Cleaning System

Amajet

Type Series Booklet

Legal information/Copyright

Type Series Booklet Amajet

Contents

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Main applications

The Amajet system can be employed wherever tanks and storage sewers require cost-efficient cleaning. The Amajet system is perfect for automatic cleaning of walls and floors in:

- Stormwater retention tanks, stormwater overflow basins and stormwater settling basins
- Storage sewers in sewer systems

Fluids handled

- Water
- Stormwater
- Waste water
- Mixed water

Operating data

Operating properties

Characteristic		Value
Sizes	DN [mm]	100
Motor rating	P_2 [kW]	5,5 - 15
Fluid temperature	T [°C]	≤ +40 [1]

Design details

Design

- Fully floodable submersible motor pump
- Not self-priming
- Close-coupled design

Impeller type

- Various application-oriented impeller types

Shaft seal

Standard bearings:

- Two bi-directional mechanical seals in tandem arrangement, with liquid reservoir

Reinforced bearings:

- Two bi-directional mechanical seals in tandem arrangement, with leakage chamber

Bearings

Standard bearings:

- Grease-packed bearings sealed for life
- Maintenance-free

Reinforced bearings:

Drive end:

- Grease-packed bearings sealed for life
- Maintenance-free

Pump-end:

- Grease-lubricated bearings
- Can be re-lubricated

Drive

- Three-phase asynchronous squirrel-cage motor
- Type of protection Ex db IIB (applies to explosion-proof pump sets only)

1) Higher fluid temperatures on request.

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Designation

Example: Amajet L 100-237/114XEG IE3

Designation key

Code	Description	
Amajet	Type series	
	Amajet	
	SewerAmajet	
	SwingAmajet	
L	Installation type	
	L	Horizontal installation
	M	Compact installation
	V	Vertical installation with guide wire and suspension arrangement
100	Nominal discharge nozzle diameter [mm]	
237	Impeller diameter [mm]	
11	Motor size	
4	Number of poles	
XE	Motor version	
	XE	Explosion protection Ⓔx II 2G Ex db h IIB T3 Gb, for fluid temperatures of up to 40 °C[2)]
G	Material variant	
	G	Standard variant, grey cast iron
	G1	Like G, with impeller made of duplex stainless steel
	G2	Like G, with impeller made of white cast iron
	GH	Like G, with impeller and discharge cover made of white cast iron
IE3	Motor efficiency classification	
	[3)]	No efficiency classification
	IE3	Efficiency classification[4)]

Configuration and function

Amajet system

The Amajet system is used for cleaning stormwater retention tanks, stormwater overflow basins and stormwater settling basins.

Design

KSB's system solution consists of:

- A robust submersible motor propulsive jet pump with non-clogging free-flow impeller
- An Amajet ejector set designed for high cleaning performance
- A control unit, optionally with operating data logging system and data storage unit[5)]
- Level monitoring equipment[5)]
- Control unit[5)]

Function

Amajet sucks in the fluid from near the tank floor and transports it to the ejector nozzle. The narrow passage through the reducing nozzle increases the flow velocity in and downstream of the nozzle, producing a low pressure in the mixing chamber compared to the fluid surrounding it and compared to the atmosphere. Through the vent line this low pressure draws in air, which is mixed with the fluid in the mixing chamber. The fluid-air mixture is ejected through the ejection pipe as a high-velocity jet that is horizontal to the tank floor. The combined effects of the water jet and the small air bubbles in the fluid generate a powerful horizontal flow with a large vertical reach in the tank. The turbulences caused in the entire tank by both transverse and longitudinal flows lift up the solids and keep them suspended. During drainage the sludge is carried out of the tank at an even rate to prevent peak demand periods for biological waste water purification. If the fill level in the tank exceeds 1 metre, the energy-saving intermittent operation mode set to approximately 10 to 50 % of the operating time is sufficient. This mode is designed for cleaning tank walls and posts. At a fill level below approximately 1 metre, the general cleaning mode (i.e. continuous operation) is activated.

Control system

Optimum operation of the Amajets is provided by KSB's electronic control unit. The parameters for all levels and hystereses needed for automatic operation can be freely set to satisfy all system requirements. Amajet only operates when the water level within the tank decreases, i.e. during the draining process. The operating times for the individual Amajets are calculated separately based on the current water levels.

2) Maximum fluid temperature and ambient temperature
3) Blank
4) IEC 60034-30 standard not binding for submersible motor pumps. Efficiencies calculated/determined according to the measurement method specified in IEC 60034-2. The marking is used for submersible motors that achieve efficiency levels similar to those of standardised motors acc. to the IEC 60034-30 standard.
5) Optional

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SewerAmajet system

The SewerAmajet system is used for cleaning storage sewers.

Design

KSB's system solution consists of:

- A robust submersible motor propulsive jet pump with non-clogging free-flow impeller
- A SewerAmajet ejector set with throttle valve and lifting magnet
- A control unit with operating data logging system and data storage unit

Function

SewerAmajet is installed on the sewer floor in the storage area. By means of a suction pipe and ejector it mixes waste water with air and ejects the mixture lengthwise along the bottom of the sewer, thus enriching the waste water with oxygen and preventing digestion. The high-grade cleaning effect of this patented cleaning equipment is achieved by combining a throttle valve with a jet nozzle. The control unit of the storage sewers transmits the required impulses for opening and closing the throttle valve at set intervals. When the valve is partly closed, the pressure increases up to 1.5 times during continuous operation of the pump set. When the valve opens, this energy is suddenly released and produces shock waves, which spread over the entire length of the storage sewer. SewerAmajet for storage sewers can usually be retrofitted without any structural modifications as long as a suitable shaft structure is available for installing SewerAmajet. A single SewerAmajet system can also be used to clean several sewers arranged in parallel, provided that specific conditions are met.

Control unit

The control unit is precisely set to match the conditions in storage sewer systems and ensures a fully automatic operation of the pump set, taking into account the storage sewer geometry, inflow and discharge conditions as well as the pollution load.

