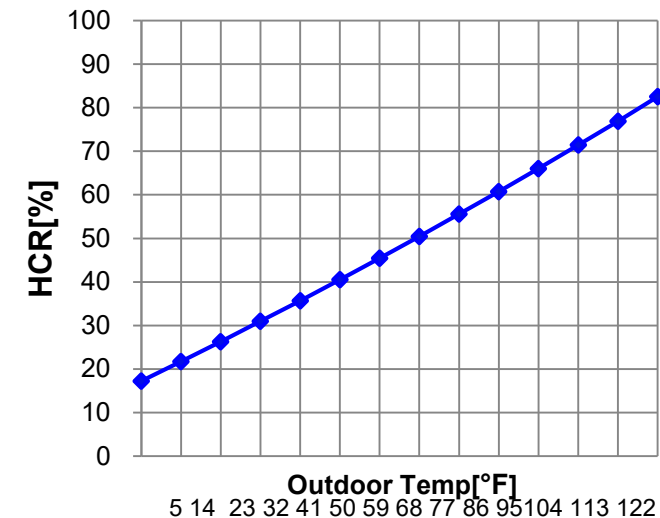


Criterion of HCR

- Value to decide mode of Heat Recovery
- Factor : Ambient temp. IDU's operating ratio, room temp.

Mode changeover in hysteresis

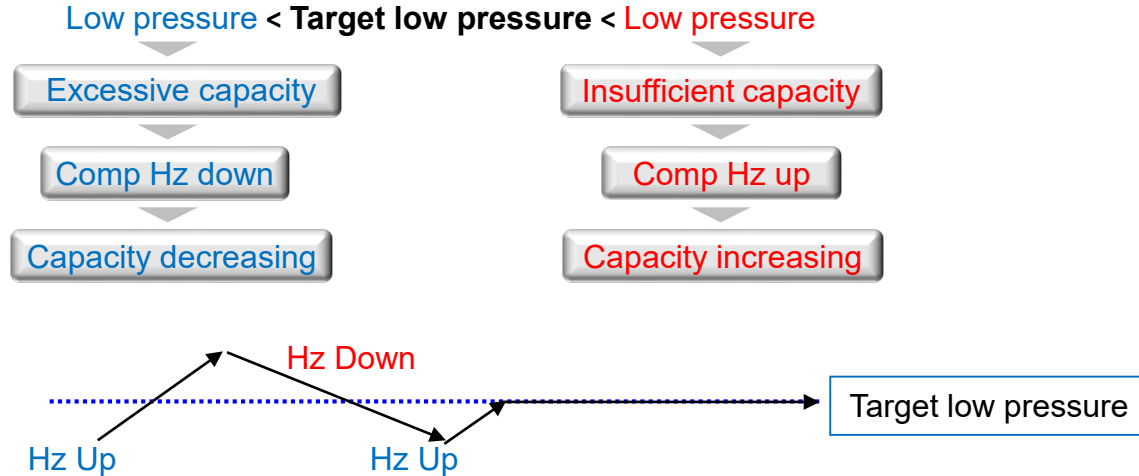
- Remaining 30 min in hysteresis area, mode changeover carry out



Outdoor Unit Control

Capacity Control - Cooling

Compressor frequency is controlled by the target low pressure which is changed by the averaging of evaporator inlet temperature



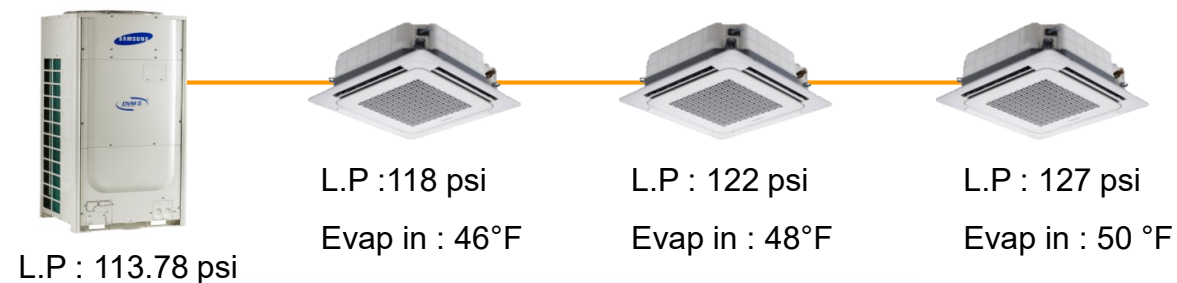
Target low pressure (psi)						
85.34	92.45	99.56	106.68	113.78	120.89	128

* Default value of target low pressure: 113.78 psi

- avg. evap. Inlet temp. = setting → target low press maintain
- avg. evap. Inlet temp. < setting → target low press increase
- avg. evap. Inlet temp. > setting → target low press decrease

Why is evaporator inlet temp used to find target low pressure?

- To compensate piping length between the ODU and IDU's



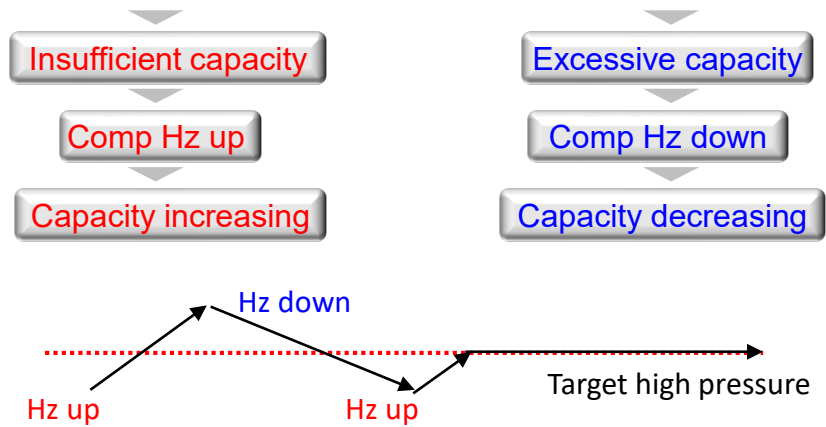
ODU Option Settings (Capacity correction)

	Seg1	Seg2	Seg3	Seg4	Temperature
Main ODU	0	1	0	0	45° - 48°F
			0	1	41° - 45°F (Default)
			0	2	48° - 52°F
			0	3	50° - 54°F
			0	4	52° - 55°F
			0	5	54° - 57°F
			0	6	55° - 59°F

Outdoor Unit Control

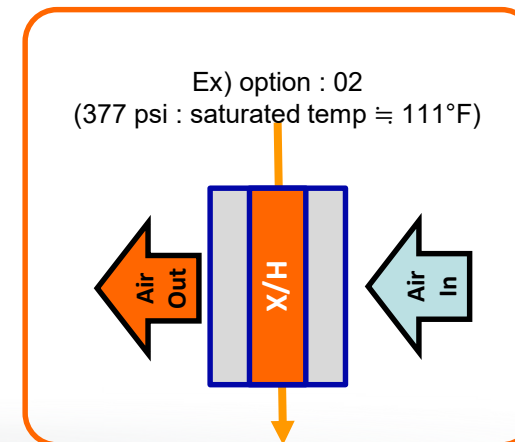
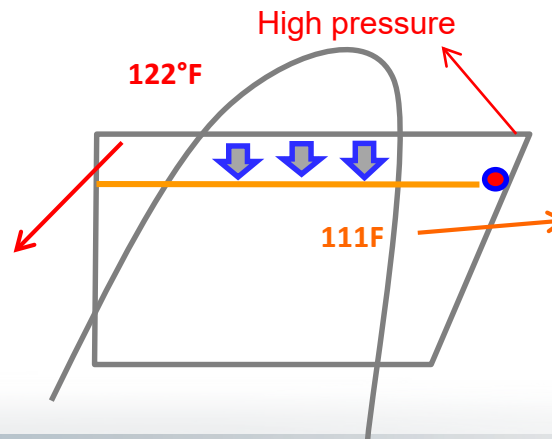
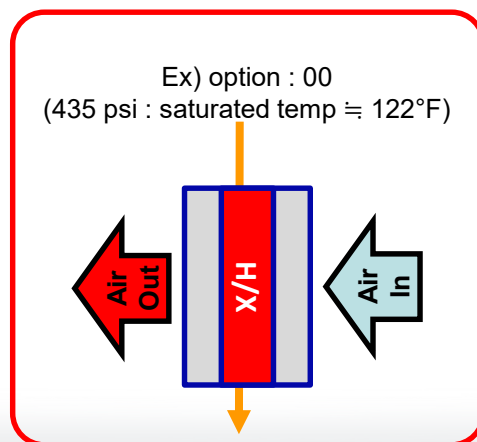
Capacity Control - Heating

High pressure < Target high pressure < High pressure



Target high pressure control
ODU option setting

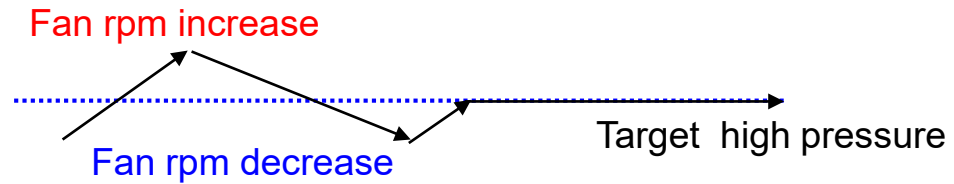
	Seg1	Seg2	Seg3	Seg4	Pressure (psi)
Main	0	2	0	0	426.7(default)
			0	1	355.6
			0	2	369.8
			0	3	384
			0	4	398.25
			0	5	412.48
			0	6	440.9
			0	7	455.15
			0	8	469.4



