LEP

Technical manual

EN

Multifunction heat pumps

40 – 420 kW

CE

R410A

Galletti

1 General description

1.1 The LEP product

LEP H multifunction units are air conditioning and domestic hot water (DHW) production units, designed for both domestic and industrial use operating 24 hours a day. They cover a thermal output range from 40 to 429 kW, guaranteeing a high level thermodynamic performance and a wide range of configuration possibilities, both in accessories and cooling circuit.

LEP machines have been built in a fully faired framework making the assembly extremely silent. They can therefore be installed in open environments without needing to be closed off. The all-new new rounded-off shape enhances their outward appearance. The exclusive use of R4120A refrigerant and of high-quality components in the chiller, hydraulic and electrical parts makes the LEP units state-of-the-art chillers in terms of efficiency, reliability and emitted sound output.

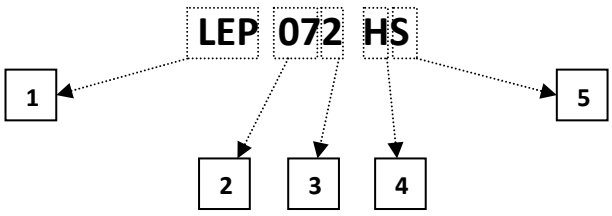
All versions are available in sizes referred to in the table below. The sizes of the LEP units are expressed in the X-coordinates of the table in terms of rated chilling output [kW], obtained in conditions with chilled water produced at 7°C and combined with the evaporative turret with dissipation circuit water at 29° inlet and 35° outlet.

Table I - Table summarising the range of LEP products in its sizes and Efficiency Packs:

Sizes:	040	050	060	070	080	090	110	130	140	160	180	200	210	240	280	310	340	370	420
Efficiency Pack 1	F1	F1	F1	F1	F1	F1	F2	F2	F2	F2	F2								
Efficiency Pack 2	F1	F1	F1	F1	F1	F1	F2	F2	F2	F2	F2								
Efficiency Pack 3														F4	F4				
Efficiency Pack 4									F3	F3	F3	F4	F4	F4	F4	F4	F4	F4	F4

The ordinates of Table I identify the available "Efficiency Pack" which determines the configuration of the cooling circuit; for further details, see paragraph 1.3 “Cooling circuit”. For example, the size “LEP 2 090” develops a 90 kW chiller output and is implemented with Efficiency Pack 2 (two compressors, one cooling circuit). The dimensions of the "Frames" of the units are specified in the cells, by means of reference symbols F1 F2 F3 (with increasing dimensions); all the information concerning the weight of the machines and the dimensions corresponding to each frame is available in paragraph 2.3 "Overall dimensions and weight".
All sizes of the LEP series can be implemented with the standard "S" set-up or the "L" soundproof set-up, covering the compressor and outer panelling with soundproof material.
All sizes of the LEP series can be combined with 2 or 4 pipe systems (see paragraph 1.1.1 for relevant information); the letter “P” indicates a heat pump with total recovery for 4-pipe systems, the letter “H” indicates multifunction heat pumps for 2-pipe systems.

The LEP units can be identified by the following symbol:



- 1 - Identification symbol of Galletti Model (e.g.: “LEP” units)
- 2 - Unit sizes expressed in rated chilling output x10 [kW] (e.g.: 70 kW)
- 3 - Efficiency Pack: layout of cooling circuit and compressors (e.g.: Efficiency Pack 2)
- 4 - Unit version (e.g.: “H”, Multifunction)
- 5 - Unit execution (e.g.: “S”, no optional soundproofing present)

1.1.1 Field of application

LEP units are intended for cooling-heating water and glycol solutions up to a maximum of 30% the weight, in civil, industrial and technological air conditioning environments.

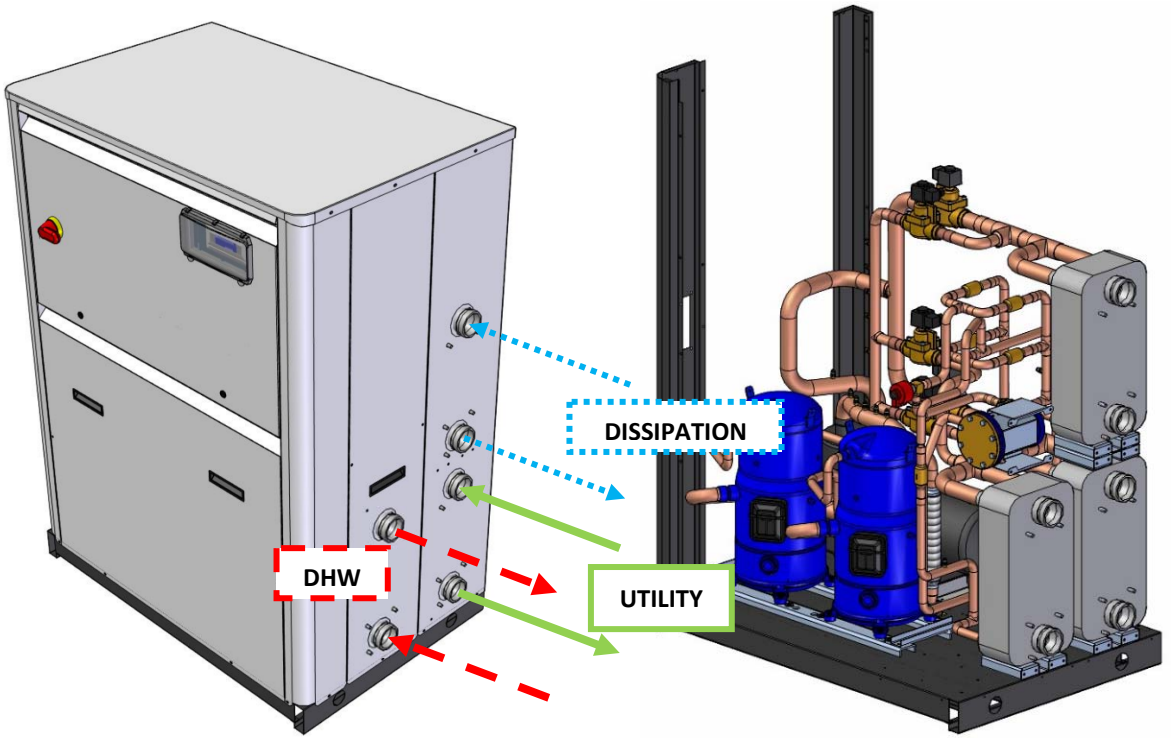
The use of LEP units is recommended within the functioning limits carried in this document, or else the warranty attached to the sales contract would cease.

LEP multifunction units have 6 water connections referring to three different hydraulic circuits for 2-pipe systems:
- Circuit 1, production of cold or hot water for utility;
- Circuit 2, production of hot or cold water for dissipation in opposition to the utility;
- Circuit 3, production of domestic hot water (DHW).

The multifunction units consequently have 3 distinct heat exchangers:
- Plate heat exchanger 1 with both evaporation and condensation function, intended for the utility circuit;
- Plate heat exchanger 2 with both evaporation and condensation function, intended for the dissipation circuit;
- Plate heat exchanger 3 for DHW circuit which acts as a condenser.

LEP multifunction unit: display of water connections and thermodynamic circuit

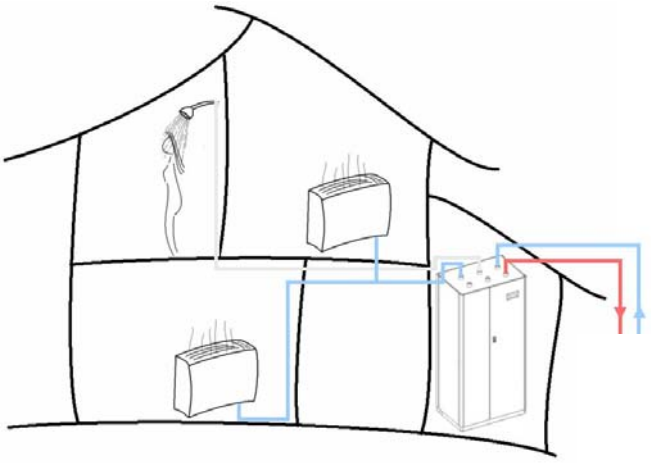
For the correct direction of the connections, always refer to the dimensional drawing attached to the documentation.



The following points schematise the operating functions of the LEP H multifunction unit:

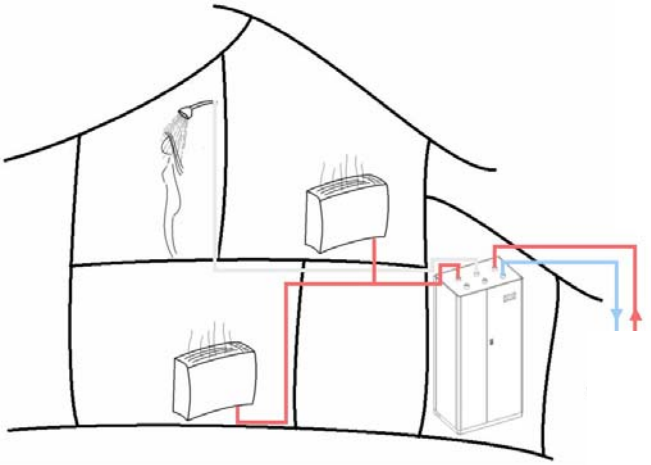
- Chilling

The LEP H multifunction unit in “Chiller” mode chills the water to cool the environment on the utility side, dissipating condensation heat by means of the water which is cooled by the dissipation heat exchanger.



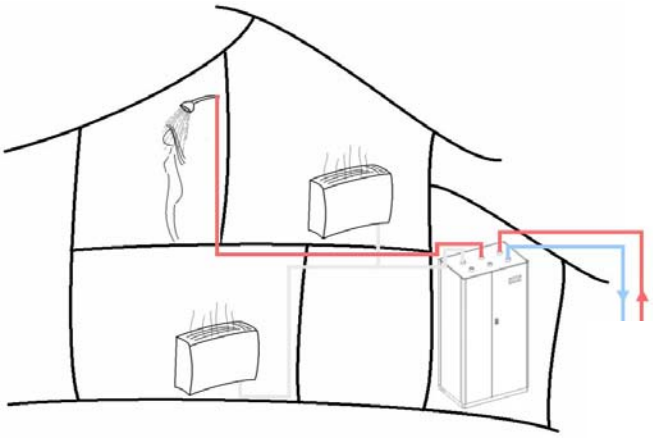
- Heating

The LEP H unit in “Heat Pump” mode heats the water in the condenser to heat the utility side, dissipating the evaporation cooling capacity by means of the water which is heated in the dissipation heat exchanger. In other words, a certain amount of heat is withdrawn from a thermal source which is then yielded to the utility after it has reached a sufficient thermal level which is suitable for its needs.



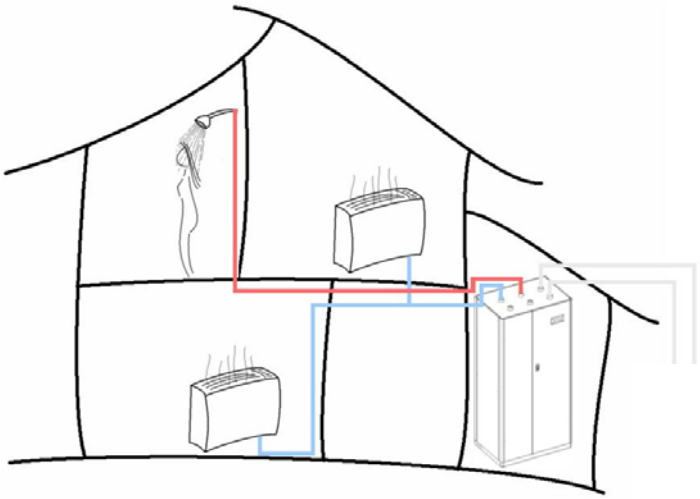
- Production of high temperature hot water for domestic use

The LEP H multifunction unit in “Production of high temperature Hot Water for domestic use” (DHW) mode heats the water in the condenser specific for DHW, dissipating the evaporation cooling capacity by means of the water which is heated in the dissipation heat exchanger.



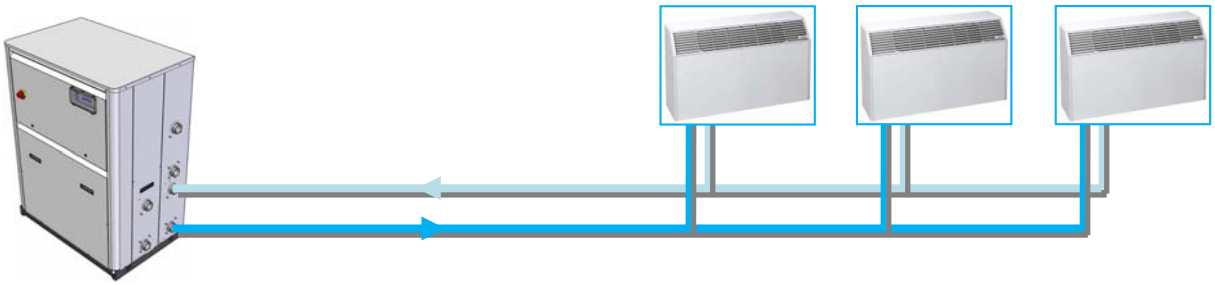
- Cooling simultaneous to production of high temperature hot water for domestic use

The LEP H multifunction unit, in “Chiller + DHW” mode, produces chilled water with the simultaneous production of high temperature hot water for domestic use, thanks to a total heat recovery.

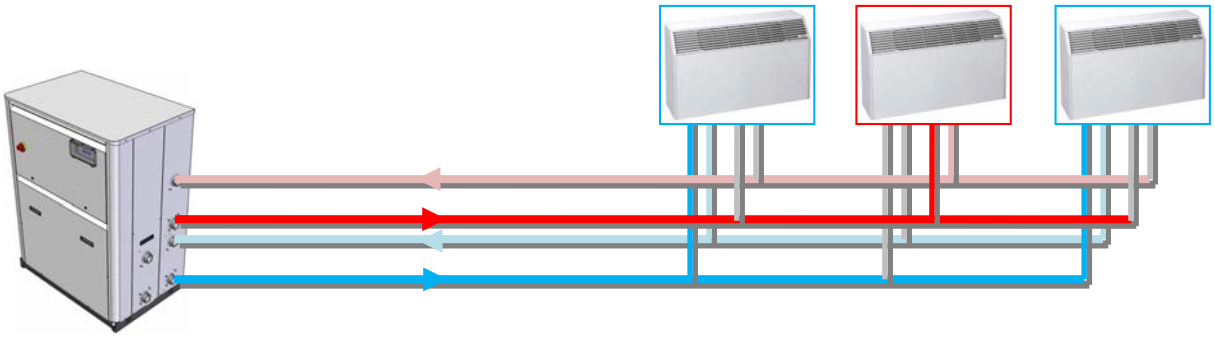


LEP units make it possible to install indifferently a simple 2 or 4 pipe air conditioning system. The two or four pipe designation refers to a water distribution system supplying each air conditioning appliance of a building. A 2-pipe system includes one supply line and one return line to the unit. The terminals supplied by a 2-pipe system have only one heat exchanger which acts alternately as a heating and cooling coil, depending on the operating mode. The 4-pipe system includes a distribution system which supplies both hot water (with relative return lines) and cold water (with relative return lines).

- 2-pipe air conditioning system layout:



- 4-pipe air conditioning system layout:



The 2-pipe systems are less flexible than 4-pipe systems because the entire building is either heated or cooled, though the installation greatly saves energy.
If the design requires a 4-pipe system, the LEP range provides, on demand, the P units which are compatible with this configuration.

1.1.2 Innovation of product

LEP units provide excellent thermodynamic performance and the maximum flexibility of use thanks to a constant research: they can drive either 2 or 4 pipe systems, produce DHW together with cold water, and cover a wide range of power outputs. The joint application of scroll compressors, advanced control systems and R410A refrigerant gas bring about compact circuit and high-level COP.
The possibility of keeping the evaporator on the inside allows you not to add glycol to the water in the system, with clear advantages in terms of thermodynamic performance, preservation from corrosion and respect for the environment. It also makes it possible for all the components requiring maintenance to be installed in an easily accessible space.
For large buildings, air conditioning can be implemented as the floors/zones are sold or rented, by installing a LEP unit for each floor in a small size technical room, thus dividing the investment in time. The overall dimensions of the units (less than 90 cm depth in the higher output sizes) make them easy to be installed since they fit through any door.

The main innovations which this product presents are summarised in the following list:

- Possibility of using water without glycol in the utility circuit
- Heat pump mode with chiller side cycle inversion
- Possibility of even heat pump versions using condensation control
- Electronically controlled expansion valve
- True multifunction executions, with simultaneous production of hot and cold water by means of total heat recovery
- High COP (Coefficient of performance) of thermodynamic cycle
- Less charging with refrigerant
- Less space taken up in plan (specific outputs up to 153 kW/m^2)
- Innovative aesthetical features and full safety since units are completely closed
- No noise on the outside, less noise on the inside due to dual-soundproofing in the low-noise version

1.2 Structure

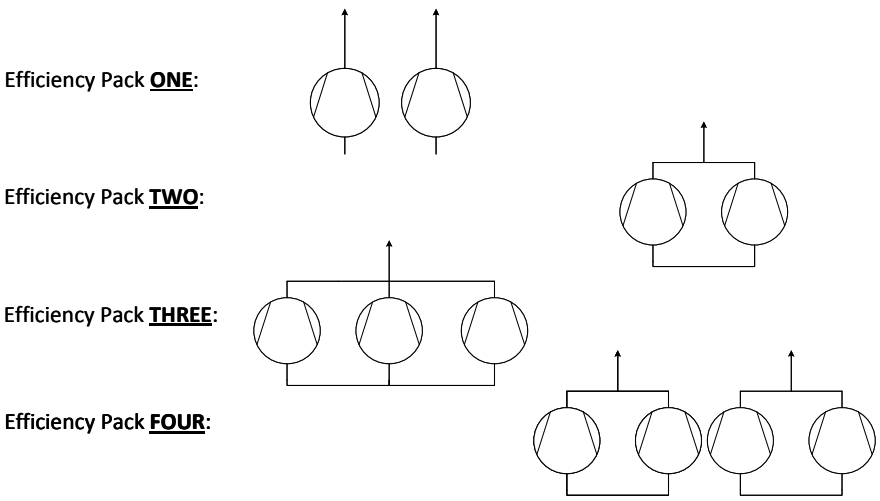
All of the LEP series units are constructed with a support base and panelling made of galvanised sheet metal painted with black polyester epoxy powders oven-polymerised at 180°C. The unit has an exclusive design enhancing the overall assembly with a smart outward appearance. Moreover the closed unit makes the components inaccessible: this aspect together with the wide use of soundproof material inside the compartment and around the compressors (optional for low-noise version) reduces the emitted sound output to exceptionally low levels (Lp < 67 dB-A @1 metre for larger sizes).
The hydraulic/chiller connections are envisioned on the right side, when looking at the electrical control board, to reduce the technical space required for installation. All the panels are removable (except for the one on the right, upon which all the hydraulic connections are fitted) making the unit fully accessible even though routine maintenance only needs accessing from the front.

1.3 Cooling circuit

The cooling circuit is fully implemented in the Factory exclusively using prime brand components and qualified operators in compliance with Directive 97/23 for all the brazing operations.

The range can be configured in the cooling circuit mode (*Efficiency Pack*) which, depending on the size, can be a dual compressor on a double circuit (*Efficiency Pack 1*) for a highly redundant system, dual compressor (tandem) on single circuit (*Efficiency Pack 2*) for greater efficiency in partial loads, three compressors (trio) on single circuit (*Efficiency Pack 3*) combining economical implementation and partial load efficiency and four compressors (two tandems) on a double circuit (*Efficiency Pack 4*) for a system which is both redundant and efficient with the reduced load.

Table II – List and graphical representation of layout of components in four Efficiency Packs:



Solutions with more than one circuit provide the utmost reliability thanks to the redundancy, while those with more than one compressor on a circuit provide partial loads with ideal efficiency, also thanks to increased heat exchange surfaces.

1.3.1 Compressors

Only prime international brand Scroll compressors are used on the LEP units. The Scroll compressor is the best solution today in terms of reliability and efficiency in the range of power outputs up to 182 kW for each circuit and the best solution in terms of emitted sound output. The optimisation of the processing together with a careful choice of the intrinsic volumetric compression ratio (RVI) provides a clear improvement in isentropic compression performance and therefore a reduction in energy loss. The use of a scroll compressor permits using low viscosity oils which compared to higher viscosity oils reduces thermal resistance for the evaporator with an evaporation Temperature increase beyond 1.5°C (more than 5.5% in EER) respect to other solutions.
The compressors are supplied complete with motor protection against overheating, overloads or excessive delivery gas temperatures. They are mounted on anti-vibration rubber, complete with oil charge and inserted in a soundproof compartment with sound-absorbing material. Also complete with automatic oil heater to prevent the oil from being diluted by the refrigerant when the compressor stops.

N.B.: Scroll compressors, just like all air-tight compressors, are classified as pressure recipients in compliance with PED CE 97/23 for that which regards the low pressure section to which the PS indicated on the data plate refers.

