SRC-W & SW series compressors

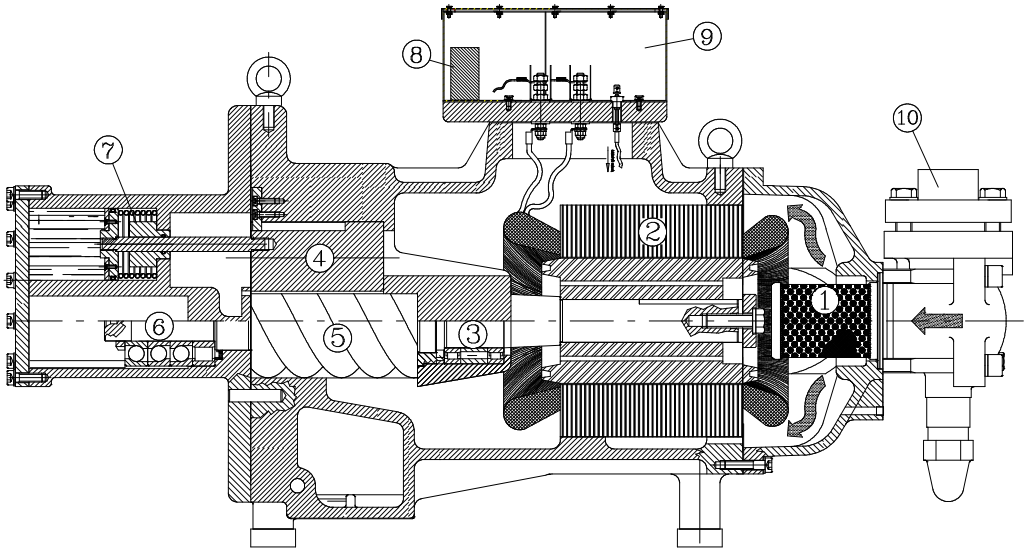
General

(WA-01-03-E)

1. General

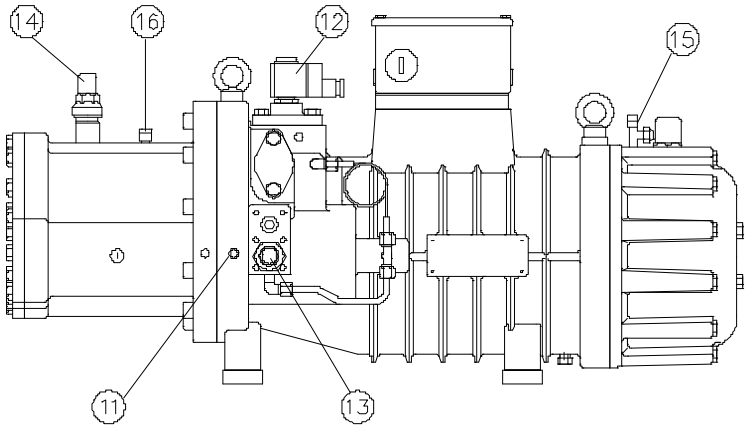
1.1 Introduction

Including a total amount of 36 screw compressors in semi-hermetic execution with external oil separator, the **SRC-W and SW series** cover the power range from 30 to 240 Hp and a displacement range from 118 to 700 m^3/h at 50 Hz.
SRC-W and SW compressor series are available with two different intrinsic volumetric ratios (Vi) optimised either for low and medium/high evaporating temperature. The user has therefore the possibility of choosing the ideal compressor depending on the particular application. As a consequence, the maximum compression efficiency is always performed.
The use of an external oil separator leads to the highest flexibility in the designing of racks with a number of compressors variable from 2 to 6 with one common oil separator (parallel compounding). Beside this, the oil cooling widens the application limits up to the hardest operating conditions.
A complete series of accessories for the oil return line (between the oil separator and the compressor) is provided in the standard delivery. Furthermore, a complete range of oil separators and oil coolers is also available.
The low vibrations level and the absence of discharge gas pulsation make the use of anti-vibrating dampers and flexible pipes not necessary.
In addition, the extremely low noise level, concentrated in the medium-high frequency range, is very easy to insulate
The SRC-W and SW series compressors feature an oil–injected helical twin screw design; the male rotor is directly connected to the electrical motor (2 poles, 3000 rpm) and drives in turn the female rotor. The perfect rolling behaviour leads to an extremely smooth running. The innovative design of rotors profile (5 lobes male rotor, 6 flutes female), the high quality production standard and the use of superior quality mechanical components lead to high compression efficiency, high reliability and long operating life.
The hydraulic slide valve and by-pass capacity control lead this compressor series to a high compression efficiency during part load operation. This makes the SRC-W and SW series particularly suitable for applications where long periods of part load operation are required reducing also the number of starts.
The use of the subcooling economiser circuit (ECO) leads to a further increase in the cycle efficiency (COP).



