ARGAL AIR

ASTRA evo

TRANSLATION FROM THE ORIGINAL LANGUAGE

OPERATIONS & MAINTENANCE MANUAL

DEALER

For Maintenance

Date of commissioning:

……

Position / system reference:

……

Service:

……

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0. GENERAL DESCRIPTION

If you have purchased an **ARGAL** pump, follow below instructions and local/national rules for a safe use.

The personnel in charge of installation, operation and maintenance of ASTRA evo pumps must be qualified to carry out the operations described in this manual.

ARGAL shall not be held responsible for the training level of personnel and for the fact that they are not fully aware of the contents of this manual.

RANGE	SIZE		MATERIALS												CONNECTIONS					
			CHAMBERS/MANIFOLDS		VERSION		DIAPHRAGMS		BALLS		BALL SEATS		O-RING		TYPE		SUCTION		DISCHARGE	
DDE	160		WR		N		Y		T		P		V		G		L		L	
	007	1/4"	WR	PP+GFR	N	PP+GFR center block	M	TPV (*)	T	PTFE	P	PP	D	EPDM	G	BSPP thread	L	LEFT	L	LEFT
	015	1/4"	FC	PVDF+CF	X	PP+CF center block / vers. ATEX	H	TPE (**)	S	AISI 316L	K	PVDF	V	FKM	N	NPT thread	R	RIGHT	R	RIGHT
	020	3/8"	WC	PP+CF	A(*3)	Aluminium center block	L	TPV+PTFE	D	EPDM	S	AISI 316L	T	PTFE	I	ISO PN10 FLANGE	F	FRONT CENTRAL	F(***)	FRONT CENTRAL
	030	1/2"	DL(*1)	POMc+GFR	2(*3)	White painted Aluminium center block	Y	TPE+PTFE	N	NBR	A	AL	N	NBR	A	ANSI #150 FLANGE	B	BACK CENTRAL	B	BACK CENTRAL
	060	1/2"	AL(*2)	AL	4(*3)	Grey painted Aluminium center block	D	EPDM	V	FKM	Z	PE UHMW	K	FFKM	C(*4)	CLAMP	V	BOTTOM CENTRAL	V	TOP CENTRAL
	080	3/4"	SS(*2)	AISI 316L	6(*3)	ATEX painted Aluminium center block	N	NBR			O(*1)	POMc	P	EPDM perox			X	SPLITTED	X	SPLITTED
	100	1"	SP(*2)	AISI 316L electropolished	W	Pump without logos	V	FKM												
	160	1"			F	"FREE"	R(*1)	NBR+PTFE												
	400	1"1/2			S	SUBMERSIBLE pump														
	650	2"																		

SPECIAL VERSIONS
In case of SPECIAL configuration an **X** replaces the third character of the size

DDE	07X	007 special versions
	15X	015 special versions
	20X	020 special versions
	30X	030 special versions
	60X	060 special versions
	80X	080 special versions
	10X	100 special versions
	16X	160 special versions
	40X	400 special versions
	65X	650 special versions

ATTENTION! For spare parts and/or accessories it is mandatoryry to provide **the serial number** of the special pump

"FREE" VERSIONS (remote control)
Includes a 5/2 bistable electro-pneumatic valve

NOTES

(*) commercial designation: Santoprene® (ExxonMobil), Geolast® (ExxonMobil)

(**)commercial designation: Keyflex® (LG Chem Ltd.), Hytrel® (LG Chem Ltd.)

(***) F-F not recommended

(*1) only for size 007

(*2) only for sizes 030-060-100-160-400-650

(*3) only for sizes 400-650

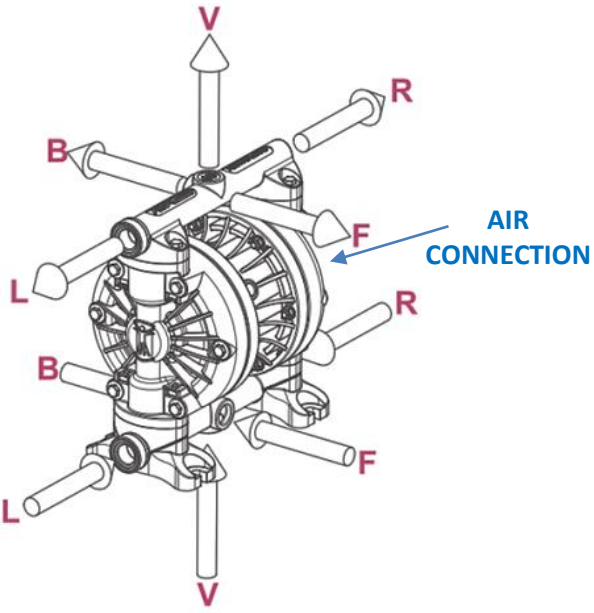
(*4) only for configurations SPN/SPX

0.2 CONNECTIONS

You can get different options for **ASTRA evo** pump connections. The standard configuration of the **ASTRA evo** series is with the suction placed to the left of the air connection, while the discharge is positioned in the upper part of the pump, on the left side of the air connection.

STANDARD CONNECTIONS

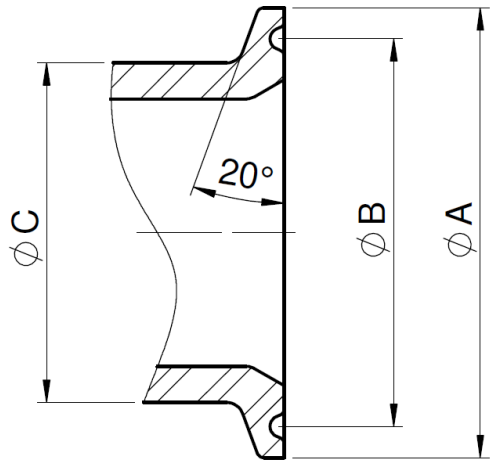
SIZE	FLUID CHAMBERS/MANIFOLDS		
	WR/WC FC/DL/AL	SS	SP
007	G LL	-	-
015	G LL	-	-
020	G LL	-	-
030	G LL	G LL	C LL
060	G LL	G LL	C LL
080	G LL	-	-
100	G LL	G LL	C LL
160	G LL	G LL	C LL
400	G LL	G FB	C FB
650	G LL	G FB	C FB



CLAMP CONNECTIONS

Valid only for SP_ configuration

SIZE	ARGAL REF.	MAIN DIMENSIONS		
		Ø A	Ø B	Ø C
030	CLAMP 1"	50.5	43.5	25.4
060				
100	CLAMP 1"1/2	50.5	43.5	38.1
160				
400	CLAMP 2"	64	56.5	51.6
650	CLAMP 2"1/2	77.5	70.5	64

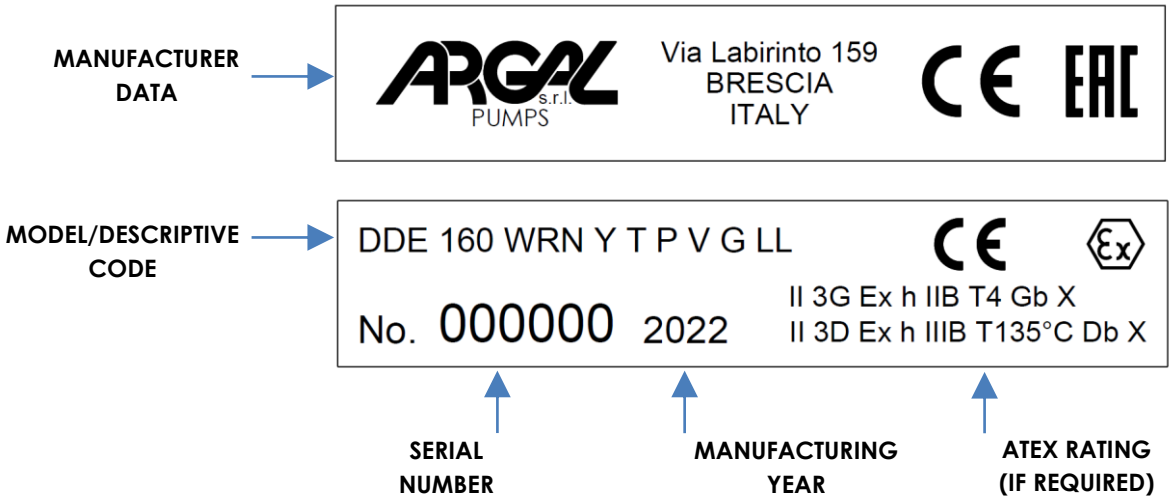


0.3 PUMP LABELING

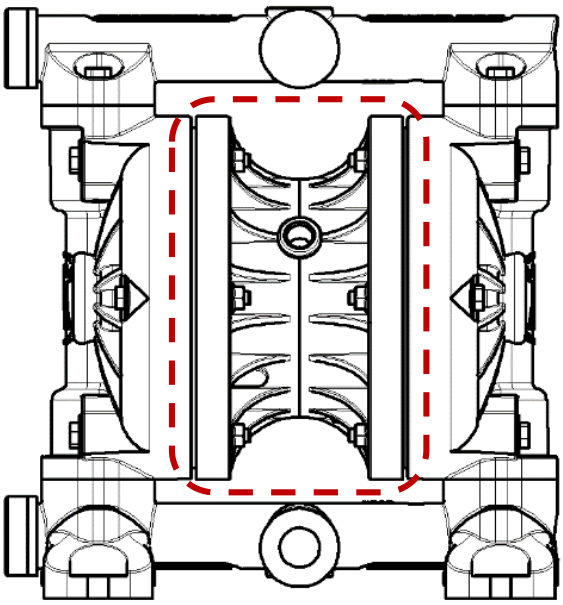
Each pump is supplied with one or two labels (depending on the pump size) containing the manufacturer's data, the model, the descriptive code, the year of manufacture, the serial number and the ATEX classification (see the paragraph 0.4.1).

Check these data upon receiving the goods. Any discrepancy between the order and the discharge must be communicated immediately.

In order to be able to trace data and information, the descriptive code, model and serial number of the pump must be quoted.



The labels are placed on the center block:



0.4 STANDARDS REFERENCE

0.4.1 ENVIRONMENTS IN DANGER OF EXPLOSION - ATEX DIRECTIVE

ASTRA EVO pumps, version **WC_ - FC_ - AL_ - SS_ - SP_**, can meet the requirements of the **category 2** of the ATEX Directive 2014/34 / EU, therefore intended to operate in potentially explosive environments classified as **zone 1**, with the following characteristics:

CE 1370 Ex **II 2G Ex h IIB T4 Gb X**
II 2D Ex h IIIB T135°C Db X

ASTRA EVO pumps, version **WR_ - WC_ - FC_ - AL_ - SS_ - SP_**, can meet the requirements of the **category 3** of the ATEX Directive 2014/34 / EU, therefore intended to operate in potentially explosive environments classified as **zone 2**, with the following characteristics:

CE Ex **II 3G Ex h IIB T4 Gb X**
II 3D Ex h IIIB T135°C Db X

Markings are explained in detail in the tables below:

ATEX 2014/34/EU

Simbol	Marking	Meaning
CE	CE marking	European Conformity
1370	Notified Body Number	
Ex	Specific Marking for Explosion Protection	Indicates that the equipment meets the requirements of the ATEX directive
II	Equipment Group	Equipment of Group II is intended for use in places with an explosive atmosphere other than mines susceptible to firedamp(typically atmospheres with the presence of gas and / or combustible dusts)
2	Equipment Category	Category of equipment designed to ensure a high level of protection and which are intended for environments in which there is likely to be an explosive atmosphere; equipment belonging to this category must ensure the required level of protection even in the event of recurring anomalies or operating defects which must usually be taken into account. Suitable for Zone 1, 2, 21, 22
3		Category of equipment designed to guarantee a normal level of protection and which are intended for environments in which there is little probability that explosive atmospheres will occur, and in any case only for a short time; equipment belonging to this category is sufficient to ensure the level of protection required during normal operation. Suitable for Zone 2 and 22
G	Environment	Suitable for areas where explosive gases, vapors, fog and air mixtures are present
D		Suitable for areas where explosive atmospheres due to dust can form

ISO 80079-36/37

Simbol	Marking	Meaning
Ex	Explosion Protection	Indicates the equipment is for use in an explosive atmosphere acc. To ISO80079-36/37
h	Type of protection	Non-electrical equipment for explosive atmospheres
IIB	Atmosfera consentita	GAS: atmospheres containing ethylene or gases of an equivalent hazard
IIIB		DUSTS: atmospheres containing combustible non-conductive dusts
T4	Maximum Surface Temperature	Temperature Code: Maximum Surface Temperature ≤ 135°C (referred to Gas atmosphere)
T135°C		Maximum Surface Temperature ≤ 135°C (referred to Dust atmosphere)
Gb	EPL (Equipment Protection Level)	Gb fos Gases, Db for DustsProtection from ignition sources during normal operation and during frequent disturbances or equipment in which faults usually need to be taken into account
Db		
X	Special operating conditions	Special operating temperature range – see next table

X = special operating conditions:

1. Permitted ambient temperature range for ATEX pumps:

VERSION	AMBIENT TEMPERATURE RANGE (Ta)
WR_ WC_ DL_	-5°C (23°F) ≤ Ta ≤ +40°C (+104°F)
FC_ AL_ SS_ SP_	-20°C (-4°F) ≤ Ta ≤ +40°C (+104°F)

2. Maximum allowed fluid pressure for ATEX applications: 8 bar (in any condition)

All ATEX version pumps are covered by the **Declaration of Compliance to the Directive 2014/34/EU for use in potentially Explosive Atmospheres.**

CLASSIFICATION	VERSION	DESCRIPTION	SIZE
"ASTRA evo" ATEX **ZONE 1 ***	***WCX*** ***FCX*** ***ALX*** ***SSX*** ***SPX***	Pump made in conductive materials: ***WCX:*** *Center Block/ Fluid Chambers/ Manifolds = PP + Carbon Fiber (PP CFF20);* ***FCX:*** *Fluid Chambers/ Manifolds = PVDF + Carbon Fiber (PVDF CFF15);* *Center Block = PP + Carbon Fiber (PP CFF20);* ***ALX:*** *Fluid Chambers/ Manifolds = ALUMINIUM (AL EN AC46100);* *Center Block = PP + Carbon Fiber (PP CFF20);* ***SSX:*** *Fluid Chambers/ Manifolds = STAINLESS STEEL (AISI 316L);* *Center Block = PP + Carbon Fiber (PP CFF20);* ***SPX:*** *Fluid Chambers/ Manifolds = STAINLESS STEEL (AISI 316L electro polished);* *Center Block = PP + Carbon Fiber (PP CFF20);* ** NOTE: The central body in version "A" (aluminum) and in version "6" (ATEX painted aluminum) is also available for sizes 400 and 650*	G 1/4" G 3/8" G 1/2" G 3/4" G 1" G 1 1/2" G 2"
"ASTRA evo" STANDARD **ZONE 2 ****	***WRN*** ***WCN*** ***DLN*** ***FCN*** ***ALN*** ***SSN*** ***SPN***	Pump made in conductive materials: ***WRN:*** *Center Block/ Fluid Chambers/ Manifolds = PP + Glass Fiber (PP GF30);* ***WCN:*** *Fluid Chambers/ Manifolds = PP + Carbon Fiber (PP CFF20);* *Center Block = PP + Glass Fiber (PP GF30);* ***DLN:*** *Fluid Chambers/ Manifolds = POMc* *Center Block = PP* ***FCN:*** *Fluid Chambers/ Manifolds = PVDF + Carbon Fiber (PVDF CFF15);* *Center Block = PP + Glass Fiber (PP GF30);* ***ALN:*** *Fluid Chambers/ Manifolds = ALUMINIUM (AL EN AC46100);* *Center Block = PP + Glass Fiber (PP GF30);* ***SSN:*** *Fluid Chambers/ Manifolds = STAINLESS STEEL (AISI 316L);* *Center Block = PP + Glass Fiber (PP GF30);* ***SPN:*** *Fluid Chambers/ Manifolds = STAINLESS STEEL (AISI 316L electro polished);* *Center Block = PP + Glass Fiber (PP GF30);* *** NOTE: The central body in version "A" (aluminum), "2" / "4" (painted aluminum) is also available for sizes 400 and 650*	G 1/4" G 3/8" G 1/2" G 3/4" G 1" G 1 1/2" G 2"

Table 1

0.4.2 FDA COMPLIANT

Materials used in the equipment (only version **SPN/SPX**) that are intended for food contact are **FDA compliant** concerning **CFR21.177 ***

***** United States Code of Federal Regulations (CFR) Title 21, Section 177

0.4.3 MACHINERY DIRECTIVE 2006/42/EC

The ***ASTRA evo*** are in conformity with the essential health and safety requirements and technical construction file requirements of the ***Machinery Directive 2006/42/EC***. Therefore these pumps are not dangerous for the operators if used according to the instructions contained within this Manual.

For safety purposes please be sure to read and follow the instructions, particularly the "warnings and cautions" contained within this Manual before pump installation and operation.

The manufacturer assumes no responsibility for any modification and/or incorrect applications that may cause damage to the security, the health of people or things in the vicinity of the pump.

All technical data are referred to a "***STANDARD PUMP"*** (see TECHNICAL FEATURES) but we remember that - for a constant technological innovation and quality research - the characteristics reported in this Manual may change without notice.

The drawings and all the other documents delivered with the machine are the property of the manufacturer, which reserves all rights and forbids making them available to third parties without his written consent.

All ARGAL pumps are covered by the following **Declaration of Conformity to Machinery Directive 2006/42/EC.**

EC DECLARATION OF CONFORMITY
(Directive 2006/42/EC Annex II.A)

The Manufacturer, production head and legal office:

ARGAL SRL
Via Labirinto, 159
25125 Brescia - Italy

CE

ARGAL produces and sells under its own registered trademark:

Product Name:	**Air-Operated Double-Diaphragm Positive-Displacement Pump**
Product Brand:	***ARGAL***
Model:	**DDE.....**
Serial Number:	**102522.20**
Year of Construction:	**2020**

The responsible person for the Technical File is:

Massimo Bolis
Via Natale Dalle Laste, 5
36063 Marostica (VI) – Italy.

ARGAL declares that the above mentioned pump is compliant with the requirements of the ***Machinery Directive 2006/42/EC*** of the European Parliament with reference to the following Harmonized Standards:

EN ISO 12100:2010, EN ISO 11200:2014, EN ISO 11201:2010, EN ISO 3746:2010, EN ISO 11688-1:2009, EN 12162:2001+A1:2009, EN 61310-1:2008, EN 61310-2:2008

BS, 25.01.2022

Omar Gabrieli
(Chairman)

0.5 MANUAL INTRODUCTION

This Use Manual is an integral part of the pump, it is a "*Safety Device*" and contains important information so that the buyer and his staff can install, use and maintain the pump in a constant state of efficiency.

When installing, operating and maintaining of the pump unit you must strictly follow the Use Manual. Otherwise injury or life hazard may occur.

In this Instruction Manual are present specific symbols used for the purposes of security and for a proper use of pump.

All the warnings and cautions will be indicated by the following symbols.

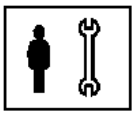
WARNING: this symbol indicates to the personnel that the described operation presents the risk of exposure to **residual dangers (with the possibility of damage to health)** if not done in accordance with the procedures and the safety regulations. If you ignore the warning described and operate the pump in an improper manner, there is the danger of serious **body injury or death**. This signal stands at points in this Instruction Manual of particular importance for compliance with regulations and directives, for the prevention of damage to destruction of the complete pumps or its subassemblies.

