



Industrial | Process | R&D

Instruction Manual

FT74XA HTST/UHT Heat Exchanger Processing Unit

Issue 18

1 Introduction

This manual contains instructions for the correct use and maintenance of the FT74XA manufactured by Armfield Limited.

The information contained in this manual is intended for the user who is required to read it carefully and to ensure that he has fully understood it before operating the machine.

The user manual must be available for ready consultation at all times.

If the manual is lost or damaged contact the manufacturer for a replacement copy.



WARNING - The manufacturer is not liable for consequences resulting from an improper use of the machine due to the user's failure to read this manual or incomplete reading of it.

The manual is an integral part of each piece of equipment and consequently must be kept throughout the entire service life of the machine and accompany it at all times, even if transferred to another user.

This manual contains instructions required for the safety, receiving, installation, storage, correct operation and maintenance of the FT74XA.



WARNING - Armfield Limited reserves the right to modify the specifications referred to in this manual or the characteristics of each machine. Some of the illustrations in this manual may include parts that are slightly different to those mounted on your machine.



WARNING - All practical work areas and laboratories should be covered by local regulations which must be followed at all times

2 EC Conformity

Each machine is accompanied by an EC Declaration of Conformity signed by the representative of Armfield Limited.

The declaration of conformity states the model and serial number.

The equipment has been constructed in compliance with the essential health and safety requirements laid down in the following applicable directives:

2006/95/EC The Low Voltage Directive

2004/108/EC The Electromagnetic Compatibility Directive

2006/42/EC The Machinery Directive

The following harmonised standards were also consulted for the design and construction of the equipment:

BS EN 61010-1:2010	Safety requirements for electrical equipment for measurement, control, and laboratory use
BS EN 61000-6-1:2007	Electromagnetic compatibility (EMC). Generic standards. Immunity for residential, commercial and light-industrial environments
BS EN 61000-6-3:2001	Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light-industrial environments

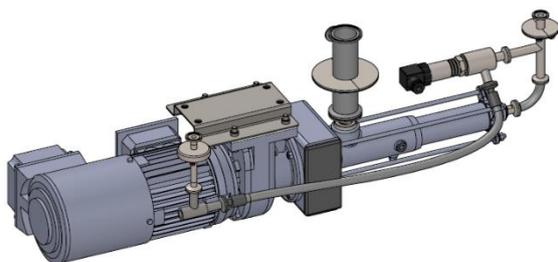


WARNING - This declaration is only valid if the Equipment is installed, used and maintained in compliance with the above mentioned directives and instructions and with the instructions and equipment described in this manual.

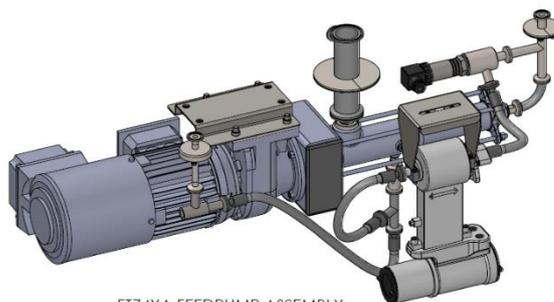
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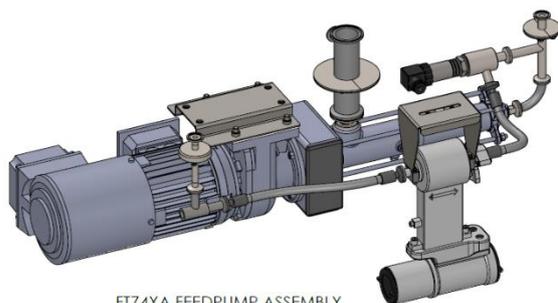
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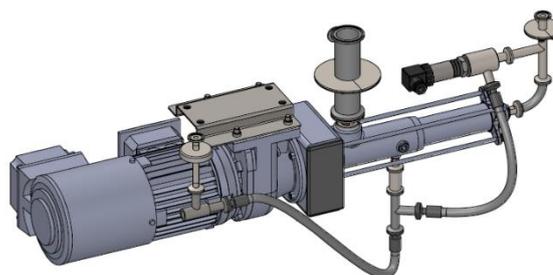
FT74XA FEEDPUMP ASSEMBLY



FT74XA FEEDPUMP ASSEMBLY WITH FT74XA-40 + FT74XA-52



FT74XA FEEDPUMP ASSEMBLY WITH FT74XA-40



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3 Disclaimer

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Should you have any queries or comments, please contact the Armfield Customer Support helpdesk (Monday to Thursday: 0830 - 1730 and Friday: 0830 - 1300 UK time). Contact details are as follows:

United Kingdom	International
(0) 1425 478781 (calls charged at local rate)	+44 (0) 1425 478781 (international rates apply)
Email: support@armfield.co.uk	
Fax: +44 (0) 1425 470916	

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5 Symbols



General warning indicating the potential risk of personal injury



Danger warning



Caution: Explosion Risk



Electrical hazard



Cold Burn hazard



High Voltage hazard



Caution: Flammable



Rotating parts hazard



Caution: Biohazard



Caution: corrosive material



Do not remove safety guards from rotating parts



Do not repair or oil machine whilst in motion



This symbol draws your attention to the information



Wear protective gloves



Wear eye protection



Wear ear protection



Wear safety shoes



Wear breathing protection

6 Safety

6.1 Failure to comply with safety standards



Failure to comply with the safety standards described in this manual and those relating to common sense can cause danger to people and the environment and damage the Equipment.

Specifically, such non-observance can cause:

- inability of machine and/or plant to perform key functions
- damage to the machine and /or plant
- electrical, mechanical and/or chemical danger to persons
- environmental danger due to leakage of hazardous substances

Failure to observe and comply with these safety standards will invalidate the warranty.

Keep these instructions and all related documents together, ensure that they are legible and easily accessible to all employees.



Do not remove any safety equipment before operating the Equipment or during its operation. Make sure that there is no evident danger before powering up the Equipment. The system must be inspected regularly to check for damage and to ensure that all safety devices are in good working order.



The Equipment contains moving parts. Do not insert limbs or materials other than the processing material while the Equipment is functioning. In the event of malfunction, danger or lack of appropriate safety systems, shut down the Equipment immediately and inform the qualified personnel.

6.2 Start up, operation and maintenance

The customer is required to verify the suitability of the Equipment for his specific needs, to provide the necessary processing data for a correct selection of the Equipment type and the accessories needed to guarantee the safety of the Equipment. If the user notices that any accessories he considers useful or essential are missing in the order confirmation, it is the customer's responsibility to contact the manufacturer and request that the accessory or accessories be applied to the Equipment.



While the Equipment is being used the safety devices provided must be present and correctly installed. Do not carry out any operation on the safety devices while the Equipment is operating.

6.3 Intended conditions of use



The Equipment must always observe the operating limitations for which it was constructed and those stated in the order confirmation: observe the temperature, pressure, capacity, viscosity and speed limits. Unless otherwise stated in the order, the Equipment must not be used in environments subject to the formation of potentially explosive atmospheres.



Homogenizer should not be used with demineralised / deionised / RO water, as this will lead to premature damage to homogenizer valves.

6.4 Safety guidelines relating to maintenance, inspection and assembly work



The user must ensure that all maintenance, inspection and assembly operations related to the Equipment are carried out by qualified technicians.

Technicians must carefully read this instruction manual before acting on the Equipment. Only authorised and trained personnel are permitted to work on the Equipment.

6.5 Arbitrary production and transformation of spare parts



Changes or modifications to the machine, within the limits that do not go beyond extraordinary maintenance, are only permitted if agreed on beforehand with the manufacturer.

Only original spare parts or parts specifically declared as compatible by Armfield Limited must be used for regular maintenance operations.

These parts have been designed specifically for the system. There is no guarantee that non-original parts can withstand the loads, and function correctly and safely.

The use of non-original parts voids the warranty.

6.6 Noise

The A-weighted sound power level emitted by the machine does not exceed 85dB(A).

This value is guaranteed if the Equipment is installed correctly, that is, in stable conditions with appropriate fastenings and measured at a distance of 1 metre from the Equipment.

6.7 Chemical Safety



The unit is designed to be used with acid and alkaline chemicals for cleaning. Please read the associated MSDS (material safety data sheet) and wear the appropriate PPE (personal protection equipment).

6.8 Control of Hazardous Substances



The Control of Substances Hazardous to Health Regulations

The COSHH regulations impose a duty on employers to protect employees and others from substances used at work which may be hazardous to health.

COSHH covers substances that are hazardous to health. Substances can take many forms and include:

- chemicals
- products containing chemicals
- fumes
- dusts
- vapours
- mists
- nanotechnology
- gases and asphyxiating gases and
- biological agents (germs). If the packaging has any of the hazard symbols then it is classed as a hazardous substance.
- germs that cause diseases such as leptospirosis or legionnaires disease and germs used in laboratories.

The regulations require you to make an assessment of all operations which are liable to expose any person to these hazards. You are also required to introduce suitable procedures for handling these substances and keep appropriate records.

