



PIPING PACKAGES



For Fan Coil & Variable Air Volume Systems

Chilled & Hot Water Applications



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All data herein is subject to change without notice. Some drawings are not shown in this catalog.


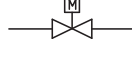
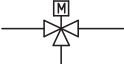



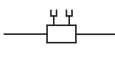

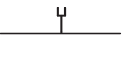
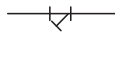
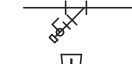
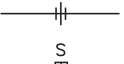

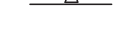

1. All the packages and components described in this brochure are optional, extra cost features. Consult your Johnson Controls sales representative for details. Not all components are available on all unit models. See valve package code charts.
2. All standard valve packages and piping components described in this catalog are for chilled and hot water applications. They may also be used with ethylene and propylene glycol solutions up to 50% concentration.
3. VAV piping packages – as well as FH, FN, FW, and FL fan coil unit packages – are factory assembled and shipped loose for field installation and wiring. All FS fan coil unit packages are factory assembled, installed, and wired.
4. FH, FN, FW and FL unit valve packages are designed to mount directly onto the coil connections.
5. Control valve actuators are removable, and may be serviced or replaced without removal of the valve body.
6. Control valves are piped normally closed to the coil. For hot water coils, control valves are available normally open.
7. 3-Way control valves are piped as mixing valves.
8. All ball isolation valves are furnished with an adjustable memory stop feature and may be used as a balancing valve.
9. When ordered, unions are installed at the water coil, and are available on VAV products, and all fan coil units except FS. Unions must be ordered on both coils of 4-pipe units. Unions are not available separately.
10. All FS units include two flexible stainless steel braided hoses and ball isolation valves per coil. This hose/valve combination provides a "union" type connection to allow coil removal.
11. Pressure/temperature (P/T) ports are located to monitor the pressure and temperature across the coil.
12. Automatic fixed flow controls (FC, FCN, FCS) are available in flow (GPM) ratings as follows:
 - 1/2" = 0.5 to 4.0 GPM in 0.5 GPM increments
 >4.0 to 6.0 GPM in 1.0 GPM increments
 - 3/4" = 3.0 to 4.0 GPM in 0.5 GPM increments
 >4.0 to 12.0 GPM in 1.0 GPM increments
 - 1" = 5.0 to 10.0 GPM in 1.0 GPM increments
 >10.0 to 20.0 GPM in 2.0 GPM increments
 Individual coil GPM requirements must be specified at time of order.
13. Component performance ratings such as Cv, maximum close-off pressure, operating temperature and pressure, are shown in Component Specifications.
14. Valve and component performance ratings shown are maximum values. Appearance and actual ratings may vary with individual vendor and component size.
15. Adjustable flow setter (AFS) is rated for full shut-off and replaces the return line ball isolation valve on all products except the FS fan coil unit.
16. 2-Pipe "change-over" units using a 2-way control valve and factory thermostat must be ordered with a 1/4" "bleed" line to assure proper changeover thermostat (aquastat) operation. The 1/4" "bleed" line is optional on 2-pipe "changeover" units with field provided thermostats.
17. Some piping packages may extend beyond the unit drain pan and/or factory auxiliary drip pan. Requirements for field furnished and installed valve package and piping insulation must be determined by others on an individual application basis.

The valve package piping and component details shown in this catalog are for standard valves and components. The suitability of all valve packages and components must be determined by others based on individual application requirements. Johnson Controls assumes no responsibility for selection and/or application of valve packages and components.

Modulating cooling valve control can increase part load space relative humidity. Johnson Controls does not encourage or endorse modulating valve control for fan coil cooling systems, and is not liable for high humidity problems that may result. Modulating heating valve control may result in low leaving air temperatures while the valve reduces flow and as setpoint is approached.

Contact the factory for any requirements not shown in this catalog.

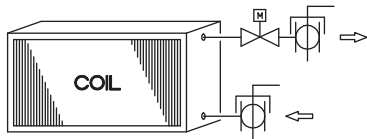
CONTROL DEVICE LEGEND

MANUAL BALL VALVE WITH MEMORY STOP (BVMS) 	2-WAY CONTROL VALVE 	3-WAY CONTROL VALVE 
FIXED FLOW CONTROL VALVE (FC) 	AUTOMATIC CARTRIDGE FLOW CONTROL WITHOUT SCREEN (FCN) 	AUTOMATIC CARTRIDGE FLOW CONTROL WITH SCREEN (FCS) 
ADJUSTABLE FLOW CIRCUIT SETTER (AFS) 	BYPASS BALANCE VALVE (BPV) 	PRESSURE-TEMPERATURE TEST PORT (PT) 
Y-STRAINER (Y-STR) 	Y-STRAINER W/CLEANOUT VALVE (YCO) 	UNION 
FLEXIBLE HOSE (FH) 	AQUA-THERMOSTAT 	SCHRADER FITTING 

