



55 Series Lobe Pumps

04/01

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User Benefits

The Jabsco 55 Series represents a radical change in the development of positive displacement lobe pumps for the pharmaceutical and food industries. The pumps have been designed to offer the very highest standards of CIP (clean-in-place), SIP (steam sterilize-in-place) and Aseptic Operation (resistance to ingress of bacteria through joints). All the areas found in traditional pump designs which make them difficult to clean and sterilize have been totally eliminated, for example:-

Front Mounted Shaft Seals eliminate crevices, yet can be inspected and serviced without stripping the pump head.

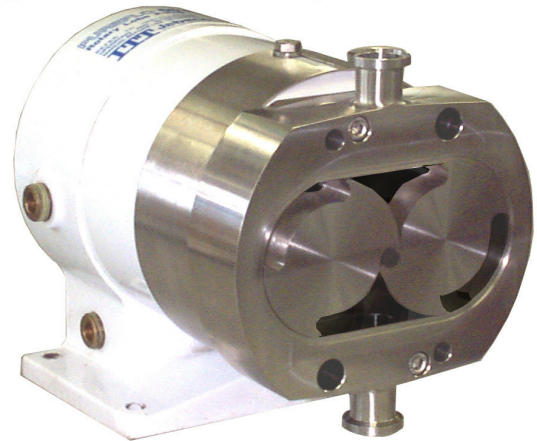
External Rotor Fixing ensures that there are no nuts, bolts, screws or splines in fluid contact, yet the rotors can be removed after removing only the end cover.

Hygienic End Cover means that there are no recesses or holes to trap contaminants.

Gasket-type Joints which do not harbor bacteria are used in place of O-rings in all fluid contact areas.

This combination of features, never previously available in a lobe pump, makes the Jabsco 55 Series the perfect pump for delicate, viscous and particle-laden fluids in Biotechnology, Pharmaceutical manufacture, high technology Food Processes and all applications where the very highest hygiene standards are required.

The philosophy behind the Jabsco 55 Series pump is to provide the user with real benefits which can be seen to improve the effectiveness of his process and reduce his operating costs by significant and measurable amounts. All users will appreciate some if not all of the following:



CLEAN IN PLACE: To claim that the pump is "CIP-able" may not seem to be a major advancement in hygienic pumps, as this has been claimed by many manufacturers before. But, CIP means different things to different processors. To some people, it may mean that most product is washed away and that the pump is visually clean or only small traces of product are still apparent. But in the case of the 55 Series, CIP means absolutely 100% microbiologically clean without the need to dismantle the pump.

Operators appreciate the reduction in the down-time, reduced costs, and minimum risk of product loss through contamination. Plant maintenance costs are also reduced as there is much lower risk of damage to the pump.

The main criteria for obtaining this high level of cleanability is AVOIDANCE OF CREVICES. This is achieved in this pump by using specially developed gasket joints and seals, external rotor retainers and a flat end cover to give a totally crevice free design allowing the pump to be easily, quickly and 100% reliably cleaned in place to the very highest standards.

STERILIZE IN PLACE: Sometimes referred to as "steaming through" or "steaming-in-place". In truly sterile processes, all product-contact components need to be sterilized.



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This is usually achieved by heating to high temperature (up to 140°C, 285°F) to kill organisms still remaining on the surface of the equipment. In other pump types, this is achieved by physically dismantling the pump and autoclaving the parts, bagging, taking back to the pump and re-assembling; a long, costly process which causes problems to personnel and can result in accidental damage to components. But when using the 55 Series it is possible to pass steam through the complete assembled system to sterilize the internal surfaces without dismantling the pump.

To achieve 100% sterility, it is important to steam through for a period long enough for the coldest part of the system to reach the correct temperature and hold for the time period required to kill off the organisms. The 55 Series pump head is designed to completely self-drain, ensuring all surfaces are exposed to steam and the component shape and choice of materials ensures thermal stability and temperature tolerance. Also, a pre-requisite for a pump which can be successfully SIP'd is one that can be CIP'd. Any product remaining after cleaning could insulate that area from the temperature thus allowing some organisms to survive and so contaminate any subsequent product being processed.

ASEPTIC OPERATION: An aseptic process is one in which all unwanted micro-organisms are kept out of the fluid stream. This prevents spoiling of sensitive products and ensures that only the intended reactions take place in the process.

In the 55 Series design, high specification joints are used instead of O-rings ensuring that microbial contaminants cannot enter the product zone. Once the system has been cleaned and sterilized it will remain clean and sterile.

For increased security, secondary "aseptic" joints can be fitted to all potential entry points to allow steam or sterile fluid barriers to be connected.

Also, a pump which is externally dirty on the outside will harbor colonies of bacteria which are more likely to infect the internal surfaces of the pump. All 55 Series pumps are designed to be easy to clean externally and are less likely to cause product contamination.

HIGH CONTAINMENT : Escape of pathogenic or otherwise hazardous products is prevented by the specially developed pump head joints, together with the optionally available steam or sterile fluid barriers.

HIGH HYGIENE: Use of US FDA listed materials maintains hygiene inside and smooth contoured externals makes the outside of the pump very easy to clean.

LOW PRODUCT DAMAGE: This is an inherent benefit of the rotary lobe pumping action but the Jabsco rotor shapes have been designed to ensure that the integrity of product structure, both microbial and particulate, is maintained.

NO HOLD UP OF PRODUCT : The modified rotor bores and vertical ports allow the pump head to completely self-drain, ensuring that expensive product is not retained in the system, that cleaning and sterilization is complete and that there is no cross-contamination between product batches.

NO CONTAMINATION: Contamination of product by foreign particles, especially those products intended for direct injection into an animal or human, is to be avoided at all costs.



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Injectable products are made mostly of water (WFI), with the addition of the particular active product. The purity of the product can be compromised by the shedding (removal) of particles from equipment surfaces. Contact between components of the 55 Series pumps during operation is avoided by use of high strength shafts, wide gears, dual lubrication system and optional hard faced seals, preventing shedding of particles into the fluid stream.

HIGH CORROSION RESISTANCE: Low-carbon austenitic stainless (316L) is used to resist carbide precipitation at welds and to resist attack from a wide range of chemicals. This material is also essential when the pump is to handle demineralized water of the type used for water of injection (WFI). Demineralized water is water that has had all its trace minerals removed and therefore has many open chemical bonds which are trying to attach to free minerals such as carbon. High-carbon-content stainless-steels are susceptible to carbon "pull-out" i.e. carbon present at the surface of the metal of the pump will be pulled out and will cause re-mineralization of the water which is undesirable. A low carbon steel is not affected in this way.

SOLIDS HANDLING ABILITY : Again, an inherent feature of rotary lobe pumps is made especially effective by the Jabsco rotor shape and large port diameters used.

METERING AND DOSING ABILITY: The smooth, pulsation free nature of the rotor design means that medium to high viscosity products (over 500 cp) can be accurately metered by controlling the pump speed.

REDUCED DOWNTIME: Jabsco 55 Series pumps are fitted with high strength shafts, wide gears, high quality seals and a dual lubrication system. Separate oil lubrication of gears and grease lubrication of bearings ensures that bearings cannot become worn by particles shed from the gears.

EASY MAINTENANCE: Despite this remarkable list of features, 55 Series pumps are very easy to maintain. The external rotor retainers and single key rotor drive allow easy removal and refitment of rotors. Front loaded seals allow access for replacement of joints or faces without disconnecting the pipe system and simple shimming for shaft and rotor synchronization, easily accessible gears and single key drive mean that semi-skilled labor can maintain the pump.

FEATURE	FUNCTION	BENEFIT
External rotor retainers	No internal recesses	Effective CIP
Crevice-free seals	Separates product from atmosphere	Effective CIP and containment
Gasket-type joints	Seals components without O-rings	Effective CIP and containment
All surfaces accessible to steam	Effective steam-in-place	Complete SIP steam sterilization
Straight-sided rotor bores	Allow fluids to drain away	No product hold-up, effective SIP
Temperature-stable design	Tolerant of steam-in-place	High reliability
Temperature-resistant materials	Tolerant of steam-in-place	High reliability
Low-carbon stainless-steel	High corrosion resistance	No pitting or crevices
Minimum number of joints	Fewer potential leak paths	No microbiological ingress
All-metal construction	No tubes or diaphragms to rupture	High reliability
Non-contacting rotor principle	No rubbing surfaces	No particles shed into product
Intermeshing rotor designs	Gentle pumping action	Minimum product damage
Adequate rotor clearances	No rubbing surfaces	No particles shed into product
Rigid bearing housing assembly	Minimum shaft deflection	No particles shed into product
US FDA Materials	High hygiene standards	No product contamination
Double barrier options	Provision of aseptic barriers	Eliminates risk of re-contamination
Optional polished surfaces	Prevents product from adhering	Improves effectiveness of cleaning
Smooth external shape	Easily cleaned	Less risk of re-contamination



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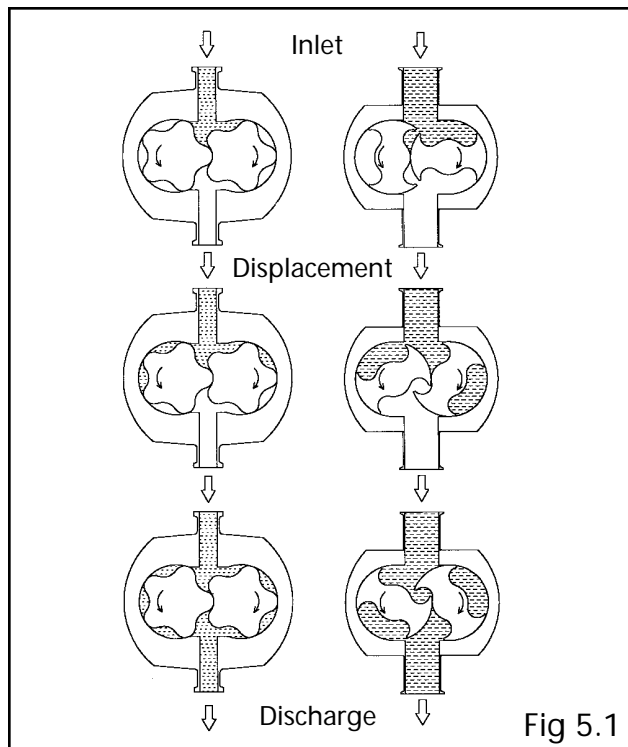
Basic Principles of Design & Operation

The Jabsco 55 Series is a range of positive displacement rotary lobe pumps designed to pump delicate, viscous and particle-laden fluids as well as thin liquids which require an all stainless steel pump made to the very highest standards of hygiene and cleanability .

Principle of Operation

The 55 Series pump has two rotors which turn in opposite directions. Fluid enters the pump from the inlet port and fills the space between the rotors. This fluid is carried around the outside of the rotors and is forced out of the discharge port as the rotor lobes mesh together – see Fig 5.1.

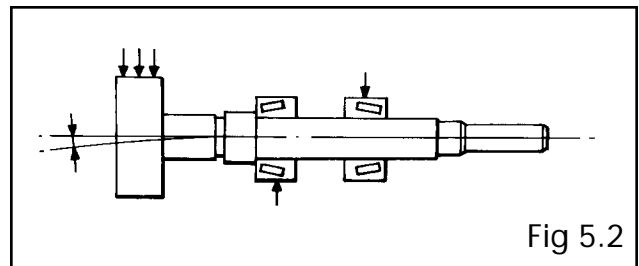
The design of the Jabsco 55 Series pumps is influenced by some fundamental engineering principles and it is useful to understand these to ensure its most effective selection and operation.



Overhung Rotors

In the Jabsco 55 Series pump, each rotor is supported on its own shaft and there are no bearings inside the pump chamber, so all forces from the fluid pressure are transmitted through the shafts to external bearings. The rotors are therefore overhung, as the shafts are cantilevered (see Fig 5.2) and are designed to resist the fluid pressure without excessive bending. The bearings are permanently lubricated and are sealed from the pump head ensuring that:

- No lubricant contaminates the pumped fluid.
- No bearing material is worn away.
- No pumped fluid (which may be corrosive or abrasive) can enter the bearings.
- No pumped fluid is trapped behind the bearings from where it cannot be cleaned out.



Rotor Clearances

When the pump is running within its operating limits, the rotors never touch each other and never touch the case in which they rotate. Fig 5.3 shows the areas where small clearances are provided: between the two rotors (a), at the tips of the rotors (b) and on the front and rear faces (c). These clearances are typically only 0.05 to 0.25mm (0.002 to 0.010 inches). This absence of contact ensures that no material contaminates the pumped fluid and also makes 55 Series pumps ideal for abrasive fluids.

Meshing clearance between the rotors is maintained by the use of separate “timing” gears, which exactly synchronize the rotation of the two shafts. This ensures that the pump head components are not easily worn, unlike for example gear pumps where one gear drives the other and can wear, resulting in a loss of efficiency.

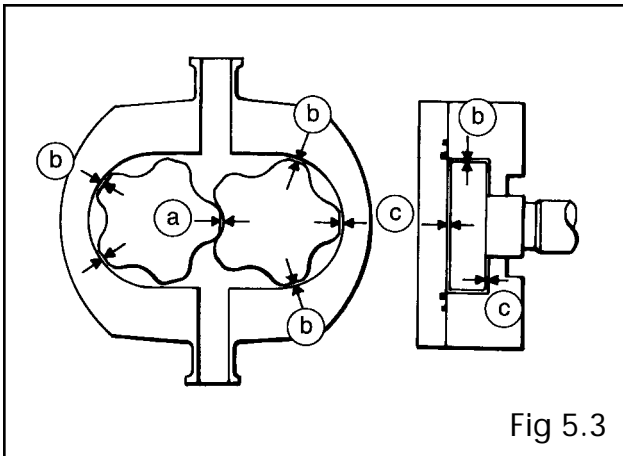


Fig 5.3

Volumetric Efficiency

The clearances within the pump head must be large enough to allow for shaft deflection under pressure and for thermal expansion without rotor contact but must also be kept as small as possible to maintain pump efficiency. Volumetric efficiency is lost when a liquid “slips” from the discharge side back to the inlet side through the rotor clearances. The amount of slip is affected by the size of the clearances, the differential pressure generated by the pump and the fluid viscosity:

Larger clearances result in higher slip; the fluid can more easily leak back through the larger area (Fig 5.4).

