

## Kombi-8F Series

### Flanged Pressure Independent Integrated Balancing Control Valve

#### Product Specifications



#### Application

Honeywell Kombi-8F Series Flanged Pressure Independent Integrated Balancing Control Valve is a new generation product used for precise temperature control of terminal air-conditioning equipment in the HVAC system and an integrated product of linear temperature control, pressure independent and electric regulating.

Honeywell Kombi-8F Series can carry out the precise linear temperature control according to the thermal output features of the terminal equipment. Additionally, such control is pressure independent: i.e., in the process of control, the flow of the terminal equipment is only affected by the temperature change in the air-conditioned area, instead of being affected by the pressure fluctuation of the water system. It can dynamically balance the pressure change of the system so as to ensure the flow of terminal equipments will not interfere with each other.

Honeywell Kombi-8F Series can also output variable differential pressure characteristic value signal to the system for the variable differential pressure control of the variable flow water system so that the air-conditioning water system can always operate in the most energy-saving mode.

Honeywell Kombi-8F Series Flanged Pressure Independent Integrated Balancing Control Valve is a kind of pressure independent, high-accuracy linear temperature-control two-way control valve, with the dimensions of DN65~DN150, which is composed of the ML-SBE Series super electric actuator component and flanged control valve. The super electric actuator component includes super electric actuator, pre-sensor, sampling straight pipe, special exhaust valve, three-way ball valve, three-way pipe and bypass hose, etc.

#### Features

##### Kombi-8F Series Flanged Pressure Independent Integrated Balancing Control Valve

- Integrated functions as linear temperature control, pressure independent and electric regulating into one valve
- Output the characteristic value feedback signal of variable differential pressure to BAS for system variable differential pressure control of variable flow water system, ensure HVAC water system can always operate in the most energy-saving mode
- High control accuracy, strong anti-interference capacity
- Wide fluctuating range of pressure difference for the system
- Simple calculation in designing the pipeline system
- Easy installation
- Extremely convenient for commissioning at site

##### Components of ML-SBE Series Super Electric Actuator

- Built-in common terminal equipment thermal output features database for high-precise linear temperature control of the terminal equipment
- Built-in pressure-independent characteristics database ensures the pressure-independent temperature and flow control
- All temperature and flow can be automatically regulated without any human interference
- Size of control valve can be set directly
- Stroke self-adaption function
- Max. flow can be preset easily according to the requirements of the terminal equipment
- Display of max. set flow
- Extremely low energy consumption

##### Control valve

- V5328A Series control valve for DN65-DN80 and V5088A Series control valve for DN100-DN150
- Balancing valve plug design ensures low energy consumption and long service life of the valve and the metallic sealing ensures basically no leakage of the valve

# Kombi-8F Series Flanged Pressure Independent Integrated Balancing Control Valve

## Major Technical Parameters

Size range:	DN65~DN150	Connection of valve:	Flange, in compliance with ISO7005-2 standard
Flow control accuracy:	±4%	Material:	Control valve cast iron GG25 Pre-sensor, stainless steel SS304 Sampling straight pipe, stainless steel SS304 Special exhaust valve, brass
Max. flow set range:	60%~100%	Media:	Water, glycol solution
Max. close-off pressure:	10Bar	Media temperature:	0~130℃
Input control signal:	0/2~10VDC 0/4~20mA	Storage temperature:	0 ~ 65° C
Feedback signal :	2~10VDC	Atmosphere:	Non-corrosive, non-explosive
Supply voltage:	24VAC(+10%,15%),50/60Hz		
Electric connection:	1 m operating power cable		
Valve rated pressure:	PN16		

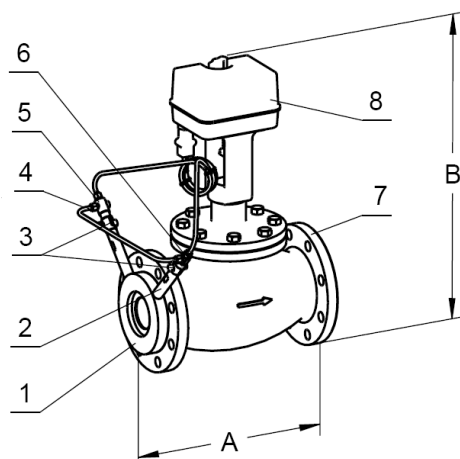
## Selection

### Kombi-8F Series Flanged Pressure Independent Integrated Balancing Control Valve Composition

Size	ML-SBE Series Super Electric Actuator Component OS#	Control Valve OS#
DN65	ML7420A8088-SBE065	V5328A1179
DN80	ML7420A8088-SBE080	V5328A1187
DN100	ML7421B1023-SBE100	V5088A1005
DN125	ML7421B1023-SBE125	V5088A1013
DN150	ML7421B1023-SBE150	V5088A1021

