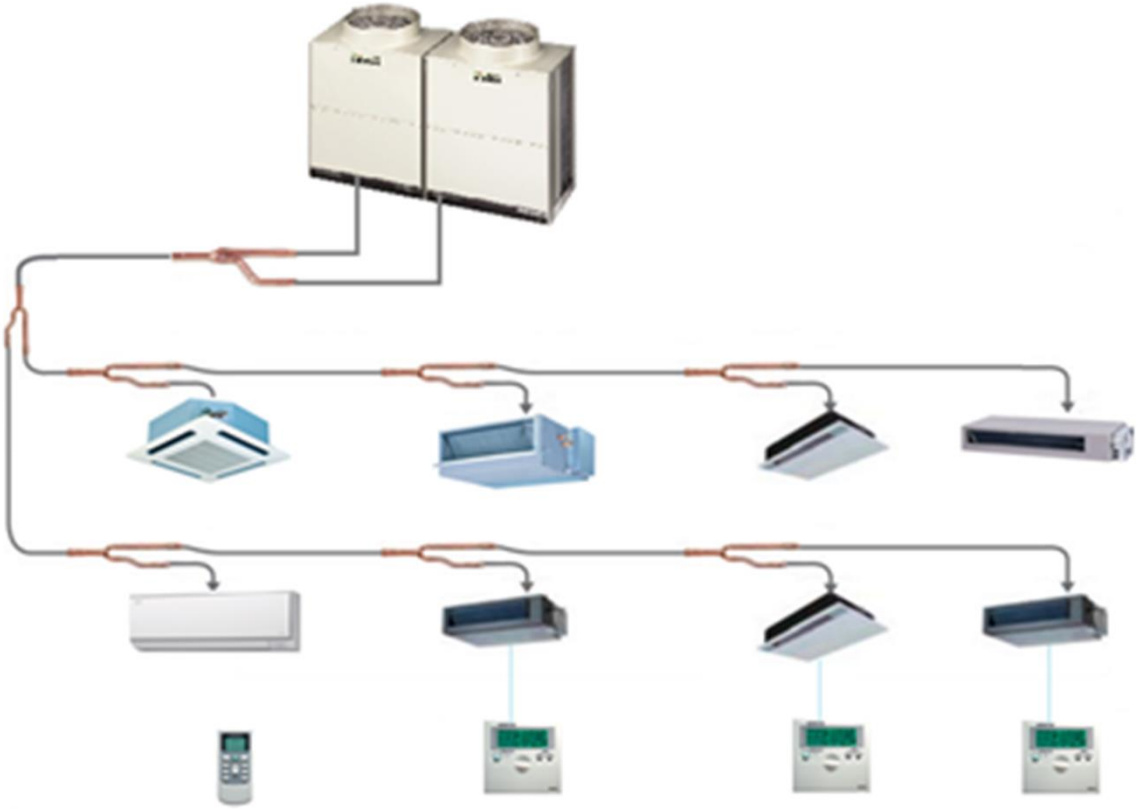


HİTACHİ VRF KLİMA SİSTEMLERİ

ÖRNEK PROJELENDİRME UYGULAMASI

Hazırlayan: Ali DEMİR (Mak.Yük.Müh.)

-DİVERSİTE HESABI

BAKIR BORU ÇAPI,

-BORU BAĞLANTI KİTLERİ,

-İLAVE SOĞUTUCU AKIŞKAN MİKTARI,

-İÇ VE DIŞ ÜNİTELERİN GERÇEK KAPASİTELERİNİN,

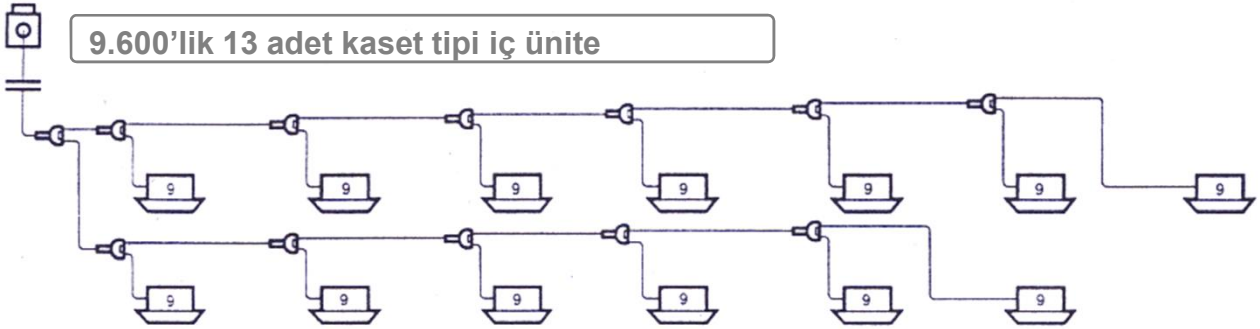
-MANUEL OLARAK TAYİNİ

-VRF SİSTEM BORULAMA LİMİTLERİ

İç ve Dış Ünite Kombinasyonları

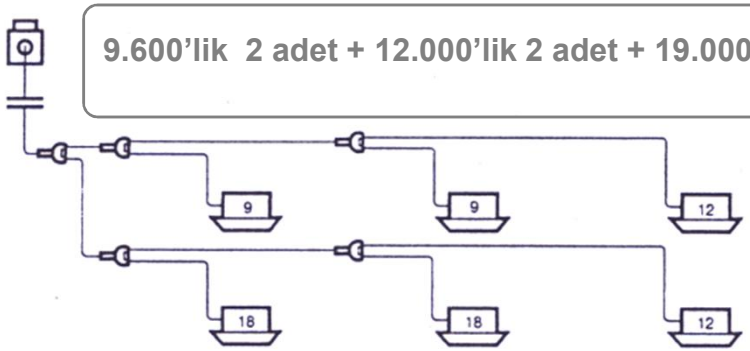
Örn. 1)

9.600'lik 13 adet kaset tipi iç ünite



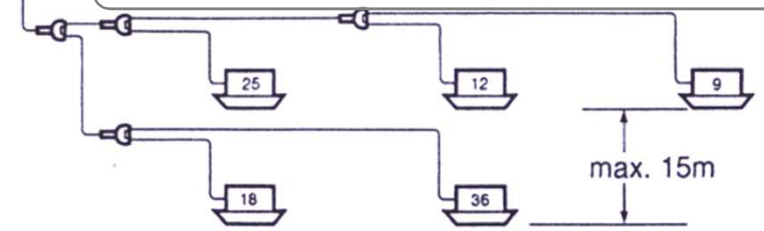
Örn. 2)

9.600'lik 2 adet + 12.000'lik 2 adet + 19.000'lik 2 adet kaset tipi iç ünite



Örn. 3)

25.000'lik 1 adet + 12.000'lik 1adet + 9.600'lik 1 adet +19.000'lik 1 adet + 36.000'lik 1 adet kaset tipi iç ünite

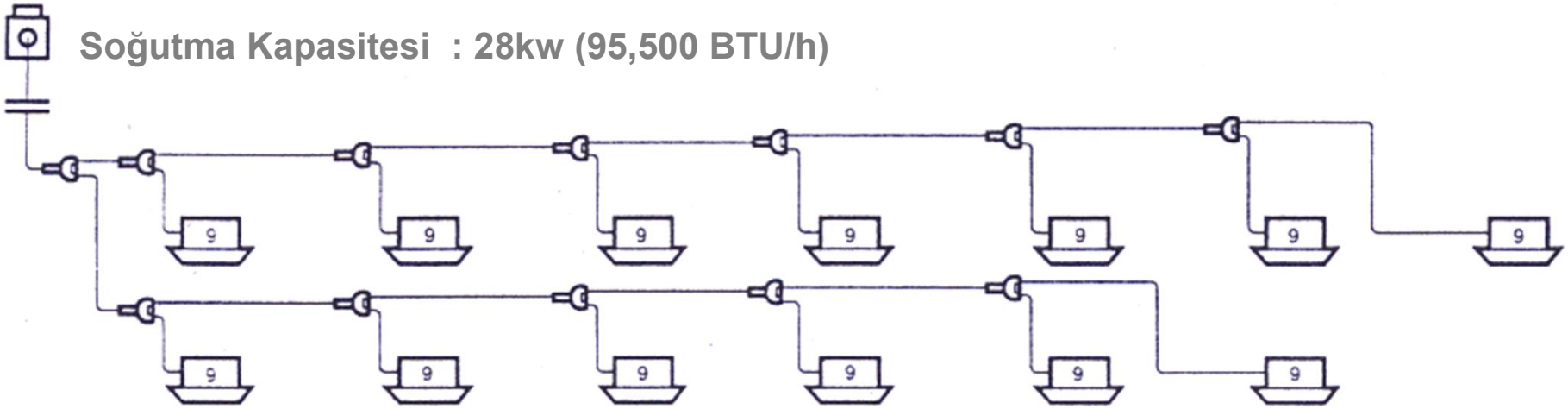


İç ve Dış Ünitelerin Kombinasyonu

Örn. 1)

13 adet 9.600 ‘lik kaset tipi iç ünite örneği (eş kapasite ve aynı tip)

Soğutma Kapasitesi : 28kw (95,500 BTU/h)



İç ünitelerin toplam soğutma kapasitesi :

9.600’lik 13 adet iç ünite

= 2.8 kw * 13

= 36.4 kw(124.800 BTU/h)

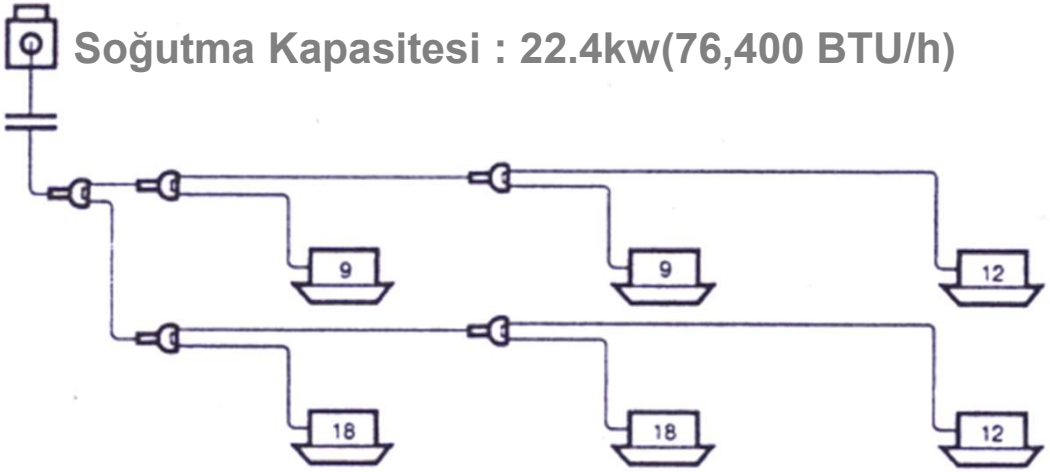
İç ünite / Dış ünite kapasite oranı (diversite) = 130(130.6)%

İç ve Dış Ünitelerin Kombinasyonu

Örn. 2)

8 HP dış üniteye bağlı olarak çalışan 6 adet farklı iç ünite

Soğutma Kapasitesi : 22.4kw(76,400 BTU/h)



İç ünitelerin toplam soğutma kapasitesi :

9.600'lik 2 adet,+ 12.000'lik 2 adet, 19.000'lik 2 adet iç ünite

= 2.8 kW x 2 + 3.6 kW x 2 + 5.6 kW x 2

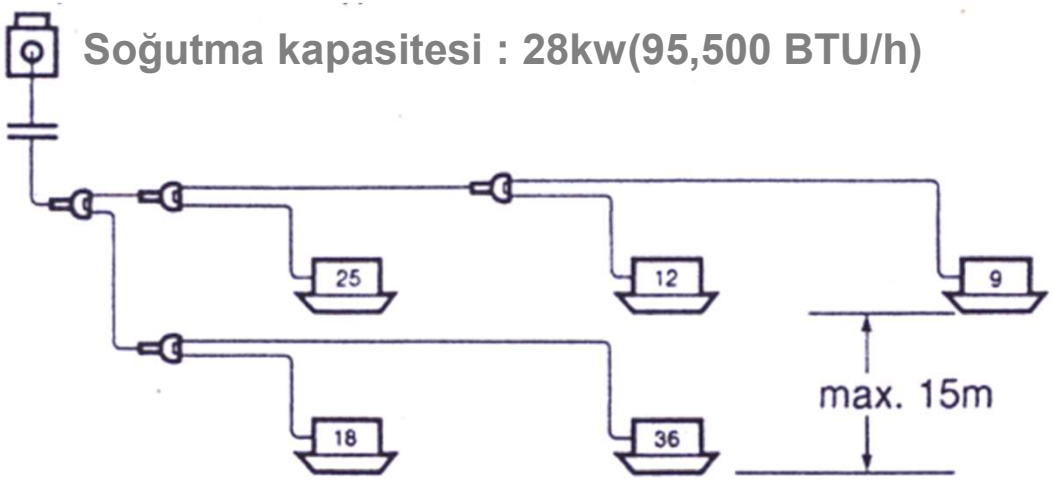
= 24kW (81.200 BTU/h)