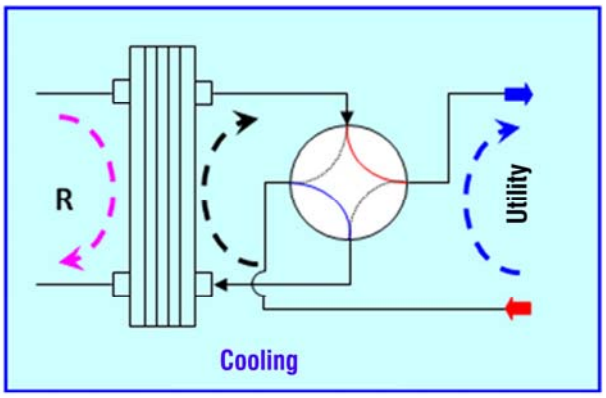
1.3.2 Heat exchangers

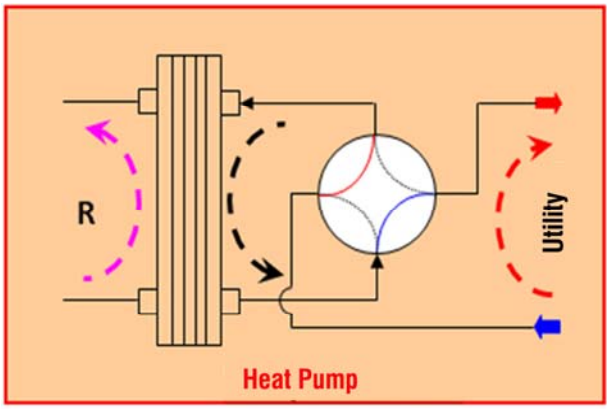
Only brazed plate heat exchangers are used, made of austenitic stainless steel AISI 316 with AISI 316L connections, featured by a reduced carbon content to simplify brazing operations. The solution of the brazed plate heat exchanger represents the state-of-the-art in terms of thermal exchange efficiency and allows a strong reduction of refrigerant load compared to standard solutions. The high degree of turbulence induced by the internal corrugation of the plates together with their perfect smoothing features, makes it difficult for filth to deposit or for limestone to build up on the condenser side. These heat exchangers also make it possible to use R410A fluid which, thanks to the high-level thermal conductivity of the liquid phase and to its practically azeotropic behaviour, enhances thermal exchange during evaporation with greater performance than other methane-derivative fluids of the HFC family.

- *N.B.: due to thermal insulation, the data plate in compliance with PED CE 97/23 is not legible, but the serial number of the heat exchanger and the declaration of conformity are detected during production and are an integral part of the Galletti archive*.

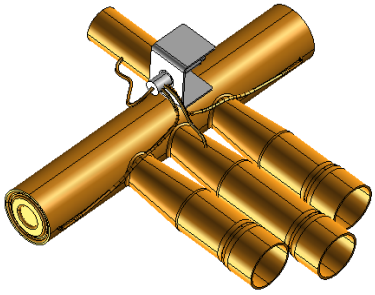
1.3.3 Utility and dissipation side cycle inversion valves (optional)

When LEP H reversible chillers switch from chiller to the heat pump and vice versa, they perform two cycle inversions: one refrigerant side and one water side. The inversion valve of the water-side cycle switches from position A to position B and vice versa, by means of an electrical driver without changing the travel direction for the outside utilities. This allows to invert the flow direction in the heat exchangers, keeping them against the flow respect to the refrigerant fluid in every operating mode. Due to the complexity of the circuit, in multifunction units the refrigerant side cycle inversion is provided by a solenoid valve system (see paragraph 1.3.6 “General thermodynamic circuit layouts” for further information). The water-side cycle inversion valve is an optional component.

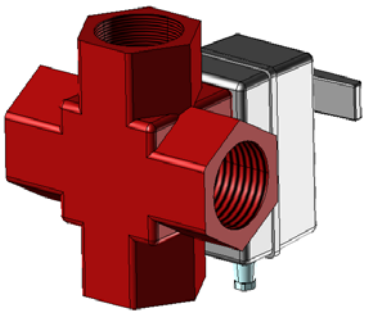




Refrigerant-side cycle inversion valve



Heat-transfer fluid-side cycle inversion valve



1.3.4 Electronically controlled expansion valve

The electronic control valve with external equalisation and built-in MOP function is managed by the software and therefore makes the cooling circuit operation very efficient, decreasing the power absorbed by the system when a sudden thermal load variation occurs. The shutter in the central part of the valve can always slide vertically with an ample stroke allowing variation of the degree of opening of the orifice of the fluid passage. The use of this valve makes a reduction in energy consumption of the compressor possible when the surrounding conditions allow to bring the pressure difference between the evaporator and the air conditioner below 5 bar, thus improving performance.

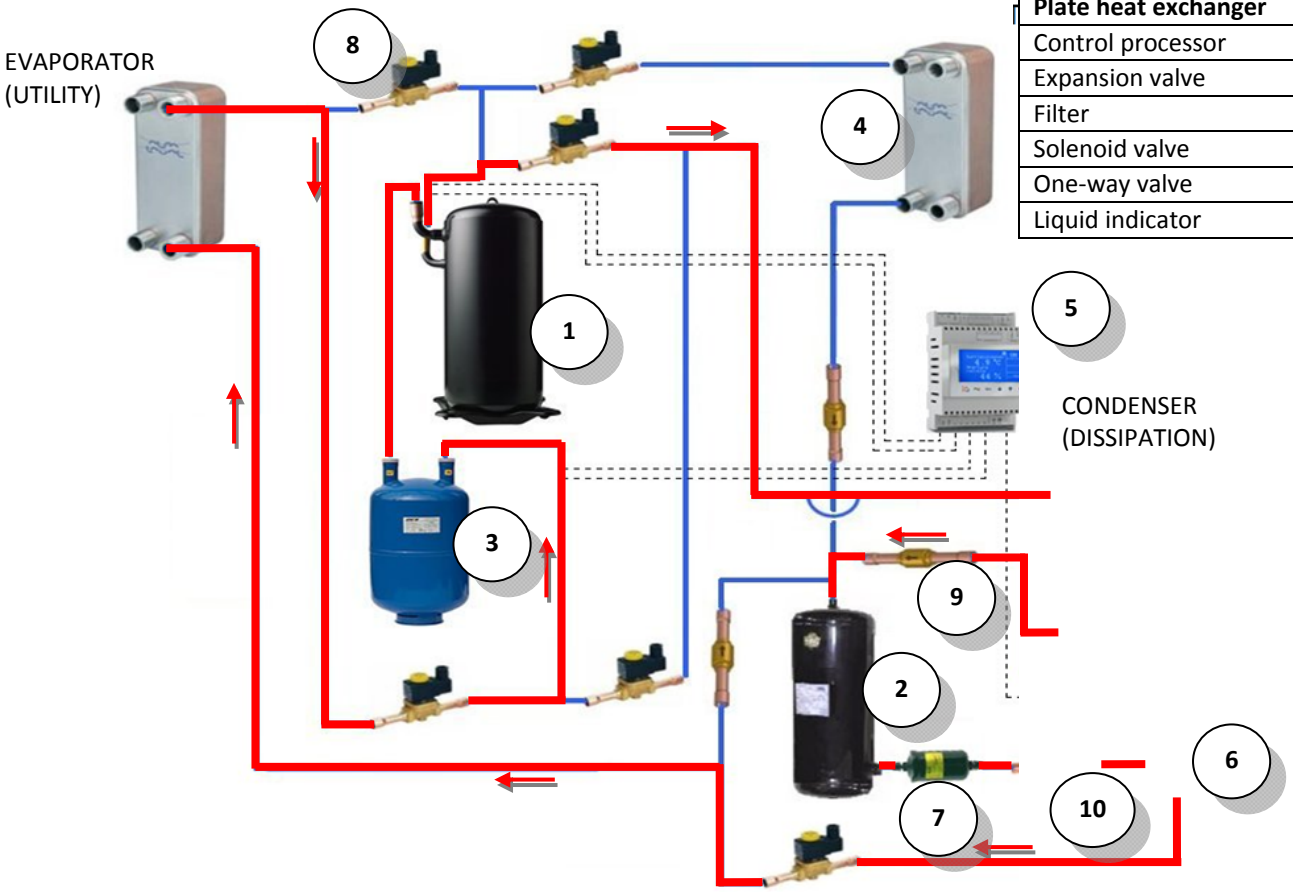
1.3.5 Other cooling components

- Molecular sieve filter dryer
- Sight glass with humidity indicator
- One-way valves (*only reversible heat pump*)
- Liquid receiver marked in compliance with EEC Directive 97/23 PED (*only reversible heat pumps or units with remote condenser*)
- High and low pressure switches
- Solenoid valves for management of different air conditioning and DHW production modes (*only for multifunction versions*)
- Schrader valves for control and/or maintenance

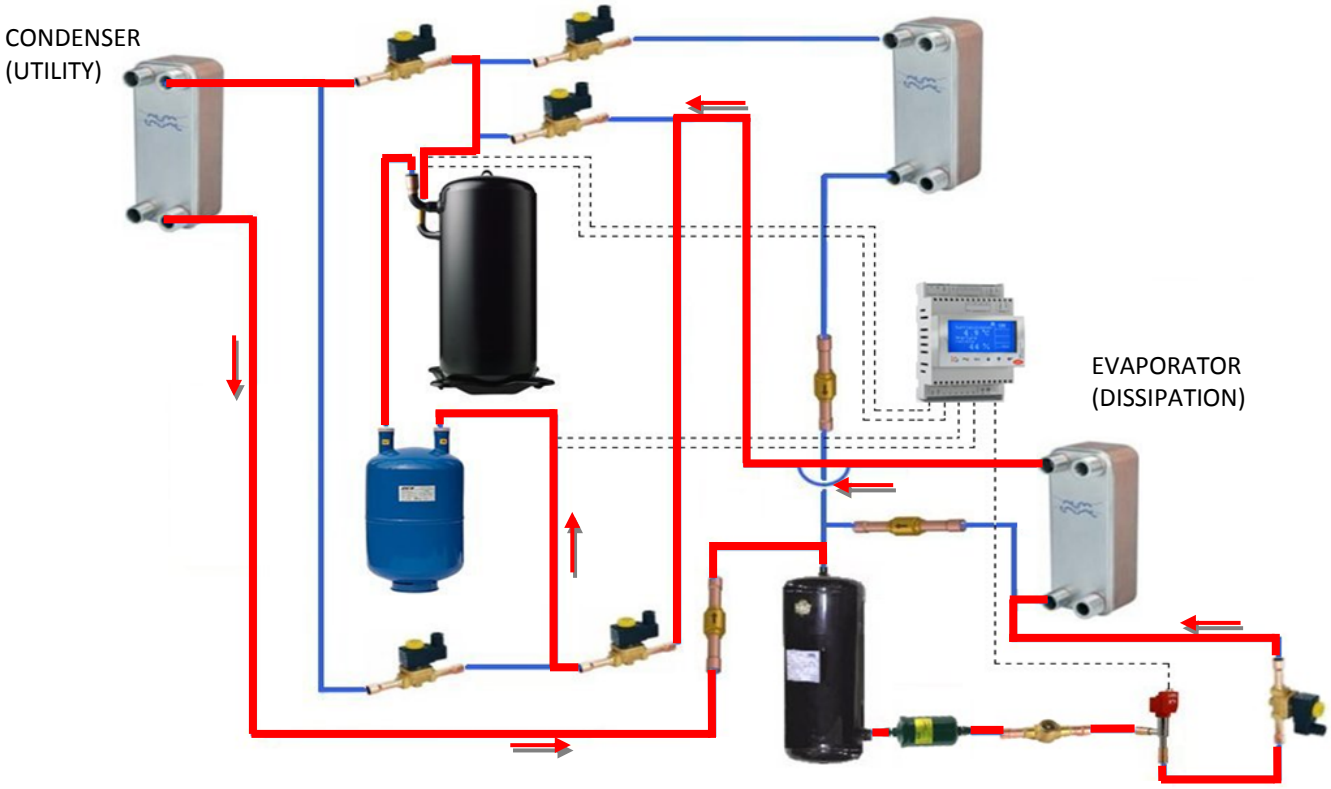
1.3.6 General thermodynamic circuit layouts

Standard layout of thermodynamic circuit of LEP units in cooling mode

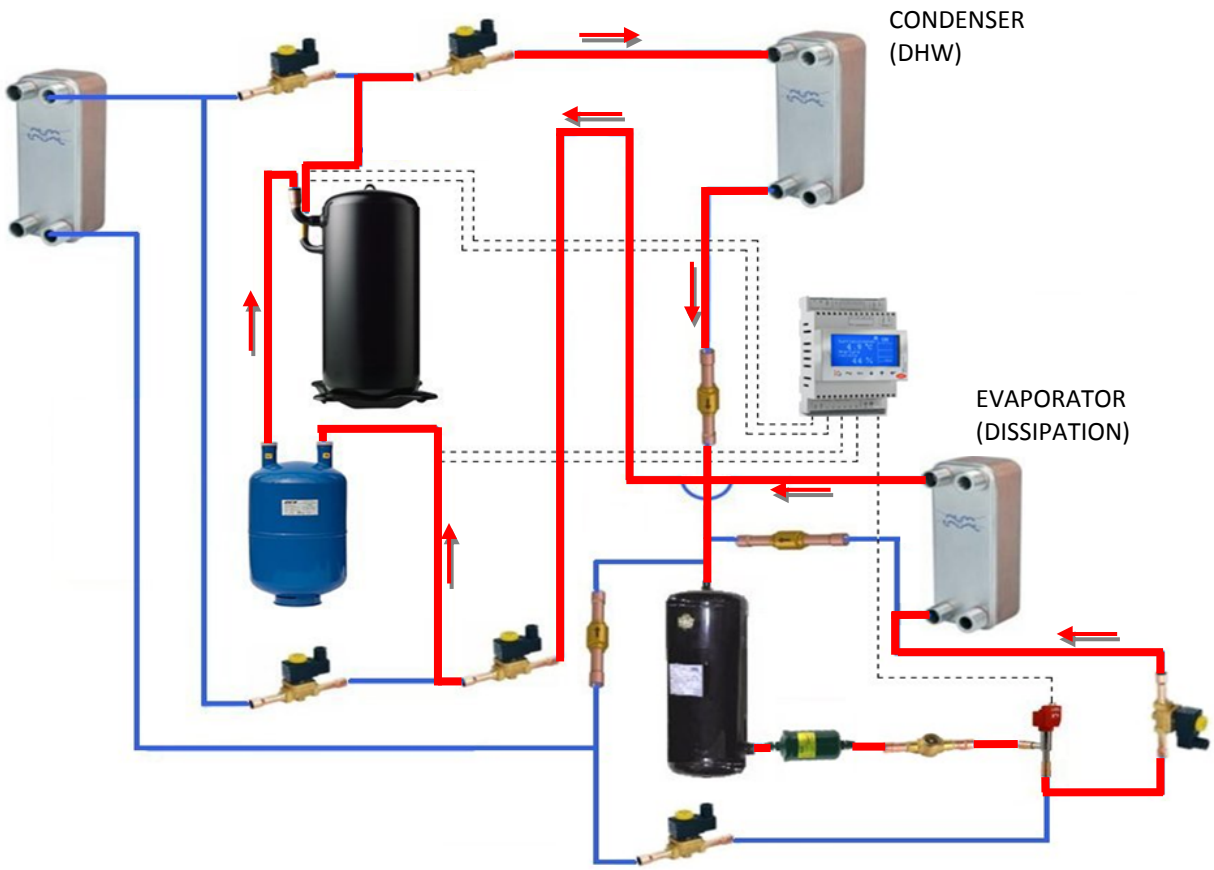
Compressor
Liquid receiver
Liquid separator
Plate heat exchanger
Control processor
Expansion valve
Filter
Solenoid valve
One-way valve
Liquid indicator



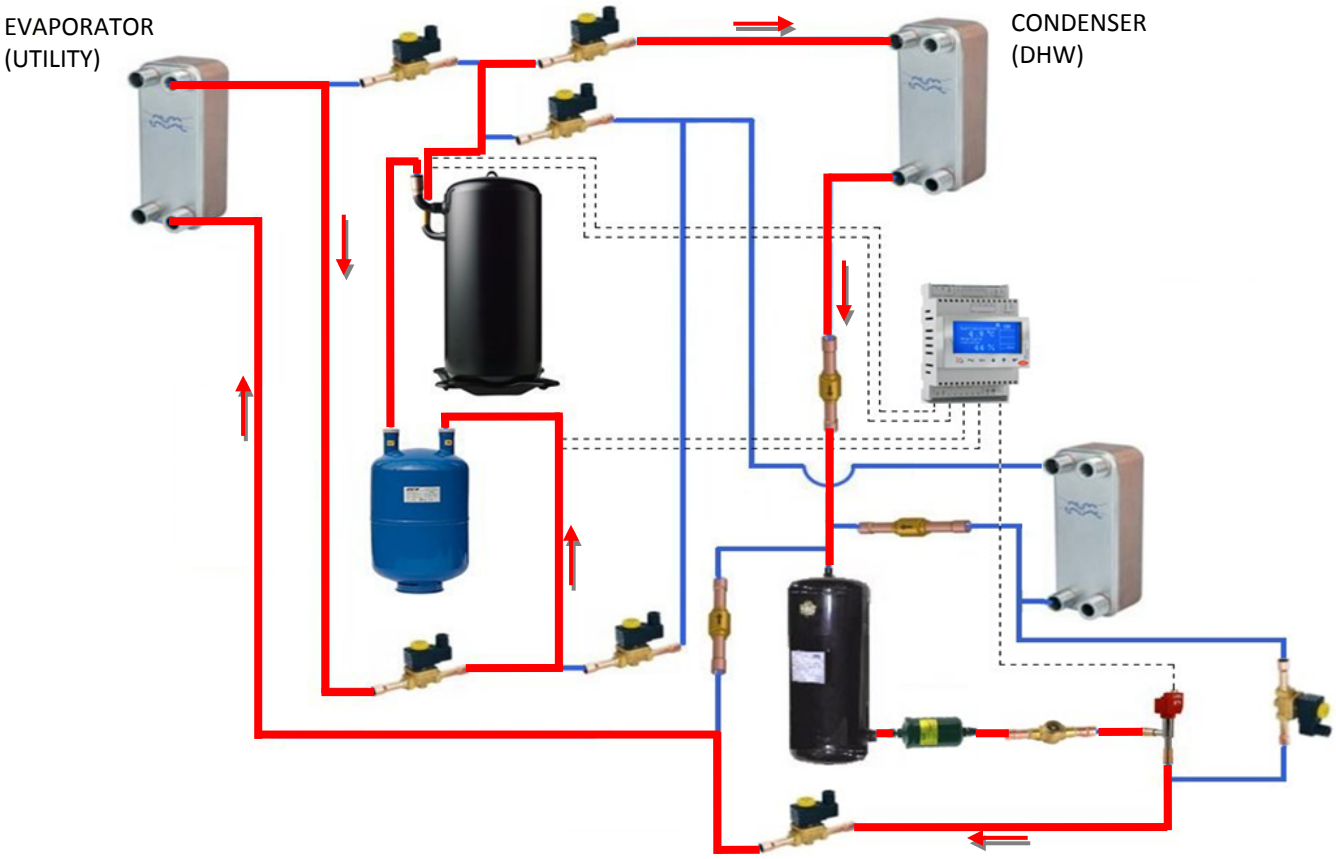
Standard layout of thermodynamic circuit of LEP units in heating mode



Standard layout of thermodynamic circuit of LEP units for DHW production



Standard layout of thermodynamic circuit of LEP units in cooling mode with simultaneous DHW production



1.4 Electrical control board

The electrical control board is implemented and wired in compliance with standard EN 60204-1. The control board can be accessed directly from the front of the unit. The components can only be accessed after the unit has been disconnected from the mains by means of the general disconnection switch with the door-locking function. All the remote controls are implemented with low voltage signals at 24 V, powered by an isolation transformer positioned inside the control board. All the control boards have an air circulation system with auxiliary fans. The position and orientation of the main disconnection switch have been studied to facilitate wiring operations in the work site without the power cords needing to perform difficult passages and improbable bends. All the utilities are protected against overloads and short-circuits and the fitting circuit breakers switches can be configured for each load (optional): however thermal protection is always implemented by thermistor chains plunged in the windings of each electric motor and adequately controlled by on-board electronics. The phase sequence relay is fitted as per standard on all the units inhibiting operation of the compressor should the phase sequence not be respected: only one rotation direction is possible for the scroll compressors, just like the screw and Rotary compressors. The unit is rated IP43 which makes it suitable for outdoor installation. The control board with the open panel maintains an IP20 rating. Inside the electrical control board of the Basic control there are two manual selectors to enable remote switching on-off, seasonal changeover (only heat pumps) and to select local or remote control: remote consents are implemented by low voltage contacts placed on the terminal board.

