3” Pump

Electric Pumps

Operation Manual / Installation Instructions
(Original instructions)

2008-9015-001
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1 Preface

This is a GEA product. GEA is the manufacturer of the Houle product line. This product was formerly known under HOULE trademark.

1.1 About this manual

The manufacturer reserves the right to make changes due to technical developments in the data and illustrations in this manual.

Reproductions, translations and copies of any kind, including extracts, require written authorization from the manufacturer.

This manual is supplied with the product.

- They should be kept close at hand and remain with the equipment even if the equipment is sold.
- This manual is not subject to an amendment service. The most recent version at any time can be obtained through the technical dealer or directly from the manufacturer.

Pictograms used


This pictogram indicates information that will help towards better understanding of a procedure or operation.


This pictogram indicates a special tool required for installation.


A correction bar in the margin indicates changes to the previous edition. The character string ”!!” in the search field of the PDF document locates the correction bar.


This pictogram indicates another document or section to refer to.

All manuals have a part number. The 4 middle digits specify the language of the instruction manual:

	Language		**Language**		**Language**
-9000-	German	-9013-	Dutch	-9032-	Serbian
-9001-	English (United Kingdom)	-9015-	English (North American)	-9034-	Slovak
-9002-	French (France)	-9016-	Polish	-9035-	Chinese
-9003-	Italian	-9018-	Japanese	-9036-	Lithuanian
-9004-	Romanian	-9021-	Danish	-9038-	Portuguese (Brazil)
-9005-	Spanish (Spain)	-9022-	Hungarian	-9039-	French (Canada)
-9007-	Swedish	-9023-	Czech	-9040-	Latvian
-9008-	Norwegian	-9024-	Finnish	-9041-	Estonian
-9009-	Russian	-9025-	Croatian	-9043-	Spanish (Central America)
-9010-	Greek	-9027-	Bulgarian		
-9012-	Turkish	-9029-	Slovene		
The instruction manuals may not be available in all the listed languages.					

1.2 Manufacturer's address

GEA Farm Technologies Canada Inc. / Division GEA Houle
4591 boul. St-Joseph
Drummondville, Qc, J2A 0C6

☎ +1 819 477 - 7444
🖷 +1 819 477 - 5565
✉ geahoule@gea.com
@ www.gea-farmtechnologies.com

1.3 Customer service

Authorized Technical Dealer

If necessary, please contact your nearest dealer.

There is a comprehensive dealer Internet search function on our website at the following address:

www.gea-farmtechnologies.com

European Contact Information:

GEA Farm Technologies GmbH
Siemensstraße 25-27
D-59199 Bönen

☎ +49 (0) 2383 / 93-70
🖷 +49 (0) 2383 / 93-80
✉ contact@gea.com
@ www.gea-farmtechnologies.com

US Contact Information:

GEA Farm Technologies, Inc.
1880 Country Farm Dr.
Naperville, IL 60563

☎ +1 630 369 - 8100
🖷 +1 630 369 - 9875
✉ contact_us@gea.com
@ www.gea-farmtechnologies.com

1.4 EC - Declaration of conformity for machines in accordance with EC Machinery Directive 2006/42 /EC, Annex II 1. A

Manufacturer: **GEA Farm Technologies Canada Inc. / Division GEA Houle**
4591 boul. St-Joseph
Drummondville, Qc, J2A 0C6

We, as manufacturer, declare in sole responsibility that the machinery

Name:	3” pump
Model:	Electric pump
Type:	
Serial number:	CA8-xxxxxxx

complies to all relevant provisions of this and the following directives:

Relevant EC Regulations:	2006/42/EC	EC Machinery Directive
Applied harmonized standards, in particular:	EN 809:2009-06	Pumps and pump units for liquids - Common safety requirements
	EN 894-1-2-3-4 (2008-11)	Safety of machinery - Ergonomics requirements
	EN 953 (2009-07)	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards
	EN 12100-1 (2009-10)	Safety of machinery - Basic concepts, general principles for design
	EN 12100-2 (2009-10)	Safety of machinery - Basic concepts, general principles for design
	EN 1037 (2008-11)	Safety of machinery - Avoidance of unexpected start-up
	EN 14121-1 (2007-12)	Safety of machinery - Risk assessment - Part:1 Principles
	EN 14121-2 (2007-12)	Safety of machinery - Risk assessment - Part 2: Practical guidance and examples of methods
	EN 60204-1 (2007-06)	Electrical equipement of machines
	NF X 08-003-1 (2006-07)	Graphic and pictographic symbols - colors and safety signs
Other applied standards and technical specifications:		

Remarks:	We also declare that the special technical documentation for this machine has been created in accordance with Annex VII, Part A and we obligate to provide these upon reasoned request from the individual national authorities by data transfer.

Authorized person for compiling and handing over technical documentation:	Josef Schröer GEA Farm Technologies GmbH Siemensstraße 25-27 D-59199 Bönen ☏ +49 (0) 2383 / 93-70

Drummondville, 13 september 2012

Yann Desrochers
(Head of Research and Development)

1.5 GEA Farm Technologies Canada Inc. / Division GEA Houle - General equipment warranty

☞ **Important notice!**
THIS GENERAL WARRANTY APPLIES TO ALL EQUIPMENT SOLD UNDER THE HOULE TRADEMARK.

1.5.1 Limited warranty

GEA Farm Technologies Canada Inc. / Division GEA Houle (hereinafter referred to as ”the Company”) warrants to the original buyer and end user (hereinafter referred to as the ”Purchaser”) that the parts of all equipment sold under the Company trademark are free from defects in material or workmanship for a period of twelve (12) months from the date of delivery of the equipment to the Purchaser. This written warranty takes precedence over any other written warranty included in previous versions of the Company's manuals. Any equipment used for commercial usage, commercial lease on one or more farms is warranted for a reduced period of thirty (30) days only.

Components from third-party manufacturers that are not built by the Company, and which are accessory to the equipment sold under the Company trademark (including, without limitation, the motors and tires), are subject to such third-party manufacturers' specific warranty coverage.

THIS WARRANTY EXTENDS ONLY TO THE PURCHASER AND DOES NOT APPLY IN THE EVENT THAT THE EQUIPMENT IS SOLD OR OTHERWISE TRANSFERRED.

1.5.2 Condition of the limited warranty

The Company, through its GEA authorized dealers only (hereinafter referred to as ”Dealer”, reserves the right to either repair or replace all parts deemed defective under the following conditions:

1. That the equipment is installed, operated and maintained in accordance with the Company directives;
2. That the Purchaser uses the equipment in accordance with specific instructions, under normal conditions, for the sole purpose for which the equipment was designed;
3. That the Purchaser notifies in writing his Authorized Dealer or the Company (whichever the case may be) of any defect of the equipment. In either case the notification must be made within the twelve (12) months following the date of the delivery to the Purchaser;
4. The Purchaser or the Authorized Dealer must keep the defective parts or equipment for inspection by the Company and return such defective parts or equipment prepaid to the Company, if requested;
5. That the Purchaser does not modify the equipment, nor attempts to repair any equipment or parts without proper authorization from the Company;
6. Depending on the nature of the equipment involved and whether it is fixed or transportable, the Company will repair or replace the defective parts of the equipment free of charge where installed, or at the business place of the Authorized Dealer or the Company, at its sole discretion.

1.5.3 Extent of limited warranty

This limited warranty DOES NOT cover:

- Defects caused by negligence of the Purchaser in the maintenance of the equipment, improper use resulting from failure to adhere strictly to the Company's manuals or non-compliance with prescribed maintenance instructions provided by the Company (including, without limitation, lack of lubrication of the equipment), as well as damages arising from non-conforming installation of the equipment, or ambient temperature or conditions of storage of the equipment that do not comply with the Company's recommendations (including, without limitation, any damages resulting from storage or operation of the equipment at a temperature equal or below (5°C/41°F));
- Damages to equipment due to normal wear and tear or to external causes, including issues of power or inadequate electrical conditions (including, without limitation, inadequate tension (neutral/ground), abnormal mechanical or environmental conditions (including, without limitation, damages caused by fire, lightning, flood or other natural disaster), damages caused by the use of sand litter or other abrasive or inadequate material (including, without limitation, damages caused by solids in the manure, such as stone, wood, iron, concrete, and strings), as well as damages caused by ice or frozen manure blocking the evacuation line of the equipment or the introduction of such solids in the equipment;
- Freight and shipping associated with repair or replacement of equipment under this limited warranty, as well as all costs relating to removal or replacement of any equipment that is welded or affixed permanently to the ground or a building (including, without limitation, labor costs, and costs related to concrete or excavation);
- Claims arising from repairs or replacements made by the Purchaser without the prior written consent of the Company. The Purchaser shall not remove or alter any safety device, guard, or warning sign.

If the Purchaser fails to comply with any of its obligations referred to in this paragraph, the Purchaser agrees to save the Company and the Authorized Dealer harmless in respect of any liability or obligation incurred by the Company or the Authorized Dealer resulting from such failure of the Purchaser.

1.5.4 Warranty limitations and exclusion

NO WARRANTY, ORAL OR WRITTEN, EXPRESS OR IMPLIED, OTHER THAN THE ABOVE WARRANTY IS PROVIDED IN RESPECT OF THE EQUIPMENT SOLD.

Some states (or jurisdictions) do not allow the exclusion of implied warranties so it is possible that this limitation may not apply.

THE COMPANY DISCLAIMS ALL IMPLIED WARRANTIES, INCLUDING THE WARRANTIES OF MERCHANTABILITY, ADAPTABILITY OR OF PERFORMANCE, PROVIDED THAT SUCH EXCLUSION OF LIABILITY COMPLIES WITH THE LAWS HAVING APPLICABLE REGULATORY JURISDICTION.

THE LIABILITY OF THE COMPANY AND ITS AUTHORIZED DEALERS UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF DEFECTIVE PARTS UP TO THE CONTRACT VALUE FOR THE PURCHASED EQUIPMENT. IN NO EVENT SHALL THE COMPANY BE LIABLE FOR ANY SPECIAL, INDIRECT, CONSEQUENTIAL, INCIDENTAL, PUNITIVE OR EXEMPLARY DAMAGES IN ANY KIND OR CHARACTER, INCLUDING INDIRECT COSTS, LOSS OF PRODUCTION, LOSS OF REVENUES OR PROFITS, AND OTHER DISBURSEMENTS WHICH MAY OCCUR.

Some states (or jurisdictions) do not allow the exclusion or limitation of incidental or consequential damages and so it is possible that these limitations or exclusions may not apply.

1.5.5 General statements

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS THAT VARY BY JURISDICTION.

THE DEALER IS NOT AUTHORIZED TO MAKE ANY ADDITIONAL REPRESENTATIONS OR PROMISES THAT DIFFER IN ANY WAY FROM THE TERM OF THIS LIMITED WARRANTY, OR MODIFY THE PROVISIONS, DURATION AND CONDITIONS OF THIS LIMITED WARRANTY. NO WAIVER OR MODIFICATION OF THIS LIMITED WARRANTY IS VALID UNLESS AGREED TO IN WRITING AND SIGNED BY THE AUTHORIZED REPRESENTATIVES OF THE COMPANY.

IN THE EVENT OF ANY CONFLICT BETWEEN THE ENGLISH LANGUAGE VERSION AND ANY OTHER TRANSLATED VERSION OF THIS LIMITED WARRANTY (WITH THE EXCEPTION OF THE FRENCH LANGUAGE VERSION) THE ENGLISH VERSION SHALL PREVAIL.

2 Safety

2.1 Owner's obligation of care

This product is designed for agricultural purposes only. Make sure to follow the local rules and regulations in relation with the use of this product.

This product is designed and constructed while taking into account a risk assessment, a selection of harmonized standards and other technical specifications to be complied with in order to guarantee a maximum level of safety.

If component(s)/equipment not manufactured by GEA is/are added to this GEA product, consider that new risk(s) may arise from this addition. Make sure the equipment and the environment surrounding the equipment remain safe.

Since agitated manure produces heavy toxic gases, make sure to follow the safety procedures for confined spaces before operating or servicing this equipment in such environment. Look at the corresponding Web site below to make sure the local safety procedures for confined spaces are followed.

Location	Administrated by	Web site
Canada	Canadian Centre for Occupational Health and Safety	www.ccohs.ca
USA	Occupational Safety and Health Administration	www.osha.gov
European Union	European Agency for Safety and Health at Work	www.osha.europa.eu

Safety is achieved when the safety instructions are followed. It is part of the owner's obligation of care to implement these safety measures and make sure they are carried out at all times.

The owner must ensure a safe environment by providing:

- this instruction manual with this product. Everyone performing activities in connection with this product must read this instruction manual and follow those instructions;
- all required personal safety gear such as hearing, eye, feet protection, etc;
- adequate training for employee(s) working or performing activities in connection with this product;
- the tools listed in this manual to perform activities in connection with this product;
- locally purchased components and/or products that comply with the technical requirements mentioned in section Technical data, if applicable;
- new parts to replace any defective, worn or damaged parts on this product;
- adequate lighting in all areas where activities in connection with this product are performed.

2.2 Explanation of safety symbols

The safety symbols draw attention to the importance of the adjacent text.

The design of the notifications is based on ISO 3864-2 and ANSI535.6.

