

# Solenoid Valves - Operating Principles

## General Features

Parker Refrigeration Solenoid Valves are designed for typical liquid line, suction line, discharge line and hot gas valve applications and are compatible with virtually all of today's CFC, HFC and HCFC refrigerants and blends. These valves are not designed for ammonia applications.

The already wide range of Refrigeration Solenoid Valves is completed by models for Refrigerated Water, Secondary Refrigerants and the outstanding Pulse Modulating Valves for the electronic metering of refrigerants when interfaced with microcomputers and appropriate sensors.

## Material Specification

Valve Body :	Forged brass (OT-58)
Connections:	Solid drawn copper for ODF or ODM models
Sealing:	Teflon (T), Rulon (L), Ruby (R) For Refrigerated Water and Secondary Refrigerants the sealing material is NBR (N), and Fluoroelastomer, respectively.
Enclosing Tube:	AISI 304 Stainless Steel
Plungers : (moveable & pole face):	AISI 430F Stainless Steel (17% Cr)
Springs:	AISI 302 Stainless Steel
Shading Ring:	Copper (99.9% Cu)
Brazing Paste:	Silver Alloy (56% Ag).

## Types Available

Type	Function	Operation	sizes
<b>Models for CFC-HFC, HCFC and Blend Refrigerants</b>			
2/2	N.C.	Direct	6mm ODM and ODF (Hermetic Construction)
2/2	N.C./ N.O.	Direct	1/4", 3/8" SAE, 6mm, 1/4", 3/8" ODF
2/2	N.C / N.O.	Pilot	3/8" - 1/2" - 5/8" - 3/4" SAE
2/2	N.C.	Pilot	10, 12, 16, 18, 22, 28mm
2/2	N.C./ N.O.	Pilot	3/8"- 1/2"- 5/8"- 3/4",-7/8", 1.1/8",- 1.3/8",- 1.5/8",- 2.1/8" ODF
3/2	Diverting Valve	Piston	1.1/8",- 1.3/8 ODF (for hot gas defrost / Evap. Line)
<b>Models for Refrigerated Water</b>			
2/2	N.C.	Pilot	3/8" to 3" BSPP
<b>Models for Secondary Refrigerants</b>			
2/2	N.C.	Hung-Pilot	5/8", -7/8", -1.1/8", -1.3/8", -1.5/8", -2.1/8" ODF
<b>Models for Pulse Width Modulating</b>			
2/2	Std Angle Pattern		3/8" ODM x 3/8"ODM and 3/8"ODM x 3/8" ODF

## Installation

Proper flow direction is indicated by an arrow on the valve body. The ideal installation is in a horizontal live with the coil located directly on top of the valve. However, Parker-SCEM Solenoid Valves may be installed in any position as long as the coil assembly is never lower than the centerline of the valve body. This is to prevent any foreign matter collecting in the armature tube.

# Series 117

## 2/2 way - Normally Closed - Direct Operating 6mm ODM Fittings



### General Description :

Parker series **117** solenoid valves are direct operated and do not require a minimum differential pressure to operate. They may be used with all types of **CFC, HCFC** and **HFC** refrigerants currently available on the market and with blends; however they cannot be used with ammonia. Series **117** valves are **normally closed** and available with extended end ODM and ODF copper solder fittings (in millimetres). Series **117** valves are hermetic.

### Temperatures :

Media temperature range is :

maximum **+115°C**

minimum **-40°C**

The maximum ambient temperature is :

**+80°C**

### Coils :

For the series **117** valves class "**F**" coils (**155°C**) are available encapsulated in thermoplastic containing 30% glass fibre (types RT, YB). All coils are for continuous service, 100% E.D. The rated voltage tolerance is **+/- 10% for A.C.** power supply. Series **117** valves can be used on direct current (Consult Factory) . The "RT" and "YB" coils can be used on a.c. with frequency 50/60 Hz (dual frequency). The "RT" coil has faston terminals for three-pole **DIN 43650A** connector with protection to IP65. The "Y" coil has terminals with 2 x 1,000mm cables with protection to **IP67**.

It is also available in a watertight version for applications where the humidity conditions are particularly critical (type "YE").

### Materials

<b>Valve body :</b>	OT58 UNI 5705 brass forging
<b>Seals :</b>	Rulon®
<b>Enclosing tube :</b>	AISI 304 Stainless steel
<b>Plunger :</b>	AISI 430 Stainless steel
<b>Spring :</b>	AISI 302 Stainless steel
<b>Shading ring :</b>	Copper

<b>Electrical Features :</b>			
Coil Type [ ]		Power [w]	Insulation Class
A.C. (~)	D.C. (=)		
RT14	-	14	F
YB14	-	14	F

### Specification

Fittings Ø ODM	Valve Type	Nominal Orifice Ø	Flow Coefficient Kv	Minimum pressure	Max. Differential pressure (M.O.P.D.)		Coil Type	Weig ht	Notes
					in A.C.(~) [bar]	in D.C.(=) [bar]			
[mm]		[mm]	[m3/h]	[bar]			[ ]	[kg]	
6	117 ALS	2,0	0,12	0	30 <sup>(2)</sup>	-	RT14 - YB14	0,20	1 - 3
6	117 CLS	2,5	0,15	0	28 <sup>(3)</sup>	-	RT14 - YB14	0,20	1 - 3

**Note:** 1) Safe working pressure : 35 bar (SWP)

2) MOPD figures relate to 50Hz with 60Hz MOPD reduce by 10%

3) MOPD figures relate to 50Hz with 60Hz MOPD reduce by 30%

## Application

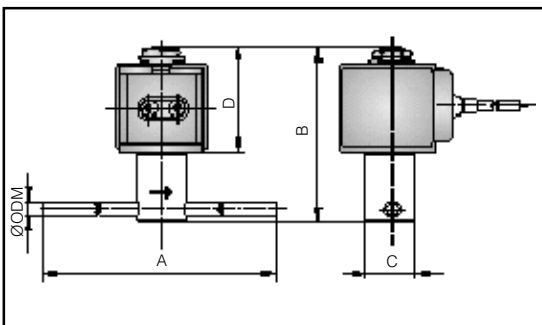
Series **117** valves are ideal for automatic control of refrigerants in applications where low flow rates are required. Some typical application examples are :-

- Ice-makers
- Crushed Ice-makers
- Cold drink dispensers
- Freezers

## Installation

The valves can be mounted in any position without jeopardising their operation. It is however advisable to install them with the coil in a vertical position above the body.

## Dimensions



Fittings Ø ODH	A	B	C	D
[ mm ]	[ mm ]	[ mm ]	[ mm ]	[ mm ]
6	175	64	18	37,5

## Order Code

<b>VE</b>	<b>117</b>		<b>L</b>	<b>S</b>			<b>[V]</b>	<b>[Hz]/d.c</b>			
Complete Valve	Series	Orifice / Fitting	Seal	Connection	Coil Type		24 V	115 V	220-230	12 V	24 V
		<b>A</b> 2.0 / 6mm	<b>L</b> Rulon	<b>S</b> Solder			50/60Hz	50/60Hz	50/60	DC	DC
		<b>C</b> 2.5 / 6mm			<b>RT 14</b>		○	○	○		
					<b>YB 14</b>		○	○	○		

**Note:** Valve supplied with coil in multipack  
Connectors to be ordered separately

# Series 127

## 2/2 way - Normally Closed - Direct Operating 6mm ODM / 6mm ODF Fittings



### General Description :

Parker series **127** solenoid valves are direct operated and do not require a minimum differential pressure to operate. They may be used with all types of **CFC**, **HCFC** and **HFC** refrigerants currently available on the market and with blends; however they cannot be used with ammonia. Series **127** valves are **normally closed** and available with extended end ODM and ODF copper solder fittings (in millimetres). Series **127** valves are hermetic.

### Temperatures :

Media temperature range is :

maximum	<b>+115°C</b>
minimum	<b>-40°C</b>

The maximum ambient temperature is :  
**+80°C**

### Coils :

For the series **127** valves class "**F**" coils (**155°C**) are available encapsulated in thermoplastic containing 30% glass fibre (types RT, YB). All coils are for continuous service, 100% E.D. The rated voltage tolerance is **+/- 10% for A.C.** power supply. Series **127** valves can be used on direct current (Consult Factory) . The "RT" and "YB" coils can be used on a.c. with frequency 50/60 Hz (dual frequency). The "RT" coil has faston terminals for three-pole **DIN 43650A** connector with protection to IP65. The "Y" coil has terminals with 2 x 1,000mm cables with protection to **IP67**. It is also available in a watertight version for applications where the humidity conditions are particularly critical (type "YE09").

### Materials

<b>Valve body :</b>	OT58 UNI 5705 brass forging
<b>Seals :</b>	Rulon
<b>Enclosing tube :</b>	AISI 304 Stainless steel
<b>Plunger :</b>	AISI 430 Stainless steel
<b>Spring :</b>	AISI 302 Stainless steel
<b>Shading ring :</b>	Copper

<b>Electrical Features :</b>			
Coil Type [ ]		Power [w]	Insulation Class
A.C. (~)	D.C. (=)		
RT14	-	14	F
YB14	-	14	F

### Specification

Fittings Ø ODM ODF	Valve Type	Nominal Orifice Ø	Flow Coefficient Kv	Minimum pressure	Max. Differential pressure (M.O.P.D.)		Coil Type	Weight	Notes
					in A.C.(~) [bar]	in D.C.(=) [bar]			
[mm]		[mm]	[m3/h]	[bar]			[ ]	[kg]	
6 ODM	127 ILS	1,6	0,10	0	30	-	RT14 - YB14	0,24	1 - 3
6 ODM	127 ALS	1,9	0,13	0	30 <sup>(2)</sup>	-	RT14 - YB14	0,24	1 - 3
6 ODM	127 CLS	2,5	0,19	0	28 <sup>(3)</sup>	-	RT14 - YB14	0,24	1 - 3
6 ODF	127.2 ILS	1,6	0,10	0	30	-	RT14 - YB14	0,24	1 - 3
6 ODF	127.2 ALS	1,9	0,13	0	30 <sup>(2)</sup>	-	RT14 - YB14	0,24	1 - 3
6 ODF	127.2 CLS	2,5	0,19	0	28 <sup>(3)</sup>	-	RT14 - YB14	0,24	1 - 3

- Note:** 1) Safe working pressure : 35 bar (SWP)  
 2) MOPD figures relate to 50Hz with 60Hz MOPD reduce by 10%  
 3) MOPD figures relate to 50Hz with 60Hz MOPD reduce by 30%

## Application

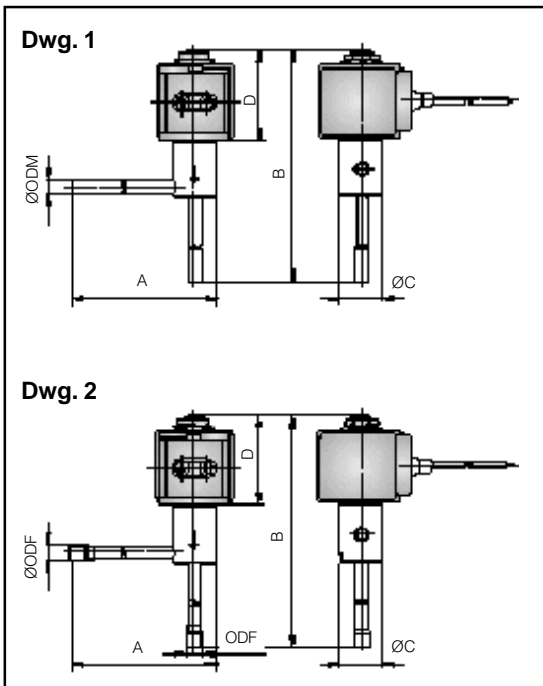
Series **127** valves are ideal for automatic control of refrigerants in applications where low flow rates are required. Some typical application examples are :-

- Ice-makers
- Cold drink dispensers
- Air conditioners

## Installation

The valves can be mounted in any position without jeopardising their operation. It is however advisable to install them with the coil in a vertical position above the body.