CAUTION: this symbol indicates to the personnel that the described operation may cause **damage to the machine and/or its components** and **consequent risks for the operator and/or the environment** if not carried out in compliance with the safety regulations. If you ignore the caution described and operate the pump in an improper manner, there is the danger of personal injury or property damage.

NOTE: this symbol provides information about the current pump operation. This symbol indicates that important directions are contained here.

OBLIGATION AND INDIVIDUAL PROTECTION: these symbols indicate that you must use suitable individual protections, as the energy status and the type of fluid transferred by the pump, could create a dangerous condition that occurs during the maintenance operation.

OPERATOR: this qualification requires a complete knowledge and understanding of the information contained in the Manufacturer's Use Manual - as well as specific skills on the type of use.



MECHANICAL MAINTAINER: this qualification requires a complete knowledge and understanding of the information contained in the Manufacturer's Use Manual, specific skills necessary to perform the installation and ordinary maintenance - as well as specific skills of each sector.

EXTRAORDINARY MAINTENANCE: this symbol identifies the actions reserved to the technical assistance which are carried out only at the manufacturer's workshops.

To indicate the type of danger and damage, the following symbols are also used along with those mentioned above:

This symbol indicates a **DON'T**, and will be accompanied by an explanation on something you must not do.

This symbol indicates a **DO**, and will be accompanied by instructions on something you must do in a certain situation.

0.6 GENERAL NOTES

0.6.1 CHARACTERISTICS OF THE PUMPS

ASTRA evo pumps are air-operated, double-diaphragm positive-displacement pumps, designed and manufactured for pumping fluids that are chemically compatible with the construction materials of the pump. The characteristics of the fluid (pressure, temperature, chemical reactivity, specific weight, viscosity, vapor pressure) and the environment must be compatible with the pump characteristics.

The best knower of the fluid is who buys the pump. The buyer is responsible for choosing the materials used for the parts in contact with the fluid.

The configuration of the pump (wetted parts) is defined in the ordering phase and is indicated on the nameplate.

ASTRA evo pumps are suitable for pumping corrosive, abrasive, aggressive, flammable, cut-sensitive chemical fluids, or with solids, such as acids, alkalis, alcohols, solvents, emulsions, oils, fuels, lubricants, sludge, industrial sewage , enamels, varnishes, glues, water based fluids (containing suspended solids), additives, detergents.

Chemical composition of the pumped fluid, concentration, temperature, amount of abrasive solids can radically change the applicability of the configured pump or significantly reduce its duration. ARGAL assumes no responsibility in this regard.

ASTRA evo pumps are **self-priming**.

The priming time of the pump depends on the continuous and localized losses in suction pipe, which depend on:

- the suction circuit (total length and pipe diameter)
- specific weight of the pumped fluid
- viscosity of the pumped fluid

The pipes can be **empty at start-up**. Pumps can be used dry, but it is important to operate at **low speed (low air pressure/flow)**.

CAUTION: an empty pump should operate at **low speeds**. During slow operation of the pump the dry suction lift is better than during high stroke frequency. At high frequency, the efficiency is lower. The suction lift capacity of a liquid filled pump, however, is much higher.

CAUTION: The long periods of dry run may cause damage to the pump.

DRY RUNNING AT HIGH STROKE FREQUENCY CAUSES PREMATURE WEAR OF THE COMPONENTS!

Dry negative suction refers to intake of water at the temperature of 20°C/68°F.

ASTRA evo pumps cannot be used to generate the vacuum.

The purchaser of the pump must be sure that he has correctly evaluated the chemical-physical characteristics of the fluid.

Note: The maximum temperature of water in continuous operation (**DESIGN TEMPERATURE**) depends on the type of construction materials (indicated on the nameplate).

VERSION	MAX TEMPERATURE °C (°F)
WRN-WCN-WRX	+60 (+140)
FCN-FCX	+90 (+194)
DLN	+80 (+176)
ALN-ALX*	+100 (+212)
SSN-SSX*	+100 (+212)
SPN-SPX*	+100 (+212)

Table 2

*: for configurations with diaphragms made of TPV the temperature restriction is 90°C (194°F).

The maximum temperature of water in continuous operation depends on the type of construction materials (indicated on the nameplate) and the environment in which the pump will be installed in.

The **AMBIENT TEMPERATURE** interval is related to the pump's construction materials (specified on the identification plate):

VERSION	MIN TEMPERATURE °C (°F)	MAX TEMPERATURE °C (°F)
WRN-WCN-WRX	-5 (23)	+40 (+104)
FCN-FCX	-20 (-4)	+40 (+104)
DLN	-5 (23)	+40 (+104)
ALN-ALX	-40 (-40)	+40 (+104)
SSN-SSX	-40 (-40)	+40 (+104)
SPN-SPX	-40 (-40)	+40 (+104)

Table 3

Note: For different temperatures consult the ARGAL technical department.

CAUTION: To optimize the pump lifetime we recommend to run at **70% of the maximum performance** of the pump. Running at maximum air pressure/flow continuously may cause premature wear of the components.

CAUTION: To ensure the operation of the pump in the absence of cavitation must be respected the following conditions:

- Avoid heavy hydraulic load losses in the suction line, increasing the pipe diameter and/or decreasing the length of the suction.
- In the presence of high prevalence, hydraulic head losses can be divided on two pumps, placed in series with appropriate distances depending on the losses of each length.
- Use the pump by positioning it as low as possible, if there is a high difference in level between pump and free surface of the fluid to be sucked.

The pumped fluid may contain particles suspended in different dimensions in accordance with the constructive materials of pump:

SIZE	007	015-020-030		060		080-100	160	400	650
MATERIAL	WR_-FC_-DL_	WR_-WC_-FC_- AL_	SS_-SP_	WR_-WC_-FC_- AL_	SS_-SP_	WR_-WC_-FC_- AL_	WR_-WC_-FC_- AL_ SS_-SP_	WR_-WC_-FC_- AL_SS_-SP_	WR_-WC_-FC_- AL_SS_-SP_
MAX DIMENSION (mm)	1.5	3	3,5	3,2	3,8	5,5	6	7	9

Table 4

0.6.2 AIR TREATMENT SYSTEM

WARNING: the pneumatic supply of **ASTRA evo** series pumps must be carried out with **oil-free**, **filtered**, **dry and un lubricated air.** Avoid pressure drops by using pipes and controlling elements having characteristics suitable for the pump.

WARNING: in case of installation in **ATEX zone**, the compressor must suck air from outside the area classified as ATEX or use inert gas.

We recommend to use an appropriate **air treatment system** in order to maintain the pump's efficiency.

If the air humidity is high, it can be used an air dryer, to lower the dew point. Otherwise, ice may form at the silencer, causing the narrowing of the air expelling surface. The possible formation of ice on the muffler cover is normal, since the temperature of the same can be of several degrees below zero, thus freezing the humidity present in the air. We recommended to pre-heat the air before it reaches the pump to raise its dew point.

The air temperature does not exceed 50°C (122°F).

Take care that no dirt or particles can intrude into the pump during the connection, as these can accumulate inside the pump and can cause malfunctions.

It is recommended to use a filtration of the air by a **5 micron filter** to prevent the entry of bulk particles. The filter removes harmful dirt and moisture from the compressed air supply.

Air quality (according to ISO 8573-1:2010. Contaminants and purity classes):

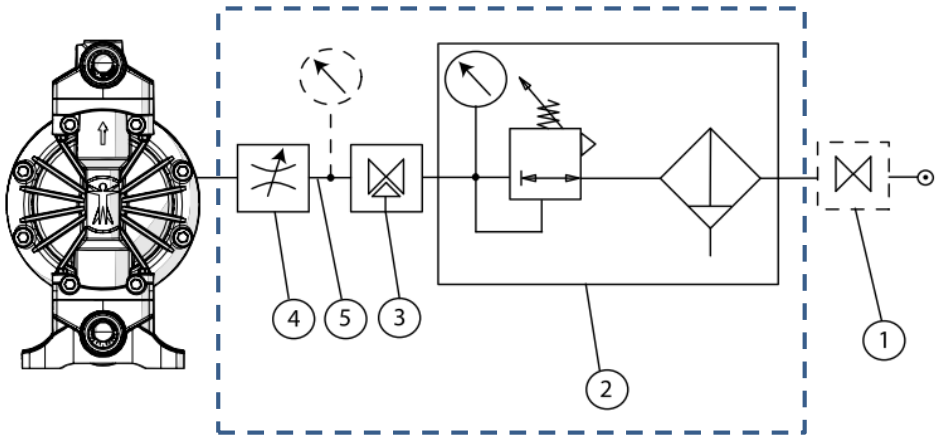
- Particles class IV;
- Water class IV;
- Oil class IV;

For most demanding applications (H ≥ 40 m.c.w for extended periods) the water content in the air must not exceed the specifications dictated by class II.

WARNING: Dirt in the air can under unfortunate circumstances be the cause of a premature wear and/or blockages.

We recommended to configure the pneumatic supply circuit of **ASTRA evo** series pumps with the following devices:

1. On-off valve to isolate the pump from the circuit (maintenance);
2. Air filter and pressure regulator with manometer;
3. 3 Ways valve;
4. Flow adjuster valve;
5. Flexible hose;
6. Fittings;



ARGAL AIR REGULATION KIT

The devices n° 2, 3, 4, 5 and all necessary fittings are included in the **ARGAL Air regulation KIT**, supplied by ARGAL upon request as an accessory.

The device n° 1 (On-off valve) is in charge of the customer/installer.

The maximum air feeding pressure for the ASTRA evo pumps is **8 bar**. Higher air pressure can damage the pump and may cause injury to personnel in vicinity of the pump.

The minimum air feeding pressure is **2 bar ***.

*** NOTE:** If you plan to use the pump with the minimum air supply pressure (2 bar), when the pump is started for the first time (new pump) or when the pump is restarted after a prolonged stop (2 weeks), run in with the supply pressure set at **4 bar, for at least 30 seconds**.

Compressed air supply pipes: **minimum EXTERNAL dimensions** are reported in the following table.

The maximum length of pipes may be **5m.**

SIZE	Ø air pipe
DDE 007 – 015	Ø 4 mm
DDE 020 - 030	Ø 6 mm
DDE 060	Ø 8 mm
DDE 080 - 100 - 160	Ø 10 mm
DDE 400	Ø 12 mm
DDE 650	Ø 14 mm

Table 5

WARNING: if head and capacity must be high there is the risk that ice accumulates in high quantity and the pump stops. To avoid this, it is very important to maintain the air quality as prescribed within this Manual.

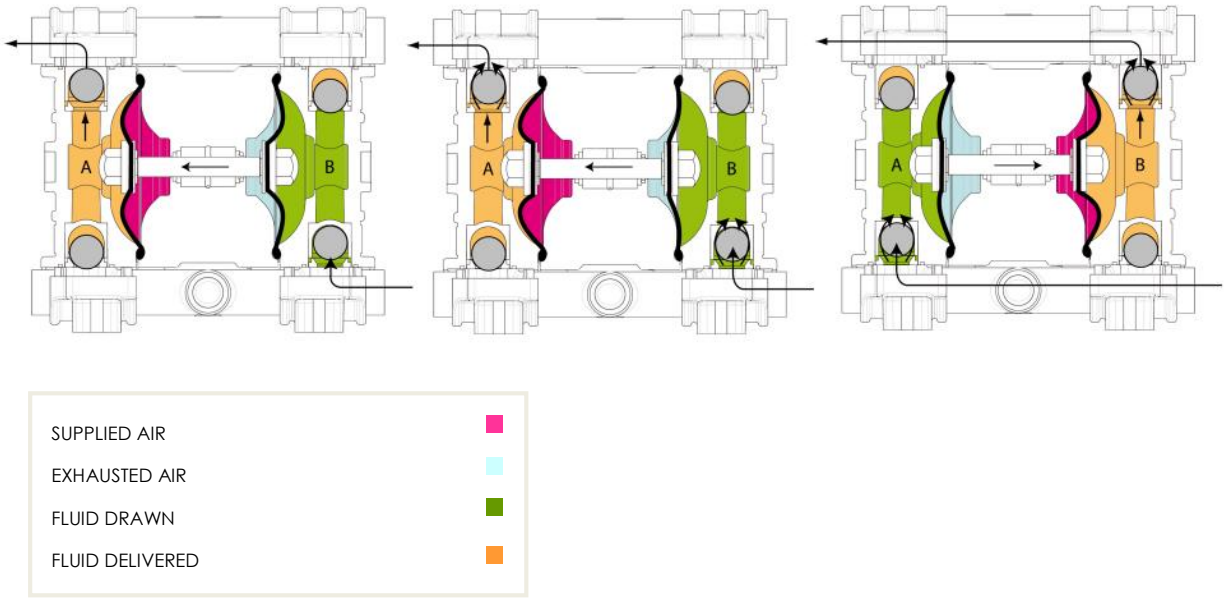
WARNING: ice may form into the pneumatic exchanger: **SCRUPULOUSLY FOLLOW THE INSTRUCTIONS WRITTEN IN THIS PARAGRAPH, TO PREVENT THE ICE FORMATION.**

0.6.3 OPERATING PRINCIPLE

The **ASTRA evo** pumps are volumetric.
The suction and discharge cycles are simultaneous at alternating phases.
The operating principle concern the VOLUME VARIATION of two chambers. As shown in the scheme below, while in a chamber a positive volume variation is observed that correspond to a pressure decrease, in the second one there is a reduction in volume and therefore an increase in pressure occurs. This causes an aspiration and a thrust on the fluid respectively.
The operation described above is regulated by the VALVES BALL installed on the ASTRA DDE pumps. The valves open due to the difference in pressure between the two environments that separate, allowing the passage of the fluid.
In particular: the overpressure that is created in the chamber (A) (fig.1) closes the suction valve and opens the discharge valve, so that the fluid is sent to the discharge pipe. The valve opens as soon as the pressure to which it is subjected exceeds the one existing in the discharge pipe. Simultaneously in the chamber (B), the pressure decrease causes the opening of the suction valve and the closing of discharge valve.
The flow rate is given exclusively by the product of the number of cycles per unit of time and the volume aspirated, and then relaunched, at each cycle, so it is adjustable in an extremely precise manner.
This type of pumps allows to confer heads directly proportional to the supply pressure.

A PUMPING CYCLE

The pneumatic distribution system sends compressed air behind one of the two diaphragms (A), which deforming causes a reduction in volume in the chamber than pushes the fluid towards the discharge circuit. Simultaneously, the opposite diaphragm (B) is in the intake phase since it is dragged by the shaft that connects it to the other diaphragm (A) that is under pressure; air present behind it is discharged into the environment through the flow rate regulator present on the pump, while a pressure drop is created in the fluid chamber which sucks the fluid from the suction circuit. When the diaphragm (A) under pressure, reaches the stroke limit, the distributor switches the two inputs to the chamber on the diaphragms air side, putting diaphragm (B) under pressure and diaphragm (A) in discharge.
When the pump reaches its original starting point, each diaphragm has carried out one air discharge stroke and one fluid discharge stroke. This sequence of movements makes up a complete pumping cycle.



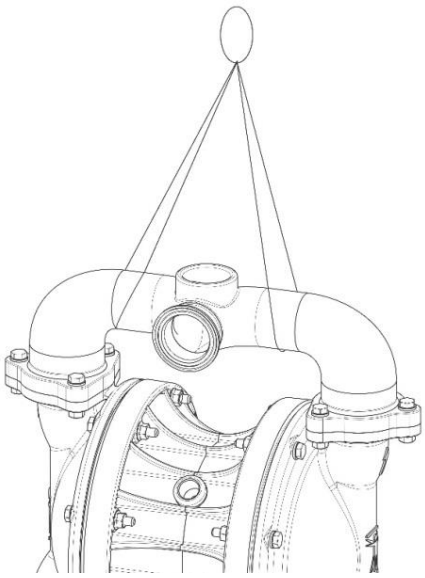
1. SAFETY: WARNINGS FOR TRANSPORT – INSTALLATION – USE – STOP OF THE PUMP

1.0 TRANSPORT

- Mount **pressure plugs**, furnished with the pump, on the hydraulic connections and keep them for a future use.
- Lift the pump without mechanical stress (shocks, jolts and vibrations can cause permanent damage).
- For transport on irregular roads, cushion the pump with suitable support plane.
- Blows and impacts may damage parts that are important to machine operation and safety.

Note: To lift the pump, use the handle provided on all the ASTRA DDE pump models.

WARNING: The DDE 400 and DDE 650 pumps must not be lifted manually. To lift them it is necessary to provide special lifting hooks/accessories, to be connected to the pump discharge manifold.



1.1 RECEIVING INSPECTION

- Check the shipment on receipt.
- Check that the packing and the pump are intact and they have not been damaged - make sure that all parts and accessories listed on the packing list are accounted for.
- Take the Use Manual and operate as described.

1.2 STORAGE

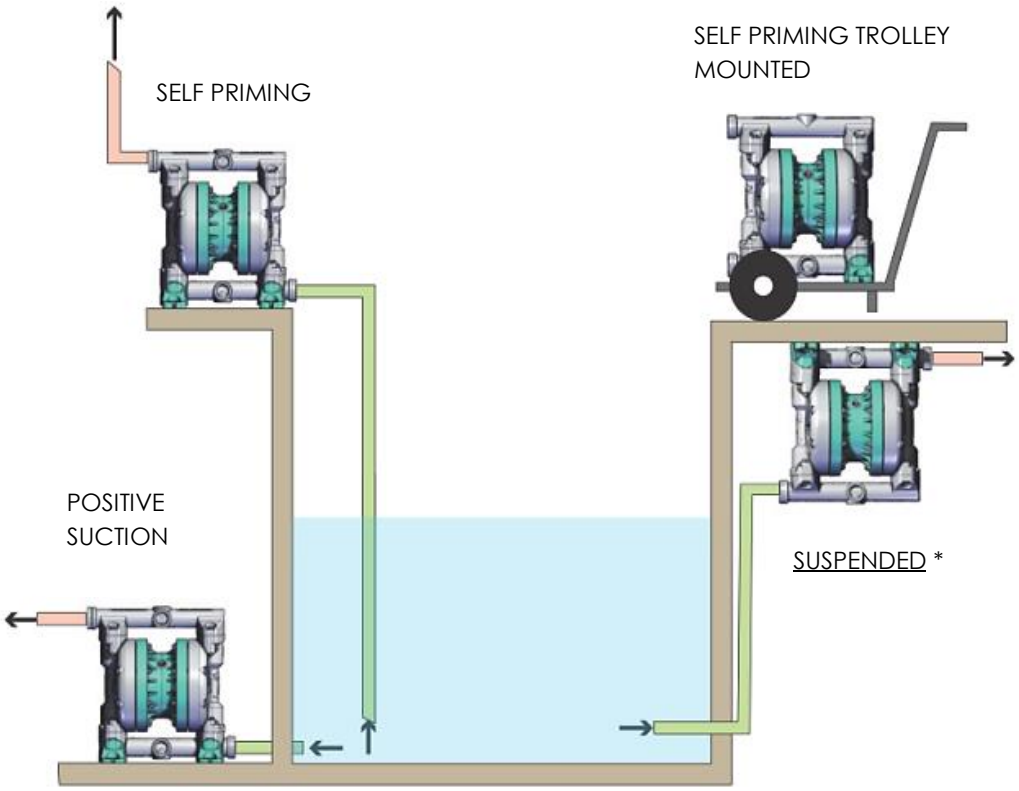
- If the equipment is to be stored prior to installation, place it in a clean location.
- Do not remove the protective covers from the suction, discharge and air connections which have been fastened to keep pump internals free of debris.
- The pump has to be protected from wetness, coldness, dirtying, UV-radiation.
- Store the pump in an original packaging. The package should be stored raised from the ground, in a closed, clean and dry environment.
- In the event that the package is not whole at the time of receipt, it is necessary to release the pump from the package, verify its integrity and restore a new package.
- The storage location must be a closed room with a temperature not lower than -5°C not exceeding 40°C and with a moisture content not exceeding 90%.
- The packing event should not be subjected to shocks, vibrations and overloads.
- Clean the pump thoroughly before installation.

