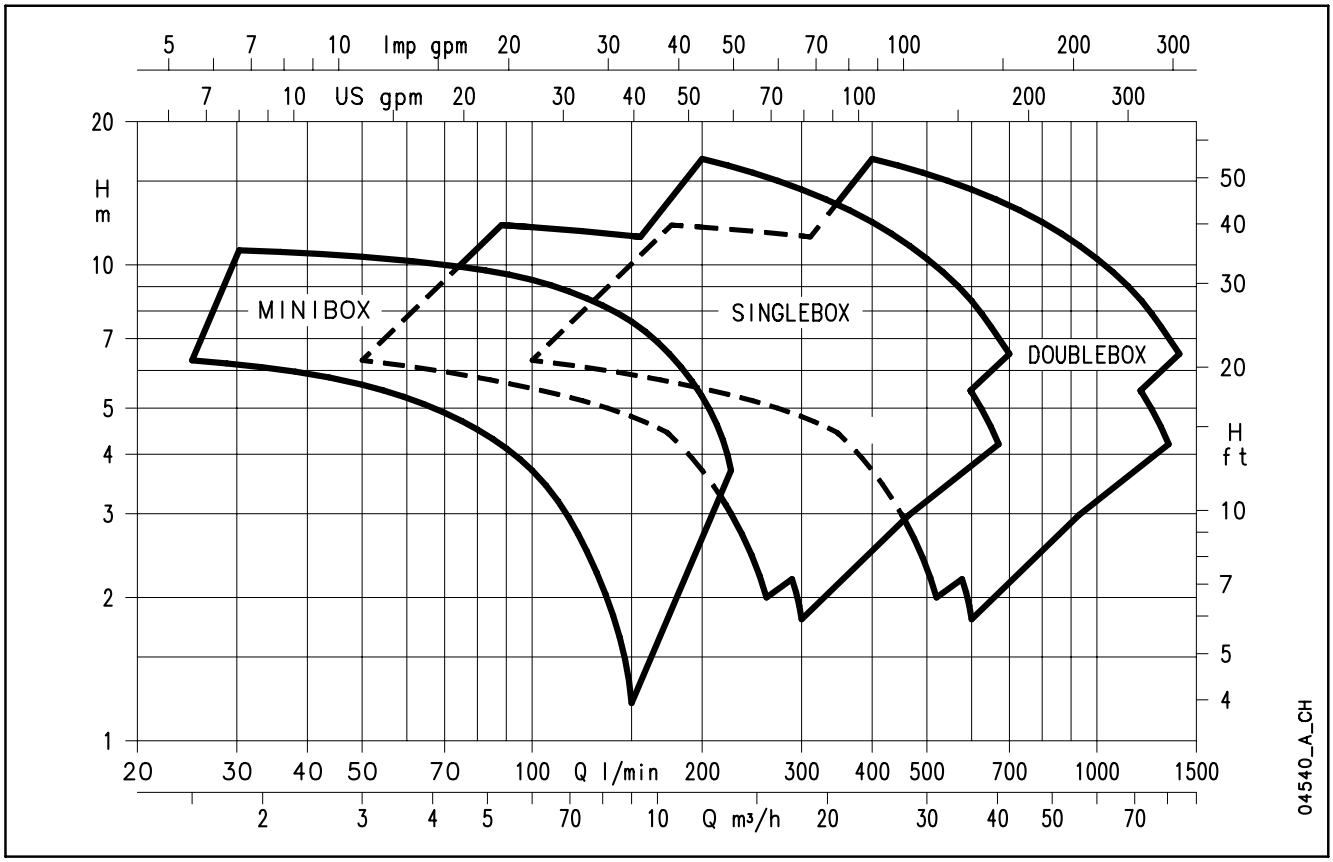
LOWARA

PREFABRICATED LIFTING STATIONS FOR SOLIDS-LADEN WASTE WATER

MINIBOX-SINGLEBOX-DOUBLEBOX SERIES



EDITION 02-2004

Lowara

ITT Industries
Engineered for life

Pre-fabricated Lifting Stations for Clear Waters

MINIBOX Series

LOWARA

MARKET SECTORS

RESIDENTIAL

APPLICATIONS

- Removal of clear water (WC excluded) where gravity drainage is impractical.

SPECIFICATIONS

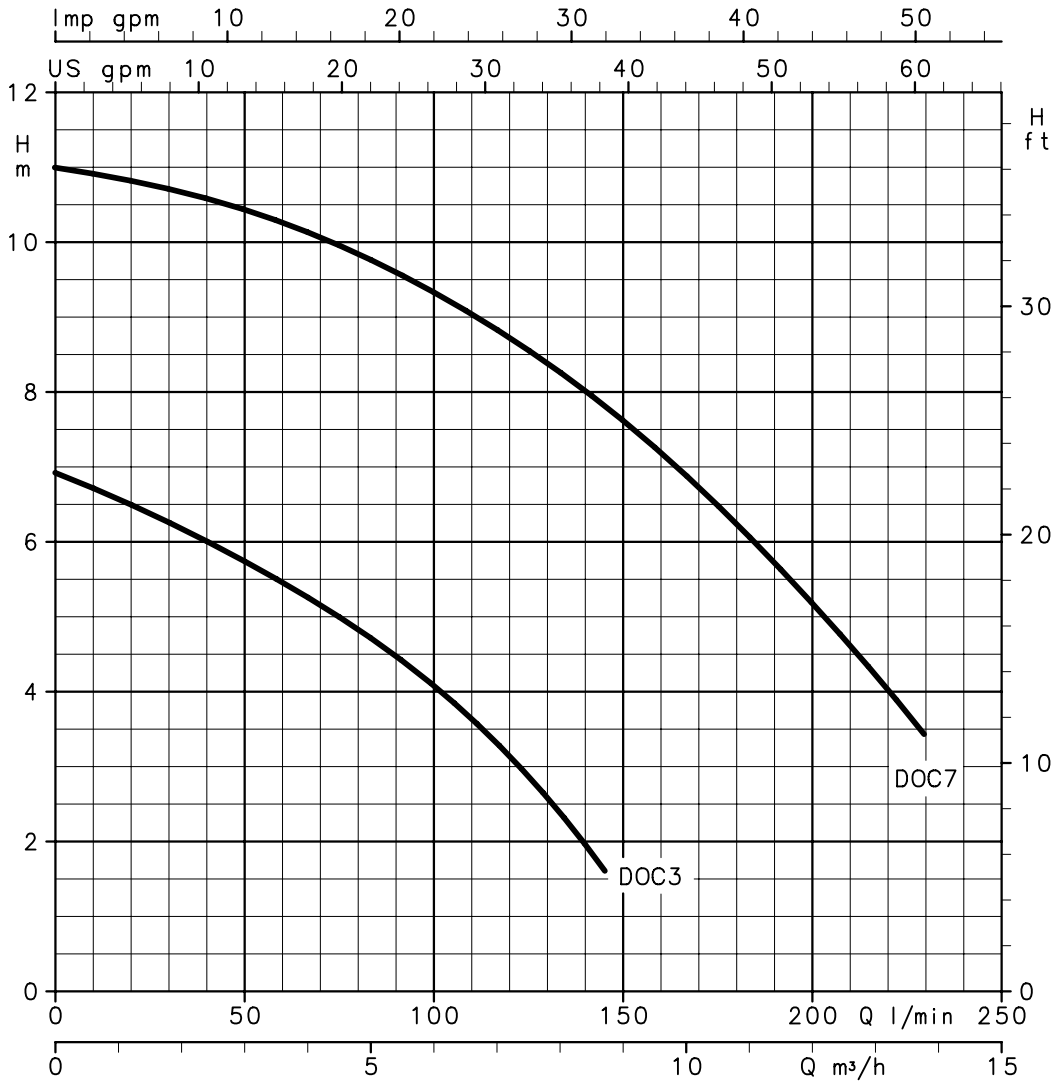
- The station is equipped with:
  - **DOC submersible pump**, with flow rate up to 230 l/min and head up to 11 m.
    Passes suspended solids up to 10 mm diameter.
    Equipped with float switch for automatic operation.
  - 85-litre high-density polyethylene **tank**.
  - 1"¼ **flexible pipe** equipped with a check valve; left- or right-hand connection.
  - **Power cord** outlet.
  - Three types of 40-mm diameter pipe inlets.
  - **Screens**.
  - **Basin** to be filled with sand or gravel to filter solid particles.
- The Minibox station can be equipped with a **DOC3** (0.25 kW rating) or a **DOC7** pump (0.55 kW).
- **Installation is quick and easy:** just connect the pipes and plug it in.
- Minibox can be installed on the floor or buried in a suitable structure (to withstand vehicle or foot traffic).

ACCESSORIES

- An **optional watertight lid** (substituting the screens) can be installed for indoor use.

MINIBOX SERIES
OPERATING CHARACTERISTICS AT 2850 rpm 50 Hz

MINIBOX	DOC	~ 2850 rpm	ISO 9906-Annex A



PUMP TYPE	RATED POWER		Q = FLOW RATE									
			l/min	0	25	50	75	100	125	150	175	225
			m^3/h	0	1.5	3	4.5	6	7.5	9	10.5	13.5
	kW	HP	H = TOTAL HEAD METRES COLUMN OF WATER									
DOC3	0.25	0.33		6.9	6.3	5.6	4.7	3.7	2.5	1.2		
DOC7	0.55	0.75		11.1	10.8	10.4	9.9	9.3	8.5	7.6	6.5	3.7

These performances are valid for liquids with density ρ = 1,0 kg/dm≥ and kinematic viscosity ν = 1 mm≤/s.

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PUMP TYPE SINGLE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-240 V A	CAPACITOR µF / 450 V
DOC 3	0.31	1.43	6.3
DOC 7	0.78	3.47	16

*Maximum values within operating range

PUMP TYPE THREE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-240 V A	INPUT CURRENT* 380-415 V A
-	-	-	-
-	-	-	-

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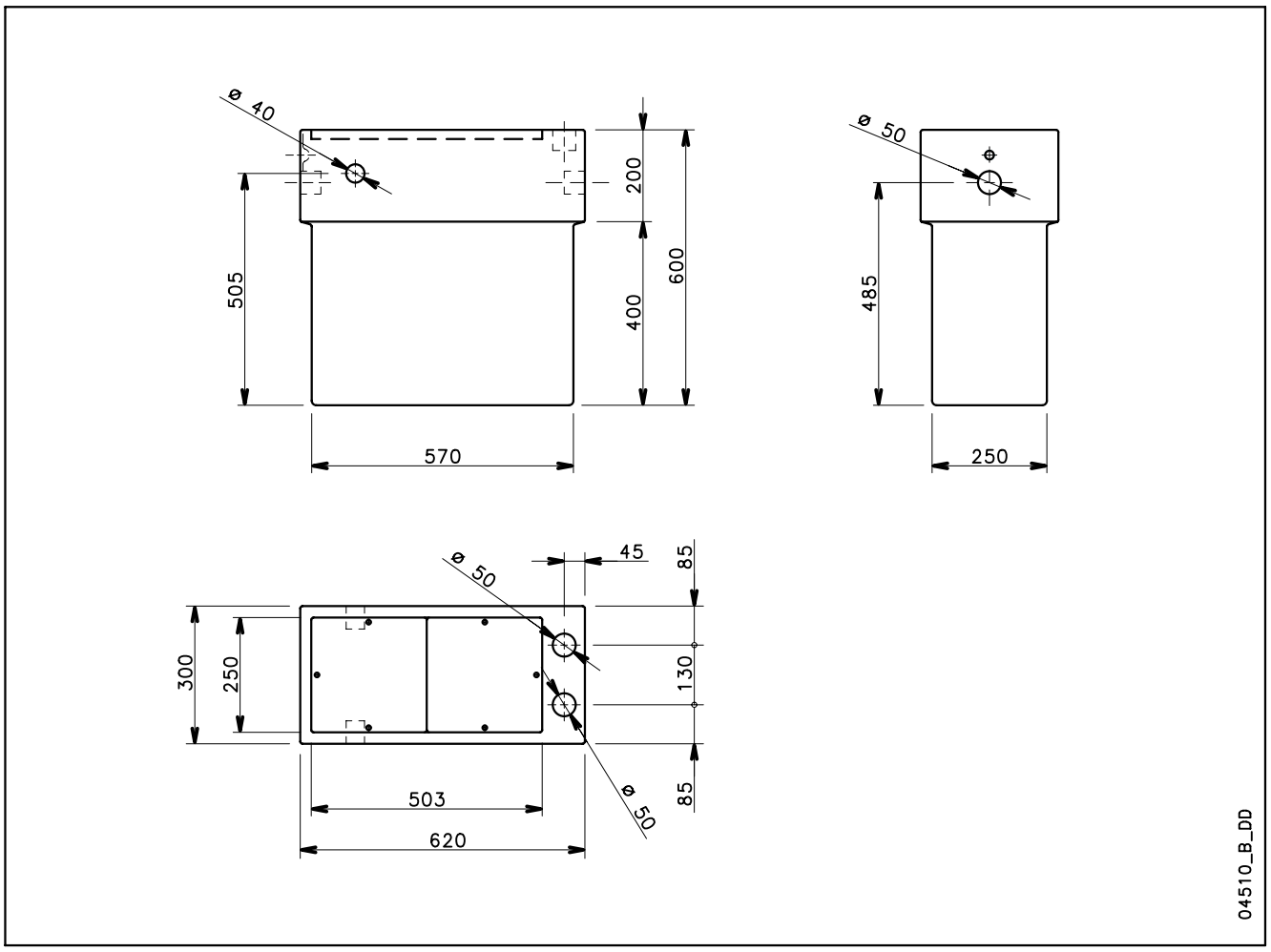
MINIBOX DIMENSIONS



Pre-fabricated Sewage Lifting Stations

SINGLEBOX Series

LOWARA

MARKET SECTORS

RESIDENTIAL

APPLICATIONS

- Suitable for delivering sewage to main sewer lines located at a higher level, or where gravity drainage is impractical.

