



MASTER PRESENTATION

Check Valves

SANHUA EUROPE



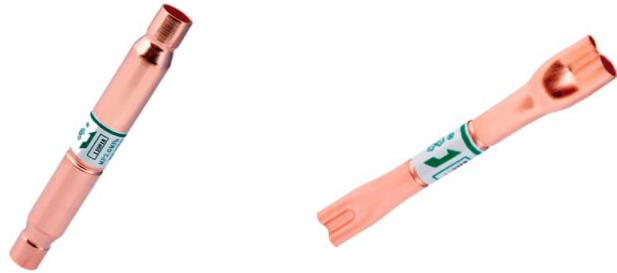
15 / 04 / 2022

CHECK VALVES

AGENDA:

- **Overview – Sanhua Check Valves Ranges**
- **Applications Examples & Working Principle**
- **Product Range – C.V. Float Type [YCV]**
- **Product Range – C.V. Piston Type [YCVS ; YCVS-R]**
- **Product Range – C.V. Magnetic Type [CCV]**
- **Product Range – C.V. R744 Type [BCV]**
- **Technical comparison**
- **Future Developments**
- **Sizing and Selection**

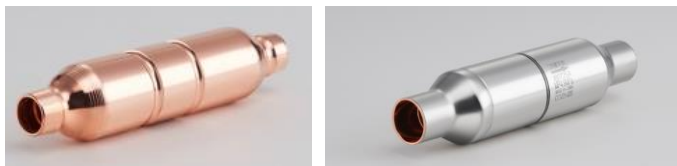
Check Valve – Overview



Float Type Series - YCV



Piston Type Series – YCVS & YCVS-R



Magnetic Type Series - CCV

CHECK VALVES PORTFOLIO

Sanhua Check Valves - 3 available series:

1. **FLOAT TYPE SERIES**

- YCV - (available on request)

2. **PISTON TYPE SERIES**

- YCVS – standard series (PS=46bar)
- YCVS-R – special series (PS=49bar)

3. **MAGNETIC TYPE SERIES**

- CCV – new series for R32 discharge line (PS=49bar)

APPLICATION EXAMPLES:

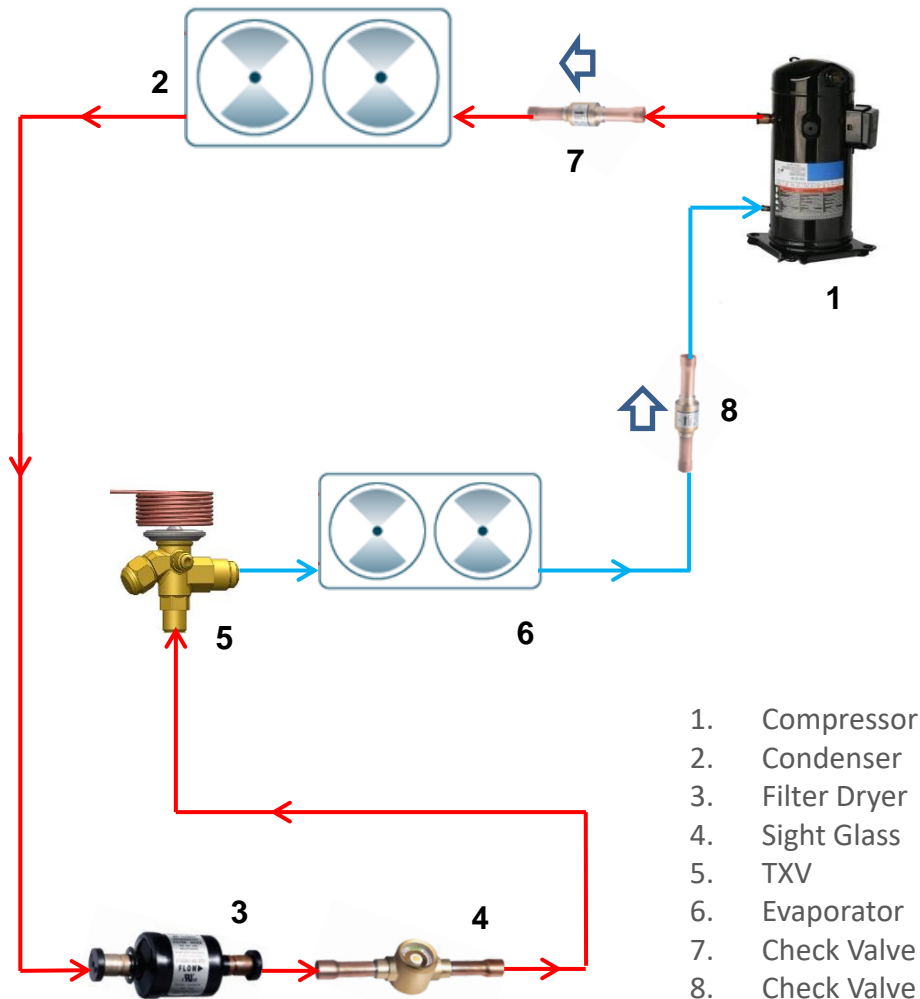
- 1) SUCTION AND DISCHARGE LINE***
- 2) UNIDIRECTIONAL TXV***
- 3) COMPRESSORS IN PARALLEL***
- 4) CHILLER WITH HEAT RECOVERY CIRCUIT***



Check Valve – Application & Working Principle



APPLICATION CASE N° 1 SUCTION & DISCHARGE LINE

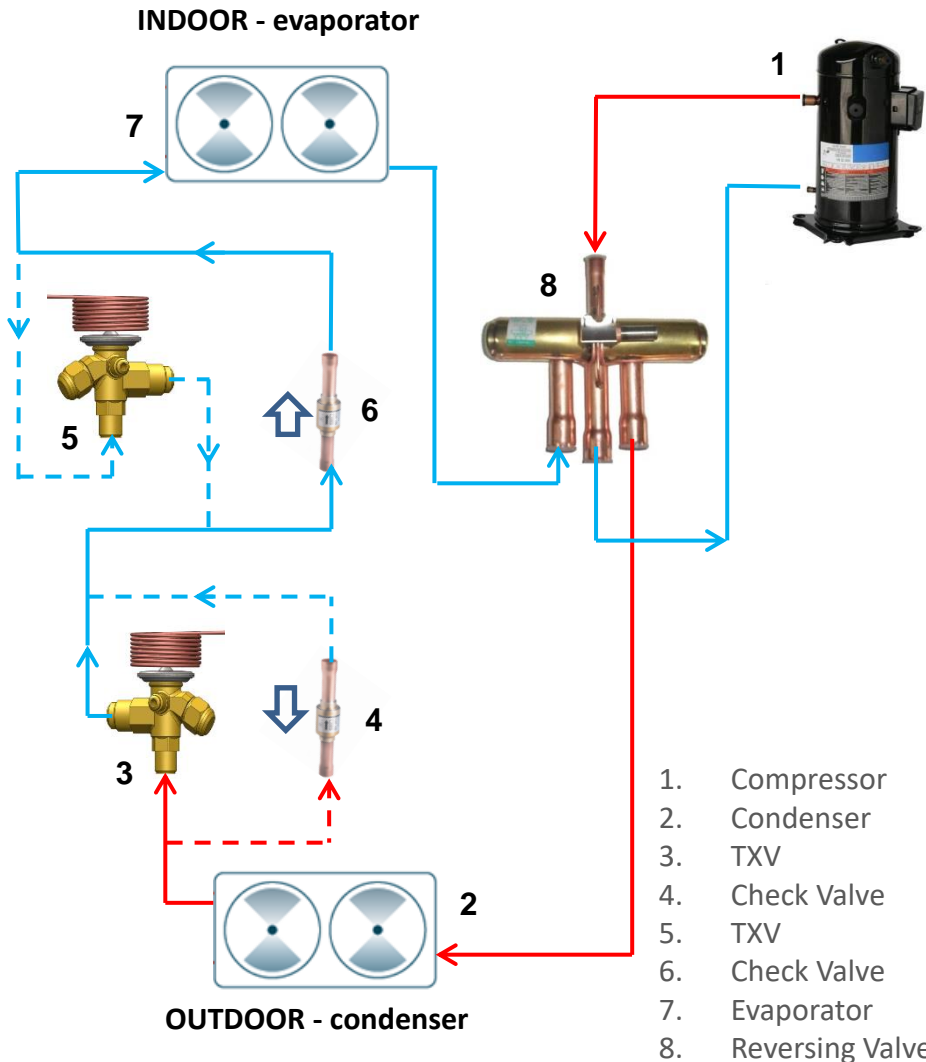


1. Check Valve can be installed on the compressor discharge line (pos.7). It prevents flow from condenser to compressor during off-cycle
2. Check Valve can be installed on the compressor suction line (pos.8). It prevents back-condensation from warm to cold evaporator