İç ünite / Dış ünite kapasite oranı (diversite) = 107(106)%

İç ve Dış Ünitelerin Kombinasyonu

Örn. 3)

10 HP dış üniteye bağlı olarak çalışan 6 adet farklı iç ünite (cihazlar farklı katlarda)



İç ünitelerin toplam kapasitesi :
25.000'lik 1 adet + 12.000'lik 1 adet + 9.600'lik 1 adet +19.000'lik 1 adet + 36.000'lik 1 adet kaset tipi iç ünite

= 7.3 kw + 3.6 kw + 2.8 kw + 5.6 kw + 10.6 kw

= 29.9kw (101.600 Btu/h)

İç ünite / Dış ünite kapasite oranı (diversite) = 107(106)%

Model seçimi ve Kapasite hesabı

①Diversiteye bakarak iç ünite kapasitesinin tayini

İç ve dış ünite kapasite oranı 100 % ~ 130%.
Örnek; 10 HP tipi

Cihaz Tipi	İç Ünite (kW)			
	9.600'lik		25.000'lik	
	Soğutma	Isıtma	Soğutma	Isıtma
100%	2,80	3,20	7,30	8,00
105%	2,70	3,06	7,08	7,58
110%	2,61	2,94	6,83	7,27
115%	2,53	2,83	6,61	6,99
120%	2,45	2,72	6,41	6,74
125%	2,38	2,63	6,23	6,50
130%	2,32	2,54	6,06	6,28

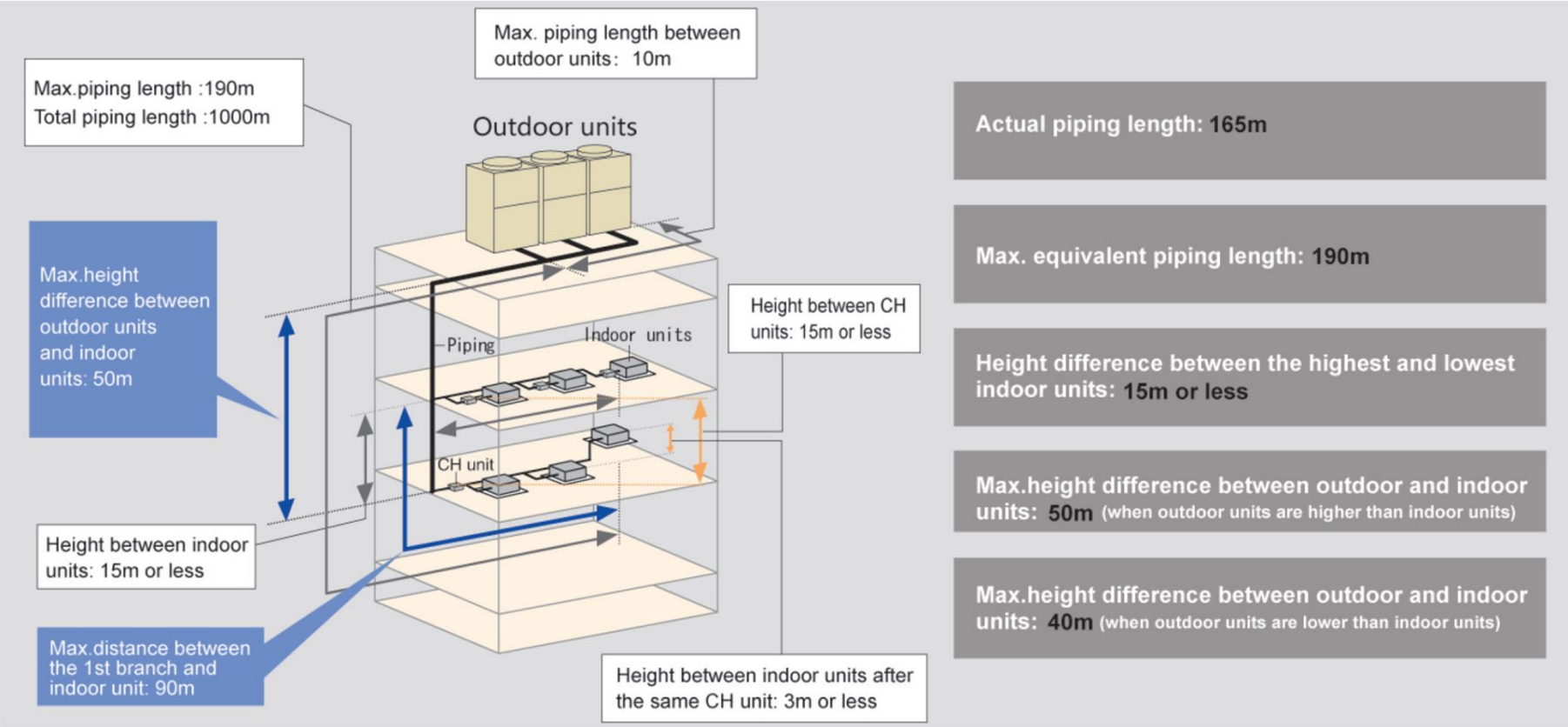
- 17%

②İç ve dış ortam sıcaklıklarına göre kapasite tayini

③Toplam borulama mesafesi ve kot farkı ile kapasite tayini

④Defrost işlemi kayıplarından kaynaklanan ısıtmadaki kapasite tayini

Bakır boru dizaynı



Bakır Boru Et Kalınlığı

● Refrigerant piping

Piping size (mm)			
O material		1/2 H, H material	
Outer diameter	Wall thickness	Outer diameter	Wall thickness
ø 6.35	t 0.8	ø 19.05	t 1.0
ø 9.52	t 0.8	ø 22.22	t 1.0
ø 12.7	t 0.8	ø 25.4	t 1.0
ø 15.88	t 1.0	ø 28.58	t 1.0
		ø 31.75	t 1.1
		ø 38.1	t 1.35

Note: When pipe bending is to be performed, the bending radius shall be at least 4 times the outer diameter. Also, take sufficient care to prevent pipe collapse and damage at the time of bending.

İlave Gaz Miktarı

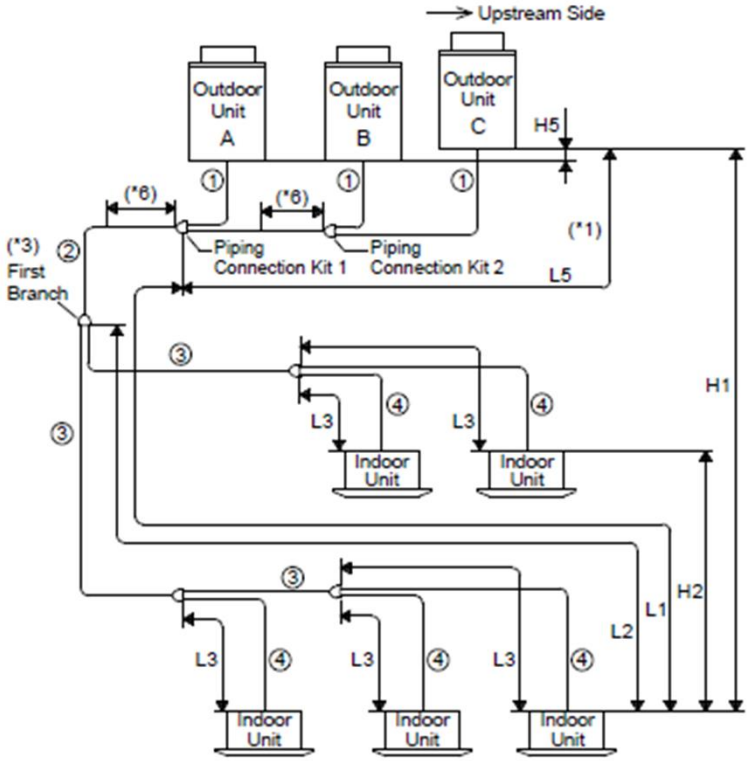
Additional Refrigerant Charge	
Liquid piping size	**Amount of refrigerant charge (g/m)**
ϕ 6,35	30
ϕ 9,53	60
ϕ 12,7	120
ϕ 15,88	190
ϕ 19,05	280
ϕ 22,22	390

Bakır Boru Çap Tayini

① Pipe Diameter for Outdoor Unit

② Main Pipe Diameter
(Base Unit or Piping Connection Kit 1 to First Branch)
[Multi-Kit of First Branch] (*2)

Outdoor Unit HP	Equivalent Piping Length < 100m	
	Gas	Liquid
8	19.05	9.53
10	22.2	9.53
12 and 14	25.4	12.7
16	28.6	12.7
18 to 24	28.6	15.88
26 to 34	31.75	19.05
36 to 54	38.1	19.05



③ [Pipe Diameter after First Branch] (*3)

Total Indoor Unit HP	Gas	Liquid
Lower than 6	15.88	9.53
6 to 8.99	19.05	9.53
9 to 11.99	22.2	9.53
12 to 15.99	25.4	12.7
16 to 17.99	28.6	12.7
18 to 25.99	28.6	15.88
26 to 35.99	31.75	19.05
Over 36	38.1	19.05

④ [Pipe Diameter between Multi-Kit and Indoor Unit] (*4)

Indoor Unit HP	Gas	Liquid
0.8 to 1.5	12.7	6.35 (*5)
1.8 and 2.0	15.88	6.35 (*5)
2.3 to 6.0	15.88	9.53
8.0	19.05	9.53
10.0	22.2	9.53

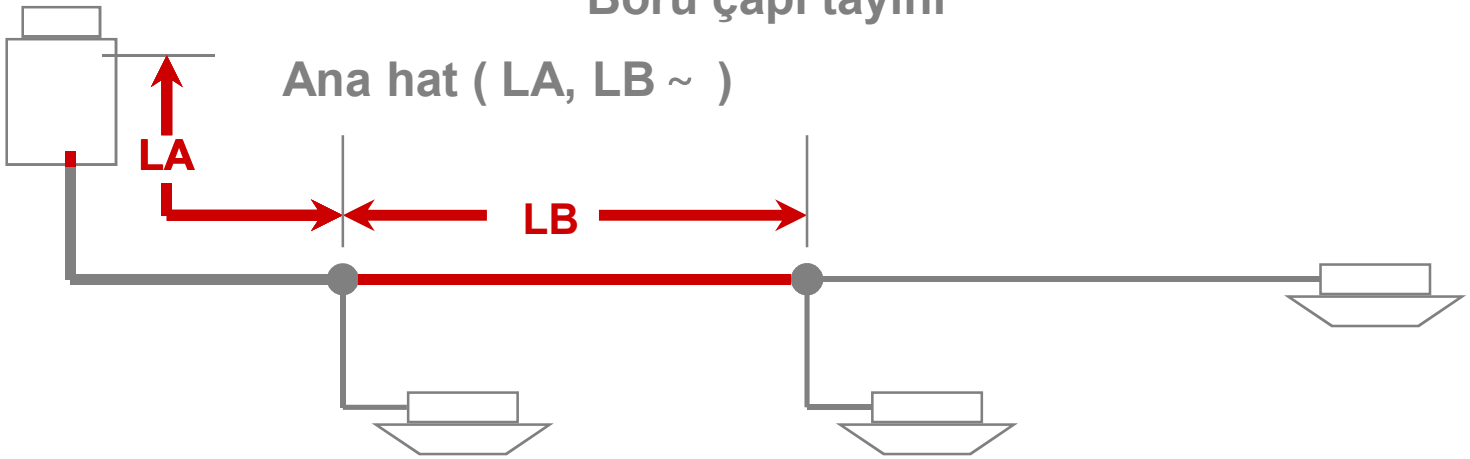
Bakır Boru Çap Tayini

- Piping Work Conditions

Item		Mark	Allowable Piping Length (*7)	
			≤ the recommended connectable number of Indoor Unit	≥ the recommended connectable number of Indoor Unit
Total Piping Length		Total Liquid Piping Actual Length	≤ 1,000m (*8)	≤ 300m
Maximum Piping Length	Actual Length	L1	≤ 165m	≤ 165m
	Equivalent Length		≤ 190m	≤ 190m
Maximum Piping Length between Multi-kit of 1st Branch and Each Indoor Unit		L2	≤ 90m	≤ 40m
Maximum Piping Length between Each Multi-kit and Each Indoor Unit		L3	≤ 40m	≤ 30m
Piping Length between Piping Connection Kit 1 and Each Outdoor Unit		L5	≤ 10m	≤ 10m
Height Difference between Outdoor Units and Indoor Units	O.U. is Higher	H1	≤ 50m	≤ 50m
	O.U. is Lower		≤ 40m	≤ 40m
Height Difference between Indoor Units		H2	≤ 15m	≤ 15m
Height Difference between Outdoor Units		H5	≤ 0.1m	≤ 0.1m