Since the equipment supplied by Armfield Limited may involve the use of substances which can be hazardous (for example, cleaning fluids used for maintenance or chemicals used for particular demonstrations) it is essential that the responsible person in authority implements the COSHH regulations or local equivalent.

Safety data sheets

The regulations also ensure that the relevant Health and Safety Data Sheets must be available for all hazardous substances used in the laboratory.

Products you use may be 'dangerous for supply'. If so, they will have a label that has one or more hazard symbols. These products include common substances in everyday use such as paint, bleach, solvent or fillers. When a product is 'dangerous for supply', by law, the supplier must provide you with a safety data sheet.

Note: medicines, pesticides and cosmetic products have different legislation and don't have a safety data sheet. Ask the supplier how the product can be used safely.

Any person using a hazardous substance must be informed of the following:

- Physical data about the substance.
- Any hazard from fire or explosion.
- Any hazard to health.
- Appropriate First Aid treatment.
- Any hazard from reaction with other substances.
- How to clean/dispose of spillage.
- Appropriate protective measures.
- Appropriate storage and handling.

Although these regulations may not be applicable in your country, it is strongly recommended that a similar approach is adopted for the protection of the users operating the equipment. Local regulations must also be considered.

More information can be found on <http://www.hse.gov.uk/coshh/index.htm>



Any such chemicals used must be stored, handled, prepared and used in accordance with the manufacturer's instructions and with all applicable local regulations. Protective clothing (e.g. gloves, eye protection) should be worn when appropriate, and users should be supplied with any relevant safety information (e.g. the correct procedure in the event of contact with skin or eyes, the correct procedure in the event of a spill, etc.).

6.9 Water Borne Hazards



The equipment described in this instruction manual involves the use of water/fluid, which under certain conditions can create a health hazard due to infection by harmful micro-organisms.

For example, the microscopic bacterium called *Legionella pneumophila* will feed on any scale, rust, algae or sludge in water and will breed rapidly if the temperature of water is between 20 and 45°C. Any water containing this bacterium which is sprayed or splashed creating air-borne droplets can produce a form of pneumonia called Legionnaires Disease which is potentially fatal.

Legionella is not the only harmful micro-organism which can infect water, but it serves as a useful example of the need for cleanliness.

Under the COSHH regulations, the following precautions must be observed:

- Any water/fluid contained within the product must not be allowed to stagnate, i.e. the water must be changed regularly.
- Any rust, sludge, scale or algae on which micro-organisms can feed must be removed regularly, i.e. the equipment must be cleaned regularly.
- Where practicable the water/fluid should be maintained at a temperature below 20°C or the water should be disinfected. Note that other hazards may exist in the handling of biocides if these are used to disinfect the water.
- After use the water system should be filled and run with water containing a mild disinfectant such as 'Milton' to kill any micro-organisms or algal growth then flushed with clean water and left empty.
- A scheme should be prepared for preventing or controlling the risk incorporating all of the actions listed above.

Further details on preventing infection are contained in the publication "The Control of Legionellosis including Legionnaires Disease" - Health and Safety Series booklet HS (G) 70.

6.10 Hot/Cold Surfaces



This unit contains components that that operate with a maximum temperature of 165°C and minimum temperature of -5°C.

Do not touch any surfaces close to 'Hot Surfaces' warning labels, any of the interconnecting tubing or components whilst the equipment is in use or returning to a safe temperature.

6.11 Hot/Cold Liquids



This unit is designed to operate with a maximum liquid temperature of 165°C and minimum liquid temperature of -5°C.

There is also a potential risk of scalding from hot liquids or vapours (e.g. steam).

Before disconnecting any of the pipes or tubing:

- Stop the liquid pump.
- Leave time for the equipment to return to room temperature.
- Check that the temperature of the Equipment and liquid is at a safe level

Do not touch any surfaces close to 'Hot Surfaces' warning labels, any of the interconnecting tubing or components whilst the equipment is in use or returning to a safe temperature.

6.12 Leakage of hazardous fluids



If the Equipment is used to pump/operate with hazardous liquids (toxic, corrosive, flammable, etc.), the volumes of fluid that leak through the seals must be collected and disposed of without endangering human health or the environment and in accordance to local legislation.

6.13 Protective clothing

Wear appropriate protective clothing to protect body parts.



Safety gloves

Wear suitable gloves to protect your hands from various types of possible hazards: mechanical, electrical, chemical and high/low temperatures.



Clothing

Wear appropriate clothing to protect your body from chemical hazards.



Footware

Wear safety footwear to protect your feet from falling objects.



Eye Protection

Wear suitable eye protection to protect your eyes from various types of possible hazards: mechanical debris, chemicals and hot water/steam.



Ear Protection

Wear suitable ear protection to protect your ears from excessive noise.



Breathing Protection

Wear suitable breathing protection to protect your respiratory system from fumes.

6.14 Machine maintenance



Do not disassemble the Equipment before emptying the contents/fluids (if applicable). Even if the tubes are all empty, some liquid could remain in the unit. The fluid(s) can be hazardous to human health and the environment, and can be very hot/cold.



All maintenance work must be carried out with the machine isolated from the power supply.



Before beginning maintenance on the Equipment remember to isolate the power supply. All the devices must be secured against automatic or accidental restart. (Where possible turn the main switch to OFF and remove the key). In particular situations where you need to run the Equipment while servicing at least 2 persons must be present so that in the event of danger one person will be able to disconnect the power supply or raise the alarm. Once maintenance has been completed remember to restore the safety devices and check that they are in good working order.



To give increased operator protection, the unit incorporates a Residual Current Device (RCD), alternatively called an Earth Leakage Circuit Breaker, as an integral part of this equipment. If through misuse or accident the equipment becomes electrically compromised, the RCD will switch off the electrical supply and reduce the severity of any electric shock received by an operator to a level which, under normal circumstances, will not cause injury to that person.



At least once each month, check that the RCD is operating correctly by pressing the TEST button. The circuit breaker MUST trip when the button is pressed. Failure to trip means that the operator is not protected and the equipment must be checked and repaired by a competent electrician before it is used.

7 General Overview

The Armfield FT74XA heat exchanger processing unit has been designed to allow small quantities of food and other products to be processed conveniently in the laboratory. The unit is designed to mirror the industrial processes of HTST and UHT treatment which are used to give increased product shelf-life.

The FT74XA is capable of producing product with physicochemical properties virtually identical to those processed in the factory. This has been achieved through the development of scaled-down stainless-steel heat exchangers which work in an identical fashion to production scale. Two heat exchanger designs are available: the plate heat exchanger which is made up of heat exchanger plates and gaskets forming heating, regeneration and cooling sections. The other design is the tubular heat exchanger which consists of a number of tubular heat exchanger sections configured into pre-heating, heating and cooling sections. Both exchangers can be configured for two stage cooling allowing both water and glycol cooling for low product outlet temperatures.

The FT74XA may be sited in most production environments and is well suited to operation in the laboratory. Typical product throughput is 10-20 L/h but, depending on processing temperature, a wide range of flow rates may be used. High-flow operation is used for clean in place (CIP) operations. Start-up times are short and the response of the temperature control system is rapid. These, combined with low product hold-up volumes, enable samples of different products and different temperature regimes to be processed rapidly.



FT74XA fitted with double area tubular heat exchanger (FT74-20-MkIV-DUAL)