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Materials

Overview of material variants

Component	Material variants			
	G	G1	G2	GH
Pump set				
Pump casing	EN-GJL-250			
Impeller	EN-GJL-250	1.4517	EN-GJN-HB555	
Discharge cover	EN-GJL-250			EN-GJN-HB555
Mechanical seal (pump end) Double mechanical seal (pump end)	SiC / SiC			
Mechanical seal (drive end) Double mechanical seal (drive end)	Carbon / SiC			
Shaft	1.4021			
Bearing bracket	EN-GJL-250			
Motor housing	EN-GJL-250			
Elastomers	NBR[6)]			
Bolts/screws	A4[7)]			
Installation parts				
Claw (for installation type V)	EN-GJL-250			
Bracket (for installation type V)	1.4517			
Guide wire suspension bracket (for installation type V)	1.4517			
Guide wire (for installation type V)	1.4401			
Support foot (for installation type V)	1.4571			
Suction elbow / discharge elbow	1.4571			
Ejector set	1.4571			
Ejector set, mixing chamber	EN-GJL-250			
Vent line	1.4571			
Connection pipe (for installation type L)	1.4571			
Other connecting pipes	1.4571			

Product benefits

- Energy-saving cleaning mode by intermittent operation matching the actual hydraulic conditions
- Intelligent control system and perfect automation by process controller: Electronic control units select a matching operating mode for each water level; operating times are computed based on the current water level.
- Low maintenance
- Low life cycle costs thanks to low maintenance costs and high energy efficiency
- Straightforward assembly of ready-made components

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6) Nitrile rubber (Perbunan)
7) Corresponds to 1.4571

Example of operating costs per cleaning process

Pump set:	1 Amajet L 100-249/154XEG IE3
Flow rate of the drainage pump:	Q = 72 m^3/h
Tank size:	20 x 8 m
Fill level:	3,5 m
Electricity costs (assumed):	0,25 €/kWh
Total tank volume:	V_B = 560 m^3
Water volume in continuous operation:	V_D = 160 m^3
Water volume in intermittent operation:	V_I = 400 m^3
Drainage times (without inflow):	
1. In continuous operation:	$t_D = \frac{160\ m^3}{72\ m^3/h} = 2{,}2\ h$
2. In intermittent operation (at relative operating time of 30 %):	$t_I = \frac{400\ m^3}{72\ m^3/h} \times 0{,}3 = 1{,}6\ h$
Operating time of the Amajet:	t_M = 2.2 h + 1.6 h = 3.8 h
Electricity costs:	K_{En} = 8.3 kW x 3.8 h x 0.25 €/kWh
	K_{En} = 7,89 €

Product information

Product information as per Regulation No. 1907/2006 (REACH)

For information as per chemicals Regulation (EC) No. 1907/2006 (REACH), see http://www.ksb.com/reach.

Selection information

Amajet system

For a pre-selection of Amajet pump sets and suitable tank shapes please contact your KSB Service GmbH sales representative.

The reference values given are based on optimum conditions. As project-specific conditions such as fluid composition, internal structures, surfaces, drainage, etc. can have a significant impact it is useful to involve us already in the planning phase.

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SewerAmajet system

Rough reference values for the cleaning capacity per pump set

Maximum cleaning reach depending on the floor gradient

Floor gradient	Max. cleaning reach per pump set[8)]
[‰]	[m]
2-3	80

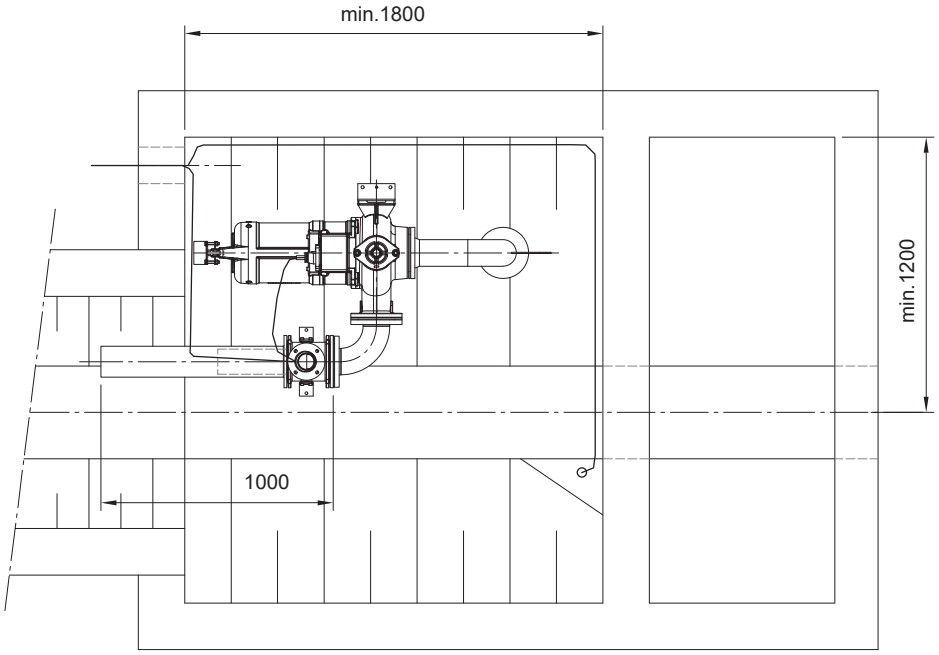

Fig. 1: Shaft structure dimensions [mm]

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8) These values are practically only achieved in ideal conditions; floors, rough surfaces and unfavourable sewer geometries may reduce the cleaning capacity.

