BINKS

Instruction Manual

For

E2-15 Electric Drive Pump

- **Model 104017 (EU Model)**
- **Model 104018 (USA Model)**
- **Model 104019 (Japan Model)**

Finishing Brands.

DeVILBISS Ransburg BGK BINKS

Product Description

Electric Pump E2, E4

This Product is designed for use with:	Solvent and Water based Materials
Suitable for use in hazardous area:	Zone 1 & 2
Protection Level:	II 2 G X T4 (Pump) II 2 G Exd/Exde IIB T4 IP55 (Motor) CE0722 II 2 GD ck T4 (Gearbox)
Manufacturer:	Binks, Justus-von-Liebig - Strasse, 63128 Dietzenbach. DE

EU Declaration of Conformity

We: Binks declare that the above product conforms with the Provisions of:
Machinery Directive 2006/42/EC
ATEX Directive 94/9/EC
Pressure Equipment Regulations 1999 (SI 1999/2001)
EMC Directive 2004/108/CE

by complying with the following statutory documents and harmonized standards:
EN ISO 12100: Safety of Machinery - General Principles for Design
EN ISO 4413: Hydraulic Fluid Power - General Rules and safety requirements

EN 12621: Machinery for the supply and circulation of coating materials under pressure - Safety requirements
EN1127-1: Explosive atmospheres - Explosion prevention - Basic concepts
EN 13463-1: Non electrical equipment for use in potentially explosive atmospheres - Basic methods and requirements
EN 13463-5: Non electrical equipment for use in potentially explosive atmospheres - Protection by constructional safety
EN 13463-8: Non-electrical equipment for potentially explosive atmospheres. Protection by liquid immersion 'k'
EN 60079-0: Explosive atmospheres - Equipment. General requirements
EN 60079-1:Explosive atmospheres - Equipment protection by flameproof enclosures "d"
EN 60079-7:2007 - Explosive atmospheres. Equipment protection by increased safety "e"
IEC 60072: Rotating electrical machine FT flange class
IEC 60034-1,5,6,7,8,9,12,14: Rotating electrical machines

Providing all conditions of safe use stated within the product manuals have been complied with and that the final equipment into which this product is installed has been re-assessed as required, in accordance with essential health and safety requirements of the above standards, directives and statutory instruments and also installed in accordance with any applicable local codes of practice.

D Smith (General Manager)
01 November 2012

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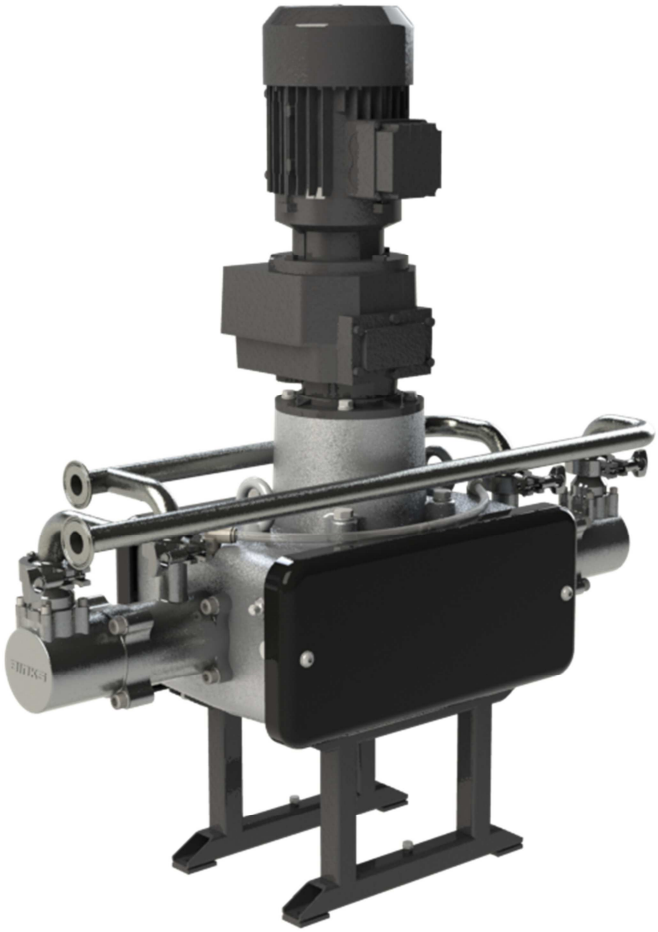
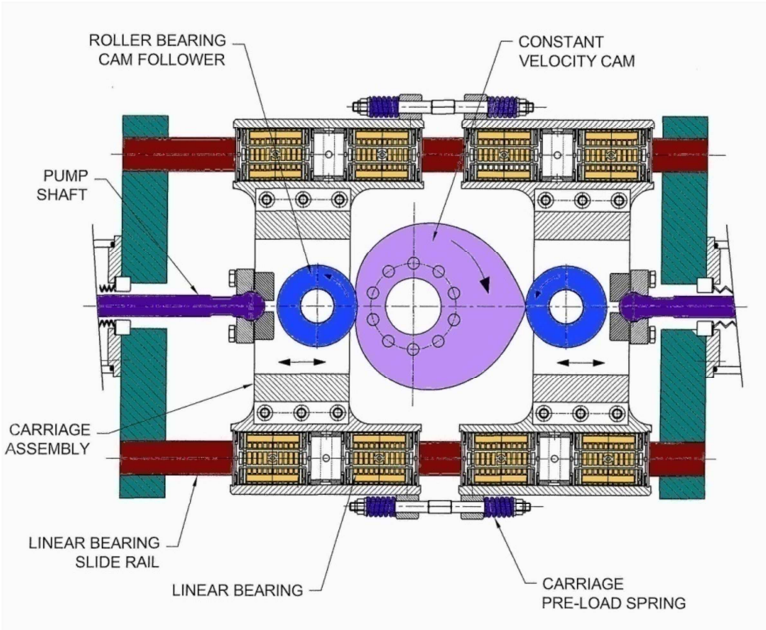
Section

General Description – Section 1.1



The E2-15 pump uses a standard EExd 4 pole AC electric motor to drive the fluid section, for pumping paints, solvents and other suitable materials.

The unit combines conventional electrical hardware to achieve optimum operating performance at a lower cost.
Running costs are much lower than compressed air driven models.



The Model E2-15 Electric Pump achieves a reciprocating drive by using a cam and cam followers combined with a sliding carriage unit.

Equal thrust on each stroke together with the special cam profile reduces fluid pressure fluctuations to an absolute minimum.

The operating speed is adjusted by an AC frequency inverter between 20 and 80 HZ and can be adjusted infinitely within this working range.

Complies with current relevant European and US Legislation

Patents Granted

Operating Principle – Section 1.2

The Assembly comprises of:-

- 1 off Electric Motor
- 1 off In Line Gearbox
- 1 off Drive Shaft / Cam assembly
- 2 off Cam Follower / Carriage assembly
- 2 off Fluid Pistons
- 2 off Fluid Pressure Chambers
- 1 off Fluid Inlet Manifold
- 1 off Fluid Outlet Manifold
- 2 off Support Stand

An AC Induction electric motor drives the fluid section via a mechanical gearbox. The electric motor speed is controlled by an AC Frequency inverter, which can adjust the frequency between 20 and 80 Hz, this being the certified range of the electric motor. The speed adjustment is made by control of the Inverter Frequency Output through manual operation or from a PLC analogue output. The motor frequency is directly proportional to the Fluid Output, (see specifications).

The gearbox is directly coupled to a drive shaft onto which a cam is mounted.
As the cam is rotated one of two diametrically opposed fluid displacement pistons is pushed via a connecting rod and cam follower / carriage assembly producing the pressure stroke.

At the same time the other fluid piston is pulled by the opposed cam follower / carriage assembly producing the suction stroke.
Each of the two carriage assemblies are held in place by 4 compression springs in order to maintain a constant connection between the cam follower bearings and the cam.

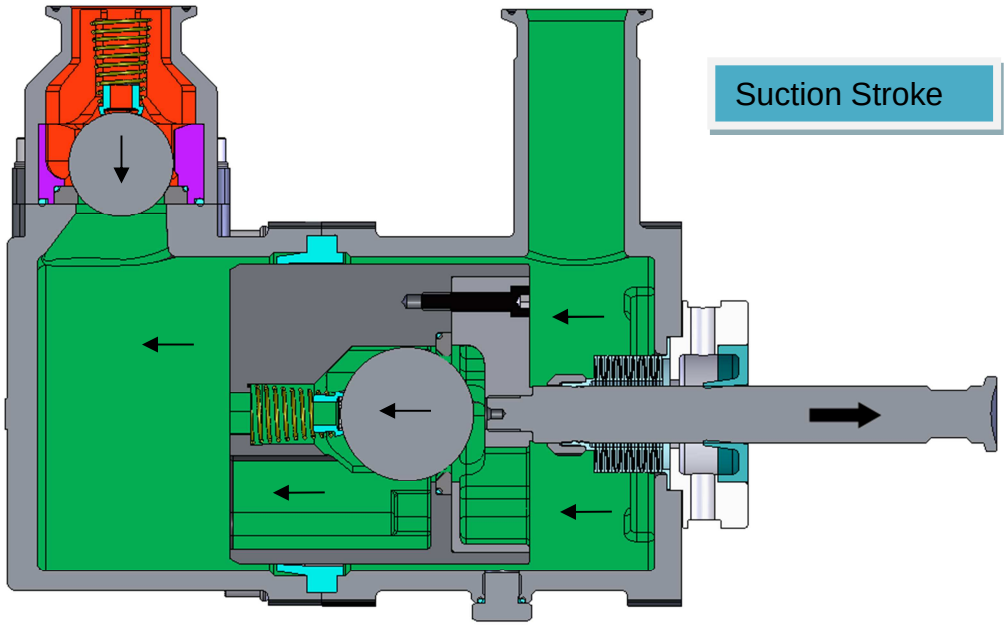
Ball checks control the fluid flow into and out of the pressure chambers during these operations.