Outdoor Unit Control

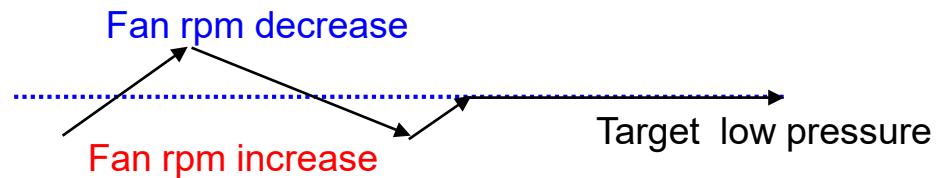
Outdoor Unit Fan Control

Cooling



ODU setting	Target high pressure for cooling
Default	355.6 psi
ODU lowest setting Menu08 / value03	398.25 psi

Heating



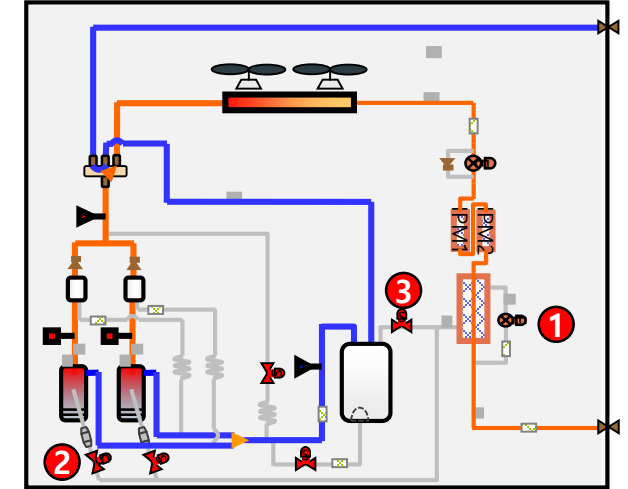
Ambient temp. (°F)	Target low pressure for heating
Below 32	106.7 psi
32 ~ 50	116.63 psi
50 ~ 68	119.47 psi
68 ~	123.74 psi

Outdoor Unit Control

EVI – EEV Control

Purpose: To increase sub-cool of system : Sub-cool $\uparrow$ $\rightarrow$ Efficiency $\uparrow$

Valve	EVI EEV	EVI Sol	EVI Bypass	*Condition
EVI Bypass mode	Open	Open	Open	Normal
EVI On mode (Vapor Injection)	Open	Open	Close	All comp in unit 60hz $\uparrow$ T out < 96.8(c)/50(h)°F * Control by unit
EVI Off mode	Close	Open	Open	Safety start Defrost



Cooling Vapor injection not working when
ODU option 8 : ODU higher
ODU option 9 : Long pipe

EVI mode	Cooling	Heating
EVI Bypass mode	▷ Sub-cooling control : 68°F (High pressure Saturated temp. – Liquid tube temp.)	▷ SH control 1. EVI out temp. – EVI In temp. > 50°F (priority) 2. T dis = 194°F
EVI On(Vapor Injection) mode		▷ SH (EVI out temp. – EVI in temp.) control : 3.6°F
Remark	If compressor discharge temp. is abnormally high, open EVI EEV to decrease the discharge temperature	

Outdoor Unit Control

Main EEV Control - Heating

► Main EEV control

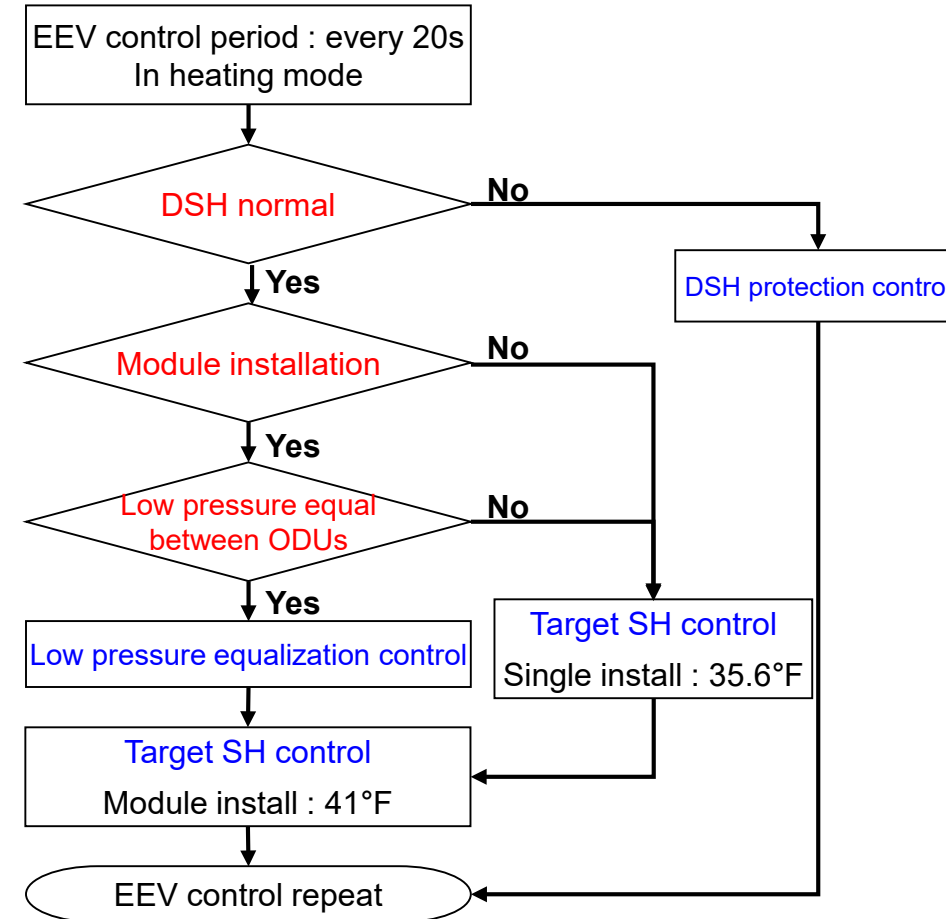
- ① Stop ODU : Main EEV close
- ② Cooling ODU : Main EEV Full open

► Main EEV control for module install

- 1. Refrigerant distribution between ODUs
- 2. Then Super Heat control (SH)
- 3. If discharge temp is high → EEV step increases

* SH = super heat
(Suction temp. – Low pressure saturated temp.)

* DSH = Discharge super heat
(discharge temp. – high pressure saturated temp.)



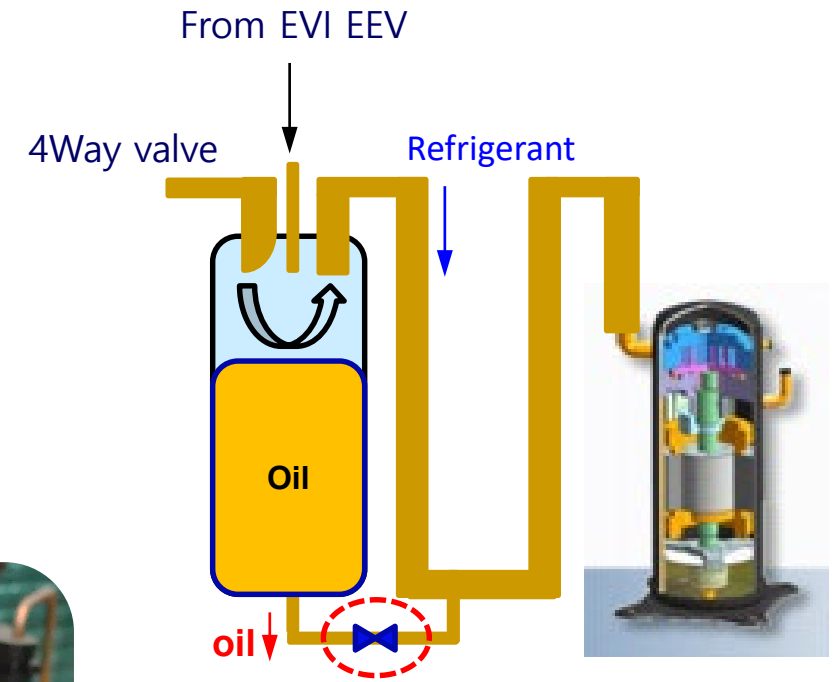
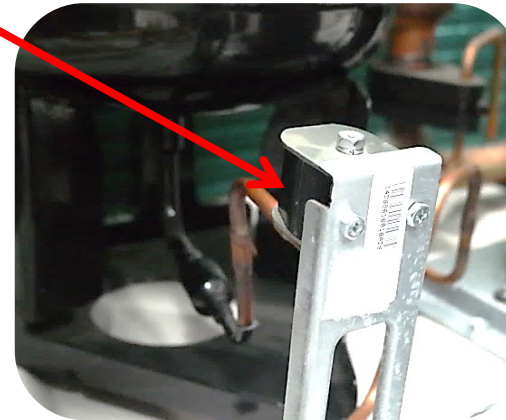
Outdoor Unit Control

Accumulator Oil Return Valve - ARV

Compressor	ARV control
Stop	Close - Prevent refrigerant flowing to compressor
Starting	Close - Prevent refrigerant flowing to compressor
Running	Open - Oil return to compressor

NOTE: Compressor damage can occur if the ARV fails due to a lack of compressor oil return