Overview of product features / selection tables

Overview of product features

Overview of product features

Feature	Material variants			
	G	G1	G2	GH
Number of motor poles				
4 poles	11 4, 15 4, 18 4, 22 4			
Motor				
Explosion protection, version XE	Ⓔx II 2G Ex db h IIB T3 Gb			
Starting method	DOL starting / star-delta starting[9)]			
Voltage	400 V / 415 V[9)] / 500 V[9)] / 690 V[9)]			
Cooling	Cooled by surrounding fluid / air cooling[9)]			
Power cable				
Length	10 m / ≤ 40 m[9)]			
Cable entry	Absolutely water-tight			
Type	See the "Overview of power cables" table			
Bearings	Grease-packed rolling element bearings sealed for life			
Sealing elements				
Elastomers	Nitrile butadiene rubber NBR / Viton = fluorocarbon rubber FPM[9)]			
Shaft seal	Mechanical seal with elastomer bellows / double cartridge seal[9)]			
Monitoring equipment				
Winding temperature	Temperature switches (bimetal) in the winding, plus PTC thermistors for explosion protection			
Leakage in the motor space	Leakage sensor in the motor space			
Coating	Environmentally friendly KSB standard coating (colour RAL 5002) / 250 µm two-component epoxy coating[9)]			
Max. ambient temperature	40 °C			
Max. fluid temperature	40 °C			
Tests/inspections				
Hydraulic system	KSB standard (ZN 56525) / F impeller (DIN EN ISO 9906 2U)[9)]			
General	KSB standard (ZN 56525)			

Overview of power cables

Feature	S1BN8-F rubber-sheathed cable	S07RC4N8-F rubber-sheathed cable	TEHSITE Tefzel cable
Design	Standard	Optional	Optional
Rated voltage	1000 V	750 V	750 V
EMC screening	-	✓	-
Insulation material	EPR[10)]	EPR[10)]	ETFE[11)]
Max. continuous temperature of insulation	90 °C	90 °C	135 °C
For permanent immersion in waste water to DIN VDE 0282-16/HD22.16	✓	✓	✓

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9) Optional
10) EPR = ethylene propylene rubber
11) ETFE = ethylene tetrafluoroethylene

Impeller

	Free-flow impeller (impeller type)	**Suitable for the following fluids:** fluids containing solids and stringy material as well as fluids with entrapped air or entrapped gas

F impellers are suitable for handling the following fluids:

- Mixed water
- Raw waste water

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Technical data

Technical data for standard operation

Size	Ejector set		Nominal power	Free passage	Speed	Installation type		
	Nozzle	Diffusor	P_2					
	[mm]	[mm]	[kW]	[mm]	[rpm]	L	M	V
100-237/114	60	104	5,5	100	1466	✗	✗	✗
100-249/154	60	104	7,5	100	1478	✗	✗	✗
100-260/184	65	104	11,0	100	1476	✗	✗	✗
100-265/224	65	104	15,0	100	1477	✗	✗	✗
100-237/184 S1	60	104	6,5	100	1479	-	-	✗
100-249/224 S1	60	104	7,5	100	1481	-	-	✗

Technical data for shock wave operation

Size	Ejector set		Nominal power	Free passage	Speed	Installation type		
	Nozzle	Diffusor	P_2					
	[mm]	[mm]	[kW]	[mm]	[rpm]	L	M	V
100-249/184	60	104	11,0	100	1476	✗	✗	✗
100-260/224	65	104	15,0	100	1477	✗	✗	✗
100-265/224	65	104	15,0	100	1477	✗	✗	✗

Motor data

Motor data for 400 V, 50 Hz, 3~

Motor type	Nominal power P_2	Input power P_1	Nominal current I_N	Power factor cos φ	Starting method	Starting current I_A DOL[12)]	Enclosure to DIN 40050	Power cable	Outside diameter of the cable
	[kW]	[kW]	[A]			[A]			[mm]
114XEG	5,5	6,14	10,8	0,82	DOL/YΔ	97	IP 68	S1BN8-F12G1,5	16,6 - 17,6
154XEG	7,5	8,3	14,6	0,82	DOL/YΔ	124	IP 68	S1BN8-F12G1,5	16,6 - 17,6
184XEG	11,0	12,0	21,7	0,80	DOL/YΔ	171	IP 68	S1BN8-F12G1,5	16,6 - 17,6
224XEG	15,0	16,3	28,3	0,83	DOL/YΔ	207	IP 68	S1BN8-F12G2,5	18,5 - 19,5
184XEG S1	6,5	7,16	12,2	0,85	DOL/YΔ	101,26	IP 68	S1BN8-F12G1,5	16,6 - 17,6
224XEG S1	7,5	8,21	15,2	0,78	DOL/YΔ	156,56	IP 68	S1BN8-F12G1,5	16,6 - 17,6

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12) See Motor Data Booklet 2553.53

Dimensions

Amajet L, horizontal installation

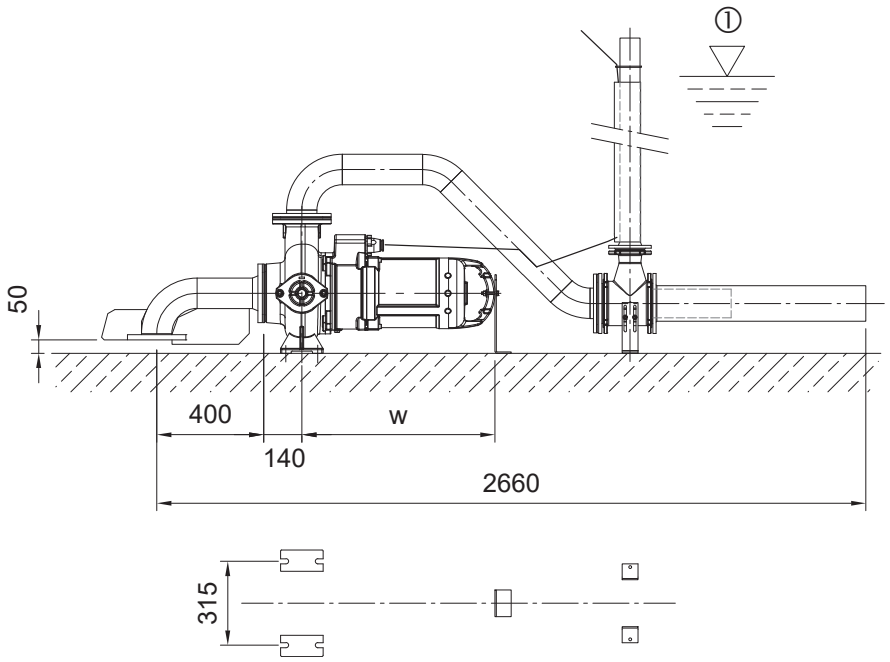

Fig. 2: Amajet L

①	Max. water level

Dimensions [mm]

