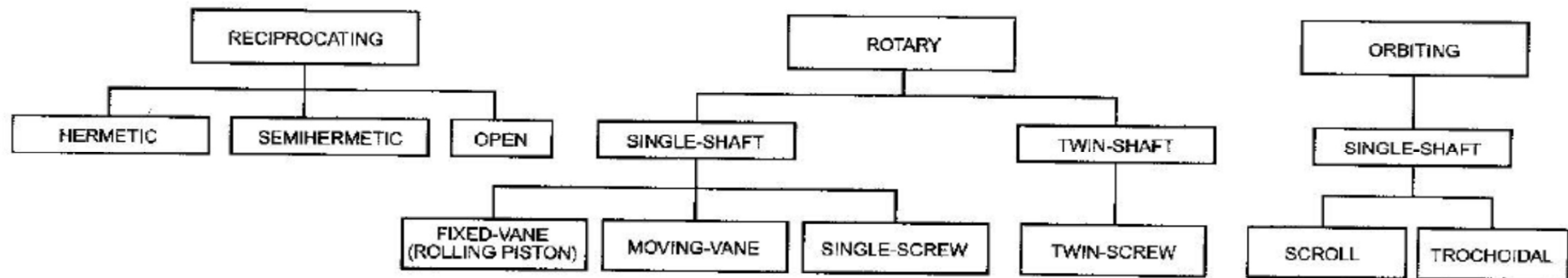
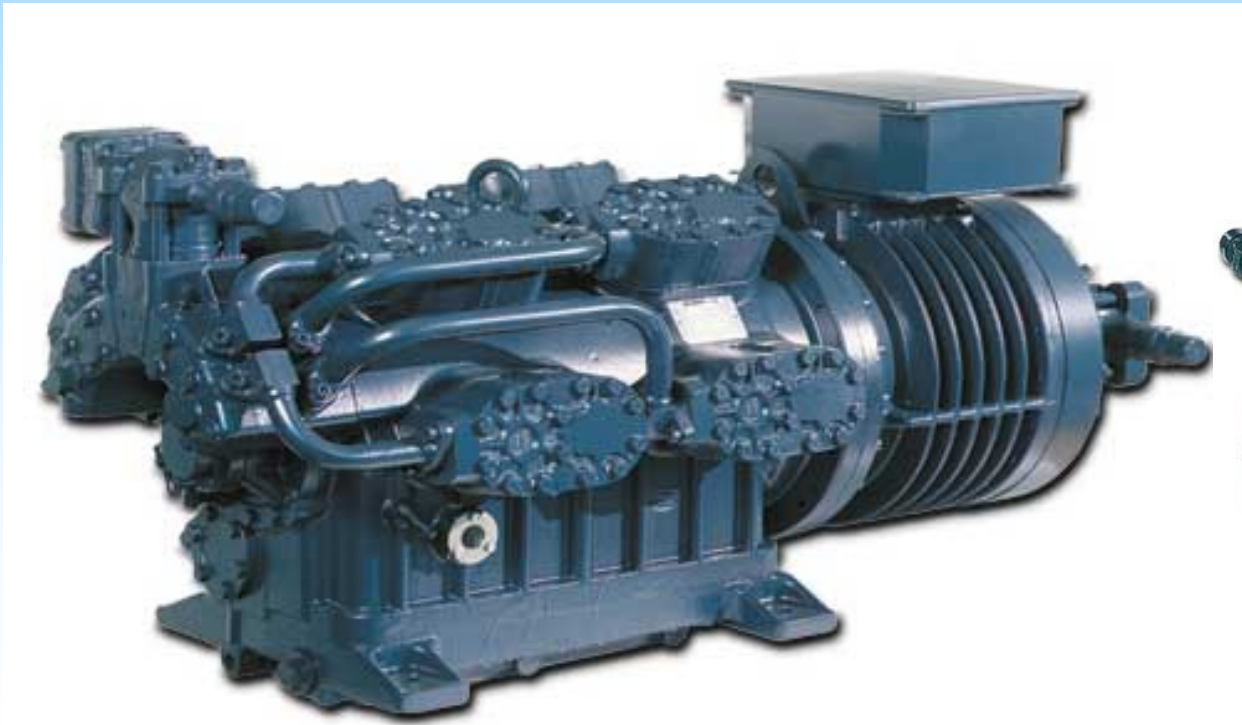
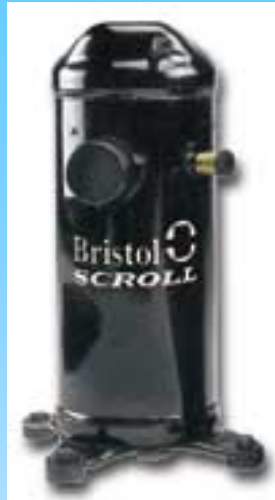


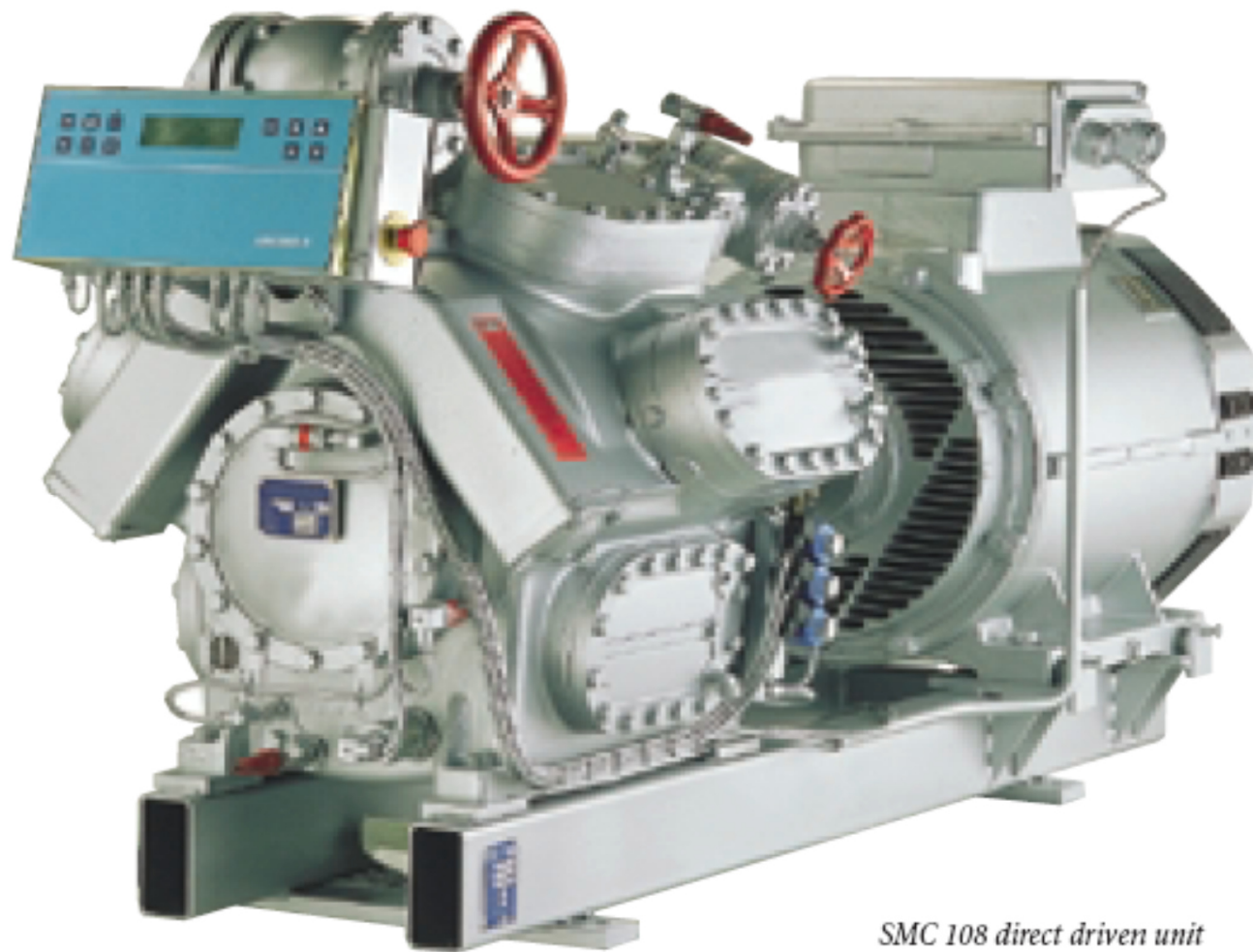
# CLASSIFICAZIONE DEI COMPRESSORI



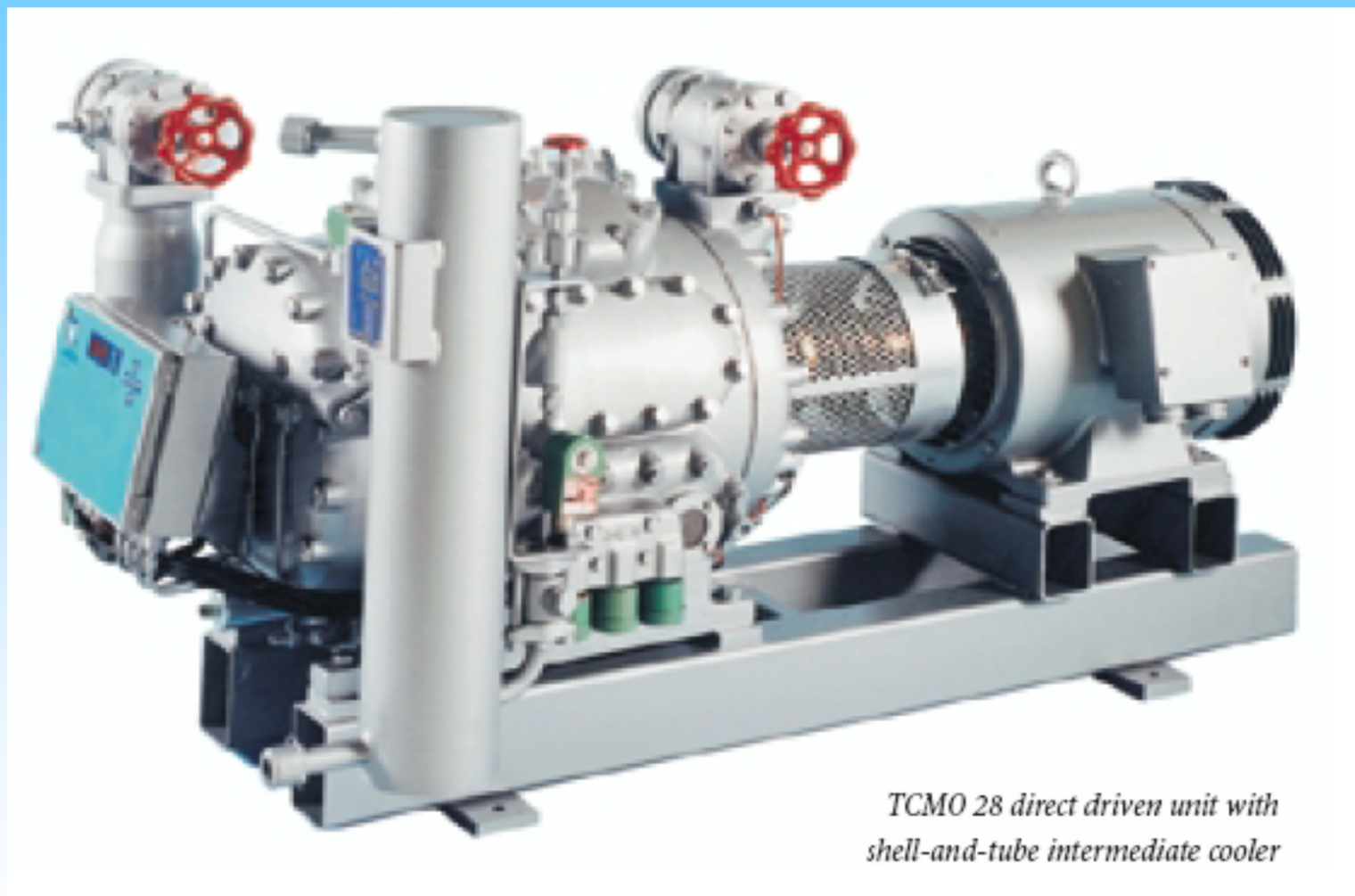
**Fig. 1** Types of Positive-Displacement Compressors



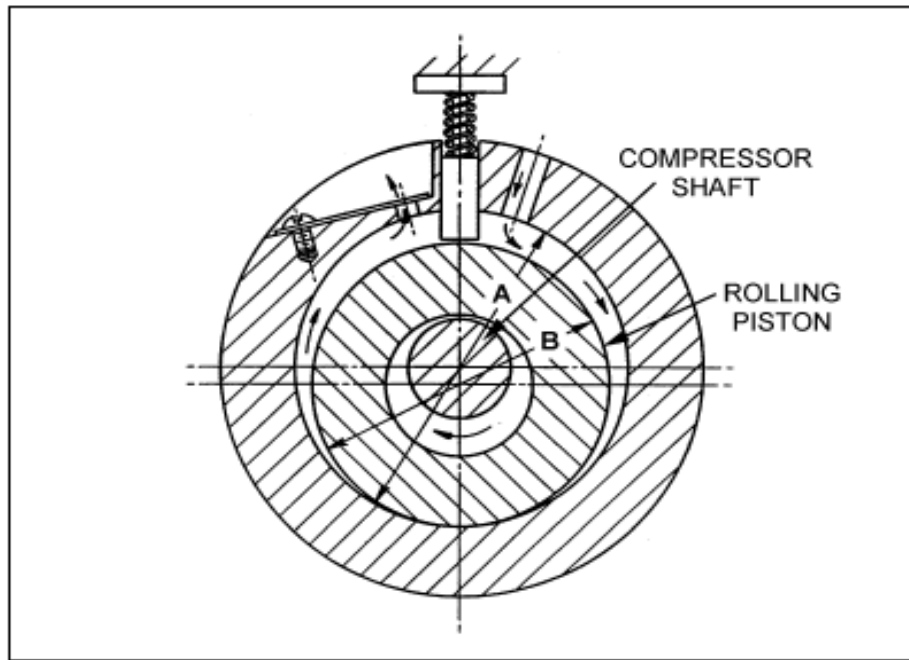




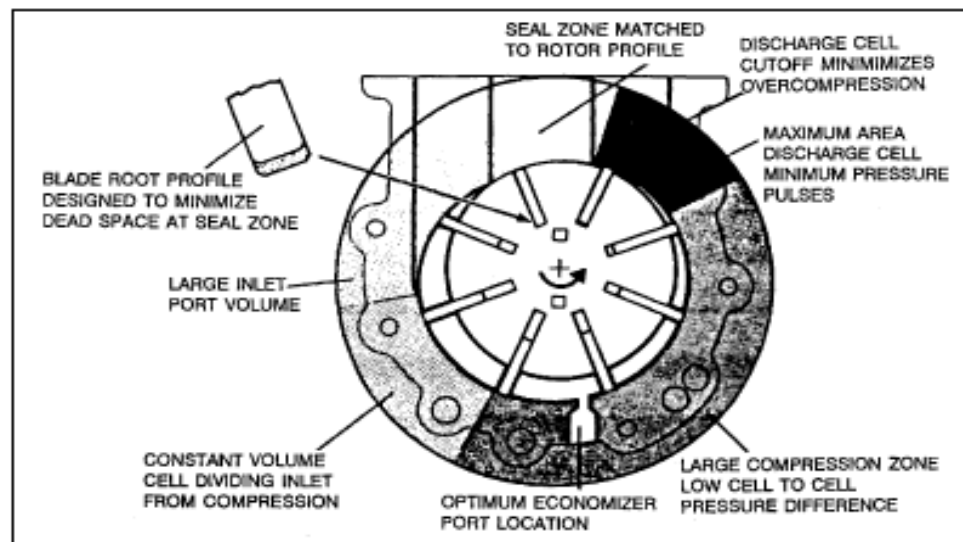
*SMC 108 direct driven unit  
with Unisab II*



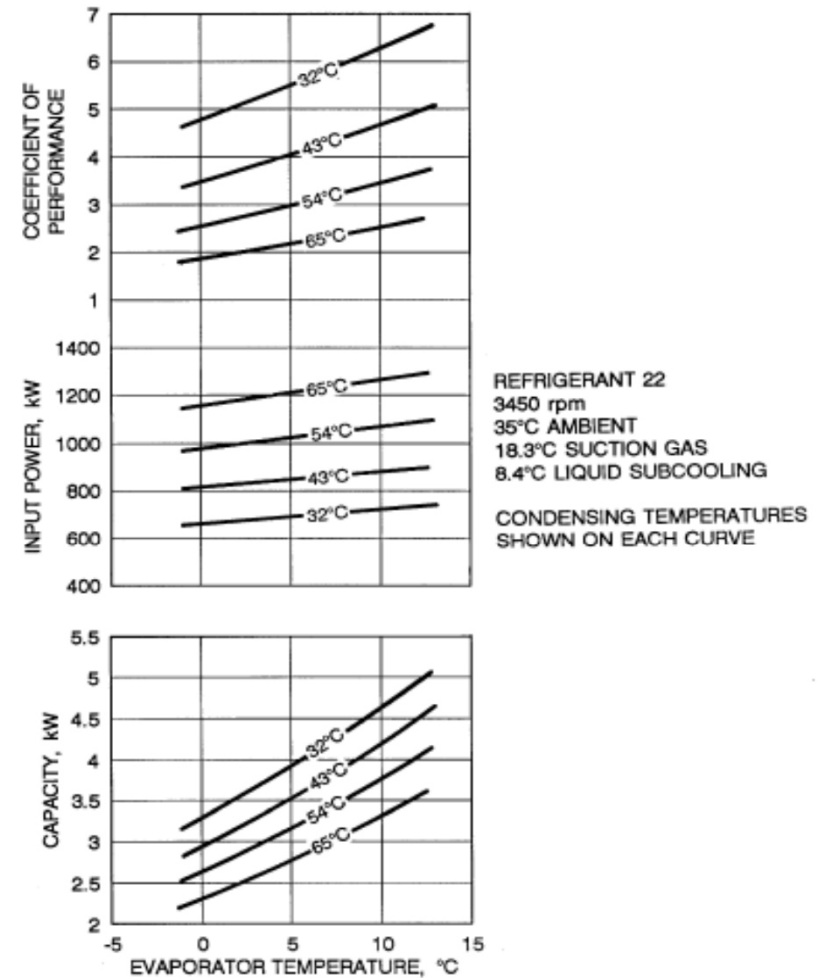
*TCMO 28 direct driven unit with  
shell-and-tube intermediate cooler*



**Fig. 4 Fixed Vane, Rolling Piston Rotary Compressor**



**Fig. 7 Rotary Vane Compressor**



**Fig. 5 Performance Curves for Typical Rolling-Piston Compressor**

## **Compressori alternativi**

Fino a qualche tempo fa non avevano concorrenti nei VITE, ma al massimo erano affiancati a un compressore a palette come stadio di BASSA (alta capacità volumetrica)

Manutenzione annuale (alcuni tra 10.000 e 20.000 ore – ispezione camere di compressione)

Rapporto di compressione massimo pari a  $8 \div 9$ .