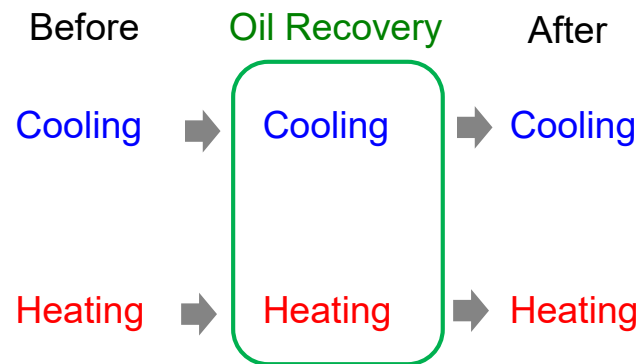
ARV



Outdoor Unit Control

Compressor Oil Recovery Operation

- Oil recovery operation starts after a cumulative compressor run time of 7 hours
 - The oil recovery interval will shorten if the outdoor unit or compressor stops
- If defrost mode is in operation for more than 3 minutes, it counts as oil recovery operation as well
- In a modular system (manifolded ODU's) on completion of oil recovery operation the master ODU will change



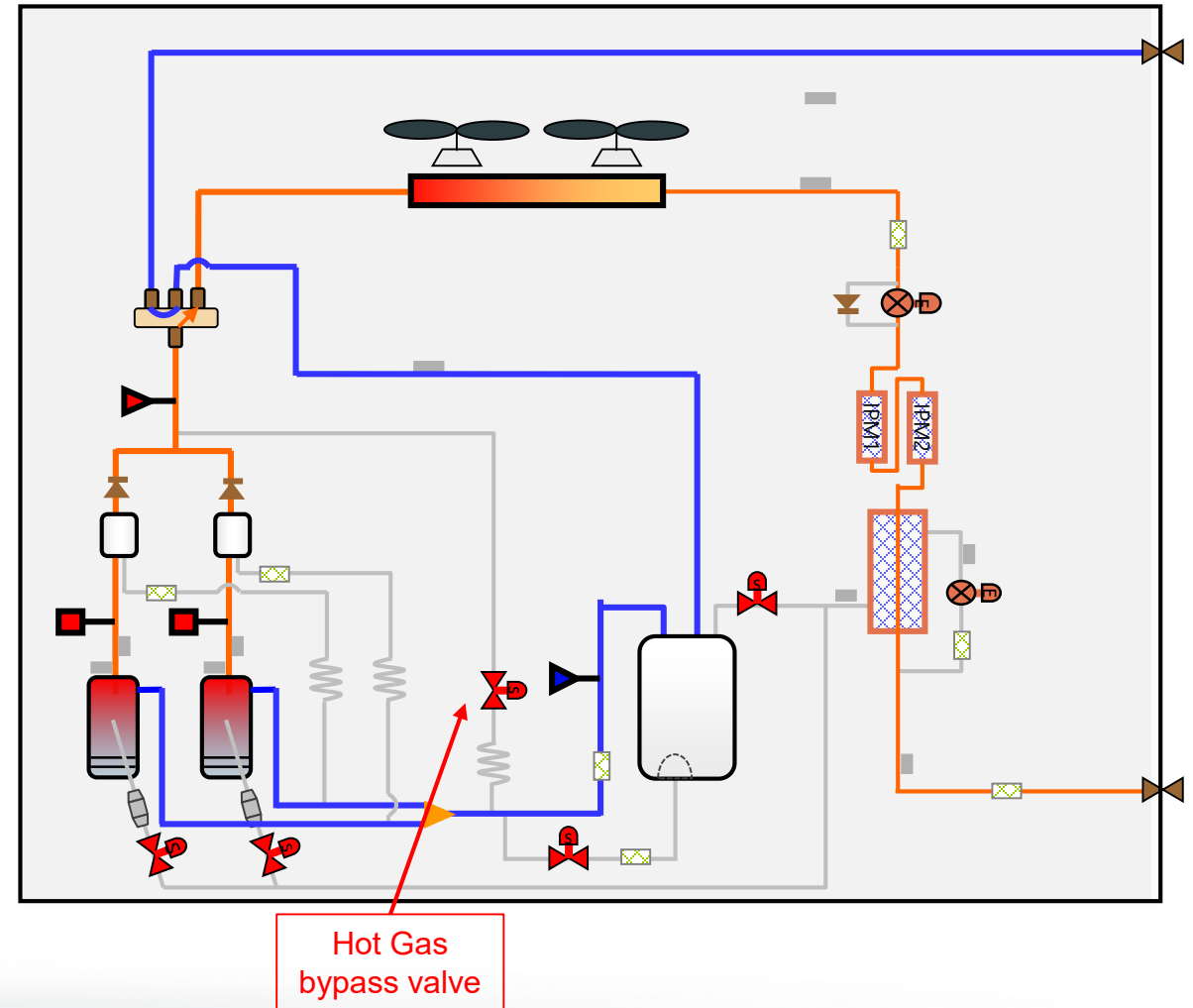
Capacity of compressor	Current capacity + additional capacity
ODU fan	Normal control
ODU EEV	Normal control
EEV of operating indoor units	Higher step of [400(C)/300(H) or Current step]
Stopped indoor unit's EEV	400(C)/300(H)
Time	3min(Cool) / 6min(Heat)

Outdoor Unit Control

Hot Gas Bypass Valve

- Hot gas bypass valve compensates for abnormal low pressure
 - Open status
 - Safety start
 - Low pressure protection control

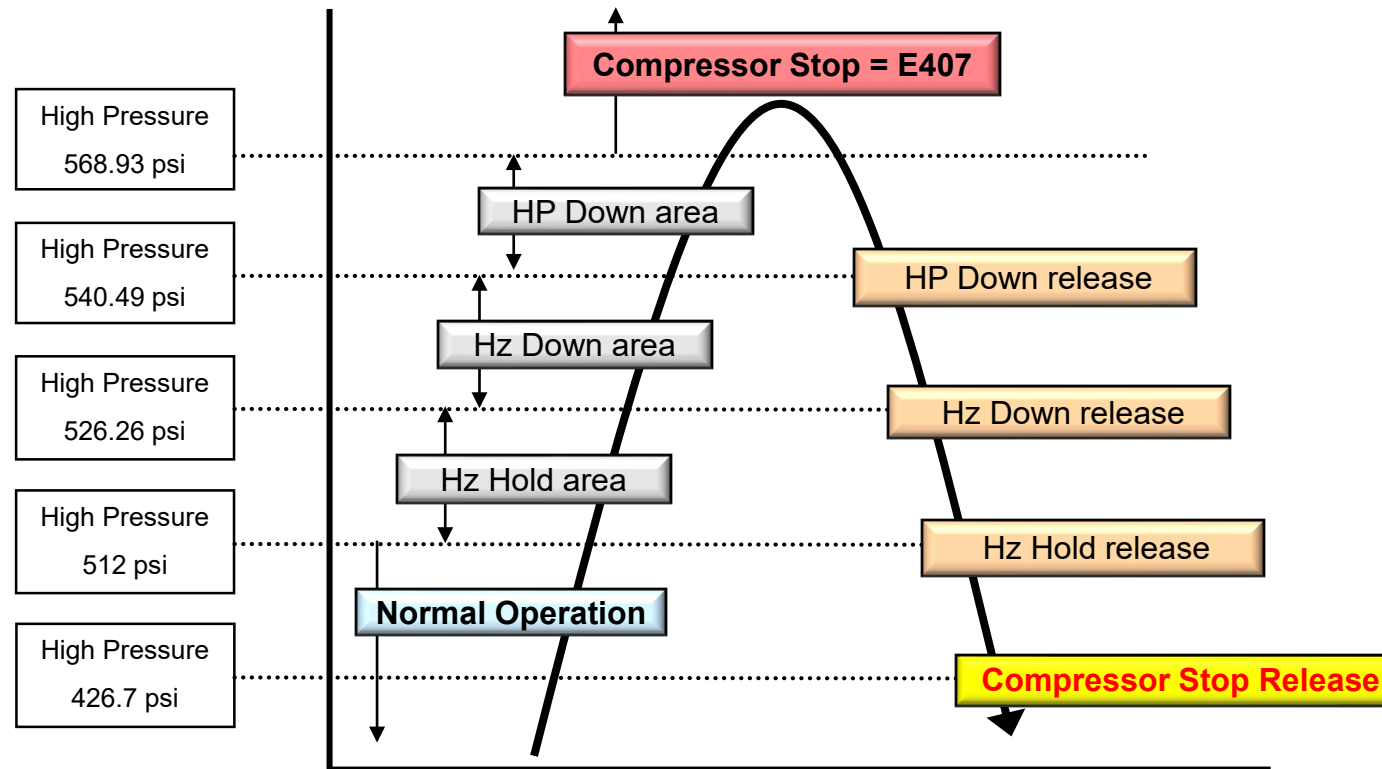
Valve control	Cooling	Heating
On (psi)	≤ 45.51	≤ 19.91
Off (psi)	≥ 59.74	≥ 34.14



Outdoor Unit Control

High Pressure Protection

- Purpose: To protect the compressor and system from excessive high pressure
- Process: Hz hold → Hz down → HP down → Compressor stop (E407)



Outdoor Unit Control

Low Pressure Protection

- Purpose: To protect the compressor and system from abnormal low pressure
- Process: Hz hold → Hz down → HP down → Compressor stop (E410)
- Compressor stop release: 3 mins. & low pressure 64↑(cool) / 42.67↑(heat) psi
Auto restart (6 X max.)