VAV PRODUCTS AND FH, FN, FW, FL FAN COILS

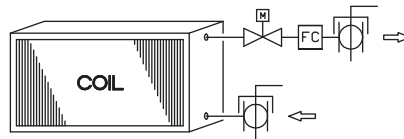
(VAV products available with 2-way packages only)

2-WAY PIPING PACKAGE											
Package Code	Components			Valve Size			Unions			P/T Ports	1/4" Bleed Line
	BVMS	FC	AFS	1/2"	3/4"	1"*	1/2"	3/4"	1"*		
24	X									X	X
25	X	X		X	X	X	X	X	X	X	X
29	X		X							X	X



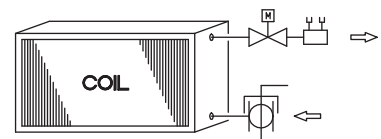
Code 24

2-Way Control Valve and Ball Valves With Memory Stop



Code 25

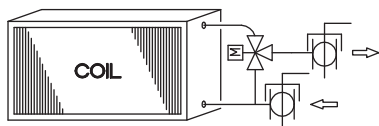
2-Way Control Valve, Ball Valves with Memory Stop, and Fixed Flow Control



Code 29

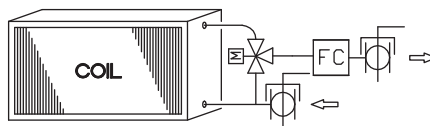
2-Way Control Valve, Ball Valve with Memory Stop, and Adjustable Flow Setter

3-WAY PIPING PACKAGE											
Package Code	Components			Valve Size			Unions			P/T Ports	
	BVMS	FC	AFS	1/2"	3/4"	1"*	1/2"	3/4"	1"*		
36	X									X	
37	X	X		X	X	X	X	X	X	X	
41	X		X							X	



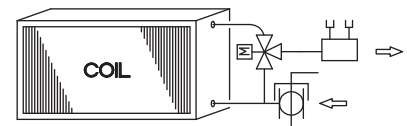
Code 36

3-Way Control Valve and Ball Valves With Memory Stop



Code 37

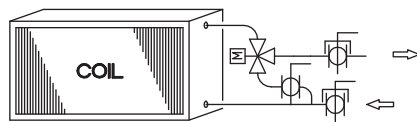
3-Way Control Valve, Ball Valves with Memory Stop, and Fixed Flow Control



Code 41

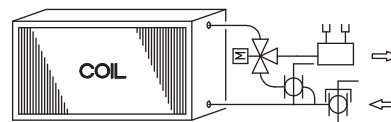
3-Way Control Valve, Ball Valve With Memory Stop, and Adjustable Flow Setter

3-WAY PACKAGE WITH BALANCE BYPASS VALVE											
Package Code	Components			Valve Size			Unions			P/T Ports	
	BVMS	FC	AFS	1/2"	3/4"	1"*	1/2"	3/4"	1"*		
50	X			X	X	X	X	X	X	X	
53	X		X							X	



Code 50

3-Way Control Valve, Ball Valve in Bypass, and Ball Valves With Memory Stop



Code 53

3-Way Control Valve, Ball Valve in Bypass, Ball Valve With Memory Stop, and Adjustable Flow Setter

LEGEND, COMPONENT PRESSURE RATINGS

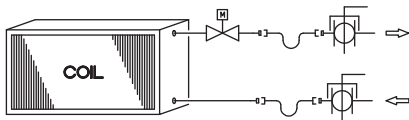
- BVMS:** Manual Ball Valves w/Memory Stop, 600 PSIG
- FC:** Fixed Flow Control, 500 PSIG
- AFS:** Adjustable Flow Circuit Setter, 300 PSIG
- P/T Port:** Pressure/Temperature Test Port, 400 PSIG
- Union:** 125 PSIG (contact factory for 600 PSIG)
- Control Valve:** 300 PSIG
- BPV:** Balance Bypass Valve, 400 PSIG

NOTES:

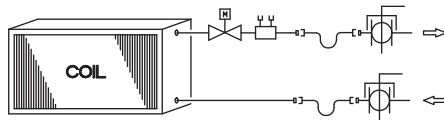
1. All drawings subject to change without prior notice.
 2. Diagrams show component position in relation to fluid flow. Actual valve package configuration varies with unit type, hand connection, and pipe size.
 3. 1/4" bleed line is required on 2-pipe cool and heat auto changeover systems with factory provided thermostats; optional for thermostats by others.
- * 1" piping packages available on FN only.