## Dimensions



Fittings Ø	A	B	C	D
ODM	[ mm ]	[ mm ]	[ mm ]	[ mm ]
6 ODM	96,5	142,0	18	37,5
6 ODF*	93,0	136,5	18	37,5

\* Dwg. 2

## Order Code

<b>VE</b>	<b>127</b>			<b>L</b>	<b>S</b>			<b>[V]</b>	<b>[Hz]/d.c</b>		
Complete Valve	Series	Fitting		Seal	Connection	Coil	24 V	115 V	220-230	12 V	24 V
		- ODM		<b>L</b> Rulon	<b>S</b> Solder	TYpe	50/60Hz	50/60Hz	50/60	DC	DC
		.2 ODF				<b>RT</b> <b>14</b>	○	○	○		
			Orifice / Fitting			<b>YB</b> <b>14</b>	○	○	○		
			<b>I</b> 1.6 / 6mm								
			<b>A</b> 31.9 / 6mm								
			<b>B</b> 2.5 / 6mm								

**Note:** Valve supplied with coil in multipack  
Connectors to be ordered separately

**Example:** VE 127 ALS RT14 220-230V 50/60Hz (ODM Version)  
VE 127 .2ALS RT14 220-230V 50/60Hz(ODF Version)

# Series 112

## 2/2 way - Normally Closed - Direct Operating 1/4" - 3/8" SAE, 6mm ODF, 1/4" - 3/8" ODF Fittings



### General Description :

Parker series **112** solenoid valves are direct operated and do not require a minimum differential pressure to operate. They may be used with all types of **CFC**, **HCFC** and **HFC** refrigerants currently available on the market and with blends; however they cannot be used with ammonia. Series **112** valves are **normally closed** and available with SAE flare fittings or extended end ODF copper solder fittings (in millimetres and inches).

### Temperatures :

Media temperature range is :

maximum **+105°C**

minimum **-40°C**

The maximum ambient temperature is :

**+80°C**

### Coils :

For the series **112** valves class **"F"** coils (**155°C**) are available encapsulated in thermoplastic containing 30% glass fibre (types RT, YB, CD). All coils are for continuous service, 100% E.D. The rated voltage tolerance is **+/- 10% for A.C.** power supply. The "RT" and "YB" coils can be used on a.c. with frequency 50/60 Hz (dual frequency) and the CD coil on D.C. The "RT" and CD coils have faston terminals for three-pole **DIN 43650A** connector with protection to IP65. The "Y" coil has terminals with 2 x 1,000mm cables with protection to **IP67**.

It is also available in a watertight version for applications where the humidity conditions are particularly critical (type "YE").

### Materials

<b>Valve body :</b>	OT58 UNI 5705 brass forging
<b>Seals :</b>	Rulon
<b>Enclosing tube :</b>	AISI 304 Stainless steel
<b>Plunger :</b>	AISI 430F Stainless steel
<b>Spring :</b>	AISI 302 Stainless steel
<b>Shading ring :</b>	Copper

<b>Electrical Features :</b>			
Coil Type [ ]		Power [w]	Insulation Class
A.C. (~)	D.C. (=)		
RT14	-	14	F
YB14	-	14	F
-	CD21	21	F

### Specification

Fittings O SAE ODF	Valve Type	Nominal Orifice O	Flow Coefficient Kv	Minimum pressure	Max. Differential pressure (M.O.P.D.)		Coil Type		Weight	Notes
					in A.C.(~) [bar]	in D.C.(=) [bar]	A.C.	D.C		
["] *[mm]		[mm]	[m3/h]	[bar]					[kg]	
1/4 SAE	112 IL	2,5	0,185	0	30 <sup>(2)</sup>	21	RT14-YB14	CD21 (4)	0,30	1 - 3
6 ODF*	112.2 ILS	2,5	0,185	0	30 <sup>(2)</sup>	21	RT14-YB14	CD21 (4)	0,32	1 - 3
1/4 ODF	112.2 ILSP	2,5	0,185	0	30 <sup>(2)</sup>	21	RT14-YB14	CD21 (4)	0,32	1 - 3
3/8 SAE	112 AL	3,0	0,270	0	21 <sup>(3)</sup>	15	RT14-YB14	CD21 (4)	0,30	1 - 3
6 ODF*	112.2 ALS	3,0	0,270	0	21 <sup>(3)</sup>	15	RT14-YB14	CD21 (4)	0,32	1 - 3
1/4 ODF	112.2 ALSP	3,0	0,270	0	21 <sup>(3)</sup>	15	RT14-YB14	CD21 (4)	0,32	1 - 3
3/8 ODF	112.2 BLSP	3,0	0,270	0	21 <sup>(3)</sup>	15	RT14-YB14	CD21 (4)	0,32	1 - 3

- Note:** 1) Safe working pressure : 35 bar (SWP)  
 2) MOPD figures relate to 50Hz with 60Hz MOPD reduce by 30%  
 3) MOPD figures relate to 50Hz with 60Hz MOPD reduce by 15%  
 4) For the CD21 coil a special "Adaptor" is needed.

## Application

Series **112** valves are ideal for automatic control of refrigerants in liquid, suction and discharge lines.  
Some typical application examples are :-

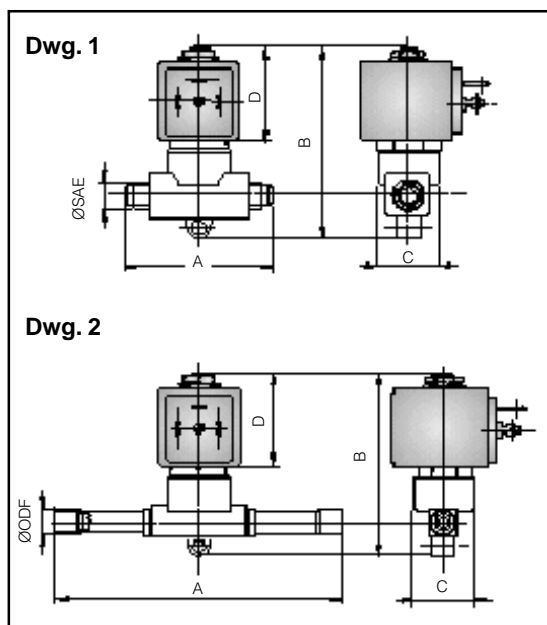
- Industrial Refrigerators
- Refrigerated glass display cases
- Cold Rooms
- Ice-cream machines
- Refrigerated counters
- Air Conditioners
- Dry-cleaning machines
- Refrigerant recovery units

## Installation

The valves can be mounted in any position without jeopardising their operation. It is however advisable to install them with the coil in a vertical position above the body.

The valve body has one mounting hole with a diameter of 5.1 mm.

## Dimensions



Fittings Ø SAE ODF	A	B		C	D	
		A.C Coil	D.C.coil		A.C Coil	D.C.coil
[ " ]	[ mm ]	[ mm ]		[ mm ]	[ mm ]	
		A.C Coil	D.C.coil		A.C Coil	D.C.coil
1/4" SAE	61	81,3	95	26	41,3	55
3/8" SAE	62	81,3	95	26	41,3	55
6mm ODF*	102	79,8	93,5	26	41,3	55
1/4" ODF*	102	79,8	93,5	26	41,3	55
3/8" ODF*	101	79,8	93,5	26	41,3	55

\* Dwg. 2

## Order Code

<b>VE</b>	<b>112</b>			<b>L</b>	<b>S</b>			<b>[V]</b>	<b>[Hz]/d.c</b>		
Complete Valve	Series	Fitting		Seal	Connection	Coil Type	24 V	115 V	220-230	12 V	24 V
		- SAE		L Rulon	- Flare	50/60Hz	50/60Hz	50/60	DC	DC	
		.2 ODF			S Solder	50/60					
					SP Solder (in ")						
		Orifice / Fitting				<b>RT 14</b>	○	○	○		
		I 2.5 / 1/4" (S=6mm)				<b>YB 14</b>	○	○	○		
		A 3.0 / 3/8" (S=6mm)				<b>CD 21</b>				○	○
		B 3.0 / 3/8"									

**Note:** Valve supplied with coil in multipack  
Connectors to be ordered separately

**Example:** VE 112 IL RT14 220-230V 50/60Hz SAE 1/4"  
VE 112.2 ILS RT14 220-230V 50/60Hz ODF 6mm  
VE 112.2 ILSP RT14 220-230V 50/60Hz ODF 1/4"

# Series 115

## 2/2 way - Normally Closed - Diaphragm Pilot Operated 3/8" SAE, 10mm ODF, 3/8" ODF Fittings



### General Description :

Parker series **115** solenoid valves are diaphragm pilot operated and require a minimum differential pressure to operate. They may be used with all types of **CFC**, **HCFC** and **HFC** refrigerants currently available on the market and with blends; however they cannot be used with ammonia. Series **115** valves are **normally closed** and available with SAE flare fittings or extended end ODF copper solder fittings (in millimetres and inches).

### Temperatures :

Media temperature range is :

maximum **+105°C**  
minimum **-40°C**

The maximum ambient temperature is :

**+80°C**

### Coils :

For the series **115** valves class **"F"** coils (**155°C**) are available encapsulated in thermoplastic containing 30% glass fibre (types RT, YB, CD). All coils are for continuous service, 100% E.D. The rated voltage tolerance is **+/- 10% for A.C.** power supply. The "RT" and "YB" coils can be used on a.c. with frequency 50/60 Hz (dual frequency) and the CD coil on d.c. The "RT" and CD coils have faston terminals for three-pole **DIN 43650A** connector with protection to IP65.

The "Y" coil has terminals with 2 x 1,000mm cables with protection to **IP67**.

It is also available in a watertight version for applications where the humidity conditions are particularly critical (type "YE09").

## Materials

<b>Valve body :</b>	OT58 UNI 5705 brass forging
<b>Seals :</b>	Rulon - PTFE (diaphragm)
<b>Enclosing tube :</b>	AISI 304 Stainless steel
<b>Plunger :</b>	AISI 430F Stainless steel
<b>Spring :</b>	AISI 302 Stainless steel
<b>Shading ring :</b>	Copper

<b>Electrical Features :</b>			
Coil Type [ ]		Power [w]	Insulation Class
A.C. (~)	D.C. (=)		
RT14	-	14	F
YB14	-	14	F
-	CD21	21	F

## Specification

Fittings Ø SAE ODF	Valve Type	Nominal Orifice Ø	Flow Coefficient Kv	Minimum pressure	Max. Differential pressure (M.O.P.D.)		Coil Type		Weight	Notes
					in A.C.(~) [bar]	in D.C.(=) [bar]	A.C.	D.C.		
["] *[mm]		[mm]	[m3/h]	[bar]					[kg]	
3/8" SAE	115 IL	6,5	0,800	0,1	30 <sup>(2)</sup>	21	RT14-YB14	CD21 (3)	0,33	1 - 2
10 ODF*	115.2 ILS	6,5	0,800	0,1	30 <sup>(2)</sup>	21	RT14-YB14	CD21 (3)	0,33	1 - 2
3/8" ODF	115.2 ILSP	6,5	0,800	0,1	30 <sup>(2)</sup>	21	RT14-YB14	CD21 (3)	0,33	1 - 2

- Note:** 1) Safe working pressure : 35 bar (SWP)  
2) MOPD figures relate to 50Hz with 60Hz MOPD reduce by 30%  
3) For the CD21 coil a special "Adaptor" is needed.