1.4.1 Control microprocessor

LEP series units have two different microprocessor control levels:

- Basic – Carel µChiller
- Advanced – Carel series pCO

This latter, besides the features described hereafter, makes it possible to customise software to meet all the requirements of the system, including management of the cascade units with *step-control* or *cascade* logic.
The microprocessor on-board the unit controls the various operating parameters by means of a keyboard set-up on the electrical control board:

- Compressor connection/disconnection to maintain the set-point of the chiller inlet water T
- Alarm management
  - High/ low pressure
  - Antifreeze
  - Flow switch
  - Pump alarm
- Alarm signals
- Display of operation parameters
- Antifreeze protection of evaporator
- Control of maximum number of compressor starts
- Serial output control (optional) RS232, RS485
- Incorrect sequence phases (not viewed on display, but keeps compressor from starting)

As for remote communication, the controls are set-up for connection with advanced BMS systems and the HSD (Galletti Software Department) structure is capable of assisting customers in integration operations. The interconnectivity possibilities of the system are synthesised as follows:

- Serial ports available
  - RS232
  - RS485
  - Ethernet (“Hiweb” board)
- GSM Modem: with prepaid card and relative antenna on-board machine for autonomous two-way control of alarms and/or set-point variations
- Protocols
  - Carel [Built In]
  - Modbus® [Built In with Advanced controls]
  - Modbus® [With external gateway with Basic controls]
  - LonWorks® [Dedicated serial board to be requested when ordering the machine]
  - BACnet™ [With external gateway]
  - TCP-IP [With external gateway]
  - TREND® [Dedicated serial board to be requested when ordering the machine]

(ref. Microprocessor control manual for further details)

1.5 Configurability, accessories and options

Variants of LEP product:

- Soundproofing:
  - Standard unit not equipped with sound insulation
  - Low-noise unit through sound-absorbing housing for each compressor and insulation of frame panels with sound-absorbing textured material
  - Rubber-based or spring anti-vibration devices

- Thermal distribution system (software set-up):
  - 2 pipes: single distribution circuit
  - 4 pipes (on demand): namely two separate circuits, hot and cold

- Downgrade to mechanical expansion valve, on demand (the electronic controlled expansion valve is standard)

Options of LEP product:

- Thermodynamic circuit
  - Condensation control via 0-10 V signal of external modulating device (2-way valve, 3-way valve, variable speed circulation pump)
  - Outdoor temperature probe for set-point compensation
  - Analogue pressure gauges

- Electrical control board:
  - Power supply in 400/3+N/50 Hz with motor circuit breakers
  - Shunt capacitors
  - Soft-starter kit for reduction of starting currents for each compressor
  - Clock board
  - ON-OFF status of compressors
  - Remote contact to limit compressor switch-on
  - Configurable digital alarm board

- Filter cut-off kit (solenoid and cock on liquid line)

- External module with recirculation pumps for dissipation circuits, utility and DHW (multifunction versions)
  - Four-way valves for water-side flow inversion (maintaining counterflow); four-way valves can also be included in supply, without the optional hydronic module
  - Pair of Vic-Taulic joints for IN/OUT water connection
  - Blade-type flow switch included

2 Technical data

Table I – Technical data of LEP H models from LEP 1 040 to LEP 1 160 in standard operating conditions for vertical probe geothermic application

Synthesis of LEP series technical data		041/2	051/2	061/2	071/2	081/2	091/2	111/2	131/2	141/2	144	161/2	164
Cooling @ 30/35 ; W12/7													
Cooling Capacity	[kW]	47,6	56,3	64,9	73,4	84,6	94,0	114	130	149	149	167	167
Absorbed Power	[kW]	10,5	13,5	14,7	17,0	18,4	21,1	24,3	28,3	32,5	33,4	37,0	36,9
Absorbed Current	[A]	15,9	20,3	22,2	25,6	28,0	32,0	37,1	42,9	49,5	50,9	56,4	56,2
EER	[-]	4,5	4,2	4,4	4,3	4,6	4,5	4,7	4,6	4,6	4,5	4,5	4,5
UTILITY Water Flow Rate	[l/h]	8219	9724	11212	12685	14604	16228	19634	22375	25727	25692	28730	28873
UTILITY Water Pressure Drops	[kPa]	33	44	45	43	34	42	37	45	42	42	47	47
DISSIPATION Water Flow Rate	[l/h]	9919	11888	13582	15422	17601	19645	23607	26965	31025	31136	34767	34889
DISSIPATION Water Pressure Drops	[kPa]	44	61	47	61	47	58	48	61	57	58	63	64
Cooling + DHW @ 12/7°C ; 45/50°C													
Cooling Capacity	[kW]	42,5	50,6	57,8	65,8	75,5	83,9	102	116	133	134	149	149
Thermal Output	[kW]	54,5	65,7	74,5	85,1	96,6	108	130	148	170	172	191	192
Absorbed Power	[kW]	12,6	15,9	17,6	20,2	22,1	25,4	29,5	34,4	39,2	39,9	44,3	44,4
Absorbed Current	[A]	19,4	24,3	26,8	31,0	34,2	39,1	45,7	53,0	60,6	61,6	68,5	68,7
COP	[-]	8,01	7,68	7,91	7,79	8,06	7,87	8,11	7,97	8,03	7,93	7,95	7,94
UTILITY Water Flow Rate	[l/h]	7333	8735	9982	11357	13019	14474	17509	19938	22954	23050	25651	25738
UTILITY Water Pressure Drops	[kPa]	27	36	36	35	27	34	30	36	35	35	38	38
DHW Flow Rate	[l/h]	9418	11336	12861	14684	16694	18668	22418	25636	29462	29671	33006	33122
DHW Pressure Drops	[kPa]	42	58	57	56	43	54	47	57	54	55	60	60
Heating @ B10/7 ; W40/45 20%eg													
Thermal Output	[kW]	54,3	65,4	74,2	84,6	96,1	108	129	148	170	171	190	191
Absorbed Power	[kW]	13,0	16,3	17,9	20,8	22,6	25,9	30,1	35,2	40,0	40,7	45,3	45,6
Absorbed Current	[A]	19,4	24,2	26,8	31,0	34,2	39,0	45,6	53,0	60,5	61,6	68,4	68,8
COP	[-]	4,18	4,01	4,15	4,07	4,25	4,15	4,29	4,19	4,24	4,20	4,19	4,19
SCOP		5,85	5,82	6,12	5,94	6,19	5,89	6,13	6,06	6,04	5,93	5,93	5,99
Energy efficiency		230	228	240	233	243	231	241	238	237	233	233	235
Energy efficiency ratio		A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++
UTILITY Water Flow Rate	[kg/h]	9376	11282	12803	14611	16614	18580	22307	25508	29316	29540	32846	33016
UTILITY Water Pressure Drops	[kPa]	41	58	57	56	43	54	46	57	54	54	59	59
DISSIPATION Water Flow Rate	[kg/h]	12146	14467	16540	18806	21561	23970	28986	33009	38001	38191	42474	42688
DISSIPATION Water Pressure Drops	[kPa]	64	87	67	87	67	83	69	88	82	83	90	92
DHW @ @ B10/7 ; W40/45 20%eg													
Thermal Output	[kW]	54,3	65,4	74,2	84,6	96,1	108	129	148	170	171	190	191
Absorbed Power	[kW]	13,0	16,3	17,9	20,8	22,6	25,9	30,1	35,2	40,0	40,7	45,3	45,6
Absorbed Current	[A]	19,4	24,2	26,8	31,0	34,2	39,0	45,6	53,0	60,5	61,6	68,4	68,8
COP	[-]	4,18	4,01	4,15	4,07	4,25	4,15	4,29	4,19	4,24	4,20	4,19	4,19
UTILITY Water Flow Rate	[kg/h]	9376	11282	12803	14611	16614	18580	22307	25508	29316	29540	32846	33016
UTILITY Water Pressure Drops	[kPa]	41	58	57	56	43	54	46	57	54	54	59	59
DISSIPATION Water Flow Rate	[kg/h]	12146	14467	16540	18806	21561	23970	28986	33009	38001	38191	42474	42688
DISSIPATION Water Pressure Drops	[kPa]	64	87	67	87	67	83	69	88	82	83	90	92
Maximum current absorption	A	30	37	40	46	50	61	71	79	91	92	102	100
Startup current	A	111	156	157	164	176	203	275	244	289	197	298	211
ESEER		6,04	5,78	6,11	6,01	6,25	6,25	6,48	6,43	6,17	6,09	6,17	6,24

Table II – Technical data of LEP H models from LEP 1 180 to LEP 4 420 in standard operating conditions for vertical probe geothermic application

Synthesis of LEP series technical data		181/2	184	204	214	243	244	283	284	314	344	374	424
Cooling @ 30/35 ; W12/7													
Cooling Capacity	[kW]	199	193	209	228	256	266	294	298	328	359	390	445
Absorbed Power	[kW]	42,9	41,2	45,1	48,4	54,5	54,4	63,8	63,7	73,3	79,3	85,4	95,0
Absorbed Current	[A]	65,7	63,2	68,8	74,1	83,4	84,5	98,7	98,7	113	122	132	146
EER	[-]	4,6	4,7	4,6	4,7	4,7	4,9	4,6	4,7	4,5	4,5	4,6	4,7
UTILITY Water Flow Rate	[kg/h]	34226	33248	35970	39338	44169	45744	50710	51237	56518	61829	67117	76633
UTILITY Water Pressure Drops	[kPa]	41	40	45	43	46	30	35	36	43	42	41	42
DISSIPATION Water Flow Rate	[kg/h]	41261	40016	43340	47280	53105	54802	61268	61798	68600	74910	81217	92312
DISSIPATION Water Pressure Drops	[kPa]	56	54	63	60	63	37	46	48	58	56	56	58
Cooling + DHW @ 12/7°C ; 45/50°C													
Cooling Capacity	[kW]	177	172	186	204	230	238	263	267	294	321	349	396
Thermal Output	[kW]	226	219	238	260	292	302	336	340	378	411	446	508
Absorbed Power	[kW]	51,3	49,7	54,5	58,8	65,3	66,7	76,6	77,3	88,1	95,1	102	118
Absorbed Current	[A]	79,6	77,3	84,5	91,2	101	104	120	121	137	148	160	184
COP	[-]	8,11	8,11	8,05	8,13	8,25	8,28	8,03	8,05	7,84	7,91	7,97	7,87
UTILITY Water Flow Rate	[kg/h]	30513	29627	32115	35085	39581	40986	45343	45905	50624	55270	60024	68143
UTILITY Water Pressure Drops	[kPa]	34	32	37	35	38	24	29	29	35	34	34	34
DHW Flow Rate	[kg/h]	39076	37935	41197	44897	50482	52229	58202	58887	65356	71210	77195	87885
DHW Pressure Drops	[kPa]	53	51	58	55	58	38	45	46	56	54	53	54
Heating @ B10/7 ; W40/45 20%eg													
Thermal Output	[kW]	225	218	237	258	290	299	334	339	376	409	444	505
Absorbed Power	[kW]	52,3	50,7	55,9	60,1	66,9	67,8	77,8	78,7	89,8	97,1	105	120
Absorbed Current	[A]	79,6	77,1	84,6	91,2	101	105	120	121	137	148	160	184
COP	[-]	4,30	4,31	4,24	4,30	4,34	4,41	4,30	4,30	4,19	4,22	4,25	4,20
SCOP		6,03	6,13	6,03	6,11	6,20	6,38	6,22	6,19	5,91	5,98	5,98	6,08
Energy efficiency		237	241	237	240	244	251	244	243	232	235	235	239
Energy efficiency ratio		A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++	A+++
UTILITY Water Flow Rate	[kg/h]	38889	37800	40982	44703	50201	51848	57875	58631	65061	70840	76847	87416
UTILITY Water Pressure Drops	[kPa]	52	50	57	55	58	37	44	46	55	54	53	54
DISSIPATION Water Flow Rate	[kg/h]	50535	49162	53122	58132	65483	67620	75020	76063	83902	91484	99445	112768
DISSIPATION Water Pressure Drops	[kPa]	81	78	90	87	92	54	66	69	84	81	80	83
DHW @ @ B10/7 ; W40/45 20%eg													
Thermal Output	[kW]	225	218	237	258	290	299	334	339	376	409	444	505
Absorbed Power	[kW]	52,3	50,7	55,9	60,1	66,9	67,8	77,8	78,7	89,8	97,1	105	120
Absorbed Current	[A]	79,6	77,1	84,6	91,2	101	105	120	121	137	148	160	184
COP	[-]	4,30	4,31	4,24	4,30	4,34	4,41	4,30	4,30	4,19	4,22	4,25	4,20
UTILITY Water Flow Rate	[kg/h]	38889	37800	40982	44703	50201	51848	57875	58631	65061	70840	76847	87416
UTILITY Water Pressure Drops	[kPa]	52	50	57	55	58	37	44	46	55	54	53	54
DISSIPATION Water Flow Rate	[kg/h]	50535	49162	53122	58132	65483	67620	75020	76063	83902	91484	99445	112768
DISSIPATION Water Pressure Drops	[kPa]	81	78	90	87	92	54	66	69	84	81	80	83
Maximum current absorption	A	116	122	132	142	153	159	174	182	204	218	232	281
Startup current	A	361	250	321	328	336	301	401	355	374	437	442	490
ESEER		6,29	6,33	6,46	6,44	6,37	6,62	6,34	6,21	6,15	6,13	6,20	6,45

2.1 Performance of LEP P and H heat pump units

All the data in the paragraph refers to ΔT = 5°C on evaporation and condensation side. Pf = chiller power [kW]; Pa = absorbed power [kW]. In order to calculate the thermodynamic EER and COP factors, take the Pf / Pa ratio. Performance has been obtained with different glycol percentages in the solution even though, from a thermodynamic point of view, with up to 30% of glycol in solution, the performance drop recorded is minor: nonetheless refer to the paragraph 4.1 “Use of glycol solutions” for further information.

Table III: performance of LEP H P units in cold water production mode using water without glycol.

		LEP P – LEP H					
	Tcond [°C]	10/30		15/30		20/30	
Size	Tev [°C]	Pf	Pa	Pf	Pa	Pf	Pa
LEP 041/2	20/15	65,9	8,6	66,5	9,5	65,2	8,9
	15/10	56,5	8,5	56,2	8,7	56,1	8,9
	10/5	49,0	9,1	48,7	9,2	48,4	9,3
LEP 051/2	20/15	78,1	11,5	77,6	11,7	77,1	11,8
	15/10	66,7	11,2	66,3	11,4	66,0	11,5
	10/5	56,5	11,0	56,2	11,1	55,8	11,2
LEP 061/2	20/15	89,8	12,4	89,2	12,5	88,7	12,7
	15/10	76,9	12,2	76,7	12,3	75,9	12,5
	10/5	65,6	11,9	65,3	12,1	64,7	12,3
LEP 071/2	20/15	100,4	14,1	99,8	14,3	99,3	14,6
	15/10	86,6	14,1	86,1	14,2	85,5	14,4
	10/5	74,3	13,8	73,8	14	73,1	14,2
LEP 081/2	20/15	116,1	15,7	115,6	15,9	144,8	16,1
	15/10	100,0	15,2	99,3	15,5	98,3	15,8
	10/5	85,1	15,2	84,8	15,3	83,9	15,7
LEP 091/2	20/15	130,3	17,4	129,8	17,6	128,7	17,9
	15/10	111,8	17,3	111,1	17,5	109,9	18,0
	10/5	95,3	17,2	94,7	17,4	93,3	17,8
LEP 111/2	20/15	157,1	20,4	156,2	20,6	155,2	20,9
	15/10	135,3	19,9	134,2	20,3	132,2	20,9
	10/5	115,3	19,6	114,4	20,1	113,0	20,6
LEP 131/2	20/15	178,8	23,7	178	24	176,6	24,3
	15/10	153,8	23,0	152,9	23,5	150,8	24,1
	10/5	131,8	22,6	130,7	23,1	128,8	23,8
LEP 141/2	20/15	204,8	27,3	203,7	27,6	202,4	28,0
	15/10	176,3	26,9	175,2	27,2	173,5	27,9
	10/5	150,4	26,6	149,5	26,9	148,0	27,5
LEP 144	20/15	203,4	28,1	202,4	28,4	201,4	28,9
	15/10	175,2	27,7	174,6	28,1	172,6	28,7
	10/5	150,4	27,3	149,3	27,8	148,1	28,2
LEP 161/2	20/15	228,2	31,0	227,3	31,3	225,6	31,8
	15/10	164,1	30,6	195,3	31,1	167,8	31,8
	10/5	167,6	26,3	166,6	30,8	164,9	31,4
LEP 164	20/15	229,6	31,6	228,5	31,9	227,1	32,4
	15/10	198,0	30,7	196,6	31,2	194,5	31,9
	10/5	168,9	30,1	167,9	30,5	166,4	31,0
LEP 181/2	20/15	272,0	36,0	270,5	36,5	269,0	37,0
	15/10	234,6	35,4	232,9	36,1	228,9	37,1
	10/5	200,2	35,1	199,1	35,7	195,6	36,7
LEP 184	20/15	266.4	34.3	265.2	34.7	263.3	35.2
	15/10	228.4	34.2	227.2	34.6	225.4	35.1
	10/5	194.3	34	193.8	34.4	192.4	34.9
LEP 204	20/15	288,5	37,6	286,8	38,1	285,3	38,7
	15/10	247,6	40,0	246,2	40,6	242,7	41,2
	10/5	211,2	36,7	209,9	37,4	207,1	38,3
LEP 214	20/15	315,1	40,7	313,2	41,2	311,7	41,8
	15/10	270,5	39,9	269	40,6	264,2	41,7
	10/5	230,6	44,3	229,4	40,1	225,2	41,2
LEP 243	20/15	353,9	45,8	352,4	46,3	350,2	47,0
	15/10	305,0	45,3	303,4	46	299,1	47,1
	P10/5	260,7	44,9	259,4	45,6	255,6	46,7
LEP 244	20/15	370,3	46,9	368,1	47,4	365,3	48,1
	15/10	318,0	45,6	317	46,3	311,7	47,5

	10/5	272,5	44,8	270,8	45,5	266,2	46,8
LEP 283	20/15	408,6	53,9	406,5	54,7	403,6	55,6
	15/10	352,5	53,4	350,4	54,2	346,0	55,7
	10/5	301,8	52,7	300	53,6	296,2	54,9
LEP 284	20/15	413,7	54,3	411,4	54,9	408,9	55,9
	15/10	357,5	53,2	354,8	54,2	349,9	55,6
	10/5	304,8	52,8	303,5	53,6	299,3	55,1
LEP 314	20/15	457,0	61,8	454,6	62,6	451,9	63,7
	15/10	394,1	61,2	391,2	62,2	387,0	63,8
	10/5	337,4	60,9	335,4	61,7	330,8	63,3
LEP 344	20/15	498,8	66,9	496,9	67,9	492,9	69,0
	15/10	430,4	66,2	428	67,3	420,9	69,1
	10/5	368,1	65,8	366,2	66,7	360,2	68,5
LEP 374	20/15	541,9	72,2	538,1	73,1	534,9	74,3
	15/10	467,6	71,0	464,3	72,4	457,5	74,1
	10/5	400,3	70,5	397,5	71,7	391,6	73,4
LEP 424	20/15	599,9	81,1	597,8	82,1	592,5	83,4
	15/10	517,8	78,5	515,5	79,8	506,2	81,7
	10/5	444,5	76,1	443	77,2	435,9	79,1

In the heat pump performance calculation, in the 5/0 evaporator conditions, on the dissipation side a 10% glycol mixture was used; in 0/-5 conditions, a 25% glycol mixture was used. Performance of the domestic hot water circuit, namely the total heat recovery condition, is described by the condition 50/55°C.

Table IV: performance of LEP H P units in heat pump and DHW production mode.