Safety symbols and key words

Danger!
The signal word ”Danger” indicates an immediate threat to the lives or health of personnel.
Death or serious injury may result if the danger is not avoided.

Warning!
The indication ”Warning” signals danger to life or health of personnel.
Death or serious injury may result if the danger is not avoided.

Caution!
The indication ”Caution” signals a hazardous situation.
Minor or moderate injury may result if the danger is not avoided.

Attention!
The word ”Attention” indicates important information on risks for the product or the environment.

2.3 Basic safety instructions

- Only trained personnel can operate this product to ensure safe operating methods. Make sure the personnel performing activities in connection with this product have the skills when special qualifications are required. Read the section Safety - Personnel qualifications.
- Wear appropriate personal safety gear such as hearing, eye, feet protection, etc. when performing activities in connection with this product. Inspect the personal gear and replace if worn and/or defective.
- Familiarize yourself with the environment surrounding the working area. Locate the elements that can be dangerous in order to avoid them.
- No one stands near this product unless they are performing instructions included in this manual. When near this product, keep body parts such as hands, feet, hair as well as clothing away from dangerous parts such as rotating parts, articulated parts, sharp edges, etc.
- Use this product only when in perfect working condition. Do not use damaged, worn or defective parts on this product, replace immediately to avoid serious damages and injuries.
- The use of any tool or lubricant is subject to certain risks. Follow the manufacturer's recommendations and wear appropriate personal safety gear.
- Never remove the safety devices such as guards, covers, chains, labels, etc. from this product to ensure safety unless otherwise indicated in this instruction manual. Refer to section Safety - Protective devices. Read and follow the instructions of the safety labels affixed on this product and make sure the safety labels are legible at all times.

2.4 Personnel qualifications

The manufacturer intends to determine the difference between trained personnel and qualified personnel.

Trained personnel

The operator was trained by the manufacturer or its legal representative to follow all safety rules, cleaning method, general maintenance as well as the operating methods.

It is the operator's responsibility to inform the farm workers of those rules, maintenance and methods.

Qualified personnel

Qualified personnel refers to those having obtained the academic knowledge of a specific field of work.

This personnel has followed a training and subsequently obtained a certification, diploma or any other official document provided by a recognized academic facility in the country of study.

An equivalence may be required when operating in other countries.

The special qualifications required will be specified in each section.

Everyone who performs work or activities in connection with the product must carefully read and understand the manual and then act accordingly.

2.5 Protective devices

This product is equipped with safety parts protecting the user against dangerous elements.

Those parts must be in perfect working condition and remain in place at all times.

Replace if damaged, worn and/or defective. Refer to the part number.

	Safety guard for drive belt (European version only) (part no. 2008-7727-440)
	Protective lower guard for drive belt (European version only) (part no. 2008-1407-730)

2.6 Safety labels

The labels affixed on this product inform the user of the potential dangers, the prohibited manoeuvres, the proper procedures and applications when performing activities in connection with this product.

The labels must remain in place and legible at all times.

Replace when damaged. Refer to the part number for the appropriate label.

	Danger! - Toxic gases (American model) Manure produces toxic gases that can cause loss of consciousness, asphyxia or death in a few seconds. Part no 2099-4720-010
	Danger! - Toxic gases (European model) Manure produces toxic gases that can cause loss of consciousness, asphyxia or death in a few seconds. Part no 2099-4725-210
	Danger! - High voltage. (American model) Always turn off main power before service and maintenance. Read the operator's manual for safety information and for operating, servicing and maintenance instructions. Part no 2099-4721-000
	Danger! - High voltage. (European model) Part no 2099-4725-240
	Danger! - Finger entanglement hazard. Part no 2099-4725-110
	Read the operator's manual for safety information. (European model) Part no 2099-4725-100

	Read the operator's manual for safety information before service and maintenance. (European model) Part no 2099-4725-130
	Always turn off and lock main power before service and maintenance. (European model) Part no 2099-4725-150

 Refer to section 11.1 - Appendix - Label position.

3 Description

3.1 Intended Use

This product is exclusively designed to:

- Transfer dairy waste water or hog manure having a maximum consistency up to 1/4 inch (6mm) according to the pump model.
- Operate in a well-ventilated environment free of explosive gases.
- Operate in a frost free environment.

☞ **Note!**
This product and its equipment are designed for agricultural purposes only. Any applications not listed above are considered as improper use.

Please note that the following is prohibited:

- processing others substances than manure and water into the pump.
- installing an electrical motor on the equipment which does not match the motor technical specifications provided in this manual. The equipment is not designed to use any other type of motor than those listed. Improper motor performance may result in damage to the equipment and/or motor.

The manufacturer/supplier is not liable for any resulting damage. The user alone bears the risk.

Correct use also includes reading the instructions and observing the inspection and maintenance conditions.

- The manufacturer expressly points out that only original parts, original accessories and original chemical substances have been adapted, tested and authorized for use with the product.
- The installation or use of products from other manufacturers may affect the specified properties of the original parts and lead to injury to people and animals.
- The manufacturer does not accept any liability for injury to people or animals, or damage to the product, caused by the use of products from other manufacturers.

3.2 Product Changes

Unauthorized product modifications can have a negative impact on the safety, service life and functionality of the product.

Any modifications not described in the product documentation are deemed to be prohibited.

For safety reasons, do not carry out any unauthorized changes!

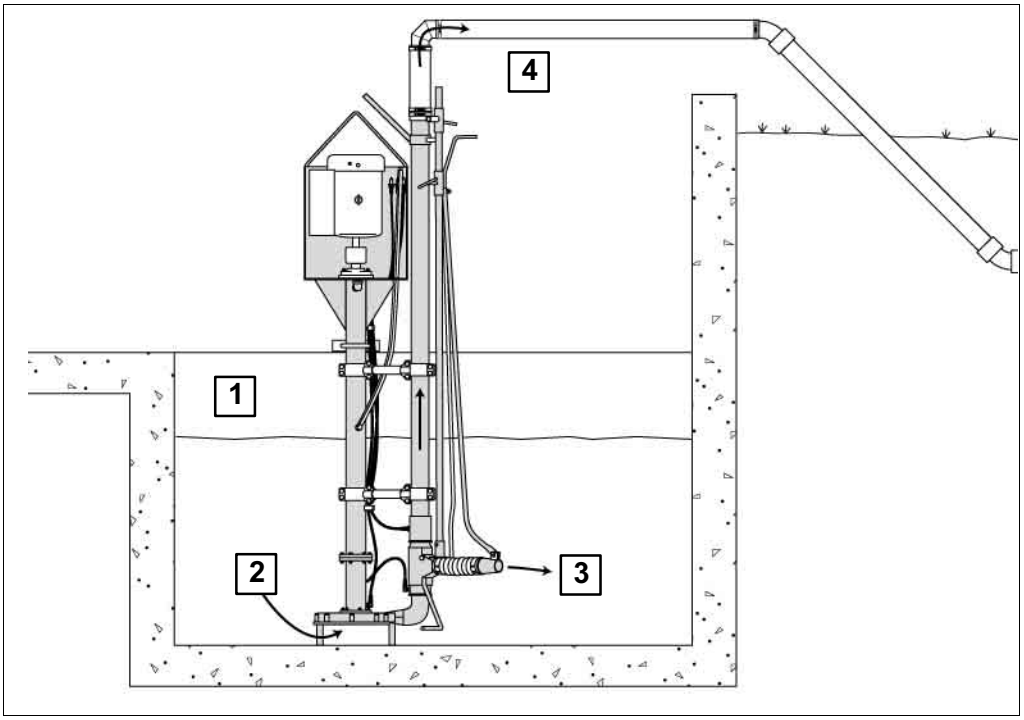
Planned changes must be approved by the manufacturer in writing.

Any unauthorized modifications to the product will invalidate the warranty and may invalidate the manufacturer's declaration or installation declaration provided.

3.3 Functional Description

The pump agitates and transfers manure from a reception pit to a main storage.

The pump either starts automatically or manually via a control panel.



Legend:			
1	Reception pit	2	Pumped liquid
3	Liquid directed through nozzle for agitation (if applicable)	4	Liquid transferred to a storage

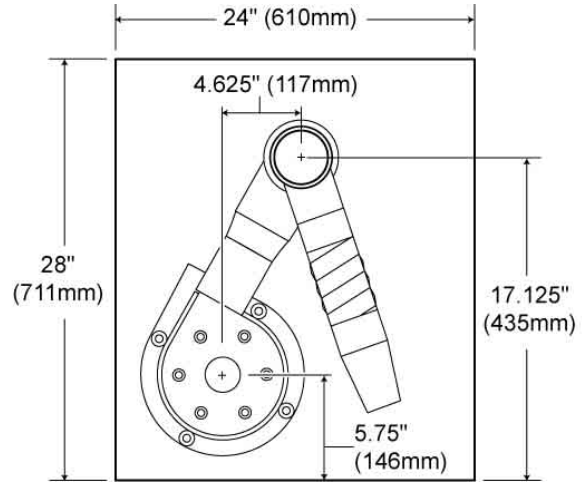
4 Technical Data

4.1 Pump geometric data

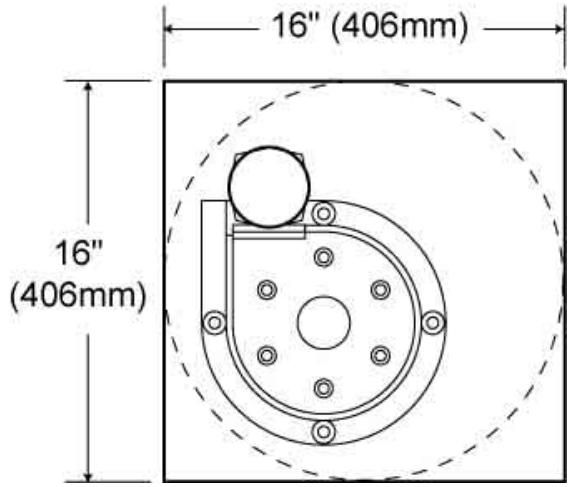
	3” Pump	3” High Pressure	3” Compact
Impeller diameter	5 7/8” [150mm] 6 9/16” [167mm] 6 13/16” [173mm]	7 1/16” [180mm] 8 1/4” [210mm] 9 1/2” [241mm]	5 7/8” [150mm] 6 9/16” [167mm]
Pump height	102” @ 174” [2.59m @ 4.42m]		
Maximum total weight	529 lbs [240kg]	551 lbs [250kg]	375 lbs [170kg]

4.2 Minimum pit opening

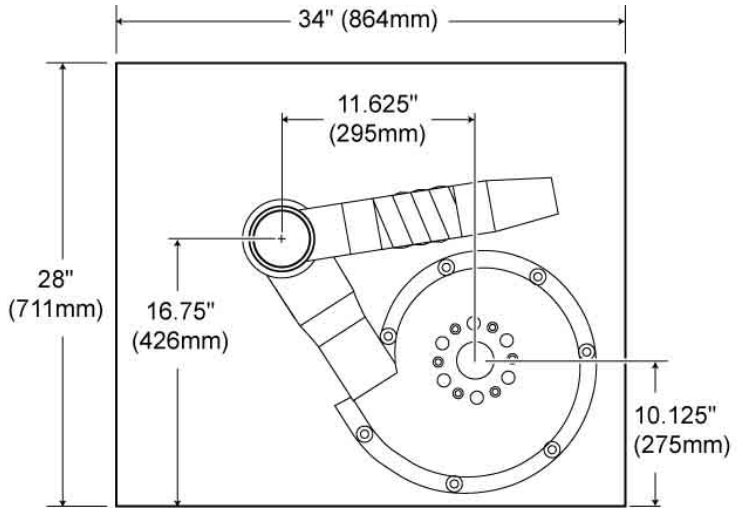
3” pump



3” compact pump



3” high pressure



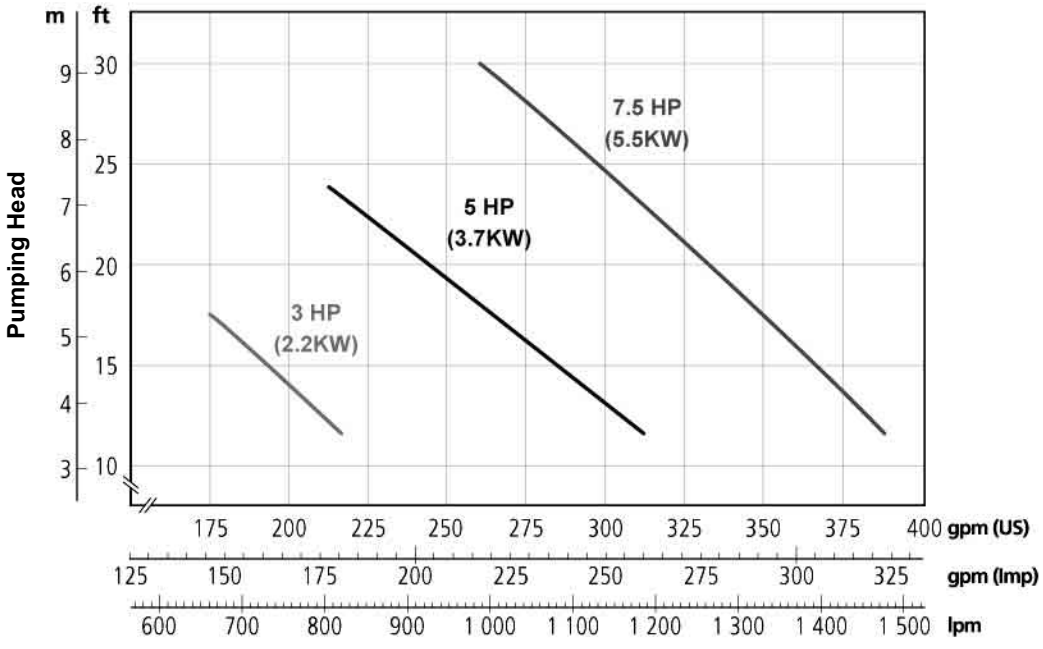
4.3 Performance data

3” pump maximum manure consistency	¼” [6.35mm]
3” high pressure pump maximum manure consistency	⅛” [3.17mm]
3” compact pump maximum manure consistency	¼” [6.35mm]
Maximum pressure	1.79 bar [26 psi]
Operating temperature	5°C [41°F] minimum

☞ **Note!**
The pulley ratio and pump performances indicated in the following tables are standard combinations. To optimize the pump performance, the pulley ratio will be adapted to the evacuation line configuration when required.

