Cell Disruptor
CF Operators Manual
Version 4

This Operating Manual Contains Important Safety Information
Read Thoroughly Before First Use.
Make Available To All Machine Operators.

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REVISION 04

1.0 INTRODUCTION

1.1 What is Cell Disruption?

Cell Disruptor Systems are designed to selectively break the cell wall allowing intracellular components to be released and harvested. This is particularly for use in Pharmaceutical and Biotechnology companies, Universities, Research Institutes and Agencies.

Cell Disruption is achieved through the use of high pressure to accelerate a sample through a small fixed orifice at high velocity under controlled, contained and repeatable conditions.

There are three stages to effective cell disruption:

1. The user loads the cell disruptor with the sample.

2. The High Pressure Piston then compresses the sample at a constant pressure, accelerating it through the small fixed orifice at high velocity. The acceleration of the product through this fixed orifice causes cell disruption.

3. When the jet of sample containing disrupted cells hits the target it is spread radially, then vertically down the cooled heat exchange surface of the cooler head. The sample is then passed from the outlet for collection by the user.

Cell Disruptors from Constant Systems incorporate the following features:

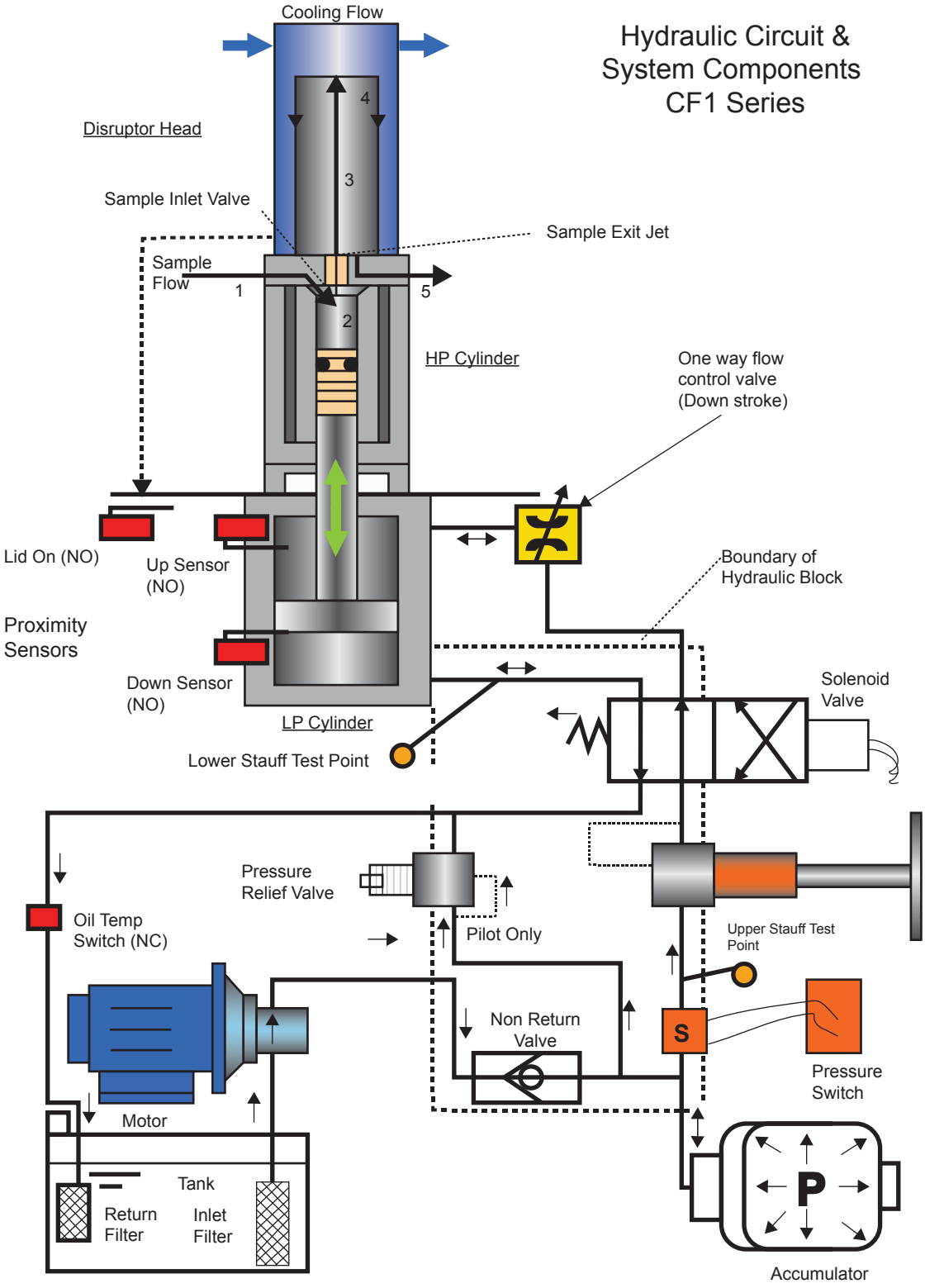
• Unique disruption head
• Cooling components and hydraulic operating and control components for high efficiency cell disruption
• Disruptor head mounted on a stainless steel tray to contain spillages
• Flow rates can be matched to your process requirements from the power rating and the maximum pressure variant purchased
• The disruption pressure is consistent and stable during the disruption cycle
• The machine design offers partial containment and a simple, externally controlled, cleaning in place (CIP) system.
• An internal relief valve is fitted for reverse flow of cleaning liquids.

NOTE: You will need to re-seat the quad O-ring (BOF1304, see page 53)

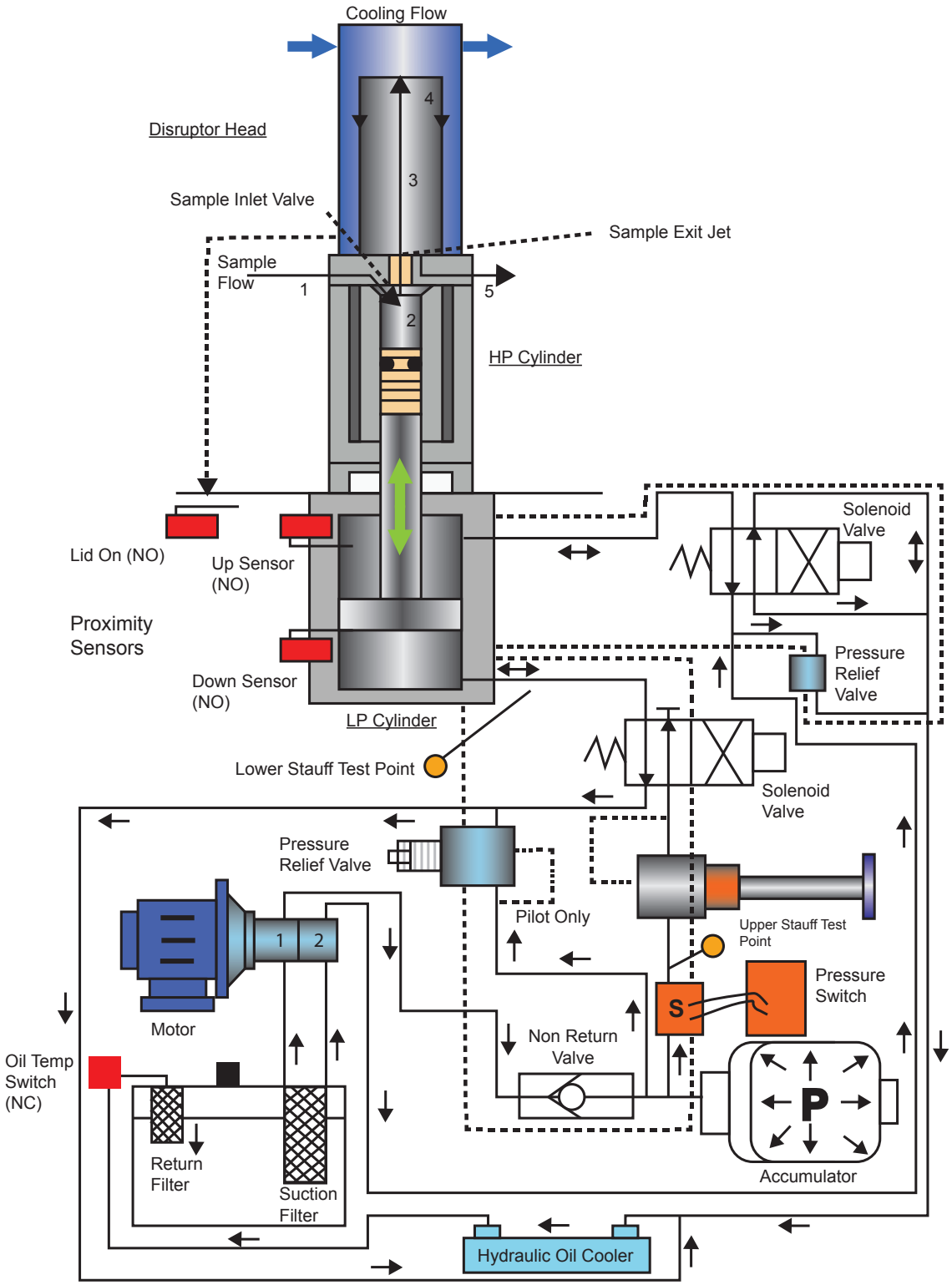
2.0 HYDRAULICS

The hydraulic circuit is shown in the following diagram. Oil is stored in the oil tank and is pumped by a gear pump around the circuit. The pump charges the accumulator until the pressure switch initiates the disruption cycle outlined above. A pressure reducing valve is adjusted as required by the operator this controls the actual disruption pressure. The PLC manages the process by receiving signals from sensors in the machine indicating the position of the operating piston, and the state of the reservoir etc.

2.1 Hydraulic Circuit & System Components CF1 Series



2.2 Hydraulic Circuit & System Components CF2 Series



3.0 SAFETY FEATURES

The volume of high pressure fluid is restricted to the capacity of a single stroke:

Maximum pressure	Cylinder Diameter	Process Volume
40 KPSI / 2720 BAR	18mm	10mL

Any failure of an associated high pressure part, e.g. HP seal or HP cylinder, is contained within a secondary structure so that HP fluid pressure is relieved back either to the LP inlet, the LP outlet of the machine, or the HP seal vent.

If, for whatever reason, the outlet pathway from the Disruptor Head becomes blocked, the possibility that the outlet system could become pressurized to the working pressure of the disruptor is prevented by a relief valve installed in the disruption jet housing. This valve operates if the outlet pressure exceeds ~15 psi (1.1bar). This valve reseats on removal of the pressure, and so it may be used to great effect for sterilization and cleaning in place (CIP) procedures.

It is essential that the free operation of this component be verified each time the cooling head is re- assembled to the machine.

The electric motor is fitted with a manual reset overload trip.
The “E-STOP” button stops the machine from operating and disconnects the supply voltage to the motor.
The supply to and from the power supply unit is still energized.

The system is also fitted with a disruption inhibit switch and sensor. The inhibit control circuit is activated when the disruption head is removed from the system, to prevent machine operation. The function is also to prevent machine operation if the disruption head is incorrectly assembled.

IT IS POTENTIALLY FATAL TO DEFEAT THE DISRUPT INHIBIT SWITCH AND OPERATE THE MACHINE WITH THE HEAD REMOVED.

4.0 USING THIS MANUAL

Before proceeding with installation, please take time to read the information contained in this manual. It contains important safety, operational and maintenance information to help ensure that you get the best performance and long life from the machine.

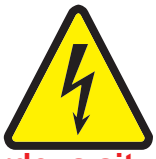
Users are required to formally assess any and all risks associated with the processing of any sample materials prior to commencing work and are responsible for their own safety in this respect.

5.0 ALERTS

In accord with common practice, three types of alert are used in this document:

- Warning (failure to observe could cause death or injury)
- Caution (failure to observe could cause damage to the equipment or process)
- Note (hint about how to make the work easier etc.)

Each alert declares which type it is.



WARNING – Indicates a potentially hazardous situation, risk of electric shock, which if not avoided could result in death or serious injury (Front panel & Back panel)

WARNING – Indicates a potentially hazardous situation, in this case a biohazard, which if not avoided could result in death or serious injury (Disruption Head)

WARNING – Surface temperature could rise to a potentially hazardous situation (Disruption Head)

WARNING – Potential hazard of fire or combustion (Oil Tank)

WARNING – Indicates a potentially hazardous situation, which if not avoided may result in minor or moderate injury (Control Box)

6.0 SAFETY CONSIDERATIONS

Various safety warning signs are attached to the machine. You should consult this document to read about the hazard in question.

WARNING – Be aware that power should be switched off when dismantling parts of the disruption head for maintenance (cleaning). Instructions to switch on the machine and later off again where this is necessary are included in the text.

CAUTION - If any work which involves dismantling any of the disruption head is to be done on the machine, the electrical supply must be isolated from the mains supply.

WARNING - If the equipment is used in a manner not specified by the manufacturer, the Protection provided by the equipment may be impaired.

CAUTION - The loading and unloading of product into and from the machine is the responsibility of the user and the user is responsible for any controls which may be required to ensure that this loading and unloading is done safely and without undue risk to the health and safety of the user and/or other persons and/or the environment.

CAUTION – This equipment is provided with a detachable mains power cord set must be replaced with the same type of cable and cord set.

WARNING – Care must be taken when running the disruptor for long periods as the high pressure cylinder assembly and hydraulic oil can get very hot.

7.0 INSTALLATION

7.1 Environment

The machine is suitable only for indoor use in a clean, dry, dust and smoke free environment between 4°C and +40°C, at an altitude up to 2000M with maximum relative humidity of 80% up to +31°C decreasing linearly to 50% at +40°C.

7.2 Location

WARNING – Do not locate the equipment in any way that makes it difficult to access the power outlet utilised by the equipment.

The Cell Disruptor must be set on a flat and level surface, positioned to allow access to the cable entry and a minimum space of 150mm each side for ventilation.

All models incorporate over temperature protection within the machine.

7.3 Lifting Equipment

Suitable lifting equipment must be used when moving the Cell disruptor.

7.4 Single Phase (1~)

Warning – Installation of the electrical wiring must be carried out only by a competent person who is trained to the local and national standards.

Single Phase equipment is provided with a moulded cord set appropriate for the destination Country's mains supply.

USA and CANADA ONLY Single Phase 110V 60Hz

All CF1 models CF1/BA (see rating plate on rear of machine) are supplied with a power cable.

EUROPE / REST OF THE WORLD Single Phase 230V 50Hz

All CF1 models CF1/AA (Europe) (see rating plate on rear of machine) are supplied with a power cable.

7.5 Three Phase (3~)

USA & Canada Only (CF1 & CF2)

Three phase machines are not supplied with a fitted power cable.

The incoming three phase supply cable shall be connected by a qualified person to points L1, L2 and L3 on the main terminal block located in the enclosure on the rear of the machine.

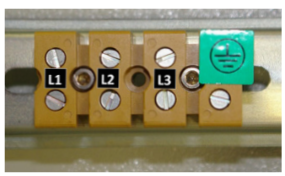
The main protective earth/ground cable must be left at a length of 1.5 – 2 inches longer than the 3~ connections and be connected to the main terminal block marked with the symbol shown here.

For model code CF1/EE (see rating plate on rear of machine)

The machine shall be isolated by a lockable 3 pole isolator capable of switching 20 Amps which must be located as close to the equipment as possible according to local codes and regulations. Each supply phase shall be fused at 10 Amp (ref. LP-CC-10 (600V)-Bussmann or equivalent).

A plug/socket combination should not be used and the installation carried out according to local codes and regulations. Suggested cable type is: SJT, 16 AWG, 4 core.

The motor overload setting is 5 Amps.



For model code CF2/EC (see rating plate on rear of machine)

The machine shall be isolated by a lockable 3 pole isolator capable of switching 32 Amps which must be located as close to the equipment as possible according to local codes and regulations. Each supply phase shall be fused at 20 Amp (ref. LP-CC-20 (600V)-Bussmann or equivalent).

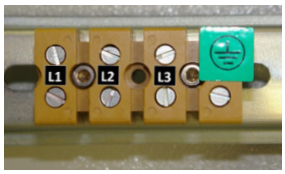
A plug/socket combination should not be used and the installation carried out according to local codes and regulations. Suggested cable type is: SJT, 12 AWG, 4 core.

The motor overload setting is 17.7 Amps.

For models code CF2/DC (See rating plate on rear of machine).

CF2/DC (see rating plate on rear of machine) The machine will be fitted with 5 core cable 1.5mm2 5 pin plug fused at 15A or directly into a switch fused at 15A, or 10A MCB located as close to the equipment as possible.

Note: The main protective earth cable must be left at a length of 1.5 – 2 inches (37.5mm – 50mm) longer than the three phase connections and be connected to the main terminal block marked with the symbol as shown in the illustration earlier in this section.



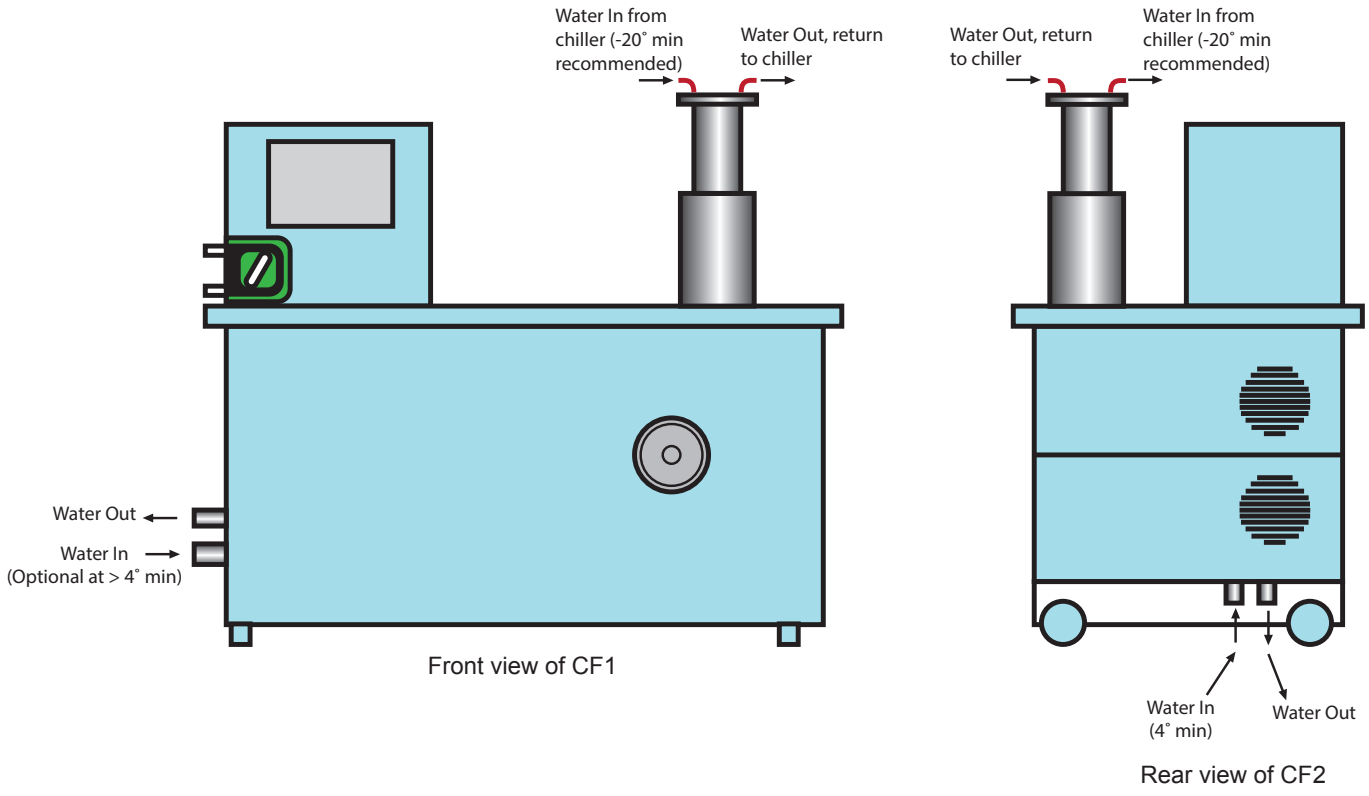
7.6 Cooling Fluids

Any suitable cooling fluid ranging from tap water to chilled water, glycol, ethanol or isopropanol may be used.

When fitted, the standard cooling flow and return hose tails should be connected by 12.7mm diameter (12.7 mm ID.) flexible tubing suitable to withstand the cooling fluid pressure (not to exceed 100psi (7 bar) max). The hose-tail connections in the top of the Disruptor Head can be replaced by other suitable connections as required by the end user. The holes for these connections have a ¼" BSP parallel thread. Cooling fluids suitable for use below 0°C may be used, but cooling fluids must not be allowed to solidify in the cooling head. The user may find valves or quick connectors useful to isolate the cooling head for maintenance of disruptor head components.

If no cooling fluid is used, the temperature of the disruption head parts will rise. This may cause the product to be degraded.

WARNING - If allowed to continue unchecked for long periods, the high surface temperature of the disruption head could be a hazard to the operator.
Note! Cooling fluids below 4°C must not be connected to the oil cooler, if fitted.



8.0 VAPOUR & PRODUCT CONTAINMENT

The liberation of vapor and product into the atmosphere is prevented by internal sealing arrangements illustrated. (See DRG927 Page53)
Nonetheless, venting may be required to prevent build- up of pressure.

There is one seal which is subjected to high pressure and for the sample to pass from the cylinder to the disruption chamber successfully, this seal must not leak. In the event of the seal leaking, the sample could be seen coming from the leak port shown as A (See DRG927 Page53)
(The 12 O'clock position when viewed from the front of the machine).

WARNING – If the sample is pathogenic, any vapour released must be contained and directed to a kill tank.

In the event of sample passing via leak port B, call a service technician. (The 10 O'clock position when viewed from the front of the machine).

It is recommended that the HP seal drain (the higher 1/8" BSP port located at the rear/lower end of the disruptor body, Port A, (See DRG927 Page53) is connected to a vented collection tank so that in the event of a HP seal failure any flow from this point is contained. If containment is required, this tank should be vented via a bio- filter and can be in the form of a kill tank.

Basic containment of the sample is provided by the design of the disruption head. The user should themselves ensure that the containment of vapour is adequate for the intended application. Under certain operating conditions, vapours of the disrupted material can exit from the product outlet. If this could be harmful to health, a suitable catchment device (e.g. condenser or particle filter) must be fitted at the outlet.

WARNING - Under certain operating conditions, a vapour of the disrupted material can exit from the product outlet. If this could be harmful to health, a suitable catchment device (e.g. condenser or particle filter) must be fitted at the outlet. Inlet pressure is not to exceed 100 psi (7 Bar).

WARNING - It is important that an operator is aware of the situation, in this case a biohazard, that occurs during LOADING of the sample and UNLOADING the processed sample as this is entirely under the control of the operator and consideration must be given to any precautions that might be necessary during these operations relative to the product being processed.

9.0 SPECIFICATIONS

COOLING	Built in cooling facility ensures that sample temperature can be controlled.	
CLEANING	Various levels available: simple clean-in-place (CIP) by running with water and disinfectant or using internal relief valve for reverse flow of cleaning fluid; taking apart, cleaning and/or autoclaving individual components.	
CONTROL	Pressure control allows pressure to be accurately pre-set before starting cycle. Touch screen control of disruption cycle. Automatic shut down when processing complete.	
MONITORING	Visual display of Cycle Finished, Jet status and Disruption Pressure.	
SAFETY	Disruption cycle is inactivated if the head is assembled incorrectly. Secondary pressure containment, so no high pressure leakage to atmosphere. CE/ETL marked and supplied with Certificate of conformity.	
MAINTENANCE	Jet, HP Seal and Target are easily changed by non-technical personnel with tools supplied.	
MATERIAL	316,316L and F51 or equivalent, EPDM rubber O-Ring, GFPTFE sliding seal and 450G PEEK (High Pressure Seal).	
POWER REQUIRED	See rating plate on rear of machine.	
SUPPLIED WITH	Outlet option A: Fixed ½" (12mm) inside diameter hose. Operating and maintenance manual. One set of consumable spares in Toolkit.	
EXTRA OPTIONS	One Shot Head Adaptor, Stainless steel trolley for Bench Top, Peristaltic Pump (Process Pump).	
HYDRAULIC OIL IS0 32	Store under cover away from heat and a source of ignition. Wear gloves and eye protection when handling or filling oil tank. Ensure no oil spills onto electrical equipment. Clean up any other spills immediately.	
SPARES	All components should be supplied by CSL and their authorised agents only.	
SIZE (W,D,H)	CF1 = W: 700mm, D: 605mm, H: 740mm, Weight: 130Kgs	CF2 = W: 700mm, D: 650mm, H: 1,290mm, Weight: 290Kgs
FUSES	User replacements - 10amp in the machine plug socket and 13amp in the mains plug. (CF1)	

SPECIFICATIONS - CONTINUED

FLOW RATE: Depends on power rating and maximum pressure rating.