1. Compressor
2. Condenser
3. Filter Dryer
4. Sight Glass
5. TXV
6. Evaporator
7. Check Valve
8. Check Valve

Check Valve – Application & Working Principle

APPLICATION CASE N° 2 UNIDIRECTIONAL TXV

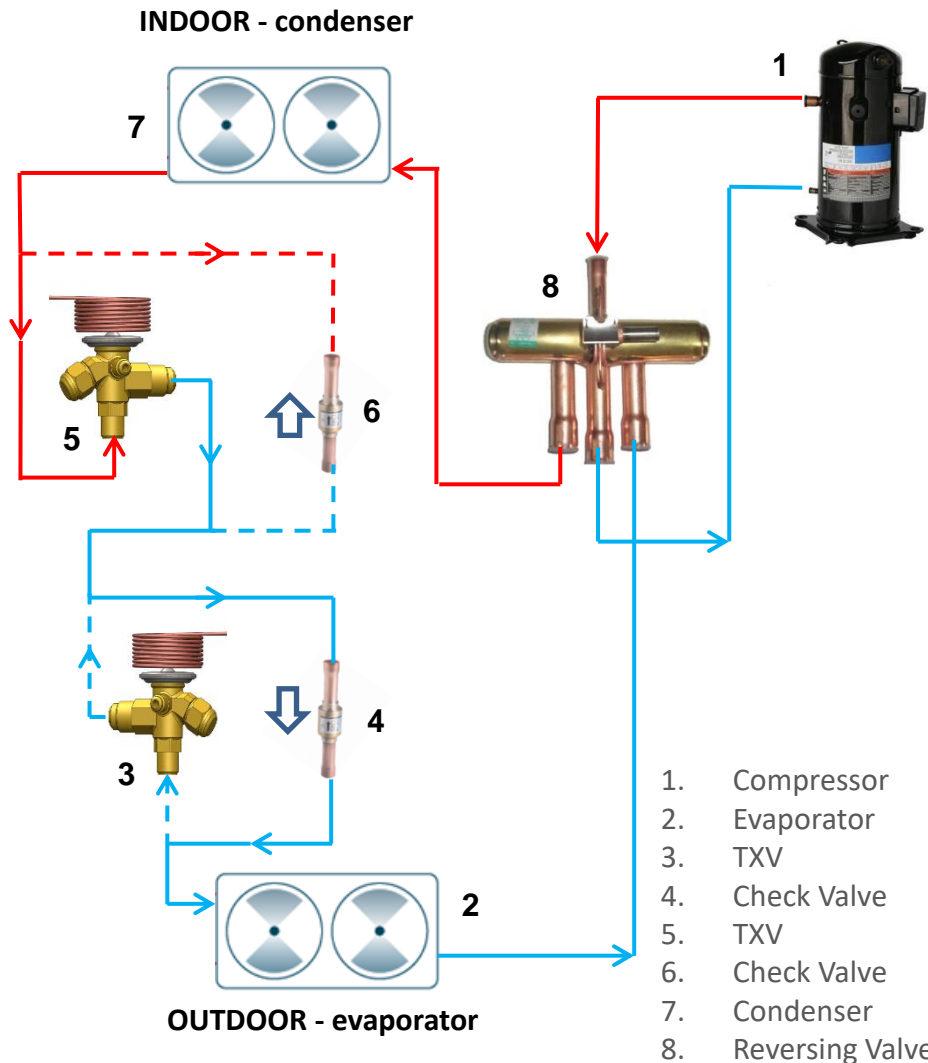


1. Check Valve must be installed on Heat Pumps equipped in parallel to the 2 unidirectional TXV
2. When the Heat Pump works in summer position the TXV n° 3 is activated while the TXV n° 5 is bypassed through the check valve n° 6

SUMMER POSITION

Check Valve – Application & Working Principle

APPLICATION CASE N^o 2 UNIDIRECTIONAL TXV

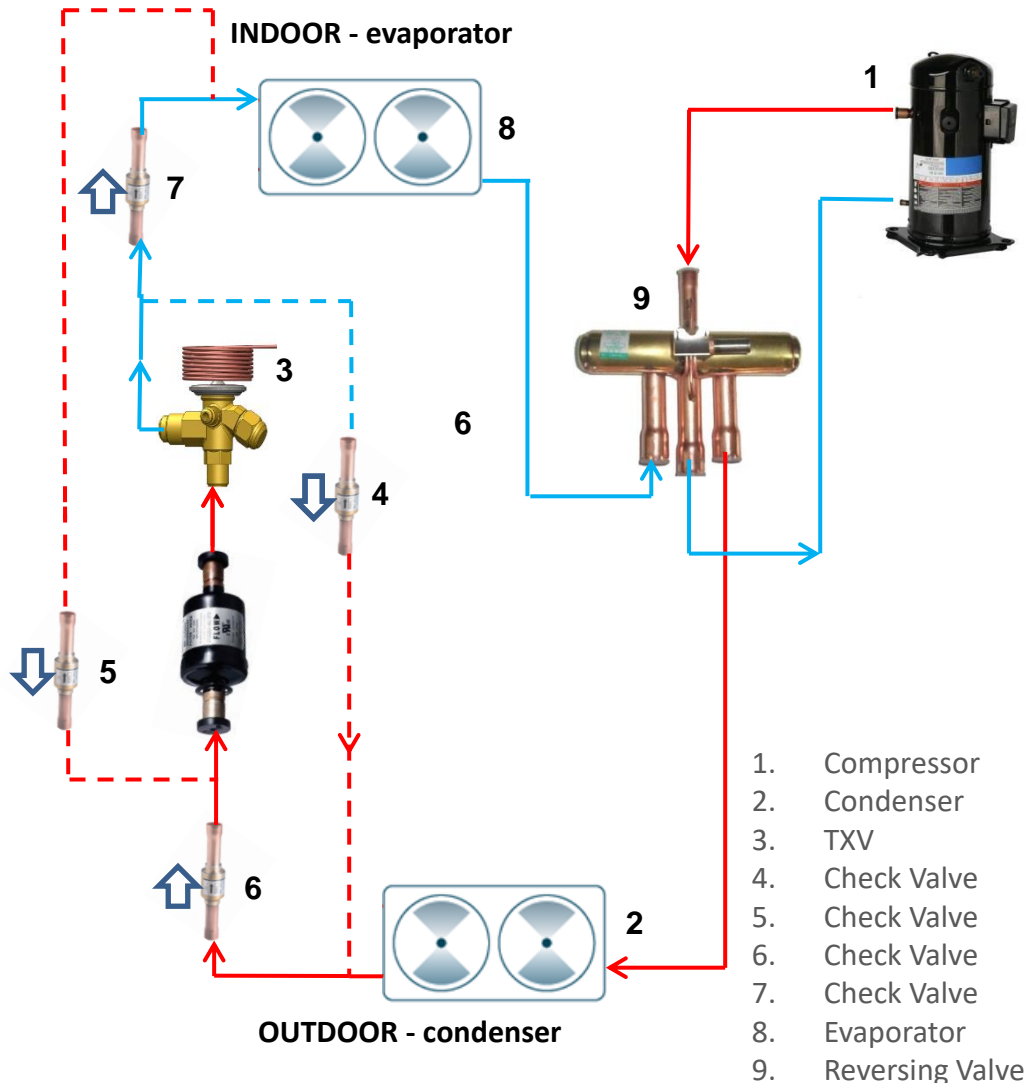


3. When the Heat Pump works in winter position the TXV n^o 5 is activated while the TXV n^o 3 is bypassed through the check valve n^o 4