FS FAN COILS

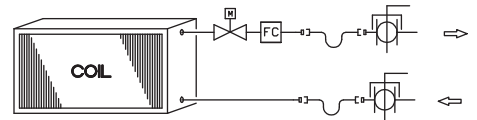
Package Code	Components					Valve Size	Y-CO	P/T Ports	1/4" Bleed Line
	FC	AFS	Y-STR	FCN	FCS	1/2"			
32						X		X	X
33		X				X		X	X
34	X					X		X	X
60			X			X	X	X	X
61	X		X			X	X	X	X
62		X	X			X	X	X	X
63				X		X			X
64					X	X			X



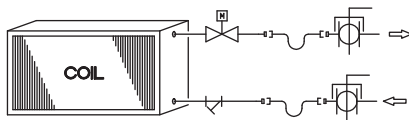
Code 32
2-Way Control Valve Only



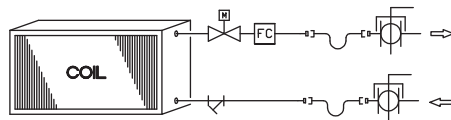
Code 33
2-Way Control Valve and Adjustable Flow Setter



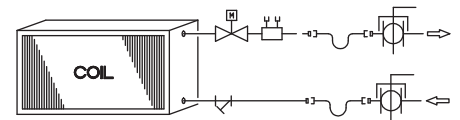
Code 34
2-Way Control Valve and Fixed Flow Control



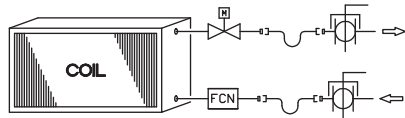
Code 60
2-Way Control Valve and Y Strainer



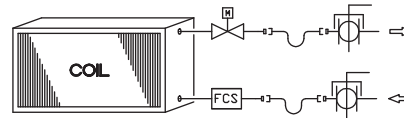
Code 61
2-Way Control Valve, Fixed Flow Control, and Y Strainer



Code 62
2-Way Control Valve, Adjustable Flow Control, and Y Strainer



Code 63
2-Way Control Valve and Auto Cartridge Flow Control



Code 64
2-Way Control Valve and Auto Cartridge Flow Control with Screen

LEGEND, COMPONENT PRESSURE RATINGS

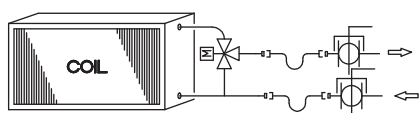
- FC: Fixed Flow Control, 500 PSIG
- AFS: Adjustable Flow Circuit Setter, 300 PSIG
- Y-STR: Y Strainer, 400 PSIG
- FCN: Fixed Cartridge Flow Control w/ PT Ports and No Screen, 230 PSIG
- FCS: Fixed Cartridge Flow Control with PT Ports and Screen, 230 PSIG
- Y-CO: Y-Strainer Cleanout, 400 PSIG
- P/T Port: Pressure/Temperature Test Port, 400 PSIG
- Control Valve: 300 PSIG

NOTES:

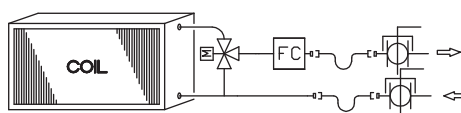
1. All drawings subject to change without prior notice.
2. Diagrams show component position in relation to fluid flow. Actual valve package configuration varies with unit type, hand connection, and pipe size.
3. 1/4" bleed line is required on 2-pipe cool and heat auto changeover systems with factory provided thermostats; optional for thermostats by others.

FS FAN COILS

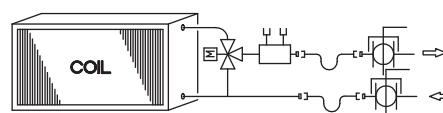
Package Code	Components					Valve Size	Y-CO	P/T Ports
	FC	AFS	Y-STR	FCN	FCS	1/2"		
43						X		X
44	X					X		X
45		X				X		X
46			X			X	X	X
47	X		X			X	X	X
48		X	X			X	X	X
65				X		X		
66					X	X		



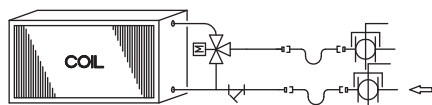
Code 43
3-Way Control Valve Only



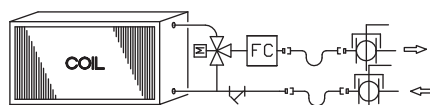
Code 44
3-Way Control Valve and
Fixed Flow Control



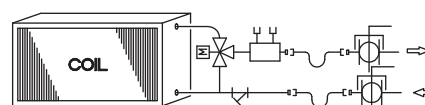
Code 45
3-Way Control Valve and
Adjustable Flow Setter



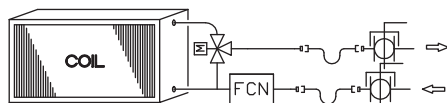
Code 46
3-Way Control Valve and Y Strainer



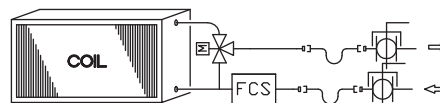
Code 47
3-Way Control Valve, Fixed Flow
Control and Y Strainer