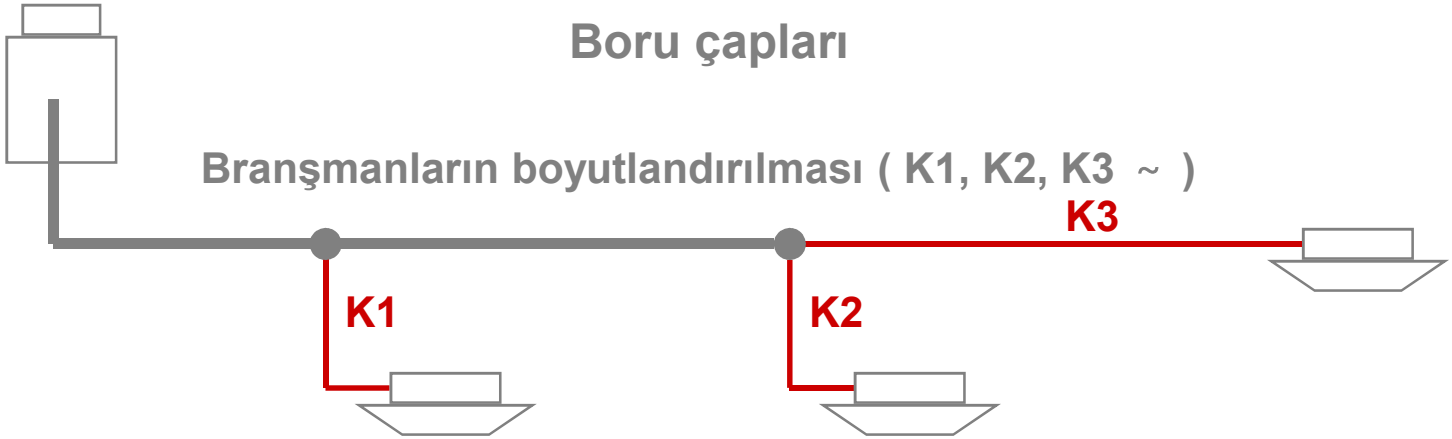
Bakır boru dizaynı

Boru çapı tayini



Pipe Diameter After First Branch								
Total indoor unit capacity (HP)	Lower than 6	6-8,99	9-11,99	12-15,99	16-17,99	18-25,99	26-35,99	over 36
Liquid	9,53	9,53	9,53	12,7	12,7	15,88	19,05	19,05
Gas	15,88	19,05	22,2	25,4	28,6	28,6	31,75	38,1

Bakır boru dizaynı



Pipe Diameter Between Joint and Indoor Unit					
indoor unit capacity (HP)	0,8-1,5	1,8-2,0	2,3-6,0	8,0	10,0
Liquid	6,35	6,35	9,53	9,53	9,53
Gas	12,7	15,88	15,88	19,05	22,2

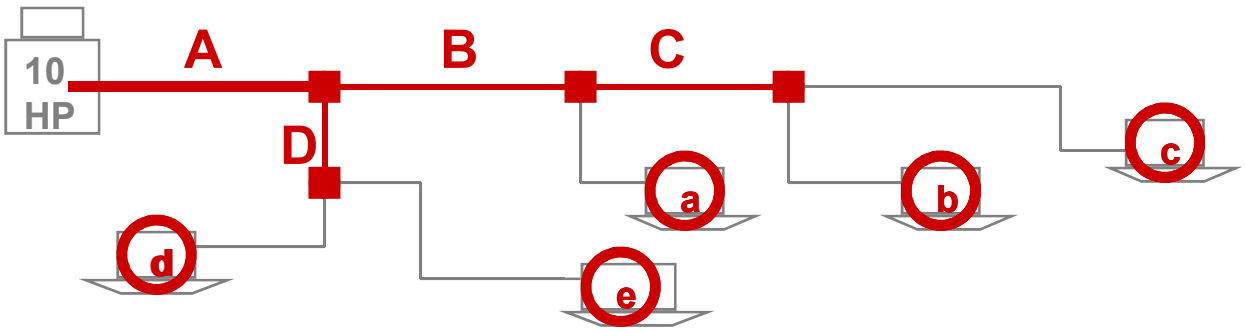
Boru bağlantı kitlerinin seçimi

First Branch

Outdoor Unit HP	Model
8 and 10	E-102SN
12 to 16	E-162SN
18 to 24	E-242SN
26 to 54	E-302SN

Pipe Diameter and Multi-Kit after First Branch

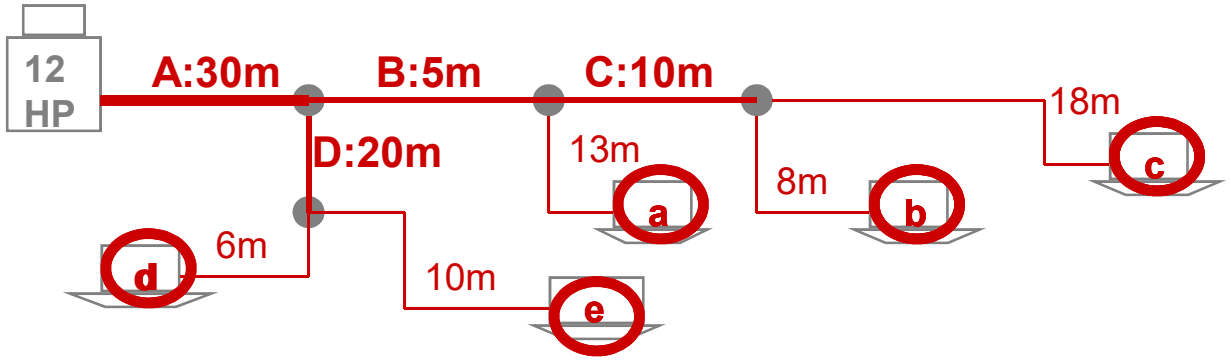
Total Indoor Unit HP	Gas (ϕmm)	Liquid (ϕmm)	Model
Lower than 6	15.88	9.53	E-102SN
6 to 8.99	19.05	9.53	
9 to 11.99	22.2	9.53	
12 to 15.99	25.4	12.7	E-162SN
16 to 17.99	28.6	12.7	
18 to 25.99	28.6	15.88	E-242SN
26 to 35.99	31.75	19.05	E-302SN
Over 36	38.1	19.05	



İç ünite Tipi	Soğutma (HP)
Tip a	5,0
Tip b	1,3
Tip c	1,0
Tip d	2,0
Tip e	3,3

		Dağıtım noktasından sonraki cihazla-rın toplam soğutma kapasitesi	Gaz hattı	Likid hattı	Bağlantı kitleri
Ana Hat	A	2,5 + 1,3 + 1,0 + 2,0 +3,3 = 12,6 HP	25,4	12,7	E-162SN
	B	2,5 + 1,3 + 1,0 = 7,3 HP	19,05 (3/4)	9.52 (3/8)	E-102SN
	C	1,3 + 1,0 = 2,3 HP	15,88 (5/8)	9.52 (3/8)	E-102SN
	D	2,0 +3,3 = 5,3 HP	15,88 (5/8)	9.52 (3/8)	E-102SN

Bakır boru çaplarının tayin edilmesi ve ilave soğutucu akışkan şarjının belirlenmesi



İç ünite Tipi	Soğutma (HP)
Tip a	5,0
Tip b	1,3
Tip c	2,5
Tip d	2,0
Tip e	4,0

		Dağıtım noktasından sonraki cihazların toplam soğutma kapasitesi	Gaz hattı	Likid hattı	① mesafe	② İlave gaz	① X ②
Ana hat	A	5,0 + 1,3 + 2,5 +2,0 +4,0 = 14,8 HP	25,4 (1)	12,7(1/2)	30m	120 g / m	3.600g
	B	5,0 + 1,3 + 2,5 = 8,8 HP	19,05(3/4)	9,52(3/8)	5m	60 g / m	300g
	C	1,3 + 2,5 = 3,8 HP	15,88(5/8)	9,52(3/8)	10m	60 g / m	600g
	D	2,0 +4,0 = 6,0 HP	19,05(3/4)	9,52(3/8)	20m	60 g / m	1.200g
Dağıtım hatları	Tip a	5,0 HP	15,88(5/8)	9,52(3/8)	13m	60 g / m	780g
	Tip b	1,3 HP	12,7(1/2)	6,35(1/4)	8m	30 g / m	240g
	Tip c	2,5 HP	15,88(5/8)	6,35(1/4)	18m	30 g / m	540g
	Tip d	2,0 HP	15,88(5/8)	6,35(1/4)	6m	30 g / m	180g
	Tip e	4,0 HP	15,88(5/8)	9,52(3/8)	10m	60 g / m	600g
Toplam miktar			———	———	———	———	8.040g

Örnek sistemde kullanılan toplam soğutucu akışkan miktarı

= Dış ünitede bulunan mevcut soğutucu akışkan + ilave edilen soğutucu akışkan miktarı

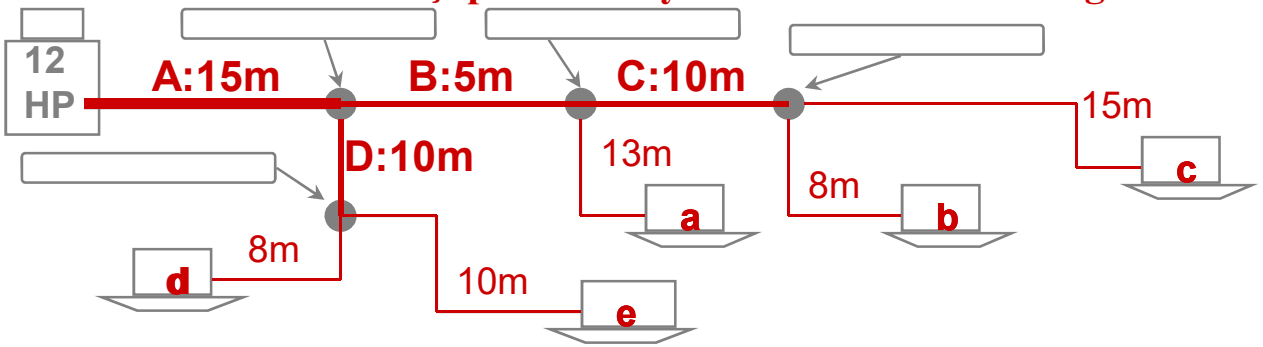
= 8.000g + 8.040g

= 16.040g

A-KOND AKADEMİYA

HITACHI Inspire the Next

Örnek : Bakır boru çaplarının tayini ve ilave edilecek soğutucu akışkan miktarının belirlenmesi



Tip	kapasite soğutma (HP)
Tip a	4,0
Tip b	2,0
Tip c	2,5
Tip d	1,0
Tip e	3,3

		Dağıtım noktasından sonraki cihazla-rın toplam soğutma kapasitesi	Gaz hattı	Likid hattı	① mesafe	② İlave gaz	① X ②
Ana hat	A	+ + + + = HP			15 m	g / m	g
	B	+ + = HP			5 m	g / m	g
	C	+ = HP			10 m	g / m	g
	D	+ = HP			10 m	g / m	g
Branşmanlar	Tip a	4,0 HP			13 m	g / m	g
	Tip b	2,0 HP			8 m	g / m	g
	Tip c	2,5 HP			15 m	g / m	g
	Tip d	1,0 HP			8 m	g / m	g
	Tip e	3,3 HP			10 m	g / m	g
Toplam			____	____	____	____	g

Örnek sistemde kullanılan toplam soğutucu akışkan miktarı

= Dış ünitede bulunan mevcut soğutucu akışkan + ilave edilen soğutucu akışkan miktarı