8 Equipment Diagrams

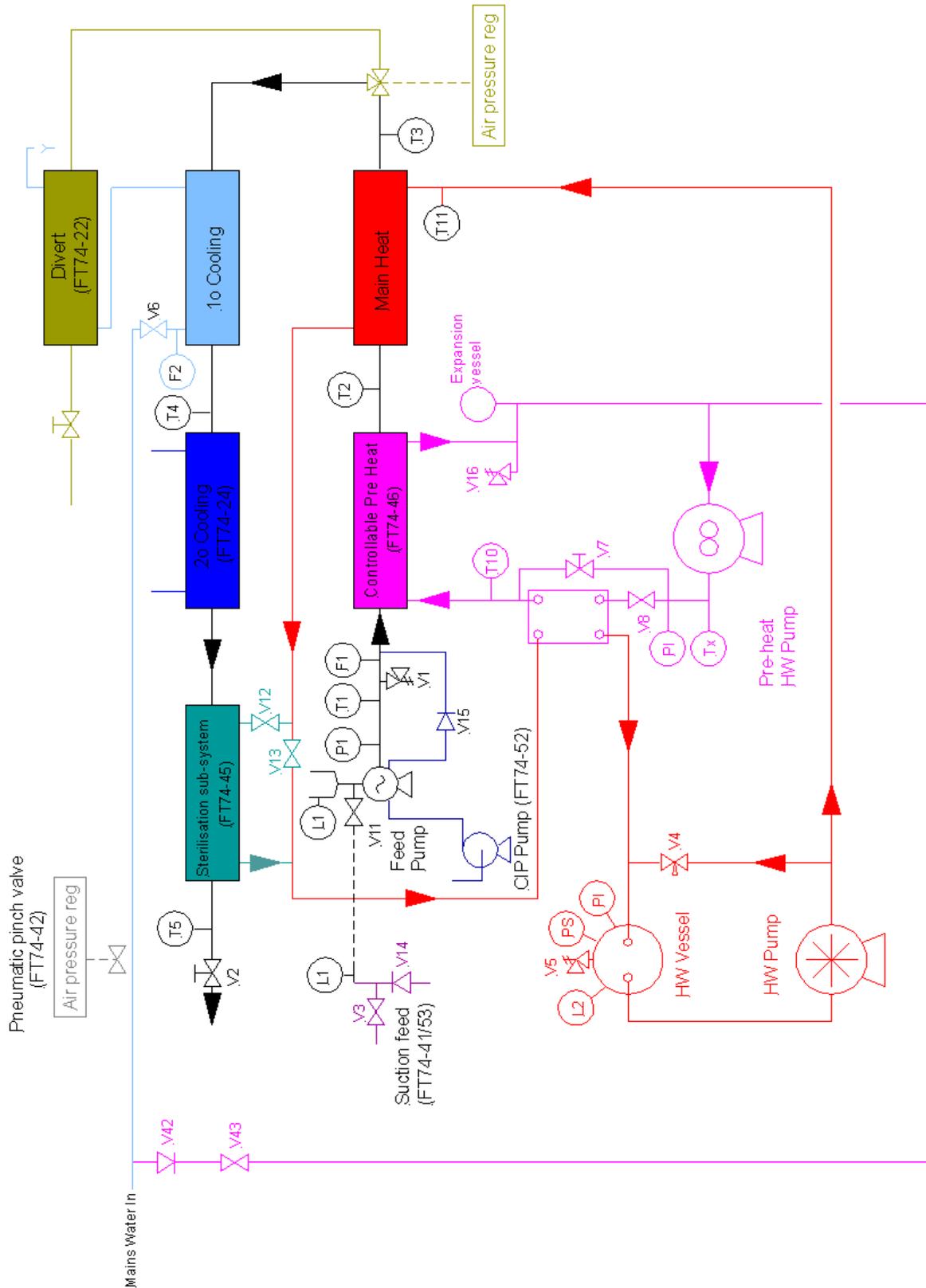


Figure 1 Process flow diagram of FT74XA fitted with tubular heat exchanger (FT74-20) T = temperature sensor, P = pressure sensor, F2 = cooling water flowmeter, L = level sensor

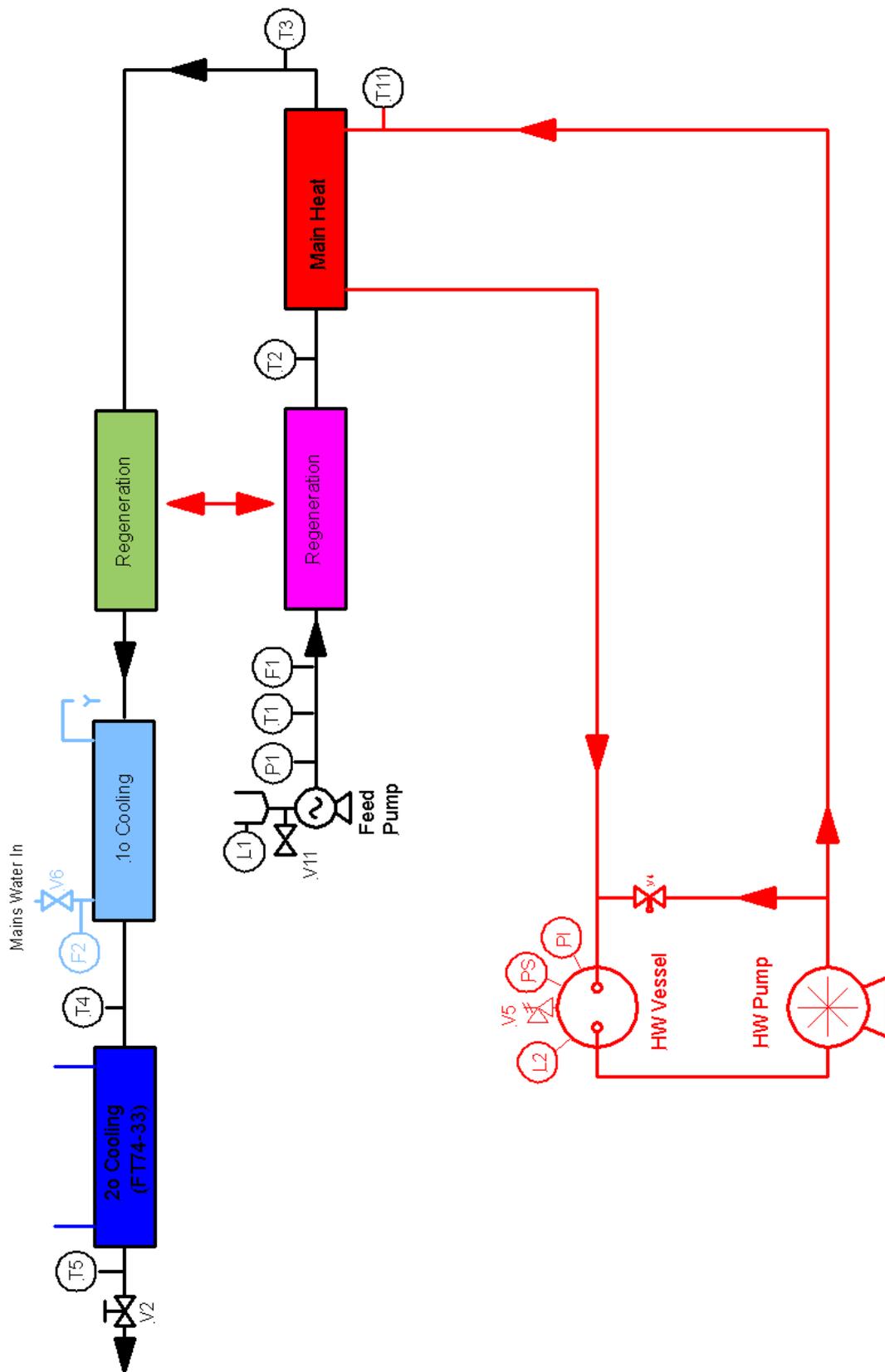


Figure 2 Process flow diagram of FT74XA fitted with plate heat exchanger (FT74-30) T = temperature sensor, P = pressure sensor, F = flowmeter, L = level sensor. Initial heating and cooling employs heat regeneration.

