فناوری پس از برداشت ۹

(Storage)

Table 1.3 Classification of fruits according to their optimal storage temperatures and potential storage-life

Potential storage-life (weeks)	Optimal storage temperatures		
	0–2°C	4–6°C	10–14°C
<2	Apricot, blackberry, fig, raspberry, strawberry	Avocado (ripe), guava, feijoa	Papaya, rambutan, sapota, soursop
2–4	Blueberry, cherry, currant, gooseberry, loquat, nectarine, peach	Cactus pear, kumquat, longan, lychee, star fruit (carambola)	Avocado, banana, breadfruit, cherimoya, jackfruit, jujube, mangosteen, passion fruit, pineapple
4–6	Cashew apple, plum, plumcot	Mandarin, pepino	Durian, mango, plantain
6–8	Coconut, grape, persimmon	Olive, orange, pomegranate, tamarillo	Grapefruit, lime, pummelo (pomelo)
>8	Apple, Asian pear, cranberry, date, kiwifruit, pear, quince, tree nuts	Apple (chilling-sensitive cultivars)	Lemon

Sources: Hardenburg *et al.*, 1986; Kader, 1992; Ryall & Pentzer, 1982.

تجهیزات سردخانه ها

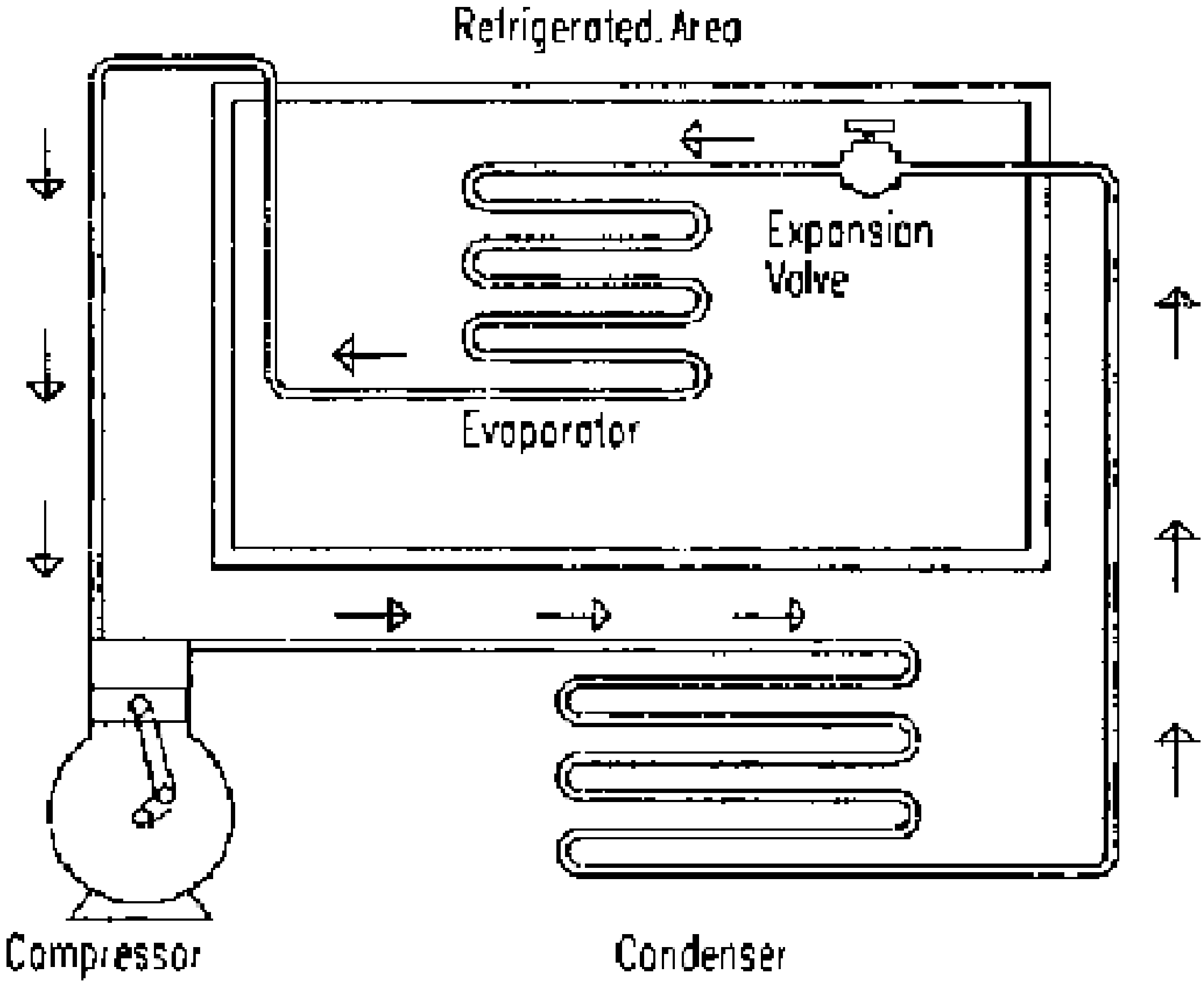
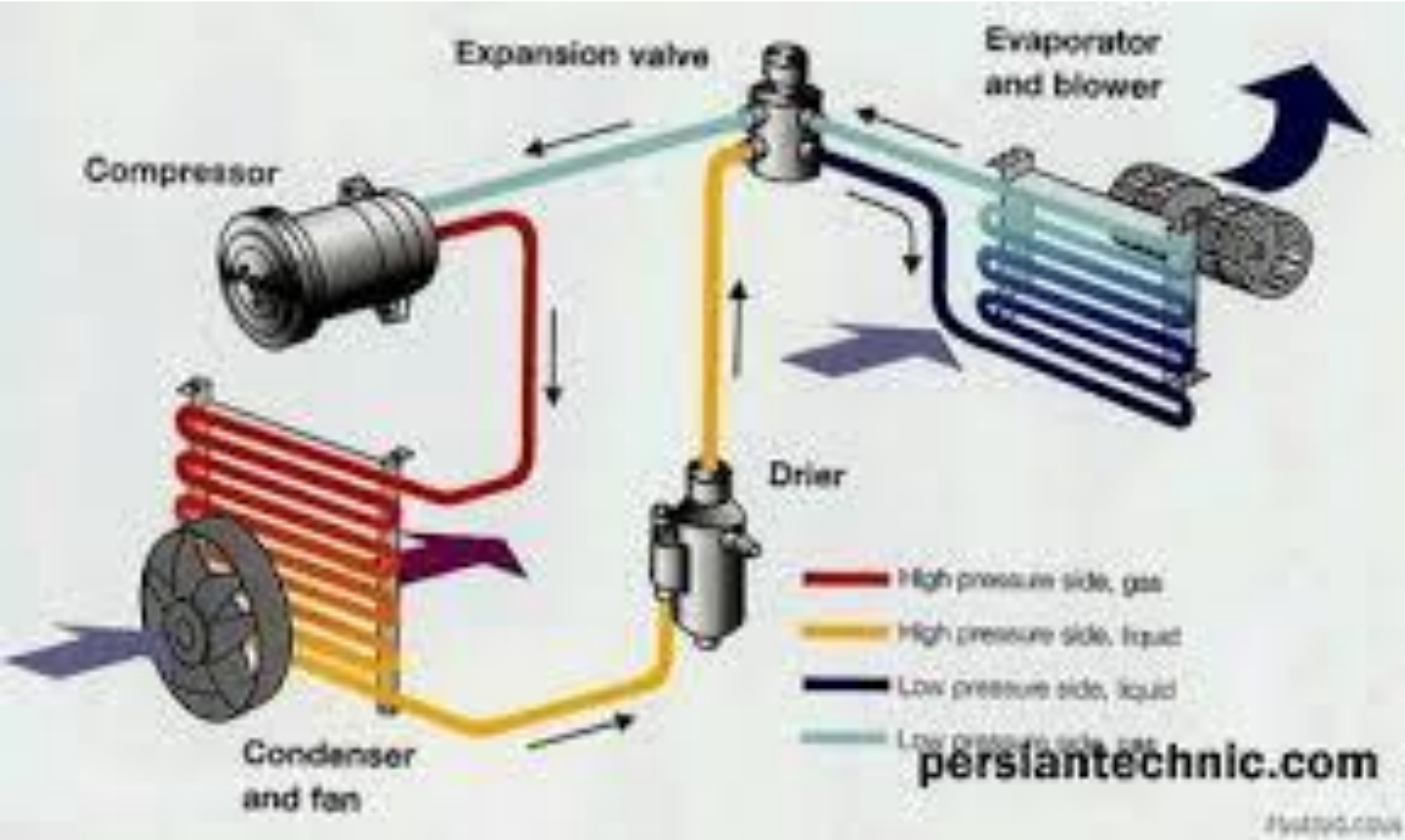
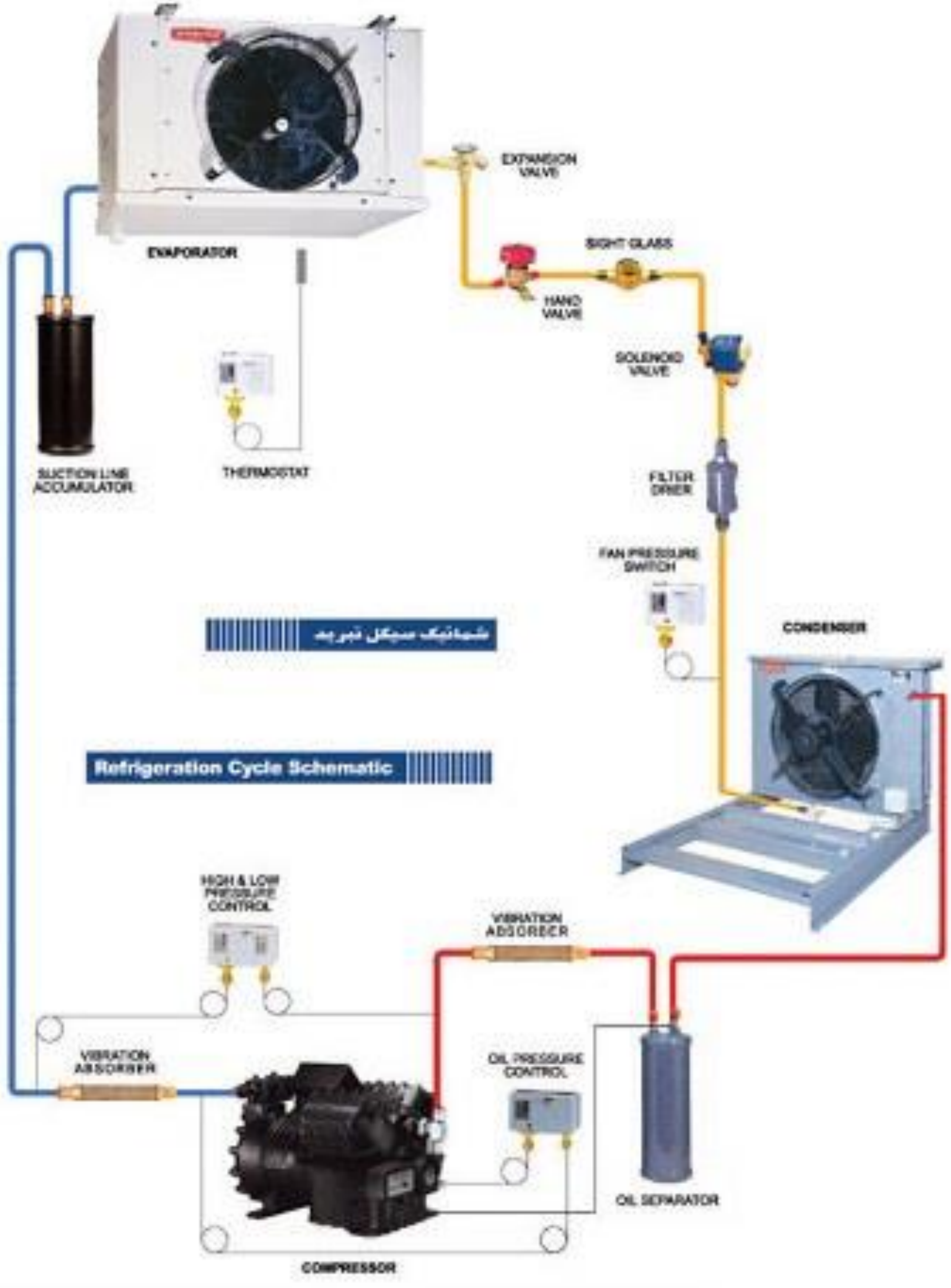
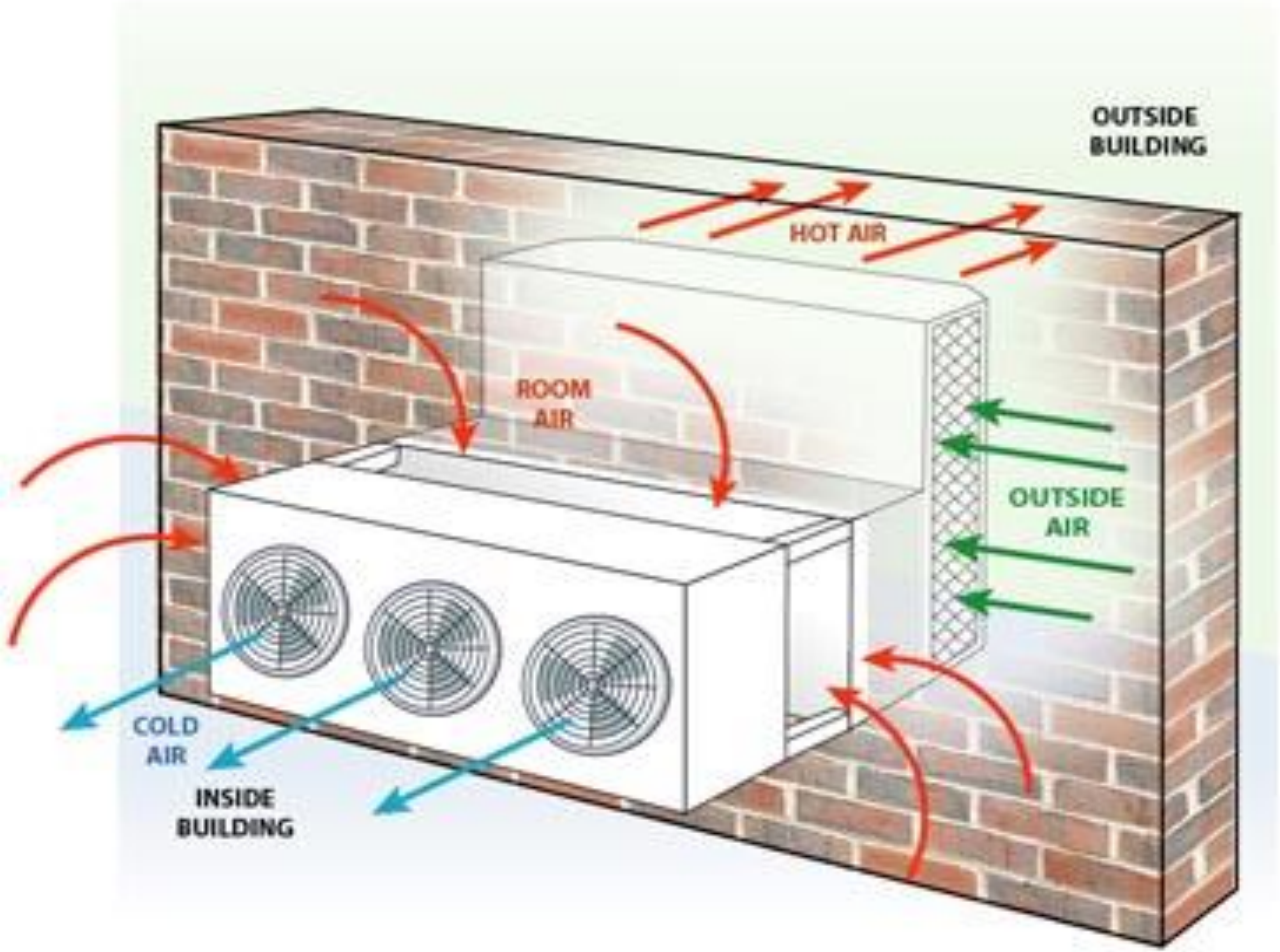