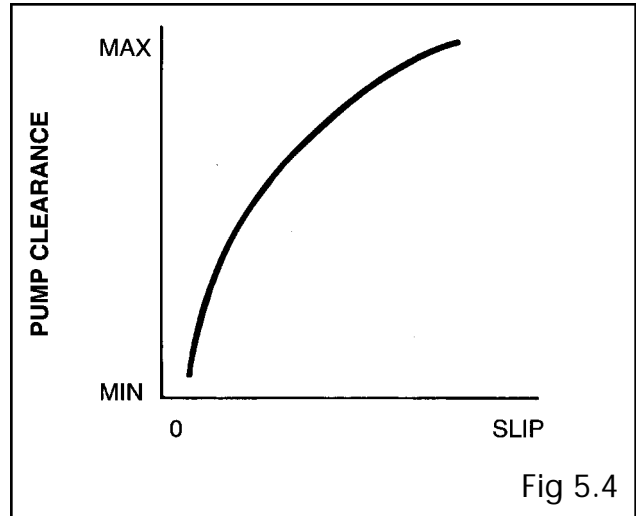


Fig 5.4

Higher pressure results in higher slip; the pressure forces more liquid back through the clearances (Fig 5.5).

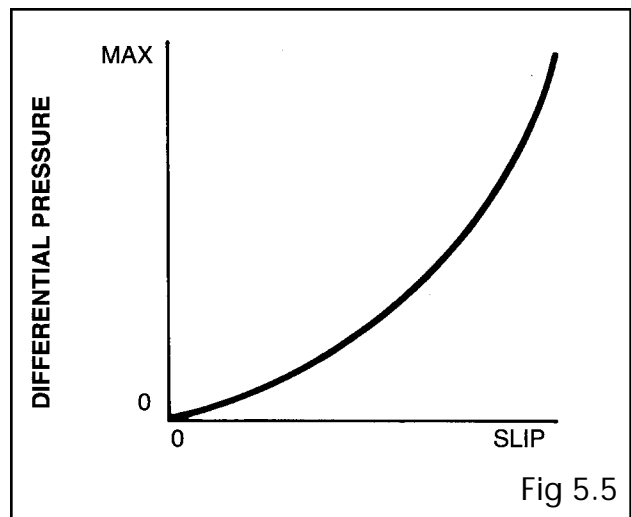


Fig 5.5

Higher fluid viscosity results in lower slip; high-viscosity liquids flow less easily through the pump head clearances than thin liquids (Fig 5.6).

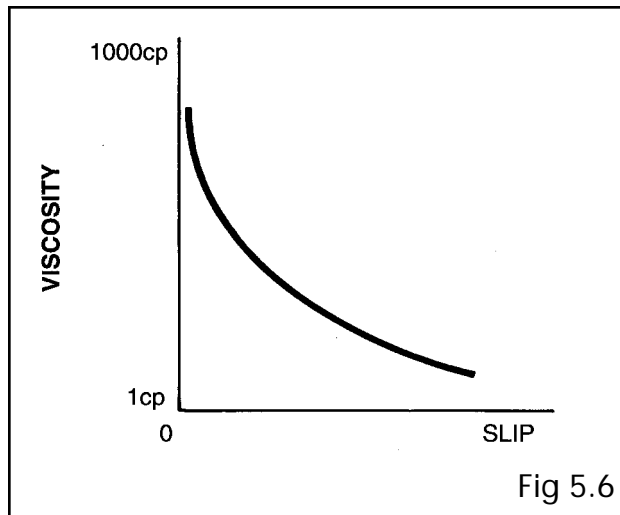


Fig 5.6

Therefore, especially when pumping thin liquids, rotor clearances are kept as small as possible to maintain efficiency. However, higher pressures force the rotors sideways within the rotor case, towards the inlet port, also slightly tilting the rotors. Therefore for higher pressures, more clearance is necessary to prevent rotor to rotor case contact, up to a maximum allowable for a particular shaft and rotor configuration.

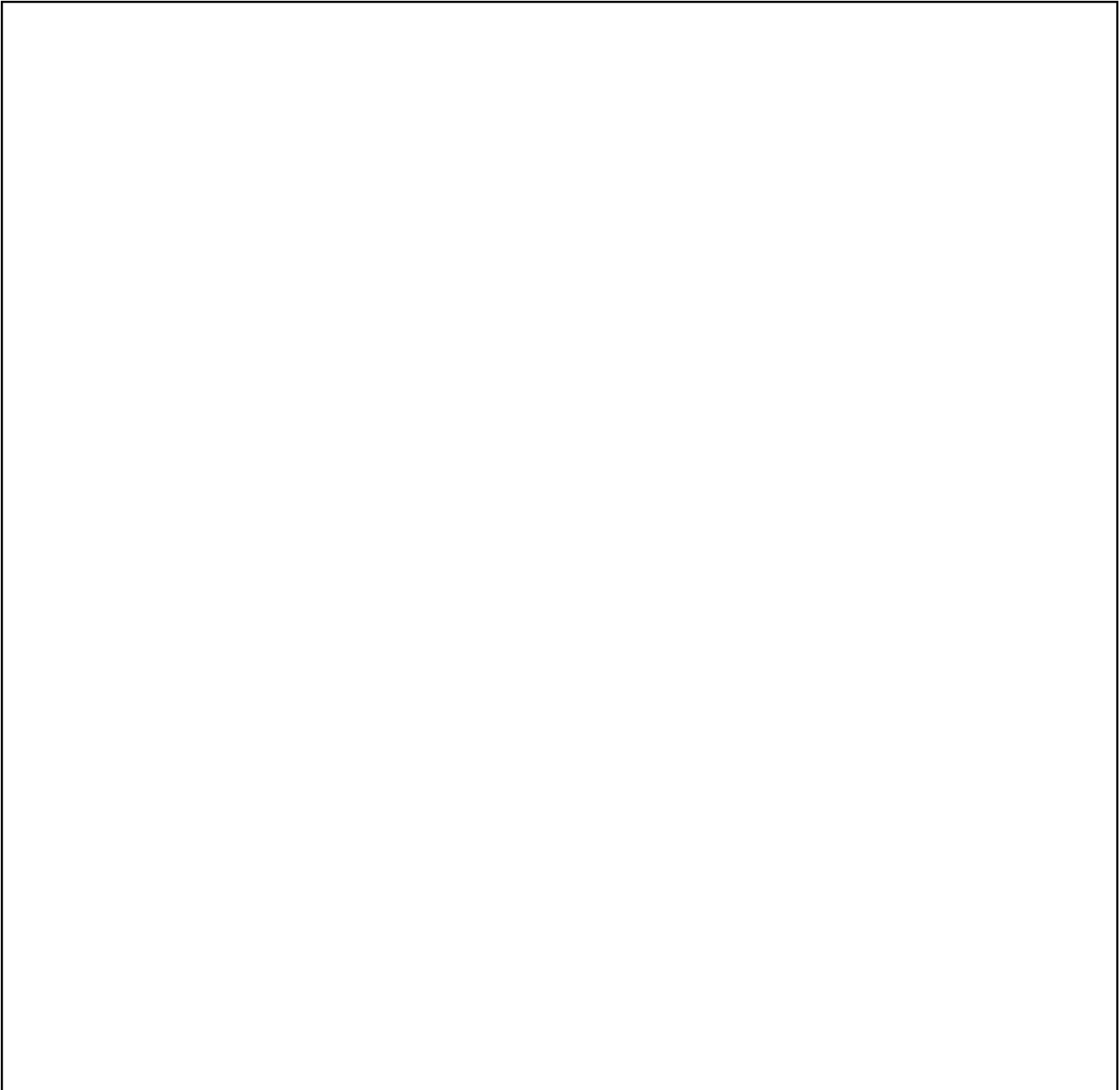
Lastly, high operating temperatures and, especially, sudden changes in temperature e.g. during CIP, result in different rates of expansion of the pump head components. Therefore sufficient clearance must be provided to allow for this.



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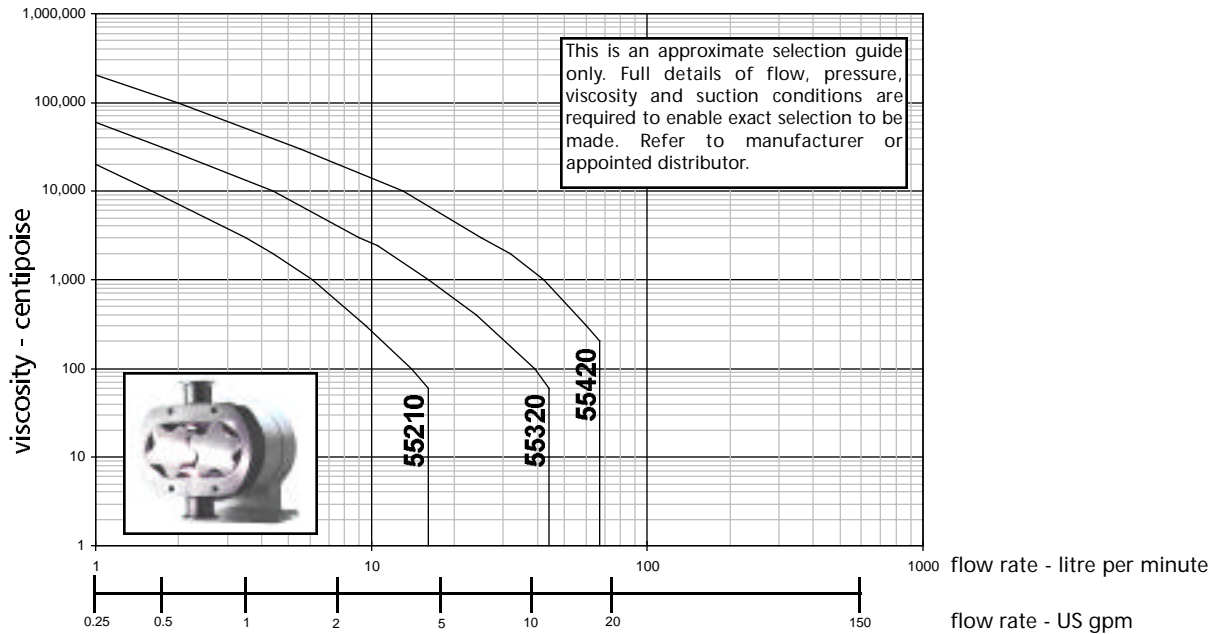
Operating Data

55 Series Lobe Pump Range

Pump Size		210	320	420
Basic part number with standard ports		55210	55320	55420
Maximum flow; litre/min (US gals/min)		16 (4.2)	44 (11.6)	67 (17.7)
Maximum pressure; bar (psi) (dependant on rotor type)		14 (200)	20 (300)	20 (300)
Displacement; litre/100 revs (US gals/100 revs)		1.05 (0.28)	2.93 (0.77)	6.7 (1.77)
Maximum speed; rpm		1500	1500	1000
Maximum soft particle size; mm (inch)		3 (1/8)	6 (1/2)	9 (3/8)
Weight; kg (lbs)		7.9 (17.4)	18.8 (41.4)	26.1 (57.4)
Standard port size; mm (inch)		12 (f)	19 (f)	25 (1)
Seal Option Availability	Double mechanical seal, SiC/SiC front, C/SiC rear	.	(b)	(b)
	Single front-loaded SiC/SiC mechanical seal	(a)	(b)	(b)
	Single front-loaded C/SiC mechanical seal	(a)	(b)	(b)
	Double mechanical seal, C/SiC front, C/SiC rear	.	(b)	(b)
Rotor Option Availability	5-lobe, high-efficiency	.	.	.
	5-lobe, standard pressure	.	.	.
	5-lobe, high pressure	.	.	.
	Scimitar, high efficiency	.	.	.
Other Option Availability	Plain end cover	.	.	.
	Jacketed end cover	.	.	.
	Sterile barrier end cover	.	.	.
	Sterile barrier and jacketed end cover	.	.	.
	Stainless steel bearing housing	.	.	.
	Machined to 0.8 micron (32 micro inch)	.	.	.
	Electro-polish to 0.8 micron (32 micro inch)	.	.	.
	Mechanical polish & electro-polish to 0.5 micron (20 micro inch)	.	.	.
	EPDM elastomers	.	.	.
	Viton elastomers	.	.	.
PTFE/Kalrez® elastomers	.	.	.	