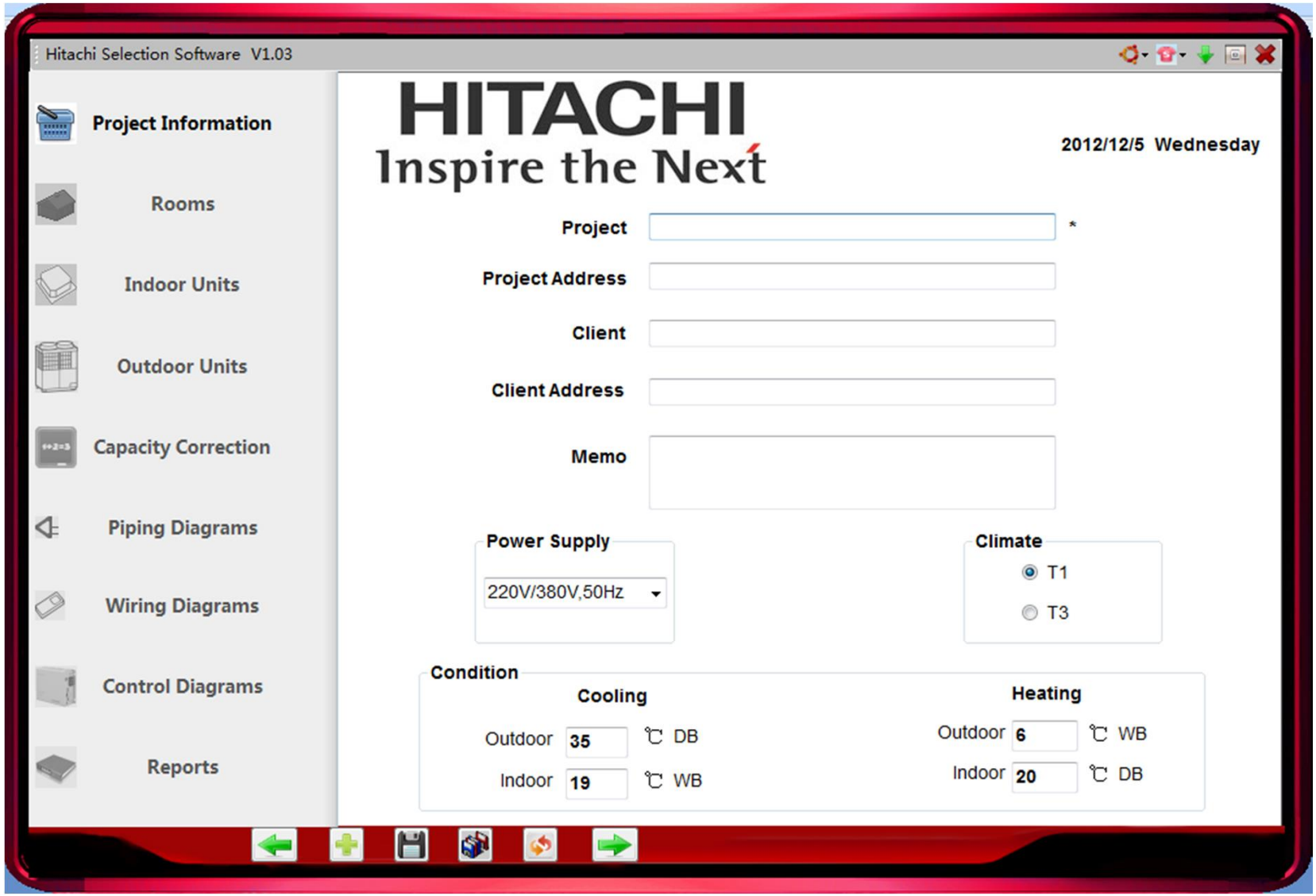
= 8.000g + ____ g

= ____ g

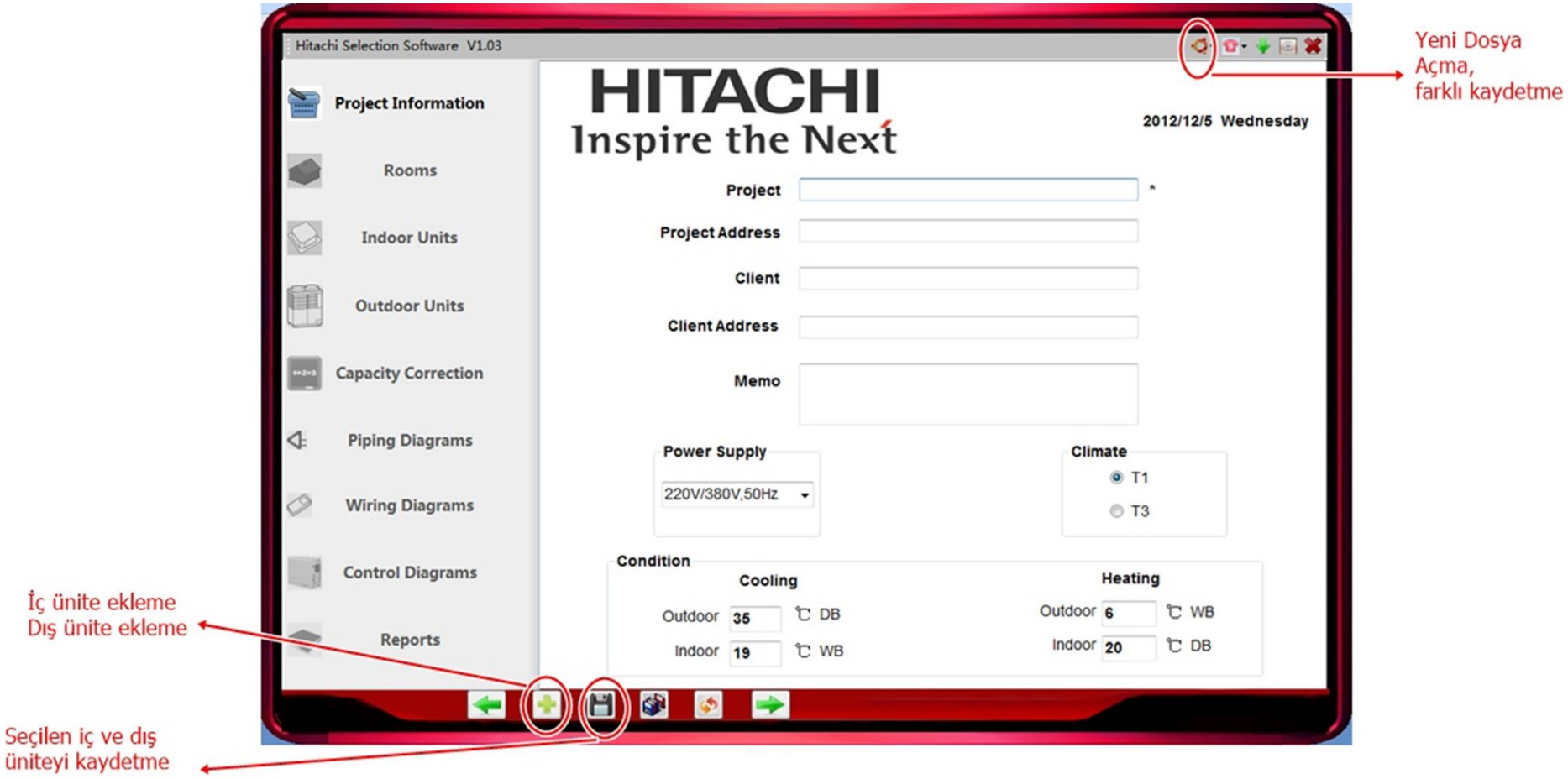
A-KOND AKADEMiYA

HITACHI Inspire the Next

HITACHI DİZAYN PROGRAMI KULLANIMI



Dizayn programı kullanımı



Dizayn programı kullanımı

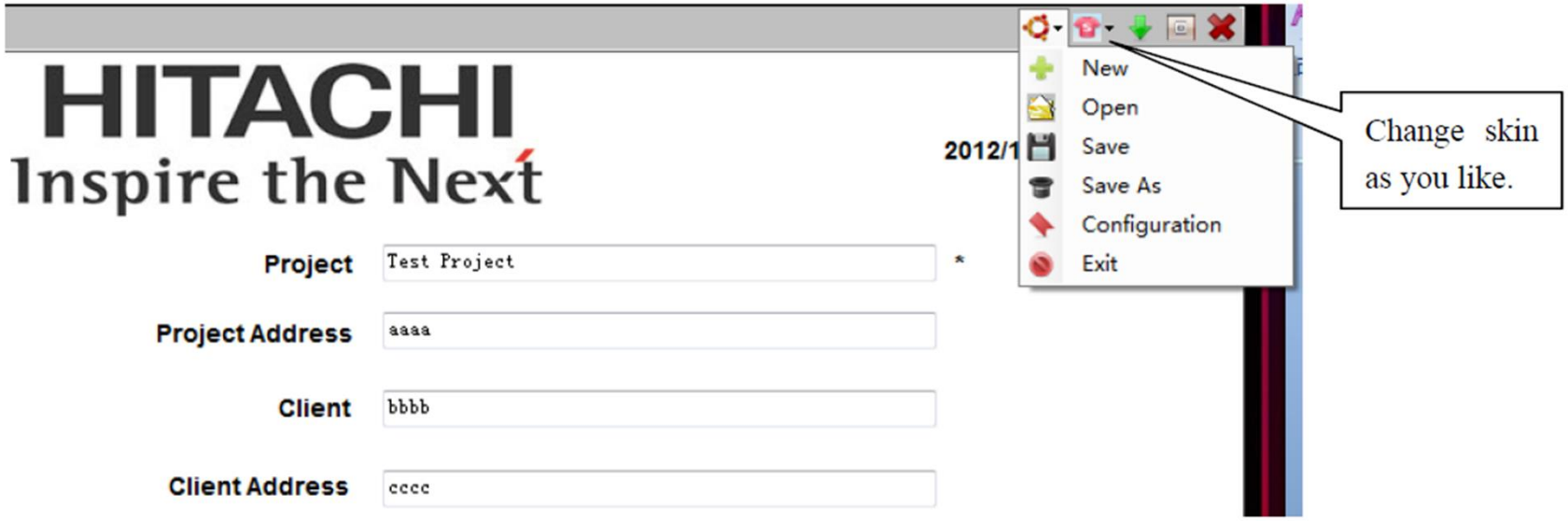
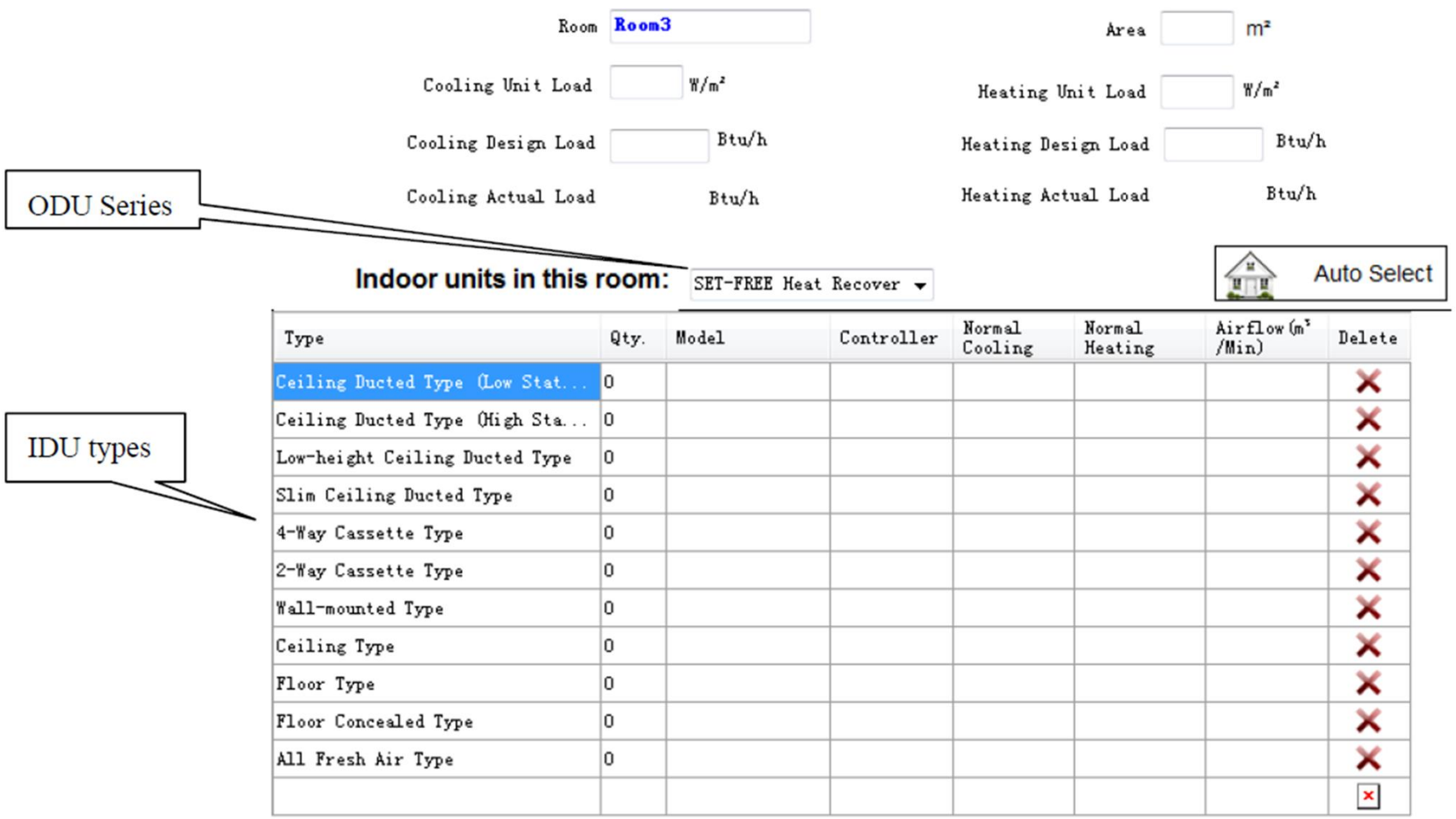


Diagram 2.28

"New"—Create a new project;
"Open"—Open an old project;
"Save"—Save current project;
"Save As"—Save current project as another project file;
"Configuration"—Config this software;
"Exit"—Exit this software.