Fig. 7 Schematic of a vapor recompression refrigeration cycle.


Expansion valve
Evaporator and blower
Compressor
Drier
High pressure side, gas
High pressure side, liquid
Low pressure side, liquid
Condenser and fan
persiantechnic.com


EVAPORATOR
EXPANSION VALVE
SIGHT GLASS
HAND VALVE
SOLENOID VALVE
SUCTION LINE ACCUMULATOR
THERMOSTAT
FILTER DRIER
FAN PRESSURE SWITCH
شماتیک سیکل تبرید
CONDENSER
Refrigeration Cycle Schematic
HIGH & LOW PRESSURE CONTROL
VIBRATION ABSORBER
VIBRATION ABSORBER
OIL PRESSURE CONTROL
OIL SEPARATOR
COMPRESSOR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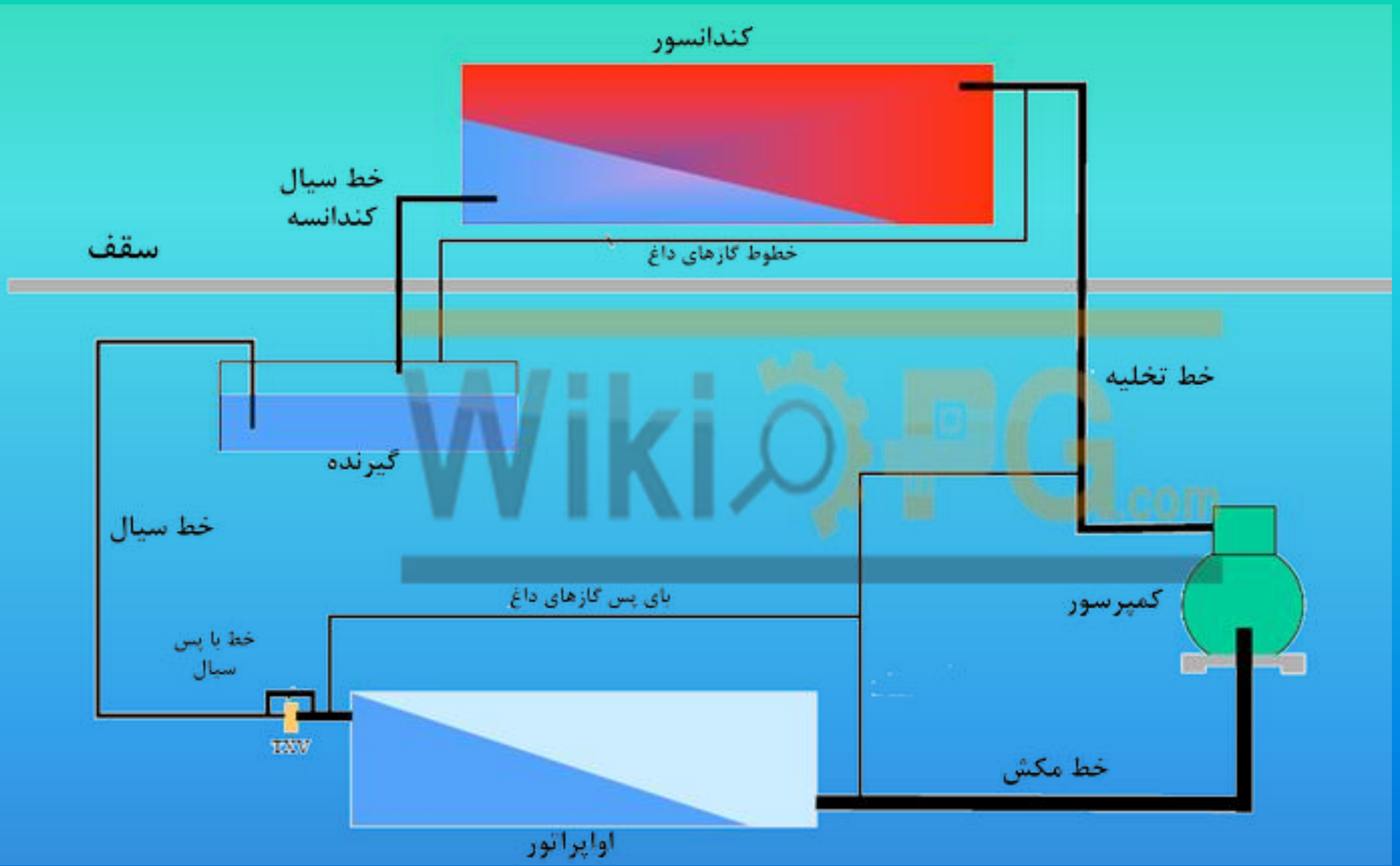
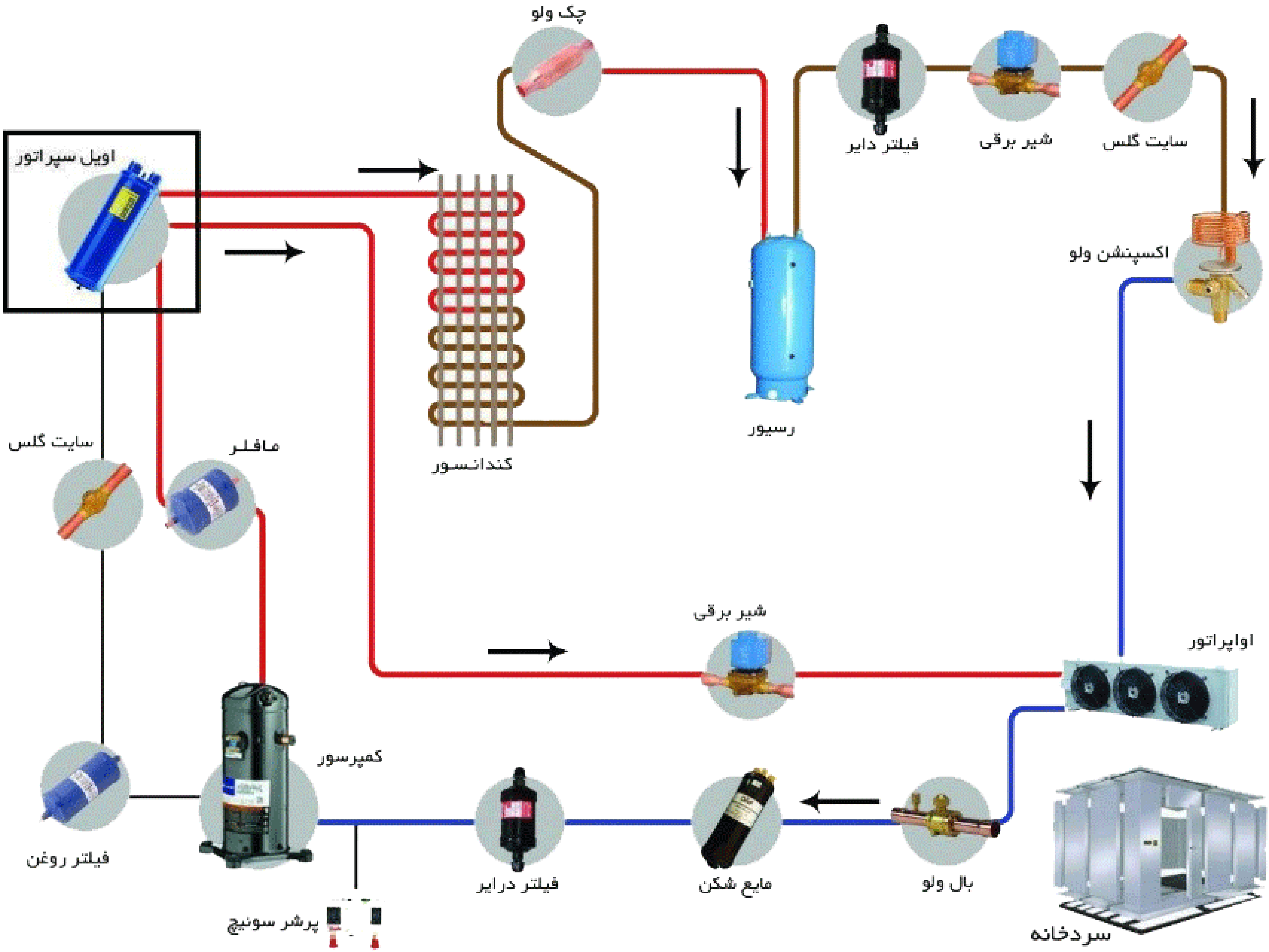
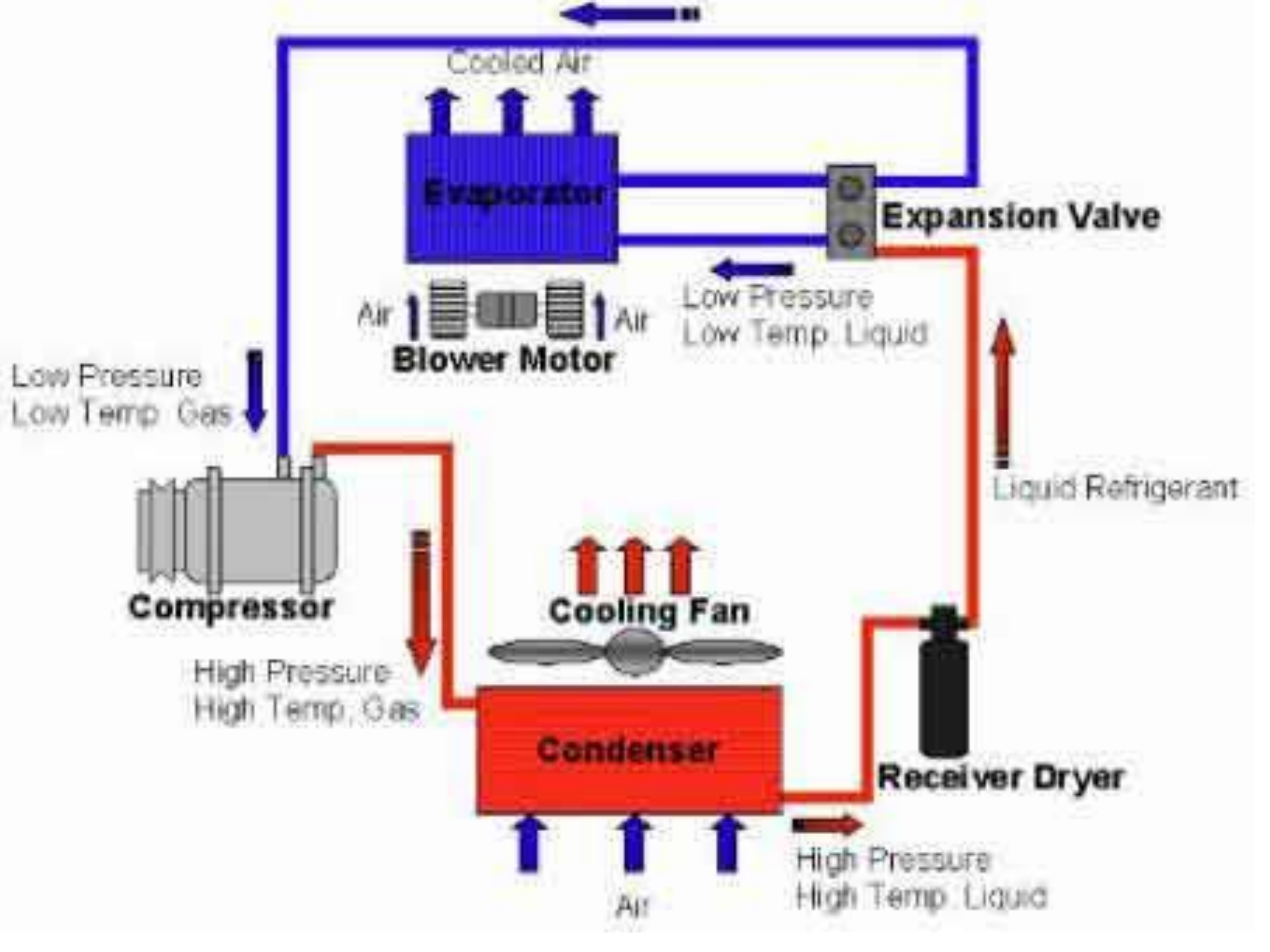
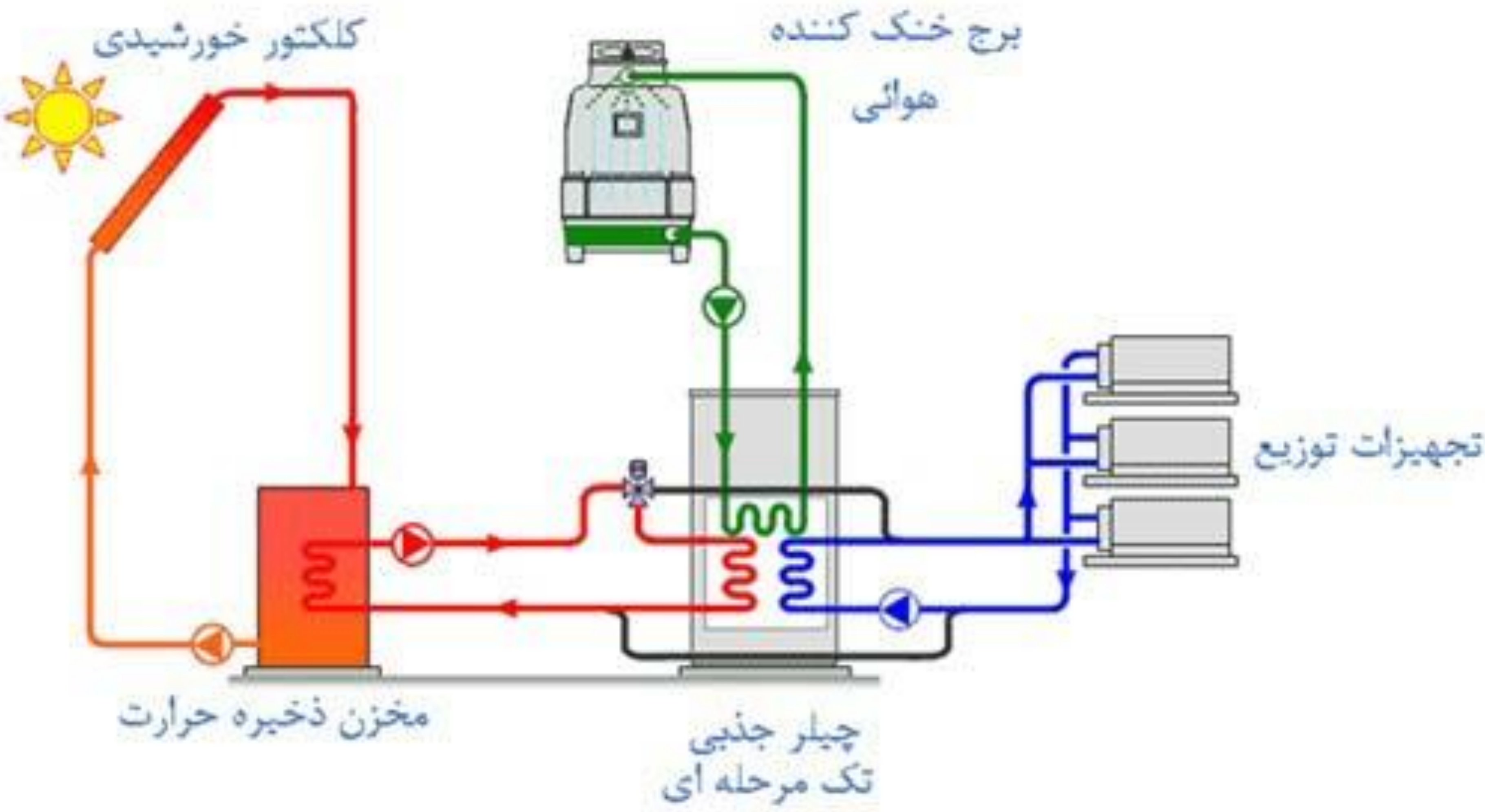
BUILDING
HOT AIR
ROOM
AIR
OUTSIDE
AIR
COLD
AIR
INSIDE
BUILDING