Parzializzazione delle realizzazioni pluricilindriche → buona efficienza ai bassi carichi

Costo iniziale ridotto rispetto al vite a pari potenzialità frigorifera

MAX Potenzialità 900kW

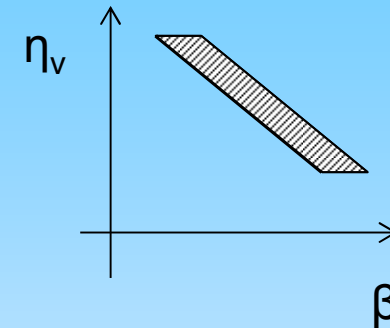
Riavvii intervallati per il naturale ripristino dei valori di pressione dell'olio necessari ad una corretta lubrificazione

Alta vulnerabilità ai “COLPI DI LIQUIDO”

## Variabili maggiormente influenti sulle prestazioni dei compressori

Temperature di lavoro (condensazione e evaporazione)

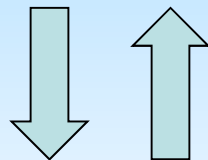
Rapporto di compressione  $\rightarrow$  rendimento volumetrico



## Prestazioni

Assorbimento di potenza [kW elettrici]

Potenzialità frigorifera [kW frigoriferi] o in gergo *capacità frigorifera*



Il compressore sarà in grado di fornire la portata necessaria all'evaporatore per scambiare quella potenzialità frigorifera a quella temperatura



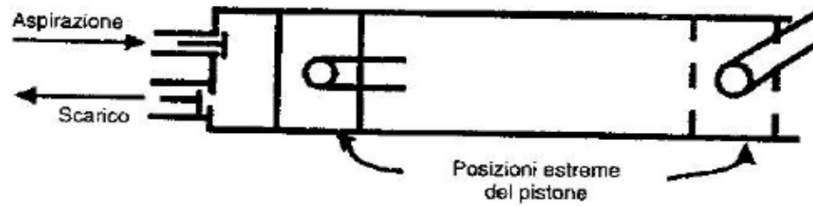
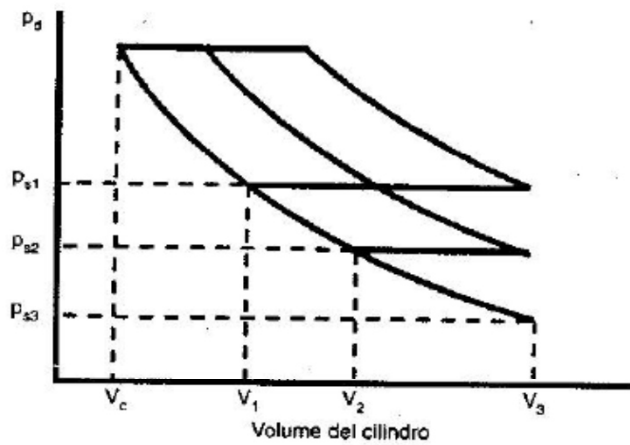
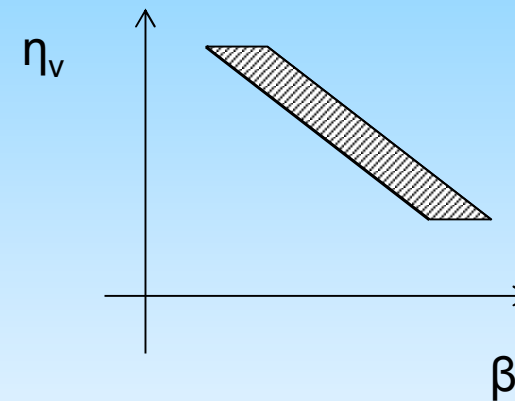


Figura 4.3 – Diagramma pressione-volume corrispondente a diverse posizioni del pistone.

$$\eta_{vc} = \frac{\dot{m}_{reale}}{\dot{m}_{ideale}}$$

Può essere calcolato anche dai cataloghi



$$\eta_{vc} = \frac{V_3 - V_1}{V_3 - V_c}$$

$$\eta_{vc} = \frac{V_3 - V_c + V_c - V_1}{V_3 - V_c} = 1 + \frac{V_c - V_1}{V_3 - V_c} = 1 - \frac{V_c}{V_3 - V_c} \left( \frac{V_1}{V_c} - 1 \right) = 1 - m \left( \frac{V_1}{V_c} - 1 \right)$$

Percentuale di spazio morto

$$m = \frac{V_c}{V_3 - V_c}$$

se

$$p_a v_a^n = p_b v_b^n; \quad \left( \frac{v_a}{v_b} \right) = \left( \frac{p_b}{p_a} \right)^{\frac{1}{n}} = (\beta)^{\frac{1}{n}}$$

$$\eta_{vc} = 1 - m \left[ \beta^{\frac{1}{n}} - 1 \right]$$

$$\dot{q}_r = \dot{V}_d \eta_v \frac{1}{v_s} \Delta h_{ev}$$

$$\dot{V} = \dot{V}_d \eta_v \quad \dot{m} = \frac{\dot{V}}{v_s}$$

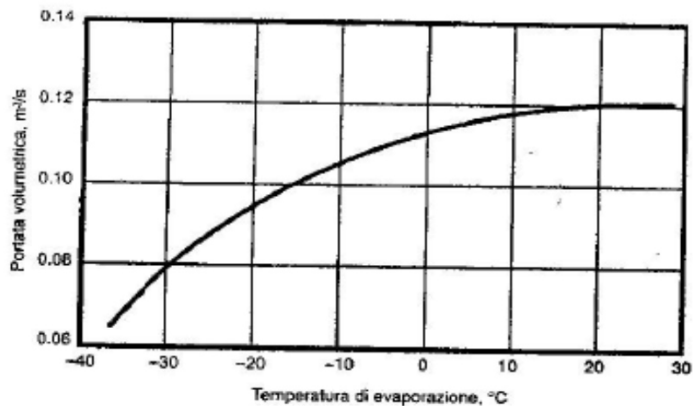


Figura 4.4 – Effetto della temperatura di evaporazione sulla portata volumetrica all'aspirazione di un compressore ad 8 cilindri con un volume generato di 0.123 m³/s e con temperatura di condensazione di 30 °C.

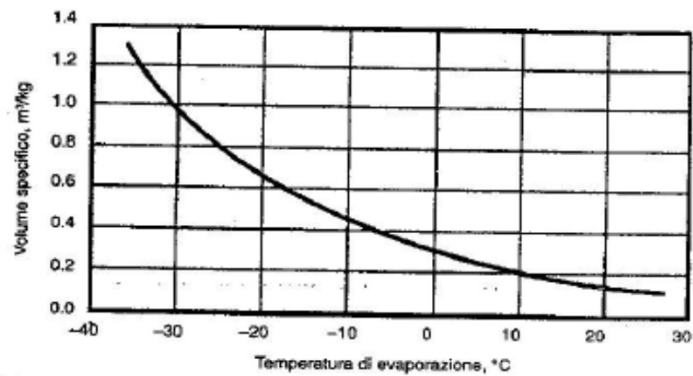
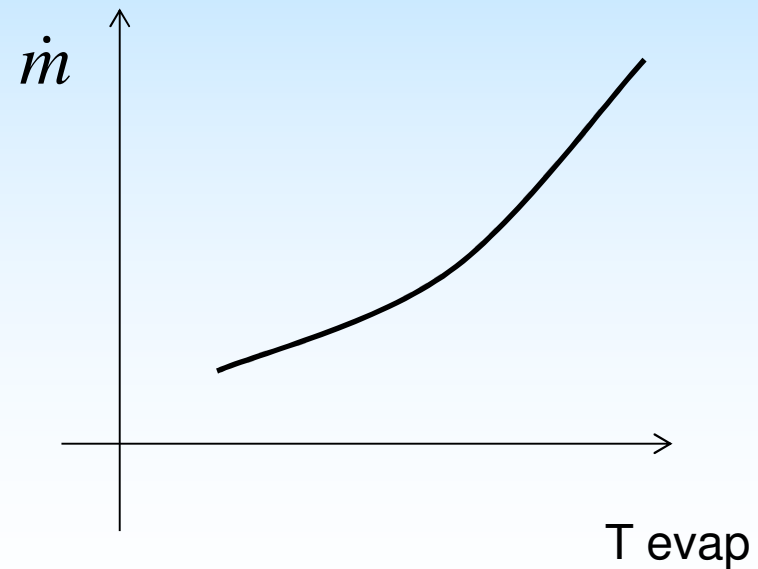


Figura 4.5 – Variazione del volume specifico con la temperatura di evaporazione per vapore di ammoniaca all'aspirazione del compressore.

## Influenza della temperatura di evaporazione sulla portata di massa elaborata

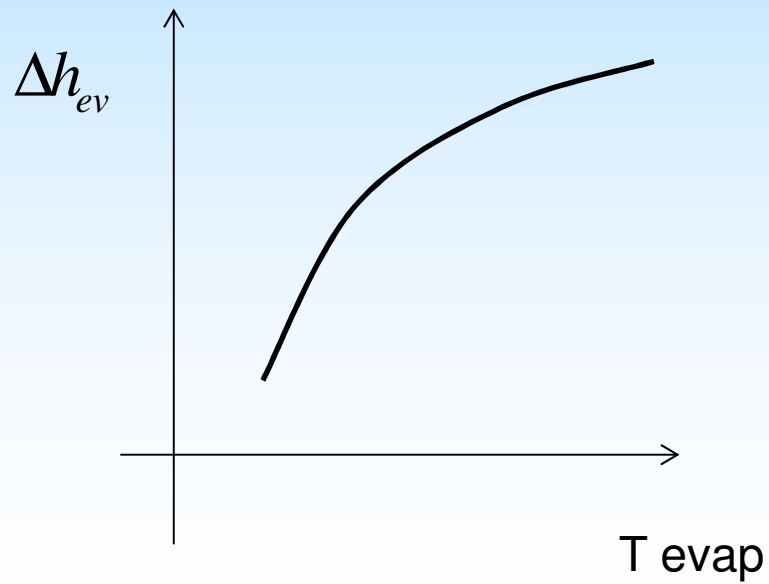
Influenza della variazione del volume specifico

Influenza della portata volumetrica

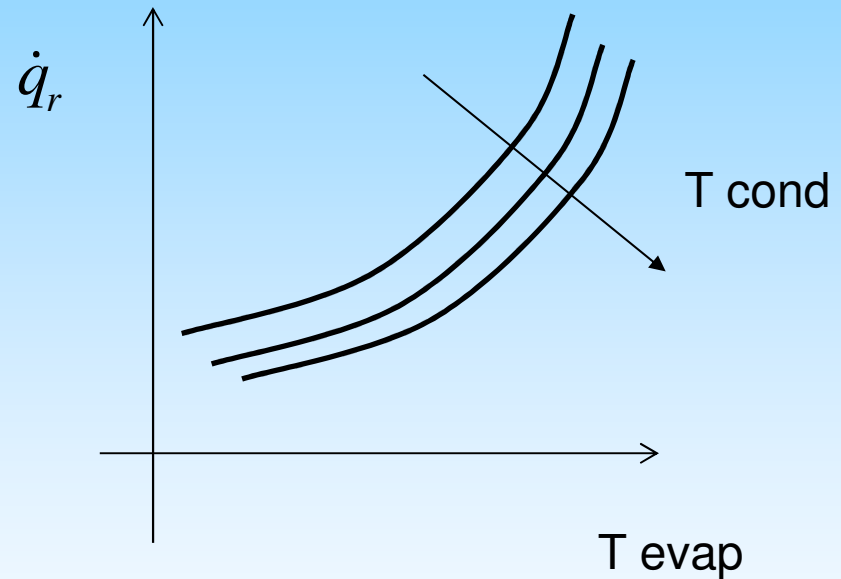


$$\dot{q}_r = \dot{V}_d \eta_v \frac{1}{v_s} \Delta h_{ev}$$

**Influenza della temperatura di evaporazione sul calore latente di evaporazione**



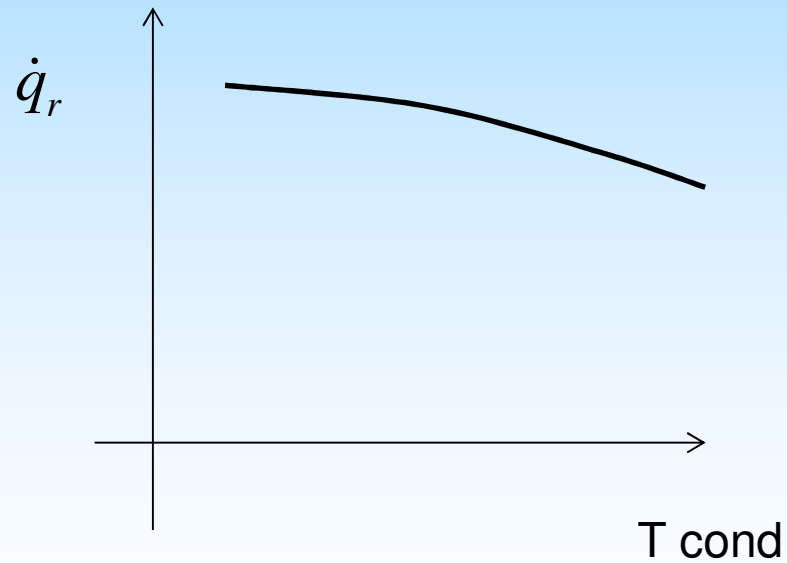
**Influenza della temperatura di evaporazione sulla capacità frigorifera**



$$\dot{q}_r = \dot{V}_d \eta_v \frac{1}{v_s} \Delta h_{ev}$$

**Influenza della temperatura di condensazione sulla capacità frigorifera**

Minore influenza di quella della temperatura di evaporazione



$$\dot{P}_{ass} = \dot{m} \Delta h_{ideal}$$

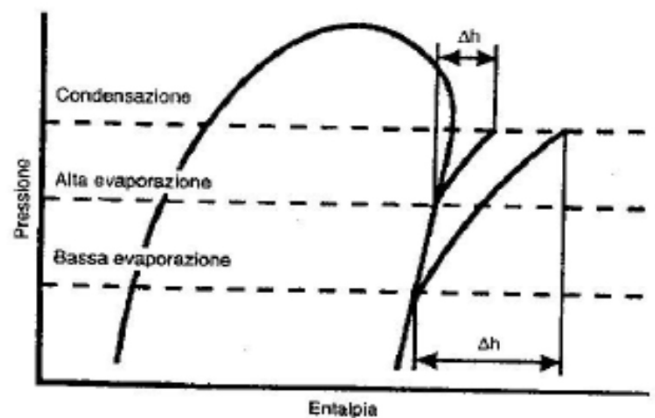


Figura 4.11 – Effetto della temperatura di evaporazione sul lavoro ideale di compressione.

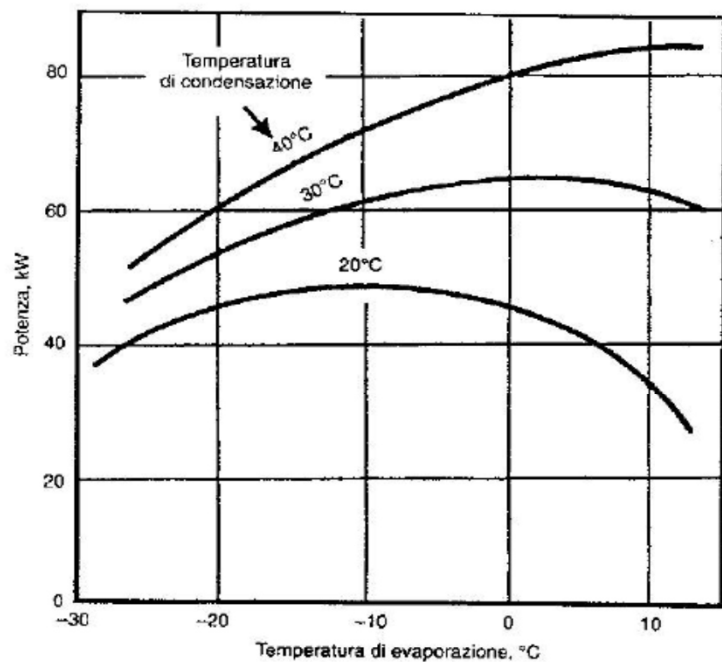


Figura 4.13 – Potenza assorbita effettiva di un compressore a 8 cilindri Sabroe 108L ad ammoniaca, a 1170 giri/l'.

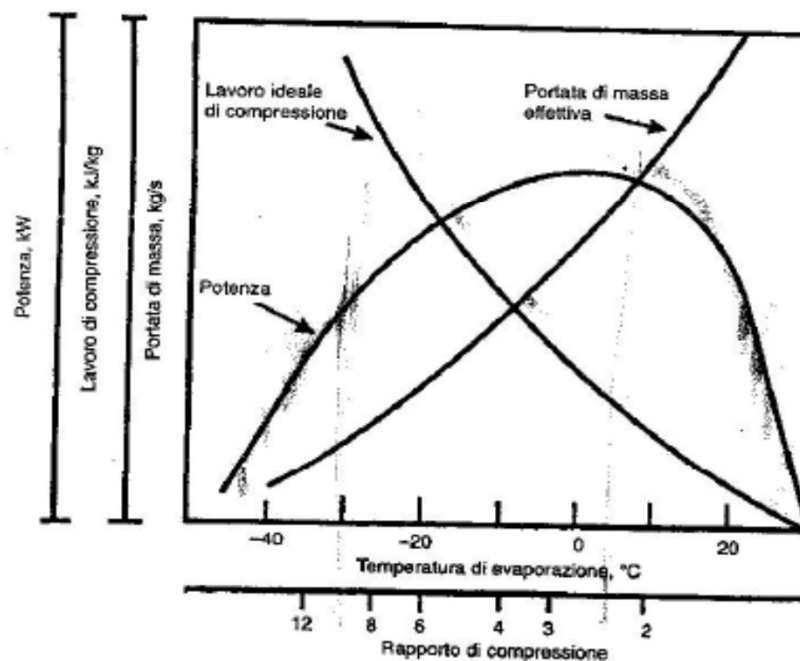


Figura 4.12 – Effetti della temperatura di evaporazione sulla portata di massa, sul lavoro ideale di compressione e sulla potenza assorbita, con temperatura di condensazione costante a 30 °C.

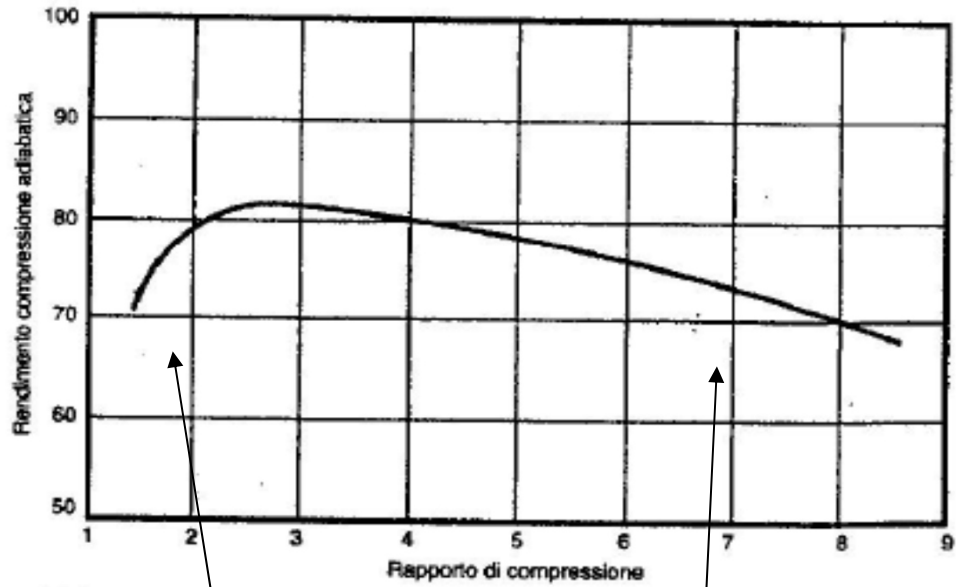
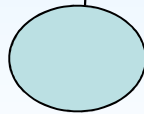
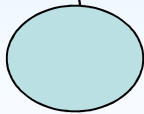
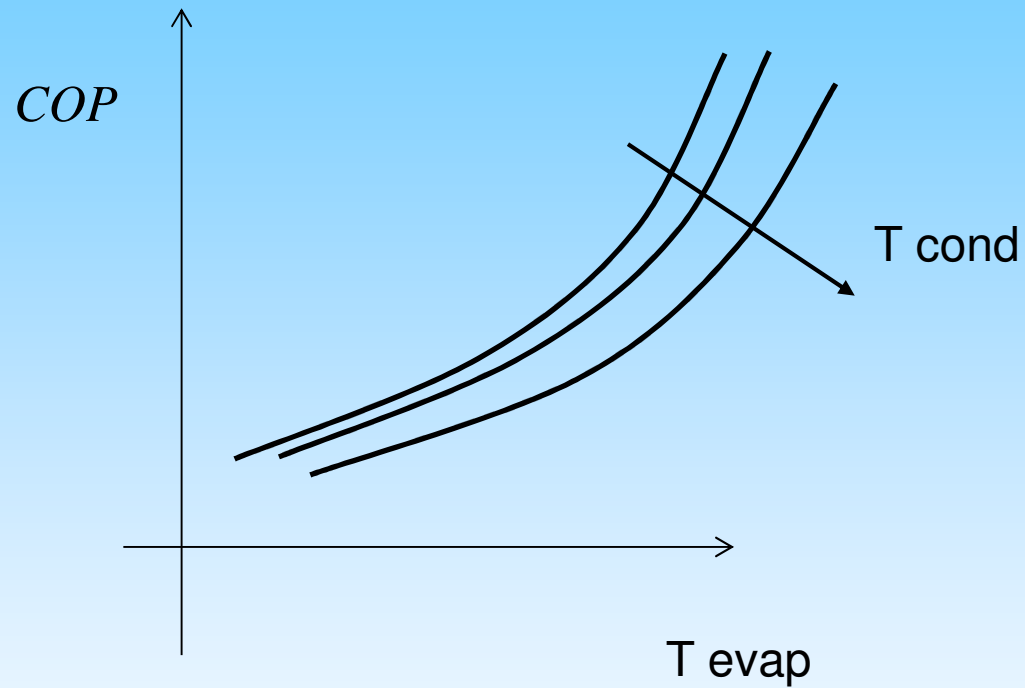