Picture 1-A: Section drawing of SW compressor model

1 Suction filter
2 Electric motor
3 Rolling bearings (suction side)
4 Slide valve capacity control (SW models)
5 Rotors
6 Rolling bearings (discharge side)
7 Hydraulic piston for capacity control (SW models)
8 Electronic protection module
9 Terminal box
10 Suction shut-off valve



Picture 1-B: example of SW series compressor

11 Oil pressure connection
12 Solenoid valves
13 Oil inlet connection
14 Discharge shut-off valve
15 Low pressure gas connection
16 High pressure gas connection

1.2 Compression process

The rotors are located in a horizontal housing provided with a suction port (motor side) and a discharge port. The extremely small clearances between the rotors and the housing are dynamically sealed by an oil film, which is directly injected on the rotor profiles. The compression takes place by a volume reduction resulting from the rotary motion; between the rotors and the housing several compression chambers are generated that decrease their volume and move along the axis at the same time; basically the process can be divided into three phases, see Picture 1-C (the following description is related to a single lobe of the male rotor and a single flute of the female rotor):

- ***Suction***

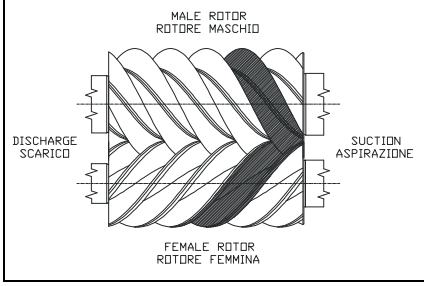
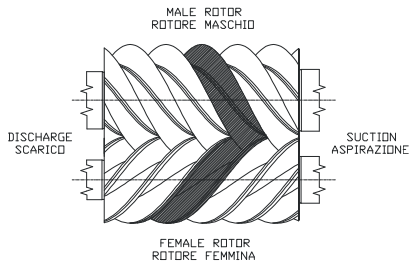
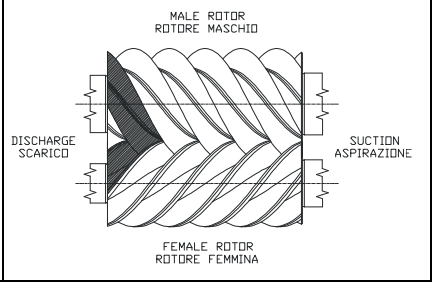
When the male rotor lobe and the female rotor flute begin to unmesh, the compression chamber is open to the suction side and a gas flow is led through the suction port, due to the rotary motion the chamber increase its volume and more gas is led into the chamber until this is not any longer open to the suction side.

- ***Compression***

With a further rotation the volume of the compression chamber is reduced and at the same time it is moved along the axis toward the discharge port, increasing the pressure of the refrigerant contained in the chamber.

- ***Discharge***

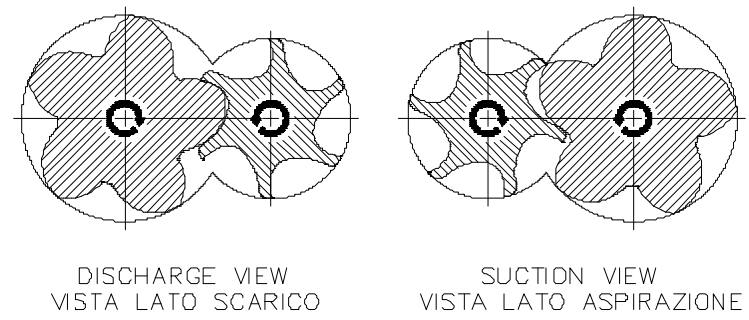
At a point, which is fixed by the housing geometry, the discharge port is uncovered and the compressed gas is discharged thanks to the further meshing of the lobe and the flute. Since the tooth ratio is 5/6 (5 lobes on the male rotor - 6 flutes on the female rotor) and the rotation speed is about 3000 rpm, there are 3000 x 5 = 15000 discharge processes every minute, resulting in a very low gas pulsation (a reciprocating compressor running at 1500 rpm should have 10 pistons to reach the same result).