Code 48
3-Way Control Valve,
Adjustable Flow Setter and Y Strainer



Code 65
3-Way Control Valve and
Auto Cartridge Flow Control



Code 66
3-Way Control Valve and Auto
Cartridge Flow Control With Screen

LEGEND, COMPONENT PRESSURE RATINGS

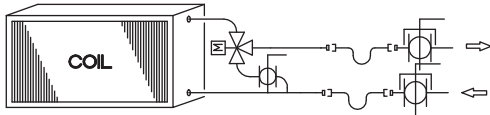
- FC: Fixed Flow Control, 500 PSIG
- AFS: Adjustable Flow Circuit Setter, 300 PSIG
- Y-STR: Y Strainer, 400 PSIG
- FCN: Fixed Cartridge Flow Control w/ PT Ports and No Screen, 230 PSIG
- FCS: Fixed Cartridge Flow Control with PT Ports and Screen, 230 PSIG
- Y-CO: Y-Strainer Cleanout, 400 PSIG
- P/T Port: Pressure/Temperature Test Port, 400 PSIG
- Control Valve: 300 PSIG

NOTES:

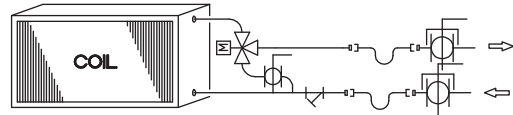
1. All drawings subject to change without prior notice.
2. Diagrams show component position in relation to fluid flow. Actual valve package configuration varies with unit type, hand connection, and pipe size.

FS FAN COILS

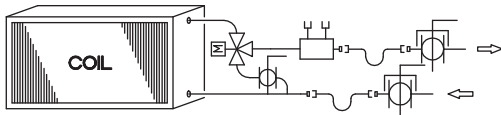
3-WAY PIPING PACKAGES WITH BALANCE BYPASS VALVE								
Package Code	Components					Valve Size	Y-CO	P/T Ports
	FC	AFS	Y-STR	FCN	FCS	1/2"		
56						X		X
58		X				X		X
57			X			X	X	X
59		X	X			X	X	X



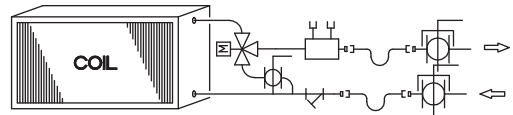
Code 56
3-Way Control Valve and
Balance Valve in Bypass



Code 57
3-Way Control Valve,
Balance Valve in Bypass and Y Strainer



Code 58
3-Way Control Valve, Balance Valve in Bypass
and Adjustable Flow Setter



Code 59
3-Way Control Valve, Balance Valve in Bypass,
Adjustable Flow Setter and Y Strainer

LEGEND, COMPONENT PRESSURE RATINGS

FC:	Fixed Flow Control, 500 PSIG
AFS:	Adjustable Flow Circuit Setter, 300 PSIG
Y-STR:	Y Strainer, 400 PSIG
FCN:	Fixed Cartridge Flow Control w/ PT Ports and No Screen, 230 PSIG
FCS:	Fixed Cartridge Flow Control with PT Ports and Screen, 230 PSIG
Y-CO:	Y-Strainer Cleanout, 400 PSIG
P/T Port:	Pressure/Temperature Test Port, 400 PSIG
Control Valve:	300 PSIG
BPV:	Balance Bypass Valve, 400 PSIG

NOTES:

1. All drawings subject to change without prior notice.
2. Diagrams show component position in relation to fluid flow. Actual valve package configuration varies with unit type, hand connection, and pipe size.

PIPING PACKAGE GUIDE SPECIFICATIONS

Provide a standard factory assembled valve piping package to consist of a 2 or 3 way, on/off, motorized electric control valve and two ball isolation valves. Control valves are piped normally closed to the coil. Maximum entering water temperature on the control valve is 200°F, and maximum close-off pressure is 40 PSIG (1/2"), 20 PSIG (3/4"), or 17 PSIG (1"). Maximum operating pressure shall be 300 PSIG.

Option: Provide 3-wire floating point modulating control valve (fail-in-place) in lieu of standard 2-position control valve with factory assembled valve piping package.

Option: Provide normally open control valve for hot water coils.

Option: Provide high pressure close-off actuators for 2-way control valves. Maximum close-off pressure is 50 PSIG (1/2"), 25 PSIG (3/4"), or 20 PSIG (1").

Option: Provide either a fixed or adjustable flow control device for each piping package.

Option: Provide unions and/or pressure-temperature ports for each piping package.

VAV Products, FH, FN, FW and FL:
Piping package shall be completely factory assembled, including interconnecting pipe, and shipped separate from the unit for field installation on the coil, so as to minimize the risk of freight damage.

Model FS:
Piping package shall be completely factory assembled, tested, mounted to coil, and include stainless steel braided hoses.

NOTE: Photos are for representation purposes only. Vendors and models subject to change without notice.



Manual Ball Valve w/Memory Stop (BVMS)

An adjustable stop position lever to limit travel of the On/Off handle. This allows the ball valve to be closed, and returned to the balance setting position without re-testing the system. 1/2" size shown.