کندانسور
خط سیال
کندانسه
سقف
خطوط گازهای داغ
خط تخلیه
گیرنده
خط سیال
کمپرسور
بای پس گازهای داغ
خط با پس
سیال
TXV
خط مکش
اواپراتور


چک ولو
اویل سپراتور
فیلتر دایر
شیر برقی
سایت گلس
اکسپنشن ولو
رسیور
کندانسور
سایت گلس
مافلر
شیر برقی
اواپراتور
کمپرسور
فیلتر روغن
فیلتر درایر
مایع شکن
بال ولو
پرشر سوئیچ
سردخانه

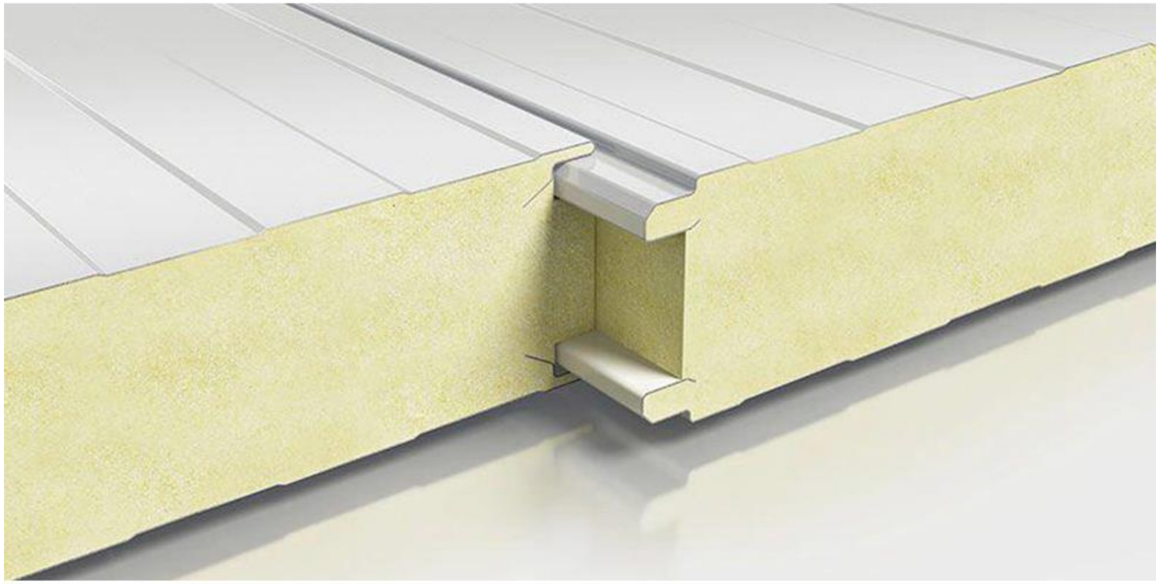

Cooled Air
Evaporator
Expansion Valve
Air
Air
Blower Motor
Low Pressure
Low Temp. Liquid
Low Pressure
Low Temp. Gas
Liquid Refrigerant
Compressor
Cooling Fan
High Pressure
High Temp. Gas
Condenser
Receiver Dryer
High Pressure
High Temp. Liquid
Air



