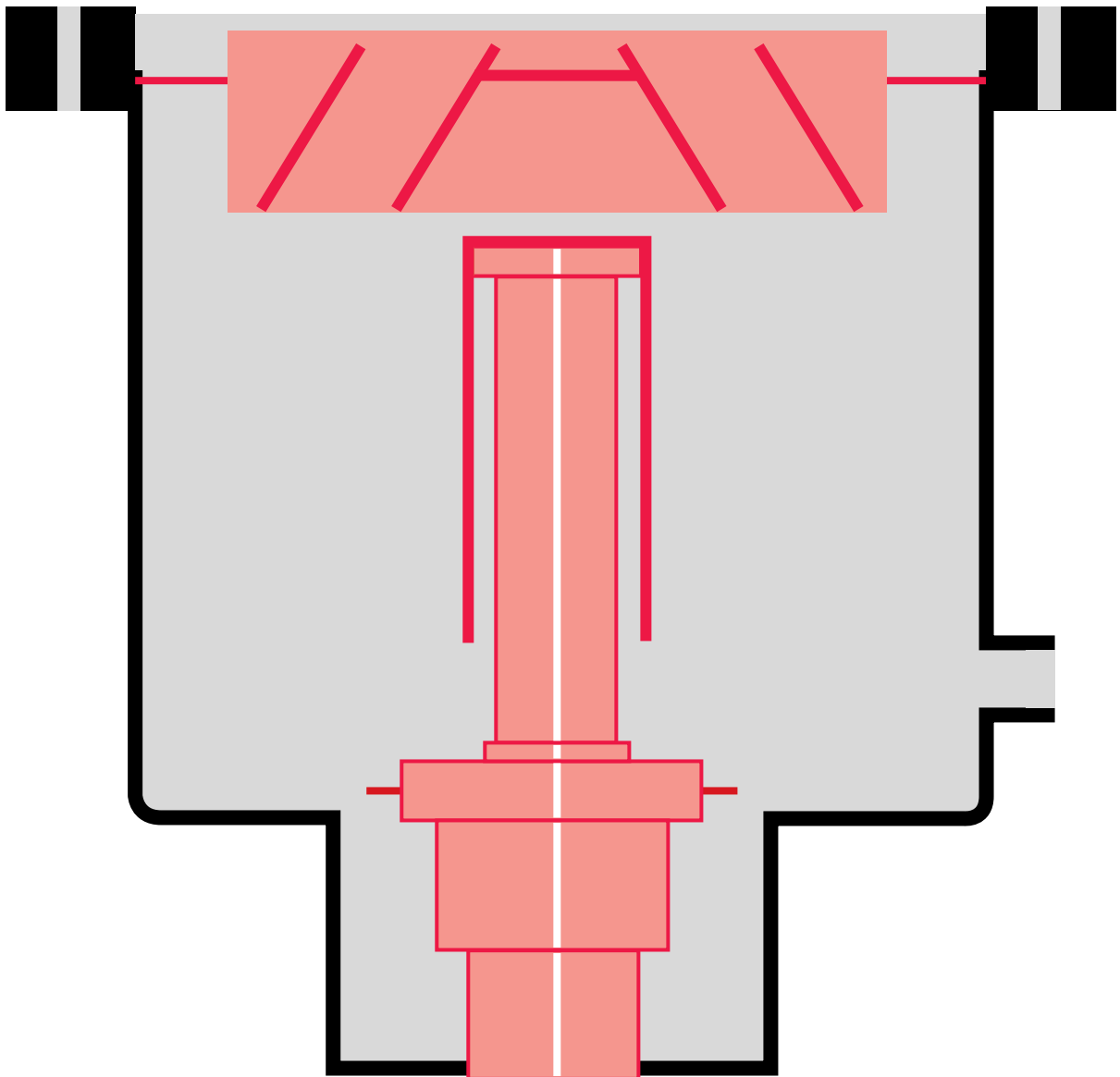


C12

Cryopumps, Cryogenics



General

Applications and Accessories	
Cryopumps	C12.03
Cold Heads	C12.04
General	
Cryopumps	C12.05
Multiple-Operation of Refrigerator Cryopumps	C12.06
Regenerating Cryopumps	C12.06
Refrigerating Capacity of Cold Heads	C12.07
Cold Heads	C12.07
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Products

Cryopumps

Standard Cryopumps	
COOLVAC 800	C12.10
Cryopumps with Fully Automatic Control	
ClassicLine	
COOLVAC 1.500 CL, 2.000 CL, 3.000 CL	C12.12
COOLVAC 5.000 CL, 10.000 CL	C12.18
COOLVAC 18.000 CL, 30.000 CL	C12.22
SemiLine	
COOLVAC 1500 SL	C12.24
System Controller SC / Power Supply PS	C12.25

Conversion of Units

Celsius, Fahrenheit, Kelvin

Kelvin (abbreviated as K) is the unit of temperature.

Temperatures on the Kelvin scale are converted into temperatures on the Celsius scale as follows:

$$n \text{ } ^\circ\text{C} \cong (n + 273.15) \text{ K.}$$

Since the following equation applies between Celsius scale and Fahrenheit scale

$$n \text{ } ^\circ\text{F} \cong 5/9 (n - 32) \text{ } ^\circ\text{C}$$

it follows that

$$n \text{ } ^\circ\text{F} \cong 5/9 (n + 459.67) \text{ K.}$$

The inverse equations are as follows:

$$m \text{ K} \cong (m - 273.15) \text{ } ^\circ\text{C}$$

$$m \text{ } ^\circ\text{C} \cong (1.8 m + 32) \text{ } ^\circ\text{F}$$

$$m \text{ K} \cong (1.8 m - 459.67) \text{ } ^\circ\text{F.}$$

The following applies in particular to absolute Zero:

$$0 \text{ K} \cong -273.15 \text{ } ^\circ\text{C} \cong -459.67 \text{ } ^\circ\text{F.}$$

$$1 \text{ bar} = 14.5 \text{ psi}$$

$$1 \text{ MPa} = 10 \text{ bar}$$

Cryogenics

Cold Heads	
Single Stage Cold Head COOLPOWER 120 T	C12.28
Dual Stage Cold Heads	
COOLPOWER 7/25, 5/100 and 5/100 T	C12.30
Compressor Units COOLPAK 4000/4200, COOLPAK 6000/6200	C12.32
General Accessories for Compressor Units COOLPAK	C12.34
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Cryopumps / Cryogenics

Controllers and Monitoring Units for Cryopumps	C12.38
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MODEL 1901 Low Temperature Measuring Instrument	C12.43
Temperature Sensors (Silicon Diode)	C12.44
Safety Valve	C12.45
Precision Manometer	C12.45

Application		Cryo pumps									
		COOLVAC 800	COOLVAC 1.500 CL	COOLVAC 2.000 CL	COOLVAC 3.000 CL	COOLVAC 5.000 CL	COOLVAC 10.000 CL	COOLVAC 18.000 CL	COOLVAC 30.000 CL	COOLVAC 1.500 SL	
UHV systems		◆	◆	◆						◆	
Beam tubes in particle accelerators		◆									
Transfer chambers / Loadlock		◆	◆	◆	(◆)					◆	
General research		◆	◆	◆	◆	◆	◆	◆	◆	◆	
Evaporation coating systems			◆	◆	◆	◆	◆	◆	◆	◆	
Sputtering systems			◆	◆	◆					◆	
Ion implanters			◆	◆	◆	(◆)				◆	
Metallization systems			◆	◆	◆	◆	◆	◆		◆	
Space simulation chambers					◆	◆	◆	◆	◆		
Electron beam welding systems						◆	◆	◆			
Accessories		Page									
COOLPAK 4000/4200 compressor unit	C12.32	◆	◆	◆	◆					◆	
COOLPAK 6000/6200 compressor unit	C12.32				[◆]	◆	◆	◆	◆		
MODEL 1901 low temperature measuring instrument	C12.43	◆									
Temperature sensors (silicon diode)	C12.44	◆									
GD 2 gas manifold	C12.34	◆	◆	◆	◆	◆				◆	
GD 4 gas manifold	C12.34	◆	◆	◆						◆	

(◆) = Only conditionally suited

[◆] = For dual operation only



Cold Heads		COOLPOWER 120 T				COOLPOWER 7/25				COOLPOWER 5/100				COOLPOWER 5/100 T			
		Application															
Cooling of samples and detectors		♦		♦		♦		♦		♦		♦		♦			
Cooling of superconductors				♦		♦		♦		♦		♦		♦			
Cooling of cryopanel		♦		♦		♦		♦		♦		♦		♦			
Cleaning of gases		♦		♦		♦		♦		♦		♦		♦			
Calibration of sensors				♦													
Optical spectroscopy				♦		♦		♦		♦		♦		♦			
Infrared spectroscopy				♦		♦		♦		♦		♦		♦			
Matrix spectroscopy				♦								♦		♦			
Testing of superconductors				♦													
Cooling of superconducting magnets, coils and components $HT_C + LT_C$								♦		♦		♦		♦			
Accessories		Page															
COOLPAK 4000/4200 compressor unit		C12.32				♦											
COOLPAK 6000/6200 compressor unit		C12.32		♦				♦		♦		♦		♦			
Modell 9700 low temperature controller		C12.42				♦		♦		♦		♦		♦			
MODEL 1901 low temperature measuring instrument		C12.43		♦		♦		♦		♦		♦		♦			
Temperature sensors (silicon diode)		C12.44		♦		♦		♦		♦		♦		♦			

Cryopumps

Cryopumps are gas entrapment vacuum pumps for the pressure range from 10^{-3} to $\leq 10^{-11}$ mbar (0.75×10^{-3} to $\leq 0.75 \times 10^{-11}$ Torr). The principle of operation is that gaseous substances are bound to the cold surfaces within the pump by means of cryocondensation, cryosorption or cryotrapping.

In order to be able to produce a high or ultra high vacuum the cold surfaces (cryopanel) must be cooled to a sufficiently low temperature. Depending on the type of cooling system used a difference is made between refrigerator cryopumps, bath cryopumps and evaporator cryopumps.

LEYBOLD manufactures only cryopumps which are cooled by means of a refrigerator.

Advantages to the User

Advantages offered by the Pumping Principle

- ◆ High effective pumping speed for all gases
- ◆ Extremely high pumping speed for water vapor

For a given diameter of the high vacuum flange, the cryopump offers the highest pumping speed of all high vacuum pumps.

Advantages offered by Design

In contrast to gas transfer high vacuum pumps (mechanically suspended turbomolecular pumps, for example), cryopumps do not have any mechanically moving, oil, or grease lubricated parts on the vacuum side.

The following advantages are a direct result of this design characteristic:

- ◆ Hydrocarbon-free vacuum in the pressure range from 10^{-3} to $\leq 10^{-11}$ mbar (0.75×10^{-3} to $\leq 0.75 \times 10^{-11}$ Torr).
- ◆ Insensitivity to mechanical disturbances from particles coming from the process or external vibrations.

Further Advantages

- ◆ Much more compact than comparable pump systems offering a pumping speed of over 1500 l x s^{-1}
- ◆ Backing pump is only required during start-up and during regeneration

- ◆ Easy process control and pump control via computer
- ◆ Favorable price-to-performance ratio and low running costs especially at higher pumping speeds

The cryopumps are cooled by the well-proven two-stage cold heads from LEYBOLD's COOLPOWER line (Gifford/McMahon principle).

The design of a refrigerator cryopump from the COOLVAC range is shown schematically in the figure below.

The first stage of the cold head (9) cools the thermal radiation shield (5) and the baffle (6) of the pump. Depending on the type of pump and the operating conditions operating temperatures of 45 to 80 K are attained.

Correspondingly water vapor condenses at this temperature.

The thermal shield and baffle are made of copper which conducts heat very well so as to optimally utilize the refrigerating capacity which is available.

Moreover, the thermal shield is metallized so that reflective losses will be minimal.

The second stage of the cold head (7) is used to cool the cryopanel (8). Depending on the operating conditions, operating temperatures of 10 to 20 K are attained.

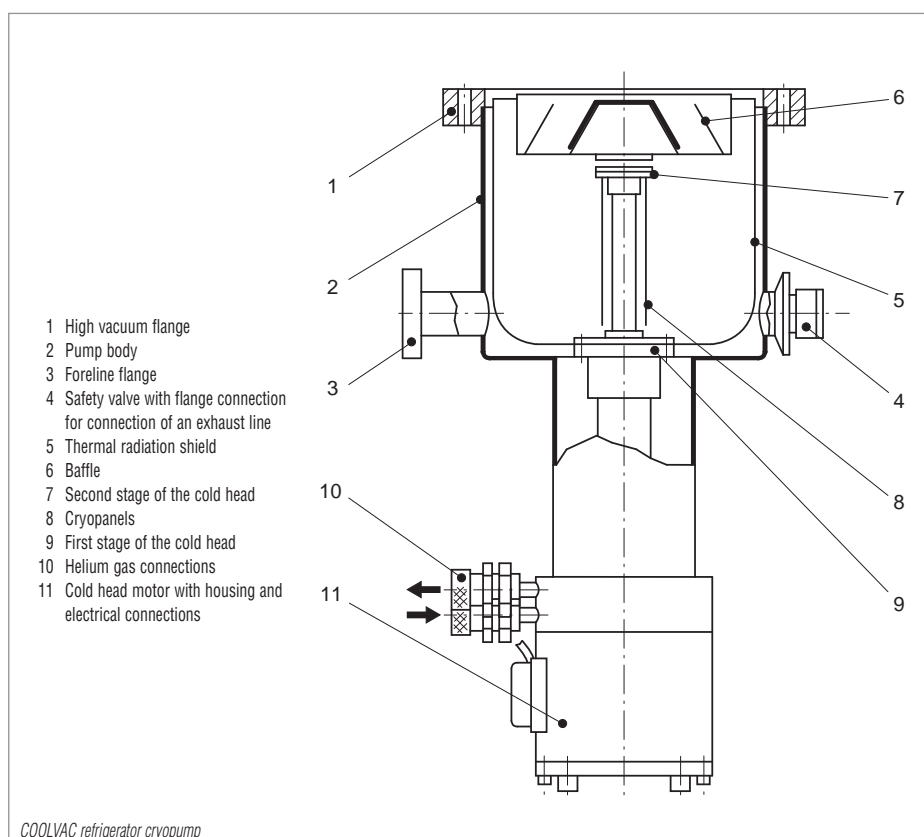
Here the process of cryocondensation of N_2 , O_2 and argon will take place.

The active pumping surfaces are made of copper of high thermal conductivity and they are tightly linked thermally to the second stage of the cold head. H_2 , Ne and He are also adsorbed on to these surfaces which are partly covered with activated charcoal.

All cryopumps from the COOLVAC range are equipped with a safety valve which is set in the factory so that it will open at an overpressure of 150 mbar (113 Torr). In order to be able to safely remove any gases which may present a health hazard when the safety valve responds, the valve is equipped with an additional DN 40 KF flange where an exhaust line is connected.

The pump's body, all flanges and the safety valve are made of high-quality stainless steel.

Upon request we will be pleased to mail you our special publication SO 182.04.02 "Benefits of modern refrigerator cryopumps in industrial processes and research".



Multiple Operation of Refrigerator Cryopumps

The powerful LEYBOLD compressor units COOLPAK 4000 D and 6000 D open up the possibility of operating two cold heads or refrigerator cryopumps simultaneously.

Multiple operation means operation of several cryopumps with one compressor unit.

Regenerating Cryopumps

An important aspect in the operation of cryopumps is that of regeneration. Since a cryopump is a gas entrapment pump, the gasses which have accumulated in the pump during the "pumping" mode must from time to time be removed from the pump. This is done by switching the compressor unit off and by warming up the cryopanel to room temperature or slightly higher so that the released substances can be pumped out by a forevacuum pump.