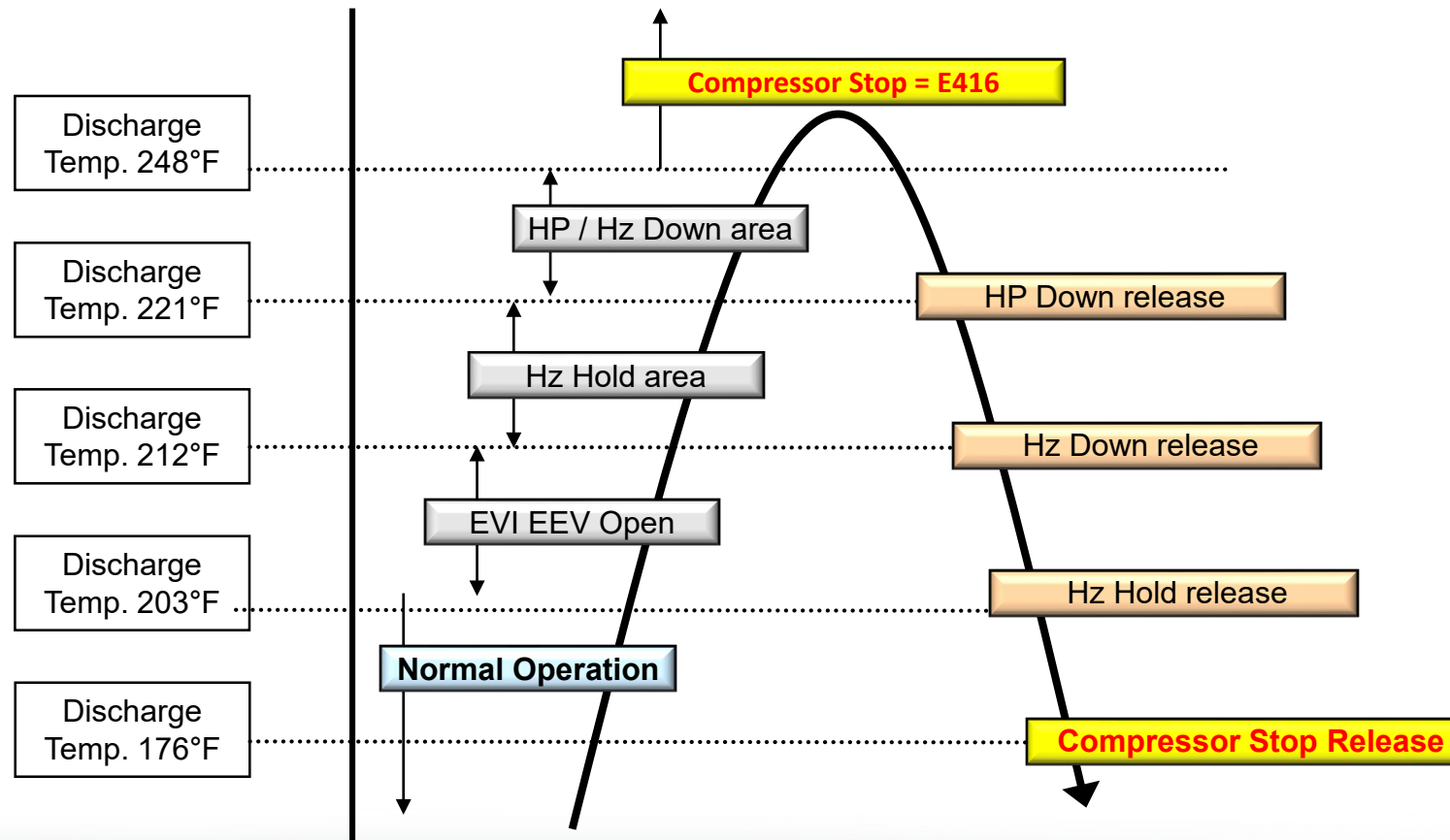
Cooling		
Operation	Outdoor temp.	Pressure (psi)
Hz Hold	Over 59°F	≤ 56.9
	Less than 59°F	≤ 42.67
Hz Down	Over 59°F	≤ 49.78
	Less than 59°F	≤ 35.56
HP Down	Over 59°F	≤ 36.98
	Less than 59°F	≤ 22.76
Comp Down [E410]		≤ 11.38 for 3mins & dis temp 194°F↑

Heating		
Operation	Outdoor temp.	Pressure (psi)
Hz Hold	Over 32°F	≤ 42.67
	32°F~14°F	≤ 28.45
	Less than 14°F	≤ 25.6
Hz Down	Over 32°F	≤ 31.29
	32°F~14°F	≤ 22.76
	Less than 14°F	≤ 17.07
HP Down	Over 32°F	≤ 25.60
	32°F~14°F	≤ 17.07
	Less than 14°F	≤ 11.38
Comp Down [E410]		≤ 7.11 for 3mins & dis temp 194°F ↑

Outdoor Unit Control

Discharge Temperature Protection

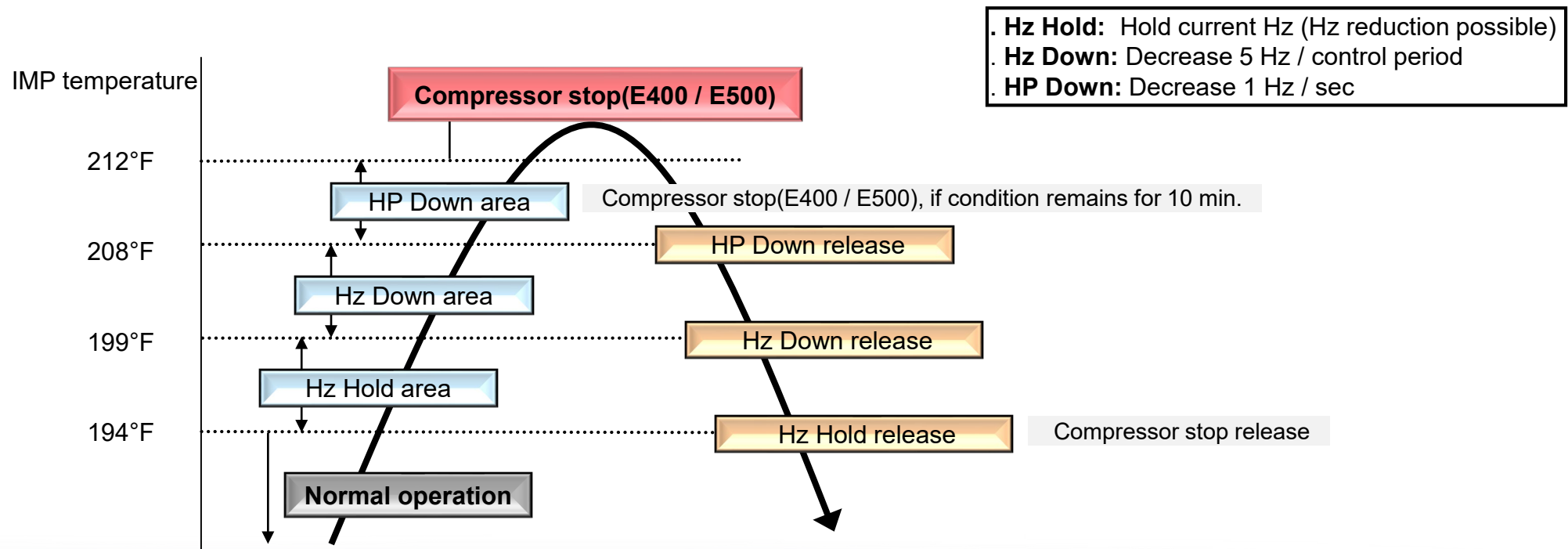
- Purpose: To protect the compressor and system from abnormal discharge temperature
- Process: ESC EEV Open → Hz Hold → Hz Down → HP Down → Comp Stop (E416)



Outdoor Unit Control

Intelligent Power Module (IPM)

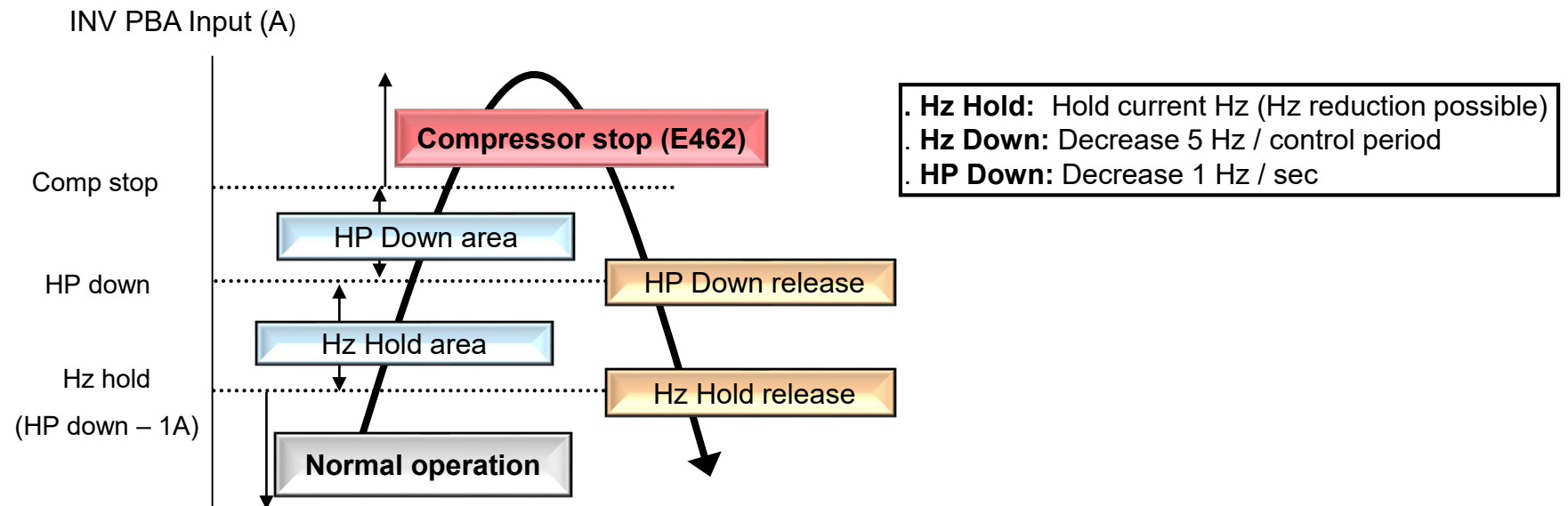
- Purpose: Protect the IGBT (Insulated Gate Bipolar Transistor) module from damage
- IGBT is a 3 terminal power semiconductor device functioning as an electronic switch
 - The switching function controls the compressor frequency rate which in turn creates heat