Figura 4.14 - Rendimento della compressione adiabatica in funzione del rapporto di compressione.

$$\dot{P}_{ass} = \dot{m} \eta_c \Delta h_{ideal}$$

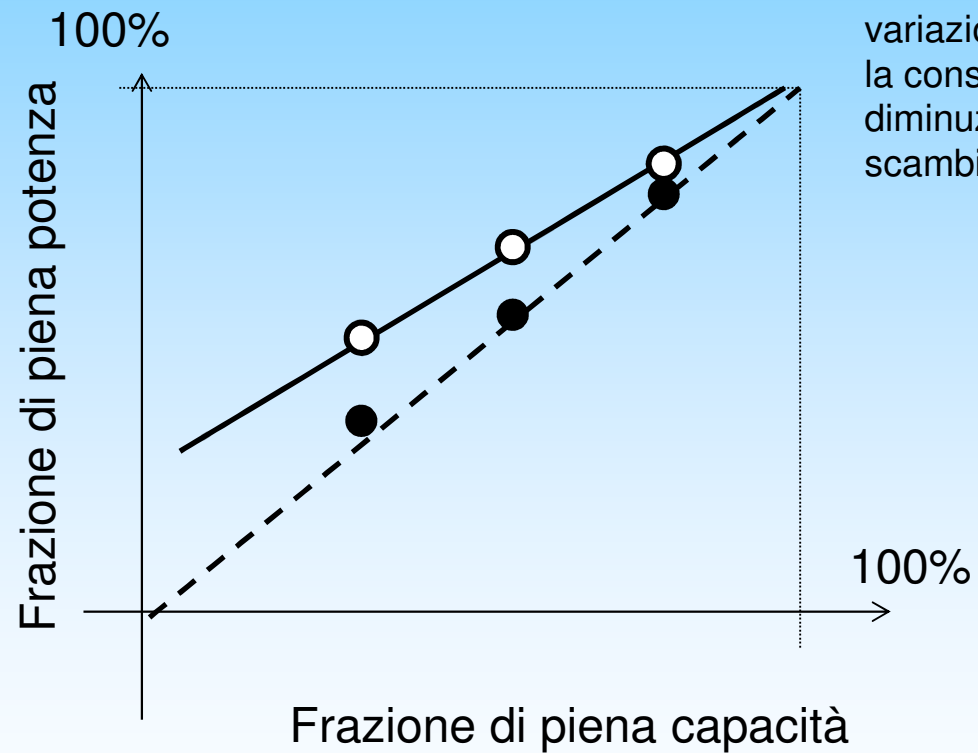


## Influenza delle temperature di lavoro sull'efficienza del ciclo



Attenzione alla considerazione sui cataloghi della presenza del sottoraffreddamento  
(Comunque indicata sui cataloghi)

## LA REGOLAZIONE CURVA POTENZA- CAPACITA'



Influenza della variazione delle T di lavoro per la variazione della portata e la conseguente diminuzione dei coeff. di scambio termico



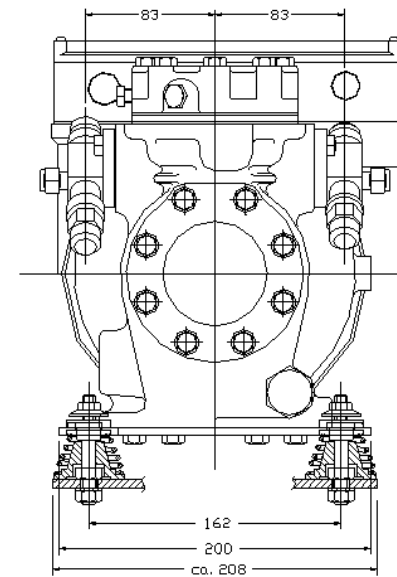
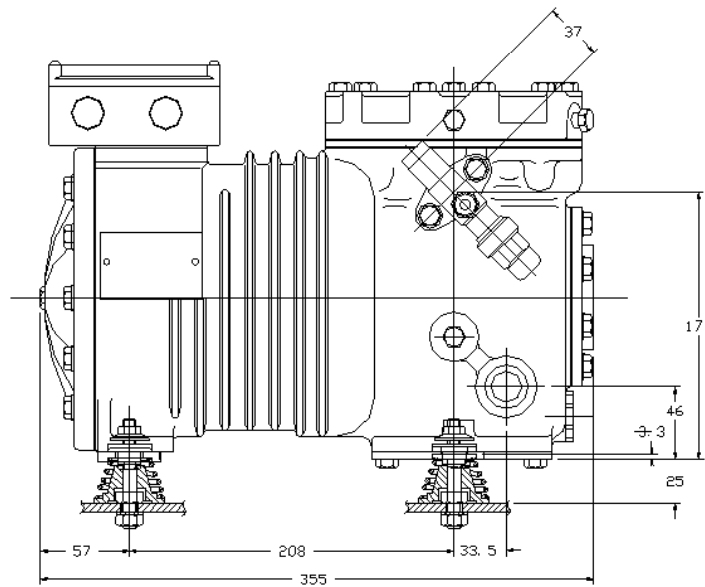
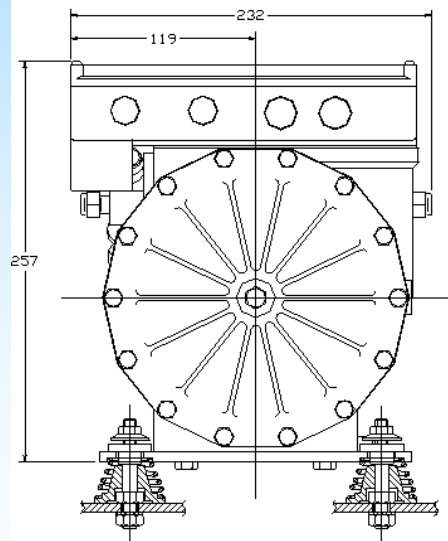
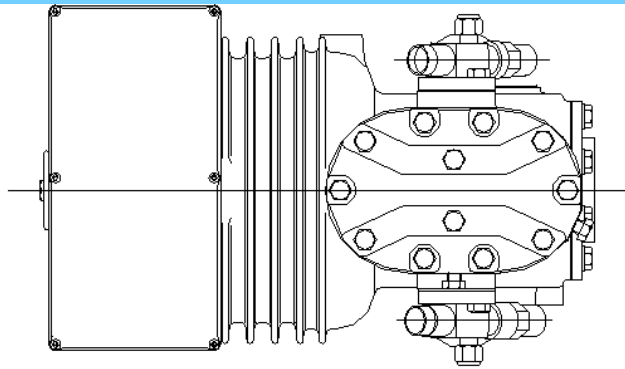
Table 1 Typical Design Features of Reciprocating Compressors

| Item  | Halocarbon Compressor |               |                 | Ammonia Compressor | Item  | Halocarbon Compressor |               |                 | Ammonia Compressor |
|---|-----------------------|---------------|-----------------|--------------------|---|-----------------------|---------------|-----------------|--------------------|
|   | Open                  | Semi-hermetic | Welded Hermetic | Open               |   | Open                  | Semi-hermetic | Welded Hermetic | Open               |
| 1. Number of cylinders—one to:  | 16                    | 12            | 6               | 16                 | 10. Bearings  |                       |               |                 |                    |
| 2. Power range  | 120 W and up          | 0.4 to 110 kW | 0.1 to 20 kW    | 7.5 kW and up      | a. Sleeve, antifriction   | X                     | X             | X               | X                  |
| 3. Cylinder arrangement   |                       |               |                 |                    | b. Tapered roller   | X                     |               |                 | X                  |
| a. Vertical, V or W, radial   | X                     | X             |                 |                    | 11. Capacity control, if provided—manual or automatic   |                       |               |                 |                    |
| b. Radial, horizontal opposed   |                       |               | X               |                    | a. Suction valve lifting  | X                     | X             | X               | X                  |
| c. Horizontal, vertical V or W  |                       | X             |                 | X                  | b. Bypass-cylinder heads to suction   | X                     | X             | X               | X                  |
| 4. Drive  |                       |               |                 |                    | c. Closing inlet  | X                     | X             |                 | X                  |
| a. Hermetic compressors, electric motor   |                       | X             | X               |                    | d. Adjustable clearance   | X                     | X             |                 | X                  |
| b. Open compressors—direct drive, V belt chain, gear, by electric motor or engine                                 | X                     |               |                 | X                  | e. Variable speed   | X                     | X             | X               | X                  |
| 5. Lubrication—splash or force feed, flooded  | X                     | X             | X               | X                  | 12. Materials   |                       |               |                 |                    |
| 6. Suction and discharge valves—ring plate or ring or reed flexing  | X                     | X             | X               | X                  | Motor insulations and rubber materials must be compatible with refrigerant and lubricant mixtures; otherwise, no restrictions |                       | X             | X               |                    |
| 7. Suction and discharge valve arrangement  |                       |               |                 |                    | No copper or brass  |                       |               |                 | X                  |
| a. Suction and discharge valves in head   | X                     | X             | X               | X                  | 13. Lubricant return  |                       |               |                 |                    |
| b. Uniflow—suction valves in top of piston, suction gas entering through cylinder walls; discharge valves in head | X                     |               |                 | X                  | a. Crankcase separated from suction manifolds, oil return check valves, equalizers, spinners, foam breakers                   | X                     | X             |                 | X                  |
| 8. Cylinder cooling   |                       |               |                 |                    | b. Crankcase common with suction manifold   |                       |               | X               |                    |
| a. Suction gas cooled   | X                     | X             | X               | X                  | 14. Synchronous speeds (50 to 60 Hz)  | 250 to 3600           | 1500 to 3600  | 1500 to 3600    | 250 to 1500        |
| b. Water jacket cylinder wall, head, or cylinder wall and head  | X                     |               |                 | X                  | 15. Pistons   |                       |               |                 |                    |
| c. Air cooled   | X                     | X             | X               | X                  | a. Aluminum or cast iron  | X                     | X             | X               | X                  |
| d. Refrigerant cooled heads   | X                     |               |                 | X                  | b. Ringless   | X                     | X             | X               | X                  |
| 9. Cylinder head  |                       |               |                 |                    | c. Compression and oil control rings  | X                     | X             | X               | X                  |
| a. Spring loaded  | X                     | X             | X               | X                  | 16. Connecting rod  |                       |               |                 |                    |
| b. Bolted head  | X                     | X             | X               | X                  | Split rod with removable cap or solid eccentric strap   | X                     | X             | X               | X                  |
|   |                       |               |                 |                    | 17. Mounting  |                       |               |                 |                    |
|   |                       |               |                 |                    | Internal spring mount   |                       | X             | X               |                    |
|   |                       |               |                 |                    | External spring mount   |                       | X             | X               |                    |
|   |                       |               |                 |                    | Rigidly mounted on base   | X                     | X             |                 | X                  |

**Table 2 Typical Performance Values for Reciprocating Compressors**

| Compressor Size and Type | Operating Conditions and Refrigerants |        |               |         |               |        |               |        |
|--------------------------|---------------------------------------|--------|---------------|---------|---------------|--------|---------------|--------|
|                          | R-404a                                |        | R-134a        |         | R-22          |        | R-22          |        |
|                          | Evap. Temp. =                         | -40°C  | Evap. Temp. = | -17.8°C | Evap. Temp. = | 4.4°C  | Evap. Temp. = | 7.2°C  |
|                          | Cond. Temp. =                         | 41°C   | Cond. Temp. = | 43°C    | Cond. Temp. = | 41°C   | Cond. Temp. = | 54.4°C |
|                          | Suction Gas =                         | 18.3°C | Suction Gas = | 18.3°C  | Suction Gas = | 12.8°C | Suction Gas = | 18.3°C |
|                          | Subcooling =                          | 0 K    | Subcooling =  | 0 K     | Subcooling =  | 0 K    | Subcooling =  | 0 K    |
|                          | Refrigerant Output/Power Input, W/W   |        |               |         |               |        |               |        |
| Large, over 19 kW        |                                       |        |               |         |               |        |               |        |
| Open                     | 0.99                                  |        | 1.89          |         | 4.95          |        | 5.04          |        |
| Hermetic                 | 0.92                                  |        | 1.76          |         | 4.16          |        | 3.05          |        |
| Medium, 4 to 19 kW       |                                       |        |               |         |               |        |               |        |
| Open                     | 0.90                                  |        | 1.74          |         | 4.71          |        | 4.71          |        |
| Hermetic                 | 0.85                                  |        | 1.64          |         | 4.10          |        | 3.02          |        |
| Small, under 4 kW        |                                       |        |               |         |               |        |               |        |
| Open                     | —                                     |        | —             |         | —             |        | —             |        |
| Hermetic                 | —                                     |        | 1.11          |         | 4.04          |        | 2.93          |        |

DK without oil pump



*Caratteristiche tecniche; Technical data*

| <i>Modello<br/>Model</i> | Volume spostato<br>Displacement<br>[m <sup>3</sup> /h] | Rub. asp.<br>Suct. Valve<br>SL | Rub. scarico<br>Disc. valve DL | Carica<br>olio [kg] | Peso<br>netto<br>[kg] |
|--------------------------|--|--------------------------------|--------------------------------|---------------------|-----------------------|
| H 290 CS                 | 14.74  | 22s                            | 16s                            | 1.4                 | 54                    |
| H 300 CC                 | 14.74  | 22s                            | 16s                            | 1.4                 | 56                    |
| H 300 CS                 | 15.94  | 28s                            | 16s                            | 1.4                 | 54                    |
| H 350 CC                 | 15.94  | 28s                            | 16s                            | 1.4                 | 56                    |
| H 350 SB                 | 17.53  | 28s                            | 16s                            | 1.4                 | 54                    |
| H 380 CC                 | 17.53  | 28s                            | 16s                            | 1.4                 | 56                    |
| H 380 SB                 | 19.53  | 28s                            | 16s                            | 1.4                 | 54                    |
| H 390 CS                 | 19.53  | 28s                            | 16s                            | 1.4                 | 56                    |
| H 392 CS                 | 23.31  | 28s                            | 16s                            | 1.4                 | 58                    |

*Caratteristiche elettriche; Electric data*

| <i>Modello<br/>Model</i> | FLA [A]<br>380 V, 50 Hz | LRA [A]<br>380 V, 50 Hz | FLA [A]<br>380 V, 60 Hz | LRA [A]<br>380 V, 60 Hz |
|--------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| H 290 CS                 | 7.5                     | 29.9                    | 8.9                     | 35.5                    |
| H 300 CC                 | 9.4                     | 43.4                    | 10.8                    | 51.6                    |
| H 300 CS                 | 7.5                     | 29.9                    | 11.4                    | 35.5                    |
| H 350 CC                 | 9.4                     | 43.4                    | 12.0                    | 51.6                    |
| H 350 SB                 | 7.5                     | 29.9                    | 12.5                    | 35.5                    |
| H 380 CC                 | 9.4                     | 43.4                    | 13.0                    | 51.6                    |
| H 380 SB                 | 7.5                     | 29.9                    | 13.0                    | 35.5                    |
| H 390 CS                 | 9.4                     | 43.4                    | 12.4                    | 51.6                    |
| H 392 CS                 | 11.5                    | 53.3                    | 13.2                    | 63.4                    |

FLA:

Mass. corrente di  
funzionamento

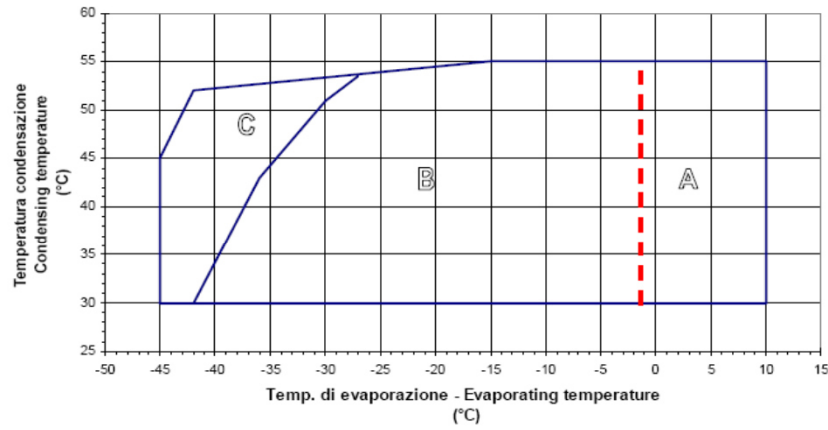
Max. operating  
current

LRA:

Corrente a rotore  
bloccato

Locked rotor  
current

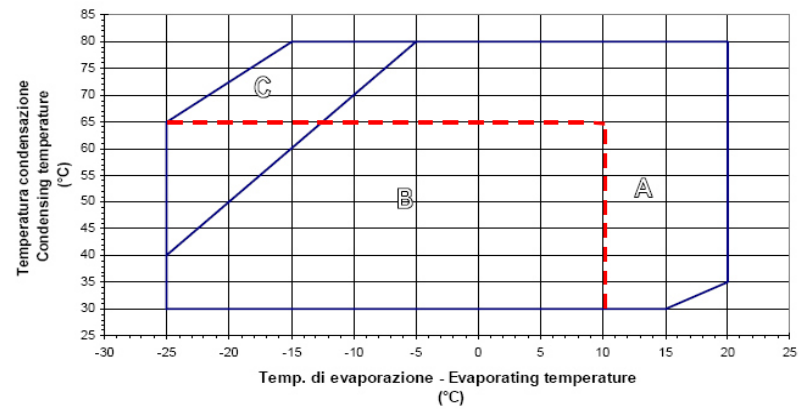
R404A



Campo di applicazione - Application envelope

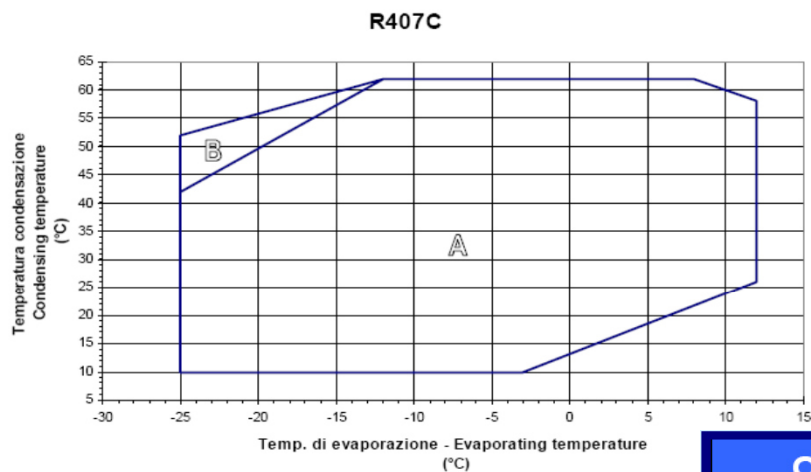
- A = Solo per modelli "CC" - "CC" models only
- B = Applicazione standard - Standard application
- C = Ventilatore su testa - Head fan

R134a



Campo di applicazione - Application envelope

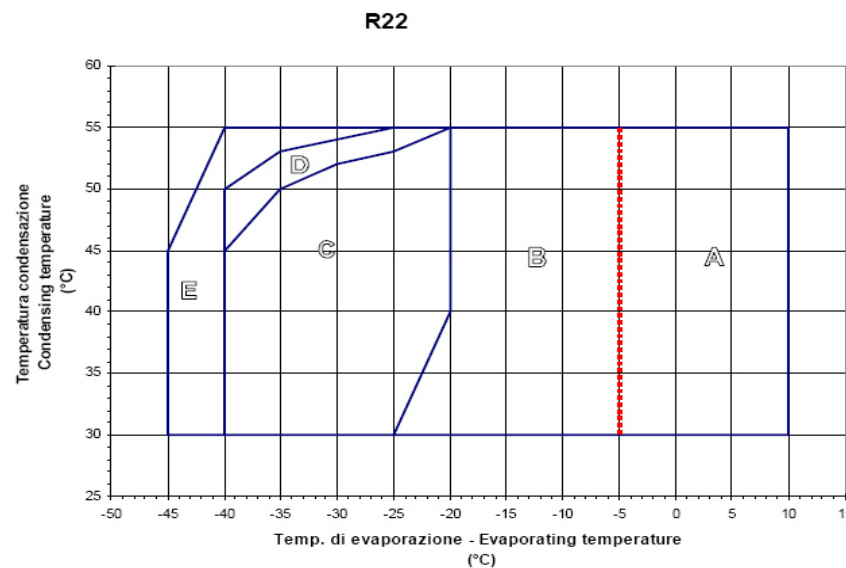
- A = Solo per modelli "CC" - "CC" models only
- B = Applicazione standard - Standard application
- C = Ventilatore su testa - Head fan



Campo di applicazione - Application envelope

A = Applicazione standard - Standard application

B = Ventilatore su testa + max surrisc. = 20K - Head fan + max superheating = 20 K



Campo di applicazione - Application envelope

A = Solo per modelli "CC" - "CC" models only

B = Applicazione standard - Normal application - Application standard - Standard einsatz.