Cryopumps without Electric Regeneration System

The cryopump is warmed up to room temperature by purging the inside of the pump with a dry, pre-warmed inert gas (such as nitrogen). In this case it is not possible to set up defined and controlled temperatures within the cryopump. Thus the simultaneous presence of gases such as hydrogen and oxygen in the pump can not be entirely excluded. The formation of ignitable gas mixtures is only prevented by the diluting effect of the dry inert gas.

Advantages to the User

- ◆ Significantly reduced investment and operating costs
- ◆ Small footprint

Cryopumps with Fully Automatic Electric Regeneration System from LEYBOLD

The cryopump is warmed up to room temperature by heating the 1st and 2nd stages of the cold head with electric heaters. In this case, a defined and controlled temperature distribution within the cryopump can be set up. This controlled warming process ensures that the pumped gases are removed sequentially, i.e. the pumped gases are released one after the other in the following sequence:

- ◆ Gases adsorbed at the cryopanel (e.g. hydrogen, helium, neon),
- ◆ Gases condensed at the cryopanel (e.g. nitrogen, oxygen, argon),
- ◆ Gases and vapors which have condensed on to the baffle and thermal radiation shield (e.g. water vapor).

The electric method of regeneration from LEYBOLD prevents gases such as hydrogen and oxygen from being present in the pump at the same time. This excludes the formation of ignitable gas mixtures right from the start.

The warming up process is fully automatic. Pressure and temperature distribution within the pump are set up and controlled by the control system at all times. The sequential regeneration of pumped gases prevents the formation of ignitable gases right from the start. This ensures the utmost safety during the regeneration of cryopumps from LEYBOLD.

In the case of cryogenic pumps with fully automatic control there exist two cryo pump lines.

1. The COOLVAC ClassicLine (COOLVAC CL) offering the following pumping speed classes for nitrogen in l/s: 1500, 2000, 3000, 5000, 10.000, 18.0000 and 30.000; COOLVAC 1500 CL, for example.
2. The COOLVAC SemiLine (COOLVAC SL) offering a pumping speed for nitrogen of 1500 l/s: COOLVAC 1500 SL.

The pumps of the ClassicLine offer total regeneration as standard and the COOLVAC 1500 SL offers in addition the possibility of fast regeneration.

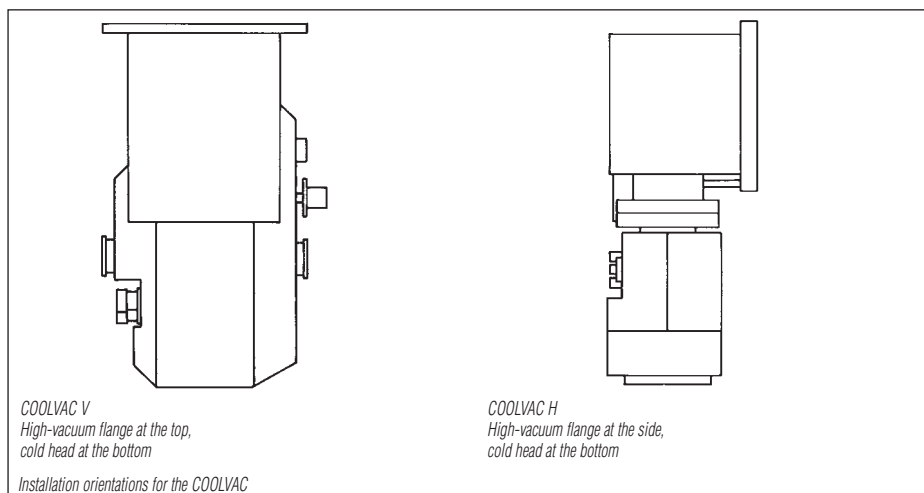
In the price list the designators "V" and "H" appear in connection with the pump designations.

"H":

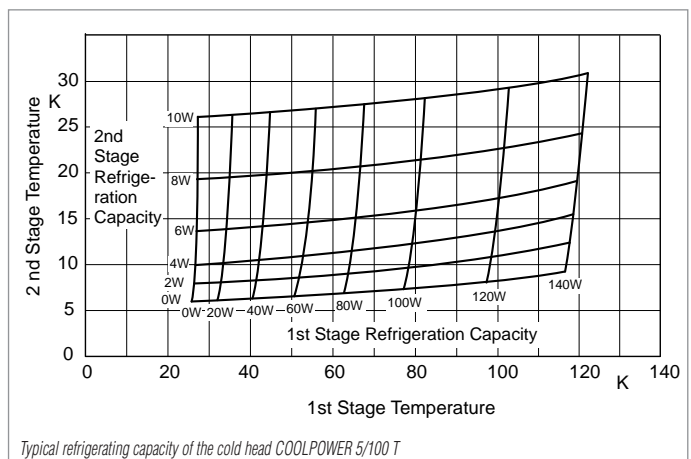
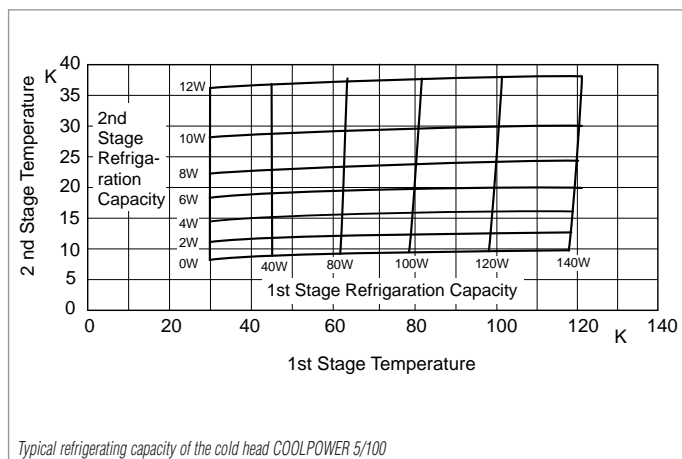
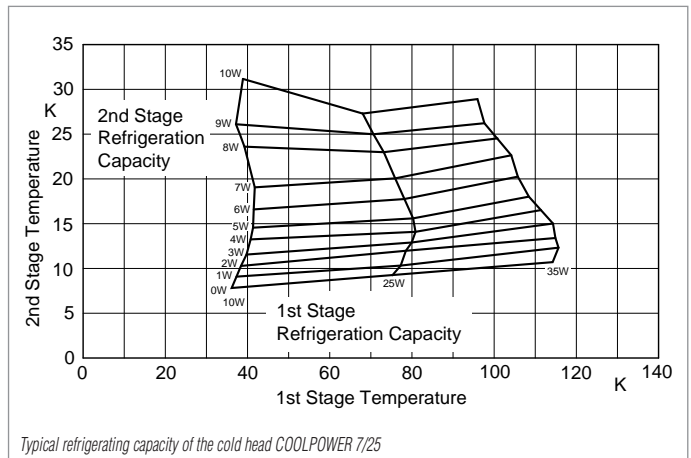
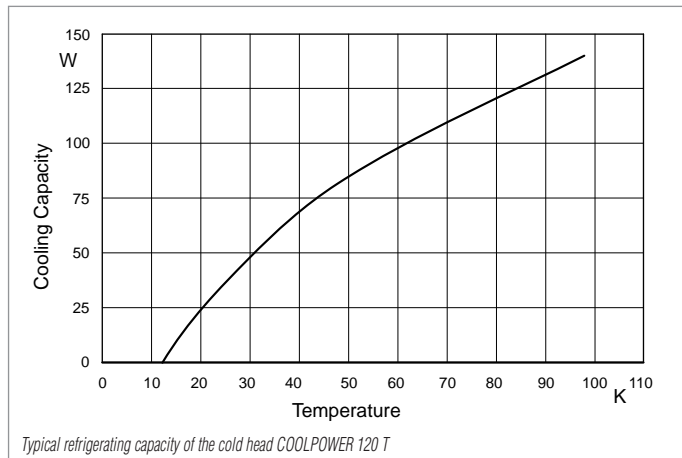
The high-vacuum flange is located at the side and the cold head below, as is the case for the COOLVAC 1500 SL-H, DN 200 CF.

"V":

The high-vacuum flange is located at the top and the cold head below, as is the case for the COOLVAC 1500 CL-V, DN 200 CF.



Refrigerating Capacity of Cryogenic Cold Heads



The refrigerating capacities stated apply to vertical operation with the cold end at the bottom.

Cold Heads

A refrigerator (cold head) is a gas cooling machine which operates on the basis of a thermodynamic cycle to produce cryogenic temperatures ($T < 120$ K).

Refrigerators operating according to the Gifford/McMahon principle have succeeded over other methods of cooling cryopumps and cryostats. It is thus employed exclusively by LEYBOLD.

In order to account for individual requirements from customers, LEYBOLD offers customized cryostats as well.

Gifford/McMahon-Refrigerators

Advantages to the User

- ◆ Low temperatures on a single key press
- ◆ No liquid helium and no liquid nitrogen are required
- ◆ Very simple to operate
- ◆ High refrigerating capacity from a small volume
- ◆ Easy process control and temperature control via a computer

Advantages by Design

- ◆ No space problems since cold head and compressor unit can be installed and operated apart
- ◆ Installation of the cold head basically in any orientation
- ◆ High reliability
- ◆ Long periods of operation without maintenance

Typical Applications

- ♦ Cooling of cryopanel in cryopumps thereby producing high or ultra high vacuum
- ♦ Cooling of superconducting magnets; in magnetic resonance tomographs, for example
- ♦ Cooling of samples and detectors; especially for cooling of
 - samples for spectroscopic analysis in the areas of solid state and surface physics
 - high temperature superconductors
 - superconductors and semiconductors
 - infrared and gamma detectors
- ♦ Calibration of sensors

Cold Heads from the COOLPOWER Range

The standard range of single-stage and two-stage cold heads matches a wide range of applications.

LEYBOLD is offering refrigerators with usable refrigerating powers of 120 W at 80 K (COOLPOWER 120, single-stage) and down to 3.5 W at 10 K (COOLPOWER 5/100 T; dual-stage).

The cold heads basically consist of three sub-assemblies:

- ♦ Drive and control unit for the displacer
- ♦ Displacer
- ♦ First stage of the cold head (and second stage in the case of two-stage cold heads).

Pneumatically driven Cold Heads

Advantages

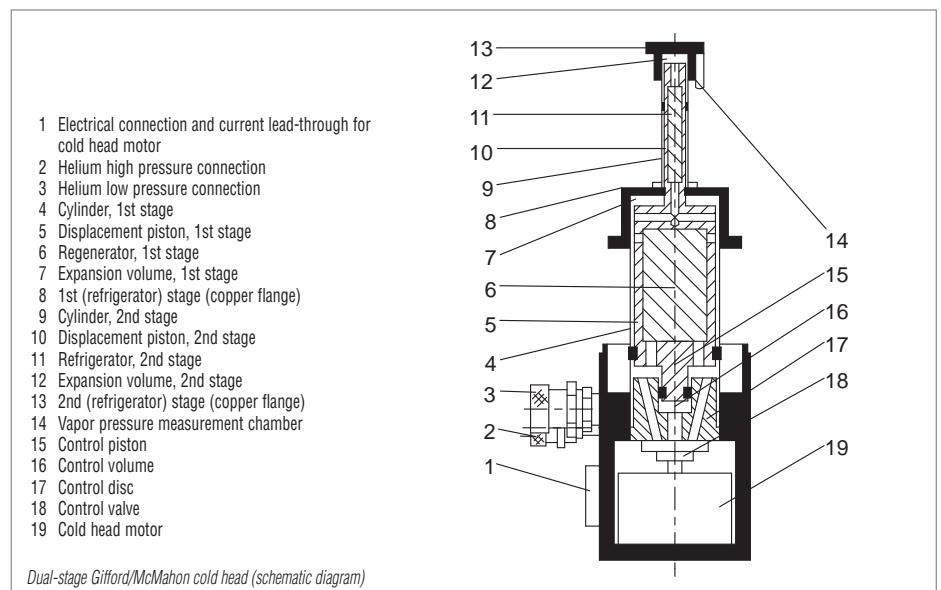
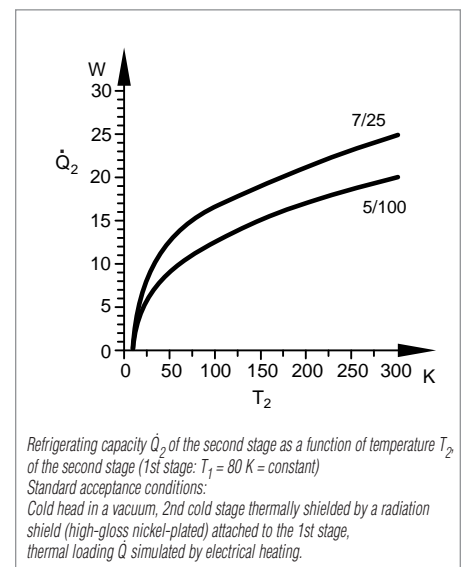
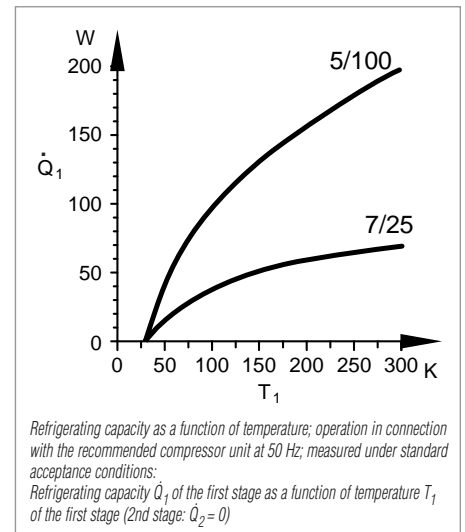
- ♦ **Simple Design**
The pneumatic drive system for the displacer of these cold heads from LEYBOLD consists of only two mechanically moving components: the rotating control valve and the synchronous motor driving the control valve.
- ♦ **Easy and quick maintenance**
All LEYBOLD cryopumps from the COOLVAC range are equipped with pneumatically driven LEYBOLD cold heads. Owing to the simple design of the built-in cold heads, maintenance is easy. Maintenance can be performed in place without detaching the cryopump from the vacuum chamber.

Advantages Through High Reliability

As to reliability, LEYBOLD cold heads are top performers.

Especially high reliability is required for medical instrumentation, specifically in connection with nuclear spin tomographs. In this application cold heads are used to cool superconducting magnets and they are thus exposed to strong magnetic fields.

The leading manufacturers of nuclear spin tomographs have therefore decided to use LEYBOLD cold heads to cool the superconducting magnets.



Refrigerator Cryostats (Basic Units)

Advantages to the User

- ◆ Can be installed basically in any orientation thereby offering a high degree of flexibility in experimental arrangements
- ◆ Can be set to any temperature within 10 and 320 K
- ◆ High refrigerating capacity, constant temperatures
- ◆ No liquid refrigerants are required

- ◆ Very simple to operate
- ◆ Temperature control without problems through standardized control- and connecting components
- ◆ Possible high throughput of samples due to short cooldown and warming-up periods

Typical Applications

- ◆ Cooling of
 - high temperature superconductors
 - superconductors and semiconductors
 - infrared and gamma detectors

- ◆ Measurement of electric and thermal transport quantities, as a function of the temperature, such as
 - electric and thermal conductance
 - electromotive force

Especially in connection with:

- ◆ Spectroscopic investigations in the infrared, visible and ultraviolet spectral ranges
- ◆ Matrix spectroscopy
- ◆ Moessbauer spectroscopy
- ◆ Magneto-optic experiments

Compressor Units

COOLPAK 4000 to 6000 compressors are available for single operation of the remaining cold heads from the COOLPOWER line as well as for multiple operation of cryopumps and cryostats.