KEY: (a) = with wave springs (b) = with coil springs . = denotes not available

Preliminary Selection Curves



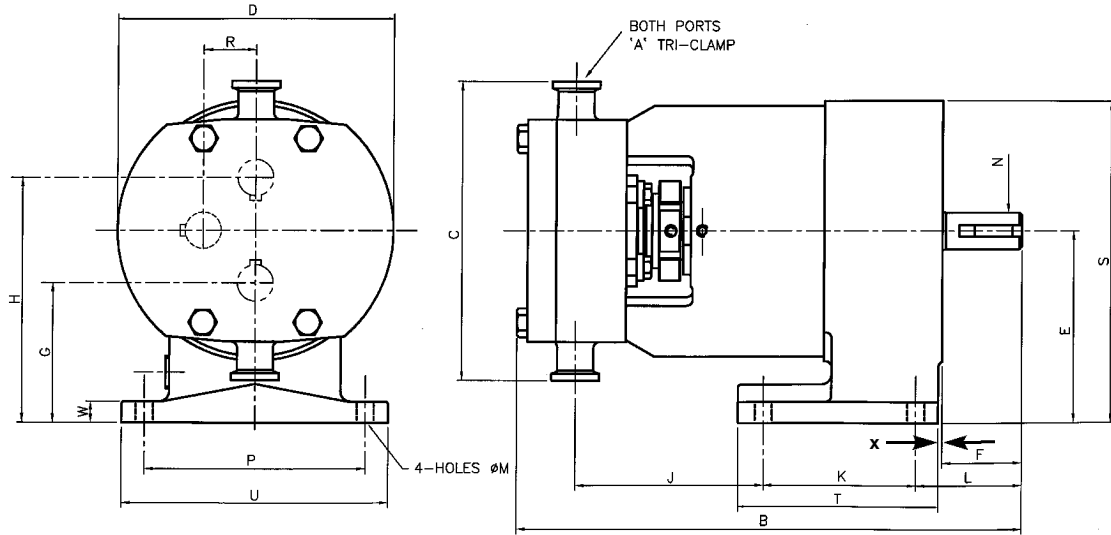


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Dimensional Drawing



MODEL	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	W	X	DRIVE KEY SIZE	Wt. Kg
55210	fi"	191	132	114	80	33	59	101	66	60	41	7	14	90	20	135	76	109	10	0.8	5 x 5	7.9
55320	fi"	264	155	145	100	43	72	128	99	80	53	9	19	116	28	168	104	139	10	0.8	6 x 6	18.8
55420	1"	302	170	168	112	53	80	145	109	90	66	9	24	136	33	191	114	160	13	0.8	8 x 7	26.1

Dimensions in mm

MODEL	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	W	X	DRIVE	Wt. Lbs
55210	fi"	7.5	5.2	4.5	3.15	1.3	2.32	3.98	2.6	2.36	1.6	0.28	0.551	3.54	0.8	5.3	3	4.3	0.4	0.03	0.197x0.197	17.4
55320	fi"	10.4	6.1	5.7	3.94	1.69	2.83	5.04	3.9	3.15	2.1	0.35	0.748	4.57	1.1	6.6	4.1	5.5	0.4	0.03	0.236x0.236	41.4
55420	1"	11.9	6.69	6.6	4.41	2.09	3.15	5.71	4.3	3.54	2.6	0.35	0.945	5.35	1.3	7.5	4.5	6.3	0.5	0.03	0.315x0.276	57.4

Dimensions in inches

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Materials and Design

55 Series pump rotor cases and end-covers are fully machined all over to precision tolerances and the rotor case is rigidly located on the bearing housing by dowels to maintain correct rotor clearances. The rotor bores have a straight-sided bore shape to allow low-viscosity liquids and cleaning solutions to self-drain when the pump is side-mounted (plumbing axis vertical). This ensures that expensive product is not retained in the system, that cleaning and sterilization is improved and that there is minimal cross-contamination between product batches. - Fig. 1

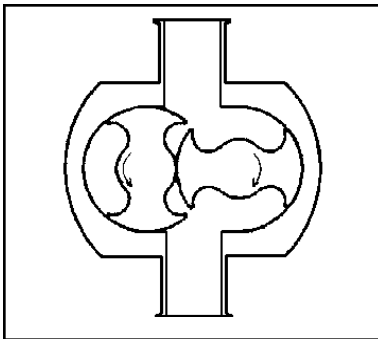


Fig. 1

Materials

55 Series liquid contact parts, Pump casing, cover and rotors are manufactured from low carbon grade of austenitic stainless-steel, generally referred to by the US designation 316L (European designation 1.4404). The precise composition of the materials are as follows:

Material Grade = 316S11				BS EN 10088-3			
C	0.03% Max.	Mn	2.0% Max.	S	0.03% Max.	Mo	2.00% to 2.50%
Si	1.0% Max.	P	0.045% Max.	Cr	16.5% to 18.5%	Ni	11.0% to 14.0%

This grade of stainless steel has less than 0.03% carbon and there are two reasons for using this grade:

- Low carbon “pull-out” (see section 5 of technical manual)
- Higher corrosion resistance

Nearest equivalent grades to other national standards are:

- USA AISI 316L
- Germany Werkstoff 1.4404
- Japan JIS SUS316L
- Din X2CrBiMo 17 13 2
- Sweden SIS 2353
- France Afnor Z2CND 17-12

High corrosion resistance: When 316 grade stainless steel is welded, the heat can cause localized precipitation of carbides in the steel. These areas of high carbide concentration are susceptible to chemical attack. Low carbon grade steel does not generate these localized weak areas.

Low carbon pull-out: Low-carbon austenitic stainless steel (316L) is required to handle demineralized water of the type used for water for injection (WFI). Demineralized water is water that has had all trace minerals removed and therefore has many open chemical bonds which are trying to attach to free minerals such as carbon. High-carbon-content stainless-steels are susceptible to carbon “pull-out” i.e. carbon present at the surface of the metal of the pump will be pulled out and will cause re-mineralization of the water which is undesirable. A low carbon steel is not affected in this way.



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Bearing Housing Assembly

55 Series pumps are designed with smooth external contours which will freely drain of wash down solutions and which have minimal areas for dust and dirt collection. Bearing housing assemblies are either cast iron or optionally stainless steel.

CAST IRON - The bearing carrier and gear housing are manufactured from cast iron to BS1452 grade 220 and coated with a high-grade epoxy-polyester coating. This coating is applied by an electrostatic powder process and gives good adhesion, excellent protection and an attractive, easy to clean surface.

STAINLESS STEEL - 55 Series pumps are also available with an all-stainless steel bearing carrier and gear housing. These are manufactured from 304 grade stainless steel.

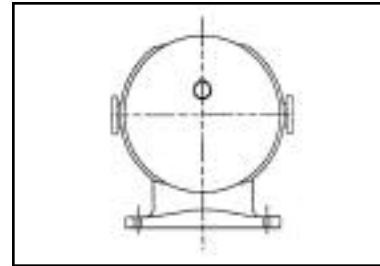
Bearing Carrier Materials Availability			
PUMP SIZE	55210	55320	55420
Cast Iron	•	•	•
Stainless Steel	*	*	*
	• as standard		* optional at extra cost

55 Series pumps are fitted with large-diameter high strength shafts. There is no shimming adjustment required for gears and bearings and the wide timing gears are easily accessible so that semi-skilled labor can maintain the pump.

55 Series pumps have an adaptable foot/gear cover and can be adapted to three mounting

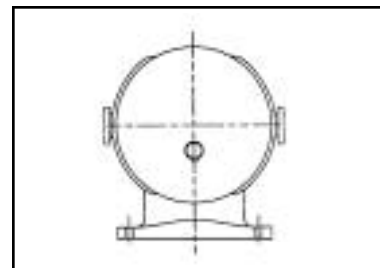
options:

Fig. 2



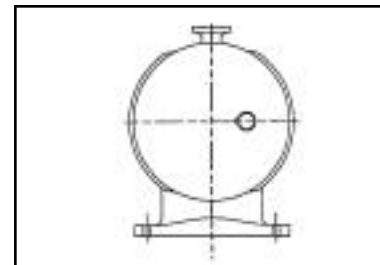
- Horizontal pipe orientation, high drive shaft position - Fig. 2

Fig. 3



- Horizontal pipe orientation, low drive shaft position - Fig. 3

Fig. 4



- Vertical pipe orientation - Fig. 4

To change any pump from vertical to horizontal plumbing or vice versa, or to convert a pump from high shaft to low shaft, it is necessary only to remove the 4 screws holding the gear cover in place, interchange the lip seal and blanking plug and assemble in the desired position. No new parts are required.

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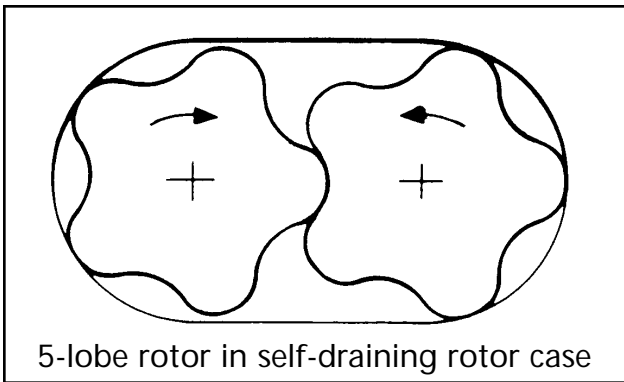
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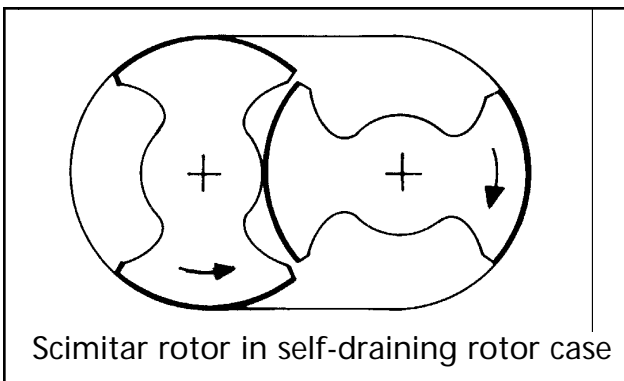
55 Series Rotors

55 Series pumps are available with two types of rotors: a 5-lobe type and scimitar type developed especially for the 55 Series Ultra-Hygienic pumps.

5-lobe rotors give a combination of gentle handling of viscous and shear sensitive liquids plus the ability to pass small soft solids with minimal damage. When used in a straight-sided self-draining rotor case shape they give good volumetric efficiency, exceptionally smooth flow and low noise even when pumping thin liquids.

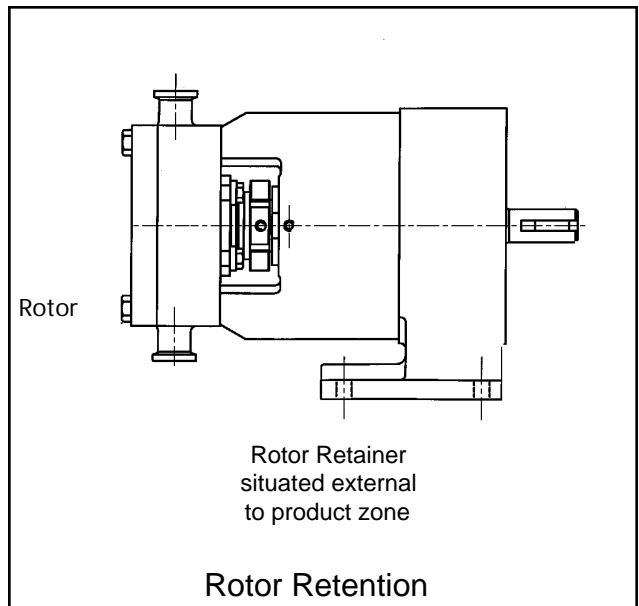


Scimitar rotors, also known as "2-wing" or "hammer-head" rotors are designed to achieve very high efficiencies on thin liquids and will also handle viscous liquids with minimal shear.



Jabsco 55 Series pumps are designed to have non-contacting pumping elements, i.e. no contact between the rotors and the casing or cover, or rotor to rotor. The large diameter rigid pump shafts ensure minimal flexing and therefore minimal possibility of any contact which could cause particles to be deposited into the product or roughening of the surface which could compromise cleaning. In pumps fitted with Scimitar rotors, the shafts do not need to be timed.

Another feature of the 55 Series pumps is the way in which the rotors are held on their shafts. Other pump types often use rotor nuts or bolts to retain the rotor on the shaft. These usually result in recesses in the rotor or end cover and they require sealing to avoid product getting into the drive of the rotor, either spline or keyway. This in turn also requires 4 more joints within the product zone so creates 4 more areas for potential product entrapment. The 55 Series pumps have eliminated the rotor retainer from the product zone altogether.





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Rotor Options

Rotors are available with up to 3 sets of clearances:

TYPE	CLEARANCE NAME	CODE	APPLICATION
5-lobe	High Efficiency	0	For thin liquids at lower pressures; give low internal slip, low shear and good metering accuracy
5-lobe	Standard	1	Standard use for higher viscosities, and also for thin liquids at medium pressures
5-lobe	High Pressure	2	Used for viscous liquids at the higher pressures
Scimitar	High Efficiency	8	Preferred choice for thin liquids (where available)
Scimitar	High Pressure	9	Used for liquids at the higher pressures

All rotors are made from 316L Stainless Steel (1.4401) except the 55210 pump where the code 8 **scimitar** rotors are manufactured from high-nickel non-galling alloy to further improve the reliability of the pump due to the very small clearances. (Galling is where two stainless-steel surfaces rub together and locally cold-weld causing roughening of the surface, pitting and possible pump seizure). Should a small hard particle pass through the pump the rotors will not gall or seize, although some scratching or scoring may occur in extreme cases.

This high nickel non-galling alloy used on the 55210 code 8 rotor is to US specification ASTM A494 SY5SnBiM and its composition is detailed in the table opposite.

C	max.	0.05%	Mo		2.0 - 3.5%
Mn	max.	1.50%	Fe	max.	2.0%
Si	max.	0.50%	Cr		11.0 - 14.0%
S	max.	0.03%	Bi		3.0 - 5.0%
P	max.	0.03%	Sn		3.0 - 5.0%
Ni	Balance (approx. 75%)				

This material used is not suitable for electro-polishing so 55210 size pumps with code 8 scimitar rotors ordered as electropolished (code Y) will be supplied with only the rotor case and end cover electropolished. The 55210 size pumps with scimitar rotors ordered as polished (code Z) will be supplied with the rotors polished and not electropolished and the rotor case and end cover polished and electropolished.

Conversions & Interchangeability

Within any one pump size, all rotors are directly interchangeable. At any time, replacement rotors of the same or any other type or clearances can be fitted but, it is advisable to check the end clearances and the timing and adjust if necessary, especially if fitting 5-lobe rotors to a pump previously fitted with scimitar rotors. Refer to Installation, Operating and Maintenance Manual.

If a pump build specification is changed at any time, the model number should be changed on the pump nameplate to ensure that correct spare parts will be ordered.

Spare Parts

Spare rotors are supplied in boxed pairs.