## Major Performance Parameters and Sizes

Size	Rated Max. Flow (m <sup>3</sup> /h)	Operating Pressure Difference Range (KPa)	Max. Flow set Range	Flow Control Accuracy	A (mm)	B (mm)
DN65	26	30~250	60% ~ 100%	±4%	310	446.5
DN80	40	30~250			330	456
DN100	63	30~250			370	617
DN125	103	30~250			420	670
DN150	137	30~250			500	687.5



### Description of Icons:

1. Pre-sensor
2. Sampling straight pipe
3. Special exhaust valve
4. Bypass hose
5. Three-way ball valve
6. Three-way pipe
7. Control valve
8. Super electric actuator

## ML-SBE Series Super Electric Actuator Component

ML-SBE Series Super Electric Actuator Component consists of super electric actuator, pre-sensor, sampling straight pipe and special exhaust valve, three-way ball valve, three-way pipe and bypass hose.

### Performance Parameters

OS#	Size for control valve	Power consumption	Stroke	Waterproof grade	Close-off Force	Total stroke time	Ambient Temp.	Relative Humidity
ML7420A6033-SBE065	DN65	6VA	20mm	IP54	≥600N	60S	-10~ 50℃	5%~95%
ML7420A6033-SBE080	DN80							
ML7421B1023-SBE100	DN100	12VA	38mm		≥1800N	175S		
ML7421B1023-SBE125	DN125							
ML7421B1023-SBE150	DN150							

## Working Principle

With water flowing into the control valve from the pre-sensor, pre-sensor senses the sampling signal, which, through sampling straight pipe, special exhaust valve, three-way pipe or three-way ball valve, enters the sampling sensing component of the super electric actuator, then transmitted to the super electric actuator and the common terminal equipment thermal output characteristics database and pressure independent characteristics database contained in the super electric actuator; the super electric actuator receives standard control signal from building automatic control system or on-the-spot controller and signal of the sampling sensing component and processes the both according to the selected terminal equipment characteristic value and pressure independent characteristic value, with the output signal changing the opening of the control valve so as to realize the high-accuracy pressure independent linear control over the temperature of the regulated object area.

## Linear Temperature Control

“Linear Temperature Control” of Kombi-8F Series Pressure Independent Integrated Balancing Control Valve means the linear control relation between the input control signal of the super electric actuator and the temperature of area controlled by the terminal equipment. Such linear relation is realized due to the common terminal equipment thermal output characteristics database contained in the super electric actuator and by means of the accurate control computing. Since the thermal output of the terminal equipment is also in the linear relation with the temperature of the controlled area, it also means the linear relation between the input signal of the super electric actuator and the thermal output of the terminal equipment.

### DDC requires the output terminal as a linear actuating element

The common field controllers such as DDC generally require that the output signal has one linear actuating element to ensure the control accuracy. As for the temperature control loop of the terminal equipment in

the air-conditioning water system, the actuating element generally means the electric control valve, ‘linear’ actuating element means to realize the linear control relation between DDC output control signal and temperature of the air-conditioned area through the regulation of the electric control valve.

### Conventional electric control valve loop is generally the non-linear temperature control

The temperature control loop of the air-conditioning water system with the actuating element being the conventional electric control valve is generally realize the linear feature of the actuating element generally in the mode of coupling the equal percent flow characteristic of the electric control valve with the thermal output features of the terminal heat-exchange equipment. In an ideal circumstance, its coupling result is linear-like.

However, in actual application: (1) terminal heat-exchange equipments such as air handling unit are in various forms, including four-coil, six-coil and eight-coil, as per number of coil pipes, the thermal output typical curve of which is not actually the same; if the thermal output features of all the terminal equipments are indicated in one curve, it is obviously inaccurate; (2) the ideal flow characteristic curve of the control valve can only be reflected when the valve authority is 1: i.e., the pressure difference at the two ends of the control valve is always 1Bar. When the control valve is installed in the actual air-conditioning water system, the valve authority is only 0.3-0.5 and thus the actual flow characteristic curve will deviate from the ideal equal-percent flow typical curve but will be close to the straight-line flow character. Therefore, the actual curve of the control valve is not necessarily consistent with the typical curve of the ideal equal-percent flow.