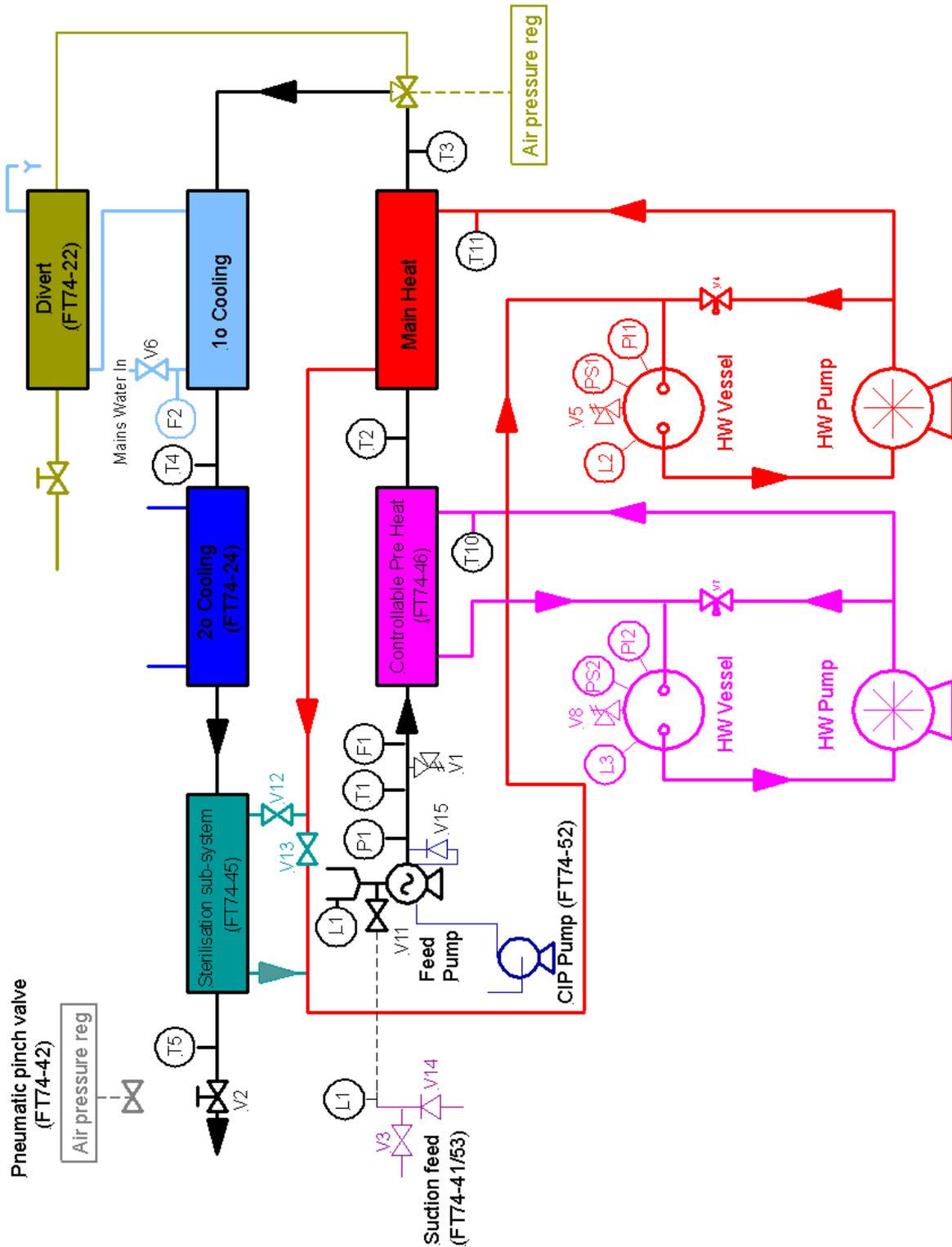
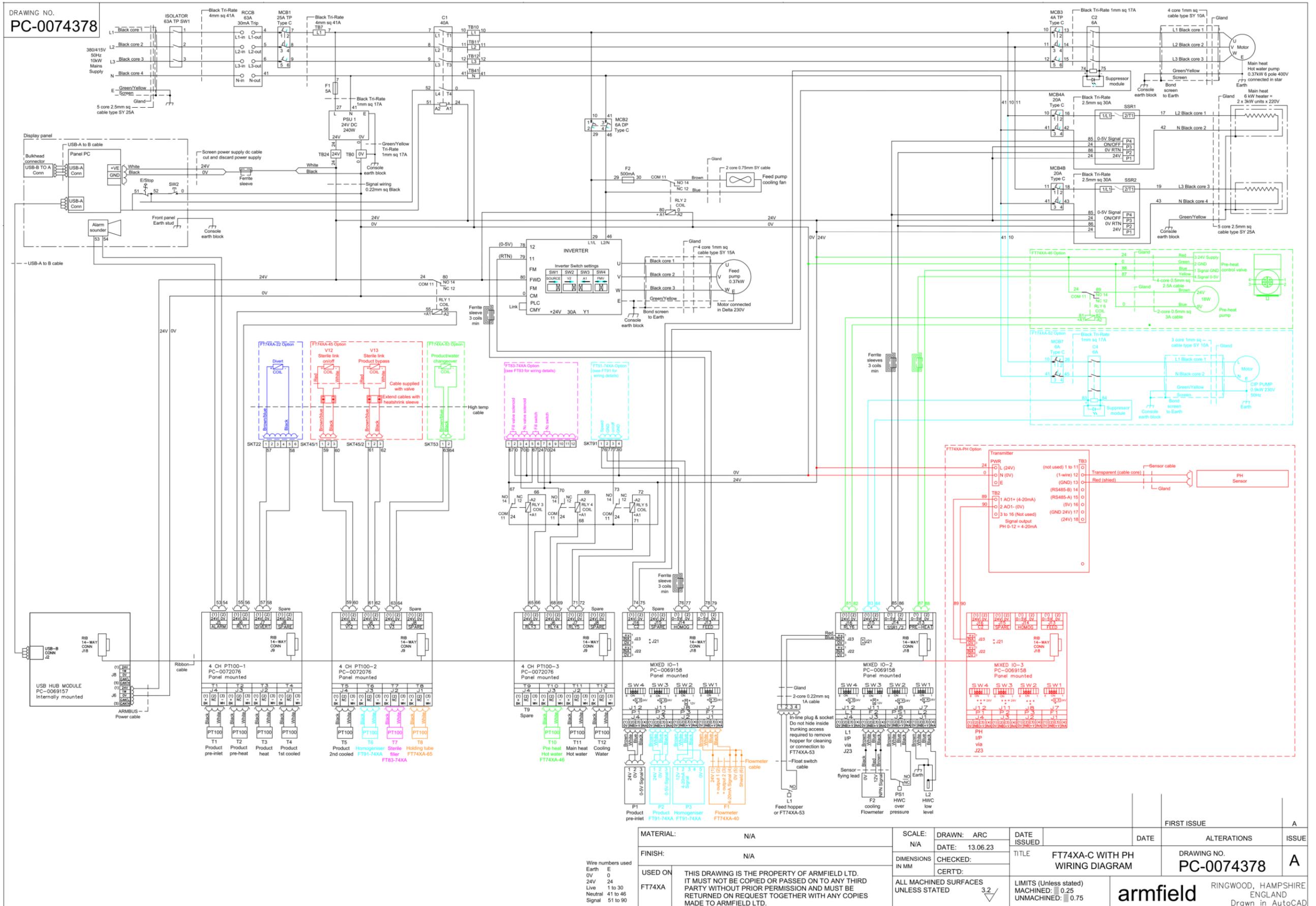


Figure 3 Process flow diagram of FT74XA fitted with options for controllable pre-heat, secondary cooling (FT74-24) and the sterilisation system (FT74-45), product divert *FT74-22), pneumatic pinch valve (FT74-42, alternative to V2 to handle products with suspended solids), suction feed (FT74-41 or FT74-53 – allows feeding from an external tank), CIP pump cleaning (FT74-52). T = temperature sensor, P = pressure sensor, F = flowmeter, L = level sensor. Initial heating and cooling employs heat regeneration.

8.1 FT74XA valve and sensor Idents

V1	Product pressure relief valve
V2	Product backpressure valve
V3	Suction feed water supply valve
V4	HWC divert valve (main heat)
V5	HWC pressure relief valve (main heat)
V6	Cooling water isolation valve
V7	HWC divert valve (pre heat – twin boiler version)
V8	HWC pressure relief valve (pre-heat – twin boiler version)
V11	Feed vessel drain valve
V12	Sterilisation sub-system (FT74-45) HW valve
V13	Sterilisation sub-system (FT74-45) HW valve
V14	Suction feed check valve
V15	CIP check valve
V16	FT74-20 pre-heat HW needle control valve
T1	Product feed temperature
T2	Product pre-heat temperature
T3	Product main heat temperature
T4	Primary cooling temperature
T5	Secondary cooling temperature
T6	Homogeniser temperature
T7	Filler temperature
T8	Holding tube temperature
T9	
T10	Pre-heat hot water temperature (twin boiler version)
T11	Main heat hot water temperature
T12	Cooling water temperature
P1	Product inlet pressure
PI1	HWC vessel pressure indicator
PI2	HWC vessel pressure indicator (pre-heat – twin boiler version)
PS1	HWC pressure switch (main heat)
PS2	HWC pressure switch (pre-heat – twin boiler version)
F1	Product flowmeter
F2	Cooling water flowmeter
L1	Product vessel level sensor
L2	HWC level sensor (main heat)
L3	HWC level sensor (pre-heat – twin boiler version)

8.2 Electrical diagram



9 Certificate of conformity – Pressure Equipment Regulations

Our Ref: EES/AK/Dec

Customer:

Supplier: Armfield Limited

Product Code: Pressurised Hot Water Circulator

Declaration:

We certify that the boiler vessel and pipework installed on the above Armfield product has been designed, manufactured and hydraulically pressure tested in accordance with the Pressure Equipment Regulations 1999 (Statutory Instruments, 1999 No 2001) Category 1.

The boiler vessel has been classified Category 1 as follows:

Type of equipment: Pressurised hot water circulator

Volume of vessel: 4.7 litres

Maximum allowable pressure: 7 bar gauge

Classification chart: 5

PS.V: 32.9 (<50)

Conformity assessment module: A

The detailed design of the pressure vessel is in accordance with BS5500:1997 (British Standard Specification for unfired fusion welded pressure vessels).

The following information is duplicated on a plate attached to the boiler vessel:

Manufactured by: See plate on equipment

Armfield index no: See plate on equipment

Maximum working pressure (PS): 6.5 bar gauge

Maximum working temperature (Tmax): 168°C

Minimum working pressure (PS): 0.0 bar absolute

Hydraulic test pressure: 13.6 bar gauge

Date of manufacture: See plate on equipment

For and on behalf of Armfield Ltd.

E E Sansom

Technical Director

Date: 12 December 2002

10 Description

Where necessary, refer to the drawings in Equipment Diagrams section 8.

10.1 Overview

10.1.1 Feed delivery

The product to be processed is pumped from the feed vessel (5.0 L capacity) to the heat exchanger by the feed pump which is mounted under the cabinet surface. A progressing cavity feed pump is used as this gives consistent volumetric flow rate for a wide range of liquid viscosities. The feed pump is protected against dry running by a level sensor in the feed tank which shuts off the feed pump once triggered. A pressure relief valve protects the feed pump and heat exchanger from excessive pressure build up in the system. An optional magnetic flow meter (FT74-40) indicates the product flow rate in litres per hour.