The period during which no maintenance will be required on the LEYBOLD compressor units depends on the service life of the adsorber. If the

values for the ambient temperature and the cooling water entry temperature remain within the specified range, LEYBOLD guarantees a service life for the adsorber – and thus a period during which no maintenance will be required – of 18 000 operating hours.

The possibilities for multiple operation of refrigerator cryo pumps are given in the following table:

Compressor unit	For the operation of Cold heads	Cryopumps
COOLPAK 4000 D	2 x COOLPOWER 7/25	2 x COOLVAC 800/1500/2000
COOLPAK 4000/4200	–	2 x COOLVAC 1500/2000
COOLPAK 6000 D	2 x COOLPOWER 7/25 up to 2 x COOLPOWER 5/100 ¹⁾	2 x COOLVAC 1500/2000 2 x COOLVAC 3000
COOLPAK 6000/6200	–	up to 3 x COOLVAC 1500/2000 2 x COOLVAC 3000

¹⁾ at reduced power

UL Approval

The LEYBOLD refrigerators in this catalog (consisting of compressor unit COOLPAK (4000/4200, 6000/6200, flex lines FL and the cold head COOLPOWER²⁾) meet – as complete systems – the requirements of the Underwriter Laboratories (UL) as Recognised Components (Urus) as well as the approval cUR performed through the Underwriter Laboratories for the Canadian Standards Association.

LEYBOLD refrigerators are listed under the UL/cUL reference number SA 8676. The marks as shown on the right for the entire system can only be found on the name plate of the compressor unit.



CE Approval

The LEYBOLD compressor units RW and COOLPAK meet the basic requirements regarding safety and health of the relevant EC directives. They carry on the name plates of the compressor units the following mark.



²⁾ resp. formerly RGD

COOLVAC 800



COOLVAC 800 (160 ISO-K)



COOLVAC 800 (160 CF)

Advantages to the User

- ◆ Hydrocarbon-free high vacuum
- ◆ High capacity for argon and hydrogen
- ◆ High pumping speed for water vapor, argon and hydrogen
- ◆ Fast, safe and efficient regeneration with an electric regeneration system

Typical Applications

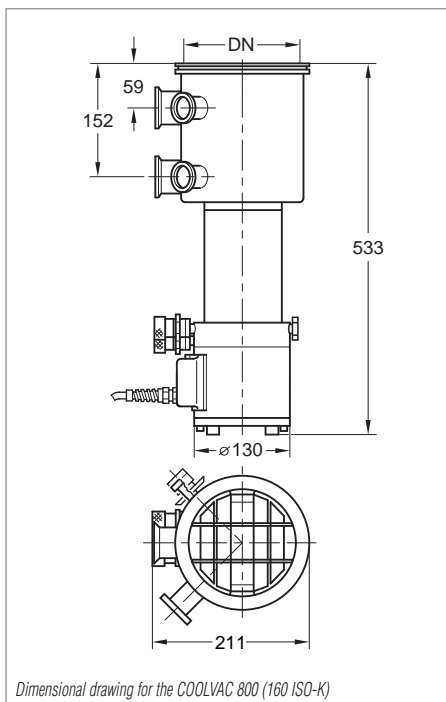
- ◆ Lamps and tubes manufacture
- ◆ Transfer chambers / Loadlock
- ◆ General research

Advantages to the User

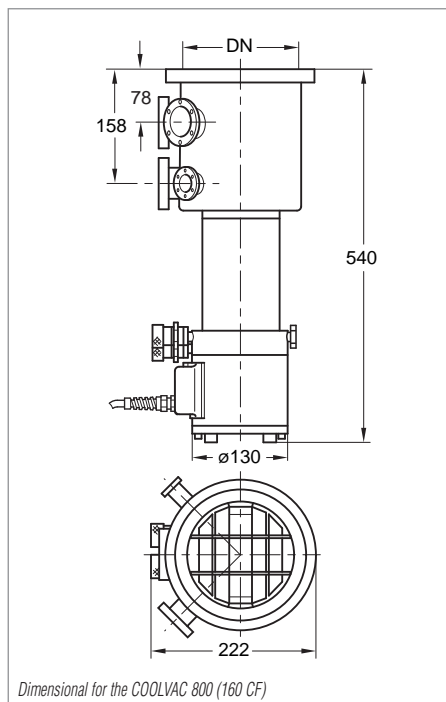
- ◆ Hydrocarbon-free ultrahigh vacuum
- ◆ High pumping speed for water vapor, nitrogen and hydrogen

Typical Applications

- ◆ Beam tubes in particle accelerators
- ◆ UHV systems



Dimensional drawing for the COOLVAC 800 (160 ISO-K)



Dimensional for the COOLVAC 800 (160 CF)

Technical Data		COOLVAC 800 (ISO-K)	COOLVAC 800 (CF)
High vacuum flange	DN	160 ISO-K	160 CF
Fore vacuum flange	DN	40 KF	40 CF
Flange for other purposes	DN	16 KF (1x), 25 KF (1x), 40 KF (1x)	40 CF (2x)
Safety valve with DN 40 FK flange connection for gas exhaust line		welded-in	burst disk mounted on DN 16 CF
Pumping speed			
H ₂ O	l x s ⁻¹	2600	
Ar/N ₂	l x s ⁻¹	640/800	
H ₂ /He	l x s ⁻¹	1000/300	
Capacity			
Ar/N ₂	bar x l (Torr x l)	270 (270 000)	
H ₂ at 10 ⁻⁶ mbar	bar x l (Torr x l)	4.3 (3225)	
He	bar x l (Torr x l)	0.5 (375)	
Built-in cold head	COOLPOWER	7/25	
Max. throughput			
Ar/N ₂	mbar x l x s ⁻¹ (Torr x l x s ⁻¹)	4 (3)	
H ₂	mbar x l x s ⁻¹ (Torr x l x s ⁻¹)	2 (1.5)	
Crossover value	mbar x l (Torr x l)	60 (45)	
Cool down time to 20 K	min	70	
Overall height	mm	503	508
Weight	kg (lbs)	12 (26.5)	14 (30.9)
Silicon diode for temperature measurements at second stage of the cold head		built-in to a DN 25 KF with two-way HV current feedthrough	built-in to a DN 16 CF with UHV feedthrough

Ordering Information		COOLVAC 800 (ISO-K)	COOLVAC 800 (CF)
COOLVAC 800		Part No. 844160V1006	Part No. 844160V1002
Accessories			
compressor unit			
COOLPAK 4000		Part No. 892 31	Part No. 892 31
COOLPAK 4200		Part No. 892 33	Part No. 892 33
Power supply cable		see Ordering Information for the Compressor Units COOLPAK	
Connecting cable Compressor – cold head, 4,5 m		Part No. 400 000 323	Part No. 400 000 323
Flexlines			
FL 4.5 (1/2", 1/2") or FL 9.0 (1/2", 1/2") and EL 4.5 (electric extension cable)		Part No. 892 87 Part No. 892 88 Part No. 893 74	Part No. 892 87 Part No. 892 88 Part No. 893 74
MODEL 1901 low temperature measuring instrument		Part No. 136 45	Part No. 136 45
Cable for the silicon diode, 10 m long		Part No. 500 085	Part No. 500 201

COOLVAC 1.500 CL

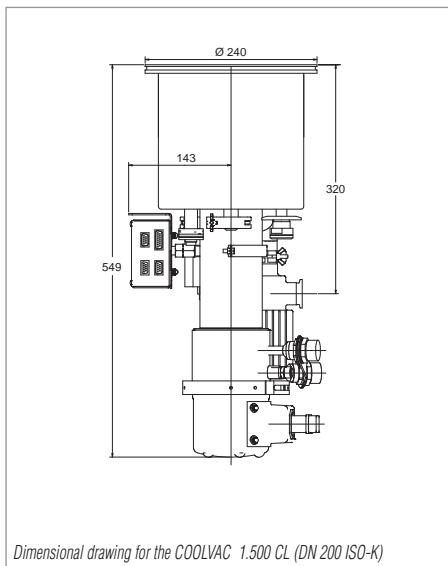


Advantages to the User

- ◆ Hydrocarbon-free high vacuum
- ◆ High capacity for argon and hydrogen
- ◆ High crossover value
- ◆ Simple operation
- ◆ Trouble-free integration into complex systems
- ◆ Fully automatic regeneration through Cryo Compact Control
- ◆ Easy servicing

Typical Applications

- ◆ Evaporators
- ◆ Sputtering systems
- ◆ Ion implanters
- ◆ Optical coating systems
- ◆ Metallization systems



COOLVAC 2.000 CL

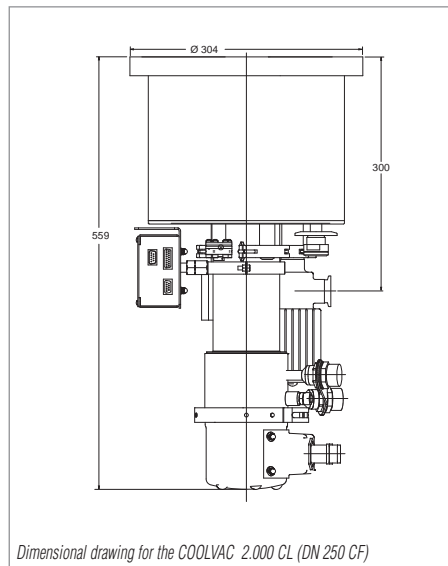


Advantages to the User

- ◆ Hydrocarbon-free high vacuum
- ◆ High capacity for argon and hydrogen
- ◆ High crossover value
- ◆ Simple operation
- ◆ Trouble-free integration into complex systems
- ◆ Fully automatic regeneration through Cryo Compact Control
- ◆ Easy servicing

Typical Applications

- ◆ Evaporators
- ◆ Sputtering systems
- ◆ Ion implanters
- ◆ Optical coating systems
- ◆ Metallization systems



COOLVAC 3.000 CL

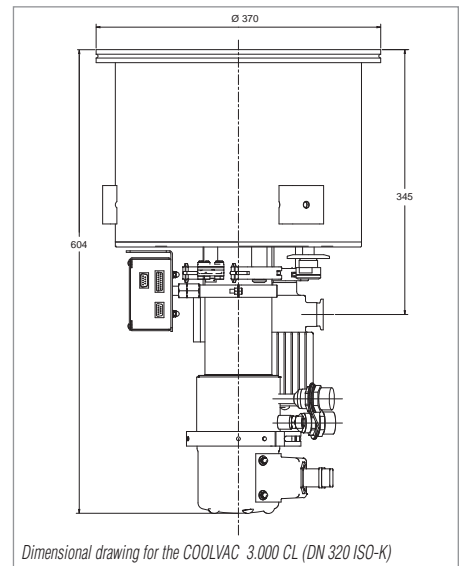


Advantages to the User

- ◆ Hydrocarbon-free high vacuum
- ◆ High capacity for argon and hydrogen
- ◆ High crossover value
- ◆ Simple operation
- ◆ Trouble-free integration into complex systems
- ◆ Fully automatic regeneration through Cryo Compact Control
- ◆ Easy servicing

Typical Applications

- ◆ Evaporators
- ◆ Sputtering systems
- ◆ Ion implanters
- ◆ Optical coating systems
- ◆ Metallization systems



Technical Data		COOLVAC 1.500 CL	COOLVAC 2.000 CL	COOLVAC 3.000 CL
High vacuum (HV) flange	DN	200 ISO-K / 200 CF / 6" ANSI	250 ISO-K / 250 CF / 8" ANSI	320 ISO-K / 10" ANSI
Fore vacuum flange	DN	25 KF		
Flange for connection a gauge head	DN	16 KF		
Flange for the electrical connection	DN	40 KF		
Safety valve with flange connection for gas exhaust line	DN	40 KF		
4-way current feedthrough for Si diode on a flange	DN	16 KF		
Heaters				
1st stage	W	160	160	160
	V AC	35	35	35
2nd stage	W	90	90	90
	V AC	35	35	35
Temperature sensor				
1st stage			Pt 100	
2nd stage			Si diode	
Built-in cold head	COOLPOWER		7/25	
Weight	kg (lbs)	25 (55.2)	25 (55.2)	35 (77.3)
Cooldown time to T ₂ = 20 K	min	90	60	80
Crossover value	mbar x l (Torr x l)	180 (135)	250 (187)	250 (187)
Pumping speed				
H ₂ O	l x s ⁻¹	4600	7000	10 500
Ar / N ₂	l x s ⁻¹	1000 / 1300	1600 / 2100	2400 / 2800
H ₂	l x s ⁻¹	2300	3200	4500
Capacity				
Ar/N ₂	bar x l	1600	1400	2500
H ₂ at 10 ⁻⁶ mbar	bar x l	12	12	12
H ₂ O	bar x l	not applicable	190	460
Max. throughput				
Ar/N ₂	mbar x l x s ⁻¹ (Torr x l x s ⁻¹)	14 (10.5)	12 (9)	15 (11.2)
H ₂ O	mbar x l x s ⁻¹ (Torr x l x s ⁻¹)	8 (6)	6.5 (4.8)	10 (7.5)
Helium connections (Self-sealing couplings: outside thread, type 5400-S2-8)	DN	1/2"	1/2"	1/2"



Ordering Information	Single Operation		COOLVAC 1.500 CL Dual Operation			Multiple Operation	
	Europe	USA/Japan	Europe	Europe	USA/Japan	Europe	USA/Japan
COOLVAC 1.500 CL DN 200 CF DN 6" ANSI DN 200 ISO-K	Part No. 844200V0002 844200V0004 844200V0006		Part No. 844200V0002 (2x) 844200V0004 (2x) 844200V0006 (2x)			Part No. 844200V0002 (3x) 844200V0004 (3x) 844200V0006 (3x)	
Electronics and cables							
System Controller SC	844 230		844 230			844 230	
Power Supply PS 230 V, 1 ph. 200 V, 3 ph.	844 135 –	–	844 135 –	– 844 235	– 844 235	– 844 235	– 844 235
Network communication cable – System Controller to the pump(s) 10 m 20 m	844 261 844 262	–	844 261 844 262	–	–	844 261 844 262	–
Network PM cable for the link between the pumps 3 m 10 m	– –	–	844 256 844 258	–	–	844 256 (2x) 844 258 (2x)	–
Power supply cable from power supply to pump 10 m 20 m	– –	–	– –	844 251 (2x) 844 252 (2x)	844 251 (2x) 844 252 (2x)	844 251 (3x) 844 252 (3x)	–
Remote control cable CP, 1 m	–	–	–	844 265	844 265	844 265	–
Cable compressor – Power Supply 10 m 20 m	844 129 844 139	–	844 129 844 139	– –	– –	– –	–
Cable System Controller – Power Supply, 1 m	844 141	–	844 141	–	–	–	–
Cable pump module PM – Power Supply 10 m 20 m	844 128 844 138	–	844 128 (2x) 844 138 (2x)	– –	– –	– –	–
Connecting cable compressor – pump, 4.5 m	400 000 323	–	400 000 323 (2x)	–	–	–	–
Compressors and flexlines							
Compressor CP 4000 D CP 4000 CP 4200 CP 6000 CP 6200	– 892 31 – – –	– – 892 33 –	892 3000 – –	– 892 31 –	– – 892 33	– – – 892 36 –	– – – 892 37
Accessories Water cooling discharge throttle	840 000 133	–	840 000 133	–	–	840 000 133	–
Power supply cable for compressor	see Ordering Information for the Compressor Units COOLPAK						
Set of flexlines FL 4.5 (1/2", 1/2") or FL 9.0 (1/2", 1/2") and EL 4.5 (electric extension cable)	892 87 892 88 893 74	–	892 87 (2x) 892 88 (2x) 893 74 (2x)	892 87 (2x) 892 88 (2x) –	892 87 (2x) 892 88 (2x) –	892 87 (3x) 892 88 (3x) –	–
Gas manifold GD 2 GD 4	– –	–	891 02 –	891 02 –	891 02 –	– 891 03	–