Size	Motor	W	Pump	Total
			[kg]	
L 100-2.../114 XEG	KA13	656	175	275
L 100-2.../154 XEG	KA16	710	196	296
L 100-2.../184 XEG	KA16	710	206	306
L 100-2.../224 XEG	KA16	710	219	319

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Amajet M, compact installation

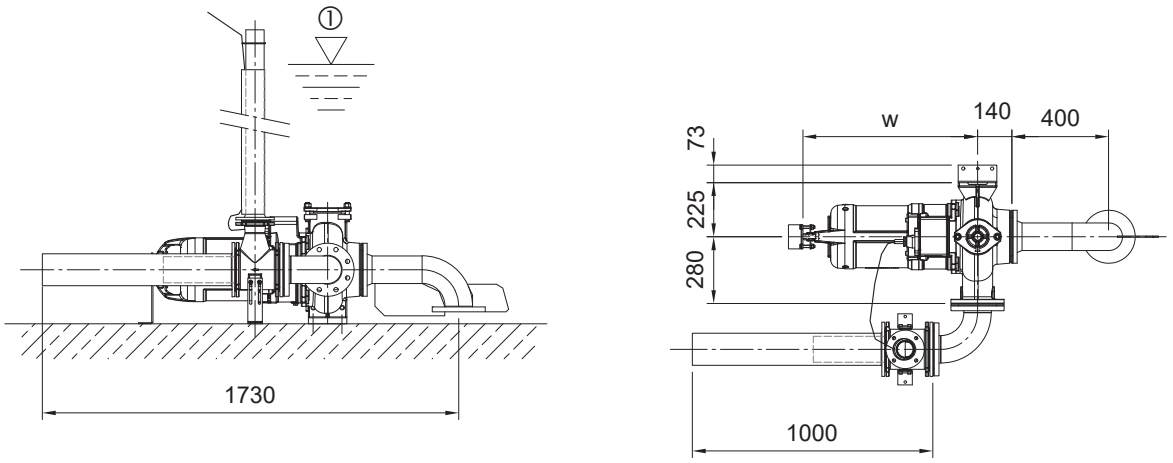

Fig. 3: Amajet M

①	Max. water level

Dimensions [mm]

Size	Motor	W	Pump	Total
			[kg]	
M 100-2... /114 XEG	KA13	656	175	275
M 100-2.../154 XEG	KA16	710	196	296
M 100-2.../184 XEG	KA16	710	206	306
M 100-2.../224 XEG	KA16	710	219	319

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Amajet V, vertical installation

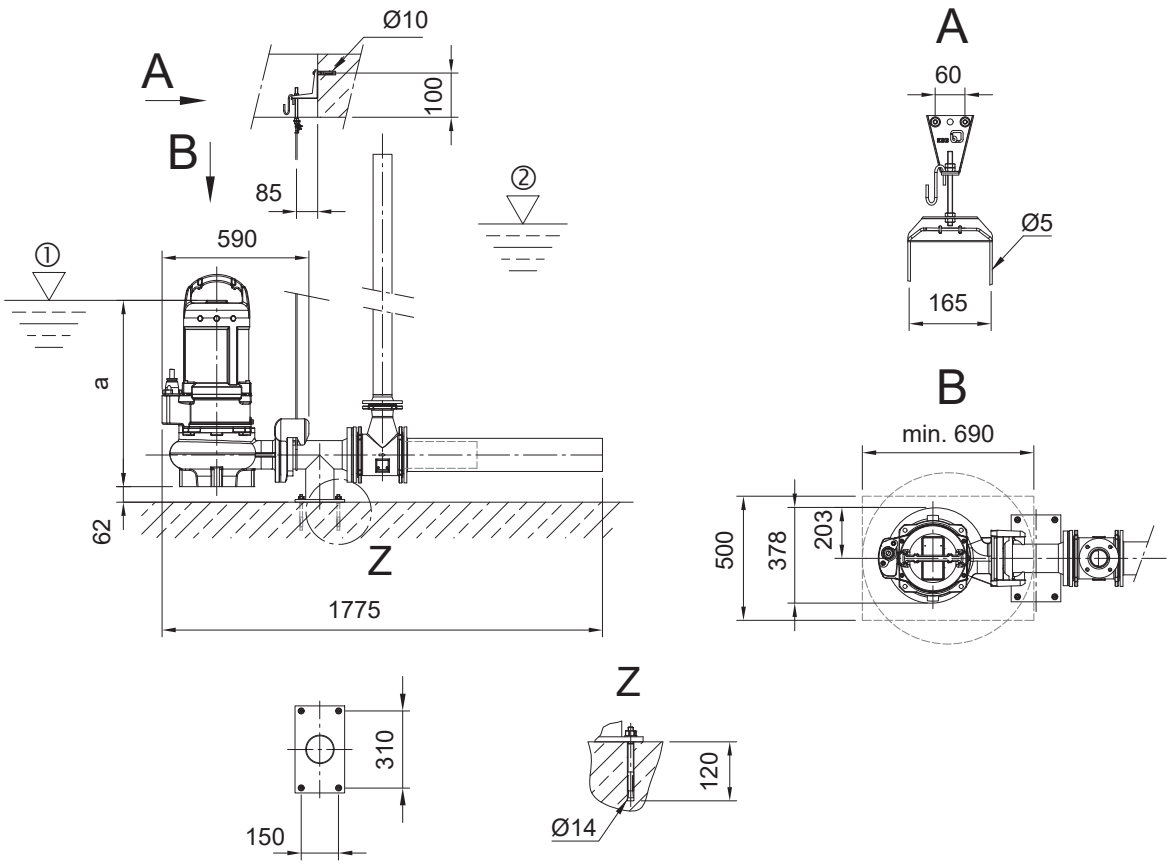

Fig. 4: Amajet V

①	Normal water level
②	Max. water level

Dimensions [mm]