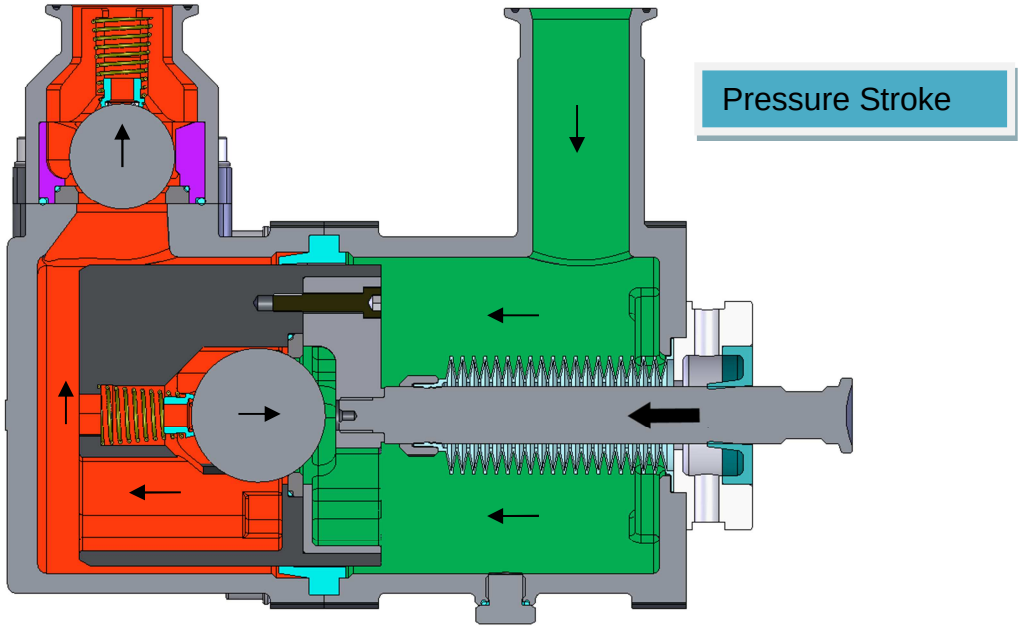
Operating Principle – Section 1.2

The Piston Assembly is a unique design as this has the Inlet ball built in to save on space.
The outlet ball check is spring assisted to minimise pressure drop at change over.

A bellows provides the fluid seal on the connecting rod within the inlet chamber, whilst a piston lip seal maintains the pump fluid pressure within the pressure chamber.

If the main piston seal starts to pass fluid due to wear, any leakage passes into the inlet chamber.

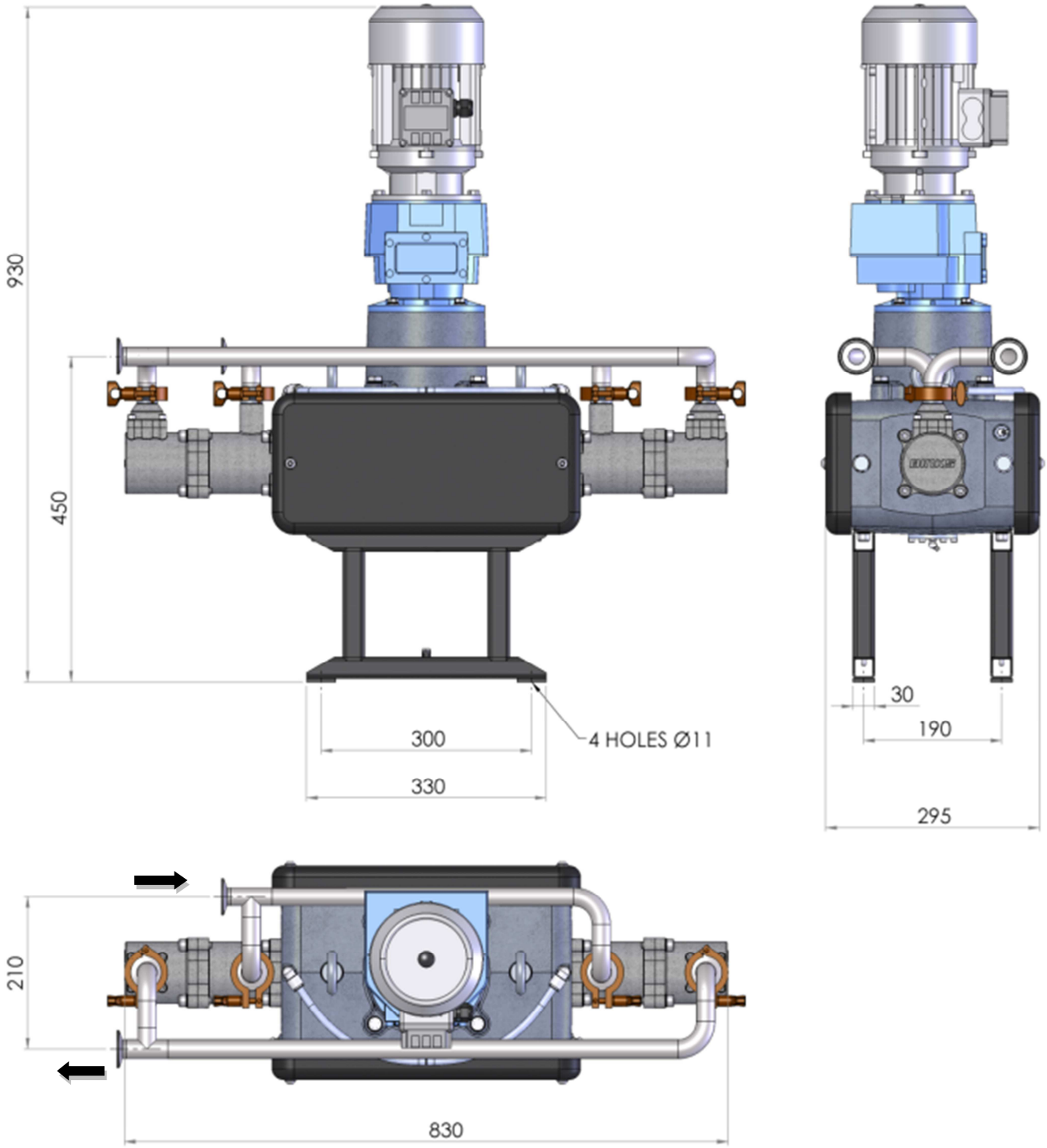




Specification – Section 1.3

Specification	
Pump Nominal Stroke	50 mm (1.97 ins)
E2-15 Maximum Fluid Pressure	18 bar (261 psi)
E2-15 Nominal Flow Volume / Cycle	0.375 Litres (0.10 US Gall)
E2-15 Fluid Output @ 20 HZ (10 cycles/min)	3.75 Litres / min (1.0 US Gall / min)
E2-15 Fluid Output @ 80 HZ (40 cycles/min)	15.0 Litres / min (4.0 US Gall / min)
Fluid Inlet / Outlet Connections	1” Sanitary
Gearbox Ratio	56:1
Gearbox Oil Quantity (EP ISO VG 220 Mineral Oil) (EU Model)	1.7 Litres (0.45 US Gall)
Gearbox Oil Quantity (SHC 630 Synthetic Oil) (USA Model)	Litres (US Gall)
AC Induction Electric Motor -EU Model 0.75 kW 4Pole 1400 RPM (0.75 kW 4Pole 1400 RPM Japan Model)	400V 3PH 0.75 kW @ 50HZ EEx d 11B T3 Rated 20 to 80 Hz (with thermisters)
AC Induction Electric Motor - USA Model	460V 3PH 1 Hp @ 60HZ Class 1, Group D. Rated 20 to 80 Hz (c/w thermostats)
Total Weight of Pump (inc electric motor)	78 Kg (172 Lb)

Dimensions and Mounting Details – Section 1.4



Important Safety Information - Section 2.1

Directions for Working Safety

This Product has been constructed according to advanced technological standards and is operationally reliable. Damage may, however, result if it is used incorrectly by untrained persons or used for purposes other than those for which it was constructed.

The locally current regulations for safety and prevention of accidents are valid for the operation of this product under all circumstances.

International, national and company safety regulations are to be observed for the installation and operation of this product, as well as the procedures involved in maintenance, repairs and cleaning.

These instructions are intended to be read, understood and observed in all points by those responsible for this product. These operating and maintenance instructions are intended to ensure trouble free operation. Therefore, it is recommended to read these instructions carefully before start-up. Binks cannot be held responsible for damage or malfunctions resulting from the non-observance of the operating instructions. These instructions including regulations and technical drawings may not be copied, distributed, used for commercial purposes or given to others either in full or in part without the consent of Binks.
We reserve the right to alter drawings and specifications necessary for the technical improvement of this product without notice.

High Pressure/Electrostatic Warning

High pressure equipment can be dangerous if used incorrectly, serious bodily injury may occur if the following instructions are ignored. Installation and maintenance should only be carried out by suitably qualified personnel.

1. Before attempting any work on a high-pressure system ensure material pump, hydraulics, compressed air motor are isolated where relevant.
2. Relieve all pressure from the system. Note: It is possible for pressure to get locked into a system, therefore, ensure all sections of the system are checked thoroughly for remaining pressure.
3. Take care when releasing fittings
4. Always replace worn hoses immediately
5. Never plug a leak with your finger, adhesive tape or other stop gap devices

Always ensure equipment is suitably earthed before running, to avoid any chance of electrostatic build up.

Equipment Misuse Hazard

Equipment misuse can cause the equipment to rupture or malfunction and result in serious injury.

- This equipment is for professional use only.
- Read all instruction manuals, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose.
- Do not alter or modify this equipment. Use only genuine Binks parts and accessories.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do not exceed the maximum working pressure stated on the equipment or in the Technical Data for your equipment. Do not exceed the maximum working pressure of the lowest rated component in your system.
- Use fluids and solvents which are compatible with the equipment wetted parts. Refer to the Technical Data section of all equipment manuals. Read the fluid and solvent manufacturer's warnings.
- Route hoses away from traffic areas, sharp edges, moving parts, and hot surfaces. Do not expose hoses to temperatures above 82°C (180°F) or below —40°C (—40°F).
- Wear hearing protection when operating this equipment.
- Do not lift pressurized equipment.
- Comply with all applicable local, state, and national fire, electrical, and safety regulations.

Important Safety Information - Section 2.1

Fire, Explosion and Electric Shock Hazard

Improper grounding, poor ventilation, open flames or sparks can cause a hazardous condition and result in a fire, explosion, or electric shock.

When installed and operated in accordance with its instructions, the Pump is approved for operation in Zone 1 (Europe) & Division 1 (North America), hazardous locations. (ATEX Cat 2)

- Electrical equipment must be installed, operated, and serviced only by trained, qualified personnel who fully understand the requirements stated in this instruction manual.
- Ground the equipment and all other electrically conductive objects in the spray area.
- Keep all covers in place while the motor is energized.
- If there is any static sparking or you feel an electric shock while using this equipment, stop spraying/dispensing immediately. Do not use the equipment until you identify and correct the problem.
- Provide fresh air ventilation to avoid the build up of flammable fumes from solvents or the fluid being pumped.
- Keep the pumping area free of debris, including solvent, rags, and gasoline.
- Electrically disconnect all equipment in the pumping area.
- Extinguish all open flames or pilot lights in the spray/dispense area.
- Do not smoke in the spray/dispense area.
- Do not turn on or off any light switch in the spray/dispense area while operating or if fumes are present.
- Do not operate a gasoline engine in the spray/dispense area.

Hot Surface Hazard

- The electric motor becomes hot during operation, and the heat may be transferred to other connected equipment. To reduce the risk of burning yourself, do not touch the motor surfaces while it is operating.
  Before servicing, allow the motor to cool.
- Keep flammable materials and debris away from the equipment.