The arrangement of the components is shown in the section "Accessories" under the heading "COOLVAC ClassicLine, System Components"

Ordering Information	Single Operation		COOLVAC 2000 CL Dual Operation			Multiple Operation	
	Europe	USA/Japan	Europe	Europe	USA/Japan	Europe	USA/Japan
COOLVAC 2000 CL DN 250 CF DN 8" ANSI DN 250 ISO-K	Part No. 844250V0002 844250V0004 844250V0006		Part No. 844250V0002 (2x) 844250V0004 (2x) 844250V0006 (2x)			Part No. 844250V0002 (3x) 844250V0004 (3x) 844250V0006 (3x)	
Electronics and cables							
System Controller SC	844 230		844 230			844 230	
Power Supply PS 230 V, 1 ph. 200 V, 3 ph.	844 135 -		844 135 -	- 844 235	- 844 235	- 844 235	
Network communication cable – System Controller to the pump(s) 10 m 20 m	844 261 844 262		844 261 844 262			844 261 844 262	
Network PM cable for the link between the pumps 3 m 10 m	- -		844 256 844 258			844 256 (2x) 844 258 (2x)	
Power supply cable from power supply to pump 10 m 20 m	- -		- -	844 251 (2x) 844 252 (2x)	844 251 (2x) 844 252 (2x)	844 251 (3x) 844 252 (3x)	
Remote control cable CP, 1 m	-		-	844 265	844 265	844 265	
Cable compressor – Power Supply 10 m 20 m	844 129 844 139		844 129 844 139	- -	- -	- -	
Cable System Controller – Power Supply, 1 m	844 141		844 141	-	-	-	
Cable pump module PM – Power Supply 10 m 20 m	844 128 844 138		844 128 (2x) 844 138 (2x)	- -	- -	- -	
Connecting cable compressor – pump, 4.5 m	400 000 323		400 000 323 (2x)	-	-	-	
Compressors and flexlines							
Compressor CP 4000 D CP 4000 CP 4200 CP 6000 CP 6200	- 892 31 - - -	- - 892 33 - -	892 3000 - - -	- 892 31 - -	- - 892 33 -	- - - 892 36 -	- - - 892 37 -
Accessories Water cooling discharge throttle	840 000 133		840 000 133			840 000 133	
Power supply cable for compressor	see Ordering Information for the Compressor Units COOLPAK						
Set of flexlines FL 4.5 (1/2", 1/2") or FL 9.0 (1/2", 1/2") and EL 4.5 (electric extension cable)	892 87 892 88 893 74		892 87 (2x) 892 88 (2x) 893 74 (2x)	892 87 (2x) 892 88 (2x) -	892 87 (2x) 892 88 (2x) -	892 87 (3x) 892 88 (3x) -	
Gas manifold GD 2 GD 4	- -		891 02 -	891 02 -	891 02 -	- 891 03	

The arrangement of the components is shown in the section "Accessories" under the heading "COOLVAC ClassicLine, System Components"

Ordering Information	COOLVAC 3000 CL				
	Single Operation		Dual Operation		
	Europe	USA/Japan	Europe	Europe	USA/Japan
COOLVAC 3000 CL DN 10" ANSI DN 320 ISO-K	Part No. 844320V0004 844320V0006		Part No. 844320V0004 (2x) 844320V0006 (2x)		
Electronics and cables					
System Controller SC	844 230		844 230		
Power Supply PS 230 V, 1 ph. 200 V, 3 ph.	844 135 –		844 135 –	– 844 235	– 844 235
Network communication cable – System Controller to the pump(s) 10 m 20 m	844 261 844 262		844 261 844 262		
Network PM cable for the link between the pumps 3 m 10 m	– –		844 256 844 258		
Power supply cable from power supply to pump 10 m 20 m	– –		– –	844 251 (2x) 844 252 (2x)	844 251 (2x) 844 252 (2x)
Remote control cable CP, 1 m	–		–	844 265	844 265
Cable compressor – Power Supply 10 m 20 m	844 129 844 139		844 129 844 139	– –	– –
Cable System Controller – Power Supply, 1 m	844 141		844 141	–	–
Cable pump module PM – Power Supply 10 m 20 m	844 128 844 138		844 128 (2x) 844 138 (2x)	– –	– –
Connecting cable compressor – pump, 4.5 m	400 000 323		400 000 323 (2x)	–	–
Compressors and flexlines					
Compressor CP 4000 CP 4200 CP 6000 D CP 6000 CP 6200	892 31 – – – –	– 892 33	– – 892 46 – –	– – – 892 36 –	– – – – 892 37
Accessories Water cooling discharge throttle	840 000 133		840 000 133		
Power supply cable for compressor	see Ordering Information for the Compressor Units COOLPAK				
Set of flexlines FL 4.5 (1/2", 1/2") or FL 9.0 (1/2", 1/2") and EL 4.5 (electric extension cable)	892 87 892 88 893 74		892 87 (2x) 892 88 (2x) 893 74 (2x)	892 87 (2x) 892 88 (2x) –	892 87 (2x) 892 88 (2x) –
Gas manifold GD 2	–		891 02	891 02	891 02

The arrangement of the components is shown in the section "Accessories" under the heading "COOLVAC ClassicLine, System Components"

COOLVAC 5.000 CL



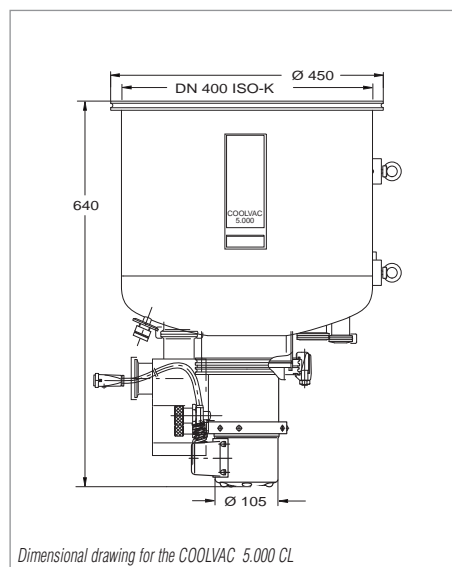
COOLVAC 5.000 CL

Advantages to the User

- ◆ Hydrocarbon-free high vacuum
- ◆ High capacity for argon and hydrogen
- ◆ High crossover value
- ◆ Simple operation
- ◆ Trouble-free integration into complex systems
- ◆ Fully automatic regeneration through Cryo Compact Control
- ◆ Easy servicing

Typical Applications

- ◆ Evaporators
- ◆ Ion implanters
- ◆ Electron beam welding systems
- ◆ Optical coating systems
- ◆ Metallization systems



Dimensional drawing for the COOLVAC 5.000 CL

COOLVAC 10.000 CL



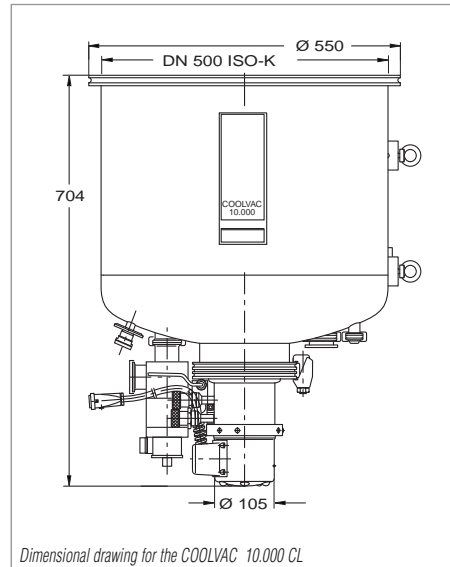
COOLVAC 10.000 CL

Advantages to the User

- ◆ Hydrocarbon-free high vacuum
- ◆ High capacity for argon and hydrogen
- ◆ High crossover value
- ◆ Simple operation
- ◆ Trouble-free integration into complex systems
- ◆ Fully automatic regeneration through Cryo Compact Control
- ◆ Easy servicing

Typical Applications

- ◆ Evaporators
- ◆ Space simulation chambers
- ◆ Electron beam welding systems
- ◆ Optical coating systems
- ◆ Metallization systems



Dimensional drawing for the COOLVAC 10.000 CL

Technical Data		COOLVAC 5.000 CL	COOLVAC 10.000 CL
High vacuum (HV) flange	DN	400 ISO-K	500 ISO-K
Fore vacuum flange	DN		40 KF
Flange for connection of a gauge head	DN		16 KF
Flange for the electrical connection	DN		40 KF
Safety valve with flange connection for gas exhaust line	DN		40 KF
4-way current feedthrough for Si diode on a flange	DN		16 KF
Heaters			
1st stage	W		160
	V AC		35
2nd stage	W		90
	V AC		35
Temperature sensor			
1st stage			Pt 100
2nd stage			Si diode
Built-in cold head	COOLPOWER		5/100
Weight	kg (lbs)	42 (92.7)	50 (110.4)
Cooldown time to T ₂ = 20 K	min	120	160
Crossover value	mbar x l (Torr x l)	700 (525)	800 (600)
Pumping speed			
H ₂ O	l x s ⁻¹	18 000	30 000
Ar / N ₂	l x s ⁻¹	3 700 / 5 000	8 400 / 10 000
H ₂	l x s ⁻¹	5 200	12 000
Capacity			
Ar/N ₂	bar x l	3 000	5 000
H ₂ at 10 ⁻⁶ mbar	bar x l	32	40
H ₂ O	bar x l	790	not applicable
Max. throughput			
Ar/N ₂	mbar x l x s ⁻¹ (Torr x l x s ⁻¹)		10 (7.5)
H ₂	mbar x l x s ⁻¹ (Torr x l x s ⁻¹)		7 (5.3)



Ordering Information	COOLVAC 5.000 CL		COOLVAC 10.000 CL	
	Europe	USA/Japan	Europe	USA/Japan
COOLVAC 5.000 CL, DN 400 ISO-K 10.000 CL, DN 500 ISO-K	Part No. 844 410 –		– Part No. 844 610	
Electronics and cables				
System Controller SC	Part No. 844 230		Part No. 844 230	
Power Supply PS 230 V, 1 ph.	Part No. 844 135		Part No. 844 135	
Network communication cable – System Controller to the pump(s) 10 m 20 m	Part No. 844 261 Part No. 844 262		Part No. 844 261 Part No. 844 262	
Cable compressor – Power Supply PS 10 m 20 m	Part No. 844 129 Part No. 844 139		Part No. 844 129 Part No. 844 139	
Cable System Controller – Power Supply, 1 m	Part No. 844 141		Part No. 844 141	
Cable pump module PM – Power Supply 10 m 20 m	Part No. 844 128 Part No. 844 138		Part No. 844 128 Part No. 844 138	
Compressors and flexlines				
Compressor CP 6000 CP 6200	Part No. 892 36 –	– Part No. 892 37	Part No. 892 36 –	– Part No. 892 37
Accessories Water cooling discharge throttle	Part No. 840 000 133		Part No. 840 000 133	
Power supply cable for compressor	see Ordering Information for the Compressor Units COOLPAK			
Set of flexlines FL 4.5 (1/2", 1/2") or FL 9.0 (1/2", 1/2") and EL 4.5 (electric extension cable)	Part No. 892 87 Part No. 892 88 Part No. 893 74		Part No. 892 87 Part No. 892 88 Part No. 893 74	

The arrangement of the components is shown in the section "Accessories" under the heading "COOLVAC ClassicLine, System Components"

COOLVAC 18.000 CL



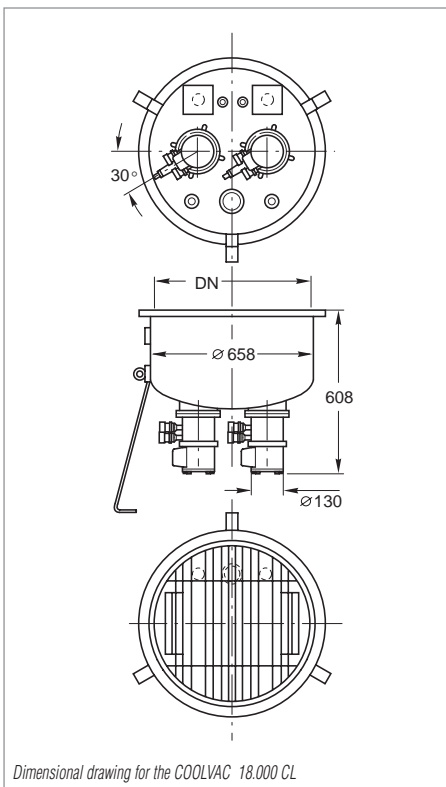
COOLVAC 18.000 CL with special flanges

Advantages to the User

- ◆ Hydrocarbon-free high vacuum
- ◆ High pumping speed for water vapor and nitrogen
- ◆ Fast, safe and efficient regeneration with the electric regeneration system
- ◆ Simple operation

Typical Applications

- ◆ Space simulation chambers
- ◆ Evaporators
- ◆ Electron beam welding systems
- ◆ Optical coating systems
- ◆ Metallization systems



Dimensional drawing for the COOLVAC 18.000 CL

COOLVAC 30.000 CL



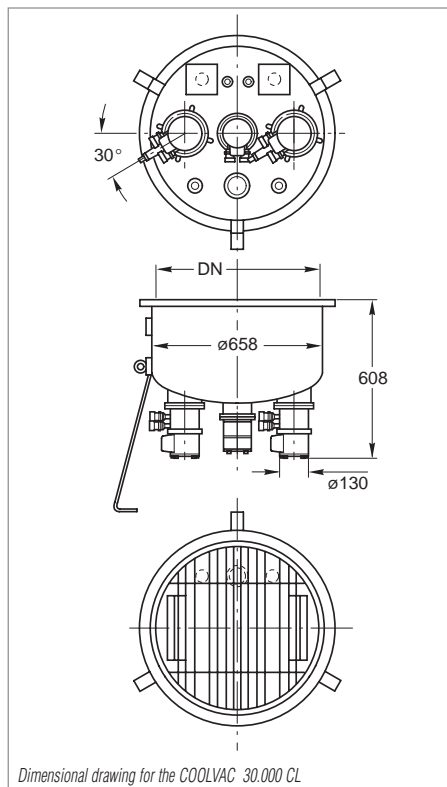
COOLVAC 30.000 CL

Advantages to the User

- ◆ Hydrocarbon-free high vacuum
- ◆ High pumping speed for water vapor and nitrogen
- ◆ Fast, safe and efficient regeneration with the electric regeneration system
- ◆ Simple operation

Typical Applications

- ◆ Space simulation chambers
- ◆ Evaporators
- ◆ General research
- ◆ Optical coating systems