Config this software

"menüden, yeni proje oluştur, oluşturduğumuz projelerin kayıt edildiği ve yedeklendiği klasörü değiştirebiliriz.



“Dış ünite ve iç ünite seçimi.

Room	Room3	Area	30 m²
Cooling Unit Load	300 W/m²	Heating Unit Load	W/m²
Cooling Design Load	30700 Btu/h	Heating Design Load	Btu/h
Cooling Actual Load	34100 Btu/h	Heating Actual Load	41200 Btu/h

Indoor units in this room: SET-FREE Heat Recover

Auto Select

Type	Qty.	Model	Controller	Normal Cooling	Normal Heating	Airflow (m³/Min)	Delete
Slim Ceiling Ducted Type	1	RPIZ-0.8FSNQS	PC-ARQ	2.2	2.8	8-7-6	✕
Slim Ceiling Ducted Type	1	RPIZ-0.8FSNQS	PC-ARQ	2.2	2.8	8-7-6	✕
4-Way Cassette Type	1	RCI-1.0FSN1Q	PC-ARQ	2.8	3.3	13-12-11	✕
2-Way Cassette Type	1	RCD-1.0FSN2	PC-ARQ	2.8	3.2	10-9-8	✕
							✕

Ceiling Ducted Type (Low Static)
Ceiling Ducted Type (High Static
Low-height Ceiling Ducted Type
Slim Ceiling Ducted Type
4-Way Cassette Type
2-Way Cassette Type
Wall-mounted Type
Ceiling Type
Floor Type
Floor Concealed Type
All Fresh Air Type

“Her bir oda bilgilerinin girilmesi ve iç ünite seçimi.

Clicking button  **Indoor Units** on the left can display the list of IDUs in current project, as shown in the following (Diagram 2.7).

Indoor Unit	Series	Type	Model	Room	Controller	Normal Cooling Capacity(Btu/h)	Normal Heating Capacity(Btu/h)	Airflow(m³/Min)	Size	ODU Connected	Detail	Delete
IDU1	SET-FREE H...	Slim Ceiling Ducted Type	RPIZ-1.0FSNQS	Room1	PC-ARQ	9500	11200	8-7-6	192*700*602			
IDU2	SET-FREE H...	Slim Ceiling Ducted Type	RPIZ-1.3FSNQS	Room1	PC-ARQ	12200	14300	10-8-7	192*700*602			
IDU3	SET-FREE H...	2-Way Cassette Type	RCD-1.0FSN2	Room2	PC-ARQ	9500	10900	10-9-8	298*860*620			
IDU4	SET-FREE H...	Wall-mounted Type	RPK-1.0FSNS...	Room2	PC-ARQ	9500	10900	10-8-7	280*780*210			
IDU5	SET-FREE H...	Ceiling Type	RPC-2.0FSN2	Room2	PC-ARQ	19100	21500	14-12-10	210*1100*670			
IDU6	SET-FREE H...	Slim Ceiling Ducted Type	RPIZ-0.8FSNQS	Room3	PC-ARQ	7500	9500	8-7-6	192*700*602			
IDU7	SET-FREE H...	Slim Ceiling Ducted Type	RPIZ-0.8FSNQS	Room3	PC-ARQ	7500	9500	8-7-6	192*700*602			
IDU8	SET-FREE H...	4-Way Cassette Type	RCI-1.0FSN1Q	Room3	PC-ARQ	9500	11200	13-12-11	248*840*840			
IDU9	SET-FREE H...	2-Way Cassette Type	RCD-1.0FSN2	Room3	PC-ARQ	9500	10900	10-9-8	298*860*620			

Seçilen iç üniteler ve iç ünite bilgileri.

Series of ODU connected

Name IDU10

Series SET-FREE Heat Recovery Modular S

Type Ceiling Ducted Type (Low Static Pre

Model RPI-0.8F SNQL

Qty. 1

Room

Cooling Design Load

Cooling Actual Load

Heating Design Load

Heating Actual Load

Normal Cooling Capacity	7500Btu/h	Normal Heating Capacity	9500Btu/h
Airflow	8-7-6m³/min	Noise	29.5-26-24.5dB(A)
Weight	46 Kg	Size	270*(650+75)*720

Controller

Wired PC-ARQ

Wireless PC-LH3A

İç ünite hakkında detaylı bilgi.

2.5 Adding Outdoor units

Click  **Outdoor Units** to manage the ODUs of current project, as mentioned above; you will see a list as Diagram 2.9:

Outdoor Unit	Series	Model	Normal Cooling Capacity(Btu/h)	Normal Heating Capacity(Btu/h)	Size(mm)	IDU Connected	Detail	Delete
ODU1	SET-FREE Heat R...	RAS-12FSXNQ	114300	127900	1720*950*765	9		

Diagram 2.9

Dış ünite bilgileri

A-KOND AKADEMiYA

HITACHI Inspire the Next

Outdoor Unit: ODU2

Series: SET-FREE Heat Recovery M

Model: RAS-26FSXNQ

Location: e. g. 1-101

Max Combination: 100 %

	Cooling	Heating
Total capacity of indoor units	245700Btu/h	273000Btu
Actual Combination	98.6%	97%

Data of Outdoor Unit

Normal Cooling Capacity	249100Btu/h
Normal Heating Capacity	281500Btu/h
Noise Level	64dB(A)
Weight	513kg
Size	1720*2180*765

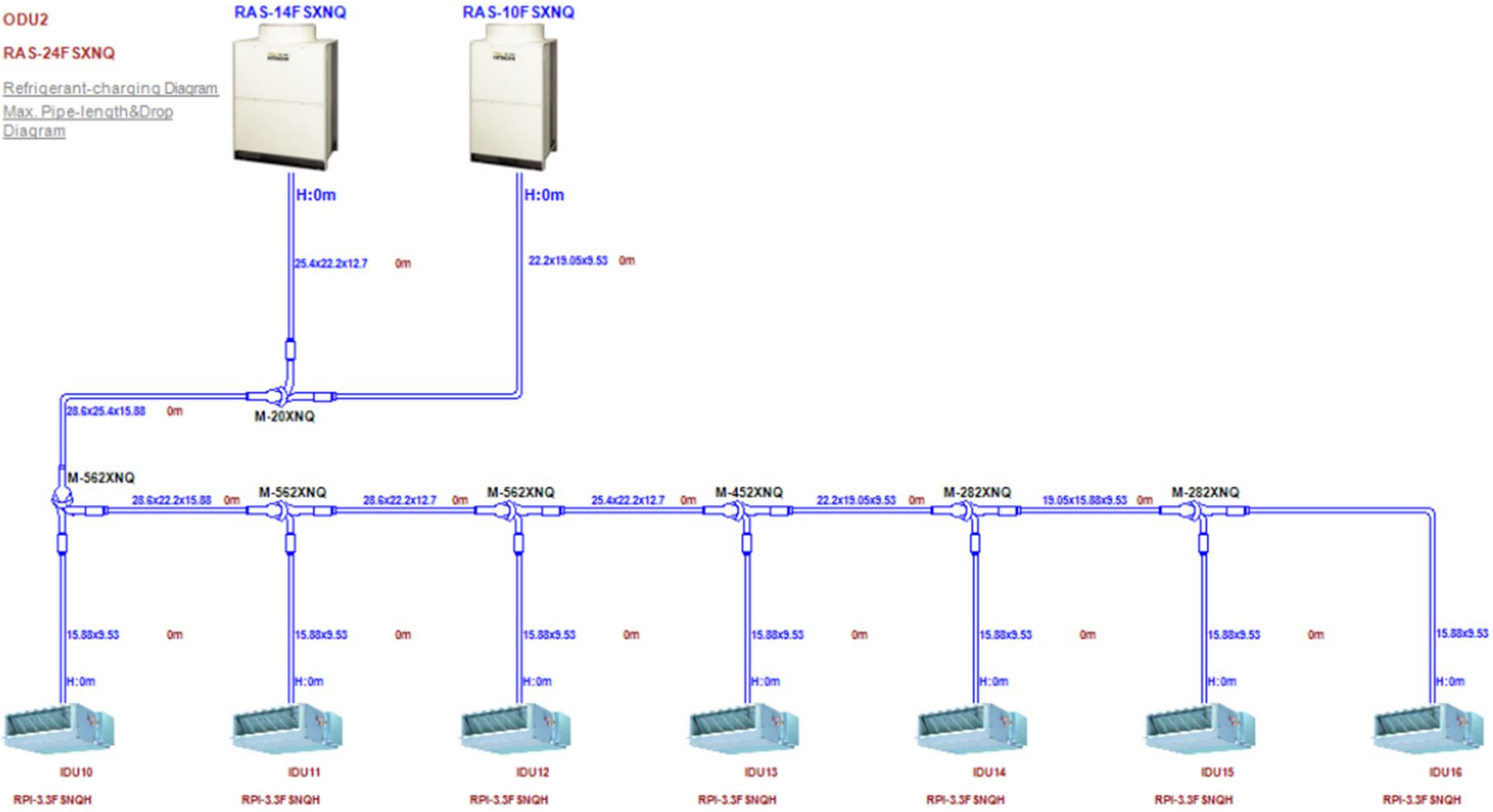
Connected to outdoor unit

IDU10(RPI-3.3FSNQH)
IDU11(RPI-3.3FSNQH)
IDU12(RPI-3.3FSNQH)
IDU13(RPI-3.3FSNQH)
IDU14(RPI-3.3FSNQH)
IDU15(RPI-3.3FSNQH)
IDU16(RPI-3.3FSNQH)
IDU17(RPI-3.3FSNQH)