Nominal Size:	1/2"	3/4"	1"
Body Material:	Brass	Brass	Brass
Ball:	Hard Chrome Plated	Hard Chrome Plated	Hard Chrome Plated
Seats:	Teflon	Teflon	Teflon
Stem Seal:	(2) Viton O-Rings	Teflon	Teflon
Connection:	Sweat	Sweat	Sweat
Pressure Rating	600	600	600
(psig):			
Temp. Rating, °F:	325	325	325
Cv:	17	32	27



Flexible Hose Kits, 18" (FH)

Materials: EPDM inner lined, Kevlar® reinforced hose with stainless steel outer covering

Flow Rates: 0.5 to 12.0 GPM, based on application

Pressure Temp. Rating (450 PSIG test pressure): 375 PSIG @ 250°F

Minimum Burst Pressure: 1500 PSI

Flame Spread: Not greater than 25 per UL 723

Smoke Development: Not greater than 50 per UL 723

Ball Valve w/Memory Stop: Full port brass

Ball: Stainless steel

Seats: Teflon

Stem Seal: (2) Viton O-Rings

Pressure Rating: 600 PSIG WOG

Temperature Rating: 325°F

Cv: 20

Available in 1/2" size only.



Typical 2-Way, 2-Position Control Valve

A 2-position water control valve driven open with spring return upon a call for heating or cooling to maintain space temperature. In open position, water can flow through the unit's water coil to heat or cool the space depending on supply water temperature. In closed position, water cannot flow through the water coil. Control valves are piped normally closed to the coil as standard. Valve actuators can be line or low (24VAC) voltage.

Nominal Size	1/2" 2-Way	3/4" 2-Way	1" 2-Way
Body Material:	Brass	Brass	Brass
Connection:	Sweat	Sweat	Sweat
Pressure Rating (psig):	300	300	300
Temperature Rating, °F:	200	200	200
Cv:	2.5	5.0	8.0
Maximum Close-off Pressure, Std. (PSIG):	40	20	17
High Close-off:	50	25	20
Power Consumption:	7VA	7VA	7VA

NOTE: Photos are for representation purposes only. Vendors and models subject to change without notice.

Typical 3-Way, 2-Position Control Valve

A 2-position water control valve driven open with spring return (bypass) upon a call for heating or cooling to maintain space temperature. Energized, the bypass port is blocked, and water can flow through the unit's water coil to heat or cool the space depending on the supply water temperature. De-energized, water cannot flow through the water coil but is forced to flow through the bypass port, bypassing the coil. Control valves are piped normally closed to the coil as standard (in full bypass). Valve actuators can be line or low (24VAC) voltage.

Nominal Size	1/2" 3-Way	3/4" 3-Way	1" 3-Way
Body Material:	Brass	Brass	Brass
Connection:	Sweat	Sweat	Sweat
Pressure Rating (psig):	300	300	300
Temperature Rating, °F:	200	200	200
Cv:	3.0	5.0	8.0
Maximum Close-off Pressure			
Operating Mode:	N/A	N/A	N/A
Power Consumption:	7VA	7VA	7VA



Typical 2-Way Modulating Control Valve

A 3-wire floating point, fail-in-place (non-spring return) modulating water control valve, driven open or closed upon a call for heating or cooling to maintain space temperature. In the open position, water can flow through the unit's water coil to heat or cool the space depending on supply water temperature. In the closed position, water cannot flow through the water coil. Factory furnished 2-way valve packages are piped normally closed to the water coil. The floating point control valve is compatible with any 24VAC three-wire signal when three minute time-out logic resides in the thermostat or system controller.

Nominal Size	1/2" 2-Way	3/4" 2-Way	1" 2-Way
Body Material:	Brass	Brass	Brass
Connection:	Sweat	Sweat	Sweat
Pressure Rating (psig):	300	300	300
Temperature Rating, °F:	200	200	200
Cv:	2.0	4.0	8.0
Maximum Close-off Pressure			
Operating Mode:	50	35	35
Power Consumption:	1VA	1VA	1VA

Contact factory for 3-wire floating, spring return applications.



Typical 3-Way Modulating Control Valve

A 3-wire floating point, fail-in-place (non-spring return) modulating water control valve, driven open or closed (bypass) upon a call for heating or cooling to maintain space temperature. In the "open" position, the bypass port is closed and water is directed through the unit's water coil to heat or cool the space depending on supply water temperature. In the "closed" position, the service (water coil) port is closed and water is directed through the bypass port. Factory furnished 3-way valve packages are piped as "mixing" valves. The floating point control valve is compatible with any 24VAC three-wire signal when three minute time-out logic resides in the thermostat or system controller.

Nominal Size	1/2" 3-Way	3/4" 3-Way	1" 3-Way
Body Material:	Brass	Brass	Brass
Connection:	Sweat	Sweat	Sweat
Pressure Rating (psig):	300	300	300
Temperature Rating, °F:	200	200	200
Cv:	2.0	4.0	8.0
Maximum Close-off Pressure			
Operating Mode:	N/A	N/A	N/A
Power Consumption:	1VA	1VA	1VA

Contact factory for 3-wire floating, spring return applications.



NOTE: Photos are for representation purposes only. Vendors and models subject to change without notice.



Automatic Fixed Flow Control (FC)

A pressure compensated automatic fixed flow control device designed to limit the flow GPM through the unit coil. Desired GPM must be specified when ordering. Device A shown is typical for controlling flow up to 8.0 GPM, and features a changeable flow cartridge. Device B is typical for flows above 8.0 GPM.