## Application

Series **115** valves are ideal for automatic control of refrigerants in typical applications on the liquid line, suction and discharge. Some typical application examples are :-

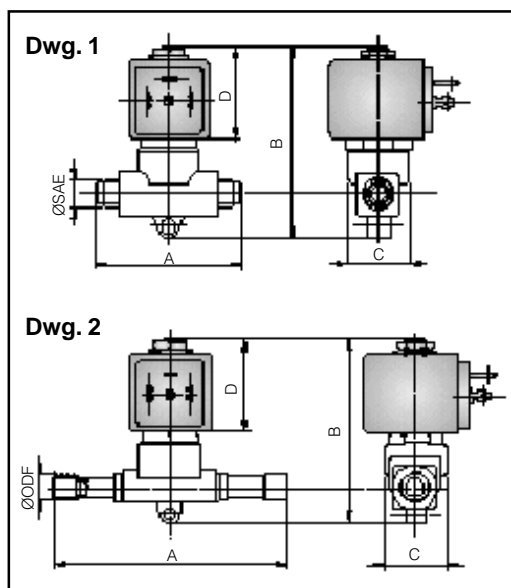
- Refrigerated Cases
- Freezing and preserving tunnels
- Air refrigerators
- Refrigerated tables
- Heat pumps
- Refrigerated vehicles
- Hot gas defrost

## Installation

The valves can be mounted in any position without jeopardising their operation. It is however advisable to install them with the coil in a vertical position above the body.

The valve body has one mounting hole with a diameter of 5.1 mm.

## Dimensions



Fittings Ø SAE ODF	A [ mm ]	B [ mm ]		C [ mm ]	D [ mm ]	
		A.C Coil	D.C.coil		A.C Coil	D.C.coil
3/8" SAE	68	85,8	99,5	30	41,3	55
10mm ODF*	106	85,8	99,5	30	41,3	55
3/8" ODF*	106	85,8	99,5	30	41,3	55

\* Dwg. 2

## Order Code

<b>PM</b>	<b>115</b>			<b>L</b>	<b>S</b>			<b>[V]</b>	<b>[Hz]/d.c</b>		
Valve Body	Series	Fitting		Seal	Connection	Coil Type	24 V 50/60Hz	115 V 50/60Hz	220-230 50/60	12 V DC	24 V DC
		- SAE .2 ODF		<b>L</b> Rulon	- Flare <b>S</b> Solder <b>SP</b> Solder(in ")	<b>RT 14</b>	○	○	○		
						<b>YB 14</b>	○	○	○		
						<b>CD 21</b>				○	○
			Orifice / Fitting								
			<b>I</b> 6.5 / 3/8" (S=10mm)								

**Note:** Valve supplied with coil in multipack  
Connectors to be ordered separately

**Example:** VE 115 IL RT14 220-230V 50/60Hz SAE 3/8"  
VE 115.2 ILS RT14 220-230V 50/60Hz ODF 10mm  
VE 115.2 ILSP RT14 220-230V 50/60Hz ODF 3/8"

# Series 142

## 2/2 way - Normally Closed - Direct Operating 1/4" - 3/8" SAE, 6mm ODF, 1/4" ODF Fittings



### General Description :

Parker series **142** solenoid valves are direct operated and do not require a minimum differential pressure to operate. They may be used with all types of **CFC, HCFC** and **HFC** refrigerants currently available on the market and with blends; however they cannot be used with ammonia. Series **142** valves are **normally closed** and available with SAE flare fittings or extended end ODF copper solder fittings (in millimetres and in Inches).

### Temperatures :

Media temperature range is :

maximum **+115°C**  
minimum **-40°C**

for valves with a neoprene seat the media temperature range is:

maximum **+90°C**  
minimum **-30°C**

The maximum ambient temperature is :  
**+80°C**

### Coils :

For the series **142** valves class **"F"** coils (**155°C**) are available encapsulated in thermoplastic containing 30% glass fibre (types RT, YB, CD). All coils are for continuous service, 100% E.D. The rated voltage tolerance is **+/- 10% for A.C.** power supply. The "RT" and "YB" coils can be used on a.c. with frequency 50/60 Hz (dual frequency) and the CD coil on d.c. The "RT" and CD coils have faston terminals for three-pole **DIN 43650A** connector with protection to IP65.

The "Y" coil has terminals with 2 x 1,000mm cables with protection to **IP67**.

It is also available in a watertight version for applications where the humidity conditions are particularly critical (type "YE09").

### Materials

<b>Valve body :</b>	OT58 UNI 5705 brass forging
<b>Seals :</b>	Ruby - Neoprene
<b>Enclosing tube :</b>	AISI 304 Stainless steel
<b>Plunger :</b>	AISI 430F Stainless steel
<b>Spring :</b>	AISI 302 Stainless steel
<b>Shading ring :</b>	Copper

<b>Electrical Features :</b>			
Coil Type [ ]		Power [w]	Insulation Class
A.C. (~)	D.C. (=)		
RT14	-	14	F
YB14	-	14	F
-	CD21	21	F

### Specification

Fittings Ø SAE ODF	Valve Type	Nominal Orifice Ø	Flow Coefficient Kv	Minimum pressure	Max. Differential pressure (M.O.P.D.)		Coil Type		Weight	Notes
					in A.C.(~) [bar]	in D.C.(=) [bar]	A.C.	D.C.		
["] *[mm]		[mm]	[m3/h]	[bar]					[kg]	
1/4 SAE	142 IR	2,5	0,185	0	30	21	RT14-YB14	CD21 (4)	0,34	1 - 3
1/4 SAE	142 BR	3,0	0,270	0	30	21	RT14-YB14	CD21 (4)	0,34	1 - 3
3/8 SAE	142 AR	3,0	0,270	0	30	21	RT14-YB14	CD21 (4)	0,35	1 - 3
6 ODF*	142.2 IRS	2,5	0,185	0	30	21	RT14-YB14	CD21 (4)	0,35	1 - 3
6 ODF*	142.2 ARS	3,0	0,270	0	30	21	RT14-YB14	CD21 (4)	0,35	1 - 3
1/4 ODF	142.2 IRSP	2,5	0,185	0	30	21	RT14-YB14	CD21 (4)	0,35	1 - 3
1/4 ODF	142.2 ARSP	3,0	0,27	0	30	21	RT14-YB14	CD21 (4)	0,35	1 - 3
1/4 SAE	142 IF	2,5	0,185	0	29 <sup>(2)</sup>	-	RT14-YB14	-	0,35	1 - 3
3/8 SAE	142 AF	3,0	0,27	0	24 <sup>(3)</sup>	-	RT14-YB14	-	0,35	1 - 3

**Note:** 1) Safe working pressure : 35 bar (SWP)

2) MOPD figures relate to 50Hz with 60Hz MOPD reduce by 15%

3) MOPD figures relate to 50Hz with 60Hz MOPD reduce by 20%

4) For the CD21 coil a special "Adaptor" is needed.

## Application

Series **142** valves are ideal for automatic control of refrigerants in liquid, suction and discharge lines.  
Some typical application examples are :-

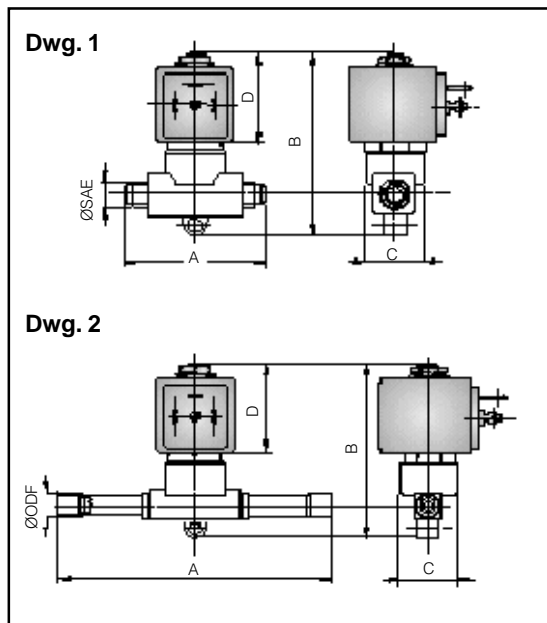
- Condensing units
- Display cases for ice-cream
- Refrigerant recovery units
- Refrigerator boxes
- Cold Rooms

## Installation

The valves can be mounted in any position without jeopardising their operation. It is however advisable to install them with the coil in a vertical position above the body.

The valve body has one mounting hole with a diameter of 5.1 mm.

## Dimensions



Fittings Ø SAE ODF	A	B		C	D	
		A.C Coil	D.C.coil		A.C Coil	D.C.coil
1/4" SAE	61	79,8	93,5	26	41,3	55
1/4" SAE	61	79,8	93,5	26	41,3	55
3/8" SAE	62	79,8	93,5	26	41,3	55
6-1/4" ODF*	102	79,8	93,5	26	41,3	55
6-1/4" ODF*	102	79,8	93,5	26	41,3	55

\* Dwg. 2

## Order Code

<b>PM</b>	<b>142</b>			<b>R</b>	<b>S</b>			<b>[V]</b>	<b>[Hz]/d.c</b>		
Valve Body	Series	Fitting		Seal	Connection	Coil Type	24 V 50/60Hz	115 V 50/60Hz	220-230 50/60	12 V DC	24 V DC
		- SAE .2 ODF		<b>R</b> Ruby <b>F</b> Neoprene	- Flare <b>S</b> Solder <b>SP</b> Solder (in ")	<b>RT 14</b>	○	○	○		
			Orifice / Fitting			<b>YB 14</b>	○	○	○		
			<b>I</b> 2.5 / 1/4" (S=6mm) <b>B</b> 3.0 / 1/4" <b>A</b> 3.0 / 3/8" (S=6mm)			<b>CD 21</b>				○	○

**Note:** Valve supplied with coil in multipack  
Connectors to be ordered separately

**Example:** PM 142 IR RT14 220-230V 50/60Hz SAE 1/4"  
PM 142.2 IRS RT14 220-230V 50/60Hz ODF 6mm  
PM 142.2 IRSP RT14 220-230V 50/60Hz ODF 1/4"

# Series 145

## 2/2 way - Normally Closed - Diaphragm Pilot Operated 3/8" - 5/8" SAE, 10-28mm ODF, 3/8" - 1.1/8" ODF Fittings



### General Description :

Parker series **145** solenoid valves are diaphragm pilot operated and require a minimum differential pressure to operate. They may be used with all types of **CFC**, **HCFC** and **HFC** refrigerants currently available on the market and with blends; however they cannot be used with ammonia. Series **145** valves are **normally closed** and available with SAE flare fittings or extended end ODF copper solder fittings (in millimetres and inches).

### Temperatures :

Media temperature range is :

maximum **+105°C**  
minimum **-40°C**

The maximum ambient temperature is :

**+80°C**

### Coils :

For the series **145** valves class **"F"** coils (**155°C**) are available encapsulated in thermoplastic containing 30% glass fibre (types RT, YB, CD). All coils are for continuous service, 100% E.D. The rated voltage tolerance is **+/- 10% for A.C.** power supply. The "RT" and "YB" coils can be used on a.c. with frequency 50/60 Hz (dual frequency) and the CD coil on d.c. The "RT" and CD coils have faston terminals for three-pole **DIN 43650A** connector with protection to IP65.