SPECIFICATIONS

- The station is equipped with:
  - **230-litre** high-density polyethylene **basin** featuring screw down lid and removable lid in two versions, with vents or sealed.
  - **Cable glands** for power supply cables (and floats).
  - **2"** delivery **pipe**.
  - **Six inlets** for discharge or ventilation, **110 and 125 mm** diameter.
  - **DOMO or DL submersible pump**, vortex or channel type. Grinder version is also available (pump without float or control panel).
  - **Lowering device**.
  - **Vent** or emergency drain plug, ready for installation.
  - **Control panel** QDR type for three-phase versions.
- Versions with **vortex impeller** suitable for:
  - clean water, effluent, sewage containing suspended solids and fibres but not chemically aggressive substances or sand.
- Version with **single or twin-channel impeller** suitable for:
  - clean water, effluent, sewage containing suspended solids but not chemically aggressive substances or sand.
- **Singlebox** can be installed on the floor or buried in a suitable structure.
- **Installation is quick and easy**: for the single-phase versions, just connect the pipes and the power cord; for the three-phase versions, connect also the control panel.
- The **bottom** is **inclined** to aid pump suction.
- **Easy maintenance**: the pump can be completely extracted from outside.

ACCESSORIES

- Available accessories:
  - Ball-type **check valve.**
  - Emergency **float switch.**
  - **Siren.**
  - **Flashing light.**

SINGLEBOX CHART

SINGLEBOX			CHARACTERISTICS					FEATURED COMPONENTS			ACCESSORIES			
			kW	HP	Q max (l/min)	H max (m)	Impeller type	QDR control panel	Float pre-assembled on pump	Float (5-m cable)	Check valve	Emergency float	Siren	Flashing light
SINGLEBOX DOMO 7	FIXED PVC PIPE FITTINGS	SINGLE-PHASE	0.55	0.75	320	10.7	TWIN CHANNEL		X		X	Check with sales network		
SINGLEBOX DOMO 7VX			0.55	0.75	260	9.1	VORTEX		X		X			
SINGLEBOX DOMO 10			0.75	1	500	10.1	TWIN CHANNEL		X		X			
SINGLEBOX DOMO 10VX			0.75	1	400	7.7	VORTEX		X		X			
SINGLEBOX DOMO 15			1.1	1.5	600	12.7	TWIN CHANNEL		X		X			
SINGLEBOX DOMO 15VX			1.1	1.5	450	9.1	VORTEX		X		X			
SINGLEBOX DOMO 7T		THREE-PHASE	0.55	0.75	320	10.7	TWIN CHANNEL	X		X	X	X	X	X
SINGLEBOX DOMO 7VXT			0.55	0.75	260	9.1	VORTEX	X		X	X	X	X	X
SINGLEBOX DOMO 10T			0.75	1	500	10.1	TWIN CHANNEL	X		X	X	X	X	X
SINGLEBOX DOMO 10VXT			0.75	1	400	7.7	VORTEX	X		X	X	X	X	X
SINGLEBOX DOMO 15T			1.1	1.5	600	12.7	TWIN CHANNEL	X		X	X	X	X	X
SINGLEBOX DOMO 15VXT			1.1	1.5	450	9.1	VORTEX	X		X	X	X	X	X
SINGLEBOX DOMO 20T			1.5	2	670	14.8	TWIN CHANNEL	X		X	X	X	X	X
SINGLEBOX DOMO 20VXT			1.5	2	550	11	VORTEX	X		X	X	X	X	X
SINGLEBOX DOMO 10	LOWERING DEVICE	SINGLE-PHASE	0.75	1	500	10.1	TWIN CHANNEL		X		X	Check with sales network		
SINGLEBOX DOMO 10VX			0.75	1	400	7.7	VORTEX		X		X			
SINGLEBOX DOMO 15			1.1	1.5	600	12.7	TWIN CHANNEL		X		X			
SINGLEBOX DOMO 15VX			1.1	1.5	450	9.1	VORTEX		X		X			
SINGLEBOX DOMO 10T		THREE-PHASE	0.75	1	500	10.1	TWIN CHANNEL	X		X	X	X	X	X
SINGLEBOX DOMO 10VXT			0.75	1	400	7.7	VORTEX	X		X	X	X	X	X
SINGLEBOX DOMO 15T			1.1	1.5	600	12.7	TWIN CHANNEL	X		X	X	X	X	X
SINGLEBOX DOMO 15VXT			1.1	1.5	450	9.1	VORTEX	X		X	X	X	X	X
SINGLEBOX DOMO 20T			1.5	2	670	14.8	TWIN CHANNEL	X		X	X	X	X	X
SINGLEBOX DOMO 20VXT			1.5	2	550	11	VORTEX	X		X	X	X	X	X
SINGLEBOX DLM 80		SINGLE-PHASE	0.6	0.8	350	7.6	SINGLE CHANNEL		X		X	Check with sales network		
SINGLEBOX DLM 90			0.6	0.8	450	9.7	SINGLE CHANNEL		X		X			
SINGLEBOX MINI VORTEX M			0.6	0.8	300	7.2	VORTEX		X		X			
SINGLEBOX DLM 109			1.1	1.5	600	18.3	SINGLE CHANNEL		X		X			
SINGLEBOX DLVM 100			1.1	1.5	500	10.6	VORTEX		X		X			
SINGLEBOX DL 80		THREE-PHASE	0.6	0.8	350	7.6	SINGLE CHANNEL	X		X	X	X	X	X
SINGLEBOX DL 90			0.6	0.8	450	9.7	SINGLE CHANNEL	X		X	X	X	X	X
SINGLEBOX MINI VORTEX			0.6	0.8	300	7.2	VORTEX	X		X	X	X	X	X
SINGLEBOX DL 105			1.1	1.5	500	14.1	SINGLE CHANNEL	X		X	X	X	X	X
SINGLEBOX DL 109			1.1	1.5	600	18.3	SINGLE CHANNEL	X		X	X	X	X	X
SINGLEBOX DLV 100			1.1	1.5	500	10.6	VORTEX	X		X	X	X	X	X
SINGLEBOX VORTEX			1.1	1.5	500	8.4	VORTEX	X		X	X	X	X	X
SINGLEBOX DL 125			1.5	2	700	21.9	SINGLE CHANNEL	X		X	X	X	X	X
SINGLEBOX DLV 115			1.5	2	600	13.1	VORTEX	X		X	X	X	X	X

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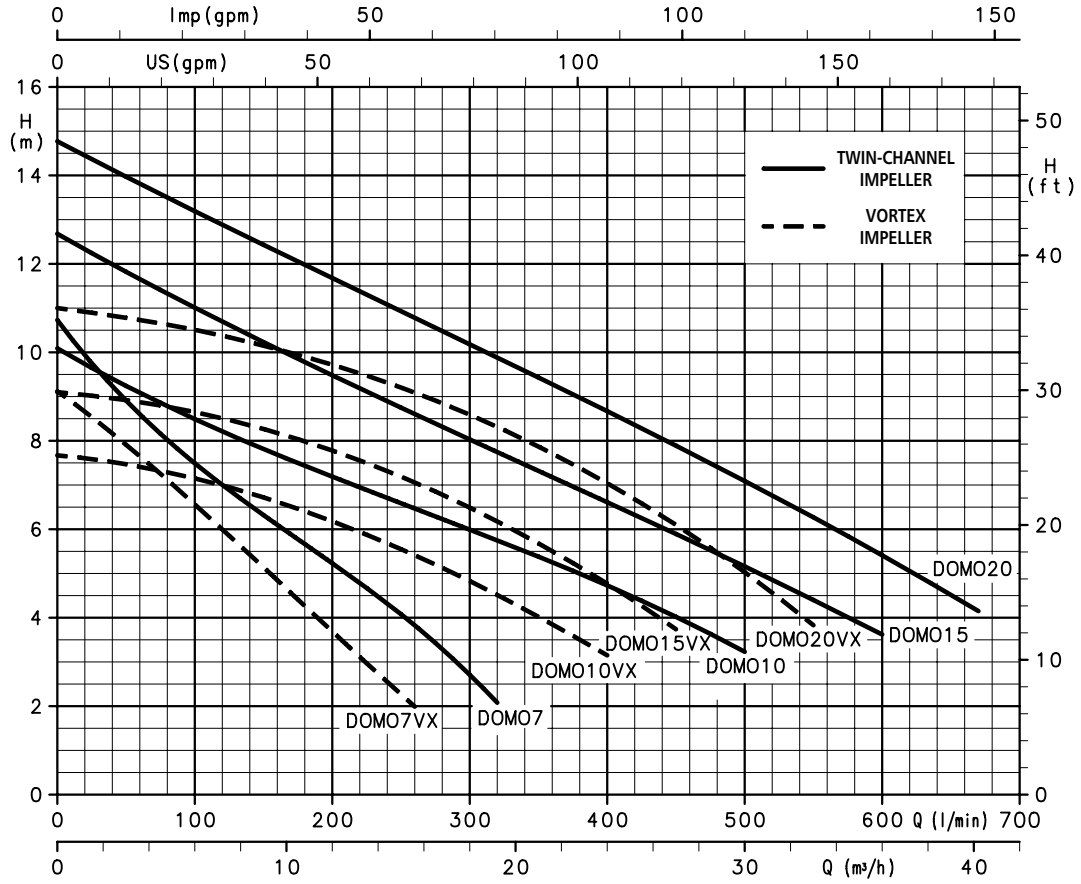
Notes	Single-phase pumps come with start capacitor, overload protection, float switch and cord with plug. Versions with control panel and accessories are available on request.

SINGLEBOX SERIES DOMO-DOMO VX
OPERATING CHARACTERISTICS AT 2850 rpm 50 Hz

SINGLEBOX	DOMO – DOMO VX	~ 2850 rpm	ISO 9906-Annex A



	PUMP TYPE	RATED POWER		Q = FLOW RATE												
				l/min	0	50	100	150	200	250	300	320	400	500	600	670
				m^3/h	0	3	6	9	12	15	18	19.2	24	30	36	40.2
DOMO		kW	HP	H = TOTAL HEAD METRES COLUMN OF WATER												
	DOMO 7(T)	0.55	0.75	10.7	8.9	7.5	6.3	5.2	4.1	2.7	2.1					
	DOMO 10(T)	0.75	1	10.1	9.2	8.5	7.8	7.2	6.6	6.0	5.8	4.7	3.2			
	DOMO 15(T)	1.1	1.5	12.7	11.8	11.0	10.2	9.5	8.8	8.0	7.8	6.6	5.2	3.6		
	DOMO 20T	1.5	2	14.8	14.0	13.2	12.4	11.7	10.9	10.2	9.9	8.7	7.1	5.4	4.2	

	PUMP TYPE	RATED POWER		Q = FLOW RATE												
				l/min	0	80	100	150	175	200	225	260	300	400	450	550
				m3/h	0	4.8	6	9	10.5	12	13.5	15.6	18	24	27	33
DOMO VX		kW	HP	H = TOTAL HEAD METRES COLUMN OF WATER												
	DOMO 7VX(T)	0.55	0.75	9.1	7.1	6.6	5.1	4.4	3.7	3.0	2.0					
	DOMO 10VX(T)	0.75	1	7.7	7.3	7.1	6.7	6.5	6.2	5.9	5.4	4.8	3.1			
	DOMO 15VX(T)	1.1	1.5	9.1	8.8	8.6	8.3	8.0	7.8	7.5	7.1	6.5	4.8	3.7		
	DOMO 20VXT	1.5	2	11.0	10.6	10.5	10.2	9.9	9.7	9.5	9.1	8.6	7.0	6.1	3.8	

These performances are valid for liquids with density ρ = 1,0 kg/dm≥ and kinematic viscosity ν = 1 mm≤/s.