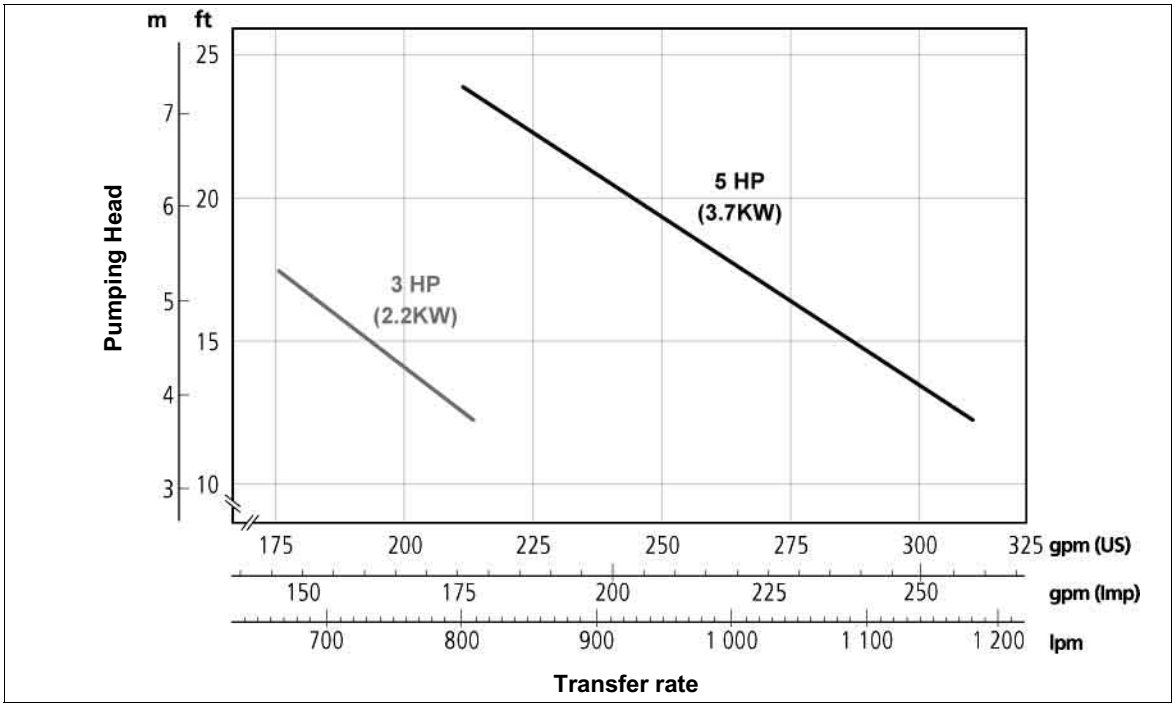
☞ **Note!**
The following charts represent the pump performance when pumping water.

4.3.1 3” pump



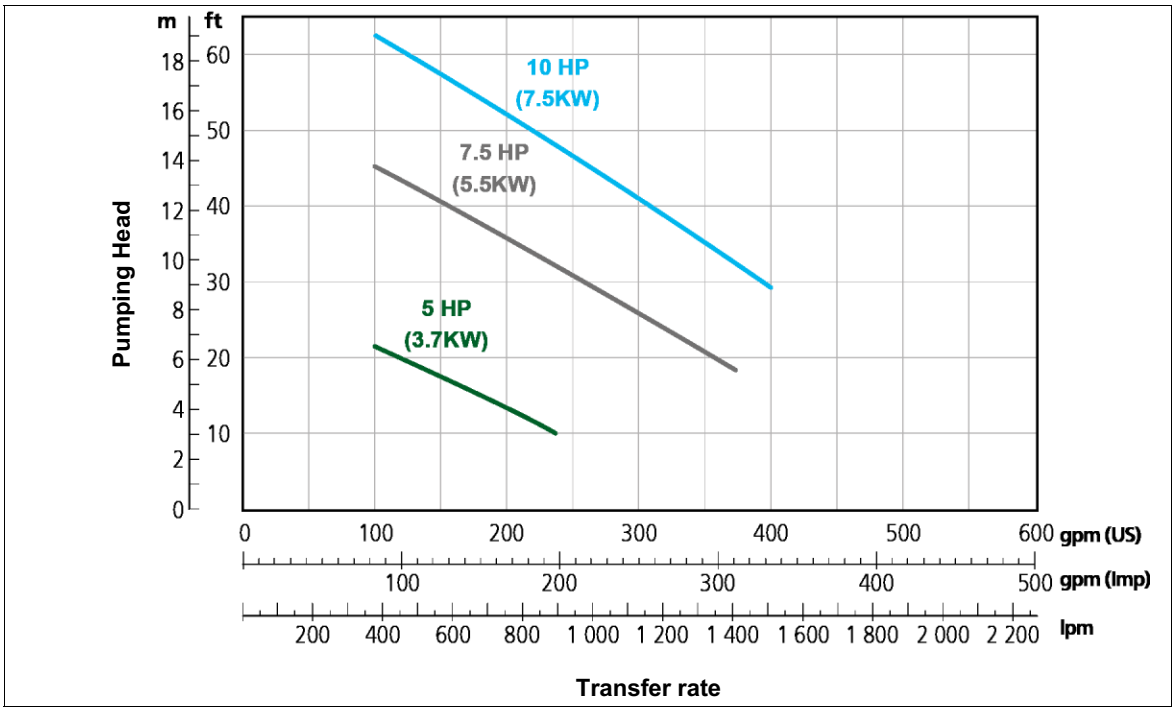
Motor size (SAE)	3HP, 5HP, 7.5HP
Motor size (metric)	2.2KW, 3.7KW, 5.5KW
Pump drive type	Direct drive
Frequency	60 Hz only
Motor RPM	1760
Maximum manure consistency	1/4” [6 mm]
Operating Temperature (minimum)	5°C [41°F]

4.3.2 3” compact pump



Motor size (SAE)	3HP, 5HP
Motor size (metric)	2.2KW, 3.7KW
Pump drive type	Direct drive
Frequency	60 Hz only
Motor RPM	1760
Maximum manure consistency	1/4” [6 mm]
Operating Temperature (minimum)	5°C [41°F]

4.3.3 3” high pressure pump



Motor size (SAE)	5HP, 7.5HP, 10HP	
Motor size (metric)	3.7KW, 5.5KW, 7.5KW	
Pump drive type	Pulley drive	Direct drive
Frequency	50 Hz	60 Hz
Motor RPM	1450	1760
Maximum manure consistency	1/8” [3 mm]	
Operating Temperature (minimum)	5°C [41°F]	

4.4 Motor specification

GEA provides specifications and wiring diagrams related to Baldor motor(s). For any other motor brand, contact the manufacturer.

Motor type	Farm duty motor	
Standard specifications	NEMA	IEC
Frame sizes required**	184T, 215T	112.132
Type of construction	B3	
Weight	No special requirements	
Frame material	No special requirements	
Degree of protection	IP 55	
Method of cooling	TEFC, IC 411 (Totally Enclosed, Fan Cooled)	
Vibration class	No special requirements	
Insulation	155(F) to 130(B)	
Duty type	S1(continuous operation)	
Direction or rotation	Bi-directional	
Rated motor voltage	As per local requirements	
Frequency	50Hz or 60Hz as per local requirements	
Rated motor power	3HP to 10HP [2.2KW to 7.5KW]*	
Rated motor speed	50Hz@1450rpm* 60Hz@1760rpm*	
Rated motor torque	No special requirements	
Rated motor current		
Power factor		
Efficiency	min. 80%	

* Depending on the pump model, some motor sizes may be unavailable. To check availability, refer to section 4.3 Performance data.

** Motor frame sizes that can be fit on the motor support.

4.5 Control panel specifications

The control panel must:

- comply with the following requirements:
  2006/95/CE directives (Electrical equipment designed for use within certain voltage limits)
  92/31/CEE directives (Electromagnetic compatibility)
- comply with the following harmonized standards:
  EN 60204-1 (Safety of machinery - Electrical equipment of machines);
  EN 61082-1 (Documents used in electrotechnology);
  EN 60617 (Graphical symbols).
- be equipped with an emergency stop.
- be protected by a lockable disconnect switch (cut-off switch).
- meet all motor specifications provided in this manual.
- meet local electrical requirements.

Special specifications:

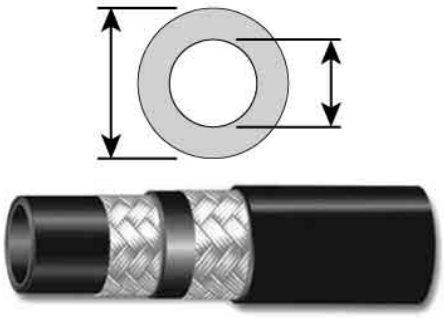
- The control panel protection devices must be designed to avoid any unexpected start.

4.6 Acoustic emission

Noise level	85 dBA

4.7 Hydraulic hoses

Outside diameter (A)	0.56 [14.22mm]
Inside diameter (B)	¼" [6.35mm]
Maximum working pressure	6000 psi [414 bar]
Minimum burst pressure	24 000 psi [1655 bar]
Feature	High pressure
Construction	Nitrile - Type C
Number of braids	2 braids high-tensile steel wire



4.8 Bolt Torque Chart

Note!
Refer to the bolt torque chart below unless otherwise specified in this manual.

Bolt	Mat.	Bolt diameter									
		1/4”	5/16”	3/8”	7/16”	1/2”	9/16”	5/8”	3/4”	7/8”	1”
SAE 2 	LCS	6 ft-lb 8Nm	12ft-lb 16Nm	20ft-lb 27Nm	32ft-lb 44Nm	47ft-lb 64Nm	69ft-lb 94Nm	96ft-lb 130Nm	155ft-lb 210Nm	206ft-lb 279Nm	310ft-lb 420Nm
SAE 5 	MCS HT	10ft-lb 14Nm	19ft-lb 26Nm	33ft-lb 45Nm	54ft-lb 73Nm	78ft-lb 106Nm	114ft-lb 155Nm	154ft-lb 209Nm	257ft-lb 349Nm	382ft-lb 518Nm	587ft-lb 796Nm
SAE 8 	MCAS	14ft-lb 19Nm	29ft-lb 39Nm	47ft-lb 64Nm	78ft-lb 106Nm	119ft-lb 161Nm	169ft-lb 229Nm	230ft-lb 312Nm	380ft-lb 515Nm	600ft-lb 814Nm	700ft-lb 949Nm
Socket Head Cap Screw	AS HT	16ft-lb 22Nm	33ft-lb 45Nm	54ft-lb 73Nm	84ft-lb 114Nm	125ft-lb 170Nm	180ft-lb 244Nm	250ft-lb 339Nm	400ft-lb 542Nm	640ft-lb 868Nm	970ft-lb 1315Nm

4.9 Lubricant specifications

Lubricant type	Product name	Grade	Purpose
Grease	PRECISION™ general purpose EP2	NLGI 2 NLGI 3	• To lubricate the equipment. • To grease the bearing housing. • To grease the sealed bearing.

5 Handling and Assembly

5.1 Special Qualifications Required for Handling

Handling must be performed by a qualified forklift operator and/or qualified overhead crane or hoist operator.

Installation work must be performed by trained personnel in accordance with the safety instructions.

Electric work and electric maintenance must be performed by a certified electrician.

Read the section Safety - Personnel qualifications.

5.2 Safety instructions for handling and assembly

Warning!
Do not stand under or near a lifted load, a falling load can cause death!

Read the section Safety.

5.3 Preparation

5.3.1 Visual inspection

Note!
Inspect all equipment and component. Do not install if damaged.

5.3.2 Special tools

Attention!
To lift the equipment, use a lifting device with a minimum capacity of: 3000 lbs (1400 kg).