Pressurized Equipment Hazard

Spray from the gun/valve, hose leaks, or ruptured components can splash fluid in the eyes or on the skin and cause serious injury.

- Do not point the gun/valve at anyone or at any part of the body.
- Do not stop or deflect leaks with your hand, body, glove or rag.
- Follow the Pressure Relief Procedure whenever instructed to relieve pressure; stop spraying/dispensing; clean, check, or service the equipment.
- Tighten all fluid connections before operating the equipment.
- Check the hoses, tubes, and couplings daily. Replace worn, damaged, or loose parts immediately. Permanently coupled hoses cannot be repaired; replace the entire hose.

Toxic Fluid Hazard

Hazardous fluid or toxic fumes can cause serious injury or death if splashed in the eyes or on the skin, inhaled, or swallowed.

- Know the specific hazards of the fluid you are using.
- Store hazardous fluid in an approved container. Dispose of hazardous fluid according to all local, state and national guidelines.
- Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.

Moving Parts Hazard

Moving parts, such as the cam and drive mechanism, can pinch or amputate your fingers.

- Keep clear of all moving parts when starting or operating the pump.
- Never remove the drive section cover while operating the pump.

Installation – Section 3.1 - General

The E2-15 Pump Units are designed for location in Zone 1 Hazardous areas, ATEX Category 2. Electrical connections must be in accordance with Local regulations for installation in Hazardous areas.

It is recommended that a Local Control Box is positioned in close proximity to the pump, as a convenient local Start / Stop facility and Junction box. The main Pump Control Panel must be positioned within an Electrically Safe Area.

A Pressure switch (and/or Pressure relief valve) must be connected to the outlet manifold port and set to stop the pump (or relieve the fluid pressure) in the event of the system overpressure e.g. blocked paint filter. This is necessary to protect the Pump mechanics from overload. An adapter to mount a pressure switch and pressure sensor is available, see accessories.

It is recommended that the switch setting is set to 1 bar (14.5 psi) above the maximum required pressure. The maximum Pressure setting the pressure switch should be set to is 19 bar (275 psi).

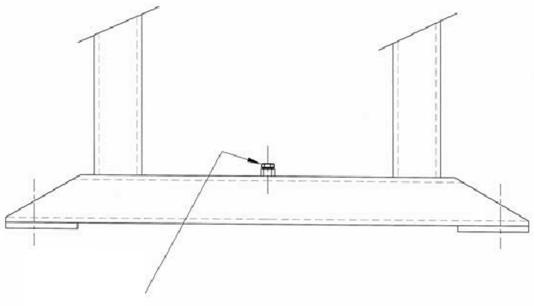
The pressure switch must be fitted and functioning correctly before the pump is put into use otherwise Pump warranty may be invalidated.

The Pressure Switch is classified as simple apparatus and as such should be electrically connected as part of an intrinsically safe electrical circuit.
The pressure switch should be wired as a Normally Closed contact (fail safe) and be hard wired to stop the motor on operation, to minimise response time.

Electric Motor

Electric Motors for hazardous areas are specially designed to comply with official regulations concerning the risk of explosion. If improperly used, badly connected, or altered no matter how minor, their reliability could be in doubt.
Standards relating to the connection and use of electrical apparatus in hazardous areas must be taken into consideration. Only trained personnel familiar with these standards should handle this type of apparatus.

The Pump Frame must be wired to a suitable earth ground to ensure that there is no possibility of static build up



M6 HEX. HEAD SCREW FOR PUMP EARTH GROUNDING

Installation – Section 3.2 - Electrical

Inverter

The pump cycle rate and thus the fluid output is controlled by adjusting the motor speed, this is achieved by changing the electrical frequency input to the motor between the range of 20 and 80 Hz.

A suitable 3PH AC inverter must be used to control the motor speed,

Where the customer provides a suitable inverter then the following parameters are to be used.

Important! The electric motor is certified for use in a hazardous area between frequencies of 20 Hz an 80 Hz, therefore it is essential that this range cannot be inadvertently exceeded by the operator as this will invalidate the certification and use of the electric motor.

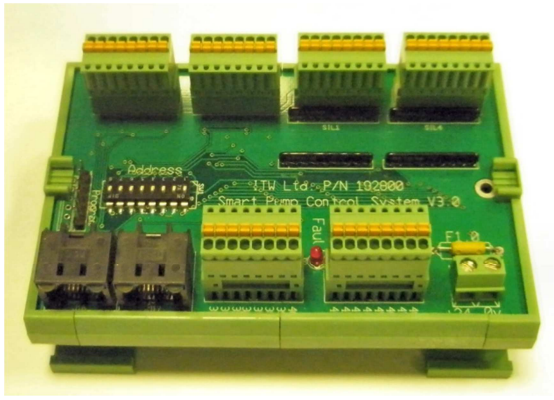
Required European Inverter Settings	Value
Maximum Hz output	80 Hz
Minimum Hz output	20 Hz
Acceleration Ramp	5 Seconds
Deceleration Ramp	0.1 Seconds
Rated Motor Power	0.75 kW
Rated Motor Current	2 A
Rated Motor Voltage	400 V
Rated Motor speed	1440 RPM
Rated Motor Power Factor	0.81
Rated Motor Efficiency	78 %
Rated Motor Frequency	50 Hz

Application Criteria

In a general manner inverters can be connected directly to the power supply line without line reactors. But in this case, ensure the following:
To prevent damage to the inverter and to ensure its expected life, minimum line impedance that introduces a voltage drop of 1%, as a function of the motor load, should be used. If the line impedance (transformers + wirings) is lower than these values, it is recommended to use line reactor.

Installation – Section 3.2 – Electrical

Smart Control - Optional

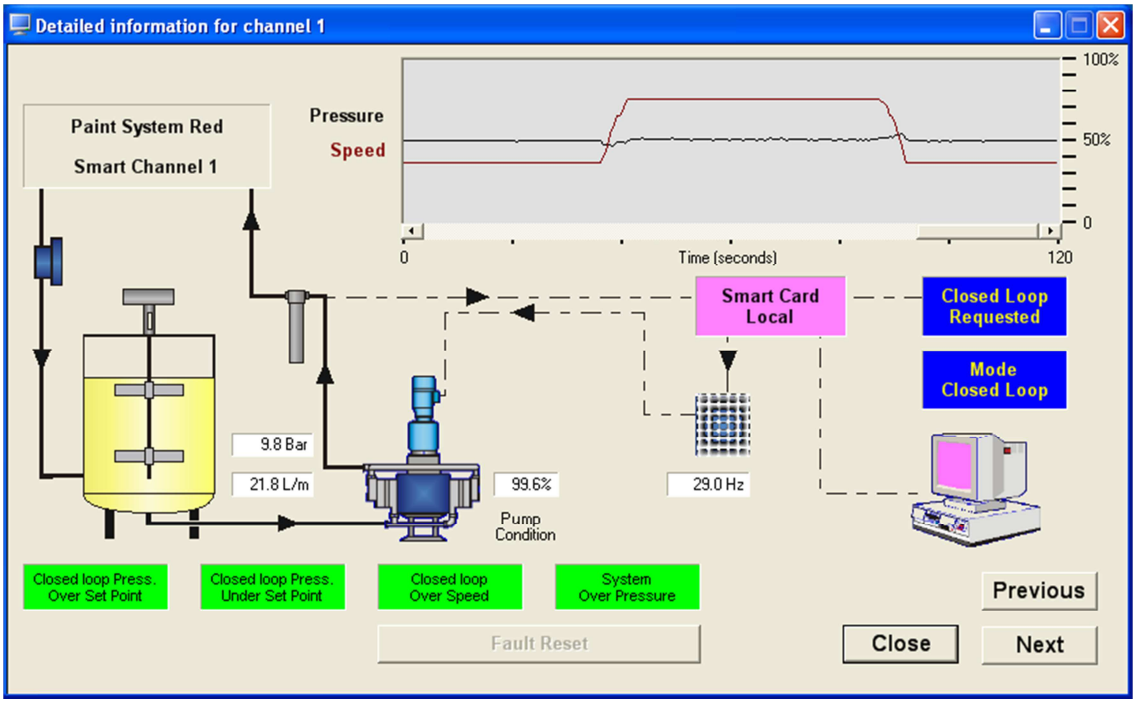


The pump can be used in either flow mode or pressure mode. When Pressure mode is required it is desirable to use a 'Smart card' to control the functionality of the pump.

The control card has in built software to control the paint flow rate and system pressure within given set parameters so that the paint system can be used in the most efficient way at all times, thus saving energy consumption.

Smart Control

The *'Smart'* system design provides for two modes of operation, fully automatic closed loop pressure control and open loop flow control.-



Detailed Status for 1 Channel showing 20L/min flow increase in the paint system and the immediate pump speed response increase

Installation – Section 3.3 - Mechanical

- Secure the Pump assembly to the floor (or purpose designed support steelwork) using the 4 off Ø10 mm holes in the base of the pump support frame.

- Attach suitable hoses (20 bar maximum working pressure) to the inlet and outlet connections. E.g. 28 mm NB Inlet and 25 mm NB Outlet hose.

- In addition to the pressure switch a Pressure relief valve can be connected and piped back to the pump supply tank to relieve pump outlet pressure in the event that the pipework system is closed (by ball valve or other means) causing system overpressure.
  This is necessary to protect the Pump mechanics from overload and subsequent damage.
  It is recommended that the relief valve setting is set to 1 bar (14.5 psi) above the maximum required pressure. The maximum Pressure setting the relief valve should be set to is 1 bar (14.5 psi) above pump maximum working pressure.

  A pressure sensor is utilised when the pump is set up in ‘Pressure Mode’ (instead of ‘Stroke Mode’) where the pump cycle rate is adjusted to respond to paint system pressure, a dedicated ‘Smart Card’ or PLC software should be incorporated in the pump control system to ensure correct operation.

- Ensure adequate air space around the Pump for maintenance and electric motor cooling requirements.

- Check that the oil plug on top of Gearbox has been replaced with the correct venting plug. The vent plug is supplied in a bag attached to the gearbox.

- Ensure the gearbox is filled with oil. (The gearbox is filled with the correct amount of oil at the factory)

Operation - Section 4.1

System Operation

Before starting: -

- Ensure all electrical and mechanical connections are correctly made.
- All required interlocks are tested and operational.
- Suitable material for pumping is available at the suction hose.
- The outlet connection is not blocked or isolated by any valves.
- Check the gearbox oil level, top up as necessary with the correct grade (see maintenance section) and that the gearbox ventilator is fitted.

Set the pump speed to the minimum frequency 20 HZ and start the pump to remove any air from the circuit. Inspect for any leaks.

Set the pump cycle rate to achieve the required paint volume and then adjust the system back pressure regulator to achieve the desired system fluid pressure. Refer to Fluid Output Table for comparison of fluid output relative to Inverter frequency and Pump cycle rate.