Size	Motor	a	Pump	Total
			[kg]	
V 100-2... /114 XEG	KA13	680	175	245
V 100-2... /154 XEG	KA16	734	196	266
V 100-2... /184 XEG	KA16	734	206	276
V 100-2... /224 XEG	KA16	734	219	289

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General assembly drawings with list of components

Amajet L

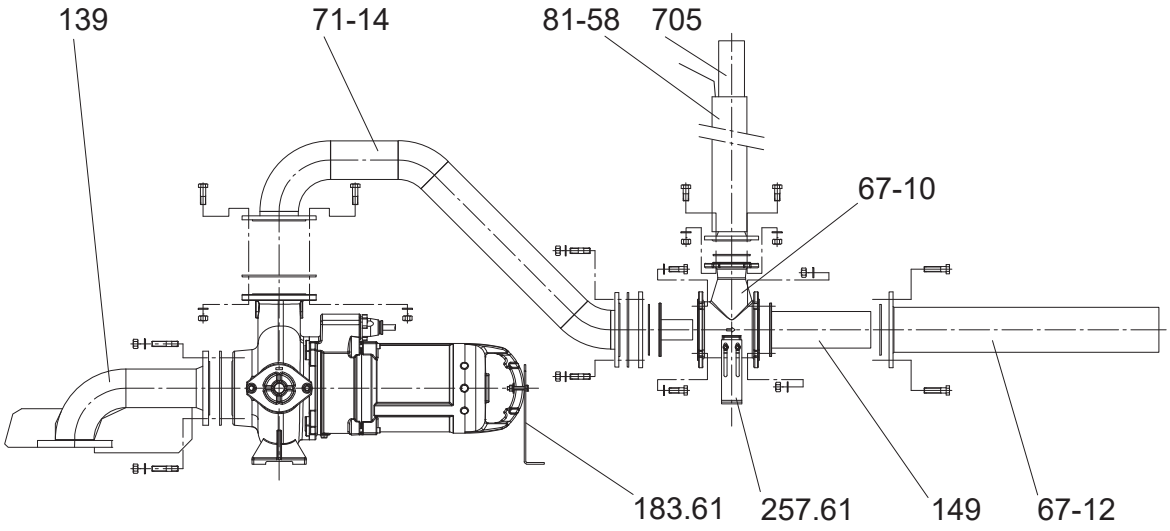

Fig. 5: Amajet L

List of components

Part No.	Description	Part No.	Description
67-10	Ejector set	149	Diffusor
67-12	Ejection pipe	183.61	Support foot
71-14	Connection pipe	257.61	Adjusting strip
81-58	Cable conduit	705	Vent line
139	Suction elbow		