		LEP P – LEP H					
	Tcond [°C]	30/35		40/45		50/55 (DHW)	
Size	Tev [°C]	Pf	Pa	Pf	Pa	Pf	Pa
LEP 041/2	15/10	63,9	10,7	60,2	12,8	55,3	14,9
	10/5	54,5	9,9	51,75	12,4	49	14,9
	5/0	47,2	9,8	45,2	12,4	43,2	15
	0/-5	40,6	9,8	39,25	12,45	37,9	15,1
LEP 051/2	15/10	75	12,8	70,9	15,3	66,5	18,4
	10/5	65,3	12,5	62,25	15,4	59,2	18,3
	5/0	56,4	12,2	54,4	15,15	52,4	18,1
	0/-5	48,2	11,9	47,15	14,9	46,1	17,9
LEP 061/2	15/10	85,5	14	80,5	16,9	75,3	20,5
	10/5	74,6	13,7	70,65	17	66,7	20,3
	5/0	64,6	13,4	61,7	16,75	58,8	20,1
	0/-5	55,4	13,1	53,45	16,45	51,5	19,8
LEP 071/2	15/10	96,8	16,1	91,7	19,5	86,2	23,7
	10/5	84,8	15,9	80,65	19,7	76,5	23,5
	5/0	73,9	15,6	70,75	19,45	67,6	23,3
	0/-5	63,7	15,3	61,6	19,15	59,5	23
LEP 081/2	15/10	110,8	17,6	104,4	21,4	97,5	26,4
	10/5	96,7	17,3	91,65	21,85	86,6	26,4
	5/0	84	17	80,3	21,65	76,6	26,3
	0/-5	72,2	16,9	69,8	21,55	67,4	26,2
LEP 091/2	15/10	123,5	20	116,9	24,4	109,6	30
	10/5	107,9	19,9	102,55	25	97,2	30,1
	5/0	93,6	19,8	89,75	25	85,9	30,2
	0/-5	80,5	19,7	77,95	25	75,4	30,3
LEP 111/2	15/10	148,6	23,3	140,3	28,6	131,6	35,3
	10/5	129,7	23	123,15	29,15	116,6	35,3
	5/0	112,5	22,9	107,75	29,15	103	35,4
	0/-5	96,7	22,8	93,5	29,05	90,3	35,3
LEP 131/2	15/10	169,4	26,9	160,3	33,2	150,7	41,2
	10/5	148,2	26,6	140,95	33,9	133,7	41,2
	5/0	128,7	26,4	123,45	33,75	118,2	41,1
	0/-5	110,8	26,2	107,3	33,5	103,8	40,8
LEP 141/2	15/10	194,9	31	184,3	37,9	172,4	46,5
	10/5	170,5	30,8	161,65	38,65	152,8	46,5
	5/0	148,1	30,5	141,55	38,45	135	46,4

	0/-5	127,6	30,2	123,05	38,1	118,5	46
LEP 144	15/10	195,6	32	185,5	38,7	174,1	47,1
	10/5	171,4	31,5	162,9	39,1	154,4	46,7
	5/0	149,2	31	142,85	38,65	136,5	46,3
	0/-5	128,7	30,5	124,3	38,1	119,9	45,7
LEP 161/2	15/10	218,6	35,3	206,3	42,8	192,5	52,1
	10/5	191,2	35,1	181	43,65	170,8	52,2
	5/0	166,2	34,8	158,65	43,5	151,1	52,2
	0/-5	143,3	34,5	138,1	43,25	132,9	52
LEP 164	15/10	219,8	35,4	207,1	43,1	193,9	53
	10/5	192,2	34,9	182,1	43,95	172	53
	5/0	166,7	34,4	159,45	43,65	152,2	52,9
	0/-5	143,5	33,9	138,8	43,3	134,1	52,7
LEP 181/2	15/10	259,1	41,2	244,4	49,9	227,7	60,7
	10/5	226,9	40,8	214,4	50,6	201,9	60,4
	5/0	197,2	40,2	187,85	50,2	178,5	60,2
	0/-5	169,9	39,7	163,45	49,7	157	59,7
LEP 184	15/10	252	39,6	238	48,2	222,7	59,3
	10/5	219,5	39,3	208,35	49,35	197,2	59,4
	5/0	190,2	39	182	49,35	173,8	59,7
	0/-5	163,6	39	158,05	49,45	152,5	59,9
LEP 204	15/10	272,9	43,1	258	52,9	241,7	65,2
	10/5	238,5	42,8	226,45	54	214,4	65,2
	5/0	206,6	42,6	197,9	54	189,2	65,4
	0/-5	177,5	42,4	171,75	53,95	166	65,5
LEP 214	15/10	297,5	46,4	281,3	57	263,7	70,5
	10/5	259,9	46	246,8	58,3	233,7	70,6
	5/0	225,5	45,7	215,85	58,15	206,2	70,6
	0/-5	193,8	45,5	187,4	58	181	70,5
LEP 243	15/10	337	52,3	318,1	63,4	296,4	77,3
	10/5	294,9	51,9	278,65	64,5	262,4	77,1
	5/0	256,4	51,5	243,95	64,2	231,5	76,9
	0/-5	221,2	51	212,2	63,65	203,2	76,3
LEP 244	15/10	348,7	53,1	329,5	65,4	309	81,2
	10/5	304,9	52,5	289,25	66,8	273,6	81,1
	5/0	264,6	51,9	253,1	66,5	241,6	81,1
	0/-5	228	51,6	220,05	66,1	212,1	80,6
LEP 283	15/10	389,7	62	367,3	75,1	342,4	91,3
	10/5	341,5	61,3	322,7	76,05	303,9	90,8
	5/0	297,2	60,5	283,05	75,45	268,9	90,4
	0/-5	256,7	59,7	246,8	74,7	236,9	89,7
LEP 284	15/10	393,9	62	371,7	75,6	348	92,9
	10/5	344,8	61,3	326,65	77,05	308,5	92,8
	5/0	299,4	60,8	286,1	76,65	272,8	92,5
	0/-5	258,8	60,3	249,2	76,05	239,6	91,8
LEP 314	15/10	437,6	70,9	413,8	85,8	386,3	104,3
	10/5	383,7	70,4	363,35	87,5	343	104,6
	5/0	334,6	69,7	319,15	87,2	303,7	104,7
	0/-5	288,5	69	278,05	86,6	267,6	104,2
LEP 344	15/10	477,7	76,9	451,6	93,1	420,6	113,2
	10/5	418,8	76,1	395,9	94,55	373	113
	5/0	364,7	75,3	346,7	93,9	328,7	112,5
	0/-5	315,7	74,4	301,75	92,95	287,8	111,5
LEP 374	15/10	517,2	82,9	487,7	100,4	454,8	122,2
	10/5	453,3	81,9	428,55	101,7	403,8	121,5
	5/0	394,8	80,9	376,1	100,85	357,4	120,8
	0/-5	341	79,7	328	99,8	315	119,9
LEP 424	15/10	571,4	90,7	538,5	109,7	505,6	134,7
	10/5	499,8	88,1	474,35	109,7	448,9	131,3
	5/0	435,8	85,9	416,45	106,7	397,1	127,5
	0/-5	377,5	84	363,95	104,1	350,4	124,2

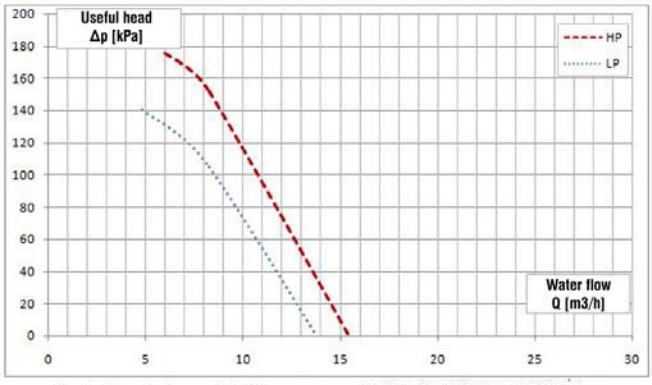
2.2 Characteristic curves of the hydraulic pumps associated to the units

The graphics displayed in this paragraph show the useful head expressed (the net value of the internal losses of the units) of the HP pumps and LP pumps in the optional hydronic module. Refer to the paragraph 4.1 “Use of glycol solutions” to assess the effect of glycol on the useful head offered by the pumps; the corrective coefficients to be applied to the curves, calculated in pure water, are carried here to facilitate consultation.

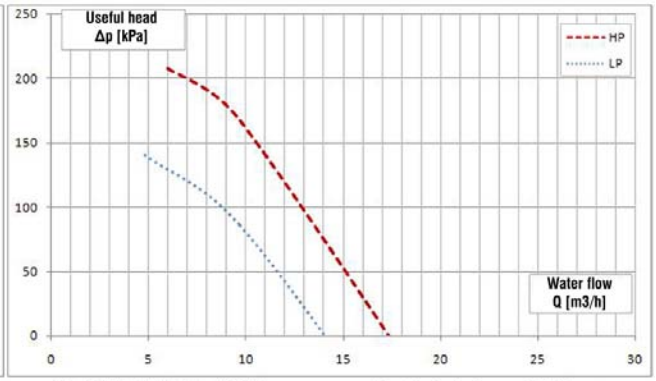
Percentage in weight of ethylene glycol	0 %	10 %	15%	25 %	30 %
Reduction percentage of useful flow rate	0 %	-5 %	-8 %	-12 %	-15 %

At the nominal flow rates listed in Tables I and II in this chapter, the low-pressure LP pumps provide 60 kPa of useful head on the utility and DHW side and 70 kPa on the dissipation side. The high-pressure HP pumps provide 140 kPa useful head for the dissipation side and utility side.

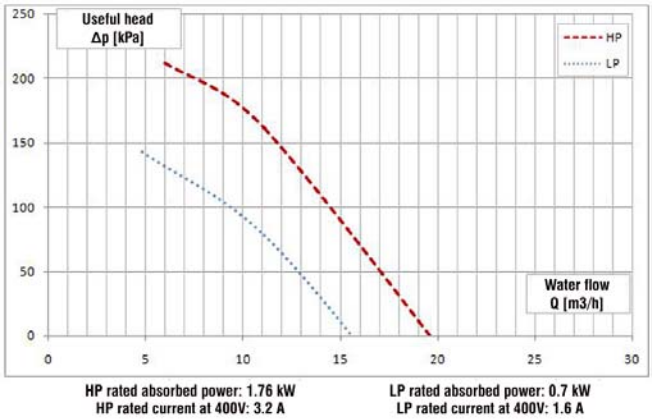
Useful head for pumps on utility side LEP 041, 042



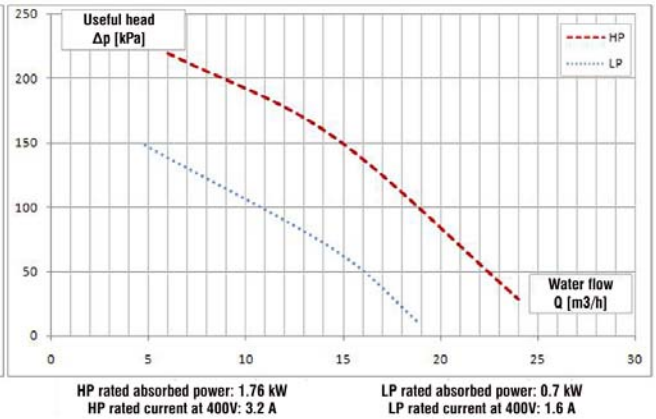
Useful head for pumps on utility side LEP 051, 052



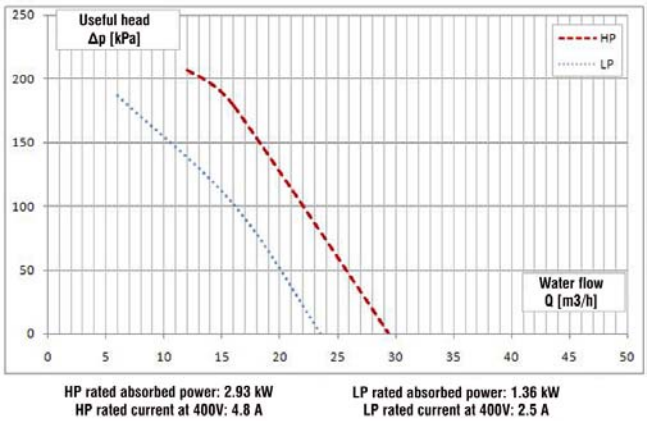
Useful head for pumps on utility side LEP 061, 062, 071, 072



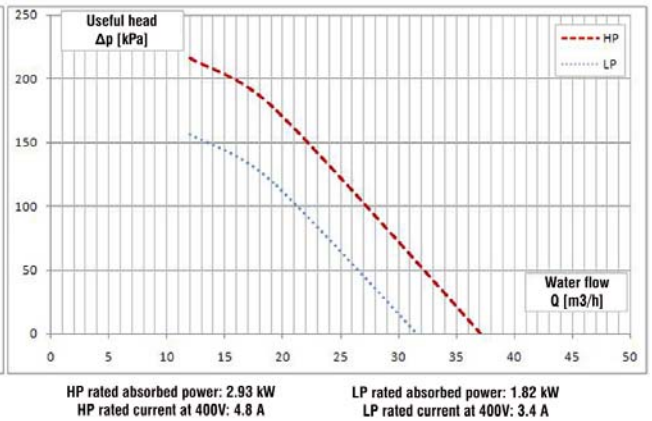
Useful head for pumps on utility side LEP 081, 082



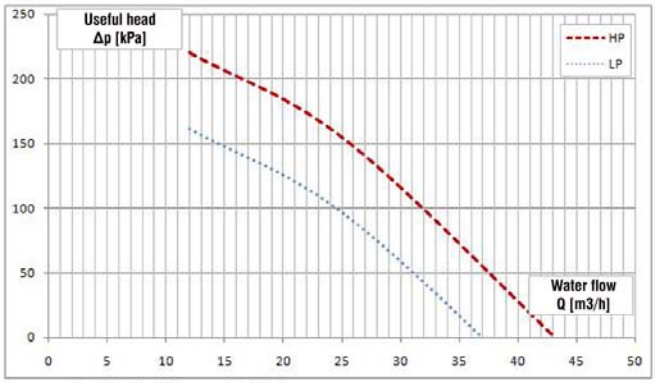
Useful head for pumps on utility side LEP 091, 092



Useful head for pumps on utility side LEP 111, 112, 131, 132



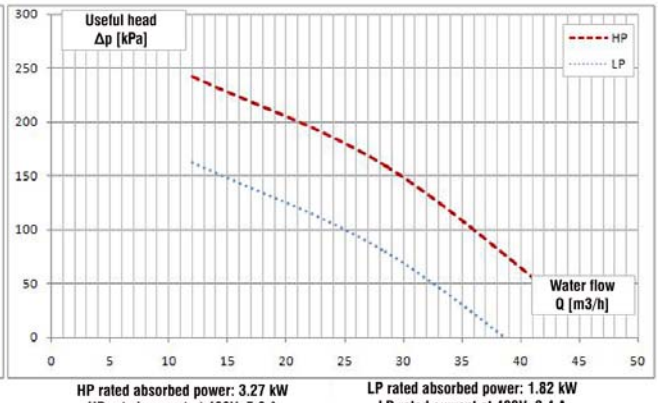
Useful head for pumps on utility side LEP 141, 142, 144



HP rated absorbed power: 2.93 kW
HP rated current at 400V: 4.8 A

LP rated absorbed power: 1.82 kW
LP rated current at 400V: 3.4 A

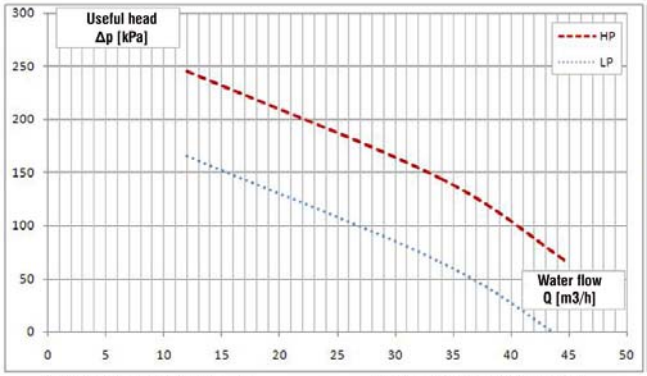
Useful head for pumps on utility side LEP 161, 162, 164



HP rated absorbed power: 3.27 kW
HP rated current at 400V: 5.6 A

LP rated absorbed power: 1.82 kW
LP rated current at 400V: 3.4 A

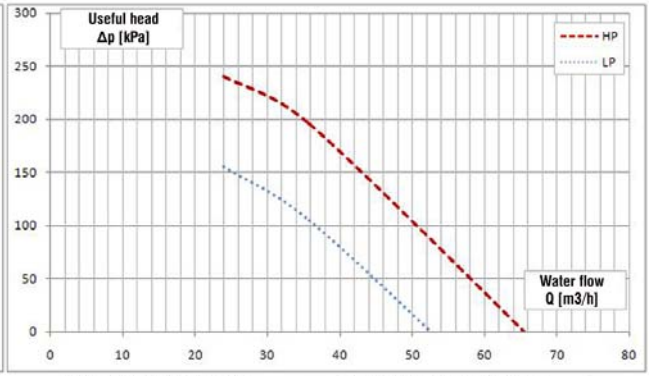
Useful head for pumps on utility side LEP 181, 182, 184



HP rated absorbed power: 3.27 kW
HP rated current at 400V: 5.6 A

LP rated absorbed power: 1.82 kW
LP rated current at 400V: 3.4 A

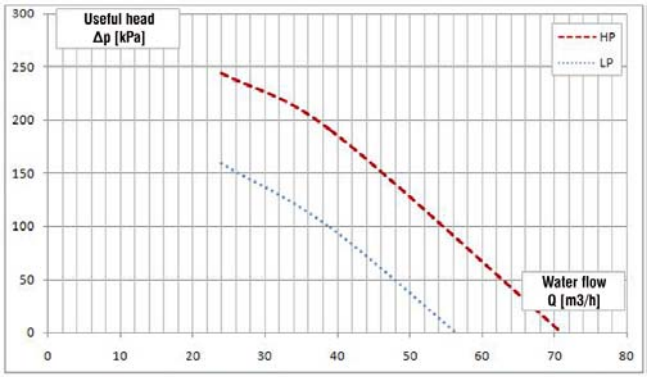
Useful head for pumps on utility side LEP 204



HP rated absorbed power: 4 kW
HP rated current at 400V: 9.2 A

LP rated absorbed power: 2.8 kW
LP rated current at 400V: 4.7 A

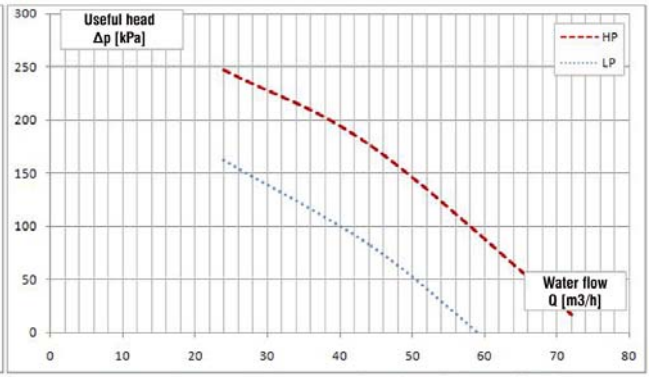
Useful head for pumps on utility side LEP 214



HP rated absorbed power: 4 kW
HP rated current at 400V: 9.2 A

LP rated absorbed power: 2.8 kW
LP rated current at 400V: 4.7 A

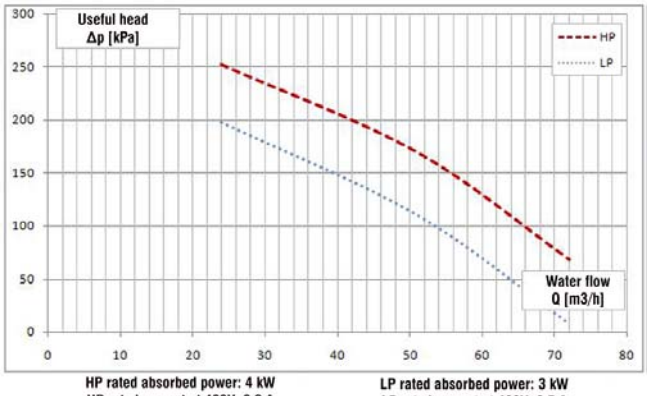
Useful head for pumps on utility side LEP 243, 244



HP rated absorbed power: 4 kW
HP rated current at 400V: 9.2 A

LP rated absorbed power: 2.8 kW
LP rated current at 400V: 4.7 A

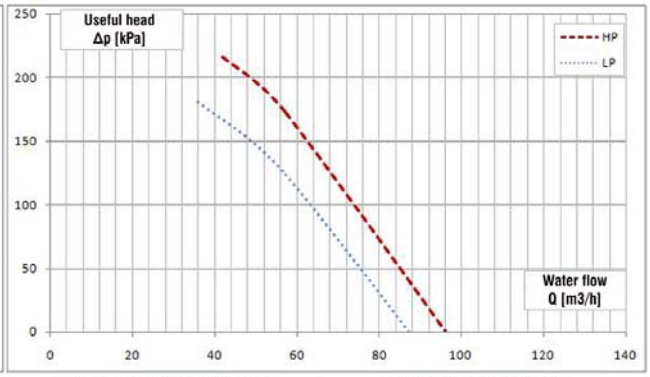
Useful head for pumps on utility side LEP 283, 284



HP rated absorbed power: 4 kW
HP rated current at 400V: 9.2 A

LP rated absorbed power: 3 kW
LP rated current at 400V: 6.5 A

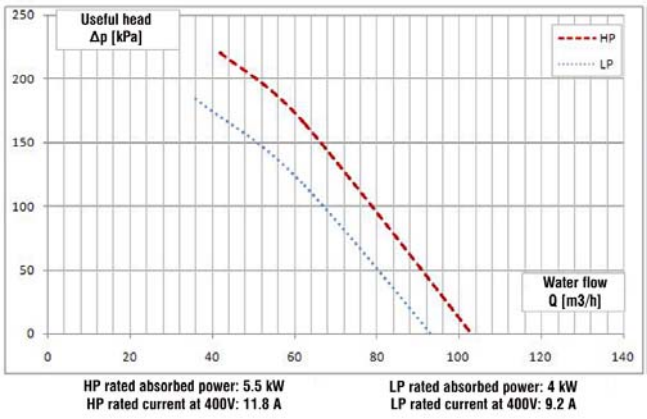
Useful head for pumps on utility side LEP 314



HP rated absorbed power: 5.5 kW
HP rated current at 400V: 11.8 A

LP rated absorbed power: 4 kW
LP rated current at 400V: 9.2 A

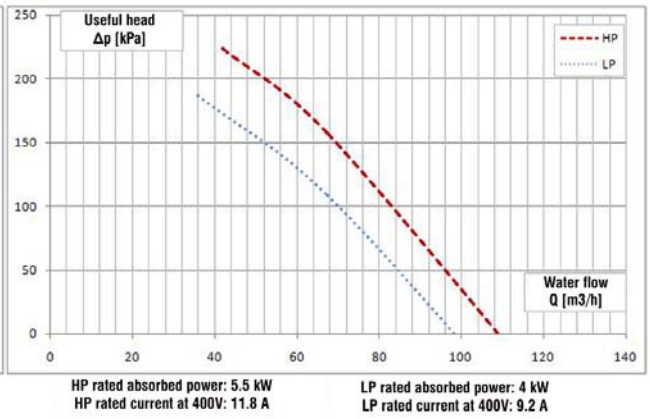
Useful head for pumps on utility side LEP 344