The return line 'back pressure' regulator responds to the changes in system fluid flow demand, (due to variable paint usage) by dynamically adjusting the paint flow rate returning to the system paint tank, thus maintaining the set pressure.

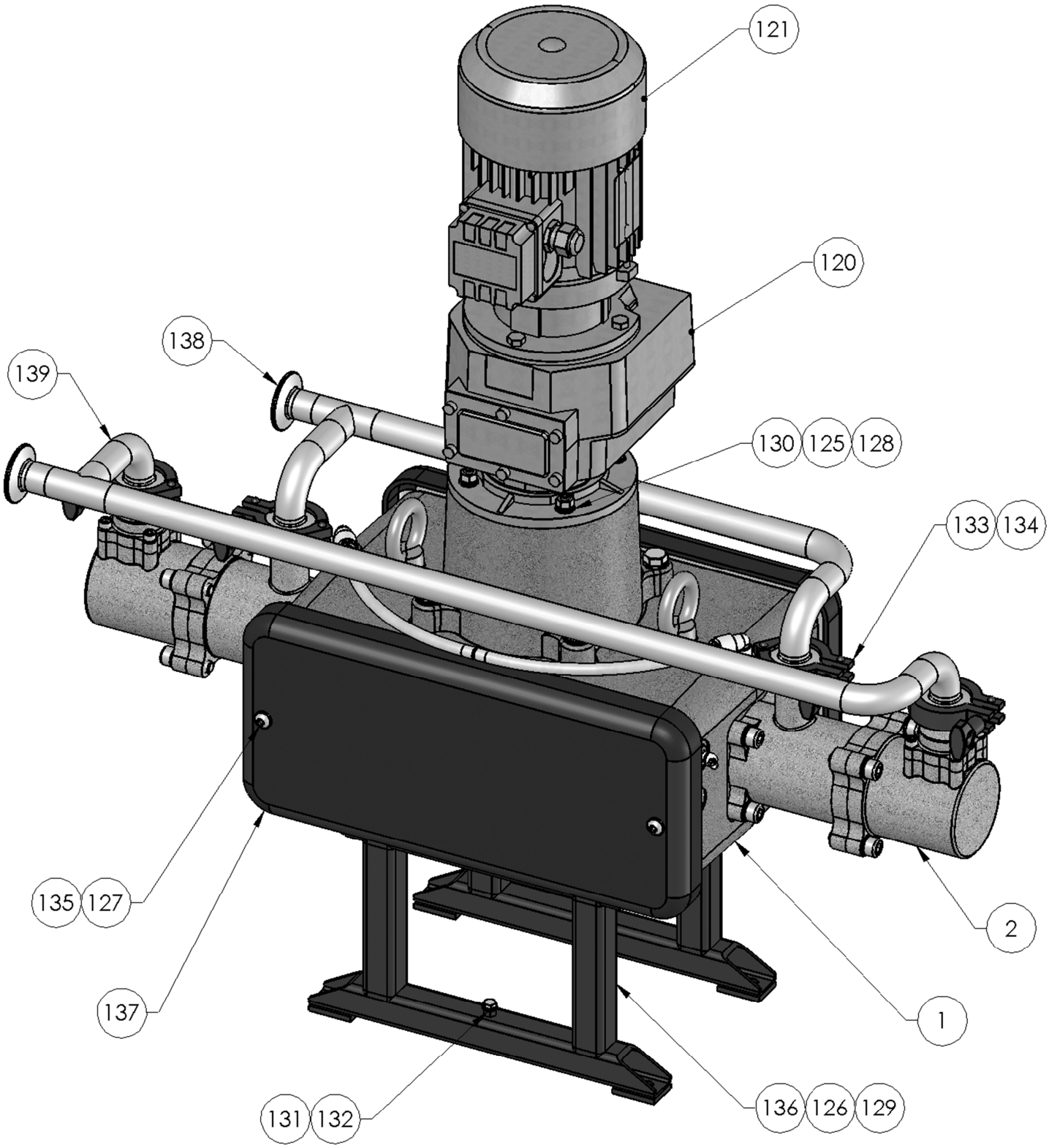
Motor Speed Fluid Output Table

Motor Speed HZ	Pump Speed Cycles/min	Fluid Flow Rate Litres/min	Fluid Flow Rate US Gall/min
20	10.0	3.75	1.0
25	12.5	4.69	1.25
30	15.0	5.62	1.5
35	17.5	6.56	1.75
40	20.0	7.50	2.0
45	22.5	8.44	2.25
50	25.0	9.37	2.5
55	27.5	10.31	2.75
60	30.0	11.25	3.0
65	32.5	12.19	3.25
70	35.0	13.12	3.5
75	37.5	14.06	3.75
80	40.0	15.00	4.0

Parts List – Section 5.1

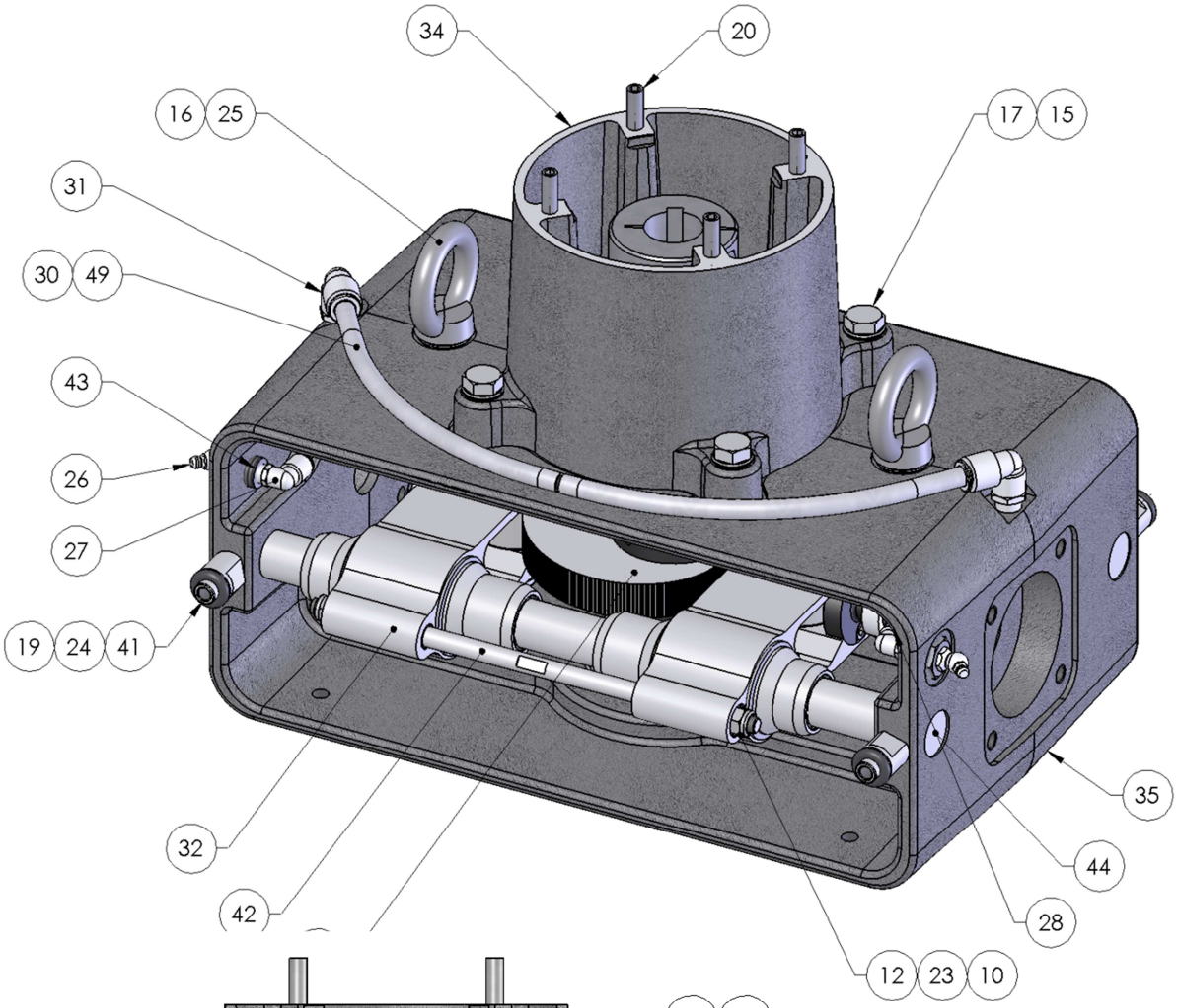
Parts List – E2-15 Main Pump Assembly				
ITEM	**PART No**	**DESCRIPTION**	**QTY**	**REMARKS**
1	-- -- --	MECHANICAL DRIVE ASSEMBLY	1	
2	192829	FLUID SECTION ASSEMBLY	2	
120	192877	GEARBOX (EU)	1	104017 PUMP
120	*193090*	*GEARBOX (USA PUMP)*	*1*	*104018 PUMP*
120	*193091*	*GEARBOX (JAPAN)*	*1*	104019 PUMP
121	193089	0.75 KW ELECTRIC MOTOR (EU)	1	104017 PUMP
121	*193093*	*1 HP ELECTRIC MOTOR (USA PUMP)*	*1*	*104018 PUMP Baldor Motor*
121	*193118*	*1 HP ELECTRIC MOTOR (USA PUMP)*		104018 PUMP Marathon Motor
121	*193092*	*0.75 KW ELECTRIC MOTOR (JAPAN)*	*1*	104019 PUMP
125	163144	M8 HEXAGON NUT	4	
126	164471	M10 x 20 CAP HD SCREW	4	
127	164474	M8 x 16 TORX SCREW (ST ST)	4	
128	165108	M8 SPRING WASHER (ST ST)	4	
129	165123	M10 SPRING WASHER (ST ST)	4	
130	165134	Ø8 Washer	4	
131	165958	M6 x 20 HEX HD SCREW (BRASS)	2	
132	165959	M6 WASHER (BRASS)	2	
133	192009	1 & 1 1/2 SANITARY CLAMP	4	
134	192206	1 SANITARY GASKET PTFE	4	❶❷
135	192485	M8 WASHER (NYLON)	4	
136	192860	MOUNTING FRAME	2	
137	192866	COVER	2	
138	192867	INLET MANIFOLD	1	
139	192868	OUTLET MANIFOLD	1	