WINTER POSITION

Check Valve – Application & Working Principle

APPLICATION CASE N° 2 UNIDIRECTIONAL TXV

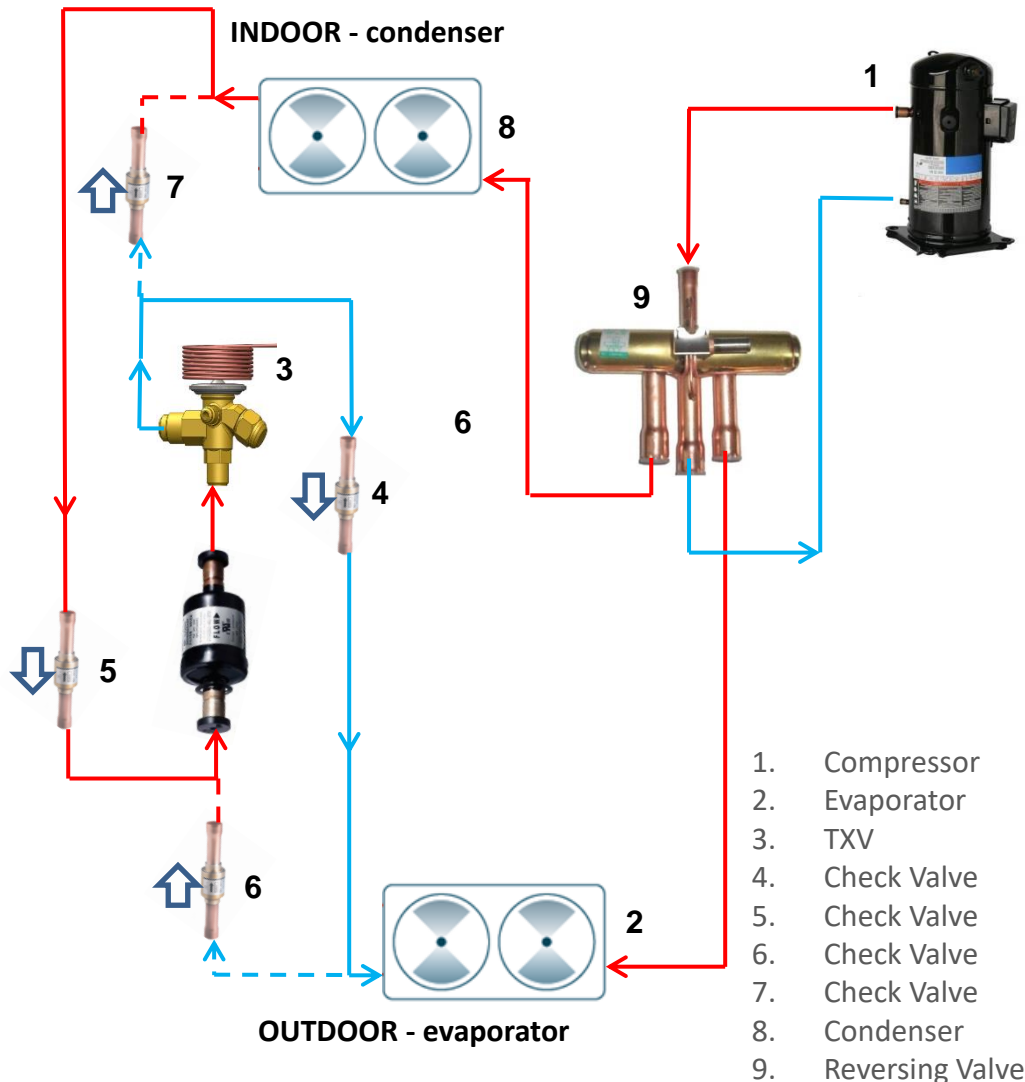


SUMMER POSITION

1. Check Valve must be installed on Heat Pumps equipped in parallel to the 2 unidirectional TXV
2. When the Heat Pump works in summer position the TXV n° 3 is activated while the TXV n° 5 is bypassed through the check valve n° 6

Check Valve – Application & Working Principle

APPLICATION CASE N° 2 UNIDIRECTIONAL TXV



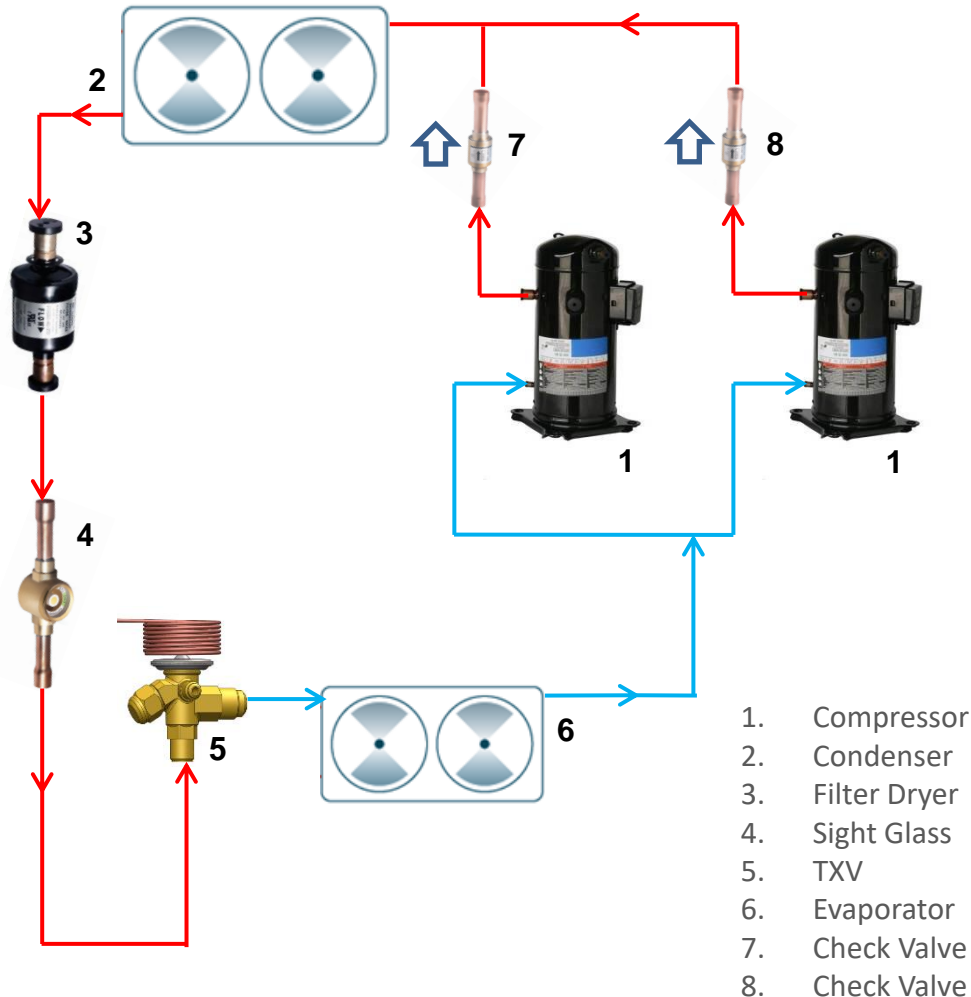
WINTER POSITION

1. Check Valve must be installed on Heat Pumps equipped in parallel to the 2 unidirectional TXV
2. When the Heat Pump works in summer position the TXV n° 3 is activated while the TXV n° 5 is bypassed through the check valve n° 6