Chamber at end of suction phase	*Chamber in compression phase*	*Chamber at start of discharge phase*
		

Picture 1-C: Compression phases in twin screws compressors

1.3 The rotors

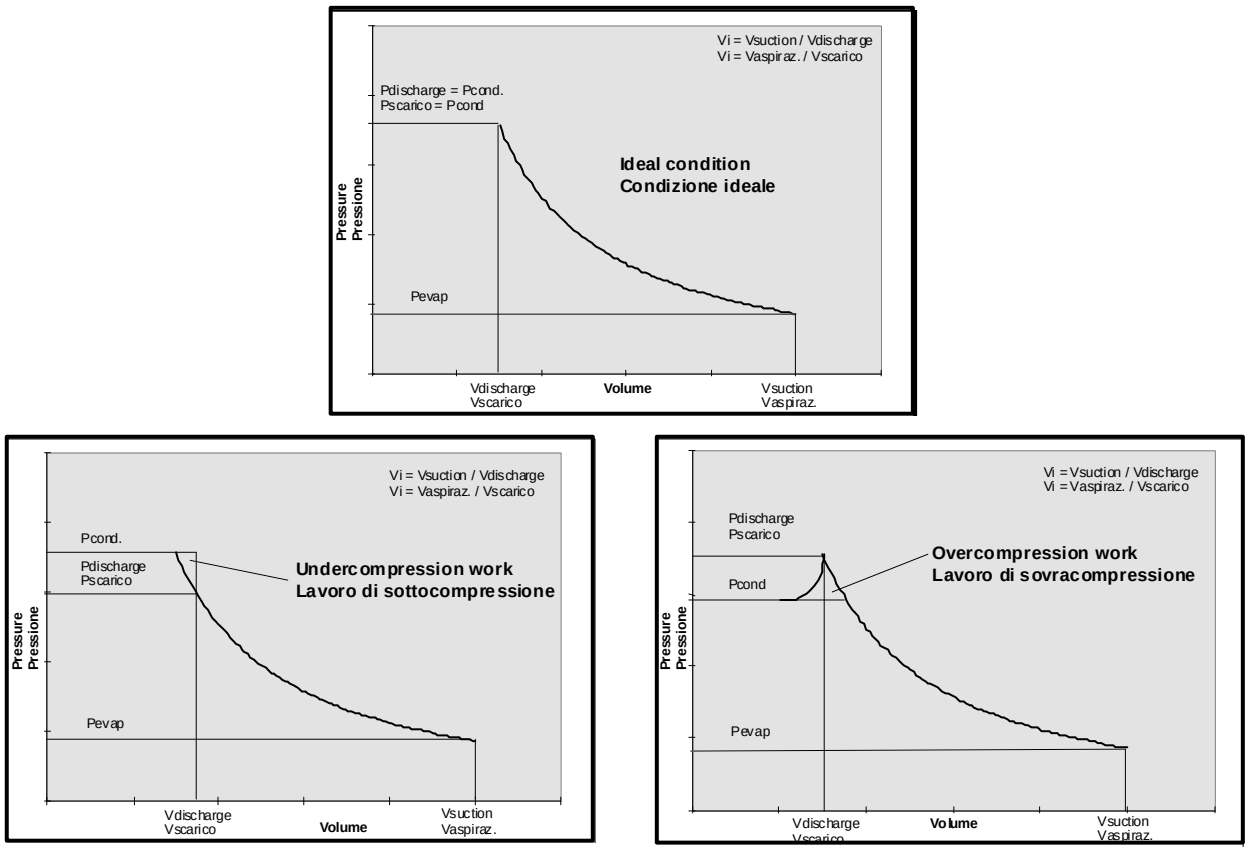
The rotors, as shown in Picture 1-D, feature a 5/6 asymmetric profile, which has been completely developed within RefComp. The perfect rolling behaviour leads to an extremely smooth running. Picture 1-D shows the correct revolving direction, too.



Picture 1-D: rotor view, with correct revolving direction

1.4 Built-in volume ratio

The dimensions and geometry of the discharge port determine the so-called "built-in volume ratio" ***Vi***, defined as the ratio between the chamber volume at the beginning and the end of the compression phase. This ratio, that is not dependent upon the operating conditions, corresponds to an ideal pressure ratio performing the maximum compressor efficiency: the gas leaving the discharge port has the same pressure of the discharge side. When otherwise the discharge pressure is different from the pressure of the gas leaving the discharge port, an overcompression or undercompression takes place.