HP rated absorbed power: 5.5 kW
HP rated current at 400V: 11.8 A

LP rated absorbed power: 4 kW
LP rated current at 400V: 9.2 A

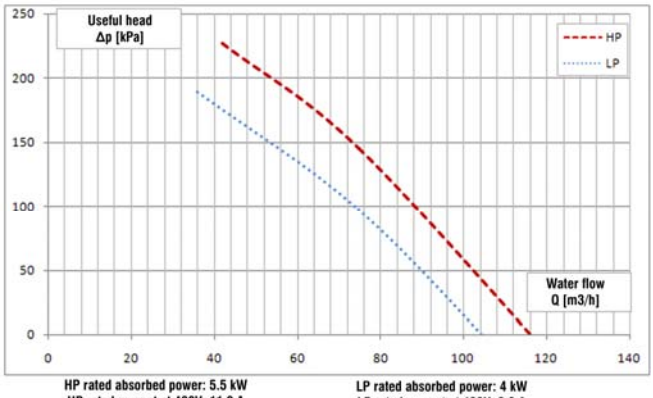
Useful head for pumps on utility side LEP 374



HP rated absorbed power: 5.5 kW
HP rated current at 400V: 11.8 A

LP rated absorbed power: 4 kW
LP rated current at 400V: 9.2 A

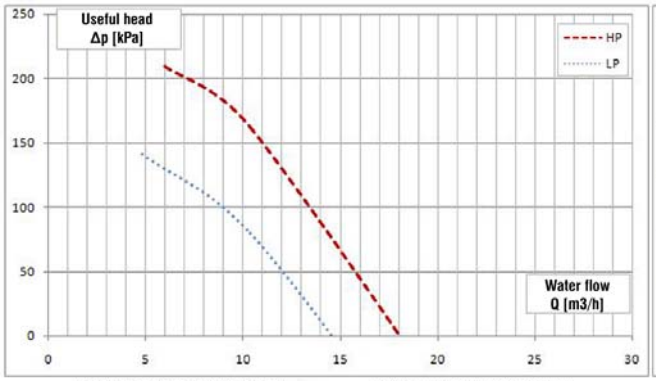
Useful head for pumps on utility side LEP 424



HP rated absorbed power: 5.5 kW
HP rated current at 400V: 11.8 A

LP rated absorbed power: 4 kW
LP rated current at 400V: 9.2 A

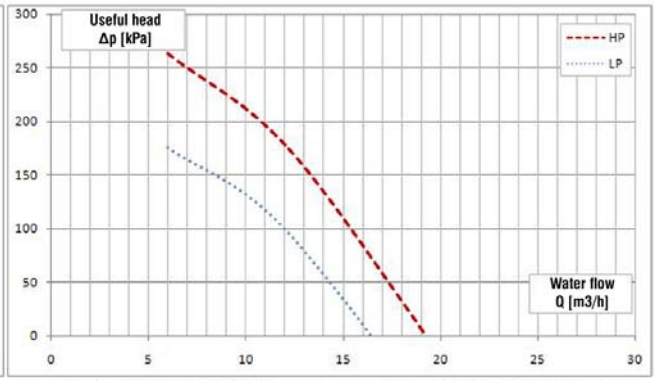
Useful head for pumps on dissipation side LEP 041, 042



HP rated absorbed power: 1.76 kW
HP rated current at 400V: 3.2 A

LP rated absorbed power: 0.7 kW
LP rated current at 400V: 1.6 A

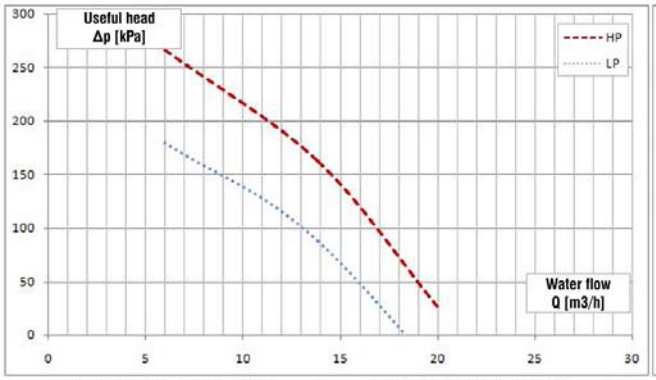
Useful head for pumps on dissipation side LEP 051, 052



HP rated absorbed power: 1.5 kW
HP rated current at 400V: 3.4 A

LP rated absorbed power: 1.36 kW
LP rated current at 400V: 2.5 A

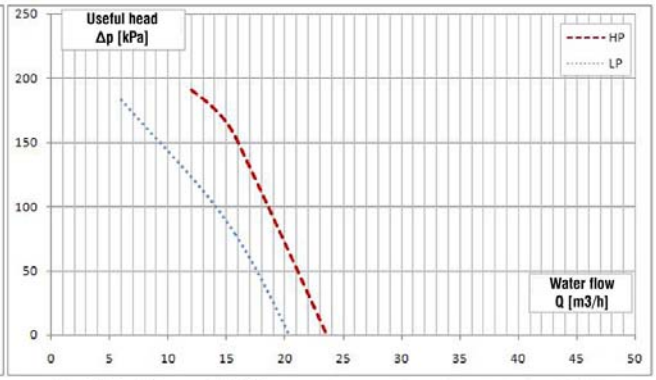
Useful head for pumps on dissipation side LEP 061, 062



HP rated absorbed power: 1.5 kW
HP rated current at 400V: 3.4 A

LP rated absorbed power: 1.36 kW
LP rated current at 400V: 2.5 A

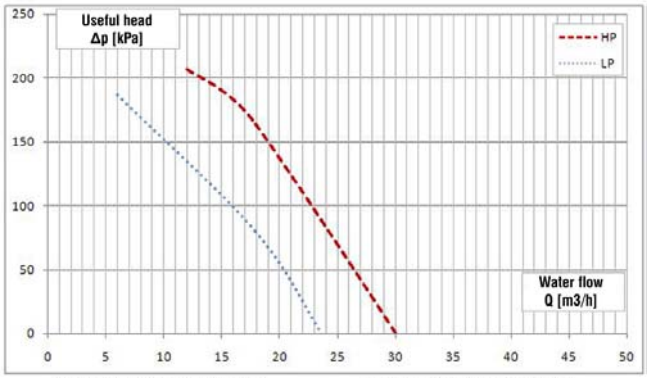
Useful head for pumps on dissipation side LEP 071, 072



HP rated absorbed power: 2.93 kW
HP rated current at 400V: 4.8 A

LP rated absorbed power: 1.36 kW
LP rated current at 400V: 2.5 A

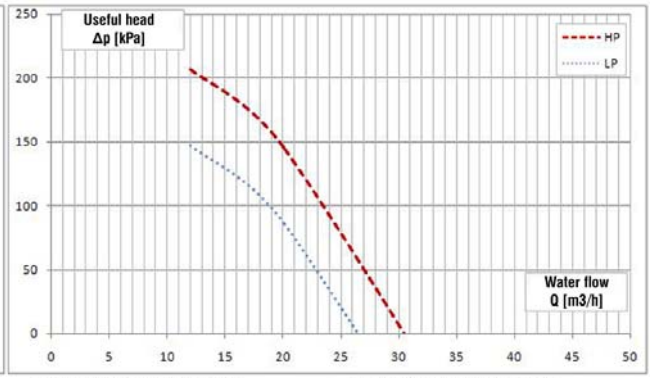
Useful head for pumps on dissipation side LEP 081, 082



HP rated absorbed power: 2.93 kW
HP rated current at 400V: 4.8 A

LP rated absorbed power: 1.36 kW
LP rated current at 400V: 2.5 A

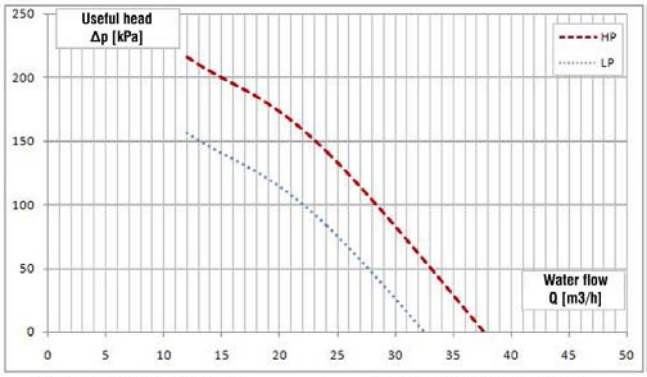
Useful head for pumps on dissipation side LEP 091, 092



HP rated absorbed power: 2.93 kW
HP rated current at 400V: 4.8 A

LP rated absorbed power: 1.82 kW
LP rated current at 400V: 3.4 A

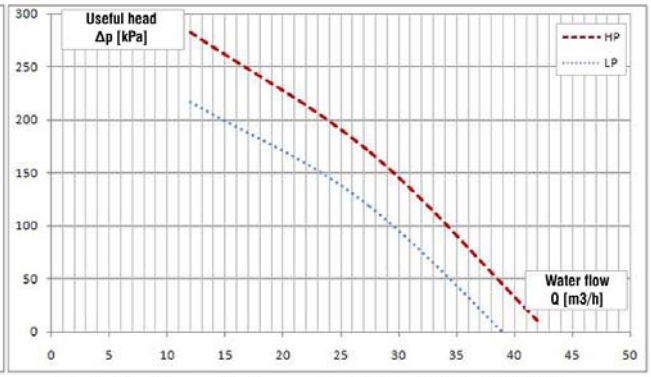
Useful head for pumps on dissipation side LEP 111, 112



HP rated absorbed power: 2.93 kW
HP rated current at 400V: 4.8 A

LP rated absorbed power: 1.82 kW
LP rated current at 400V: 3.4 A

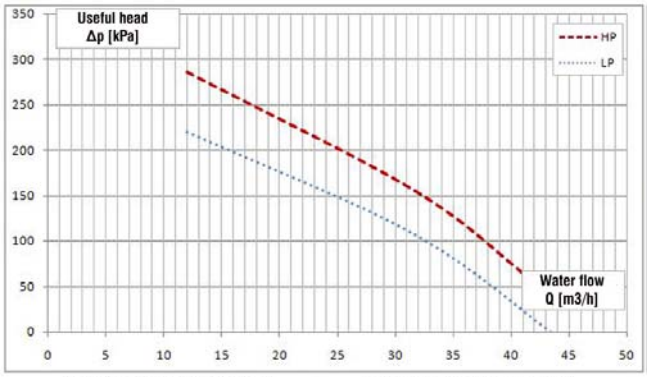
Useful head for pumps on dissipation side LEP 131, 132



HP rated absorbed power: 3.7 kW
HP rated current at 400V: 6.8 A

LP rated absorbed power: 2.93 kW
LP rated current at 400V: 4.8 A

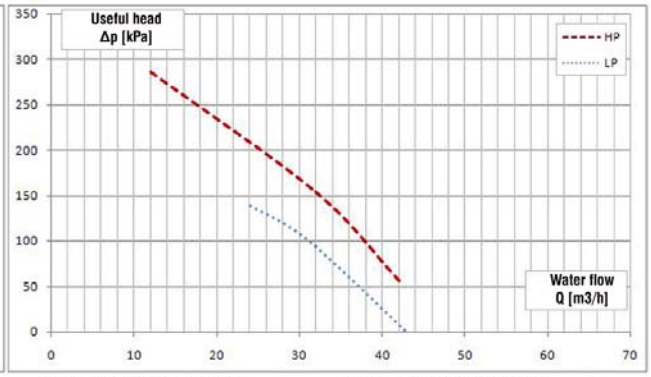
Useful head for pumps on dissipation side LEP 141, 142



HP rated absorbed power: 3.7 kW
HP rated current at 400V: 6.8 A

LP rated absorbed power: 2.93 kW
LP rated current at 400V: 4.8 A

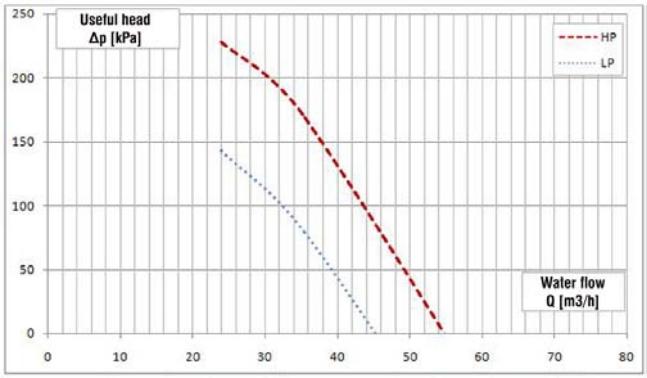
Useful head for pumps on dissipation side LEP 144



HP rated absorbed power: 3.7 kW
HP rated current at 400V: 6.8 A

LP rated absorbed power: 2.8 kW
LP rated current at 400V: 4.7 A

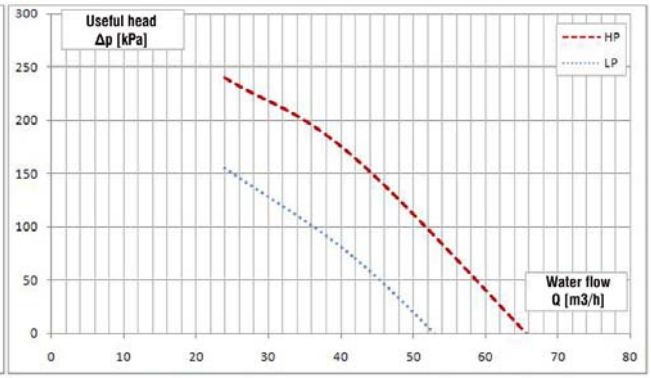
Useful head for pumps on dissipation side LEP 161, 162, 164



HP rated absorbed power: 4 kW
HP rated current at 400V: 9.2 A

LP rated absorbed power: 2.8 kW
LP rated current at 400V: 4.7 A

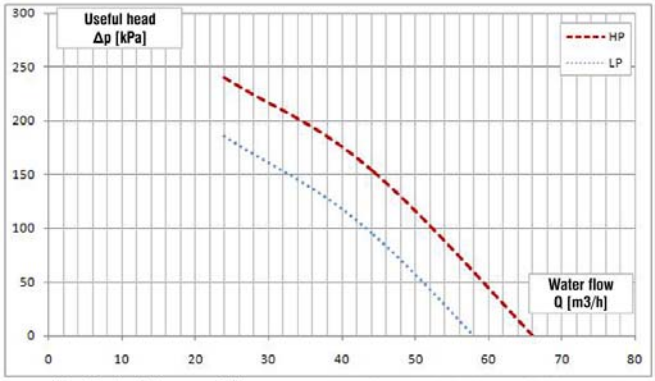
Useful head for pumps on dissipation side LEP 181, 182, 184



HP rated absorbed power: 4 kW
HP rated current at 400V: 9.2 A

LP rated absorbed power: 2.8 kW
LP rated current at 400V: 4.7 A

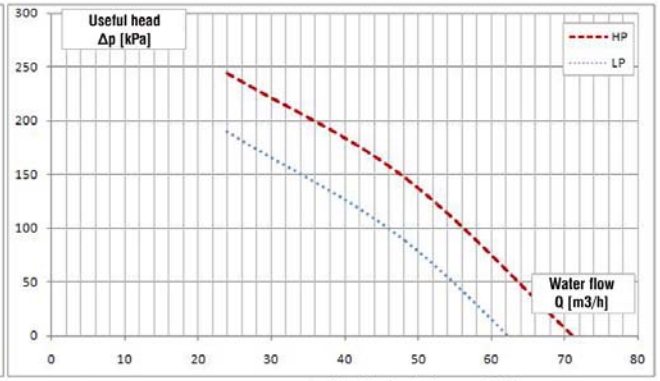
Useful head for pumps on dissipation side LEP 204



HP rated absorbed power: 4 kW
HP rated current at 400V: 9.2 A

LP rated absorbed power: 3 kW
LP rated current at 400V: 6.5 A

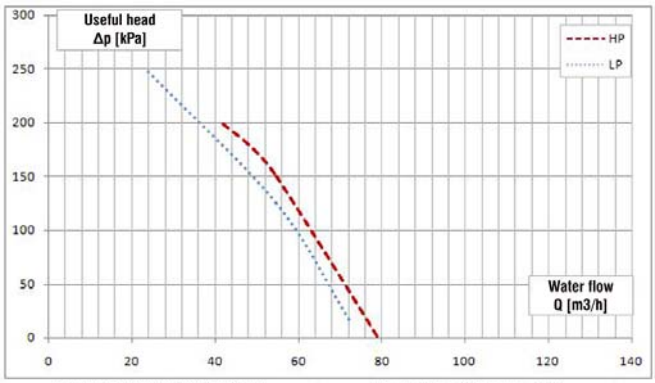
Useful head for pumps on dissipation side LEP 214



HP rated absorbed power: 4 kW
HP rated current at 400V: 9.2 A

LP rated absorbed power: 3 kW
LP rated current at 400V: 6.5 A

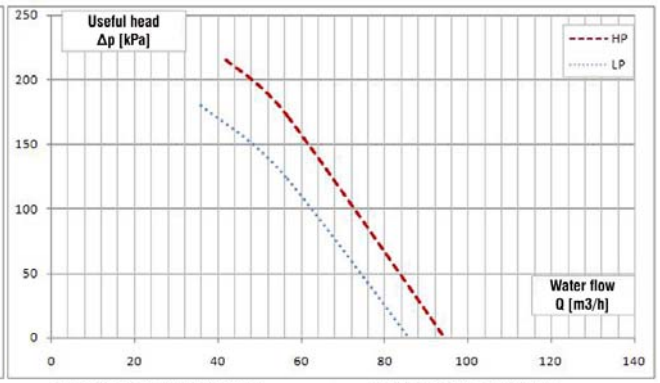
Useful head for pumps on dissipation side LEP 243



HP rated absorbed power: 5.5 kW
HP rated current at 400V: 11.8 A

LP rated absorbed power: 4 kW
LP rated current at 400V: 9.2 A

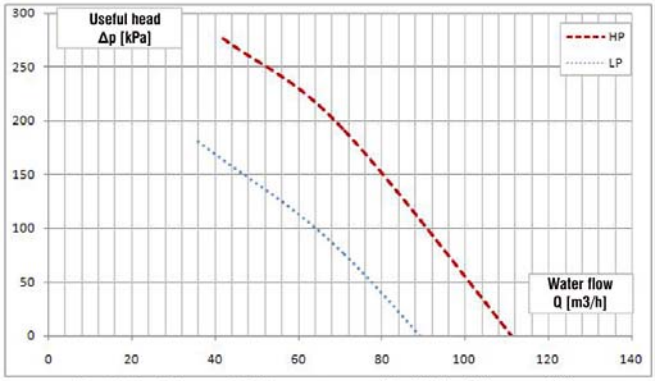
Useful head for pumps on dissipation side LEP 244, 283, 284



HP rated absorbed power: 5.5 kW
HP rated current at 400V: 11.8 A

LP rated absorbed power: 4 kW
LP rated current at 400V: 9.2 A

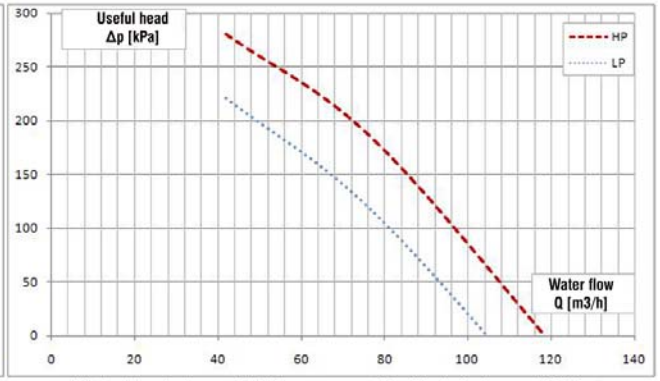
Useful head for pumps on dissipation side LEP 314



HP rated absorbed power: 7.5 kW
HP rated current at 400V: 15.7 A

LP rated absorbed power: 4 kW
LP rated current at 400V: 9.2 A

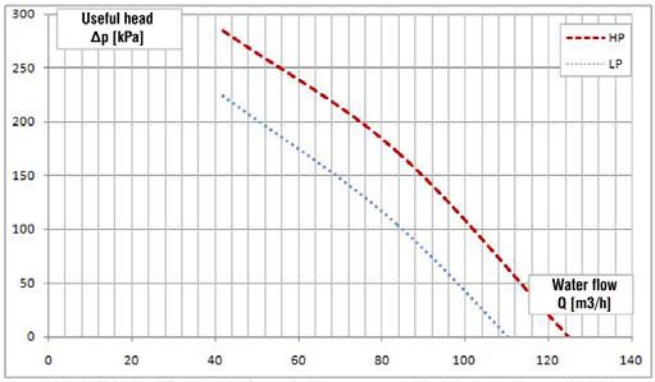
Useful head for pumps on dissipation side LEP 344