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Single Shaft Seals

55 Series pumps are fitted with high quality mechanical shaft seals to prevent leakage of product from the pump into the atmosphere and to prevent contamination by airborne micro-organisms. All pumps are available with single face seals - Fig. 1, and with flushed or double seals as an option; see separate data sheets. This seal design is unique to Jabsco and has a number of features which are of major benefit to the user:

- Hydraulically pressure-balanced.
- Crevice-free for highest standards of CIP and SIP capability.
- Fully self-draining.
- Withstands SIP temperatures and thermal shock.
- Solid faces, no metal parts in fluid contact.
- No moving parts or springs in fluid contact.
- Fitting length pre-set.
- Front-loading: seal can be inspected/ serviced without removing rotor case.
- Fully interchangeable parts.
- Simple spare parts ordering.

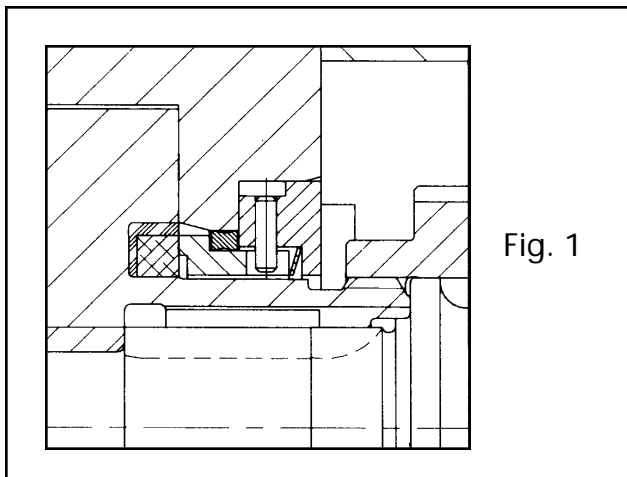


Fig. 1

Seal Position and Design

The seal faces are of a balanced design so that the contact pressure between the faces is controlled. This gives excellent sealing even at very low pressures as well as long life at high pressures. Also, the Jabsco pump seal is specially developed to fully expose the sealing faces and the joints around the seal to the fluid. This ensures good circulation of product to avoid stagnant areas where bacteria can multiply, see Fig. 2 below, good cooling of the seal faces and maximum flow of cleaning fluids around the seal. (Other pump types have the seal mounted in a cavity in the rear of the pump which is not easily cleaned due to its inaccessibility). This design also ensures that, when the pump is stopped, fluid can drain from the seal area.

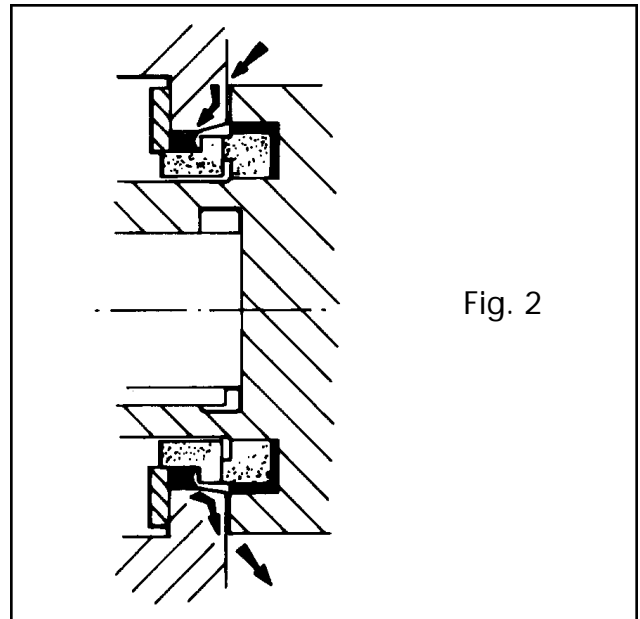
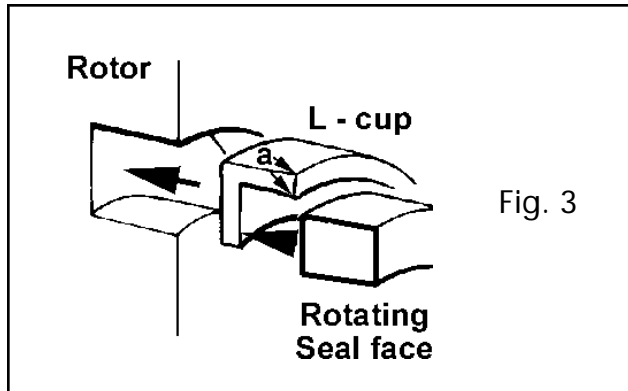


Fig. 2

The 55 Series pump seals do not use O-rings anywhere in product contact (except certain elastomer options - see Elastomers data sheet) Fig. 3 shows the specially developed joint around the rotating seal face. The rotating seat is fitted directly into the back of the rotor to eliminate crevices and the 'L'- section seal cup is slightly flared at its edges "a".



The stationary seat is sealed directly to the rotor case by a ring with a modified square cross-section (except certain elastomer options - see Elastomers data sheet). Both these joints are, in effect, types of gasket. But whereas a flat gasket could allow some penetration of product at its edges when pressurized, these joints prevent this due to the higher contact force where they interface with the product zone. It can be seen quite clearly that these joints are far less likely to harbor bacteria than conventional joints.

Materials and Applications

Single seals are available in two face material combinations:

- | | |
|------------------------------------|--------|
| Carbon on Silicon-Carbide | code 3 |
| Silicon-carbide on Silicon-Carbide | code 2 |

The code 3 single carbon on Silicon-Carbide seal is suitable for many clean fluids which do not require a more sophisticated seal type i.e. those which:

- Are non-toxic and non hazardous
- Have some lubricating properties
- Are not highly abrasive
- Have a viscosity less than 150,000 cp
- Do not require steam or sterile fluid (aseptic) barrier
- Do not change state in contact with air i.e. do not, form a film, dry out or precipitate solids
- Are pumped at a temperature less than 80°C (70°F)
- Are not excessively temperature sensitive (do not degrade when heated by the friction of the seal faces)

The code 2 single Silicon-carbide on Silicon-carbide seal is used where carbon is not acceptable in fluid contact or where face wear would be unacceptable, i.e.

- For abrasive fluids containing crystals, powders or particles which would rapidly wear away the carbon of the standard seal.
- Where shedding of particles into the fluid stream must be avoided. The seal faces are the only area in the pump design where rubbing contact is unavoidable. Silicon carbide is extremely hard (only boron carbide and diamond are harder), so the seal does not wear i.e. particles are NOT shed into the product.
- For pure water.

Refer to Pump Selection data sheet for more information on seal selection.



Code 2 silicon carbide-on-silicon carbide seals are not recommended for steam-purged applications as the seal faces can bind together - see Cleaning and Sterilizing data sheet.

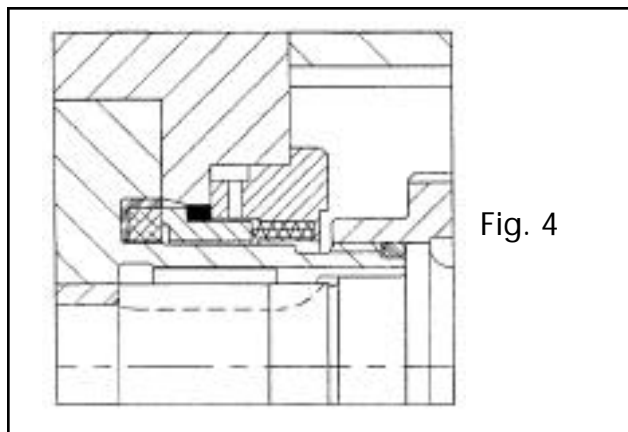


Fig. 4

Installation Procedure

Pumps fitted with single seals require no special installation but pumps must never be run completely dry for more than 30 seconds as this will cause excessive heating of the seal faces. Use flushed seals in pumps that need to run dry. For seal installation and repair, refer to Installation, Operation and Maintenance manual.

Conversions and Interchangeability

Pumps built with single seals can be converted as follows:

- To other face materials e.g. from code 3 to code 2, simply by changing seal faces.
- To other elastomer materials. See Elastomers data sheet.
- To double or flushed seals. See appropriate data sheet. Conversion kits are available which contain all the parts necessary to convert a single-seal pump to flushed or double seals.

Refer to Installation, Operating and Maintenance Manual for instructions on seal removal and fitting.

If a pump build specification is changed at any time, the model number must be changed on the pump name plate to ensure that correct spare parts will be ordered.

Spare Parts

Single seal spare parts are supplied as:

- Primary seal face kits - 2 kits required per pump.
- Seal trim kits containing all the elastomer parts for the complete seal - 2 kits required per pump.
- Wave springs or coil springs supplied individually.
- Housings supplied individually.
- Drive plates supplied individually.

When servicing seals, it is not normally necessary to fit new springs and housings. Drive plates should be inspected for wear and replaced as necessary. Face kits do not contain elastomers. Ensure that the correct elastomer trim kits are ordered for the application.

Refer to Spare Parts data sheets for part numbers.



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Double Shaft Seals

The double seals fitted to 55 Series pumps retain all the features of the single seals, but with the facility to contain a fluid behind the primary seal.

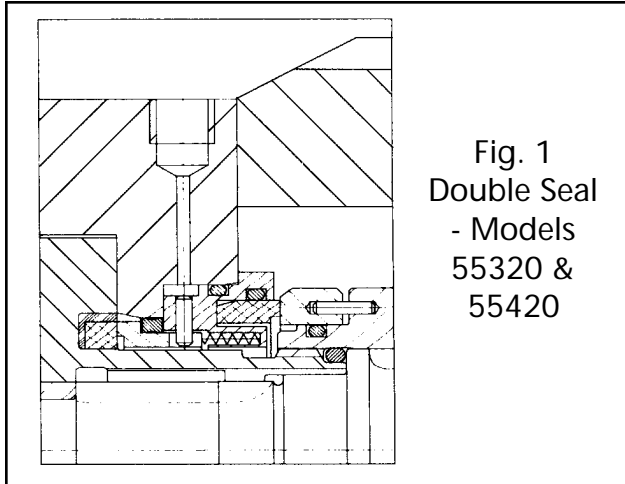


Fig. 1
Double Seal
- Models
55320 &
55420

This allows the pump to be used for applications where the single seal is unsuitable.

Features of the double seals include:

- Highly effective sealing of flushing fluids
- Can be used with steam aseptic barrier
- As easy to assemble and service as single seals
- Share many common parts with single seals

Seal Position and Design

The double seal uses a pair of seal faces mounted behind the primary seal. One face is fitted into the back of the seal housing and the other fits onto the rotor retainer. Springs fitted to the rotor retainer keep these faces together. This seal was designed especially for the 55 Series pump and enables the double seal to be fitted into a very small space within the pump so that pump performance is not compromised.

In use the space between the primary and

secondary seals is fed with fluid or steam supplied through pipes connected to drilled holes in the rotor case.

Materials and Applications

Double seals are available in two face material combinations:

Carbon on Silicon-carbide primary faces – designated code 4

Silicon-carbide on Silicon-carbide primary faces – designated code 1

In all double seals, secondary faces are always **Carbon on Silicon-carbide**.

Double seals Codes 1 and 4 are run with a fluid between the primary and secondary seals to form a barrier between the pump and the atmosphere. They are used with:

a) A high pressure liquid flush (fig. 2) when:

- The pumped fluid is toxic or hazardous and must not escape from pump even in minute quantities.
- The pumped fluid has no lubricating properties and cannot be allowed onto seal faces.
- Pumped fluid is highly viscous, i.e. over 150,000 cp.
- A high pressure sterile liquid barrier is required.

b) Steam (fig. 3) when:

- No bacteria or contamination can be allowed to enter pump, i.e. an aseptic barrier.

- c) A low-pressure liquid flush (fig. 4), when:
- Pumped fluid changes state in contact with air, e.g. crystallizes, forms a film, dries out or precipitates solids. The flush dissolves and rinses away the small amount of residue which could build up on the edges of the seal faces.
 - Pump fluid is hot, i.e. over 80°C (175°F). The flushing fluid is used to cool the seal faces.
 - Pumped fluid is temperature sensitive and degrades when heated by the shearing action of the seal faces.
 - Pump must run "dry", i.e. no liquid in the pump chamber.
 - Pump is under high vacuum.
 - A low pressure sterile barrier is required.

The code 1 double **Silicon-carbide on Silicon-carbide** seal is used where face wear would be unacceptable, i.e.

- For abrasive fluids containing crystals, powders or particles which would rapidly wear away the carbon of the code 4 seal.
- Where shedding of particles into the fluid stream must be avoided.

Refer to section 8 of the technical manual for more information on seal selection.

Detail Differences

Note that model 55210 cannot be fitted with double seals.