1.3 FOUNDATION

- The pump can be installed without being fixed to a foundation only in case of temporary and short-term operations. If fixation is needed for an installation, make sure the foundation is able to absorb vibrations. **As option ARGAL provides special anti-vibration rubber devices**. It is essential for the operation of the pump to mount the pump with the feet in a downward direction (see sketch);
- Below the scheme for the possible installations:

1.3.1 POSSIBLE INSTALLATIONS

For the following operations:
- *Trasfer*
- *Supply*
- *Circolation*
- *Injection*
- *Evacuation*
- *Metering*



*Note: suspended version to be specified in the request for quotation.

1.4 BEFORE INSTALLING THE PUMP

- Check the tightening torque of the external screws. See par. 3.18.2 TIGHTENING TORQUES
- Before starting the pump is not necessary to fill it with liquid, if not previously agreed in special cases.
- To verify the absence of losses we recommend to conduct a run test with air to make sure that the pump operates correctly and does not leak.

1.5 SUCTION AND DISCHARGE PIPING


WARNING: The suction and discharge piping should be *flexible* to prevent undue stress and strain on the pump connections. Alternatively use *flexible joints* between the discharge/suction connection and any rigid fixed piping.

Rigid piping may cause strong vibration and the manifolds to break.

Avoid configuring the connections with the third character F (i.e. GFF - GBF). It could occur the dripping of the product pumped onto the pneumatic supply connection.

1.5.1 CONNECTION OF SUCTION PIPE

It is recommended to be very careful during the connection operation of the suction pipe, since just a small air infiltration will dramatically reduce the suction capability of the pump. Be especially careful during pump priming. When connecting the suction pipe, following is recommended:

The suction hose must be non-collapsible, reinforced type as the pumps are capable of generating a moderate degree of vacuum (the suction power may shrink the hose).

Do not use pipes with nominal diameter smaller than the diameter of the pump connections to have best suction capability. For negative suction installation and when pumping viscous fluids, use pipes with nominal diameter greater than the diameter of the pump connections.

It is essential that the suction pipe is leak-proof for the pump self-priming operation.

Position the pump as close as possible to the point of suction. It is better to use a short suction pipe to avoid air pockets.

Check that the connections hose-pump are correctly tight, and there are no leaks.

Avoid installing filters with a solid passage lower than the values stated in the related table. Place filters that have a filtration surface of at least 20x the nominal section of the pipe.

In the case of installation of the above mentioned filters, connect a suction pressure monitoring system, in order to signal those values which may lead to cavitation or diaphragms ropture.

WARNING: if the negative pressure on the suction port is below of 600 mbar (millibar) the pump must be stopped

Any fine mesh filters must be installed in the delivery line.

WARNING: the pump cannot accept a positive suction pressure higher than 0.5 bar

1.5.2 CONNECTION OF DISCHARGE PIPE

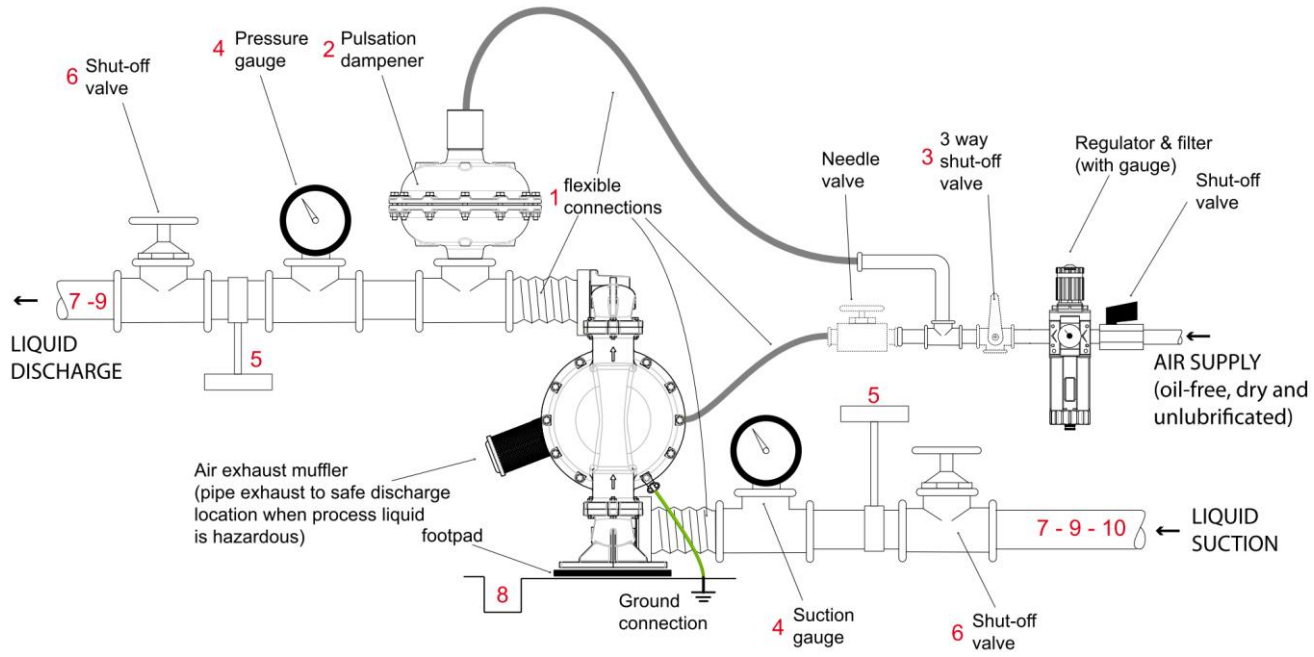
All components (hose, pipe, valves etc.) on the discharge piping must be designed for **PN10**.

1.5.3 AIR CONNECTION

- Screw the air hose into the air intake on the central casing of the pump.
- We recommend that the diameter of the flexible hose must conform to the values shown in (Table 6) or above.
- Maximum pipe length between air plant and pump: 5m. If a longer length is required, choose a pipe diameter that does not cause a pressure drop of more than 0.2 bar between the air pickup point and the pump inlet.

1.6 RECOMMENDED INSTALLATION

USE THE PLANT SOLUTIONS INDICATED IN THE FOLLOWING DIAGRAM



POSSIBLE PLANT SOLUTION

1. Use flexible pipes reinforce with rigid spiral to connect the hydraulic circuit of the pump. Do not use pipes with nominal diameter smaller than the diameter of the pump connections (a smaller piping can cause cavitation (suction line) as well as a loss of performance (suction and discharge line). In case the pipe is too big, the dry suction capacity of the pump can decrease. For negative suction installation and when pumping viscous fluids, use pipes with nominal diameter greater than the diameter of the pump connections.
2. Use pulsation damper when the residual pressure ripple is undesirable for the goodness of the process.
3. Use the **3-way valve** on the air supply for starting and stopping of the pump.

4. Use suction and discharge pressure gauges with pressure switches for additional protection. Cut off the pump when there is an excessive discharge pressure (to protect the system) and an excessive suction depression (to protect the pump).
5. Use pipe anchoring.
6. Place shut-off valves on both suction and discharge piping for pump isolation. The pump performance can be adjusted by normal flow control on the discharge side of the system using the gate valve.
7. Ensure that there are no air pockets in pipeline, they can be a cavitation symptom; the circuit must be linear and short.
8. Use collector tank around the base of pump to contain leakage. In case of pumping particularly dangerous fluids, a collection tank equipped with a system that signals, or rather stops the pump, in the presence of liquid in the tank itself must be installed. Alternatively, the tank can be equipped with a channel that allows the percolated fluid to be collected. Provide the shielding of the pump by installing a cover in appropriate material, which, in case of serious loss, protects the environment and operators from the projection of dangerous substances.
9. The horizontal length (S) of the suction pipe must be smaller as possible. In the case of high viscosity fluids, increase the suction pipe diameter.
10. Slope the suction pipe towards the pump, to prevent the formation of air locks in the line which would affect the running time of pump.

Notes

- ✓ Install wide and rigid filtering separator in case where the fluid suction system creates the conditions for generating vortices or reels.
- ✓ Fluids having a viscosity different from those of water:
  - *DN Discharge Piping ≥ DN Connection;*
  - *DN Suction Piping must be greater than DN Connection.*

FURTHERMORE

- Ensure proper drainage of fluid which may emerge of the pump;
- fix the pump using all the available locking holes, the support points **must be leveled** (the pump must be fix to a foundation before starting), a slope of 10% or less is allowed;
- arrange enough space around the pump for operator to move around;
- arrange free space above the pump for lifting;
- inform the presence of aggressive fluid with suitable colored labels in accordance with the related standards;
- do not install the pump near heat source;
- do not install pump in places with the risk of falling solids and/or fluids;
- do not install the pump close to fixed workshop or at places with high human traffic;
- install additional protection shield for the pump or operator as appropriate;
- install a spare equivalent pump in parallel to prevent undesirable arrests of the process;

- **WARNING**: In the event of diaphragm failure, the fluid may contaminate the pneumatic circuit. **ASTRA evo** 400 and 650 are equipped with a conveyed air exhaust, in order to convey the air exhaust in a pipe up to a safe area;

- **WARNING**: for pumps size 400 and 650 installed in an **explosive atmosphere**, convey the air exhaust of the pneumatic distributor outside the explosive atmosphere;

- if the pump is made from conductive materials and is suitable for flammable products and is installed in an **explosive atmosphere**, at least one fluid chamber must be equipped with suitable grounding cable: **DANGER OF EXPLOSION AND/OR FIRE;**

- **WARNING**: The pumps installed in an explosive atmosphere must always be grounded to a suitable electrical ground. Lack of grounding or incorrect grounding will violate the requirements for safety and protection against risk of explosion; ASTRA EVO pumps for ATEX applications are supplied as standard with crimp terminals mounted on the pump body, suitable for an earthing cable with a section of 2.5mm^2

- only use the **3 way valve** on the air supply for starting and stopping the pump. **IT IS FORBIDDEN TO STOP THE PUMP THROUGH THE TWO-WAY VALVE ON THE DISCHARGE PIPE AND/OR THE SUCTION PIPE;**

- **WARNING:** USE THE PRESSURE REGULATOR AND THE NEEDLE VALE (ON THE SIR SUPPLY) TO ADAPT THE CHARACTERISTICS OF THE PUMP TO THE RATED POINT.

1.7 FIRST START UP

- Check the correct execution indicated in the par. 1.4 BEFORE INSTALLING THE PUMP and par. 1.6 RECOMMENDED INSTALLATION
- It is essential that the suction pipe is leak-proof for the pump self-priming operation.
- Clean the system before connecting the pump.
- The pump must not contain foreign bodies and all seals on the hydraulic connections must be removed.
- Check that all the screws are tightened.
- The fluid discharge manifold must always be positioned at the upper part, considering the pump is anchored with the feet on a horizontal plane.
- Fasten securely the pump onto the floor.
- Position the pump as close as possible to the point of suction.
- It is recommended to start the pump **slowly**, especially if it is not filled with liquid at the beginning. Remember that the suction capacity is greater when the pump runs slowly.
- if the pump has been filled with liquid, the air pressure/flow may be raised in order to increase the suction capacity of the pump. Remember that suction capacity is higher when pump runs slowly.
- Check that the intake and discharge pipes of the hydraulic circuit are correctly connected.
- Open the intake and discharge valves of the pump hydraulic circuit.

- Open the 3-way valve of the air circuit.
- The performance of the pump can be adjusted by using the air flow regulator valve and the pressure reducer, supplied with the air regulation KIT. The performance can also be adjusted by the two way valve on the discharge side of the system.
- With supply pressure value below 2 bar, the pump may not work properly; with pressure value above 8 bar, the pump may breakdown and/or yields with consequential spillage of the pumped fluid.
- To solve any deadlock situations:
    1. adjust the supply pressure above the 4 bar;
    2. stop the pneumatic supply via a three-way valve;
    3. supply the pneumatic supply again;
    4. the pump start again its regular functioning.
- For pump with split manifold, the two fluids pumped must have the same viscosity; pumping fluids with different viscosity may stall the pump and/or break the diaphragms. Different viscosities require the pump rated point to be adjusted considering the most viscous fluid.
- Do not operate at the limits of the operation curves: the maximum head or maximum flow.
- Check that there are no anomalous vibrations or noise due to the too elastic support structure, unsuitable fastening or cavitation.
- After 2 hours of operation stop the pump correctly and check the tightening of all the screws on the pump.
- When installation is new or the pump is reinstalled, it is better to check the pump screws tightening torque and to conduct a run test on the pump with water (to make sure that there are no leaks).

1.8 OPERATION

- After one week of operation and then periodically, the torque of the screws should be checked again to prevent leakages.
- Do not hold the pump under pressure for a long time if the discharge valve is closed. **RISK OF ENVIRONMENTAL CONTAMINATION.**
- Risk of harmful water hammers occurring due to incorrect or sudden operation (valves must be operated only by trained personnel).
- Empty and flush out fluid inside the pump in case different fluids must be pumped.
- Insulate and empty the pump if the fluid crystallization temperature is equal to or below the ambient temperature.
- Stop the pump if the fluid temperature exceeded the maximum allowed temperature indicated in the GENERAL NOTES. If the operating temperature exceeds by about 20%, it is necessary to inspect the condition of the internal parts after pumping operation.
- **NEVER LEAVE THE PUMP** with a too hot liquid inside it.
- Stop the pump and close the valves if leakages are observed.

- Wash with water only if it is chemical compatibility; alternatively, use a suitable solvent that does not generate hazardous exothermic reactions.
- Consult the fluid supplier to decide the most suitable fire-prevention method.
- Empty the pump if it is not in use for a long period of time (especially for fluids that tend to crystallize).
- Check that there is no gas in the delivering fluid, stop the pump if there is (probable cavitation).

1.9 STOP OF THE PUMP

To stop the pump, operate exclusively on the air supply by closing the 3-way valve. Discharge residual pressure from the pneumatic system of the pump.

WARNING: Never stop the pump by completely closing the suction and/or discharge valves on the hydraulic circuit.

DANGER: FOR LONGER STOPPAGE DO NOT TURN OFF THE PUMP BY CLOSING THE DISCHARGE: THE PUMP COULD REMAIN IN PRESSURE WITH THE RISK OF ENVIRONMENTAL CONTAMINATION!

WARNING: During the pump stopping operations, attention that the fluid not be spreaded in the environment.

2. SAFETY RISKS

2.1 GENERAL PRESCRIPTION

The pump must be installed according to local and national safety rules.

The pumps are constructed for particular applications. Do not use the pump on applications different from that for which it was sold without consulting ARAGL to ascertain its suitability.

WARNING! CHEMICAL RISK. Pumps are intended for operation with different types of fluids and chemical solutions. Follow the specific internal instructions for decontamination during the inspection or maintenance operations. If the pump has been used to pump aggressive, dangerous or toxic liquids, in case of diaphragm rupture the fluid may enter and damage the pneumatic circuit, and emerge from the discharge port. **Therefore, it is necessary to pipe the air discharge to a safe area. ARGAL recommends to use appropriate individual safety equipment and protection equipment for the environment.**

WARNING! CHEMICAL RISK. The pumps are tested with water. Drops of water may remain inside the pump after testing. Some liquids (example: sulfuric acid) in contact with water can trigger a strong reaction that can lead to an explosion. Always check the compatibility of the pumped fluid with water. Otherwise, make sure that the inside of the pump is completely free of water

WARNING! ELECTRICAL RISK: The pump installed in an explosive atmosphere must always be earthed independently from other members connected to it. Connect a suitable earth wire to the stainless steel earth connection that is placed on the inside of two pump casings. Connect the other end of the earth wire to earth and also make sure that other equipment like hoses/pipes/containers are properly earthed/connected. To avoid ignition hazards the formation of dust deposits on the pumps must be prevented. In explosion proof areas, maintenance/repair operations must be carried out only after a careful evaluation of the practicability and with appropriate tools.

WARNING! Safety requirements and explosion risk prevention, in case the pump was installed in an explosive atmosphere are not fulfilled if the pump is not earthed or is incorrectly earthed or the other equipment like hoses/pipes/containers are properly earthed/connected.

WARNING! The diaphragms (in contact with the fluid pumped) are components highly subjected to wear. The diaphragm service life is strongly affected by the operating conditions and chemical and physical stresses. From the tests carried out on thousands of pumps installed with temperature value from 0° to 18°C, the ordinary life of a diaphragm exceeded a lot of million cycles. For safety reasons, in environment with explosion risk, it is necessary to disassemble and check the diaphragms every 5 million cycles and replace them every 15 million cycles.

WARNING! In situations where the user foresees the possibility of exceeding the temperature limits indicated in this manual, it is necessary to install a protection device on the equipment to prevent exceeding the maximum operating temperature allowed. If exceeded, respect to the maximum marked temperature is not guaranteed.

CAUTION! Safety risks to persons are mainly caused by improper usage or accidental damage of the pump. These risks may be personal injury caused by operators working on an open pump, or the nature of the fluids pumped by this type of pump. Therefore, it is extremely important to diligently carry out all the instructions contain in this manual in order to eliminate the causes of accidents that may lead to the pump failure. The consequential spillage of fluid may be hazardous to persons and the environment.

It is essential to wear protective clothing and safety goggles when operating, and/or working in the vicinity of ARGAL pumps.

WARNING! The maximum air pressure for **ASTRA EVO** pumps is *8 bar*. Higher air pressure than 8 bar can damage the pump and may cause injury to the machinists in proximity of the pump.

CAUTION! ARGAL declares that the pump **NOISE LEVEL** does not exceed **85 dB(A)**. ARGAL performed the noise test with the source undergoing a characteristic work cycle under defined conditions. The noise level of the pump is influenced by the different modes of operation. So under different modes of operation, for example if the pump is operating under high air pressure at low discharge head, the noise can be hazardous for the operators working for long periods near the equipment.

WARNING! You must wear adequate ear protection in case of exceeding the Sound Pressure value equal to 85 dB (A). Alternatively lower the air pressure and/or increase the discharge head.

When installation is new or reinstalled, check the pump casing screws tightening torque. After one week operation, the torque should be checked again. This is important to prevent leakage.

CAUTION! The increase in temperature can cause damage to the pump and/or pipes. **DANGER for the personnel in vicinity of the plant (pump and piping)!**

Avoid rapid temperature variations and do not exceed the maximum temperature specified when ordering the pump. **RESPECT THE MAX TEMPERATURE VALUES (BASED ON WATER) WITHIN THIS MANUAL.** If a hot or cold (temperature below 0°C) product is pumped, the pump must not remain still, having the fluid inside it. We recommend to empty and clean the pump thoroughly.

WARNING! For installation and operation of pump in a **potentially explosive environments**, comply with these general precautions:

- ascertain that the pumped fluid does not contain large solids and/or abrasives (see the technical features)
- ensure that the intake or discharge ports are not obstructed nor limited to avoid cavitation and decrease in pump efficiency
- check that the piping weight, including the internal fluid weight, will not damage the pump connections
- if the pump is not in use for a long period of time, clean it carefully by running non-flammable liquid detergent that is compatible with the construction materials through it
- if the pump must be turned off for a long period of time, circulate clean water in it for some minutes to avoid incrustations
- after the pump is not in use for a long period of time, clean the internal and external surfaces with a damp cloth before starting, after eliminating any deposits
- check the efficiency of the grounding; grounding provides an escape wire for the electrical current; use only grounded hoses with a minimum length and having a cross-section of not less than 4 mm^2
- always protect the pump against blunt objects or various materials that may damage it or react with the construction materials
- protect the surrounding environment of the pump from splashes in case of accidental pump failure

WARNING! When pumping aggressive or toxic liquids or liquids that may represent a health hazard, install suitable protection on the pump to contain, collect and signal any spillage: **DANGER OF POLLUTION, CONTAMINATION, INJURIES AND/OR DEATH!**

WARNING! The pump must not be used to pump fluids that are not compatible with its construction materials or install in places containing incompatible fluids.