10.1.2 Sensors

P1	Product inlet pressure
T1	Product inlet temperature
T2	Pre heat or regeneration temperature
T3	Product hold temperature
T4	Product temperature after 1o cooling
T5	Product temperature after 2o cooling (optional)
T6	Homogenisation temperature (optional)
T7	Filler (FT83) temperature (optional)
T8	Holding tube outlet temperature (optional)
T10	Pre-heat hot water temperature (optional)
T11	Main heat hot water temperature
T12	1o cooling medium temperature
pH	Product pH

10.1.3 Product heating system

A pressurised hot water circulator heats product indirectly in the pre-heat (except for the basic plate heat exchanger which pre-heats by regeneration) and main heat sections of the heat exchanger (tubular or plate). The heater is 4 kW or 6 kW when the controllable pre-heat option (FT74-46) is specified.

Product is pre-heated in interchange section of the plate heat exchanger and in the pre-heat section of the tubular heat exchanger. The heating sections of both heat exchangers are connected to a pressurised hot water system which consists of an electric heating element contained in a heating vessel. A rotary vane pump circulates the hot water to the heat exchanger and back to the heating vessel. A bypass valve on the hot water circulator can be used to regulate the flow rate of water to the heat exchanger. The pressurised hot water system is situated inside the cabinet and is accessed via the large door at the rear of the unit using the key provided.

10.1.4 Product cooling system

The FT74XA has two quick release connections on the side of the unit, at the bottom, for attachment of a cooling medium supply to feed the primary cooling section of the heat exchanger. The medium may be mains water, Armfield's FT63 recirculating glycol chiller, or the user's own cooling system. The cooling medium passes through a flowmeter sited inside the cabinet and coolant flow rate is displayed on the touchscreen and datalogged. There is an isolation valve on the top of the cabinet to isolate the coolant supply to the heat exchanger.

Where two stage cooling is used then the first stage coolant is supplied as indicated above and the second stage coolant is attached directly to the heat exchanger. With two stage cooling the first stage is usually mains water or chilled water and the second stage is a usually glycol-based refrigerant.

10.1.5 Product processing

Product is pumped by a progressive cavity pump through an inlet pressure sensor (P1), temperature sensor (T1) and an optional electromagnetic flowmeter (F1, FT74-40) to the heat exchanger. The FT74XA provides services for two heat exchangers, plate and tubular, to cater for a wide range of product viscosities. In the plate heat exchanger (-46 option not specified) product is first heated by hot product in the interchange section before entering the heating section where it is further heated by pressured hot water to the desired holding temperature. In the tubular heat exchanger the product is pre-heated by pressurised hot water the flow of which can be controlled in order to reach a desired pre-heat temperature. This allows thermal shocking to be avoided. Product then enters the main heating tubes where it is heated to the desired holding temperature. The feed pump is rated to 12 bar but the product system pressure is limited to 10 bar by the pressure relief valve sited immediately downstream of the feed pump.

When controllable pre-heat (-46) is specified then for both the plate and tubular heat exchangers product is pre-heated by a separate pre-heat hot water circuit. In this case the product pre-heat temperature (T2) is set by the operator on the touchscreen and is PID controlled.

The holding temperature (T3) is operator-set and PID controlled. Standard holding times are 2s and 15s. Additionally, if the Variable Holding Tube (FT74-65) has been specified then a wide range of holding times between 30s and 120s may be used. Special holding tubes can be ordered to suit customer requirements. The maximum product temperature set point is 150 °C.

After heat treatment product is cooled. In the plate heat exchanger this begins in the regeneration section and continues in the cooling section. The cooling section may consist of a single stage or two-stage (FT74-33 option) if lower product outlet temperatures are required. With the tubular heat exchanger product cooling occurs in the cooling section which consists of 4 tubes. These can be configured for single stage or two-stage cooling. The first stage of cooling typically uses mains water or a chilled water supply with the second stage using recirculated glycol (FT63). **Note:** both heating and cooling flow is counter-current to product flow for efficient heat transfer.

There is a sprung back-pressure valve at the product outlet (end of the cooling section) in order to create pressure in the system required at elevated processing temperatures to prevent product boiling. Such boiling causes product damage and fouling of the heat exchanger surfaces. A pneumatic pinch valve (FT74-22) is available for products with particulates.

10.2 Feed Vessel

This is a 5 L stainless steel vessel fitted to the top of the feed pump. The vessel is fitted with a level sensor which when detecting a low liquid level cuts power to the feed pump to prevent dry running so as not to damage of the feed pump stator. The level sensor works well with most food products but care should be taken to test operation with all new products since a particularly viscous product may stick to the sensor therefore preventing detection of the low level. When switching between different liquid types it is often desirable to completely drain

the feed tank before adding the new liquid. This may be achieved by activating the LEVEL OVERRIDE function on the pop up window on the touch screen control panel. A valve is situated directly below the feed tank to allow drainage and also for clean in place (CIP) recirculation.

10.3 Feed pump

The progressing cavity feed pump consists of a stainless steel rotor within a food-grade rubber stator. All metal parts of the pump which come into contact with product are made from 316L stainless steel. A mechanical seal isolates the product from the drive system. The feed pump is variable speed.

Control of the pump speed is controlled from the touch screen panel on the front of the unit.

Immediately downstream of the feed pump is a pressure relief valve which provides mechanical protection against system over-pressure. This is set and sealed during factory inspection to 10 barg.

When the equipment is new there is often grease in the feed pump which can enter product during the first few uses of operation. Performing a Cleaning in place (CIP) procedure in section 12.6 will remove grease from the feed pump.

10.4 Process sensors

The temperature sensors are a hygienic PT100 design which are sited in the product flow in order to give an accurate indication of temperature. The temperature sensor is screwed into a housing and the PTFE gasket forms the seal preventing product leakage even under high pressures. Should any leakage be seen then processing should be stopped and the sensor removed and dismantled for cleaning before being re-installed.

There are two flowmeters

- F1 Product flowmeter (FT74-40)
- F2 Primary coolant flowmeter

A 316L stainless steel hygienic diaphragm type pressure sensor is used for process lines. This has a range of 0-16 barg.

- P1 Inlet product pressure sensor
- P2 Homogeniser product line pressure
- P3 Homogenisation pressure (analogue gauge on the homogeniser) (0-1000 bar).

Temperature sensor values are displayed on the touch screen panel.

- T1 Inlet product temperature sensor
- T2 Pre-heat temperature sensor
- T3 Product hold temperature
- T4 Product temperature after 10 cooling
- T5 Product temperature after 20 cooling
- T6 Product temperature at homogeniser
- T7 Product/sterilisation temperature at filler
- T8 Variable holding tube product temperature

- T10 Pre-heat hot water temperature
- T11 Main heat hot water temperature
- T12 Primary coolant inlet temperature

Optional, hygienic pH probe is in place to measure product pH in the range of 0-12. The output is displayed in the transmitter screen on the console and in the datalogging screen

pH Product pH reading

10.5 Touch screen control panel and Operation Modes

The FT74XA unit is controlled via a touch screen panel on the front of the unit. The touch screen panel is activated whenever power is applied to the unit. The introduction screen is shown below:

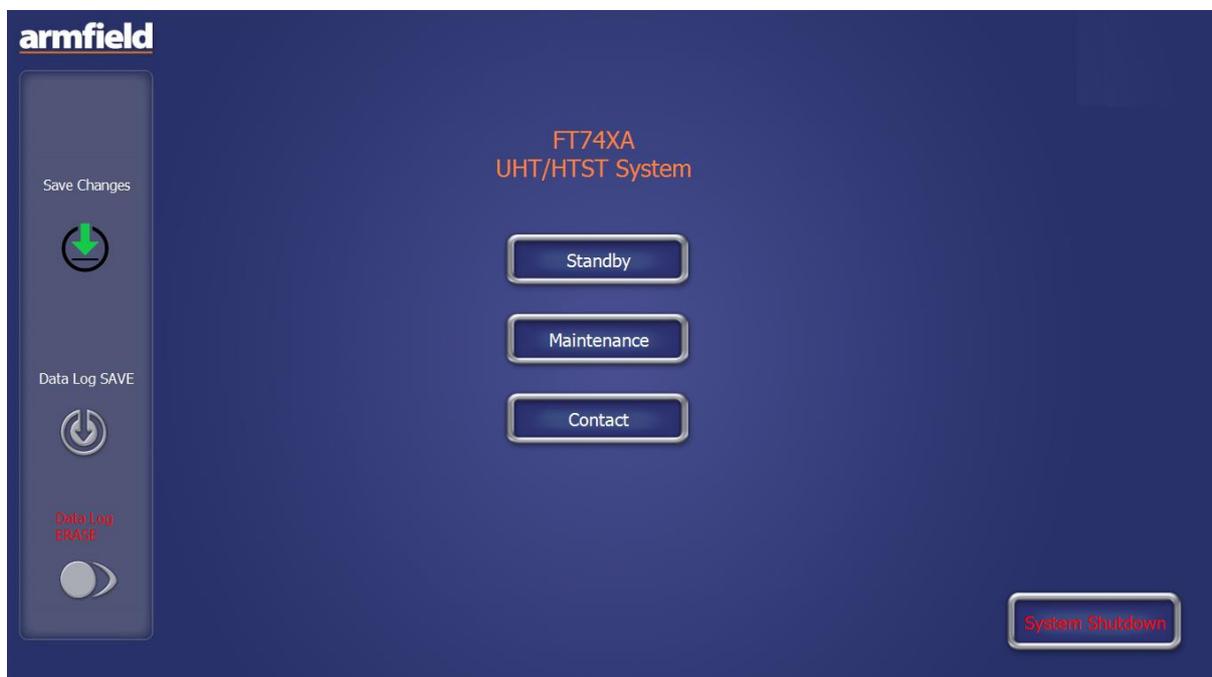


Figure 4 Introductory screen. Standby accesses operations. Maintenance is password protected and is used for factory inspection and fault diagnosis. Contact shows Armfield's contact details and the software version number.