کلکتور خورشیدی
برج خنک کننده
هوائی
تجهیزات توزیع
مخزن ذخیره حرارت
چیلر جذبی
تک مرحله ای







Controlled Atmosphere Storage

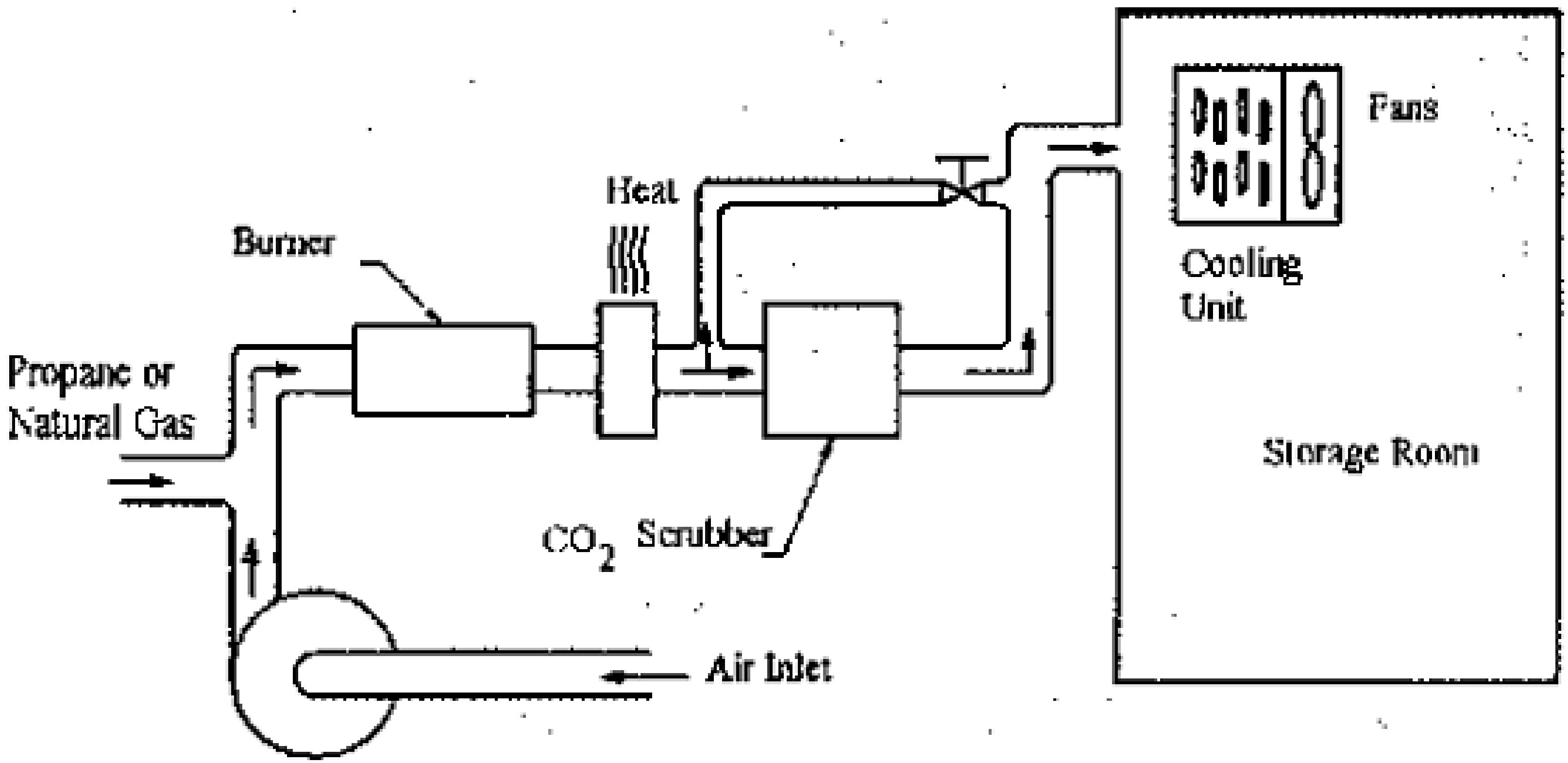


Fig. 9 Schematic of an external gas generator for an O_2 control system.

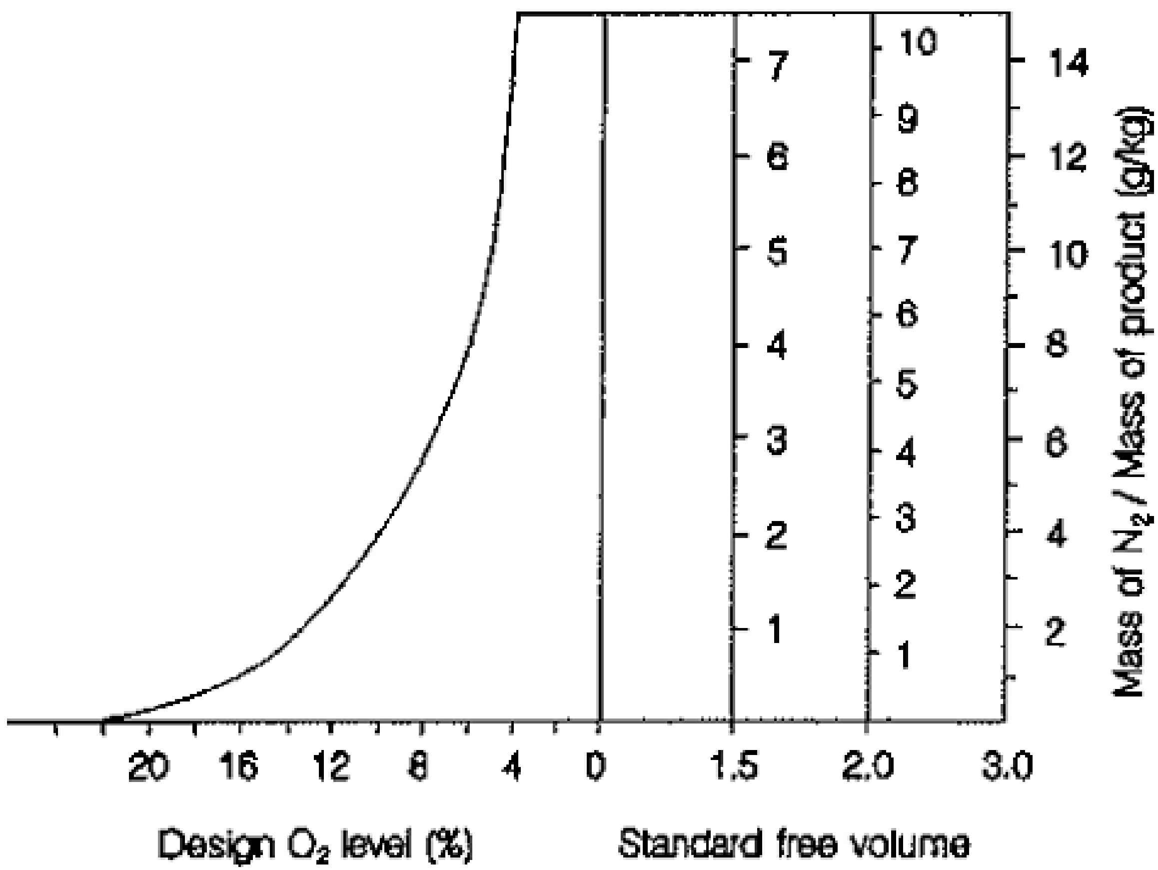


Fig. 10 Amount of N_2 needed for the flushing of O_2 as a function of the desired O_2 concentration and the standard free volume.