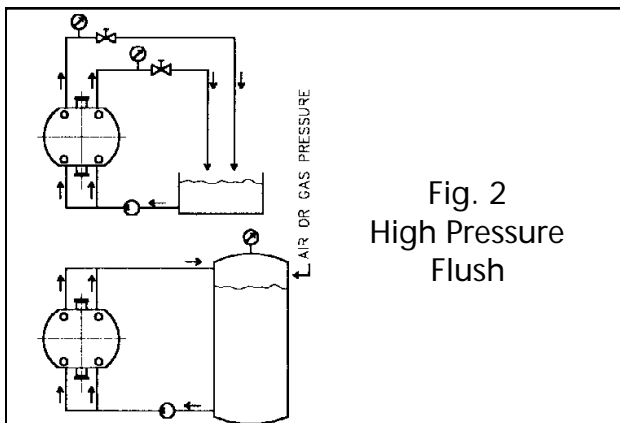


Fig. 2
High Pressure
Flush

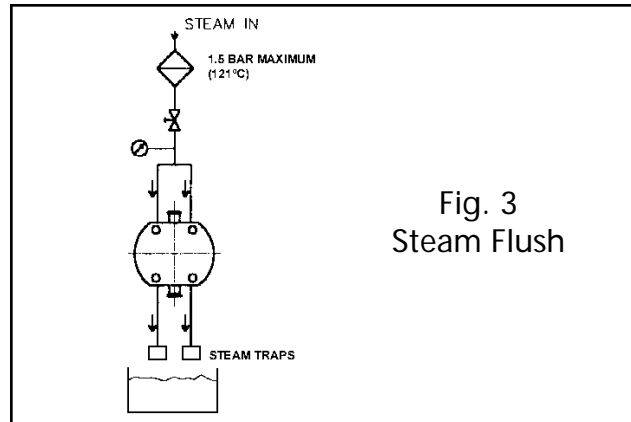


Fig. 3
Steam Flush

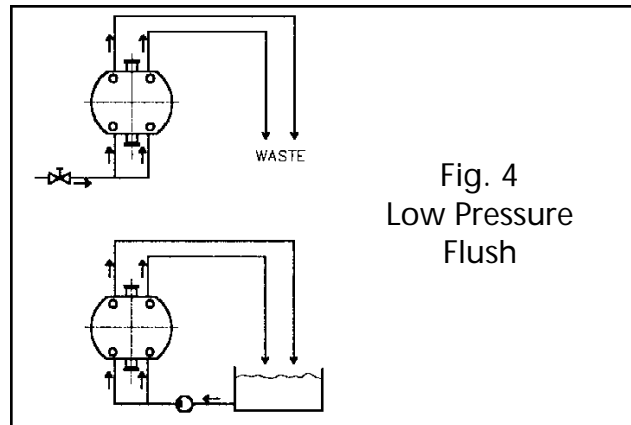


Fig. 4
Low Pressure
Flush

Installation Procedure

a) When the double seal is used with a high-pressure flush for the reason described above, a flushing system must be installed as follows:

- The flushing liquid used must itself be compatible with the pumped fluid and must itself not require a complex seal, i.e. must be non hazardous, non abrasive and lubricating.
- Flush liquid must be at a pressure of 1 bar (15psi) above the discharge pressure of the 55 Series pump and should flow at 35 to 55 liters/hour (10 to 15 US gal/hour) per seal. See Figure 2.



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b) When the double seal is used with a steam barrier, the steam must be:

- Clean, filtered and wet, i.e. not superheated, but the pressure of the steam should be as low as possible consistent with the desired temperature. Wherever possible, sterile liquid e.g. steam condensate should be used as a flush but where steam is essential, great care must be taken with the design of plumbing, steam traps and controls. The steam should be connected as shown opposite to allow any condensate to drain from the lowest point.

c) When the double seal is to be used with a low pressure flush, a flushing fluid system should be installed as follows:

- Liquid must be compatible with the pumped fluid; water is the most commonly used liquid.
- Pressure shall typically be 0.5 bar (7 psi) gauge.
- Temperature shall be maximum of 70°C (160°F) for water, less for volatile liquids (minimum of 30°C (55°F) below boiling point).
- Flow rate shall be 2 to 3 liters/min. (0.5 to 0.75 US gal/min) per seal.
- Plumbing should be as shown in the diagram (fig 4).

Conversions and Interchangeability

For seal installation and repair, refer to installation, operation and maintenance manual. Pumps built with double seals can be converted as follows:

- To other face materials e.g. from code 4 to code 1.
- To other elastomer materials, see Elastomers Data Sheet.
- To single seals, simply by removing the secondary seal faces, springs and joint rings. See Single Seals Data Sheet.

All pumps except model 55210 can be converted from single to double seals.

Refer to Installation, Operation and Maintenance Manual for instructions on seal removal and fitting.

If a pump build specification is changed at any time, the model number should be changed on the pump nameplate to ensure that correct spare parts will be ordered.

Spare Parts

Double seal spare parts are supplied as:

Primary seal face kits –

2 kits required per pump.

Secondary seal face kits –

2 kits required per pump.

Seal trim kits containing all the elastomer parts for the complete seal –

2 kits required per pump.

Springs supplied individually.

Housings supplied individually.

When servicing seals, it is not normally necessary to fit new springs and housings.

Face kits do not contain elastomers. Ensure that the correct elastomer trim kits are ordered for the application.

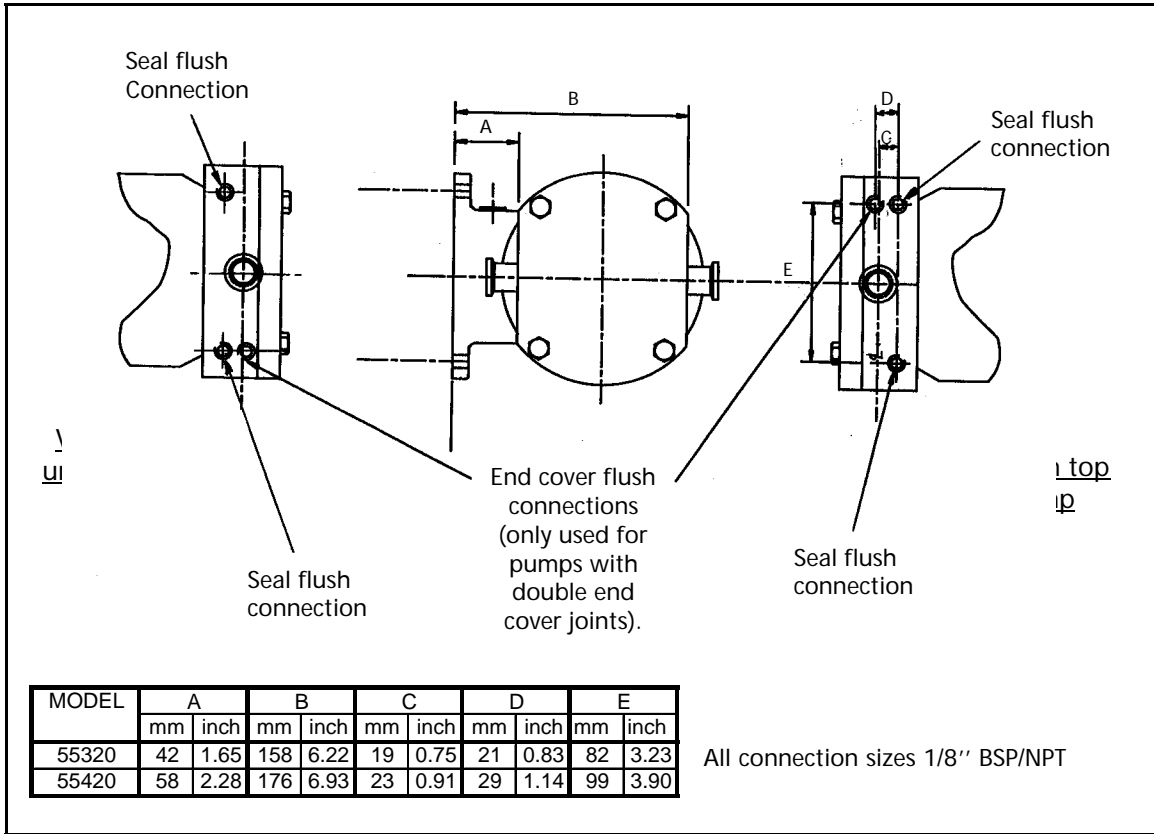
Refer to Spare Parts Data Sheets for part numbers.



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55 Series Elastomers

In a 55 Series pump there are only 5 sealing components in contact with the pumped fluid, 2 joints on each primary seal and one joint to seal the end cover to the rotor case, and these are all specially molded gasket-type joints. Great care is taken in the manufacture of the seals to ensure that there are no imperfections on the surfaces which can harbor bacteria and the design of the moulds is such that there is no moulding flash on critical sealing edges.

Materials & Standards

55 Series pumps can be specified with 3 alternative sealing materials:

A hygienic grade of EPDM which conforms to the requirements of the US FDA Code of Federal Regulations Title 21 section 177.2600 "Rubber Articles Intended for Repeated Use". This material is chosen for its excellent resistance to water-based solutions, and particularly to hot water and steam, and also for its acceptability in contact with pharmaceutical products, foods etc. EPDM is not suitable for contact with mineral oils. For full details of material compatibility, refer to Jabsco Liquid Compatibility Guide, publication number SD932.

VITON® – correctly referred to as F.P.M. This has excellent resistance to many chemicals, oils and solvents and also has a wide operating temperature range. FPM is less suitable for SIP (steam-in-place) applications.

PTFE / Perfluoroelastomer – also referred to as Teflon® / Kalrez®. These materials have outstanding chemical resistance. In pumps specified with this elastomer option, the end cover joint ring is supplied in solid virgin PTFE

conforming to US CFR Title 21, 177.1550. The seal cup rubbers are molded in a proprietary grade of perfluoroelastomer ROP550. The seal stationary seats are sealed to the rotor case with O-rings in Kalrez® grade 4079.

Conversions & Interchangeability

Pumps can easily be converted to other elastomer specifications by ordering a complete pump head trim kit. Refer to Installation, Operating and Maintenance Manual for instructions on seal removal and fitting.

If a pump build specification is changed at any time, the model number should be changed on the pump nameplate to ensure that correct spare parts will be ordered.

Spare Parts

Elastomer spares can be ordered as:

- Seal trim kit – containing all the elastomer parts for one complete seal – 2 kits required per pump.
- End cover joint ring – supplied individually
- Pump Head trim kit – consists of all the elastomer parts required for one complete pump.

Refer to Spare Parts data sheets for part numbers.

MATERIAL	TEMPERATURE RANGE	MODEL NO. SUFFIX
EPDM	-30 to +140°C (-22 to +285°F)	None
FPM (Viton®)	-25 to +180°C (-13 to +355°F)	V
PTFE / Kalrez® (Teflon®)	-20 to +180°C (-4 to +355°F)	P



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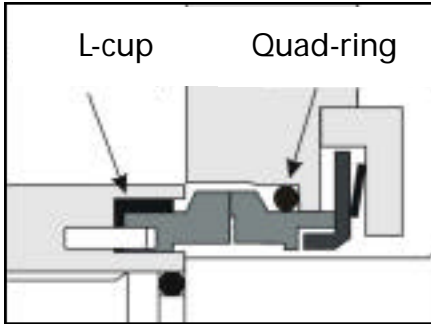


Fig 1 - Viton® & EPDM

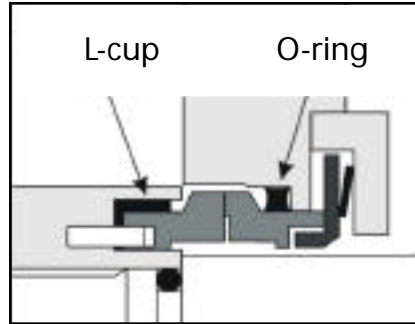



Fig 2 - PTFE / Kalrez®

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End Covers

The standard 55 Series end covers are completely flat. This ensures that there are no crevices where contaminants can collect and that the pump can easily be cleaned in place. The end cover is held in place by bolts and can easily be removed for inspection of the pump head and for servicing.

The 55 Series end cover does not use an O-ring. Instead it is sealed by a special gasket type joint ring, fitted in a groove machined in the front face of the rotor case - Fig 1. There are no crevices at all in the fluid-contact area and there is no groove in the end cover. This joint ring has flared edges to ensure excellent sealing against product leakage and ingress of airborne bacteria. It is a controlled-compression design to prevent extrusion due to overtightening. In combination these features contribute to the 55 Series exceptionally high CIP capability.

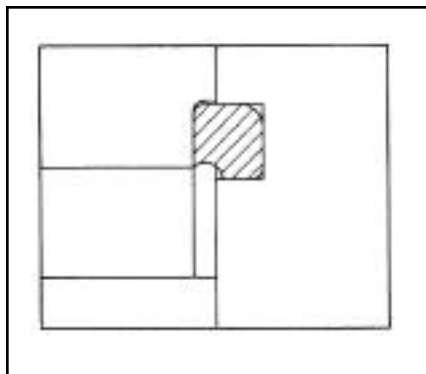


Fig. 1

Refer to Elastomers data sheet for material availability.

End Cover Sterile Barrier

55320 & 55420 size pumps may also be fitted with an end cover to accommodate an aseptic barrier of sterile liquid or steam - Fig 2.

This can be specified at the time of ordering the pump by using code 5 for the end-cover in the model number.

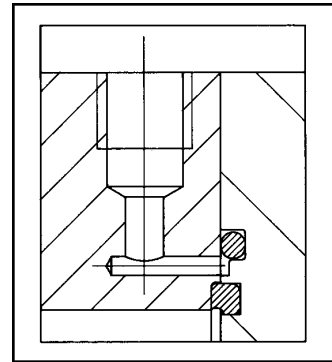


Fig. 2

Existing pumps can be modified by changing the end cover and rotor case. The end-cover barrier will normally only be used in conjunction with double seals. The barrier fluid is connected in a similar way - Fig 3.

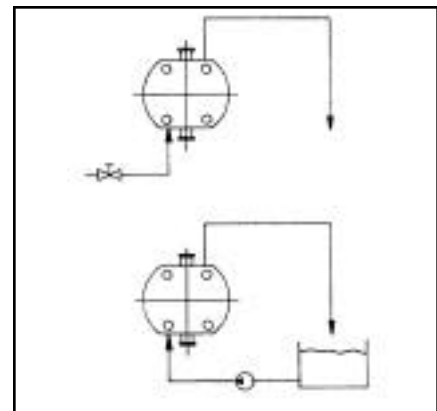


Fig. 3

For dimensional drawing see Double Shaft Seal data sheet.

End Cover Temperature Control Jackets

Pumps are available with an optional jacket end cover. This allows hot water or steam to be piped to the pump to maintain product temperature in the pump or to heat the pump prior to starting.



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This can prevent product spoiling due to excessive cooling and can protect the pump starting on solidified product.