Parts List – Section 5.1



Parts List – Mechanical Assembly

ITEM	PART No	DESCRIPTION	QTY	REMARKS
10	160524	CARRIAGE SPRING	4	
11	162709	Ø30 x Ø42 x 7 SEAL	1	❸
12	163161	M8 NYLOC NUT	4	
13	163921	M6 x 25 CAP HEAD SCREW (ST ST)	6	
14	163960	M5 x 16 CAP HEAD SCREW (ST ST)	6	
15	165044	M12 SPRING WASHER (ST ST)	6	
16	165100	M16 SPRING WASHER	2	
17	165351	M12 x 50 HEX. BOLT	4	
18	165558	M8 x 50 CAP HEAD SETSCREW	8	
19	165661	M8 x 20 - GRUBSCREW - STST	4	
20	165666	M8 x 45 GRUBSCREW	4	
21	165972	M5 x 25 CAP HD SCREW	6	❶
22	165974	M25 BEARING LOCKNUT	1	
23	192400	SPRING RETAINING WASHER	4	
24	192440	Ø10.4 'O' RING (COVER)	4	
25	192441	M16 EYE BOLT	2	
26	192650	1/8 x 45 GREASE NIPPLE	3	
27	193130	1/8R - 6MM PUSH IN ELBOW	2	
28	192668	SHAFT CLAMP ASSY	2	
29	192703	M30 BEARING LOCKNUT	1	
30	192751	HOSE PLUG	1	
31	193131	1/4 10 PUSH IN ELBOW	2	
32	192849	CARRIAGE ASSEMBLY	2	
33	192850	CONSTANT VELOCITY CAM	1	
34	192853	BELL HOUSING MACHINING	1	
35	192854	MAIN BODY MACHINING	1	
36	192855	TOP SHAFT - E2-15	1	
37	192856	BOTTOM SHAFT - E2-15	1	
38	192857	TOP BEARING CAP	1	
39	192858	BOTTOM BEARING CAP	1	
40	192859	BOTTOM BEARING HOUSING	1	
41	192865	COVER SPACER	4	
42	192869	LINEAR SPRING PIN	2	
43	192870	GREASE BULKHEAD	2	
44	192872	LINEAR BEARING ROD	2	
45	192873	Ø30 x Ø72 x 30.2 BALL BEARING	1	❸
46	192874	Ø25 x Ø52 ROLLER BEARING	1	❸
47	192875	DRIVE SHAFT COUPLING	1	❸(SPIDER ONLY)
48	192878	8 x 7 x 30 KEY	1	❸
49	192879	Ø10 VENT HOSE	2	225mm
50	192880	Ø6 GREASE HOSE	2	460mm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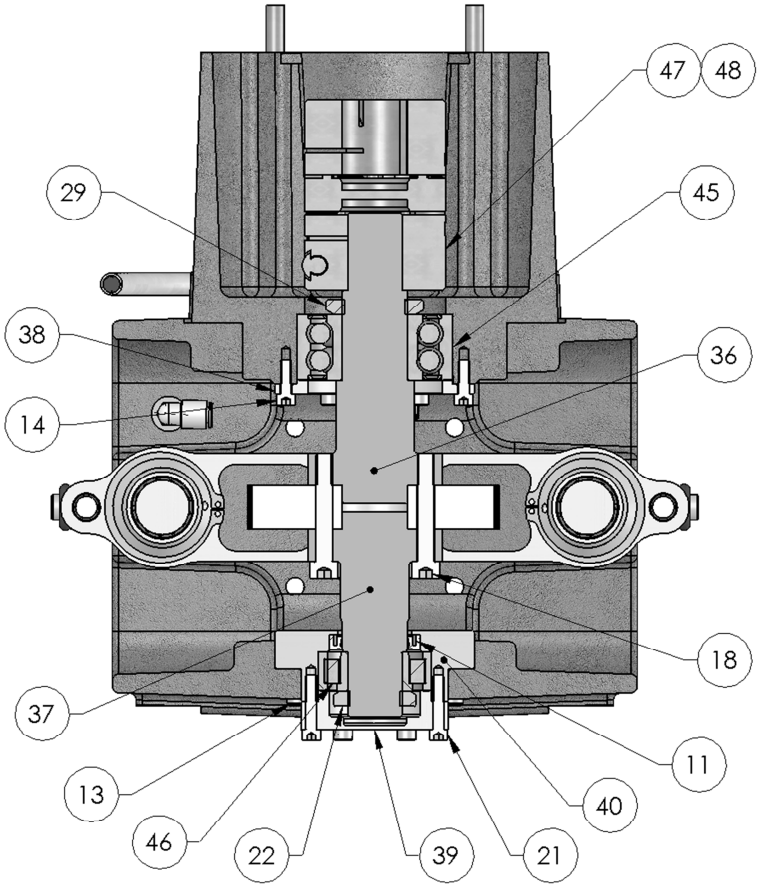
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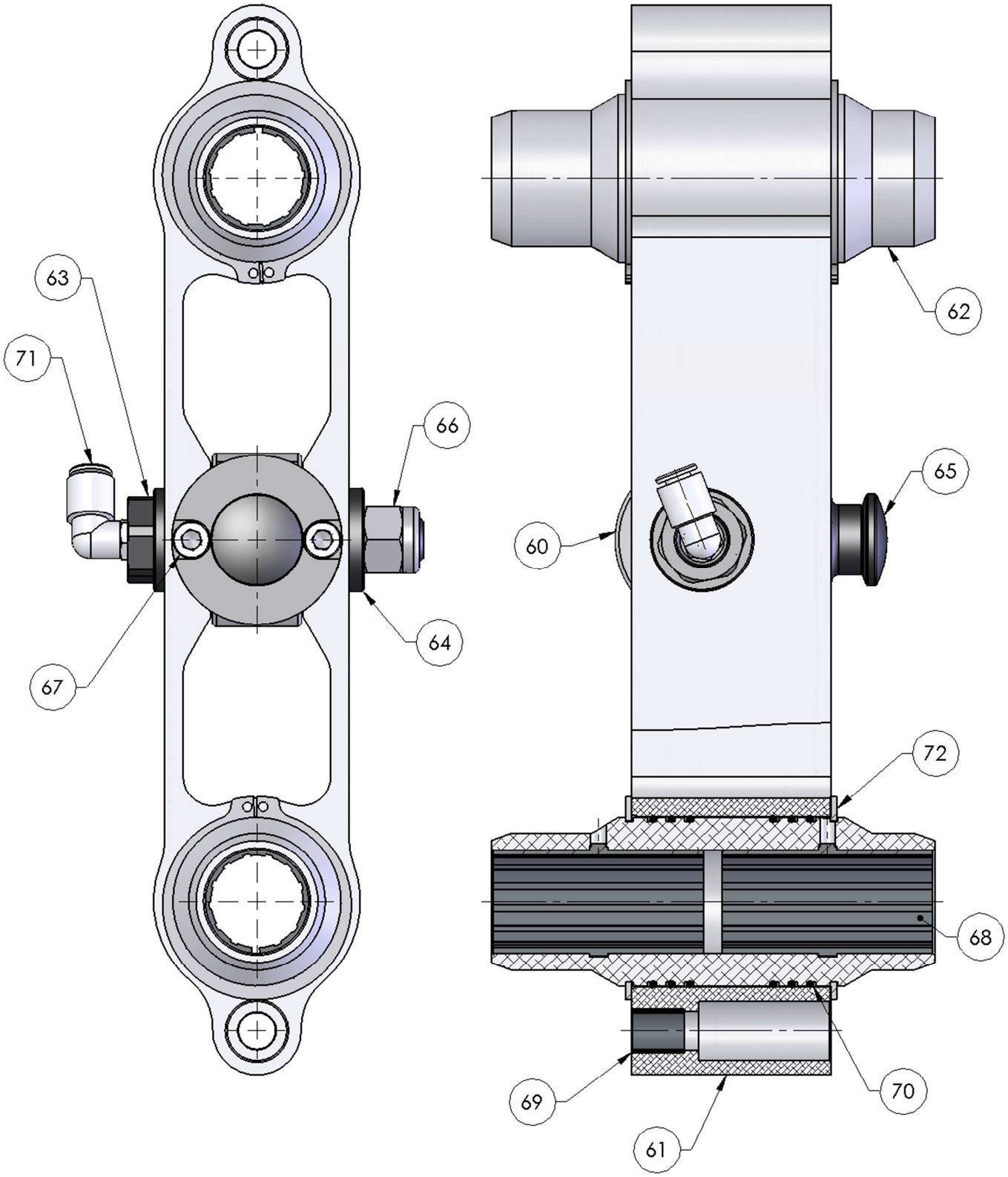
Parts List – Section 5.2

Parts List – Mechanical Assembly - Carriage 192849				
ITEM	**PART No**	**DESCRIPTION**	**QTY**	**REMARKS**
60	192392	Ø47 CAM FOLLOWER	1	
61	192852	LINEAR BEARING CARRIAGE	1	
62	192851	LINEAR BEARING HOUSING	2	
63	192862	CAM FOLLOWER PIN	1	
64	192863	FOLLOWER NUT WASHER	1	
65	192861	CARRIAGE ADAPTOR	1	
66	163159	M12 LOCKING NUT	1	
67	165542	M6 x12 SOCKET CAPSCREW	2	
68	192871	Ø25 LINEAR BEARING	4	
69	193112	9 X 12 X 14 LINEAR BEARING	2	
70	162734	Ø41 x 1.78 SECTION 'O' RING	12	
71	192661	1/8R - 6MM PUSH IN ELBOW	1	
72	166156	Ø46 EXTERNAL CIRCLIP	4	