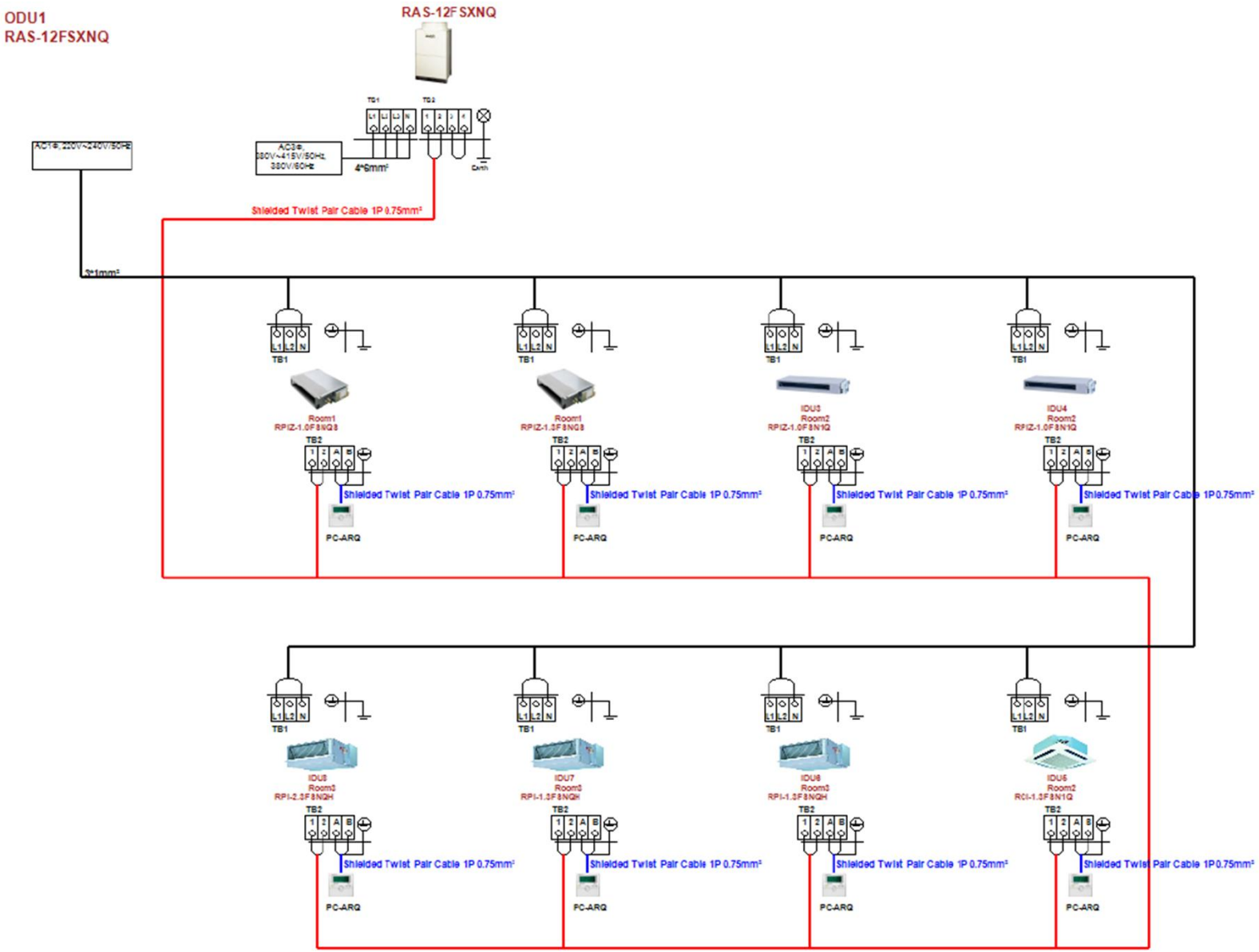
Total Indoor Units

IDU18(RPI-0.8FSNQL)
IDU19(RPI-0.8FSNQL)
IDU20(RPI-0.8FSNQL)

Dış ünite grubu hakkında detaylı bilgi.



Kolon şeması ile bakır boru çapları, joint tipleri ve boru uzunlukları tespit edilimiş oluyor.

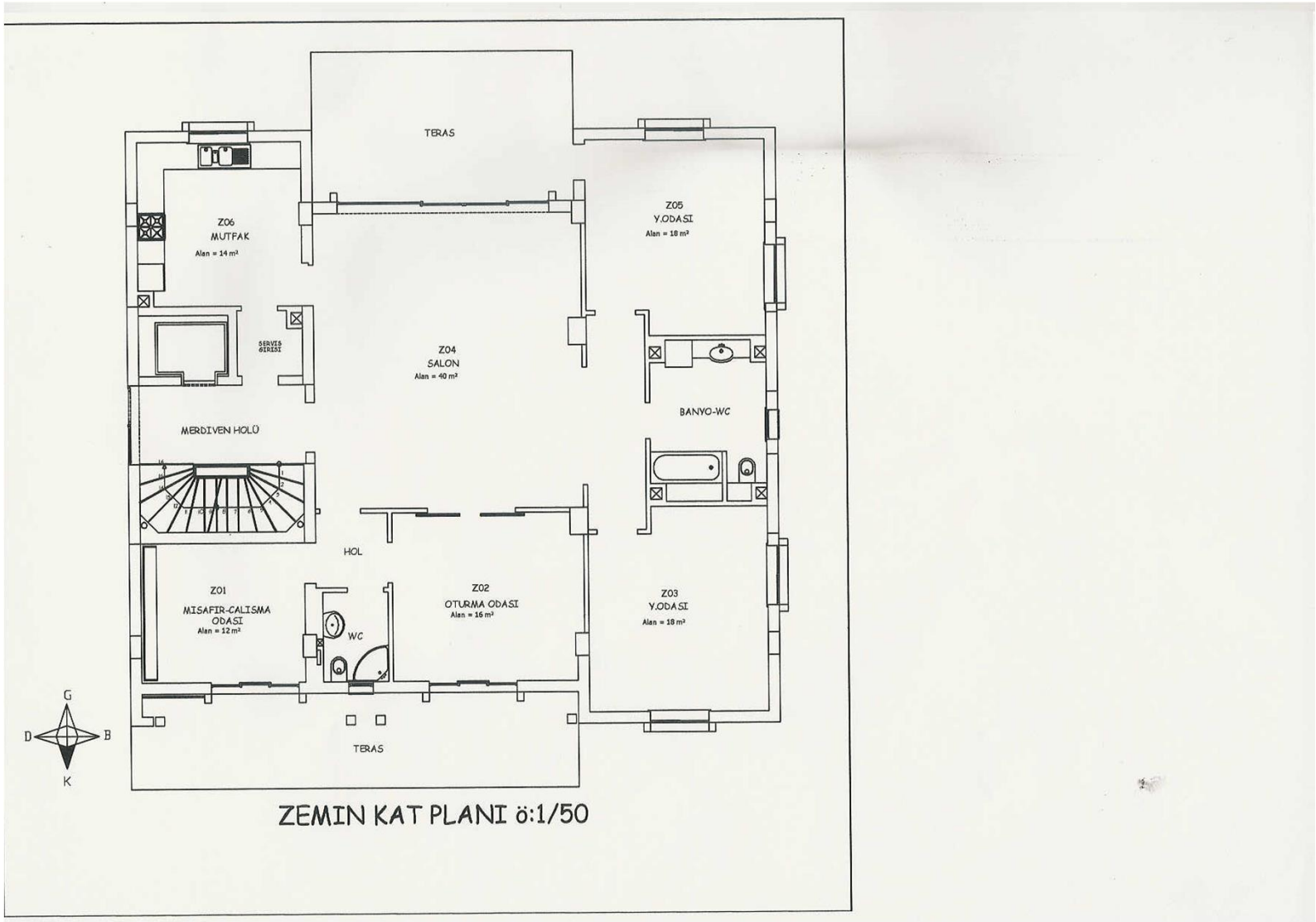


Elektrik ve sinyal hattı kablolama projesi.

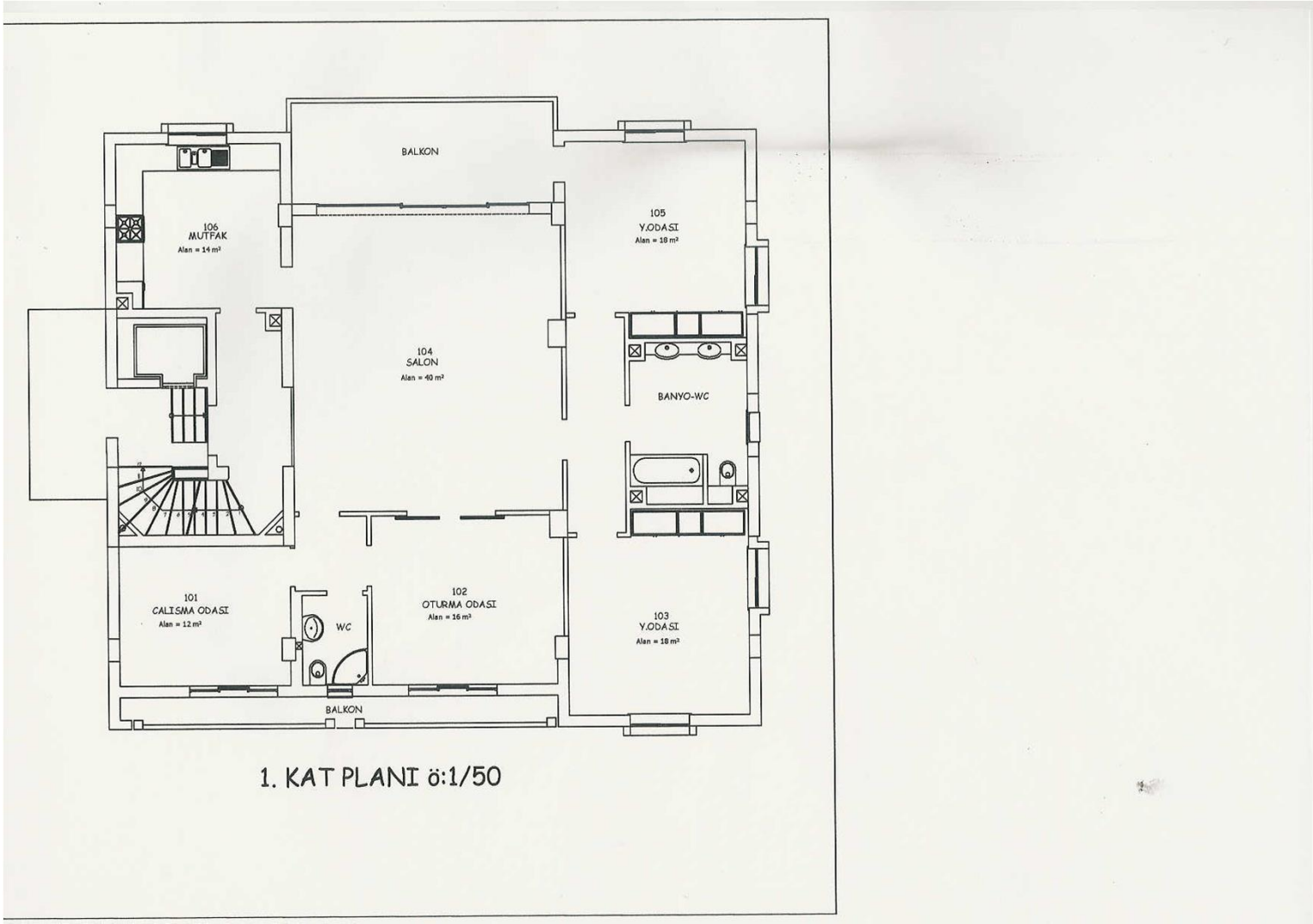
A-KOND AKADEMİYA

HITACHI Inspire the Next

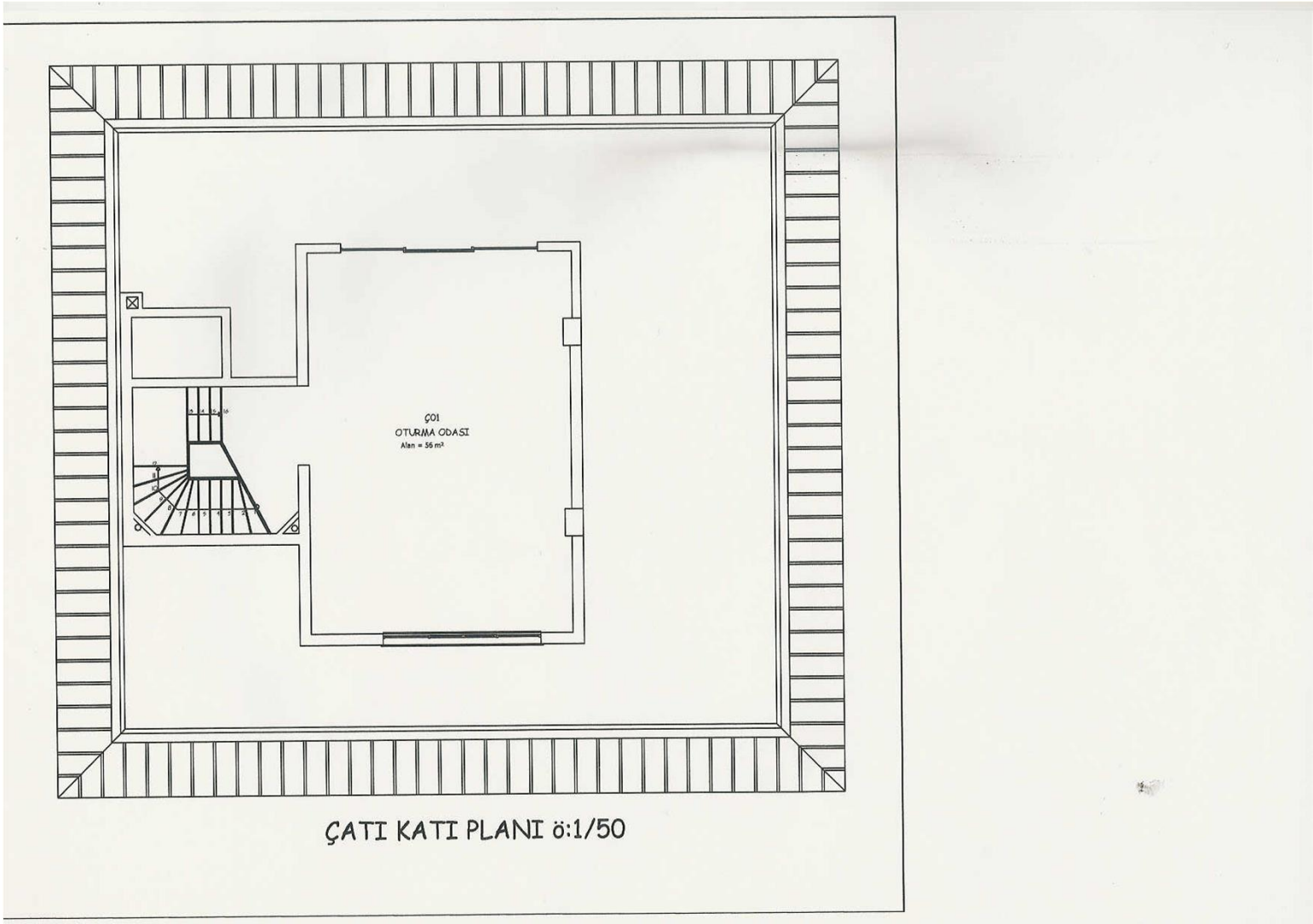
ÖRNEK VİLLA PROJESİ UYGULAMASI



Örnek uygulama için seçilen binanın mimari projesi.