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Amajet M

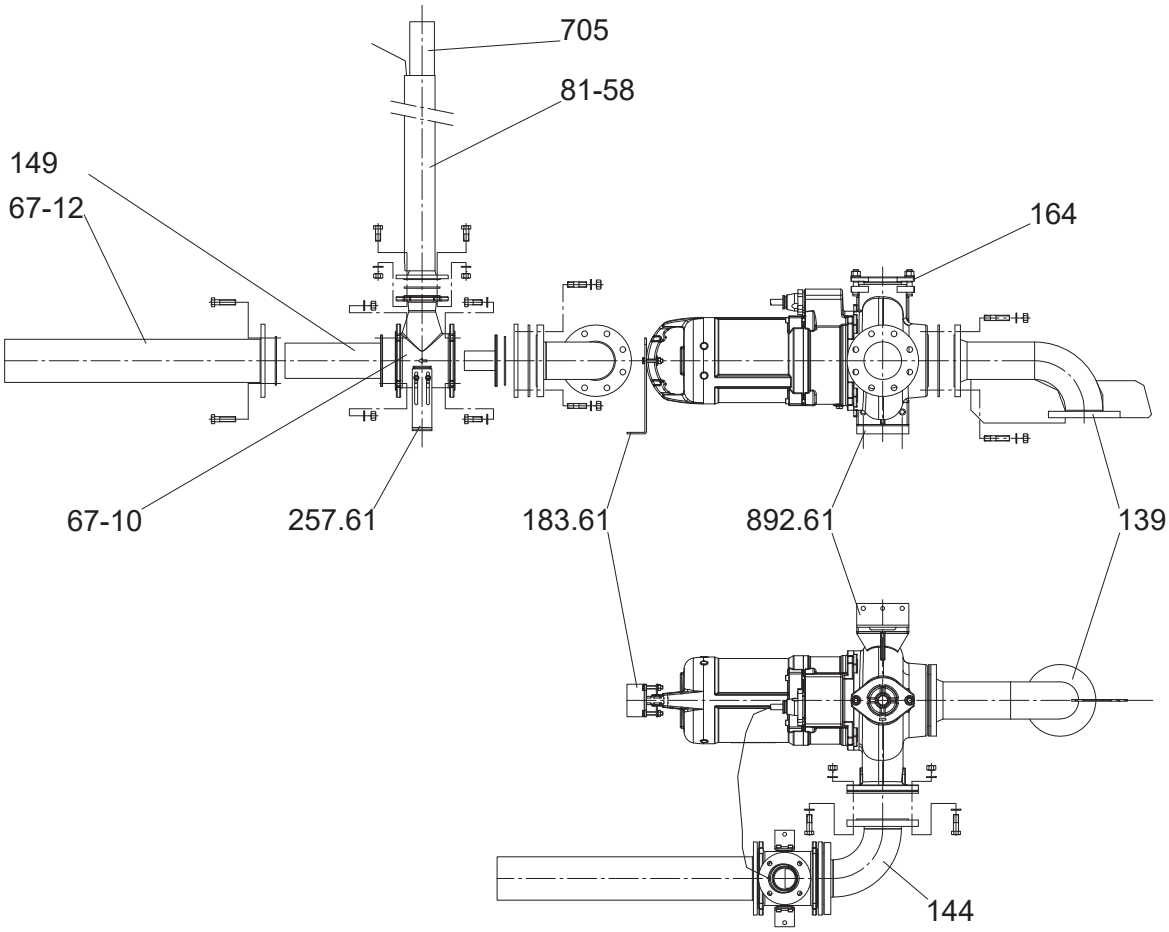

Fig. 6: Amajet M

List of components

Part No.	Description	Part No.	Description
67-10	Ejector set	164	Inspection cover
67-12	Ejection pipe	183.61	Support foot
81-58	Cable conduit	257.61	Adjusting strip
139	Suction elbow	705	Vent line
144	Discharge elbow	892.61	Foot plate
149	Diffusor		

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Amajet V

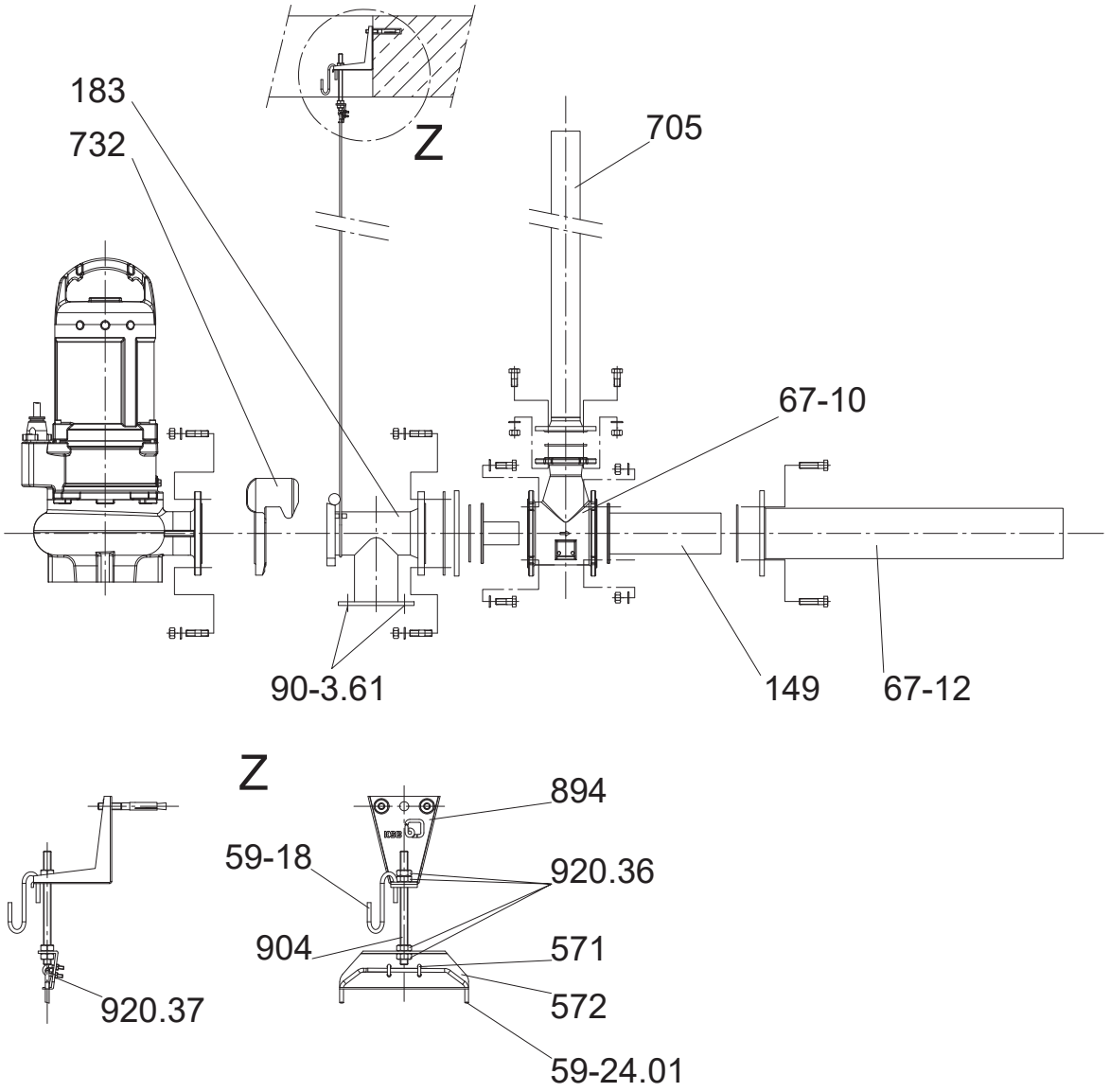

Fig. 7: Amajet V

List of components

Part No.	Description	Part No.	Description
59-18	Hook	571	Bail
59-24.01	Wire	572	Guide wire suspension bracket
67-10	Ejector set	705	Vent line
67-12	Ejection pipe	732	Claw
90-3.61	Anchor bolt	894	Mounting bracket
149	Diffusor	904	Grub screw
183	Support foot	920.36/.37	Nut