Therefore, even though one electric control valve with equal percent ideal flow features installed in the actual air-conditioning water system, their coupling result is not necessarily linear. In other words, the temperature control of the conventional electric control valve loop is generally non-linear, which fails to meet the requirement of DDC for the linear actuating element.

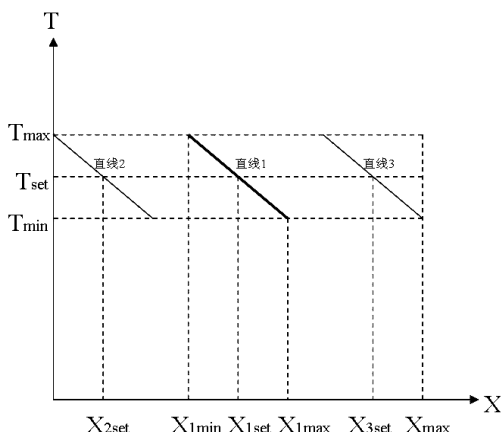
**Kombi-8F is the linear actuating element required by DDC**

Kombi-8F Series Pressure Independent Integrated Balancing Control Valve has the function of “linear temperature regulation”, which is realized through the common terminal equipment thermal output characteristics database built in the super electric actuator and by means of the accurate control computing.

Kombi-8F has requirements for the regulating features of control valve, but it does not involve the flow characteristic curve of the control valve in the process of linear temperature control.

Kombi-8F Series are the linear actuating element required by DDC .

**Characteristic Curve of Linear Temperature Control**



The right figure is the characteristic curve (T~X curve) (in summer air conditioning state) of linear temperature regulation for Kombi-8F Series. Abscissa X is the standard input control signal of Kombi8 Series, while ordinate T is the temperature of the air-conditioned area. {0, Xmax} on Abscissa X indicates the range of standard input signal, Tset on Ordinate T indicates the set temperature of the air-conditioned area and {Tmin, Tmax} indicates the tolerant temperature fluctuation range of the air-conditioned area.

With the air-conditioned area of the terminal equipment in a certain state of air-conditioning load, Kombi8 receives the standard control signal X1set from DDC for regulation. Then, the temperature of the air-conditioned area is stabilized at the set temperature Tset (see Straight line 1 in the figure) and the system is in a state of balance.

When the measured temperature T of the air-conditioned area is higher than the set temperature Tset due to the fluctuation of the system, the temperature measured in DDC will be compared with the set temperature and the output control signal, i.e., the input signal X of Kombi-8F will increase (input signal change of Kombi-8F is consistent with the opening changing direction of the valve). Due to the linear temperature regulation feature of Kombi-8F, when the input signal X of Kombi-8F increases, the

change of temperature in the air-conditioned area meets the straight-line 1, when the temperature in the air-condition area will decrease and will be close to the set temperature Tset; or otherwise. In other words, in the process of regulating the temperature T in the air-conditioned area, the input signal of Kombi-8F and the temperature of the air-conditioned area always meet the linear control relation of Straight line 1, as is the linear temperature regulation of Kombi-8F.

The position for the characteristic curve (T-X Curve) of linear temperature regulation on input control signal X axle depends on the load of the terminal equipment. When the load of the terminal equipment is changing, the curve will move horizontally between Straight line 2 and Straight line 3 in the figure.

The gradient of characteristic curve (T-X Curve) for the linear temperature regulation depends on the proportional relation between the rated thermal output of the terminal equipment and the heating capacity of the air-conditioned area.

**Pressure Independent Features**

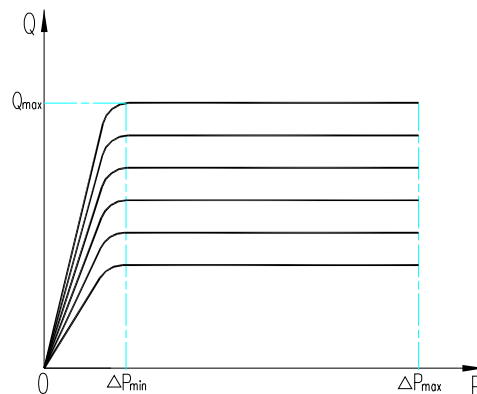
The “pressure independent” character of Kombi-8F Series Pressure Independent Integrated Balancing Control Valve means the flow and temperature change of Kombi-8F Series is only associated with the standard input control signal, but not with the pressure fluctuation of the air-conditioning water system. Given certain standard input control signal, Kombi-8F Series can dynamically balance the pressure change of the system so as to maintain its flow constant .