Dimensional drawing for the COOLVAC 30.000 CL

Technical Data		COOLVAC 18.000 CL	COOLVAC 30.000 CL
High vacuum flange	DN	630 ISO-F	35" ANSI (892 mm)
Fore vacuum flange	DN	63 ISO-K	63 ISO-K
Flange with current feedthrough *) for silicon diode	DN	25 KF (2x)	25 KF (2x), *) 2 way
Flange for other purposes	DN	40 KF	40 KF
Safety valve with DN 40 KF flange connection for gas exhaust line		welded-in	welded-in (2x)
Pumping speed			
H ₂ O	l x s ⁻¹	46 000	93 000
Ar/N ₂	l x s ⁻¹	13 500/18 000	25 000/30 000
H ₂ /He	l x s ⁻¹	14 000/4 000	30 000/7 000
Capacity			
Ar/N ₂	bar x l	5 000	6 500
H ₂ at 10 ⁻⁶ mbar	bar x l	65	120
H ₂ O	bar x l	945	-
Built-in cold head	COOLPOWER	5/100 (2x)	5/100 (2x) + 120
Max. throughput			
Ar/N ₂	mbar x l x s ⁻¹ (Torr x l x s ⁻¹)	14 (10.5)	14 (10.5)
H ₂	mbar x l x s ⁻¹ (Torr x l x s ⁻¹)	7 (5.25)	7 (5.25)
Crossover value	mbar x l (Torr x l)	850 (638)	1200 (900)
Cool down time to 20 K	min	180	260
Overall height	min	606	711
Weight	kg (lbs)	65 (143)	245 (540)
Silicon diode for temperature measurements at the second stage of the cold head		built-in (2x)	built-in (2x)
Regeneration heaters at the first and second stage of the cold head		built-in (2x)	built-in (2x)

Ordering Information	COOLVAC 18.000 CL	COOLVAC 30.000 CL
Cryopump COOLVAC 18.000 CL, 630 ISO-F COOLVAC 30.000 CL, 35" ANSI	upon request -	- upon request
Accessories		
Compressor unit		
COOLPAK 6000	upon request (2x)	upon request (3x)
COOLPAK 6200	upon request (2x)	upon request (3x)
Power supply cable	see Ordering Information for the Compressor Units COOLPAK	
Set of flexlines FL 4.5 (1/2", 1/2") or FL 9.0 (1/2", 1/2") and EL 4.5 (electric extension cable)	Part No. 892 87 (2x) Part No. 892 88 (2x) Part No. 893 74 (2x)	Part No. 892 87 (3x) Part No. 893 74 (3x) Part No. 893 74 (3x)
Compact Controller and cable kit	upon request	

COOLVAC 1500 SemiLine



COOLVAC 1500 SL

LEYBOLD, world-wide leader in vacuum and cryo technology has added a new cryopump system to meet the needs for current and future demands in state-of-the-art cryopump applications: COOLVAC 1500 SemiLine. This system is the unique cryopump technology that cuts "cold to cold" regeneration from several hours to 45 minutes or less. This significant reduction of regeneration time has been achieved by combining the COOLVAC 1500 SL cryopumps with a compact and intelligent control system that allows control and monitoring of up to 30 cryopumps by only a single control unit.

COOLVAC 1500 SemiLine system is designed for a high level of tool integration. The cryopumps can easily be adapted to the process chambers because of their proven drop-in compatibility.

For remote control the cryopump system can be fully integrated to the equipment's host computer via the standard RS 232 C interface of the System Controller SC. Existing tools can be upgraded fast and without any modifications because the system has proven their "plug and play" compatibility to other cryopump systems.

COOLVAC 1500 SemiLine system is uniquely designed for a simple and fast entire service and maintenance procedure direct on the process chamber.

A complete displacer change is done within 20 minutes without breaking the vacuum connection. After cryopump maintenance no leak check and no vacuum or process requalification is required.

Advantages to the User

- ◆ Qualified at all major OEM's
- ◆ Drop-in compatible to all major equipments
- ◆ Higher flexibility and availability of the process system
- ◆ Increased productivity and improved yield
- ◆ No extra tool downtime caused by regeneration
- ◆ Lowest Cost of Ownership

Typical Applications

COOLVAC 1500 SemiLine system should be used wherever production time, optimized quality, higher tool availability and improved CoO are important issues.

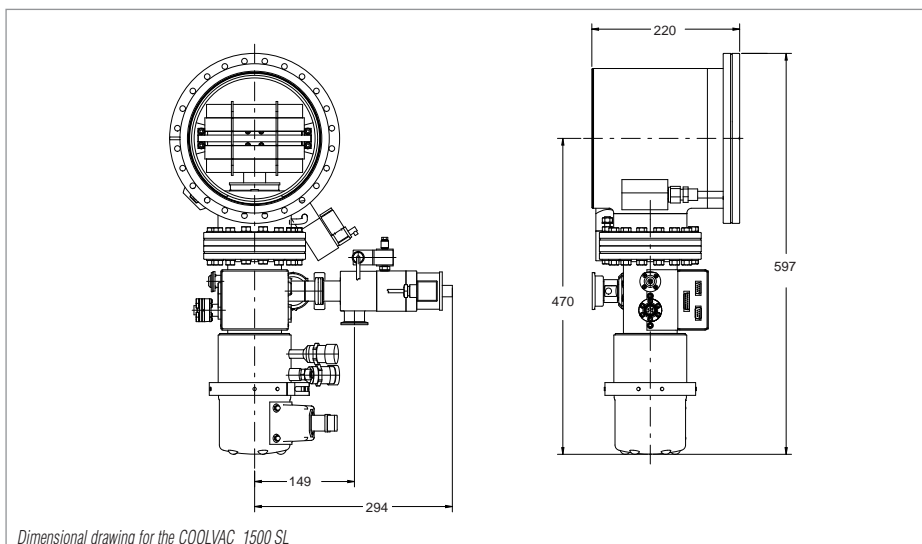
In particular, the overall equipment performances of

- ◆ Sputtering (PVD) Systems
- ◆ Ion Implanters
- ◆ Vacuum Coating Systems
- ◆ Transfer Chambers
- ◆ Load Lock Chambers

can be increased significantly.

Design Features

- ◆ "Fast Regeneration" capability from "cold to cold" in 45 minutes or less. During the fast regeneration of the COOLVAC 1500 SL only the second stage of the pump is regenerated. Consequently, "Fast Regeneration" is synonymous with the regeneration of all gases pumped by the cryo's second stage, e.g. H_2 , Ar, N_2 , O_2 .
- ◆ "Total Regeneration" capability from "cold to cold" in about 2.5 hours. During the total regeneration of the COOLVAC 1500 SL the second stage as well as the first stage of the pump are regenerated and all gases are released, e.g. H_2 , Ar, N_2 , O_2 as well as H_2O and other easily condensable gases.
- ◆ The fast as well as the total regeneration cycle is optimized with respect to
 - time
 - safety
 - cleanness of the pump.
 Only with clean pumping surfaces can a low base pressure, maximum pumping speeds and capacities be attained.
- ◆ Easy to operate
 - only one compact control unit for up to 30 pumps
 - simple push button operation
 - fully automatic regeneration
 - complete monitoring of pump operation



Dimensional drawing for the COOLVAC 1500 SL

- ◆ Easy to integrate
 - compatible pump sizes and connectors to replace other cryopumps
 - drop-in tool compatibility at all major equipments
 - designed to be fully integrated to the equipment's host computer via the standard RS 232 C interface
 - optional network and 24 V DC interface capabilities
- ◆ Electrical heaters for regeneration only
 - no expensive and complex purge gas system
 - sequential regeneration of all pumped gases
- better control of the regeneration cycles
- highest safety standards during regeneration
- ◆ Suitable for multiple operation
 - up to 30 COOLVAC 1500 SL cryopumps can be operated by one compact System Controller SC.
 - up to 3 COOLVAC 1500 SL cryopumps can be supported by one multiple Power Supply PS.
 - up to 3 COOLVAC 1500 SL cryopumps can be supported by one Compressor Unit CP.
- ◆ Easy to service
 - displacer exchange is possible without removing the COOLVAC from the production system.
 - back-up pool needs just displacer rather than expensive pumps
 - Extended service and maintenance intervals
 - data collection for service and trend analysis
- ◆ All known features of cryopumps are maintained:
 - high pumping speeds and capacity for H₂O, H₂, Ar, N₂
 - high crossover values
 - hydrocarbon-free vacuum

System Controller SC



System Controller SC for COOLVAC 1500 SL

Design Features

- ◆ 1/4 19" rack module
- ◆ 3 height units
- ◆ Dimensions (W x H x W)
106 x 129 x 178 mm

The intelligent COOLVAC System Controller SC automatically controls and monitors up to 30 COOLVAC pumps.

Online monitoring, help functions and a service interface for easy diagnostic are just a few user friendly features.

It can be installed as a "stand alone system" or remote controlled via an interface.

Power Supply PS



Power Supply PS for COOLVAC 1500 SL

Design Features

- ◆ 19" rack module
- ◆ 4 height units
- ◆ Dimensions (W x H x W)
435 x 190 x 440 mm

The COOLVAC Power Supply PS provides the power for the cold head motor, the electrical heaters and the supplies voltage to the electronics for up to 3 COOLVAC pumps.

Controlled via the System Controller SC the PS turns the compressor unit on and off if required by the connected pumps.

Technical Data		COOLVAC 1500 SL	
High vacuum (HV) flange	DN	DN 200 CF	
Fore vacuum flange		DN 25 KF	
Regeneration valve		DN 40 KF	
Pumping speed			
H ₂ O / Ar / H ₂	l x s ⁻¹	4600 / 1300 / 2500	
O ₂	l x s ⁻¹	1600	
Ultimate pressure	mbar	≤ 5 x 10 ⁻¹⁰	
Capacity for			
Ar	bar x l	1800	
H ₂ at 10 ⁻⁶ mbar	bar x l	16	
H ₂ O	bar x l	190	
Max. pumping speed for			
Ar / N ₂	mbar x l x s ⁻¹ (sccm)	14 (840)	
H ₂	mbar x l x s ⁻¹ (sccm)	6 (360)	
Crossover value	mbar x l (Torr x)	210 (160)	
Recovery time from 10 mTorr to ≤ 5 x 10 ⁻⁷ Torr	s	< 4	
Regeneration times			
Fast regeneration (cold to cold, 2nd stage at 20 K)	min	< 50	
Total regeneration (cold to cold, 2nd stage at 20 K)	min	< 170	
Warm-up from operating temperature to 300 K	min	< 30	
Cool-down from 300 K up to operating temperature	min	< 80	
Fast regeneration cycles between total regeneration		> 50	
Noise, measured at 1 m (3 ft.) radius from the pump	dB(A)	< 70	
Heaters			
1. stage	W	160	
	V AC	35	
2. stage	W	90	
	V AC	35	
Temperature measurement			
1. stage		Pt 100	
2. stage		Si diode	
Built-in coldhead	COOLPOWER	7/25	
Weight	kg (lbs)	25 (55.2)	

Ordering Information	Single Operation		COOLVAC 1.500 SL Dual Operation			Multiple Operation	
	Europe	USA/Japan	Europe	Europe	USA/Japan	Europe	USA/Japan
COOLVAC 1.500 SL DN 200 CF other flanges	Part No. 844 212 upon request		Part No. 844 212 (2x) upon request (2x)			Part No. 844 212 (3x) upon request (3x)	
Solenoid fore-vacuum valve, DN 25 KF with electric valve position indicator and for 24 V DC supplies	287 46		287 46 (2x)			287 46 (3x)	
Electronics and cables							
System Controller SC	844 230		844 230			844 230	
Power Supply PS 230 V, 1 ph. 200 V, 3 ph.	844 135 -		844 135 -	- 844 235	- 844 235	- 844 235	
Network communication cable – System Controller to the pump(s) 10 m 20 m	844 261 844 262		844 261 844 262			844 261 844 262	
Network-PM cable between the pumps 3 m 10 m	- -		844 256 844 258			844 256 (2x) 844 258 (2x)	
Power supply cable for the pump 10 m 20 m	- -		- -	844 251 (2x) 844 252 (2x)	844 251 (2x) 844 252 (2x)	844 251 (3x) 844 252 (3x)	
Remote control cable CP, 1 m	-		-	844 265	844 265	844 265	
Cable compressor – Power Supply 10 m 20 m	844 129 844 139		844 129 844 139	- -	- -	- -	
Cable System Controller – Power Supply, 1 m	844 141		844 141	-	-	-	
Cable pump module PM – Power Supply 10 m 20 m	844 128 844 138		844 128 (2x) 844 138 (2x)	- -	- -	- -	
Connecting cable compressor – pump, 4.5 m	400 000 323		400 000 323 (2x)	-	-	-	
Compressors and flexlines							
Compressor CP 4000 D CP 4000 CP 4200 CP 6000 CP 6200	- 892 31 - - -	- - 892 33 -	892 3000 - - -	- 892 31 -	- - 892 33	- - - 892 36 -	- - - 892 37
Accessories Water cooling discharge throttle	840 000 133		840 000 133			840 000 133	
Power supply cable for compressor	see Ordering Information for the Compressor Units COOLPAK						
Set of flexlines FL 4.5 (1/2", 1/2") or FL 9.0 (1/2", 1/2") and EL 4.5 (electric extension cable)	892 87 892 88 893 74		892 87 (2x) 892 88 (2x) 893 74 (2x)	892 87 (2x) 892 88 (2x) -	892 87 (2x) 892 88 (2x) -	892 87 (3x) 892 88 (3x) -	
Gas manifold GD 2 GD 4	- -		891 02 -	891 02 -	891 02 -	- 891 03	

The arrangement of the components is shown in the section "Accessories" under the heading "COOLVAC ClassicLine, System Components"

COOLPOWER 120 T Single Stage Cold Heads



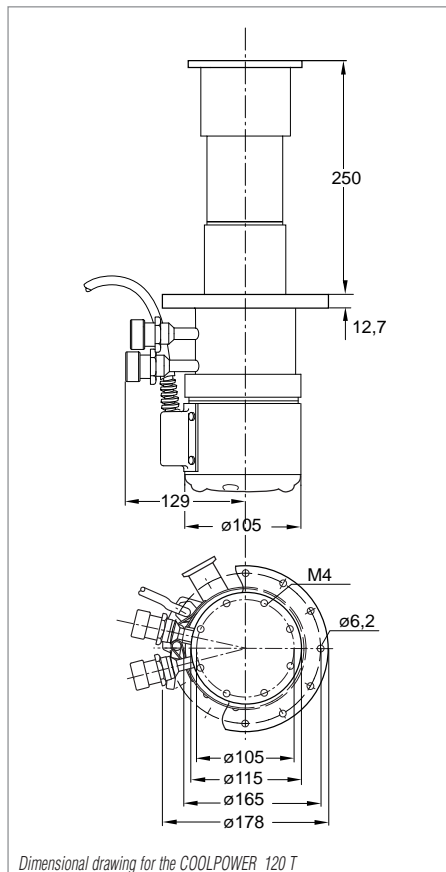
COOLPOWER 120 T single stage cold head

Advantages to the User

- ◆ For installation mostly in any orientation
- ◆ High refrigerating capacity
- ◆ No liquid refrigerants are required
- ◆ Very simple to operate
- ◆ Short cooldown time

Typical Applications

- ◆ Cooling of cryopanel in cryopumps and thus generation of high vacuum and ultra high vacuum pressures
- ◆ Cooling of samples and detectors; especially for cooling of
 - samples for spectroscopic investigations in solid state and surface physics
 - high temperature superconductor and semiconductor conditions
 - infrared and gamma detectors
- ◆ Calibration of sensors



