Trabajo autónomo 04 - solució

Si no se indica otra cosa, el formato de entrega de las tareas es en documento PDF.

Cada día de retraso en la entrega resta 0,5 puntos de la nota

Tarea 4:

Un compresor Bitzer, modelo 4FDC 5Y, trabaja en las siguientes condiciones:

Refrigerante R410A

$\upsilon_C = 55\,^oC$

$\upsilon_E = 0\,^oC$

SE = 10 K

SC = 10 K

1. Utiliza el programa de simulación Bitzer software para obtener la potencia frigorífica $\dot{Q}_E$, el número y dimensiones de los cilindros y las dimensiones de las tomas de aspiración y descarga.

   $\dot{Q}_E = 11{,}09\,kW$

   Número cilindros 4

   Diámetro 41 mm

   Carrera 27 mm

   Toma aspiración 22 mm - 7/8”

   Toma descarga 16 mm - 5/8”

2. Calcula el caudal de masa utilizando los datos del diagrama p h

$$\dot{m} = \frac{\dot{Q}_E}{Q_E} = \frac{Q_E}{(h_1 - h_4)} = \frac{11{,}09\,kW}{(435\,\frac{kJ}{kg} - 280\,\frac{kJ}{kg})} = 0{,}071\,\frac{kg}{s}$$

3. Dibuja el ciclo en el diagrama p h

4. Calcula la eficiencia del ciclo

$$EER = \frac{\dot{Q}_E}{P_{comp}} = 11{,}09\,\frac{kW}{4{,}79}\,kW = 2{,}32$$

5. Calcula el volumen desplazado (frecuencia de 50 Hz) y el rendimiento volumétrico

$$\dot{V}_{desp} = V_{motor} \cdot \frac{RPM}{60\,\frac{s}{min}}$$

$$V_{motor} = Z \cdot A \cdot s = 4 \cdot \pi \cdot (0{,}0205\,m)^2 \cdot 0{,}027\,m = 0{,}000143\,m^3$$

Z número de cilindros

A sección cilindro en m^2

s carrera cilindro en m

$$\dot{V}_{desp} = V_{motor} \cdot \frac{RPM}{60\,\frac{s}{min}} = 0{,}000143\,m^3 \cdot \frac{1450\,RPM}{60\,\frac{s}{min}} = 0{,}003444\,\frac{m^3}{s} = 12{,}4\,\frac{m^3}{h}$$

$$\dot{V}_1 = \dot{m} \cdot v_{esp\,1} = 0{,}071\,\frac{kg}{s} \cdot 0{,}035\,\frac{m^3}{kg} = 0{,}0025\,\frac{m^3}{s}$$

$$\eta_{vol} = \frac{\dot{V}_1}{\dot{V}_{despl}} = \frac{0{,}0025\,\frac{m^3}{s}}{0{,}003444\,\frac{m^3}{s}} = 0{,}721$$

6. Calcula la velocidad del refrigerante en aspiración y descarga (grueso de pared del tubo 1 mm)

$$v=\frac{\dot{V}}{A}$$

Aspiración:

$$\dot{V}_1=0{,}0025\,\frac{m^3}{s}$$

$$A_1=\pi\cdot(0{,}011\,m)^2=0{,}000379\,m^2$$

$$v_1=\frac{\dot{V}}{A}=\frac{0{,}0025\,\frac{m^3}{s}}{0{,}000379\,m^2}=6{,}6\,\frac{m}{s}$$

Descarga:

$$\dot{V}_2=\dot{m}\cdot v_{esp\,2}=0{,}071\,\frac{kg}{s}\cdot 0{,}01\,\frac{m^3}{kg}=0{,}00071\,\frac{m^3}{s}$$

$$A_2=\pi\cdot(0{,}008\,m)^2=0{,}0002\,m^2$$

$$v_2=\frac{\dot{V}}{A}=\frac{0{,}00071\,\frac{m^3}{s}}{0{,}0002\,m^2}=3{,}6\,\frac{m}{s}$$

7. Adjunta capturas de pantalla de los programas de simulación Bitzer software

Envia el trabajo por correo electrónico a pposada@cifpnauticopesquera.es

El plazo de entrega es martes 27/01/26.

BITZER SOFTWARE

Reciprocating Compressors, Semi-Hermetic

Mode	Refrigeration and air conditio...
Refrigerant	R410A
Reference temperature	Dew point temp.
Compressor type	Single Compressor
Series	Standard
Motor version	all

Compressor selection

Cooling capacity	10 kW
Compressor model	4FDC-5Y
Incl. former types	

Operating point

Evaporating SST	0 °C
Condensing SDT	55 °C

Operating conditions

Liq. subc. (in condenser)	10 K
Suct. gas superheat	10 K
Useful superheat	100 %
Operating mode	Auto

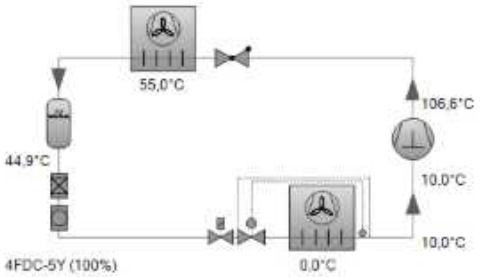
Capacity control

- without
- VARISTEP — Auto
- Stepped — 100%

Power supply

Supply frequency	50Hz
Supply voltage	400V-Y (40S)