Nominal Size (A):	1/2" and 3/4"
Nominal Size (B):	3/4" and 1"
Body Material:	Copper
Connection:	Sweat
Pressure Rating (psig) (A):	600
Pressure Rating (psig) (B):	522
Temp. Rating, °F:	220
Cv:	Variable With Inlet Pressure



Automatic Cartridge Flow Control (FCN, FCS)

An automatic fixed flow control device with a replaceable stainless steel cartridge, and two pressure/temperature ports, designed to limit the flow GPM through the unit coil to ±5% of rated GPM. Desired GPM must be specified when ordering. Available with 20 mesh stainless steel screen. 1/2" size shown.

Nominal Size:	1/2", 3/4", and 1"
Body Material:	Forged brass
Connection:	Sweat
Seals:	EPDM O-Rings
Pressure Rating (psig):	230
Temp. Rating, °F:	250
PSIG Range:	2 - 32

Optional Strainer:

Body Material:	20 mesh stainless steel*
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* The optional strainer is internal and does not affect the dimensions.



Adjustable Flow Circuit Setter (AFS)

A control device designed to allow maximum water flow through the unit coil in the Open (0%) position, and as little as 10% of flow through the unit coil in the Closed (90%) position. The device has a calibrated nameplate, built in test ports and adjustable mechanical stops, and is suitable for positive shutoff.

Nominal Size:	1/2", 3/4", and 1"
Body Material:	Bronze
Connection:	Sweat
Pressure Rating (psig):	300
Temp. Rating, °F:	250
Cv:	Variable

NOTE: Photos are for representation purposes only. Vendors and models subject to change without notice.

Balance Bypass Valve (BPV)

A plug type valve designed to balance the water flow through the bypass circuit of a 3-way control valve. Manual adjustment is required. No calibration is provided at the valve.

Nominal Size:	1/2", 3/4", and 1"
Body Material:	Bronze
Connection:	Sweat
Pressure Rating (psig):	400
Temp. Rating, °F:	200
Cv:	Adjustable



Unions

A fitting used to provide a mechanical connection between the coil and valve package that can be connected, disconnected, and re-connected without the need to cut tubing or unsolder a joint. Unions are installed at the coil on FH, FN, and FW fan coil units. Unions are not available on FS fan coil units.

Nominal Size:	1/2", 3/4", and 1"
Body Material:	Bronze/Copper
Connection:	Sweat
Pressure Rating (psig):	125*
Temp. Rating, °F:	200*

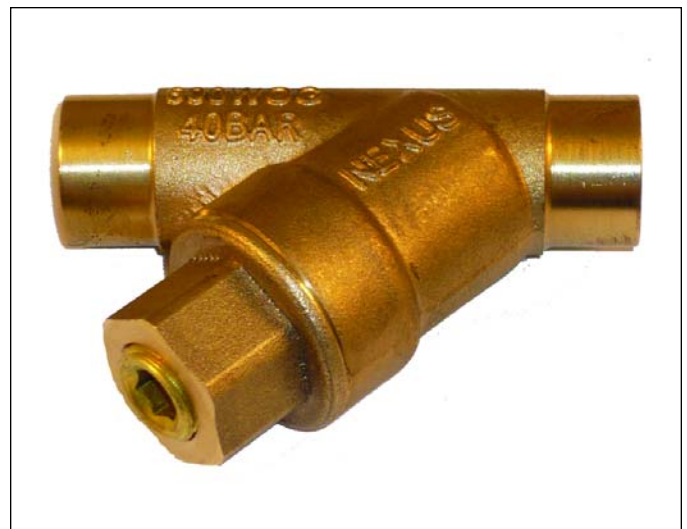
*Contact factory for unions rated at 600 PSIG and 325°F.



Y-Strainer (Y-STR)

Designed to allow water to flow through a built in screen to filter debris or contaminants from the water system. With the water system isolated, the plug can be removed from the blowdown leg of the strainer and the captured debris removed from the screen. After the plug is replaced, the system can be put back in operation and the strainer will continue to filter the unit's water.

Nominal Size:	1/2" and 3/4"
Body Material:	Forged Brass
Connection:	Sweat
Pressure Rating (psig):	600
Temp. Rating, °F:	325
Screen:	20 Mesh Stainless Steel



NOTE: Photos are for representation purposes only. Vendors and models subject to change without notice.



Cleanout Valve for Y-Strainer (Y-CO)

A standard ball valve installed on the strainer blowdown leg to allow flushing the strainer screen without removing the plug in the blowdown leg. This valve has a standard 1/2" garden hose connection to allow fluid to be piped to a container or remote location during cleaning. Not available separately.

Nominal Size:	1/4"
Body Material:	Bronze
Connection:	MPT
Pressure Rating (psig):	600
Temp. Rating, °F:	200



Optional Pressure/Temperature Test Port Locations (P/T)

Designed to allow testing of water pressure, differential pressure or water temperature without interrupting the waterside operation of the Fan Coil Unit. Sensor probes (1/8") are not included.