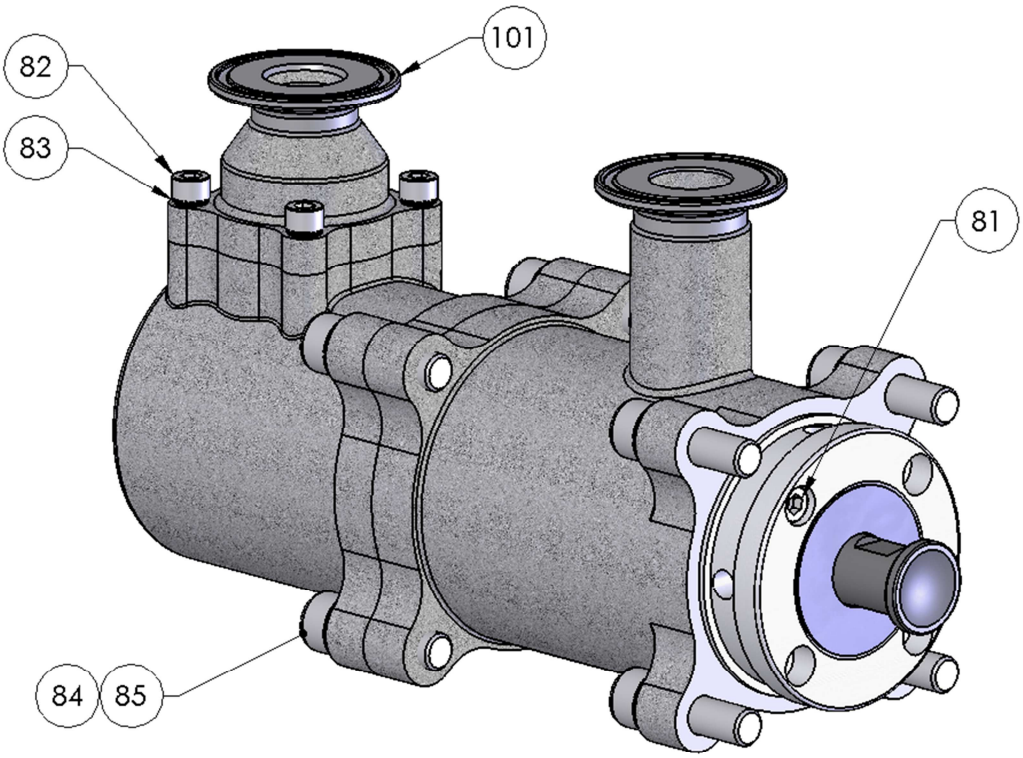
Parts List – Section 5.2

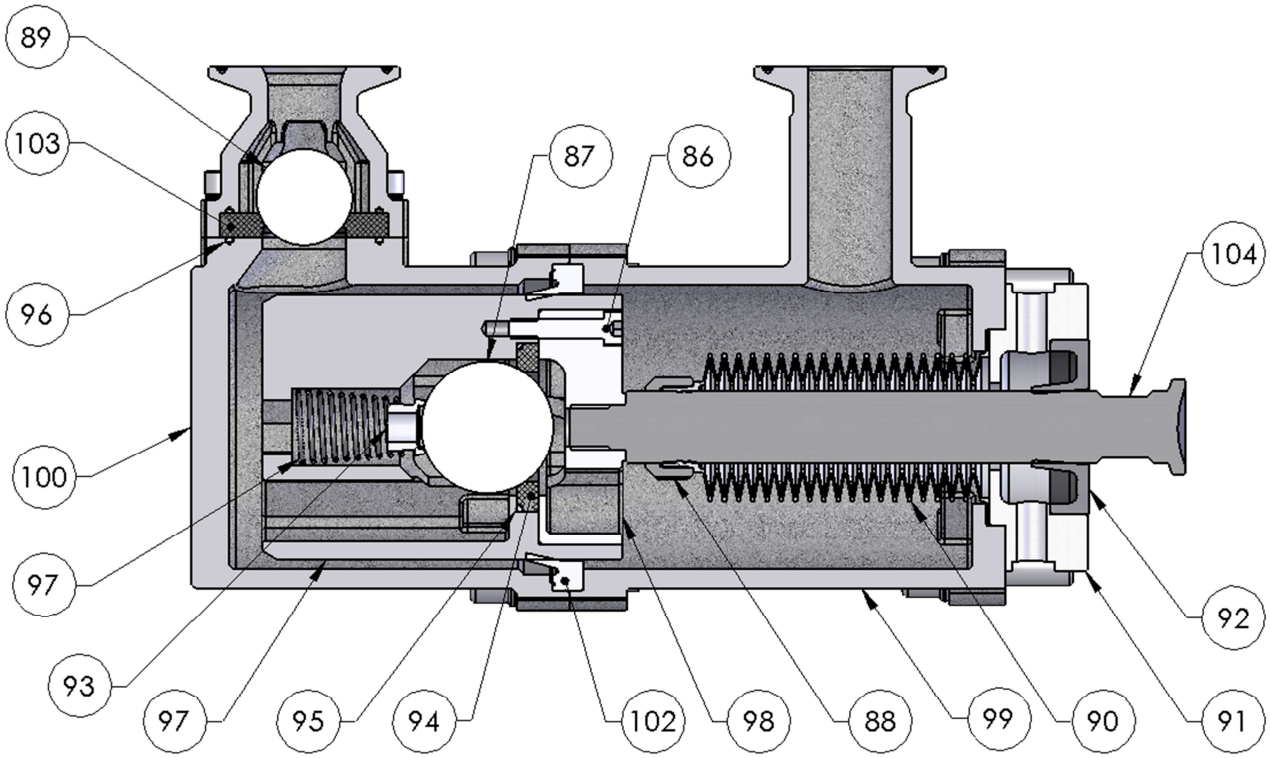


Parts List – Section 5.3

Parts List – E2-15 (192829) Fluid Section				
ITEM	**PART No**	**DESCRIPTION**	**QTY**	**REMARKS**
80	160513	CONICAL SPRING	1	❶❷
81	163921	M6 x 25 CAP HD SCREW (ST ST)	1	
82	163952	M6 x 20 CAP HD SCREW (ST ST)	4	
83	165087	M6 SPRING WASHER (ST ST)	4	
84	165123	M10 SPRING WASHER (ST ST)	8	
85	165947	M10 x 35 CAP HD SCREW	8	
86	165972	M5 x 25 CAP HD SCREW	5	❶❷
87	171788	1⅜" BALL	1	❷
88	192374	RETAINING NUT	1	
89	192382	1" BALL	1	❷
90	192579	KNIFED BELLOWS	1	❷
91	192627	BELLOWS SPACER	1	
92	192628	SHAFT SEAL	1	❷
93	192629	INLET SPRING KEEP	1	❶❷
94	192632	SEAT (FOR 1⅜" BALL)	1	❷
95	192648	Ø41.0 x 1.78 SECTION 'O' RING	1	PTFE❶❷
96	192712	Ø37.8 x 1.78 SECTION 'O' RING	2	PTFE❶❷
97	192822	Ø70 PISTON	1	
98	192823	Ø70 KEEP PLATE	1	
99	192825	INLET CYLINDER	1	
100	192826	OUTLET CYLINDER	1	
101	192827	OUTLET CHECK	1	
102	192828	PISTON SEAL	1	❶❷
103	192833	SEAT (FOR 1" BALL)	1	❷
104	192864	PISTON SHAFT	1	

Parts List – Section 5.3





Maintenance – Section 6.1 - Assembly Procedure

Top Bell Housing Assembly.

1. Apply bearing Loctite 641 to ball bearing (45) and bell housing (34) bore. Using tool (193121) press bearing into housing until it stops.
2. Fit bearing cap (38) with screws (14) using Loctite 222 on threads, tighten to 8Nm.

Lower Bearing Housing Assembly.

1. Lightly grease seal (11) and push seal into housing (40). Note orientation of seal, ‘U’ cup away from bearing. (502375 grease) Remove spring from ‘U’ cup if fitted
2. Apply bearing loctite 641 to bearing (46) & housing (40). Using tool (193122) press in bearing until it stops. Retain the bearing inner race for later assembly to the bottom shaft.

Main Shaft Assembly

1. Hold top shaft (36) securely in a vice with the aid of the key (48) within the keyway.
2. Place cam (33) onto top shaft and then place base shaft (37) on top of cam.
3. Align holes and fit screws (18) using loctite 243 on threads, tighten to 30Nm.

Bell Housing & Shaft Assembly

1. Fit the shaft assembly into the bell housing bearing using Loctite 641, secure with locking nut (29) using tool 193119
2. Grease # the lip seal of the lower bearing housing and the shaft end. Remove the inner race of bearing the housing and slide onto the shaft. Now refit the inner race, securing with locking nut (22) using tool 193120
3. Fit cap (39) with screws (21) using Loctite 222 on the threads, tighten to 6Nm

Carriage Assembly – 192849

1. Using the tapered end carefully push 2 off bearings (69) into the ends of the carriage (61).
2. Fit 2 off bearings (68) into each of the carriage housings (62).
3. Fit 6 off ‘O’ rings (70) onto each of the carriage housings (62).
4. Fit 1 off circlip (72) into the carriage housing groove as shown.
5. Lightly grease # the ‘O’ rings and inside of the carriage, push the housing into the carriage up to the circlip. Then fit the second circlip. Do this for both ends.
6. Insert carriage adaptor (65) into the carriage and loosely fit 2 off screws (67) with Loctite 222.

Maintenance – Section 6.1 - Assembly Procedure

7. Fit cam follower pin (63) and cam follower (60), securing with washer (64) and nut (66) tightening to 40Nm.
8. Tighten 2 off screws (67) to 10Nm.
9. Loosely fit grease fitting (71), this will be orientated later.

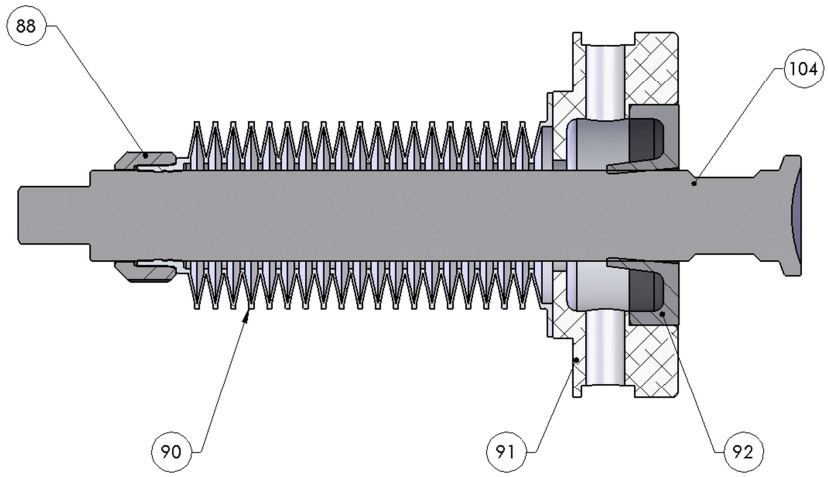
Main Drive Assembly

1. Fit the legs (136) to the main body (35) with screws (126) & washer (129), using Loctite 243 on the threads. Tighten to 38Nm.
2. With the unit standing on its legs, insert the bell housing assembly, being careful to align both upper and lower bearing housings.
3. Fix the bell housing into position using screws (17) and washers (15) using Loctite 243 on the threads. Tighten to 50Nm.
4. Orientate the lower housing so that the grease nipple hole is on one side of the unit. Fit screws (21) using Loctite 222 on the threads, tighten to 12Nm. Insert grease nipple (26) and orientate to the front of the pump.
5. Slide in 2 off linear rods (44) so that approx 25mm shows on the inside of the assembly. Onto these bars, slide on a carriage sub-assembly, when in position push the bars through the carriage. Offer up the second carriage and continue pushing the bars through the bearings. When the bars are located on the other side and central within the casting fit screws (19), using Loctite 243 on the threads, tighten to 15Nm.
6. Pull both carriages together so that the bearings contact the cam. Slide the spring bar through the ends of the carriages, lightly grease # and fit the springs (10), washers (23) and lock nuts (12). Tightening all nuts equally, but finally tighten to 12Nm.
7. Fit the 2 off Ø6 ‘push in’ elbows into the side plate (27) front grease ports and position to face the back of the pump. Fit Ø6 hoses (50) to the elbow.
8. Fill hoses with 502375 grease, (approx. 9 strokes of the grease gun), until grease comes out of the hose. Clean off excess grease and connect the hose ends to the opposite cam follower pin ‘push in’ fittings.
9. Coat the drive input shaft with anti-fretting grease and slide on one half of coupling (47) tighten screw to 16Nm.
10. Fit eyebolts (25) and washers (16) using Loctite 243 on the threads. Tighten to 50Nm.
11. Fit vent elbows (31), vent hose (49) and plug (30).
12. Fit cover spacers (41) using Loctite 243 on the threads.
13. Fit grub screws (19) using Loctite 2701 on the threads. Tighten to 22Nm.
14. Fit earthing screw (131) and washer (132).