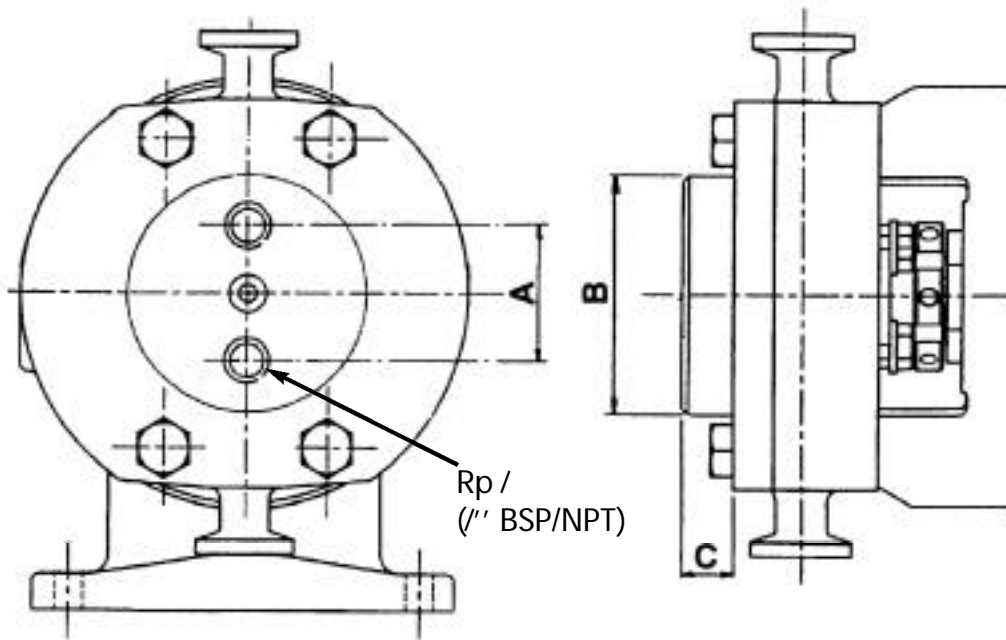
Alternatively, cold liquid can be piped through the jacket to counteract heating of product withing the pump. This is particularly useful on steam or hot water aseptic barrier applications.

The jacket is 316L stainless steel and is sealed to the pump end cover by Viton® 'O' rings. The jacket liquid never comes into contact with the pumped product. Pipe connection size is Rp / (1/2" BSP/NPT).

Application limits are:

Jacket Pressure: 2 bar (30psi).

Temperature : 130°C (265°F).



PUMP SIZE	55210	55320	55420
Dimension ' A ' mm (inch)	34 (1.3)	64 (2.5)	64 (2.5)
Dimension ' B ' mm (inch)	60 (2.3)	94 (3.7)	94 (3.7)
Dimension ' C ' mm (inch)	13 (0.5)	16 (0.6)	16 (0.6)

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Surface Finishes

55 Series pumps are available with three alternative finishes for all fluid-contact surfaces i.e. rotors, internal surfaces of rotor case and end cover, port bores.

Finish	Surface Roughness	Approx. grit equivalent	Ordering suffix code
Standard Machined	0.8 μ Ra (32 microinch)	150	none
Electropolish	0.8 μ Ra (32 microinch)	180	Y
Mechanical Polish	0.5 μ Ra (20 microinch)	240	Z

Standard Finish

Product contact surfaces are machined to 0.8 micron Ra (32 micro inch). This conforms to the current requirements of US 3A Standard 02-09. This is accepted by many users as adequate for hygienic applications.

Electropolish Option

Some users, particularly in the pharmaceutical industries, specify electropolish and although the measurable change on surface roughness after electropolishing is small, the effects are:-

- a) Rounding and smoothing of surface imperfections - thus reducing the ability of product to adhere to the surface or be damaged by the sharp protrusions on the surface.
- b) Cleaning and passivating the surface - improves corrosion resistance and prevents the release of surface impurities into the product.

Components having product-contact surfaces are electropolished all over and therefore give improved external cleanability.

Mechanical Polish Option

Users requiring the very highest standards of purity can specify mechanical polishing. All product contact surfaces are polished to a surface finish of 0.5 microns Ra, (equivalent to 20 microinches Ra and approximating to 240 grit finish) and then electropolished. The advantages of this are:-

- a) Improved cleanability. Due to the virtual elimination of crevices, even micro-biological particles cannot become trapped, i.e. "held up" on the surface during cleaning
- b) Less product damage. The removal of the small but sharp surface peaks left by machining operations reduces damage, particularly to cellular products

All product contact surfaces are polished with silicon carbide abrasive. The last grit utilised is 240 grit or finer and results in a surface roughness of 0.5 micron Ra. The polishing process is controlled to remove the minimum amount of material from the component surfaces consistent with achieving the above requirements. Surface contours are maintained and square corners are not rounded thus minimising loss of pump performance. Following mechanical polishing, components are electropolished on all surfaces.

Users should be aware that, although polishing improves the flow through valves, pipes, etc. it reduces the output from a positive-displacement pump when pumping low-viscosity liquids. Polishing increases slippage so the pump needs to be run faster to compensate. This may be undesirable as it can result in greater shear stress and greater shear damage to the liquid. It is possible that the additional shear damage to delicate liquids resulting from the extra slippage can outweigh the benefits of polishing. Also, an unnecessarily large pump may be needed to compensate for the loss of output.



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Cleaning In Place (CIP) And Manual Cleaning (Strip Clean)

Cleaning of process equipment

In many applications not only in the hygienic industries (food, pharmaceutical etc) but also in chemical and industrial duties, fast and effective cleaning is important. Living contaminants such as bacteria and other organisms must not be introduced or allowed to multiply and all traces of fluid must be removed at the end of a batch, process or at product changeover to prevent any intermixing. To understand the features and benefits of the 55 Series pumps it is important to understand why and how equipment is cleaned.

How Clean Is Clean ?

In order to clean a pump or other piece of 'closed' equipment, it must either be dismantled (manual cleaning), or cleaned in place (CIP) as part of the procedure for cleaning the entire process. The higher the standard required, the more sophisticated the cleaning process. The standard (level) of cleaning required depends on the needs of the process. There are four generally recognized levels:

Users requirement	Level of Cleaning
To prevent intermixing of, for example, paints, dyes, insert chemicals at product change-over.	Visually clean. Manual cleaning or simple CIP.
Food processes for ingredients, pre-pasteurisation, stable foods and short storage life.	Hygienic, with small but acceptable levels of bacteria remaining. Rigorous manual cleaning, or ordinary CIP.
After pasteurisation, medicines, unstable and long shelf-life foods, multi-product chemicals facilities.	Semi (pseudo) sterile, no or almost no micro-organisms remaining in the pump. Can only be achieved with CIP.
Sterile pharmaceuticals manufacture, bio-technology.	Truly sterile. Absolutely no living organisms remaining in the pump, guaranteed every time. CIP followed by SIP (sterilize in place with steam).

Cleaning Systems

The type of cleaning system used depends partly on the level of cleaning required but also on what is to be removed. Cleaning, whether mechanical or CIP, depends on a combination of:

Chemical reaction	Detergents, acid, alkalis
Scouring action	Tubulent flow, scrubbing
Heat	Hot Water
Time	Residence time for cleaning liquids in contact

Organic materials such as oils, fats, proteins need a different system to inorganic materials such as mineral salts. Detergent manufacturers can give advice on the correct use of chemicals and temperature. CIP usually needs a velocity of 1.5 m/sec (5 ft/sec) through the pipeline to achieve the turbulent flow required

Choice of Cleaning Processes

Manual cleaning has the advantage that no special plumbing and CIP equipment (tank, heater etc) are needed. But CIP is becoming much more common as there are many advantages of CIP over manual cleaning.



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Benefit of CIP	Value to the user
CIP is faster by up to 75% so saves time	Process equipment is available for production for more hours (up-time) when it is earning profits not standing idle
CIP can be controlled automatically	Less labour costs - people can carry out other more productive work
CIP achieves a much higher standard of cleaning if suitable pumps are installed	Equipment is cleaner and is more consistently clean. This gives much higher confidence in the process and reduces risk of product contamination. It is essential for very high levels of cleaning but only some pumps can be CIP cleaned to an accept
Pump does not need to be stripped down to be CIP cleaned	No risk of damage to parts during cleaning so less cost of spares, no chance of incorrect re-assembly so pump will always work correctly when process is re-started
Easy access to the pump is less important	Pump can be positioned anywhere, allowing more efficient use of space, shorter pipe runs and a safer working environment
High temperatures and aggressive chemicals can be used	No danger of injury to operators

Design

Most pumps with internally-contacting parts or with internal bearings can not generally be cleaned in place to the standards demanded by the contaminant-sensitive industries. This includes most gear pumps, sliding-vane pumps etc. Also manufacturers of many older designs of lobe pumps claim that their products can be CIP cleaned but this may be only partly true, depending on the pump design and on the level of cleaning required by the customer.

55 Series lobe pumps from Jabsco are designed to be CIP cleaned to a high standard. (For more details on these features, refer to appropriate data sheets).

Crevice free shaft seals: 55 Series pumps use shaft seals which not only provide a bacteria-tight joint but also meet the highest CIP requirements. In most rotary lobe pumps the fluid contacts the inside diameter of the shaft seals, an area from which it can be very difficult to clean out product and contaminants. In the 55 Series seal, fluid only contacts the outside diameter of the seal.

Self-Draining Features: By careful attention to the shape of not only the rotor bores but also the shaft seals, 55 Series pumps can be drained of fluid prior to cleaning. Also, they can be completely emptied of CIP fluid prior to restarting the process by mounting the pump with the inlet and outlet pipes vertical.

Surface Finish: 55 Series lobe pumps are manufactured to a high standard of internal smoothness, 0.8 μ Ra (32 micro-inches). Optional electropolishing cleans and smoothens the surfaces without reducing efficiency and a further option of mechanical polishing to a surface finish down to 0.5 μ Ra (20 micro inches) can be specified.

External rotor retainers: by holding the rotors onto their shafts outside the pump chamber any areas where pumped fluid can collect around bolts and recesses can be totally eliminated,

Gasket Type Joints: the 55 Series design completely eliminates O-ring joints from the fluid-contact areas including the shaft seals and the end-cover joint.



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The Jabsco 55 Series pump has passed the only internationally recognized tests designed to prove the hygienic standards of pumps and similar equipment. The pump was tested at TNO, the Dutch national testing authority, to test protocols developed by the European Hygienic Equipment Design Group (EHEDG). An independent association, with members drawn from users and manufacturers of equipment as well as from research associations. EHEDG was established to influence standards of design and testing of hygienic equipment to ensure foods and similar products are processed hygienically and safely. The 55 series pump easily passed all three tests:

- 1) In-place cleanability
- 2) In-line steam sterilizability
- 3) Bacteria tightness

The EHEDG clean-in-place protocol compares the cleanliness of the pump to the cleanliness of a piece of reference pipe connected to the pump and subjected to the same test procedure. The system is soiled under pressure with a soured milk solution containing spores of a bacterium strain. The assembly is subjected to a light clean-in-place routine, drained and then the inner surfaces are covered with a molten agar. After incubation, the degree of discoloration of agar (resulting from residual bacteria after cleaning) is compared to that from the reference pipe. All components must show no greater discoloration than the reference pipe for the pump to pass the test, proving that there are no crevices in which product and hence bacteria could accumulate. The pumps easily passed this test. Copies of the TNO certificate number 95-087 and TNO test reports numbers V95.159 and V95.189, as well as full details of the test protocols, are available on request from Jabsco.

Procedures For Cleaning In Place

Each pump is supplied in a generally clean condition but it is the responsibility of the user to establish suitable cleaning and sterilizing regimes appropriate to the fluid and process. These should be implemented before the pump is first used and as often as required thereafter. The following guidelines will help with effective cleaning of 55 Series pumps and minimize risk of damage to the pump.

1. Rinse through system with a suitable liquid, usually water at approximately 50°C (120°F), as soon as possible after completion of process to remove bulk of residues before they dry onto surfaces.
2. If CIP will not be carried out immediately after rinsing, leave pump and system full of rinse liquid.
3. Choose chemical cleaning agents to suit the nature of the contamination to be removed and use them in accordance with manufacturer's recommended dilution, temperature and circulation time but do not exceed 90°C (195°F). Confirm compatibility with pump materials of construction.
4. CIP fluid flow should result in a mean pipeline velocity of at least 1.5 m/sec. (5 ft/sec).

Model	Port Size	Flow l/min	Flow US gal/min
55210	½" (12mm)	7	1.8
55320	¾" (19mm)	18	4.7
55420	1" (25mm)	35	9.2



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If using the lobe pump to circulate the CIP fluid, refer to the Performance Data Sheet for pump speed to give required flow, taking account of pressure losses through plumbing. Note that all pumps are more susceptible to cavitation when pumping hot liquids. Ensure adequate Net Inlet Pressure available. If using a separate pump to circulate CIP fluids, the lobe pump may need to be rotated at a speed sufficiently high to allow the fluid to pass freely through. If sufficient pipe velocity cannot be achieved, fit a by-pass loop to divert excess flow past pump.

CIP fluid pressures must equal or exceed process pressure at all points in the system to ensure fluid reaches all contact surfaces. It may be necessary to restrict flow in discharge plumbing to achieve this but do not exceed differential pressure and temperatures shown on pump Performance Data Sheet. A minimum differential pressure of 1 bar is recommended for effective cleaning.

- 5. After CIP, rinse through with neutralisers and clean water to remove all traces of cleaning agents.



Do not pass cold liquid through pump immediately after hot - allow temperature to change slowly. Failure to observe can result in pump seizure.

Procedure For Manual Cleaning


See Installation, Operating and Maintenance Manual for procedures to dismantle and re-assemble fluid contact parts. 55 Series pumps are not intended to be manually cleaned, however, if it does become necessary to manually clean the pump, take note of the following:-

Take care not to scratch or damage pump parts especially seal faces.

Do not use steel abrasive wool or brushes on fluid wetted surfaces as particles may become embedded in the surface and cause corrosion.

Use suitable cleaning agents in accordance with their manufacturer's instructions regarding temperatures, dilutions, skin contact precautions and other safety information. Thoroughly clean all fluid contact surfaces and rinse as required. As a minimum it will be necessary to remove the end cover and rotors and stationary seal faces. It should not be necessary to remove the seal rotating seats from the rotors during routine cleaning.

This information is provided for guidance only. It is the responsibility of the pump user to satisfy himself that the CIP protocol chosen is adequate to achieve the desired levels of cleanliness and Jabsco cannot accept any responsibility for contamination or loss of pumped fluids.