	Description	Purpose
	Forklift truck	To lift the equipment
	Lifting chains	To lift the equipment
	Chain hoist	To lift the equipment

	Hammer drill	To make holes in the concrete floor
	Concrete drill bit	To make holes in the concrete floor
	Hammer	To insert anchor bolts
	Wrench set	To tighten bolts and anchor bolts
	Ratchet tool set	To tighten bolts and anchor bolts
	Allen wrenches Pulleys installation	To tighten set screws on pulleys
	Torque wrench	To tighten bolts and anchor bolts at the specified torque

5.3.3 To be provided by the customer

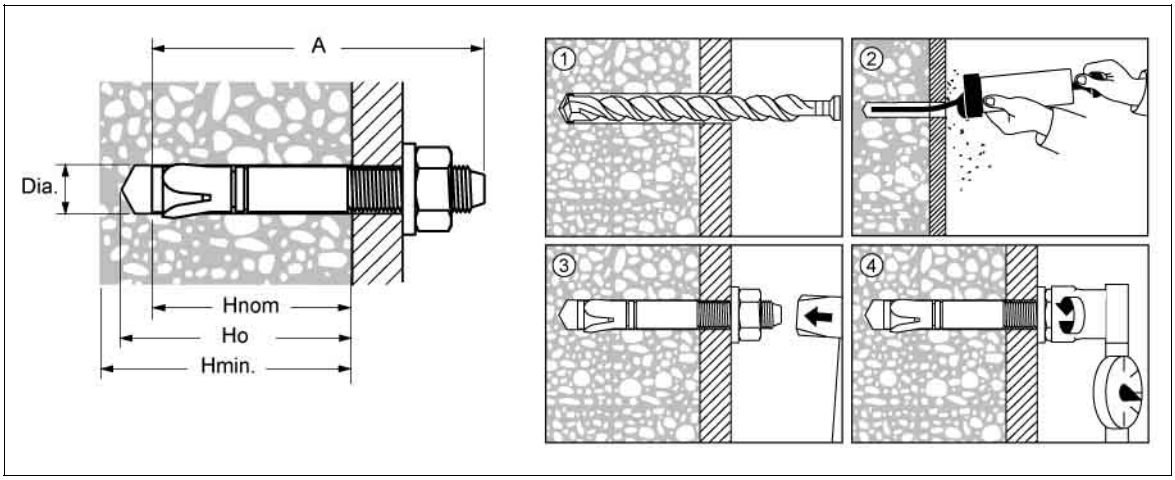
- Safety fences installed around the equipment/reservoir to prevent fall.
- An electric motor meeting the technical specifications provided in this manual. Refer to section 4.4 - Technical Data - Motor specifications.
- A GEA control panel. Refer to section 4.5 - Technical Data - Control panel specifications.

5.4 Packing material disposal

Handle the packing material properly and dispose according to your local rules and regulations on waste disposal. Please contact to your local resources for any questions. Recycle if possible.

5.5 Anchor bolt installation procedure

Attention!
Wait at least 7 days before drilling into concrete so that the slab has harden sufficiently.



Bolt diameter	3/8” [10mm]	1/2” [13mm]			3/4” [19mm]
Bolt length **(A)**	3” [76mm]	2 3/4” [70mm]	3 3/4” [95mm]	3 3/4” [95mm]	5 1/2” [140mm]
Material	Steel	Steel	Steel	SS 304	Steel
Minimum hole depth **(Ho)**	2 5/8” [67mm]	2” [51mm]	2 5/8” [67mm]	2 1/2” [63.5mm]	4 1/2” [114mm]
Hnom	2 3/8” [60mm]	1 3/4” [45mm]	2 1/4” [57mm]	2 1/4” [57mm]	4 1/4” [108mm]
Hmin	4” [101mm]	4” [101mm]	4” [101mm]	4” [101mm]	6” [152mm]
Concrete drill bit diameter **(Dia.)**	3/8” [10mm]	1/2” [13mm]	1/2” [13mm]	1/2” [13mm]	3/4” [19mm]
Torque	20ft-lb (25Nm)	40ft-lb (54Nm)	40ft-lb (54Nm)	40ft-lb (54Nm)	110ft-lb (150Nm)

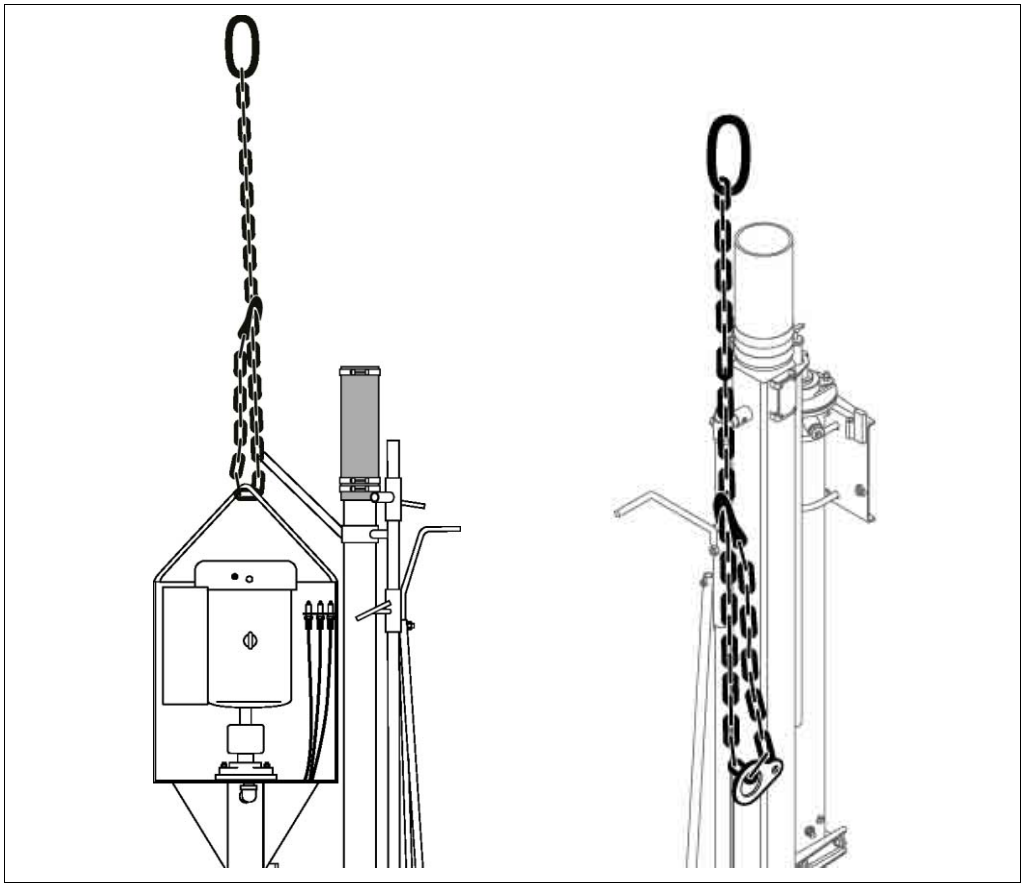
- Position the component on the concrete surface.
- Drill through the holes of the component to 3 ¾” depth (1).
- Remove the particles inside the holes (2).
- Insert the anchor bolts. Keep 1 ½” of length exceeding from the concrete surface.
- Tap the anchor bolt using a hammer until it firmly secures the component.
- Tighten the assembly to appropriate torque. Refer to the following table.
- Cut the exceeding threads of the bolts when indicated.

5.6 Pump handling

Warning!
Do not stand under or near a lifted load, a falling load can cause death!

Attention!
To lift the equipment, use a lifting device with a minimum capacity of: 3000 lbs (1400 kg).

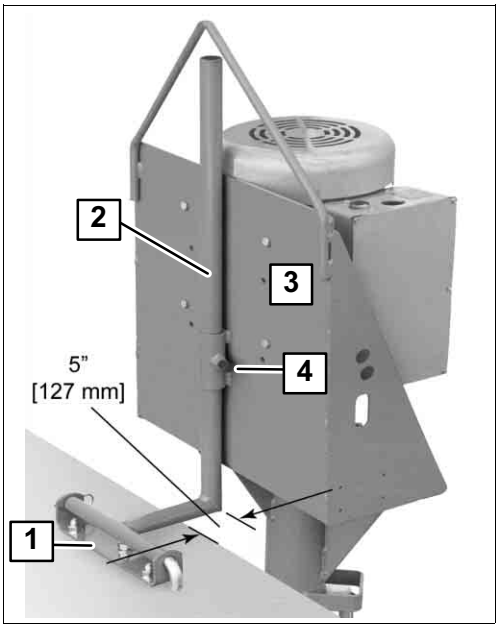
- Choose most appropriate lifting method illustrated.
- Attach safety chains as shown;



5.7 Installing the pump in the reception pit

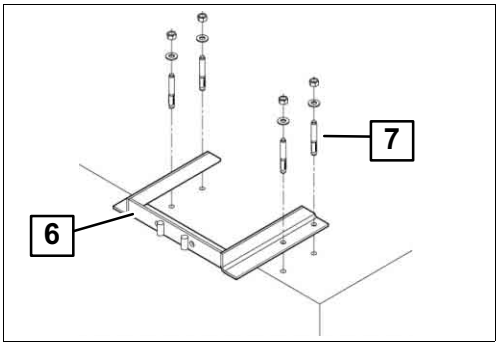
5.7.1 Direct drive pump model

- Position the support as shown;
- Secure the support (1) on the concrete floor using anchor bolts;
- Assemble the support (2) on the pump frame (3) and tighten the adjustment bolt (4);
- Lower the pump into the pit and secure the support (2) to the support base (1);



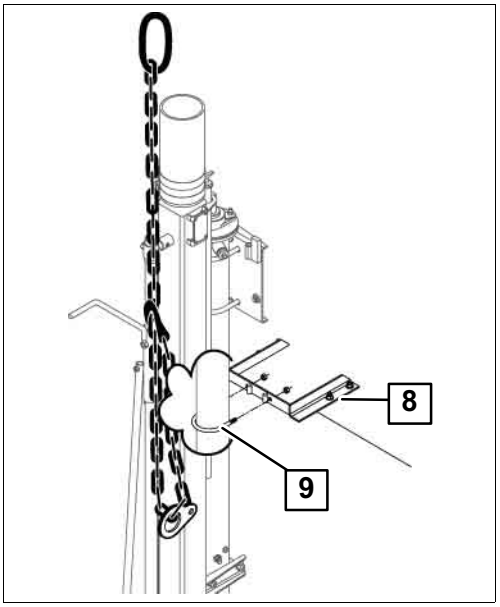
5.7.2 Pulley drive pump model (European 3" high pressure pump only)

- Install the pump support (6) on the concrete floor using 4 anchor bolts (7). Refer to section 5.5 - Anchor bolt installation procedure.



Attention!
When installing the U-bolt, make sure the U-bolt does not compress grease lines.

- Position the pump against the support (8) while making sure it stays vertical;
- Attach the pump to the support using the U-bolt (9). Make sure the U-bolt does not compress the grease lines;
- Tighten the U-bolt to secure the pump onto the support.



5.8 Control panel installation

Danger!
High voltage! Rick of electric shock!
All electric connections must be performed by a qualified electrician.
Follow local and national electric standards.

Warning!
Risk of electric shock!
Connect the control panel and all conductive equipments to an equipotential bond.

This symbol indicates that the terminal must be connected to earth ground.

Refer to the manufacturer's installation pre-requisites.

Step #1: Check the control panel electric components

- Before performing any electric connection, tighten the screws of all the electric components inside the control panel.
- Make sure all wires are properly connected and secured.

Step #2: Locate the control panel

- On a solid wall, at a convenient height, sheltered from sun ray and weather conditions;
- In a convenient area for the operator;
- Near the pump;
- Near the external cut-off switch;
- In an area having free space around the control panel for aeration purposes.

Step #3: Wall mount the control panel

- Place the control panel on the wall and use the holes to sketch the drill pattern;
- Drill through the bolt pattern;
- Secure the control panel in place. DO NOT OVERTIGHTEN.

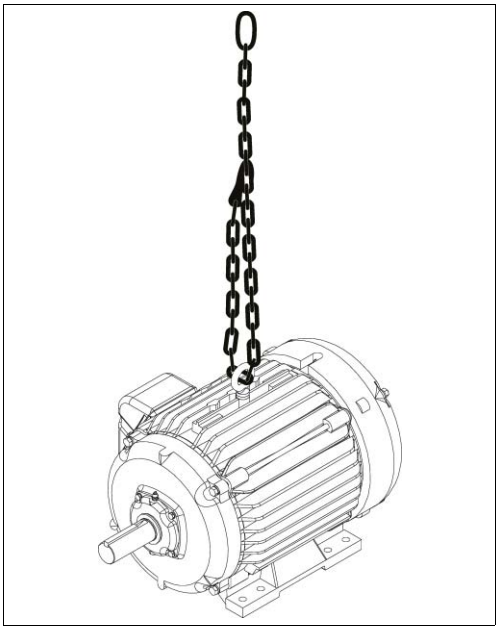
5.9 Electric motor installation

Warning!
Always shut off and lock the power supply before installing the equipment.

Attention!
To lift this product use a lifting device with a minimum lifting capacity of 1000 lbs [450 kg].