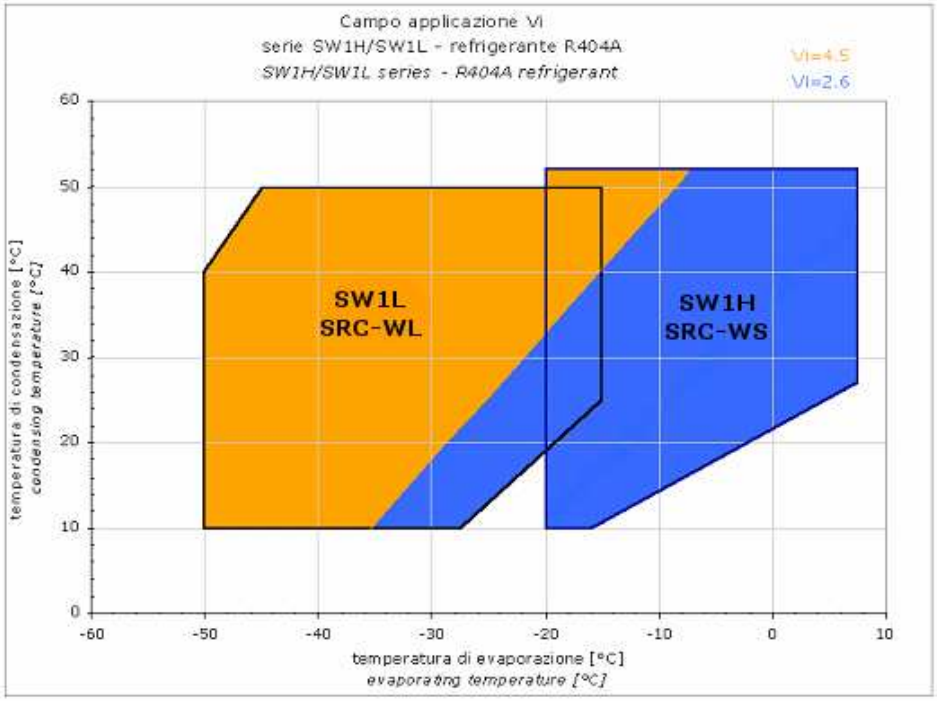


Picture 1-E: Compression process in the p-V diagram

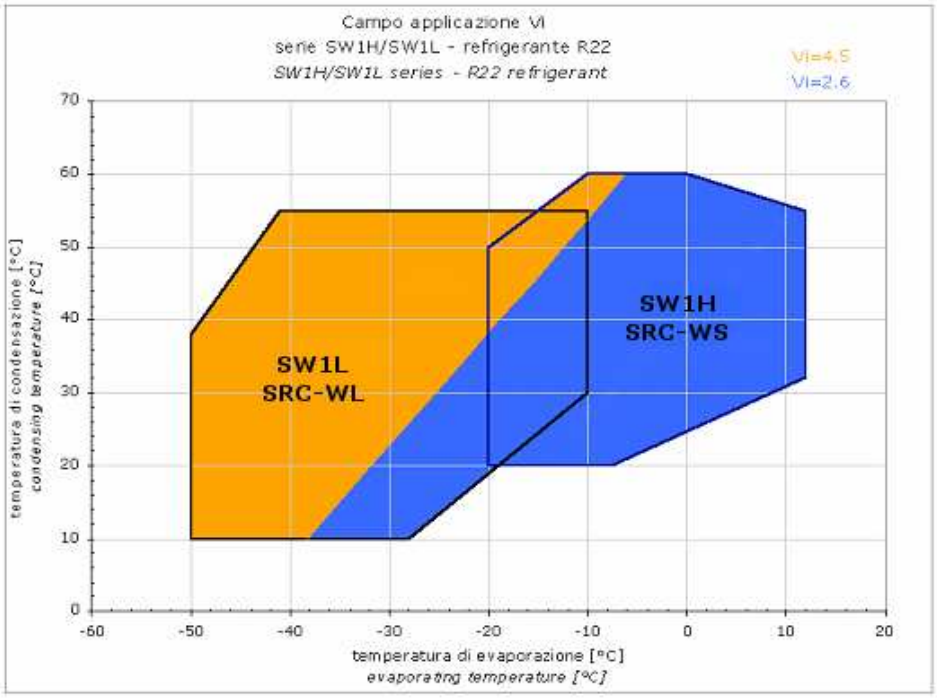
SRC-W and SW compressors series have a built-in volume ratio suitable for medium / high and low temperature applications. The Vi are respectively:

- Vi = 4.4: models SW1L e SRC-WL for low evaporating temperature applications;
- Vi = 2.6: models SW1H e SRC-WS for medium / high evaporating temperature applications (Vi = 3.2 only for models SRC-WS 70/80).

The following charts, see Picture 1-F and Picture 1-G, shows the application limit and the best built-in volume ratio "***Vi***" for the requested working conditions. The application limit are obtained in function of the refrigerant condensing and evaporating temperature.



Picture 1-F: Vi application range for the refrigerant R22



Picture 1-G: Vi application range for the refrigerant R404A / R507