IT IS THE BUYER'S RESPONSIBILITY TO EVALUATE THE CHEMICAL COMPATIBILITY OF THE PUMP'S CONSTRUCTION MATERIALS WITH THE PUMPED FLUID!

CAUTION! Installing pump without on-off valves on intake and discharge sides to intercept the pumped fluid in case of spillage is forbidden: **DANGER OF UNCONTROLLED PRODUCT!**

WARNING! It is forbidden installing the pumps without on-off and three way valves on the air supply piping to prevent that the pumped fluid, entering into the pneumatic circuit in case of the diaphragms breakage, is expelled into the compressed air circuit: **DANGER OF FLUID ENTERING COMPRESSED AIR CIRCUIT AND DISCHARGING INTO THE ENVIRONMENT!**

WARNING! The use of pumps made with non-conductive material, which become charged with electrostatic, and without suitable grounding for flammable liquids is forbidden: **RISK OF EXPLOSIONS DUE TO ELECTROSTATIC CHARGE.**

CAUTION! Aggressive, toxic or dangerous liquids may cause serious injuries or damage to health. Therefore, **IT IS FORBIDDEN TO RETURN PUMP CONTAINING SUCH PRODUCTS TO MANUFACTURER OR SERVICE CENTER.** Empty the internal circuits. Wash and treat the pump before returning the pump.

CAUTION! ASTRA evo pumps cannot be used to pump *Acetylene, Hydrogen and Carbon Disulfide*.

CAUTION! The air distributor of the **ASTRA evo** pumps is <u>self-lubricating</u> and does not require any greasing. Therefore, <u>avoid using lubricated and non-dried air</u>.

WARNING! Ascertain that no abnormal noise or vibrations appears during operation. Otherwise, stop the pump immediately.

WARNING! Ascertain that the fluid at the discharge side does not contain gas. Otherwise, stop the pump immediately.

WARNING! Periodic control must be made to ensure that there is no powder and/or deposits on the external and internal surfaces of the pump. They must be cleaned with a damp cloth, if necessary.

WARNING! Removal of the silencer and the air supply fitting must be done when the pump is free of powder. Before restarting the pump, ensure that no powder has entered the pneumatic distributor.

To replace worn parts, use only genuine spare parts.

Failure to comply with the above may increase the risks of injuries to the operator, technicians, persons and damages to the pump and/or the environment that cannot be ascribed to the manufacturer.

However five general elements are important:

1. all the operations must be carried out by skilled personnel or monitored by qualified personnel as appropriate

2. implement personal protection works (when the pump is installed in places with high human traffic) against splashes of fluorescent fluid in case of accidental breakage and always direct possible leakages towards collection tanks
3. wear appropriate Protective Person Equipment (PPE) when operating on the pump
4. make sure that the intake and discharge valves are correctly closed during the disassembly
5. make sure that no air is supplied to the pneumatic circuit and discharge the residual air from the pneumatic circuit during disassembly

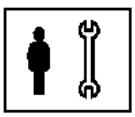
It is very important to recognize systems with well arranged, identifiable piping, suitably equipped shut-off valves and comfortable compartments and passages for operators who must inspect the pump (since the pressure developed by the pump may promote failures in the system if it is defective or worn).

WARNING! Raised temperature can cause damage on the pump and/or piping and may also be hazardous for personnel in the vicinity of the pump/piping. Avoid quick temperature changes and do not exceed the maximum temperature specified. The pump should not remain stopped for long time with a hot fluid inside. When the pump is stopped we recommend emptying it from the fluid. We recommend checking frequently the tightening torques of the pump casing screws, if the pump is subjected to high variations in the ambient temperature.

3. MAINTENANCE

- All the operation must be carried out by qualified personnel;
- do not carry out maintenance and/or repairs when the air circuit is pressurized;
- carry out periodic inspections (2-30 days in accordance with the fluid pumped) on the filter element of the suction strainer (if any) and remove any trapped filtrate when pumping fluids with solids;
- carry out periodic inspections (3-5 months in accordance with the fluid pumped and the environment conditions);
- ensure correct operation of the system start/stop units;
- the presence of fluid under pump casing may indicate failure of the pump;
- damaged parts must be replaced with complete original parts and not repaired parts;
- the replacement of damaged parts must be carried out in a clean and dry place.

3.1 OPERATORS FOR INSTALLATION AND START-UP

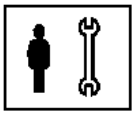


Interventions to be carried out only by **skilled personnel who may delegate operations to others in accordance with specific evaluations** (required technical skills: plumbing, pneumatic and/or electric qualification as appropriate).

3.2 OPERATORS FOR OPERATION AND MAINTENANCE

Interventions to be carried out by **generic operators** (after being instructed on the correct use of the equipment):

- pump start-up/stop;
- valves opening / closing when the pump is stopped;
- emptying and washing of pump casing by means of the prearranged valves and pipes;
- filtering elements cleaning;



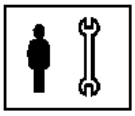
Interventions to be carried out by **skilled personnel** (required technical skills: general knowledge of the mechanical, electrical, chemical aspects of the pump and fluid pumped):

- environmental condition check;
- pumped fluid condition check;
- inspections of start-up/stop devices;
- detection of malfunction;

3.3 OPERATORS FOR REPAIR

Work to be carried out by **generic operators** supervised by skilled personnel:

- pump stopping;
- valves closing;
- emptying of pump casing;
- disconnecting piping from connections;
- unlocking of fastening screws to the base;
- washing with water or suitable solvent as appropriate;
- transporting;



Work to be carried out by **skilled personnel** (required technical skills: notions of mechanical processing, sensitivity to damaged parts due to impact or abrasion during handling, familiar with tightening bolts on different plastic/metal materials, use of precision measuring instruments):

- opening and reclosing of pump casing;
- removing and replacing of damaged parts;

3.4 PUMP INSPECTION

WHEN THE PUMP IS NEW OR REASSEMBLED:

- We recommend to retighten the Fluid Chamber screws after a few days of operation. Make sure to use the right torque, see par. 3.18.2 TIGHTENING TORQUES.
- We recommend to conduct a **PERFORMANCE TEST** when the pump is new to measure the capacity at specific air pressure/flow. This information is useful for checking performance as wear takes place.
- We recommend to conduct a **ROUTINE INSPECTION** on the pump to detect any problems (for example a change in sound of the running pump can be an indication of wearing parts). Through this test we can see the presence of liquid leaks and variations in the performance of the pump itself.

3.5 COMPLETE INSPECTION

- The intervals for a **COMPLETE INSPECTION** depend upon the characteristics of the liquid, temperature, materials used in the pump and running time.
- Please contact our Technical Office for any questions and / or requests regarding the need for a complete inspection. Refer to the paragraph TROUBLESHOOTING AND POSSIBLE CAUSES within this manual.
- In the manual we indicate also which parts are most subject to wear (ARGAL provides them as spare parts for start up and 2 years).

3.6 TROUBLESHOOTING AND POSSIBLE CAUSES

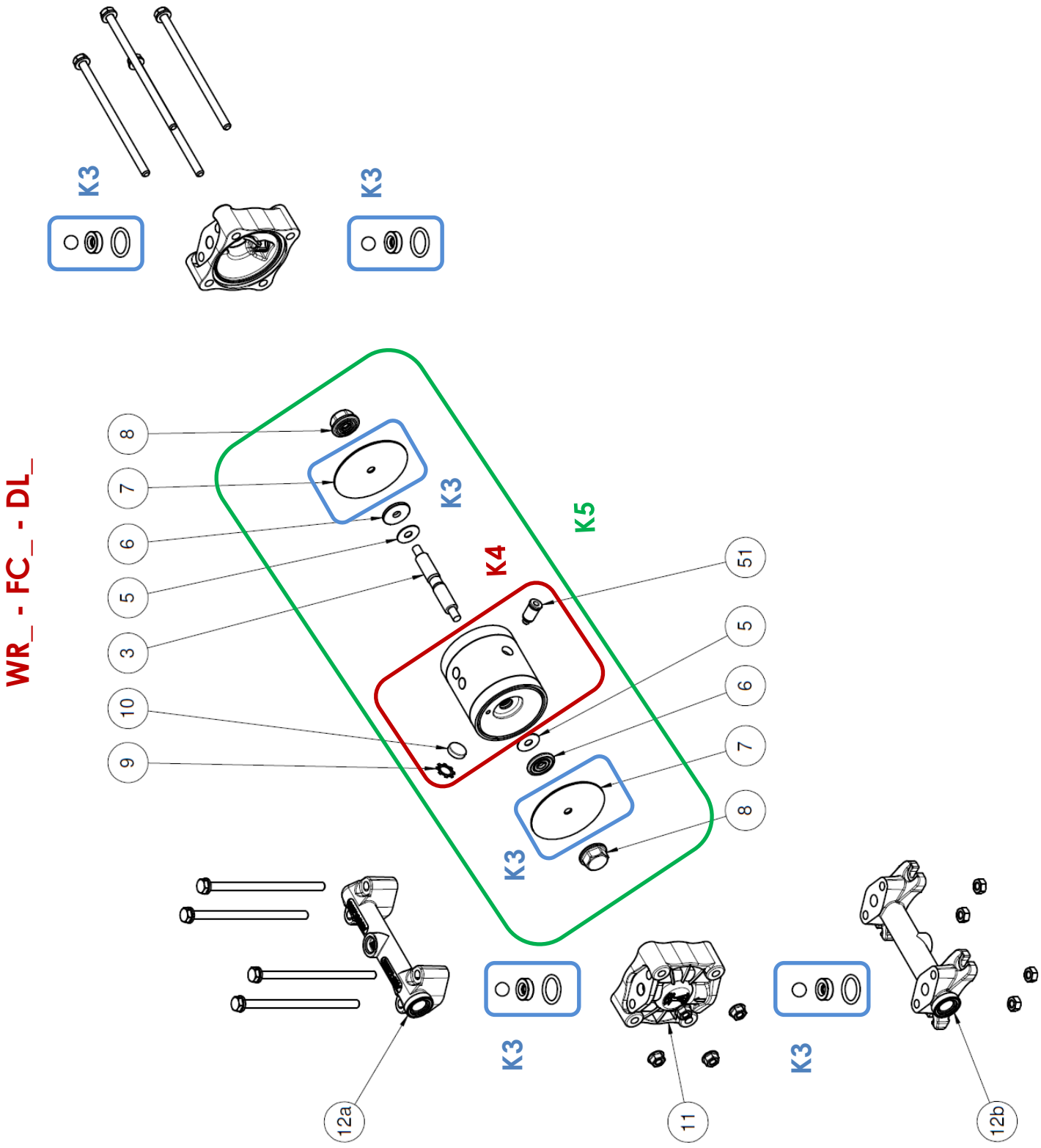
	DEFECT	CAUSE	SUGGESTION
1	**The pump does not run**	*Circuit without air*	Check the circuit: valves, connections, pressure regulators
		Insufficient air pressure	Increase the air pressure
		Insufficient air flow rate	Check that the pipes and fittings have suitable passages
		The air connection is blocked	Check / clean the air supply connection
		The 3-way air valve is defective	Clean / replace complete the 3-way air valve
		Damaged pneumatic exchanger	Replace the pneumatic exchanger
		Pump discharge and/or suction closed	Open the valves, or remove the pipes and check if the pump starts
		Diaphragms breakdown	Replace diaphragms
		Silencer is blocked	Check / clean / replace silencer
		Dirt in the pump fluid chambers	Remove debris from the fluid chambers

2	**The pump works but it does not pump**	*Valve balls do not close / Valve seats are worn*	Disassemble the manifolds and clean the seats or replace the balls and the seats if worn
		Suction connection is not tight	Tighten the suction line
		Suction line is blocked	Clean the suction line
		Silencer is blocked	Check / clean / replace silencer
		Pump starts with high pressure	Start the pump slowly (follow the indications into the use manual)
		Air in suction / discharge line	Vent suction / discharge line
		Excessive suction height	Reduce the suction height
		Too viscous fluid	Install pipes with greater size especially for intake and decrease the pumps cycles
3	**The pump works with slow cycles**	*Excessively viscous fluid*	No remedy
		Clogged discharge pipe	Check and clean
		Clogged suction pipe	Check and clean
4	**Insufficient suction**	*Suction connections not tightened*	Check and re-tighten the connections
		Clogged suction pipe	Check / clean / replace
		Silencer is blocked	Check / clean / replace silencer
		Valve balls do not close / Valve seats are worn	Disassemble the manifolds and clean the seats or replace the balls and the seats if worn
5	**The pump works irregularly**	*Internal pneumatic exchanger clogged or defective*	Replace the pneumatic exchanger
		Diaphragms breakdown	Replace diaphragms
		Valve balls do not close / Valve seats are worn	Disassemble the manifolds and clean the seats or replace the balls and the seats if worn
		Air valves are defective	Clean / replace the air valves
		Worn shaft	Replace the pneumatic exchanger
		Ice on the discharge	Dehumidify and filter air
		Insufficient air volume or pressure	Check the pressure with a gauge installed on the pump and with running pump. If pressure in that point is too low related to the mains pressure, check all the air connections. Check that all the air control devices have a sufficient flow rate
6	**The pump stalls**	*Suction pipe clogs during operation*	Replace the suction pipe
		Dirty air, full of condensate or oil	Check the air line. Follow the indications within the use manual
		Insufficient air volume or pressure	Check the pressure with a gauge installed on the pump and with running pump. If pressure in that point is too low related to the mains pressure, check all the air connections. Check that all the air control devices have a sufficient flow rate

		Defective pneumatic exchanger	Replace pneumatic exchanger
		The stop procedure was not respected	Respect the stop procedure
7	**Liquid leaks from the pump**	*Screws on the fluid chamber not properly tightened*	Check tightening torques of the screws
		O-rings on manifolds damaged	Replace O-rings
		Damaged diaphragms	Check / replace diaphragms
8	**The pump does not deliver the flow rate indicated on the table**	*Suction or air connection blocked*	Check / clean air supply / suction connection
		The product suction pipe is not correctly connected or not correctly dimensioned	Check the suction line
		Clogged pipes	Check and clean
		Too viscous fluid	Install pipes with greater size especially for suction and decrease the pumps cycles
		Valve balls do not close / Valve seats are worn	Disassemble the manifolds and clean the seats or replace the balls and the seats if worn
		Insufficient air volume	Check the pressure with a gauge installed on the pump and with running pump. If pressure in that point is too low related to the mains pressure, check all the air connections. Check that all the air control devices have a sufficient flow rate.
		Diaphragms breakdown	Check / replace diaphragms
		Icing on the silencer	Improve the air quality
		Pressure losses on suction side	Check / change installation on suction side
		Pressure fall in air supply	Increase the air pressure via a filter-regulator
9	**Diaphragms breakdown**	*Pressure too high during installation*	Use a protective treatment system / air regulation (follow the use manual)
		Dry running of the pump for long periods	Run the pump slowly if not filled with fluid (dry running case) – follow the instructions within use manual
		Pressure too high on suction side	Make sure there is a pressure balance between the air side and the fluid side of the diaphragm
10	**Leakage of fluid from the silencer**	*Diaphragms breakdown*	Check / replace diaphragms

Table 6

3.7 PART LIST & RECOMMENDED SPARE PARTS: DDE 007



LEGEND DDE 007

Pos.	Part name	Q.ty.	recommended spare parts	
			start up	2 years
3	Shaft	1		
5	Belleville Washer	2		
6	Cap (Air Side)	2		
7*	Diaphragm	2		
8	Cap (Fluid Side)	2		
9	Retaining ring (exhaust silencer)	1		
10	Exhaust Silencer	1		
11	Fluid Chamber	2		
12a	Discharge manifold	2		
12b	Suction manifold	1		
51	Air Connection	1		
**Note: configuration "R" provide coupled diaphragms NBR + PTFE*				

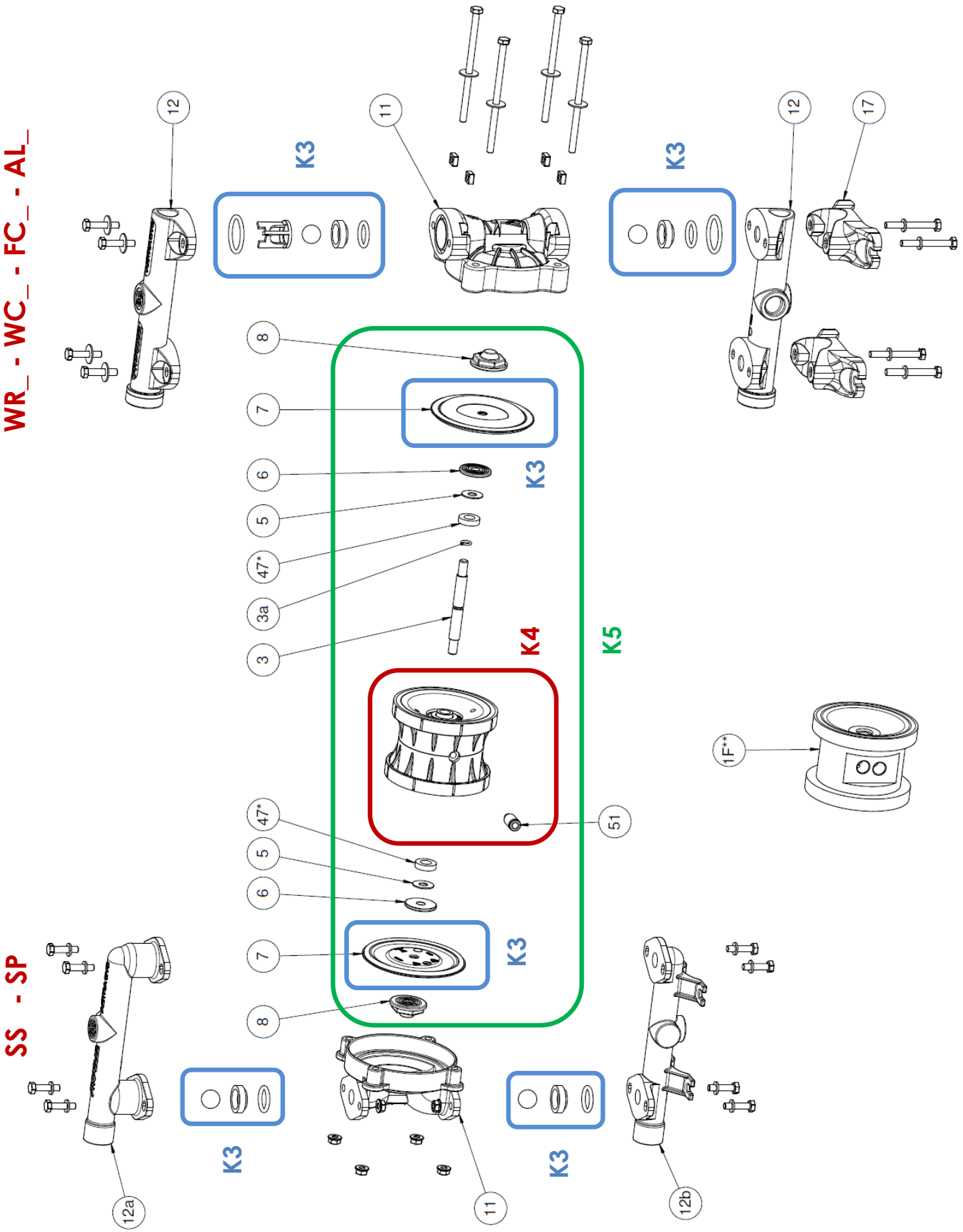
3.8 SPARE PART KITS ASTRA EVO DDE 007

During the operation of the pump it is normal that some parts are subject to wear.
ARGAL recommends having spare parts in stock, and offers various KITs.