Örnek uygulama için seçilen binanın mimari projesi.



Örnek uygulama için seçilen binanın mimari projesi.

A-KOND AKADEMİYA

HITACHI Inspire the Next

YAPILAN ISI KAYBI VE ISI KAZANCI DEĞERLERİNE GÖRE SEÇİLEN CİHAZLAR

		Isı Kazancı (Btu/h)			Isı Kaybı	Seçilen İç Ünite			
	Mahal	**08:00**	**12:00**	**16:00**	**Btu/h**	**Model**	**Kapasite**	**Miktar**	**Toplam**
Zemin	Z01	5.179	5.282	5.179	6.556	RCI 1.0	9.600	1	9.600
	Z02	5.427	5.530	5.427	6.532	RCI 1.0	9.600	1	9.600
	Z03	5.588	5.682	8.762	7.652	RCI 1.0	9.600	1	9.600
	Z04	9.914	14.620	9.914	10.264	RCI 2.0	19.000	1	19.000
	Z05	5.413	6.348	8.587	7.424	RCI 1.0	9.600	1	9.600
	Z06	5.894	6.782	5.894	5.780	RCI 1.0	9.600	1	9.600
1.Nor.Kat	101	5.851	5.954	5.851	6.916	RCI 1.0	9.600	1	9.600
	102	3.629	3.346	3.629	5.568	RCI 1.0	9.600	1	9.600
	103	6.596	6.690	9.770	8.152	RCI 1.0	9.600	1	9.600
	104	9.914	14.620	9.914	12.048	RCI 2.0	19.000	1	19.000
	105	6.421	7.356	9.595	7.736	RCI 1.0	9.600	1	9.600
	106	5.894	6.782	5.894	6.104	RCI 1.0	9.600	1	9.600
Çatı Katı	Ç01	20.548	24.680	20.548	22.556	RCI 4.0	38.200	1	38.200
								13	**172.200**

Not: Yukarıdaki seçilen iç üniteler yapılan ilk hesaplara göre seçilmiştir.

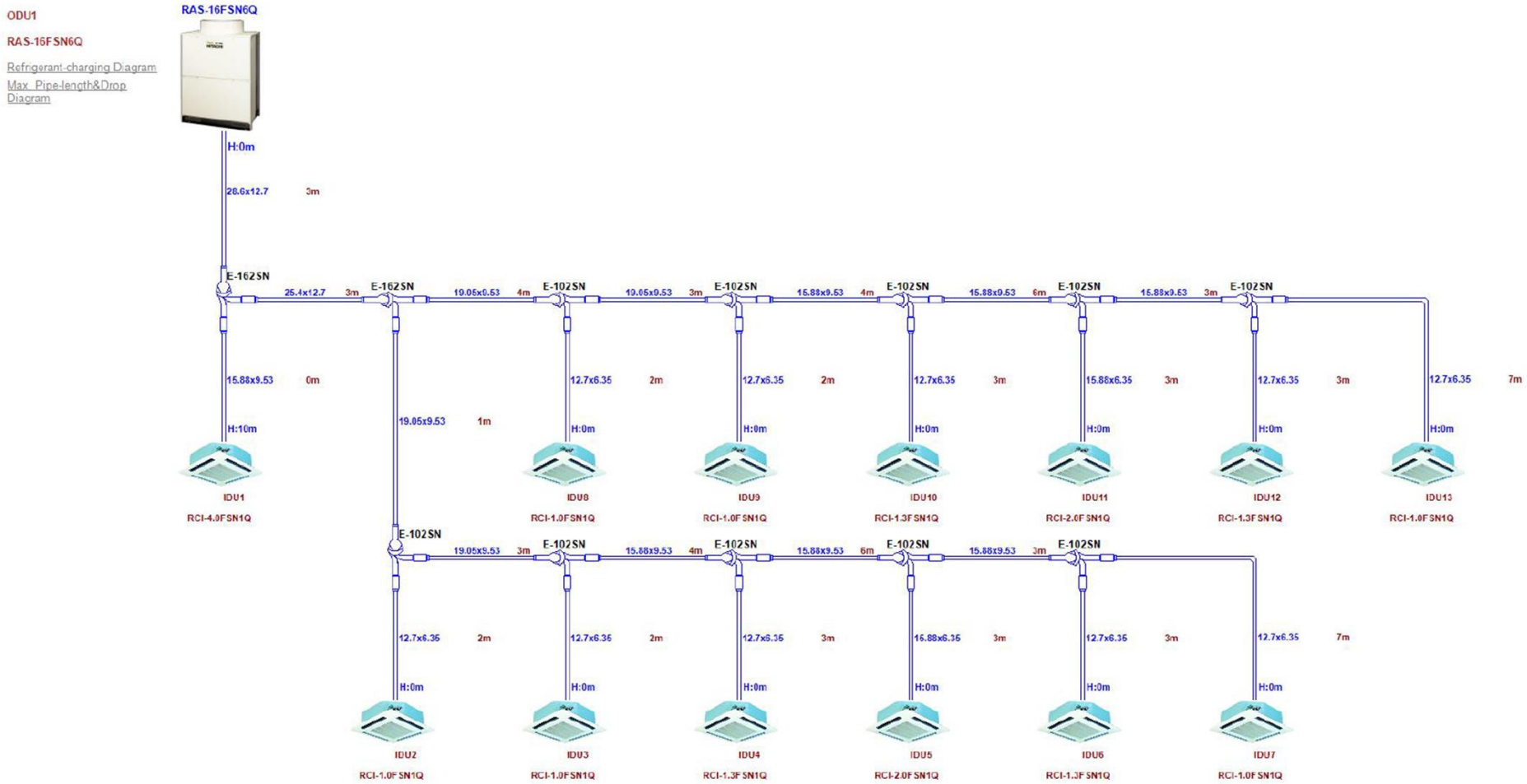
DIŞ ÜNİTE SEÇENEKLERİ

SET FREE HEAT RECOVERY MODULAR SERIES
SET FREE HEAT PUMP MODULAR SERIES
SET FREE FRONT FLOW SERIES
SET FREE COOLING ONLY MODULAR SERIES
SET FREE MINI SERIES
IVX MINI SERIES

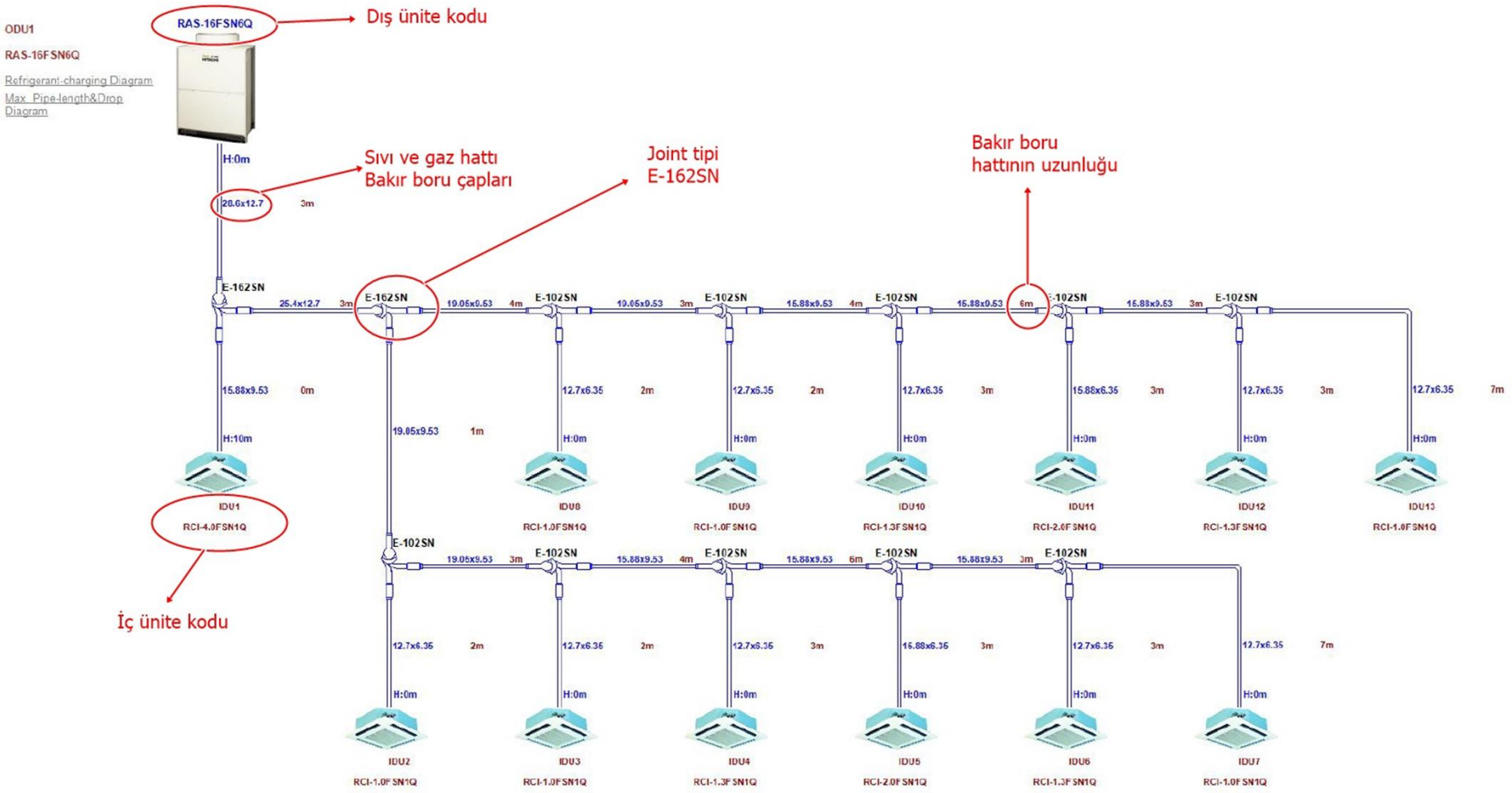
Seçeceğimiz dış ünite, yukarıdakilerden biri olmalı

İç üniteler, Dizayn programındaki gerçek kapasitelere (Actual Capacity) göre revize edilmiştir.