Nominal Size:	1/4"
Body Material:	Brass
Connection:	MPT
Pressure Rating (psig):	400
Temp. Rating, °F:	250



Aqua Thermostat

The aqua thermostat, also called an automatic seasonal changeover switch or aquastat, is a switch designed to change a room thermostat from heating to cooling and back, based on the temperature of the water supplied to a 2-pipe unit to be used for both heating and cooling. The switch is shipped loose and is mounted in the field on the water tubing using the integral clip or spring.

Nominal Size:	1/2", 3/4" and 1"
Switch Action:	SPDT
	Switch on temperature rise, 85°F (± 6°F)
	Switch on temperature fall, 70°F (± 6°F)
Current Rating:	120VAC = 5.8 FLA/34.8 LRA (Inductive), 10.0 Amps (Resistive)
	208/240VAC = 2.9 FLA/17.4 LRA (Inductive), 2.0 Amps (Resistive)
	277VAC = 3.6 FLA/21.6 LRA (Inductive), 1.0 Amp (Resistive)
Agency Approval:	UL Listed, CSA Approved

Ratings may vary with vendor and size.

Copper Tube Dimensional & Physical Data

Nominal Diameter (in.)	Wall Thickness (t, in.)	Diameter		Surface Area		Cross Section		Weight			
		Outside (d, in.)	Inside (d, in.)	Outside (ft ² /ft)	Inside (ft ² /ft)	Metal Area (in ²)	Flow Area (in ²)	Tube (lb/ft)	Water (lb/ft)	1/2" Ins. (lb/ft)	3/4" Ins. (lb/ft)
Type - K (color code: green)											
3/4	0.065	0.875	0.745	0.229	0.195	0.165	0.436	0.641	0.189	0.04	0.06
1	0.065	1.125	0.995	0.295	0.260	0.216	0.778	0.839	0.336	0.05	0.07
1 1/4	0.065	1.375	1.245	0.360	0.326	0.268	1.217	1.037	0.527	0.06	0.09
1 1/2	0.072	1.625	1.481	0.425	0.388	0.351	1.723	1.361	0.745	0.07	0.11
2	0.083	2.125	1.959	0.556	0.513	0.532	3.014	2.063	1.304	0.09	0.14
2 1/2	0.095	2.625	2.435	0.687	0.637	0.755	4.657	2.926	2.015	0.11	0.17
3	0.109	3.125	2.907	0.818	0.761	1.033	6.637	4.002	2.872	0.14	0.20
Type - L (color code: blue)											
3/4	0.045	0.875	0.785	0.229	0.206	0.117	0.484	0.455	0.209	0.04	0.06
1	0.050	1.125	1.025	0.295	0.268	0.169	0.825	0.654	0.357	0.05	0.07
1 1/4	0.055	1.375	1.265	0.360	0.331	0.228	1.257	0.884	0.544	0.06	0.09
1 1/2	0.060	1.625	1.505	0.425	0.394	0.295	1.779	1.143	0.770	0.07	0.11
2	0.070	2.125	1.985	0.556	0.520	0.452	3.095	1.751	1.339	0.09	0.14
2 1/2	0.080	2.625	2.465	0.687	0.645	0.64	4.772	2.479	2.065	0.11	0.17
3	0.090	3.125	2.945	0.818	0.771	0.858	6.812	3.325	2.947	0.14	0.20
Type - M (color code: red)											
3/4	0.032	0.875	0.811	0.229	0.212	0.085	0.517	0.328	0.224	0.04	0.06
1	0.035	1.125	1.055	0.295	0.276	0.120	0.874	0.464	0.378	0.05	0.07
1 1/4	0.042	1.375	1.291	0.360	0.388	0.176	1.309	0.682	0.566	0.06	0.09
1 1/2	0.049	1.625	1.527	0.425	0.400	0.243	1.831	0.94	0.792	0.07	0.11
2	0.058	2.125	2.009	0.556	0.526	0.377	3.170	1.459	1.372	0.09	0.14
2 1/2	0.065	2.625	2.495	0.687	0.653	0.523	4.889	2.026	2.116	0.11	0.17
3	0.072	3.125	2.981	0.818	0.780	0.691	6.979	2.676	3.020	0.14	0.20

Source : CDA Copper Development Association - *The Copper Tube Handbook*

Soldered and Brazed Joint Rated Working Pressure

Alloy Used for Joints	Water and Noncorrosive Liquids and Gases ^a			
	Service Temperature (°F)	Nominal Tube Size (Types K, L, M)		
		3/4" to 1"	1 1/4" to 2"	2 1/2" to 3"
50-50 Tin-Lead ^b Solder (ASTM B32 Gr 50A)	100	200	175	150
	150	150	125	100
	200	100	90	75
	250	85	75	50
95-5 Tin-Antimony ^c Solder (ASTM B32 Gr 50TA)	100	500	400	300
	150	400	350	275
	200	300	250	200
	250	200	175	150
Brazing Alloys – Melt Temperature >= 1000° F	100 to 200	Note d	Note d	Note d
	250	300	270	170
	350	270	190	150