sbox_domo-domovx-2p50_a_th

PUMP TYPE SINGLE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-240 V A	CAPACITOR µF / 450 V
DOMO 7	0.8	3.94	16
DOMO 10	1.14	5.84	22
DOMO 15	1.58	7.02	30
-	-	-	-
DOMO 7VX	0.79	3.91	16
DOMO 10VX	1.15	5.88	22
DOMO 15VX	1.36	6.11	30
-	-	-	-

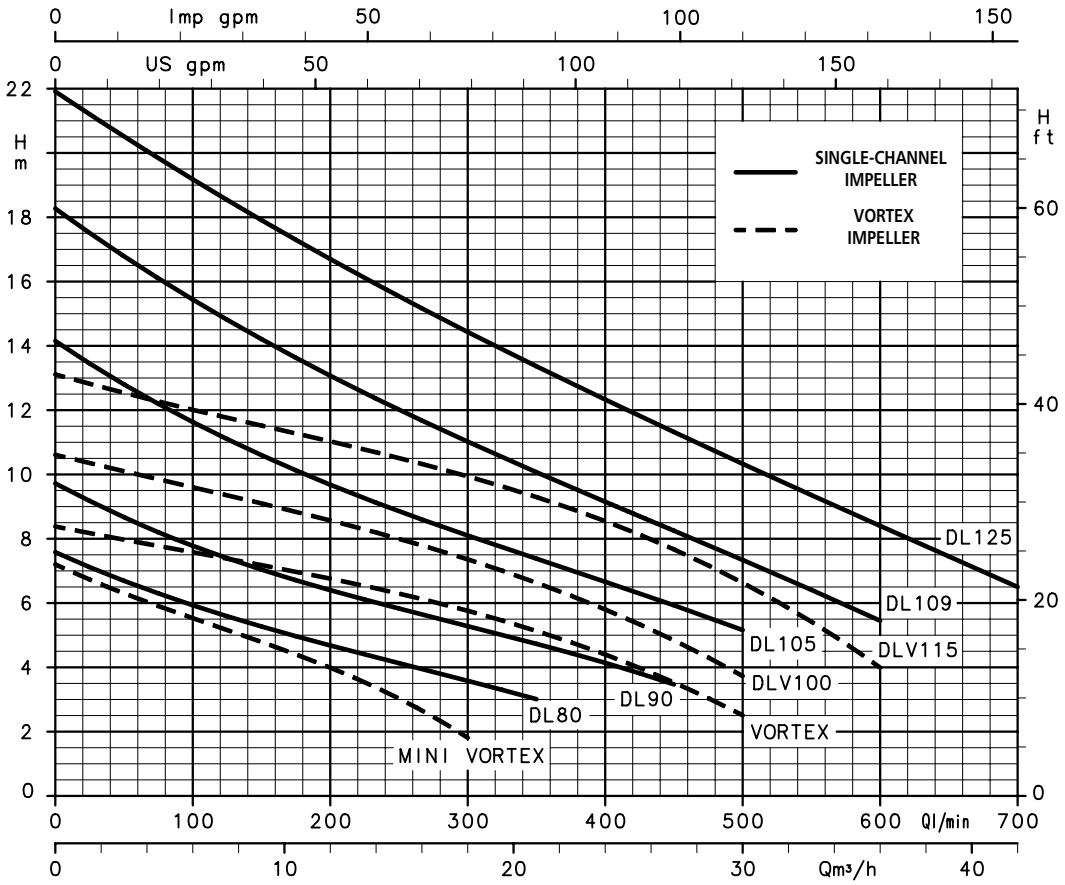
*Maximum values within operating range

PUMP TYPE THREE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-240 V A	INPUT CURRENT* 380-415 V A
DOMO 7T	0.73	2.58	1.49
DOMO 10T	1.09	4.09	2.36
DOMO 15T	1.49	4.73	2.73
DOMO 20T	1.96	6.6	3.81
DOMO 7VXT	0.71	2.56	1.48
DOMO 10VXT	1.1	4.09	2.36
DOMO 15VXT	1.26	4.31	2.49
DOMO 20VXT	1.74	6.22	3.59

sbox_domo-domovx-2p50_a_te

SINGLEBOX SERIES DL-DLV
OPERATING CHARACTERISTICS AT 2850 rpm 50 Hz

SINGLEBOX	DL - DLV	~ 2850 rpm	ISO 9906-Annex A



	PUMP TYPE	RATED POWER		Q = FLOW RATE												
				l/min	0	100	150	200	250	300	350	400	450	500	600	700
				m³/h	0	6	9	12	15	18	21	24	27	30	36	42
		kW	HP	H = TOTAL HEAD METRES COLUMN OF WATER												
DL	DL(M) 80	0.6	0.8	7.6	5.9	5.3	4.7	4.1	3.6	3.0						
	DL(M) 90	0.6	0.8	9.7	7.8	7.0	6.4	5.8	5.3	4.7	4.1	3.5				
	DL 105	1.1	1.5	14.1	11.6	10.6	9.7	8.9	8.1	7.4	6.7	5.9	5.2			
	DL(M) 109	1.1	1.5	18.3	15.4	14.2	13.1	12.0	11.0	10.1	9.2	8.2	7.3	5.4		
	DL 125	1.5	2	21.9	19.2	17.9	16.7	15.5	14.4	13.4	12.3	11.3	10.3	8.4	6.5	

	PUMP TYPE	RATED POWER		Q = FLOW RATE											
				l/min	0	50	100	150	200	250	300	350	400	450	500	600
				m³/h	0	3	6	9	12	15	18	21	24	27	30	36
		kW	HP	H = TOTAL HEAD METRES COLUMN OF WATER												
DLV	MINI VORTEX(M)	0.6	0.8	7.2	6.3	5.5	4.8	4.0	3.0	1.8						
	VORTEX	1.1	1.5	8.4	8.0	7.6	7.2	6.8	6.3	5.8	5.1	4.4	3.5	2.5		
	DLV(M) 100	1.1	1.5	10.6	10.1	9.6	9.1	8.6	8.0	7.4	6.6	5.8	4.8	3.7		
	DLV 115	1.5	2	13.1	12.5	12.0	11.5	11.0	10.5	9.9	9.3	8.5	7.7	6.6	4.0	

These performances are valid for liquids with density ρ = 1,0 kg/dm≥ and kinematic viscosity ν = 1 mm≤/s.

sbox_dl-dlv-2p50_a_th

PUMP TYPE SINGLE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-240 V A	CAPACITOR µF / 450 V
DLM 80	0.79	3.91	25
DLM 90	0.89	4.27	25
-	-	-	-
DLM109	1.55	6.87	35
-	-	-	-
MINI VORTEX M	1.05	4.82	25
-	-	-	-
DLVM100	1.64	7.3	35
-	-	-	-

*Maximum values within operating range

PUMP TYPE THREE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-240 V A	INPUT CURRENT* 380-415 V A
DL 80	0.8	-	2.09
DL 90	0.92	3.81	2.2
DL 105	1.43	4.66	2.69
DL 109	1.54	5.44	3.14
DL 125	2.14	6.58	3.8
MINI VORTEX	1.1	-	2.36
VORTEX	1.66	5.11	2.95
DLV 100	1.65	5.63	3.25
DLV 115	2.25	6.81	3.93

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Pre-fabricated Sewage Lifting Stations

DOUBLEBOX Series

LOWARA

MARKET SECTORS

RESIDENTIAL

APPLICATIONS

- Suitable for delivering sewage to main sewer lines located at a higher level, or where gravity drainage is impractical.

SPECIFICATIONS

- The station is equipped with:
  - **450-litre** high-density polyethylene **basin** featuring screw down lid and removable lid in two versions, with vents or sealed.
  - **Cable glands** for power supply cables (and floats).
  - **2"** delivery **pipe**.
  - **Nine inlets** for discharge or ventilation, **110 and 125 mm** diameter.
  - **DOMO or DL subsubmersible pump**, vortex or channel type. **GRINDER version is also available** (pump without float or control panel).
  - **Lowering device**.
  - **Vent** or emergency drain plug, ready for installation.
  - **Control panel**, 9QDR2 type for three-phase versions.
- Version with **vortex impeller** suitable for:
  - clean water, effluent, sewage containing suspended solids and filaments but not chemically aggressive substances or sand
- Versions with **single or twin-channel impeller** suitable for:
  - clean water, effluent, sewage containing suspended solids but not chemically aggressive substances or sand.
- **Singlebox** can be installed on the floor or buried in a suitable structure.
- **Installation is quick and easy**: for the single-phase versions, just connect the pipes and the power cord; for the three-phase versions, connect also the control panel.
- The **bottom** is **inclined** to aid pump suction.
- **Easy maintenance**: the pump can be completely extracted from outside.

ACCESSORIES

- Available accessories:
  - Ball-type **check valve**.
  - Emergency **float switch**.
  - **Siren**.
  - **Flashing light**.