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SewerAmajet L

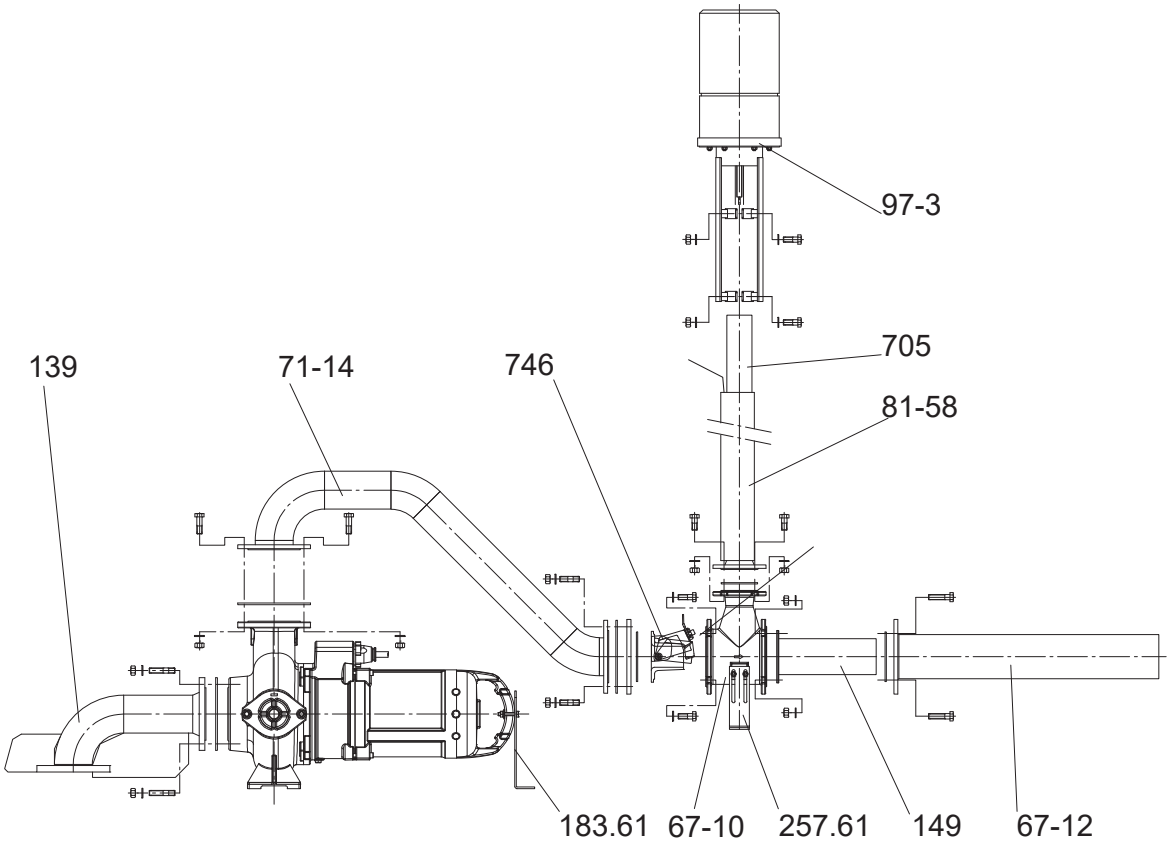

Fig. 8: SewerAmajet L

List of components

Part No.	Description	Part No.	Description
67-10	Ejector set	149	Diffusor
67-12	Ejection pipe	183.61	Support foot
71-14	Connection pipe	257.61	Adjusting strip
81-58	Cable conduit	705	Vent line
97-3	Lifting magnet (including holder)	746	Throttle valve
139	Suction elbow		