C = Ventilatore su testa + max surrisc. = 30K - Head fan + max superheating = 30K

D = Ventilatore su testa + max surrisc. = 20K - Head fan + max superheating = 20K

E = Solo per applicazioni speciali - Special operation only



| Resa frigorifera / Refrigerating capacity [W]<br>Potenza assorbita / Power absorbed [kW] |    | 50 hz |       |       |       |       |       |       |       |       |       | R22   |  |
|--|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| Modello<br>Model   | Tc | Te    |       |       |       |       |       |       |       |       |       |       |  |
|  |    | 10°C  | 5°C   | 0°C   | -5°C  | -10°C | -15°C | -20°C | -25°C | -30°C | -35°C | -40°C |  |
| H290CS   | 35 | -     | -     | -     | 9752  | 7992  | 6468  | 5161  | 4051  | 3120  | 2348  | 1716  |  |
|  | 45 | -     | -     | -     | 3,50  | 2,82  | 2,58  | 2,34  | 2,11  | 1,87  | 1,65  | 1,43  |  |
| H300CC   | 35 | -     | -     | -     | 8399  | 6823  | 5464  | 4305  | 3327  | 2510  | 1835  | 1283  |  |
|  | 45 | -     | -     | -     | 3,35  | 3,08  | 2,80  | 2,53  | 2,26  | 1,99  | 1,73  | 1,48  |  |
| H300CC   | 35 | 16792 | 14002 | 11556 | 9422  | 7573  | 5977  | 4605  | -     | -     | -     | -     |  |
|  | 45 | 2,96  | 2,97  | 2,91  | 2,77  | 2,59  | 2,38  | 2,16  | -     | -     | -     | -     |  |
| H300CS   | 35 | 14481 | 12006 | 9841  | 7954  | 6318  | 4901  | 3675  | -     | -     | -     | -     |  |
|  | 45 | 3,65  | 3,51  | 3,31  | 3,07  | 2,80  | 2,53  | 2,28  | -     | -     | -     | -     |  |
| H300CS   | 35 | -     | -     | -     | 10378 | 8484  | 6849  | 5453  | 4274  | 3292  | 2484  | 1831  |  |
|  | 45 | -     | -     | -     | 3,27  | 2,99  | 2,74  | 2,48  | 2,22  | 2,00  | 1,78  | 1,57  |  |
| H350CC   | 35 | -     | -     | -     | 8921  | 7243  | 5804  | 4582  | 3558  | 2709  | 2015  | 1454  |  |
|  | 45 | -     | -     | -     | 3,59  | 3,28  | 2,98  | 2,69  | 2,42  | 2,15  | 1,90  | 1,67  |  |
| H350CC   | 35 | 18850 | 15690 | 12919 | 10502 | 8407  | 6599  | 5045  | -     | -     | -     | -     |  |
|  | 45 | 3,33  | 3,38  | 3,32  | 3,18  | 2,98  | 2,75  | 2,48  | -     | -     | -     | -     |  |
| H350SB   | 35 | 16268 | 13470 | 11022 | 8890  | 7040  | 5439  | 4052  | -     | -     | -     | -     |  |
|  | 45 | 4,14  | 4,00  | 3,80  | 3,54  | 3,24  | 2,92  | 2,60  | -     | -     | -     | -     |  |
| H350SB   | 35 | -     | -     | -     | -     | -     | -     | 5488  | 4313  | 3318  | 2485  | 1796  |  |
|  | 45 | -     | -     | -     | -     | -     | -     | 2,30  | 2,08  | 1,87  | 1,68  |       |  |
| H380CC   | 35 | -     | -     | -     | -     | -     | -     | 4683  | 3631  | 2743  | 2003  | 1392  |  |
|  | 45 | -     | -     | -     | -     | -     | -     | 2,50  | 2,25  | 2,01  | 1,78  |       |  |
| H380CC   | 35 | 20409 | 17012 | 14032 | 11434 | 9181  | 7237  | 5566  | -     | -     | -     | -     |  |
|  | 45 | 3,47  | 3,48  | 3,41  | 3,28  | 3,08  | 2,84  | 2,55  | -     | -     | -     | -     |  |
| H380SB   | 35 | 17616 | 14628 | 12014 | 9737  | 7762  | 6052  | 4571  | -     | -     | -     | -     |  |
|  | 45 | 4,36  | 4,22  | 4,01  | 3,75  | 3,44  | 3,08  | 2,68  | -     | -     | -     | -     |  |
| H380SB   | 35 | -     | -     | -     | -     | -     | -     | 7252  | 5743  | 4458  | 3376  | 2471  |  |
|  | 45 | -     | -     | -     | -     | -     | -     | 2,97  | 2,67  | 2,40  | 2,15  |       |  |
| H390CS   | 35 | -     | -     | -     | -     | -     | -     | 6098  | 4769  | 3640  | 2688  | 1888  |  |
|  | 45 | -     | -     | -     | -     | -     | -     | 3,21  | 2,86  | 2,54  | 2,24  |       |  |
| H390CS   | 35 | -     | -     | -     | 13178 | 10881 | 8888  | 7171  | 5707  | 4469  | 3432  | 2570  |  |
|  | 45 | -     | -     | -     | 4,06  | 3,81  | 3,53  | 3,25  | 2,96  | 2,68  | 2,41  | 2,18  |  |
| H392CS   | 35 | -     | -     | -     | 11489 | 9424  | 7638  | 6106  | 4802  | 3700  | 2776  | 2003  |  |
|  | 45 | -     | -     | -     | 4,62  | 4,28  | 3,90  | 3,52  | 3,17  | 2,84  | 2,55  | 2,30  |  |
| H392CS   | 35 | -     | -     | -     | -     | -     | -     | 8793  | 7003  | 5491  | 4223  | 3171  |  |
|  | 45 | -     | -     | -     | -     | -     | -     | 3,62  | 3,28  | 2,97  | 2,68  |       |  |
| H392CS   | 35 | -     | -     | -     | -     | -     | -     | 7519  | 5921  | 4571  | 3438  | 2491  |  |
|  | 45 | -     | -     | -     | -     | -     | -     | 3,91  | 3,50  | 3,14  | 2,80  |       |  |

## Standard - R407C (Dew Point / Point de rosée / Taupunktaten)

S-Series / Série S / S-Familie

50 Hz

| Compressor<br>Compresseur<br>Verdichter | Cond<br>Temp<br>°C | Evaporating Temperature<br>Température d'évaporation °C<br>Verdampfungstemperatur |     |     |     |     |     |       |       |       |       |       |       |       |       |       |       |
|---|--------------------|---|-----|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|   |                    | -50   | -45 | -40 | -35 | -30 | -25 | -20   | -15   | -10   | -5    | 0     | 5     | 7     | 10    | 12.5  |       |
| D4SA-200X                               | Q                  | 30  |     |     |     |     |     | 12.00 | 16.80 | 21.50 | 27.20 | 34.00 | 41.50 | 51.00 | 55.00 | 61.00 | 67.00 |
|   | 50                 | 40  |     |     |     |     |     | 12.75 | 18.10 | 23.00 | 28.80 | 35.50 | 43.50 | 47.00 | 53.00 | 58.00 |       |
|   | P                  | 30  |     |     |     |     |     | 6.95  | 7.90  | 8.85  | 9.75  | 10.60 | 11.40 | 11.90 | 12.10 | 12.30 | 12.30 |
|   | 50                 | 40  |     |     |     |     |     | 8.50  | 9.60  | 10.70 | 11.80 | 12.90 | 13.80 | 14.10 | 14.50 | 14.80 |       |
| D4SH-250X                               | Q                  | 30  |     |     |     |     |     | 14.15 | 20.20 | 26.10 | 33.50 | 42.00 | 52.00 | 63.50 | 68.50 | 76.50 | 84.00 |
|   | 50                 | 40  |     |     |     |     |     | 15.50 | 22.10 | 28.30 | 35.50 | 44.50 | 54.50 | 59.00 | 66.00 | 72.50 |       |
|   | P                  | 30  |     |     |     |     |     | 8.60  | 9.80  | 11.00 | 12.30 | 13.50 | 14.50 | 15.30 | 15.60 | 15.90 | 16.00 |
|   | 50                 | 40  |     |     |     |     |     | 10.60 | 12.00 | 13.50 | 15.00 | 16.40 | 17.60 | 18.00 | 18.60 | 19.00 |       |
| D6SA-300X                               | Q                  | 30  |     |     |     |     |     | 13.20 | 21.10 | 28.30 | 37.00 | 47.00 | 59.00 | 72.00 | 78.00 | 87.00 | 95.00 |
|   | 50                 | 40  |     |     |     |     |     | 15.40 | 23.90 | 31.50 | 40.00 | 50.50 | 62.00 | 67.00 | 75.00 | 82.00 |       |
|   | P                  | 30  |     |     |     |     |     | 10.20 | 11.60 | 13.10 | 14.60 | 15.90 | 17.10 | 18.10 | 18.40 | 18.70 | 18.90 |
|   | 50                 | 40  |     |     |     |     |     | 12.70 | 14.40 | 16.10 | 17.80 | 19.40 | 20.80 | 21.30 | 22.00 | 22.40 |       |
| D4SJ-300X                               | Q                  | 30  |     |     |     |     |     | 14.25 | 22.40 | 29.80 | 38.50 | 49.00 | 61.00 | 75.00 | 81.00 | 90.50 | 99.00 |
|   | 50                 | 40  |     |     |     |     |     | 15.90 | 24.60 | 32.50 | 41.50 | 52.00 | 64.00 | 69.50 | 78.00 | 85.50 |       |
|   | P                  | 30  |     |     |     |     |     | 9.30  | 11.50 | 13.60 | 15.40 | 16.90 | 17.90 | 18.40 | 18.50 | 18.40 | 18.10 |
|   | 50                 | 40  |     |     |     |     |     | 12.00 | 14.40 | 16.50 | 18.40 | 20.00 | 21.00 | 21.30 | 21.60 | 21.70 |       |

Q(kW)= Capacity / Puissance / Kälteleistung

P(kW)= Power Input / Puissance absorbée / Leistungsaufnahme

Operating Conditions

Conditions de fonctionnement

Einsatzbedingungen

Suction Gas Return

20°C Gaz aspirés

Sauggastemperatur

HIGH DISCHARGE TEMP - additional cooling required

Température de refoulement élevée - refroidissement additionnel nécessaire

Druckgastemperatur - Zusatzkühlung notwendig

10K Suction Superheat / Surchauffe / Sauggasüberhitzung

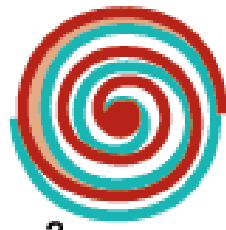


## Compressor scroll



1

Compression in the scroll is created by the interaction of an orbiting spiral and a stationary spiral. Gas enters an outer opening as one of the spirals orbits.



2

The open passage is sealed off as gas is drawn into the spiral.



3

As the spiral continues to orbit, the gas is compressed into an increasingly smaller pocket.



4

By the time the gas arrives at the center port, discharge pressure has been reached.



5

Actually, during operation, all six gas passages are in various stages of compression at all times, resulting in nearly continuous suction and discharge.



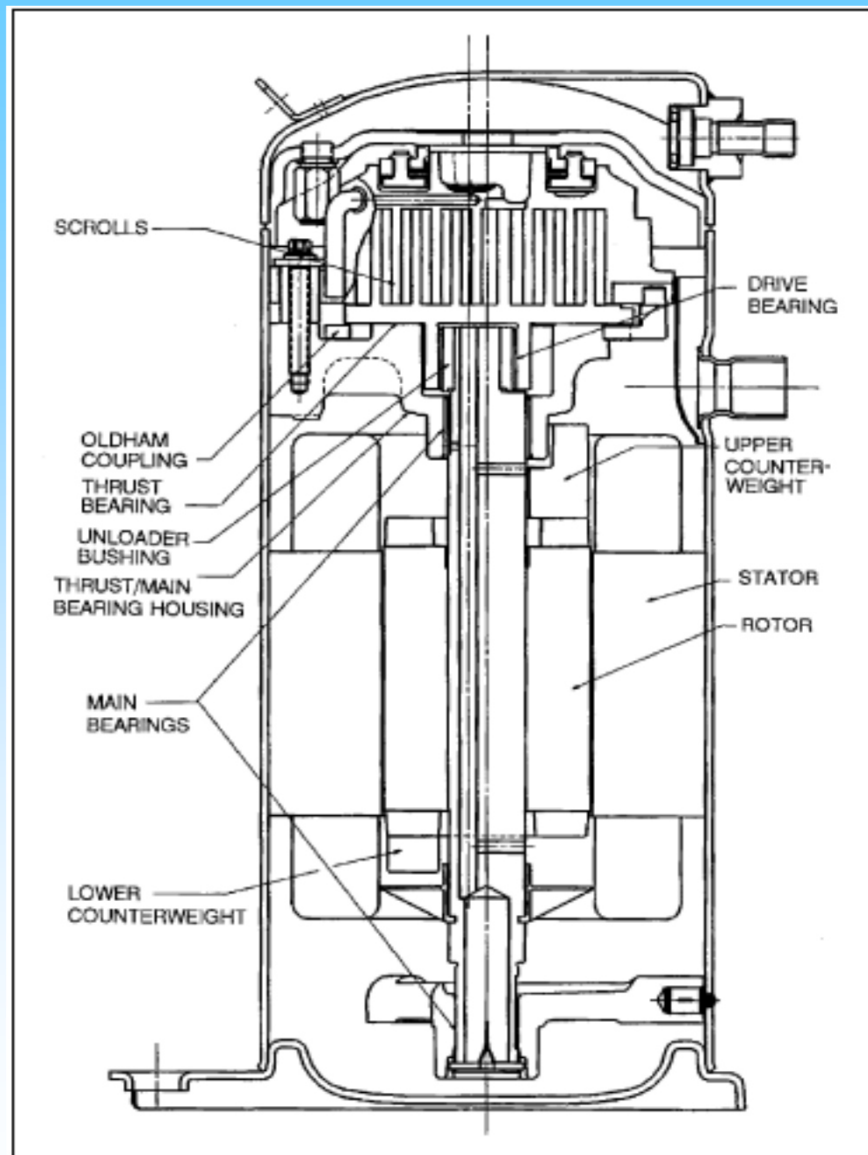


Fig. 35 Bearings and Other Components of Scroll Compressor  
(Elson et al. 1990)

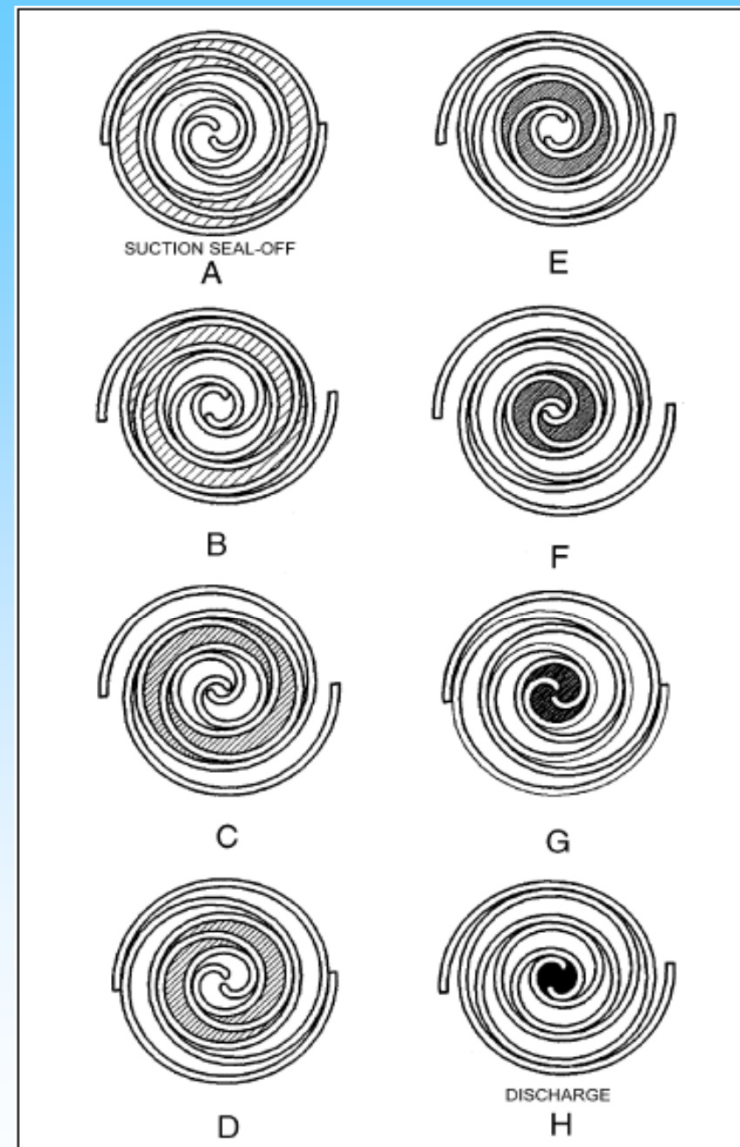


Fig. 34 Scroll Compression Process  
(Purvis 1987)

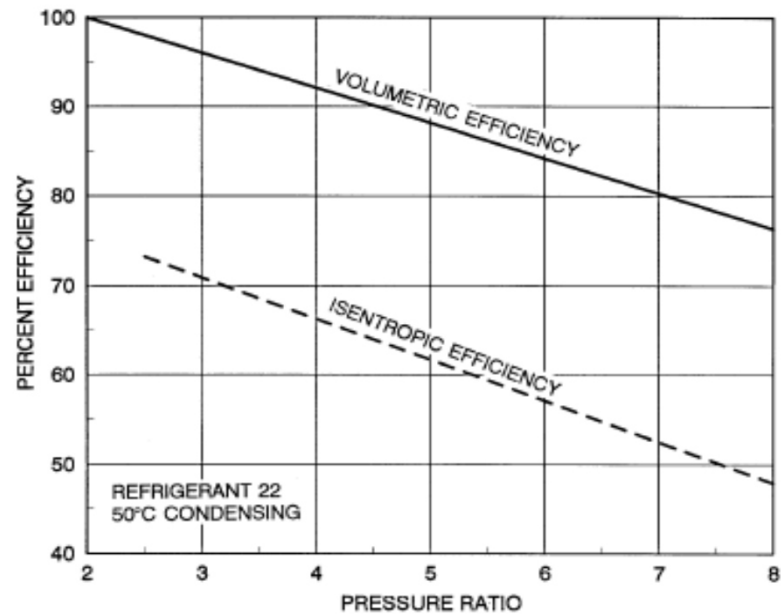


Fig. 36 Volumetric and Isentropic Efficiency Versus Pressure Ratio for Scroll Compressors (Elson et al. 1990)