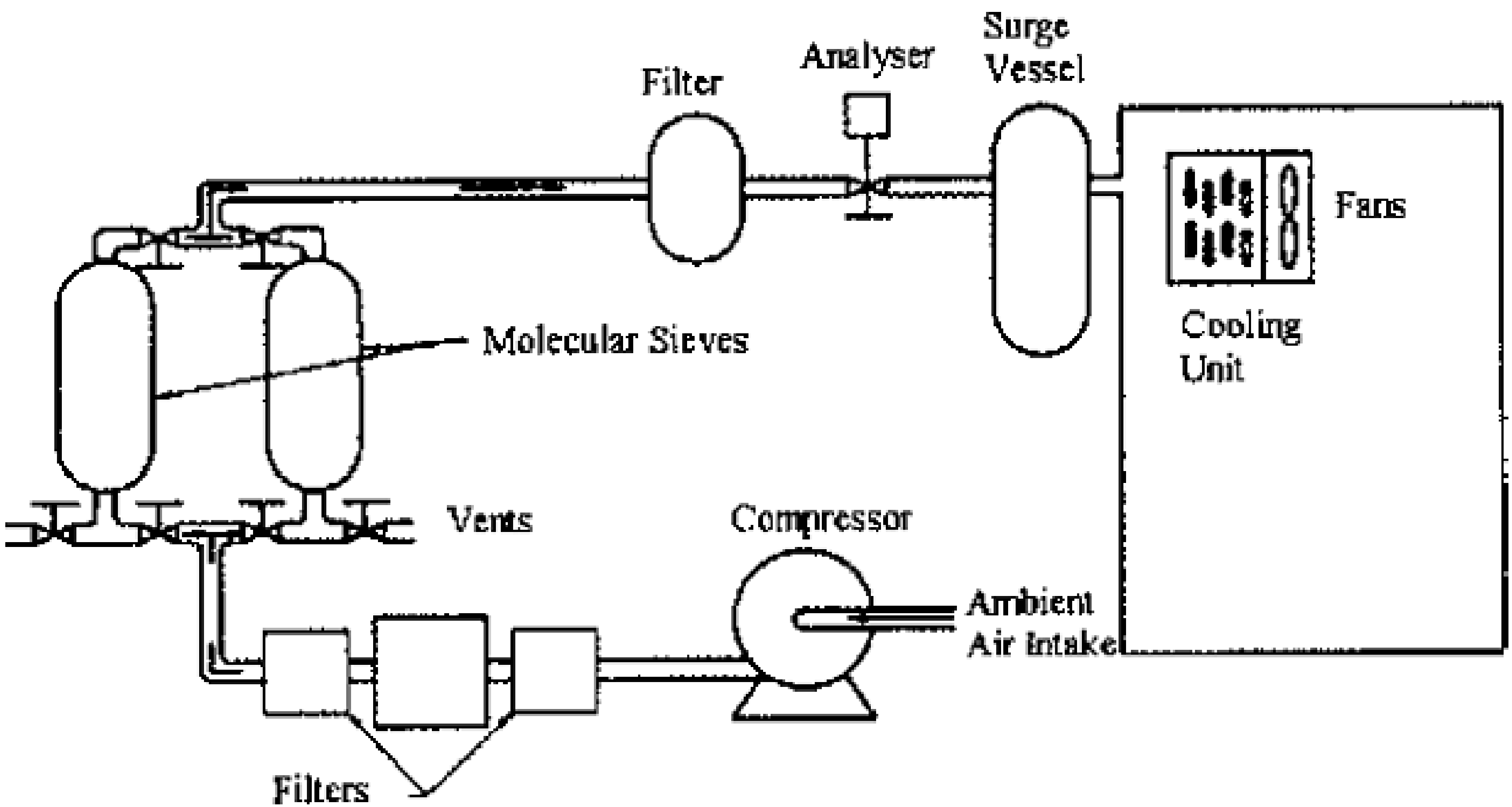


Fig. 11 Schematic of a pressure swing absorption system.

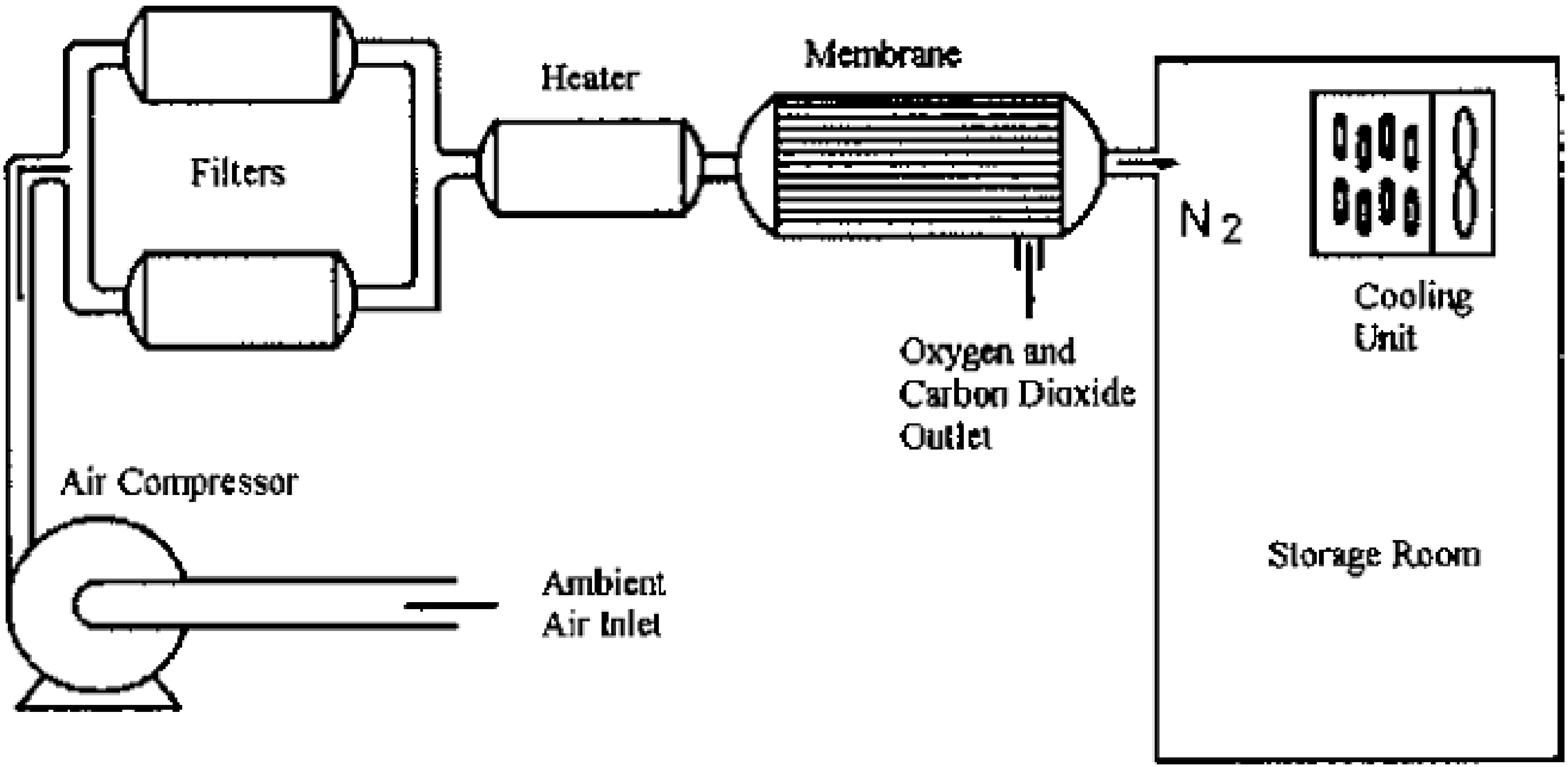


Fig. 12 Schematic of a hollow fiber membrane system.