Outdoor Unit Control

Inverter PCB Input Current Control

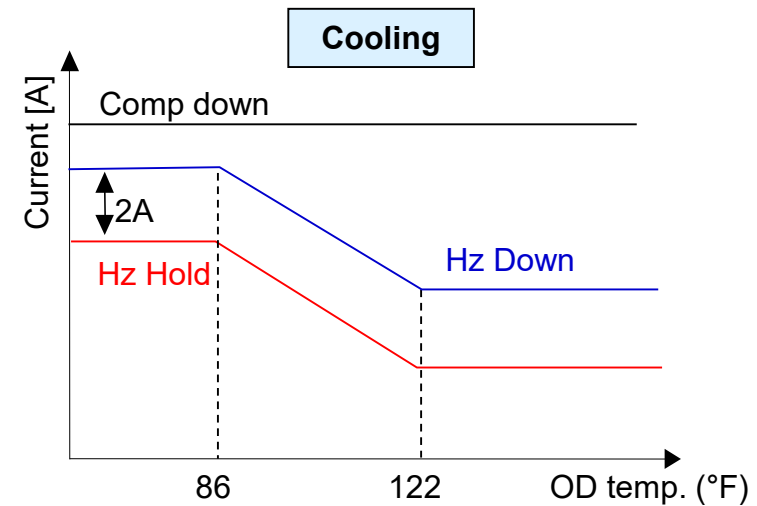
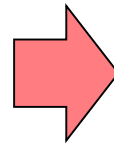
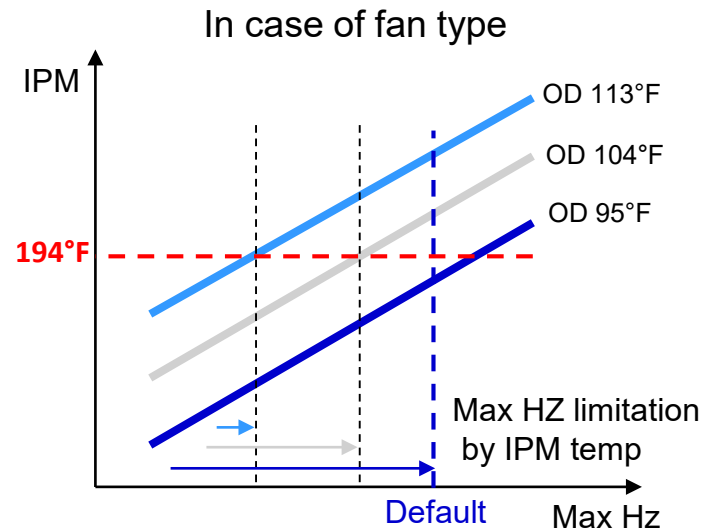
Purpose: Inverter input current is controlled to protect circuit components from failure



Outdoor Unit Control

Current Control

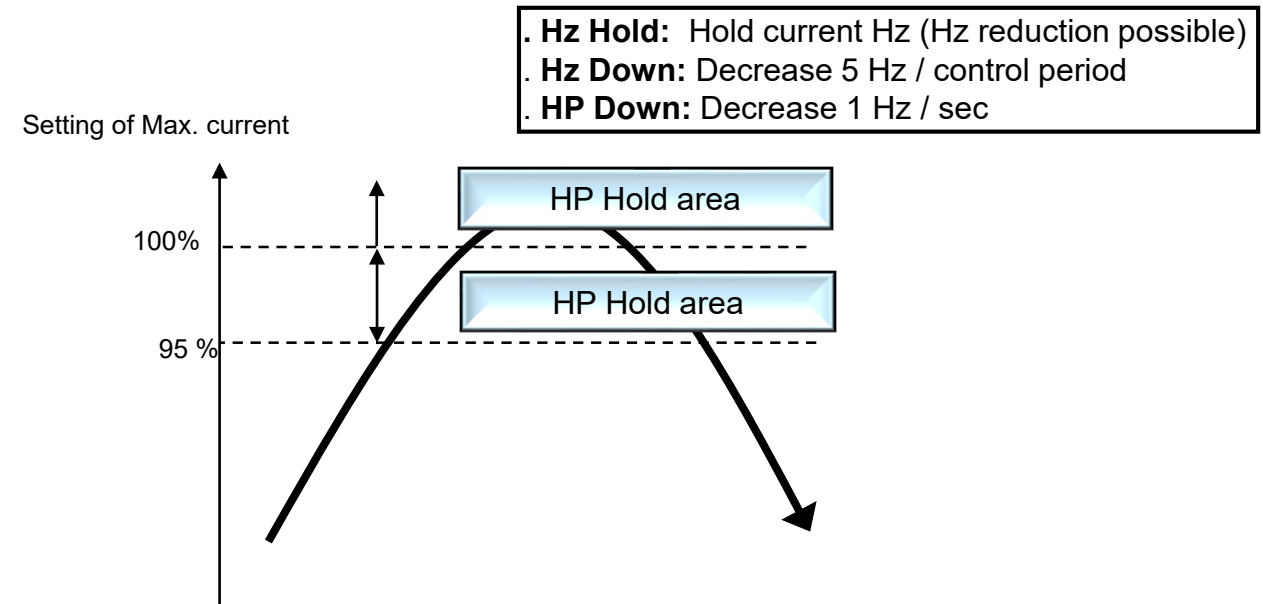
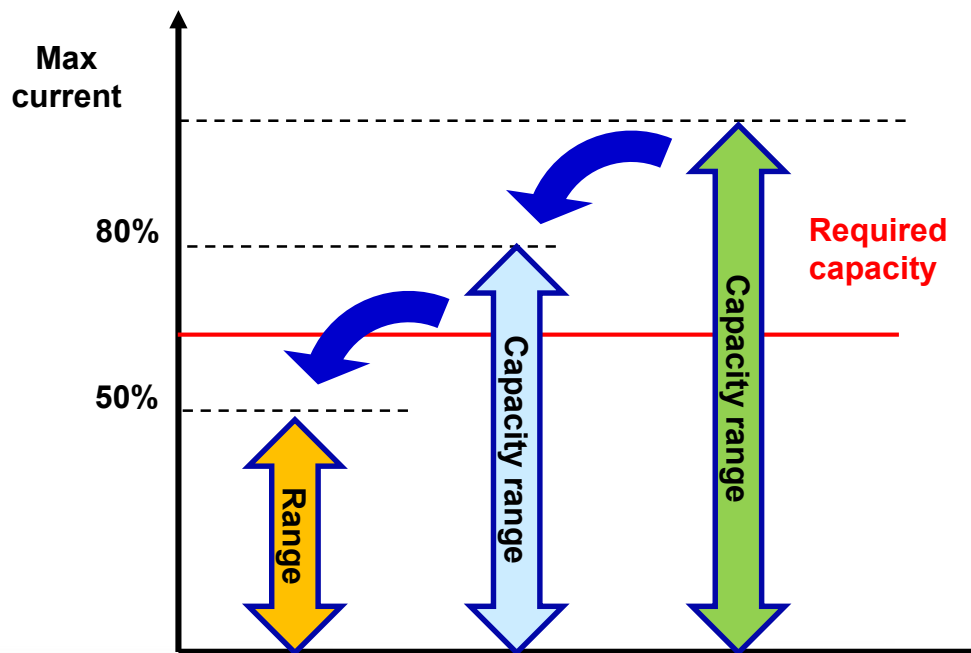
- Purpose: To protect the IPM module from overheating
- Reason: Outdoor temp increases → IPM temp increases → Max. Hz limitation