Dimensional drawing for the COOLPOWER 120 T

Technical Data		COOLPOWER 120 T	
Refrigeration capacity at 50/60 Hz ¹⁾			
1st stage at 80 K, approx.	W		120
2st stage at 20 K, approx.	W		25
Lowest attainable temperature ¹⁾	K		≤ 15
Cooldown time down to 20 K	min		≤ 55
Permissible ambient temperature	°C		10 to 40
He filling pressure at room temperature	bar		16
He connections			
Self-sealing screwed connections			
High pressure connection			1/2" (#8 ²⁾)
Low pressure connection			1/2" (#8)
Weight	kg (lbs)		13 (29)
Length of the electrical connection line to the compressor unit	m		15
Ordering Information		COOLPOWER 120 T	
Cold head COOLPOWER 120 T		Part No. 103 59	
Accessories			
Compressor unit (for operation of one cold head)			
COOLPAK 6000, 400 V/50 Hz; 470 V/60 Hz			Part No. 892 36
COOLPAK 6200, 200 V/50 Hz; 200 V, 230 V/60 Hz			Part No. 892 37
Power supply cable		see Ordering Information for the Compressor Units COOLPAK	
Set of flexlines			
FL 4.5 (1/2", 1/2")			Part No. 892 87
or FL 9.0 (1/2", 1/2")			Part No. 892 88
Options			
Temperature measurement			
Silicon diode			Part No. 890 89
MODEL 1901 low temperature measuring instrument			Part No. 136 45
Measuring cable		see Ordering Information for the MODEL 1901 low temperature measuring instrument	

¹⁾ The refrigerating capacities and temperatures stated apply to vertical operation with the cold end at the bottom

²⁾ Series 8 from Aeroquip

COOLPOWER 7/25, 5/100 and 5/100 T Dual Stage Cold Heads



COOLPOWER 7/25 dual stage cold head



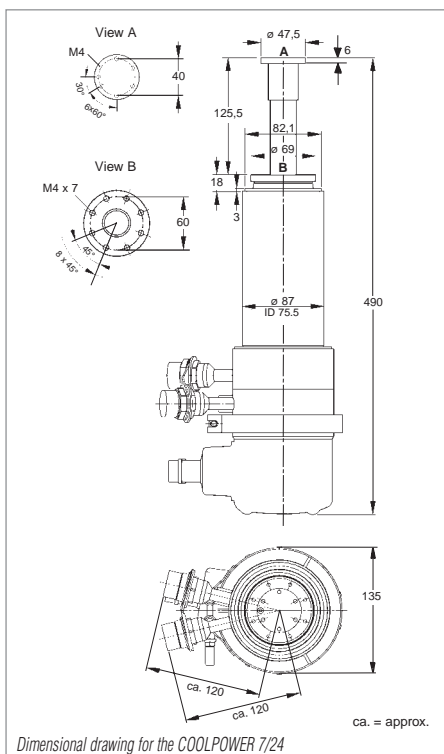
COOLPOWER 5/100 dual stage cold head, COOLPOWER 5/100 T similar

Advantages to the User

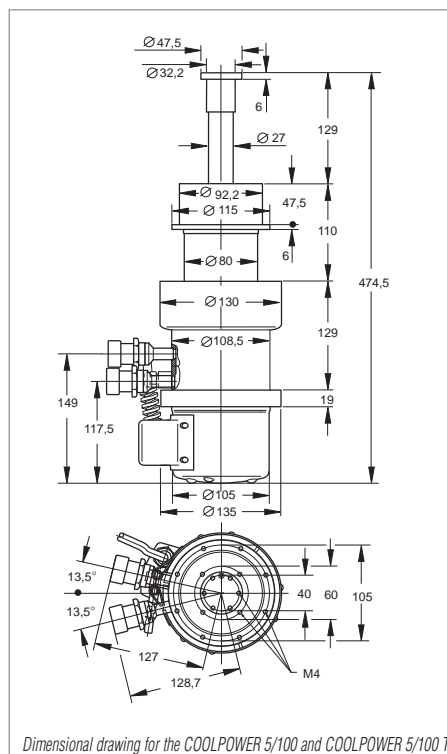
- ◆ For installation in any orientation
- ◆ High refrigerating capacity
- ◆ No liquid refrigerants are required
- ◆ Very simple to operate
- ◆ Short cooldown time

Typical Applications

- ◆ Cooling of cryopanel in cryopumps and thus generation of high vacuum and ultra high vacuum pressures
- ◆ Cooling of samples and detectors; especially for cooling of
 - samples for spectroscopic investigations in solid state and surface physics
 - high temperature superconductors
 - superconductors and semiconductors
 - infrared and gamma detectors
- ◆ Calibration of sensors
- ◆ Cooling of accelerator components in the area of high energy physics
- ◆ Cooling of superconducting magnets; in nuclear magnetic resonance tomographs, for example (only COOLPOWER 5/100 and 5/100 T)



Dimensional drawing for the COOLPOWER 7/24



Dimensional drawing for the COOLPOWER 5/100 and COOLPOWER 5/100 T

Technical Data	COOLPOWER		
	7/25	5/100	5/100 T
Refrigeration capacity at 50/60 Hz ¹⁾			
1st stage at 80 K, approx.	W 25	100	100
2nd stage at 20 K, approx.	W 7	5	7.5
1st stage at 10 K, approx.	W –	–	3.5
2nd stage at 40 K, approx.	W –	–	35
Lowest attainable temperature ¹⁾			
1st stage, approx.	K ≤ 35	≤ 35	28
2nd stage, approx.	K ≤ 10	≤ 10	6
Cooldown time of the			
2nd stage to 20 K, approx.	min 20	20	20
1st stage to 80 K, approx.	min 20	20	20
2nd stage to 10 K, approx.	min –	–	35
1st stage to 40 K, approx.	min –	–	30
2nd stage to 6 K, approx.	min –	–	45
1st stage to 30 K, approx.	min –	–	40
Permissible ambient temperature	°C	5 to 40	
He filling pressure at room temperature	bar	16	
He connections			
Self-sealing screwed connections			
High pressure connection		1/2" (#8 ²⁾)	
Low pressure connection		1/2" (#8)	
Weight	kg (lbs)	11 (24.3)	
Length of the electrical connection line to the compressor unit (included with cold head)	m	4.5	
Ordering Information	COOLPOWER		
	7/25	5/100	5/100 T
Cold head			
COOLPOWER 7/25	Part No. 842 040	–	–
COOLPOWER 5/100	–	Part No. 893 05	–
COOLPOWER 5/100 T	–	–	Part No. 129 78
Accessories			
Connecting cable			
Compressor – cold head, 4.5 m	Part No. 400 000 323	included with the cold head	included with the cold head
Compressor unit (for operation of one cold head)			
COOLPAK 4000	Part No. 892 31	–	–
COOLPAK 4200	Part No. 892 33	–	–
COOLPAK 6000	–	Part No. 892 36	Part No. 892 36
COOLPAK 6200	–	Part No. 892 37	Part No. 892 37
Power supply cable	see Ordering Information for the Compressor Units COOLPAK		
Set of flexlines			
FL 4.5 (1/2", 1/2")		Part No. 892 87	
or FL 9.0 (1/2", 1/2")		Part No. 892 88	
and EL 4.5 (electric extension cable)		Part No. 893 74	
Options			
Temperature measurement / control			
Silicon diode		Part No. 890 89	
MODEL 1901 low temperature measuring instrument		Part No. 136 45	
Measuring cable	see Ordering Information for the MODEL 1901 low temperature measuring instrument		
Electrical heaters		upon request	
Modell 9700 low temperature controller		Part No. 842 400	
Measuring cable, 3 m long		Part No. 842 401	

¹⁾ The refrigerating capacities and temperatures stated apply to vertical operation with the cold end at the bottom

²⁾ Series 8 from Aeroquip

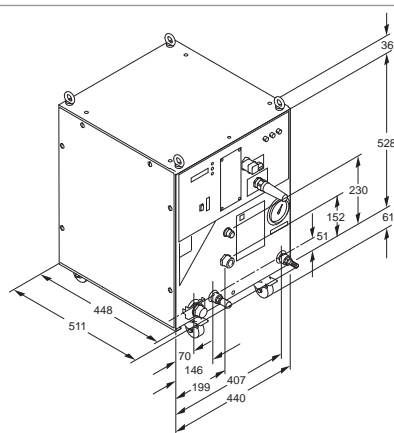
COOLPAK 4000/4200, COOLPAK 6000/6200



Compressor units COOLPAK 4000/4200/(COOLPAK 6000/6200, COOLPAK 6000 MD/6200 MD similar)

Advantages to the User

- ◆ Highly effective and even more powerful when connected with LEYBOLD cryopumps and refrigerators
- ◆ Excellent long-term reliability owing to the modular design and the longlife components
- ◆ Silent and low vibration operation through scroll compressors
- ◆ Easy to install and operate
- ◆ Global power supply compatibility
- ◆ Easy integration in complex systems due to 24 V DC or RS 232 C interfaces
- ◆ Almost maintenance-free
- ◆ Small footprint
- ◆ Low cost of ownership



Dimensional drawing for the COOLPAK 4000/4200 and COOLPAK 6000/6200

Technical Data	COOLPAK 4000		COOLPAK 4200		COOLPAK 6000		COOLPAK 6200	
	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
Number of electrical connections for cold heads	1		1		1		1	
Helium system filling pressure at room temperature bar	14	13	14	13	15	14	14	13
Ambient temperature °C	5 to 40		5 to 40		5 to 40		5 to 40	
Cooling-water consumption ¹⁾ l/min	3.5		3.5		5.0		5.0	
Cooling-water entry temperature °C	5 to 25		5 to 25		5 to 25		5 to 25	
Main voltage (3 phase) upon delivery V	400 ± 10%	–	200 ± 10%	200 ²⁾ + 10% - 5%	400 ± 10%	–	230 ³⁾ - 10%	230 ± 10%
alternative setting V	–	470 ± 10%	230 ³⁾ - 10%	230 ± 10%	–	470 ± 10%	200 ± 10%	200 ± 10%
Operating currents with the cold head cool A	6.4 to 7.4	6.2 to 7,3	14.6 to 16.5	13.8 to 17.0	9.5 to 10.5	9.0 to 10.0	15.5 to 22.0	16.0 to 23.0
with the cold head warm A	8.5	8.1	18.3	19.5	13.7	12.0	25.0	25.0
Electrical power consumption with the cold head cool kW	3.8 to 4.5	4.2 to 5.3	4.0 to 4.6	4.4 to 5.3	6.0 to 6.5	6.5 to 6.9	5.5 to 6.2	5.9 to 6.7
with the cold head warm kW	5.3	5.8	5.3	5.9	8.2	8.7	7.6	7.8
Remote control via interface	24 V DC or RS 232 C		24 V DC or RS 232 C		24 V DC or RS 232 C		24 V DC or RS 232 C	
Helium connections								
Self-sealing couplings								
High pressure side	1/2"		1/2"		1/2"		1/2"	
Low pressure side	1/2"		1/2"		1/2"		1/2"	
Water connections	Hose nozzle DN 12 / G 1/2" outside thread				Hose nozzle DN 12 / G 1/2" outside thread			
Sound level (at 1 m distance) dB(A)	53		53		53		53	
Dimensions (W x H x D) mm	440 x 589 x 511		440 x 589 x 511		440 x 589 x 511		440 x 589 x 511	
Weight kg (lbs)	93 (205)		93 (205)		94 (207)		94 (207)	
Ordering Information	COOLPAK 4000		COOLPAK 4200		COOLPAK 6000		COOLPAK 6200	
	Europe	USA/Japan	USA/Japan		Europe	USA/Japan	USA/Japan	
Compressor unit without power supply cable								
Single cold head operation	Part No. 892 31		Part No. 892 33		Part No. 892 36		Part No. 892 37	
Dual cold head operation	Part No. 892 3000 ⁴⁾		–		Part No. 892 46 ⁵⁾		–	
Power supply cable								
3.5 m, CEE plug, 32 A/6h, 3 pole + N + PE	Part No. 893 95	–	–		Part No. 893 95	–	–	
3.5 m, NEMA plug, L 16-20 P, 20 A/480 V, 3 pole + PE (AWG 12)	–	Part No. 893 96	–		–	Part No. 893 96	–	
3.5 m, NEMA plug, L 15-20 P, 20 A/250 V, 4 pole - PE (AWG 12)	–		Part No. 840 110		–		–	
10 m, with end splice (AWG 10)	–		Part No. 840 111		–		Part No. 840 111	
Spare part								
Adsorber CACP 4000/6000	Part No. 893 52		Part No. 893 52		Part No. 893 52		Part No. 893 52	

¹⁾ At a cooling water entry temperature of 25 °C

²⁾ ± 10% at 12 bar filling pressure

³⁾ At 13 bar filling pressure

⁴⁾ COOLPAK 4000 D

⁵⁾ COOLPAK 6000 D

General Accessories for Compressor Units COOLPAK

Technical Data	Length	Connections on both sides (inside thread)	
		High pressure line	Low pressure line
Flexlines ^{1), 2)}			
FL 4.5 (1/2", 1/2")	4.5 m	1/2"	1/2"
FL 9.0 (1/2", 1/2")	9.0 m	1/2"	1/2"
Adaptor			
Accessories for Flexlines	Outside thread (m)	Inside thread (f)	
Adapter for flexlines			
AD (1/2" m, 3/4" f)	1/2"	3/4"	
AD (1/2" f, 3/4" m)	3/4"	1/2"	
Connections			
	Outside thread (m)	Inside thread (f)	
Elbow 1/2" for flexlines	1/2"	1/2"	
Isolating piece 1/2" for flexlines	1/2"	1/2"	
Connections on both sides			
Outside thread (m)			
Coupling 1/2" for interconnecting two 1/2" flexlines	1/2"		
Gas manifold - Connections			
	Number of gas distributors	At the compressor (inside thread)	At the cold head (outside thread)
Gas manifold for dual operation ²⁾ (consisting of two Tees)			
GD 2 (for dual operation)	2	1/2"	2 x 1/2"
GD 4 (for up to quad operation)	4	1/2"	4 x 1/2"
Length			
EL 4.5 extension cable for linking cold head and compressor unit	4.5 m		

Ordering Information

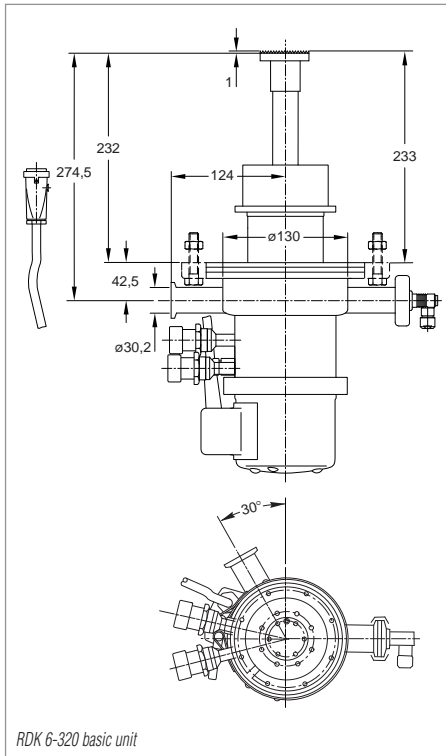
Flexlines ^{1), 2)}	
FL 4.5 (1/2", 1/2")	Part No. 892 87
FL 9.0 (1/2", 1/2")	Part No. 892 88
Adaptor	
AD (1/2" m, 3/4" f)	Part No. 892 89
AD (1/2" f, 3/4" m)	Part No. 892 90
Elbow 1/2"	Part No. 891 73
Coupling 1/2"	Part No. 891 71
Gas manifold	
GD 2 (for dual operation) ²⁾	Part No. 891 02
GD 4 (for dual operation) ²⁾	Part No. 891 03
EL 4.5 extension cable for linking cold head and compressor unit ²⁾	Part No. 893 74

All flexible pressure lines, adaptor pieces, bends, isolating pieces, line couplings and gas manifolds are equipped with self-sealing Aeroquip fittings and filled in the factory with high-purity helium gas (purity: 99.999 %). The filling pressure is 16 bar

¹⁾ Minimum bending radius: 30 cm

²⁾ Only suited for pneumatically driven cold heads and cryopumps

Refrigerator Cryostats based on the RDK 6-320



The RDK 6-320 basic unit includes the COOLPOWER 5/100 T two-stage cold head. Its high refrigerating capacity at low temperatures permits experiments which previously could not be performed by relying on refrigerators and which required the use of liquid helium.