HP rated absorbed power: 7.5 kW
HP rated current at 400V: 15.7 A

LP rated absorbed power: 5.5 kW
LP rated current at 400V: 11.8 A

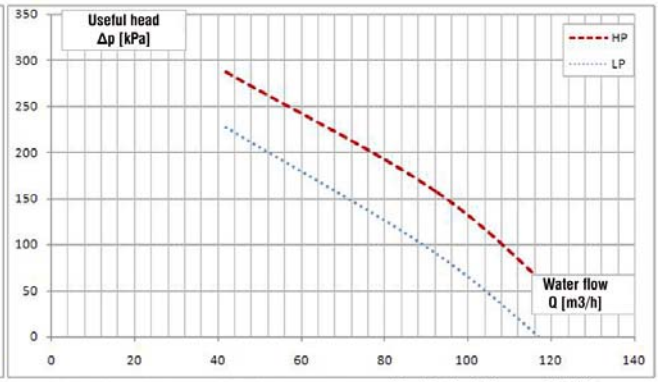
Useful head for pumps on dissipation side LEP 374



HP rated absorbed power: 7.5 kW
HP rated current at 400V: 15.7 A

LP rated absorbed power: 5.5 kW
LP rated current at 400V: 11.8 A

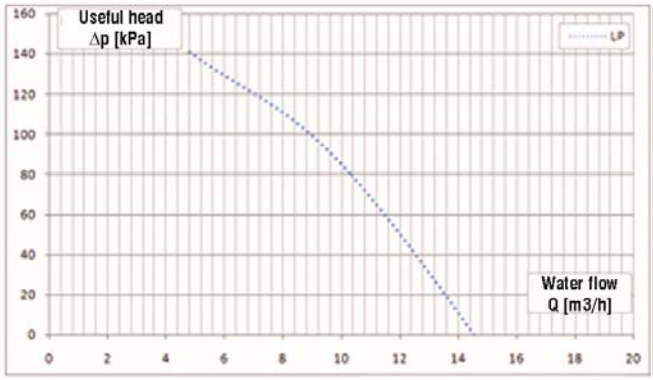
Useful head for pumps on dissipation side LEP 424



HP rated absorbed power: 7.5 kW
HP rated current at 400V: 15.7 A

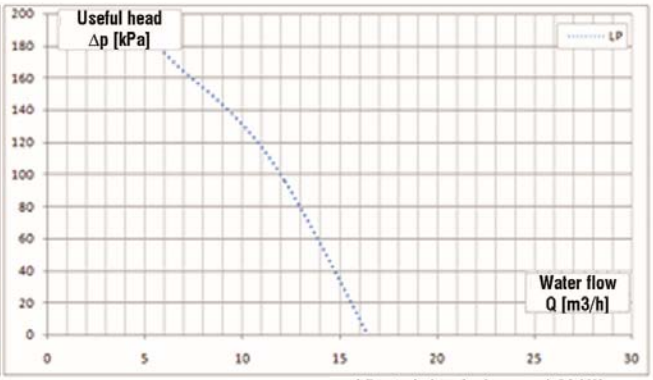
LP rated absorbed power: 5.5 kW
LP rated current at 400V: 11.8 A

Useful head for pumps on DHW side LEP 041, 042



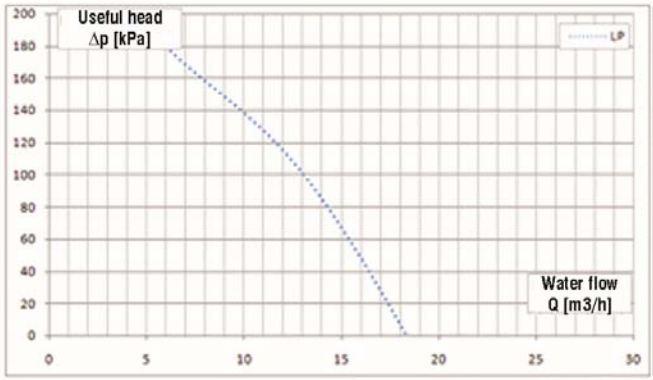
LP rated absorbed power: 0,7 kW
LP rated current at 400V: 1,6 A

Useful head for pumps on DHW side LEP 051, 052



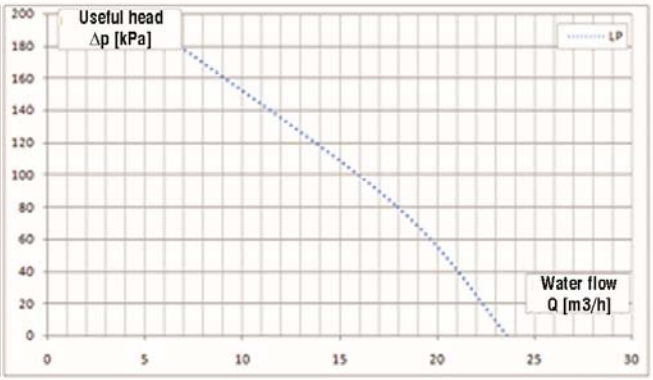
LP rated absorbed power:1,36 kW
LP rated current at 400V: 2,5 A

Useful head for pumps on DHW side LEP 061, 062, 071, 072



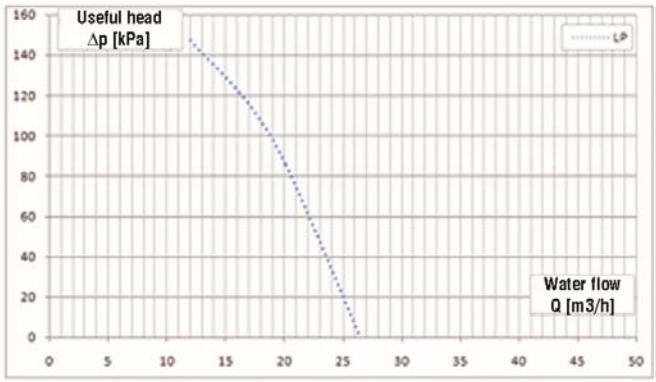
LP rated absorbed power:1,36 kW
LP rated current at 400V: 2,5 A

Useful head for pumps on DHW side LEP 081, 082



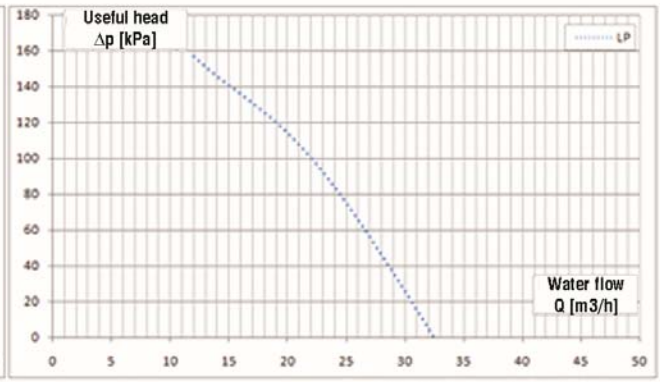
LP rated absorbed power:1,36 kW
LP rated current at 400V: 2,5 A

Useful head for pumps on DHW side LEP 091, 092



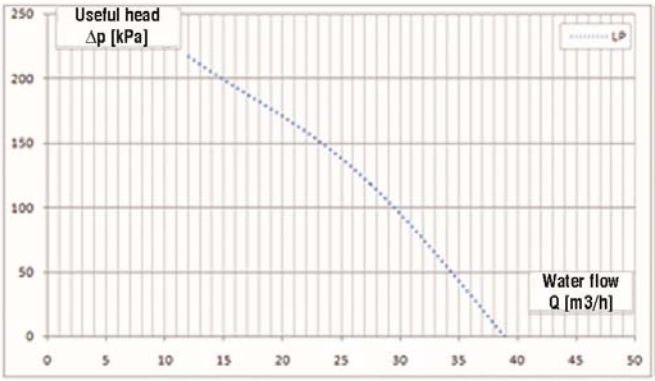
LP rated absorbed power:1,82 kW
LP rated current at 400V: 3,4 A

Useful head for pumps on DHW side LEP 111, 112



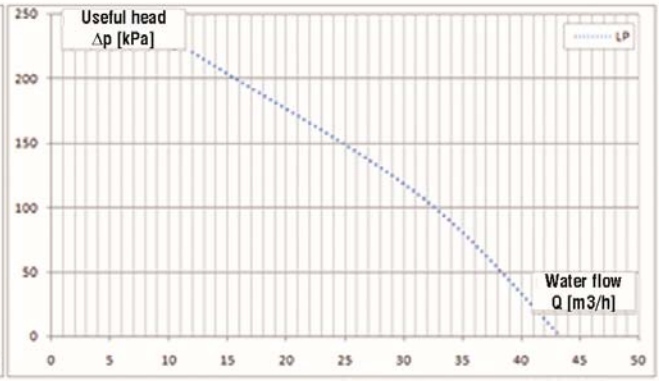
LP rated absorbed power:1,82 kW
LP rated current at 400V: 3,4 A

Useful head for pumps on DHW side LEP 131, 132



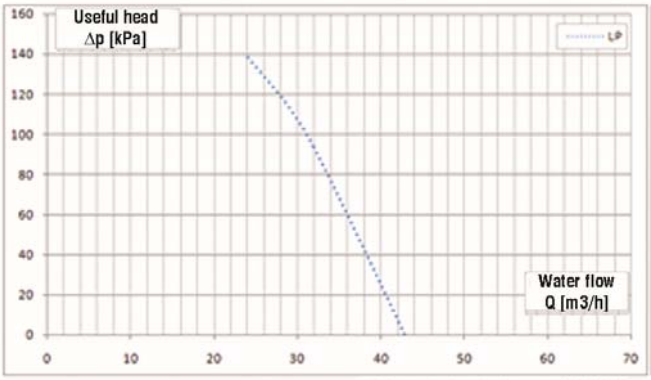
LP rated absorbed power: 2,93 kW
LP rated current at 400V: 4,8 A

Useful head for pumps on DHW side LEP 141, 142



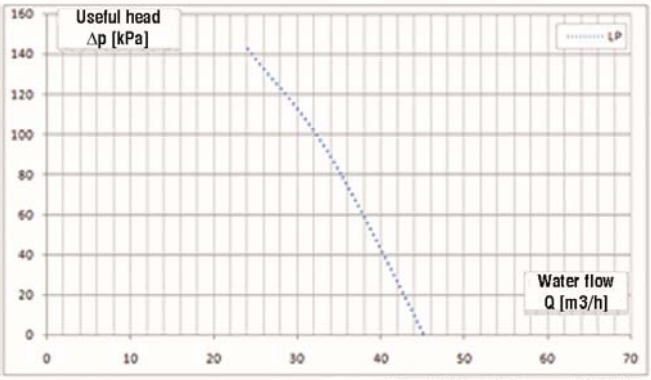
LP rated absorbed power: 2,93 kW
LP rated current at 400V: 4,8 A

Useful head for pumps on DHW side LEP 144



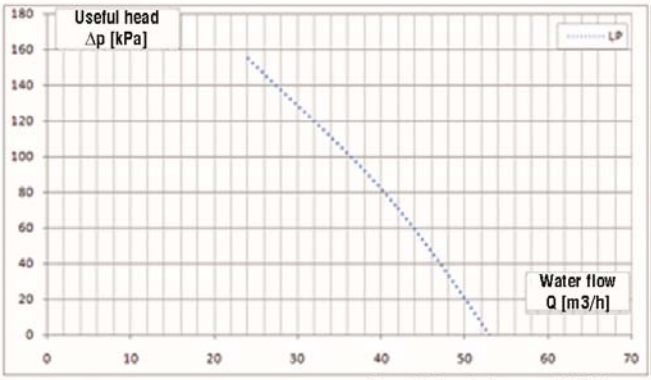
LP rated absorbed power: 2,8 kW
LP rated current at 400V: 4,7 A

Useful head for pumps on DHW side LEP 161, 162, 164



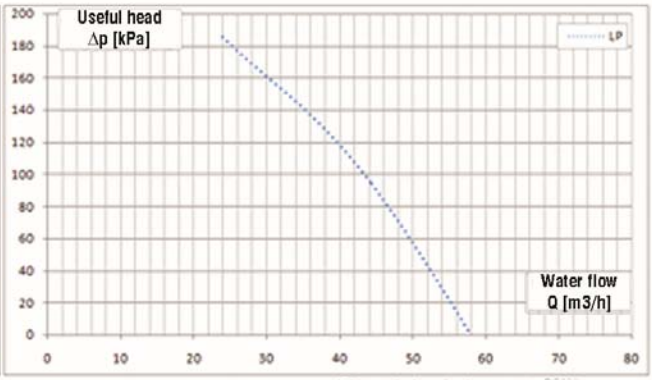
LP rated absorbed power: 2,8 kW
LP rated current at 400V: 4,7 A

Useful head for pumps on DHW side LEP 181, 182, 184



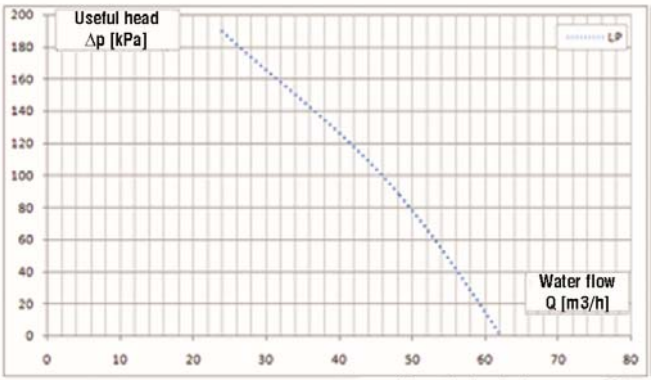
LP rated absorbed power: 2,8 kW
LP rated current at 400V: 4,7 A

Useful head for pumps on DHW side LEP 204



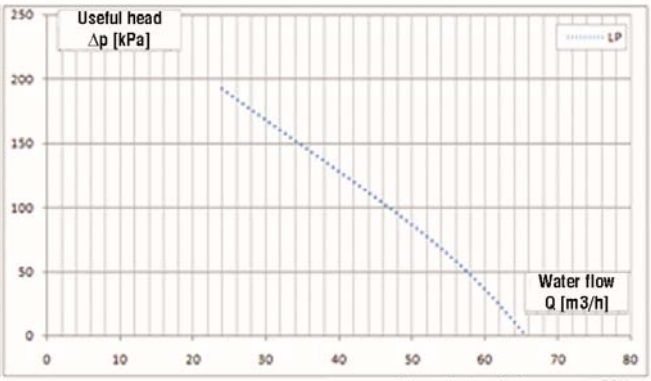
LP rated absorbed power: 3 kW
LP rated current at 400V: 6,5 A

Useful head for pumps on DHW side LEP 214



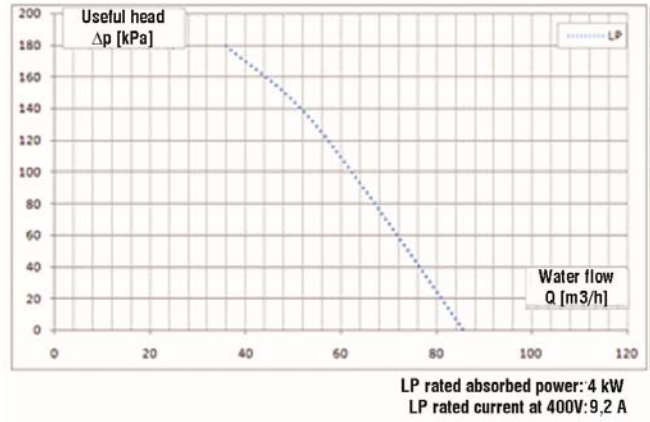
LP rated absorbed power: 3 kW
LP rated current at 400V: 6,5 A

Useful head for pumps on DHW side LEP 243

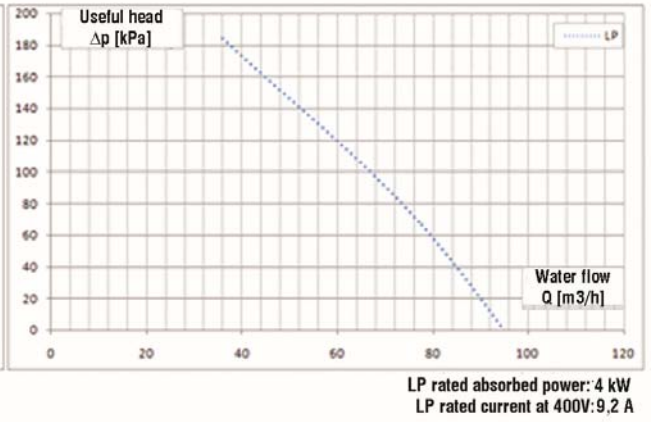


LP rated absorbed power: 3 kW
LP rated current at 400V: 6,5 A

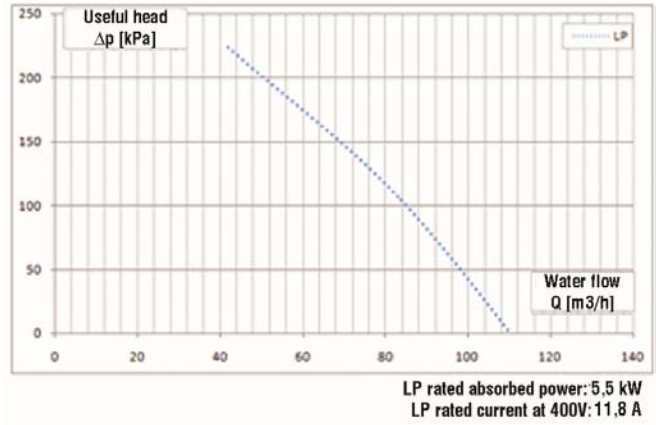
Useful head for pumps on DHW side LEP 244, 283, 284, 314



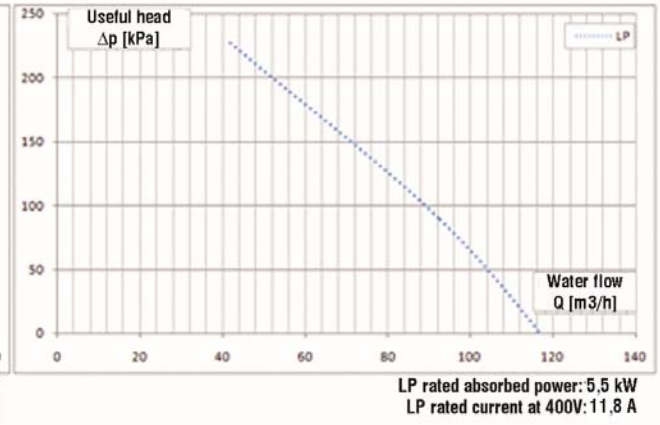
Useful head for pumps on DHW side LEP 344



Useful head for pumps on DHW side LEP 374



Useful head for pumps on DHW side LEP 424



2.3 Noise emission

WE units have been built in a fully faired framework making the assembly extremely silent. They can therefore be installed in open environments without needing to be closed off. All sizes of the WE series are available in the standard "S" set-up or the "L" (Low-noise) soundproof set-up, covering the compressor and outer panelling with soundproof material.

Table V: noise emissions of LEP units: Lw: Sound power Lp: Sound pressure

	Sizes:	040	050	060	070	080	090	110	130	140	160	180	200	210	240	280	310	340	370	420
Lw [db(A)]	Standard version	72	72	73	73	74	76	76	77	80	80	81	81	81	82	82	82	83	83	83
	Low-Noise version	68	68	69	69	70	72	72	73	76	76	77	77	77	78	78	78	79	79	79
Lp [db(A)] @ 10 m	Standard version	44	44	45	45	46	48	48	49	52	52	53	53	53	54	54	54	55	55	55
	Low-Noise version	40	40	41	41	42	44	44	45	48	48	49	49	49	50	50	50	51	51	51
Lp [db(A)] @ 5 m	**Standard version**	50	50	51	51	52	54	54	55	58	58	59	59	59	60	60	60	61	61	61
	Low-Noise version	46	46	47	47	48	50	50	51	54	54	55	55	55	56	56	56	57	57	57

2.4 Overall dimensions and weight

The LEP product range consists in different frames. In the following paragraph, the overall drawings of the LEP models and their optional modules are attached. They can be referred to directly when consulting the identification codes carried in the tables in this paragraph. The tables below list the weights, reference drawings and overall dimensions of all the LEP models as well as their optional hydraulic modules. The overall drawings of reference are displayed in the following paragraph.