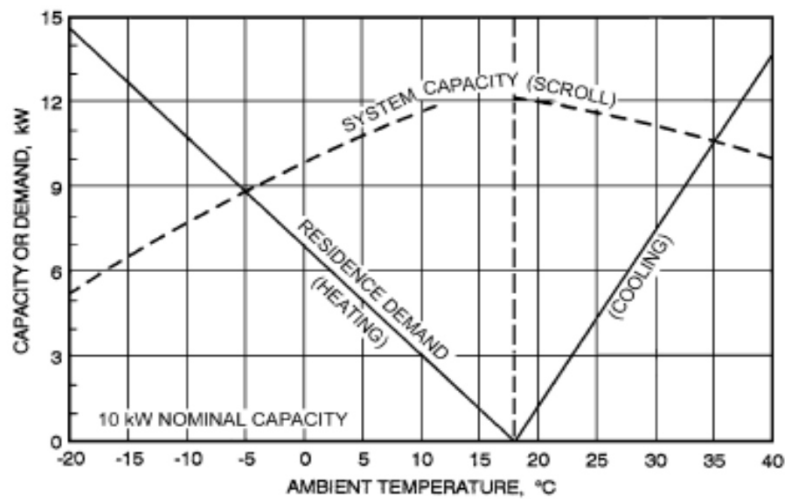


Fig. 37 Scroll Capacity Versus Residence Demand (Purvis 1987)

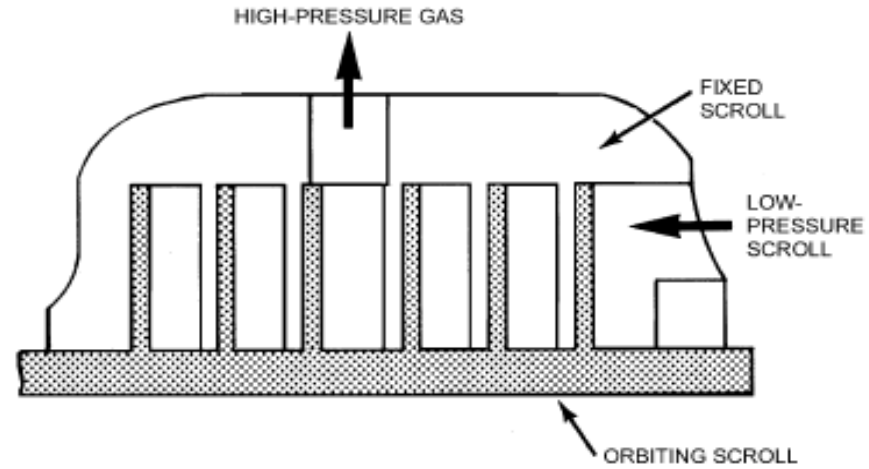


Fig. 33 Interfitted Scroll Members (Purvis 1987)

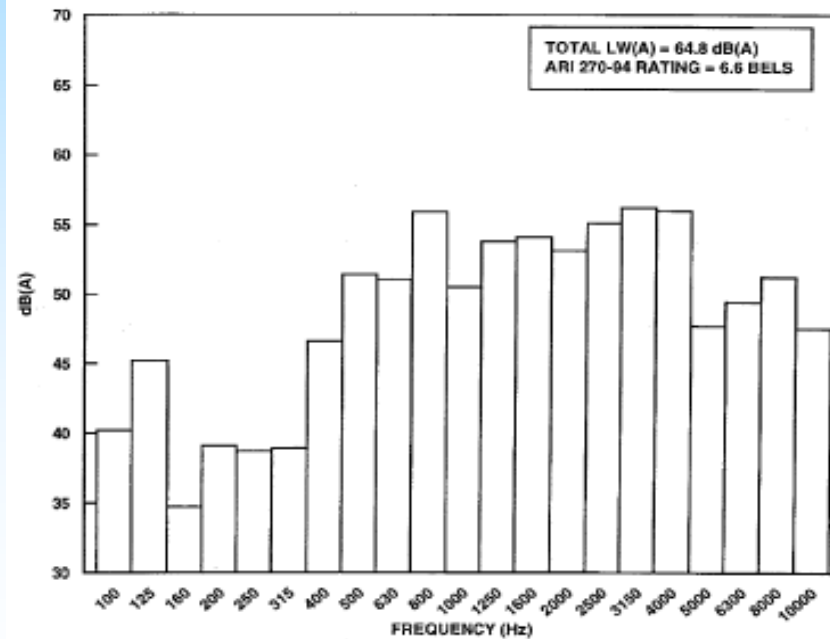


Fig. 38 Typical Scroll Sound Spectrum

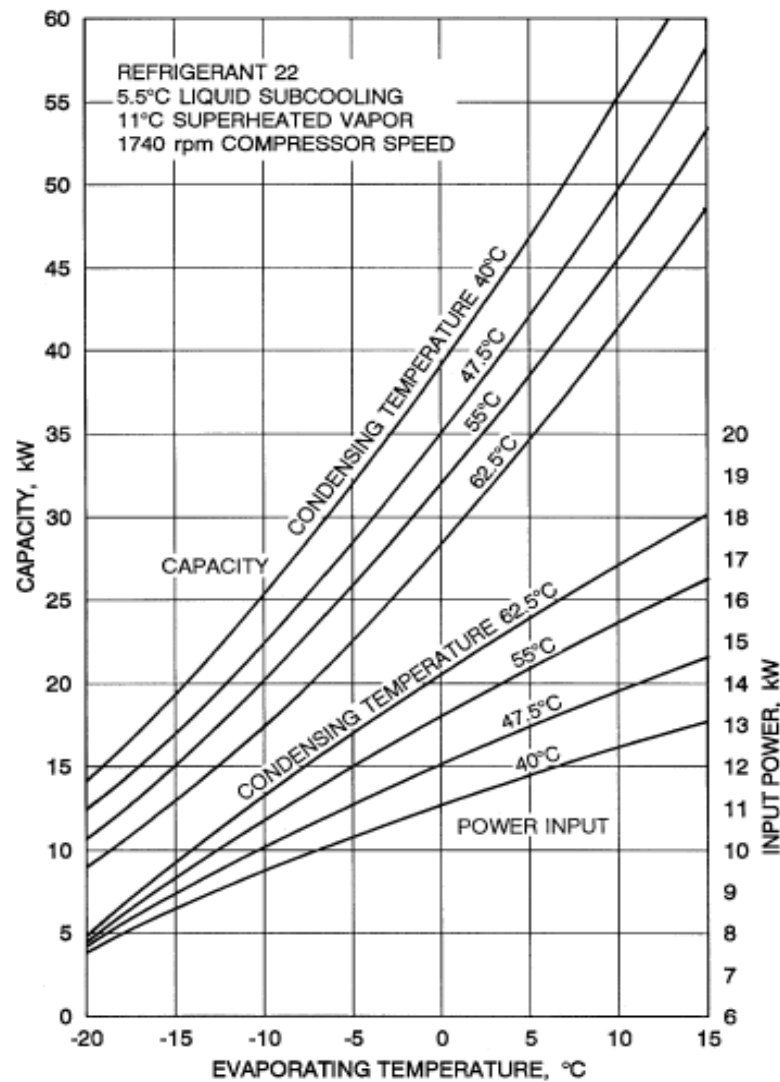


Fig. 1 Capacity and Power-Input Curves for Typical Hermetic Reciprocating Compressor

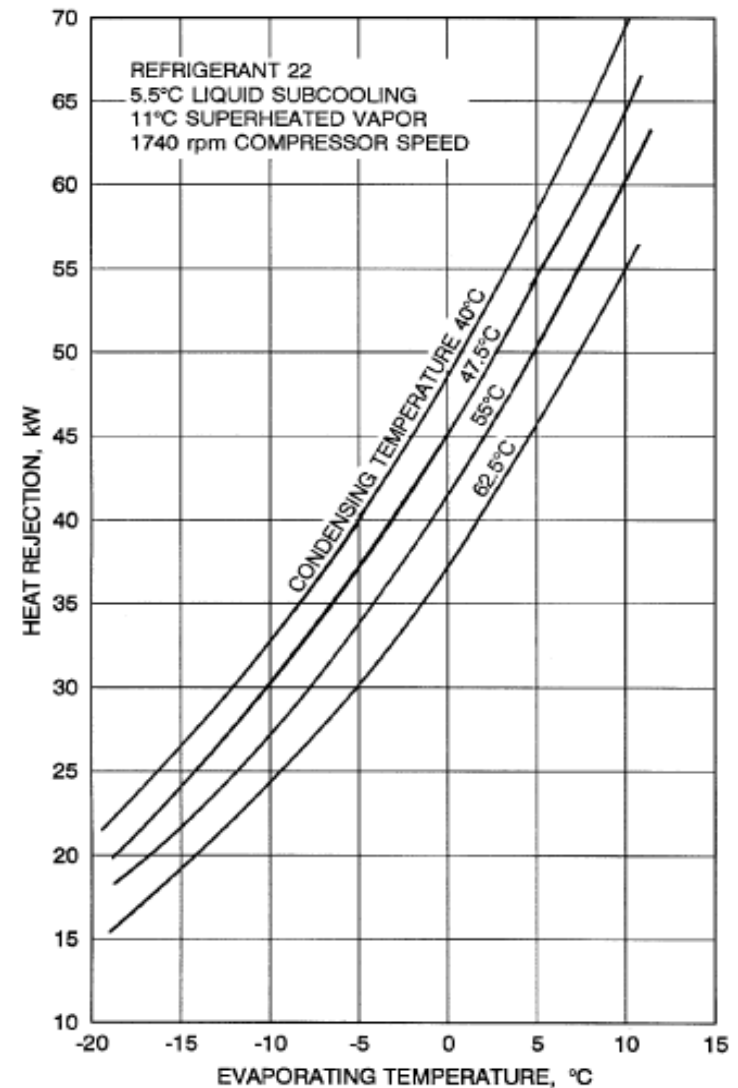


Fig. 2 Heat Rejection Curves for Typical Hermetic Reciprocating Compressor



## Compressori a vite

Si sta progressivamente sostituendo agli alternativi anche se per certe applicazioni i secondi continuano ad essere competitivi, in particolare per le applicazioni con minore richiesta di potenzialità frigorifera (<350kW).

Bassa manutenzione (30.000 – 60.000 ore)

Rapporti di compressione molto più elevati di un alternativo (fino a 20) → possibilità di funzionare in modalità monostadio con evaporatori a bassa temperatura quando si hanno carichi ridotti.

Costo elevato di acquisto (più recente acquisizione del know-how costruttivo e maggiore criticità di tenuta e precisione costruttiva). Minori costi sulle potenze alte dove si è costretti a raddoppiare il numero degli alternativi.

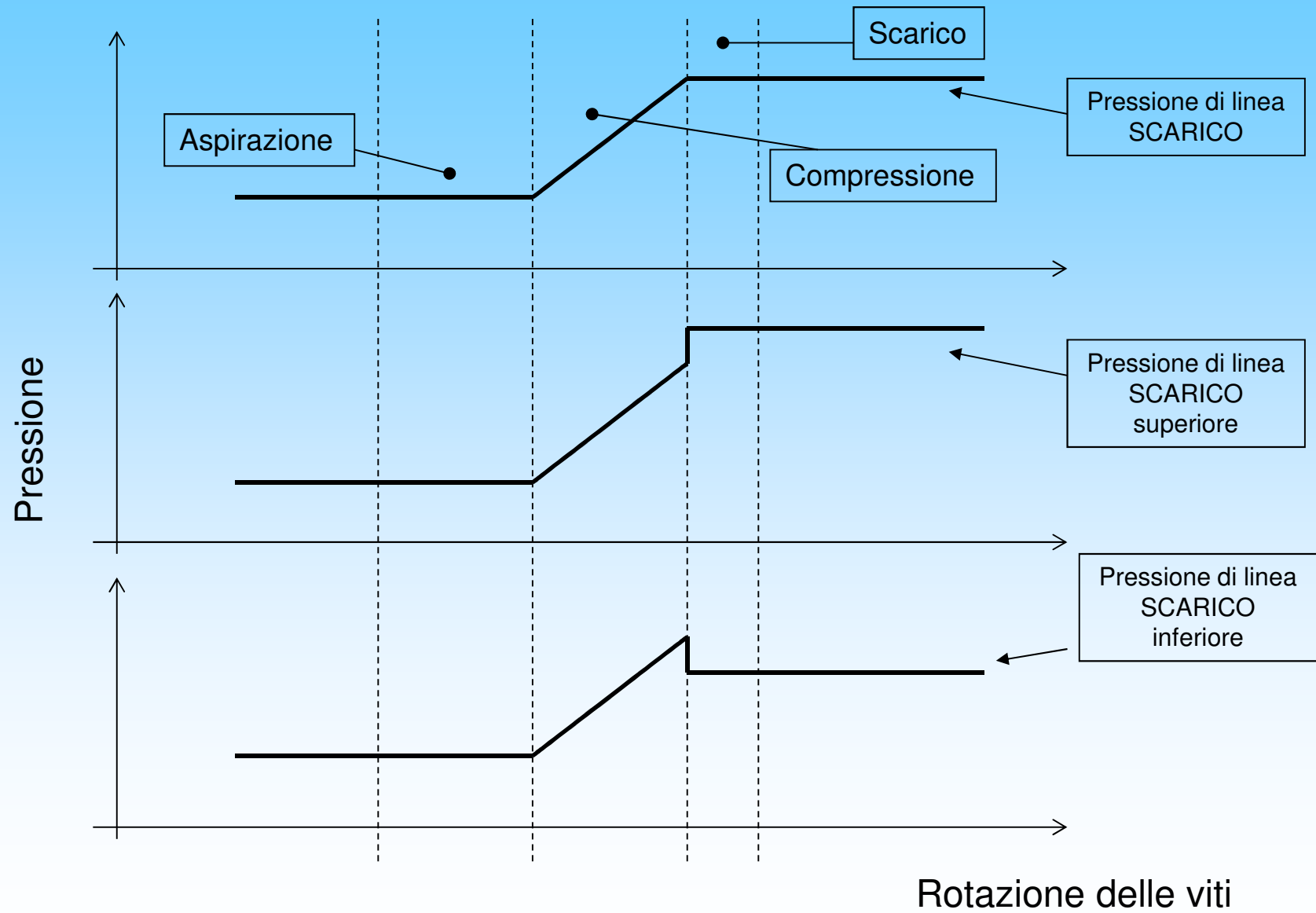
MAX potenzialità 4000kW

Assenza di vibrazioni e abbassamento dei livelli sonori

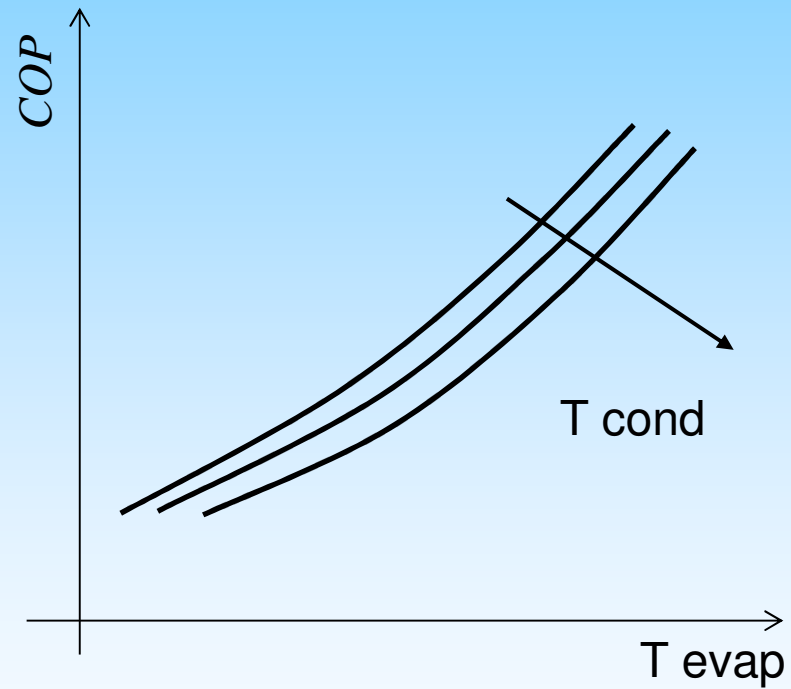
Possibile aspirazione ad una temperatura intermedia (doppio livello di evaporazione)

Minore vulnerabilità ai “COLPI DI LIQUIDO” (anche se ci possono essere vaporizzazioni improvvise che impediscono una corretta e continua lubrificazione)

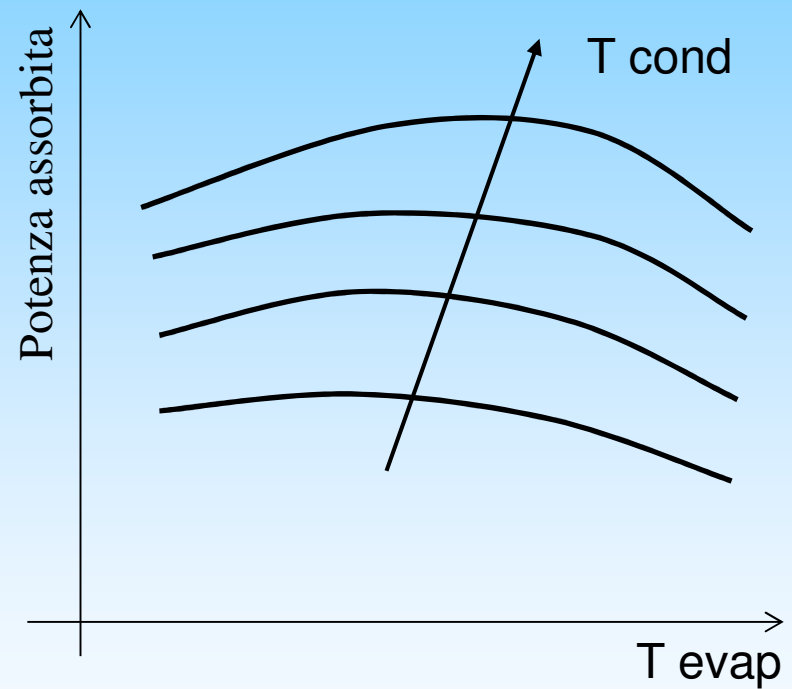
# Evoluzione delle pressioni durante il funzionamento del Compressore VITE



### Influenza delle temperature di lavoro sull'efficienza del ciclo



### Influenza delle temperature di lavoro sulla potenza assorbita





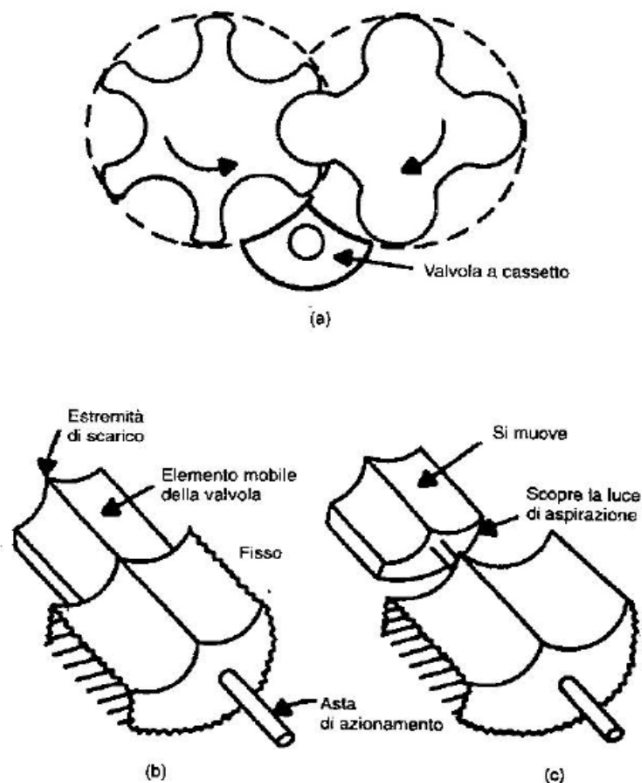


Figura 5.11 – Valvola a cassetto del controllo di capacità di un compressore a vite; (a) sua posizione relativa ai rotori, (b) valvola in posizione di piena capacità, e (c) valvola in posizione di capacità ridotta.