The "Y" coil has terminals with 2 x 1,000mm cables with protection to **IP67**.

It is also available in a watertight version for applications where the humidity conditions are particularly critical (type "YE09").

## Materials

<b>Valve body :</b>	OT58 UNI 5705 brass forging
<b>Seals :</b>	Ruby - PTFE (diaphragm)
<b>Enclosing tube :</b>	AISI 304 Stainless steel
<b>Plunger :</b>	AISI 430F Stainless steel
<b>Spring :</b>	AISI 302 Stainless steel
<b>Shading ring :</b>	Copper

<b>Electrical Features :</b>			
Coil Type [ ]		Power [w]	Insulation Class
A.C. (~)	D.C. (=)		
RT14	-	14	F
YB14	-	14	F
-	CD21	21	F

## Specification

Fittings Ø SAE ODF	Valve Type	Nominal Orifice Ø	Flow Coefficient Kv	Minimum pressure	Max. Differential pressure (M.O.P.D.)		Coil Type		Weight [kg]	Notes
					in A.C.(~) [bar]	in D.C.(=) [bar]	A.C.	D.C.		
3/8" SAE	145.5 IR	8,0	1,40	0,1	30	21	RT14-YB14	CD21(2)	0,51	1 - 2
1/2" SAE	145.5 AR	10,0	1,88	0,1	30	21	RT14-YB14	CD21(2)	0,52	1 - 2
5/8" SAE	145.5 BR	15,0	3,30	0,1	30	10	RT14-YB14	CD21(2)	0,70	1 - 2
10* or 3/8 ODF	145.6 IRS or IRSP	8,0	1,40	0,1	30	21	RT14-YB14	CD21(2)	0,47	1 - 2
12* or 1/2 ODF	145.6 ARS or ARSP	10,0	1,88	0,1	30	21	RT14-YB14	CD21(2)	0,47	1 - 2
16* or 5/8 ODF	145.6 BRS or BRSP	15,0	3,30	0,1	30	10	RT14-YB14	CD21(2)	0,77	1 - 2
18* or 3/4 ODF	145.6 CRS or CRSP	18,0	3,85	0,1	30	10	RT14-YB14	CD21(2)	0,77	1 - 2
22* or 7/8 ODF	145.6 DRS or DRSP	18,0	4,32	0,1	30	10	RT14-YB14	CD21(2)	0,77	1 - 2
28* or 1.1/8 ODF	145.6 ERS or ERSP	18,0	4,32	0,1	30	10	RT14-YB14	CD21(2)	0,89	1 - 2

**Note:** 1) Safe working pressure : 35 bar (SWP)  
2) For the CD21 coil a special "Adaptor" is needed.

## Application

Series **145** valves are ideal for automatic control of refrigerants in liquid suction and discharge lines.  
Some typical application examples are :-

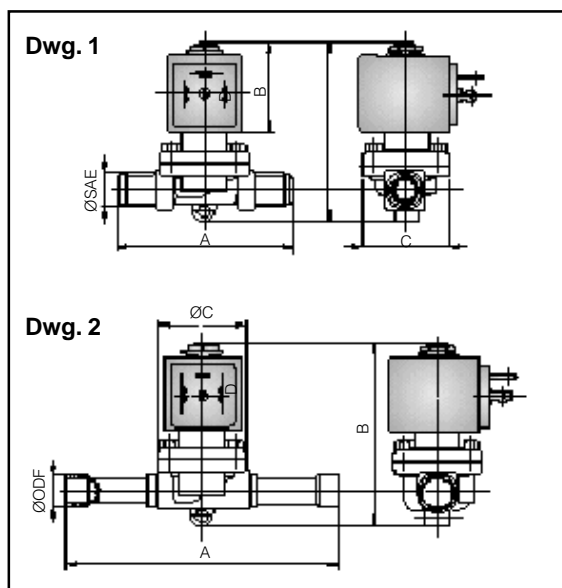
- Refrigerated Counters
- Cold Rooms
- Air Conditioning Systems
- Industrial refrigerators
- Refrigeration Units
- Ice-makers

## Installation

The valves can be mounted in any position without jeopardising their operation. It is however advisable to install them with the coil in a vertical position above the body.

The valve body has one mounting hole with a diameter of 5.1 mm.

## Dimensions



Fittings Ø SAE-ODF	A	B		C	D	
		[ mm ]	[ mm ]		[ mm ]	[ mm ]
[ " ]	[ mm ]	[ mm ]		[ mm ]	[ mm ]	
		A.C Coil	D.C.coil		A.C Coil	D.C.coil
3/8" SAE	80	85,3	99	40	41,3	55
1/2" SAE	84	85,3	99	40	41,3	55
5/8" SAE	104	85,3	103,5	51	41,3	55
10-3/8" ODF*	111	79,3	193	40	41,3	55
12-1/2" ODF*	127	79,3	93	40	41,3	55
16-5/8" ODF*	153	93,3	107	51	41,3	55
18-3/4" ODF*	160	93,3	107	51	41,3	55
22-7/8" ODF*	170	93,3	107	51	41,3	55
28-1.1/8" ODF*	180	96,3	110	51	41,3	55

\* Dwg. 2

## Order Code

<b>PM</b>	<b>145</b>			<b>R</b>	<b>S</b>			<b>[V]</b>	<b>[Hz]/d.c</b>		
Valve Body	Series	Fitting		Seal	Connection	Coil Type	24 V 50/60Hz	115 V 50/60Hz	220-230 50/60	12 V DC	24 V DC
		.5 SAE .6 ODF		<b>R</b> Ruby	- Flare <b>S</b> Solder (mm) <b>SP</b> Solder (in " )	<b>RT 14</b>	○	○	○		
						<b>YB 14</b>	○	○	○		
						<b>CD 21</b>				○	○

Orifice / Fitting	
<b>I</b>	8 / 3/8" (S=10mm)
<b>A</b>	10 / 12" (S=12mm)
<b>B</b>	15 / 5/8" (S=16mm)
<b>C</b>	18 / 3/4" (S=18mm)
<b>D</b>	18 / 7/8" (S=22mm)
<b>E</b>	18 / 1.1/8" (S=28mm)

**Note:** Valve supplied with coil in multipack  
Connectors to be ordered separately

# Series RB

## 2/2 way - Normally Closed - Diaphragm Pilot Operated 7/8" - 2.1/8" ODF



### General Description :

Parker series **RB** solenoid valves with various pilot systems allow refrigerants to be controlled in applications with high flow rates.

The **RB** valve series are **normally closed** and available with extended end ODF copper solder fittings.

Additional models are available with manual opener (RBM)

### Coils :

For the series **RB** valves class "**F**" coils (**155°C**) are available encapsulated in epoxy resin.

The R-23 coils can be used on a.c. with frequency 50/60 Hz (dual frequency).

The rated voltage tolerance is:

**-15% +0%** in **A.C.** and **D.C.** all the coils have faston terminals for **DIN 43650A** connector with protection to IP65.

### Temperatures :

Media temperature range is :

maximum **+115°C**

minimum **-30°C**

The ambient temperature range is :-

maximum **+ 50°C**

minimum **-30°C**

### Materials

<b>Valve body :</b>	OT58 UNI 5705 brass stamping
<b>Seals :</b>	PTFE
<b>Enclosing tube :</b>	AISI 304 Stainless steel
<b>Plunger :</b>	AISI 430F Stainless steel
<b>Spring :</b>	AISI 302 Stainless steel
<b>Shading ring :</b>	Copper

Electrical Features :				
Coil Type [ ]		Power [w]		Insulation Class
A.C. (~)	D.C. (=)	A.C. (~)	D.C. (=)	
R - 23	R - 23	11	16	F

### Specification

Fittings Ø ODF	Valve Type	Nominal Orifice Ø	Flow Coefficient Kv	Minimum pressure	Max. Differential pressure (M.O.P.D.)		Coil Type	Weight	Notes
					in A.C.(~) [bar]	in D.C.(=) [bar]			
[ ]		[mm]	[m <sup>3</sup> /h]	[bar]				[kg]	
7/8	RB 21 E7	22,3	6,17	0,07	21	21	R - 23	1,60	1 - 2
1.1/8	RB 21 E9	22,3	6,17	0,07	21	21	R - 23	1,60	1 - 2
1.1/8	RB 41 E9	25,4	8,88	0,07	21	21	R - 23	2,30	1 - 2
1.3/8	RB 41 E11	25,4	8,88	0,07	21	21	R - 23	2,30	1 - 2
1.5/8	RB 81 E13	31,7	21,55	0,14	21	21	R - 23	4,60	1 - 2
2.1/8	RB 81 E17	31,7	21,55	0,14	21	21	R - 23	4,60	1 - 2

**Note:** 1) Safe working pressure : 35 bar manual bypass available on request. (SWP)

2) Manual bypass available on request.

## Application

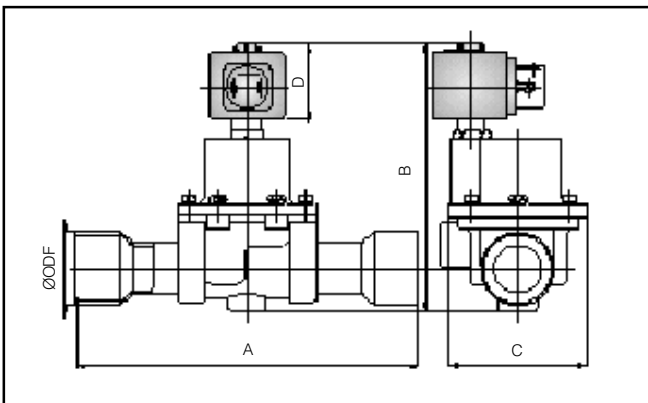
Series **RB** valves are ideal for control of refrigerants in machines and systems with high capacity.  
Some typical application examples are :-

- Heat Pumps
- Chillers
- Air conditioning units
- Supermarkets
- Food preserving systems
- Industrial refrigeration systems (not ammonia)

## Installation

The valves can be mounted in any position without jeopardising their operation. It is however advisable to install them with the coil in a vertical position above the body.

## Dimensions



Fittings Ø ODF	A	B	C	D
[ " ]	[ mm ]	[ mm ]	[ mm ]	[ mm ]
7/8"	190	113	73	51
1.1/8"	215	113	73	51
1.1/8"	255	130	82	51
1.3/8"	278	140	82	51
1.5/8"	280	195	112	51
2.1/8"	280	195	112	51

## Order Code

RB		Capacity		Fitting		Orifice / Fitting		Coil Type		[V] [Hz]/d.c				
<b>R</b>	Refrig.	Model	Kw	<b>E</b>	ODF	<b>7</b>	22.3 / 7/8"	<b>R</b>	<b>23</b>	24 V 50/60Hz	110-120 50/60Hz	208-240V 50/60	12 V DC	24 V DC
<b>B</b>	Brass Casing	21	74			<b>9</b>	22.3 / 1.1/8"	○	○	○	○	○	○	○
		41	144			<b>9</b>	25.4 / 1.1/8"							
		81	285			<b>11</b>	25.4 / 1.3/8"							
						<b>13</b>	31.7 / 1.5/8"							
						<b>17</b>	31.7 / 2.1/8"							

**Note:** Valve supplied with coil  
Connectors to be ordered separately

# Series ORB

## 2/2 way - Normally Open - Diaphragm Pilot Operated 7/8" - 2.1/8" ODF



### General Description :

Parker series **ORB** solenoid valves with various pilot systems allow refrigerants to be controlled in applications with high flow rates.