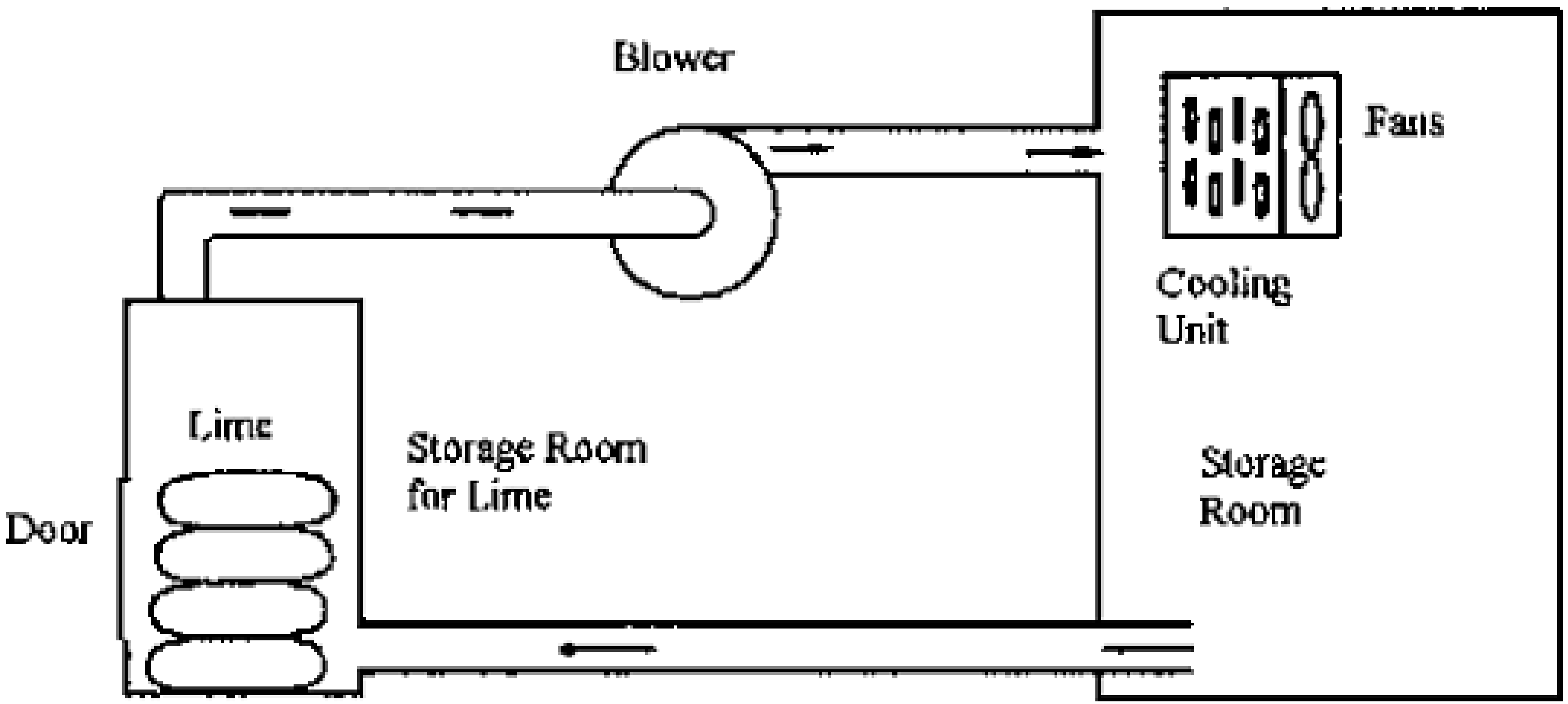


Fig. 13 Schematic of a hydrated lime system for the removal of CO_2.

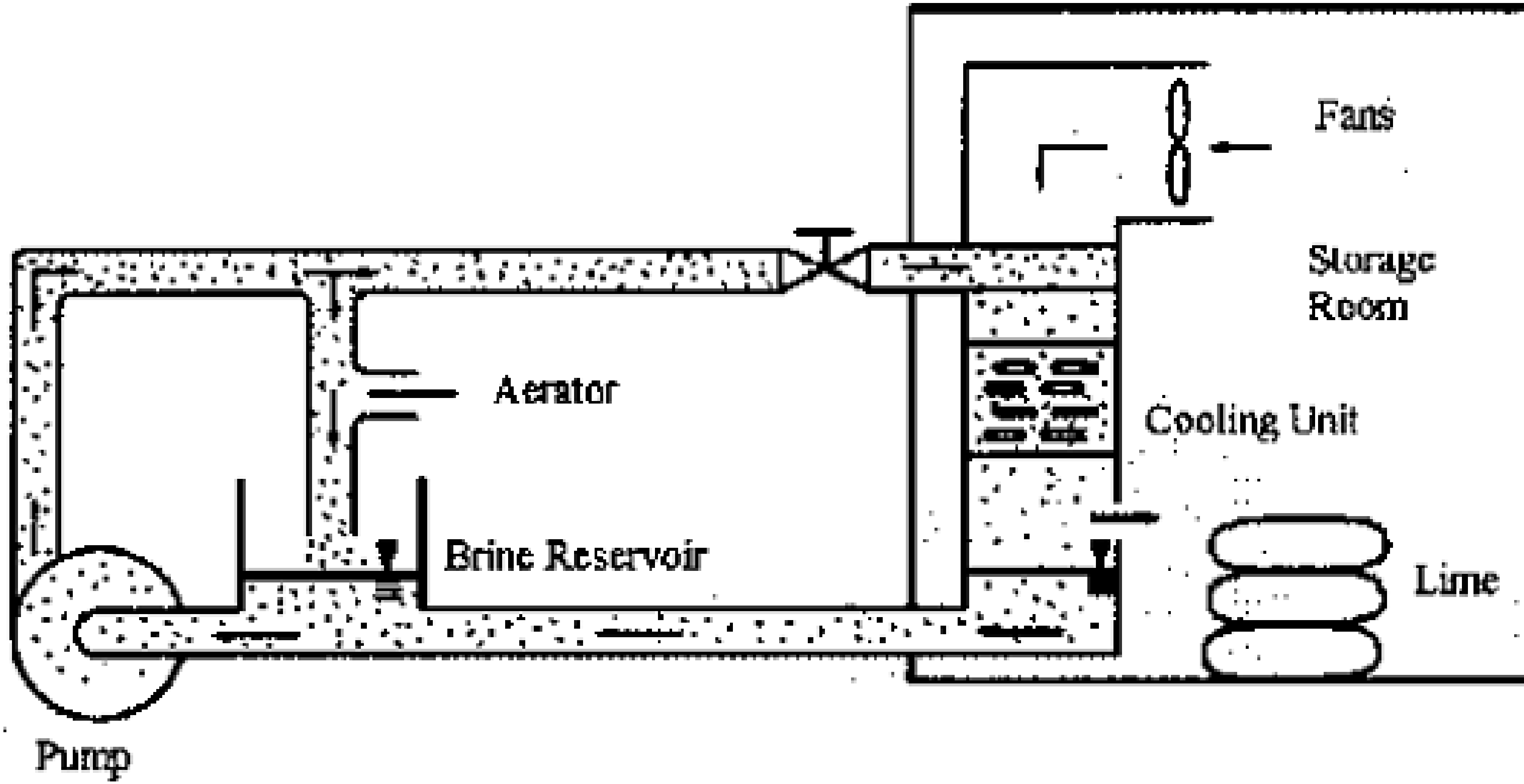


Fig. 14 Schematic of a water scrubber to remove CO_2

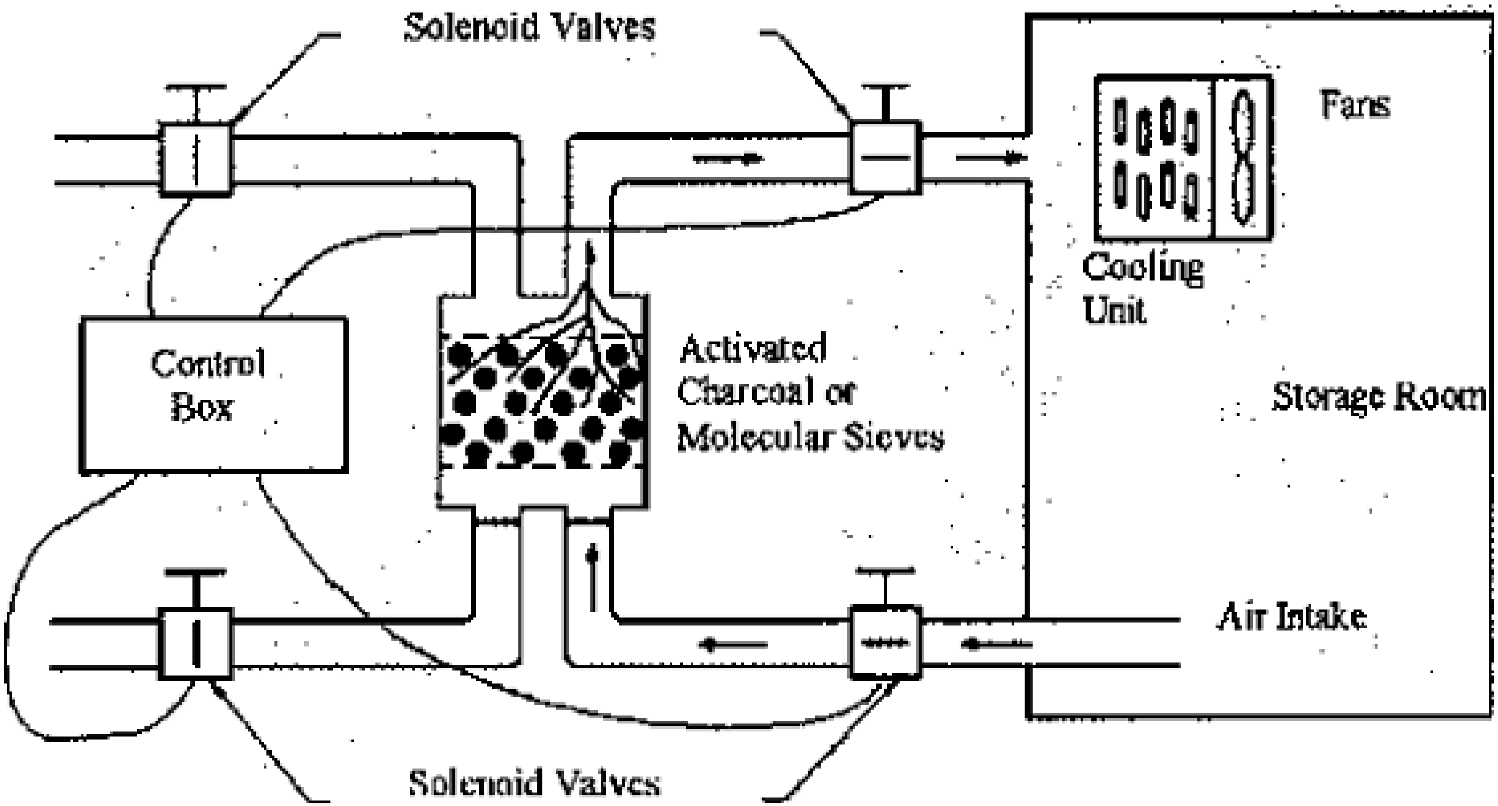


Fig. 15 Schematic of an activated charcoal/molecular sieve system for the removal of CO_2