Outdoor Unit Control

Maximum Current Control

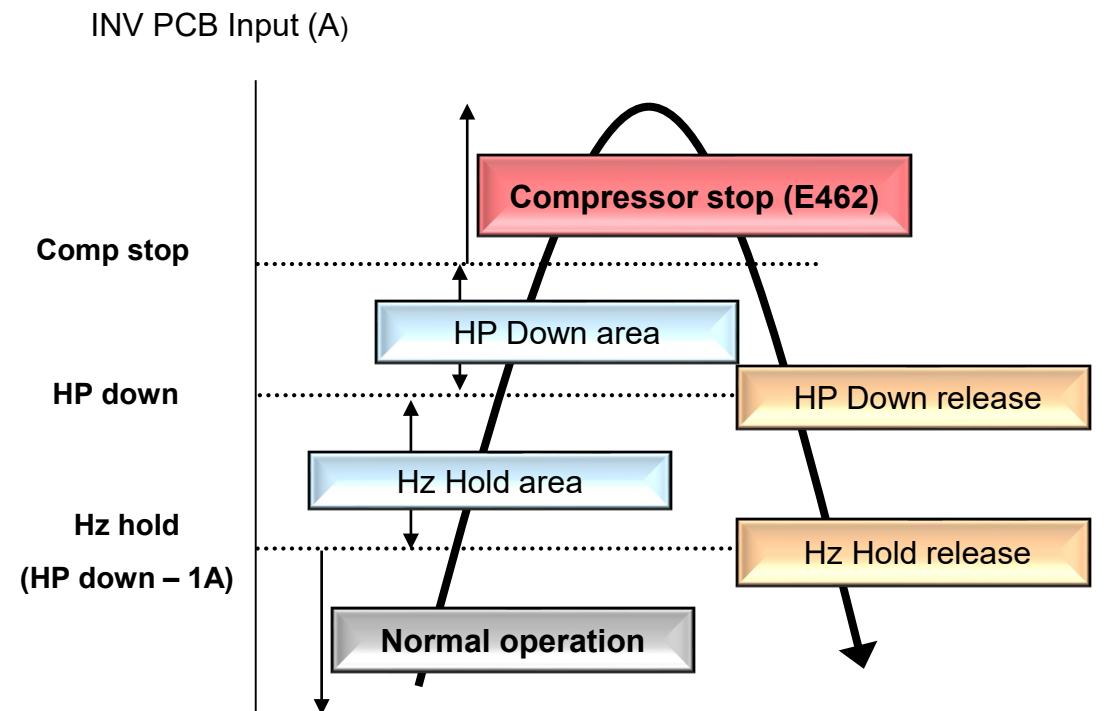
- Outdoor Unit option setting: 50% - 100%
 - Hz Hold: Compressor current + Fan current > 95% of setting current
 - Hz Down: Compressor current + Fan current > setting current
- 100%=Maximum current (MCA) of the system
- Setting: Outdoor unit option setting or DMS2 setting range (50% to 100%)



Outdoor Unit Control

Inverter PCB Current Control

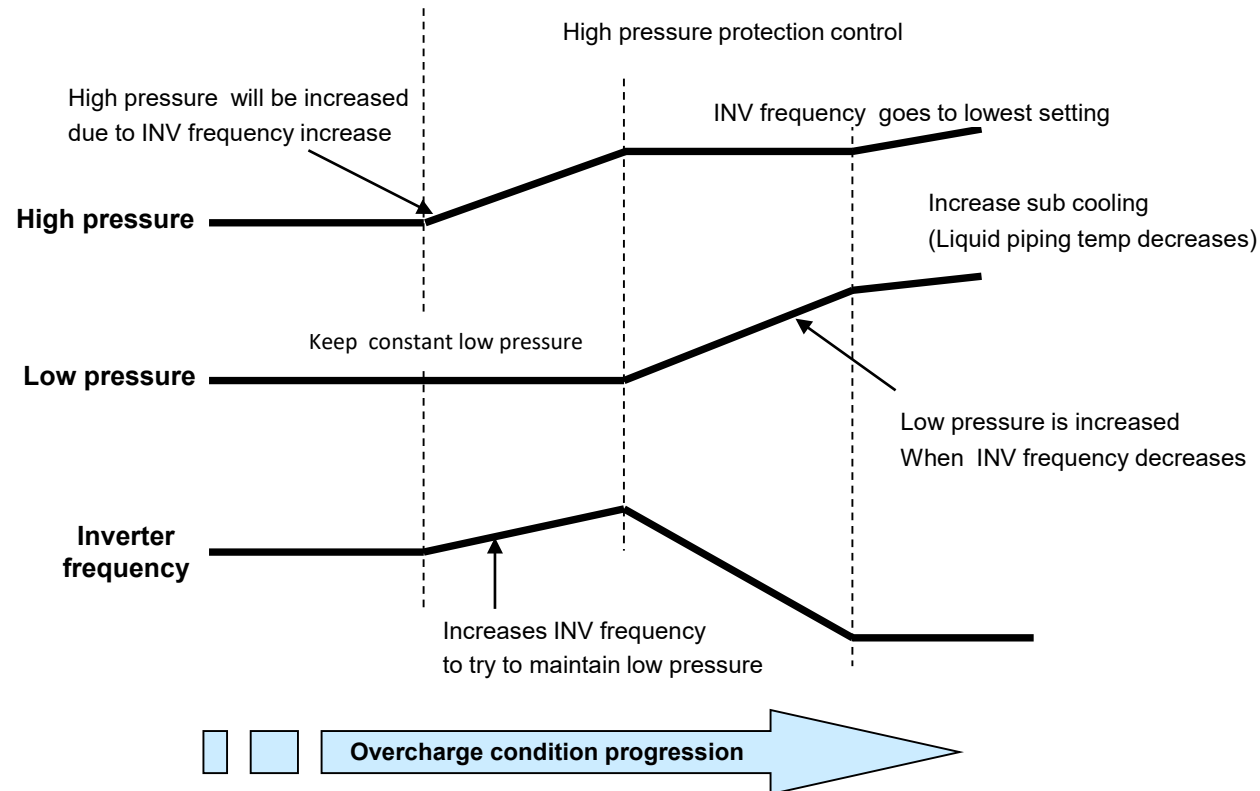
Inverter PCB input current is controlled to protect circuit components from failure



Outdoor Unit Control

Refrigerant Overcharge - Cooling

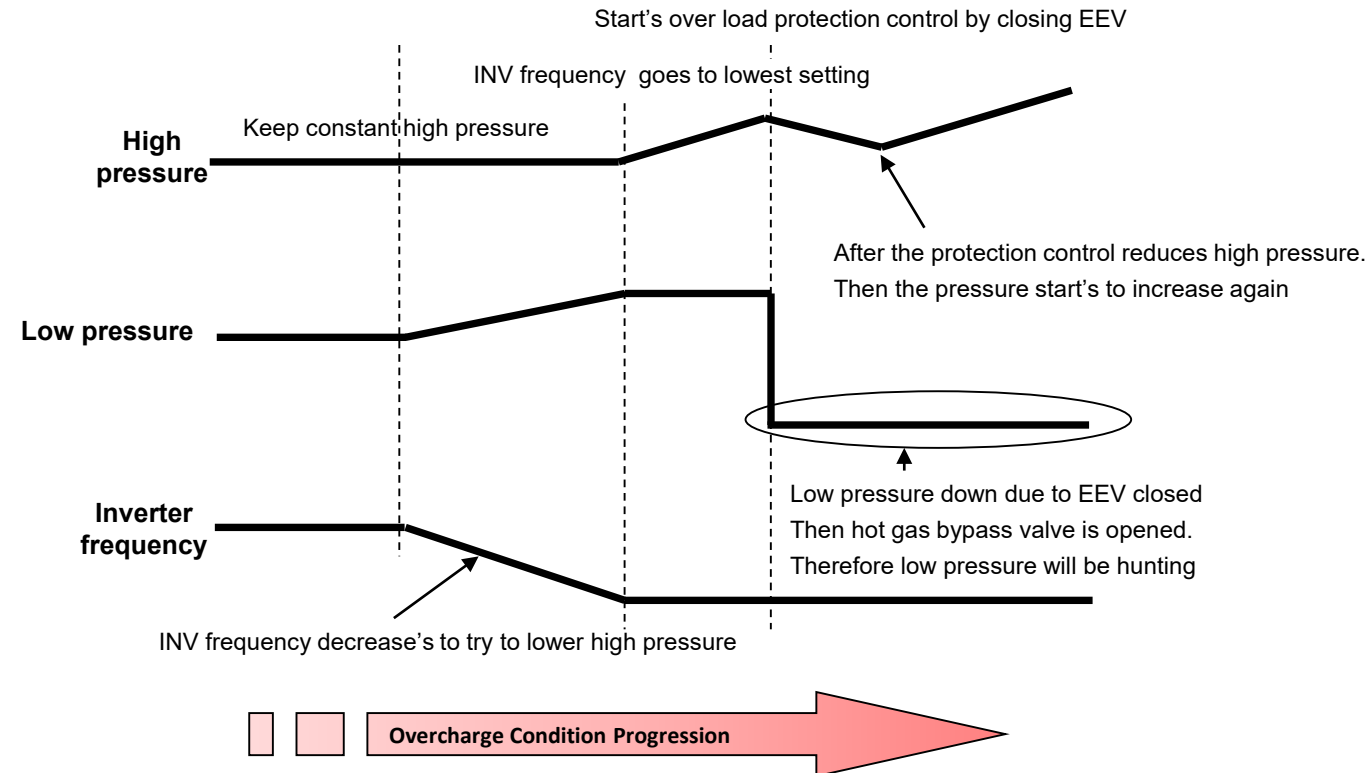
- System will run in normal operation until it is above regulated capacity