The **ORB** valve series are **normally open** and available with extended end ODF copper solder fittings.

### Coils :

For the series **ORB** valves class "**F**" coils (**155°C**) are available encapsulated in epoxy resin.

The R-23 coils can be used on a.c. with frequency 50/60 Hz (dual frequency).

The rated voltage tolerance is:

**-15% +0%** in **A.C.** and **D.C.** all the coils have faston terminals for **DIN 43650A** connector with protection to IP65.

### Temperatures :

Media temperature range is :

maximum **+115°C**

minimum **-30°C**

The ambient temperature range is :

maximum **+ 50°C**

minimum **-30°C**

## Materials

<b>Valve body :</b>	OT58 UNI 5705 brass stamping
<b>Seals :</b>	PTFE
<b>Enclosing tube :</b>	AISI 304 Stainless steel
<b>Plunger :</b>	AISI 430F Stainless steel
<b>Spring :</b>	AISI 302 Stainless steel
<b>Shading ring :</b>	Copper

### Electrical Features :

Coil Type [ ]		Power [w]		Insulation Class
A.C. (~)	D.C. (=)	A.C. (~)	D.C. (=)	
OR - 23	OR - 23	11	16	F

## Specification

Fittings Ø ODF	Valve Type	Nominal Orifice Ø	Flow Coefficient Kv	Minimum pressure	Max. Differential pressure (M.O.P.D.)		Coil Type	Weight	Notes
					in A.C.(~) [bar]	in D.C.(=) [bar]			
[ ]		[mm]	[m <sup>3</sup> /h]	[bar]				[kg]	
7/8	ORB 21 E7	22,3	6,17	0,07	17	17	OR - 23	1,60	1 - 3
1.1/8	ORB 21 E9	22,3	6,17	0,07	17	17	OR - 23	1,60	1 - 3
1.1/8	ORB 41 E9	25,4	8,88	0,07	17	17	OR - 23	2,30	1 - 3
1.3/8	ORB 41 E11	25,4	8,88	0,07	17	17	OR - 23	2,30	1 - 3
1.5/8	ORB 81 E13	31,7	21,55	0,14	17	17	OR - 23	4,60	1 - 3
2.1/8	ORB 81 E17	31,7	21,55	0,14	17	17	OR - 23	4,60	1 - 3

- Note:** 1) Safe working pressure : 35 bar (SWP)  
2) Other sizes ORB-3-15 available - Consult Factory.  
3) Manual bypass available on request.

## Application

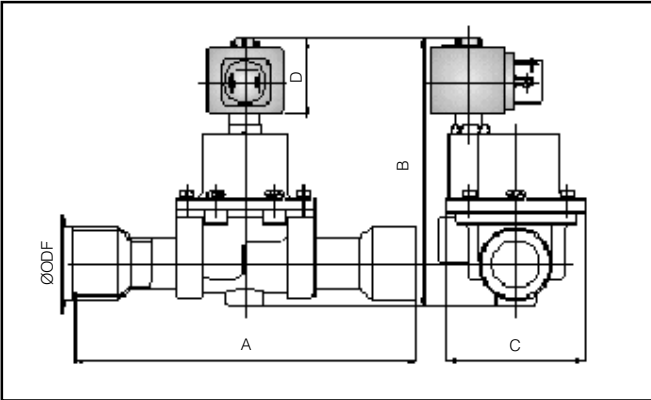
Series **ORB** valves are ideal for control of refrigerants in machines and systems with high capacity.  
Some typical application examples are :-

- Heat Pumps
- Chillers
- Air conditioning units
- Supermarkets
- Food preserving systems
- Industrial refrigeration systems (not ammonia)

## Installation

The valves can be mounted in any position without jeopardising their operation. It is however advisable to install them with the coil in a vertical position above the body.

## Dimensions



Fittings Ø ODF	A	B	C	D
[ " ]	[ mm ]	[ mm ]	[ mm ]	[ mm ]
7/8"	190	113	73	51
1.1/8"	215	113	73	51
1.1/8"	255	130	82	51
1.3/8"	278	140	82	51
1.5/8"	280	195	112	51
2.1/8"	280	195	112	51

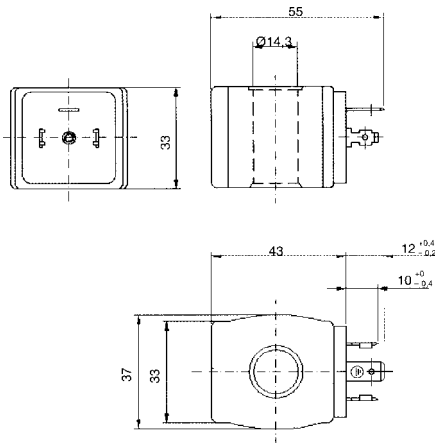
## Order Code

<b>ORB</b>		<b>E</b>				<b>[V]</b>	<b>[Hz]/d.c</b>		
TYPE	Capacity	Fitting	Orifice / Fitting	Coil Type	24 V 50/60Hz	110-120 50/60Hz	208-240V 50/60	12 V DC	24 V DC
<b>OR</b> Refrig.	Model Kw	<b>E</b> ODF	<b>7</b> 22.3 / 7/8"	<b>OR 23</b>	○	○	○	○	○
<b>B</b> Brass Casing	21 74 41 144 81 285		<b>9</b> 22.3 / 1.1/8" <b>9</b> 25.4 / 1.1/8" <b>11</b> 25.4 / 1.3/8" <b>13</b> 31.7 / 1.5/8" <b>17</b> 31.7 / 2.1/8"						

**Note:** Valve supplied with coil  
Connectors to be ordered separately

# Electric Coils

## RT Coil



Coil manufactured from **class H** copper wire, moulded in thermoplastic  
 - (polyester) with 30% glass fiber  
 - Anti-moisture aggression seals with plastic nut.

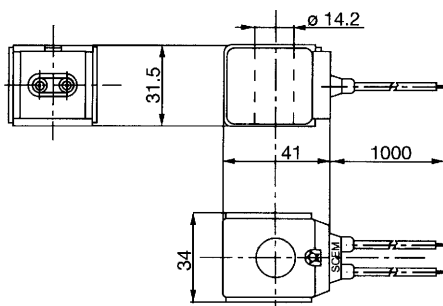
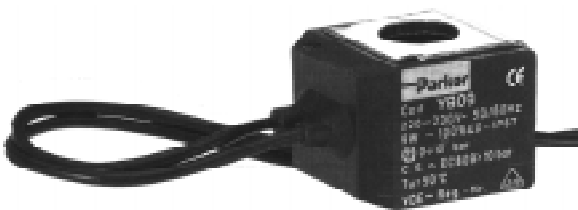
### Features:

**Protection** DIN 40050 = IP 65 with connector  
**Connector** DIN 43650 A - PG 9 or PG 11  
**Frequency** 50/60 Hz

### Types available:

Class F (155°C)  
 RT 14 = 25 VA - 14 W a.c. Service (33 VA - Inrush)  
 IMQ approval

## Y Coil



Coil manufactured from **class H** copper wire, moulded in thermoplastic (polyester) with 30% glass fiber

### Features:

**Protection** DIN 40050 = IP 67  
**Electrical Connector** two 1000mm cables  
**Frequency** 50/60 Hz

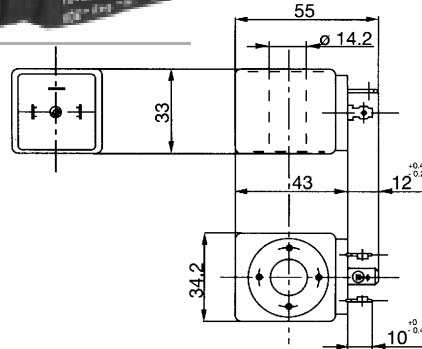
### Types available:

\* **IMQ, VDE, UL** approved for standard voltages

- 1) Class F (155°C)  
 YB14 = 24 VA - 14 W a.c. Service (32 VA - Inrush)  
 YB09 = 15 VA - 9 W a.c. Service (24 VA - Inrush)  
 YB12 = 12 W d.c.  
 YB16 = 16 W d.c.
- 2) Class E (120°C)  
 YEO9 = 15 VA - 9 W a.c.

**Note:** Recommended for applications where humidity is particularly severe and where ice formation or defrosting may occur.

## ZB Coil



Coil manufactured from **class H** copper wire, moulded in thermoplastic  
 - (polyester) with 30% glass fiber (type ZB);  
 - (polyphenylene) with 40% glass fiber (type ZH)

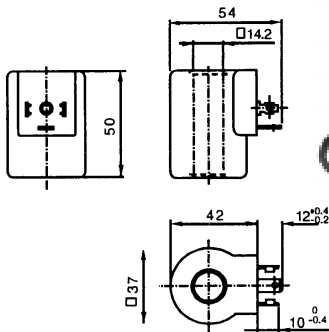
### Features:

**Protection** DIN 40050 = IP 65 with connector  
**Connector** DIN 43650 A - PG 9 or PG 11  
**Frequency** 50/60 Hz

### Types available:

- \* **IMQ, VDE, UL** approved for standard voltages
- Class F (155°C)  
 ZB14 = 25 VA - 14 W a.c. Service (33 VA - Inrush)  
 ZB09 = 16 VA - 9 W a.c. Service (25 VA - Inrush)  
 ZB12 = 12 W d.c.  
 ZB16 = 16 W d.c.
  - Class H (180°C)  
 ZH14 = 25 VA - 14 W a.c. - Service (33 VA - Inrush)  
 ZH16 = 16 W d.c.

## CD Coil



Coil manufactured from **class H** copper wire, moulded in thermoplastic:  
 - (polyester) with 30% glass fiber  
 - Anti-moisture aggression seals  
 - Special DC adaptor for higher performance

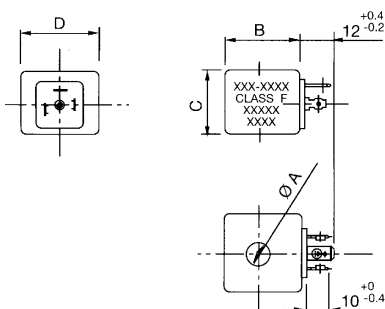
### Features:

**Protection** DIN 40050 = IP 65  
**Electrical Connector** DIN43650A - PG 9 or PG 11

### Types available:

- Class F (155°C)  
 CD21 = 21 W d.c.

## BH-DH, C-23, R-23 Coil



Coil manufactured from **class H** copper wire, moulded in epoxy resin.