Figure 5 From the Standby screen the mode of operation, Process, Clean in place (CIP) and Sterilisation in place (SIP) can be selected.

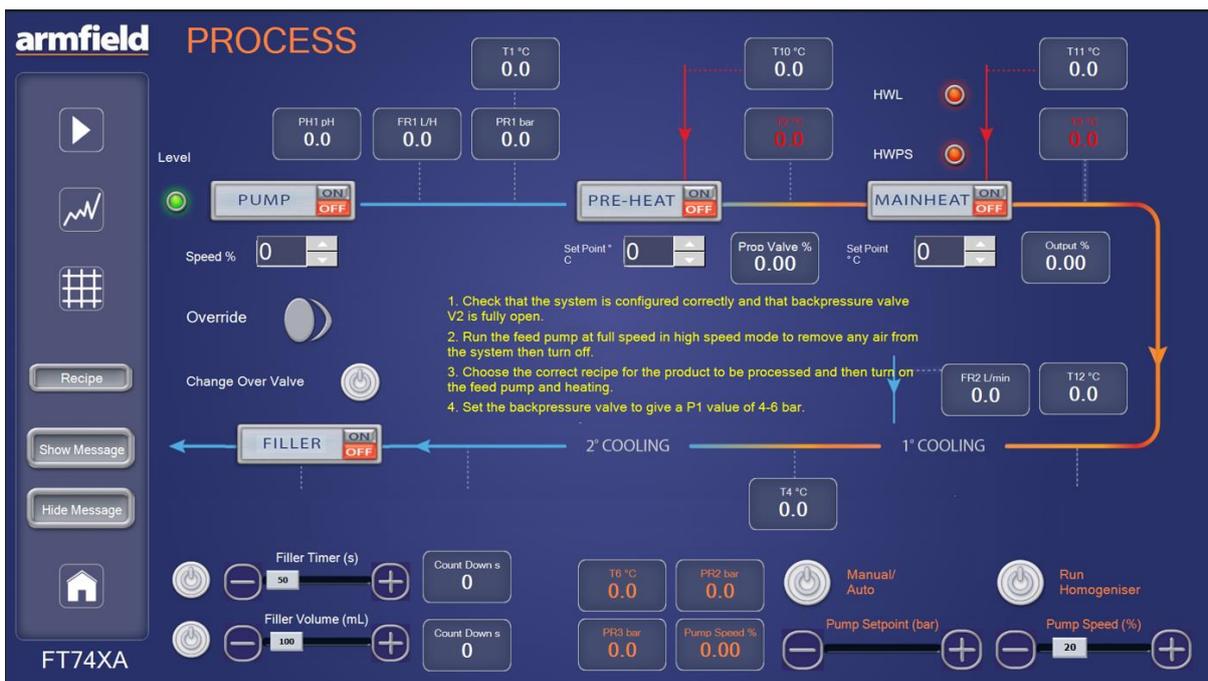


Figure 6 Process mode with controllable pre-heat (-46), Suction feed with change over valve to switch between product and water (-53), homogeniser (FT91-74XA). The system includes FT83 filler with controls. HWL indicates hot water level in the pressure vessel. HWPS indicates normal or overpressure situation in the pressure vessel with overpressure resulting in a cut of power to the heater until the pressure drops below the upper limit. Override button enables the pump to be run when tank is low level to minimise product dilution when switching from water to product processing.



Figure 7 Recipe screen: There are 10 recipes for which processing parameters for a particular product can be saved. Processing parameters include the PID tuning parameters for pre-heat (-46 option only) and main heat which may need to be changed depending on flow rate and temperature of operation. Recipe 1 and 2 are reserved and contain the PID settings for the tubular heat exchanger with 2s and 15s holding tubes respectively. The remaining 8 recipes can be changed by the operator. Pressing the Apply button saves the new data to the current recipe. The screen also calculates the F0 value based on the holding tube volume and the current flow rate.

Recipes 1 and 2 are reserved and contain the PID settings for the tubular heat exchanger with 2s and 15s holding tubes respectively

Recipe 1 default settings are set as per table below:

Recipe 1	P	I	D
Pre heat	150	80	1
Main heat	12	50	2
Homogeniser	20	50	0

Recipe 2 default settings are:

Recipe 2	P	I	D
Pre heat	150	80	1
Main heat	16	51	4
Homogenizer	20	50	0



Figure 8: Data logged during processing can be monitored graphically. This screen is accessed by pressing the  button from the Process screen. The operator can select which parameters to display on the right hand side of the screen (4). The time scale displayed is adjusting using the buttons underneath the graph (8). Other features are explained below.

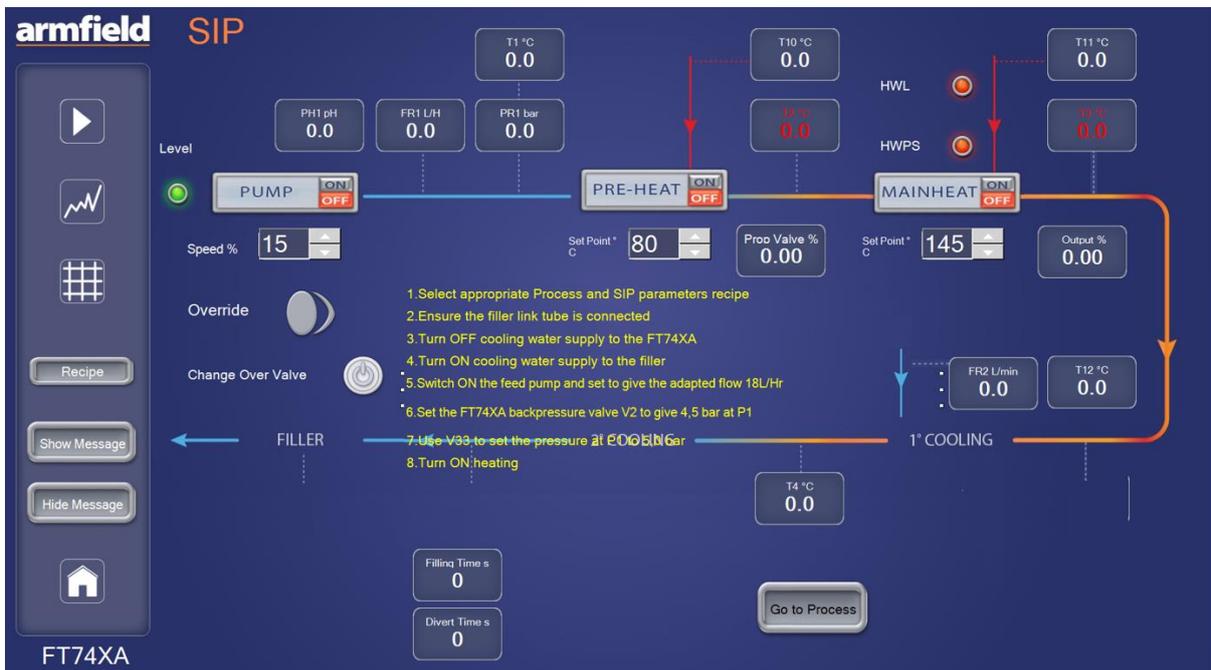


Figure 9 SIP. Pressing the SIP button from the Standby screen brings up the SIP intro screen where a list of instructions must be completed and confirmed before SIP can begin. SIP mode enables the FT74XA, FT83 Sterile filler and connecting pipework to be sterilised prior to processing product for sterile packaging. Once the SIP process is complete and operator can progress to Process mode by pressing the Go to Process button.