Maintenance – Section 6.1 - Assembly Procedure

Fluid Section Assembly - Shaft / Bellows Sub-assembly

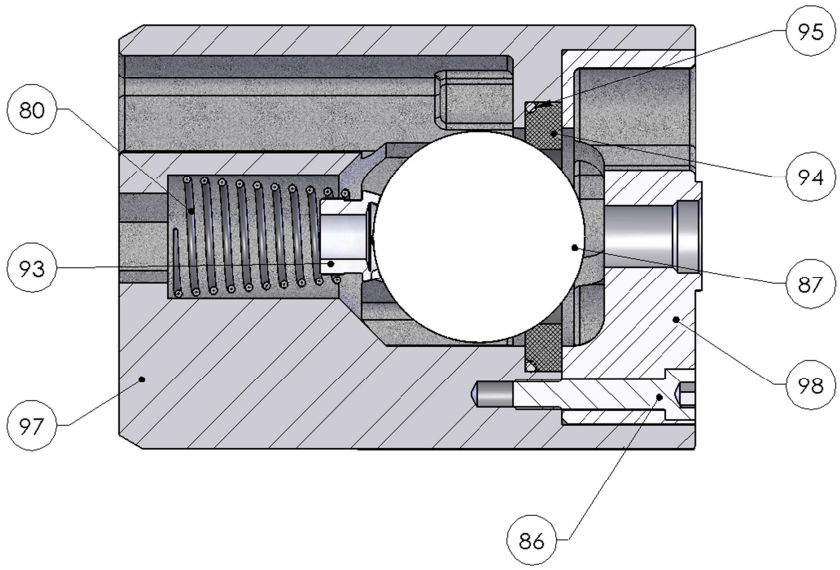
1. Screw 502382 assembly spigot onto the piston shaft (104).
2. Push seal (92) and bellows spacer (91) over the piston shaft.
3. Using tool 502377 push the bellows (90) over the assembly spigot until the bellows internal spigot locates into the shaft groove. (Using the tool prevents damage to the convolutions)



4. Smear a film of loctite 572 over the nose of the bellows then thread the nut (88) onto the bellows using tool 502377 to push against the nut ensuring the thread starts squarely. Grip the bellows and tighten the nut with a 1” A/F spanner until the nut contacts the bellows shoulder. Remove 502382 assembly spigot.

Fluid Section Assembly [2] – Piston Assembly

1. Insert spring (80) and spring keep (93) into piston
2. Place the ball (87) against spring keep.
3. Fit the ‘O’ ring (95) and inlet seat (94) into piston (97).
4. Fit piston keep plate (98) and assemble with 5 off screws (86) use Loctite 222 on the threads, tighten evenly to 8Nm.



Maintenance – Section 6.1 - Assembly Procedure

Fluid Section Assembly

1. Place a shaft / bellows sub-assembly into the pocket on the back of the inlet cylinder (99). Hold in position and loosely assemble with 4off screws (81) use Loctite 222 on the threads.
2. Lightly lubricate with suitable grease a piston seal (102) and push the seal onto the piston sub-assembly with the seal lip facing away from the shaft end of the piston. (see drawing)
3. Apply Loctite 243 to the piston shaft thread and loosely screw the piston sub-assembly onto the piston shaft. Locate the piston seal (102) into the inlet cylinder (99) (this *will centralize the piston*). Hold the piston and prevent from turning with 14 mm Allen key, tighten the piston onto the shaft with 16mm spanner to 50Nm. Finally tighten 4 off screws (81) to 12Nm.
4. Locate the outlet cylinder (100) over the piston seal until there is a small gap between the cylinders.
5. Lightly grease the thread of 4off screws (85) and assemble with 4off washers (84) to hold the cylinders together. Tighten screws in a ‘criss cross’ fashion to 50Nm.
6. Fit o-ring seals (96) to outlet check (101) and outlet cylinder (100).
7. Place ball (89) and seat (103) into the outlet check (101)
8. Grease threads of 4 off screws (82) and with washers (83) fit outlet check to cylinder. Tighten evenly to 12Nm.

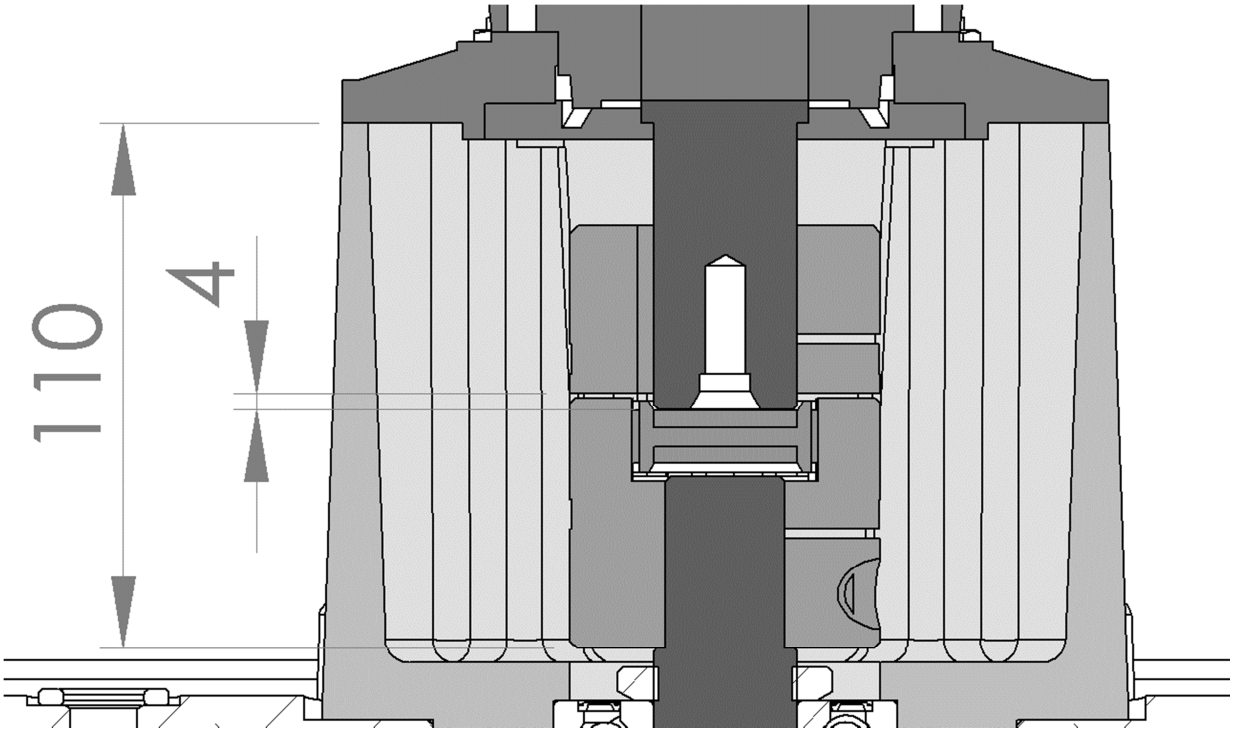
Assemble Fluid Sections to Main Drive Assembly

1. Hold a fluid section assembly and feed the piston shaft through the side of the mechanical section, locate the bellows spacer into the counterbore in the casting. Lightly grease thread of 4off screws (85) and with 4off washers (84) fasten the cylinders to the side plate. Tighten all screws to 25Nm in ‘criss cross’ fashion and then to 50Nm
2. Pull the piston shaft until the shaft and the carriage adaptor are touching. Fit the quick release shaft clamp (28) and tighten to 12Nm

Maintenance – Section 6.1 – Assembly Procedure

Final Assembly

1. Brush anti-fretting grease onto the gearbox shaft and key. Slide a coupling half over the gearbox shaft and key until the end of the shaft is exposed from the coupling by 4 to 5 mm. Apply Loctite 222 and tighten the screw to 22Nm. Fit the plastic spider into the coupling half.



2. Using suitable lifting equipment, lower the motor / gearbox assembly onto the pump assembly, ensure that the spider correctly locates into each coupling half. Fit the 4 off M8 nuts (125), and washers (130) (128), tighten to 22Nm.
3. Fit inlet manifold (138) to the pump with 1 1/2” sanitary clamps (133) and seals (134) to the orientation required.
4. Fit outlet manifold (139) to the pump with 1 1/2” sanitary clamps (133) and seals (134) to the orientation required.
5. Fit the covers (137) over the cover spacer and secure with M8 Security *TORX* screws (127) and nylon washers (135)

Maintenance – Section 6.2 - General

The working life and thus the expected life prior to replacement of parts within a Paint Pump are greatly affected by three main factors: -

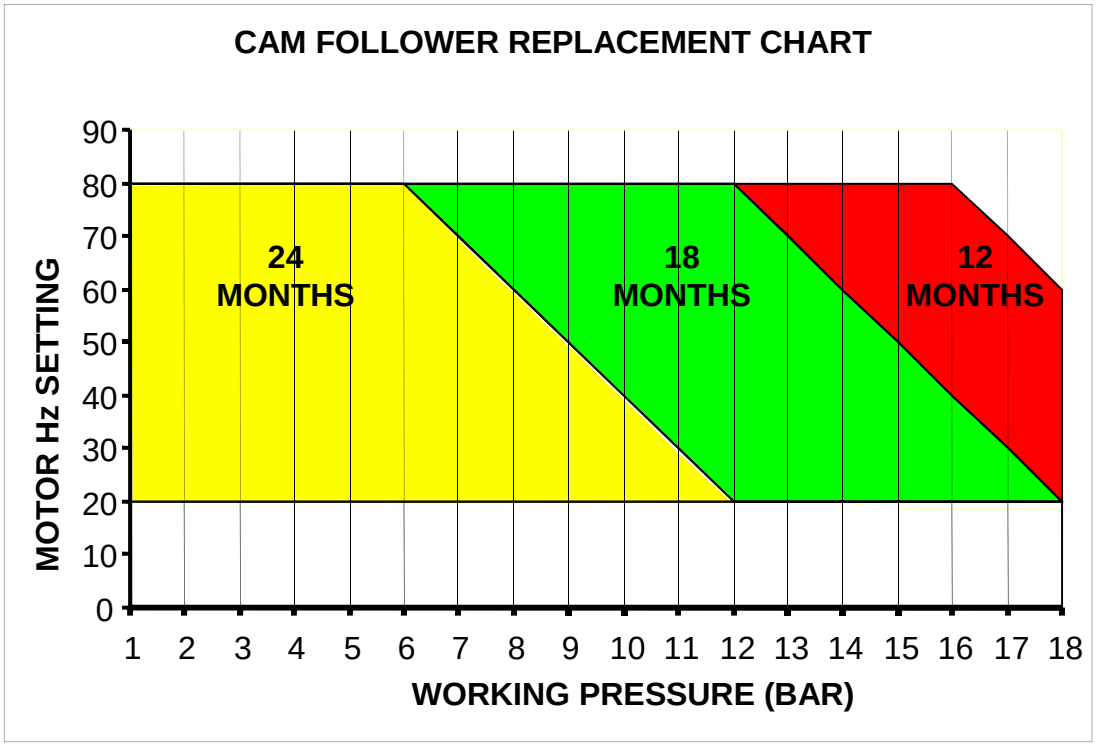
- Abrasiveness of Fluid Pumped
- Pump Duty Cycle
- Fluid Pressure Output requirement

The two components which are more greatly affected by the above criteria than any other components in the pump are: The Main piston Seal and the Cam Follower ; it is therefore recommended that these two items are stocked as spare parts in addition to the recommended spare parts kits.