	MAX PRESSURE RATING PSI/BAR
Power Rating	**40KPSI (2720 Bar)**
CF1 0.75KW (USA ONLY)	40mL / min (2.4L/hr.)
CF1 1.1KW	100mL / min (6L.hr.)
CF2 4KW	405mL / min (24L.hr.)

EXTRA OPTIONS

- One Shot Head Adaptor.
- Stainless steel trolley.
- Peristaltic Pump (Process Pump).

SPARES

All components should be supplied by Constant Systems Ltd and their authorized agents only.

10.0 GLOSSARY OF TERMS

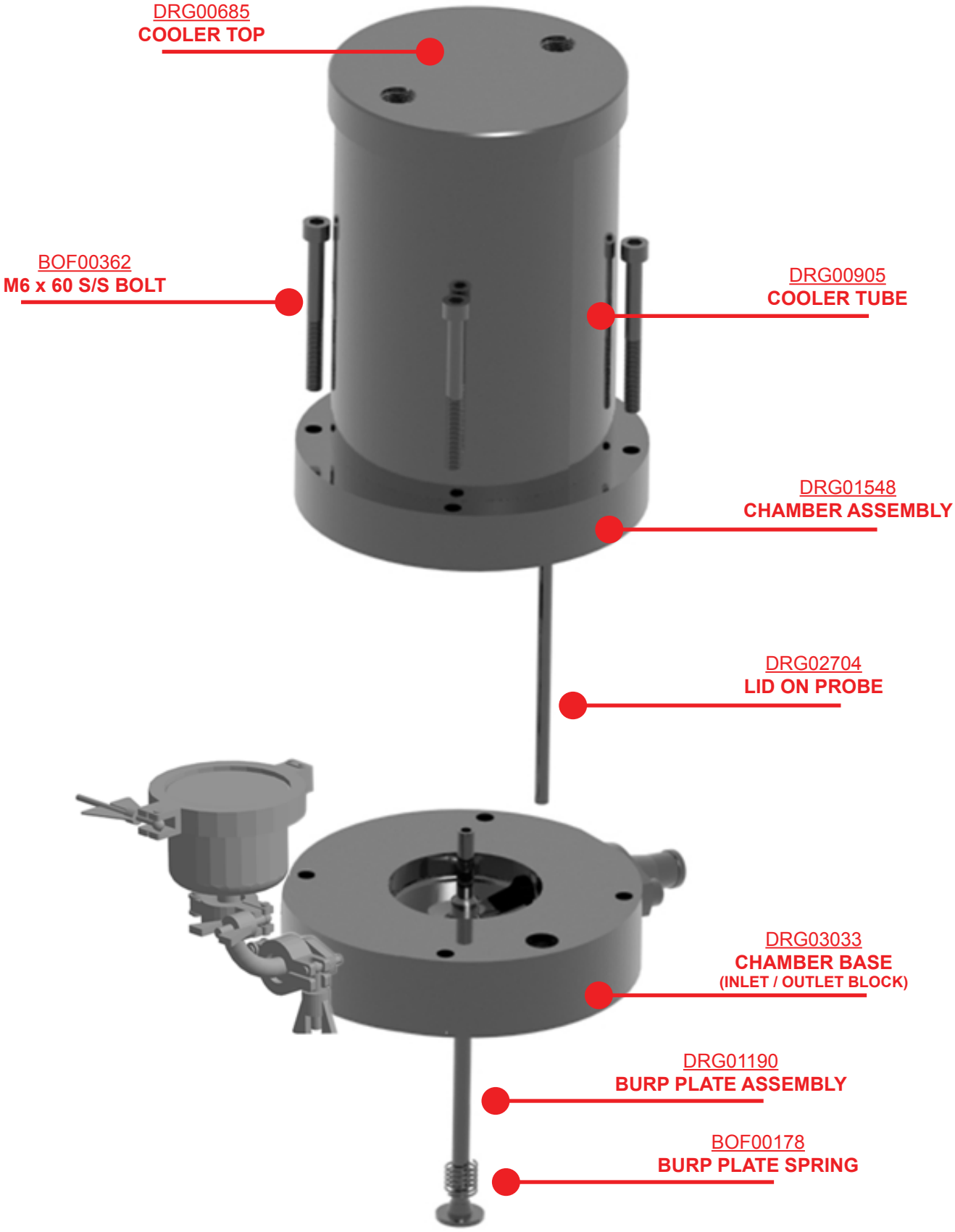
Vapour	The part of the disrupted product that is in the form of gas.
Autoclaving	The process of cleaning/sterilising by application of compressed steam at a temperature at approximately 150°C.
Body	The outer casing of the disruption assembly which must be in place when a disruption cycle is taking place.
Cup (One Shot Head Adaptor Only)	The container which collects the disrupted product.
Cycle	See Disruption Cycle.
Dead Loss	The term used in the industry to describe the remnant that is left unprocessed.
Disruption Cycle	The process which begins when the start button is pressed.
Disruption Pressure	The pressure at which the sample is forced through the jet. This pressure persists for only a fraction of a second in each disruption cycle.
HP Seal	High pressure seal which forms the bottom of the cavity which holds the sample. It is driven upwards during a disruption cycle by the piston.
Input Cavity	A cylindrical cavity formed by the inside surface of the cylinder and the HP Seal at the bottom.
Jet	A machined hole of 0.18 mm Ø in a stainless steel body.
Piston	The part which drives the HP Seal upwards to compress the sample during the disruption cycle.
Pressure	The word ‘pressure’ can have different meanings in this context. For operational use it is always qualified by the term ‘Disruption Pressure’.
Pressure Adjustment Knob	The circular knob on the front of the cabinet which adjusts the Disruption Pressure.
Probe	The rod which passes through the body and which is used to start a disruption cycle.
Down	The ‘DOWN’ button provides a means of moving the piston, under manual control, to the bottom of its travel, usually for maintenance.
Up	The ‘UP’ button provides a means of moving the piston, under manual control, to the top of its travel, usually for maintenance. The piston moves while the button is held pressed. It is used only when the HP Seal is visible.

11.0 MAIN PARTS OF THE MACHINE

11.1 Main Parts Of The Machine DRG921

DRG921

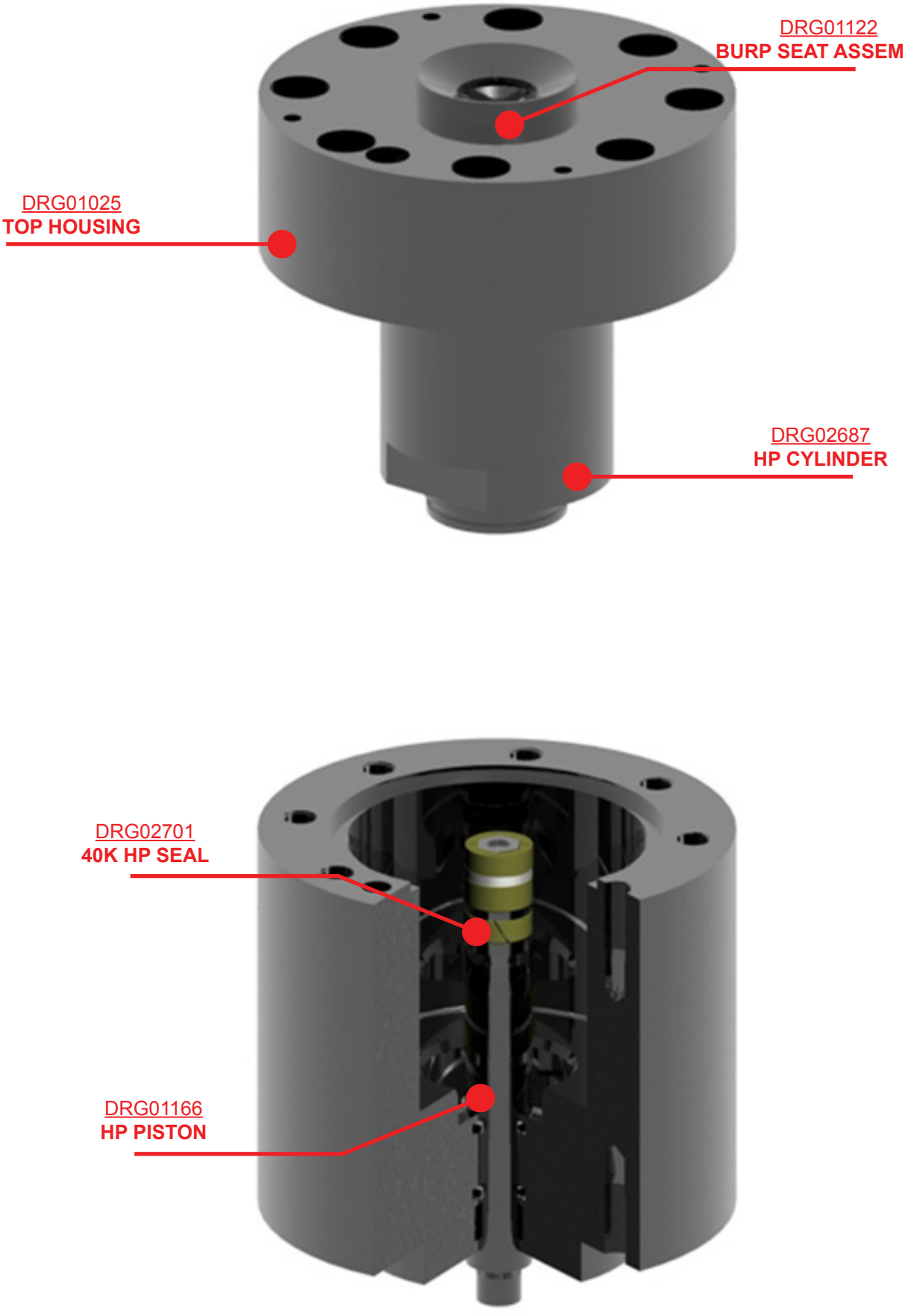
All CF (Continuous Flow) Models



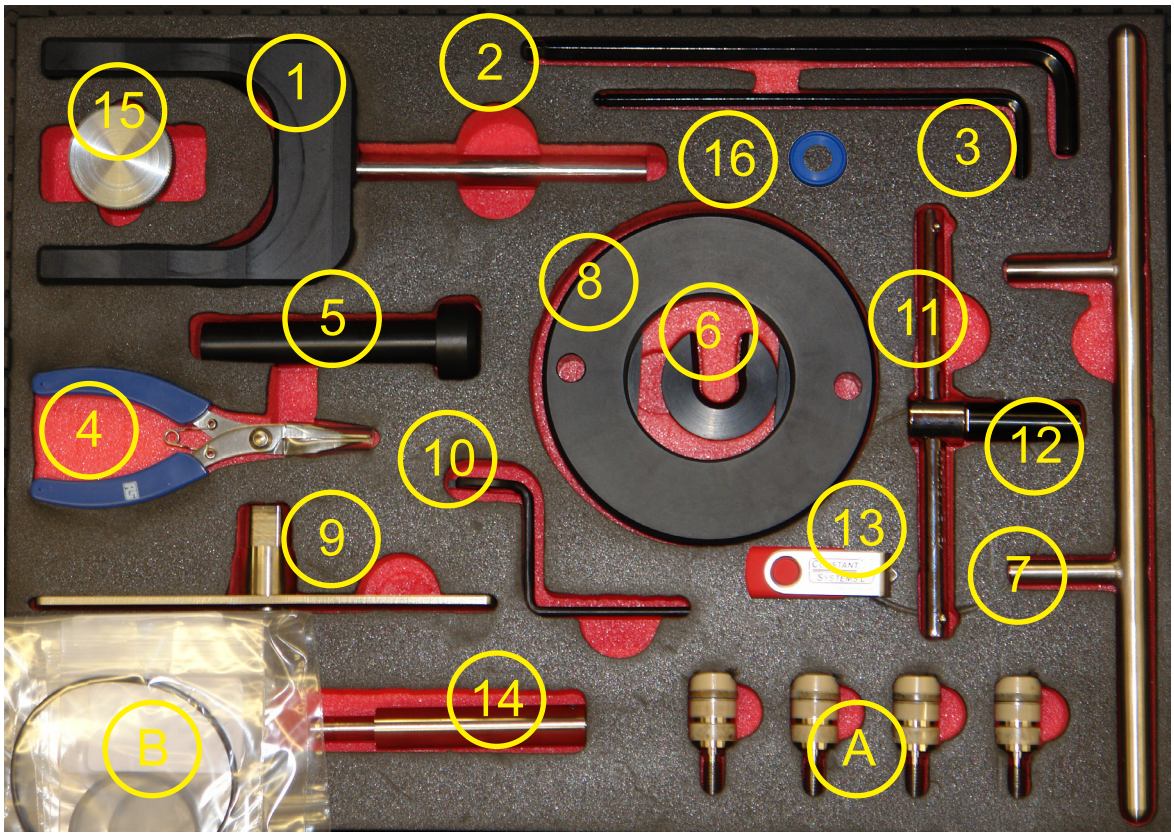
11.2 Main Parts Of The Machine DRG922

DRG922

All CF (Continuous Flow) Models



12.0 TOOLS AND SPARES FOR THE CF SERIES MACHINES



NOTE: REGARDING PARTS REPLACED UNDER WARRANTY.

Any parts replaced under warranty must be returned to Constant Systems Limited by the user/ distributor within a period of 30 days for examination.

Parts not returned within 30 days and/or parts identified by examination to be not a valid warranty claim will be invoiced to the user/distributor at the current list price.

12.1 Tool Kit

ITEM	DESCRIPTION	PART No.
1	Top Housing Lift Block	DRG02643
2	8mm Hexagon Wrench	BOF00662
3	5mm Hexagon Wrench	BOF00227
4	Jet Removal Pliers	BOF00153
5	Inlet Valve Removal Tool	DRG02680
6	Target Removal Tool	DRG02849
7	Lifting Bar	DRG01490
8	Cylinder Vice	DRG01307
9	Socket Weld Assembly	DRG02731
10	HP Piston Bent Spanner	DRG01313
11	3/8” Drive T-Bar	BOF00229
12	11mm A/F Socket	DRG02734
13	14mm A/F Flat Spanner	DRG01468
14	Manual (USB)	DRG03004
15	Pressure Adjust Spindle	DRG01699
16	Pressure Adjust Knob	DRG01338

12.2 Spares List

ITEMS IN BAG A, B & C	DESCRIPTION	PART No.
SPARE CONSUMABLE LIST:		
A	4 x 40KPSI HP Seal	DRG02701
B	Tri-Clover Seal	BOF01638
O-RINGS LIST:		
C	Top HP Cylinder Assembly O-Ring	BOF00079
C	Top Housing O-Ring (internal)	BOF00080
C	Top Housing O-Ring (Top)	BOF00086
C	Burp Valve Quad Ring	BOF01304
C	2 x Inlet Valve O-Ring	BOF00073
C	Jet Retainer O-Ring	BOF00221

13.0 HMI

Constant Systems Cell Disruptor Machines are fitted with electronic HMI panels. These instructions detail the navigation and operation of the operating system and the functionality of the embedded control screens.

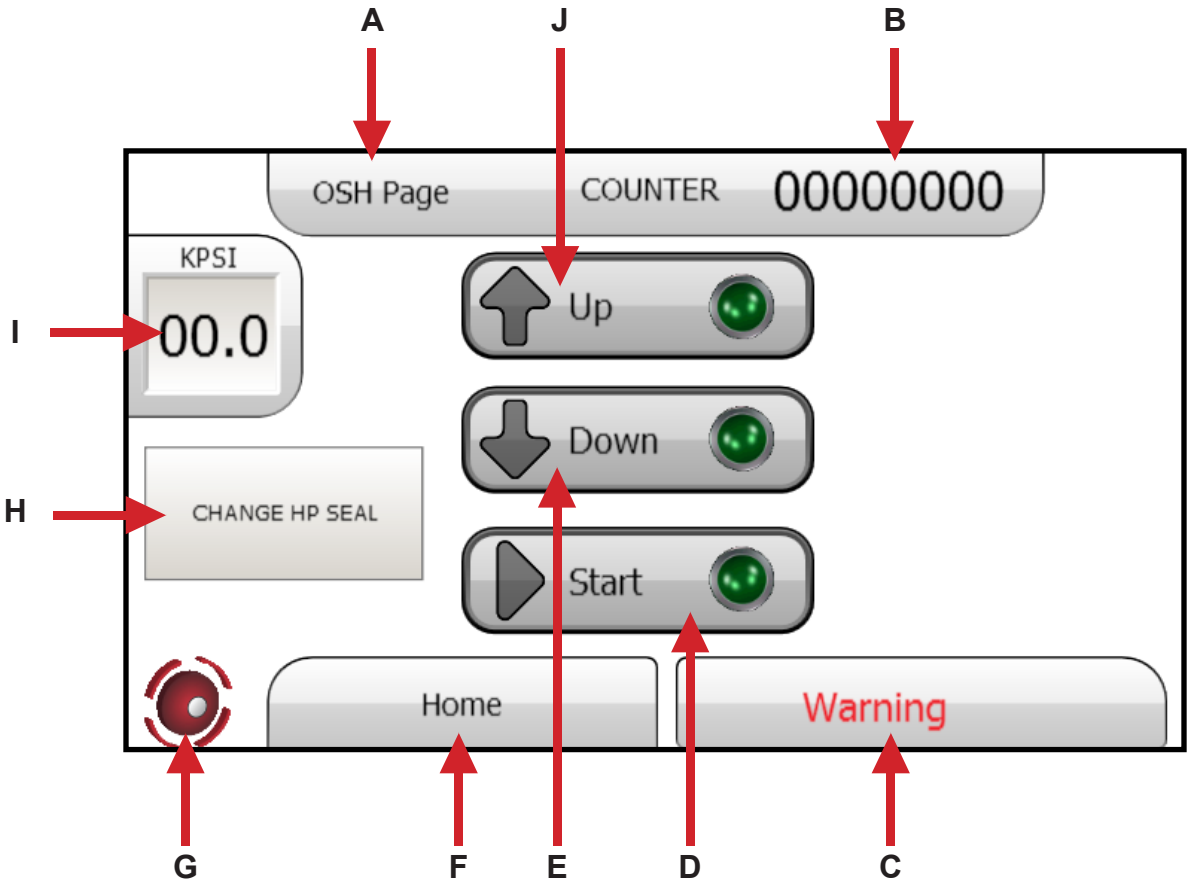
13.1 Main Menu

All operating system elements are accessed through the Main Menu Screen (Home).

From here you can navigate to all of the pages.

From the MAIN MENU page, press the ‘One Shot Head’ (optional extra) button, this action will navigate to the One Shot Head page, where the following information is displayed.

13.2 One Shot Head Page:



A. 40KPSI;
Indicates what unit of pressure the display shows.

B. MAIN COUNTER;
This will display the total number of strokes the machine has completed (This counter cannot be re-set).

C. INFORMATION INDICATOR;
During operation the information indicator may appear in the bottom right hand box.

These indicators are:

1) Jet blocked (See page 62).
2) Solenoid Jammed (See page 63).
3) Machine Temp High (See page 64).
4) Bottom Sensor (See page 65).
5) Main Relief (See page 66).
6) Top & Bottom Sensor (See page 67).
7) Low System Pressure (See page 68).
8) Cycle Finish.

These indicators appear when PLC detects certain pre-set parameters during operation.

D. START BUTTON;
Starts the machine.

E. DOWN BUTTON;
The operator can manually move the HP Psion down.

F. HOME BUTTON;
Navigates back to the main menu.

G. FAULT INDICATOR;
This will inform the operator that a fault has occurred, press the icon, this will then take the operator to the correct fault page with information.

H. CONSUMABLE CHANGE INDICATOR;
Informs the operator when a consumable item has reached its recommended life span (I.e. HP Seal Change).

I. KPSI PRESSURE DISPLAY;
Displays the pressure set by the operator, it also allows the operator to switch between pressures.

I. KPSI – Thousands of PSI.
II. KBAR – Thousands of BAR.
III. MPa – Mega pascal.

J. UP BUTTON;
The operator can manually move the HP Piston up.

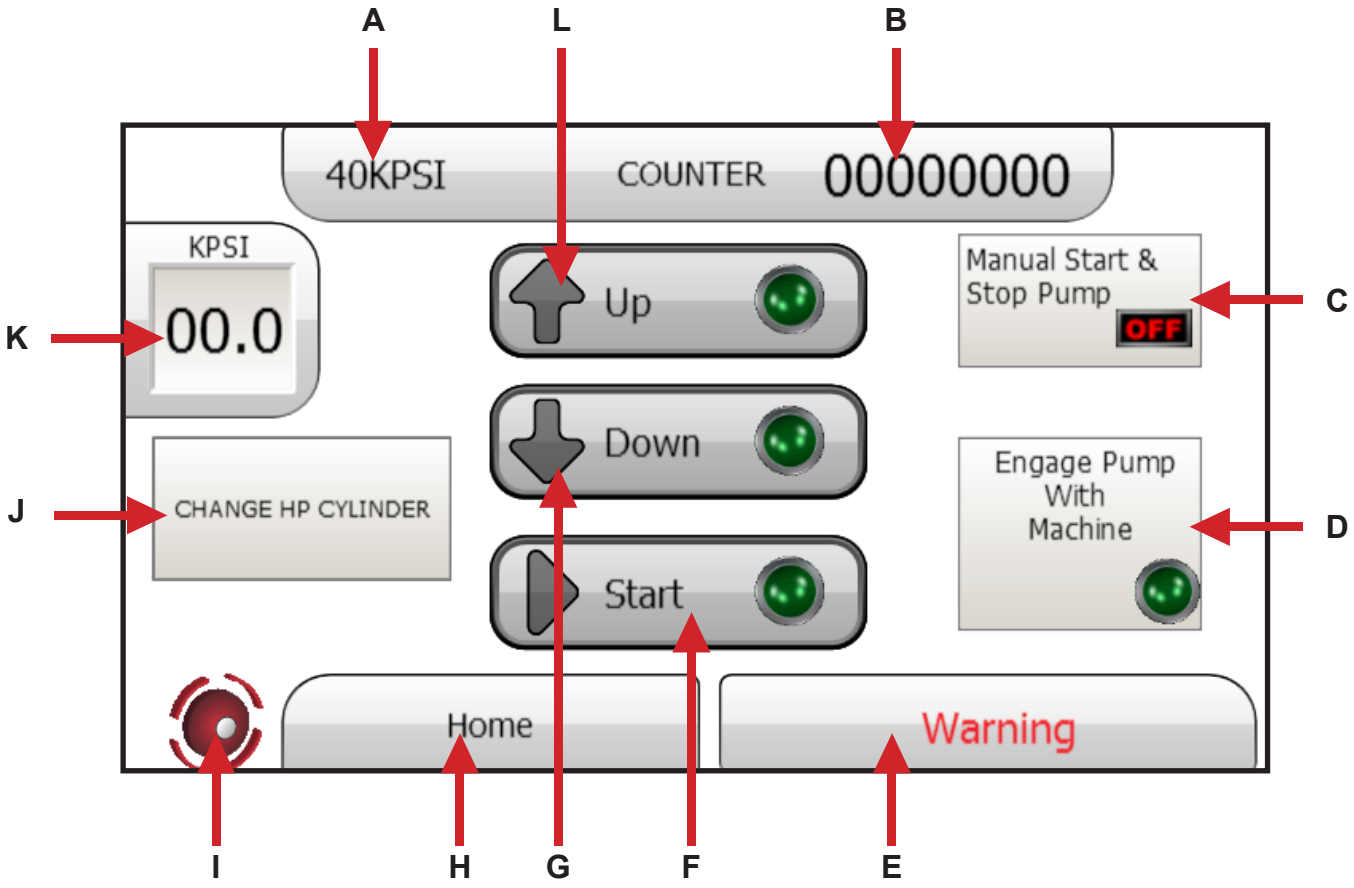
13.3 Continuous Flow

From the MAIN MENU page, press the ‘Continuous Flow’ button, this action will navigate to the options page, where the following information is displayed (CF1 Only).

If the Cell Disruptor has a Peristaltic Pump (Optional extra) you can choose to utilize this by pressing ‘Operate with Process Pump’ button (See page 28).

If the Cell Disruptor does not have a Peristaltic Pump (Optional extra) press the ‘Operate without Process Pump’ button (See page 30 CF1 Only).

13.4 40KPSI Run Page With Process Pump:



A. 40KPSI;
Indicates what unit of pressure the display shows.

B. MAIN COUNTER;
This will display the total number of strokes the machine has completed (This counter cannot be re-set).