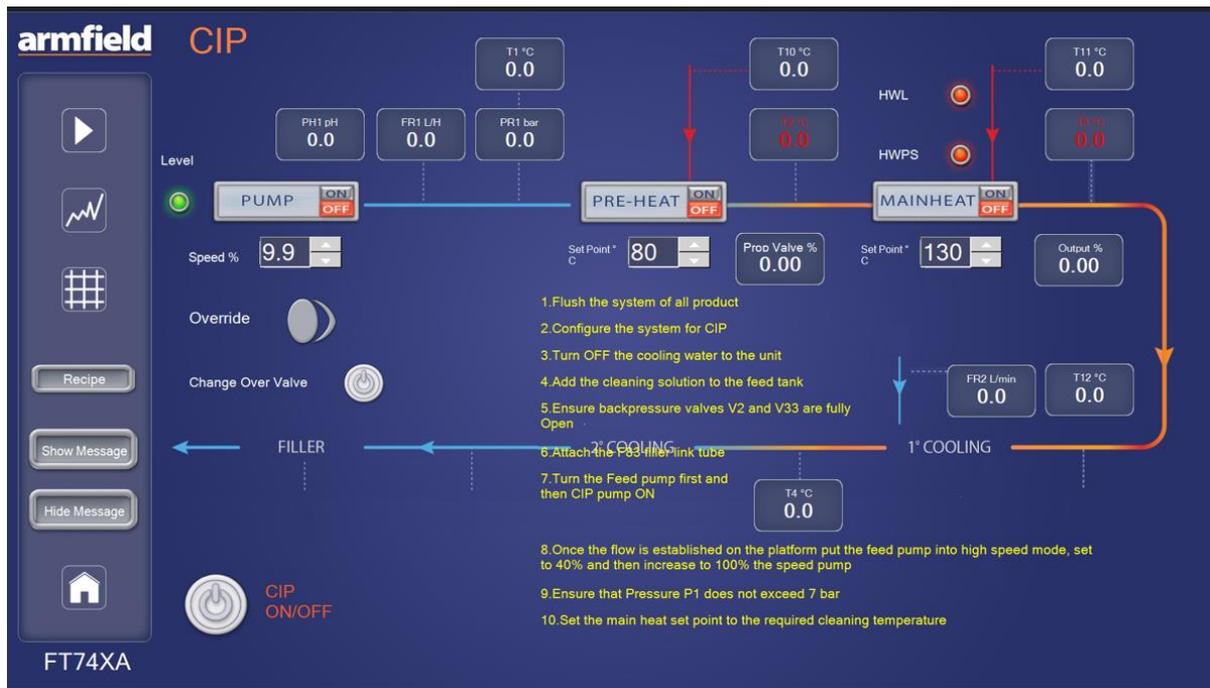


Figure 10 Selecting CIP (clean in place) from the Standby screen brings up the CIP intro screen where a list of instructions must be completed and confirmed before CIP can begin. CIP allows the system to be cleaned by recirculating a cleaning solution, usually caustic or acid

10.6 Armbus operation

10.6.1 Data Log (Screen)

armBUS™ software uses the *Begin Data Logging* switch (▶) to trigger logging/tabulating of sensor data. The Data Log screen shown in Figure 1, is common to all Modes.

Data Table										
Date Time	Notes	FR1	PR1	T1	T2	T3	T4	T5	RP1	
21/09 14:23:54										
21/09 14:23:55		0	0	2047.81	5.00	3.98	0	0	0	
21/09 14:23:56		0	0	2047.81	5.00	3.99	0	0	0	
21/09 14:23:57		0	0	2047.81	5.00	3.97	0	0	0	
21/09 14:23:58		0	0	2047.81	5.00	4.00	0	0	0	
21/09 14:23:59		0	0	2047.81	5.00	4.02	0	0	0	
21/09 14:24:00		0	0	2047.81	5.00	3.98	0	0	0	
21/09 14:24:01		0	0	2047.81	5.00	3.99	0	0	0	
21/09 14:24:02		0	0	2047.81	5.00	3.98	0	0	0	
21/09 14:24:03		0	0	2047.81	5.00	4.02	0	0	0	
21/09 14:24:04		0	0	2047.81	5.00	4.03	0	0	0	
21/09 14:24:05		0	0	2047.81	5.00	3.98	0	0	0	
21/09 14:24:06		0	0	2047.81	5.00	3.99	0	0	0	
21/09 14:24:07		0	0	2047.81	5.00	3.99	0	0	0	
21/09 14:24:08		0	0	2047.81	5.00	4.04	0	0	0	
21/09 14:24:09		0	0	2047.81	5.00	3.97	0	0	0	
21/09 14:24:10		0	0	2047.81	5.00	3.99	0	0	0	
21/09 14:24:11		0	0	2047.81	5.00	3.99	0	0	0	
21/09 14:24:12		0	0	2047.81	5.00	4.01	0	0	0	
21/09 14:24:13		0	0	2047.81	5.00	4.02	0	0	0	
21/09 14:24:14		0	0	2047.81	5.00	3.97	0	0	0	
21/09 14:24:15		0	0	2047.81	5.00	3.99	0	0	0	
21/09 14:24:16		0	0	2047.81	5.00	3.98	0	0	0	
21/09 14:23:53		0	0	2047.81	5.00	4.03	0	0	0	

Figure 11 Data Table

Number	Title	Description
--------	-------	-------------

Standard elements:		
(1)	Save as	<ul style="list-style-type: none"> Navigate to a storage location, enter a filename for the export file. Click Save.
(2)	Auto / Manual Sampling	<ul style="list-style-type: none"> When in Manual mode, every time user clicks Manual Data Entry (4) a row of sensor data will be added with time stamp. When in Auto mode, choose the frequency of automatic sampling (3) in seconds.
(3)	Auto Sampling interval	Choose the frequency of automatic sampling (3) in seconds.
(4)	Auto Sampling interval	Every time user clicks Manual Data Entry (4) a row of sensor data will be added with time stamp.

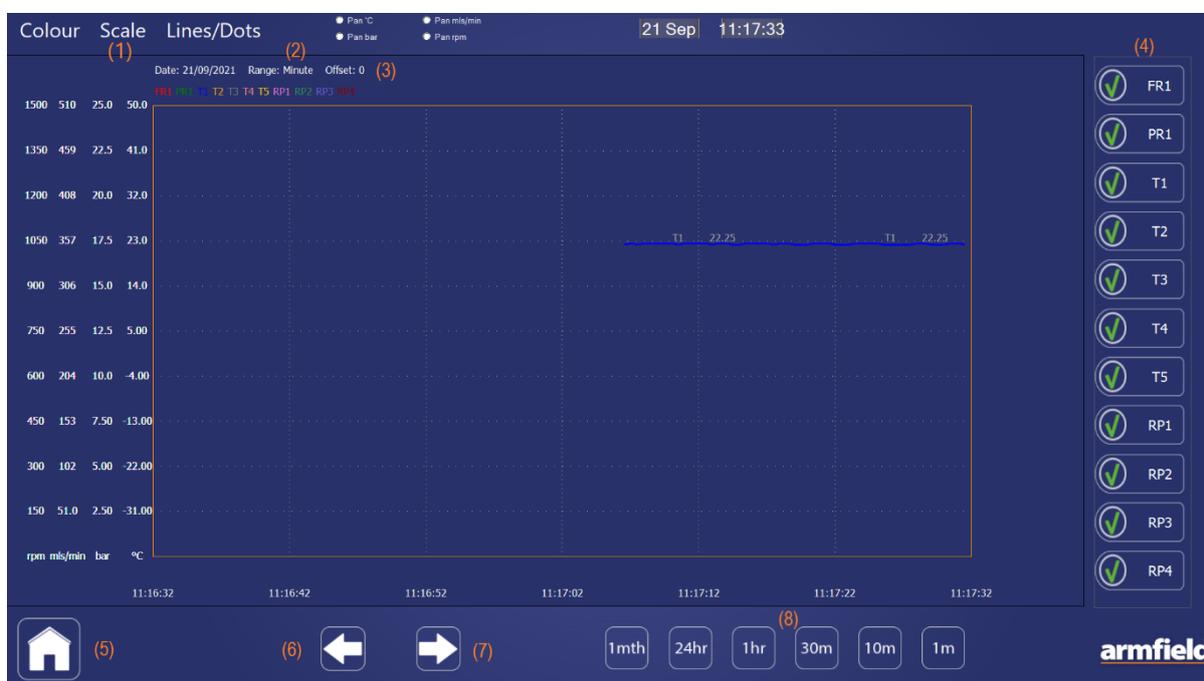


Figure 12 The Data Log Screen

Where no data exists, the screen displays an empty chart; the y-axis displays sensor units and the x-axis, time. The chart is surrounded by the following screen elements:

Number	Title	Description
Standard elements:		
(1)	Scale	Selecting scale will let you change the y axis min/max to zoom in or out.
(2)	Date / Range	Displays the data log date. Displays the current chart range (Minute / Hour / Day)
(3)	Offset	Using buttons (6) or (7); <i>Offset</i> displays the step number back from the measured timestamp.
Operator input values:		

(4)	Sensor Window Selection	<p>Click to select sensor(s) data to display Unselected sensors display a red X;</p> <ul style="list-style-type: none"> Selected sensors display a green ✓. <p>(i) Selected sensor names appear above the chart: names are colour-coded to correspond with chart plot.</p>
(5)	Home / Back	Press to return to the previous screen.
(6)	Back (in Range)	Tap to step backward through the chart from the latest timestamp.
(7)	Forward (in Range)	Tap to step forward through the chart to the latest timestamp.
(8)	Minute/Hour/Day (Range)	Press to select minute/hour/day view of chart: <i>notice the time-shift beneath the chart.</i>

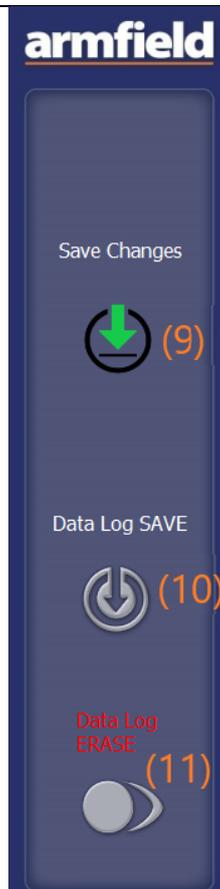


Figure 13 Data Save/Delete

(9)	Save Changes	Press to save changes from the maintenance/recipe. Operator will be prompted to confirm.
(10)	Data Log SAVE	Press to download log data to a USB mass storage (Minimum 2GB). Operator will be prompted to confirm.
(11)	Data Log ERASE	Deadman's safety switch: press to display confirmation to delete all Equipment-stored data log files. Operator will be prompted to confirm.