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Sterilizing In Place

In truly sterile processes, all product-contact components need to be sterilized. This is usually achieved by heating to high temperature (up to 140°C, 285°F) to kill organisms still remaining on the surface of the equipment. This can be achieved by physically dismantling the pump and autoclaving the parts, bagging, taking back to the pump and re-assembling; a long, costly process which causes problems to personnel and can result in accidental damage to components. But when using the 55 Series pumps it is possible to pass steam through the complete assembled system to sterilize the internal surfaces without dismantling the pump.

To achieve 100% sterility, it is important to steam through for a period long enough for the coldest part of the system to reach the correct temperature and hold for the time period required to kill off the organisms. The 55 Series pump head is designed to completely self drain, ensuring all surfaces are exposed to steam and the component shape and choice of materials ensures thermal stability and temperature tolerance.

The Jabsco 55 Series pump has passed the EHEDG (European Hygienic Equipment Design Group) test protocols for In-Line Steam Sterilizability. These were carried out at TNO, the Dutch national testing authority. Copies of the TNO test report No. V95.189, as well as full details of the test protocols are available on request from Jabsco.

Procedure

If using chemical sanitizers, follow guidelines as for CIP above.

If using steam, pump specification must be chosen at time of selection noting:

EPDM elastomers offer best resistance to repeated steam contact but will need to be changed periodically. PTFE (Teflon) is least suitable for steam contact - PTFE end cover joints may need to be replaced every time the pump is sterilized.

Pump should be mounted with the port axis vertical to avoid collecting liquid pools.

1. Thoroughly clean pump and process lines prior to sterilization.
2. If pump is fitted with sterile barriers (on seals, end cover) for the purpose of maintaining sterility, barrier fluid must be connected throughout SIP cycle to avoid re-infection.
3. Pass clean, wet steam through system until all component temperatures have stabilized. Steam must be free of scale, rust and particles - a filter may be necessary. Typically steam will be at 121°C (250°F) and 1 bar (15 psi). Soak time, to bring the pump up to temperature, is typically 20 minutes but this should be established, e.g. using thermocouples, as the required soak time will vary with individual installations.



Do not rotate the lobe pump during this heating phase.



Do not loosen or remove any pump components or pipe connections during steam sterilization as escaping steam may cause serious injury.



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4. Continue to pass wet steam through the lobe pump and process lines during the hold time. Hold time will be determined by the user to achieve desired level sterility. Typically this will be between 20 and 60 minutes.



The lobe pump should not be rotated during this hold time unless absolutely essential to achieve sterility, due to increased risk of pump seizure.

All pump components will normally reach desired temperature by thermal conduction without rotating the pump.

If essential, the lobe pump can be rotated during hold time by hand - beware of danger of hot surfaces - or at a maximum of 50 rpm if the pump is fitted with either:

Single carbon/silicon carbide seals (Code 8).

Double seals (codes 1 or 4) provided a liquid flush, e.g. condensate, is connected and operating at a pressure above the steam pressure within the pump during SIP. If the lobe pump is fitted with single silicon carbide/silicon carbide seals (Code 2) it must not be rotated during hold time as the seal faces can bind together.

5. At the end of hold time, pump must be allowed to cool naturally or can be purged with sterile air/inert gas.



Pump must not be rotated during cooling.

6. Do not allow cool liquid to enter the lobe pump before pump temperature has fallen to 60°C (140°F) or lower.

If the pump is fitted with single silicon carbide/silicon carbide seals (Code 2), flood it with liquid to lubricate the seals before rotating it.

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Aseptic Operation

An aseptic process is one in which all unwanted micro-organisms are kept out of the fluid stream. This prevents spoiling of sensitive products and ensures that only the intended reactions take place in the process. In the 55 Series design, high specification joints are used instead of O-rings ensuring that microbial contaminants cannot enter the product zone. Once the system has been cleaned and sterilized it will remain clean and sterile.

For increased security, secondary joints can be fitted to all potential entry points of 55 Series pumps to allow steam or sterile fluid barriers to be connected. Also, a pump which is externally dirty on the outside will harbor colonies of bacteria which are more likely to infect the internal surfaces of the pump. All 55 Series pumps are designed to be easy to clean externally and are therefore less likely to cause product contamination.

Secondary Joints are:

- Endcover barrier - see separate data sheet.
- Double Mechanical shaft seal - see separate data sheet.

Certification

The Jabsco 55 Series pump has passed the EHEDG (European Hygienic Equipment Design Group) test protocols for In-Line Steam Sterilizability and Bacteria Tightness. These were carried out at TNO, the Dutch national testing authority. Copies of the TNO test report No. V95.189, as well as full details of the test protocols are available on request from Jabsco.



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Pump Selection Procedure

55 Series pumps must be correctly selected and applied for each individual application. Following the procedures below will ensure long and satisfactory service.

Summary of Selection Procedure:

- (1) Collect application information.
- (2) Make preliminary pump selection.
- (3) Select materials, surface finish requirements, shaft seal type.
- (4) Calculate inlet (NIPA), outlet and differential pressures.
- (5) Select rotor type and clearances.
- (6) Establish pump speed for process and CIP flow rates.
- (7) Check for risk of cavitation.
- (8) Calculate power.
- (9) Select drive.
- (10) Select options and accessories.

- (1) Collect application information**
- Details of fluid:** Viscosity
Specific gravity
Temperature
Vapor pressure
Abrasives
Particles / solids
Crystallizing
Hazards / toxicity
Aseptic requirements
Corrosive / compatibility
- Application:** Flow rate(s)
Inlet & outlet pressures
or Pipe layout
Duty cycle
Cleaning requirements
- Environment:** Electrical (volts / frequency / phases)
Water, steam
Atmosphere, hazards
Installation, position

- (2) Make preliminary pump selection**
Use the table and graph at start of section 9 of this technical manual to establish if the 55 Series is suitable for the application and approximately which size of the pump should be selected.

- (3) Select materials, surface finish requirements, shaft seal type**
Check that fluid is compatible with materials of construction of the 55 Series pump. Establish any special surface finish requirements, as polished pumps have different performance characteristics.

Use flow chart on page 55.08.03 to select the most suitable shaft seal for the fluid and the application. This must be done now as not all shaft seal types are available on all models of 55 Series pumps.

- (4) Calculate inlet (NIPA), outlet and differential pressures**
If precise pressures are not known, these must be calculated from the flow rates, fluid viscosities and plumbing details. Also, the fluid vapor pressure must be considered, especially for hot or volatile liquids, as this affects the net inlet pressure available (NIPA) at the pump.

- (5) Select rotor type and clearances**
Use the chart at the start of section 9 to indicate the most likely rotor type and clearance for the application.

- (6) Establish pump speed for process and CIP flow rates**
Establish the pump running speeds for all the application points required, including CIP using the correct performance data sheet for the pump size, rotor type and surface finish selected (Fig.1)



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- (6.1) Check that differential pressure does not exceed limit at operating temperature.
- (6.2) If liquid has viscosity similar to water (1cP or less) use the diagonal lines to determine correct speed for given required flow rates according to the differential pressure.
- (6.3) If liquid viscosity is high (over approx. 1,000 cP), read speed directly from 0 bar line irrespective of the differential pressure.
- (6.4) For lower viscosities:
 - (6.4.1) read horizontally across from fluid viscosity on left-hand scale to intersect the correct differential pressure curve.
 - (6.4.2) read vertically up to intersect the zero flow line.
 - (6.4.3) read diagonally parallel to 1 cP lines up to intersect with required flow rate.
 - (6.4.4) at intersect read vertically up to top line to determine speed.

(7) Check for risk of cavitation

Using reverse side of Performance Data sheet, read NIPR at chosen speed corresponding to liquid viscosity. If NIPR is greater than NIPA calculated from pipe system information, either:

- (i) Repeat selection procedure from step (5) for next (larger) pump size.
- (ii) Increase NIPA, e.g. by increasing pipe diameter or reducing length of inlet pipe.

Note that performance data given is for a typical pump in new condition. In production, individual pumps can vary by up to $\pm 10\%$. When selecting pumps to operate at low flow rates, especially on thin liquids, a small variation in pump efficiency or fluid viscosity can have a very large effect on flow rate and on running speed required for a given flow rate. Take special care when selecting pumps which operate below the broken line (6.4.5) because:

- (i) a variable speed drive is recommended to compensate for performance variability.
- (ii) excessive fluid shear can damage delicate products due to the high ratio (> 10:1) of internal slip to pump output.

If pump speed is too high based on the nature of the fluid to be pumped, the application and the maximum speed of the chosen pump, repeat selection procedure from step (5) for next (larger) pump size.

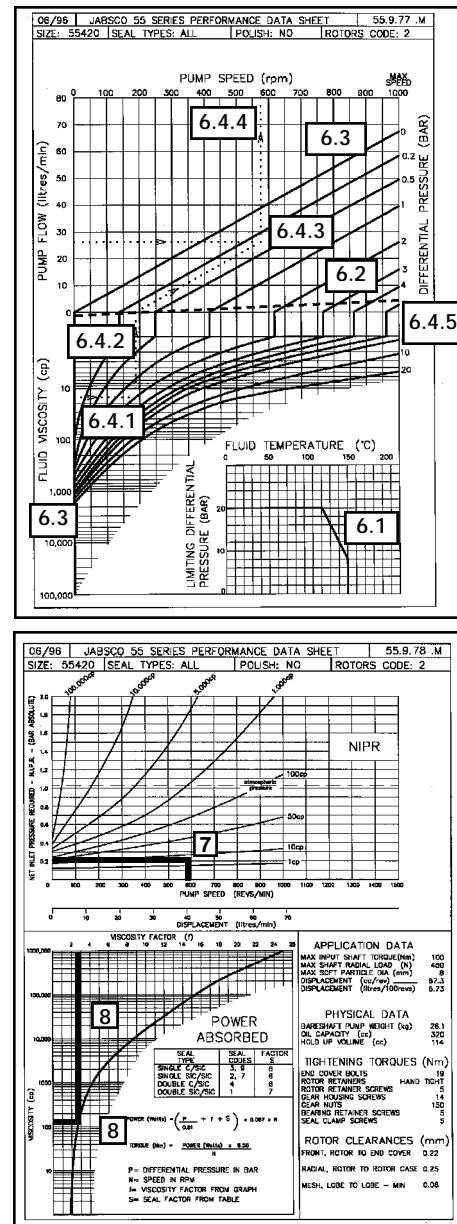


Figure 1



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(8) Calculate power

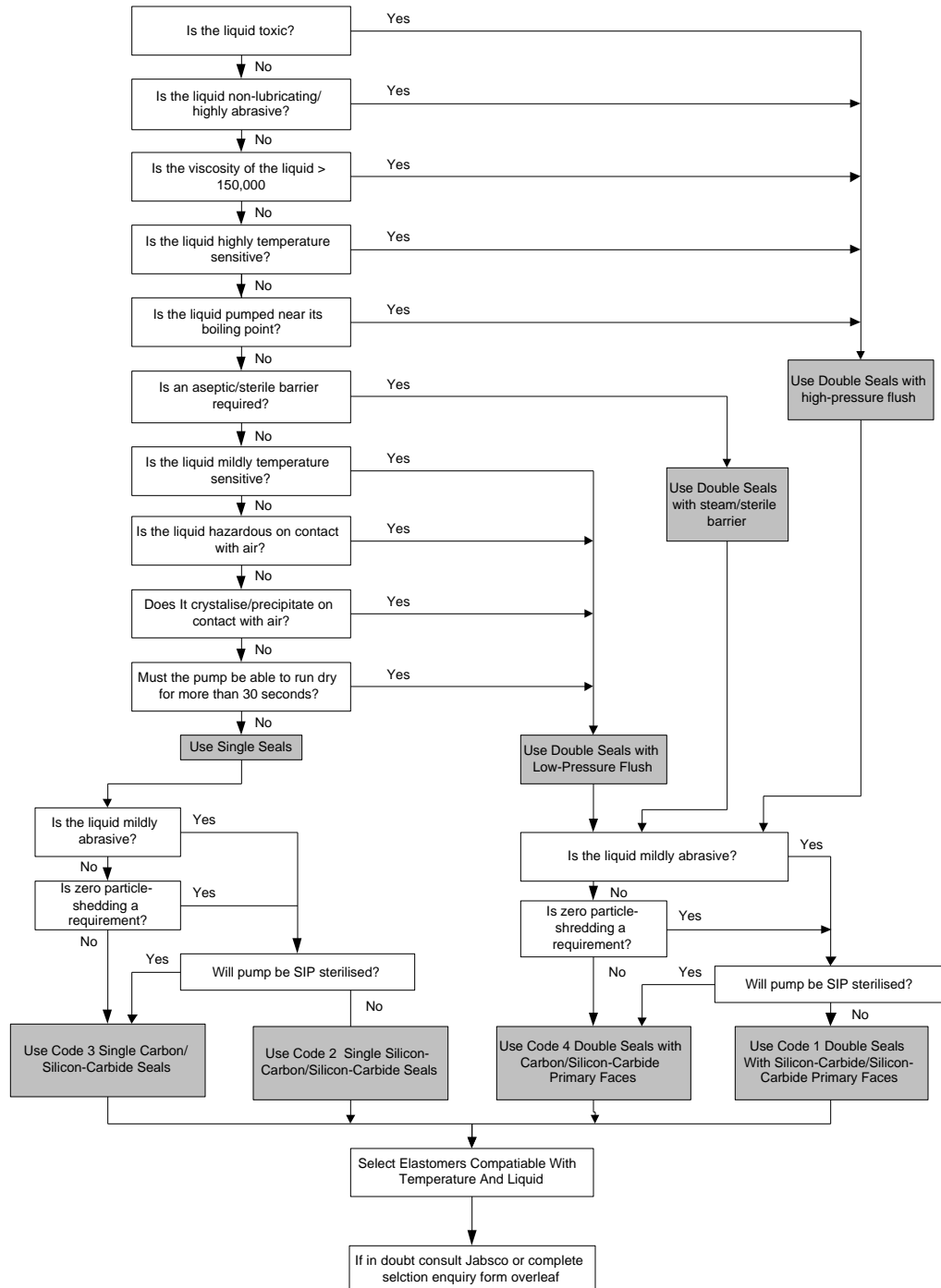
Calculate absorbed power from chart and formula on reverse of Performance Data Sheet, using correct viscosity factor f and seal factor S .