C. MANUAL START & STOP PUMP;
This enables the operator to manually start & stop the process pump.

D. ENGAGE PUMP WITH MACHINE;
This allows the operator to automatically fill their reservoir.

NOTE: The green light must be illuminated, then press the start button, the process pump will start filling the reservoir for 30 seconds, then the machine will start processing automatically.

E. INFORMATION INDICATOR;
During operation the information indicator may appear in the bottom right hand box. These indicators are:

1) Jet blocked (See page 62).
2) Solenoid Jammed (See page 63).
3) Machine Temp High (See page 64).
4) Bottom Sensor (See page 65).
5) Main Relief (See page 66).
6) Top & Bottom Sensor (See page 67).
7) Low System Pressure (See page 68).
8) Cycle Finish.

These indicators appear when PLC detects certain pre-set parameters during

F. START BUTTON;
Starts the machine.

G. DOWN BUTTON;
The operator can manually move the HP Psion down.

H. HOME BUTTON;
Navigates back to the main menu.

I. FAULT INDICATOR;
This will inform the operator that a fault has occurred, press the icon, this will then take the operator to the correct fault page with information.

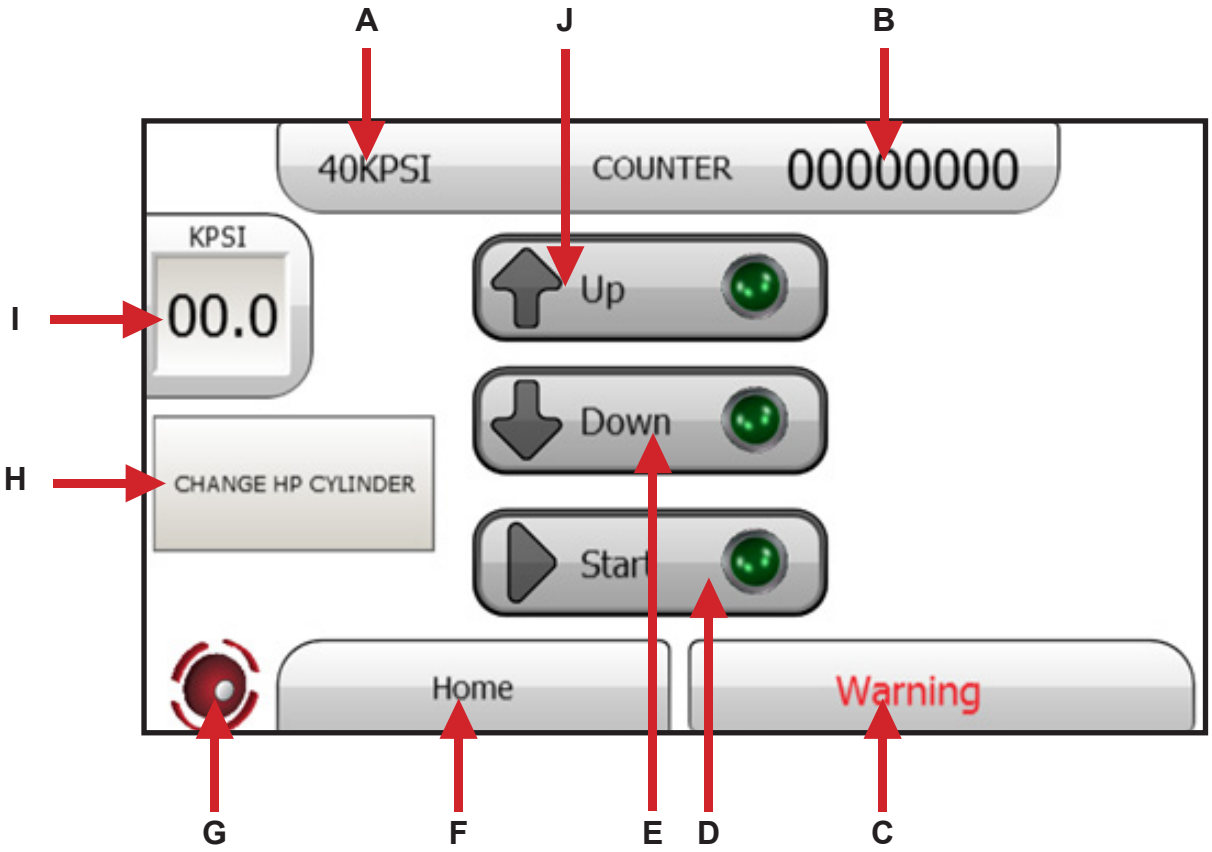
J. CONSUMABLE CHANGE INDICATOR;
Informs the operator when a consumable item has reached its recommended life span (I.e. HP Cylinder Change).

K. KPSI PRESSURE DISPLAY;
Displays the pressure set by the operator, it also allows the operator to switch between pressures.

I. KPSI – Thousands of PSI.
II. KBAR – Thousands of BAR.
III. MPa – Mega pascal.

L. UP BUTTON;
The operator can manually move the HP Piston up.

13.5 40KPSI Run Page Without Process Pump:



A. 40KPSI;
Indicates what unit of pressure the display shows.

B. MAIN COUNTER;
This will display the total number of strokes the machine has completed (This counter cannot be re-set).

C. INFORMATION INDICATOR;
During operation the information indicator may appear in the bottom right hand box. These indicators are:

1) Jet blocked (See page 62).
2) Solenoid Jammed (See page 63).
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5) Main Relief (See page 66).
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7) Low System Pressure (See page 68).
8) Cycle Finish.

These indicators appear when PLC detects certain pre-set parameters during

D. START BUTTON;
Starts the machine.

E. DOWN BUTTON;
The operator can manually move the HP Psion down.

F. HOME BUTTON;
Navigates back to the main menu.

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This will inform the operator that a fault has occurred, press the icon, this will then take the operator to the correct fault page with information.

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Informs the operator when a consumable item has reached its recommended life span (e.g. HP Cylinder Change).

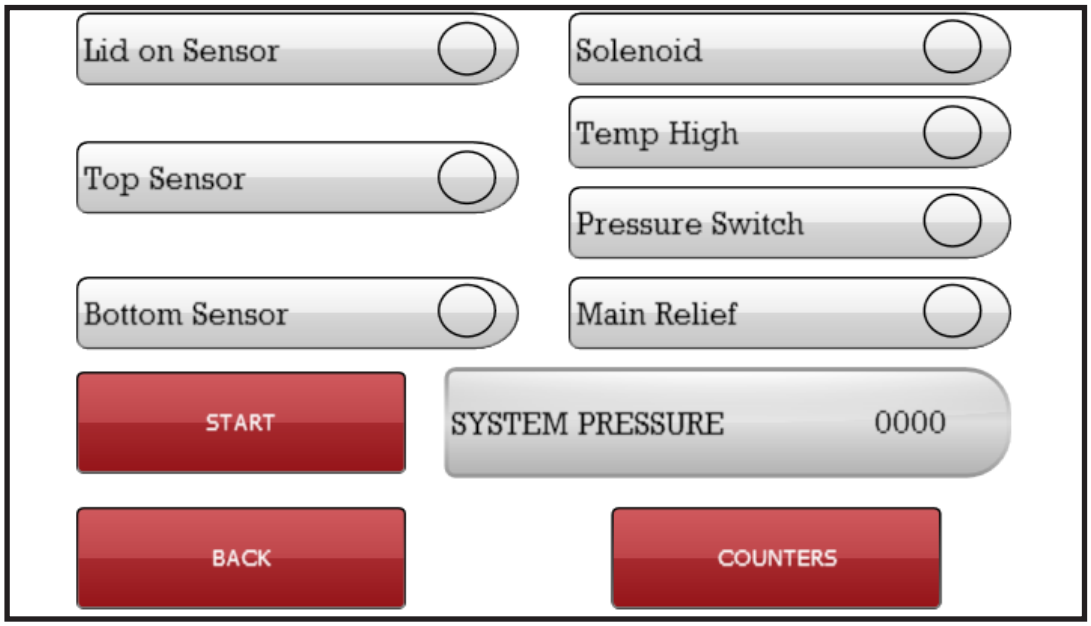
I. KPSI PRESSURE DISPLAY;
Displays the pressure set by the operator, it also allows the operator to switch between pressures.

I. KPSI – Thousands of PSI.
II. KBAR – Thousands of BAR.
III. MPa – Mega pascal.

J. UP BUTTON;
The operator can manually move the HP Piston up.

13.6 System Page

From the MAIN MENU page, press the ‘System Page’ button, this action will navigate to the System page, where the following information is displayed.



The systems page shows information that could help diagnose faults, as well as main components working correctly. The ‘System’ pressure is also displayed to show the operator that the machine is creating pressure.

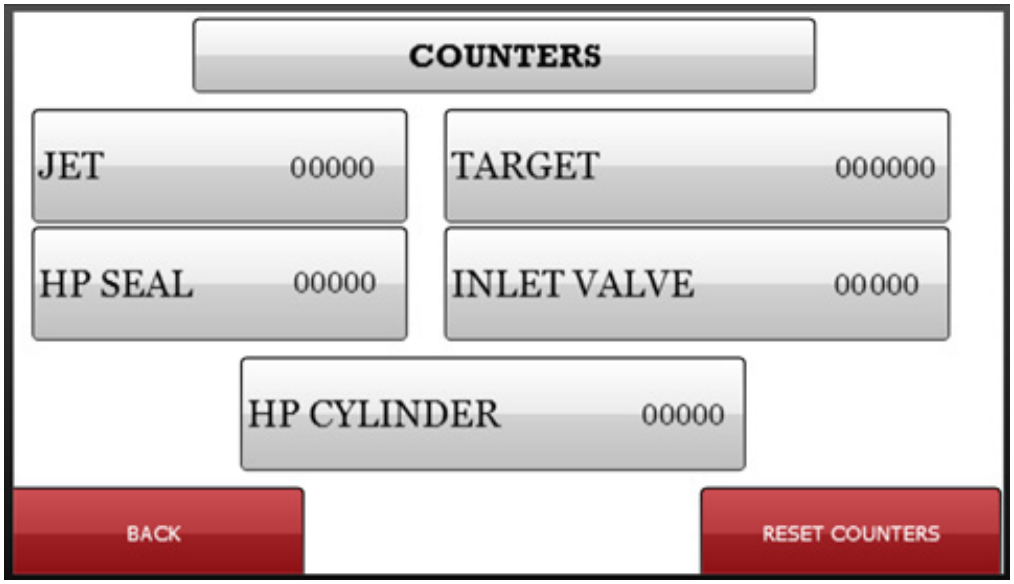
NOTE: The operator can start and monitor the machine from this page.

The indicators will illuminate green when a particular sensor, switch or component is activated.

By pressing the ‘Counters’ button the operator can view the amount of strokes each consumable item has performed.

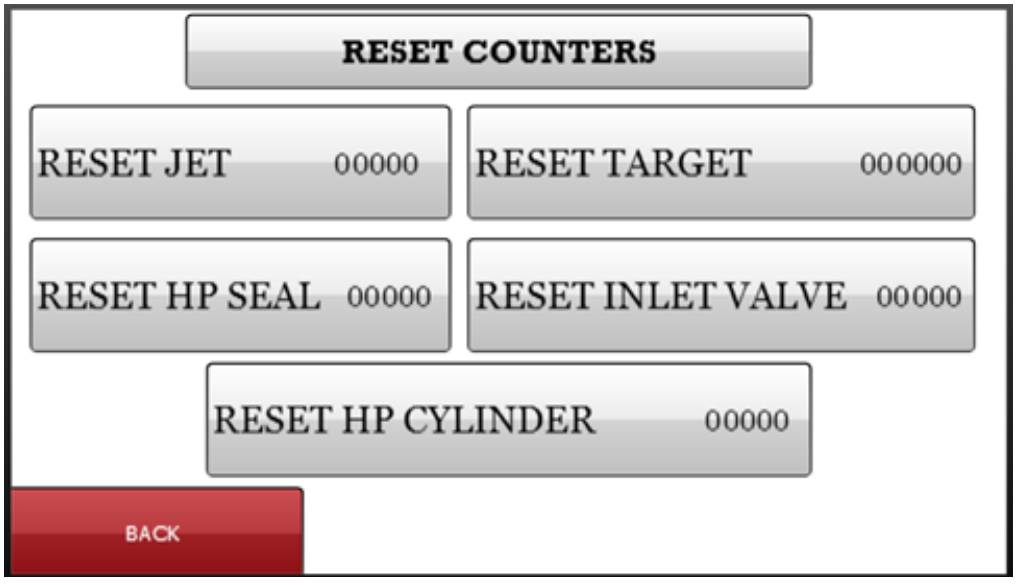
13.7 Counters Page

From the ‘Service’ page, press the ‘Counters’ button, this action will navigate to the counters page, where the following information is displayed.



In the counters page, the operator can monitor the amount of strokes each individual consumable item had performed.

From the ‘Counters’ page, press the ‘Reset Counters’ button, this action will navigate to the reset counters page, where the following information is displayed.



The ‘Reset Counters’ page allows the operator to manually reset each individual consumable item.

NOTE: An advisory will appear on the ‘One Shot Head’ & ‘Continuous Flow’ page to notify the operator when each individual consumable item has completed its recommended life span (For more information see page 36).

14.0 OPERATING SEQUENCE:

CAUTION – Continuous intermittent operation
(Pressing the up / down or start / stop buttons) can cause damage to the motor capacitors. This type of activity should be limited to 20 start / stops per hour.

1. This is a list of operations describing the basic use of the cell disruptor. The operations indicated as (only for start-up) will not be needed to be repeated for every sample if the disruptor is not switched off.

2. Switch on the disruptor at rocker switch located by the mains power inlet (only for start-up).

3. From the MAIN MENU page displayed on the HMI press the “RUN IN CONTINUOUS” button. This action will navigate the display to the 40KPSI pressure head page.

4. Rotate the pressure adjust knob to set the required pressure.

5. Pour the sample into the inlet reservoir and fit the lid if required.

6. Press the START button (Green light illuminates).

7. The disruptor will continue to run until the STOP button is pressed or the reservoir is empty.

Note: When the reservoir is empty, the machine will continue to run for 3 “Empty” cycles and stop automatically, this is normal operation.

8. The “CYCLE FINISHED” message will now appear on the screen.

9. Dead Loss remains in the input cavity after the disruption cycle.

If it is important that the input cavity is cleaned before the next cycle, follow the “Internal Cleaning and Sterilization” instructions, which can be found on page 55 (Only if necessary).

NOTE – System pressure is maintained for 90 seconds after the last cycle and the high pressure piston is held at the top of its travel. This is a safety feature to prevent the disruptor from firing when parts are removed. To reduce system pressure, press the STOP button.

14.1 OPERATING SEQUENCE WITH PROCESS PUMP

CAUTION – Continuous intermittent operation
(Pressing the up / down or start / stop buttons) can cause damage to the motor capacitors. This type of activity should be limited to 20 start / stops per hour.

1. This is a list of operations describing the basic use of the cell disruptor with the process pump attached.

2. Switch on the disruptor at rocker switch located by the mains power inlet (only for start-up).

3. From the MAIN MENU page displayed on the HMI press the “RUN IN CONTINUOUS” button. This action will navigate the display to the 40KPSI pressure head page.

4. Rotate the pressure adjust knob to set the required pressure

5. Fit the required tubing to the process pump, reservoir lid and flask / container.

6. Press the ‘Engage Pump with Machine’ (Green light will illuminates).

7. Press the START button (Green light illuminates).

8. The Process Pump will fill the reservoir for 30seconds and then the machine will start automatically.

9. The disruptor will continue to run until the STOP button is pressed or the reservoir is empty.

Note: When the reservoir is empty, the machine will continue to run for 3 “Empty” cycles and stop automatically, this is normal operation.

10. The “CYCLE FINISHED” message will now appear on the screen.

11. Dead Loss remains in the input cavity after the disruption cycle.

If it is important that the input cavity is cleaned before the next cycle, follow the “Internal Cleaning and Sterilization” instructions, which can be found on page 55 (Only if necessary).

NOTE - System pressure is maintained for 90 seconds after the last cycle and the high pressure piston is held at the top of its travel. This is a safety feature to prevent the disruptor from firing when parts are removed. To reduce system pressure, press the STOP button.

15.0 MAINTENANCE FOR OPERATORS:

Maintenance covers only the dismantling, cleaning and re-assembly of the disruption head which may be necessary when changing between samples and consumables. It may, therefore, be carried out by operational staff or local technicians who have received documented training.

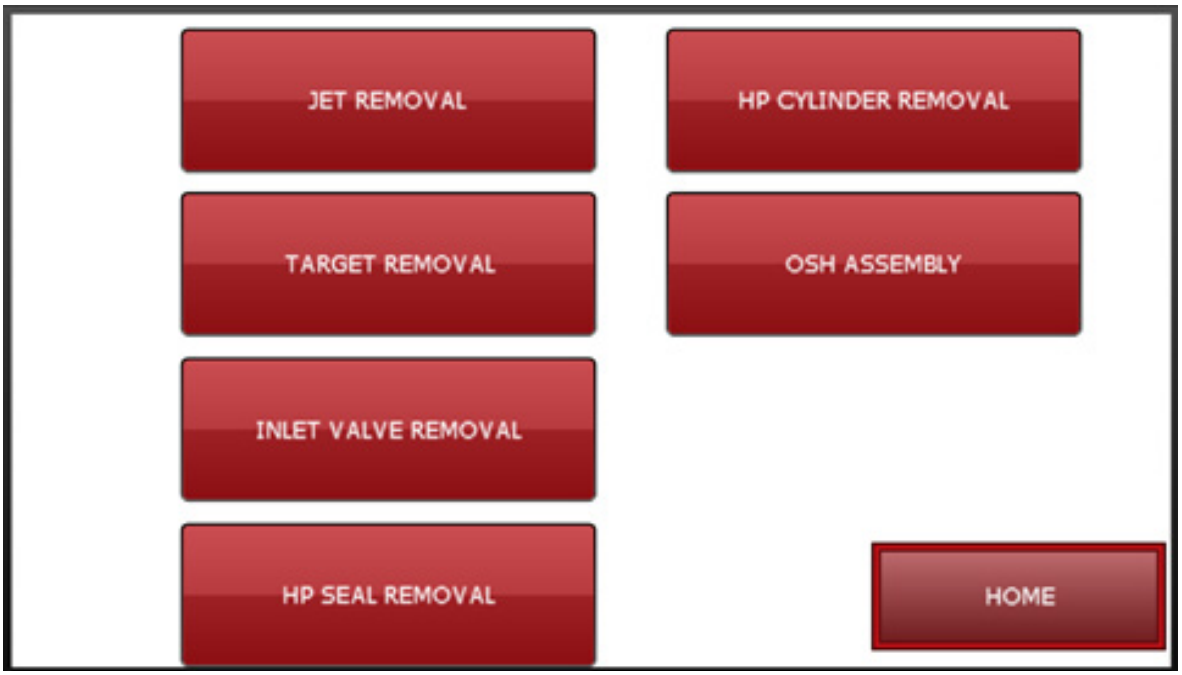
WARNING -
Only qualified service personnel may carry out any procedures inside the machine

WARNING -
As a general precaution, keep the power switched off at all times when carrying out maintenance, switch it ON only when necessary and OFF again as soon as possible.

15.1 Expected Life Of Consumables:

CONSUMABLE	RECOMMENDED CHANGE FREQUENCY
High Pressure Seal	10,000 Strokes
Inlet Valve O-Ring / Back Up PEEK Ring	50,000 Strokes
Spiro lox ring	100,000 Strokes
Jet	50,000 Strokes
Inlet Valve	20,000 Shots (Refurbishment)
Carbide Insert Target	100,000 Strokes
High Pressure Cylinder	50,000 Strokes

From the ‘MAIN MENU’ page, press the ‘DISASSEMBLY OF DISRUPTION CHAMBER’ button, this action will navigate to the maintenance page, where the following information is displayed.



NOTE: Before disassembling the disruption chambers, refer to section 15.2.

15.2 Removal Of The Chamber Base:

This instruction is common to all the procedures described in this manual. Proceed as follows:

1. Ensure the Reservoir is empty. Remove the Reservoir at the Tri-Clover clamp connector, or the 2 x M6 socket cap bolts.

2. Remove the outlet (if needed) by removing the 2 x M6 bolts.

3. If the Cooling Head/Chamber Assembly does need to be disassembled, remove the 2 coolant hoses, undo the 4 x M6 socket cap bolts and lift the cooling head straight up about 300mm to clear the “Lid ON” Probe, and Centre Tube. Sit the assembly to one side, so that the Probe does not get damaged.

NOTE: Keep the cooling head upright as it will still contain about 500mL of coolant. If this is just water then this can be drained out down the sink. If the coolant contains inhibiters then this will need to drain into a correct storage tank, and can be reused.

4. To remove the Chamber Base, lightly lift the Centre Tube a few millimeters of movement to de-seat it from the Internal Pressure Release Valve (PRV) Seat.

NOTE: Do not lift the chamber base with the tube.

5. While the Centre Tube is de-seated hold the chamber base itself and lift it from the top housing. Carefully remove the tube from the chamber base being careful to not lose the spring.

15.3 Changing The Jet:

1. Carry out the procedure described under Removal of the Chamber Base page 32.

2. Remove the Internal PRV Seat from the Jet Retainer.

3. Locate the square section flat “T Bar” into the top of the Inlet Valve. Slide the machined 11mm A/F Socket “T Bar” down through the middle of the square section flat “T Bar” so it engages onto the Jet Retainer.

4. Alter the orientation of the 11mm A/F “T Bar” to enable a comfortable span allowing both hands to grip both the “T Bars” and squeeze together tightly, to undo the Jet Retainer.

NOTE: Keep the flat “T Bar” still and do not let it turn; only rotate the 11mm A/F socket “T Bar”.

WARNING -
DO NOT ALLOW THE SOCKET WELD ASSEMBLY TO ROTATE AS THIS MAY DAMAGE THE VALVE AND CYLINDER; RESULTING IN A COSTLY REPAIR.

5. Remove the Jet Retainer and withdraw the Jet using the Jet Removal Pliers supplied.

6. Clean or replace the Jet.

7. Re-fit the Jet Retainer and tighten, as described in point 4 above, to tighten the Jet Retainer.

NOTE: The Jet Retainer must be tight.

WARNING -
DO NOT ALLOW THE SOCKET WELD ASSEMBLY TO ROTATE AS THIS MAY DAMAGE THE VALVE AND CYLINDER; RESULTING IN A COSTLY REPAIR.

8. Push the Pressure Relief Valve Seat Assembly onto the Jet Retainer.

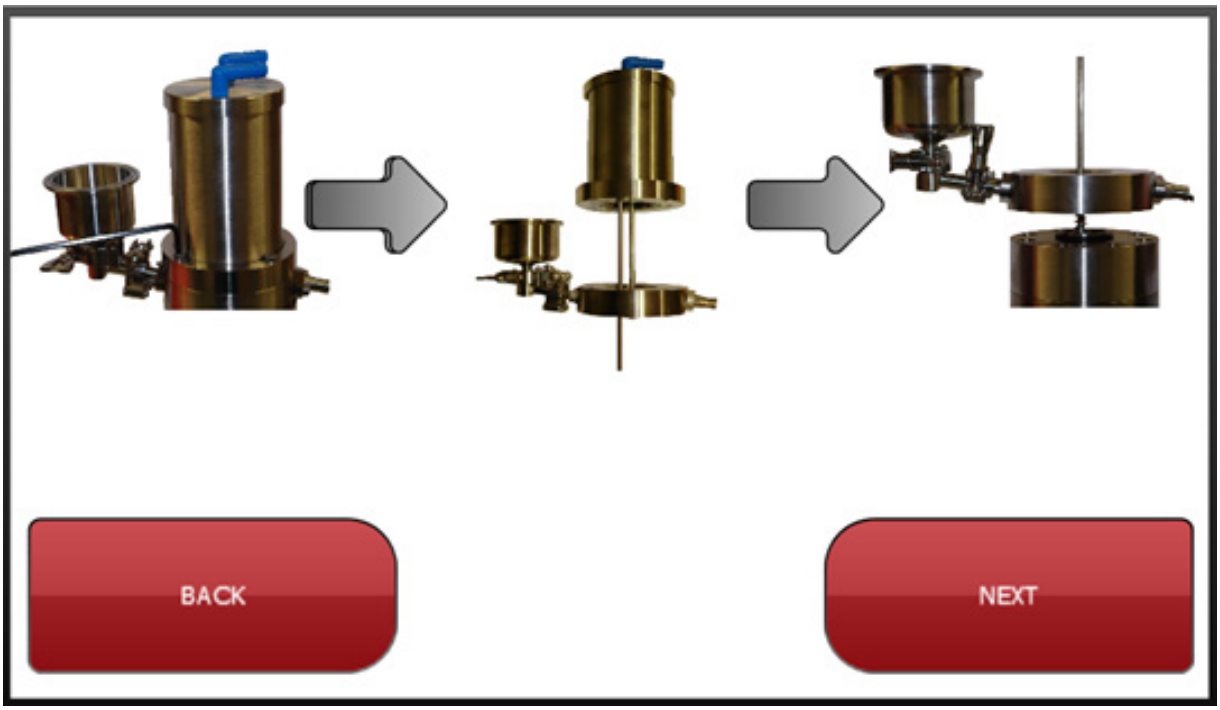
9. To reassemble the Disruption Assembly:
   a. Fit the spring onto the Centre Tube.
   b. Carefully fit the Centre Tube into the Chamber Base.
   c. Ensure that the Internal PRV Seat is fitted onto the Jet Retainer and the BOF00086 O-ring is in place around the collar on the top of the Top Housing.
   d. Push the Centre Tube up underneath the Chamber Base and hold from the top end.
   e. Hold the Chamber Base itself and lift and lower into place on top of the Top Housing, before letting the Centre Tube seat back down onto the PRV Seat.
   f. Ensure the Centre Tube Assembly moves freely after the Chamber Base is fitted.