SPARE PARTS		start up	2 years
K3	Wetted parts	1	1
K4	Center block		1
K5	Center block + diaphragms + fluid caps		

Table 7

3.9 PART LIST & RECOMMENDED SPARE PARTS: DDE 015 – 020 – 030



LEGEND: DDE 015 – 020 – 030

Pos.	Part name	Q.ty.	recommended spare parts	
			start up	2 years
1F**	Center Block (Monoblock)for "FREE" version	1		
3	Shaft	1		
3a	Shaft O-Ring	1		
4	Seeger ring	2		
5	Belleville Washer	2		
6	Cap (Air Side)	2		
7*	Diaphragm	2		
8	Cap (Fluid Side)	2		
11	Fluid Chamber	2		
12	Manifold (version WR_ - WC_ - FC_ - AL_)	2		
12a	Discharge Manifold (version SS_ - FDA SP_)	1		
12b	Suction Manifold (version SS_ - FDA SP_)	1		
17	Foot (version WR_ - FC_ - AL_)	2		
47***	Stroke Spacer	2		
51	Air Connection	1		
*Note: Configurations "Y" and "L" respectively provide coupled diaphragm: TPE + PTFE / TPV + PTFE				
**Note: it replaces parts K4 for pumps "FREE" version				
***Note: the spacers pos. 47 may be not installed				

3.10 SPARE PART KITS ASTRA EVO DDE 015 – 020 – 030

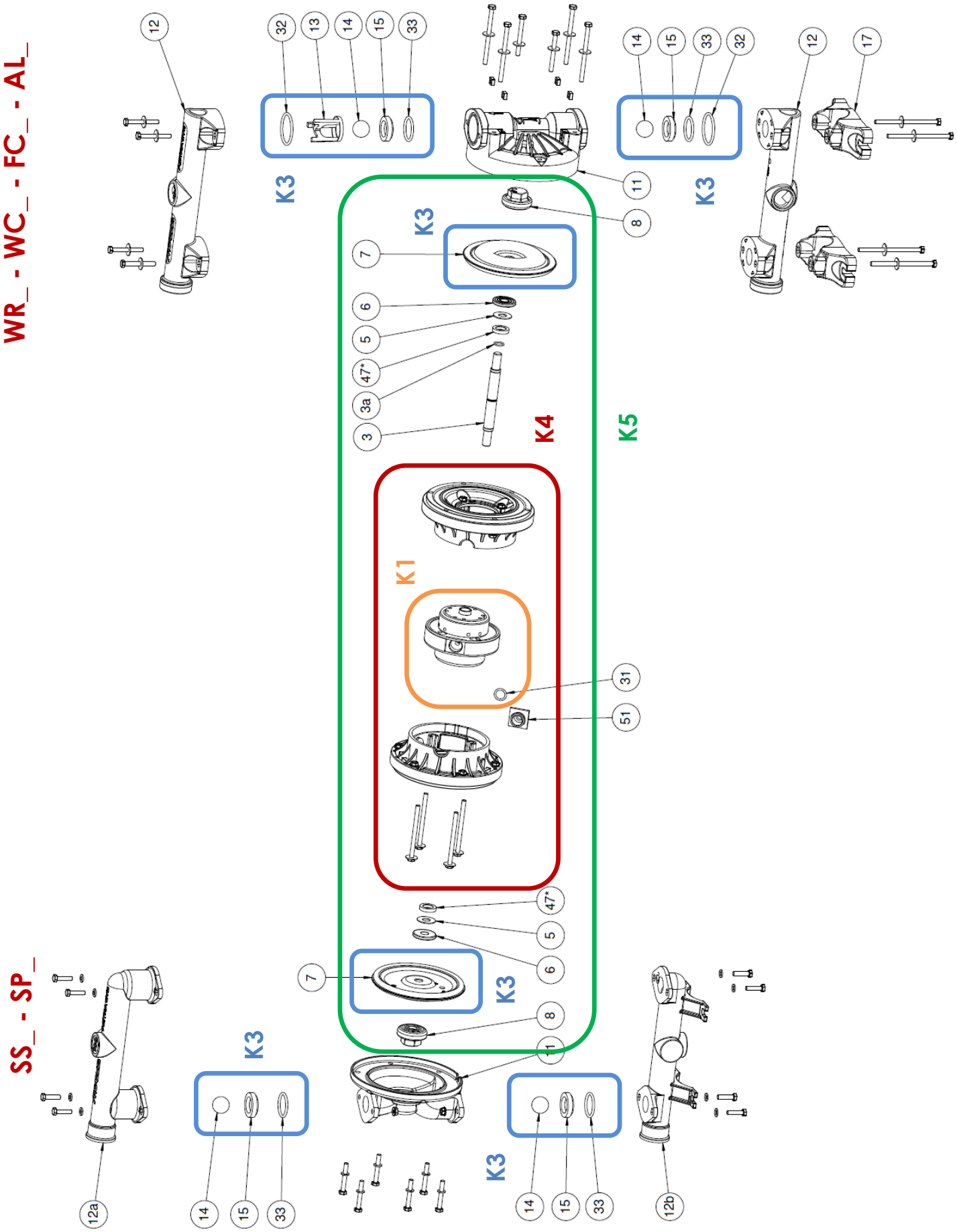
During the operation of the pump it is normal that some parts are subject to wear.

ARGAL recommends having spare parts in stock, and offers various KITs.

SPARE PARTS		start up	2 years
K3	Wetted parts	1	1
K4	Center block		1
K5	Center block + diaphragms + fluid caps		

Table 8

3.11 PART LIST & RECOMMENDED SPARE PARTS: DDE 060 – 080 – 100 – 160



LEGEND: DDE 060 – 080 – 100 – 160

Pos.	Part name	Q.ty.	recommended spare parts	
			start up	2 years
3	Shaft	1		
3a	Shaft O-Ring	1		
5	Belleville Washer	2		
6	Cap (Air Side)	2		
7*	Diaphragm	2		
8	Cap (Fluid Side)	2		
11	Fluid Chamber	2		
12	Manifold (version WR_ - WC_ - FC_ - AL_)	2		
12a	Discharge Manifold (version SS_ - FDA SP_)	1		
12b	Suction Manifold (version SS_ - FDA SP_)	1		
13	Ball Runner Cage (version WR_ - WC_ - FC_ - AL_)	2		
14	Ball	4		
15	Ball Seat	4		
17	Foot (version WR_ - WC_ - FC_ - AL_)	2		
31	O-Ring	1		
32	O-Ring Upper (version WR_ - WC_ - FC_ - AL_)	4		
33	O-Ring Lower	4		
47**	Stroke Spacer	2		
51	Air Connection	1		
*Note: configurations "Y" and "L" respectively provide coupled diaphragm: TPE + PTFE / TPV + PTFE				
**Note: the spacers pos. 47 may be not installed				

3.12 SPARE PART KITS ASTRA EVO DDE 060 – 080 – 100 – 160

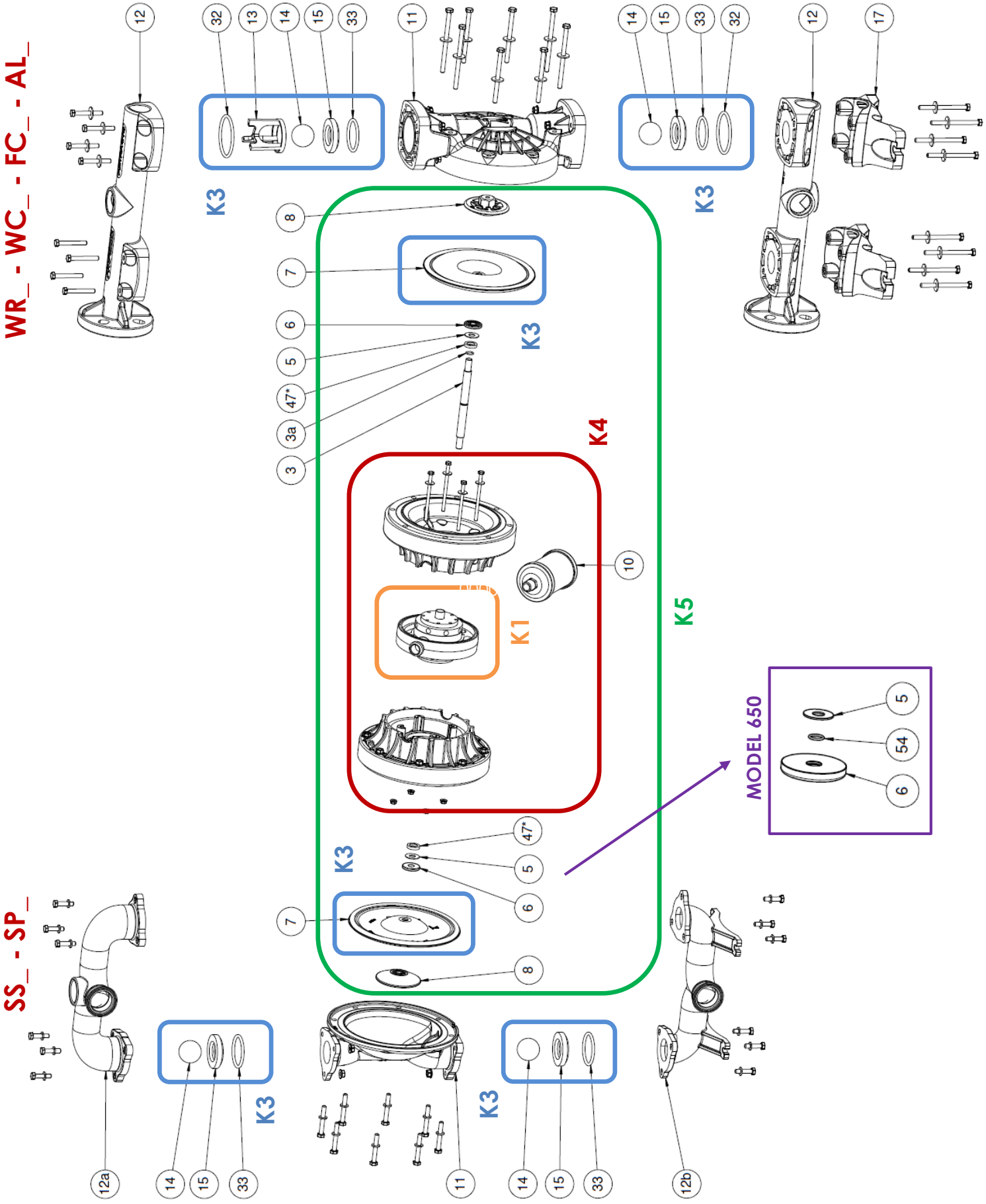
During the operation of the pump it is normal that some parts are subject to wear.

ARGAL recommends having spare parts in stock, and offers various KITs.

SPARE PARTS		start up	2 years
K1	Pneumatic exchanger (gaskets and silencers included)		1
K3	Wetted parts	1	1
K4	Center block		
K5	Center block + diaphragms + fluid caps		

Table 9

3.13 PART LIST & RECOMMENDED SPARE PARTS: DDE 400 – 650



LEGEND: DDE 400 – 650

Pos.	Part name	Q.ty.	recommended spare parts	
			start up	2 years
3	Shaft	1		
3a	Shaft O-Ring	1		
5	Belleville Washer	2		
6	Cap (Air Side)	2		
7*	Diaphragm	2		
8	Cap (Fluid Side)	2		
10	Exhaust Silencer	1		
11	Fluid Chamber	2		
12	Manifold (version WR_ - WC_ - FC_ - AL_)	2		
12a	Discharge Manifold (version SS_ - FDA SP_)	1		
12b	Suction Manifold (version SS_ - FDA SP_)	1		
13	Ball Runner Cage (version WR_ - WC_ - FC_ - AL_)	2		
14	Ball	4		
15	Ball Seat	4		
17	Foot (version WR_ - WC_ - FC_ - AL_)	2		
32	O-Ring Upper (version WR_ - WC_ - FC_ - AL_)	4		
33	O-Ring Lower	4		
47**	Stroke Spacer	2		
54***	O-Ring (cap air side)	2		
*Note: Configurations "Y" and "L" respectively provide coupled diaphragm: TPE + PTFE / TPV + PTFE				
**Note: the spacers pos. 47 may be not installed				
***Note: valid only for model 650				

3.14 SPARE PART KITS ASTRA EVO DDE 400 – 650

During the operation of the pump it is normal that some parts are subject to wear.

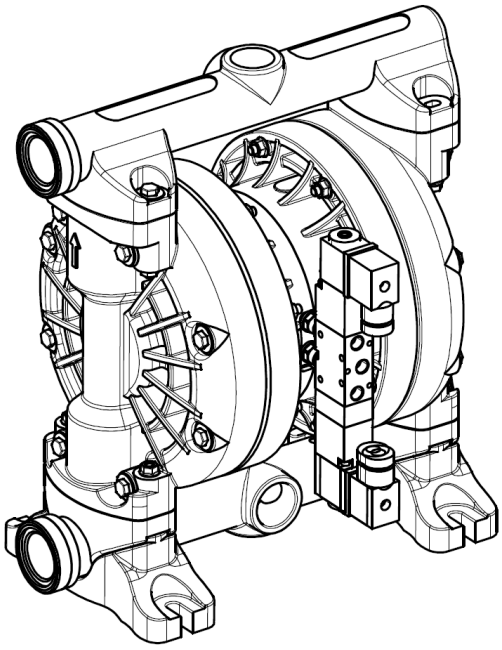
ARGAL recommends having spare parts in stock, and offers various KITs.

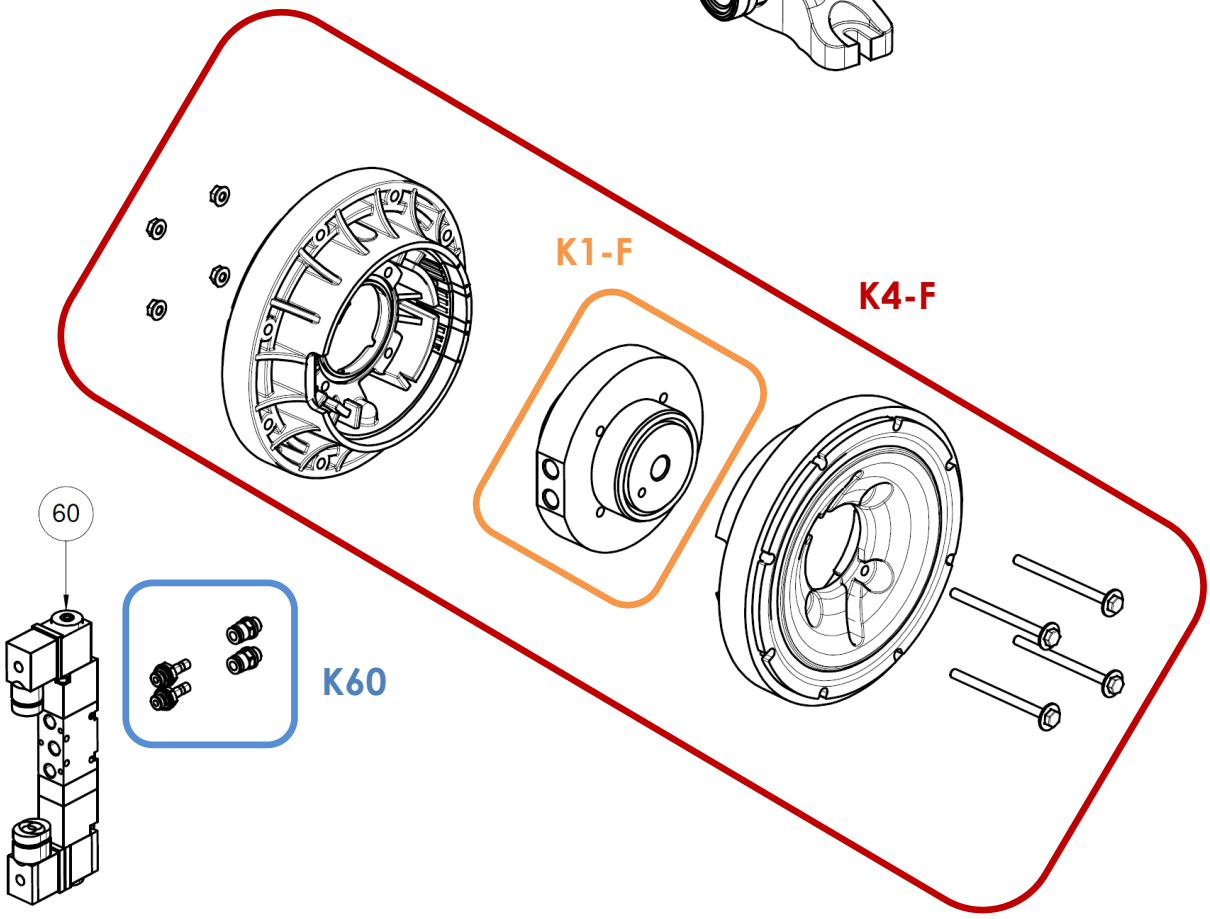
SPARE PARTS		start up	2 years
K1	Pneumatic exchanger		1
K3	Wetted parts	1	1
K4	Center block		
K5	Center block + diaphragms + fluid caps		

Table 10

3.15 " FREE " PUMPS (remote control)

The standard version is equipped with a bistable 5/2 electro-pneumatic valve that can be mounted directly on the pump, with a specific fitting kit





SPARE PARTS		start up	2 anni
K1-F	Pneumatic exchanger – FREE version		
K4-F	Center block – FREE version		
K60	Fitting KIT for on-board mounting		
60	Electro-pneumatic valve (type 5/2 bistable)		

Table 11

3.16 RECOMMENDATIONS

WARNING: Before performing any maintenance or repair work on the pump, disconnect the pump from the air supply line. Disconnect the hydraulic connections and discharge the fluid which is contained within the pump itself.

- all operations must be carried out by qualified personnel;
- wear appropriate Personal Protective Equipment (PPE) when disconnecting pump from the system and cleaning the pump;
- clean the pump before carrying out maintenance operation;
- do not dispose the cleaning waste into the environment.

3.17 PUMP DISASSEMBLY

Before the pump disassembly, perform the shutdown procedure:

- disconnect the air connection and discharge from pump all fluid;
- clean carefully the pump;
- disconnect the suction and discharge connections.

Check that the tools are compatible with the pump clamping elements. Than follow the instructions below:

- Check that the pump is completely empty (turn it upside down and collect any leaking);
- Clean all the pump external surfaces with a damp cloth.