SewerAmajet M

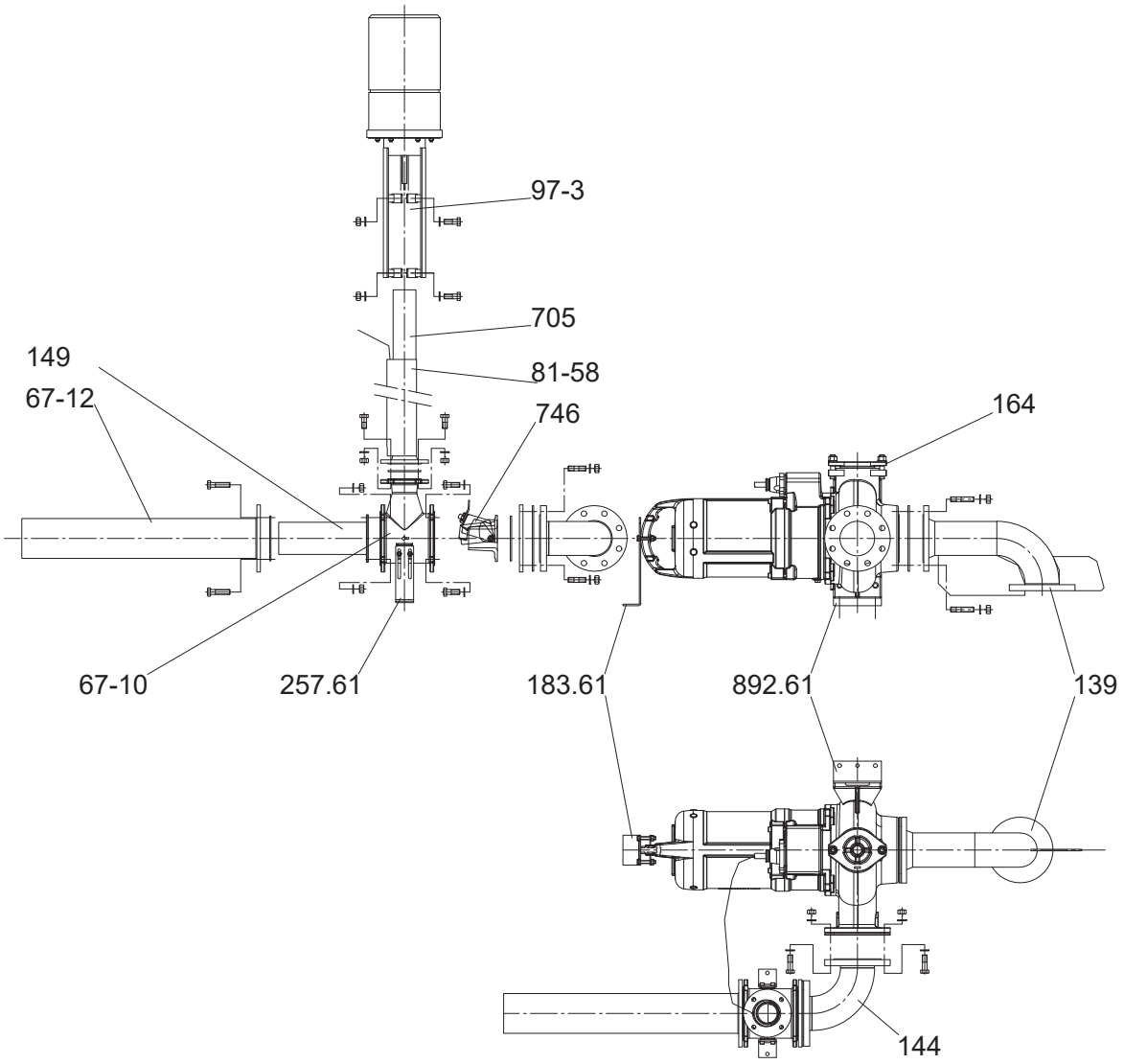

Fig. 9: SewerAmajet M

List of components

Part No.	Description	Part No.	Description
67-10	Ejector set	164	Inspection cover
67-12	Ejection pipe	183.61	Support foot
81-58	Cable conduit	257.61	Adjusting strip
97-3	Lifting magnet (including holder)	705	Vent line
139	Suction elbow	746	Throttle valve
144	Discharge elbow	892.61	Foot plate
149	Diffusor		

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SewerAmajet V

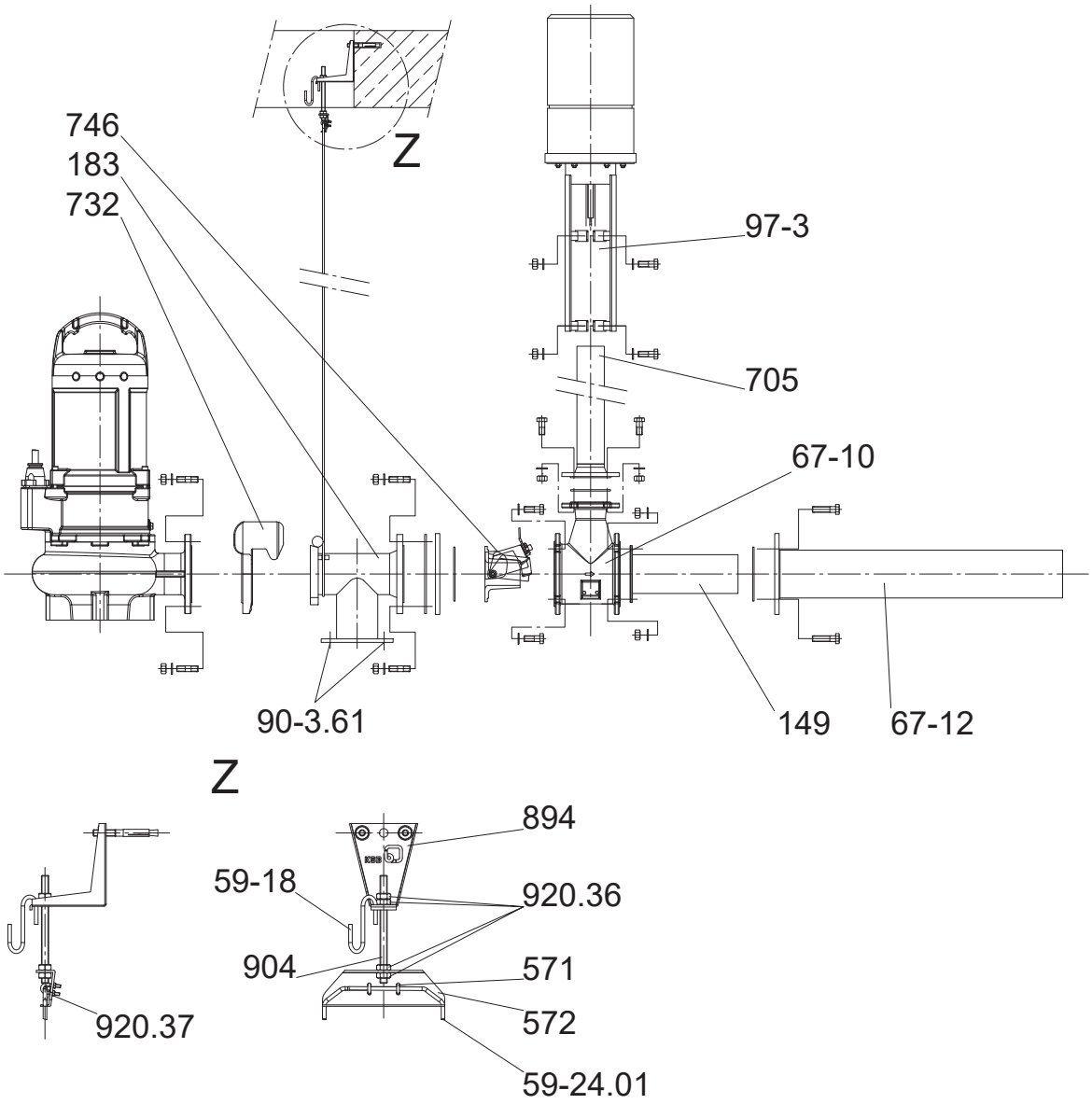

Fig. 10: SewerAmajet V

List of components

Part No.	Description	Part No.	Description
59-18	Hook	571	Bail
59-24.01	Wire	572	Guide wire suspension bracket
67-10	Ejector set	705	Vent line
67-12	Ejection pipe	732	Claw
90-3.61	Anchor bolt	746	Throttle valve
97-3	Lifting magnet (including holder)	894	Mounting bracket
149	Diffusor	904	Grub screw
183	Support foot	920.36/37	Nut

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