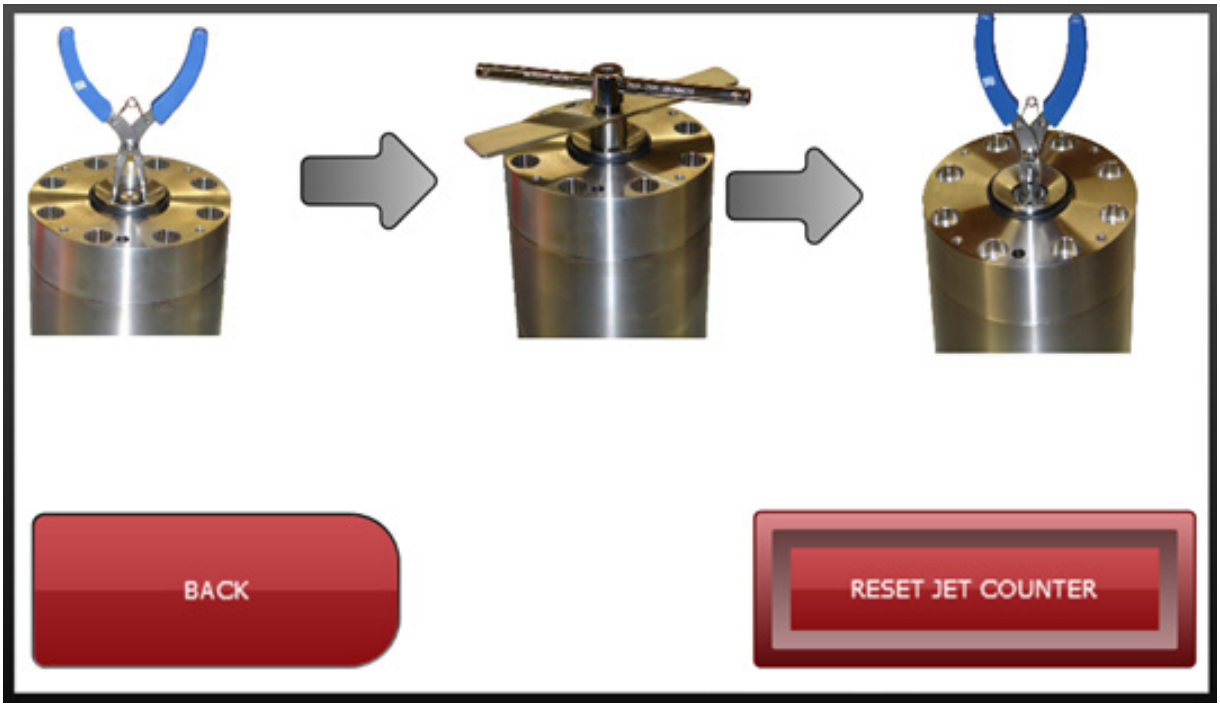
10. Check the two O-rings (BOF00305 & BOF00306) are fitted in place into the two face grooves in the bottom face of the Cooling Jacket.

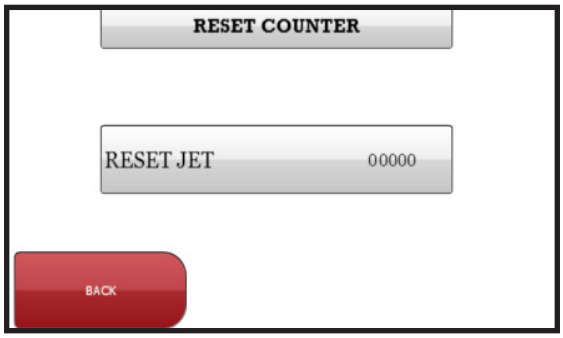
11. Align the Lid On Probe into the guide bore and lower it into place.

12. Check that the Cooling Jacket has seated down correctly before lightly tightening the 4 off M6 bolts.

15.4 Jet Removal







NOTE: Only reset the counter when the Jet has completed its recommended life span.

15.5 Changing The Target:

1. Carry out the procedure described under Removal of the Chamber Base page 32.

NOTE: Ensure that the coolant has been drained from the cooler Jacket.

2. Undo the 3 Cooler Nuts on the underside of the Chamber Assembly using the 5mm Hexagon Wrench.

NOTE: These will not remove entirely due to the O-Rings.

3. Remove the Cooler Top from the Cooler Tube by lifting off. Check the sealing rings for damage. Note the position of the Flow Divider, and then remove.
The Cooler Top/Cooler Tube/Chamber Assembly may have bonded together over a period of time, and may have to be tapped apart.

4. The top of the Chamber Assembly and Target Cap are now exposed.

5. Replace the Chamber Assembly back onto the disruptor and fasten down with the 4 x M6 Socket Head screws to provide a firm base to work on.

NOTE: Ensure the 3 Cooler Nuts are flush with the bottom of the Chamber Assembly, to prevent damage to the Chamber Base.

6. Using the 5mm Hexagon Wrench loosen the Target Cap and then continue to remove with fingers only.

7. Take care not to damage the threads inside the Target Cap and on top of the Chamber Assembly.

8. Slide the Target Removal Tool under the chamfered head of the Target, then lift up, removing the Target from the Chamber Assembly.

9. Inspect the target for erosion or cracking and replace if any erosion is deeper than 2mm or the target is cracked.

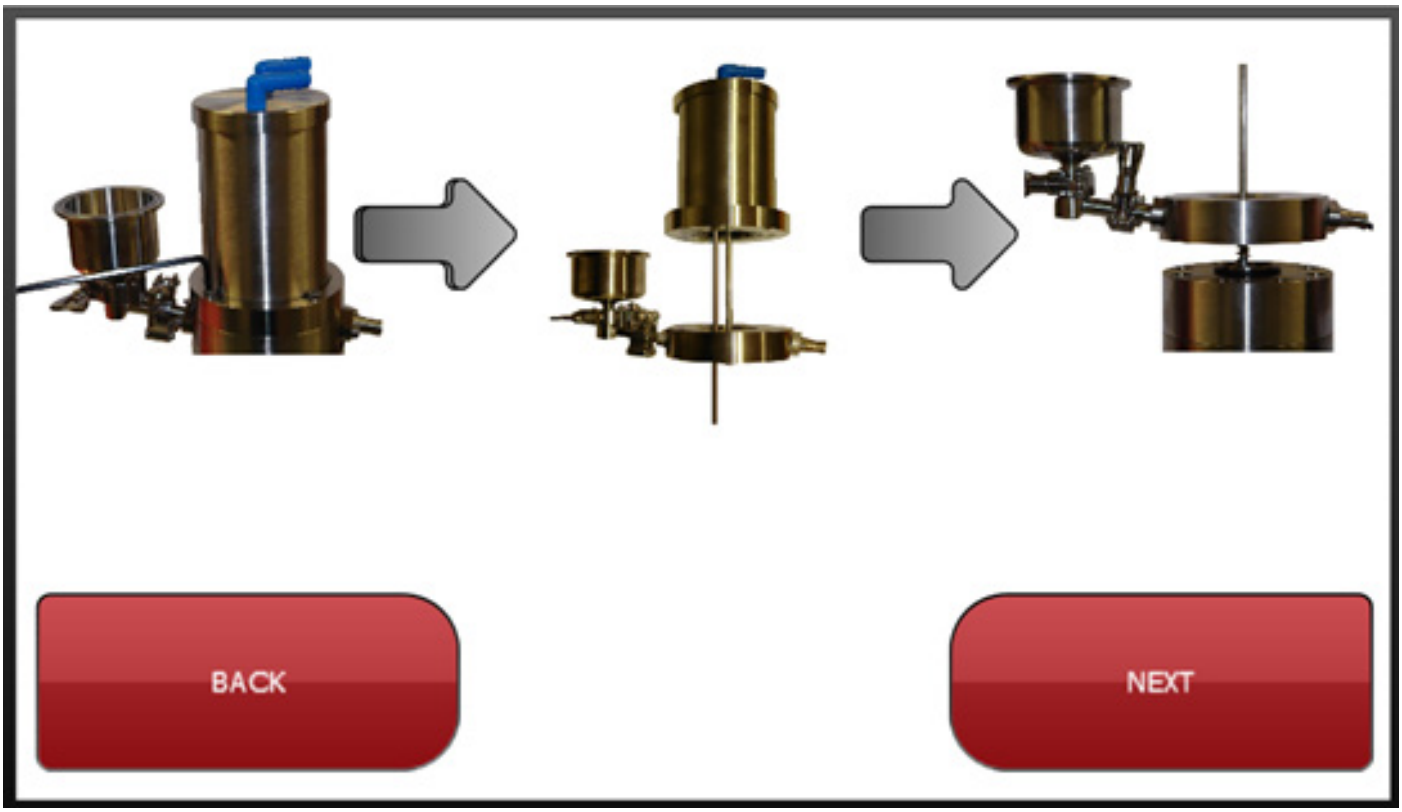
10. To re-assemble, reverse the steps above checking and replacing O-rings (BOF00314 & BOF00176) if necessary.

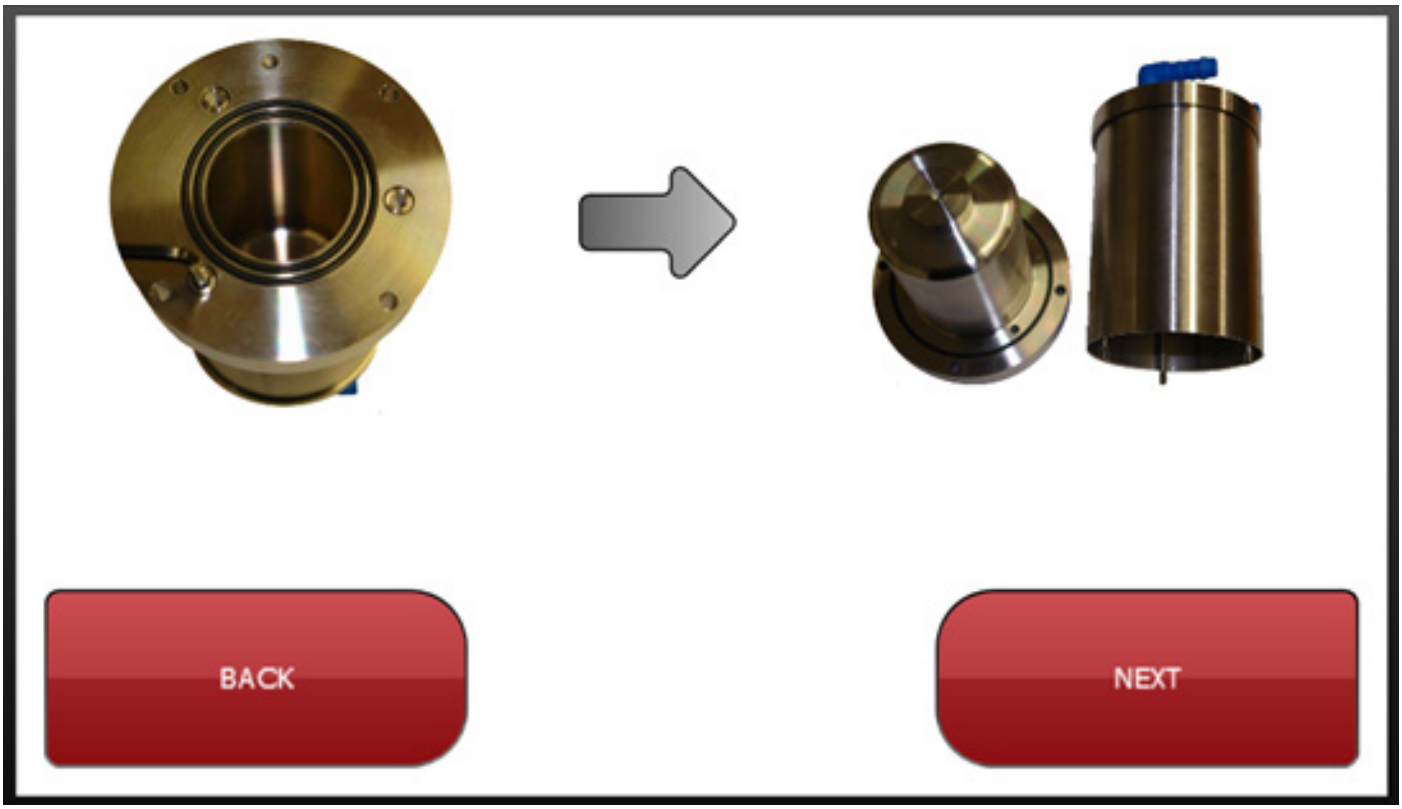
i) Fit a new Target with two new O-rings (BOF00314 & BOF00176), if re-fitting the same Target use the original O-rings. Fit the smaller O-ring (BOF00176) into the groove around the diameter of the Target body. Fit the larger O-ring (BOF00314) into the recess in the top of the Chamber assembly.

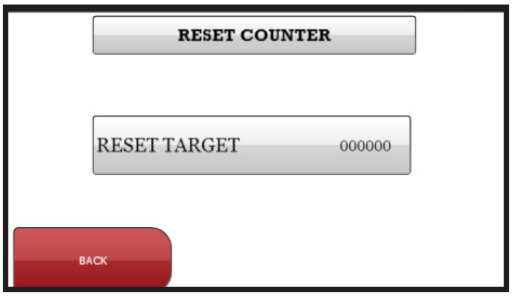
ii) Push the Target down into place on top of the Chamber Assembly and refit and tighten the Target Cap.

NOTE: It is recommended that a Target should be checked after 30 Litres of product is processed and replaced if any surface marking is deeper than 2mm.

15.6 Target Removal







NOTE: Only reset the counter when the Target has completed its recommended life span.

15.7 Replacing The Inlet Valve O-Ring & Back Up Rings:

1. Follow the procedure described under Removal of the Chamber Base page 32.

2. Undo the eight M10 Socket head bolts with the hexagon wrench provided.

CAUTION -
Do not allow the Top Housing to rotate anti-clockwise.

CAUTION -
The HP Cylinder/Top Housing assembly is very heavy (5Kg). Take care when lifting and handling it. Place the cylinder in a safe place where it cannot roll off the bench and cause injury.

3. Check that the down sensor is showing, then press and hold the Up button until you can hear the motor stop. The high pressure Cylinder should rise by approximately 40mm. Release the Up button.

4. Holding the handle, slide the Top Housing Lifting Block fully into the gap then release the handle. Press and hold the Down button on the touch screen display until the motor stops.

5. Remove the Top Housing and HP Cylinder assembly from the machine, and place carefully to one side, on a flat and level surface leave the lifting block in place. Remove the lifting block, and the High Pressure Seal is now exposed.

6. Turn the Top Housing upside down and unscrew the HP Cylinder, this should only be finger tight.

7. If this is too tight to undo by hand then use the Cylinder Vice. Bolt the Cylinder Vice to the Lower Seal Housing with two M10 bolts (have the round central hole upwards).

8. Insert the HP Cylinder (and Top Housing) into the Cylinder Vice and firmly holding the Top Housing rotate it anti-clockwise. The two machined flats on the bottom of the HP Cylinder will locate into the Cylinder Vice.

NOTE: Only use the cylinder vice to loosen the HP Cylinder.

9. Place the Top Housing on a flat, clean surface ready for re-assembly later.

10. Remove the Inlet Valve from the HP Cylinder by inserting the Inlet Valve Removal Tool into the open bore of the HP Cylinder.

NOTE: Only ever use this plastic tool inserted in the bore to prevent damage.

11. Place the HP Cylinder upright on a sturdy bench with the pusher at the base.

12. Place one hand cupped over the Inlet Valve around the HP Cylinder's largest diameter, avoiding the lower spigot with your fingers. Push the HP Cylinder down slowly but firmly onto the pusher. The Inlet Valve will slide out into the cupped hand at the top.

13. Remove the Spiro lox Ring (BOF01599).

14. Discard the O-ring (BOF00073).

15. Remove the PEEK Back-Up ring (DRG02862), and ensure the inside is clean.

16. Thoroughly rinse the Inlet Valve Assembly under a running tap, ensuring any debris is removed and the Valve is clean.

17. Refit the PEEK Back-Up ring, and ensure this seats correctly with no gap. Turn the back-up ring over if it does not seat correctly.

18. Apply a thin film of silicone grease to the new O-ring (BOF00073). Slide the “O” Ring onto the Valve Stem and rotate it, to ensure it has seated correctly.

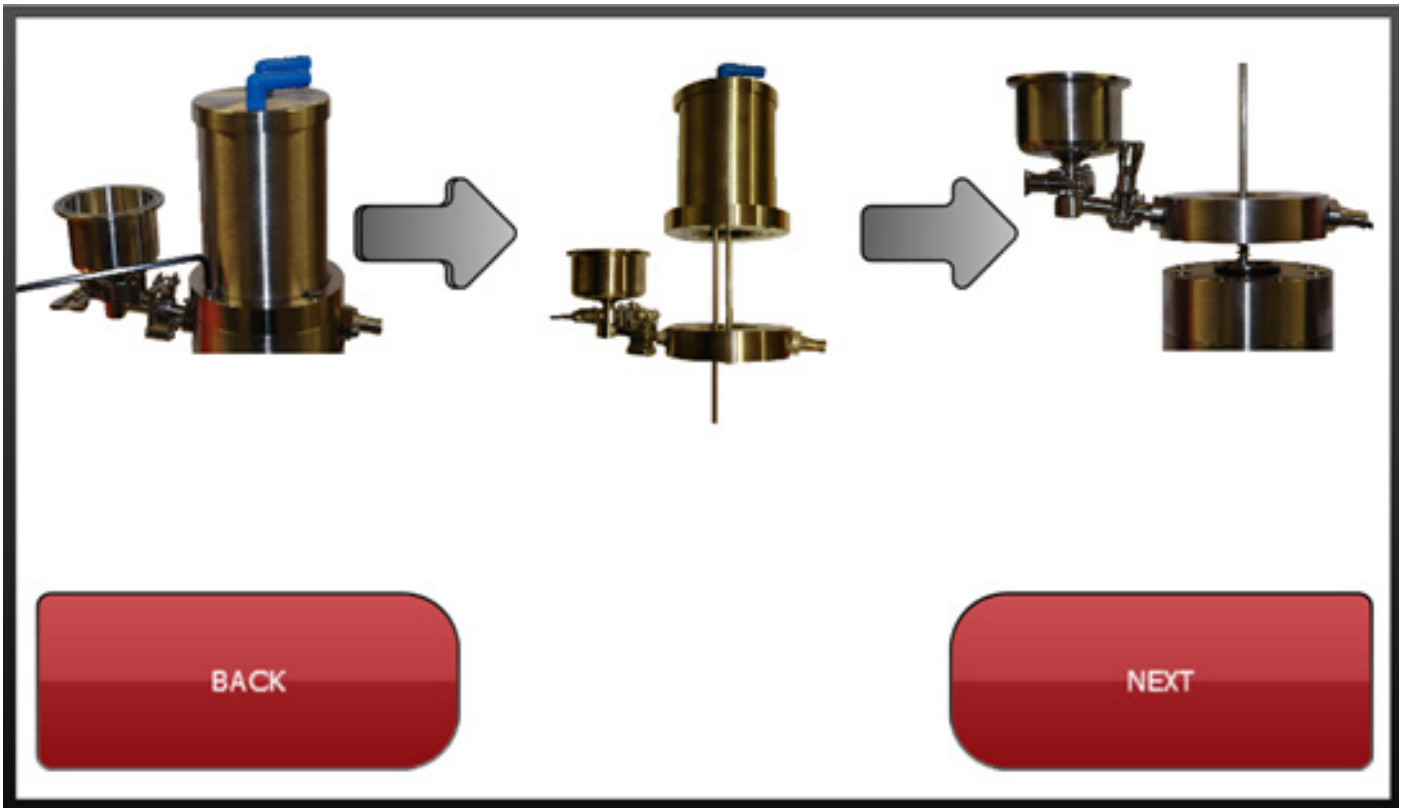
19. Refit the backup ring (DRG02862), O-ring (BOF00073) & Spiro lox ring (BOF01599).

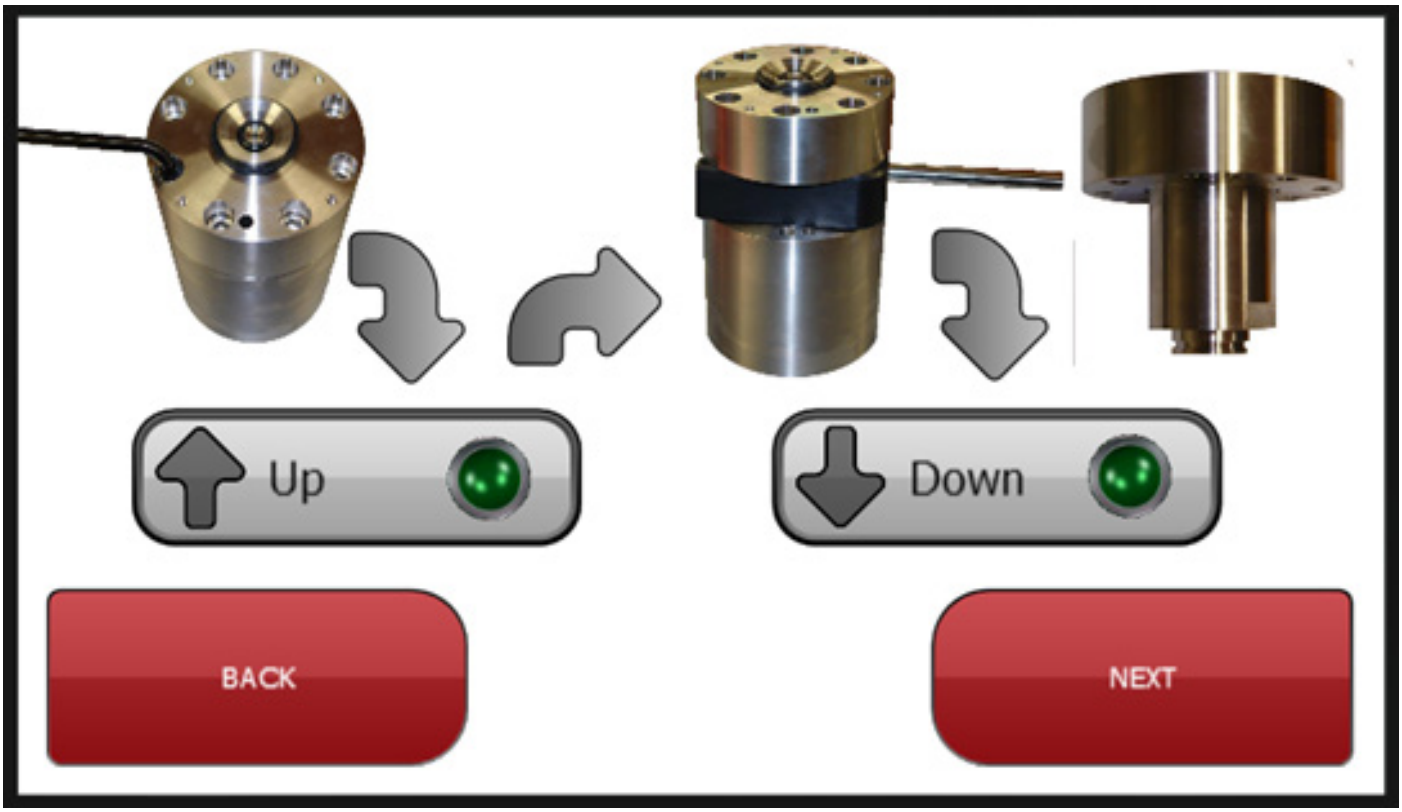
20. Check the PEEK backup ring, “O” Ring, and Spiro lox Ring are all seated correctly and are not interfering with the free movement of the Valve Plate.