DOUBLEBOX CHART

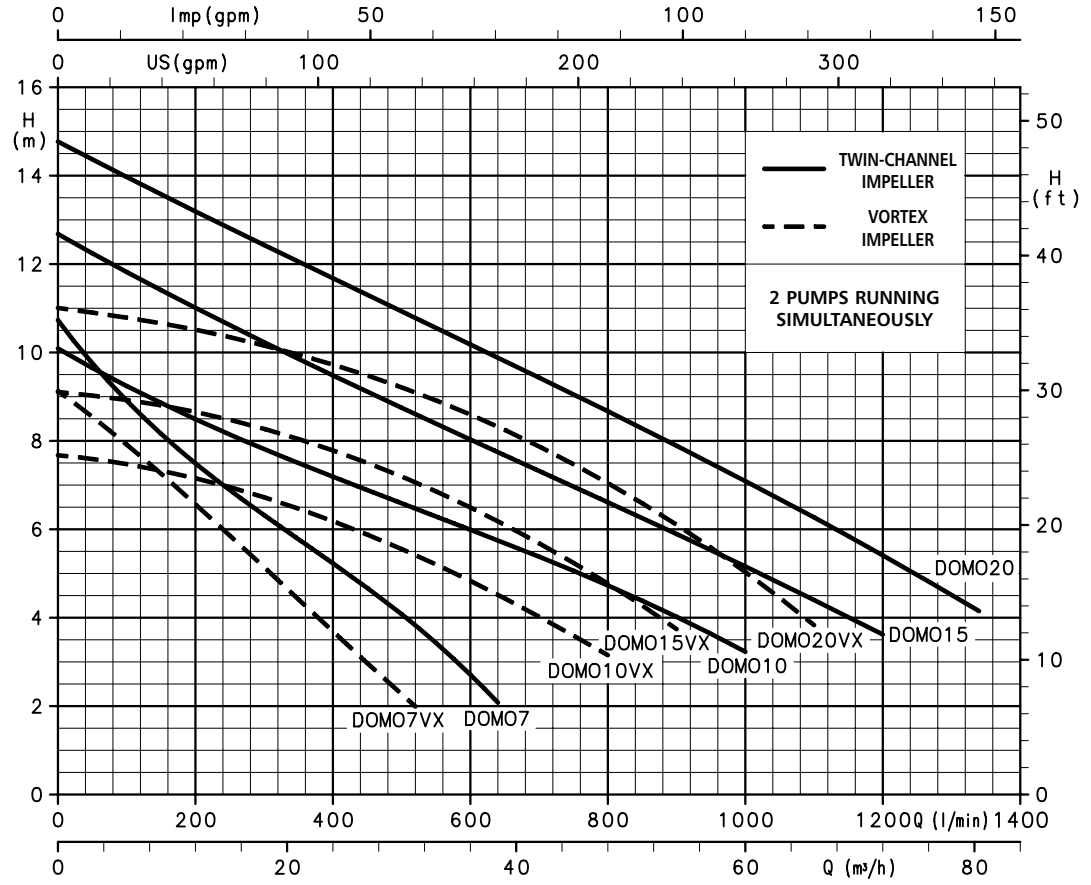
DOUBLEBOX DATA REFER TO 2 PUMPS RUNNING SIMULTANEOUSLY			CHARACTERISTICS					FEATURED COMPONENTS			ACCESSORIES			
			kW	HP	Q max (l/min)	H max (m)	Impeller type	* Control panel	Float pre-assembled on pump	Float (5-m cable)	Check valve	Emergency float	Siren	Flashing light
DOUBLEBOX DOMO 7	FIXED PVC PIPE FITTINGS	SINGLE-PHASE	2x0.55	2x0.75	640	10.7	TWIN CHANNEL		X		X	Check with sales network		
DOUBLEBOX DOMO 7VX			2x0.55	2x0.75	520	9.1	VORTEX		X		X			
DOUBLEBOX DOMO 10			2x0.75	2x1	1000	10.1	TWIN CHANNEL		X		X			
DOUBLEBOX DOMO 10VX			2x0.75	2x1	800	7.7	VORTEX		X		X			
DOUBLEBOX DOMO 15			2x1.1	2x1.5	1200	12.7	TWIN CHANNEL		X		X			
DOUBLEBOX DOMO 15VX			2x1.1	2x1.5	900	9.1	VORTEX		X		X			
DOUBLEBOX DOMO 7T		THREE-PHASE	2x0.55	2x0.75	640	10.7	TWIN CHANNEL	X		X	X	X	X	X
DOUBLEBOX DOMO 7VXT			2x0.55	2x0.75	520	9.1	VORTEX	X		X	X	X	X	X
DOUBLEBOX DOMO 10T			2x0.75	2x1	1000	10.1	TWIN CHANNEL	X		X	X	X	X	X
DOUBLEBOX DOMO 10VXT			2x0.75	2x1	800	7.7	VORTEX	X		X	X	X	X	X
DOUBLEBOX DOMO 15T			2x1.1	2x1.5	1200	12.7	TWIN CHANNEL	X		X	X	X	X	X
DOUBLEBOX DOMO 15VXT			2x1.1	2x1.5	900	9.1	VORTEX	X		X	X	X	X	X
DOUBLEBOX DOMO 20T			2x1.5	2x2	1340	14.8	TWIN CHANNEL	X		X	X	X	X	X
DOUBLEBOX DOMO 20VXT			2x1.5	2x2	1100	11	VORTEX	X		X	X	X	X	X
DOUBLEBOX DOMO 10	LOWERING DEVICE	SINGLE-PHASE	2x0.75	2x1	1000	10.1	TWIN CHANNEL		X		X	Check with sales network		
DOUBLEBOX DOMO 10VX			2x0.75	2x1	800	7.7	VORTEX		X		X			
DOUBLEBOX DOMO 15			2x1.1	2x1.5	1200	12.7	TWIN CHANNEL		X		X			
DOUBLEBOX DOMO 15VX			2x1.1	2x1.5	900	9.1	VORTEX		X		X			
DOUBLEBOX DOMO 10T		THREE-PHASE	2x0.75	2x1	1000	10.1	TWIN CHANNEL	X		X	X	X	X	X
DOUBLEBOX DOMO 10VXT			2x0.75	2x1	800	7.7	VORTEX	X		X	X	X	X	X
DOUBLEBOX DOMO 15T			2x1.1	2x1.5	1200	12.7	TWIN CHANNEL	X		X	X	X	X	X
DOUBLEBOX DOMO 15VXT			2x1.1	2x1.5	900	9.1	VORTEX	X		X	X	X	X	X
DOUBLEBOX DOMO 20T			2x1.5	2x2	1340	14.8	TWIN CHANNEL	X		X	X	X	X	X
DOUBLEBOX DOMO 20VXT			2x1.5	2x2	1100	11	VORTEX	X		X	X	X	X	X
DOUBLEBOX DLM 80		SINGLE-PHASE	2x0.6	2x0.8	700	7.6	SINGLE CHANNEL	X		X	X	X	X	X
DOUBLEBOX DLM 90			2x0.6	2x0.8	900	9.7	SINGLE CHANNEL	X		X	X	X	X	X
DOUBLEBOX MINI VORTEX M			2x0.6	2x0.8	600	7.2	VORTEX	X		X	X	X	X	X
DOUBLEBOX DLM 109			2x1.1	2x1.5	1200	18.3	SINGLE CHANNEL	X		X	X	X	X	X
DOUBLEBOX DLVM 100			2x1.1	2x1.5	1000	10.6	VORTEX	X		X	X	X	X	X
DOUBLEBOX DL 80		THREE-PHASE	2x0.6	2x0.8	700	7.6	SINGLE CHANNEL	X		X	X	X	X	X
DOUBLEBOX DL 90			2x0.6	2x0.8	900	9.7	SINGLE CHANNEL	X		X	X	X	X	X
DOUBLEBOX MINI VORTEX			2x0.6	2x0.8	600	7.2	VORTEX	X		X	X	X	X	X
DOUBLEBOX DL 105			2x1.1	2x1.5	1000	14.1	SINGLE CHANNEL	X		X	X	X	X	X
DOUBLEBOX DL 109			2x1.1	2x1.5	1200	18.3	SINGLE CHANNEL	X		X	X	X	X	X
DOUBLEBOX DLV 100			2x1.1	2x1.5	1000	10.6	VORTEX	X		X	X	X	X	X
DOUBLEBOX VORTEX			2x1.1	2x1.5	1000	8.4	VORTEX	X		X	X	X	X	X
DOUBLEBOX DL 125			2x1.5	2x2	1400	21.9	SINGLE CHANNEL	X		X	X	X	X	X
DOUBLEBOX DLV 115			2x1.5	2x2	1200	13.1	VORTEX	X		X	X	X	X	X

dbox_modelli_a_sc

Notes	Single-phase pumps come with start capacitor, overload protection, float switch and cord with plug. Versions with control panel and accessories are available on request. * Single-phase versions come with 9QDRM2 control panel. Three-phase versions come with 9QDR2 control panel.

DOUBLEBOX SERIES DOMO-DOMO VX
OPERATING CHARACTERISTICS AT 2850 rpm 50 Hz

DOUBLEBOX	DOMO – DOMO VX	~ 2850 rpm	ISO 9906-Annex A



	PUMP TYPE	RATED POWER		Q = FLOW RATE												
				l/min	0	100	200	300	400	500	600	640	800	1000	1200	1340
				m³/h	0	6	12	18	24	30	36	38.4	48	60	72	80.4
DOMO		kW	HP	H = TOTAL HEAD METRES COLUMN OF WATER												
	DOMO 7(T)	2x0.55	2x0.75	10.7	8.9	7.5	6.3	5.2	4.1	2.7	2.1					
	DOMO 10(T)	2x0.75	2x1	10.1	9.2	8.5	7.8	7.2	6.6	6.0	5.8	4.7	3.2			
	DOMO 15(T)	2x1.1	2x1.5	12.7	11.8	11.0	10.2	9.5	8.8	8.0	7.8	6.6	5.2	3.6		
	DOMO 20T	2x1.5	2 x 2	14.8	14.0	13.2	12.4	11.7	10.9	10.2	9.9	8.7	7.1	5.4	4.2	

	PUMP TYPE	RATED POWER		Q = FLOW RATE											
				l/min	0	160	200	300	350	400	450	520	600	800	900	1100
				m³/h	0	9.6	12	18	21	24	27	31.2	36	48	54	66
DOMO VX		kW	HP	H = TOTAL HEAD METRES COLUMN OF WATER												
	DOMO 7VX(T)	2x0.55	2x0.75	9.1	7.1	6.6	5.1	4.4	3.7	3.0	2.0					
	DOMO 10VX(T)	2x0.75	2x1	7.7	7.3	7.1	6.7	6.5	6.2	5.9	5.4	4.8	3.1			
	DOMO 15VX(T)	2x1.1	2x1.5	9.1	8.8	8.6	8.3	8.0	7.8	7.5	7.1	6.5	4.8	3.7		
	DOMO 20VXT	2x1.5	2 x 2	11.0	10.6	10.5	10.2	9.9	9.7	9.5	9.1	8.6	7.0	6.1	3.8	

These performances are valid for liquids with density ρ = 1,0 kg/dm≥ and kinematic viscosity ν = 1 mm≤/s.

dbox_domo-domovx-2p50_a_th

PUMP TYPE SINGLE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-240 V A	CAPACITOR µF / 450 V
DOMO 7	2x0.8	2x3.94	2x16
DOMO 10	2x1.14	2x5.84	2x22
DOMO 15	2x1.58	2x7.02	2x30
-	-	-	-
DOMO 7VX	2x0.79	2x3.91	2x16
DOMO 10VX	2x1.15	2x5.88	2x22
DOMO 15VX	2x1.36	2x6.11	2x30
-	-	-	-

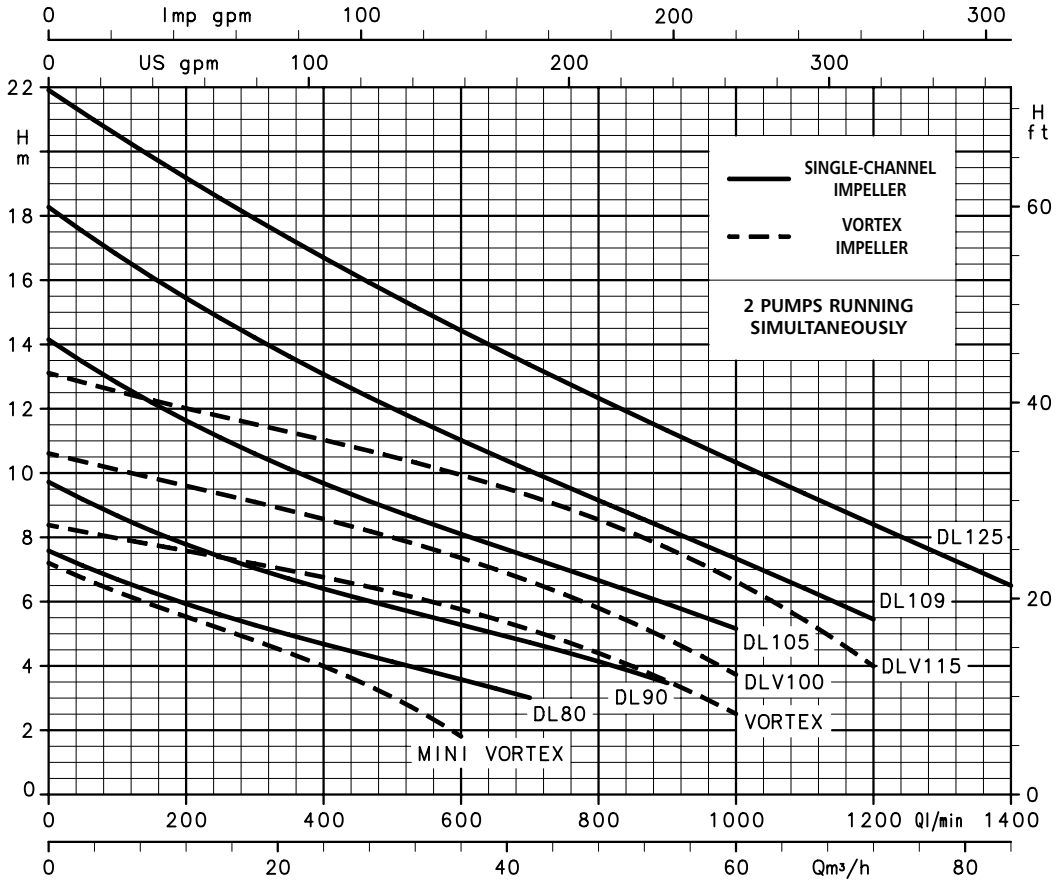
*Maximum values within operating range

PUMP TYPE THREE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-240 V A	INPUT CURRENT* 380-415 V A
DOMO 7T	2x0.73	2x2.58	2x1.49
DOMO 10T	2x1.09	2x4.09	2x2.36
DOMO 15T	2x1.49	2x4.73	2x2.73
DOMO 20T	2x1.96	2x6.6	2x3.81
DOMO 7VXT	2x0.71	2x2.56	2x1.48
DOMO 10VXT	2x1.1	2x4.09	2x2.36
DOMO 15VXT	2x1.26	2x4.31	2x2.49
DOMO 20VXT	2x1.74	2x6.22	2x3.59

dbox_domo-domovx-2p50_a_te

DOUBLEBOX SERIES DL-DLV
OPERATING CHARACTERISTICS AT 2850 rpm 50 Hz

DOUBLEBOX	DL – DLV	~ 2850 rpm	ISO 9906-Annex A



	PUMP TYPE	RATED POWER		Q = FLOW RATE											
				l/min	0	200	300	400	500	600	700	800	900	1000	1200	1400
				m^3/h	0	12	18	24	30	36	42	48	54	60	72	84
		kW	HP	H = TOTAL HEAD METRES COLUMN OF WATER												
DL	DL(M) 80	2x0.6	2x0.8	7.6	5.9	5.3	4.7	4.1	3.6	3.0						
	DL(M) 90	2x0.6	2x0.8	9.7	7.8	7.0	6.4	5.8	5.3	4.7	4.1	3.5				
	DL 105	2x1.1	2x1.5	14.1	11.6	10.6	9.7	8.9	8.1	7.4	6.7	5.9	5.2			
	DL(M) 109	2x1.1	2x1.5	18.3	15.4	14.2	13.1	12.0	11.0	10.1	9.2	8.2	7.3	5.4		
	DL 125	2x1.5	2x2	21.9	19.2	17.9	16.7	15.5	14.4	13.4	12.3	11.3	10.3	8.4	6.5	