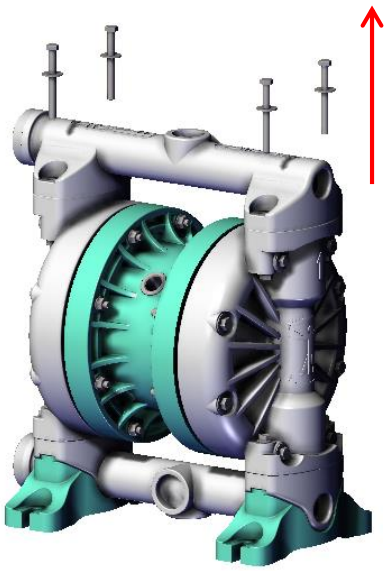
3.17.1 TOOLS REQUIRED:

- **DDE 007**: hex. spanners 10mm - 17mm
- **DDE 015 – 020 – 030 – 060 – 080 – 100 – 160**: hex. spanners 10mm - 27mm
- **DDE 400**: hex. spanners 10mm - 13mm – 21mm (SS_-SP_) / 27mm (AL_) / 30mm (WR_-FC_)
- **DDE 650**: hex. spanners 13mm – 25mm (SS_-SP_) / 32mm (AL_) / 50mm (WR_-FC_)
- Torque wrench
- O-ring pick

3.17.2 DISASSEMBLY PROCEDURE FOR MAINTENANCE

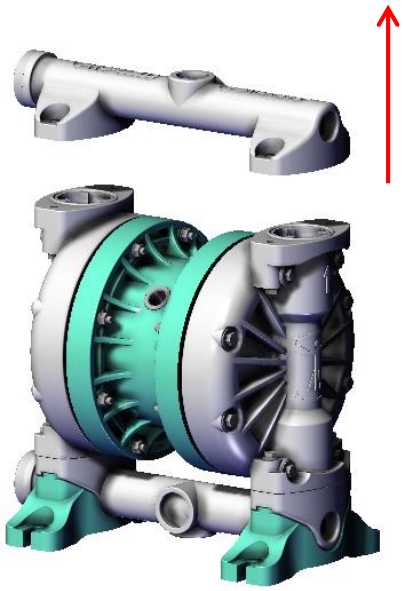
The following instructions must be strictly applied to perform maintenance on the pump.

NOTE: all the threads are right-hand threads.



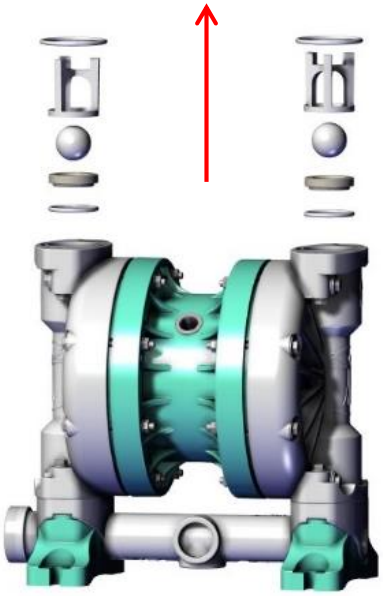
STEP 1

Remove the discharge manifold bolts (pos.19).



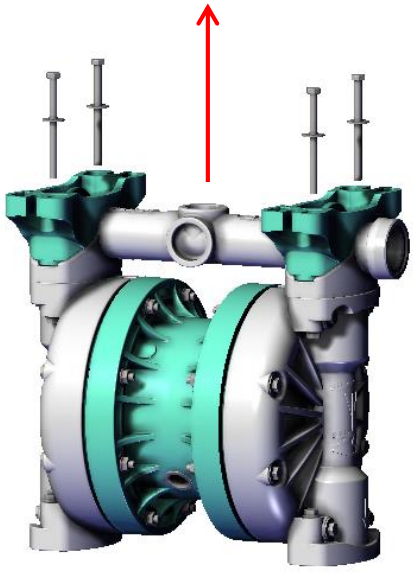
STEP 2

Remove the discharge manifold (pos.12a).
NOTE: keep caution during removal.



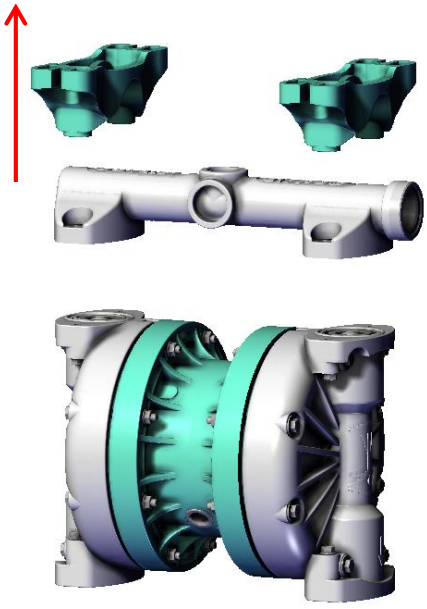
STEP 3

Remove the O-rings, the cages, the balls and the ball seats. Check the status of these parts. Replace worn or damaged parts.



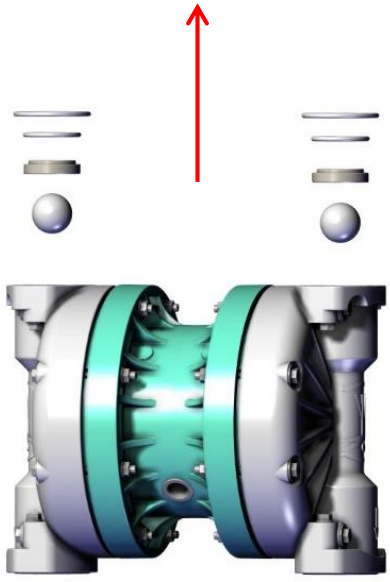
STEP 4

Rotate the pump and place it on the discharge manifold side. Remove the suction manifold bolts (pos.20).



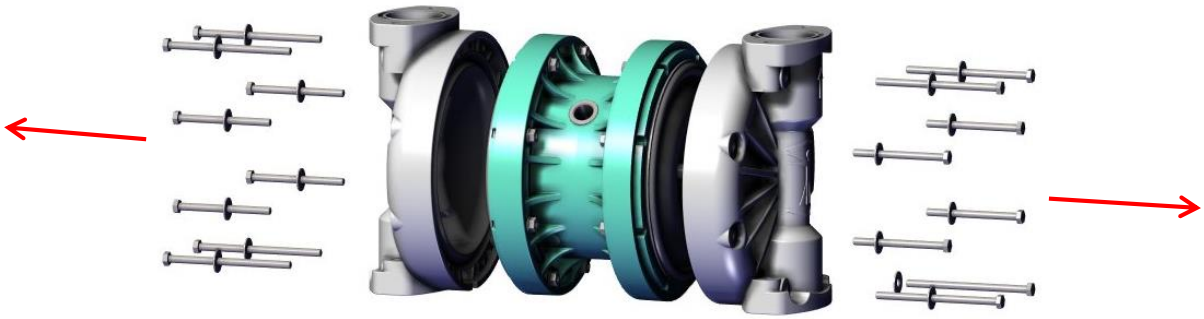
STEP 5

Remove the feet, then the suction manifold (pos.12b).
NOTE: keep caution during removal.



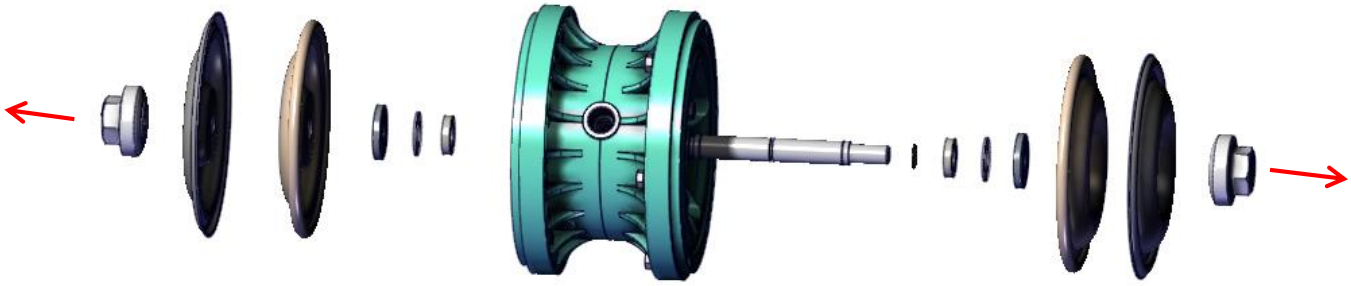
STEP 6

Remove the O-rings, the cages, the balls and the ball seats. Check the status of these parts. Replace worn or damaged parts.



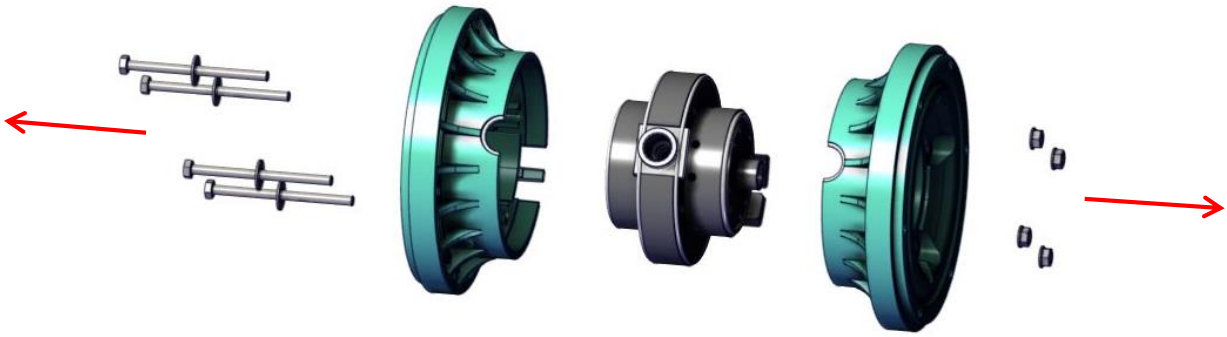
STEP 7

To remove the fluid chambers (pos.11), place it as shown in the above picture. Remove the bolts (pos.21) from both the fluid chambers.



STEP 8

Unscrew the fluid caps (pos.8), remove the diaphragms from the shaft (pos.7), remove the air caps (pos.6), the belleville washers (pos.5), the spacers (pos.47) if present, then remove the pump shaft (pos.3) from the center block. Then remove the O-ring (pos.3a) from the shaft (pos.3).

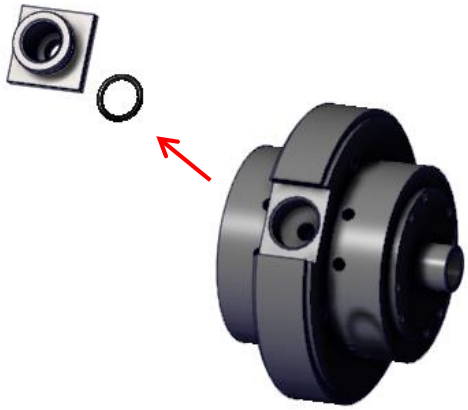


STEP 9

Remove the blots (pos.22) from the center block, then open up the 2 half parts (pos.1).

STEP 10

Remove the O-rings (pos.28 – 29) – then remove the silencers (pos.10). For the models 400 e 650 unscrew the external silencer (pos.10).



STEP 11

Only for models 60-100-160 remove the air connection (pos.51) and it's O-ring (pos..31) from the pneumatic exchanger (pos.2).

PNEUMATIC EXCHANGER

WARNING: The pneumatic exchanger must not be opened to prevent incorrect reassembly, that may cause the pump malfunctioning.

OPERATION RESERVED FOR ARGAL PERSONNEL OR AUTHORIZED BY ARGAL!

INSPECTION

Check for the presence of:

- excessive abrasion on the thermoplastic parts;
- clogged materials and/or agglomerates caused by pumped fluid;
- deformations and/or surface lesions on the diaphragms;
- deformations and/or breakages on the valve seats.

Replace the parts: broken, cracked, deformed. Reopen all the clogged ducts and eliminate any chemical agglomerates. Clean all the surfaces before reassembly, particularly the OR gaskets seats (risk of leakage).

CLEANING AND REPLACING THE DIAPHRAGMS

- control and internal cleaning every 500.000 cycles;
- diaphragm check every 5.000.000 cycles;
- diaphragm replacement every 15.000.000 cycles.

3.18 PUMP ASSEMBLY

To reassemble the pump, follow the instructions given in this paragraph.

- clean all the parts with a damp cloth;
- replace the worn parts with genuine spare parts;
- stainless steel bolts should be lubed to reduce the possibility of seizing (suggested **copper grease**);
- to reassemble the pump, follow the disassembly instructions in the reverse order.

3.18.1 PROCEDURE FOR TIGHTENING THE FLUID CHAMBERS ON THE CENTER BLOCK

With empty pump:

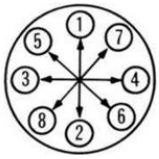
1. Manually tighten the fluid chambers bolts (pos.21) on both sides.

2. Connect the air supply line, set the air pressure to 5 bar (72.5 psi), then start the pump.

3. In most cases air leaks will occur and the pump may not work. This is normal.

4. While the pump is running, gradually tighten the bolts (pos.21) on both sides, according to a cross pattern*, until there are no more leaks.

5. Evenly tighten the bolts (pos.21) to the prescribed torque (see table 7), again according to a cross pattern *

* Diametrically opposite sequence. Example : 

3.18.2 TIGHTENING TORQUES

MODEL	POS.	CONNECTION	TIGHTENING TORQUE (Nm)
007	n.a.	Manifold Connection: Discharge Side/ Suction Side	6÷8
	n.a.	Connection Fluid Chamber	6÷8
	8	Cap (Fluid side)	8
015 020 030	n.a.	Manifold Connection: Discharge Side/ Fluid Chamber	6÷8
	n.a.	Manifold Connection: Suction Side/ Fluid Chamber	6÷8
	n.a.	Connection Fluid Chamber	6÷8
	8	Cap (Fluid side)	15
060 080 100 160	n.a.	Manifold Connection: Discharge Side/ Fluid Chamber	6÷8
	n.a.	Manifold Connection: Suction Side/ Fluid Chamber	6÷8
	n.a.	Connection: Fluid Chamber/ Center Block (Half Part)	6÷8
	n.a.	Connection Center Block	6÷8
	8	Cap (Fluid side)	30
400	n.a.	Manifold Connection: Discharge Side/ Fluid Chamber	10÷12
	n.a.	Manifold Connection: Suction Side/ Fluid Chamber	10÷12
	n.a.	Connection: Fluid Chamber/ Center Block (Half Part)	10÷12
	n.a.	Connection Center Block	6÷8
	8	Cap (Fluid side)	30
650	n.a.	Manifold Connection: Discharge Side/ Fluid Chamber	10÷12
	n.a.	Manifold Connection: Suction Side/ Fluid Chamber	10÷12
	n.a.	Connection: Fluid Chamber/ Center Block (Half Part)	10÷12
	n.a.	Connection Center Block	10÷12
	8	Cap (Fluid side)	50

Table 12

4. TECHNICAL DATA

4.1 TECHNICAL DATA

Plastic pumps

MODEL		007		015		020		030		060		080		100		160		400		650	
MATERIAL		WR DL	FC	WR	FC	WR	FC	WR	FC	WR	FC	WR	FC	WR	FC	WR	FC	WR	FC	WR	FC
Max. flow rate	L/min	10.8		21		26		52		76				130		175		370		715	
Max. discharge head*	m.c.w.	80*		80*		80*		80*		80*		80*		80*		80*		80*		80*	
Max. supply air pressure	bar	8		8		8		8		8		8		8		8		8		8	
Min. startup air pressure	bar	2		2		2		2		2		2		2		2		2		2	
Max. discharge pressure	bar	8		8		8		8		8		8		8		8		8		8	
Max. suction lift dry	m.c.w.	3		4		4		4		4		4		4		4.5		4.5		4,5	
Max. suction lift wet	m.c.w.	9		9		9		9		9		9		9		9		9		9	
Max. size of passable solids	mm	1.5		3		3		3		3,2		5,5		5,5		6		7		9	
Noise – sound pressure level (Lp)	dB(A)	63		72		72		72		75		80		80		80		80**		80**	
Weight	kg	0.7	0.9	1.5	1.9	1.6	2	1.6	2	3.5	4	4.8	5.5	4.8	5.5	6.4	7.7	18	24	31	40

Table 13

***WARNING: with NBR/EPDM balls do not exceed 50 m.c.w. of discharge head**

** MEASURED WITH STD AIR MUFFLER ASSEMBLED

Metallic pumps

MODELLO		030			060			100			160			400			650		
MATERIALE		AL	SS	SP	AL	SS	SP	AL	SS	SP	AL	SS	SP	AL	SS	SP	AL	SS	SP
Max. flow rate	L/min	52			76			130			175			370			715		
Max. discharge head*	m.c.w.	80*																	
Max. supply air pressure	bar	8			8			8			8			8			8		
Min. startup air pressure	bar	2			2			2			2			2			2		
Max. discharge pressure	bar	8			8			8			8			8			8		
Max. suction lift dry	m.c.w.	4			4			4			4.5			4.5			4,5		
Max. suction lift wet	m.c.w.	9			9			9			9			9			9		
Max. size of passable solids	mm	3	3,5		3,2	3,8		5,5			6			7			9		
Noise – sound pressure level (Lp)	dB(A)	72			75			80			80			80**			80**		
Weight	kg	2.2	3.7		4	5.5		5.5	8.5		7.8	11		24	25		39	49	

Table 14

***WARNING: with NBR/EPDM balls do not exceed 50 m.c.w. of discharge head**

** MEASURED WITH STD AIR MUFFLER ASSEMBLED

Strokes and Displacements

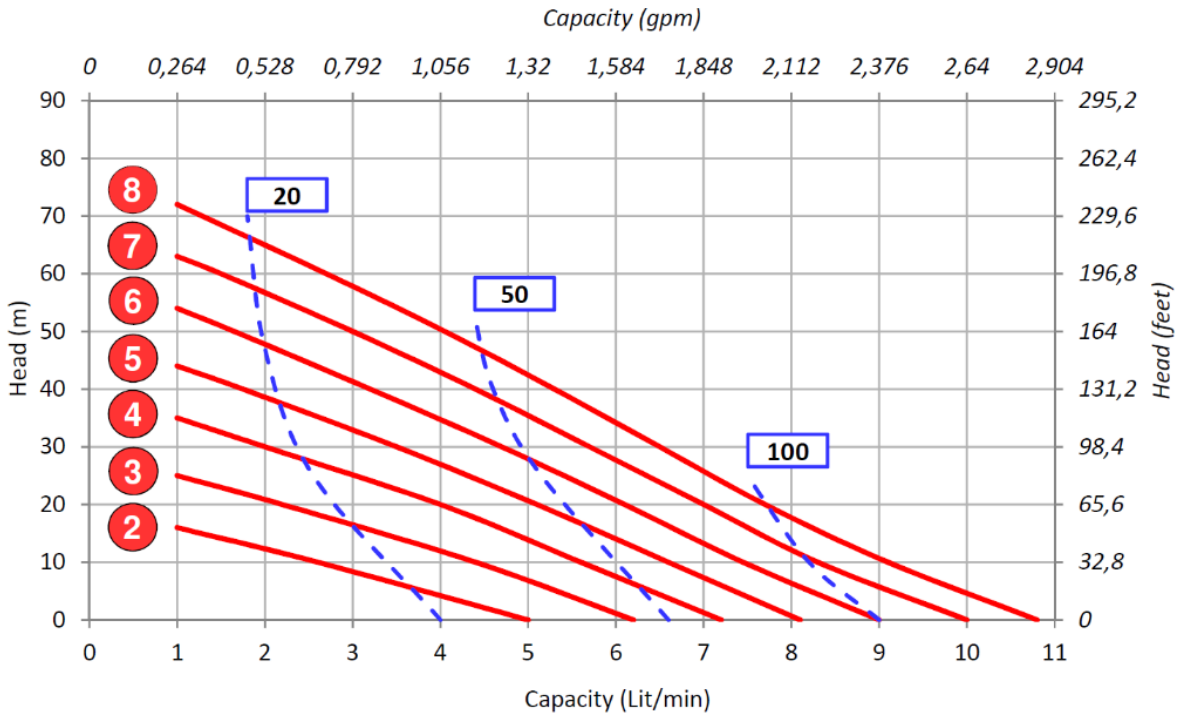
MODEL	STROKE [mm]	DISPLACEMENT per chamber [cc]	DISPLACEMENT per cycle [cc]
007	11	10	20
015 – 020 – 030	13,6	35	70
060	18	75	150
100	25	120	240
160	31	220	440
400	57,5	670	1340
650	70	1910	3820