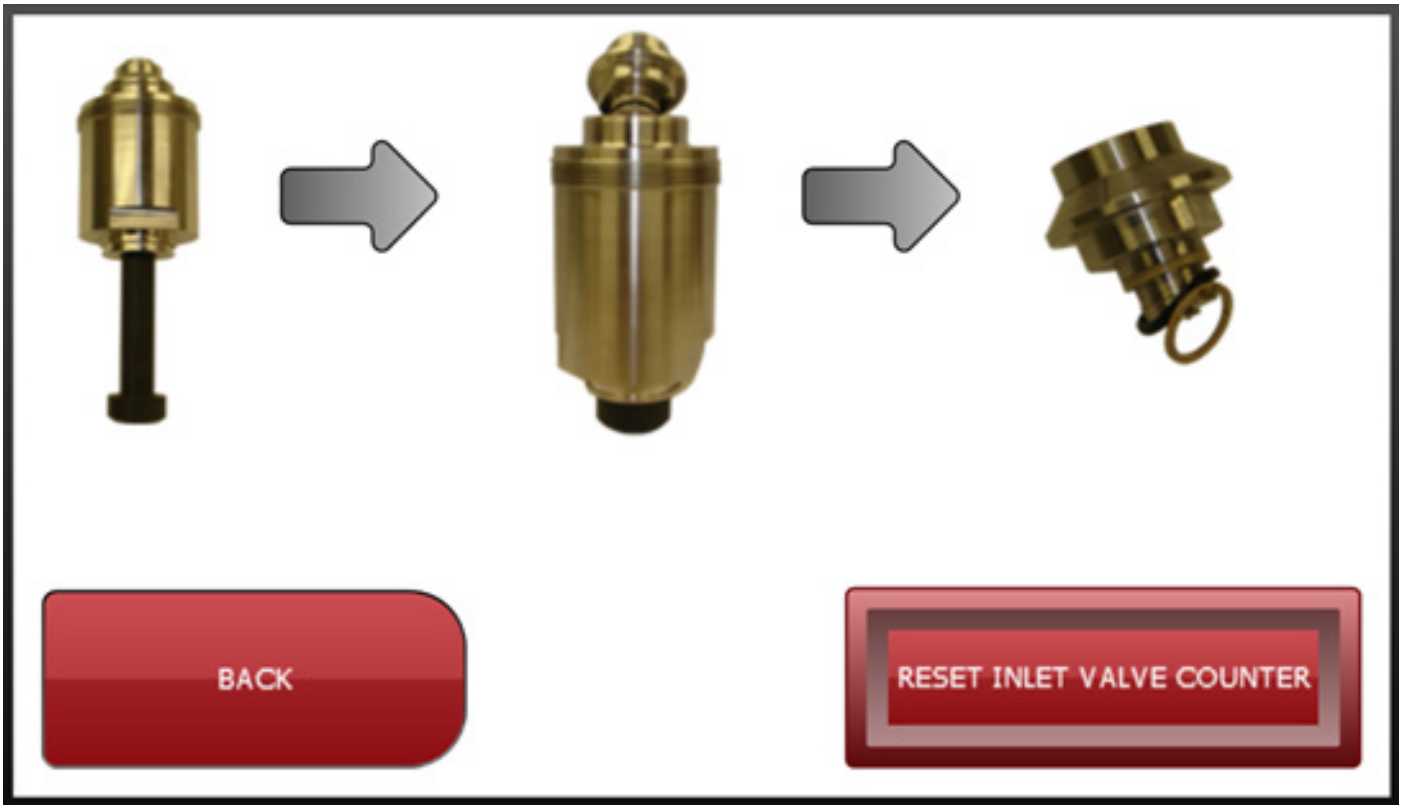
NOTE: Apply water or buffer solution to the O-ring to avoid twisting and to lubricate the O-ring during fitment.

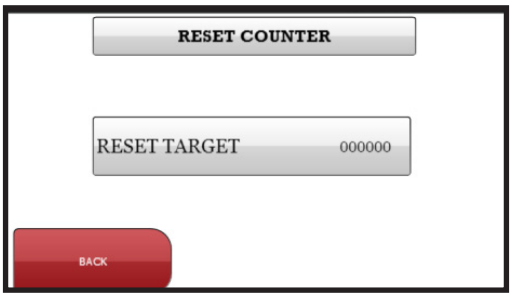
DO NOT TWIST THE INLET VALVE DURING FITMENT AS THIS MAY CAUSE DAMAGE TO THE HP CYLINDER; RESULTING IN A COSTLY REPAIR.

15.8 Inlet Valve Removal









NOTE: Only reset the counter when the Inlet Valve has completed its recommended life span.

15.9 Changing The HP Seal:

1. Follow the procedure described under Removal of the Chamber Base page 32.

2. Undo the eight M10 Socket head bolts with the hexagon wrench provided.

CAUTION:
Do not allow the Top Housing to rotate anti-clockwise.

CAUTION:
The HP Cylinder/Top Housing assembly is very heavy (5Kg). Take care when lifting and handling it. Place the cylinder in a safe place where it cannot roll off the bench and cause injury.

3. Check that the down sensor is showing, then press and hold the Up button until you can hear the motor stop. The High Pressure Cylinder should rise by approximately 40mm. Release the Up button.

4. Holding by the handle, slide the Top Housing Lifting Block fully into the gap then release the handle. Press and hold the Down button on the touch screen display until the motor stops.

5. Remove the Top Housing and HP Cylinder assembly from the machine, and place carefully to one side, on a flat and level surface leave the lifting block in place. Remove the lifting block, and the High Pressure Seal is now exposed.

6. Drive the HP Seal to the top of its stroke by pressing the Up button on the touch screen. The Piston will rise slowly and stop at the highest position for a timed 10 minute period. Screw one of the M10 Socket Cap screws into one of the bolt holes at the back of the Lower Seal Housing.

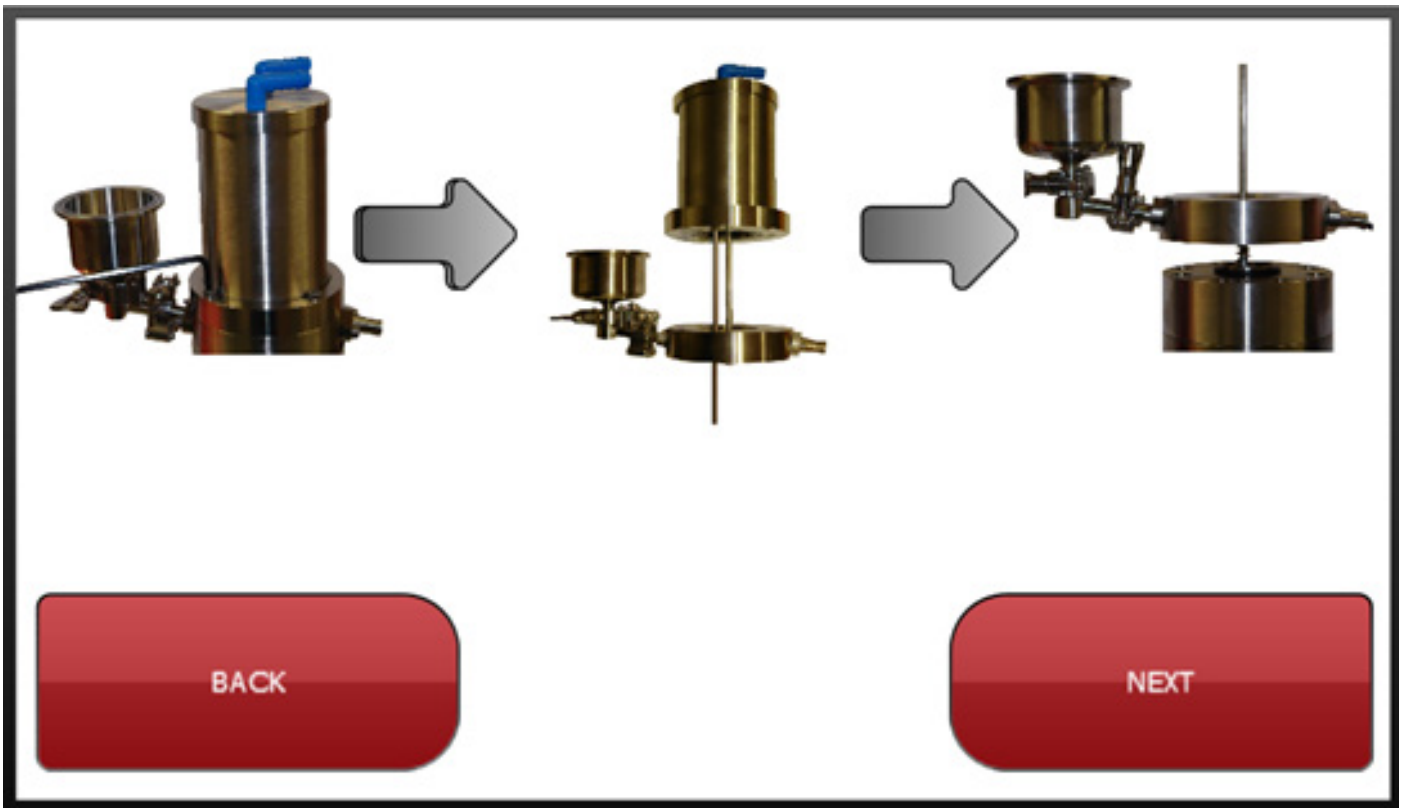
7. A 14mm A/F Bent Spanner locates onto the spanner flats on the top of the HP Piston. The complete HP Seal and HP Piston assembly will rotate with the spanner. The handle of the Bent Spanner will rotate with the HP Piston and sit against the M10 Socket Cap screw to hold the Piston in place. Rotate the spanner anti-clockwise so that it sits against the M10 socket cup bolt.

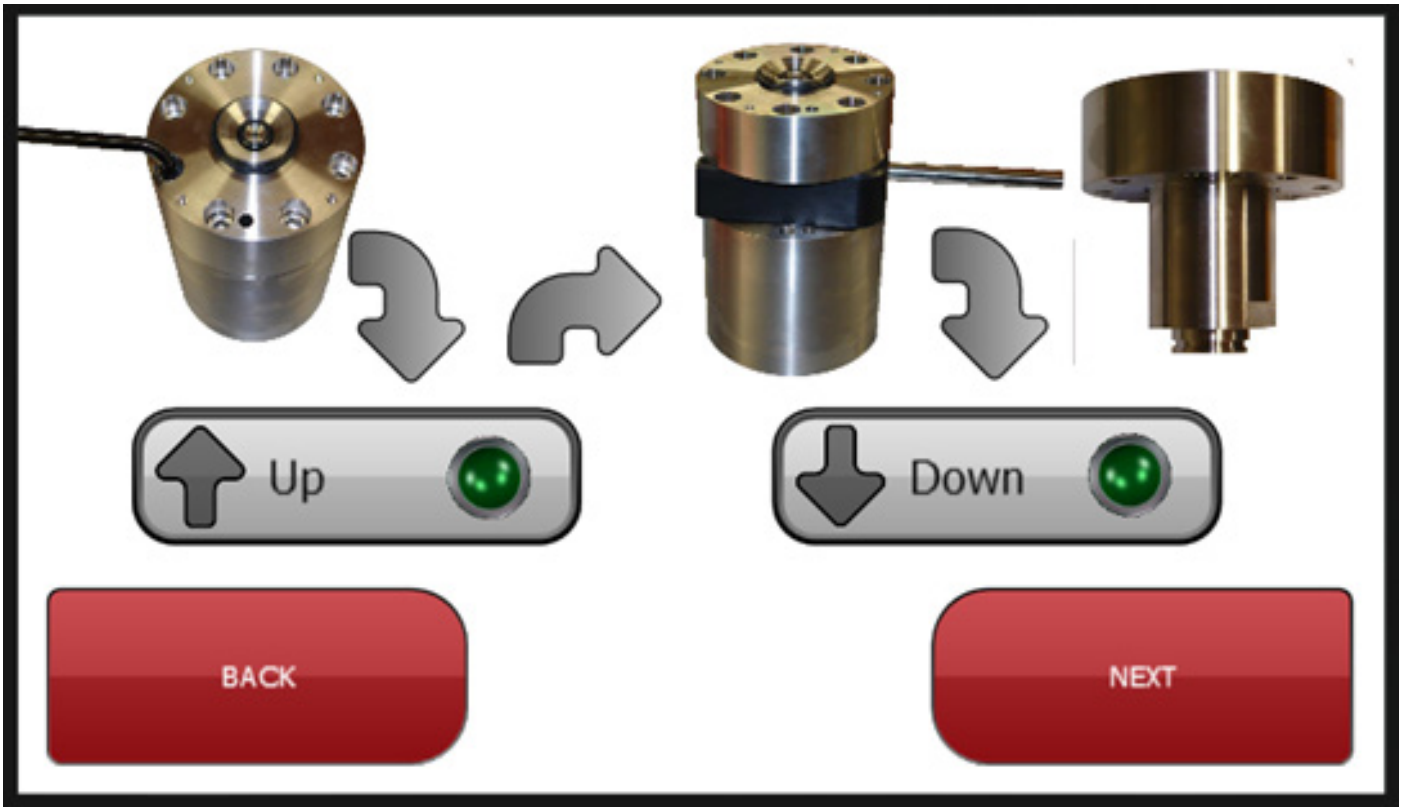
NOTE: Take care not to damage the HP Piston immediately below the HP Seal with this spanner.

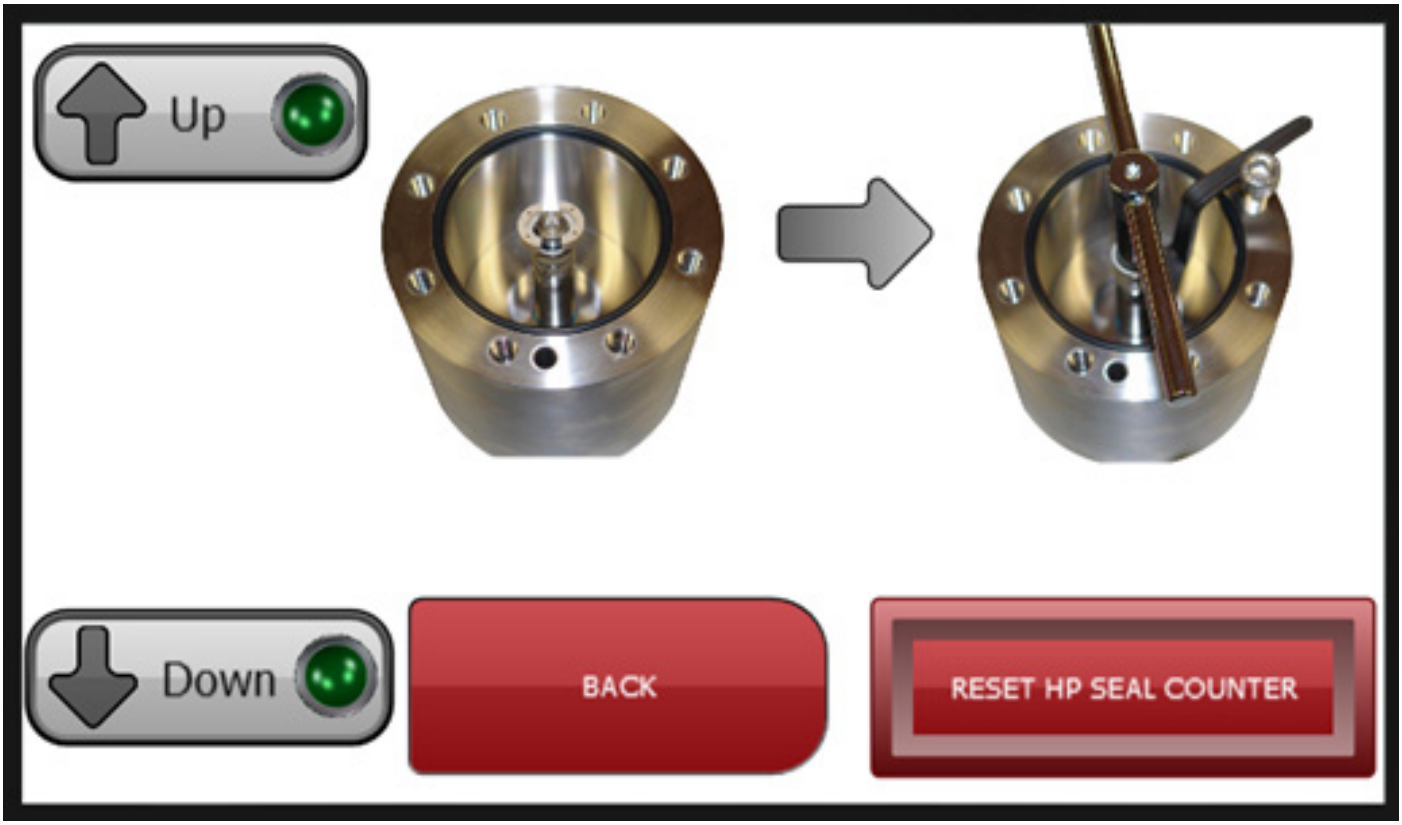
8. Remove the two part PEEK caps from the top of the HP Seal, (by sliding them outwards) and then using the 11mm A/F Socket and 3/8” T-Bar; remove the HP Seal. With the Bent Spanner holding the HP Piston in place, both hands can then be used to loosen the HP Seal.

9. Fit the new HP Seal using the tools indicated above. Make sure that the mating faces on the HP Piston and the new Seal are clean and that the new Seal is screwed fully down. Rotate the bent spanner and HP Piston clockwise so that the spanner handle sits against the M10 bolt, holding the HP Piston allowing you to use both hands to tighten the T-bar and socket. Replace the two part PEEK caps.

15.10 HP Seal Removal







NOTE: Only reset the counter when the HP Seal has completed its recommended life span.

15.11 Changing The HP Cylinder:

1. Follow the procedure described under Removal of the Chamber Base page 32.

2. Undo the eight M10 Socket head bolts with the hexagon wrench provided.

CAUTION -
Do not allow the Top Housing to rotate anti-clockwise.

CAUTION -
The HP Cylinder/Top Housing assembly is very heavy (5Kg). Take care when lifting and handling it. Place the cylinder in a safe place where it cannot roll off the bench and cause injury.

3. Check that the down sensor is showing, then press and hold the Up button until you can hear the motor stop. The HP Cylinder should rise by approximately 40mm. Release the Up button.

4. Holding by the handle, slide the Top Housing Lifting Block fully into the gap then release the handle. Press and hold the Down button on the touch screen display until the motor stops.

5. Remove the Top Housing and HP Cylinder assembly from the machine, and place carefully to one side, on a flat and level surface leave the lifting block in place. Remove the lifting block, and the High Pressure Seal is now exposed.

6. Turn the Top Housing upside down and unscrew the HP Cylinder, this should only be finger tight.

7. If this is too tight to undo by hand then use the Cylinder Vice. Bolt the Cylinder Vice to the Lower Seal Housing with two M10 bolts (have the round central hole upwards).

8. Insert the HP Cylinder (and Top Housing) into the Cylinder Vice and firmly holding the Top Housing rotate it anti-clockwise. The two machined flats on the bottom of the HP Cylinder will locate into the Cylinder Vice.

NOTE: If you cannot loosen by hand, use the lifting bar provided, place 2 x M6 cooler bolts through the lifting bar and secure using a 5mm Hexagon wrench. Only use the cylinder vice to loosen the HP Cylinder.

9. Place the Top Housing on a flat, clean surface ready for re-assembly later.

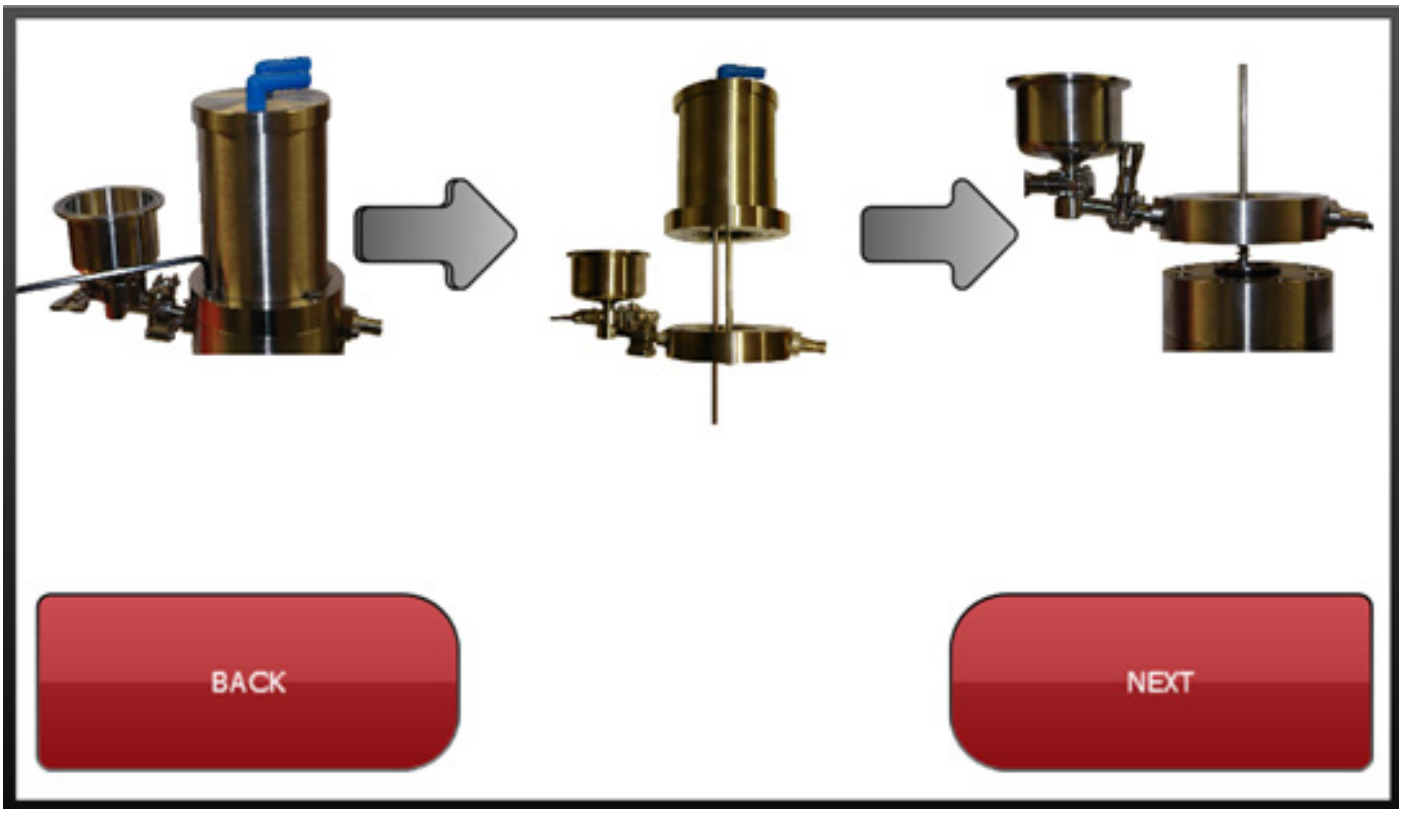
10. Remove the Inlet Valve from the HP Cylinder by inserting the Inlet Valve Removal Tool into the open bore of the HP Cylinder.