	PUMP TYPE	RATED POWER		Q = FLOW RATE											
				l/min	0	100	200	300	400	500	600	700	800	900	1000	1200
				m3/h	0	6	12	18	24	30	36	42	48	54	60	72
		kW	HP	H = TOTAL HEAD METRES COLUMN OF WATER												
DLV	MINI VORTEX(M)	2x0.6	2x0.8	7.2	6.3	5.5	4.8	4.0	3.0	1.8						
	VORTEX	2x1.1	2x1.5	8.4	8.0	7.6	7.2	6.8	6.3	5.8	5.1	4.4	3.5	2.5		
	DLV(M) 100	2x1.1	2x1.5	10.6	10.1	9.6	9.1	8.6	8.0	7.4	6.6	5.8	4.8	3.7		
	DLV 115	2x1.5	2x2	13.1	12.5	12.0	11.5	11.0	10.5	9.9	9.3	8.5	7.7	6.6	4.0	

These performances are valid for liquids with density ρ = 1,0 kg/dm≥ and kinematic viscosity ν = 1 mm≤/s.

dbox_dl-dlv-2p50_a_th

PUMP TYPE SINGLE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-240 V A	CAPACITOR µF / 450 V
DLM 80	2x0.79	2x3.91	2x25
DLM 90	2x0.89	2x4.27	2x25
-	-	-	-
DLM109	2x1.55	2x6.87	2x35
-	-	-	-
MINI VORTEX M	2x1.05	2x4.82	2x25
-	-	-	-
DLVM100	2x1.64	2x7.3	2x35
-	-	-	-

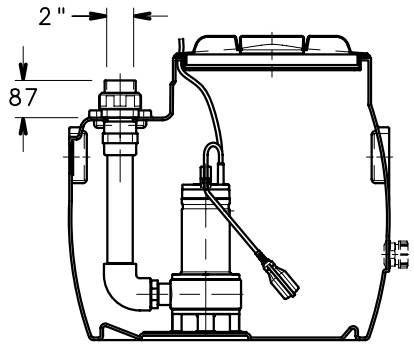
*Maximum values within operating range

PUMP TYPE THREE-PHASE	INPUT POWER* kW	INPUT CURRENT* 220-240 V A	INPUT CURRENT* 380-415 V A
DL 80	2x0.8	-	2x2.09
DL 90	2x0.92	2x3.81	2x2.2
DL 105	2x1.43	2x4.66	2x2.69
DL 109	2x1.54	2x5.44	2x3.14
DL 125	2x2.14	2x6.58	2x3.8
MINI VORTEX	2x1.1	-	2x2.36
VORTEX	2x1.66	2x5.11	2x2.95
DLV 100	2x1.65	2x5.63	2x3.25
DLV 115	2x2.25	2x6.81	2x3.93

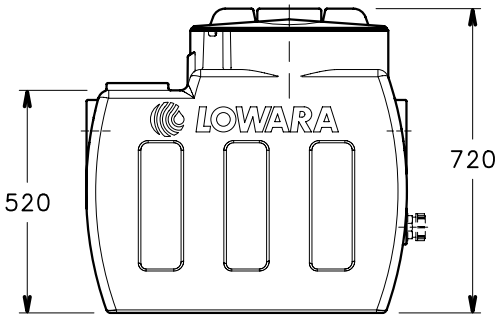
dbox_dl-dlv-2p50_a_te

SINGLEBOX / DOUBLEBOX DIMENSIONS AND VERSIONS

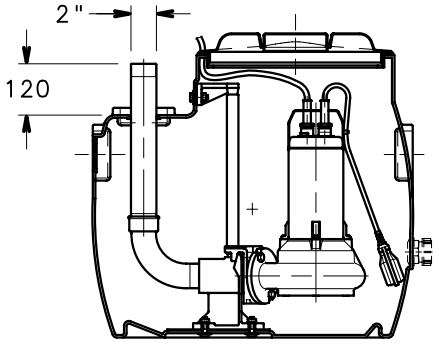
BOX + DELIVERY KIT FOR "DOMO"



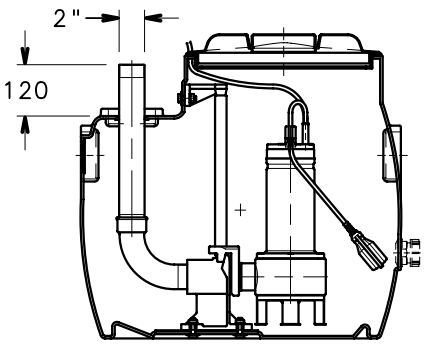
BOX

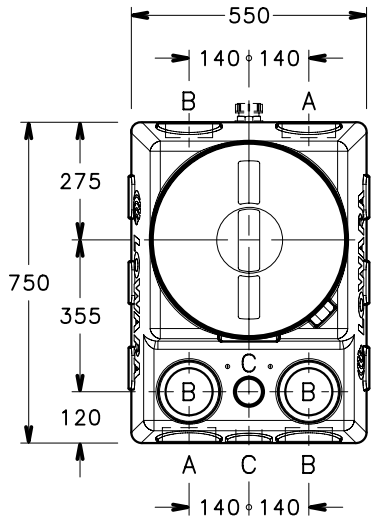


BOX + LOWERING DEVICE FOR "DL"



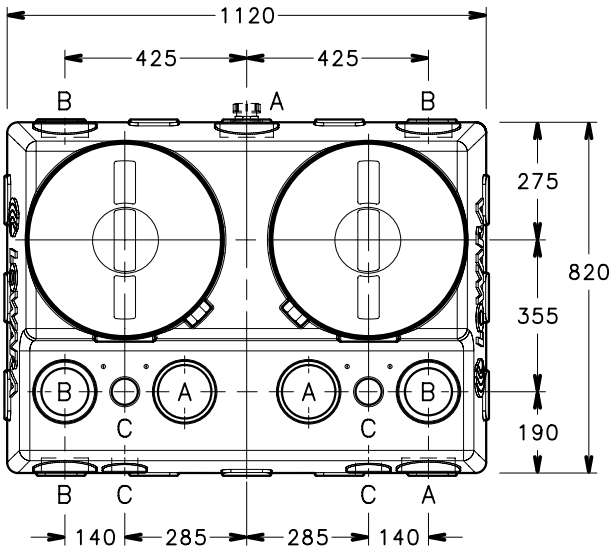
BOX + LOWERING DEVICE FOR "DOMO"





SINGLEBOX

A=ø125
B=ø110
C= ø61



DOUBLEBOX

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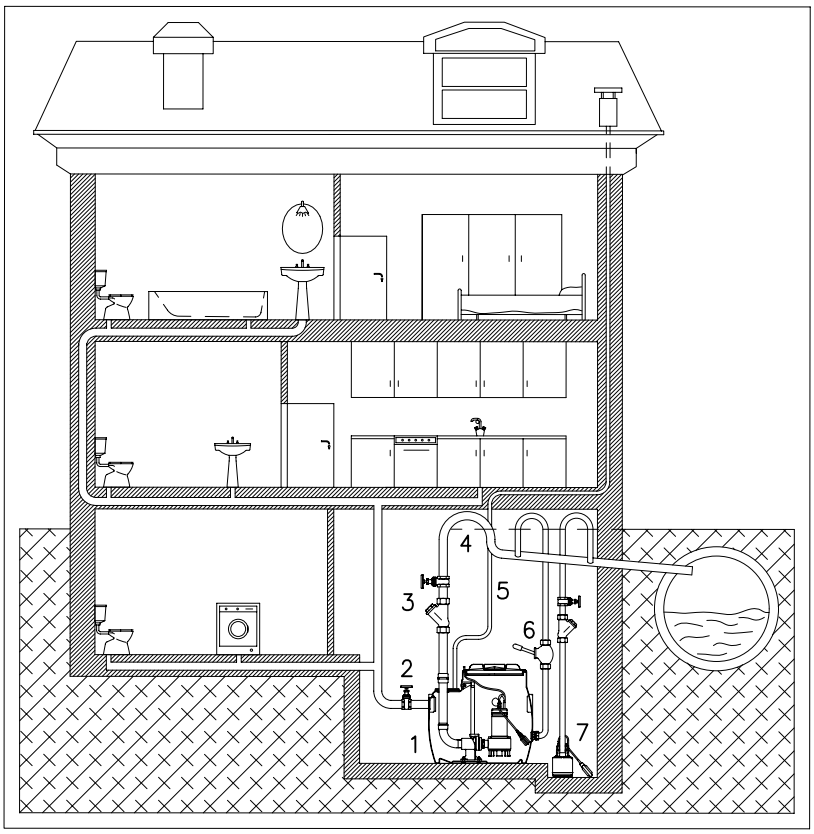
APPLICATION EXAMPLES



1 Lifting station

2 Inlet pipe with on-off valve, flexible couplings or pipes, pipe supports

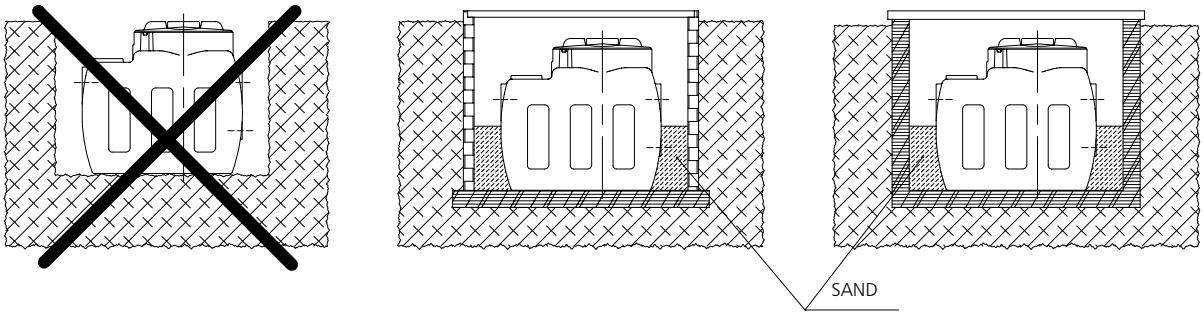
3 Outlet pipes with on-off valve, check valve, flexible couplings or pipes, pipe supports