A useful design feature of the Pump is that only one side of the Cam is under load during operation (Pushing the cam Follower); therefore the life of this component is doubled by reversing the position of the cam on the shaft when excessive wear has taken place.

It is also a requirement of the E.U. ATEX directive (Use of Equipment in Potentially Explosive Atmospheres) that any Bearings should be replaced when they have reached 90% of their calculated operational life. The following chart is included as a helpful guide, as the working life of the Cam Follower bearings used in the Pump is greatly dependant upon the Duty Cycle and Fluid Pressure Output Requirement.

Before any maintenance always switch off the pump and secure against any unintentional start up.



Maintenance – Section 6.2 - General

Maintenance Schedule	
Inspection	**Operation**
Daily	Check for any fluid leakage.
Weekly	Check for any excessive mechanical noise Check for excessive fluid pressure pulsation
3 Monthly	Grease Cam Follower Bearings (2 off) with 502375 grease. while the pump is running. Inject about 8 full strokes from a standard grease gun fitted with a standard collet connector.
6 Monthly	Grease Main Shaft Bearing with 502375 grease Check Gearbox Oil Level. Inspect Linear Bearings (68), Rod (44), Cam (33) and Cam followers (60) for excessive wear, replace if excessive wear can be felt or seen.
Annually	Inspect Piston (97) and replace if damaged. Replace Piston Seals (102), Bellows (90) & Springs (80). Inspect Piston & Outlet Ball Checks, replace as necessary. Replace gearbox oil (per ATEX regulations)
Every 5 Years	Replace main shaft bearings. Linear Guide Bearings, Guide Rails and Cams if excessive wear can be seen.
Use only 502375 (KP2N-20 DIN 51825) Grease for Cam Follower Bearing.	

Maintenance –Section 6.2 - Initial Run Period

Following approximately 1 month running of the pump remove the cover and grease all bearings. Remove any excess grease and any dust particles present in the cam area, (Any particles present are from the cam follower tyre, this is a normal function of the bearing ‘bedding in’ with the cam surface).

Maintenance – Section 6.3 – Gearbox / Motor

Wait until the unit has cooled sufficiently after stopping and isolation.

Gearbox

Every 1000 hours verify the good condition of oil seals and gaskets.

Oil Plugs / Ventilator

Remove the ventilator plug prior to removing level and/or drain plug.
The gearbox is supplied factory fitted with (see chapter 1.3) oil, only 'top up' with the same type of oil and never overfill as this may cause overheating and leakage. Check the ventilator is clean and fitted correctly.
If changing the oil place a suitable container underneath the plug for draining.
Note: It is recommended that the oil should be warm (40-50º C) to facilitate easier draining.
After filling with fresh oil refit the ventilator, level and/or drain plugs and clean up any oil spillage. *Not applicable for sealed for life units.*

Lubrication

Check the oil level every 3,000 hours or 6 months top up if applicable.
Replace gearbox oil as per Gearbox manufacturer's instructions (ATEX regulations).
Never mix different oil types.

Electric Motors

Maintenance of Ex Motors - are reported by EN 60079-17 standard, in particular:-

-The electric connections must be correctly locked to avoid resistance-increases, with consequent contact overheating.
- The insulation air-distance and the surface-distance between conductors, required by the standards, must be respected.
- All the screws, used to assemble the parts of the motors and of the terminal box, must be completely tightened.
- The replacement of seals and of components for cable entrance would be made using spare parts, supplied from the manufacturer, in order to guarantee the original type of protection.
- The Ex joint surfaces have not to be machined and it is not allowed to insert, between them, any kind of seals, not foreseen or supplied from the manufacturer. The join surfaces have just to be cleaned and, in order to avoid corrosion or water entrance.

Repair procedures of the Ex motors - are reported by IEC 79-19 standard.
When it is not possible to make the repairs of Ex motors at the manufacturer's plant, the outside workshops, deputed to this task, must be endowed by the necessary capability, including:
- Sufficient technical knowledge of these motors.
- Factory equipment with tooling and facilities, suitable to make repairs.
- Quality control department, for the checks and the tests, requested after repairs.
- For the Ex motors the repairs of parts, directly involved on the protection against the explosion risk, must be done without any modification to the original motor design.

Fault Finding – Section 6.4

Symptom	Possible Cause	Remedy
Mechanics		
Gearbox Output shaft does not rotate, even though the motor is running.	Drive between shafts in the gear unit interrupted	Return the unit for repair and replace gearbox
Gearbox Oil leaking • from the gear unit cover • from the motor flange • from the gear unit flange • from the output oil seal	a) Defective gasket on gear unit cover. b) Defective gasket. c) Gear unit not ventilated.	a) Retighten screws on gear unit cover. b) Return gearbox c) Check vent is clean/fitted and not the transportation plug
Gearbox Oil leaking from ventilator	a) Unit Overfilled with oil.	Check and correct the oil level
Cam Followers bearing generating heat / noise	Bearing needs lubrication	Grease bearing or replace if damage is too great
Carriage does not maintain contact with cam	a) Spring tension insufficient b) Fluid seal friction or piston movement prevented	Check and replace springs Check fluid section
Noisy Changeover	Coupling spider worn	Replace green spider coupling
Fluid Section		
Pump will not 'Prime'	a) Air entering the suction hose/manifold b) Worn piston seals c) Ball checks not seating correctly	a) Check o-rings and hose connections b) Replace piston seals c) Inspect, clean/replace balls/seats
Pump will not run	a) No power b) Inverter Unit or safety interlocks 'tripped'	a) Check electrical supply b) Check inverter and fault conditions
Pump runs but lack of pressure	a) Worn piston seals b) Ball checks not seating correctly	a) Replace piston seals b) Inspect, clean/replace balls/seats
Paint leaking from inside cover	Bellows seal failure	Replace bellows seal Check Piston seal, replace as necessary
Excessive Pressure Pulsation	a) Ball checks not seating correctly b) Main shaft bearings worn c) Cam follower worn	a) Inspect, clean/replace balls/seats b) Replace bearings c) Replace bearings

Testing and Lubricating – Section 6.5

Testing and Lubrication (Qualified personnel only)

1. Connect pump to paint system.
2. Connect electric motor to a suitable electrical supply.
3. Fit the gearbox vent plug.
4. Turn on paint system and set back pressure regulator to zero.
5. Turn the pump on at the local isolation mounted switch. (Important – Never allow the pump to run with a closed ('valved off') inlet or outlet connection)
6. Allow the pump to run for about 10 minutes between 60 to 80Hz to ensure any trapped air is correctly vented. Check for any leaks and mechanical noises.
7. While running apply *(502375)* grease to cam follower bearings, 8 strokes of a standard 'cartridge' grease gun (502373).
8. While running apply *(502375)* grease to main shaft bearing (40 strokes of a grease gun on a new bearing and 6 pumps on a bearing in current use)
9. Run the pump at 20 cycles/min (50 HZ) and increase the back pressure to 10 Bar and run for 1 hour. Check for any leaks and mechanical noises.

Fluid Drain Down

Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.

1. Stop the pump (turn off the electric motor); isolate the paint supply and place a suitable container underneath the hose to prevent spillage.
2. Disconnect the outlet hose and position securely into a suitable container.
3. Start the pump and run at slow speed (20Hz) for 1 minute. The pump will now have most of the paint removed; however, some material will remain within the fluid cylinders and manifolds.
4. If required to finally remove any paint from the pump, place the supply hose in a compatible solvent and run the pump until sufficiently clean.

Spare Parts List - Section 7.1

Recommended Spare Parts and Kits for E2-15 Pumps			
Kit No.	**Part No.**	**Description**	**Remarks**
#	192850	Constant Velocity Cam	(33)
#	192822	Ø70 Piston.	(97)
#	192392	Cam Follower Bearing	(60)
#	192871	Linear Bearing	(68)
#	192579	Bellows (fluid section)	(90)
❶	250625	Fluid Piston Seal Kit	
❷	250641	Wet section overhaul Kit	
❸	250642	Main Bearing Overhaul Kit	

Check Main Parts List for details of individual Kit Contents

Accessories - Section 8.1

Accessories / Maintenance		
Part No.	**Description**	**Remarks**
192800	Smart Card	V3.0
502371	Local Isolation Box	
502483	Electrical Panel for Single Pump Operation	Inc Smart Card
502144	Pressure Switch	
192720	Sensor Manifold	
192547	Pressure Sensor (4-20 mA / 0-25 Bar)	Pressure feedback
502373	Grease Gun for Cam Follower (& Main Bearings)	Collet Connector
502375	Grease for Cam Follower (& Main Bearings)	
192206	1” Sanitary Gasket	
192009	1” Sanitary Clamp	

Special Assembly Tools Required		
Part No.	**Description of Use**	**Remarks**
192450	M8 Torx Security Screwdriver for Cover	FOC with a New Pump
193119	Top Bearing Locknut Tool	
193120	Bottom Bearing Locknut Tool	
193121	Top Bearing Press Tool	
193122	Bottom Bearing Press Tool	
502377	Bellows Assembly Tool	
502382	Bellows Assembly Spigot	

Justus-von-Liebig-Straße 31, 63128 Dietzenbach. DE
Tel. +49 (0) 6074 403 1 Fax. +49 (0) 607 403 300
General e-mail: info@finishingbrands.eu

Ringwood Road, Bournemouth, Dorset BH11 9LH. UK
Tel. +44 (0)1202 571 111 Fax. +44 (0)1202 573 488
General e-mail: info@finishingbrands.eu

163-171, Av. des Auréats, 26014 Valence cedex. FR
Téléphone : +33 (0) 4 75 75 27 53 Télécopie: +33 (0) 4 75 75 27 79
General e-mail: info@finishingbrands.eu

USA Canada Customer Service
195 Internationale Blvd.
Glendale Height,IL 60139
630-237-5000

Toll Free Customer Service and
Technical Support 800-992-4657
Toll Free Facsimile 800-246-5732