(9) Select drive

Refer to Installation, Operating, Maintenance and Spares information on drives.

(10) Select option and accessories

Consider need for jacketed end cover, port adaptors, spares for start-up etc.







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FAX YOUR DETAILS TO JABSCO FOR SEAL RECOMMENDATION	
Please fill in fields marked with * to enable correct recommendation	
TO: ITT Industries - Jabsco	FROM:
FAX NO.: +44 (0)1992 467132	FAX NO.:
ATTENTION: Doug Leuty (Internal Sales Engineer)	CONTACT NAME:
DATE:	
Please provide a seal recommendation for the following:	
*PUMP TYPE:	
*PRODUCT:	
*PUMPING TEMPERATURE:	
*VISCOSITY:	
*DISCHARGE PRESSURE:	
*SUCTION PRESSURE:	
*SPEED:	
*SHAFT SIZE / MODEL NO.:	
ADDITIONAL INFORMATION:	
----- RECOMMENDATION	
SEAL TYPE:	SINGLE / DOUBLE
FACE MATERIALS:	
ELASTOMERS:	
AUXILIARY SERVICES:	
COMMENTS:	

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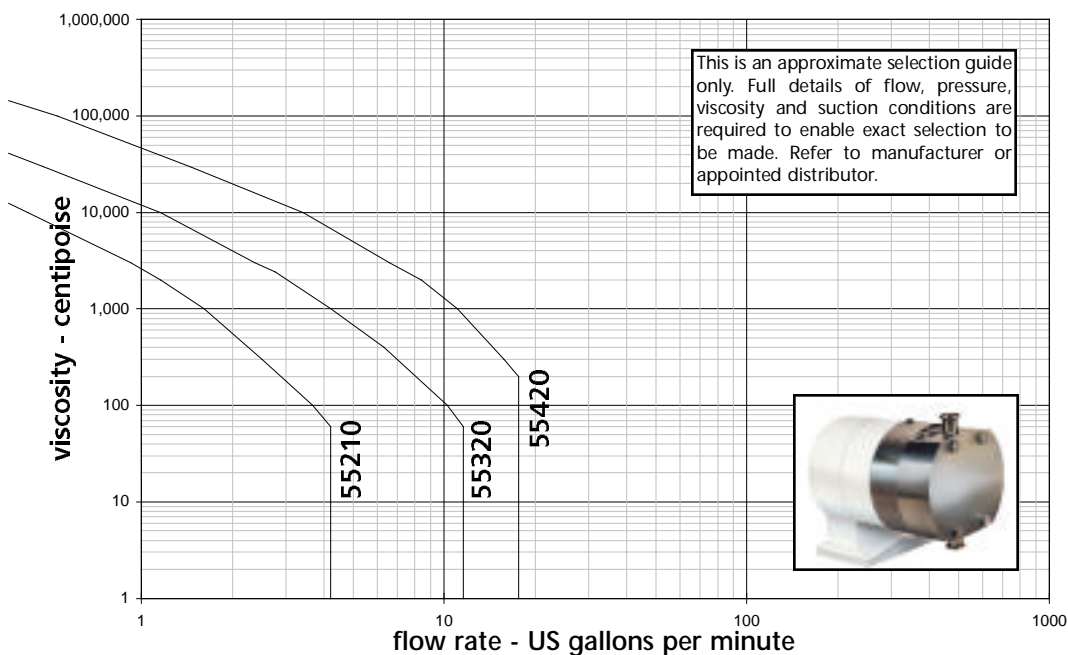
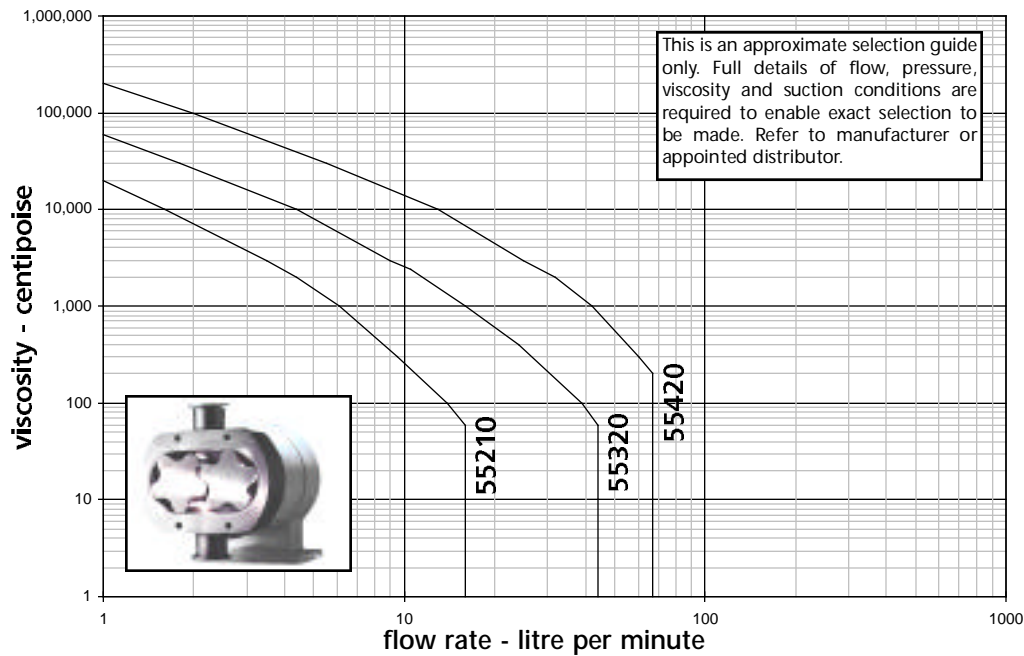
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55.9.01

Performance Summary

Preliminary Selection

The graphs below allow a preliminary pump selection to be made. These graphs show the reduced maximum flow of each pump at higher viscosities assuming that atmospheric pressure is available at the pump inlet. A selection made from these graphs are only approximate and the full procedure described in section 8 of this technical manual should be followed.





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Basic Performance Data

The maximum differential pressures shown in the table below apply up to the normal operating temperature of the pump. Reduced maximum pressures apply at higher temperatures. See individual performance data sheets.

Model No.	Displacement		Maximum Differential Pressure - bar (psi) for each rotor type						Max. Speed rpm	Maximum Flow	
	l/100 rev	US Gal / 100 revs	Code 0	Code 1	Code 2	Code 8 * Note 1	Code 9 * Note 1	l/min		US Gal/ min	
55210	1.05	0.28	5 (75)	N/A	14 (200)	5 (75) * Note 2	4 (58)	1500	16	4.2	
55320	2.93	0.77	5 (75)	10 (150)	20 (300)	5 (75)	N/A	1500	44	11.6	
55420	6.73	1.77	5 (75)	10 (150)	20 (300)	5 (75)	N/A	1000	67	17.7	

The maximum flow figures shown above, and the 0 psi line on the performance data sheets on the previous page, are derived from the theoretical maximum displacement of each pump. In practice this flow can rarely be achieved and allowance must be made during selection for internal slip and NIPR requirements. The performance shown on the performance data sheets at other pressures is the result of controlled laboratory tests on representative pumps in new condition.

Due to manufacturing tolerances, internal slip can cause actual performance of any production pump to vary by $\pm 10\%$.

* Note 1 - Scimitar rotors, code 8 & 9, have slightly lower displacement compared to 5 lobe rotors (codes 0, 1 & 2).

* Note 2 - Rotor material is non-galling alloy (see 55.6.06).

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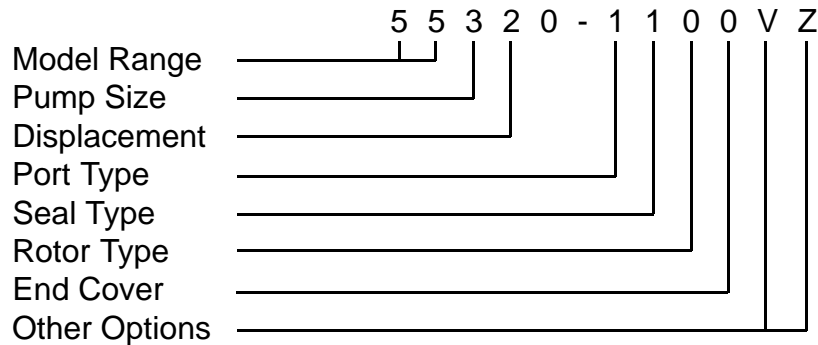
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55.10.01

Model Numbering System

Each number uniquely describes one aspect of the pump as follows:

Standard Pumps - Example



Special Pumps - Example

5 5 3 2 0 - 0 7 - 1 1 0 0 V Z

Special Variant ———
 e.g. drive arrangement, special parts (consult your supplier for details).

Model Range

55 = 55 Series Lobe Pump

Pump Size

- Code 2 = 200 Size
- Code 3 = 300 Size
- Code 4 = 400 Size

Displacement

- Code 1 = Standard flow, short shaft
- Code 2 = Standard flow, long shaft

Port Type

- Code 1 = Clamp ("Tri-clamp")

Seal Type

- Code 1 = Double, SiC/SiC front, C/SiC rear
- Code 2 = Single SiC/SiC
- Code 3 = Single C/SiC
- Code 4 = Double, C/SiC front, C/SiC rear

Rotor Type

- Code 0 = 5-lobe high efficiency
- 1 = 5-lobe standard
- 2 = 5-lobe high pressure
- 8 = Scimitar - Stainless Steel (Non-Galling alloy on 55210)
- 9 = Scimitar - Stainless Steel (55210 only)

End Cover

- Code 0 = Plain
- Code 4 = Heating / cooling jacket
- Code 5 = Aseptic barrier
- Code 7 = Jacket & barrier

Elastomers

- Code P = PTFE / Kalrez® elastomers
- Code V = Viton elastomers

Other Options

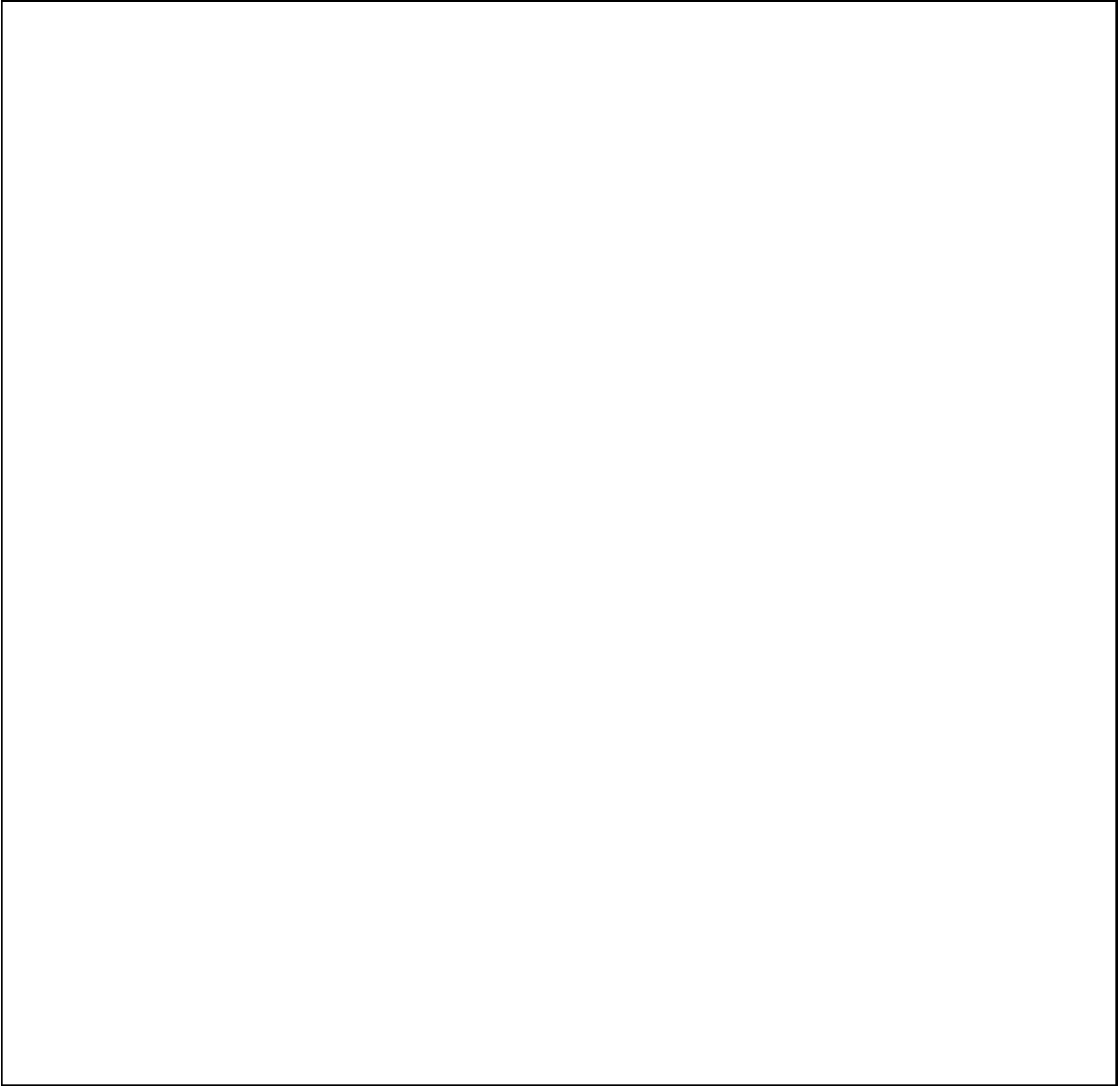
- Code B = Horizontal ports, bottom shaft drive
- Code H = Horizontal ports, top shaft drive
- Code S = Stainless steel bearing housing & gear cover
- Code Y = Electropolish to 0.8 micron (32 micro inch)
- Code Z = Mechanical polish & electro polish to 0.5 micron (20 micron inch)



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