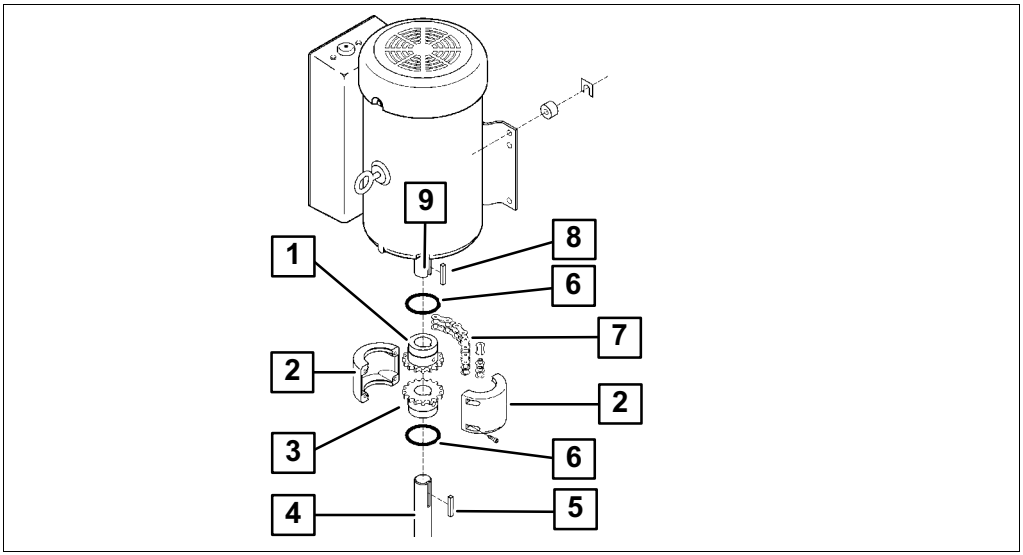
Attention!
GEA provides specifications and wiring diagrams related to Baldor motor(s). For any other motor brand, contact the manufacturer.

- Lift the motor, as illustrated;
- Place the motor in the proper bolt pattern. Refer to the following illustration;



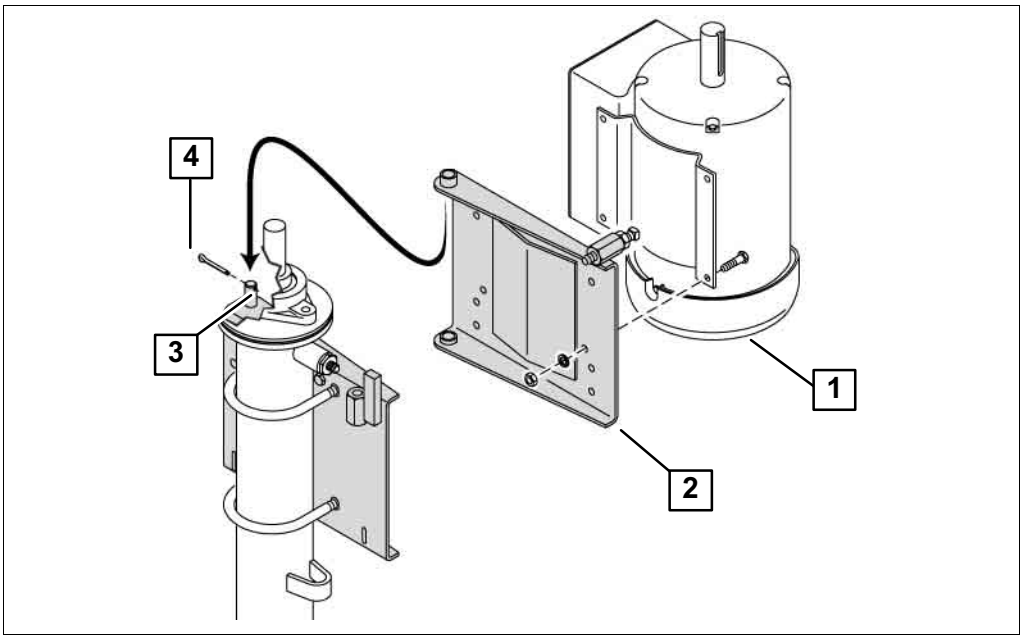
Refer to section 4.8 Bolt Torque Chart.

5.9.1 Direct drive



- Position an O-ring (6) on each half-joint (1,3);
- Install key (5) on the pump shaft (4);
- Place the chain half-joint (3) on the pump shaft (4). Make sure it is even with the top end of the shaft, tighten;
- Install key (8) on the motor shaft (9);
- Place the chain half-joint (1) onto the motor shaft (9). Make sure it is even with the end of the shaft, tighten;
- Place the motor in the proper bolt pattern on the support and secure using lock washers and nuts. Align the motor to the two half-joints (1,3) using the spacers and shims provided. Tighten the assembly;
- Check the alignment of the chain half-joints. Re-adjust, if necessary;
- Loosen up the motor half-joint (1) until it slides on the shaft;
- Install the chain (7) over the half-joints (1, 3);
- Verify the chain coupling alignment by turning it by hand. Make sure the half-joints are perfectly aligned to avoid applying tension on the chain;
- Fill the guard (2) with synthetic grease for ball bearing and place over the chain joint. Make sure the O-rings (6) are properly positioned and seated inside guard before securing the assembly.

5.9.2 Pulley drive (European 3" high pressure pump only)



- Bolt the motor (1) to the support (2). Make sure the support hinge (3) is locked with the cotter pin (4);

5.9.3 Motor direction of rotation

Warning!
Risk of electric shock!
Electric wiring and connection must be performed by an electrician.

Attention!
Improper wiring of the motor can cause motor failure.

- Have an electrician connect the electric motor to the control panel. Refer to the wiring diagram supplied in the starter panel control box;

Warning!
Inadvertent start causing injuries!
Never connect an external cut-off switch directly to the motor(s). The external cut-off switch must be connected to the control panel to shutdown or energize the entire cleaning system through the control panel only.

Attention!
Make sure the motor rotates in the direction indicated on the label apposed on the pump shaft. Inverted rotation can unscrew the impeller and cause a major breakdown.

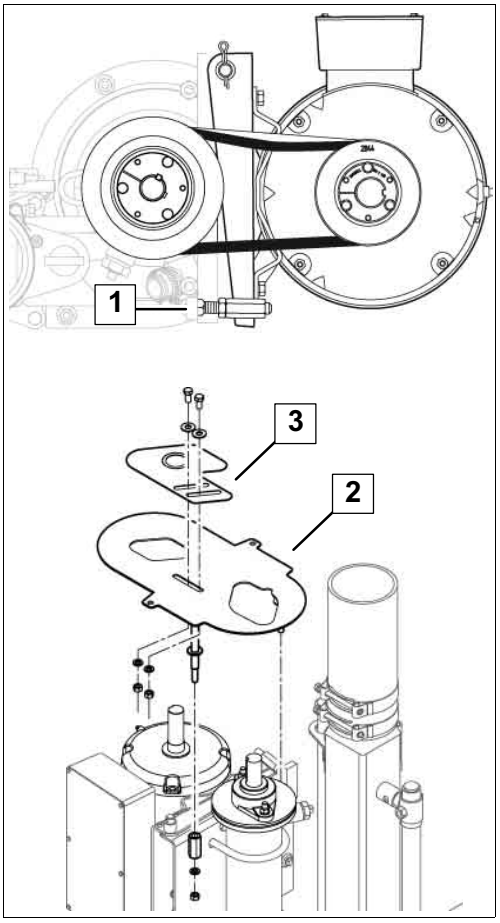
- Engage the motor to check if it rotates in the same direction as the label apposed on the pump shaft;

Warning!
Shutdown is required! shut the main power supply and lock with a locking device. Post a sign on the panel stating: ”Do not turn on, maintenance work in progress” in order to prevent an inadvertent energizing of the main electric supply.

- Shut down and lock the main power supply until all steps in this section are completed.

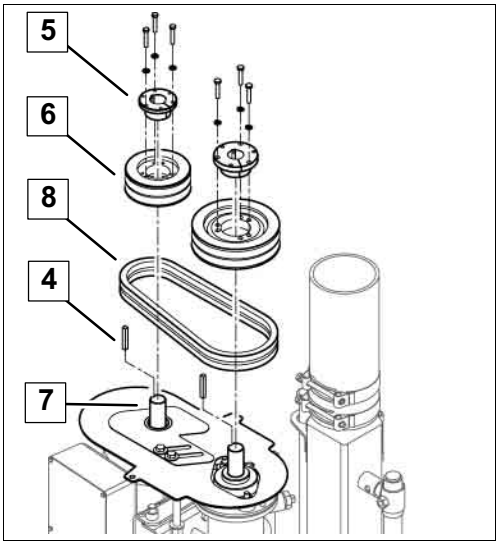
5.10 Drive system installation

- Unscrew the adjustment screw (1) of the motor support in order to install the lower guard (2) and sliding plate (3) using 4 bolts and washers;



Legend:	
A	Segment to be removed to fit on large diametre motor shaft.

- Assemble keys (4), hubs (5) and pulleys (6) on the shafts (7);
- Dry mount assembly only, never use lubricants or antiseize compounds on the hub and hub mounting area;
- Align the pulleys using a straight edge;
- Torque the caps screws of the hubs once the pulleys. Refer to the instructions supplied in the hub box;
- Install the belts (8);

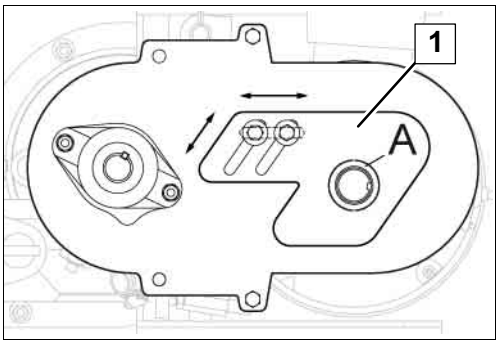


Attention!
Tighten the screws evenly and progressively. Never allow the pulley to be drawn in contact with the flange of the hub.

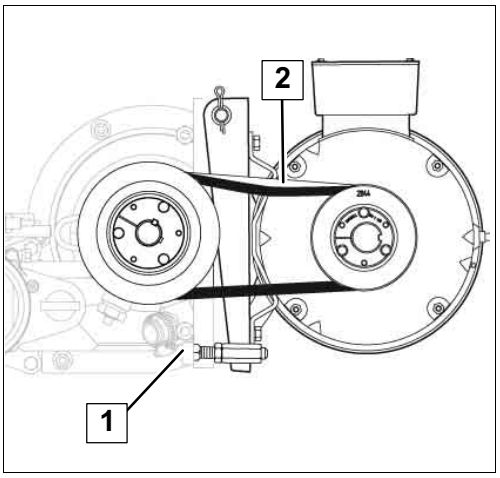
Note!
The following table contains torque requirements specified by the manufacturer. The information may not reflect the current torque requirements. Refer to manufacturer for more information.

Hub set screw torque	
Set screw size	**Torque (Lbf-inches) [Nm]**
#10 - 24	32 [3.62]
¼" - 20	60 [6.8]
5/16 - 18	110 [12.4]
⅜ - 16	200 [22.6]
½ - 13	400 [45.2]
⅝ - 11	860 [97.2]

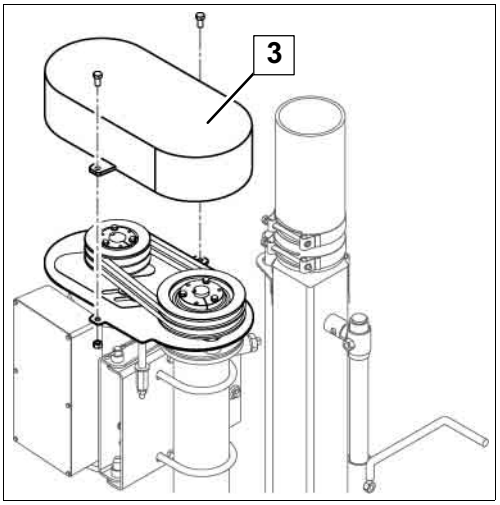
- Adjust the sliding plate (1) according to the distance between the pump and the motor shafts, as shown below.



- Tighten the adjustment screw (1) of the motor support apply tension to the belt;
- The belts must deflect roughly 1/2” (13mm) when applying pressure of 12 lbs (5kg) midway (2) between the pulleys;
- Check pulley alignment and readjust, if required.

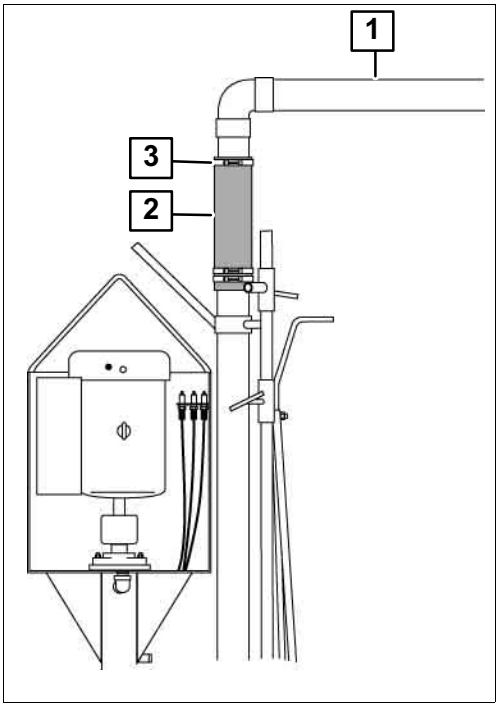


- Install the safety guard (3) over the pulleys assembly and tighten in place using 2 bolts;
- Install the safety guard on its support and fix it in place using 2 lock nuts.