Table 15

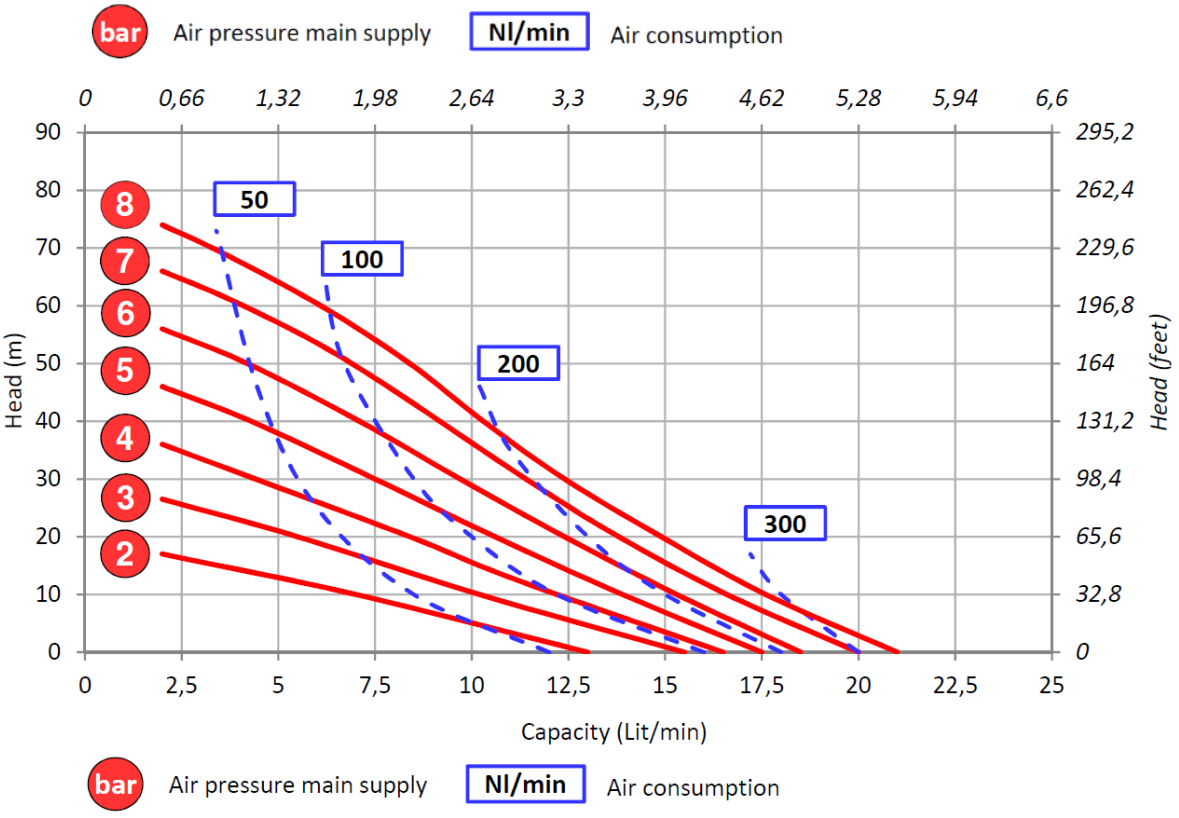
4.2 CAPACITY CURVES

The performances shown below are the maximum achievable by the pump, at ambient temperature with water at 20°C. The plant configuration and/or different fluids or environmental conditions may change the performances. The curves shown below refer to the **"Y"** and **"L"** configuration: **TPE + PTFE - TPV + PTFE**.