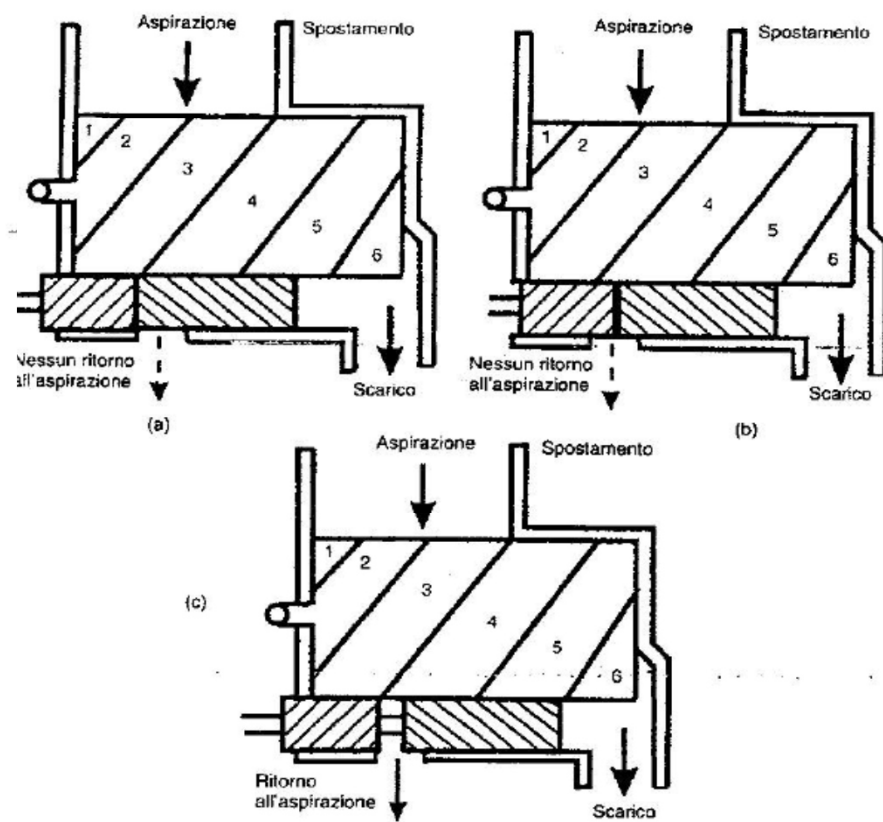


Figura 5.17 – Un dispositivo di  $v_1$  variabile alle seguenti condizioni operative: (a) pieno carico e basso  $v_1$ ; (b) pieno carico e alto  $v_1$ ; e (c) carico parziale e alto  $v_1$ .

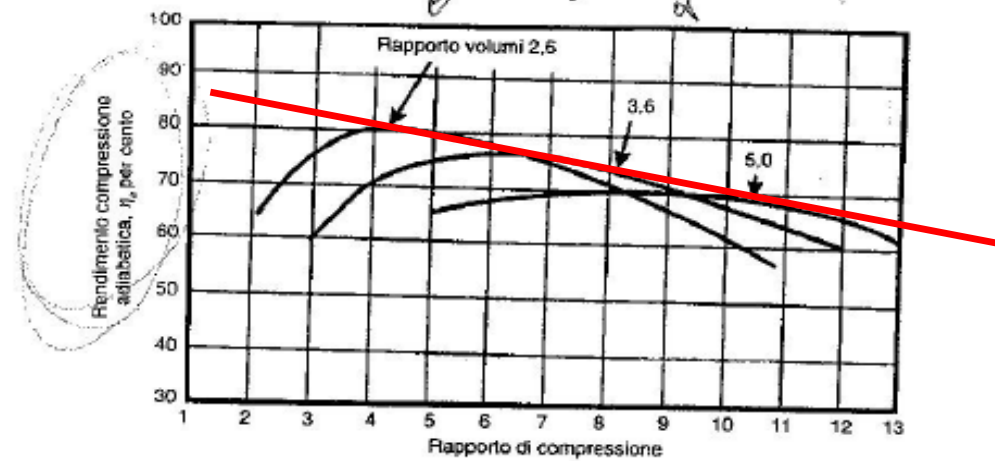


Figura 5.7 – Rendimento di compressione adiabatica del compressore a vite ad ammoniaca.



Figura 5.8 – Scelta di un compressore quando il suo rendimento di picco avviene a un valore inferiore al rapporto di compressione di progetto.

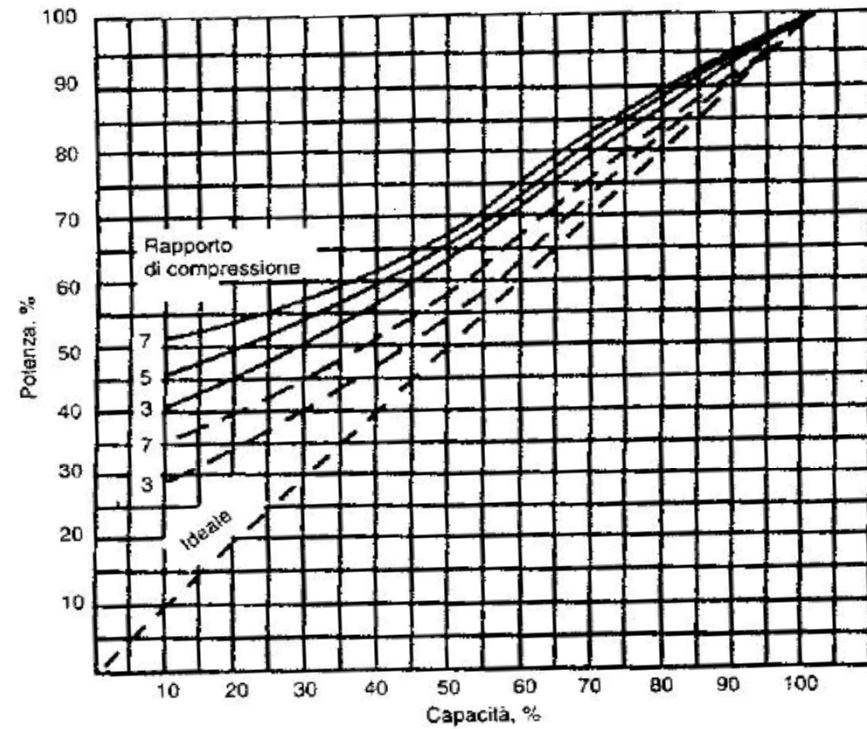


Figura 5.13 – Potenza assorbita dal compressore a vite a carico parziale. Le linee piene riguardano le temperature costanti di evaporazione e di condensazione, mentre quelle tratteggiate riflettono l'abbassamento della temperatura di condensazione e l'incremento di quella di evaporazione a carico parziale.

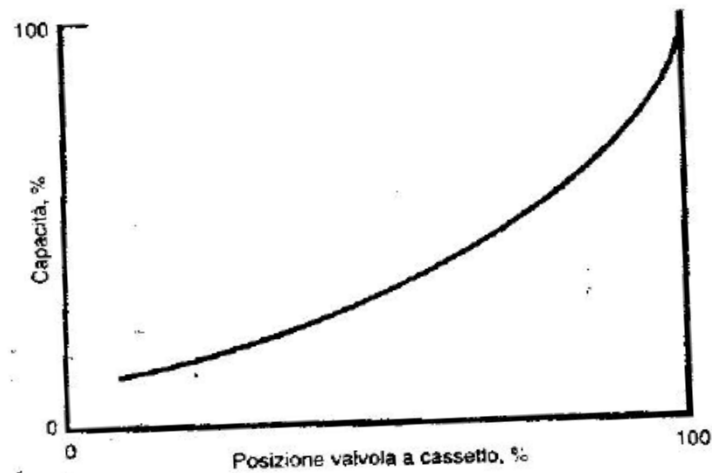
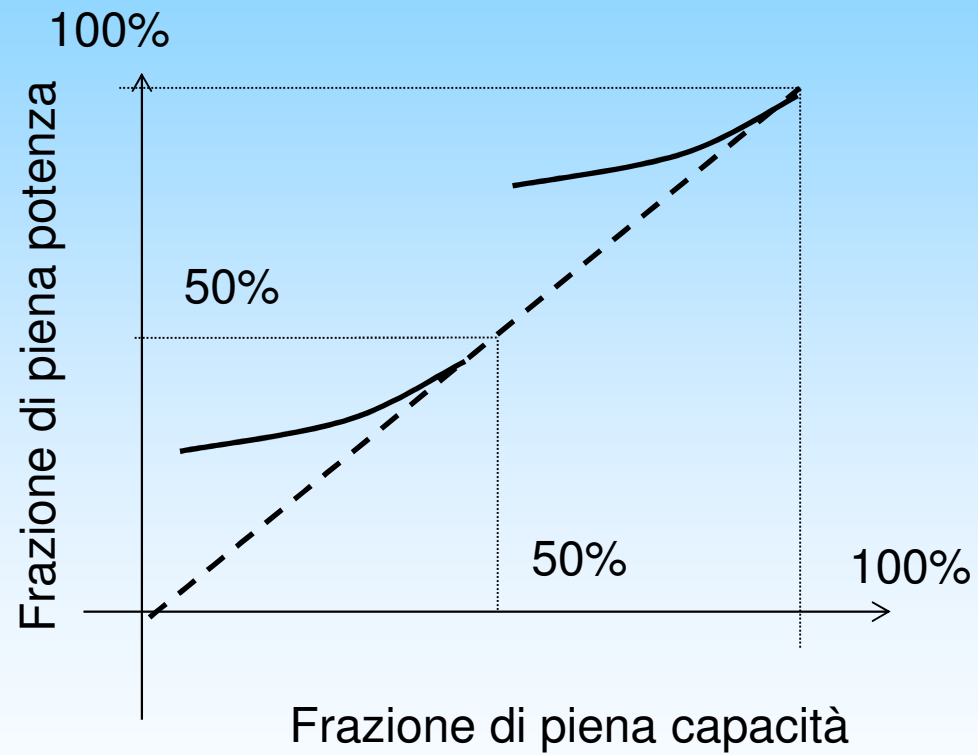
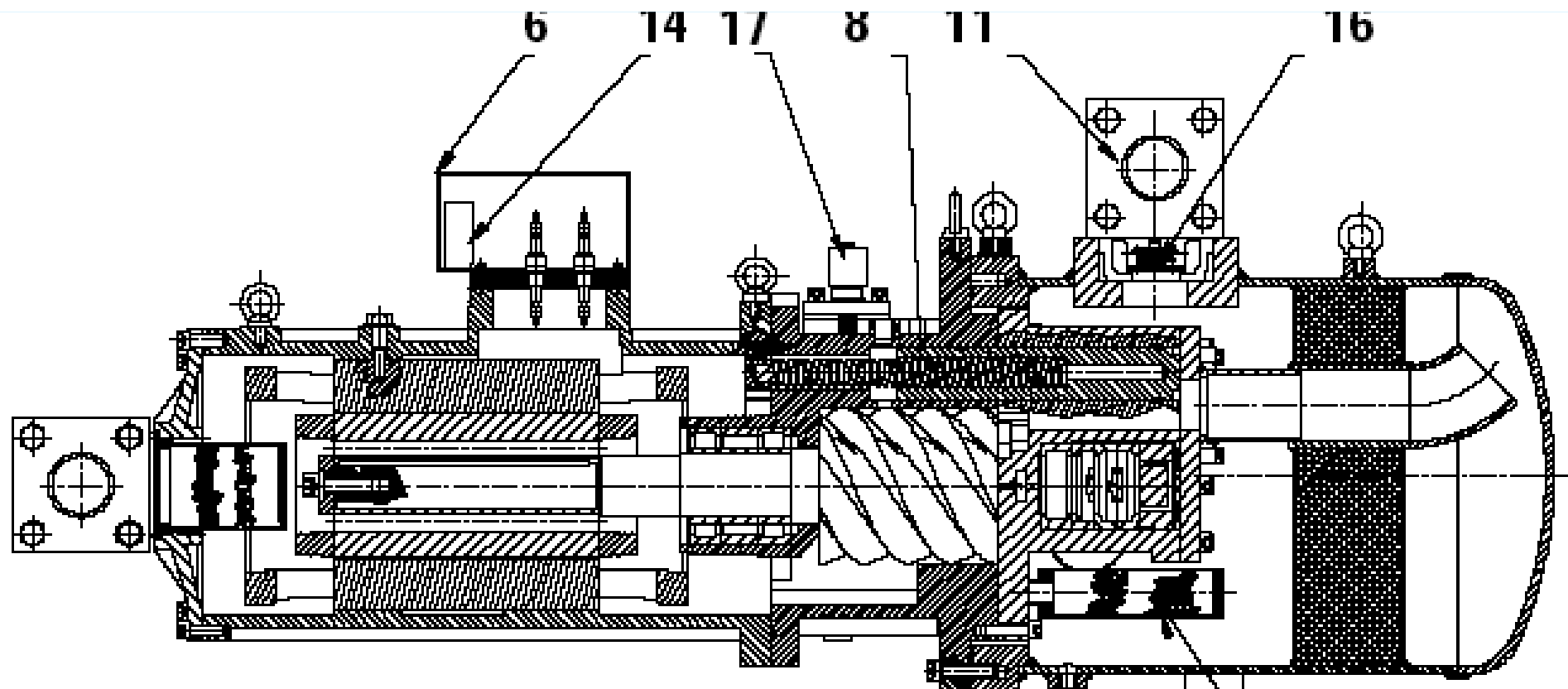


Figura 5.14 – Variazione della capacità del compressore in funzione della posizione della valvola a cassetto.

## LA REGOLAZIONE CURVA POTENZA- CAPACITA'

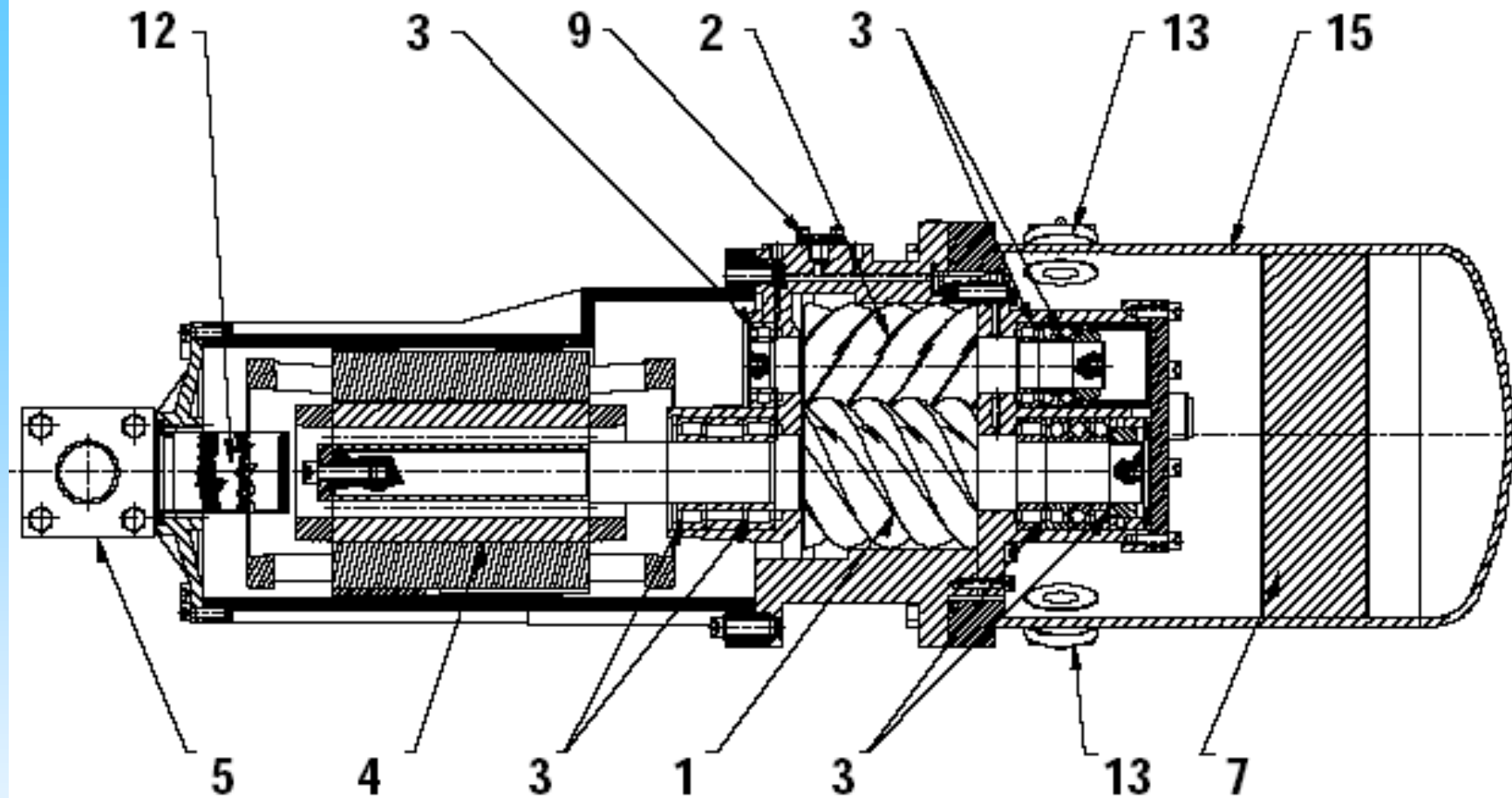
Curva di regolazione con  
motore a 2 velocità





- |          |   |           |                                  |
|----------|---|-----------|----------------------------------|
| <b>1</b> | vite maschio                            | <b>10</b> | filtro olio                      |
| <b>2</b> | vite femmina                            | <b>11</b> | rubinetto di compressione        |
| <b>3</b> | cuscinetti                              | <b>12</b> | filtro di aspirazione            |
| <b>4</b> | motore elettrico                        | <b>13</b> | spia livello olio                |
| <b>5</b> | rubinetto di aspirazione                | <b>14</b> | modulo elettronico di protezione |
| <b>6</b> | scatola terminali                       | <b>15</b> | separator d'olio integrato       |
| <b>7</b> | filtro coalescente                      | <b>16</b> | valvola di ritegno               |
| <b>8</b> | pistone del controllo di capacità       | <b>17</b> | valvola controllo di capacità    |
| <b>9</b> | attacchi per raffreddatore olio esterno | <b>18</b> | tappo scarico olio               |

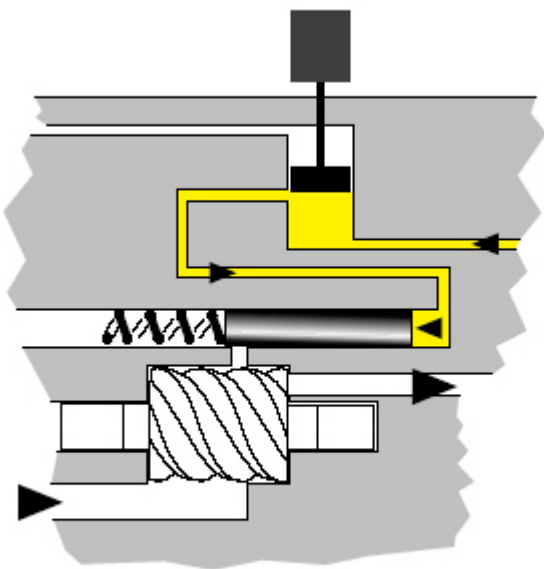
**18**      **10**



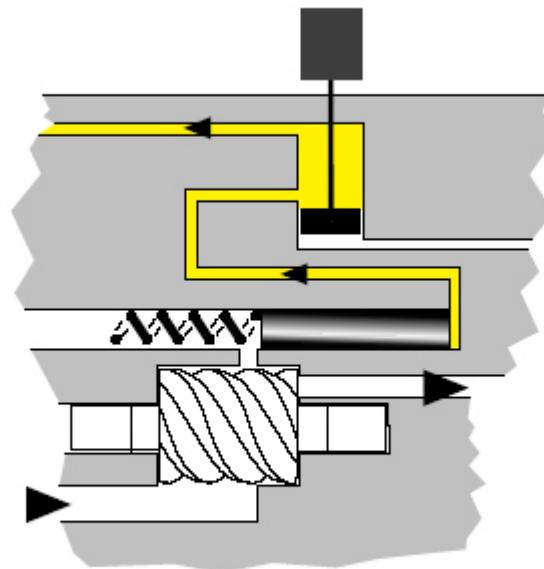
- 1** vite maschio
- 2** vite femmina
- 3** cuscinetti
- 4** motore elettrico
- 5** rubinetto di aspirazione
- 6** scatola terminali
- 7** filtro coalescente
- 8** pistone del controllo di capacità
- 9** attacchi per raffreddatore olio esterno