The pressure variation of the system is an unfavorable external interference with the temperature regulation in the air-conditioned area. Therefore, the pressure-independent features of Kombi-8F can dynamically weaken or screen such external interference so as to increase the control accuracy of the air-conditioning system over the temperature and flow.

“Pressure independent” has actually shown the rigid flow out character of Kombi-8F.

**Characteristic Curve of Pressure Independent**

The below figure shows the characteristic curve of pressure independent for Kombi-8F Series: Abscissa P is the inlet and outlet pressure difference of the valve, [ΔPmin, ΔPmax] is the tolerant range of operating pressure difference and Ordinate Q is the flow. From the figure, it may be observed that within the tolerant range of operating pressure difference, irrespective of how the pressure of the system change, Kombi-8F can always maintain the constant value of output flow.



## Characteristic Value of Variable Differential Pressure

Kombi-8F Series Pressure Independent Integrated Balancing Control Valve can output the characteristic value feedback signal of variable differential pressure to building automatic control system for the variable differential pressure control of the variable-flow total hydraulic balance system so that the air-conditioning water system can always operate in the most energy-saving mode.

## Constant Differential Pressure Mode of Conventional HVAC Variable-flow Water System

The conventional variable-flow water system has mainly two modes for constant differential pressure control. One is to stabilize the pressure difference between the water distributor and collector or water supply and return pipeline; the other is to stabilize the pressure difference between several branch water supply and return pipelines of most unfavorable loop. The two modes of constant differential pressure of the system are both system constant differential pressure mode. In other words, irrespective of in what operating state the air-conditioning system is, the constant differential pressure value of the system is determined by the full thermal load. Thus, when, in partial load, the actual flow of the terminal equipment decreases, in order to maintain the fixed constant differential pressure value, it will be naturally required to close the control valve of the terminal equipment to increase the resistance, causing the waste of energy. It is even more obvious for the constant differential pressure of the water distributor and collector. However, when selecting several most unfavorable loops for remote constant differential pressure, how to select these loops and how to stabilize the differential pressure show some unpredictable risks.

Therefore, Constant differential pressure mode is not an ideal and energy-saving mode in variable flow water system.

## Variable Differential Pressure Mode of Kombi-8F

Kombi-8F Series can output the characteristic value feedback signal of variable differential pressure control to help the system in realizing the variable differential pressure control so that the system is ensured to operate in the most comfortable and energy-saving mode.

The control process of variable differential pressure with Kombi-8F System is as follows:

Kombi-8F Pressure Independent Integrated Balancing Control Valve of the terminal equipment outputs the characteristic value feedback signal of variable differential pressure control to the field DDC that transmits such signal to BAS Central Station. The central station receives and compares the characteristic value feedback signal from Kombi-8F of different terminal equipments, outputs the signal to the field DDC of the system's constant differential pressure equipments as measuring signal and compares the set value of such signal in DDC, outputs the control signal to the constant differential pressure equipment of the system (such as FM pump, pressure-difference bypass valve) for controlling its action so as to realize the variable differential pressure control of the water system.

## Why is the variable differential pressure mode of Kombi-8F most comfortable and energy-saving?

The standards to evaluating if the differential pressure mode of a system is most comfortable and energy-saving are: (1) if all the terminal equipments have reached but not exceeded the instant flow required for the air-conditioned area of the terminal equipments; (2) if the flow of different terminal equipments is stable and if the regulation of flow between different terminal equipments will interfere with each other; (3) if the most unfavorable loop resistance of the system can be always minimized.

Kombi-8F Series have such functions as linear temperature regulation and pressure independent, can ensure that the terminal equipments can reach but not exceed the instant flow value required for the air-conditioned area of the terminal equipments, and can ensure that flow regulation between different terminal equipments will not interfere with each other.

The characteristic value of variable differential pressure control of Kombi-8F is substantially a feedback signal of valve position, which is the coupling result of change in the valve position required to screen the pressure fluctuation of the system and the change of valve position required to regulate the flow according to the input signal for the purpose of meeting the temperature requirement of the air-conditioned area by means of accurate control computing. Therefore, it truly reflects the resistance changes in the loop of the water system of terminal equipments due to the pressure independent and electric regulation functions of Kombi-8F.

In order to ensure that the most unfavorable loop resistance of the system is always minimized, it is necessary to monitor timely the opening of the control valve of different terminal equipments and always keep the most unfavorable loop is a full-open state (the position of the most unfavorable loop in the operation of the system may change).