Outdoor Unit Control

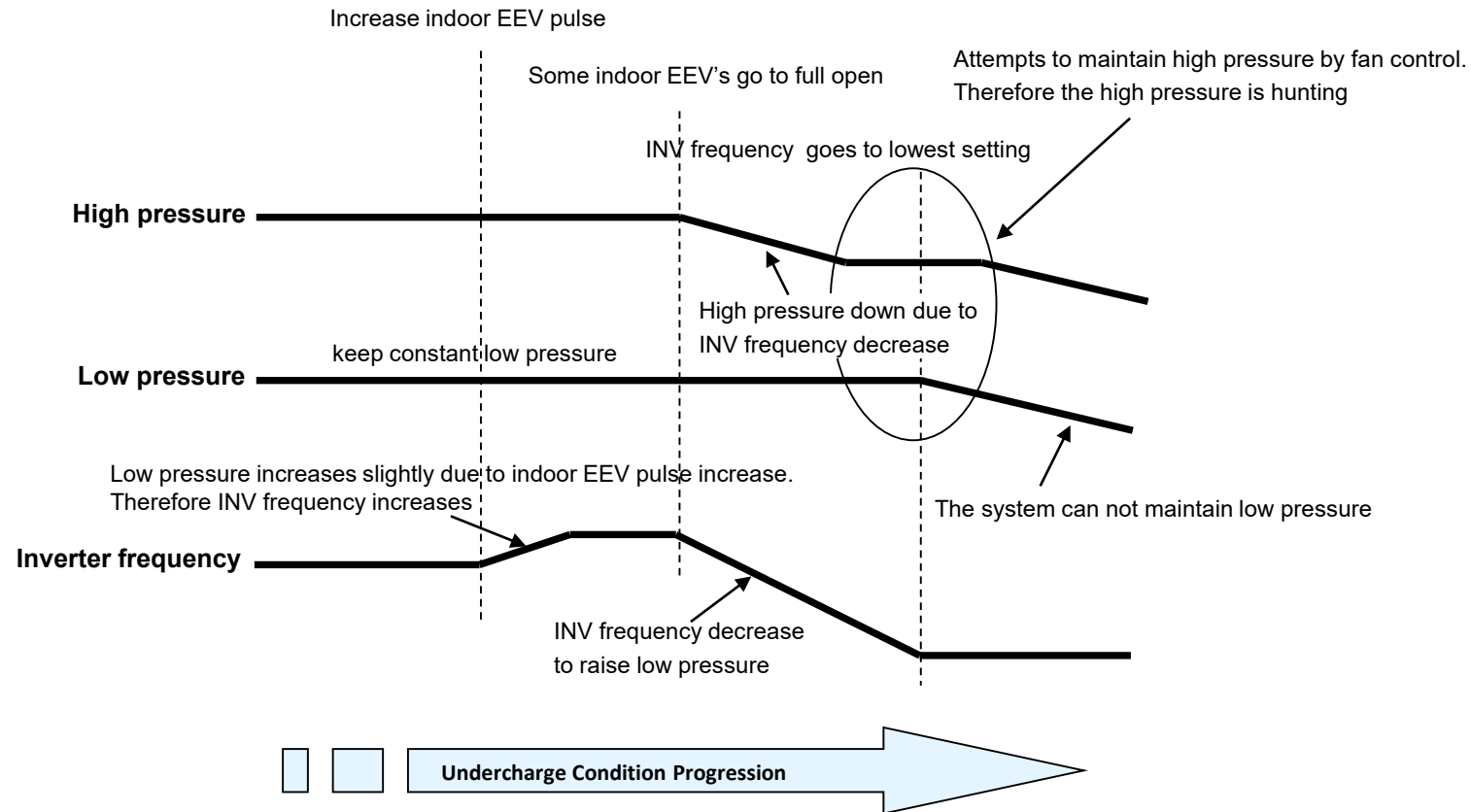
Refrigerant Overcharge - Heating

- System will run in normal operation until it is above regulated capacity



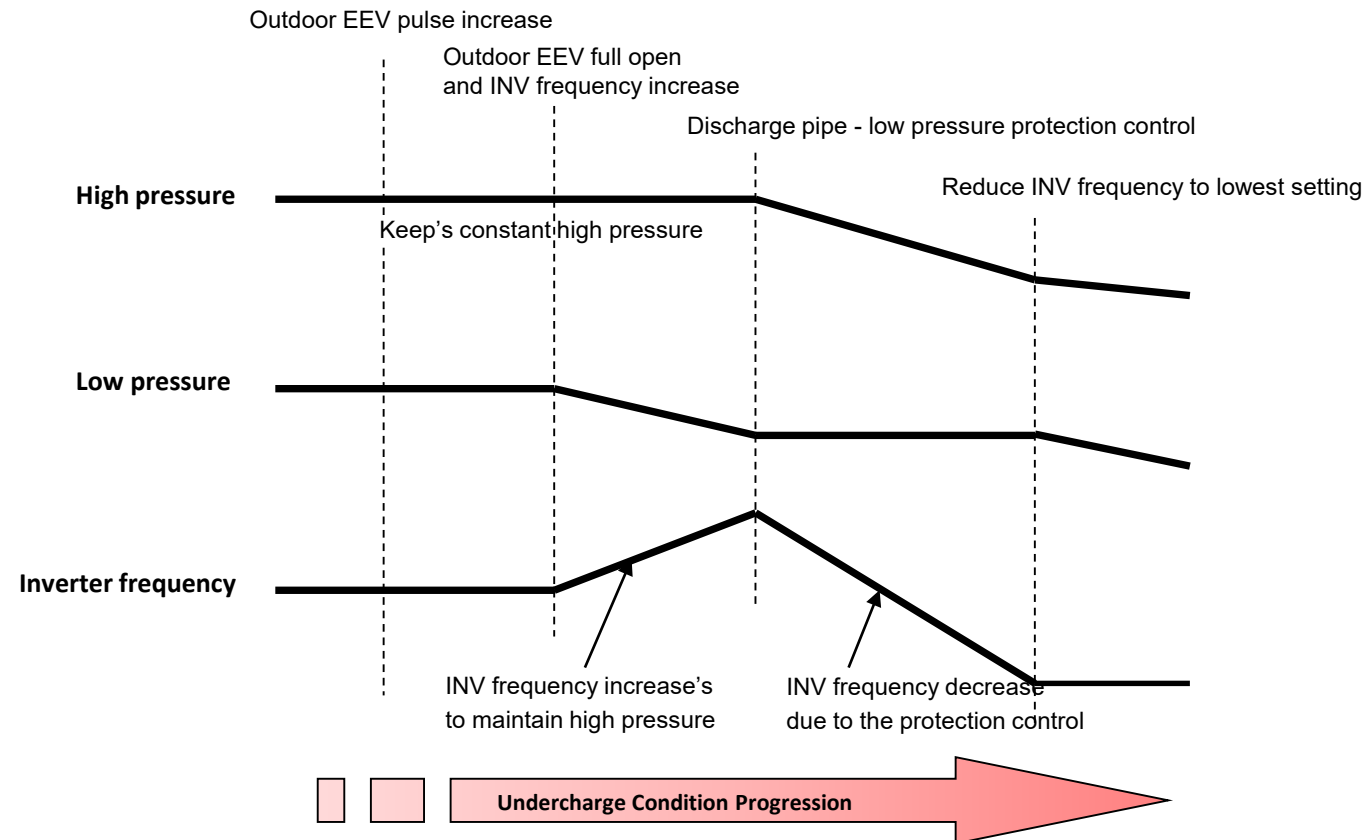
Outdoor Unit Control

Refrigerant Undercharge - Cooling



Outdoor Unit Control

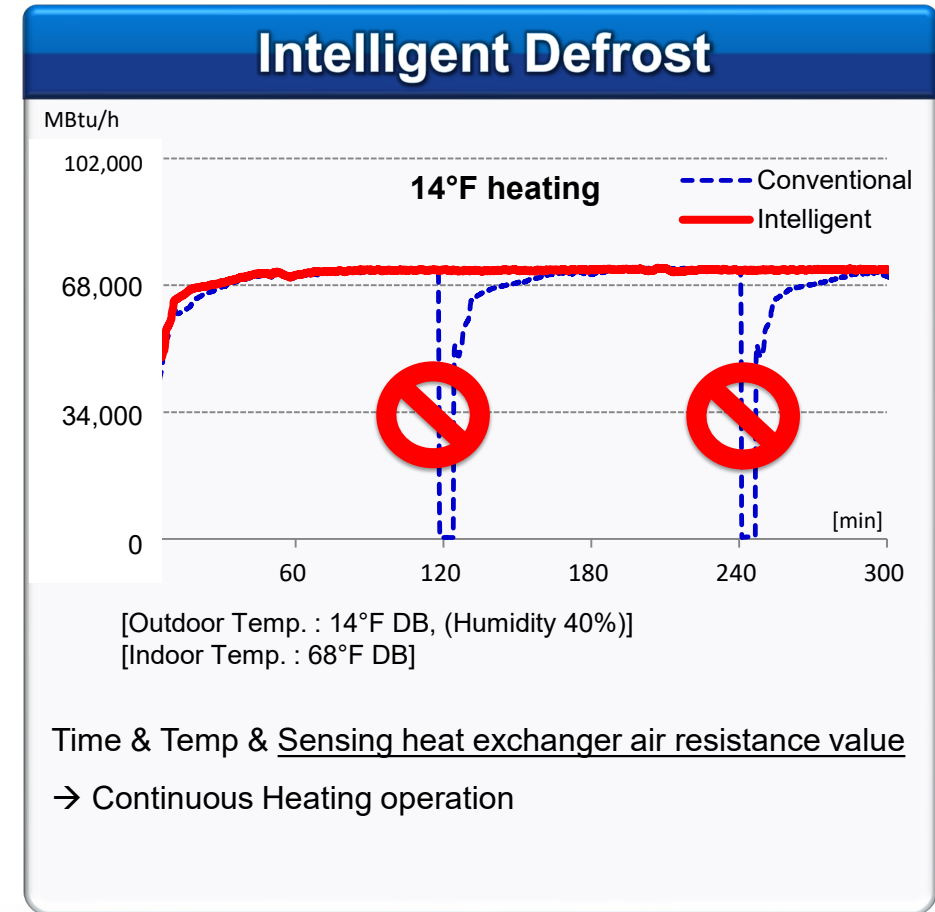
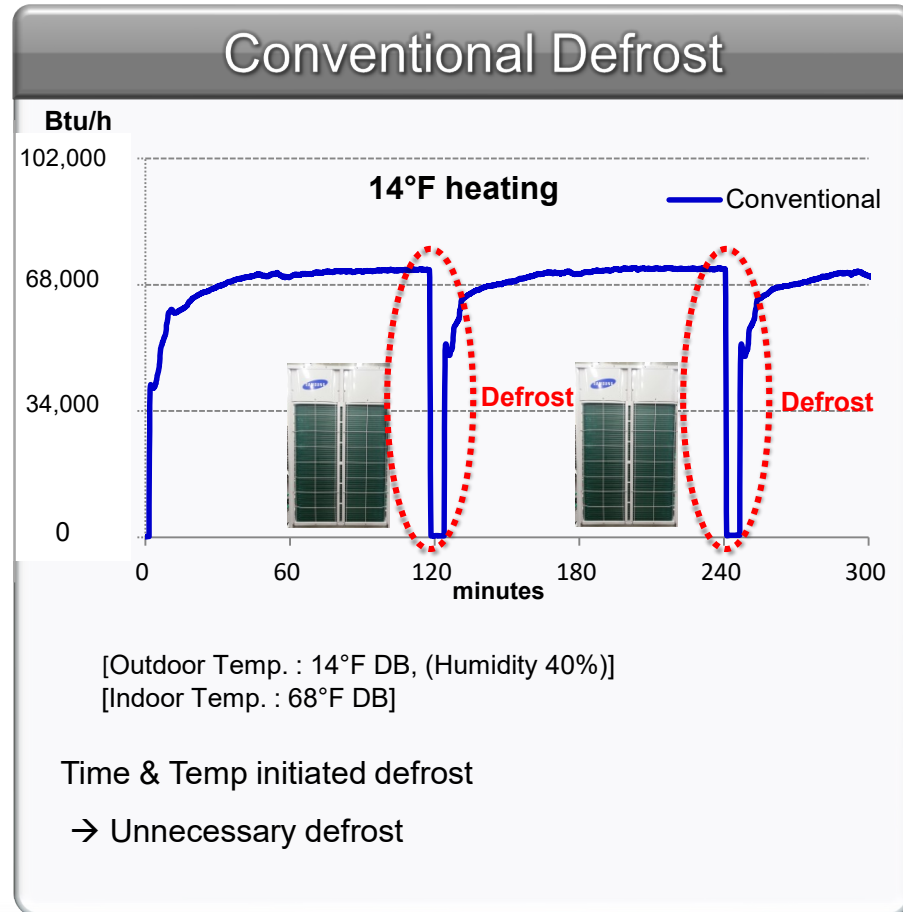
Refrigerant Undercharge - Heating



Outdoor Unit Control

Intelligent Defrost

Optimal judgement for initiating defrost operation

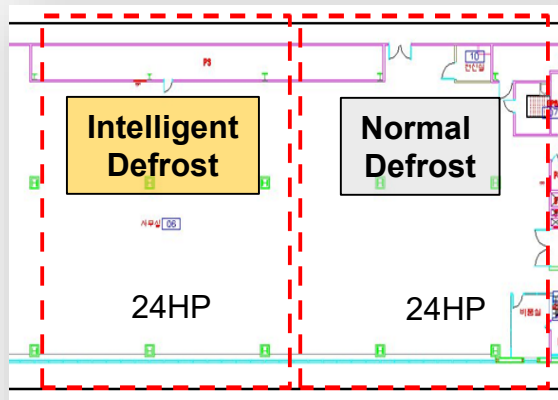


Outdoor Unit Control

Intelligent Defrost

Test condition

- Installation 24HP Outdoor for each zone.



- . Indoor unit operation rate 10~40%
- . Lowest ambient temperature 17.6°F ~ 32°F
- . Highest ambient temperature 33.8°F ~ 59°F
- . Test period 10 days.

Test result

*** Only 2 defrost cycles for 10 days**

Result	Intelligent Defrost	Conventional Defrost
Total Operating time(min)	12,130	11,568
Defrost operation(times)	2	19
Average Heating Operation without defrost(min)	6,065	608

Outdoor Unit Control