Result | Limits | Technical Data | Dimensions | Accessories | Information



Next →

Compressor	4FDC-5Y-40S
Capacity steps	100%
Cooling capacity	11,09 kW
Cooling capacity *	9,77 kW
Evaporator capacity	11,09 kW
Power input	4,79 kW
Current (400V)	8,85 A
Voltage range	380-420V
Condenser capacity	15,88 kW
COP/EER	2,31
COP/EER *	2,04
Mass flow	255 kg/h
Operating mode	Standard
Discharge gas temp. w/o cooling	106,6 °C

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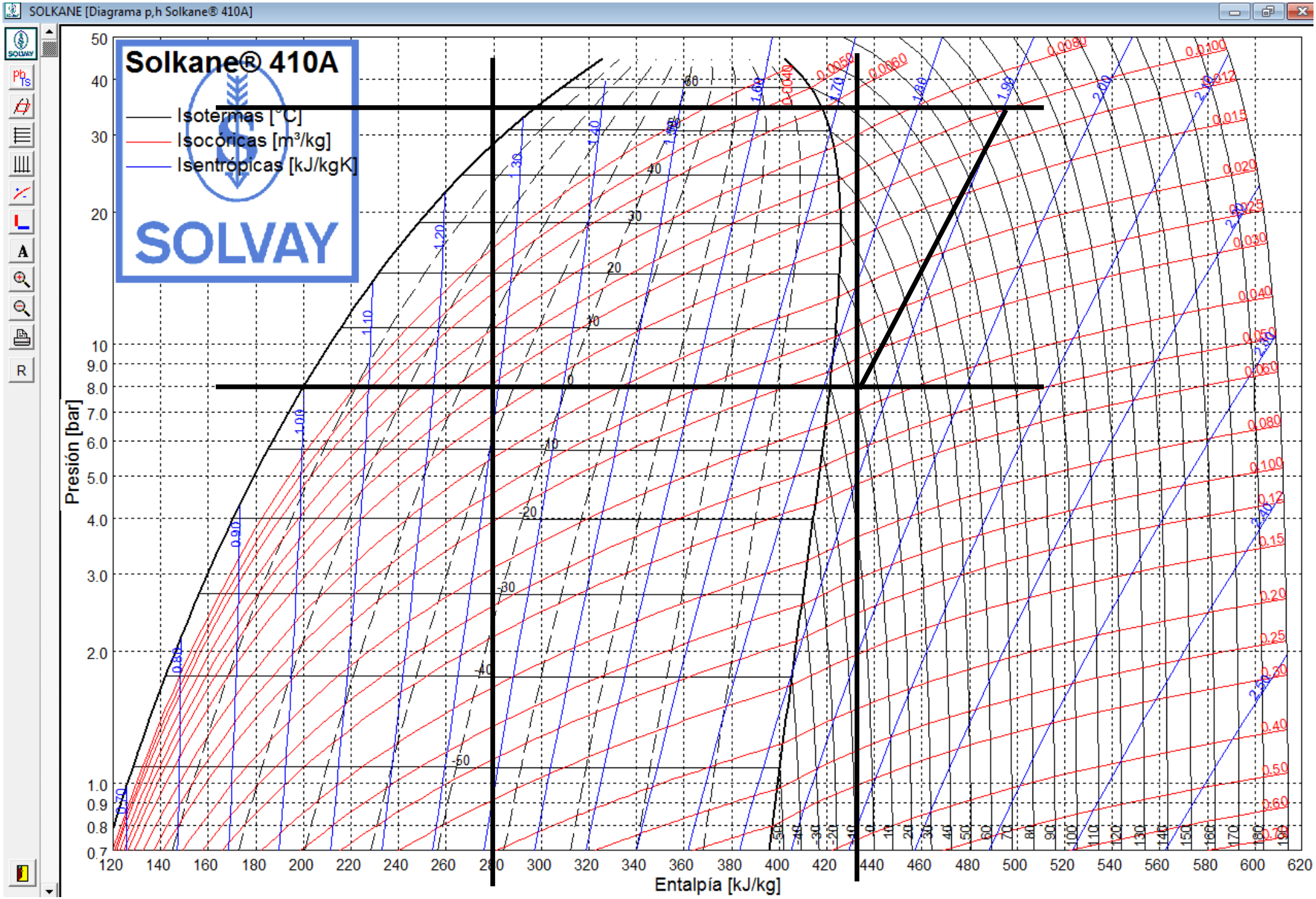
4FDC-5Y

Technical Data	
Displacement (1450rpm 50Hz)	12,4 m3/h
Displacement (1750rpm 60Hz)	15,0 m3/h
No. of cylinder x bore x stroke	4 x 41 mm x 27 mm
Weight	105 kg
Max. pressure (LP/HP)	25 / 42 bar
Connection suction line	22 mm - 7/8"
Connection discharge line	16 mm - 5/8"
Oil type R410A	BSE55 (Standard)

Motor Data	
Motor voltage (more on request)	380-420V Y-3-50Hz
Max. operating current	10.6 A
Starting current (Rotor locked)	62.2 A
Max. power input	6,4 kW

Extent Of Delivery (Standard)	
Motor protection	SE-B3(Standard), SE-B2(Option)
Enclosure class	IP65
Vibration dampers	Standard
Oil charge	2,00 dm³

Available Options	
Discharge gas temperature sensor	Option
Start unloading	Option


SOLKANE [Diagrama p,h Solkane® 410A]
Solkane® 410A
Isotermas [°C]
Isocóricas [m³/kg]
Isentrópicas [kJ/kgK]
SOLVAY
Presión [bar]
Entalpía [kJ/kg]