Source : Based on ASME Standard B31.9 - *Building Services Piping*

Notes:

- ^a Solder Joints shall not be used for:
 - Flammable or toxic gases or liquids
 - Gas, vapor or compressed air in tubing over 4 inch, unless maximum pressure is limited to 20 psig.
- ^b Lead based solders must not be used on potable water systems
- ^c Tin-Antimony solder is allowed for potable water supplies in some jurisdictions.
- ^d Rated pressure for up to 200°F applies to the tube being joined – see pipe internal pressure chart.
 - Tin-Lead solder shall not be used in Johnson Controls products.
 - Tin-Antimony solder is used on Johnson Controls valve packages and "packed" or "gasketed" parts.
 - Brazing alloy is used for all Johnson Controls coils, risers and piping runs.

Copper Tube Rated Internal Working Pressure (PSIG)

Nominal Size (in)	Annealed (Soft)				Drawn (Hard)			
	S=6000 psi	S=5100 psi	S=4800 psi	S=4800 psi	S=9000 psi	S=9000 psi	S=9000 psi	S=9000 psi
	100° F	150° F	200° F	250° F	100° F	150° F	200° F	250° F
Type K (green color code)								
3/4	852	724	682	682	1278	1278	1278	1278
1	655	557	524	524	982	982	982	982
1 1/4	532	452	425	425	797	797	797	797
1 1/2	494	420	396	396	742	742	742	742
2	435	370	348	348	652	652	652	652
2 1/2	398	338	319	319	597	597	597	597
3	385	328	308	308	578	578	578	578
Type L (blue color code)								
3/4	582	495	466	466	873	873	873	873
1	494	420	395	395	741	741	741	741
1 1/4	439	373	351	351	658	658	658	658
1 1/2	408	347	327	327	613	613	613	613
2	364	309	291	291	545	545	545	545
2 1/2	336	285	269	269	504	504	504	504
3	317	270	254	254	476	476	476	476
Type M (red color code)								
3/4	407	346	326	326	611	611	611	611
1	337	286	270	270	506	506	506	506
1 1/4	338	285	270	270	507	507	507	507
1 1/2	331	282	265	265	497	497	497	497
2	299	254	239	239	448	448	448	448
2 1/2	274	233	219	219	411	411	411	411
3	253	215	203	203	380	380	380	380

Source : CDA Copper Development Association - *The Copper Tube Handbook*

Notes:

1. Table values based on the maximum allowable stress in tension (psi) for the indicated service temperature (° F.)
2. When brazing or soldering is used to join drawn (hard) tubing, the corresponding annealed rating shall be used.
3. Type-M Annealed temper is not readily available. Annealed values indicated for use when heating or forming drawn tube.

Soldered and Brazed Joints Pressure - Temperature Ratings

Maximum Pressure & Temperature Rating of 95-5 Tin-Antimony Solder Joints Using Copper Tubing (PSIG)

Nominal Size (in)	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	
3/4																				
1																				
1 1/4																				
1 1/2																				
2																				
2 1/2																				
3																				
Service Temp.	250°F		200°F			150°F			100°F											

Maximum Pressure & Temperature Rating for Brazing Alloy Joints Using Copper Tubing (PSIG)

Nominal Size (in)	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600	
3/4																				
1																				
1 1/4																				
1 1/2																				
2																				
2 1/2																				
3																				
Service Temp.	350°F		250°F			200°F			150°F		100°F									

Notes:

1. Pressure Ratings Based on *ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings*.
2. Tubing Pressure Ratings may exceed those shown if joints are not present and tubing is not annealed. See Copper Tube Internal Pressure Ratings Chart for those cases.

Piping System Component Maximum Working Pressure (PSIG)

System Working Pressure (PSIG)	Water and Steam Coil		Ball Valves	Motorized Control Valves ^a				Flow Control			1/4" Schraeder Valve	Pressure / Temp. Test Port	Flexible Hose Kit	Y-Strainer		Unions ^g	
	Coil	Air Vent Manual / Auto		2 Position	Modulating ^b		Automatic	Adjustable		Body				Clean-out			
			1/2"	3/4"	1"	1/2"	3/4"	1"	Fixed	Cartridge ^c	Circuit Setter	Balance Valve					
100	250 @ 200°F, 15 PSIG Steam	400 @ 200°F		40	20	300 @ 200°F	300 @ 200°F	300 @ 200°F									
200																	
300																	
400																	
500																	
600																	

Notes:

- a. All valves use sweat connections. 2 position valves are N.C. spring return; modulating valves are floating point non-spring return fail in place.
- b. Valve close off pressure is rated at powered operating mode.
- c. Cartridge type flow control devices utilize a replaceable flow compensation cartridge to adjust desired flow rate.
- d. Pressure ratings will be reduced as temperatures exceed those shown above.
- e. Maximum allowable system pressure is limited to the components selected with the lowest working pressure.
- f. Johnson Controls assumes no responsibility for misapplication and selection of piping components.
- g. Contact factory for unions rated at 600 PSIG and 325°F.

xx = Valve close off pressure

NOTES

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