- 10** filtro olio
- 11** rubinetto di compressione
- 12** filtro di aspirazione
- 13** spia livello olio
- 14** modulo elettronico di protezione
- 15** separatore d'olio integrato
- 16** valvola di ritegno
- 17** valvola controllo di capacità
- 18** tappo scarico olio

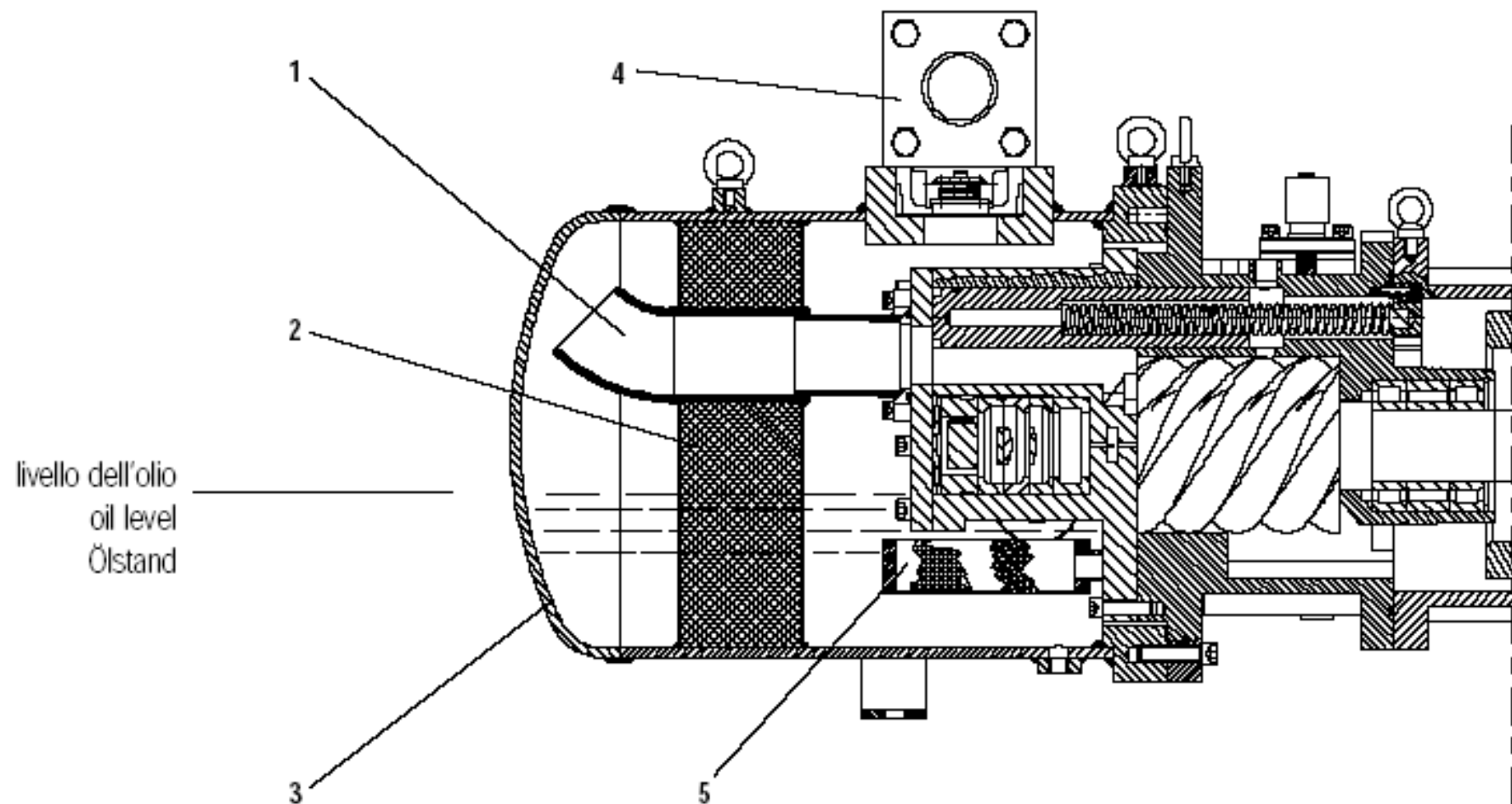
# controllo di capacità



**2a**  
funzionamento a pieno carico



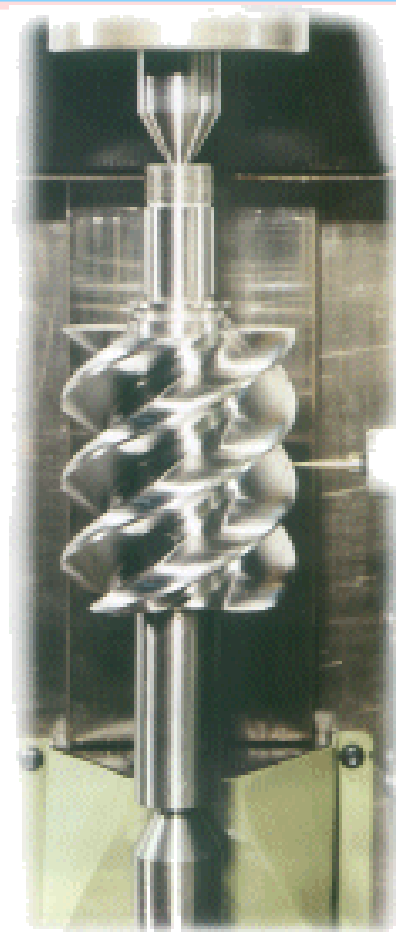
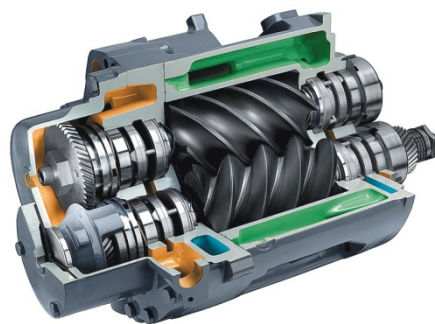
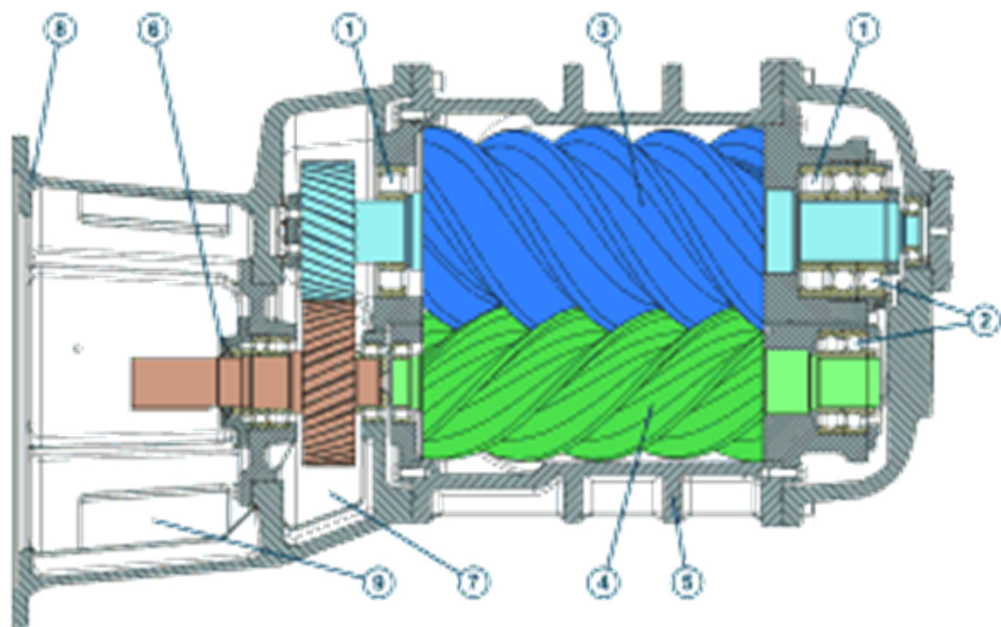
**2b**  
funzionamento a carico ridotto



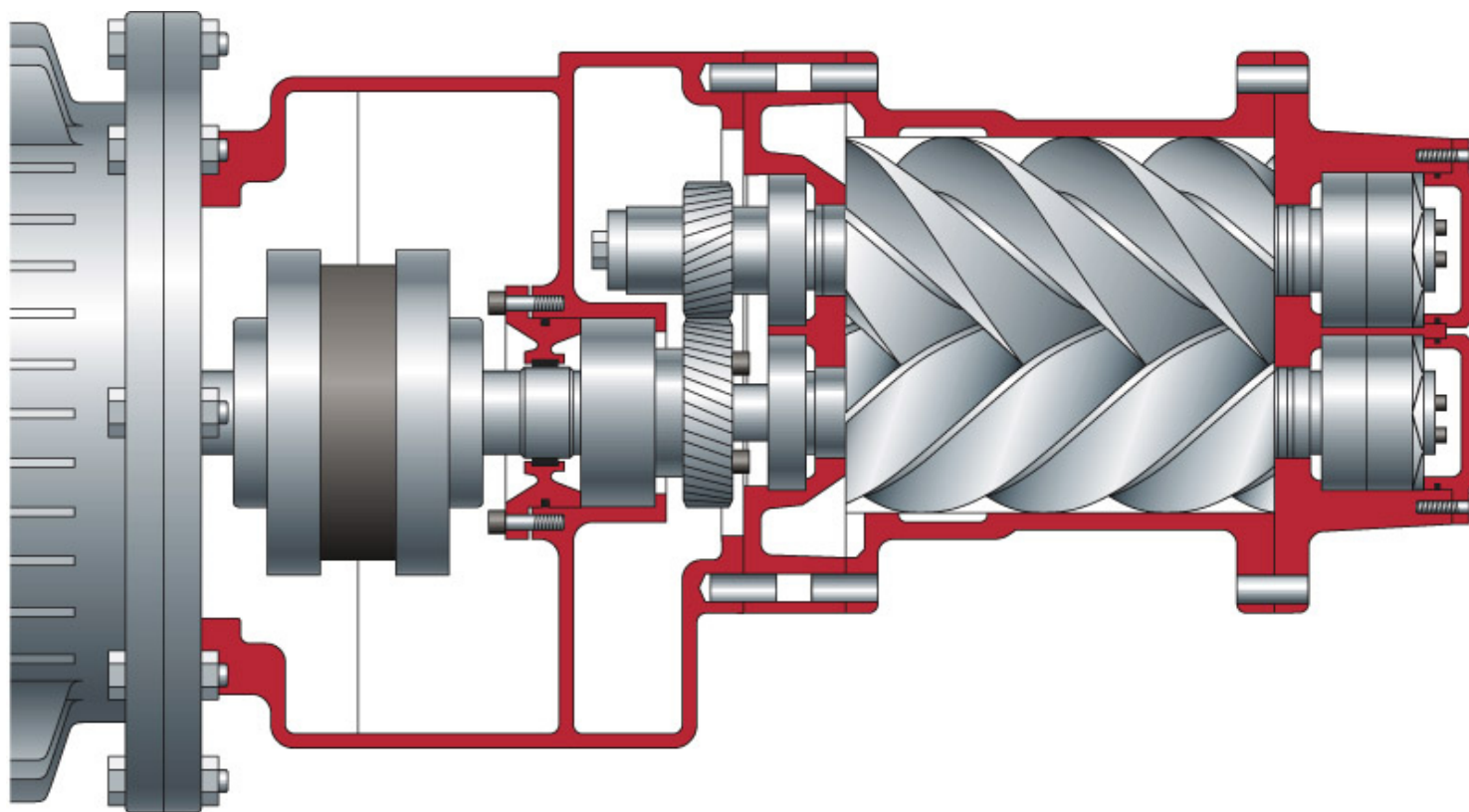
- 1 condotto di compressione
- 2 filtro coalescente
- 3 mantello del separatore
- 4 rubinetto di compressione
- 5 filtro olio



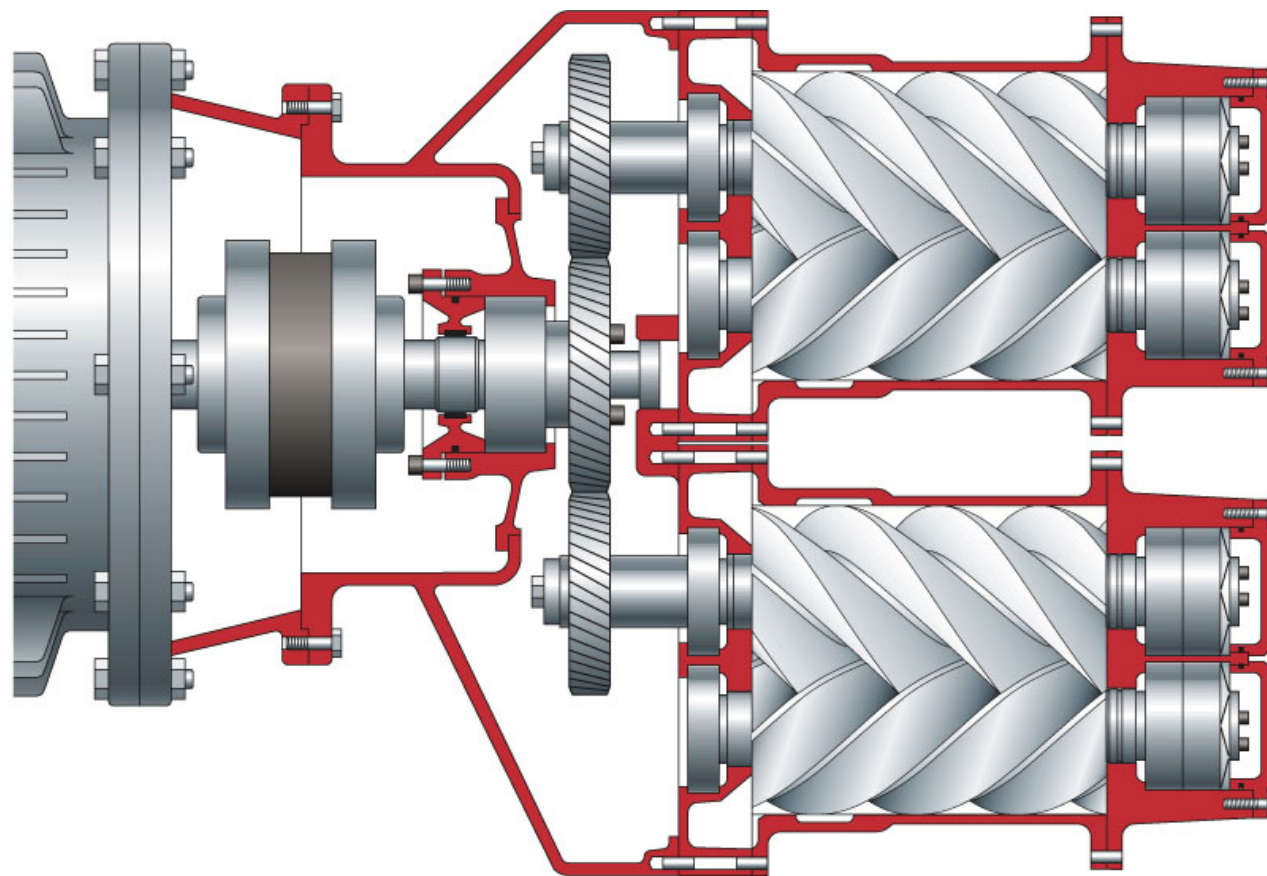
# Compressori a vite



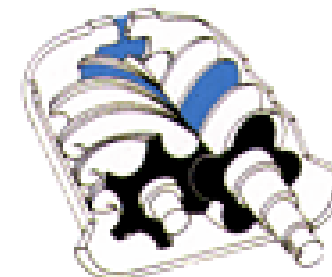
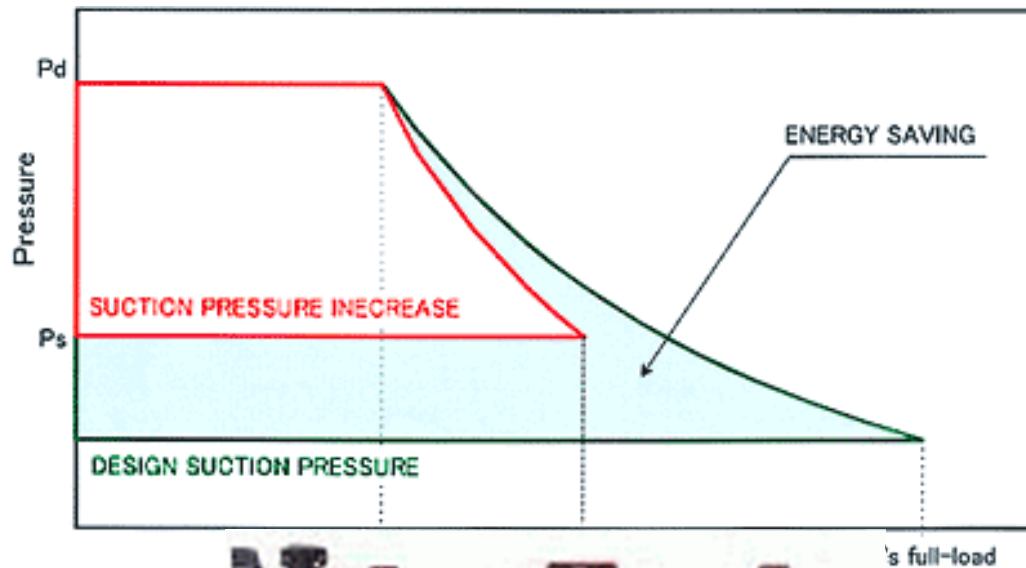
# Compressori a vite