Modified Atmosphere Storage

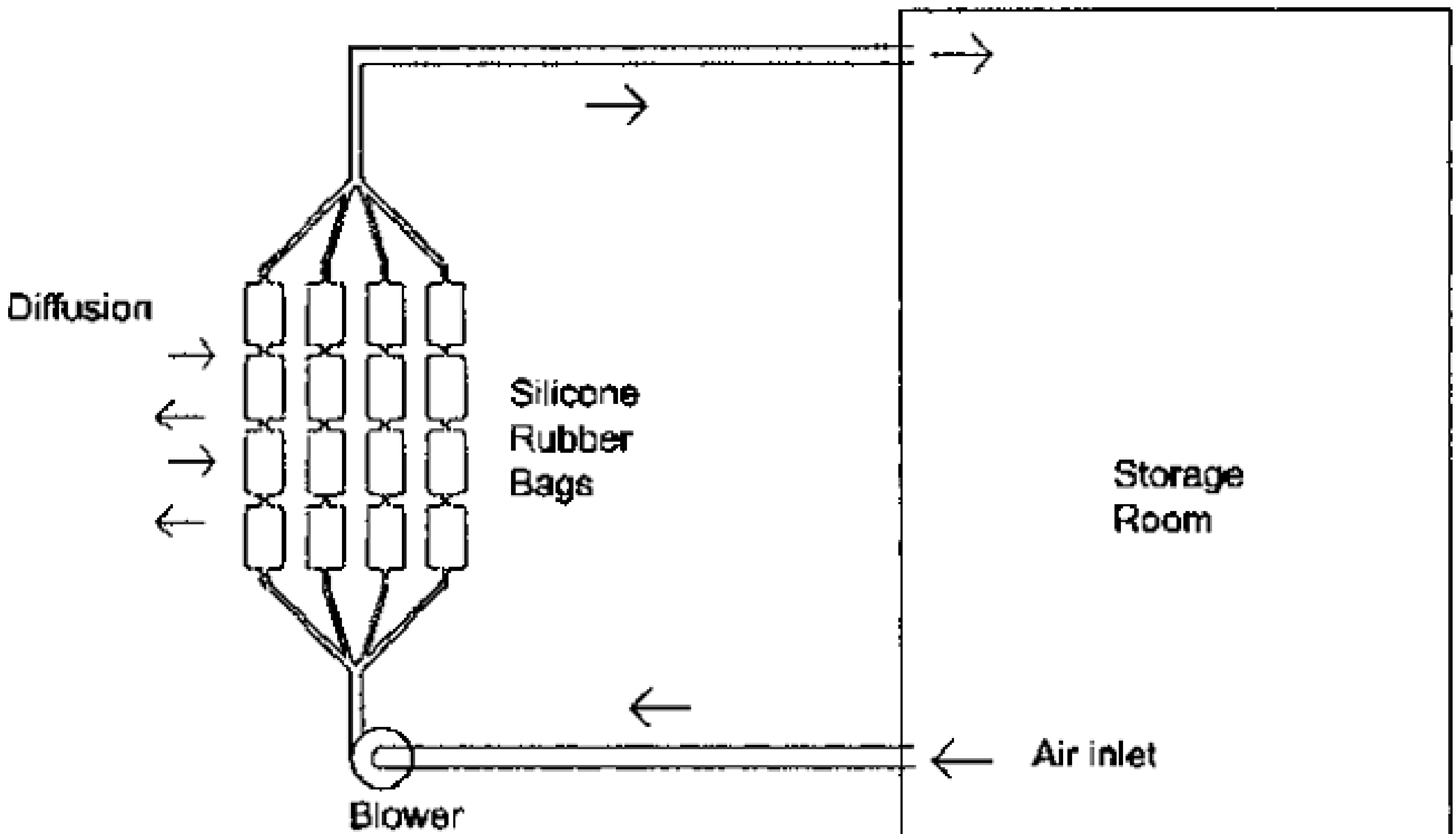


Fig. 16 The Marcellin system.

Table 3 Recommended Modified Atmosphere Conditions for Fruits and Vegetables

	Storage Temperature	Atmosphere	
Commodity	(°C)	O_2	CO_2
Apple	0–5	2–3	1–2
Apricot	0–5	2–3	1–2
Avocado	5–13	2–5	3–10
Banana	12–15	2–5	2–5
Cherry (sweet)	0–5	3–10	10–12
Grapefruit	10–15	3–10	5–10
Kiwifruit	0–5	2	5
Mango	10–15	5	5
Papaya	10–15	5	10
Peach	0–5	1–2	5
Pear	0–5	2–3	0–1
Pineapple	10–15	5	10
Strawberry	0–5	10	15–20
Asparagus	0–5	20	5–10
Beans, snap	5–10	2–3	5–10
Broccoli	0–5	1–2	5–10
Brussels sprouts	0–5	1–2	5–7
Cabbage	0–5	3–5	5–7
Cantaloupe	3–7	3–5	10–15
Cauliflower	0–5	2–5	2–5
Corn, sweet	0–5	2–4	10–20
Cucumber	8–12	3–5	0
Honeydew melon	10–12	3–5	0
Lettuce	0–5	2–5	0
Mushrooms	0–5	Air	10–15
Bell peppers	8–12	3–5	0
Spinach	0–5	Air	10–20
Tomatoes (mature)	12–20	3–5	0
Tomatoes (partly ripe)	8–12	3–5	0

Source: From Kader (1986).

Table 6.4 Optimum controlled atmosphere storage conditions for different cultivars of mango.

Cultivars	Country	Recommended CA		Storage temperature (°C)	Storage life (days)
		O_2 kPa	CO_2 kPa		
Alphonso	India	5	5	8–13	30–45
Amelie	Senegal	5	5	10–12	28
Banganapalli	India	5	3	8–13	35–45
Carlota	Brazil	6	10	8	35
Chok Anan	Malaysia	2 or 5	0	15	28
Delta R2E2	Australia	3	6	13	34
Haden	Brazil	6	10	8	30
Irwin	Japan	5	5	8–12	28
Irwin (Tree ripe)	Japan	5	5–10	5–15	30
Jasmin	Brazil	6	10	8	35
Julie	Senegal	5	5	10–12	28
Kensington Pride	Australia	2–4	4–6	13	30–35
Rad	Thailand	6	4	13	25
Sao Quirino	Brazil	6	10	8	35
Tommy Atkins	USA, Chile	3–5	0–5	12–15	21–31

Source: Narayana *et al.* (2012).

Table 4 Permeabilities of Packaging Films Used in Modified Atmosphere Packaging of Fruits and Vegetables

	Permeability to[a]	
Film type	Carbon dioxide	Oxygen
Polyethylene, low density (LDPE)	7,700–77,000	3,900–13,000
Polyvinyl chloride (PVC)	4,263–8,138	620–2,248
Polypropylene (PP)	7,700–21,000	1,300–6,400
Polystyrene (PS)	10,000–26,000	2,600–7,700
Saran (PVDC)	52–150	8–26
Polyester (PET)	180–390	52–130

[a] Permeability expressed as cubic centimeters per square meter per mil per day per atmosphere (cm^3/m^2/mil/day/atm).

Source: From Zagory and Kader (1988).

Table 5 Shelf Life of Selected Fruits and Vegetables Stored Under Modified Atmosphere Packaging Conditions

Commodity	Packaging film	Modified atmosphere environment $\%O_2$	Modified atmosphere environment $\%CO_2$	Shelf life
Apples + Pears	Sealed PE bags	10–15	0.5–2.5	6 Months
Apples	Sealed PE film tubes	2–5	5–7	4 Months
Blueberries	PE pallet covers	1–2	3–5	~6 Weeks
Peaches	Cryovac PE film	10–15	15–25	NA
Avocados	Sealed PE bags	3–5	7–9	8–10 Days
Kiwifruit	Sealed PE bags	N/A	3–4	6 Months
Banana	PVC overwrap	3	3	15 Days
Cabbage	PVC overwrap	2–3	3–4	2–3 Weeks
Brussels sprouts	PVC overwrap	2–3	3–4	2–3 Weeks
Lettuce	Sealed PE bags	5	10	~12 Days
Beans	Cellophane film	0.5	~30	7 Days
Peppers	PVC film	14	3	NA
	PE bags	6–11	4–6	NA
Sweet corn	PE bags	2–5	5–10	NA
Artichokes	PE bags	3–4	3–6	8 Weeks
Broccoli	PE bags + 4.5% EVA	1–2	8	3 Weeks
Celery	PE bags/liners	5	9	5 Weeks
Carrots	PE bags	17	3	15 Months
Mushrooms	PVC overwrap	2	10–12	5 Days
Mixed salad greens	PVC overwrap	2	10	6–7 Days

Source: Adapted from Prince (1989).