The RDK 6-320 basic unit is a complete system for measurements in the temperature range between 6 and 320 K.

The COOLPOWER 5/100 cold head is augmented by:

- ◆ Silicon diode for measuring the temperatures at the second stage of the cold head
- ◆ Heater at the second stage of the cold head provided with overheating protection
- ◆ 11-way current feedthrough with matching external connector
- ◆ DN 25 KF pumpdown port
- ◆ DN 160 ISO-K vacuum flange

Advantages to the User

- ◆ Compact
- ◆ Very reliable
- ◆ Comprehensive range of accessories from one source
- ◆ For installation in any orientation
- ◆ Simple to operate
- ◆ Short cooldown time
- ◆ Cost-effective in long-term experiments since no liquid helium is required
- ◆ Simple and rapid servicing through the use of the standard COOLPOWER 5/100 cold head with pneumatic drive system for the displacer

Typical Applications

- ◆ Cooling of samples and detectors
- ◆ Material research and testing
- ◆ Spectroscopic applications
- ◆ Matrix isolation spectroscopy with neon and argon

General Remarks on Refrigerator Cryostats

Isolating Vacuum

A two-stage rotary vacuum pump will normally be adequate to produce an isolating vacuum. However, this pump should be equipped on the suction side with an adsorption trap and a isolation valve.

If the application requires that the cold surfaces remain free of hydrocarbons, we recommend the use of our small turbomolecular pump system PT 50 (see Product Section C10).

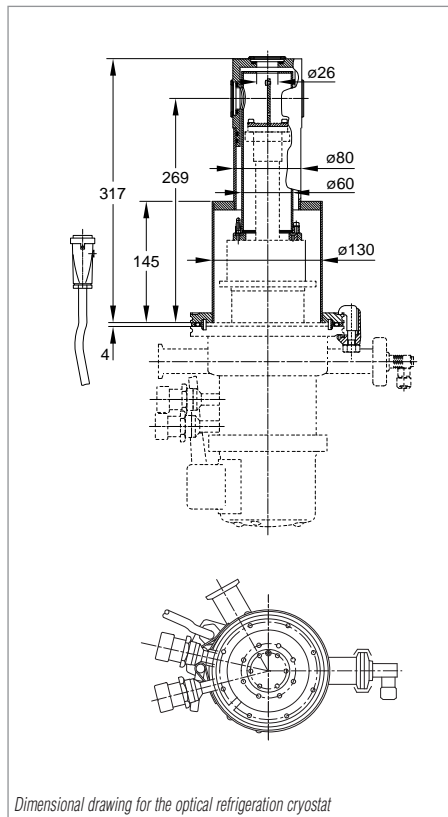
Temperature Measurement

In order to avoid measurement errors due to thermal resistances, the temperature at the sample should preferably be measured by a second optional silicon diode which is installed as close to the sample as possible. If possible it should be maintained at the same temperature level as that of the probe.

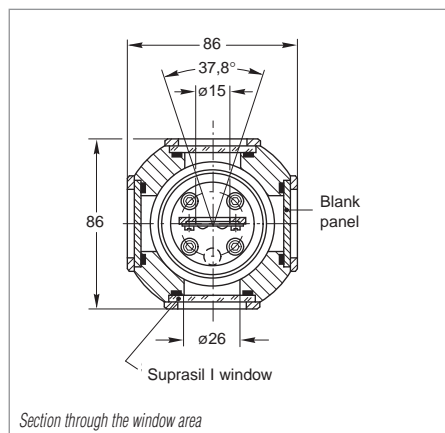
Temperature Control

The temperature at the second stage of the cold head (or that of the probe) is controlled by heating against the cooling effect produced by the refrigerator (while the cold head is running).

Optical Refrigerator Cryostat based on the RDK 6-320



Upgraded as an optical cryostat (option) the RDK 6-320 is tailor-made for experiments involving temperatures down to about 7 K.



Supplied Equipment

- ◆ Basic unit RDK 6-320
- ◆ Temperature attenuation disk out of Pb Sn
- ◆ Sample holder out of Al 99.5
- ◆ Thermal radiation shield out of E-Cu
- ◆ Vacuum jacket out of aluminum / stainless steel
- ◆ Five exchangeable windows (four windows on the sides, one window in the longitudinal axis of the cryostat); two windows on the sides and the window in the longitudinal axis are made of SUPRASIL I, the two other windows are blanked off and are made of brass

Technical Data		RDK 6-320	
Temperature range			
2nd stage of the cold head	K		6 to 320
1st stage of the cold head	K		28 to 320
Silicon diode for temperature measurements at the 2nd stage of the cold head			built-in
Heater at the 2nd stage of the cold head			built-in
Heating power	W		50
Heating current	A		1
Heating voltage	V DC		50
Permissible ambient temperature	°C		5 to 40
He filling pressure at room temperature	bar		16
He connections			
Self-sealing screwed connections			
High pressure connection (outside thread)			1/2"
Low pressure connection (outside thread)			1/2"
Length of the connection cable to the compressor unit	m		4.5 (included)
Weight	kg (lbs)		13 (28.7)
Ordering Information		RDK 6-320	
Basic unit RDK 6-320			Part No. 842 403
Optical cryostat consisting of RDK 6-320 and Expansion Kit ROK			Part No. 842 404
Accessories			
Compressor unit			
COOLPAK 6000, 400 V/50 Hz; 470 V/60 Hz			Part No. 892 36
COOLPAK 6200, 200 V/50 Hz; 200 V, 230 V/60 Hz			Part No. 892 37
Power supply cable			see Ordering Information for the Compressor Units COOLPAK
Flexlines			
FL 4.5 (1/2", 1/2")			Part No. 892 87
Temperature measurement at 2nd stage with			
Modell 9700 low temperature controller			Part No. 842 400
Measuring cable, 3 m long			Part No. 842 401

Controllers and Monitoring Units for Cryopumps

System Controller COOLVAC SC



System Controller COOLVAC SC

Design Features

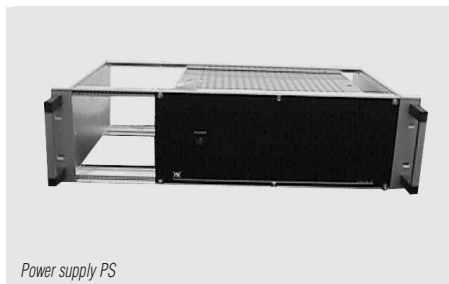
- ◆ 1/4 19" rack module
- ◆ 3 height units
- ◆ Dimensions (W x H x D)
106 x 129 x 178 mm
- ◆ Operation through pushbuttons

The intelligent COOLVAC System Controller SC automatically controls and monitors up to 30 COOLVAC pumps.

Online monitoring, help functions and a service interface for easy diagnostic are just a few user friendly features.

It can be installed as a "stand alone system" or remote controlled via an interface.

Power Supply PS for up to Two Cryopumps



Power supply PS

Design Features

- ◆ 19" rack module
- ◆ 3 height units
- ◆ Dimensions (W x H x D)
485 x 135 x 320 mm

The System Controller COOLVAC SC (not included) will fit into the empty space.

The COOLVAC Power Supply PS provides the power for the cold head motor, the electrical heaters and the supplies voltage to the electronics for up to 2 COOLVAC pumps.

Controlled via the System Controller SC the PS turns the compressor unit on and off if required by the connected pumps.

Power Supply PS for up to Three Cryopumps



Power supply PS

Design Features

- ◆ 19" rack module
- ◆ 4 height units
- ◆ Dimensions (W x H x D)
435 x 190 x 440 mm
- ◆ Single LED indicates correct direction of rotation for the rotating field

The COOLVAC Power Supply PS provides the power for the cold head motor, the electrical heaters and the supplies voltage to the electronics for up to 3 COOLVAC pumps.

Controlled via the System Controller SC the PS turns the compressor unit on and off if required by the connected pumps.

Advantages to the User

- ◆ Interface to external system controller
- ◆ For easy integration with external system controllers
- ◆ For safe pumping of hydrogen

Typical Applications

- ◆ For automated operation of the COOLVAC cryopumps of the ClassicLine and the SemiLine

Ordering Information

System Controller

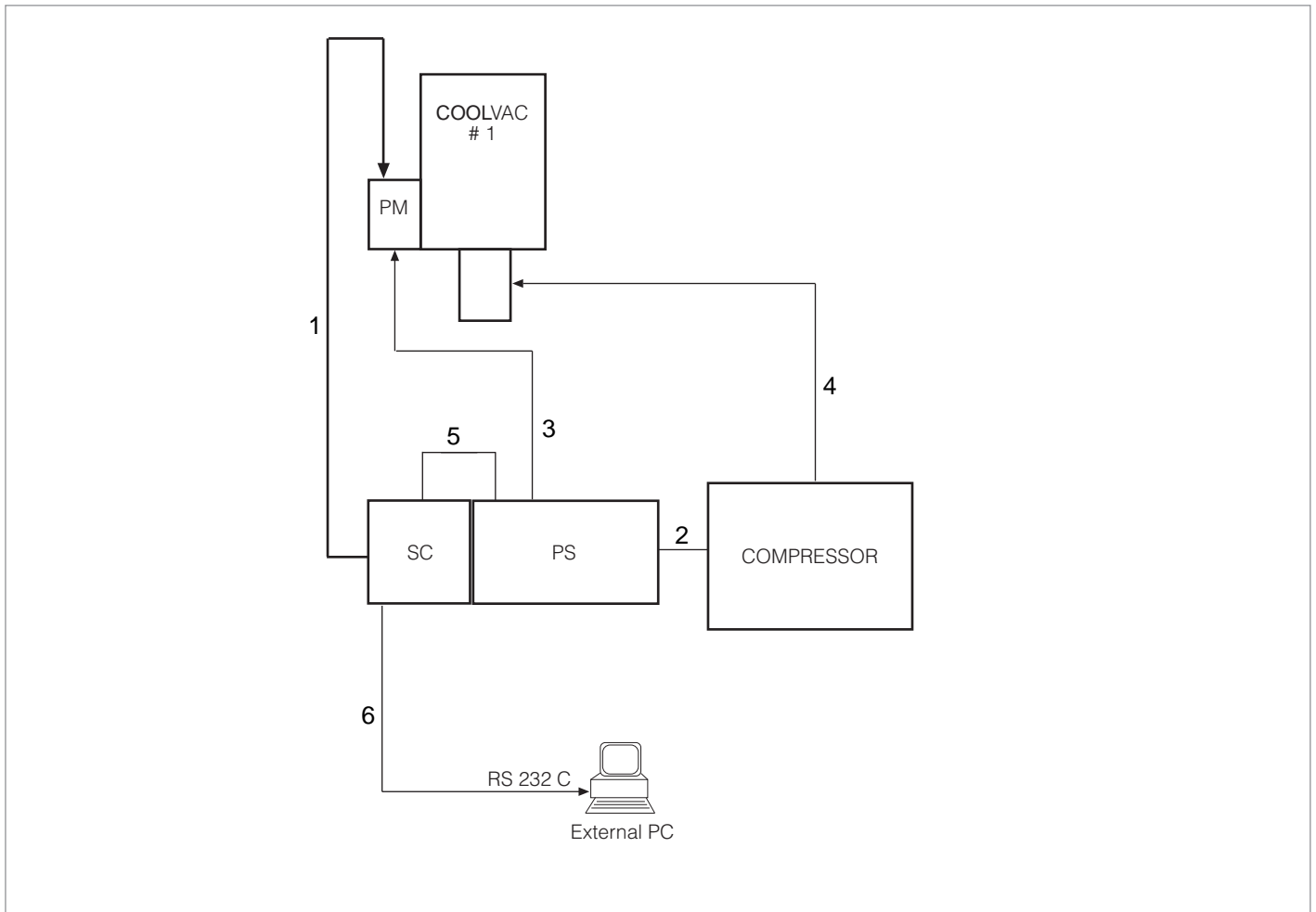
Part No. 844 230

Power Supply PS

for up to 2 Cryo pumps
for up to 3 Cryo pumps

Part No. 844 135
Part No. 844 235

COOLVAC ClassicLine, Single System Configuration

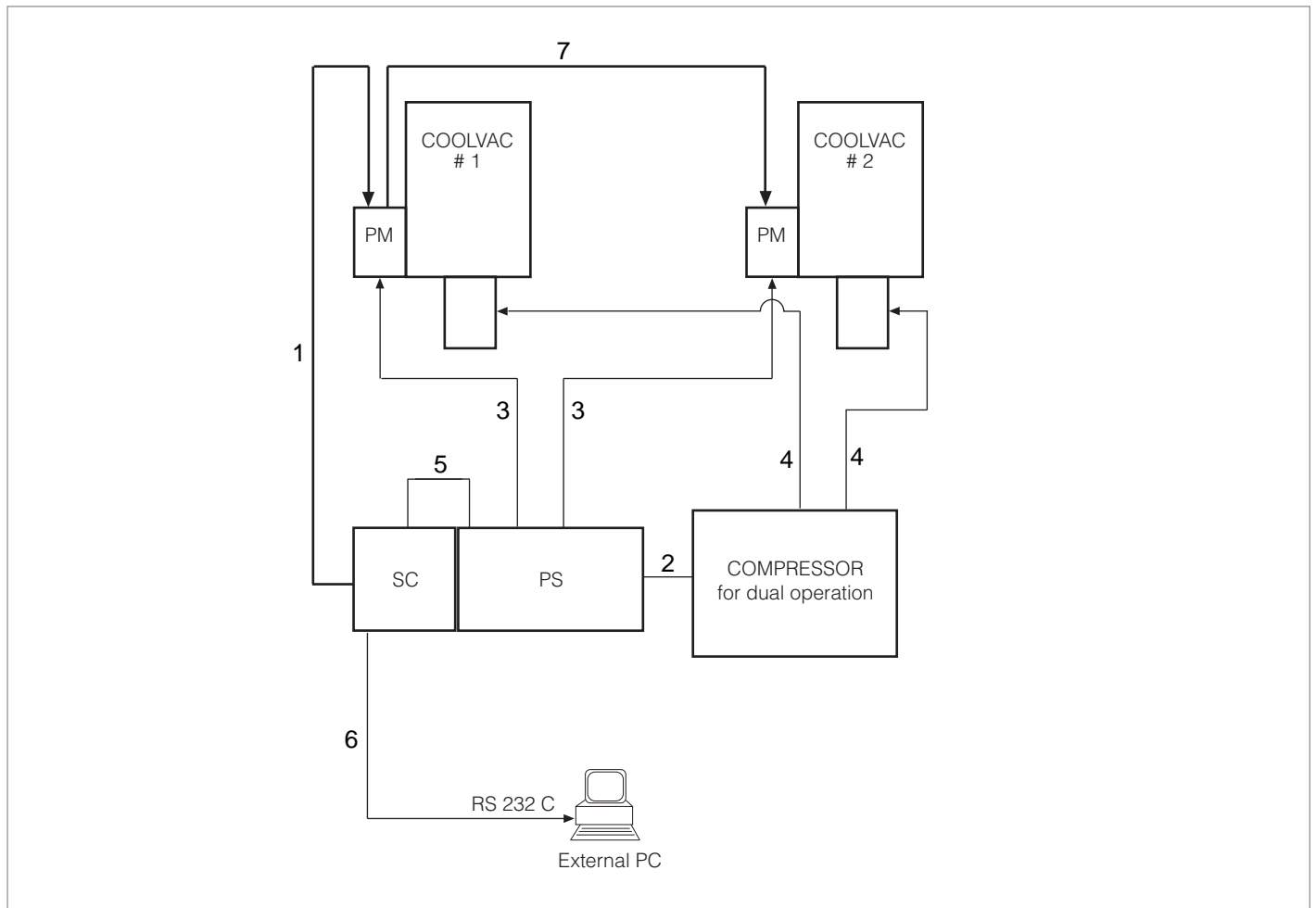


Key to the diagram "Single System Configuration"