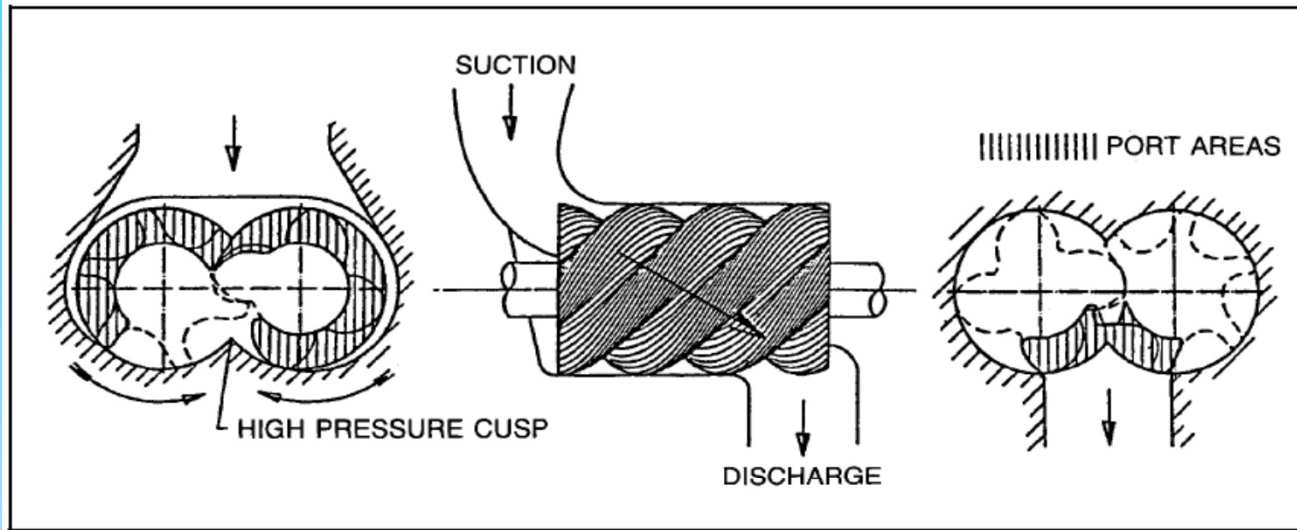


# Compressori a vite

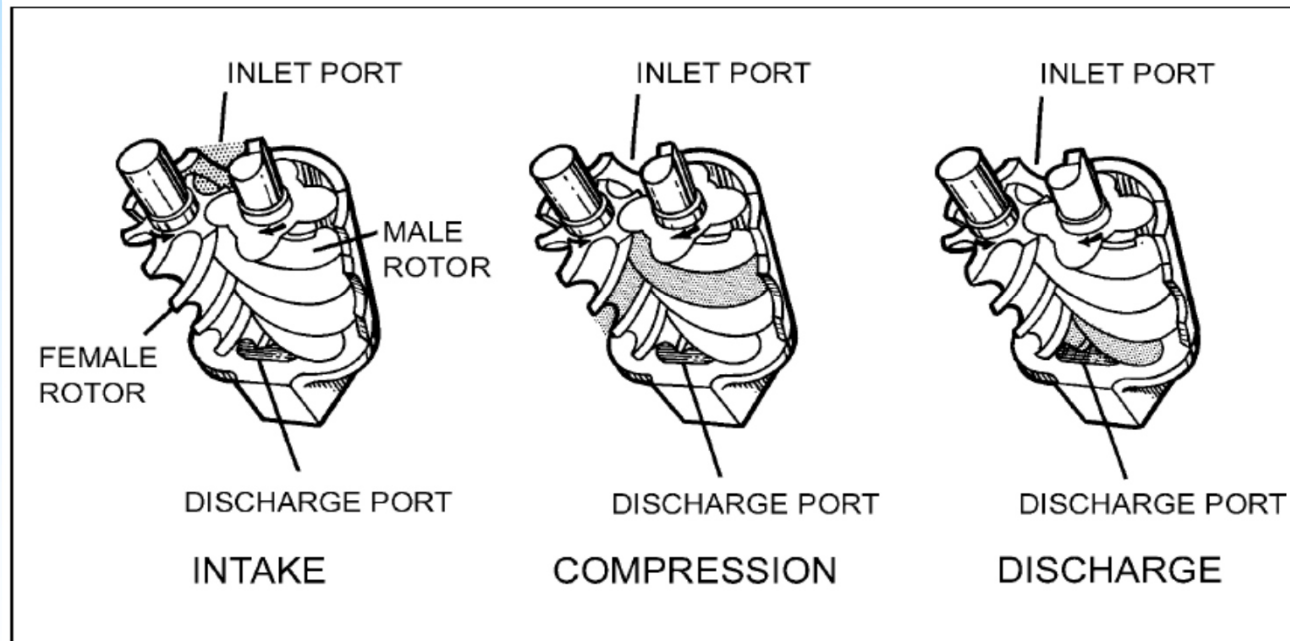


# Compressori a vite



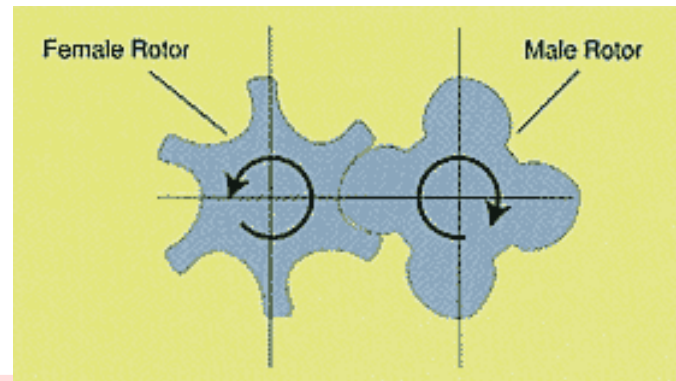
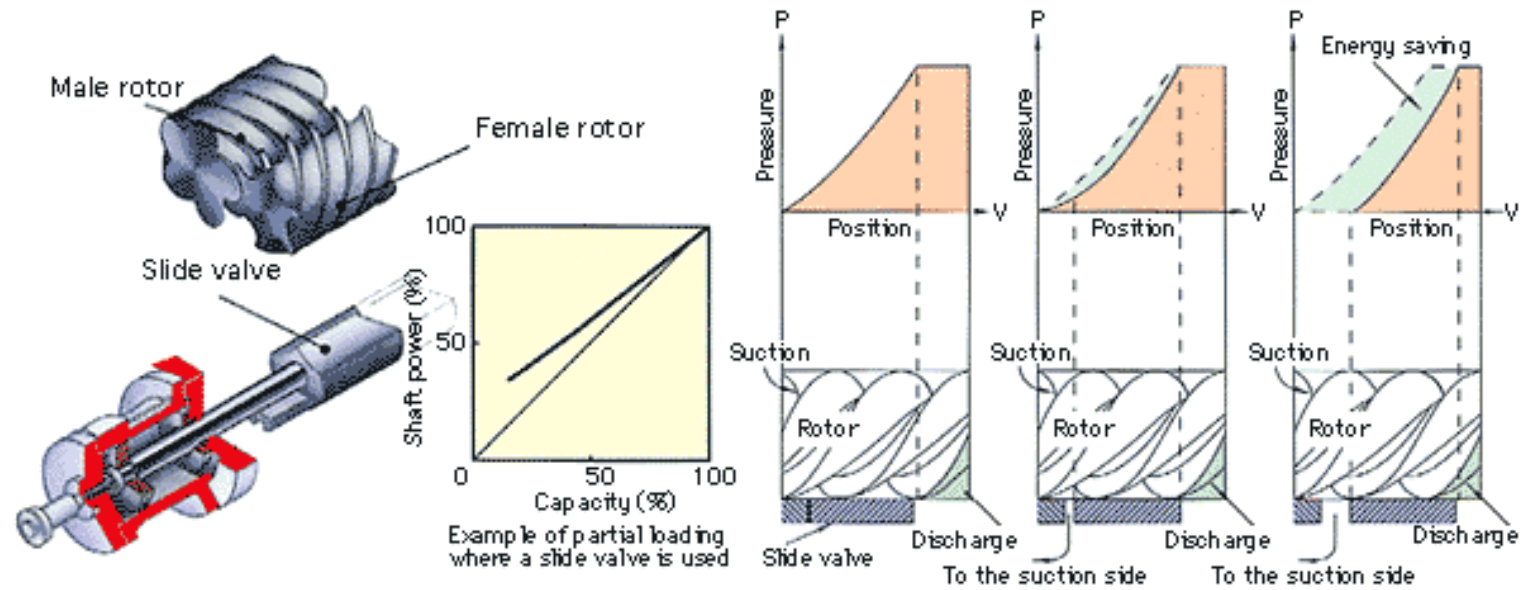


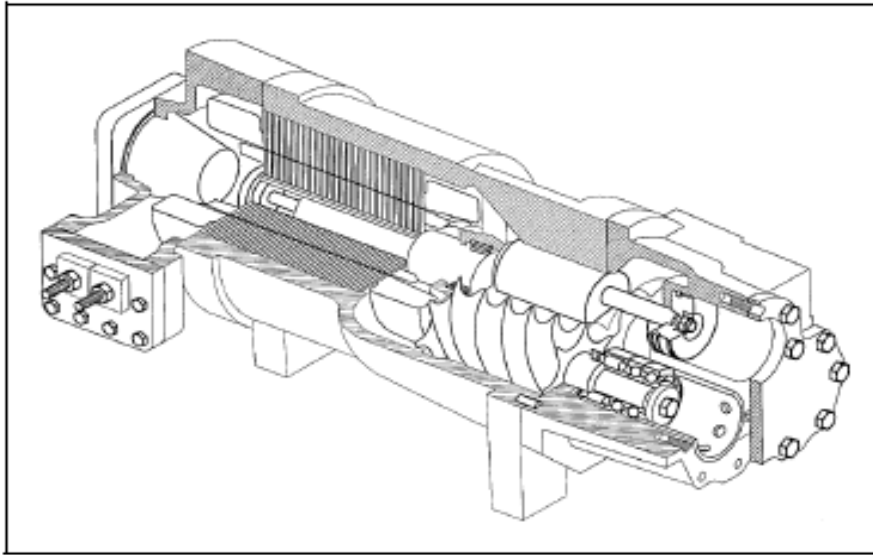
**Fig. 24 Twin-Screw Compressor**



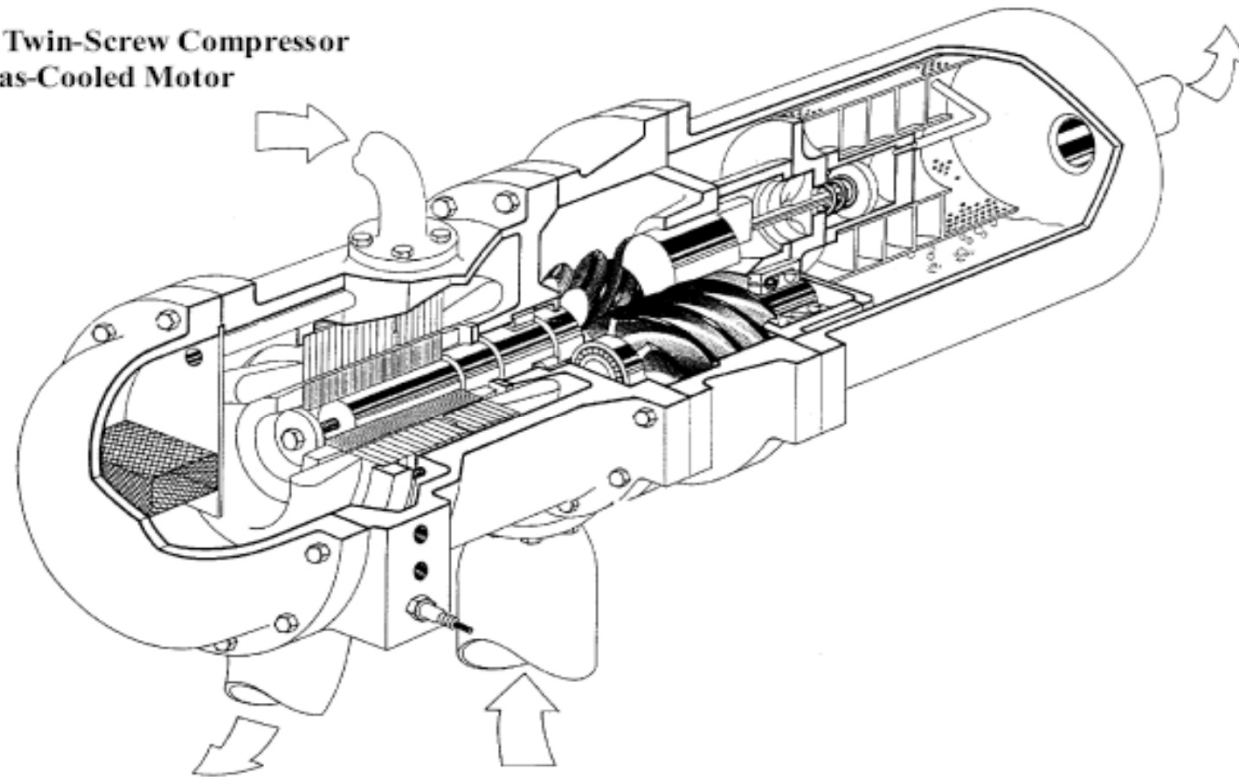
**Fig. 25 Compression Process**

# Compressori a vite





**Fig. 30 Semihermetic Twin-Screw Compressor with Suction Gas-Cooled Motor**



**Fig. 31 Semihermetic Twin-Screw Compressor with Motor Housing Used as Economizer; Built-In Oil Separator**

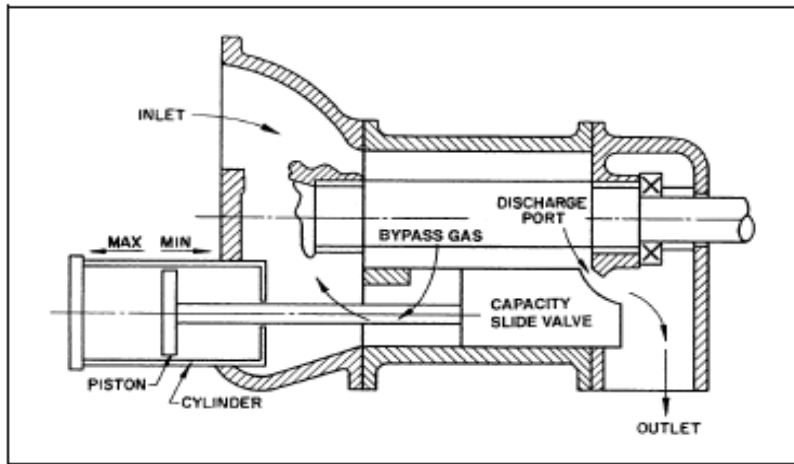


Fig. 26 Slide Valve Unloading Mechanism

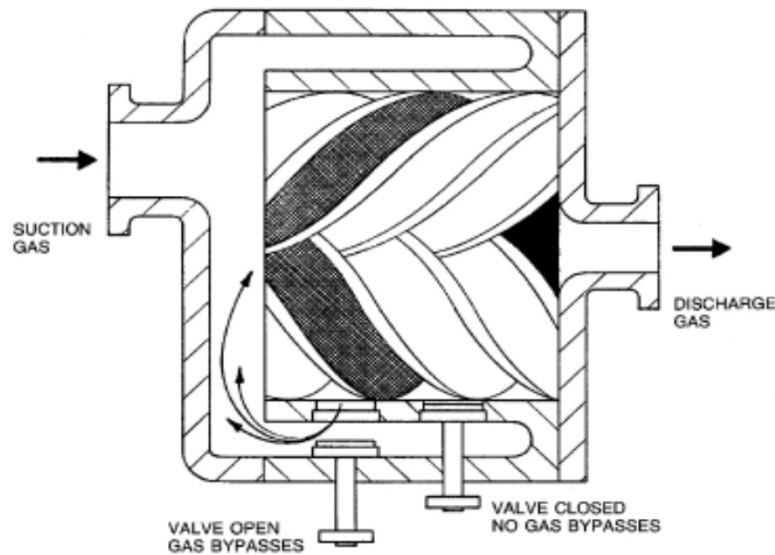


Fig. 27 Lift Valve Unloading Mechanism

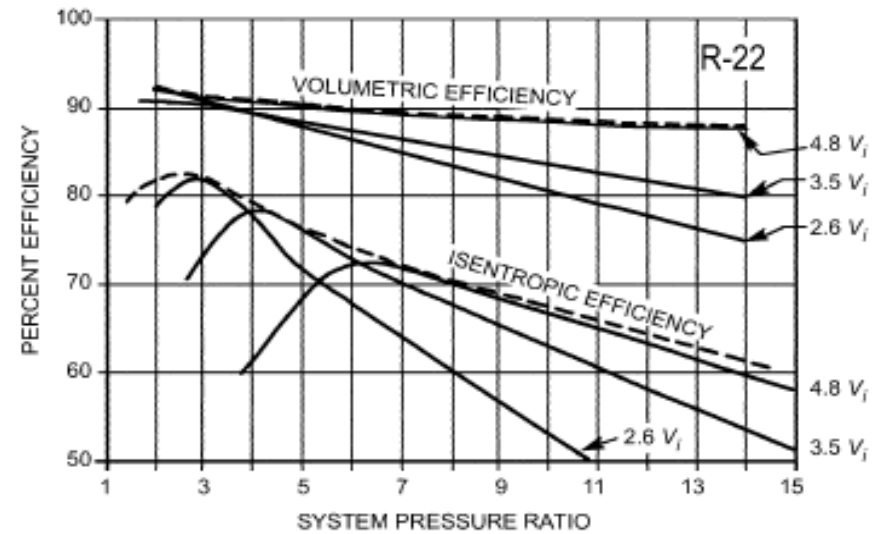
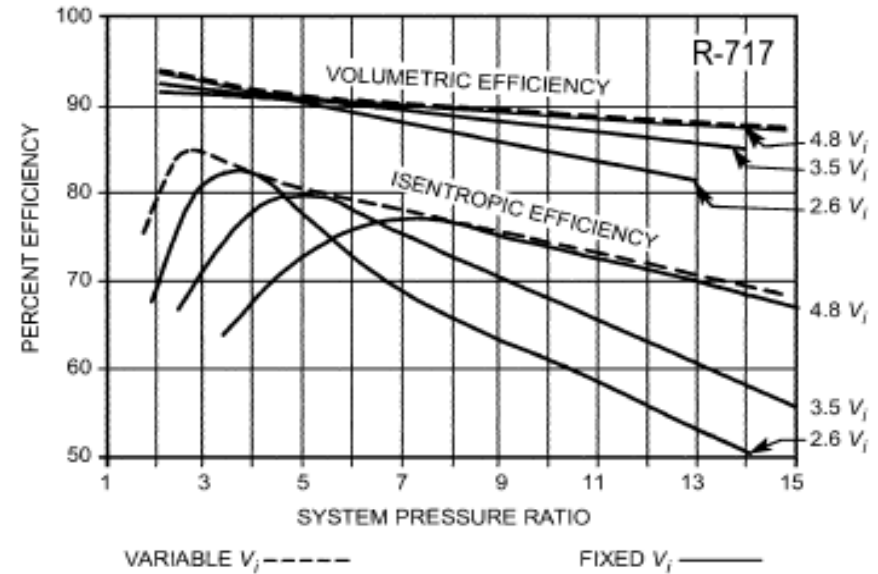
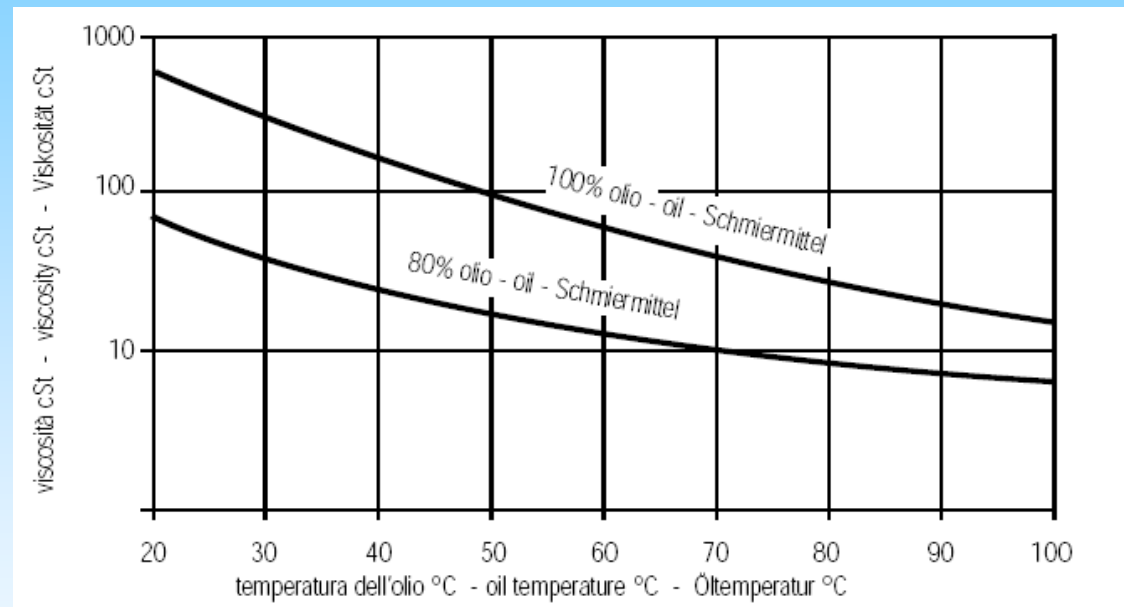


Fig. 29 Twin-Screw Compressor Efficiency Curves



## Raffreddamento dell'olio



## Il lubrificante

### Lubrificante FRASCOLD FCL

|                       |               |
|-----------------------|---------------|
| refrigerante          | R407C / R134a |
| viscosità cinematica: |               |
| a 40°C                | cSt 150       |
| a 100°C               | cSt 14.5      |
| punto di accensione   | °C 252        |
| densità               | g/ml 0.96     |

### Lubrificante FRASCOLD FCH

|                       |           |
|-----------------------|-----------|
| refrigerante          | R22       |
| viscosità cinematica: |           |
| a 40°C                | cSt 150   |
| a 100°C               | cSt 14.5  |
| punto di accensione   | °C 252    |
| densità               | g/ml 0.96 |