Check Valve – Application & Working Principle

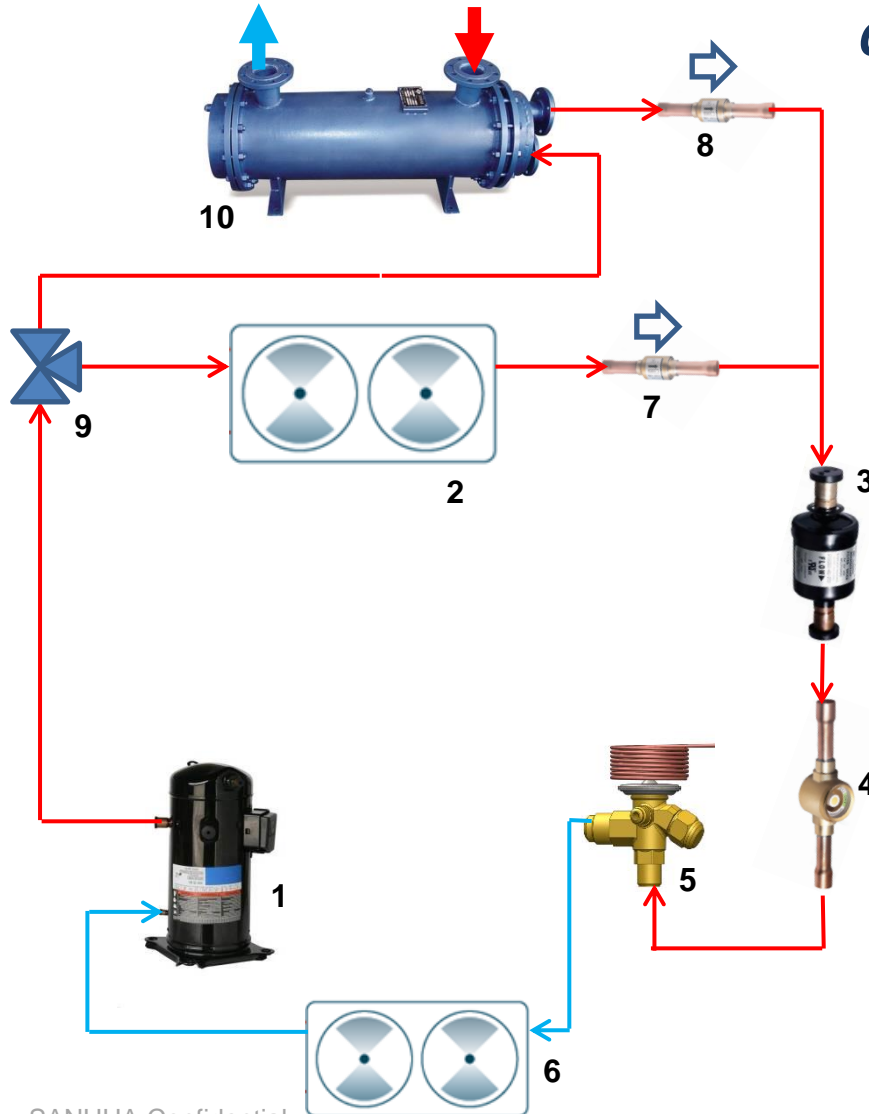


APPLICATION CASE N° 3 COMPRESSORS IN PARALLEL



1. Check Valves placed in pos.7 and pos.8 prevent flow from operating compressor to idled compressor
2. In systems with compressors connected in parallel, it is suggested to use check valve with reinforced spring (YCVSH models) and bigger values of Min. OPD
3. YCVSH models are also suitable in order to avoid resonance problems at partial load in the refrigerant plant.

APPLICATION CASE N° 4 CHILLER WITH HEAT RECOVERY CIRCUIT



1. Check Valves can be installed on a chiller equipped with heat recovery circuit. When the water is required the check valve in pos.7 avoids the flow back to the condenser. The check valve in pos.8 has a similar function when there isn't hot water necessity.

1. Compressor
2. Condenser
3. Filter Dryer
4. Sight Glass
5. TXV
6. Evaporator
7. Check Valve
8. Check Valve
9. 3 ways valve
10. Heat recovery exchanger

Check Valve (YCV) – Main Parts



MAIN FUNCTION

YCV - FLOAT TYPE SERIES

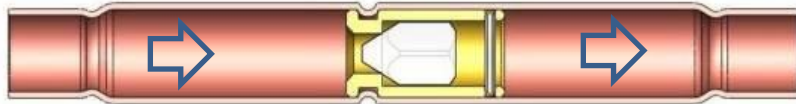


1. Check valve (YCV series) with floating element are mainly used in air conditioning systems in shunt connection with capillary tubes
2. They ensures only correct flow direction
3. Prevents back-condensation from warm to cold evaporator

VALVE BODY

Valve body:	COPPER
Connections:	COPPER
Internal Core:	PLASTIC

(ΔP = Inlet Pressure – Outlet Pressure)

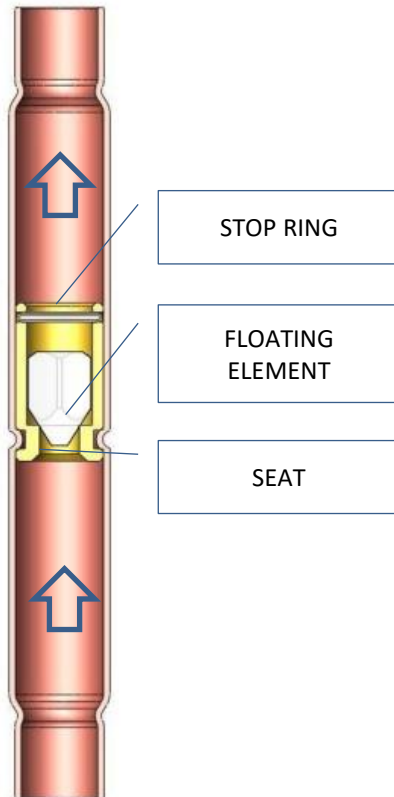


OPERATING PRINCIPLE

YCV - FLOAT TYPE SERIES

1. Check valves with floating internal element are mainly used in AC systems in shunt connection with capillary tubes.
2. Considering the indicated flow direction, when the pressure difference ΔP is $>$ of Minimum Opening Pressure Difference the refrigerant flow can pass through the valve
3. The internal floating element presents a cone shape; when the ΔP is sufficient, the flow pushes forward the cone that permits the flow passage.
4. If the Outlet Pressure is $>$ than the Inlet Pressure the ΔP push the cone in the opposite direction: it closes the passage holes

Check Valve (YCV) - Main Features



MAIN FEATURES

YCV - FLOAT TYPE SERIES

1. Very cheap solution indicated for small units (e.g. split systems)
2. The valve sealing is supported only by the pressure difference ($P_{out} - P_{in}$)
3. The suggested mounting position is vertical with the flow direction from bottom to the top [the sealing is helped by the gravity]
4. No any internal force (e.g. elastic or magnetic) is used to help keeping close the valve: poor performance
5. No standard range for Europe; YCV models are available on request