### Features:

**Protection** DIN 40050 = IP 65 with connector  
**Connector** DIN 43650 A - PG 9 or PG 11  
**Frequency** 50 Hz  
**Insulation class** H (180°C)

### Types available:

- \* **IMQ, UL** approved for standard voltages
- Class H (180°C)  
 PH14 = A.C. 16 VA - 10.2 W a.c. Service (26 VA - Inrush)  
 PH14 = A.C. 23 VA - 16 W a.c. Service (32 VA - Inrush)  
 1H PH = C.C. 9.5 W  
 3H PH = C.C. 11.5 W  
 R-23, C-23 = A.C. 15 VA - 11 W a.c. Service (36 VA - Inrush)  
 R-23, C-23 = C.C. 16 W

	BH C-23	DH R-23
ØA	11mm	14.4mm
B	39.5mm	44.5mm
C	34.2mm	39.1mm
D	41.5mm	47mm

# Metric Extended Capacities in Kilowatts

## Suction Line

Type	K [l/min]	Kv [m <sup>3</sup> /h]	Cv (USA)	Refrig.	Δ P [bar]	SUCTION LINE [kW]									
						Evaporator temperature [°C]									
						+10	+5	0	-5	-10	-15	-20	-30	-40	
145.5 IR 145.6 IRS	23,30	1,40	1,62	<b>R134a</b>	0,10	3,32	2,92	2,60	2,30	2,14	1,91	1,76	1,31	0,91	
					0,15	4,32	3,83	3,52	3,22	2,84	2,60	2,30	1,83	1,53	
				<b>R22</b>	0,10	3,54	3,19	2,90	2,61	2,38	2,15	1,92	1,57	1,28	
					0,15	4,71	4,24	3,89	3,37	3,14	2,85	2,50	2,03	1,45	
				<b>R502</b>	0,10	3,08	2,67	2,32	2,09	1,86	1,74	1,51	1,16	0,87	
					0,15	3,89	3,60	3,14	2,30	2,56	2,32	1,97	1,62	1,33	
				<b>R404A</b>	0,10	3,35	2,91	2,52	2,27	2,03	1,89	1,65	1,26	0,95	
					0,15	4,24	3,92	3,42	3,16	2,79	2,52	2,14	1,76	1,45	
				<b>R410A</b>	0,10	3,47	3,13	2,84	2,56	2,33	2,11	1,88	1,54	1,25	
					0,15	4,62	4,16	3,81	3,30	3,08	2,79	2,45	1,99	1,42	
				<b>R407c</b>	0,10	3,58	3,22	2,93	2,64	2,40	2,17	1,94	1,59	1,29	
					0,15	4,76	4,28	3,93	3,40	3,17	2,88	2,53	2,05	1,46	
145.5 AR 145.6 ARS	31,30	1,88	2,18	<b>R134a</b>	0,10	4,64	4,29	3,76	3,45	3,06	2,84	2,46	1,83	1,37	
					0,15	5,64	5,21	4,61	4,56	3,68	3,30	2,92	2,22	1,53	
				<b>R22</b>	0,10	5,17	4,59	4,30	3,89	3,49	3,08	2,79	2,21	1,68	
					0,15	6,28	5,75	5,23	4,71	4,30	3,78	3,43	2,67	2,03	
				<b>R502</b>	0,10	4,36	3,94	3,60	3,31	2,90	2,61	2,32	1,80	1,39	
					0,15	5,29	4,71	4,36	3,95	3,54	3,14	2,85	2,21	1,62	
				<b>R404A</b>	0,10	4,75	4,30	3,92	3,60	3,16	2,84	2,53	1,96	1,51	
					0,15	4,76	5,14	4,75	4,30	3,85	3,42	3,11	2,41	1,76	
				<b>R410A</b>	0,10	5,07	4,50	4,21	3,81	3,42	3,02	2,73	2,17	1,65	
					0,15	6,15	5,64	5,13	4,62	4,21	3,70	3,36	2,62	1,99	
				<b>R407c</b>	0,10	5,22	4,64	4,34	3,93	3,52	3,11	2,82	2,23	1,70	
					0,15	6,34	5,81	5,28	4,76	4,34	3,82	3,46	2,70	2,05	
145.5 BR 145.6 BRS	55,00	3,30	3,83	<b>R134a</b>	0,10	7,12	6,44	5,90	5,37	4,83	4,37	3,76	2,84	1,91	
					0,15	9,66	8,59	7,75	7,06	6,36	5,76	5,06	3,76	2,38	
				<b>R22</b>	0,10	7,79	7,09	6,45	5,87	5,35	4,82	4,36	3,43	2,44	
					0,15	10,35	9,36	8,54	7,79	7,03	6,39	5,75	4,59	3,31	
				<b>R502</b>	0,10	6,92	6,10	5,35	4,88	4,36	3,95	3,43	2,79	2,03	
					0,15	9,18	9,08	7,15	6,51	5,87	5,35	4,59	3,72	2,73	
				<b>R404A</b>	0,10	7,54	6,65	5,83	5,31	4,75	4,30	3,74	3,04	2,21	
					0,15	10,01	9,89	7,79	7,09	6,39	5,83	5,00	4,05	2,97	
				<b>R410A</b>	0,10	7,63	6,95	6,32	5,75	5,24	4,72	4,27	3,36	2,39	
					0,15	10,14	9,17	8,37	7,63	6,89	6,26	5,64	4,50	3,24	
				<b>R407c</b>	0,10	7,87	7,16	6,51	5,93	5,40	4,87	4,40	3,46	2,46	
					0,15	10,45	9,45	8,63	7,87	7,10	6,45	5,81	4,64	3,34	
145.6 CRS	64,20	3,85	4,47	<b>R134a</b>	0,10	7,42	6,75	6,22	5,68	5,13	4,67	3,99	3,06	2,07	
					0,15	9,97	8,90	8,05	7,37	6,60	5,98	5,29	3,91	2,53	
				<b>R22</b>	0,10	8,14	7,38	6,62	6,10	5,58	4,94	4,47	3,54	2,56	
					0,15	10,69	9,59	8,78	8,02	7,26	6,62	5,99	4,76	3,43	
				<b>R502</b>	0,10	7,15	6,33	5,52	5,00	4,47	4,07	3,54	2,90	2,09	
					0,15	9,42	8,25	7,32	6,68	5,99	5,58	4,76	3,83	2,58	
				<b>R404A</b>	0,10	7,79	6,89	6,01	5,45	4,87	4,43	3,85	3,16	2,27	
					0,15	10,26	8,99	7,97	7,28	6,52	6,08	5,18	4,17	3,10	
				<b>R410A</b>	0,10	7,98	7,23	6,49	5,98	5,47	4,84	4,38	3,47	2,51	
					0,15	10,48	9,40	8,60	7,86	7,11	6,49	5,87	4,66	3,36	
				<b>R407c</b>	0,10	8,22	7,45	6,69	6,16	5,64	4,99	4,51	3,58	2,59	
					0,15	10,80	9,69	8,87	8,10	7,33	6,69	6,05	4,81	3,46	

# Metric Extended Capacities in Kilowatts

## Suction Line

Type	K [l/min]	Kv [m <sup>3</sup> /h]	Cv (USA)	Refrig.	ΔP [bar]	SUCTION LINE [kW]								
						Evaporator temperature [°C]								
						+10	+5	0	-5	-10	-15	-20	-30	-40
145.6 DRS 145.6 ERS	72,00	4,32	5,01	R134a	0,10	7,73	7,06	6,60	5,83	5,21	4,75	4,14	3,14	2,07
					0,15	10,50	9,36	8,53	7,67	6,90	6,28	5,52	4,14	2,60
				R22	0,10	8,49	7,73	7,03	6,39	5,87	5,29	4,76	3,78	2,67
					0,15	11,28	10,23	9,30	6,49	7,67	6,97	6,28	5,00	3,60
				R502	0,10	7,56	6,62	5,81	5,35	4,76	4,30	3,72	3,02	2,21
					0,15	10,00	8,83	7,79	7,09	6,39	5,81	5,00	4,07	3,02
				R404A	0,10	8,24	7,21	6,33	5,83	5,18	4,68	4,05	3,29	2,40
					0,15	10,90	9,62	8,49	7,72	6,96	6,33	5,45	4,43	3,29
				R410A	0,10	8,32	7,58	6,89	6,26	5,75	5,18	4,66	3,70	2,62
					0,15	11,05	10,03	9,11	6,36	7,52	6,83	6,15	4,90	3,53
				R407c	0,10	8,57	7,81	7,10	6,45	5,93	5,34	4,81	3,82	2,70
					0,15	11,39	10,33	9,39	6,55	7,75	7,04	6,34	5,05	3,64
RB21	103,00	6,17	7,16	R134a	0,10	11,20	10,20	9,20	8,40	6,90	6,30	6,20	5,60	-
					0,15	13,10	12,00	10,80	9,80	8,10	7,40	7,20	6,60	-
				R22	0,10	10,50	9,50	10,50	9,50	8,50	7,70	6,60	6,00	4,60
					0,15	12,20	11,10	12,20	11,10	9,90	9,00	7,70	7,00	5,40
				R502	0,10	10,00	9,10	8,10	7,40	6,60	6,00	5,10	4,60	3,50
					0,15	11,70	10,70	9,50	8,70	7,70	7,00	5,90	5,40	4,10
				R404A	0,10	11,20	10,20	9,20	8,40	7,60	7,00	6,30	5,30	4,20
					0,15	13,00	12,00	10,80	9,80	8,90	8,20	7,40	6,20	4,90
				R410A	0,10	10,29	9,31	10,29	9,31	8,33	7,55	6,47	5,88	4,51
					0,15	11,96	10,88	11,96	10,88	9,70	8,82	7,55	6,86	5,29
				R407c	0,10	10,61	9,60	10,61	9,60	8,59	7,78	6,67	6,06	4,65
					0,15	12,32	11,21	12,32	11,21	10,00	9,09	7,78	7,07	5,45
RBG1	148,00	8,88	10,30	R134a	0,10	16,20	14,70	13,20	11,90	10,70	9,10	8,20	8,40	-
					0,15	19,00	17,20	15,50	13,90	12,60	10,70	9,60	9,80	-
				R22	0,10	18,20	16,50	14,90	13,30	12,00	10,90	9,80	8,40	6,70
					0,15	21,30	19,30	17,40	15,60	14,00	12,80	11,50	9,80	7,90
				R502	0,10	14,60	13,30	12,00	10,50	9,50	8,40	7,60	6,30	4,90
					0,15	17,10	15,60	14,00	12,30	11,10	9,80	8,90	7,40	5,70
				R404A	0,10	16,20	14,70	13,20	11,90	10,70	9,80	8,80	7,40	6,00
					0,15	19,00	17,20	15,50	13,90	12,60	11,50	10,30	8,70	7,00
				R410A	0,10	17,84	16,17	14,60	13,03	11,76	10,68	9,60	8,23	6,57
					0,15	20,87	18,91	17,05	15,29	13,72	12,54	11,27	9,60	7,74
				R407c	0,10	18,38	16,67	15,05	13,43	12,12	11,01	9,90	8,48	6,77
					0,15	21,51	19,49	17,57	15,76	14,14	12,93	11,62	9,90	7,98
RB81	359,00	21,55	25,00	R134a	0,10	43,60	39,60	35,60	30,80	27,70	23,10	20,80	17,20	-
					0,15	51,10	46,40	41,80	36,10	32,50	27,10	24,40	20,20	-
				R22	0,10	43,90	39,90	35,90	32,60	29,30	25,60	23,00	20,00	15,10
					0,15	51,40	46,80	42,10	38,20	34,40	30,00	27,00	23,40	17,70
				R502	0,10	35,10	31,90	28,70	25,60	23,00	20,00	18,00	15,10	11,20
					0,15	41,10	37,40	33,60	30,00	27,00	23,40	21,10	17,70	13,10
				R404A	0,10	38,90	35,40	31,90	29,10	26,20	22,80	20,50	17,50	13,30
					0,15	45,60	41,50	37,30	34,10	30,70	26,70	24,00	20,50	15,60
				R410A	0,10	43,02	39,10	35,18	31,95	28,71	25,09	22,54	19,60	14,80
					0,15	50,37	45,86	41,26	37,44	33,71	29,40	26,46	22,93	17,35
				R407c	0,10	44,34	40,30	36,26	32,93	29,59	25,86	23,23	20,20	15,25
					0,15	51,91	47,27	42,52	38,58	34,74	30,30	27,27	23,63	17,88