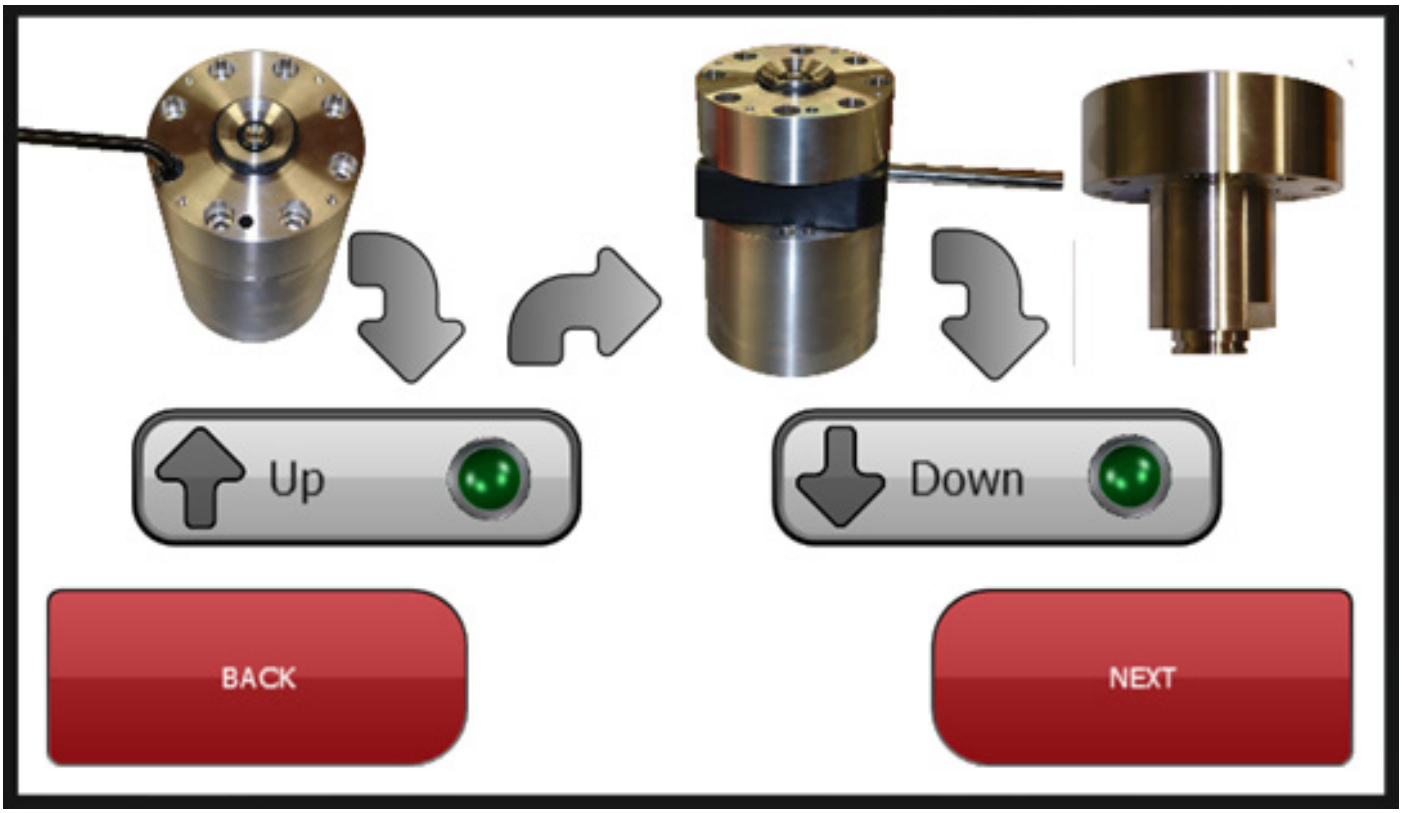
NOTE: Only ever use this plastic tool inserted in the bore to prevent damage.

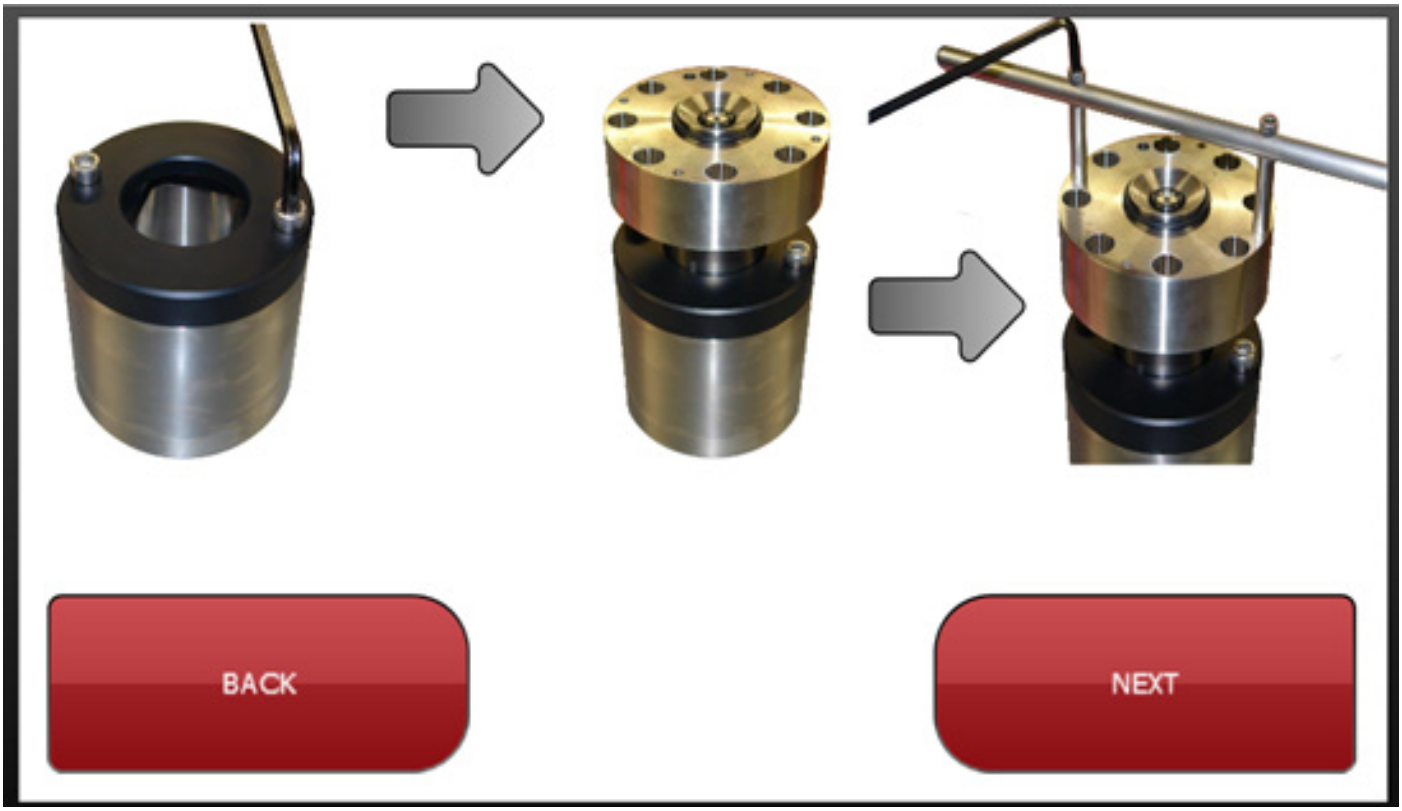
11. Place the HP Cylinder upright on a sturdy bench with the pusher at the base.

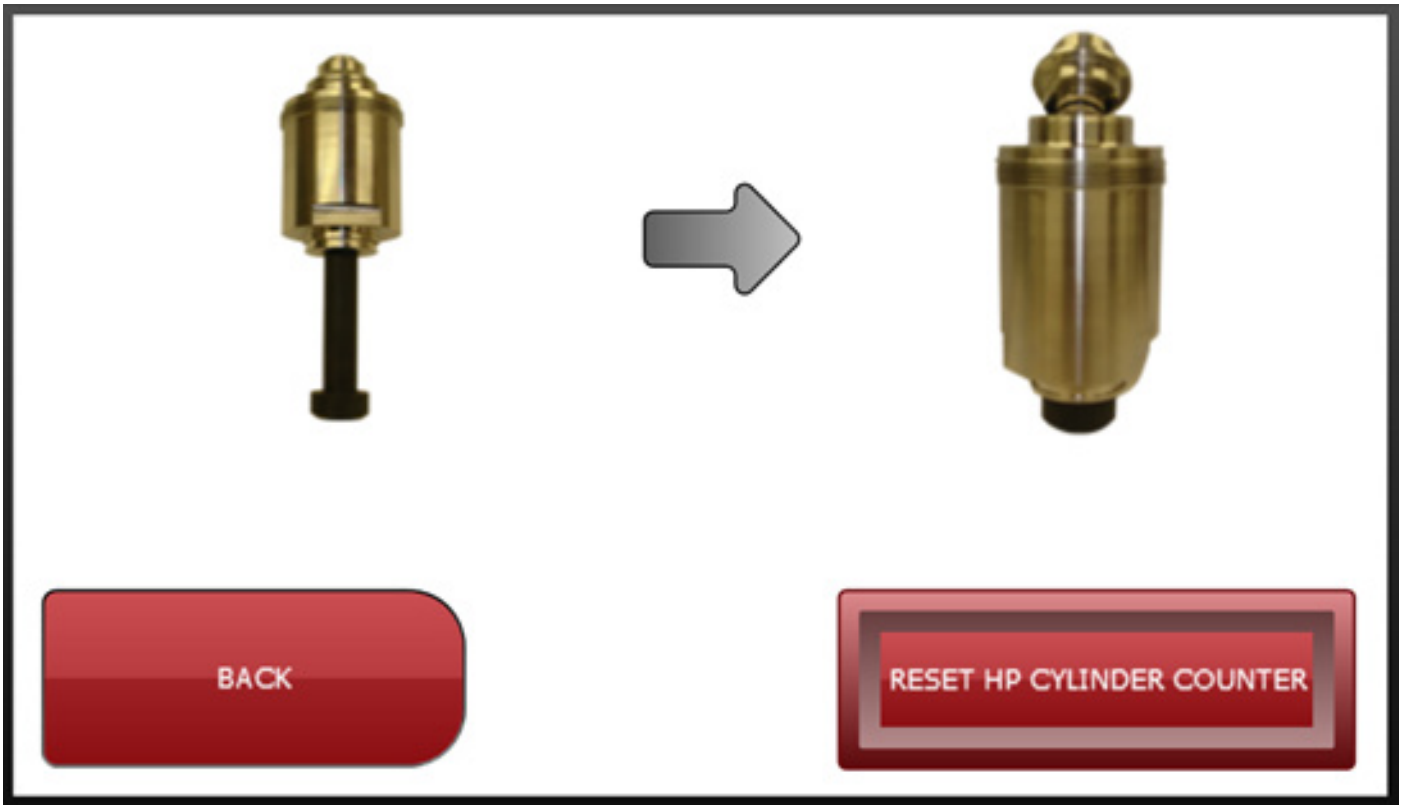
12. Place one hand cupped over the Inlet Valve around the HP Cylinder's largest diameter, avoiding the lower spigot with your fingers. Push the HP Cylinder down slowly but firmly onto the pusher. The Inlet Valve will slide out into the cupped hand at the top.

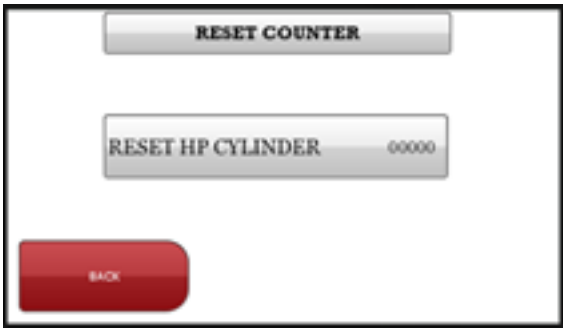
15.12 HP Cylinder Removal











NOTE: Only reset the counter when the HP Cylinder has completed its recommended life span.

15.13 Re-Assembly of Cooler Chamber:

Re-assembly is, in each case, the reverse of the above procedure. When assembling the cooler/ chamber, re-build this upside down.
1.0 Start with the Cooler Top upside down, with the 3 studs pointing upwards, and ensure the sealing ring is sitting in the groove.

2.0 Lower the cooler tube over the studs, so that it sits on the rubber seal.

3.0 Lower the flow diverter into the cooler so that it lies against 2 of the 3 studs, and separates the inlet and outlet threaded holes, and insert the Flow Divider as a “U” orientation.

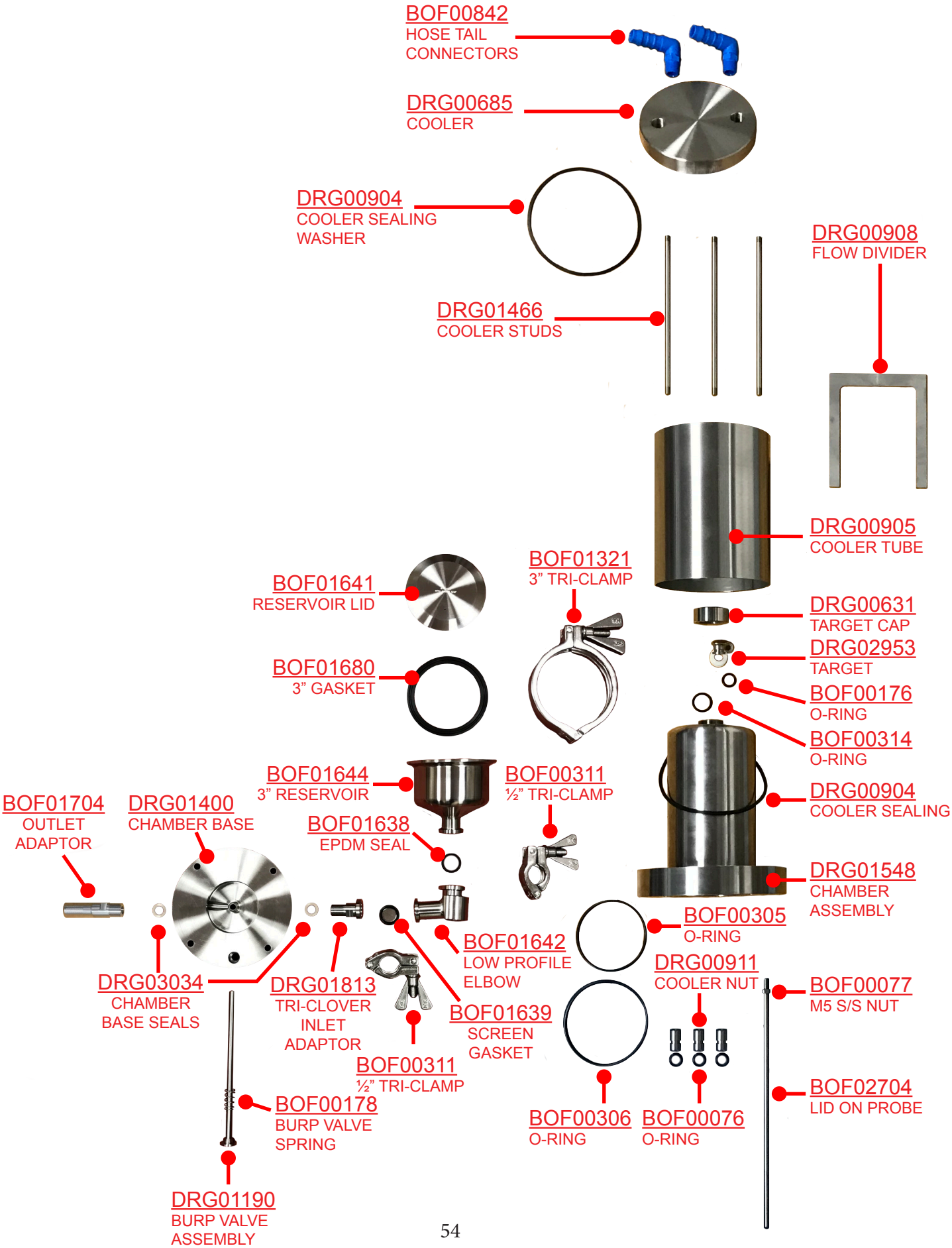
4.0 Check the second sealing ring is in place in the chamber assembly base, turn this upside down and lower into the cooler tube, so that the 3 studs locate up into the 3 cooler nut holes.

NOTE: This will only assemble in one orientation as the studs are not equally spaced so if the holes/ studs do not line up, then rotate the upper and lower parts 1/3 of a turn to locate.

Caution -
Ensure that all eight M10 and all four M6 socket head bolts are tightened down Evenly. Tighten M10 bolts to 10 Nm and M6 bolts light finger pressure.

16.0 DIAGRAMS

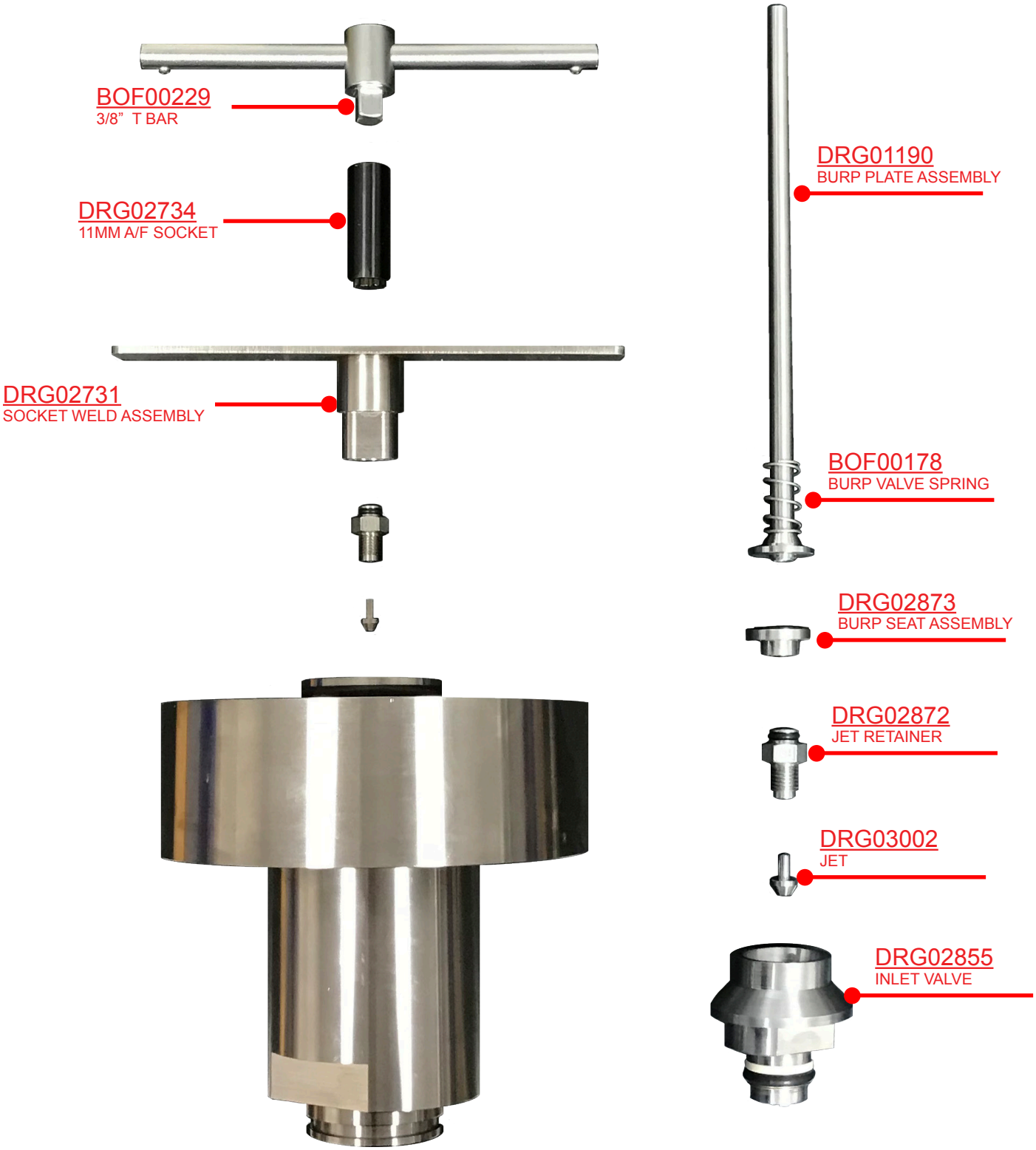
16.1 Cooler Chamber & Chamber Base Assembly (DRG923)



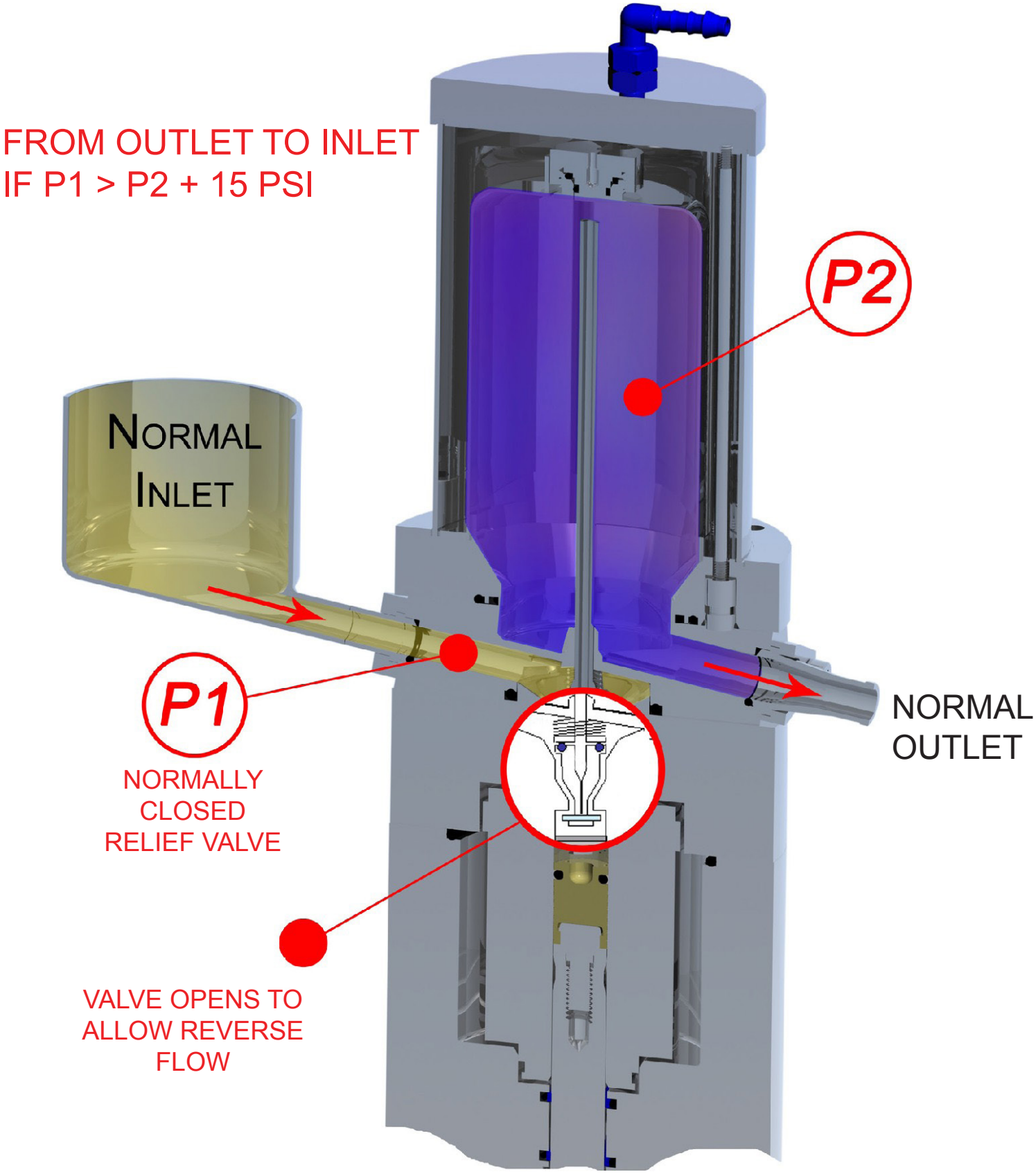
16.2 Mounting of the Chamber Assembly & Chamber Base (DRG924)

16.3 Jet, Jet Retainer & Burp Valve Seat Assembly (DRG925)

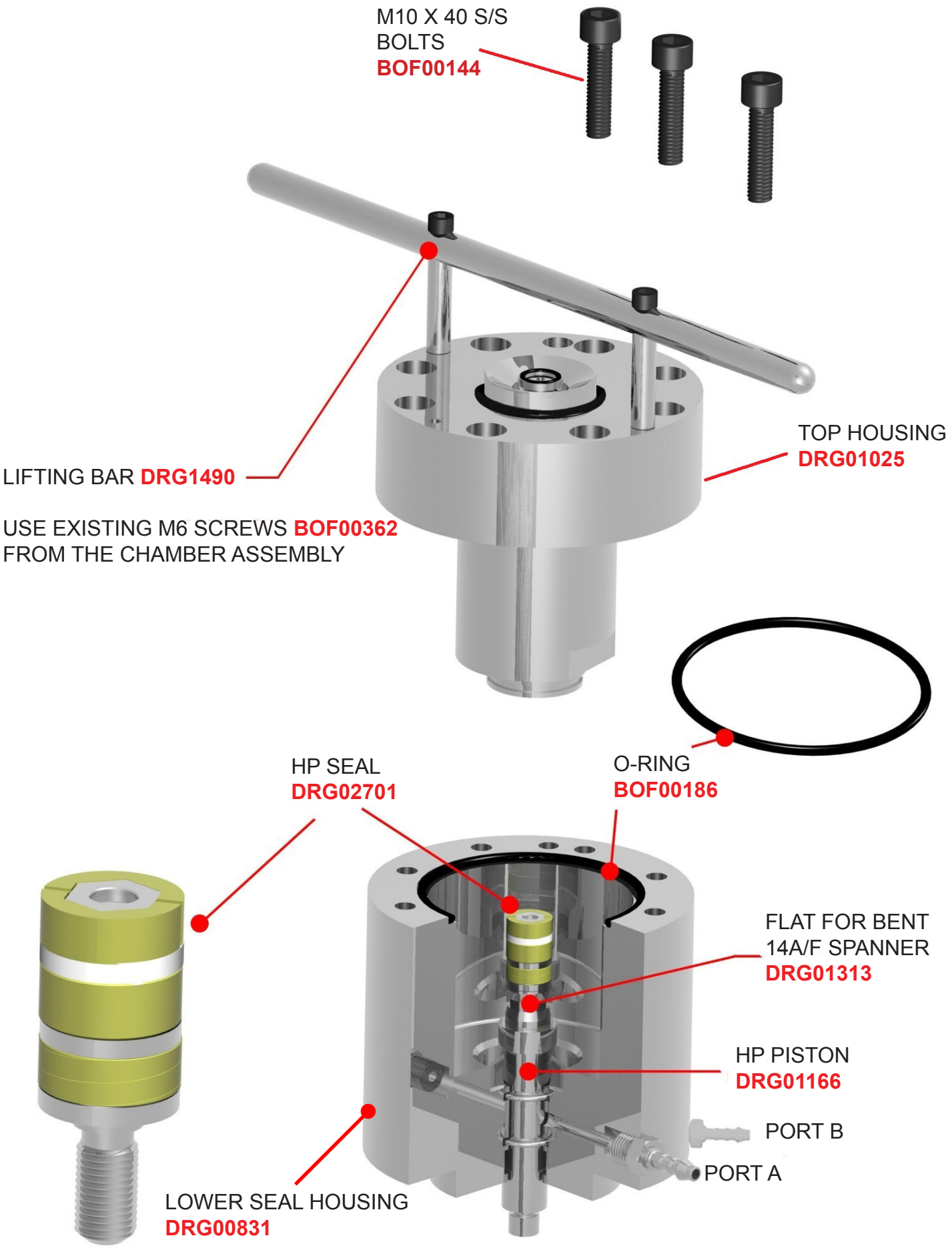
NOTE: ITEMS DRG01190 AND BOF00178 MAY REMAIN IN THE DRG03033 CHAMBER BASE (INLET/OUTLET BLOCK)