Check Valve (YCVS) – Main Parts



Straightway Version



Angle-way Version

MAIN FUNCTION

YCVS - PISTON TYPE SERIES

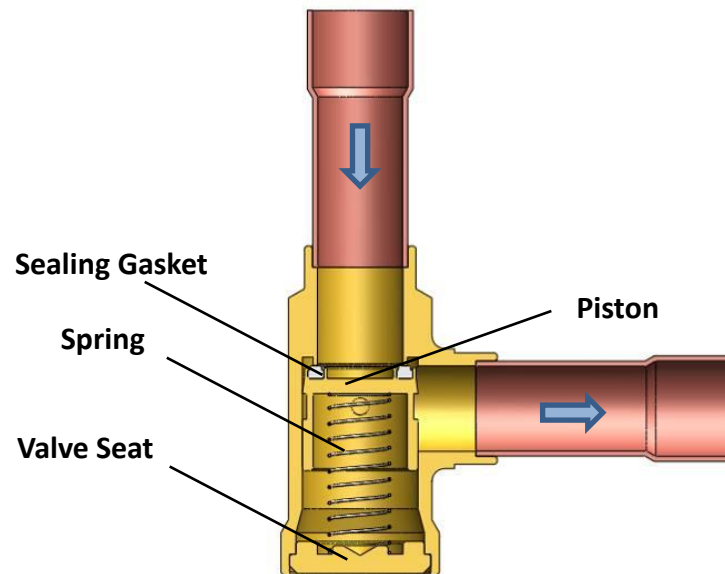
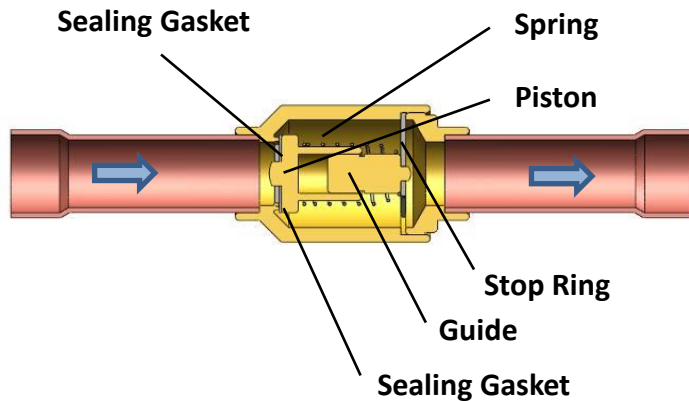
1. Check valve (YCVS series) can be installed in all the positions in the system
2. They ensure only correct flow direction
3. Available in straightway and angle-way versions
4. Built-in damping piston that makes the valves suitable for installation in lines where pulsation can occur, e.g. in the discharge line from the compressor (YCVSH series)
5. New series YCVS-R with an increased PS to 49bar suitable for R32 systems

VALVE BODY

Valve body:	BRASS
Connections:	COPPER
Internal Spring:	STAINLESS STEEL

CHECK VALVE PARTS

STANDARD PRODUCT - PISTON TYPE SERIES



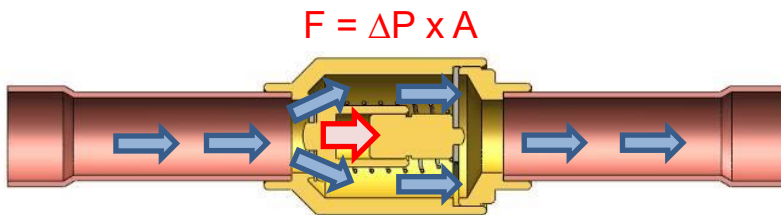
1. The core of the valve is the piston that can move on the guide from close to full open position.
2. When the check valve is in closed position the piston is pushed against the sealing gasket in order to avoid internal leakage
3. When the check valve is opened the bottom of the piston touches the stop ring

Check Valve (YCVS) – Operating Principle



OPERATING PRINCIPLE PISTON TYPE SERIES – STRAIGHTWAY VERSION

($\Delta P = \text{Inlet Pressure} - \text{Outlet Pressure}$)



Check Valve is opened when:

$$\Delta P > \text{Min. OPD} = (k_{\text{spring}} * \Delta x) / \text{Area}$$

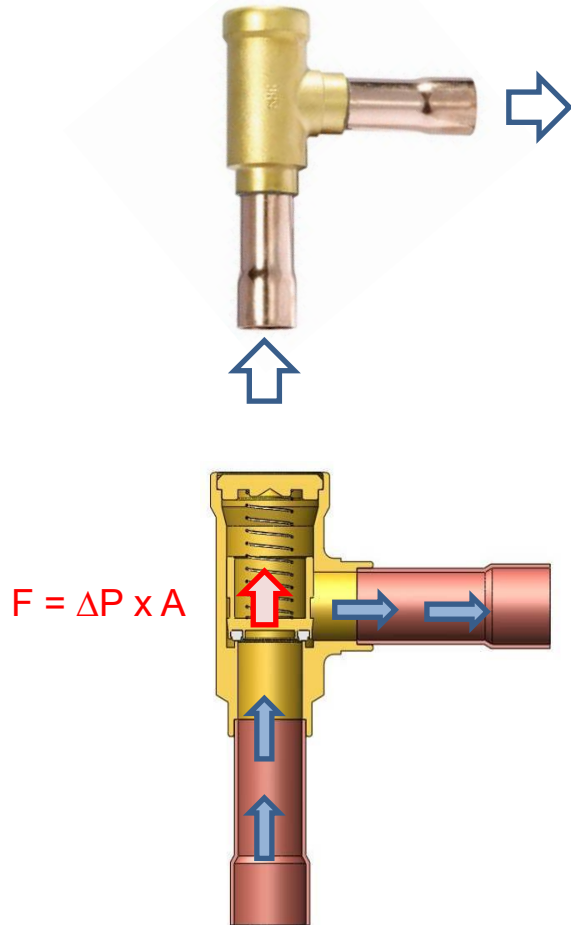
1. Considering the indicated flow direction, when the pressure difference ΔP is $>$ of Minimum Opening Pressure Difference the refrigerant flow can pass through the valve
2. The internal element (piston) is kept in the closure position thanks to the elastic force of the spring; when the ΔP is sufficient, the flow pushes the piston compressing the spring; this action permits the flow passage.
3. If the Outlet Pressure is $>$ than the Inlet Pressure the ΔP acts on the piston forcing it in the closure position.

Check Valve (YCVS) – Operating Principle



($\Delta P = \text{Inlet Pressure} - \text{Outlet Pressure}$)

OPERATING PRINCIPLE PISTON TYPE SERIES – ANGLEWAY VERSION



1. Considering the indicated flow direction, when the pressure difference ΔP is $>$ of Minimum Opening Pressure Difference the refrigerant flow can pass through the valve
2. The internal element (piston) is kept in the closure position thanks to the elastic force of the spring; when the ΔP is sufficient, the flow pushes the piston compressing the spring; this action permits the flow passage.
3. If the Outlet Pressure is $>$ than the Inlet Pressure the ΔP acts on the piston forcing it in the closure position.

Check Valve is opened when:

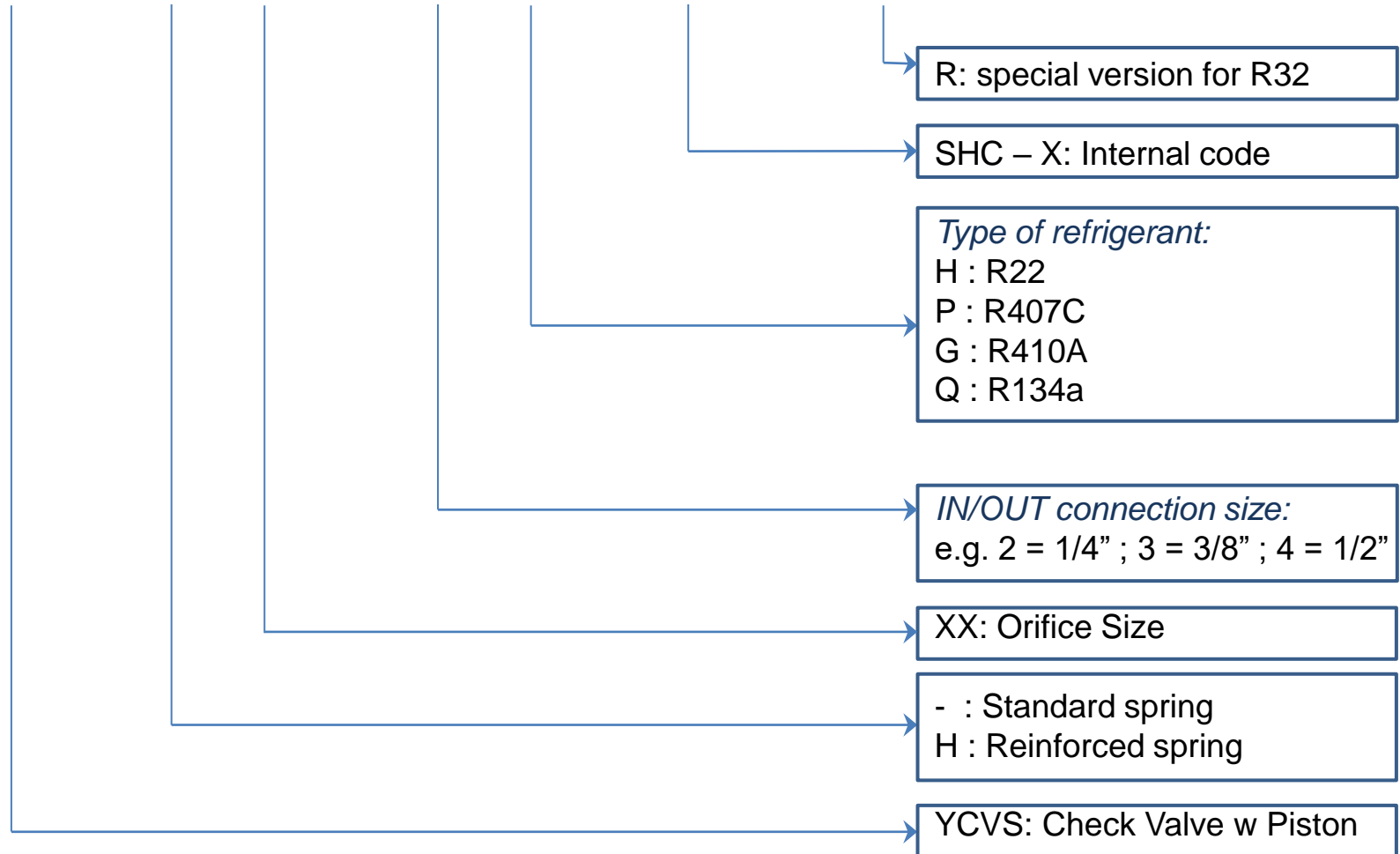
$$\Delta P > \text{Min. OPD} = (k_{\text{spring}} * \Delta x) / \text{Area}$$

Check Valve – Product Range



NOMENCLATURE:

YCVSH 26 - 88GSHC – 1R



Check Valve (YCVS) – Product Range



CHECK VALVE – **YCVS** SERIES STANDARD PRODUCT - PISTON TYPE SERIES STRAIGHTWAY VERSION

Models with Standard Spring [Min.OPD=5bar]	Models with Reinforced Spring [Min.OPD=15bar]	Connection Size [INCH]	Connection Size [mm]	Kv (m3/h)	PED Category Fluid Group 1	PED Category Fluid Group 2	MOP (bar)
YCVS 5-11GSHC-1	-	-	6	0,6	Art. 4.3	Art. 4.3	46
YCVS 5-22GSHC-1	-	1/4	-	0,6	Art. 4.3	Art. 4.3	46
YCVS 8-33GSHC-1	YCVSH 8-33GSHC-1	3/8	-	1,4	Art. 4.3	Art. 4.3	46
YCVS 8-33GSHC-2	YCVSH 8-33GSHC-2	-	10	1,4	Art. 4.3	Art. 4.3	46
YCVS 10-33GSHC-1	YCVSH 10-33GSHC-1	-	12	2,1	Art. 4.3	Art. 4.3	46
YCVS 10-44GSHC-1	YCVSH10-44GSHC-1	1/2	-	2,1	Art. 4.3	Art. 4.3	46
YCVS 13-55GSHC-1	YCVSH 13-55GSHC-1	5/8	16	3,9	Art. 4.3	Art. 4.3	46
YCVS 17-55GSHC-1	YCVSH 17-55GSHC-1	-	18	5,5	Art. 4.3	Art. 4.3	46
YCVS 17-66GSHC-1	YCVSH 17-66GSHC-1	3/4	-	5,5	Art. 4.3	Art. 4.3	46
YCVS 17-77GSHC-1	YCVSH 17-77GSHC-1	7/8	22	5,5	Art. 4.3	Art. 4.3	46

Check Valve (YCVS) – Product Range



CHECK VALVE – **YCVS** SERIES STANDARD PRODUCT - PISTON TYPE SERIES ANGLEWAY VERSION

Models with Standard Spring [Min.OPD=10bar]	Models with Reinforced Spring [Min.OPD=30bar]	Connection Size [INCH]	Connection Size [mm]	Kv (m3/h)	PED Category Fluid Group 1	PED Category Fluid Group 2	MOP (bar)
YCVS 20-77GSHC-1	YCVSH 20-77GSHC-1	7/8	22	13,2	Art. 4.3	Art. 4.3	46
YCVS 26-88GSHC-1	YCVSH 26-88GSHC-1	-	28	19,0	Cat. II	Art. 4.3	46
YCVS 26-99GSHC-1	YCVSH 26-99GSHC-1	1 1/8	-	19,0	Cat. II	Art. 4.3	46
YCVS 31-BBGSHC-1	YCVSH 31-BBGSHC-1	1 3/8	35	29,1	Cat. II	Art. 4.3	46
YCVS 31-DDGSHC-1	YCVSH 31-DDGSHC-1	1 5/8	-	29,1	Cat. II	Art. 4.3	46
YCVS 31-DDGSHC-2	YCVSH 31-DDGSHC-2	-	42	29,1	Cat. II	Art. 4.3	46

WARNING:

YCVS models in PED category II, are not covered by a notified body certification, so they cannot be used with flammable refrigerants (Fluids Group 1)

Check Valve (YCVS-R) – Product Range



CHECK VALVE – **YCVS-R** SERIES STANDARD PRODUCT - PISTON TYPE SERIES STRAIGHTWAY VERSION

Models with Standard Spring [Min.OPD=5bar]	Models with Reinforced Spring [Min.OPD=15bar]	Connection Size [INCH]	Connection Size [mm]	Kv (m3/h)	PED Category Fluid Group 1	PED Category Fluid Group 2	MOP (bar)
YCVS 5-11GSHC-1R	-	-	6	0,6	Art. 4.3	Art. 4.3	49
YCVS 5-22GSHC-1R	-	1/4	-	0,6	Art. 4.3	Art. 4.3	49
YCVS 8-33GSHC-1R	YCVSH 8-33GSHC-1R	3/8	-	1,4	Art. 4.3	Art. 4.3	49
YCVS 8-33GSHC-2R	YCVSH 8-33GSHC-2R	-	10	1,4	Art. 4.3	Art. 4.3	49
YCVS 10-33GSHC-1R	YCVSH 10-33GSHC-1R	-	12	2,1	Art. 4.3	Art. 4.3	49
YCVS 10-44GSHC-1R	YCVSH10-44GSHC-1R	1/2	-	2,1	Art. 4.3	Art. 4.3	49
YCVS 13-55GSHC-1R	YCVSH 13-55GSHC-1R	5/8	16	3,9	Art. 4.3	Art. 4.3	49
YCVS 17-55GSHC-1R	YCVSH 17-55GSHC-1R	-	18	5,5	Art. 4.3	Art. 4.3	49
YCVS 17-66GSHC-1R	YCVSH 17-66GSHC-1R	3/4	-	5,5	Art. 4.3	Art. 4.3	49
YCVS 17-77GSHC-1R	YCVSH 17-77GSHC-1R	7/8	22	5,5	Art. 4.3	Art. 4.3	49