5.11 Connecting the discharge to the evacuation line

- Assemble and connect the evacuation line (1) to the pump discharge hose (2) using a collar (3).



Connection to an outside evacuation line

To ensure proper drainage of the evacuation line, connect the pump outlet to a PVC pipe long enough to provide a minimum of 5% slope towards the main pit.

Connection to an underground evacuation line

To ensure proper drainage of the evacuation line, connect the pump outlet to a PVC pipe buried under the frost line. The underground line must provide a minimum of 1% slope towards the main pit.

6 Starting for the first time

6.1 Special personnel qualification required for initial commissioning

Initial commissioning must be performed by trained personnel in accordance with the safety instructions.

Read the section Safety - Personnel qualifications.

6.2 Safety instructions for initial commissioning

Warning!
Do not operate this product until the initial commissioning checklist is completed.

6.3 Initial commissioning checklist

This checklist must be completed by the dealer and the customer. The initial commissioning steps intend to test the product to validate its functionality. Therefore, the dealer and the customer must operate the product to make sure the product is assembled and/or installed according to the manufacturer's instructions.

General	**DONE**	**N/A**
The owner received the instruction manual from the dealer and commits to read it.		
The owner is instructed by the dealer on how to operate and maintain the product.		
The safety labels are installed.		
The lubrication points are lubricated.		
All bolts are torqued.		
All connections are secured.		
A visual inspection is performed to ensure there are no leaks, signs of distortion or defective parts.		
The equipment/component provided by the owner comply with the specifications contained in section Technical data.		
The motor belts tension is adjusted.		
The pulley hubs are secured with a set screw.		
The belts safety guard is installed and bolted.		
Both motor pulleys are aligned and parallel.		
The pump rotates in the proper direction.		
The control panel is connected to an external cut-off switch.		
The pump can be shut down only through the control panel cut-off switch.		

☞ **Note!**
The dealer and the owner must fill the warranty registration form when the checklist is completed.

Dealer's signature: _____

Owner's signature: _____

Date: _____

6.4 Checks after initial commissioning

The owner must make sure that:

- there are no damaged, worn, defective parts or signs of distortion;
- the safety devices such as guards, covers, chains, etc. are in perfect working condition and remain in place to ensure safety;
- the lubricants such as grease, oil, etc. are at an appropriate level;
- there are no leaks;
- all bolts are tight. Refer to section 4.8 - Technical data - Bolt torque chart;
- the product works perfectly;

6.5 Handing over to the owner

Hand over warranty registration form

The warranty registration form must be completed and signed by the customer and the dealer. The warranty registration form must be returned to GEA Farm Technologies Canada Inc. / Division GEA Houle to validate the warranty.

Declaration of conformity and CE mark
(only necessary for European Union member states)

A declaration of conformity must be produced and a CE mark applied if an entire operational installation is assembled from individual components.

If several directives apply to the complete system, the CE mark indicates that the requirements of all relevant directives have been met.

The technical center/specialist dealer performing the installation work must:

- perform the installation work in accordance with the installation and safety information given in the relevant operating and installation manuals;
- complete the hand-over report and have it signed;
- produce the declaration of conformity for the total installation being handed over;
- Apply the CE mark so that it is clearly visible on the installation.

7 Operating

7.1 Special Qualifications Required for Operating

Operating must be performed by trained personnel in accordance with the safety instructions.

Read the Section: Safety - Personnel Qualifications.

7.2 Safety Instructions for Operating

Read the Section: Safety.

7.3 Transferring mode

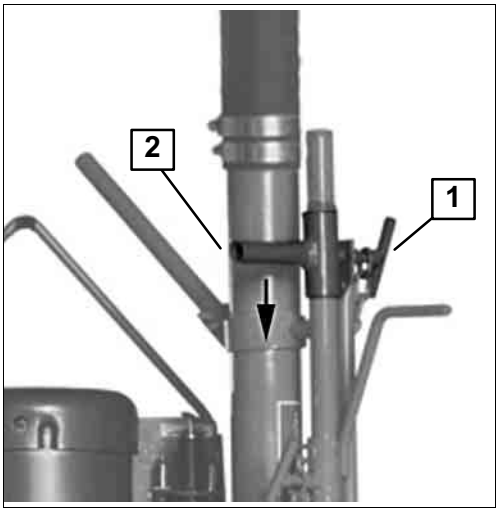
7.3.1 Pump without agitation nozzle

- Start the pump using the control panel.

7.3.2 Pump with agitation nozzle (optional)

Attention!
Stop the motor of the pump before switching from agitation mode to transfer mode and vice-versa.
Make sure all control levers are locked at desired position before starting the motor.

- Unscrew the locking handle (1);
- Push down the valve control lever (2);
- Tighten the locking handle (1) into transfer position;
- Start the pump using the control panel.

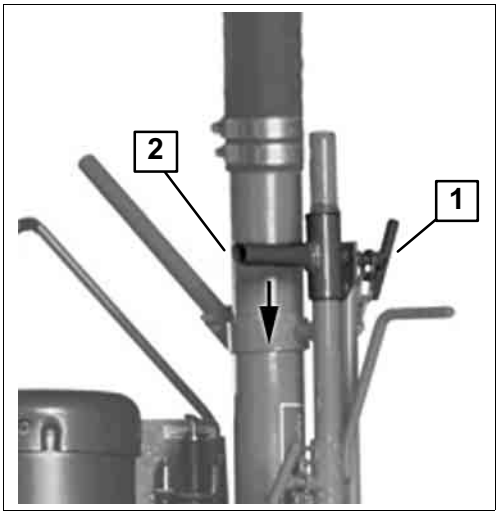


7.4 Agitating mode (optional)

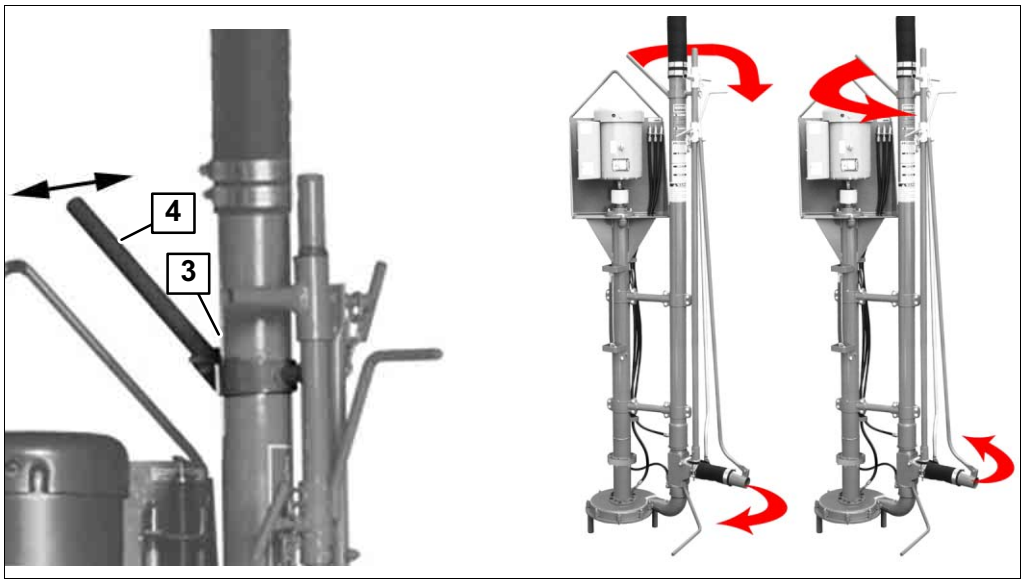
Attention!
Stop the motor of the pump before switching from agitation mode to transfer mode and vice-versa.
Make sure all control levers are locked at desired position before starting the motor.

STEP #1: Set the directional valve in agitation mode

- Unscrew the locking handle (1);
- Pull up the valve control lever (2);
- Tighten the locking handle (1) into agitation position.

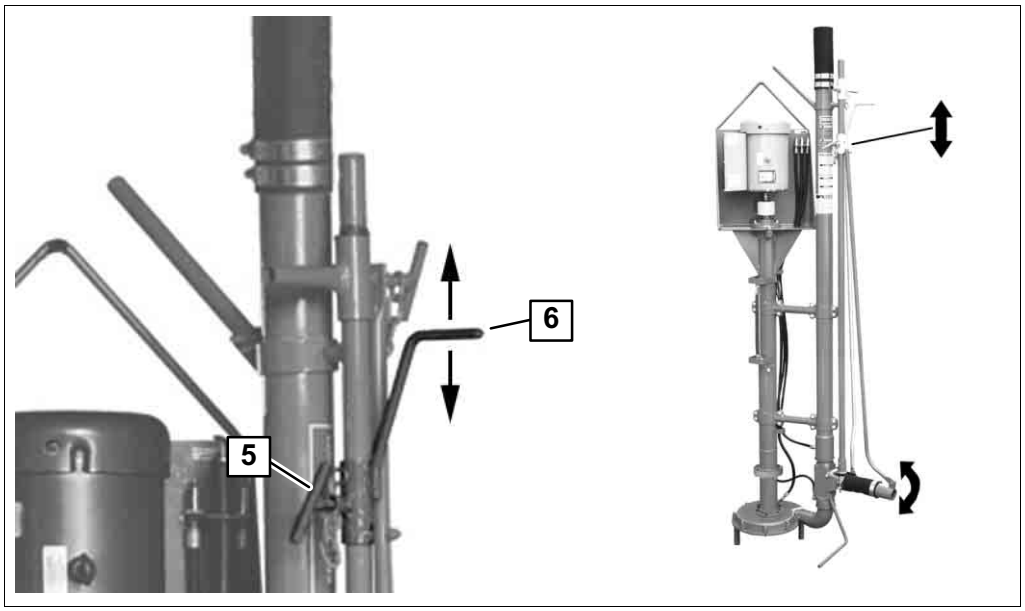


STEP #2: Set the agitation nozzle direction



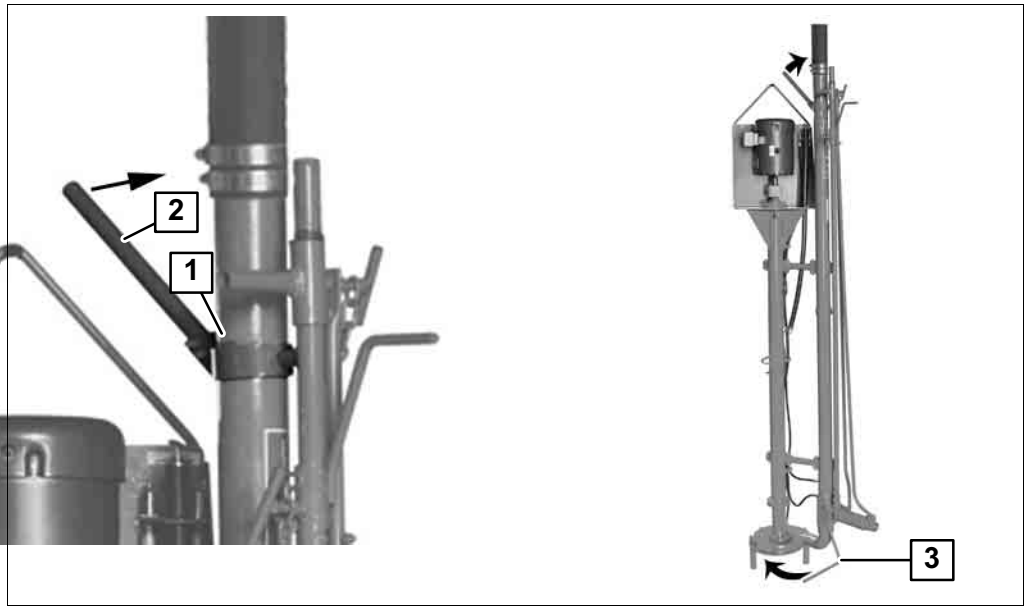
- Unscrew the locking handle (3);
- Turn the nozzle direction control handle (4) in the desired direction;
- Tighten the locking handle (3) in position.

STEP #3: Set the agitation nozzle height adjustment



- Unscrew the locking handle (5) to unlock the nozzle height adjustment handle;
- Set the nozzle height adjustment handle (6) up to raise the agitation nozzle or set it down to lower the agitation nozzle;
- Tighten the locking handle (5) in position;
- Start the pump using the control panel.

7.5 Sweeping accumulations under the pump intake (only with agitation nozzle)



- Unscrew the locking handle (1);
- Turn the nozzle direction control handle (2) to move the sweeping rod (3) under the pump intake;

8 Operating faults

8.1 Special Qualifications Required for Troubleshooting

Troubleshooting must be performed by trained personnel in accordance with the safety instructions.

Read the Section: Safety - Personnel Qualifications.