- PM = Pump Module (included with the pump)
- SC = System Controller
- PS = Power Supply
- 1 = e. g. Part No. 844 262
- 2 = e. g. Part No. 844 139
- 3 = e. g. Part No. 844 138
- 4 = Part No. 400 000 323
- 5 = Part No. 844 141
- 6 = to be provided by the customer

COOLVAC ClassicLine, Dual System Configuration

Only for European mains voltages and for compressors suited for dual operation



Key to the diagram "Dual System Configuration"

PM = Pump Module (included with the pump)

SC = System Controller

PS = Power Supply

1 = e.g. Part No. 844 262

2 = e.g. Part No. 844 139

3 = e.g. Part No. 844 138

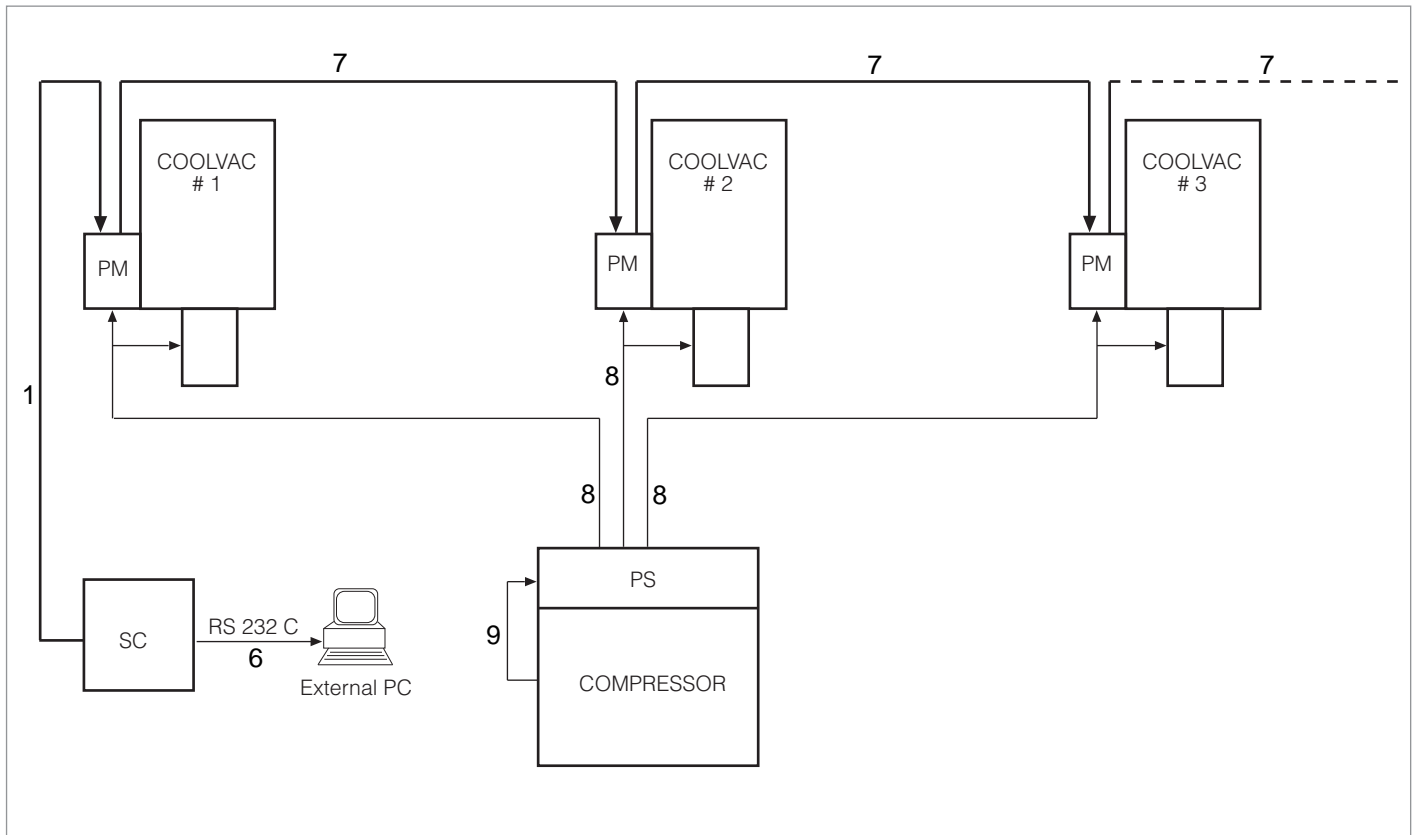
4 = Part No. 400 000 323

5 = Part No. 844 141

6 = to be provided by the customer

7 = e.g. Part No. 844 256

COOLVAC ClassicLine, Dual and Multiple System Configuration



Key to the diagram "Dual and Multiple System Configuration"

- PM = Pump Module (included with the pump)
- SC = System Controller
- PS = Power Supply
- 1 = e.g. Part No. 844 262
- 6 = to be provided by the customer
- 7 = e.g. Part No. 844 256
- 8 = e.g. Part No. 844 252
- 9 = Part No. 844 265



Modell 9700 Low Temperature Controller



Advantages to the User

- ♦ Microprocessor controlled PID controller
- ♦ Digital temperature readout in Kelvin
- ♦ Control by means of counter heating
- ♦ High control accuracy over the entire temperature range (1.5 to 450 K)
- ♦ Electric heating power up to 50 W
- ♦ Programmable heater power limit
- ♦ Generation of linear temperature ramps
- ♦ Up to 50 program steps are programmable
- ♦ Standard interface RS 232 C and IEEE-488
- ♦ Data from two sensors can be displayed
- ♦ Analogue temperature outputs for both channels
- ♦ Can be used in three operating modes
 - Manual
 - Program
 - External computer control

Typical Applications

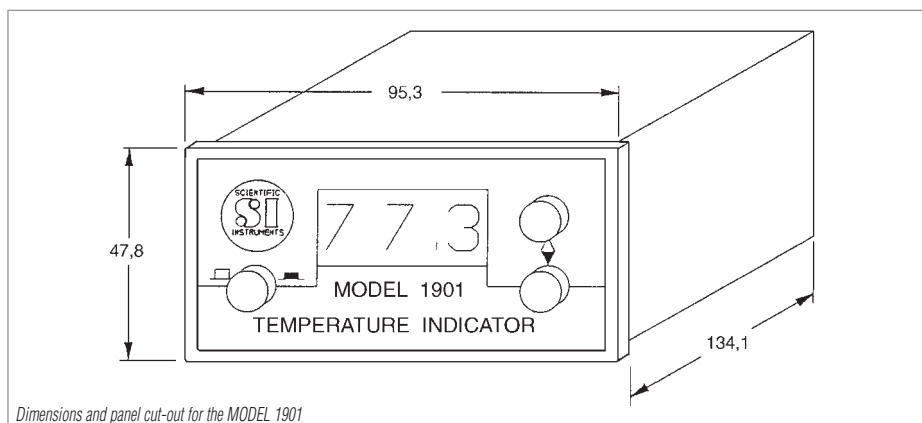
- ♦ Temperature control at refrigerator cryostats

Technical Data		Modell 9700
Mains connection, 50/60 Hz	V AC	85-240
Power consumption, max.	W	150
Entry of data		3 x 4 membrane key pad
Data memory		EPR0M
Display		Two line, 20 digit LED digital display
Temperature measurement		
Sensors		2 x silicon diodes type D or 2 x silicon diodes with standard temperature resistance characteristics
Measurement current	µA	10
Measurement range	K	1.5 to 450
Measurement range of the silicon diode type D	K	1.4 to 325 K
Number of channels		2
Resolution		Simultaneous display of both channels
A/D converter resolution	bit	24
Switching outputs		2 relays (n.o. and n.c. contacts)
Temperature resolution	K	0.1
Temperature control		PID controller
Heating power, max.	W	50
Heating current, max.	A	1
Heating voltage, max.	V DC	0 to 50
Computer interface		RS 232 C and IEEE-488
Permissible ambient temperature	°C	+ 10 to + 30
Mechanical design/cabinet		Table-top unit (8.5" x 3.5" x 12")
Dimensions (W x H x D) [high H without feet]	mm	215.9 x 88 x 304.8
Weight	kg (lbs)	2.3 (5)
Dimensions of the packaging (W x H x D)	mm	360 x 230 x 450
Weight (including packaging, approx.)	kg (lbs)	4.2 (9.3)
Length of mains cord	m	2.5
Ordering Information		Modell 9700
Modell 9700 low temperature controller		Part No. 842 400
Sensor cable, 3 m long		Part No. 842 401
Silicon diode type D with connection cable and miniature plugs		Part No. 890 89

MODEL 1901 Low Temperature Measuring Instrument



MODEL 1901 low temperature measuring instrument



Dimensions and panel cut-out for the MODEL 1901

Advantages to the User

- ◆ Supports one silicon diode
- ◆ 3-digit LED display
- ◆ Temperature readout between 1 and 450 Kelvin
- ◆ Two trigger thresholds
- ◆ RS 232 C interface

Typical Applications

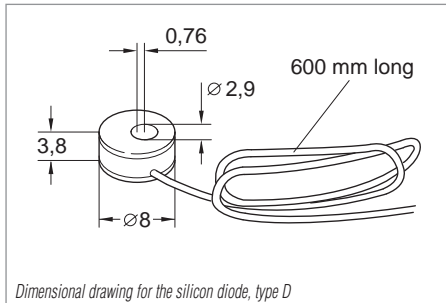
- ◆ Temperature measurements on cryostats
- ◆ Temperature measurements on cryopumps for monitoring their operation and to control pump systems

Technical Data		MODEL 1901
Measurement current	μA	10
Display		LED, 3-digits
Temperature range	K	1.5 to 450
Resolution		0.1 K from 1.5 to 99.9 K 1.0 K from 100 to 450 K
Accuracy		± 0.1 K from 1.5 to 99.9 K ± 1.0 K from 100 to 450 K
Power supply voltage		9 V DC @ 500 mA through the supplied 220 V AC / 9 V DC power adaptor
Trigger thresholds		2
Switched output		2 relays (n.c. and n.o.)
RS 232 C interface		a) Temperature output b) External adjustment of switching thresholds
Admissible ambient temperature	$^{\circ}\text{C}$	+10 to +35
Mechanical design/housing		Benchtop unit
Dimensions (W x H x D)	mm	95.3 x 47.8 x 134.1
Packaging dimensions (W x H x D)	mm	320 x 180 x 120
Weight (including packaging)	kg (lbs)	1.5 (3.3)

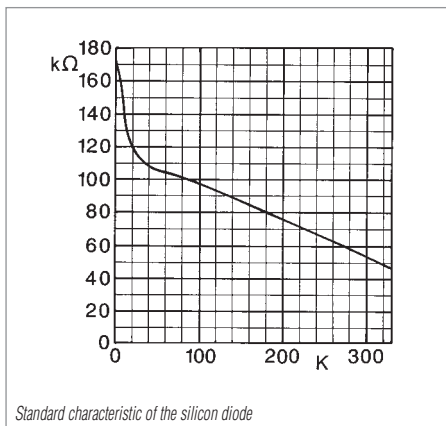
Ordering Information		MODEL 1901
MODEL 1901 low temperature measurement instrument		Part No. 136 45
HV cable with plug, 10 m long *)		Part No. 500 085
UHV cable with plug, 10 m long *)		Part No. 500 201
Silicon diode, type D, with connecting cable and micro plugs - without current feedthrough		Part No. 890 89
HV current feedthrough on a flange DN 25 KF, 2 way		Part No. 200 19 256
UHV current feedthrough on a flange DN 16 KF, 2 way		Part No. 500 217

*) for COOLPOWER and COOLVAC pumps

Temperature Sensors



Dimensional drawing for the silicon diode, type D



Standard characteristic of the silicon diode

In contrast to vapor pressure thermometers, electric temperature sensors can be used for continuous measurements within a wide range of temperatures.

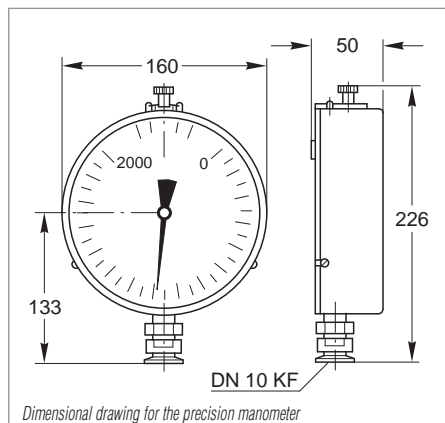
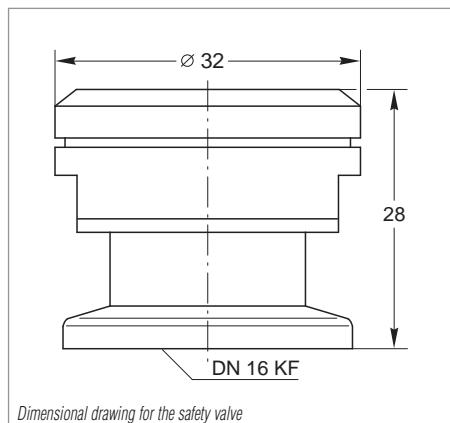
Silicon diodes offer a negative temperature coefficient of resistance, i.e. their resistance drops as the temperature increases. The slope of the temperature/resistance characteristic and the absolute resistance are decisive regarding the suitability of these diodes. The slope determines the sensitivity of the sensor and a high electrical resistance permits accurate measurements while keeping the thermal load small (microwatts).

In systems which are degassed at high temperatures, silicon diodes can only be fitted after degassing has been completed.

The type D silicon diode is compatible to the MODEL 1901 low temperature display unit.

Technical Data		Type D Silicon Diode
Temperature range	K	1.4 to 325
Temperature coefficient (dR/dT)		
qualitative		Negative in the entire temperature range
quantitative	Ω/K	Non-linear characteristic
Measurement current	μA	10
Bakeable to	°C	60
Ordering Information		Type D Silicon Diode
Temperature Sensors		Part No. 890 89

Safety Valve / Precision Manometer



Typical Applications

- ◆ Protecting sealed vacuum systems like cryo-pumps, cryostats, lifting devices, for example against internal overpressures
- ◆ Mandatory for systems which are separated when cold, as a means of protection against overpressures

Typical Applications

- ◆ Pressure readout for vapor pressure thermometers

Technical Information

For operation and measurements at pressures exceeding 1013 mbar the small flange seal must be equipped with an outer centering ring Part No. 183 53.

Technical Data		Safety Valve	Precision Manometer
Responding pressure	mbar	120 to 160, over-pressure	-
Flow at 140 mbar	l x h ⁻¹	500	-
Valve disk		Spring loaded, with O-ring seal	-
Leak rate in the closed state	mbar x l x s ⁻¹ (Torr x l x s ⁻¹)	< 1 x 10 ⁻⁸ (< 0.75 x 10 ⁻⁸)	-
Connection	DN	16 KF	10 KF
Measurement range	mbar (Torr)	-	0 to 2000 (0 to 1500)
Accuracy		-	1 % of full scale
Diameter	mm	32	160
Length of the dial	mm	-	320
Internal volume, approx.	cm ³	-	20
Overall height	mm	28	226
Weight	kg (lbs)	0.3 (0.7)	1.4 (3.1)
Ordering Information		Safety Valve	Precision Manometer
Safety valve on DN 16 KF flange		Part No. 890 39	-
Precision manometer		-	Part No. 890 50