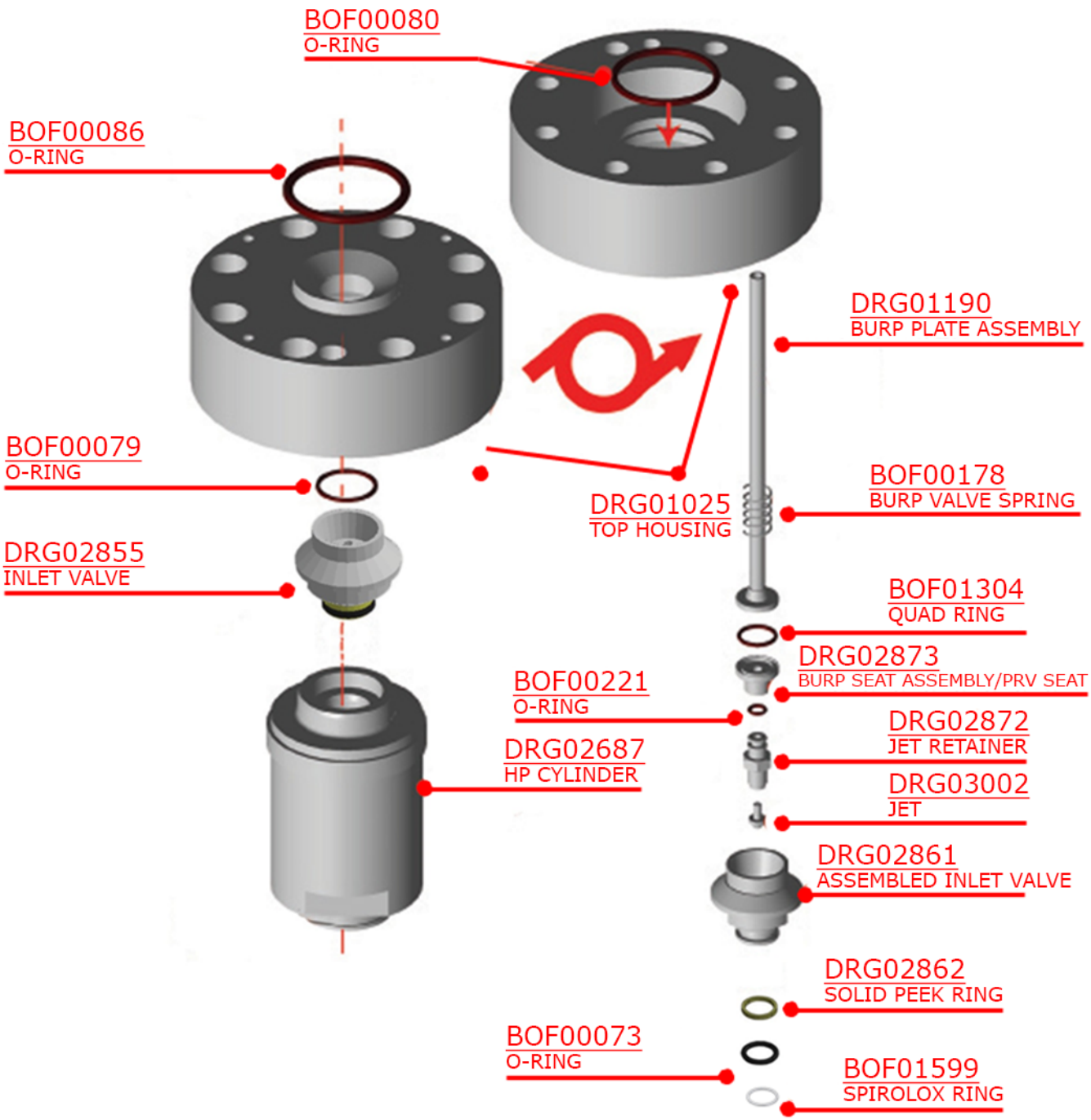
16.4 View of Inlet / Outlet (DRG926)



16.5 Top Housing & Lower seal Housing Assembly (DRG927)



16.6 Top Housing, Inlet Valve & Cylinder Assembly (DRG928)



17.0 INTERNAL CLEANING AND STERILISATION: NORMAL OPERATION

1. Pass 200mL of cleaning fluid, i.e. commercially available detergent, bleach or ethanol through the disruptor, operating in the normal way, set at the maximum pressure setting. This should be followed by a similar amount of clean water. This process can be repeated as required.

NOTE: Correct Personal Protective Equipment (PPE) should be worn.

NOTE: If bleach is used, this must be thoroughly rinsed from the system with clean water to prevent prolonged contact.

2. Additional cleaning may be required depending upon the organism being disrupted.

3. This may be achieved by applying a supply of cleaning fluid to the outlet. A pressure in excess of 15psi is required to lift the “Internal Relief Valve”. Continue this process until the fluid coming out of the inlet is judged to be clear.

4. Repeat the reverse flow process with clean water.

5. Repeat the disruption process with water as detailed above.

NOTE: If the machine is fitted with an inlet reservoir some arrangement must be made to collect the cleaning fluid. The reservoir can be inverted to achieve this.

6. In the event of the machine being left for long periods without cleaning, or perhaps before a new project, the disruption head can be cleaned by dismantling as for a target change and then soaking and washing manually in suitable fluids and finally rinsing in clean water.

NOTE: The Quad O-ring must be checked prior to using the machine, and re-seated as required (See page 51).

Typically, a cleaning regime could comprise of: - (Continued)

1. Cold water wash - the effectiveness of the wash can be monitored by OD and protein concentration of effluent.

2. Detergent (at manufacturers recommended concentration and temperature, usually around 60°C) - the effectiveness of the wash can be monitored by pH of effluent.

3. Hot water wash - the effectiveness of the wash can be monitored by pH of effluent.

4. Cold water wash - the effectiveness of the wash can be monitored by pH of effluent.

5. De-ionized water wash - the effectiveness of the wash can be monitored by pH of effluent.

17.1 Sterilization

The whole of the Disruptor Head including the inlet and outlet fittings can be autoclaved.

NOTE: Care must be taken to ensure that both the disruption chamber and the cooling jacket are drained before autoclaving.
NOTE: Do not Autoclave the carbide insert Target.

18.0 TROUBLESHOOTING:

Basic Fault Diagnosis

18.1 No power (Touch Screen does not illuminate)

• Check that Machine is switched on at rocker switch & plug socket.
• Check for a blown or faulty fuse (plug or inlet socket) or reset MCB.
• Check if the 24v fan is working - Contact service agent.

18.2 Motor does not start after switching on

• Check that power is applied to machine (see above)
• Check that CPU overload trip in the electrical box in the back of the machine has not cut out. Reset if required. This should be Black if OK and a White Band showing if this has tripped out.
• Make sure housing is assembled correctly.
• Check that the Green LED is illuminated on the start button of the HMI
• Contact service agent.

18.3 Pressure control knob does not change pressure display

• Pressure adjuster knob has become loose on spindle. Tighten grub screw with hex wrench.
• Contact Service Agent.

18.4 Pressure cycle does not disrupt within 50 seconds of machine being started

• Check bottom proximity switch is made. This can be seen on the HMI display, the “Down” LED should be illuminated, if not press the ‘Down’ button.
• Solenoid may not be activating.
• Contact Service Agent.

18.5 Disruption cycle completes but sample does not flow through system

Possible ‘Blow Back’ due to:

• Failed inlet O-ring.
• Inlet valve requires re-lapping.
• Loose Jet.
• HP Seal leak.
• Contact Service Agent

18.6 Fluid flows out of port B (See page 58)

• Glyde Ring (BOF30) leak.

18.7 Fluid flows out of port A (See page 58)

• HP Seal leak.

NOTE: Record how many strokes the current HP Seal has performed then, contact Service Agent.

18.8 No output of sample and stroke does not complete

• Possible blocked Jet (“Jet blocked” light appears on touch screen display) - increase pressure setting to clear jet.
• Remove Jet and sonicate.
• Replace Jet.
• Navigate to the Service page, press the ‘UP’ button until top sensor text appears (If this does not appear contact service agent) if text does appear, press ‘Down’ button until bottom sensor text appears (If this does not appear contact service agent).
• Contact Service Agent

18.9 Sample flows back into reservoir during disruption stroke

• Ensure the Jet is fitted correctly and fully tightened
• Replace or overhaul Inlet valve and/or Inlet valve “O”-ring.
• Contact service agent, the Inlet valve may need re-lapping.

18.10 Machine completes one disruption stroke only

• Possible failure to control circuit.
• Make sure Continuous flow has been selected on HMI
• Contact Service Agent.

18.11 Re-start the HMI

• Press the logo on the main screen (Home).

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Cell Disruption Made Easy

• If you wish to re-start the HMI press the yes button (The HMI will now restart)
• If you do not wish to re-start the HMI press the no button (The HMI will navigate back to the main screen).

19.0 TESTING THE CELL DISRUPTOR:

A very simple and informative test to check the efficiency of the disruptor is as follows:

1. Fill the reservoir with approx. 200mL of water.

2. Start the machine cycle as if it was disrupting a sample.

3. After 2-3 strokes stop the machine and clear any liquid from the outlet.

4. The swept volume of the 40,000PSI disruptor is approximately 10mL, therefore we should expect 100mL; if more than 110mL has been collected then there is leakage from the inlet area to the outlet area by-passing the high pressure stroke (this will give poor disruption results as not all of the entire sample is being processed).

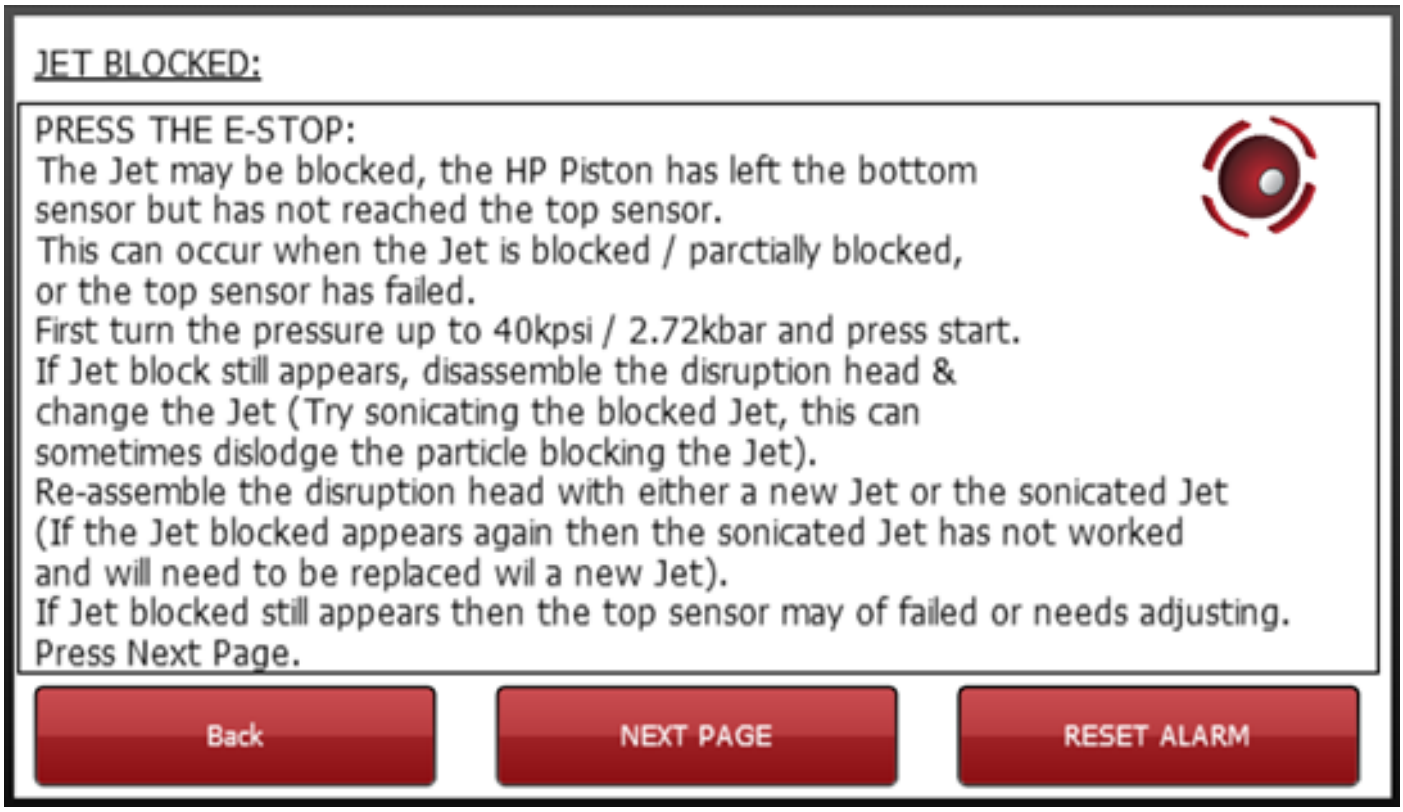
5. If less than 90mL has been collected then some leakage of the high pressure route is likely, e.g. partial failure of the High Pressure Seal, or Inlet Valve assembly and Jet.

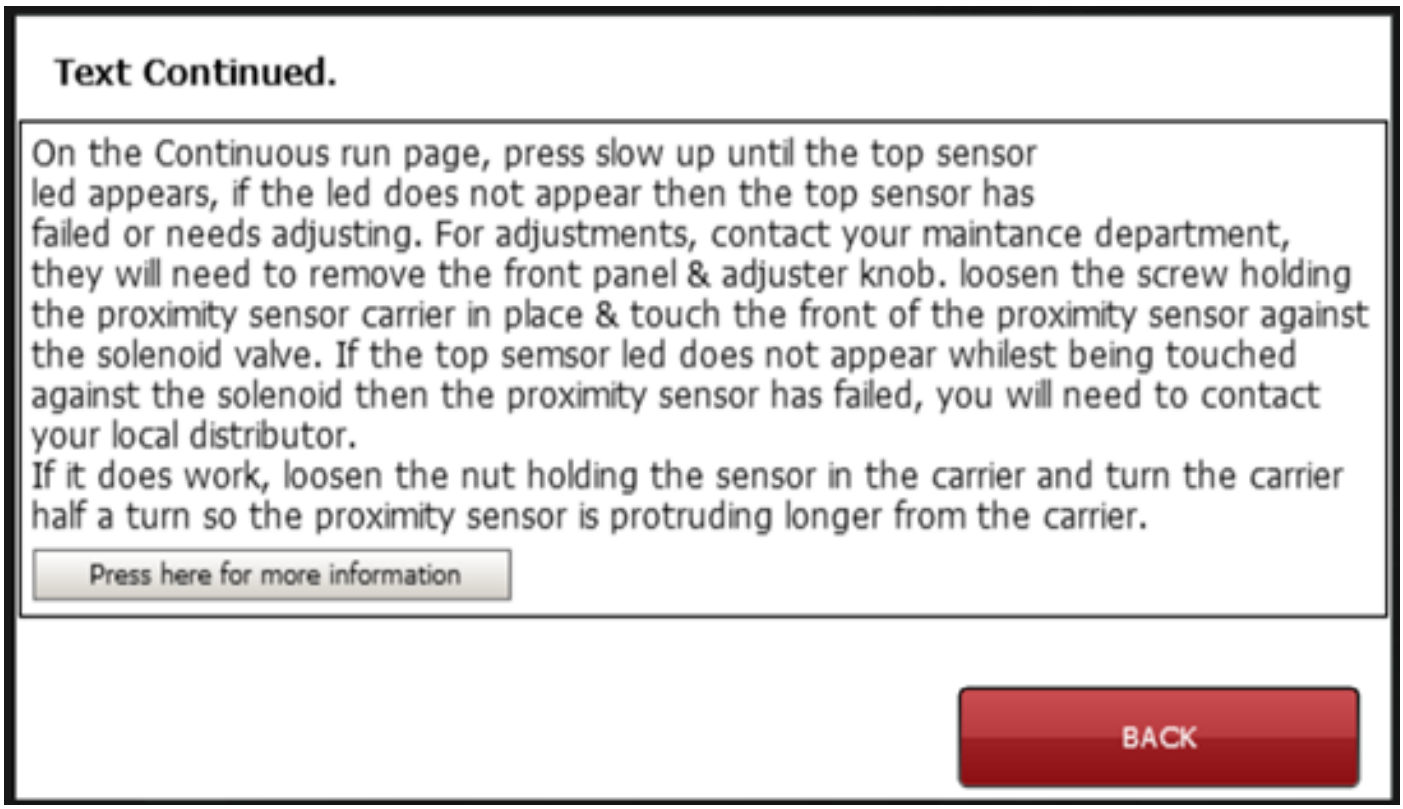
6. In either case the fault has to be rectified to ensure correct working and throughput of the disruptor.

20.0 FAULT ICONS:

20.1 Jet Blocked

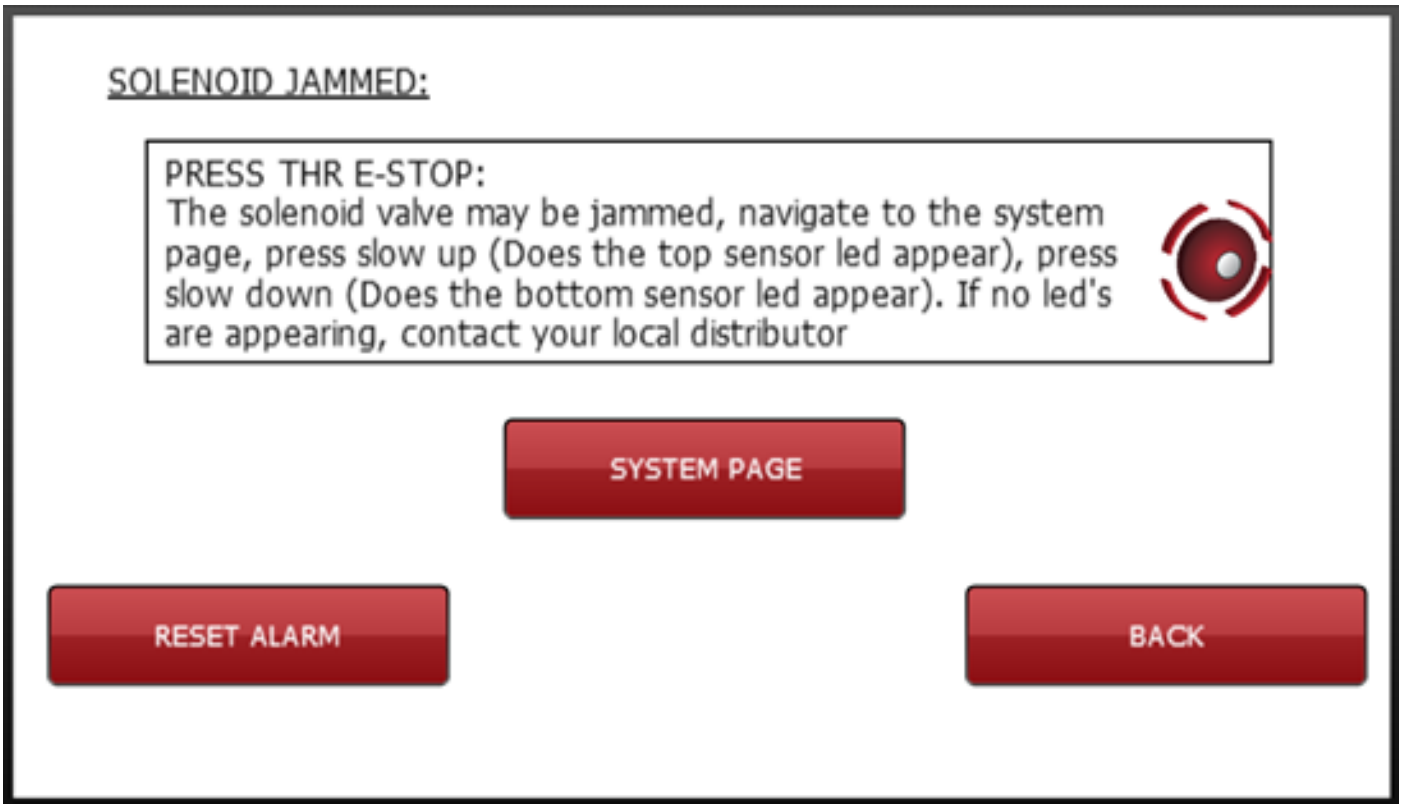
If the Jet Blocked warning appears please follow the instruction on the HMI.





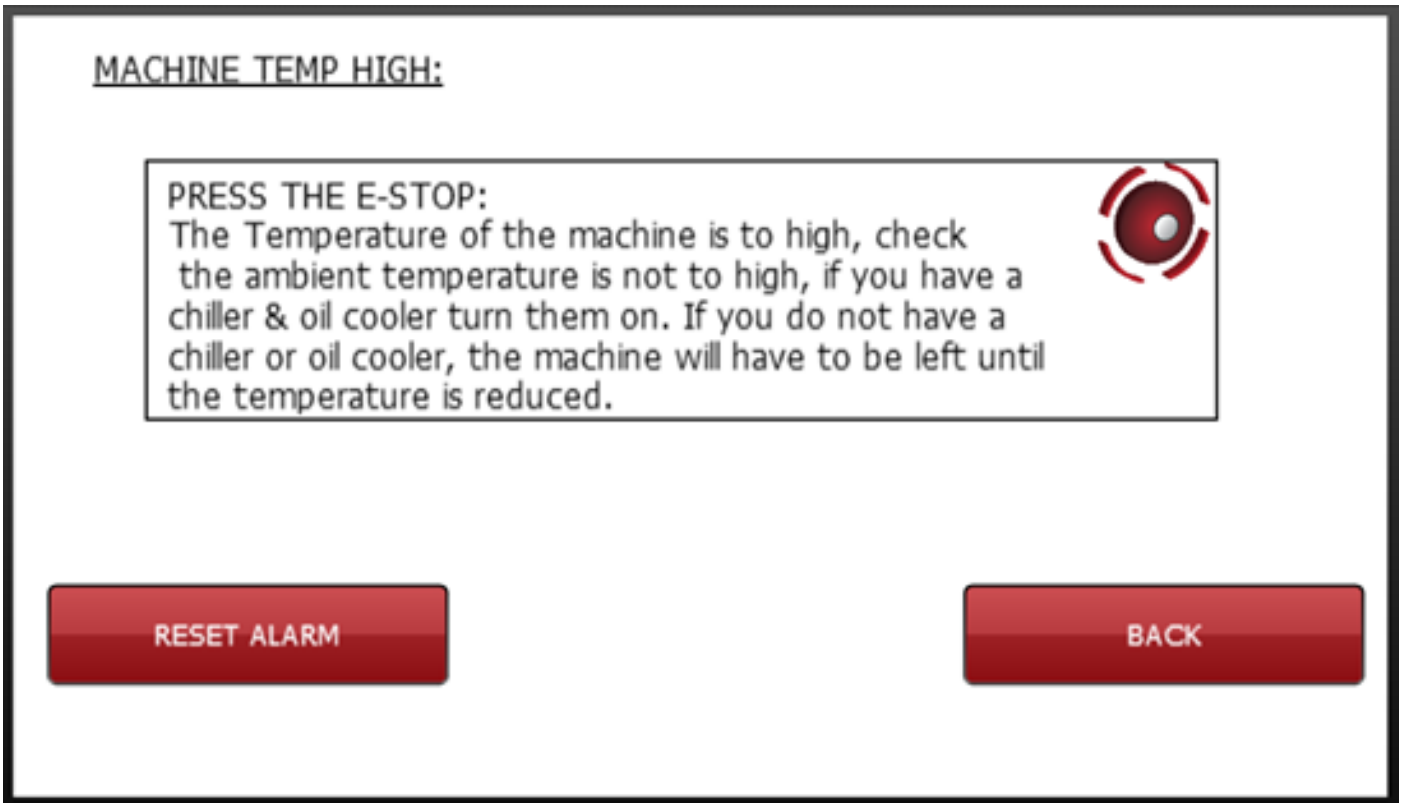
20.2 Solenoid Jammed

If the Solenoid Jammed warning appears please follow the instruction on the HMI.