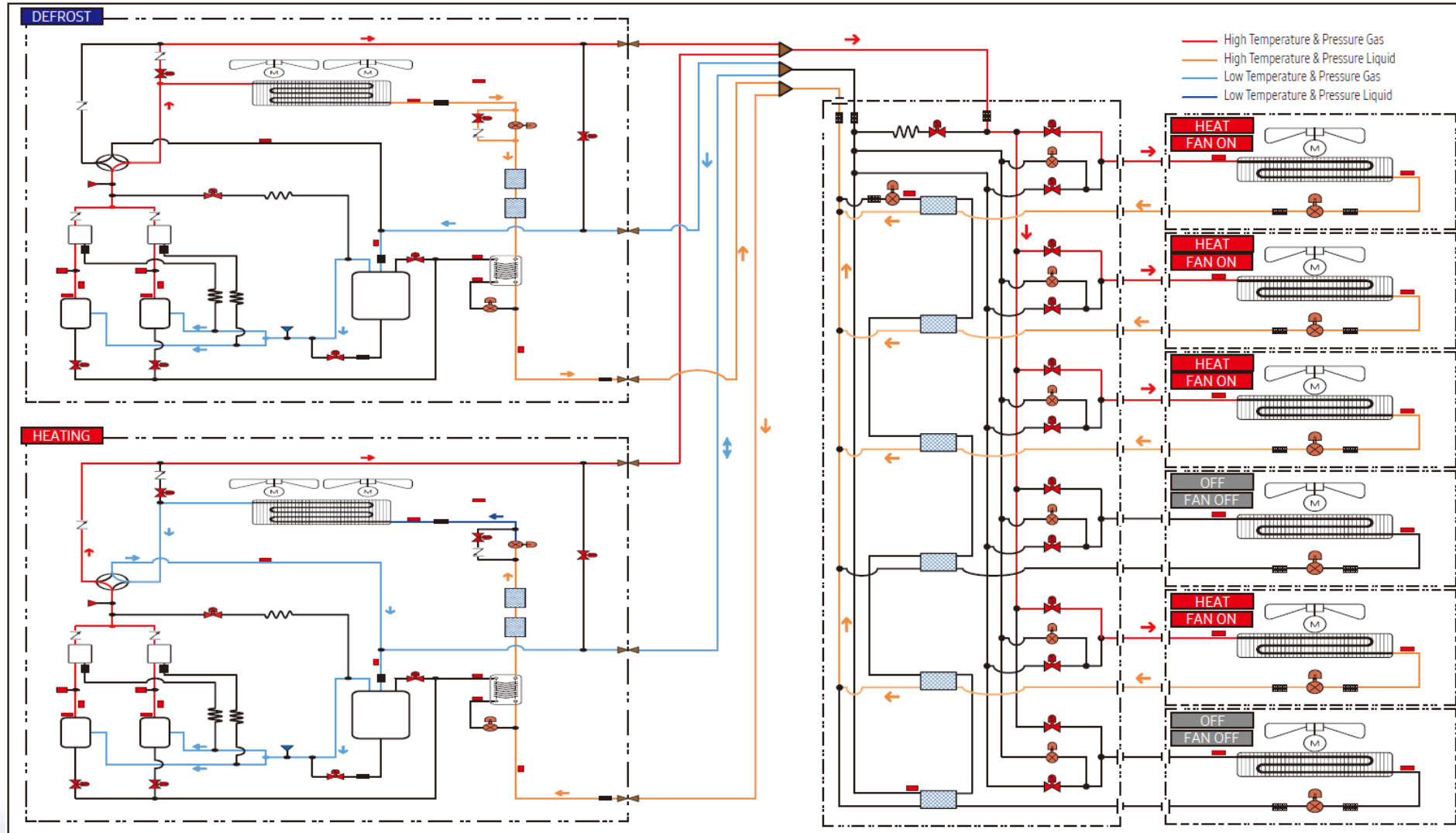
Rotation Defrost Operation - Heat Recovery

- Module systems (2 or 3 connected units) – Defrost operation is actuated in sequential order to improve heating efficiency
- Operation requires option setting at commissioning

Actuator			Outdoor units in defrost mode	Units not being in defrost mode
Compressor			Depends on the outdoor unit capacity (86-110Hz)	General control
Outdoor EEV			Full close	General control
Outdoor Fan			0 step	General control
HR EEV			Off	General control
Main cooling valve			ON	General control
Indoor EEV	Cooling indoor unit	Active unit	General control	
		Inactive unit	Required step for control of the superheat degree	
	Heating Indoor unit	Active unit	General control	
		Inactive unit	General control on inactive units	
Indoor Fan	Cooling indoor unit	Active unit	General control	
		Inactive unit	Set fan speed	
	Heating Indoor unit	Active unit	Mid fan speed	
		Inactive unit	Off	
Time			Maximum of 12 min	-

Outdoor Unit Control

Rotation Defrost Operation - Heat Recovery



DVMS Training

Thank You !

This concludes “Part I” training