Table VI: overall dimensions of frames of main units (F_) and optional hydraulic modules (M_) used in LEP range

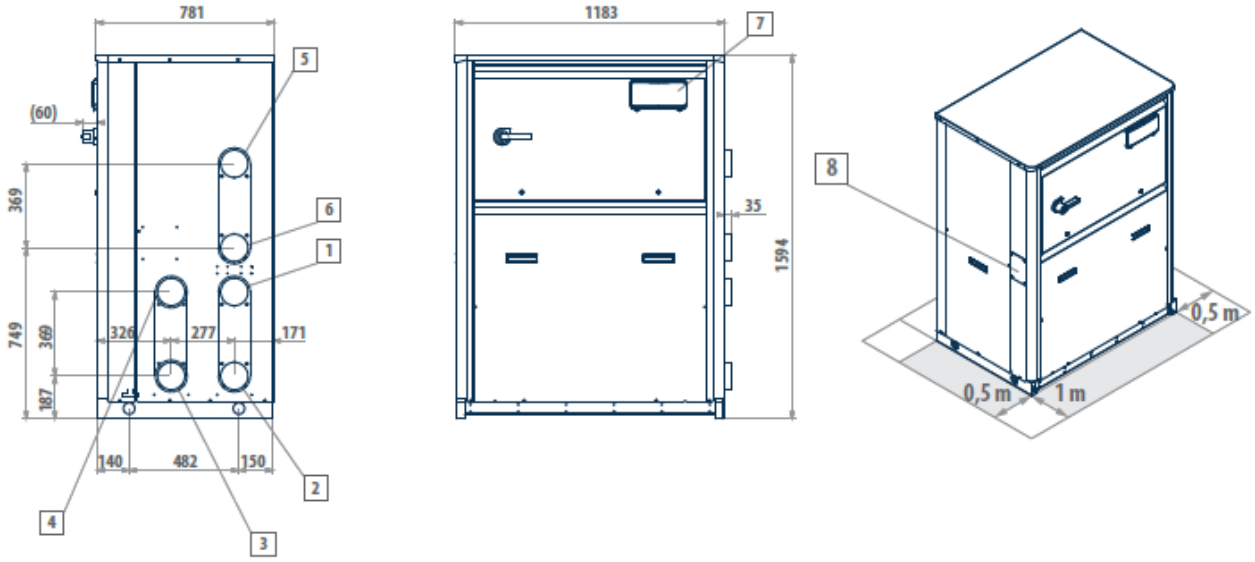
Frame of main unit	Height (H)	Width (L)	Depth (P)
F1	1594	1183	781
F2	1594	1653	781
F3	1854	2383	881
F4	1855	3130	881

Table VII: weight of the LEP units.

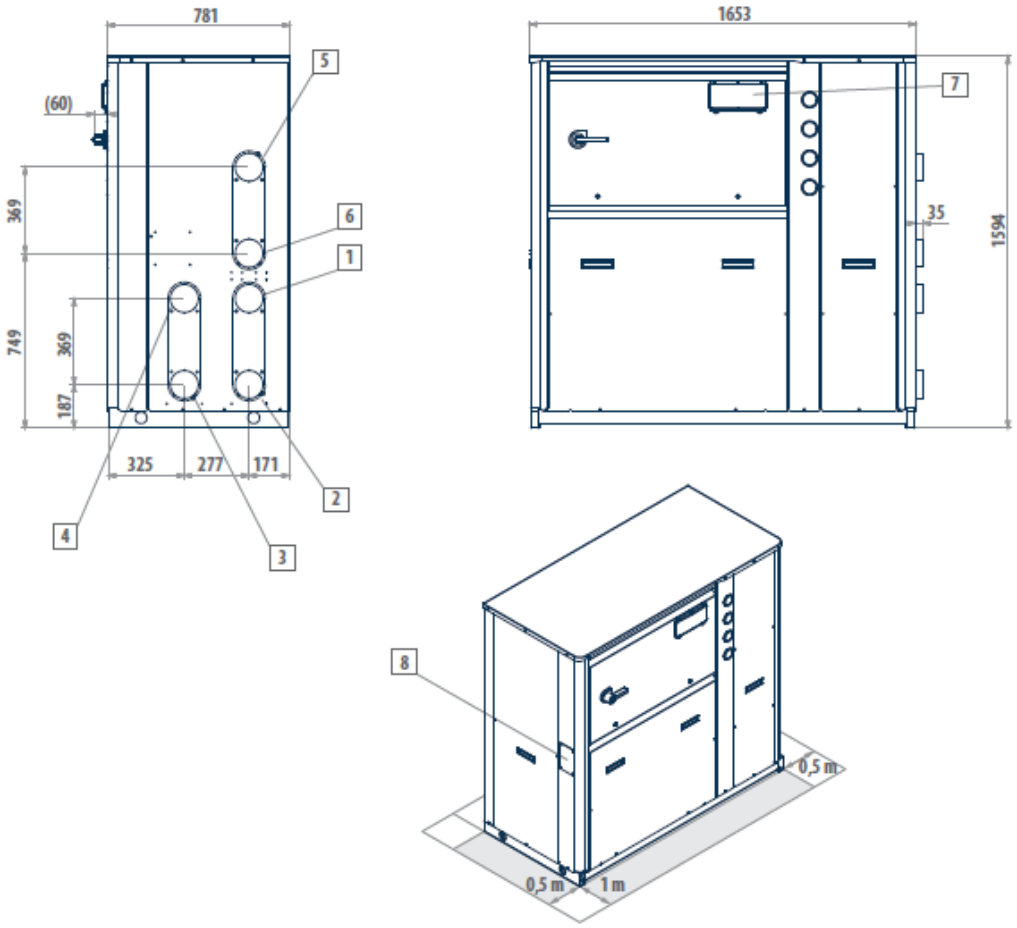
Model:	040	050	060	070	080	090	110	130	140	160	180	200	210	240	280	310	340	370	420
Frame 1	410	420	450	460	490	510													
Frame 2							690	700	770	830	890								
Frame 3									1010	1050	1130								
Frame 4												1280	1350	1840	1940	2040	2110	2180	2380

2.5 Overall Drawings

Frame 1



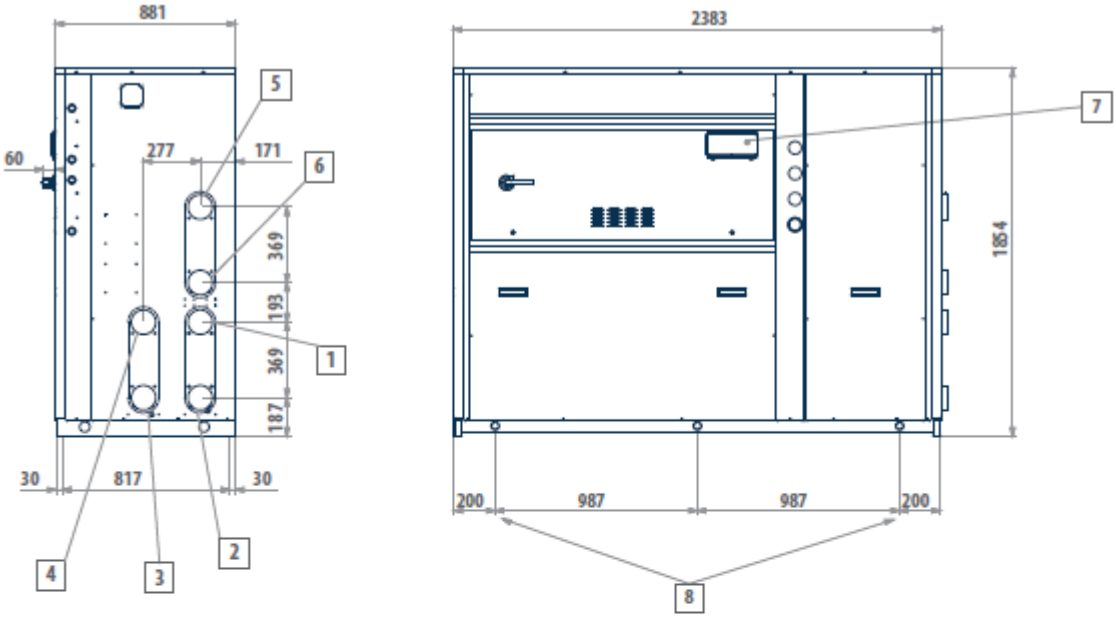
1 User side - inlet (Victaulic 2½")
2 User side - outlet (Victaulic 2½")
3 DHW side - inlet (Victaulic 2½")
4 DHW side - outlet (Victaulic 2½")
5 Dissipation side - inlet (Victaulic 2½")
6 Dissipation side - outlet (Victaulic 2½")
7 User interface
8 Power supply input

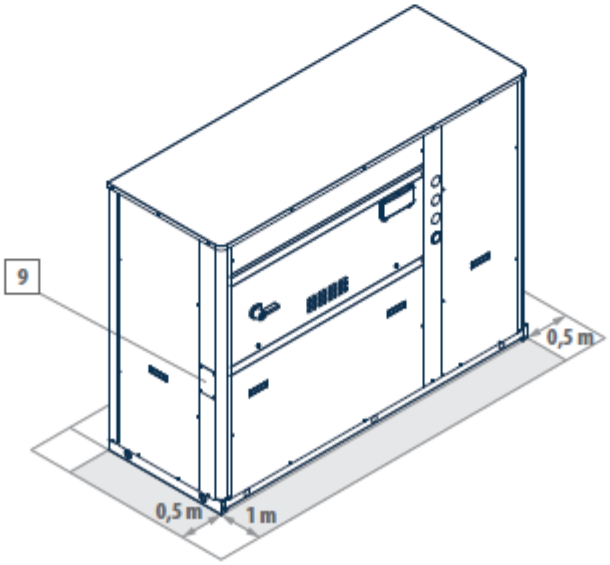


1 User side - inlet (Victaulic 2½")
2 User side - outlet (Victaulic 2½")
3 DHW side - inlet (Victaulic 2½")
4 DHW side - outlet (Victaulic 2½")
5 Dissipation side - inlet (Victaulic 2½")
6 Dissipation side - outlet (Victaulic 2½")
7 User interface
8 Power supply input

Model	Version
LEP 112	M-P S-L
LEP 132	M-P S-L
LEP 142	M-P S-L
LEP 162	M-P S-L
LEP 182	M-P S-L

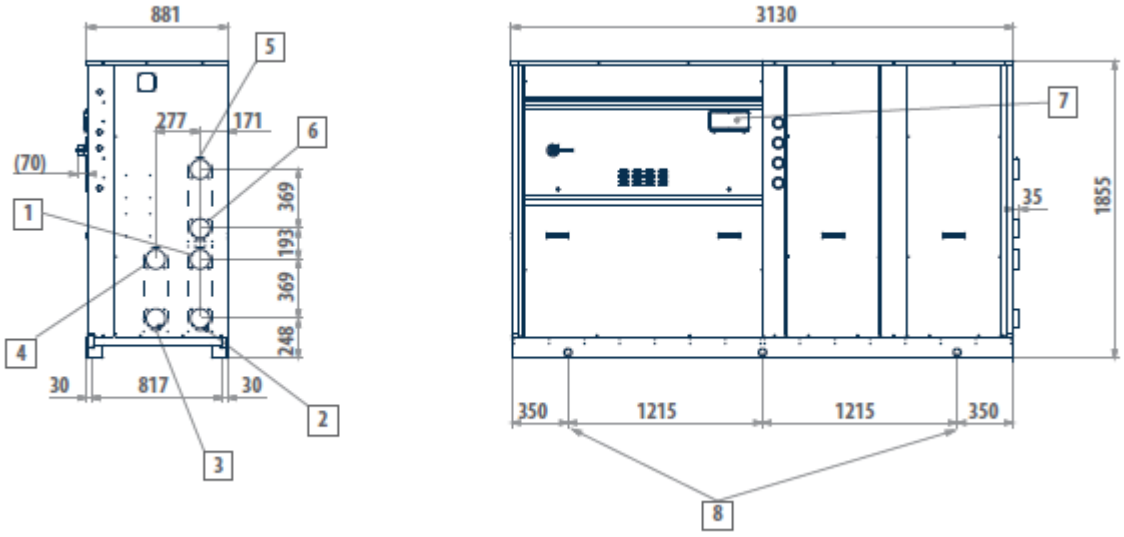
Frame 3

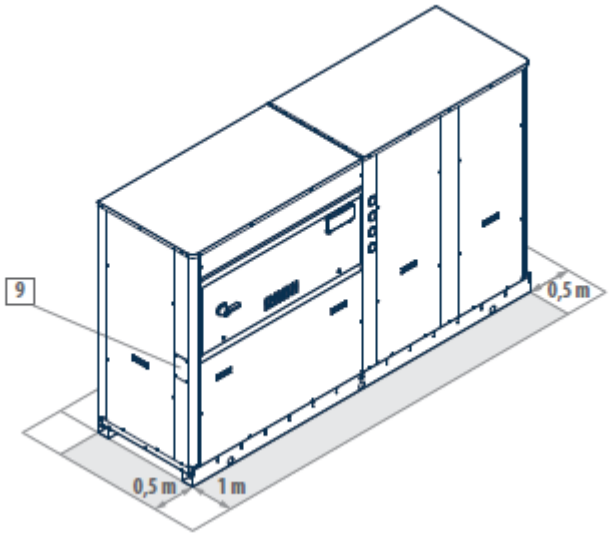




1 User side - inlet (Victaulic 2½")
2 User side - outlet (Victaulic 2½")
3 DHW side - inlet (Victaulic 2½")
4 DHW side - outlet (Victaulic 2½")
5 Dissipation side - inlet (Victaulic 2½")
6 Dissipation side - outlet (Victaulic 2½")
7 User interface
8 Fastening points
9 Power supply input

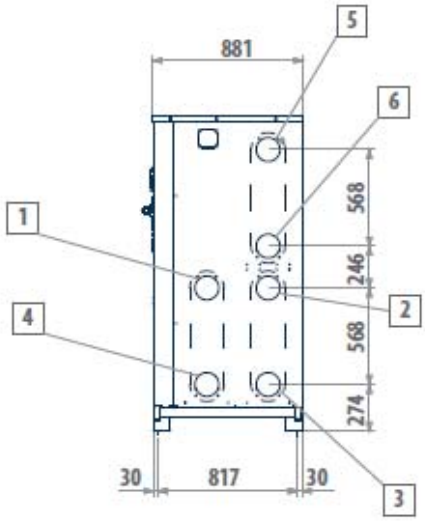
Model	**Version**
LEP 144	M-P S-L
LEP 164	M-P S-L
LEP 184	M-P S-L

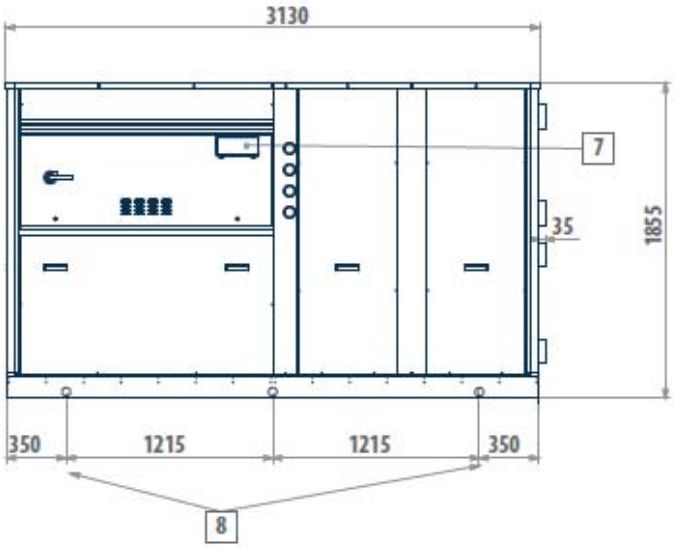


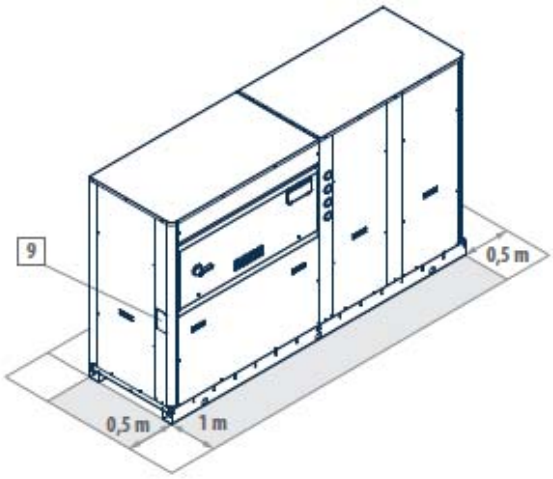


1 User side - inlet (Victaulic 2½")
2 User side - outlet (Victaulic 2½")
3 DHW side - inlet (Victaulic 2½")
4 DHW side - outlet (Victaulic 2½")
5 Dissipation side - inlet (Victaulic 2½")
6 Dissipation side - outlet (Victaulic 2½")
7 User interface
8 Fastening points
9 Power supply input

Model	**Version**
LEP 204	M-P S-L
LEP 214	M-P S-L







1 User side - inlet (Victaulic 2½")
2 User side - outlet (Victaulic 2½")
3 DHW side - inlet (Victaulic 2½")
4 DHW side - outlet (Victaulic 2½")
5 Dissipation side - inlet (Victaulic 2½")
6 Dissipation side - outlet (Victaulic 2½")
7 User interface
8 Fastening points
9 Power supply input

Model	Version
LEP 243	M-P S-L
LEP 244	M-P S-L
LEP 283	M-P S-L
LEP 284	M-P S-L
LEP 314	M-P S-L
LEP 344	M-P S-L
LEP 374	M-P S-L
LEP 424	M-P S-L

3 Installation

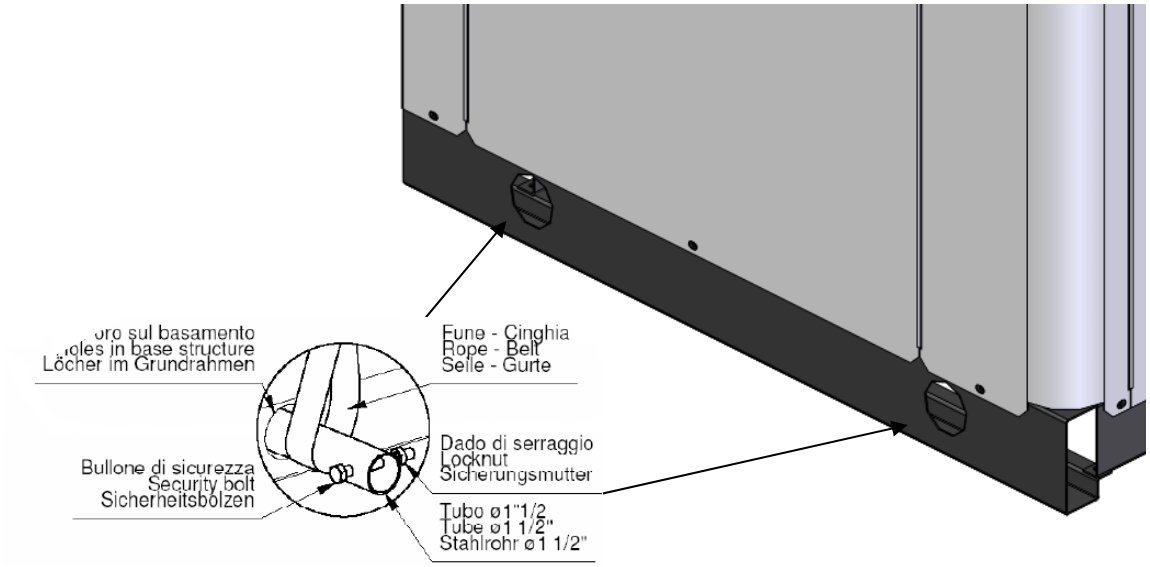
3.1 Preliminary procedures

Upon receiving the unit, check that it is perfectly intact: the chiller left the factory in perfect conditions; immediately report any signs of damage to the carrier and note them on the Delivery Slip before signing it.
Galletti or its Agent must be promptly notified concerning the extent and type of damage.
The Customer must submit a written report describing every significant sign of damage.

3.1.1 Lifting and conveyance

While the unit is being unloaded and positioned, utmost care must be taken to avoid abrupt or violent manoeuvres. The unit must be handled carefully and gently. Avoid using machine components as anchorages when lifting or moving it.
The unit should be lifted using Ø1½" GAS steel pipes at least 3mm thick, to be inserted in the holes provided on the base side members (see fig. below) and identified by means of stickers. The pipes, which should protrude by at least 300mm on every side, must be slung with ropes of equal length secured to the lifting hook (provide stops at the ends of the pipes to prevent the ropes from slipping off due to the weight).
Use ropes or belts long enough to extend beyond the height of the unit and place spacer bars and boards on the top of the unit to avoid damaging the sides and top of the unit itself.

Attention: In all lifting operations make sure that the unit is securely anchored in order to prevent accidental falls or overturning.



3.1.2 Unpacking

The packing must be carefully removed to avoid the risk of damaging the unit. Different packing materials are used: wood, cardboard, nylon etc. It is recommended to keep them separately and deliver them to suitable waste disposal or recycling facilities in order to minimise their environmental impact.
Once the unit has been positioned, take the bolts off in order to remove the pallet. Afterwards push the unit from below and slide it off onto its proper position.

3.1.3 Siting

You should bear in mind the following aspects when choosing the best site for installing the unit and the relative connections:

- size and origin of water pipes;
- location of power supply;

- accessibility for maintenance or repairs;
- solidity of the supporting surface.