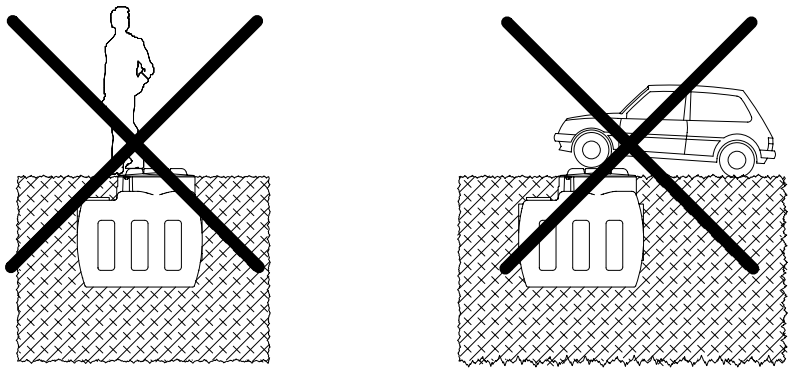
4 Trap

5 Vent with flexible couplings or pipes, pipe supports

6 Emergency drain system with hand-operated diaphragm pump, flexible couplings or pipes, pipe supports

7 Auxiliary drain pump with on-off valve, check valve, flexible couplings or pipes and pipe supports





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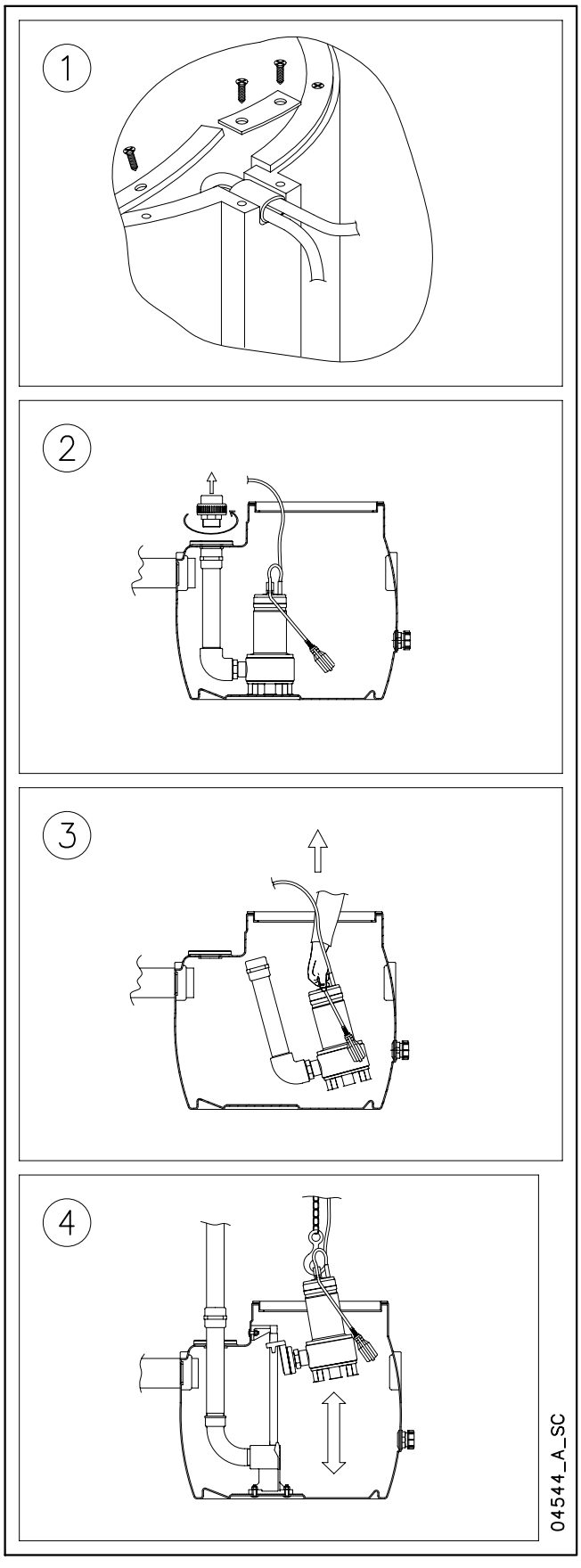
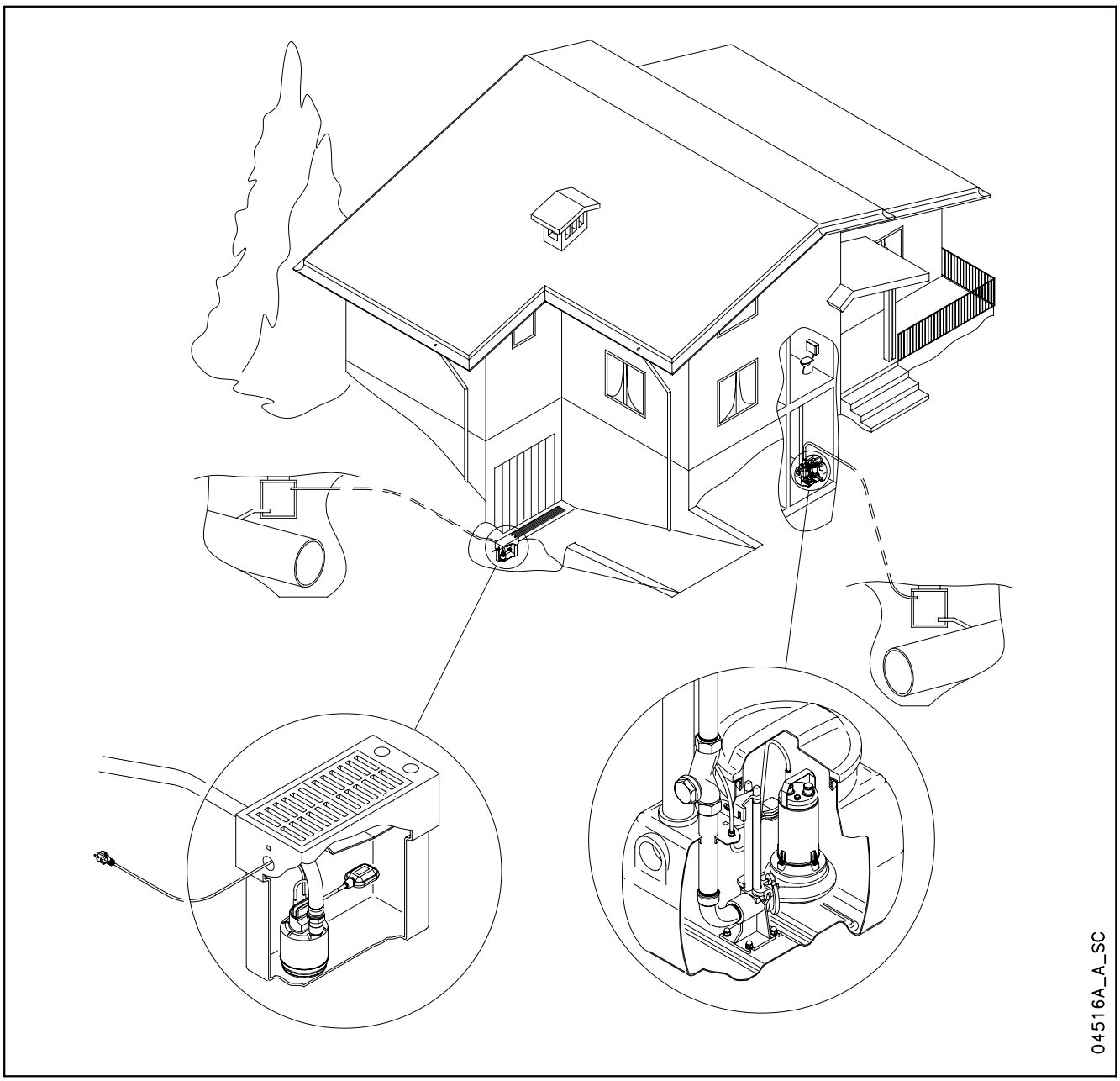


① Innovative system for cable removal from the outside

② ③ Easy pump extraction in systems featuring fixed pipe fittings, involving few operations performed from the outside

④ Easy pump extraction in slide systems

Note: for correct installation see instruction manuals.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TECHNICAL APPENDIX

DROP CABLES

Maximum length of the motor supply cable, referring to H07RNF cables with suitable insulation for operating temperatures of the conductor up to 60 °C.

Direct starting - DOL				Cable section: 4 x …mm²						
Voltage V	Version	Power		1	1,5	2,5	4	6	10	16
		kW	Hp	Maximum length in metres						
220-230	Single-phase	0,25	0,33	65	95	160				
220-230	Single-phase	0,37	0,50	55	80	130				
220-230	Single-phase	0,55	0,75	35	55	90	140			
220-230	Single-phase	0,75	1	25	40	65	105	160		
220-230	Single-phase	1,1	1,5	20	30	50	75	115	190	
220-230	Single-phase	1,5	2		22	36	60	90	145	230
220-230	Single-phase	2,2	3			25	40	60	100	165
380-415	Three-phase	0,37	0,50	315						
380-415	Three-phase	0,55	0,75	210	315					
380-415	Three-phase	0,75	1	165	240					
380-415	Three-phase	1,1	1,5	120	180	285				
380-415	Three-phase	1,5	2	90	135	225	260			
380-415	Three-phase	2,2	3	65	100	165	255	390		
380-415	Three-phase	3	4	45	65	110	180	255	420	
380-415	Three-phase	4	5,5	35	50	85	135	195	330	516
380-415	Three-phase	5,5	7,5		42	70	110	165	270	422

If three-phase, 220 V electric pumps are used, the maximum length of the cable is one-third of the length given above for three-phase 380 V.

Direct starting - DOL				Cable section: 4 x… mm²									
Voltage V	Version	Power		1,5	2,5	4	6	10	16	25	35	50	70
		kW	Hp	Maximum length in metres									
380-415	Three-phase	7,5	10	32	53	84	126	207	324	482			
380-415	Three-phase	11	15		37	58	87	144	225	335	470		
380-415	Three-phase	15	20			46	69	114	178	265	372	490	
380-415	Three-phase	18,5	25				55	90	141	210	269	390	
380-415	Three-phase	22	30				46	76	120	178	251	330	
380-415	Three-phase	30	40					57	89	132	186	245	340
380-415	Three-phase	37	45					45	70	105	145	190	265
380-415	Three-phase	45	60					37	60	90	120	160	221

Star-Delta starting SD				Cable section: 4 x… mm²									
Voltage V	Version	Power		1,5	2,5	4	8	10	16	25	35	50	70
		kW	Hp	Maximum length in metres									
380	Three-phase	3	4	108	180	285	427	705					
380	Three-phase	3,7	5	93	153	243	365	600					
380	Three-phase	5,5	7,5	65	108	171	256	423	660				
380	Three-phase	7,5	10	48	79	126	189	310	486	723			
380	Three-phase	11	15		55	87	131	216	337	502	705		
380	Three-phase	15	20			69	103	171	267	397	558	735	
380	Three-phase	18,5	25				82	135	212	345	444	585	
380	Three-phase	22	30				69	114	180	267	376	495	
380	Three-phase	30	40					85	133	198	279	368	510

For 415 V the maximum permissible length of the drop cable is 10% greater than the value shown in the table.

WATER REQUIREMENTS IN CIVIL USERS

Water requirements in condominiums

The first operation that is necessary for sizing a booster set is determining the quantity of water and the pressure it has to supply.

The table at page 21 shows maximum water consumption values for each delivery point, depending on the plumbing amenities.

The maximum theoretical requirement is given by the sum of the water consumption values of each delivery point. In actual fact, the delivery points are never used all together; only a few of them are used.

Therefore, it is extremely important to determine the maximum number of delivery points that are more likely to be used at the same time.

The first step is establishing the value of the contemporaneity factor, which depends on the number of delivery points.

Values have been calculated with the following formulas:

- Apartments with one bathroom

$$f = 1/ (0.643 \times Nr \times Na)^{1/2} \times 1.05 \text{ with flush tank WC}$$

$$f = 1/ (0.857 \times Nr \times Na)^{1/2} \times 1 \text{ with controlled flushing system WC}$$

- Apartments with two bathrooms

$$f = 1/ (0.545 \times Nr \times Na)^{1/2} \times 1.03 \text{ with flush tank WC}$$

$$f = 1/ (0.727 \times Nr \times Na)^{1/2} \times 0.8 \text{ with controlled flushing system WC}$$

where Nr = number of delivery points
Na = number of apartments

The table at page 166 shows the maximum contemporaneity flow-rate values for apartments with one or two bathrooms provided with flush tank WC or controlled flushing system WC. As regards apartments with one bathroom, 7 drawing points have been taken into consideration, while 11 points have been considered for apartments with two bathrooms.

Water requirements for community buildings

The requirements of buildings intended for specific uses, such as hospitals, hotels, offices, boarding schools, residential hotels, department stores, are different from those of condominiums, and both their global daily water consumption and the maximum contemporaneity flow rate are usually greater.

The diagram at page 23 shows the requirements of a few communities, for guidance.

These requirements must be determined case by case, with the utmost accuracy, according to particular needs and local provisions.

WATER REQUIREMENTS IN CIVIL USERS

NUMBER OF APARTMENTS	WITH FLUSH TANK WC		WITH CONTROLLED FLUSHING SYSTEM WC	
	1	2	1	2
	Flow rate (l/min)			
1	32	40	60	79
2	45	56	85	111
3	55	68	105	136
4	63	79	121	157
5	71	88	135	176
6	78	97	148	193
7	84	105	160	208
8	90	112	171	223
9	95	119	181	236
10	100	125	191	249
11	105	131	200	261
12	110	137	209	273
13	114	143	218	284
14	119	148	226	295
15	123	153	234	305
16	127	158	242	315
17	131	163	249	325
18	134	168	256	334
19	138	172	263	343
20	142	177	270	352
21	145	181	277	361
22	149	185	283	369
23	152	190	290	378
24	155	194	296	386
25	158	198	302	394
26	162	202	308	401
27	165	205	314	409
28	168	209	320	417
29	171	213	325	424
30	174	217	331	431
35	187	234	357	466
40	200	250	382	498
45	213	265	405	528
50	224	280	427	557
55	235	293	448	584
60	245	306	468	610
65	255	319	487	635
70	265	331	506	659
75	274	342	523	682
80	283	354	540	704
85	292	364	557	726
90	301	375	573	747
95	309	385	589	767
100	317	395	604	787