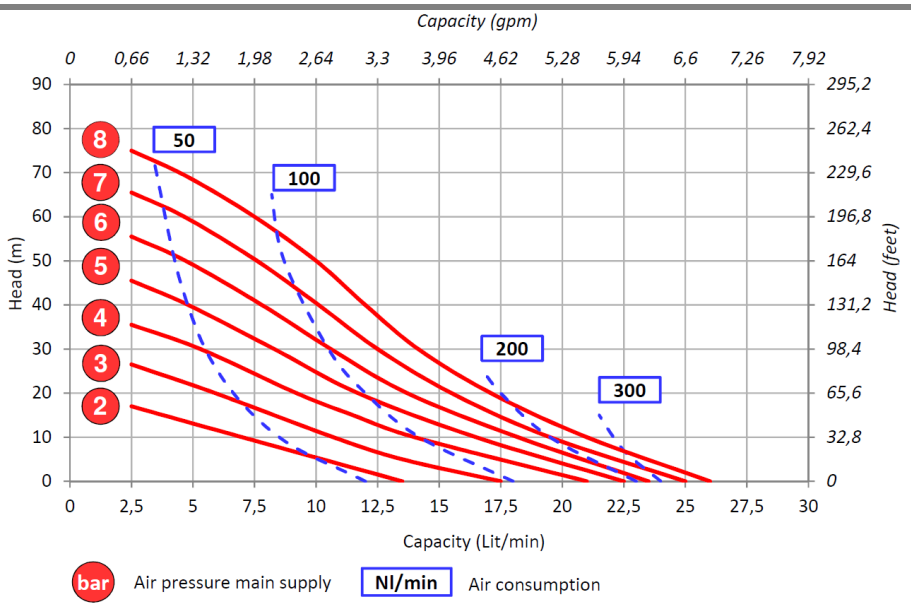
DDE 007



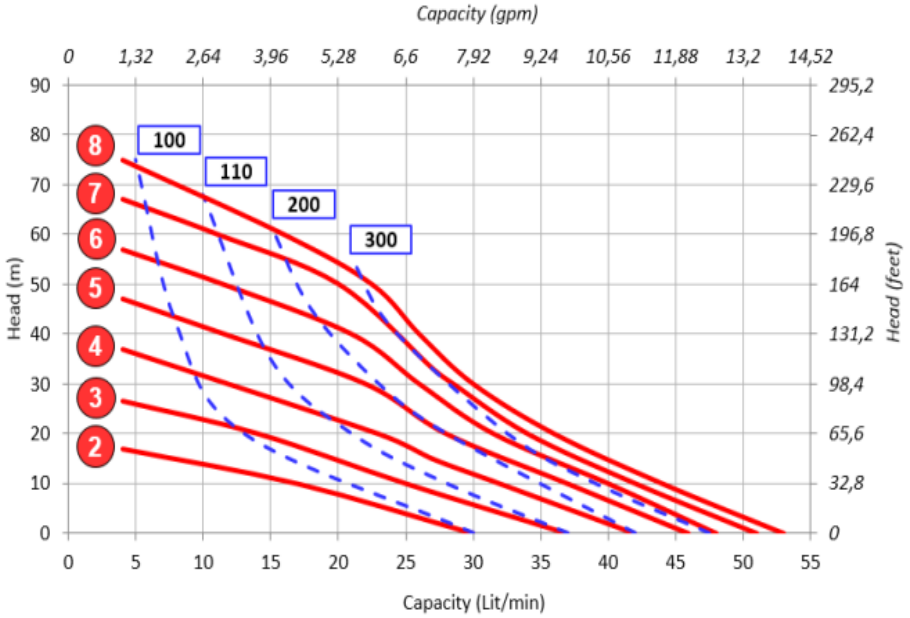
DDE 015



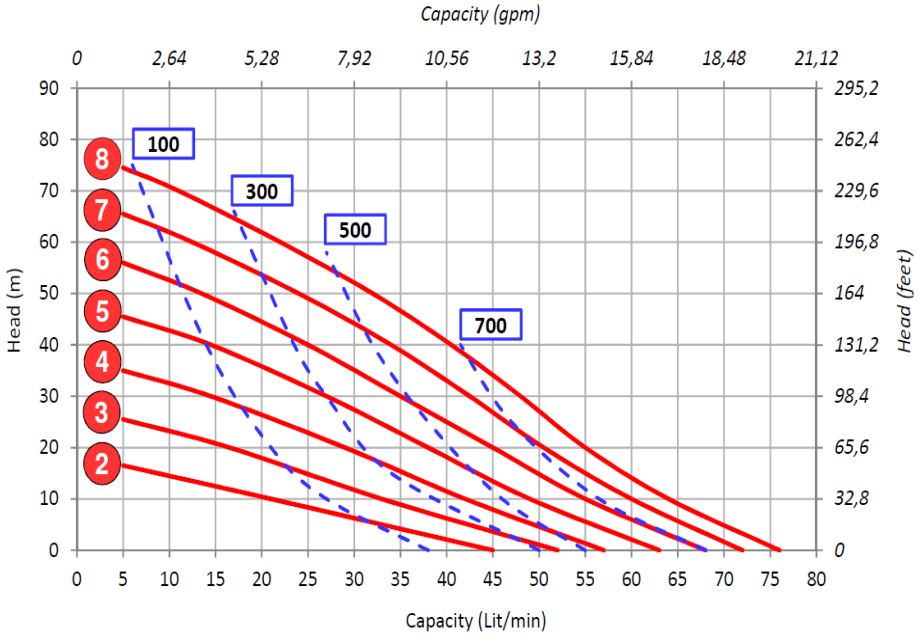
DDE 020



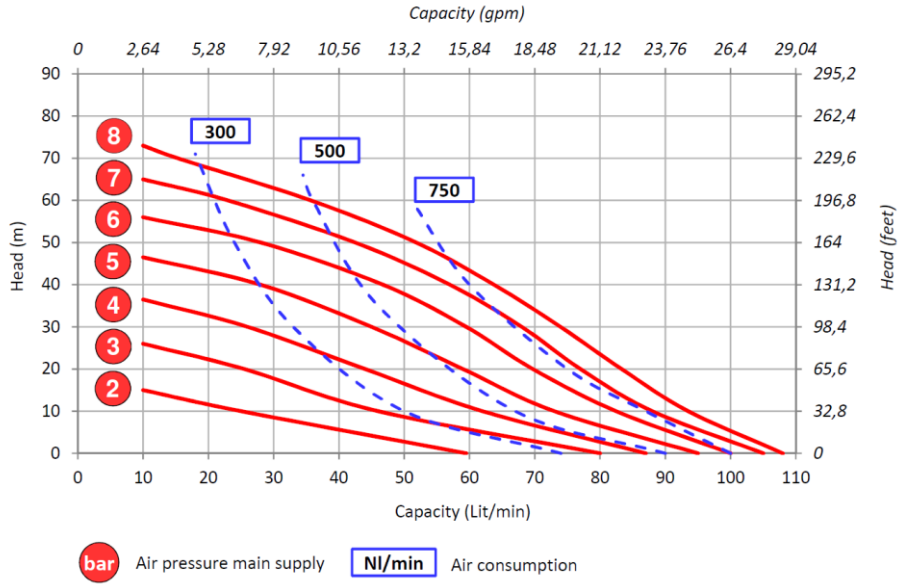
DDE 030



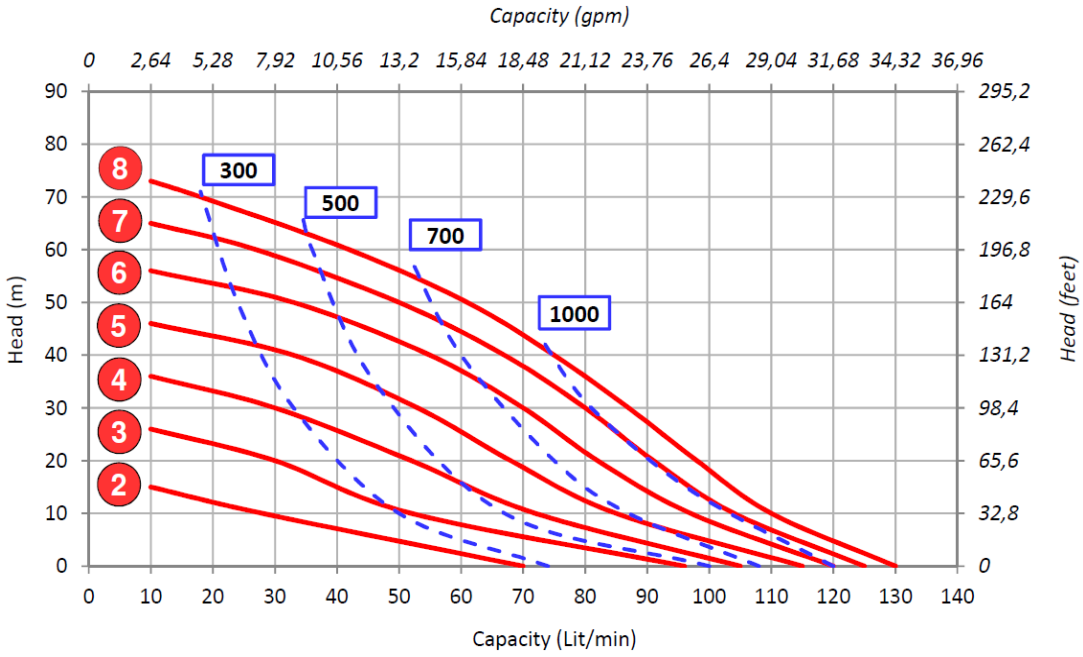
DDE 060



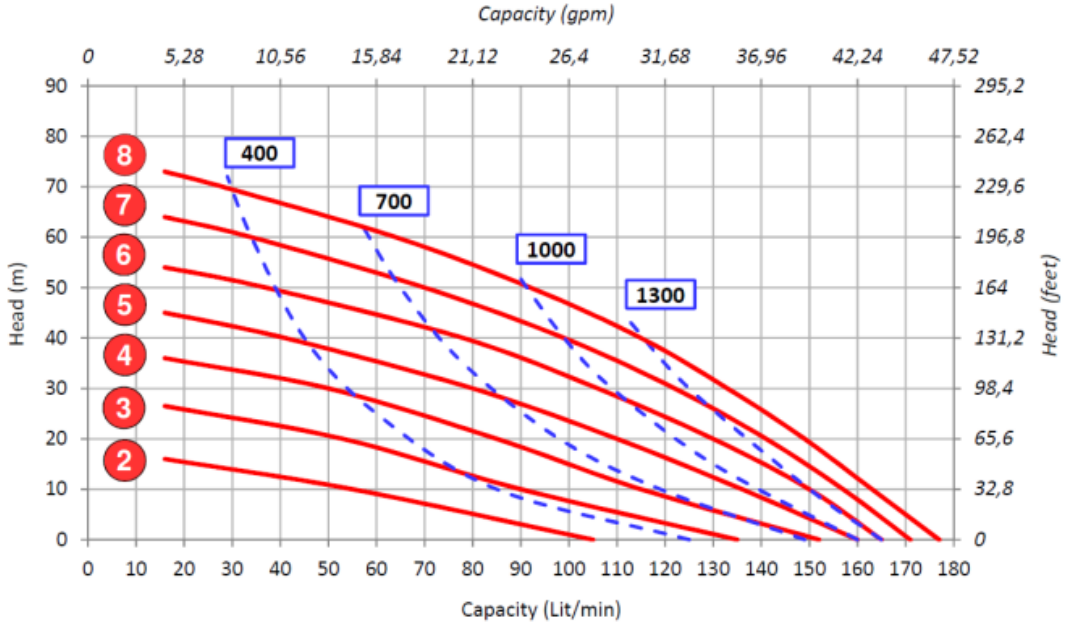
DDE 080



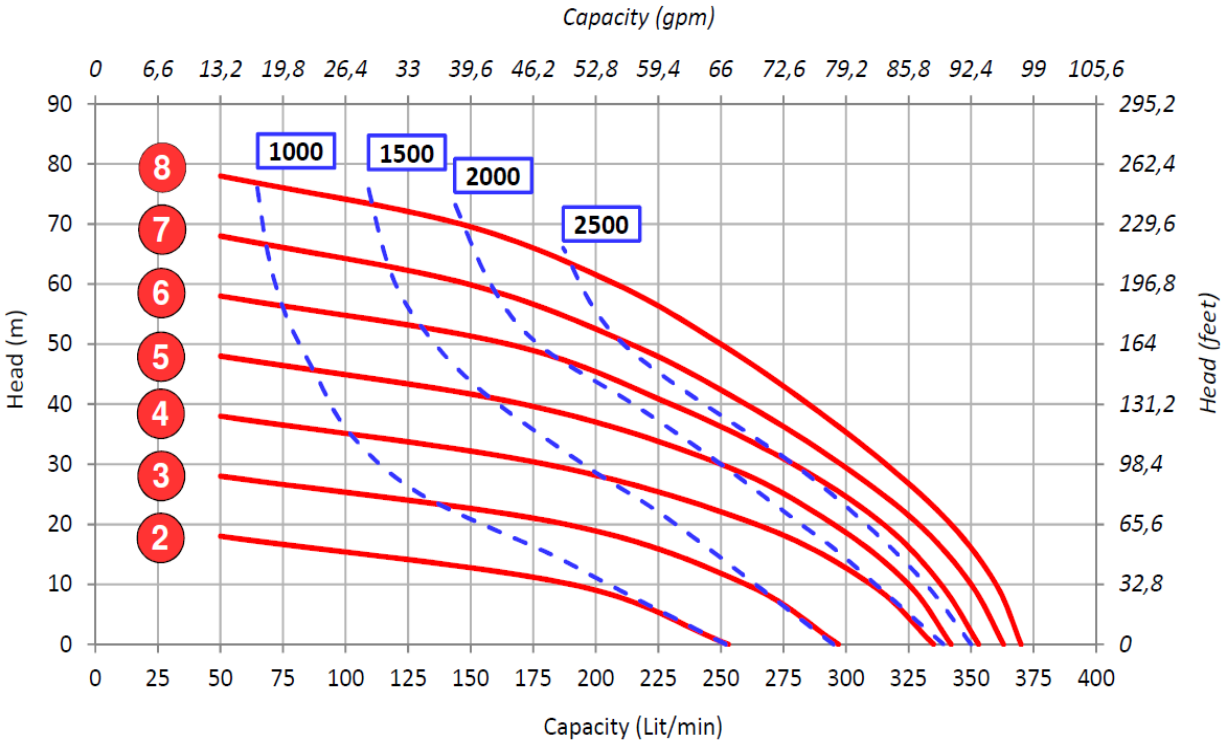
DDE 100



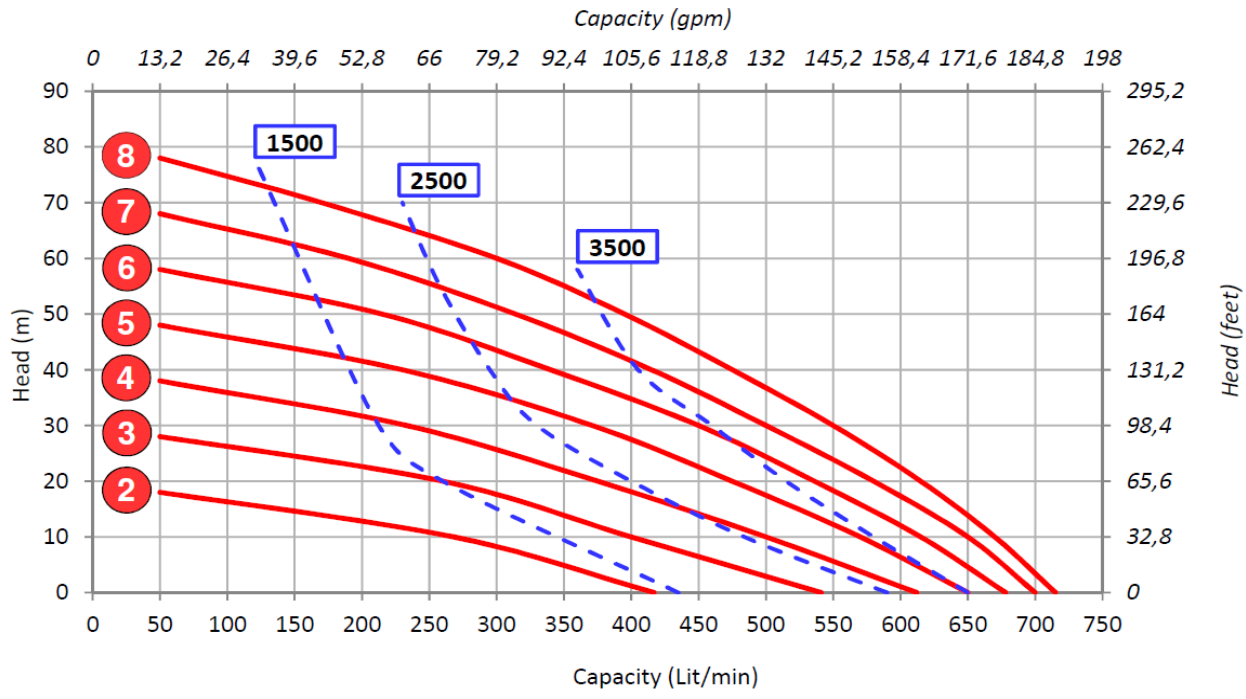
DDE 160



DDE 400

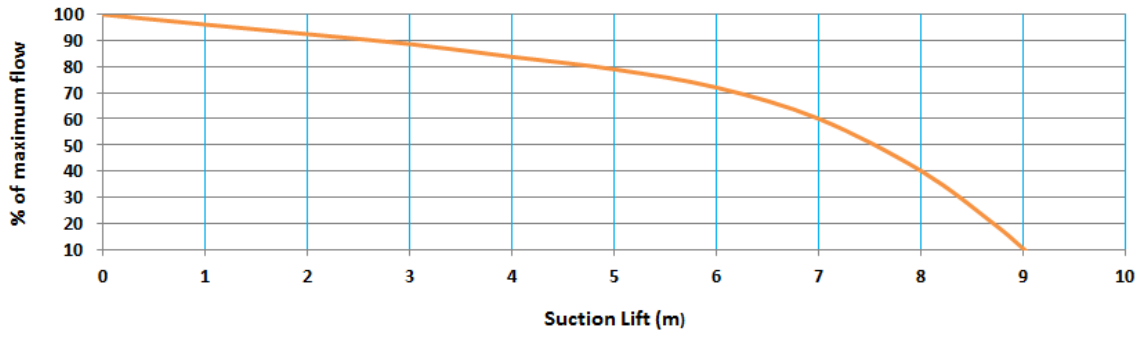


DDE 650



bar Air pressure main supply Nl/min Air consumption

CAPACITY CHANGES AT DIFFERENT SUCTION HEADS



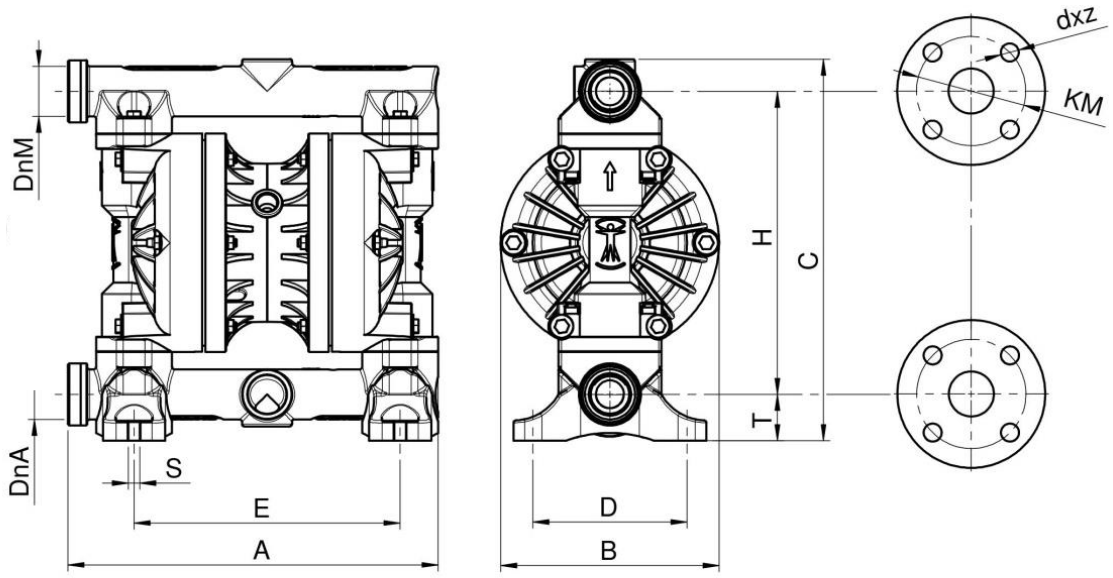
4.3 DIMENSIONAL DRAWINGS

007 – 015

020 – 030

060 – 080

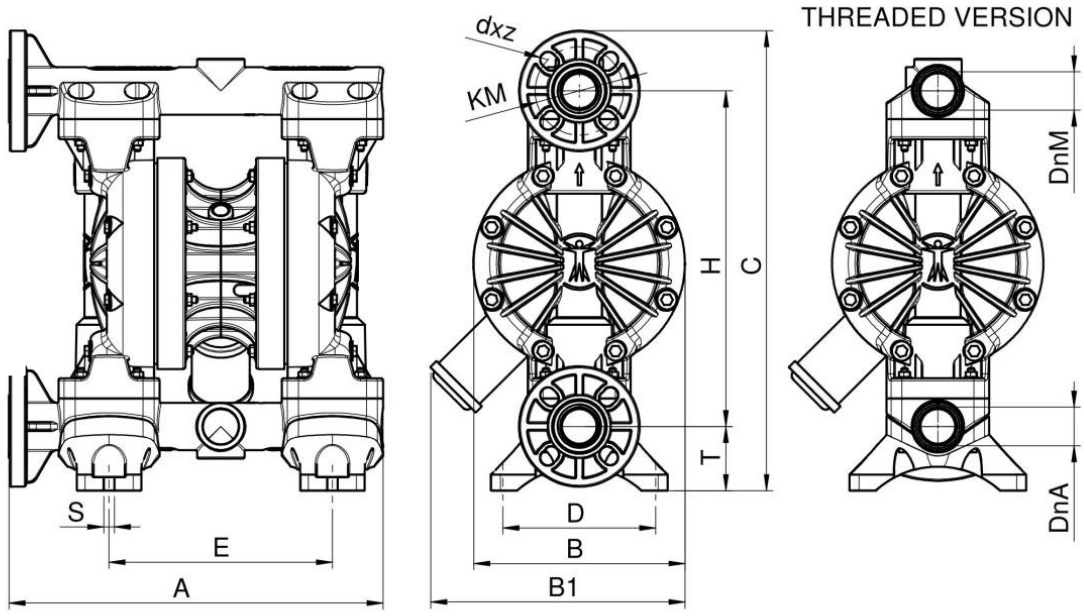
100 – 160



450 – 650

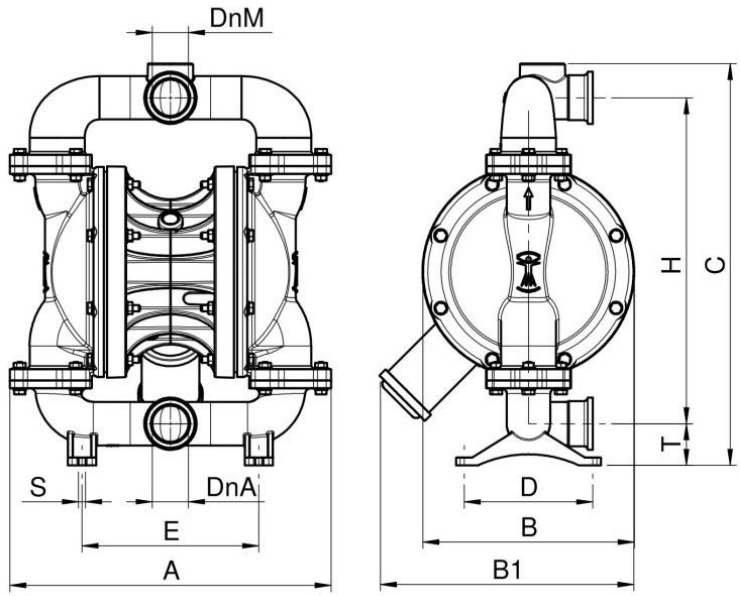
WR_/WC_

FC_/AL_



450 – 650

SS_/SP_



MODEL				007	015	020	030	060	080	100	160	400 THREADED	400 FLANGED	650 THREADED	650 FLANGED
DnA			inch	1/4”	1/4”	3/8"	1/2"	1/2"	3/4"	1"	1"	1"1/2	1"1/2	2"	2"
DnM			inch	1/4”	1/4”	3/8"	1/2"	1/2"	3/4"	1"	1"	1"1/2	1"1/2	2"	2"
A			mm	128	183	192,5	192,5	243	288	288	310	429,5	465,5	563	594
B			mm	74	107	107	107	160	170	170	203	263	263	345	345
B1			mm	/	/	/	/	/	/	/	/	317	317	382	382
C			mm	126	203	209	209	260,5	297	297	344,5	538	573	662,5	690
D			mm	57	93	93	93	104	120	120	140	190	190	225	225
E			mm	95	130	130	130	177	207	207	220	278	278	384	384
H			mm	97	153	156	156	215	236	236	283	418	418	512,5	512,5
S			mm	5.5	7	7	7	9	9	9	9	13	13	13	13
T			mm	16	35	35	35	27,5	36	36	36,5	80	80	95	95
SUCTION BSP/NPT			inch	1/4"	1/4"	3/8"	1/2"	1/2"	3/4"	1"	1"	1 1/2"	/	2"	/
DISCHARGE BSP/NPT			inch	1/4"	1/4"	3/8"	1/2"	1/2"	3/4"	1"	1"	1 1/2"	/	2"	/
FLANGES	ISO	KM	mm	/	/	/	65	65	75	85	85	/	110	/	125
		dxz	mm	/	/	/	14x4	14x4	16x4	16x4	16x4	/	18x4	/	18x4
	ANSI	KM	mm	/	/	/	60	60	69.8	79.4	79.4	/	98.4	/	120.6
		dxz	mm	/	/	/	16x4	16x4	19x4	16x4	16x4	/	16x4	/	19x4
AIR CONNECTION				Tube OD Ø4mm-Ø5/32”		Tube OD Ø6mm or Ø1/4”		1/4"BSP or 1/4”NPT	3/8"BSP or 3/8”NPT			1/2"BSP or 1/2”NPT		3/4"BSP or 3/4”NPT	

Table 16

MODEL				030			060			100			160			400			650		
MATERIAL				AL_	SS_	SP_	AL_	SS_	SP_	AL_	SS_	SP_	AL_	SS_	SP_	AL_	SS_	SP_	AL_	SS_	SP_
DnA			inch	1/2"			1/2"			1"			1"			1"1/2			2"		
DnM			inch	1/2"			1/2"			1"			1"			1"1/2			2"		
A			mm	194	203	203	245,5	246,5	246,5	292	275,5	273,5	310	312	310	467	400		594	478	
B			mm	107			160			170			203			263,5			345	346	
B1			mm	/			/			/			/			317			381		
C			mm	205	197	202,5	253,5	247,5	253	289	288		335	321,5		573	501		688	694	
D			mm	93	65		104	80		120	89		140	100		190	160		225	220	
E			mm	130	95		177	136		207	140		220	150		278	220		384	280	
H			mm	150	152		206	190		225	220		270,5	253,5		418	406		511,5	556	
S			mm	7	7		9	7		9	9		9	9		13	9		13	13	
T			mm	35	25		27,5	37,5		36	40		36	40		80	52		93,5	85	
SUCTION BSP/NPT			inch	1/2"		/	1/2"		/	1"		/	1"		/	1 1/2"		/	2"		/
DISCHARGE BSP/NPT			inch	1/2"		/	1/2"		/	1"		/	1"		/	1 1/2"		/	2"		/
FLANGES	ISO	KM	mm	65		/	65		/	85		/	85		/	110		/	125		/
		dxz	mm	14x4		/	14x4		/	16x4		/	16x4		/	18x4		/	18x4		/
	ANSI	KM	mm	60		/	60		/	79		/	79		/	98		/	121		/
		dxz	mm	16x4		/	16x4		/	16x4		/	16x4		/	16x4		/	19x4		/
CLAMP			inch	nd	nd	1"	nd	nd	1"	nd	nd	1"1/2	nd	nd	1"1/2	nd	nd	2"	nd	nd	2"1/2
AIR CONNECTION				Tube OD Ø6mm or Ø1/4"			1/4"BSP or 1/4"NPT			3/8"BSP or 3/8"NPT						1/2"BSP or 1/2"NPT			3/4"BSP or 3/4"NPT		

Table 17

5. PUMP DISPOSAL

The pump is not composed of hazardous materials or pieces. In all cases, at the end of life of the same, to perform the disposal you have to:

WARNING! Drain from the pump the fluid still present. In the case of dangerous fluids, toxic and/or harmful to health and environment you must carry out a correctly cleaning and treatment: risk of injury, damage to health and/or death.

1. Disconnect the air supply from the pump;
2. Disassemble the pump from the installation;

3. Separate the components by type;

WARNING! For disposal contact the appropriate authorized companies. Sure not to leave or disperse in the environment large or small parts that can cause pollution, accidents or any direct or indirect damages. For different types of materials: separate plastic parts from metal parts and dispose by authorized companies.

6. WARRANTY & REPAIR

The **ASTRA evo** pump is a product of high quality. If a defect occurs contact the MANUFACTURER'S ASSISTANCE SERVICE, that will help you as soon as possible.

Indicate in each case as follows:

1. The full address of firm;
2. The identification of the pump (serial number);
3. The description of the anomaly;

All ARGAL pumps are covered by WARRANTY, shown on the next page.

Note: The Warranty Service will only be carried out at our workshop, upon agreement, receipt of a completed guarantee questionnaire and when the defective pump has been sent. In the event of repair or replacement of pump parts the warranty will not be prolonged.

RETURNING PARTS

Follow this procedure:

- Consult the use manual for the packing instructions;
- Prevent any damage under transport;
- The returning parts must be completely empty from fluid;

Warranty is excluded in all cases of misuse or incorrect applications and noncompliance of the information contained in this manual. For any dispute the competent Court is Brescia (Italy).

www.argalpumps.com - info@argal.it

GENERAL CONDITIONS OF SALE FOR ASTRA EVO (DDE)

1. COMPLAINTS

Complaints of any type must be made upon receiving the goods and within on week of discovering the defect. Complaints about incomplete orders or deterioration during transit must be made to us immediately and all the proofs of the irregularity must be collected in order to substantiate any claims against the carrier.

2. WARRANTY

Specifications, dimensions and any other information contained in our catalogues is to the best of our knowledge accurate. However, the above information is merely illustrative and is subject to modification without warning. In all cases we reserve the right to at any moment make any changes to our products that we deem to be appropriate and such changes shall not entitle the purchaser to make any claims against us. All drawings remain our exclusive property and may not be passed on to third parties or be reproduced without our written approval.

DURATION OF WARRANTY: ARGAL manufactures its products from first-class materials, uses qualified personnel and tests the different production stages. Within **twelve months from the time of installation** and no more than **eighteen months from delivery** ARGAL undertakes to examine any defective parts and to promptly replace any faulty parts free of charge if it is responsible for the fault. Such faults must not be due to wear, inexpert use or carelessness on the purchaser's part, fortuitous events or force majeure. The warranty period is shortened to *six months if the machines work continuously twenty-four hours a day*. Even machines that are under warranty must be sent to ARGAL carriage paid. Once the machines have been repaired they will be returned to the purchaser carriage forward. The replaced parts remain the property of ARGAL and must be returned to ARGAL. The warranty is voided: 1a) if the machines have not been properly maintained; 1b) if they have not been used in accordance with the technical standards set out in the manuals supplied with the delivery; 1c) if the machines are dismantled without our prior authorization; 1d) if the machines are 'mistreated'; 1e) if the machines are used to circulate liquids in applications that are different from those which have been specifically approved beforehand by ARGAL. We shall not be liable for the downtime arising from repairs to or the replacement of any machines of ours that are under warranty.

ARGAL shall not be responsible for any direct, accidental or indirect damage, injury or loss (including, but not limited to accidental or indirect damage arising from loss or profit or sales, or for any personal injury or damage arising or any other accidental or indirect loss) or for damage and injury caused by use of the machine or inability to use the machine. Before using the machine the user must check the suitability of the machine for its intended purpose and shall use the machine entirely at his own risk and responsibility. The user notes that the pumps supplied to him by us oblige him, in accordance with Article 2050 of the Italian Civil Cod, to comply with all the legislative and regulatory standards governing dangerous activities such as using, storing and conveying aggressive and polluting chemical products. The user also undertakes to comply with the prescriptions that apply to the system (such as guards, washers, seals etc.) in which the pumps will be used and to comply with the installation instructions, checks and maintenance prescribed for pumps and installations.

The user must also allow us, if necessary, to check the operating efficiency of the systems and to subsequently check that the pump has been correctly installed. If the user fails to comply with the prescriptions laid down by us or prevents us from carrying out the above inspection, he voids all contractual warranty rights and warranty rights under the terms of Articles 1667 and 1668 of the Italian Civil Code.

BS, 31.10.2017

ARGAL S.r.l

Rev. 0 - 2017

ARGAL S.R.L. – Via Labirinto, 159 – 25125 BRESCIA (ITALY) – Tel. +390303507011 Fax. +3903003507077
Mail: pec@pec.argal.it - P. IVA/ VAT 00583130174 – Joint Stock € 51.480,00 I.V. - R.E.A. 203878 – Co. registration 11615

www.argalpumps.com - info@argal.it

WARRANTY FORM

Company:_____

Telephone:_____ Fax:_____

Address:_____

Country:_____ Contact Name:_____

E-mail:_____

Delivery Date:_____ Pump was installed (date):_____

Pump type:_____ Serial no.:_____

Description of the fault:_____

_____

_____

The installation

Liquid:_____

Temperature (°C):_____ Viscosity (cPs):_____ Spec. grav. (Kg/m^3):_____ PH-value:_____

Contents of particles:_____ %, of max size (mm):_____

Flow (l/min):_____ Duty (h/day):_____ No. of starts per day:_____

Discharge head (mwc):_____ Suction head/lift (m):_____

Air pressure (bar):_____

Other:_____

_____

_____

Place for sketch of the installation

ARGAL S.R.L. – Via Labirinto, 159 – 25125 BRESCIA (ITALY) – Tel. +390303507011 Fax. +3903003507077
Mail: pec@pec.argal.it - P. IVA/ VAT 00583130174 – Joint Stock € 51.480,00 I.V. - R.E.A. 203878 – Co. registration 11615

7. MANUFACTURER DATA

	Production head and legal office: Via Labirinto, 159 - 25125 BRESCIA - ITALY Tel: +39 030 3507011 - Fax: +39 030 3507077 Administration: Tel: 030 3507019 Sales Operation Manager: Tel: 030 3507025 Customer service: Tel: 030 3507023 Web: www.argalpumps.com E-mail: sales@argalpumps.com