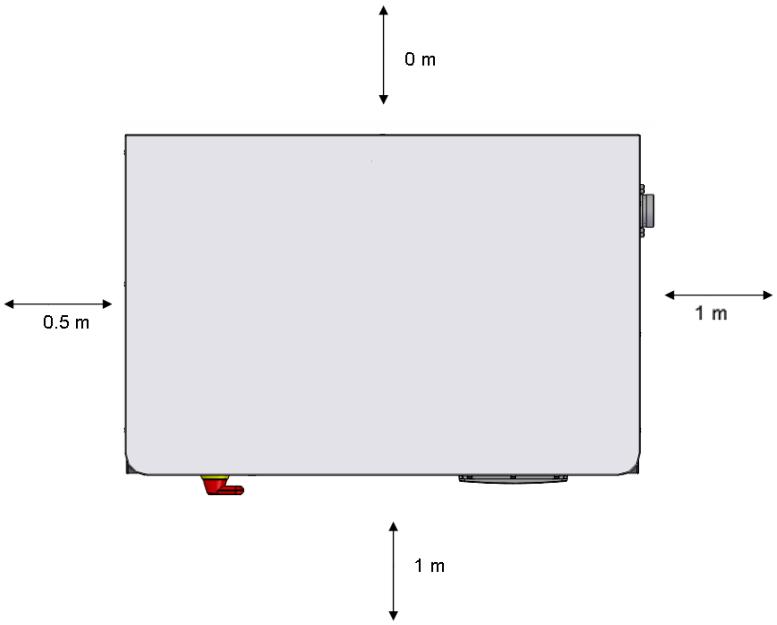
All the models of the LEP series have been designed and built for indoor or outdoor installations. Due to the special care given to soundproofing and the fact that components and hot parts in general are closed inside, they do not require special rooms.
It is advisable to place a rigid anti-vibration rubber strip between the base frame and the supporting surface.

In the vicinity of open flames or in a room without sufficient air exchange, should refrigerant leak, it could catch fire and become harmful for persons deriving from toxic combustion products.

3.1.4 Installation clearance requirements

The hydraulic connections are all foreseen on the right side of the unit, when looking at the front panel. This way the back of the unit can be against the wall. It is essential to ensure the following service spaces:

- rear side: min. 0 m
- electric control board side: min. 1.0 m to guarantee access for inspection and/or maintenance of components
- right side: min. 1.0 m to be able to connect the hydraulic piping properly
- top side: min. 1.0 m



These distances refer to the basic LEP units; the same considerations hold true for the optional hydronic modules.

For safety purposes, when installing the unit, one must take the correct precautions so that the ambient temperature does not exceed 50°C, both with the unit on or off.

3.2 Hydraulic connections

When you are getting ready to set up the water circuit for the evaporator you should follow the directions below and in any case make sure you comply with national or local standards (use the diagrams attached to this document as your reference). **Fit the piping to the chiller with flexible joints in order to avoid transmitting vibrations and to compensate thermal expansion.** Refer to the technical data table for the type and dimensions of the hydraulic connections.
Install the following components on the piping:

- temperature and pressure indicators for routine maintenance and monitoring of the unit. Pressure control on the

water side allows to assess the correct functioning of the expansion tank and to detect water leakage in advance.
- sumps on inlet and outlet piping for temperature detection, for a direct view of operating temperatures. They can also be consulted on the display on-board the unit (if pCO).
- cut-off valves (gate valves) to isolate the unit from the hydraulic circuit for maintenance.
- **metal net filter (inlet piping) with mesh no larger than 1 mm, to protect heat exchanger from slag or impurities inside the piping. This rule is especially important for commissioning**.
- air vent valve placed on the higher parts of the hydraulic circuit to bleed the air. [The internal pipes of the unit are fitted with manual air vent valves for bleeding the unit itself: **this operation may only be carried out when the unit is disconnected from the power supply**.
- discharge cock and drain tank, where needed, in order to empty the system for maintenance or seasonal stops
- For process applications, it is recommended to install a decoupling heat exchanger to avoid the probable dirtying of the heat exchangers

3.2.1 Hydraulic connection to evaporator

The LEP series units have no internal water unit fitted, as it is fitted externally to the unit.

It is extremely important that the water inlet corresponds with the connection marked with the writing “Water Inlet”.

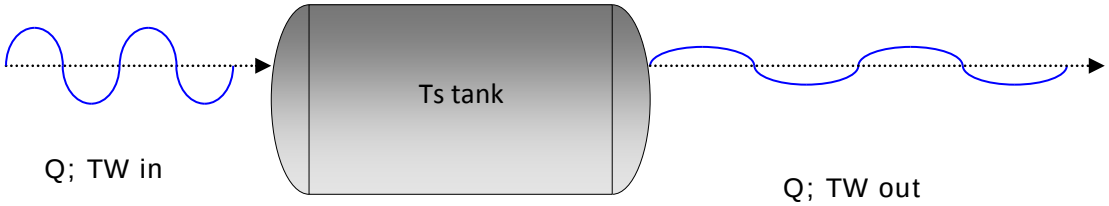
Otherwise the evaporator would be exposed to the risk of freezing since the antifreeze thermostat would not be able to perform its function; moreover the reverse cycle would not be activated in the cooling mode, resulting in additional risks of malfunctioning This position does not enable consent by the water flow control device.
The dimensions and position of the hydraulic connections are carried in the dimensional tables and overall drawings.

The water circuit must be set up in such a way as to guarantee that the rated flow rate of the water supplied to the evaporator remains constant (+/- 15%) in all operating conditions.

The ON/OFF-type compressors work intermittently since the chilling demand of the utility does not generally coincide with that supplied by the compressor. In systems containing little water, where the thermal inertia of the water is lower, it is a good idea to check that the water content in the section delivering to users satisfies the condition below:

$$V = \frac{Cc \times \Delta\tau}{\rho \times Sh \times \Delta T \times Ns}$$

V	= water content in user section	[m3]
Sh	= specific heat of the fluid	[J/(kg/°C)]
ρ	= fluid density	[kg/m3]
Dτ	= minimum time lapse between 2 compressor restarts	[s]
DT	= allowed water T differential	[°C]
Cc	= Chilling power	[W]
Ns	= No. of partialization steps	



A **standard** feature of LEP units is a device for controlling the water flow rate (blade-type flow switch included in supply).
Any tampering with said device will immediately invalidate the warranty.
It is recommended to install a metal net filter on the water inlet piping.

Attention: During hydraulic connection operations, never work with open flames near or inside the unit.

3.2.2 Filling tank and/or pumps (if foreseen by the system)

The tank has not generally been designed to withstand a depression greater than -0.15 Bar. For this reason, make sure the intake pressure of the pump, where the expansion tank is positioned, is always greater than 0.5 Bar while the pump is operating: this helps to reduce the risk of cavitation.

It is extremely important that the installer follows and verifies the following procedure point by point in order to prevent the risk of the tank exploding or pump cavitation.

- Discharge the expansion tank until it reaches the pressure of 0.5 bar.
- Fill the system and pressurise it until approximately + 1 Bar at pump intake (pump stopped).
- Bleed the system.
- Check the pump intake pressure (approximately 1 bar) and start-up the system.
- Stop the pump after 15-30 minutes and repeat point from point 3 until you hear no more noise due to the presence of air in the system.

3.3 Electrical connections

Before carrying out any work on electrical parts, make sure the power supply is disconnected.

Check that the mains electricity supply is compatible with the specifications (voltage, number of phases, frequency) shown on the unit rating plate.
The power connection is made by means of a three-core cable plus "N" neutral point cable to power single-phase loads (power supply with neutral optional).

The cross-section of the cable and line protections must conform to the specifications provided in the wiring diagram.

The supply voltage may not undergo fluctuations exceeding ±5% and the unbalance between phases must always be below 2%.

The above operating conditions must always be complied with: failure to ensure said conditions will result in the immediate invalidation of the warranty.

The electrical connections must be made in accordance with the information shown in the wiring diagram provided with the unit and current regulations.
An earth connection is **mandatory**. The installer must connect the earthing wire using the earthing terminal situated on the electric control board (yellow and green wire).
The power supply to the control circuit is shunted from the power line through a transformer situated on the electric control board.
The control circuit is protected by suitable fuses or automatic switches depending on the size of the unit.

3.4 Electric connections of the circulation pump

All the units of the LEP series are provided with a voltage-free contact in the electrical control board with which a low-voltage consent for the pump to start is powered.

Since it is an integral part of the supply, the pump must be started before the chiller and stopped after the latter (minimum recommended start delay: 60 seconds). If connected to the terminal in the electrical control board, this function is already performed by the microprocessor on the unit.

3.4.1 Remote Controls

If you wish to include a remote control for switching the unit on and off, you must remove the jumper between the contacts indicated in the wiring diagram and connect the remote control to the terminals themselves [see annexed wiring diagram] and then you must enable the "REMOTE" function with the specific switch in the electrical control board.

3.4.2 Remote Summer-Winter changeover (heat pump and multifunction versions)

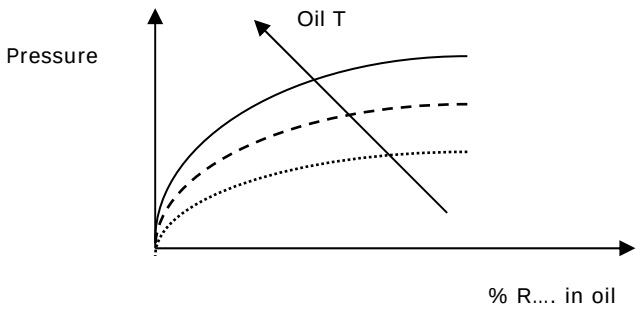
If you wish to include a remote summer/winter changeover for the unit, you must remove the jumper between the contacts indicated in the wiring diagram and connect the remote control to the terminals themselves [see annexed wiring diagram] and then you must enable the "REMOTE" function with the specific switch in the electrical control board.

3.5 Starting up

- Check that the valves in the cooling circuit are open, if present.
- Check that the electrical connections have been made properly and that all the terminals **are securely tightened**. This check should also be included in a periodic six-month inspection.
- Check that the voltage at the RST terminals is 400 V ± 5% and **make sure** the yellow indicator light of the phase sequence relay is on. The phase sequence relay is positioned in the electrical control board; if the sequence is not duly observed, it will not enable the machine to start.
- Make sure there are no refrigerant leaks that may have been caused by accidental impacts during transport and/or installation.
- Check the power supply to the crankcase heating elements, where present.

The oil sump heating elements must be turned on at least 12 hours before the unit is started. This function is carried out automatically when the main switch is off. Their function is to raise the T of the oil in the sump and limit the quantity of refrigerant dissolved in it.

To verify whether the heating elements are working properly, check the lower part of the compressors: it should be warm or in any case at a temperature 10 -15°C higher than the ambient temperature.



The diagram above illustrates a specific property [Charles' Law] of gases, which are more soluble in liquids as the pressure increases but less soluble as the temperature increases: if the oil in the sump is held at a constant pressure, an increase in temperature will significantly reduce the amount of refrigerant dissolved in it, thus ensuring that the lubricating function desired is maintained.

- Check that the hydraulic connections have been properly made according to the indications given on the plates to be found on the unit itself (proper inlet and outlet connections).

- Make sure that the water circuit is duly bled to completely eliminate the presence of air: fill the circuit gradually and open the air vent valves on the top part, which the installer should have set in place.

3.5.1 Commissioning instructions for LEP series chillers

Hydraulic connections:
- Attention: the machine is loaded with HFC R410A refrigerant – Group II EN 378 (non-hazardous substances) and in compliance with that prescribed by the EEC regulation 2037/00.
- Hydraulic connections must be carried out respecting the inlets and outlets as marked on the connections. Pay special attention not to invert the condenser and evaporator circuits.
- Provide cut-off valves on the water side to be able to intercept the unit respect to the system and insert a net filter (which can be inspected) both on the evaporator side and on the condenser side.
- Load the hydraulic circuit making sure to bleed all the air inside of it.

Electrical connections:
- Open the main switch, turn the locking screws of the electric panel ½-turn and open it.
- Introduce the power cable 400/3/50+N through the hole provided on the left side of the unit and secure it with a cable gland.
- Connect the power supply and earthing wire to the terminals of the main switch.
- Disconnect the "QF" circuit breaker of the compressor to prevent it from starting up in the wrong direction in the event of an incorrect phase sequence.
- Only for mCH2 control - Place the Local/remote selector button (SLR) in the centre at the top of the electrical control board at LOCAL and power it by turning the main switch (IG) to ON.
- Verify whether the phase sequence R-S-T is correct by checking the phase sequence relay situated in the middle of the electric control board is lit green: if this does not occur, disconnect the unit power supply from the external distribution panel and swap over two phases; then repeat the operation. IN NO CASE SHOULD YOU TAMPER WITH THE WIRING DOWNSTREAM FROM THE MAIN SWITCH since this may alter the correct sequence of other devices, e.g. pump(s).
- Rearm the "QF" compressor circuit breaker.
- Close the electrical control board and lock it by means of the ½- turn locks.

Starting up:
- Check that all external cocks of the water circuit are open and water flows properly (the flow alarm should not be triggered).
- Put the main switch at the ON position.
- The (external) pump will start immediately.
- After 60 seconds the compressor will start
- Check the water temperature differential (12-7°C to be detected by means of a thermometer on the inlet and outlet water pipes of the unit).
- Check that there are no leaks on the refrigerant side and water side.
- Using all the screws supplied, close the unit.

Use:
- consult the document and the µChiller or pCO1 manual supplied with the unit for all maintenance and/or set-up operations.

3.5.2 Starting operation

Before starting the unit, turn the main switch off, select the operating mode desired from the control panel and press the "ON" button on the control panel. The unit will start up if enabled:
- by the safety devices of the water circulation pump/s
- by the flow switch (or differential pressure switch)
- by the T sensor measuring the temperature of the water returning from the system [chiller inlet]
- and no alarms have been triggered.

If the unit fails to start up, check whether the service thermostat has been set at the rated calibration values

You should not disconnect the unit from the power supply during periods when it is inoperative but only when it is to be taken out of service for a prolonged period (e.g. at the end of the season).

3.5.3 Checks during operation

- Check the phase sequence relay on the control board to verify whether the phases occur in the correct sequence: if they do not, disconnect the unit from power supply and swap two phases of the three-core cable at the unit input. **Never** attempt to modify internal electrical connections as any undue modifications will render the warranty null and void.
- Check that the temperature of the water entering the evaporator is close to the service thermostat set value.

3.5.4 Checking refrigerant load

- After a few hours of operation, check whether the liquid level indicator has a green crown: a yellow colour indicates the presence of humidity in the circuit. In such a case the circuit must be dehumidified by qualified personnel.

- Large quantities of bubbles should not appear through the liquid level indicator. A constant passage of numerous bubbles may indicate that the refrigerant level is low and needs to be topped up.

- Also check that the end-of-evaporation temperature shown on the pressure gauge (refer to the pressure gauge scale for the refrigerant R410A) is no more than about 4 °C above the temperature of the water leaving the evaporator.

- Make sure the superheating of the refrigerant fluid is limited to between 5 and 8 °C. To this end:
  - read the temperature indicated by a contact thermometer placed on the compressor intake pipe;
  - read the temperature indicated on the scale of a pressure gauge likewise connected to the intake side; refer to the pressure gauge scale for the refrigerant R410A.

  The degree of superheating is given by the difference between the temperatures thus determined.

- Make sure the sub-cooling of the refrigerant fluid is limited to between 3 and 5°C. To this end:
  - read the temperature indicated by a contact thermometer placed on the condenser outlet pipe;
  - read the temperature indicated on the scale of a pressure gauge connected to the liquid inlet at the condenser outlet; refer to the pressure gauge scale for the refrigerant R410A.

  The degree of sub-cooling is given by the difference between the temperatures thus determined.

Attention: all the units of the LEP series are loaded with R410A refrigerant except for the versions with remote condenser which are loaded with nitrogen. Eventual top-ups must be done with the same type of refrigerant and are part of the routine maintenance operations performed by qualified personnel.

Attention: the R410A refrigerant requires “POE” polyolester oil of the type and viscosity indicated on the compressor data plate.
For no reason should a different type of oil be introduced into the oil circuit.

3.5.5 Stopping the unit

The unit can be stopped by pressing the "OFF" button on the front panel of the display.

Attention: you should avoid stopping the unit using the main switch: the latter device should be used to disconnect the unit from the electricity supply when there is no passage of current, i.e. when the unit is already turned OFF.
Moreover, if you completely disconnect the unit from the electricity supply, the crankcase heating elements, if included, will receive no power, thereby jeopardising the integrity of the compressor the next time the unit is started.

4 Operating limits:

This paragraph carries a list of operating limits of the LEP chillers relating to water outlet temperature on the utility side and water inlet temperature at the dissipation heat exchanger. For applications with water T greater than the limits indicated, they must run with R134a refrigerant *(on demand)*. For relevant details contact the zone Agent.

Water temperature	Minimum	Maximum	N.B.
Evaporator inlet (cooling phase)	10	20	Without using anti-freeze
Condenser inlet (cooling phase)	25	45	Below 15°C , condensation pressure must be controlled
Evaporator inlet (*) (heating phase)	9	45	Without using anti-freeze
Condenser inlet (*) (heating phase)	25	45	Without using anti-freeze

(*) in heat pump mode, the heat exchangers operate with inverted function.

4.1 Use of glycol solutions

Water can be produced at temperatures below 5°C as low as -10°C by using glycol solutions which lower the freezing point as shown in the following table:

Minimum temperature of produced water	5 °C	2°C	-1 °C	-5°C	-10 °C
Percentage in weight of ethylene glycol	0 %	10 %	15%	25 %	30 %
Freezing temperature of mixture	0 °C	-4 °C	- 8 °C	-14 °C	-18 °C

The useful head which the pump supplies, at the same volumetric water flow, depends on the glycol percentage as shown in the following table:

Percentage in weight of ethylene glycol	0 %	10 %	15%	25 %	30 %
Reduction percentage of useful flow rate	0 %	-5 %	-8 %	-12 %	-15 %

Performance loss of the thermodynamic circuit is minor with up to 30% of glycol in the solution.

4.2 Working limits

- Heat transfer fluid: water or mixture of water and max 30% glycol antifreeze
- Maximum pressure water side = 3 bar
- Maximum pressure high pressure side = 42 bar-r
- Maximum ambient temperature = 45 °C
- Minimum ambient temperature = -10 °C
- Maximum pressure low pressure side = 29 bar-r (*)
- Power voltage: = +/- 10% compared to the voltage on the ID plate
- Maximum storage temperature = + 50 °C
- Minimum storage temperature = -20 °C (limit dictated by on-board electronics)

(*) this value can be reached only during storage and it determines the saturation pressure of 30 bar-r of the refrigerant on the low pressure side of the circuit, the value which actually defines the limits.

4.3 Water flow to evaporator

The nominal flow rate is based on a temperature differential of 5° C between inlet and outlet water, in relation to the cooling capacity provided at the nominal water (12/7 °C) temperatures.

The maximum allowed flow rate is associated with a temperature differential of 3 °C. Higher flow rates cause high drops in pressure.

The minimum allowed flow rate is associated with a temperature differential of 8 °C. lower flow rates could cause excessively low evaporation temperatures, which may trigger the safety devices and cause the unit to stop, or else incorrect distribution and risk of thermal exchange with non-turbulent or not-fully-turbulent motion conditions.

5 Calibration of control devices

All of the control equipment is calibrated and test inspected at the factory before the unit is shipped. However, after the unit has worked for a reasonable amount of time, a control of the operation and safety devices may be carried out. The calibration values are carried on Tables I and II.

All servicing of the control equipment is part of extraordinary maintenance and must be carried out EXCLUSIVELY BY QUALIFIED PERSONNEL: incorrect calibration values can seriously damage the unit and persons as well.

Many of the functioning parameters and calibrations of the control systems which affect the integrity of the unit are set by the microprocessor control and are protected by passwords.

Table I - Calibration of control devices

Control device	Set Point °C	Differential °C
Service thermostat - C	12	2
Service thermostat - H	40	2

Table II - Calibration of safety devices

Control device	Unit of measurement	Activation	Differential	Resetting
Antifreeze thermostat	**°C**	+4	2	Automatic
Maximum pressure switch cat. IV PED	**bar**	42,0	-	Manual
Low pressure safety valve cat. IV PED	**bar**	29,0	-0 / +10%	-
Minimum pressure switch	**bar**	1,5	1,0	Automatic
Modulating condensation control [optional]	**bar**	18	10	-
Time between two start-ups of same compressor	**s**	480	-	-
Flow meter alarm delay	**s**	20	-	-
Low pressure alarm delay	**s**	1	-	-

Calibration of maximum pressure switch
The high pressure switch shuts down the compressor when delivery pressure exceeds the calibrated value.

Attention: it is not allowed to modify calibration of the maximum pressure switch: Should the latter fail to work, rising pressure causes the high pressure safety valve to open.

The high pressure switch is rearmed **manually** and can be done only when pressure has dropped below the value indicated by the set differential (see Table II).

Calibration of minimum pressure switch
The low pressure switch shuts down the compressor when the intake pressure falls below the set value for more than

120 seconds.
It is rearmed automatically only when pressure has risen above the value indicated by the set differential (see Table II).

Calibration of service thermostat function
The function of this device is to start and stop the compressors according to the water temperature reading at the chiller unit inlet [water returning from the circuit]. Refer to section of document concerning microprocessor control for further details.

Calibration of antifreeze thermostat function
The antifreeze probe is located at the evaporator outlet and shuts down the compressor should the water temperature drop below the pre-set limit. Together with the flow switch and low pressure switch, this device protects the evaporator from the risk of freezing as a result of faults in the water circuit. Refer to microprocessor control manual for further details.

Calibration of anti-recycle timer function
The function of the timer is to prevent excessively frequent compressor starts and stops. It sets a minimum time of 480 seconds between two consecutive starts. Refer to microprocessor control manual for further details.

Never modify the factory default delay value: incorrect values could cause the unit to be damaged seriously.

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