8.2 Safety Instructions for Troubleshooting

Warning!
Shutdown is required! shut the main power supply and lock with a locking device. Post a sign on the panel stating: ”Do not turn on, maintenance work in progress” in order to prevent an inadvertent energizing of the main electric supply.

Read the Section: Safety.

8.3 Troubleshooting possible faults

Fault	Possible Cause	Solution
Pump is not working.	Power supply has been disconnected.	Have a certified electrician check the wiring of the motor and control panel.
	Emergency stop switch has been pressed.	Check the control panel emergency stop switch and reactivate.
	The liquid manure is too thick.	Perform a consistency test. Refer to section 11.3 - Appendix - Consistency test.
Motor is running without pumping.	Directional valve damaged and jammed in agitation mode.	Repair or replace defective parts.
	Obstruction in the impeller intake.	Contact your dealer.
Pump is working without reaching performance.	Improper manure consistency.	Perform a consistency test. Refer to section 11.3 - Appendix - Consistency test.
	Wrong system configuration (elevation, evacuation line).	Contact your dealer.
	Electrical motor wired incorrectly.	Have a certified electrician check the wiring of the motor.
Pump performance decreases.	Improper manure consistency.	Perform a consistency test. Refer to section 11.3 - Appendix - Consistency test.
	Impeller damaged or worn.	Contact your dealer.
Vibration in the driveline.	Pump bearing worn.	Contact your dealer.
	Impeller deformed.	

9 Maintenance

9.1 Special Qualifications Required for Maintenance Work

Maintenance work must be performed by trained personnel in accordance with the safety instructions.

Electric work must be performed by an electrician.

Read the Section: Safety - Personnel Qualifications.

9.2 Safety Instructions for Maintenance

Warning!
Shutdown is required!

Shut the main power supply and lock with a locking device. Post a sign on the panel stating: ”Do not turn on, maintenance work in progress” in order to prevent an inadvertent energizing of the main electric supply.

Warning!
Always remove the equipment from the reservoir before servicing.

Read the section Safety.

9.3 Scheduled maintenance responsibilities

Note!
When operating this GEA Houle product using other manufacturer's components and/or products such as a PTO, a tractor, a motor, a pump, etc., ALWAYS perform maintenance of the component and/or product as recommended by its manufacturer.

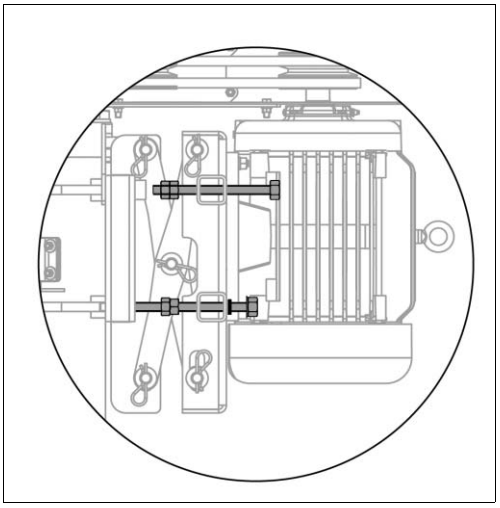
3” pump							
Task	**When required**	**Every 24 hours of use**	**After the first 50 hours of use**	**Every 100 of use or once a week, which ever comes first**	**After the first 1000 hours of use**	**Every 4000 hours of use**	**Every 6 years**
Maintenance to be performed by trained personnel							
Motor support threaded bolts lubrication	X						
Bearing housing lubrication		i					
Check the bolts torque			X				
Check the motor belt tension (if applicable)			X				
Visual inspection			X	X			
Upper bearing lubrication				X			
Maintenance to be performed by a dealer							
Bearing housing seals inspection					i	i	
Chain joint lubrication						X	
Impeller and housing inspection						i	
Hydraulic hoses change							X
Motor belt change							X

i	If this product operates in an environment where abrasive material such as sand is present, perform this maintenance task twice as often. For example, if maintenance is scheduled at 1000 hours, perform maintenance every 500 hours.

9.4 Motor support threaded bolts lubrication

Note!
To prevent seizing of metal parts, apply a significant coat of grease when performing the following maintenance.

- Apply PRECISION™ general purpose EP2 grease on each threaded rod of the motor support.



9.5 Bearing housing lubrication

Note!
Adding grease into the bearing housing prevents contaminants from entering the bearing housing.

- Wipe clean the grease fitting of the remote grease lines;
- Fill the bearing housing with 10 grams of PRECISION™ general purpose EP2 grease.

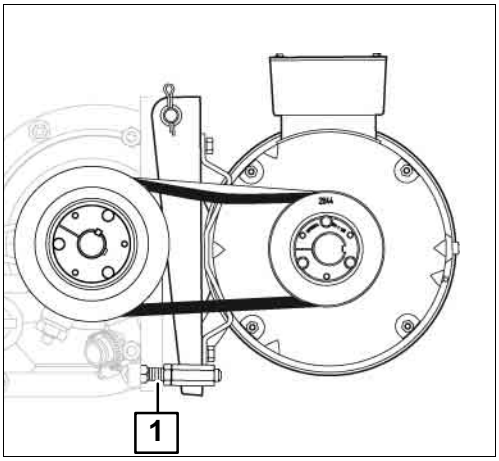
9.6 Check bolts torque

- Check the tightness of all bolts and anchor bolts;
- Retighten to proper torque, if required.

Refer to section 4.8 - Technical data - Bolt torque chart.

9.7 Check the motor belt tension

- Make sure the belts deflect roughly 1/2” (13mm) when applying 12 lbs (5kg) of pressure midway between the pulleys;
- Use adjustment screw (1) on the motor support to adjust belt tension. Only use bolts indicated to adjust the support.



9.8 Visual inspection

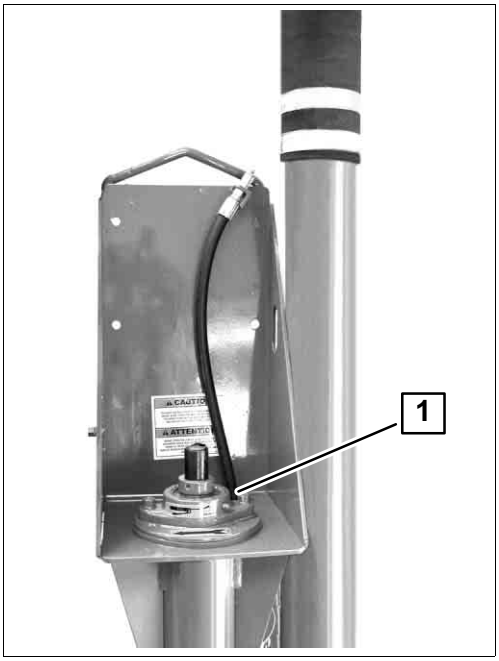
- Monitor closely the product to find any signs of leaks, distortion, wear, damages, vibrations, unusual noise, etc. To repair or change defective part, contact your dealer.

9.9 Upper bearing lubrication

Attention!
Slowly lubricate this bearing to avoid applying significant pressure on the seals. Applying too much pressure will damage the seals inside the bearing.

Note!
Avoid splashing water over the bearing unit! If water contacts the bearing unit, wipe clean the bearing and grease immediately to prevent premature wear.

- Wipe clean the grease fitting (1);
- Slowly add 2 grams of PRECISION™ general purpose EP2 grease while the bearing runs, if possible. Grease must contain mineral oil and lithium thickener having a NLGI rating of 2 or 3 (without MOLY) .



9.10 Bearing housing seals inspection

Seal wear is common and varies according to the environment in which the product operates. Performing seal inspection helps foresee seal replacement in order to prevent important bearing housing wear.

10 Decommissioning

10.1 Special personnel qualification required for decommissioning

Decommissioning may only be performed by specially qualified personnel in accordance with the safety instructions.

Read the section Safety - Personnel qualifications.

10.2 Safety instructions for decommissioning

Read the section Safety.

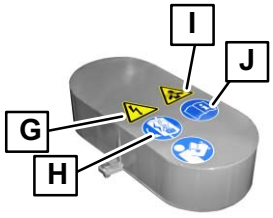
10.3 Final decommissioning/disposal

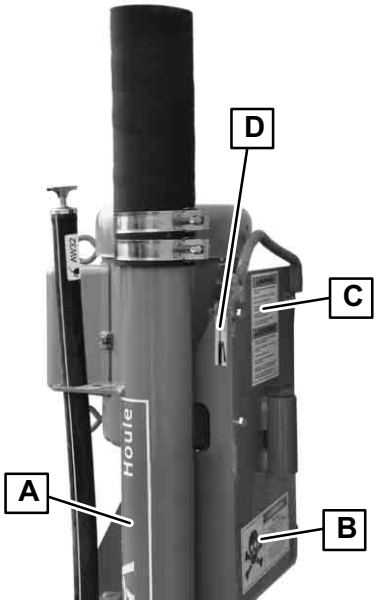
After final decommissioning, handle all components properly and dispose of them in accordance with your valid local rules and regulations on waste disposal. Recycle if possible.

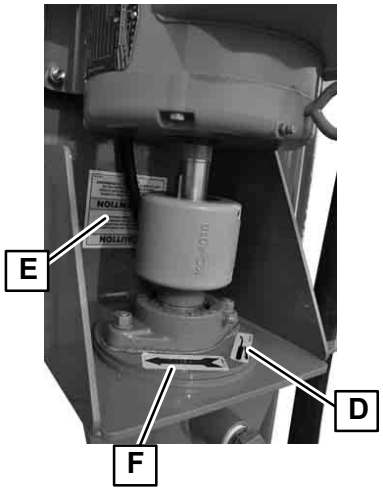
11 Appendix

11.1 Label Position

European model
(pulley drive)







A	US + EU 2010-4700-400	B	US 2099-4720-010	C	US 2099-4721-010
D	US 2099-4701-240	E	US 2099-4720-020	F	US + EU 2099-4700-390
G	EU 2099-4725-240	H	EU 2099-4725-150	I	EU 2099-4725-210
J	EU 2099-4725-100	K	US + EU 2099-4725-110		

11.2 Pumping Head Calculation

Note!
Read the following information before calculating and filling the Pumping Head Formula.

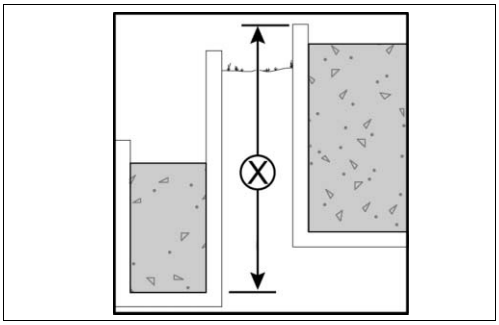
11.2.1 Transfer rate

- In SAE, the transfer rate is expressed in US GPM.
- In metric, the transfer rate is expressed in Liters per minute.

11.2.2 Elevation (X)

The elevation is the height difference between the reception pit bottom and the top of the storage pit.

- In SAE, it is expressed in feet.
- In metric, it is expressed in meters.



11.2.3 Manure consistency

The manure consistency is the viscosity of a well-agitated slurry. A test must be performed to determine the consistency of the manure.

Refer to section 11.3 - Appendix - Consistency test.

11.2.4 Friction coefficient

The friction coefficient is the force engaged between two objects. In this case, the friction occurs between the piping and the manure.

The friction coefficient changes according to the type of pipe/hose (PVC/FLEXIBLE/STEEL) and its diameter as well as the intended flow rate and the manure consistency.

11.2.5 Pipe length equivalence for elbows, adaptors and valves

To complete the total friction loss calculation, each elbow, adapter and valve must be converted into it's equivalent linear dimension of line and added to the length of line.

Components	Pipe Diameter													
	S.A.E.							METRIC						
	3”	4”	6”	8”	10”	12”	15”	75mm	100mm	150mm	200mm	250mm	300mm	350mm
45° PVC elbow	9 '	12 '	18 '	24 '	30 '	36 '	45 '	3 m	3,5 m	5,5 m	7,5 m	9 m	11 m	14 m
90° PVC elbow	9 '	32 '	48 '	64 '				7,5 m	10 m	14,5 m	19,5 m			
45° Houle * steel elbow		8 '	12 '	16 '		24 '			2,5 m	3,5 m	5 m		7,5 m	
90° Houle * steel elbow*		22 '	32 '	42 '		48 '			7 m	10 m	13 m		14,5 m	
”Y” Houle * steel						48 '							14,5 m	
Houle valve	8 '		15 '	20 '				2,5 m		4,5 m	6 m			
Flush tank adaptor *						48 '							14,5 m	
PVC adaptor 12¾” to 15”						45 '								
PVC adaptor 304,8 mm to 381 mm													14 m	

* For 12” [300 mm] GEA Houle steel components, use the Friction Loss Coefficient for PVC pipes.