BAS Central Station receives and accesses the characteristic value feedback signal of variable differential pressure control from Kombi-8F of different terminal equipments, sorts out the maximum value loop of the valve position as the most unfavorable loop and transmits the value to the field DDC of the pressure stabilizing equipment of the system as the measuring signal. When the value indicates the most unfavorable loop is in a state of non-full-opening, the field DDC of the pressure stabilizing equipment of the system will output the control signal to lower the speed of the FM pump or increase the opening of the pressure difference bypass valve on the main pipeline to reduce the output pressure difference of the system till the most unfavorable loop is in a full-open position, when the resistance of the system's most unfavorable loop is minimum and HVAC variable-flow water system is in a state of most energy-saving and comfortable operation.



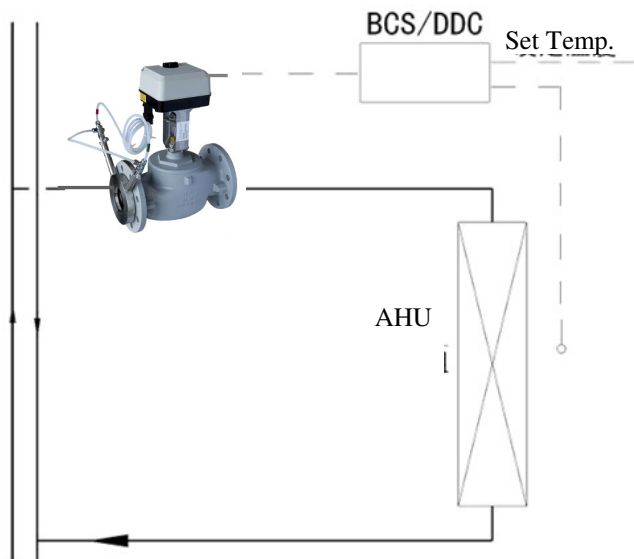
**Reference for Selection:**

As shown in the right figure, Pressure Independent Integrated Balancing Control Valve Kombi-8F is installed on the water supply pipe of the air handling unit. Given that the summer design flow of the air handling unit is 60m<sup>3</sup>/h and the winter design flow is 36m<sup>3</sup>/h, then how to select Kombi-8F?

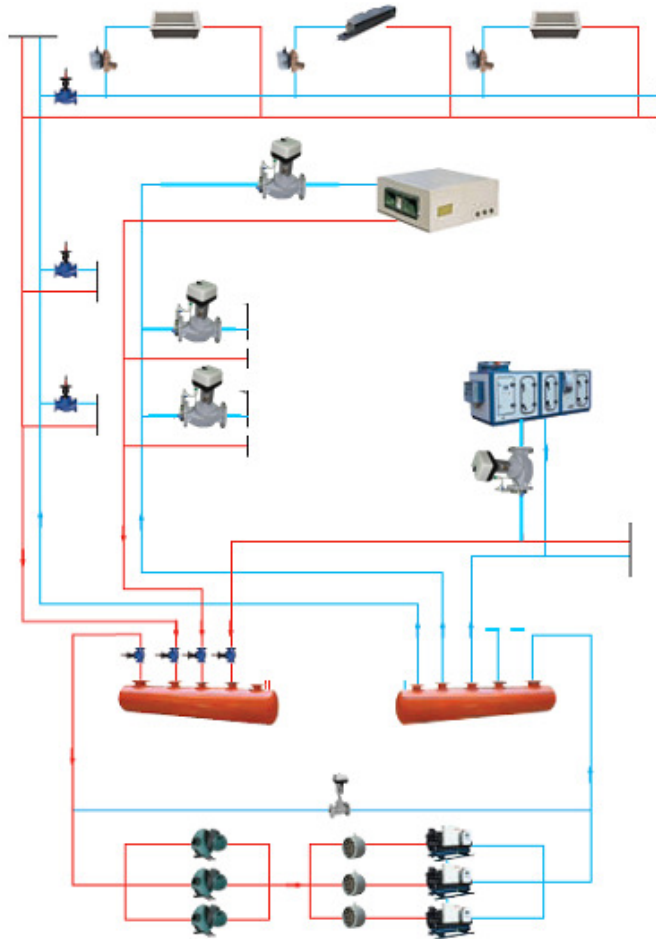
**Steps for Selection:**

- (1) According to the summer design flow requirement of 60m<sup>3</sup>/h, check List of “Major Performance Parameters and Sizes” for Kombi-8F; DN100 meets the requirement;
- (2) OS code for Kombi-8F DN100 is:

ML-SBE Series Super Electric Actuator Component	Control valve
ML7421B1023-SBE100	V5088A1005



**Application of Kombi-8F in Variable-flow Total Hydraulic Balance System**



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