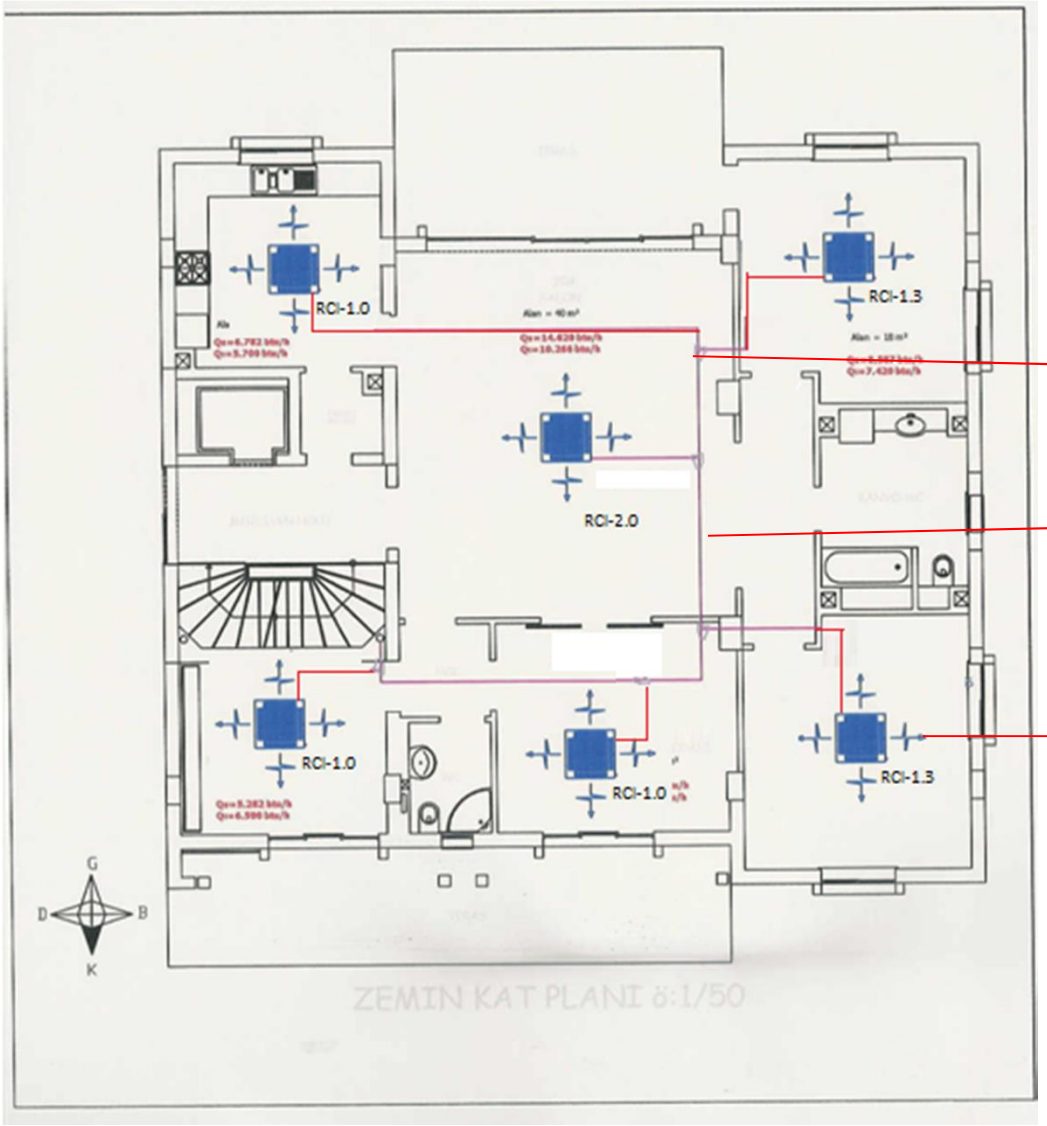
		Isı Kazancı (Btu/h)			Isı Kaybı	Seçilen İç Ünite			
	Mahal	**08:00**	**12:00**	**16:00**	**Btu/h**	**Model**	**Kapasite**	**Miktar**	**Toplam**
Zemin	Z01	5.179	5.282	5.179	6.556	RCI 1.0	9.600	1	9.600
	Z02	5.427	5.530	5.427	6.532	RCI 1.0	9.600	1	9.600
	Z03	5.588	5.682	8.762	7.652	***RCI 1.3***	***12.000***	1	12.000
	Z04	9.914	14.620	9.914	10.264	RCI 2.0	19.000	1	19.000
	Z05	5.413	6.348	8.587	7.424	***RCI 1.3***	***12.000***	1	12.000
	Z06	5.894	6.782	5.894	5.780	RCI 1.0	9.600	1	9.600
1.Nor.Kat	101	5.851	5.954	5.851	6.916	RCI 1.0	9.600	1	9.600
	102	3.629	3.346	3.629	5.568	RCI 1.0	9.600	1	9.600
	103	6.596	6.690	9.770	8.152	***RCI 1.3***	***12.000***	1	12.000
	104	9.914	14.620	9.914	12.048	RCI 2.0	19.000	1	19.000
	105	6.421	7.356	9.595	7.736	***RCI 1.3***	***12.000***	1	12.000
	106	5.894	6.782	5.894	6.104	RCI 1.0	9.600	1	9.600
Çatı Katı	Ç01	20.548	24.680	20.548	22.556	RCI 4.0	38.200	1	38.200
								13	**181.800**



Örnek proje için seçilen villanın Dizayn programından alınan “Bakır Boru Diyagramı”.



Bakır Boru Diyagramının açıklaması.

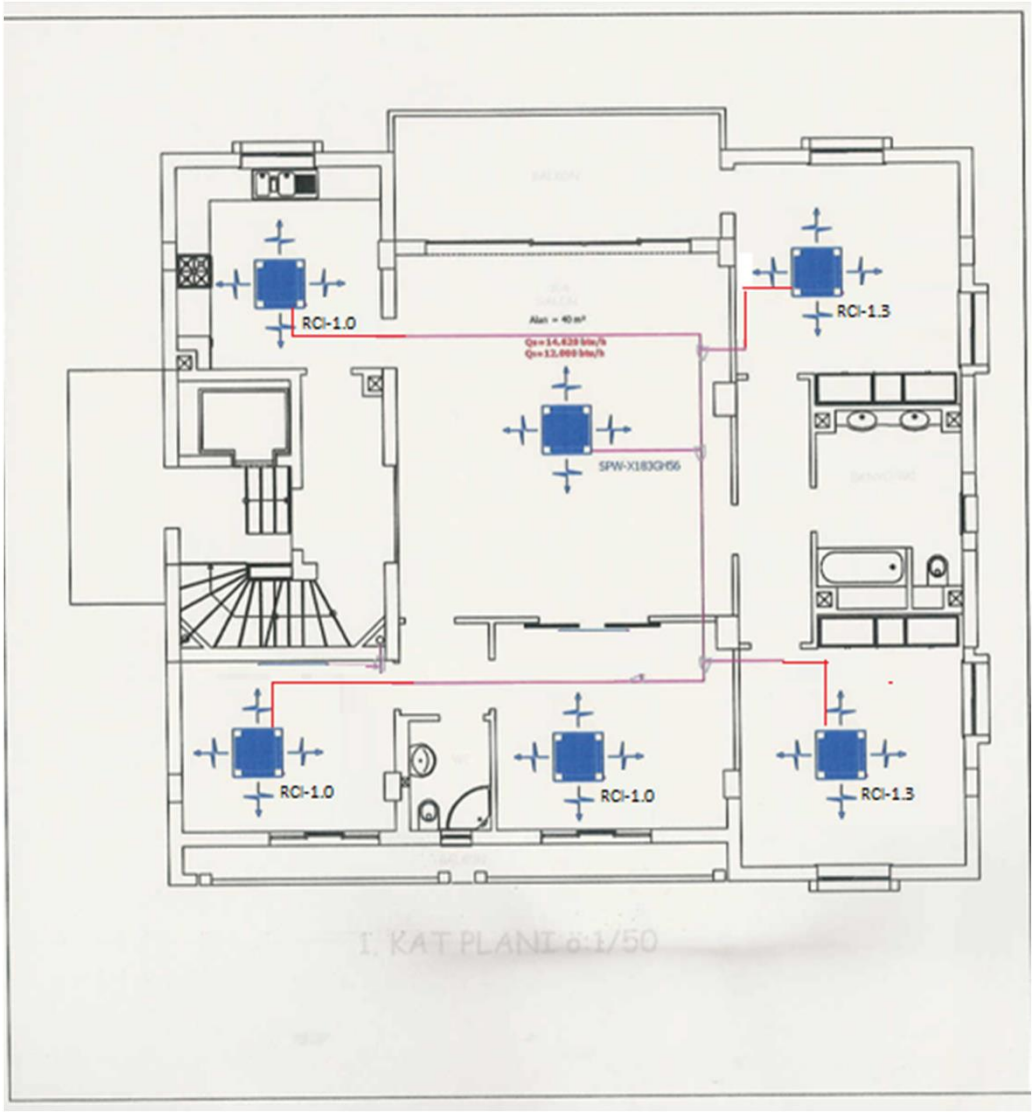


Boru bağlantı kiti (Joint)

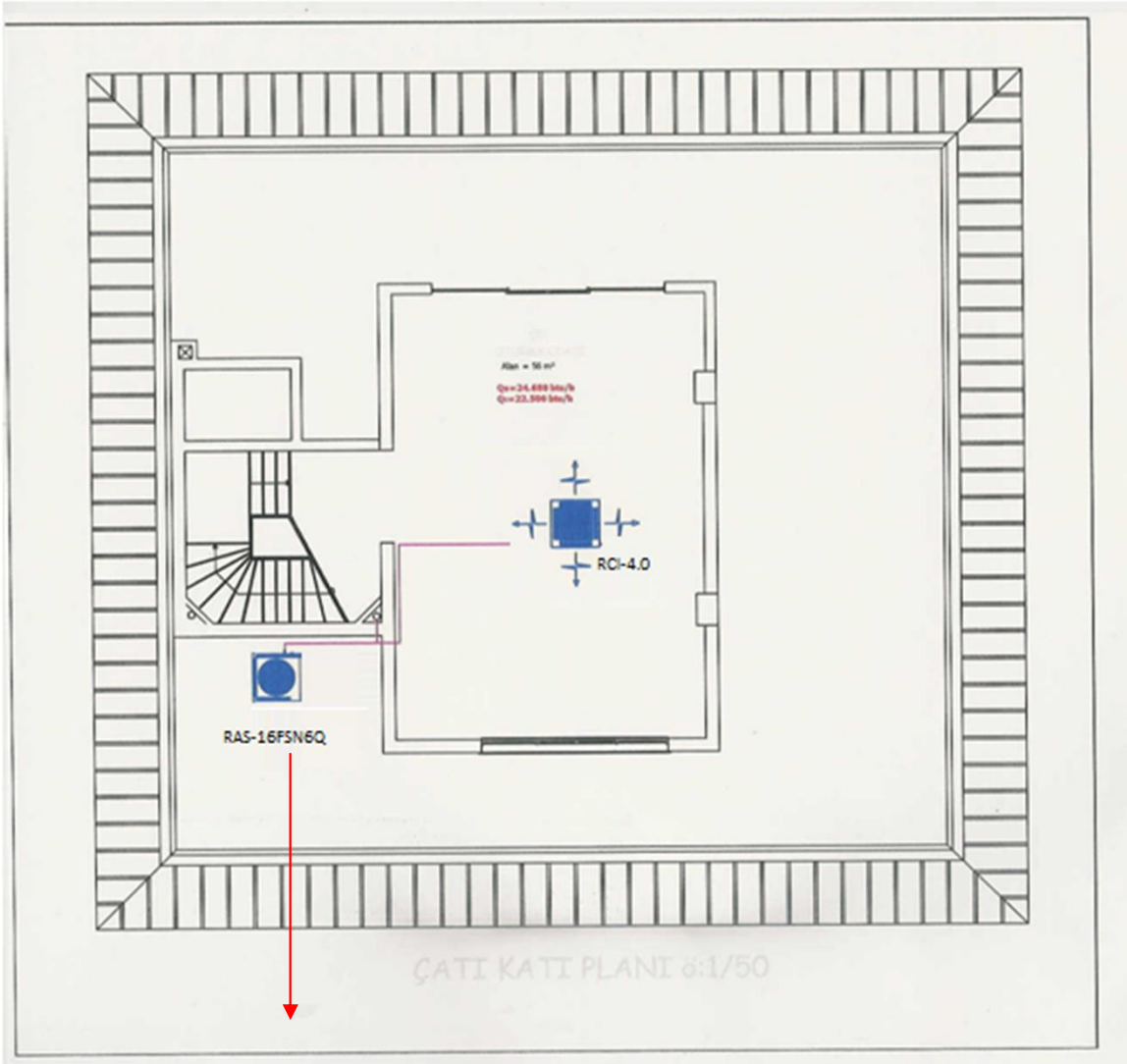
Bakır boru hattı

İç Ünite

Mimari proje: Zemin Kat (İç üniteler, boru bağlantı kitleri projeye işlenmiş durumda)



Mimari proje: 1. Kat



Dış Ünite

Mimari proje: Çatı Katı

A-KOND AKADEMiYA

HITACHI Inspire the Next

For the Professional

HITACHI

Thank you for your kind attention.