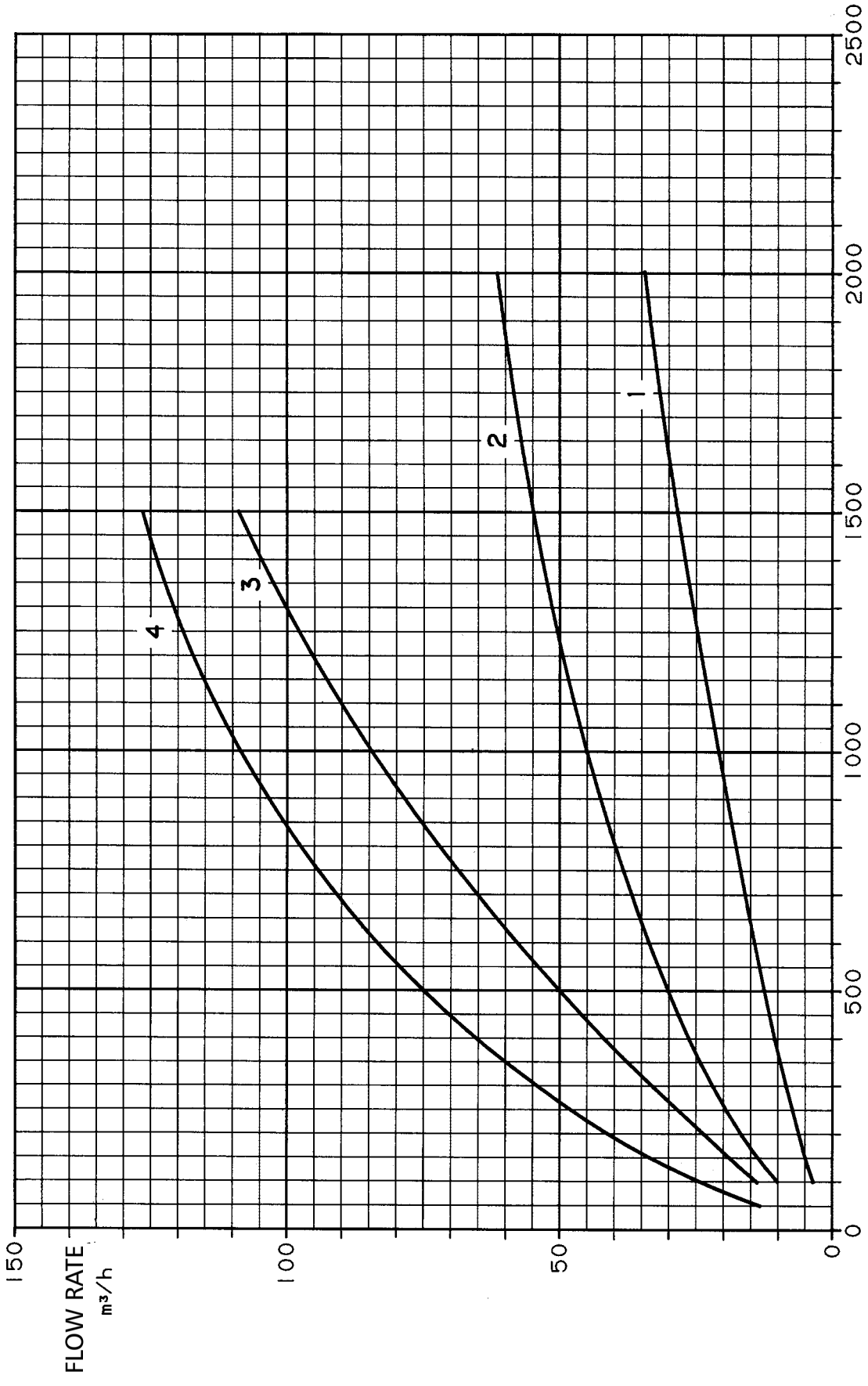
WATER REQUIREMENTS IN CIVIL USERS

NUMBER OF APARTMENTS	WITH FLUSH TANK WC		WITH CONTROLLED FLUSHING SYSTEM WC	
	1	2	1	2
	Flow rate (l/min)			
100	317	395	604	787
120	347	433	662	863
140	375	468	715	932
160	401	500	764	996
180	425	530	811	1056
200	448	559	854	1114
220	470	586	896	1168
240	491	612	936	1220
260	511	637	974	1270
280	530	661	1011	1318
300	549	685	1047	1364
320	567	707	1081	1408
340	584	729	1114	1452
360	601	750	1146	1494
380	618	771	1178	1535
400	634	791	1208	1575
450	672	838	1282	1670

Note: For seaside resorts, a flow rate increased by at least 20% must be considered.

TYPE	FLOW RATE l/min
Sink	9
Dishwasher	10
Bathtub	15
Washbasin	6
Bidet	6
Flush tank WC	6
Washing machine	12
Shower	12
Controlled flushing system WC	90

WATER REQUIREMENTS IN CIVIL USERS



NPSH

The minimum operating values that can be reached at the pump suction end are limited by the onset of cavitation.

Cavitation is the formation of vapour-filled cavities within liquids where the pressure is locally reduced to a critical value, or where the local pressure is equal to, or just below the vapour pressure of the liquid.

The vapour-filled cavities flow with the current and when they reach a higher pressure area the vapour contained in the cavities condenses. The cavities collide, generating pressure waves that are transmitted to the walls. These, being subjected to stress cycles, gradually become deformed and yield due to fatigue. This phenomenon, characterized by a metallic noise produced by the hammering on the pipe walls, is called incipient cavitation.

The damage caused by cavitation may be magnified by electrochemical corrosion and a local rise in temperature due to the plastic deformation of the walls. The materials that offer the highest resistance to heat and corrosion are alloy steels, especially austenitic steel. The conditions that trigger cavitation may be assessed by calculating the total net suction head, referred to in technical literature with the acronym NPSH (Net Positive Suction Head).

The NPSH represents the total energy (expressed in m.) of the liquid measured at suction under conditions of incipient cavitation, excluding the vapour pressure (expressed in m.) that the liquid has at the pump inlet.

To find the static height hz at which to install the machine under safe conditions, the following formula must be verified:

$$h_p + h_z \geq (NPSHr + 0.5) + h_f + h_{pv} \quad ①$$

where:

- **h_p** is the absolute pressure applied to the free liquid surface in the suction tank, expressed in m. of liquid; hp is the quotient between the barometric pressure and the specific weight of the liquid.
- **h_z** is the suction lift between the pump axis and the free liquid surface in the suction tank, expressed in m.; hz is negative when the liquid level is lower than the pump axis.
- **h_f** is the flow resistance in the suction line and its accessories, such as: fittings, foot valve, gate valve, elbows, etc.
- **h_{pv}** is the vapour pressure of the liquid at the operating temperature, expressed in m. of liquid. hpv is the quotient between the Pv vapour pressure and the liquid's specific weight.
- **0.5** is the safety factor.

The maximum possible suction head for installation depends on the value of the atmospheric pressure (i.e. the elevation above sea level at which the pump is installed) and the temperature of the liquid.

To help the user, with reference to water temperature (4°C) and to the elevation above sea level, the following tables show the drop in hydraulic pressure head in relation to the elevation above sea level, and the suction loss in relation to temperature.

Water temperature (°C)	20	40	60	80	90	110	120
Suction loss (m)	0,2	0,7	2,0	5,0	7,4	15,4	21,5

Elevation above sea level (m)	500	1000	1500	2000	2500	3000
Suction loss (m)	0,55	1,1	1,65	2,2	2,75	3,3

Flow resistance is shown in the tables at pages 26-27 of this catalogue. To reduce it to a minimum, especially in cases of high suction head (over 4-5 m.) or within the operating limits with high flow rates, we recommend using a suction line having a larger diameter than that of the pump's suction port.
It is always a good idea to position the pump as close as possible to the liquid to be pumped.

Make the following calculation:

Liquid: water at 15°C y = 1 kg/dm³
Flow rate required: 30 m³/h
Head for required delivery: 43 m.
Suction lift: 3.5 m.
The selection is an FHE 40-200/75 pump whose NPSH required value is, at 30 m³/h, 2.5 m.

For water at 15°C the hpv term is $\frac{Pv}{\gamma}$ = 0,174 m (0.01701 bar)

and h = $\frac{Pa}{\gamma}$ = 10,33m

The Hf flow resistance in the suction line with foot valves is 1.2 m.
By substituting the parameters in formula ¿ with the numeric values above, we have:

$$10,33 + (-3,5) \geq (2,5 + 0,5) + 1,2 + 0,17$$

from which we have: 6.8 > 4.4

The relation is therefore verified.

ps VAPOUR PRESSURE AND ⇐DENSITY OF WATER TABLE

t °C	T K	ps bar	ρ kg/dm³
0	273,15	0,00611	0,9998
1	274,15	0,00657	0,9999
2	275,15	0,00706	0,9999
3	276,15	0,00758	0,9999
4	277,15	0,00813	1,0000
5	278,15	0,00872	1,0000
6	279,15	0,00935	1,0000
7	280,15	0,01001	0,9999
8	281,15	0,01072	0,9999
9	282,15	0,01147	0,9998
10	283,15	0,01227	0,9997
11	284,15	0,01312	0,9997
12	285,15	0,01401	0,9996
13	286,15	0,01497	0,9994
14	287,15	0,01597	0,9993
15	288,15	0,01704	0,9992
16	289,15	0,01817	0,9990
17	290,15	0,01936	0,9988
18	291,15	0,02062	0,9987
19	292,15	0,02196	0,9985
20	293,15	0,02337	0,9983
21	294,15	0,2485	0,9981
22	295,15	0,02642	0,9978
23	296,15	0,02808	0,9976
24	297,15	0,02982	0,9974
25	298,15	0,03166	0,9971
26	299,15	0,03360	0,9968
27	300,15	0,03564	0,9966
28	301,15	0,03778	0,9963
29	302,15	0,04004	0,9960
30	303,15	0,04241	0,9957
31	304,15	0,04491	0,9954
32	305,15	0,04753	0,9951
33	306,15	0,05029	0,9947
34	307,15	0,05318	0,9944
35	308,15	0,05622	0,9940
36	309,15	0,05940	0,9937
37	310,15	0,06274	0,9933
38	311,15	0,06624	0,9930
39	312,15	0,06991	0,9927
40	313,15	0,07375	0,9923
41	314,15	0,07777	0,9919
42	315,15	0,08198	0,9915
43	316,15	0,09639	0,9911
44	317,15	0,09100	0,9907
45	318,15	0,09582	0,9902
46	319,15	0,10086	0,9898
47	320,15	0,10612	0,9894
48	321,15	0,11162	0,9889
49	322,15	0,11736	0,9884
50	323,15	0,12335	0,9880
51	324,15	0,12961	0,9876
52	325,15	0,13613	0,9871
53	326,15	0,14293	0,9862
54	327,15	0,15002	0,9862
55	328,15	0,15741	0,9857

t °C	T K	ps bar	ρ kg/dm³
56	329,15	0,16511	0,9852
57	330,15	0,17313	0,9846
58	331,15	0,18147	0,9842
59	332,15	0,19016	0,9837
60	333,15	0,19920	0,9232
61	334,15	0,2086	0,9826
62	335,15	0,2184	0,9821
63	336,15	0,2286	0,9816
64	337,15	0,2391	0,9811
65	338,15	0,2501	0,9805
66	339,15	0,2615	0,9799
67	340,15	0,2733	0,9793
68	341,15	0,2856	0,9788
69	342,15	0,2984	0,9782
70	343,15	0,3116	0,9777
71	344,15	0,3253	0,9770
72	345,15	0,3396	0,9765
73	346,15	0,3543	0,9760
74	347,15	0,3696	0,9753
75	348,15	0,3855	0,9748
76	349,15	0,4019	0,9741
77	350,15	0,4189	0,9735
78	351,15	0,4365	0,9729
79	352,15	0,4547	0,9723
80	353,15	0,4736	0,9716
81	354,15	0,4931	0,9710
82	355,15	0,5133	0,9704
83	356,15	0,5342	0,9697
84	357,15	0,5557	0,9691
85	358,15	0,5780	0,9684
86	359,15	0,6011	0,9678
87	360,15	0,6249	0,9671
88	361,15	0,6495	0,9665
89	362,15	0,6749	0,9658
90	363,15	0,7011	0,9652
91	364,15	0,7281	0,9644
92	365,15	0,7561	0,9638
93	366,15	0,7849	0,9630
94	367,15	0,8146	0,9624
95	368,15	0,8453	0,9616
96	369,15	0,8769	0,9610
97	370,15	0,9094	0,9602
98	371,15	0,9430	0,9596
99	372,15	0,9776	009586
100	373,15	1,0133	0,9581
102	375,15	1,0878	0,9567
104	377,15	1,1668	0,9552
106	379,15	1,2504	0,9537
108	381,15	1,3390	0,9522
110	383,15	1,4327	0,9507
112	385,15	1,5316	0,9491
114	387,15	1,6362	0,9476
116	389,15	1,7465	0,9460
118	391,15	1,8628	0,9445
120	393,15	1,9854	0,9429

t °C	T K	ps bar	ρ kg/dm³
122	395,15	2,1145	0,9412
124	397,15	2,2504	0,9396
126	399,15	2,3933	0,9379
128	401,15	2,5435	0,9362
130	403,15	2,7013	0,9346
132	405,15	2,8670	0,9328
134	407,15	3,041	0,9311
136	409,15	3,223	0,9294
138	411,15	3,414	0,9276
140	413,15	3,614	0,9258
145	418,15	4,155	0,9214
150	423,15	4,760	0,9168
155	428,15	5,433	0,9121
160	433,15	6,181	0,9073
165	438,15	7,008	0,9024
170	433,15	7,920	0,8973
175	448,15	8,924	0,8921
180	453,15	10,027	0,8869
185	458,15	11,233	0,8815
190	463,15	12,551	0,8760
195	468,15	13,987	0,8704
200	473,15	15,55	0,8647
205	478,15	17,243	0,8588
210	483,15	19,077	0,8528
215	488,15	21,060	0,8467
220	493,15	23,198	0,8403
225	498,15	25,501	0,8339
230	503,15	27,976	0,8273
235	508,15	30,632	0,8205
240	513,15	33,478	0,8136
245	518,15	36,523	0,8065
250	523,15	39,776	0,7992
255	528,15	43,246	0,7916
260	533,15	46,943	0,7839
265	538,15	50,877	0,7759
270	543,15	55,058	0,7678
275	548,15	59,496	0,7593
280	553,15	64,202	0,7505
285	558,15	69,186	0,7415
290	563,15	74,461	0,7321
295	568,15	80,037	0,7223
300	573,15	85,927	0,7122
305	578,15	92,144	0,7017
310	583,15	98,700	0,6906
315	588,15	105,61	0,6791
320	593,15	112,89	0,6669
325	598,15	120,56	0,6541
330	603,15	128,63	0,6404
340	613,15	146,05	0,6102
350	623,15	165,35	0,5743
360	633,15	186,75	0,5275
370	643,15	210,54	0,4518
374,15	647,30	221,2	0,3154