# Metric Extended Capacities in Kilowatts

## Liquid Discharge Line

Type	K [l/min]	Kv [m <sup>3</sup> /h]	Cv (USA)	Refrig.	LIQUID LINE [kW]					DISCHARGE LINE [kW]					
					ΔP [bar]					ΔP [bar]					
					0,10	0,15	0,20	0,30	0,30	0,50	1,00	2,00	3,00	4,00	5,00
127 ILS	1,70	0,10	0,12	R134a	1,30	1,70	2,10	2,40	0,41	0,52	0,72	0,93	1,06	-	-
				R22	1,50	2,10	2,50	2,90	0,29	0,37	0,52	0,58	0,70	0,88	0,94
				R502	1,00	1,40	1,70	2,20	0,17	0,22	0,31	0,44	0,53	0,61	0,66
				R404A	1,02	1,42	1,73	2,24	0,17	0,22	0,31	0,44	0,54	0,62	0,67
				R410A	1,47	2,06	2,45	2,84	0,28	0,36	0,51	0,57	0,69	0,86	0,92
				R407c	1,52	2,12	2,53	2,93	0,29	0,37	0,53	0,59	0,71	0,89	0,95
117 ALS 127 ALS	2,20	0,13	0,15	R134a	1,80	2,20	2,40	3,00	0,52	0,59	0,97	1,44	1,90	-	-
				R22	2,30	2,80	3,10	3,90	0,33	0,48	0,70	1,05	1,30	1,52	1,78
				R502	1,50	1,80	2,20	2,80	0,26	0,39	0,55	0,74	1,05	1,20	1,40
				R404A	1,63	1,83	2,24	2,65	0,26	0,39	0,56	0,75	1,07	1,22	1,42
				R410A	2,25	2,74	3,04	3,82	0,32	0,47	0,69	1,03	1,27	1,49	1,74
				R407c	2,32	2,83	3,13	3,94	0,33	0,48	0,71	1,06	1,31	1,54	1,80
117 CLS	2,50	0,15	0,17	R134a	2,10	2,50	2,80	3,60	0,60	0,80	1,13	1,66	2,19	-	-
				R22	2,80	3,20	3,70	4,60	0,38	0,55	0,80	1,20	1,50	1,75	2,05
				R502	1,80	2,20	2,50	3,10	0,31	0,45	0,65	0,85	1,20	1,40	1,60
				R404A	1,83	2,24	2,55	3,16	0,31	0,45	0,66	0,86	1,22	1,42	1,63
				R410A	2,74	3,14	3,63	4,51	0,37	0,54	0,78	1,18	1,47	1,72	2,01
				R407c	2,83	3,23	3,74	4,65	0,38	0,56	0,81	1,21	1,52	1,77	2,07
112 IL 112.2 ILS 127 CLS 142 IR 142.2 IRS	3,20	0,19	0,22	R134a	2,20	2,80	3,10	3,90	0,80	1,00	1,46	1,73	1,96	-	-
				R22	2,90	3,80	4,20	5,00	0,58	0,72	1,05	1,32	1,55	1,85	2,15
				R502	2,00	2,40	2,90	3,60	0,47	0,58	0,86	1,05	1,25	1,45	1,65
				R404A	2,04	2,44	2,95	3,67	0,48	0,59	0,87	1,07	1,27	1,48	1,68
				R410A	2,84	3,72	4,12	4,90	0,57	0,71	1,03	1,29	1,52	1,81	2,11
				R407c	2,93	3,84	4,24	5,05	0,59	0,73	1,06	1,33	1,57	1,87	2,17
112 AL 112.2 BLSP 142 AR 142.2 ARS 142 BR 142.2 ARS	4,50	0,27	0,31	R134a	3,50	4,20	4,90	5,90	1,00	1,46	1,90	2,80	3,60	-	-
				R22	4,40	5,40	6,20	7,60	0,95	1,20	1,70	2,40	2,70	3,00	3,10
				R502	3,00	3,70	4,30	5,30	0,60	0,70	1,00	1,40	1,70	1,90	2,10
				R404A	3,06	3,77	4,38	5,40	0,61	0,71	1,02	1,42	1,73	1,94	2,14
				R410A	4,31	5,29	6,08	7,45	0,93	1,18	1,67	2,35	2,65	2,94	3,04
				R407c	4,44	5,45	6,26	7,68	0,96	1,21	1,72	2,42	2,73	3,03	3,13
115 IL 115.2 ILS	13,30	0,80	0,93	R134a	14,00	14,10	17,70	23,40	4,58	5,20	6,40	9,58	9,70	-	-
				R22	15,00	15,50	19,60	25,80	4,82	6,10	8,27	11,40	11,80	15,70	19,60
				R502	10,00	10,40	13,10	17,60	3,79	5,30	6,62	9,22	9,60	12,70	16,00
				R404A	10,20	10,60	13,30	17,90	3,86	4,87	6,76	9,40	9,79	12,90	16,30
				R410A	14,70	15,19	19,21	25,28	4,72	5,98	8,10	11,17	11,56	15,39	19,21
				R407c	15,15	15,66	19,80	26,06	4,87	6,16	8,35	11,51	11,92	15,86	19,80
145.5 IR 145.6 IRS	23,30	1,40	1,62	R134a	19,00	24,60	30,40	35,70	5,70	7,30	10,01	13,00	14,00	-	-
				R22	22,10	29,60	36,50	43,90	4,10	5,20	7,30	9,60	10,50	11,30	12,50
				R502	15,60	21,00	26,20	31,00	2,40	3,10	4,40	6,20	7,50	8,40	9,20
				R404A	15,90	21,40	26,70	31,60	2,44	3,16	4,48	6,32	7,65	8,55	9,38
				R410A	21,66	29,01	35,77	43,02	4,02	5,10	7,15	9,41	10,29	11,07	12,25
				R407c	22,32	29,90	36,87	44,34	4,14	5,25	7,37	9,70	10,61	11,41	12,63

Liquid temperature: +25°C

Evaporator temperature: -10°C

Condensing temperature: +30°C

# Metric Extended Capacities in Kilowatts

## Liquid Discharge Line

Type	K [l/min]	Kv [m <sup>3</sup> /h]	Cv (USA)	Refrig.	LIQUID LINE [kW]				DISCHARGE LINE [kW]						
					ΔP [bar]				ΔP [bar]						
					0,10	0,15	0,20	0,30	0,30	0,50	1,00	2,00	3,00	4,00	5,00
145.5 AR 145.6 ARS	31,30	1,88	2,18	R134a	24,20	29,70	34,50	38,60	7,80	9,40	13,70	20,30	26,20	-	-
				R22	31,10	38,30	44,20	49,40	5,60	6,80	9,80	14,30	19,00	21,70	25,20
				R502	21,40	26,20	30,30	33,90	4,70	5,50	7,90	11,50	14,50	17,20	19,80
				R404A	21,80	26,70	30,90	34,50	4,79	5,61	8,05	11,70	14,70	17,50	20,20
				R410A	30,48	37,53	43,32	48,41	5,49	6,66	9,60	14,01	18,62	21,27	24,70
				R407c	31,41	38,68	44,64	49,89	5,66	6,87	9,90	14,44	19,19	21,92	25,45
145.5 BR 145.6 BRS	55,00	3,30	3,83	R134a	41,00	54,80	66,70	80,60	11,80	15,00	21,10	27,90	30,40	-	-
				R22	49,30	65,70	80,30	96,20	8,80	10,80	15,70	21,10	23,80	27,30	28,40
				R502	34,60	46,50	57,50	69,20	5,00	6,20	8,80	12,90	15,60	16,90	19,40
				R404A	35,20	47,40	58,60	70,50	5,10	6,32	8,97	13,10	15,10	17,20	19,80
				R410A	48,31	64,39	78,69	94,28	8,62	10,58	15,39	20,68	23,32	26,75	27,83
				R407c	49,79	66,36	81,10	97,16	8,89	10,91	15,86	21,31	24,04	27,57	28,68
145.6 CRS	64,20	3,85	4,47	R134a	43,90	56,40	68,20	82,20	12,20	15,70	21,90	29,20	32,10	-	-
				R22	51,70	68,30	82,80	99,00	9,30	11,20	16,20	21,80	24,00	28,20	29,20
				R502	35,80	47,60	59,00	70,90	5,20	6,50	9,20	13,20	16,50	17,30	20,50
				R404A	36,50	48,55	60,10	72,30	5,30	6,83	9,38	13,40	16,80	17,60	20,90
				R410A	50,67	66,93	81,14	97,02	9,11	10,98	15,88	21,36	23,52	27,64	28,62
				R407c	52,22	68,98	83,63	99,99	9,39	11,31	16,36	22,02	24,24	28,48	29,49
145.6 DRS 145.6 ERS	72,00	4,32	5,01	R134a	44,80	59,90	72,90	88,00	13,00	16,30	23,10	30,60	33,20	-	-
				R22	53,80	71,70	87,60	105,00	9,60	11,80	17,20	23,40	26,00	29,80	31,00
				R502	37,80	50,80	62,80	75,40	5,50	6,80	9,60	14,10	17,00	18,50	21,20
				R404A	38,50	51,80	64,00	76,90	5,61	6,93	9,79	14,30	17,30	18,90	21,80
				R410A	52,72	70,27	85,85	102,90	9,41	11,56	16,86	22,93	25,48	29,20	30,38
				R407c	54,34	72,42	88,48	106,05	9,70	11,92	17,37	23,63	26,26	30,10	31,31
RB21	103,00	6,17	7,16	R134a	67,00	91,00	112,00	147,00	30,00	42,00	54,00	63,00	88,00	112,00	143,00
				R22	70,00	105,00	126,00	168,00	33,00	46,00	58,00	74,00	98,00	125,00	161,00
				R502	49,00	70,00	84,00	112,00	27,00	39,00	49,00	56,00	81,00	103,00	132,00
				R404A	44,80	63,00	77,00	102,00	30,00	40,60	52,00	65,50	88,00	112,00	143,00
				R410A	68,60	102,90	123,48	164,64	32,34	45,08	56,84	72,52	96,04	122,50	157,78
				R407c	70,70	106,05	127,26	169,68	33,33	46,46	58,58	74,74	98,98	126,25	162,61
RB 41	148,00	8,88	10,30	R134a	102,00	147,00	179,00	231,00	49,00	70,00	90,00	105,00	144,00	184,00	235,00
				R22	116,00	168,00	210,00	277,00	56,00	77,00	99,00	119,00	165,00	211,00	270,00
				R502	77,00	116,00	144,00	154,00	42,00	60,00	76,00	95,00	130,00	166,00	212,00
				R404A	70,00	102,00	123,00	158,00	49,00	70,00	90,00	105,00	147,00	188,00	241,00
				R410A	113,68	164,64	205,80	271,46	54,88	75,46	97,02	116,62	161,70	206,78	264,60
				R407c	117,16	169,68	212,10	279,77	56,56	77,77	99,99	120,19	166,65	213,11	272,70
RB 81	359,00	21,55	25,00	R134a	249,00	354,00	434,00	560,00	147,00	207,00	264,00	315,00	424,00	542,00	694,00
				R22	266,00	375,00	459,00	592,00	140,00	200,00	255,00	308,00	422,00	540,00	690,00
				R502	179,00	252,00	312,00	403,00	112,00	154,00	197,00	242,00	333,00	426,00	545,00
				R404A	172,00	245,00	298,00	385,00	126,00	179,00	229,00	273,00	378,00	484,00	619,00
				R410A	260,68	367,50	449,82	580,16	137,20	196,00	249,90	301,84	413,56	529,20	676,20
				R407c	268,66	378,75	463,59	597,92	141,40	202,00	257,55	311,08	426,22	545,40	696,90

Liquid temperature: +25°C

Evaporator temperature: -10°C

Condensing temperature: +30°C

# Pulse Width Modulating Valves (PWM)



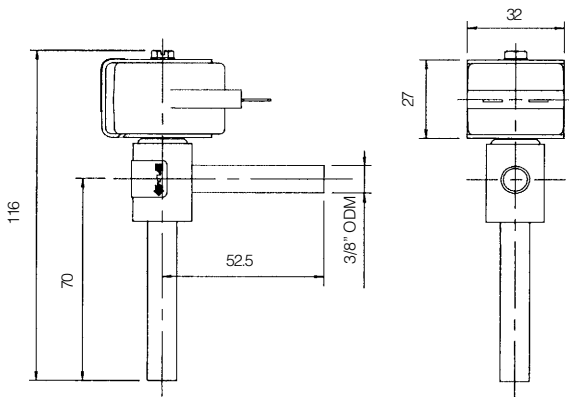
## General Description :

Parker pulse width solenoid valves are designed to meter the refrigerant flow of mechanical refrigeration systems. The pulse width solenoid valve, (PWM) when interfaced with microcomputers and appropriate sensors, precisely meters the refrigerant flow to control superheat, evaporator pressure and other system parameters including the implementation of diagnostic functions (i.e. charge level, crankcase temperature, oil pressure, current draw, values of high and low side pressures and temperature). Using a modified solenoid valve construction coupled with technology developed within Parker Hannifin, life cycles in excess of 100 million cycles are attainable. The PWM valve is well suited for systems employing variable speed compressor technology where pulse frequencies as low as 5 Hz may be used.