Note: Medium temperature TS min./max.: -50° C / +150° C

Check Valve (YCVS-R) – Product Range



CHECK VALVE – **YCVS-R** SERIES STANDARD PRODUCT - PISTON TYPE SERIES ANGLEWAY VERSION

Models with Standard Spring [Min.OPD=10bar]	Models with Reinforced Spring [Min.OPD=30bar]	Connection Size [INCH]	Connection Size [mm]	Kv (m3/h)	PED Category Fluid Group 1	PED Category Fluid Group 2	MOP (bar)
YCVS 20-77GSHC-1R	YCVSH 20-77GSHC-1R	7/8	22	13,2	Art. 4.3	Art. 4.3	49
YCVS 26-88GSHC-1R	YCVSH 26-88GSHC-1R	-	28	19,0	Cat. II	Art. 4.3	49
YCVS 26-99GSHC-1R	YCVSH 26-99GSHC-1R	1 1/8	-	19,0	Cat. II	Art. 4.3	49
YCVS 31-BBGSHC-1R	YCVSH 31-BBGSHC-1R	1 3/8	35	29,1	Cat. II	Art. 4.3	49
YCVS 31-DDGSHC-1R	YCVSH 31-DDGSHC-1R	1 5/8	-	29,1	Cat. II	Art. 4.3	49
YCVS 31-DDGSHC-2R	YCVSH 31-DDGSHC-2R	-	42	29,1	Cat. II	Art. 4.3	49

Note: Medium temperature TS min./max.: -50° C / +150° C

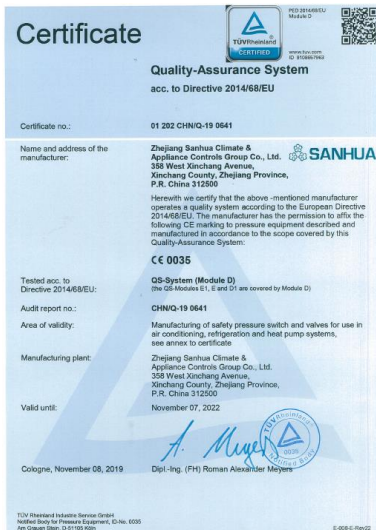
Check Valve – Product Range



CHECK VALVE – YCVS-R SERIES

MODELS WITH PED CAT.II CERTIFICATION (Fluid Group 1)

Models with Standard Spring [Min.OPD=10bar]	Models with Reinforced Spring [Min.OPD=30bar]	Connection Size [INCH]	Connection Size [mm]	Kv (m3/h)	PED Category Fluid Group 1	PED Category Fluid Group 2	MOP (bar)
YCVS 26-88GSHC-1R	YCVSH 26-88GSHC-1R	-	28	19,0	Cat. II	Art. 4.3	49
YCVS 26-99GSHC-1R	YCVSH 26-99GSHC-1R	1 1/8	-	19,0	Cat. II	Art. 4.3	49
YCVS 31-BBGSHC-1R	YCVSH 31-BBGSHC-1R	1 3/8	35	29,1	Cat. II	Art. 4.3	49
YCVS 31-DDGSHC-1R	YCVSH 31-DDGSHC-1R	1 5/8	-	29,1	Cat. II	Art. 4.3	49
YCVS 31-DDGSHC-2R	YCVSH 31-DDGSHC-2R	-	42	29,1	Cat. II	Art. 4.3	49



All the YCVS-R models with DN > 25mm are in CATEGORY II for Fluid Group 1 according to 2014/68/EU (PED directive).

Sanhua can provide a well recognized Notify Body certification for Cat.II according to PED directive

Check Valve (CCV) – Overview



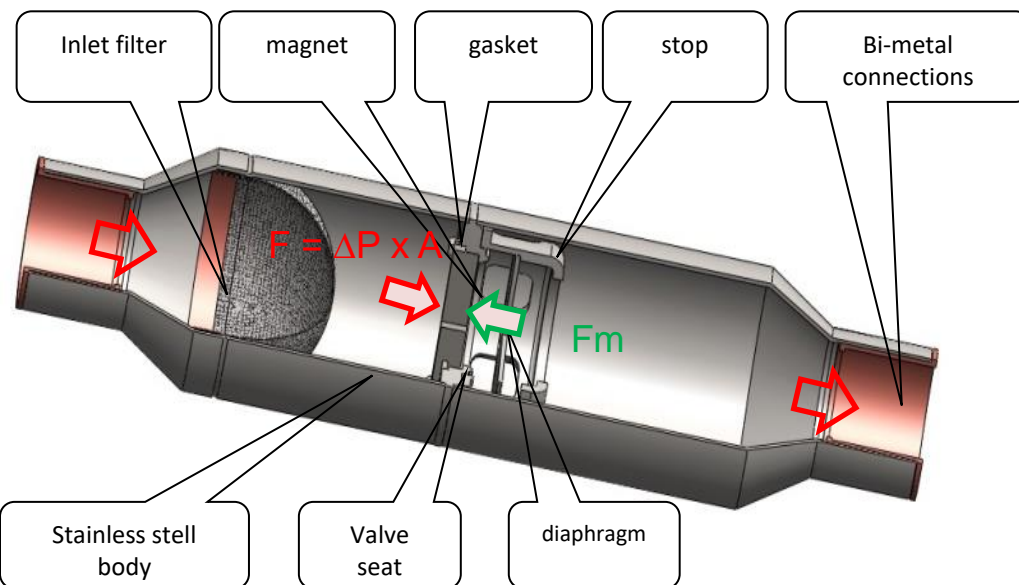
OVERVIEW

CCV - MAGNETIC TYPE SERIES

1. Check valves with magnetic internal element can be used in A/C and Refrigeration systems.
2. The robust design (coming from Oil & Gas applications) guarantees very high performances and reliability
3. The product simplicity permits wide operation limits (PS 49bar, TS: -40/+160° C)
4. The advanced technical features allow the safe use of CCV valves in the Discharge line of R32 systems



OPERATING PRINCIPLE CCV - MAGNETIC TYPE SERIES



Check Valve is opened when:

$$\Delta P > \text{Min. OPD} = F_{\text{magnetic}} / \text{Area}$$

($\Delta P = \text{Inlet Pressure} - \text{Outlet Pressure}$)

1. Considering the indicated flow direction, when the pressure difference ΔP is $>$ of Minimum Opening Pressure Difference the refrigerant flow can pass through the valve
2. The internal element (magnet) is kept in the closure position thanks to the magnetic force; when the ΔP is sufficient, moving the magnet close to the stop ring; this action permits the flow passage.
3. If the ΔP is lower than Min.OPD value, the magnetic force move the magnet in the valve seat closing it.

Check Valve (CCV) – Product Range



CHECK VALVE – **CCV** SERIES

STANDARD PRODUCT - MAGNETIC TYPE SERIES with PS=49bar

STRAIGHTWAY VERSION with TS [-40 / +160 ° C]

Models [Min.OPD=5bar]	Connection Size [INCH]	Material of the Body	Kv (m3/h)	PED Category Fluid Group 1	PED Category Fluid Group 2	MOP (bar)
CCV10-021	1/4	COPPER	0,8	Art. 4.3	Art. 4.3	49
CCV10-019	3/8	COPPER	1,2	Art. 4.3	Art. 4.3	49
CCV17-001	1/2	COPPER	2,7	Cat. II	Art. 4.3	49
CCV17-017	5/8	COPPER	2,9	Cat. II	Art. 4.3	49
CCV17-018	3/4	COPPER	2,9	Cat. II	Art. 4.3	49
CCV25-020	7/8	STAINLESS S.	6,5	Cat. II	Cat. I	49
CCV32-001	1 1/8	STAINLESS S.	11,4	Cat. II	Cat. I	49
CCV38-001	1 3/8	STAINLESS S.	16,2	Cat. II	Cat. I	49
CCV50-001*	1 5/8	STAINLESS S.	24,0	N.A.	Cat. I	49

All the CCV models in PED category II, are covered by **a notified body certification**, so they can be used with flammable refrigerants (Fluids Group 1), included R32.