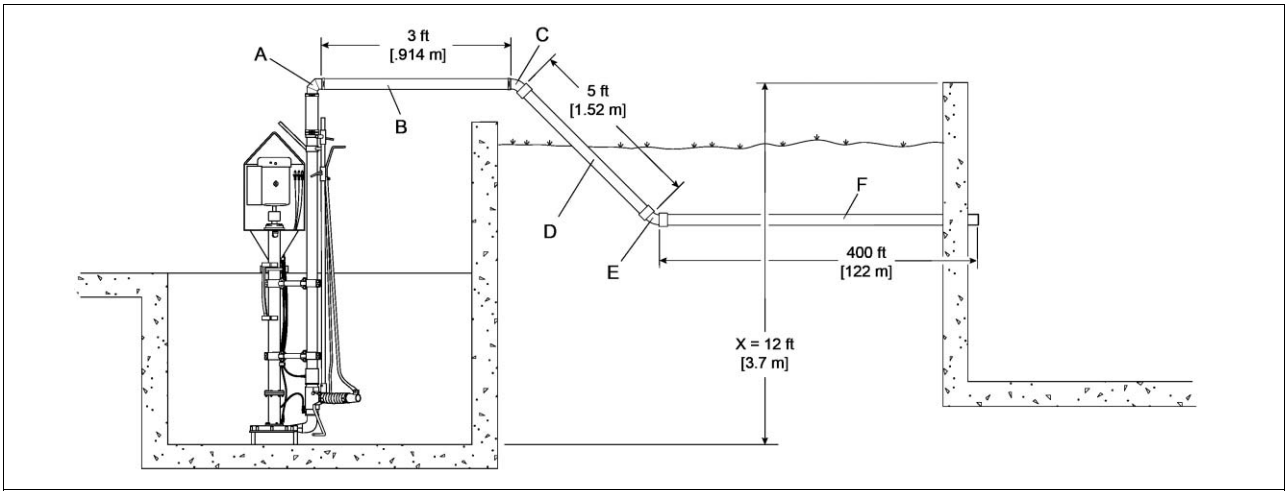
11.2.6 Friction Loss Coefficient of PVC Piping

Diametre	US Gallons per minute	Litres per minute	Liquid and manure consistency				
			Water	1/8" (3mm)	1/4" (6mm)	1/2" (12mm)	3/4" (18mm)
3" (75mm)	150	570	0.0526	0.0599	0.0710	0.1041	0.1519
	210	800	0.0980	0.1117	0.1323	0.1940	0.2832
	270	1020	0.1560	0.1778	0.2106	0.3088	0.4508
	330	1250	0.2261	0.2577	0.3052	0.4477	0.6534
4" (100mm)	200	760	0.0220	0.0251	0.0297	0.0436	0.0636
	280	1060	0.0410	0.0468	0.0554	0.0813	0.1186
	360	1360	0.0653	0.0745	0.0882	0.1294	0.1888
	440	1670	0.0947	0.1080	0.1278	0.1875	0.2737
	520	1970	0.1290	0.1470	0.1741	0.2554	0.3728
6" (150mm)	400	1510	0.0110	0.0125	0.0148	0.0218	0.0318
	500	1890	0.0166	0.0189	0.0224	0.0329	0.0480
	600	2280	0.0233	0.0265	0.0314	0.0461	0.0673
	700	2650	0.0310	0.0353	0.0418	0.0613	0.0895
8" (200mm)	500	1890	0.0041	0.0047	0.0055	0.0081	0.0118
	700	2650	0.0076	0.0087	0.0103	0.0151	0.0220
	900	3410	0.0121	0.0138	0.0164	0.0240	0.0350
	1100	4160	0.0176	0.0200	0.0237	0.0348	0.0508
10" (250mm)	800	3030	0.0033	0.0037	0.0044	0.0065	0.0095
	1100	4160	0.0059	0.0068	0.0080	0.0117	0.0171
	1400	5300	0.0093	0.0105	0.0125	0.0183	0.0267
	1700	6440	0.0133	0.0151	0.0179	0.0262	0.0383
12" (300mm)	1200	4540	0.0029	0.0033	0.0039	0.0057	0.0083
	1600	6060	0.0049	0.0056	0.0066	0.0096	0.0141
	2000	7570	0.0074	0.0084	0.0099	0.0146	0.0213
	2400	9480	0.0103	0.0118	0.0139	0.0204	0.0298
	2800	10600	0.0137	0.0156	0.0185	0.0272	0.0396
15" (350mm)	1500	5680	0.0015	0.0017	0.0020	0.0029	0.0042
	2000	7570	0.0025	0.0028	0.0033	0.0049	0.0072
	2500	9460	0.0037	0.0043	0.0051	0.0074	0.0108
	3000	11360	0.0053	0.0060	0.0071	0.0104	0.0152

11.2.7 Friction Loss Coefficient for Flexible Hoses and Steel Piping

Diametre	US Gallons per minute	Litres per minute	Liquid and manure consistency				
			Water	1/8" (3mm)	1/4" (6mm)	1/2" (12mm)	3/4" (18mm)
3" (75mm)	150	570	0.0682	0.0777	0.0920	0.1350	0.1970
	210	800	0.1271	0.1448	0.1715	0.2516	0.3672
	270	1020	0.2023	0.2306	0.2730	0.4005	0.5845
	330	1250	0.2932	0.3342	0.3958	0.5805	0.8473
4" (100mm)	200	760	0.0286	0.0326	0.0386	0.0565	0.0825
	280	1060	0.0532	0.0607	0.0718	0.1054	0.1538
	360	1360	0.0847	0.0966	0.1144	0.1677	0.2448
	440	1670	0.1228	0.1400	0.1658	0.2431	0.3549
	520	1970	0.1673	0.1907	0.2258	0.3312	0.4834
6" (150mm)	400	1510	0.0143	0.0163	0.0193	0.0282	0.0412
	500	1890	0.0215	0.0246	0.0291	0.0427	0.0623
	600	2280	0.0302	0.0344	0.0408	0.0598	0.0873
	700	2650	0.0402	0.0458	0.0542	0.0795	0.1161
	800	3030	0.0514	0.0586	0.0694	0.1018	0.1486
	900	3410	0.0639	0.0729	0.0863	0.1266	0.1848
	1000	3790	0.0777	0.0886	0.1049	0.1538	0.2245
	1100	4160	0.0927	0.1056	0.1251	0.1835	0.2678
8" (200mm)	600	2280	0.0074	0.0085	0.0100	0.0147	0.0215
	800	3030	0.0126	0.0144	0.0171	0.0250	0.0365
	1000	3790	0.0191	0.0218	0.0258	0.0378	0.0552
	1200	4540	0.0268	0.0305	0.0361	0.0530	0.0774
	1400	5300	0.0356	0.0406	0.0481	0.0705	0.1029
	1600	6060	0.0456	0.0520	0.0616	0.0903	0.1318
	1800	6810	0.0567	0.0646	0.0765	0.1123	0.1638
	2000	7570	0.0689	0.0785	0.0930	0.1364	0.1991
	2200	8330	0.0822	0.0937	0.1109	0.1627	0.2375
	2400	9480	0.0965	0.1100	0.1303	0.1911	0.2790
	2600	9840	0.1119	0.1276	0.1511	0.2216	0.3235
	2800	10600	0.1284	0.1464	0.1733	0.2542	0.3710
	3000	11360	0.1459	0.1663	0.1969	0.2888	0.4215

11.2.8 Pumping head formula



INFORMATION						FORMULA				
	1 Intended transfer rate	**2** Type of piping and material	**3** Evacuation line diameter	**4** Manure consistency		**5** Linear equivalence or pipe/hose length		**6** Friction lost coefficient		**TOTAL**
A	210 USGPM [800 lpm]	90º PVC elbow	3” [75mm]	⅛” [3mm]		9' [2.7m]	x	0.1117	=	1.005' [0.31m]
B	210 USGPM [800 lpm]	Hose				3' [0.91m]	x	0.1448	=	0.43' [0.131m]
C	210 USGPM [800 lpm]	45º PVC elbow				18' [5.48m]	x	0.1117	=	2.01' [0.612m]
D	210 USGPM [800 lpm]	PVC pipe				18' [5.48m]	x	0.1117	=	2.01' [0.612m]
E	210 USGPM [800 lpm]	45º PVC elbow				5' [1.52m]	x	0.1117	=	0.559' [0.17m]
F	210 USGPM [800 lpm]	PVC pipe				400' [122m]	x	0.1117	=	44.68' [13.6m]
								SUM of each total	=	50.69' [15.45m]

ELEVATION (X)	+	12' [3.7m]
TOTAL PUMPING HEAD of the transfer line	=	**62.69' [19.10m]**

1. Determine the intended transfer rate;

2. Specify the type of piping and material (elbow, valve, pipe, hose - PVC, steel, flexible);

3. Specify the diameter of each pipe, hose, elbow and valve;

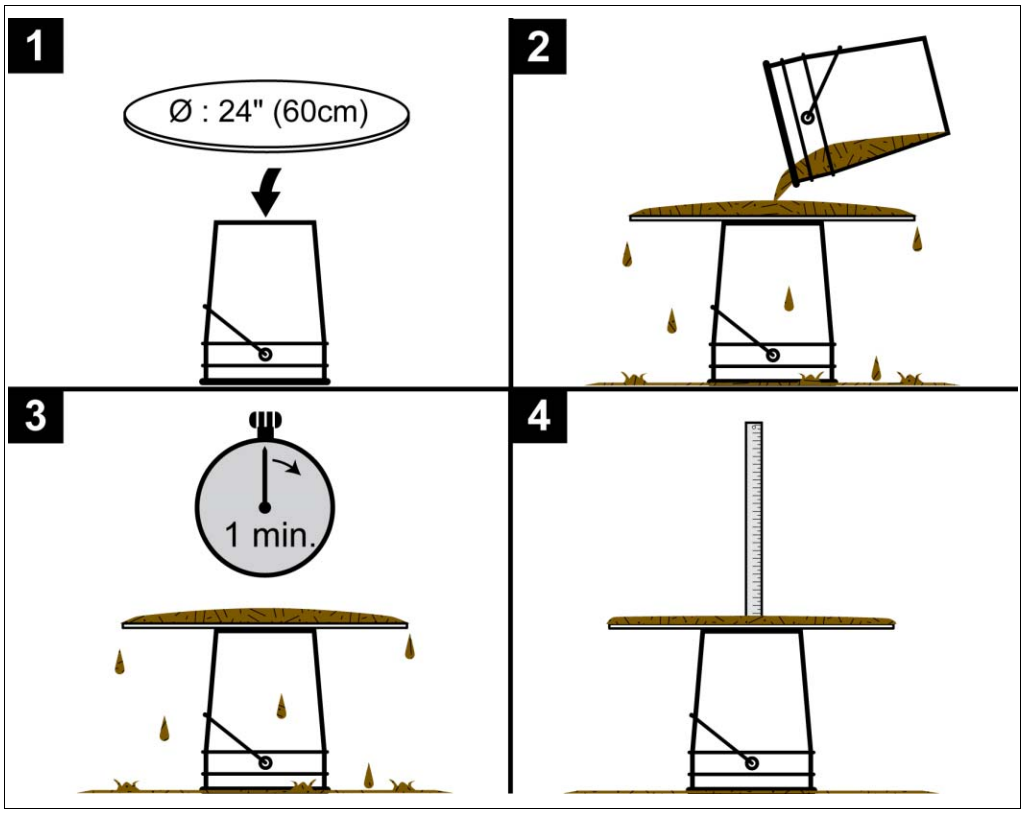
4. Enter the manure consistency after performing a consistency test;

5. Enter the linear equivalence of each elbow and valve (refer to table 11.2.5 - Pipe length equivalence for elbows, adaptors and valves) and enter the length of each pipe and hose;

6. Find the friction lost coefficient for each component (refer to the previous tables 11.2.6 - 11.2.7).

11.3 Consistency test

GEA Houle determined the following method to verify if the viscosity of the liquid manure is suitable for this product.



1. Set a pail on a level surface and install a 24” [60cm] round plate at the center of the pail.
2. Fill a second pail with homogenized liquid manure and slowly pour it in the center of the plate until it overflows all around the plate. Remain close to the plate when pouring the liquid manure.
3. Wait one minute.
4. Measure the thickness of the liquid manure at the center of the plate to determine the consistency.

11.4 Abbreviations

Terms	Explanation	Terms	Explanation
@	at	Ø	diameter
EC	European Community	CW	clockwise
CCW	counterclockwise	fax	facsimile
I.D.	inside diameter	Inc.	Incorporated
NC	national coarse	O.D.	outside diameter
PTO	power take off	PVC	polyvinyl chloride
QC	Quebec	SAE	Society of Automotive Engineers
USA	United States of America	WWW	World Wide Web

Units	Explanation	Units	Explanation
A	ampere	kg	kilogram
AC	alternative current	kPa	kilopascal
cm	centimeter	kW	kilowatt
°	degree	km/h	kilometres per hour
°C	degree Celsius	lpm	liter per minute
°F	degree Fahrenheit	lb	pound
DC	direct current	m	meter
ft	foot	min	minute
ft-lb	foot-pound	mph	miles per hour
gal	gallon	mm	millimeter
gpm	gallons per minute	NM	newton meter
HP	horsepower	psi	pounds per square inch
hr	hour	RPM	revolutions per minute
Hz	hertz	s	second
in.	inch	v	volt

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GEA Canada
GEA Farm Technologies Canada Inc. / Division GEA Houle
4591 boul. St-Joseph
Drummondville, Qc, J2A 0C6
☏ +1 819 477 - 7444
🖷 +1 819 477 - 5565
geahoule@gea.com
www.gea.com