## Key Features

- Long life (100 million cycles)
- Suitable for all common refrigerants except ammonia
- Maximum use of entire evaporator surface with minimum superheat results in increased efficiency (SEER)
- No superheat adjustment necessary
- Wide range capacity results in reduced inventory
- Fast, precise response to load changes
- Readily adaptable to provide functions related to Maximum Operating Pressure (MOP)
- Remote system control
- Readily interfaces with a microcomputer and variable speed capacity compressor technology.
- Standard angle pattern solder connections-  
3/8 ODM x 3/8 ODM (Model HP)  
3/8 ODM x 1/2 ODF (Models CS/DS)  
(Consult factory for difference connections)
- U.L. Recognised - File MH5567.

## HP Series



## Model HP Mechanical Specifications:

<b>Safe working pressure</b>	35 bar
<b>Burst pressure</b>	175 bar
<b>Operating pressure differential</b>	Table 1
<b>Operating temperature</b>	-29°C to 116°C
<b>Storage temperature</b>	82°C
<b>Capacities</b>	See capacity charts

## Electrical Features

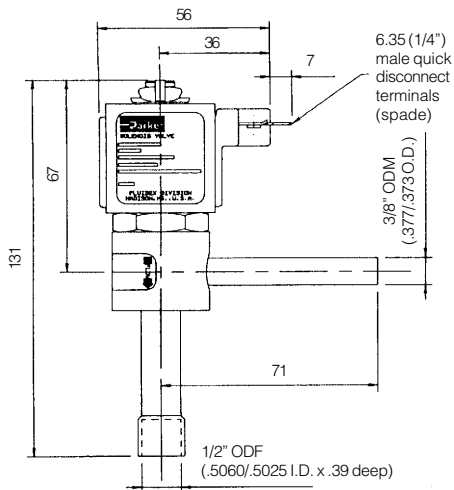
<b>Operating voltages</b>	Table 1
<b>Insulating system</b>	Class F
<b>Terminals</b>	Spade, 18" Leads, DIN
<b>Enclosures</b>	Open frame, Conduit hub

## Specification

Model	MOPD (bav)	Orifice (mm)	Expansion Capacity kW (R22)	Electrical Characteristics
HP120	20	0.40	0.88	AC Rectified Coils: H-23R 24V/60Hz, 24V/50Hz 110-120V/50-60Hz (9.5w) 220-240V/50-60Hz
HP130	20	0.80	1.8	
HP145	20	1.20	2.6	DC Coils: 24V,12V H23 (8.5w)
HP160	20	1.60	3.5	

# Pulse Width Modulating Valves

## CS / DS Series



## Model HP Mechanical Specifications:

<b>Safe working pressure</b>	35 bar
<b>Burst pressure</b>	175 bar
<b>Operating pressure differential</b>	Table 1
<b>Operating temperature</b>	-29°C to 116°C
<b>Storage temperature</b>	82°C
<b>Capacities</b>	See capacity charts

## Electrical Features

<b>Operating voltages</b>	Table 1
<b>Insulating system</b>	Class F
<b>Terminals</b>	Spade, 18" Leads, DIN
<b>Enclosures</b>	Open frame, Conduit hub

## Specification

Model	MOPD (bav)	Orifice (mm)	Expansion Capacity tons (R22)	Electrical Characteristics
CS1073	20	2.0	5.3	AC Rectified Coils: C-23R 24V/60Hz, 24V/50Hz, 110-120V/50-60Hz (11.2W) 220-240V/50-60Hz D-23R 24V/60Hz, 24V/50Hz, 110-120V/50-60Hz (16.0W) 220-240V/50-60Hz
CS1085	20	2.4	7	
DS1100	20	2.8	10.5	
DS1120	20	3.2	17.5	

## Typical Applications

PWM valves can be used for:-

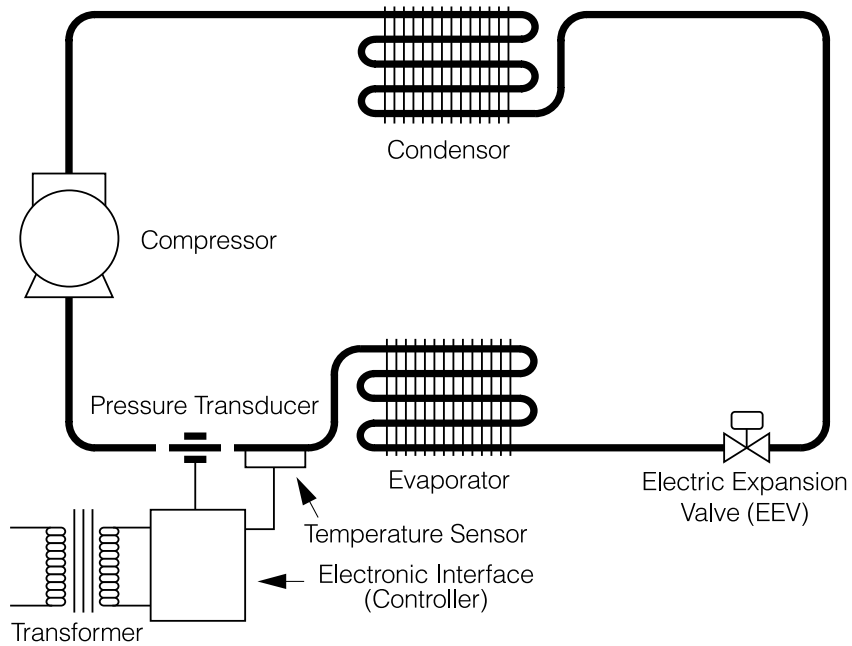
- Superheat Control
- Evaporator temperature control

# Pulse Width Modulating Valves - Applications

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## Superheat Control

Using appropriate temperature sensors, the temperature difference between the inlet and the outlet of the evaporator will define a temperature which is related directly to superheat. Flooding is present if the temperature difference is zero. Adjustments to actual superheat must be made when the system has large evaporator pressure drops.

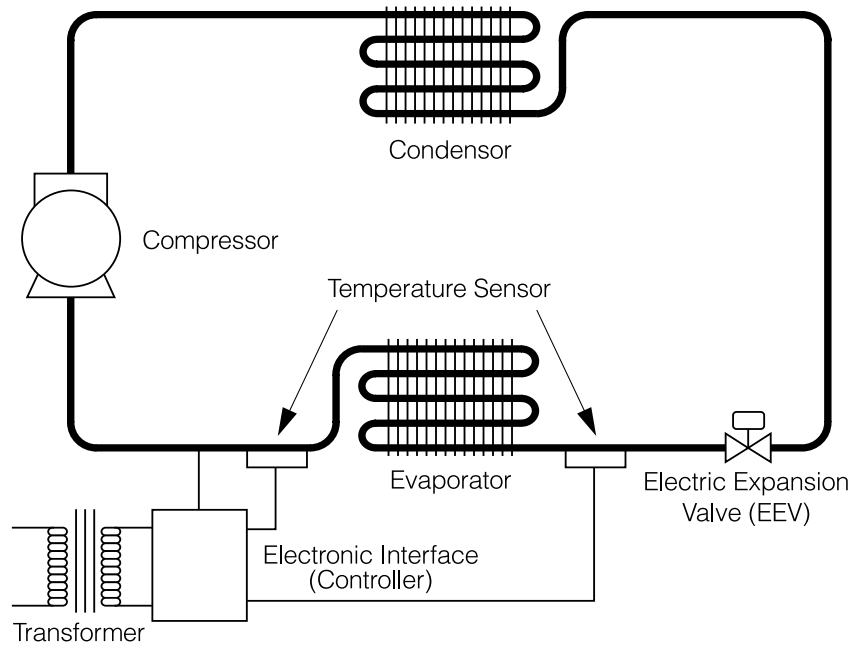


**Superheat Control Using the Temperature & Pressure of Evaporator Outlet**

# Pulse Width Modulating Valves - Applications

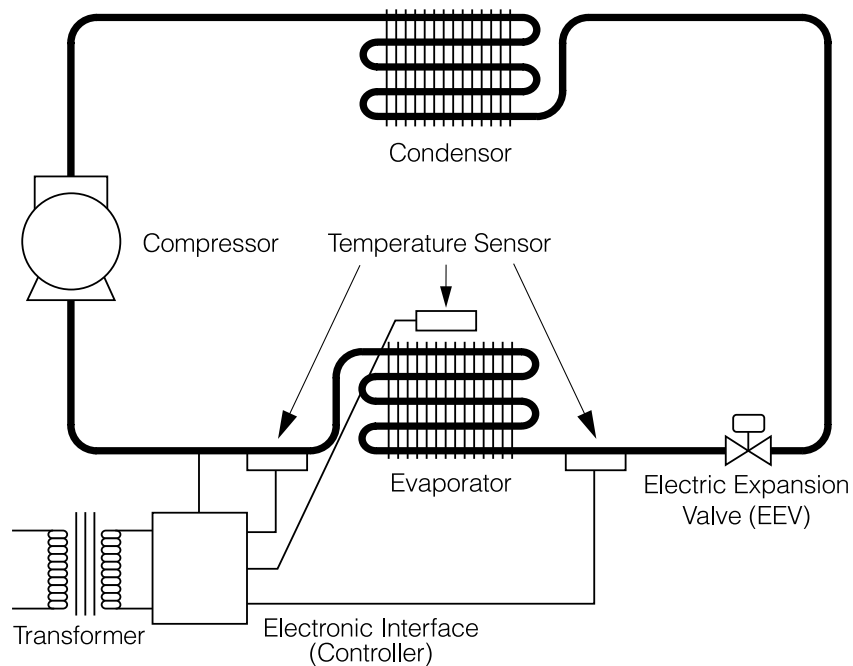
## Evaporator Temperature Control

In addition to the superheat control, the microcomputers could include a sensor to control the evaporator temperature or pressure.



## Superheat Control Using Two Temperature Sensors

Superheat can also be measured directly by sensing the temperature and pressure at the evaporator outlet. In this case the pressure sensor could be a pressure transducer.



## Superheat & Evaporator Temperature Control Using Three Temperature Sensors