The Maximum allowed temperature is +160 ° C so CCV valves are **suggested for installation on the discharge line in R32 systems without liquid injection**

** Note: model CCV50-001 is not covered by PED cat.II certification*



CCV – MAIN FEATURES & ADVANTAGES

KEY FEATURES

1. High value of Max. Operating Pressure for all the range
2. Huge Ref. Temperature Range (from -40° C to $+160^{\circ}$ C)
3. Straight Design, compact, light, and without installation position limitation
4. Check Valve with a Strainer built in: Increase reliability
5. Robust: it can be installed in system with pressure pulses without risk to destroy the spring
6. From size CCV25 with S.S. body: for a higher corrosion resistance
7. Suitable for usage with flammable refrigerants included R32 (PED cat.II certification)
8. Huge range with models from 1/4" to 1" 5/8 (ODF connections)

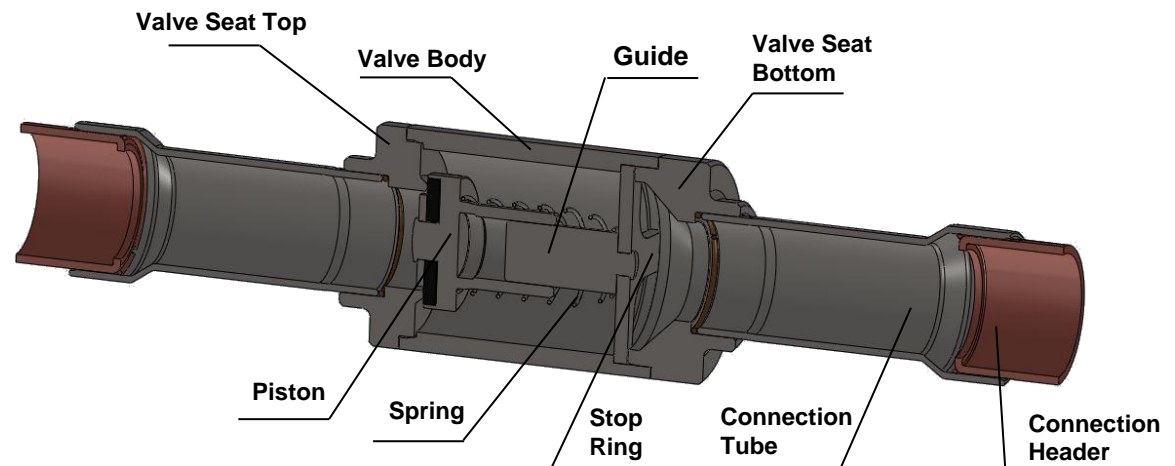
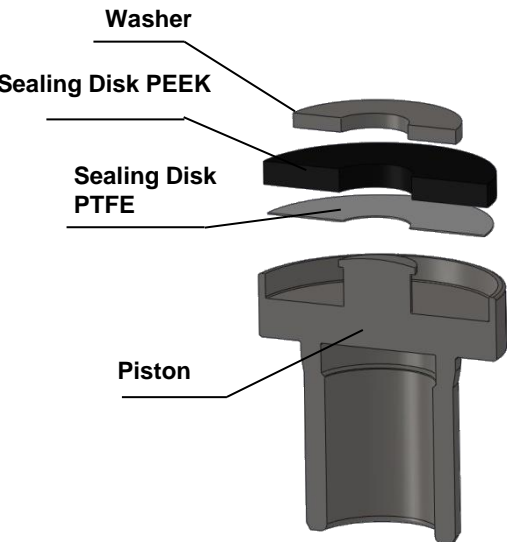
Check Valve (BCV) – Overview



OVERVIEW

BCV - PISTON TYPE SERIES FOR R744

1. BCVs are available on 2 sizes BCV08 and BCV13, with connections size 3/8", 1/2", 5/8"
2. All the BCV models (with exception of BCV08-005) have PS 140bar suitable for Trans Critical R744 systems
3. Model BCV08-005 is a low leakage rate valve with soft sealing. PS is limited to 90bar



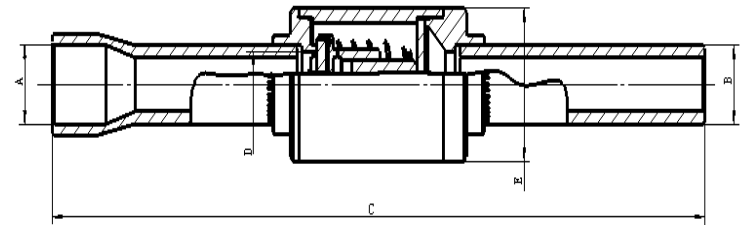
Note: 3D pictures referred to size BCV013
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Check Valve (BCV) – Product Range

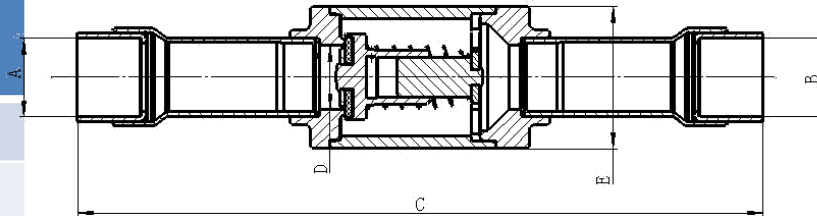


CHECK VALVE – BCV SERIES STANDARD PRODUCT - MAGNETIC TYPE SERIES for R744

Models [Min.OPD=0.4bar]	Connection Size [INCH]	Kv (m3/h)	PED Category Fluid Group 2	MOP (bar)
BCV08-005	3/8	0,9	Art. 4.3	90
BCV08-001	3/8	0,9	Art. 4.3	140



Models [Min.OPD=0.4bar]	Connection Size [INCH]	Kv (m3/h)	PED Category Fluid Group 2	MOP (bar)
BCV13-002	1/2	2,9	Art. 4.3	140
BCV13-001	5/8	3,3	Art. 4.3	140
BCV17-001	7/8	5,1	Art. 4.3	140

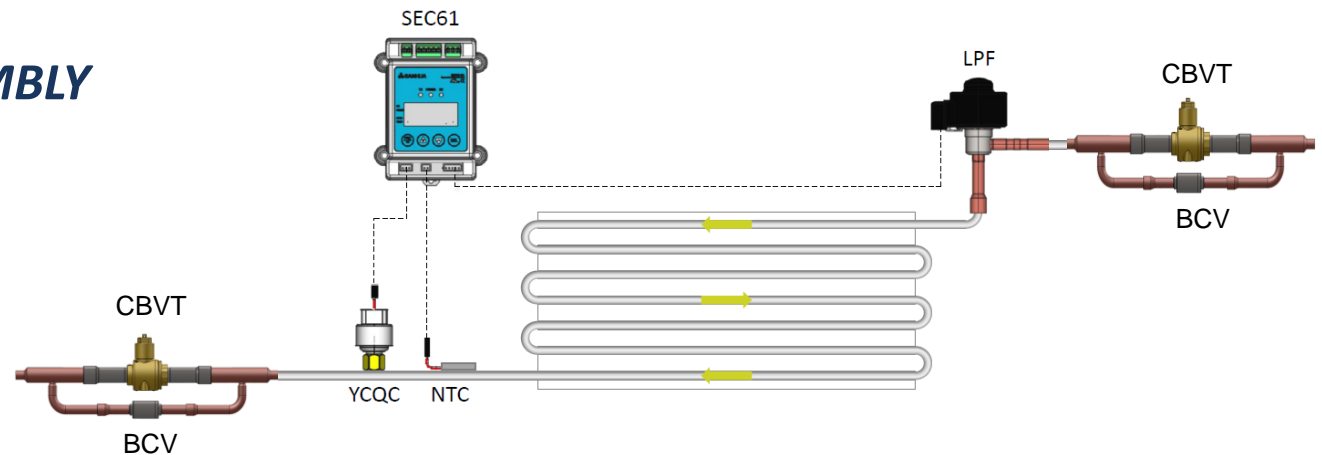


Note: BCV08 Piping : copper ; BCV13 Piping : Stainless Steel with internal copper layer ; TS range: -50 ° C / +140 ° C

Check Valve (BCV) – Overview

APPLICATION

BCV on a SUB-ASSEMBLY



BCV08-005 model is used in the GWZJ-66 sub-assemblies together with CBVT ball valves.

The low leakage rate of the BCV valves allows to install the 2 subassemblies before and after the evaporator; during the service operation of the evaporator, the low internal leakage rate of CBVT and BCV valves guarantee no refrigerant leakage to the atmosphere



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