TABLE OF FLOW RESISTANCE IN 100 m OF A NEW AND STRAIGHT CAST IRON PIPELINE

FLOW RATE				NOMINAL DIAMETER IN mm AND INCHES																
m³/h	l/min.			15 ½"	20 ¾"	25 1"	32 1 ¼"	40 1½"	50 2"	65 2½"	80 3"	100 4"	125 5"	150 6"	175 7"	200 8"	250 10"	300 12"	350 14"	400 16"
0,6	10	V		0,94	0,53	0,34	0,21													
		hr		11,8	2,82	1	0,25													
0,9	15	V		1,42	0,8	0,51	0,31													
		hr		25,1	6,04	2,16	0,55													
1,2	20	V		1,89	1,06	0,68	0,41	0,27												
		hr		43,1	10,4	3,72	0,95	0,31												
1,5	25	V		2,36	1,33	0,85	0,52	0,33												
		hr		64,5	15,8	5,68	1,47	0,47												
1,8	30	V		2,83	1,59	1,02	0,62	0,4												
		hr		92	22,3	8	2,09	0,66												
2,1	35	V		3,3	1,86	1,19	0,73	0,46	0,3											
		hr		123	29,8	10,8	2,81	0,89	0,31											
2,4	40	V		3,77	2,12	1,36	0,83	0,53	0,34											
		hr		164	38,2	13,8	2,65	1,15	0,4											
3	50	V		4,72	2,65	1,7	1,04	0,66	0,42											
		hr		246	58,2	21,5	5,6	1,75	0,61											
3,6	60	V			3,18	2,04	1,24	0,8	0,51											
		hr			82	30	8	2,48	0,86											
4,2	70	V			3,72	2,38	1,45	0,93	0,59											
		hr			110	40	10,8	3,33	1,14											
4,8	80	V			4,25	2,72	1,66	1,06	0,68											
		hr			141	51,5	13,9	4,3	1,46											
5,4	90	V				3,06	1,87	1,19	0,76	0,45										
		hr				64	17,5	5,4	1,82	0,46										
6	100	V				3,4	2,07	1,33	0,85	0,5										
		hr				79	21,4	6,6	2,22	0,56										
7,5	125	V				4,25	2,59	1,66	1,06	0,63										
		hr				120	33	10	3,4	0,86										
9	150	V					3,11	1,99	1,27	0,75	0,5									
		hr					47	14,2	4,74	1,21	0,43									
10,5	175	V					3,63	2,32	1,49	0,88	0,58									
		hr					63	19	6,3	1,63	0,57									
12	200	V					4,15	2,65	1,7	1,01	0,66									
		hr					82	24,5	8,1	2,1	0,74									
15	250	V					5,18	3,32	2,12	1,26	0,83	0,53								
		hr					126	37,5	12,3	3,2	1,12	0,36								
18	300	V						3,98	2,55	1,51	1	0,64								
		hr						53	17,3	4,5	1,58	0,51								
24	400	V						5,31	3,4	2,01	1,33	0,85								
		hr						92	29,5	7,8	2,7	0,89								
30	500	V						6,63	4,25	2,51	1,66	1,06	0,68							
		hr						140	44,8	12	4,13	1,36	0,48							
36	600	V							5,1	3,02	1,99	1,27	0,82							
		hr							63	16,9	5,8	1,93	0,68							
42	700	V							5,94	3,52	2,32	1,49	0,95							
		hr							84	22,6	7,8	2,6	0,9							
48	800	V							6,79	4,02	2,65	1,70	1,09	0,75						
		hr							108	29	10	3,35	1,16	0,43						
54	900	V							7,64	4,52	2,99	1,91	1,22	0,85						
		hr							134	36	12,5	4,2	1,45	0,54						
60	1000	V								5,03	3,32	2,12	1,36	0,94						
		hr								44,5	15,2	5,14	1,76	0,66						
75	1250	V								6,28	4,15	2,65	1,70	1,18	0,87					
		hr								68	23	7,9	2,68	1	0,48					
90	1500	V								7,54	4,98	3,18	2,04	1,42	1,04					
		hr								96	32,6	11,2	3,77	1,42	0,68					
105	1750	V								8,79	5,81	3,72	2,38	1,65	1,21	0,93				
		hr								129	43,5	15	5,04	1,9	0,91	0,45				
120	2000	V									6,63	4,25	2,72	1,89	1,39	1,06	0,68			
		hr									56	19,4	6,5	2,43	1,18	0,58	0,16			
150	2500	V									8,29	5,31	3,40	2,36	1,73	1,33	0,85			
		hr									85	30	9,8	3,75	1,79	0,89	0,25			
180	3000	V									9,95	6,37	4,08	2,83	2,08	1,59	1,02	0,71		
		hr									120	42	13,8	5,3	2,53	1,25	0,35	0,15		
300	5000	V										10,62	6,79	4,72	3,47	2,65	1,70	1,18	0,87	0,66
		hr										124,9	41,3	16,74	7,81	4,03	1,34	0,54	0,25	0,13
600	10000	V											13,59	9,44	6,93	5,31	3,4	2,36	1,73	1,33
		hr											161	65	30,2	15,6	5,16	2,09	0,97	0,5
1200	20000	V															6,79	4,72	3,47	2,65
		hr															20,1	8,13	3,8	1,95
1800	30000	V																7,7	5,2	4,0
		hr																18,07	8,39	4,32
3000	50000	V																11,8	8,67	6,63
		hr																49,5	23	11,8
4500	75000	V																17,7	13	9,9
		hr																110,5	51,3	26,4
6000	100000	V																	17,33	13,27
		hr																	90,6	46,6

THE FLOW RESISTANCE MUST BE MULTIPLIED BY:
- 0.8 for stainless steel pipes
- 1.25 for slightly rusted steel pipes
- 1.7 for pipes with deposits that reduce the flow section
- 0.7 for aluminium pipes
- 1.3 for fibre-cement pipes

Hr = FLOW RESISTANCE (m/100 m OF PIPELINE)

V = WATER SPEED (m/sec)

TABLE OF FLOW RESISTANCE IN BENDS, VALVES AND GATES IN cm OF COLUMN OF WATER

WATER SPEED	SHARP BENDS					SMOOTH BENDS					STANDARD GATE VALVES	FOOT VALVES	CHECK VALVES
													
m/sec	a = 30°	a = 40°	a = 60°	a = 80°	a = 90°	$\frac{d}{R}$ = 0,4	$\frac{d}{R}$ = 0,6	$\frac{d}{R}$ = 0,8	$\frac{d}{R}$ = 1	$\frac{d}{R}$ = 1,5			
0,10	0,03	0,04	0,05	0,07	0,08	0,007	0,008	0,01	0,0155	0,027	0,030	30	30
0,15	0,06	0,07	0,10	0,14	0,17	0,016	0,019	0,024	0,033	0,06	0,033	31	31
0,2	0,11	0,13	0,18	0,26	0,31	0,028	0,033	0,04	0,058	0,11	0,058	31	31
0,25	0,17	0,21	0,28	0,4	0,48	0,044	0,052	0,063	0,091	0,17	0,090	31	31
0,3	0,25	0,30	0,41	0,6	0,7	0,063	0,074	0,09	0,13	0,25	0,13	31	31
0,35	0,33	0,40	0,54	0,8	0,93	0,085	0,10	0,12	0,18	0,33	0,18	31	31
0,4	0,43	0,52	0,71	1,0	1,2	0,11	0,13	0,16	0,23	0,43	0,23	32	31
0,5	0,67	0,81	1,1	1,6	1,9	0,18	0,21	0,26	0,37	0,67	0,37	33	32
0,6	0,97	1,2	1,6	2,3	2,8	0,25	0,29	0,36	0,52	0,97	0,52	34	32
0,7	1,35	1,65	2,2	3,2	3,9	0,34	0,40	0,48	0,70	1,35	0,70	35	32
0,8	1,7	2,1	2,8	4,0	4,8	0,45	0,53	0,64	0,93	1,7	0,95	36	33
0,9	2,2	2,7	3,6	5,2	6,2	0,57	0,67	0,82	1,18	2,2	1,20	37	34
1,0	2,7	3,3	4,5	6,4	7,6	0,7	0,82	1,0	1,45	2,7	1,45	38	35
1,5	6,0	7,3	10	14	17	1,6	1,9	2,3	3,3	6	3,3	47	40
2,0	11	14	18	26	31	2,8	3,3	4,0	5,8	11	5,8	61	48
2,5	17	21	28	40	48	4,4	5,2	6,3	9,1	17	9,1	78	58
3,0	25	30	41	60	70	6,3	7,4	9	13	25	13	100	71
3,5	33	40	55	78	93	8,5	10	12	18	33	18	123	85
4,0	43	52	70	100	120	11	13	16	23	42	23	150	100
4,5	55	67	90	130	160	14	21	26	37	55	37	190	120
5,0	67	82	110	160	190	18	29	36	52	67	52	220	140

1) Flow resistance in bends is due to the contraction of the liquid threads resulting from the change of direction: the development of the bends must therefore be included in the length of the pipeline.
2) Flow resistance in valves and gates was determined on the basis of practical tests.

VOLUMETRIC CAPACITY

litres per minute l/min	cubic metres per hour m^3/h	cubic feet per hour ft^3/h	cubic feet per minute ft^3/min	imp. gal. per minute imp. gal./min	US gal. per minute US gal./min
1,0000	0,0600	2,1189	0,0353	0,2200	0,2640
16,6670	**1,0000**	35,3147	0,5886	3,6660	4,4030
0,4720	0,0283	**1,0000**	0,0167	0,1040	0,1250
28,3170	1,6990	60,0000	**1,0000**	6,2290	7,4800
4,5460	0,2728	9,6326	0,1605	**1,0000**	1,2010
3,7850	0,2271	8,0209	0,1337	0,8330	**1,0000**
0,1100	0,0066	0,2339	0,0039	0,0240	0,0290

PRESSURE AND HEAD

Newton per square metre N/m^2	kiloPascal kPa	bar bar	pound force per square inch psi	metre of water $m\ H_2O$	millimetre of mercury mm Hg
1,0000	0,0010	1×10^5	$1,45 \times 10^{-4}$	$1,02 \times 10^{-4}$	0,0075
1.000,0000	**1,0000**	0,0100	0,1450	0,1020	7,5000
100.000,0000	100,0000	**1,0000**	14,5000	10,2000	750,1000
98.067,0000	98,0700	0,9810	14,2200	10,0000	735,6000
6.895,0000	6,8950	0,0690	**1,0000**	0,7030	51,7200
2.984,0000	2,9840	0,0300	0,4330	0,3050	22,4200
9.789,0000	9,7890	0,0980	1,4200	**1,0000**	73,4200
133,3000	0,1330	0,0013	0,0190	0,0140	**1,0000**
3.386,0000	3,3860	0,0338	0,4910	0,3450	25,4000

LENGTH

millimetre mm	centimetre cm	metre m	inch in	foot ft	yard yd
1,0000	0,1000	0,0010	0,0394	0,0033	0,0011
10,0000	**1,0000**	0,0100	0,3937	0,0328	0,0109
1000,0000	100,0000	**1,0000**	39,3701	3,2808	1,0936
25,4000	2,5400	0,0254	**1,0000**	0,0833	0,0278
304,8000	30,4800	3,0480	12,0000	**1,0000**	0,3333
914,4000	91,4400	0,9144	36,0000	3,0000	**1,0000**

VOLUME

cubic metre m^3	litre l	millilitre ml	imp. gallon imp. gal.	US gallon US gal	cubic foot ft^3
1,0000	1.000,0000	1×10^6	220,0000	264,2000	35,3147
0,0010	**1,0000**	1.000,0000	0,2200	0,2642	0,0353
1×10^{-6}	0,0010	**1,0000**	$2,2 \times 10^{-4}$	$2,642 \times 10^{-4}$	$3,53 \times 10^{-5}$
0,0045	4,5460	4.546,0000	**1,0000**	1,2010	0,1605
0,0038	3,7850	3.785,0000	0,8327	**1,0000**	0,1337
0,0283	28,3170	28.317,0000	6,2288	7,4805	**1,0000**

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