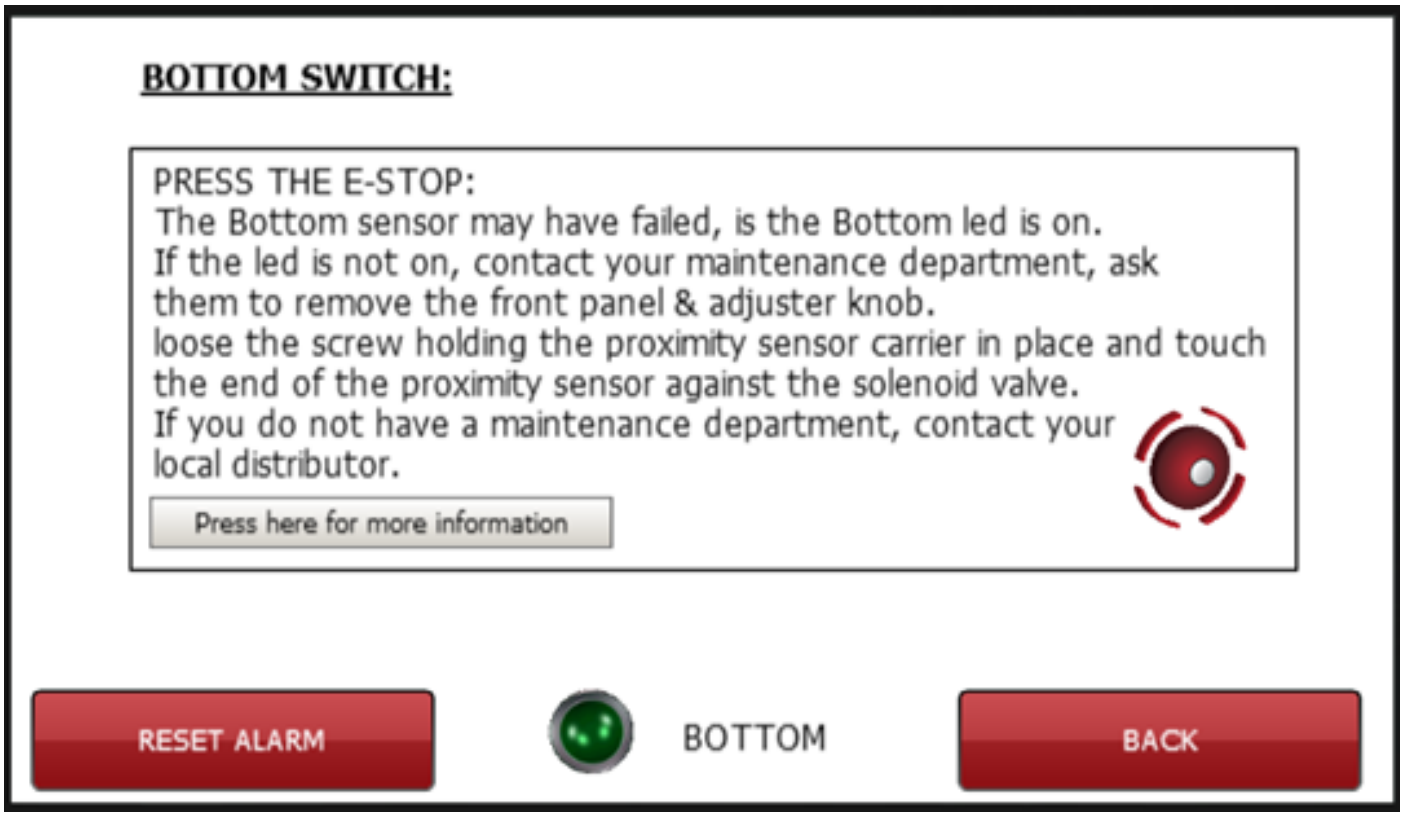
20.3 Machine Temp High

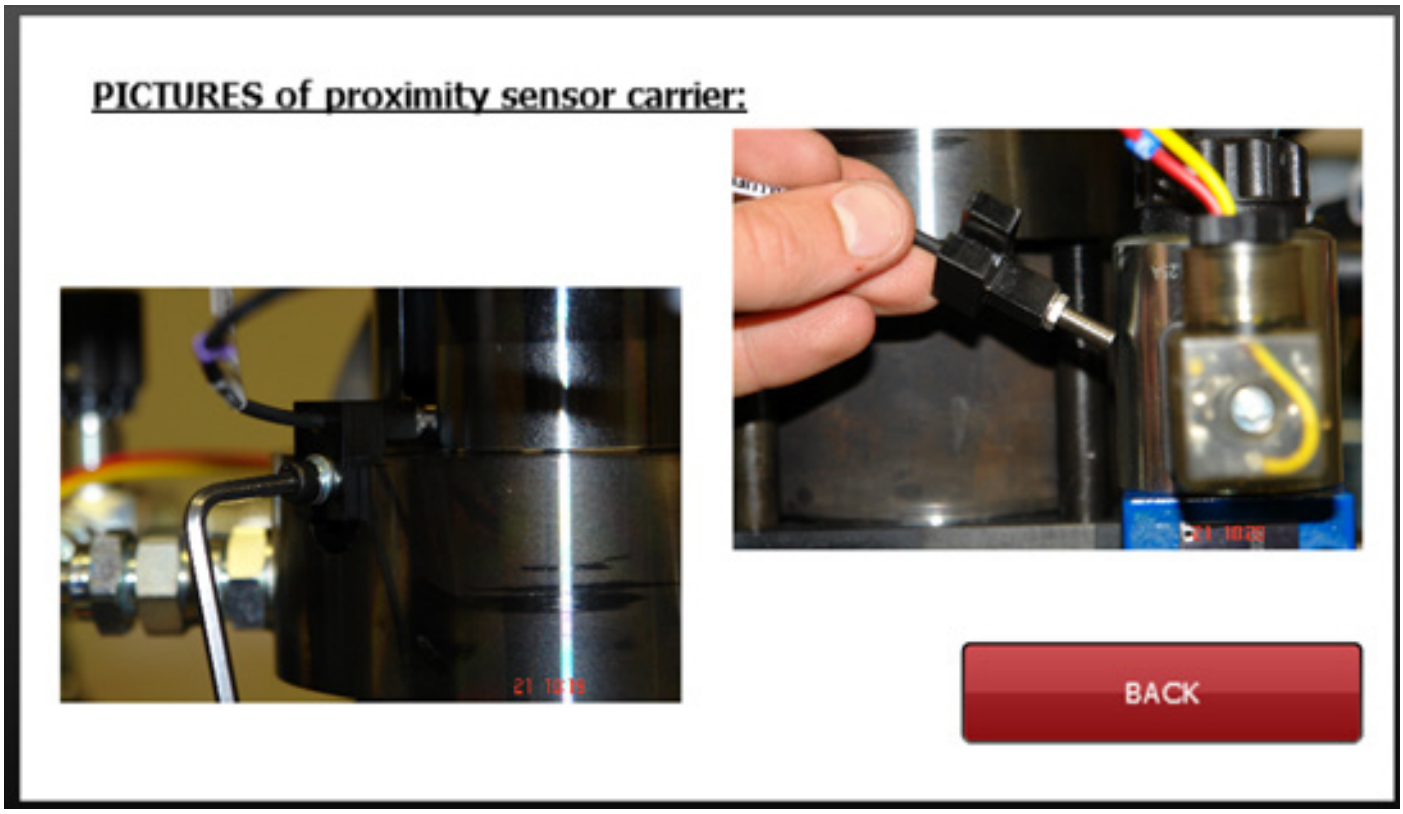
If the Machine Temp High warning appears please follow the instruction on the HMI.



20.4 Bottom Switch

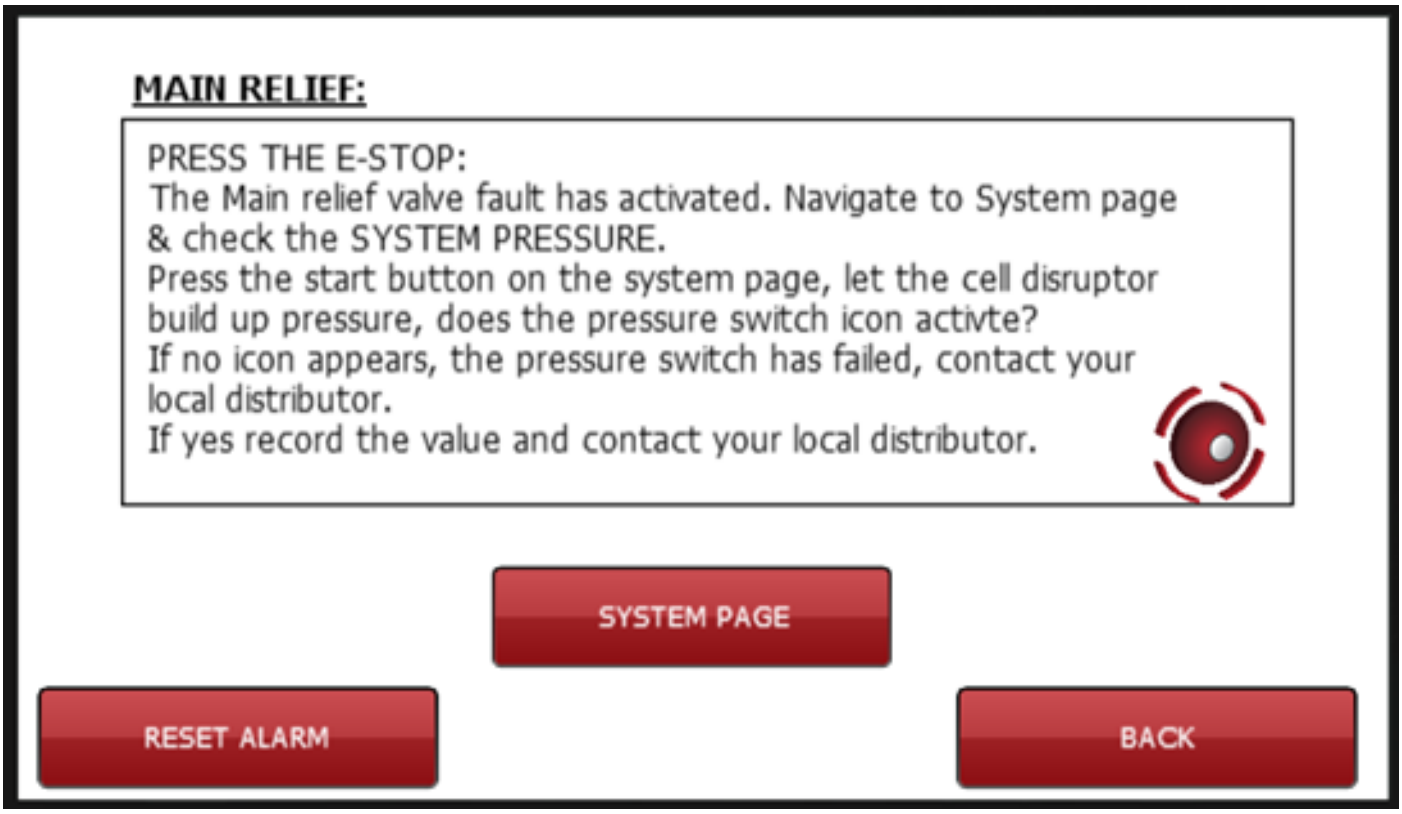
If the Bottom Switch warning appears please follow the instruction on the HMI.





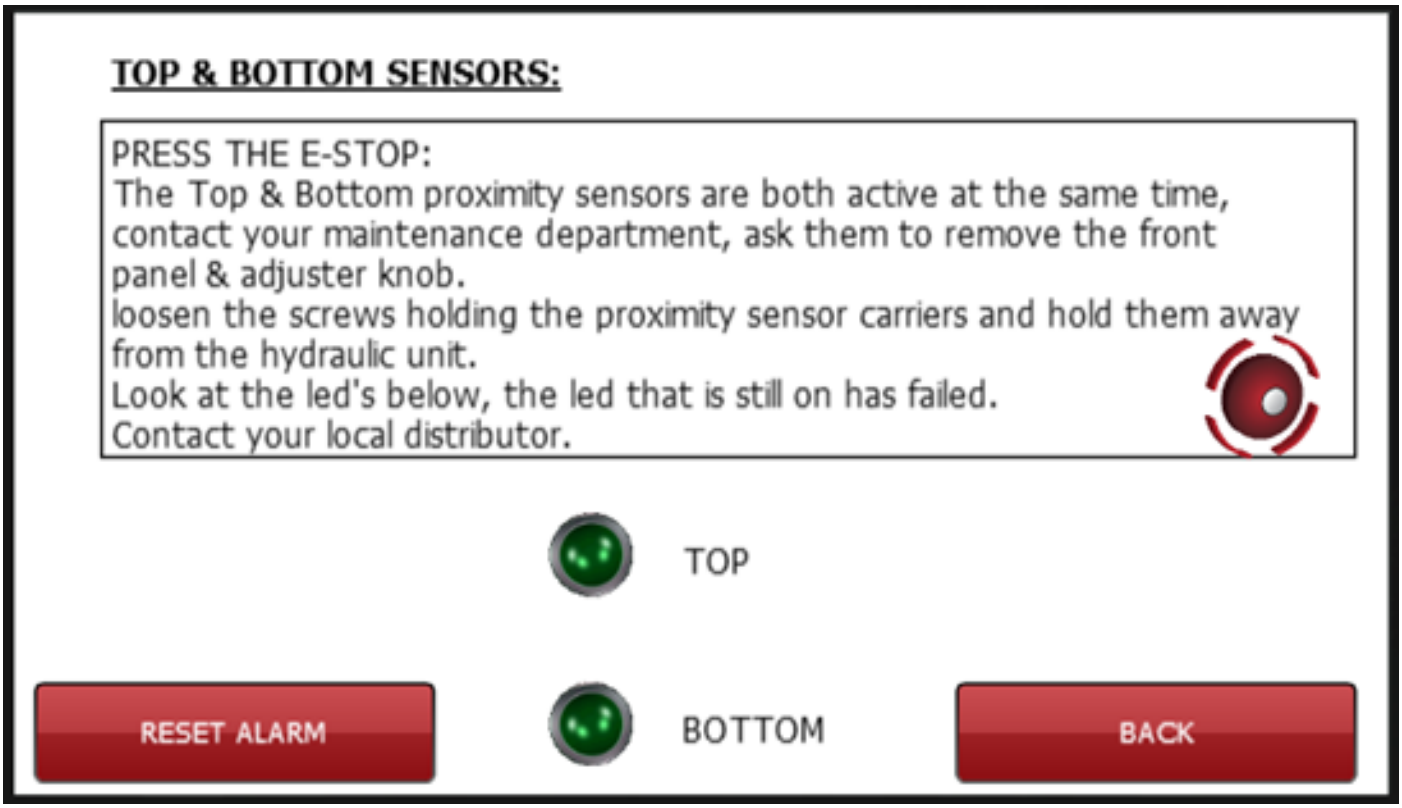
20.5 Main Relief

If the Main Relief warning appears please follow the instruction on the HMI.

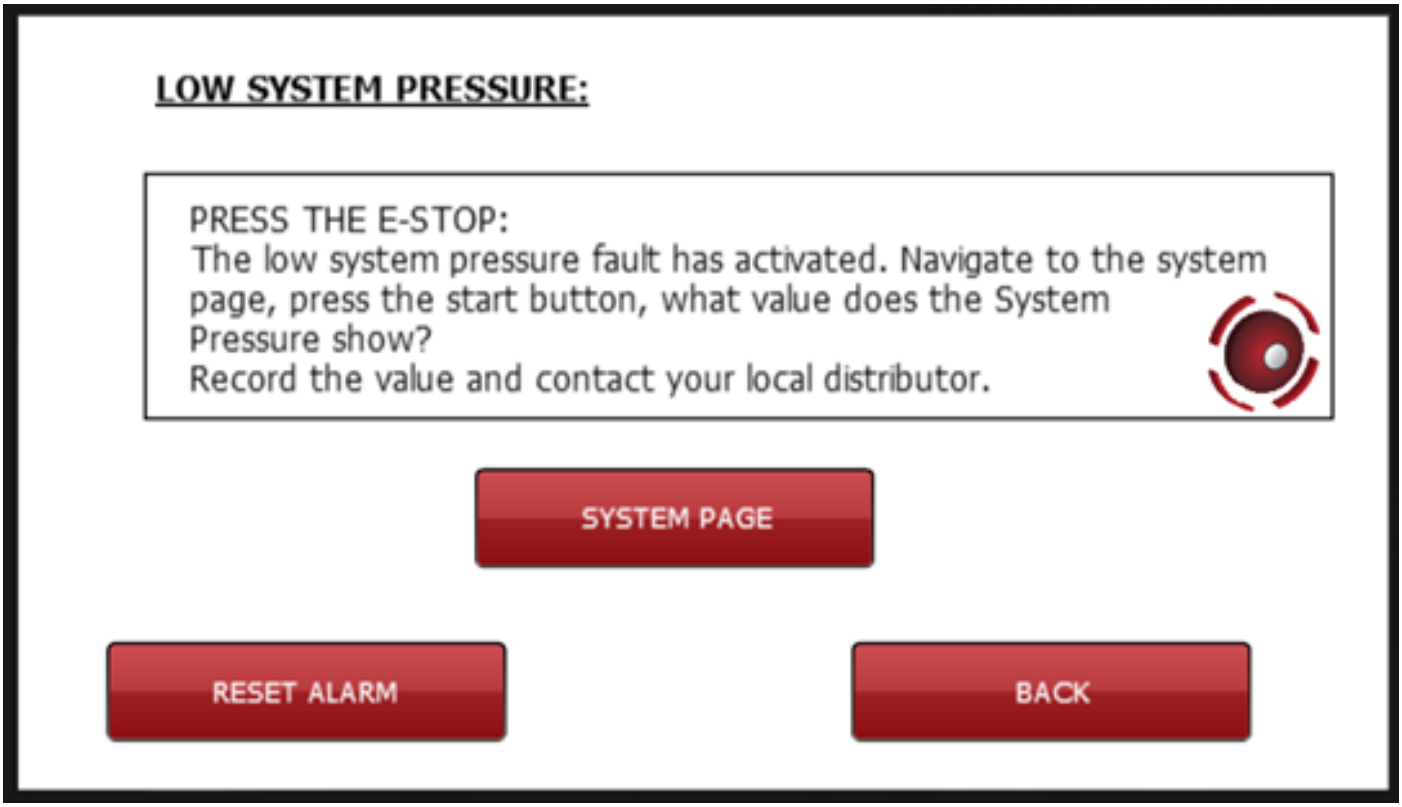


20.6 Top & Bottom Sensor

If the Top & Bottom Sensor warning appears please follow the instruction on the HMI.



20.6 Low System Pressure



21.0 APPENDICES

21.1 EC Declaration Of Conformity

We Constant Systems Ltd under our sole responsibility declare that the product as listed below.

Product Category: **CELL DISRUPTOR**
Model: **CF SERIES**

Conforms to principal safety objectives of the **European Directive 2014/68/EU** (Pressure Equipment Directive) in accordance with conformity assessment procedure: **Module A.**

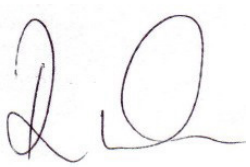
The pressure equipment constituting the Pressure Equipment Assembly consists of the following: Disruptor Pump (Category 1), Accumulator (Article 3.3-SEP), & Hydraulic Operating Circuits (Article 3.3 – SEP).

Conforms to principal safety objectives of the **European Directive 2014/35/EU** ('Low Voltage Directive').

Conforms to the protection requirements of **European Directive 2014/30/EU** ('EMC Directive').

This certificate also confirms that all tests specified in our build instructions have been satisfactorily completed.

The machine should at all times be operated as instructed in the Operating Manual.

Signed: 

Richard Mallabar

Title: Managing Director

On Behalf Of Constant Systems Ltd
Date: JULY 2016

21.2 Intertek Authorization To Mark

Intertek

AUTHORIZATION TO MARK

This authorizes the application of the Certification Mark(s) shown below to the models described in the Product(s) Covered section when made in accordance with the conditions set forth in the Certification Agreement and Listing Report. This authorization also applies to multiple listee model(s) identified on the correlation page of the Listing Report.

This document is the property of Intertek Testing Services and is not transferable. The certification mark(s) may be applied only at the location of the Party Authorized to Apply Mark.

Applicant:	Contant Systems Limited	**Manufacturer:**	Contant Systems Limited
Address:	Low March Daventry Northants NN11 4SD	**Address:**	Low March Daventry Northants NN11 4SD
Country:	United Kingdom	**Country:**	United Kingdom
Contact:	Mr. James Amos	**Contact:**	Mr. James Amos
Phone:	+44 (0) 1327 314 146	**Phone:**	+44 (0) 1327 314 146
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Email:	james.amos@constantsystems.com	**Email:**	james.amos@constantsystems.com

Party Authorized To Apply Mark: Same as Manufacturer
Report Issuing Office: Leatherhead, UK

Control Number: 3092407 **Authorized by:**

Ulla-Pia Johanss - Nilsson
For Dean Davidson, Certification Manager

C ETL CM US LISTED

Intertek

This document supersedes all previous Authorizations to Mark for the noted Report Number.

Intertek Testing Services NA Inc.
545 East Algonquin Road, Arlington Heights. IL 60005 Telephone
800-345-3851 or 847-439-5667 Fax 312-283-1672

Standard(s) :	UL 61010-1: Issued: 2004/07/12 Ed:2 Rev: 2008/ 10/28, Electrical Equipment for Measurement, Control and Laboratory Use; Part 1: General Requirements CAN/CSA C22.2 No. 6 1010-1; Issued: 2004/07/ 12 Ed: 2 (R2009) Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part 1: General Requirements, with general instruction No. 12008/ 10/28
Product:	Cell Disruptor Systems
Brand Name:	Constant Systems

AUTHORIZATION TO MARK

Models :	One Shot series models OS15/01/BA, OS20/01/BA, OS30/01/ BA and OS40/01/BA. Multi Shot series model MS40/MS5/BA TS2 series models BT15/TS2/BA, BT20/TS2/BA, BT30/TS2/BA and BT40/TS2/BA. TS5 series models BT15/TS5/EE, CAB15/TS5/EB and CAB15/TS5/EC. TS5 series models BT20/TS5/EE, CAB20/TS5/EB and CAB20/TS5/EC. TS5 series models BT30/TS5/EE, CAB30/TS5/EB and CAB30/TS5/EC. TS5 series models BT40/TS5/EE, CAB40/TS5/EB and CAB40/TS5/EC. TS6 series models BTH15/TS6/BA, BTH15/TS6/EE, CAB15/TS6/EB and CAB15/TS6/EC. TS6 series models BTH20/TS6/BA, BTH20/TS6/EE, CAB20/TS6/EB and CAB20/TS6/EC. TS6 series models BTH30/TS6/BA, BTH30/TS6/EE, CAB30/TS6/ EB and CAB30/TS6/EC. TS6 series models BTH40/TS6/BA, BTH40/TS6/EE, CAB40/TS6/EB and CAB40/TS6/EC. TS7 series models BTB15/TS7/EE, CABB15/TS7/ EB and CABB15/TS7/EC. TS7 series models BTB20/TS7/EE, CABB20/TS7/EB and CABB20/TS7/ EC. TS7 series models BTB30/TS7/ EE, CABB30/TS7/EB and CABB30/TS7/EC. TS7 series

22.0 CONSTANT SYSTEMS CELL DISRUPTOR LOG BOOK

DATE	TIME	OPERATOR	PRESSURE	NOTES (INCLUDE ORGANISMS & PRESSURE)	Stroke Counter