Shutting Down

If the unit is to be shut down completely the operator should first shut down the software. This is performed from the home screen and the button  pressed and the software allowed to shut down completely before power is turned off.

10.6.2 Data Log Files

A database log file is created for *each day of use*, containing all logged data for that day. Log files can be exported for reading in armBUS™ Results Viewer, and in turn exported for viewing in spreadsheet software.

- Pressing *Begin Data Logging* for the first time on **day 1**, triggers the creation of a log file for **day 1**.
- Subsequent starting and stopping of data logging during **day 1** adds to the log file for **day 1**.
- Pressing *Begin Data Logging* for the first time on **day 2**, triggers the creation of a new log file for **day 2**.
- Subsequent starting and stopping of data logging during **day 2** adds to the log file for **day 2** (etc.).

 **Once pressed and while data logging is in progress, the switch is shown red. Logging will continue until the switch is pressed again.**

 **Ambient data will be recorded when no Operator values are entered.**

10.6.3 File Naming

The log file created each day, is named by the armBUS™ software using the following convention:

EQUIPMENT NAME	DAY (XX)	-MONTH (XX)	- YEAR (XXXX)	RESULTS (text)	EXTENSION (.ardb)
-------------------	-------------	----------------	------------------	-------------------	----------------------

Example: **FT18-MKII 30-01-2019 Results.ardb**

1. Log Data Export

A USB mass storage device (i.e. USB key) is required to export log data from the Equipment:

 **Multiple data logs are relatively small (typically < 20MB); ensure sufficient free capacity to save log files (no information is deleted / overwritten from the USB device during data transfer).**

1. Locate the USB slot in the side of the main Electrical enclosure and unscrew cover.
2. Insert USB key device;
3. Navigate to the Data Log screen, press *Data Log SAVE (10)*; during save, the button will momentarily display green;
4. When the button is black, remove key and replace cover over USB slot.

 **The Equipment may be used with a USB device present. Data log files will automatically be transferred to the device when data logging has been stopped by the operator.**

2. Clearing Log Data

For each run-period, the armBUS™ software will create an additional data log file. Over time, the number of daily files will build, inevitably needing to be cleared as the number of files exported each time, begins to increase.

In order to clear all historical Equipment-stored data log files, press the safety switch (11): a confirmation will appear to which the Operator must confirm **Yes** or **No**.



WARNING: This action will permanently delete all *historical* data log files from the Equipment. Ensure an export is made prior to deletion.



The most recent log file will remain stored on the Equipment, this is required to ensure correct function of software.



Data log files can be deleted from the USB mass storage device at any time.

10.6.4 armBUS™ Results Viewer

To accompany your Equipment, Armfield supplies the armBUS™ Results Viewer, a software platform designed to simplify the viewing of exported sensor log data.



The armBUS™ Results Viewer is a common platform used by all armBUS™ driven-products, therefore some options provided may not be available for your equipment.



The armBUS™ Results Viewer supports Microsoft Windows™ versions 7, 8 and 10.

On a suitable Windows-based PC, install the viewer provided on the Armfield USB key supplied with your Equipment: in the armBUS Results Viewer folder, double click *setup.exe* and follow the installation process.

The application creates a Start Menu folder, 'Armfield Limited'. To launch the viewer, click *armBUS Results Viewer* from this folder or the corresponding icon on the Windows desktop.

10.6.5 Application Screen

Upon launch, the software displays the screen shown in the figure below.

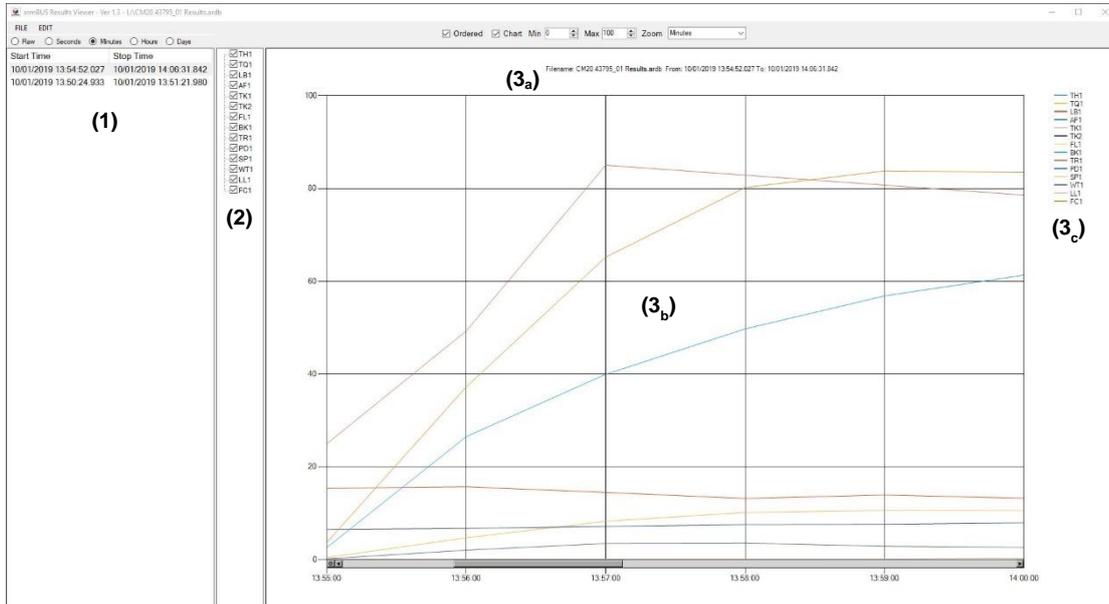


Figure 14 armBUS™ Result Viewer (Screen)

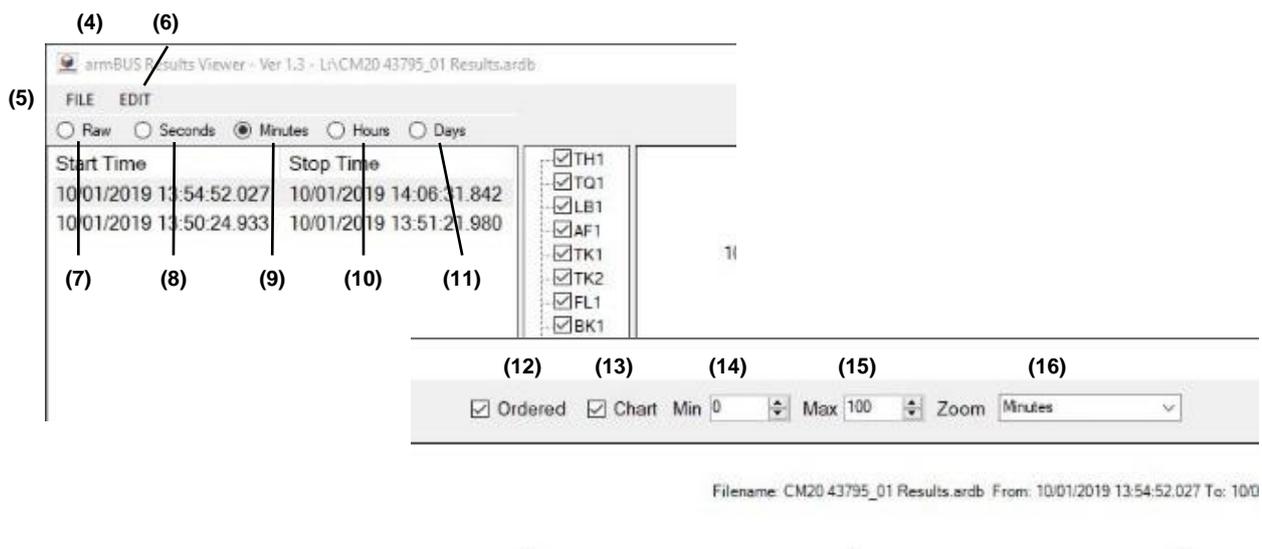


Figure 15 Data Log Screen Elements

Contact screen elements are defined as:

Number	Title	Description
(1)	Stop / Stop (Pane)	Screen area displaying list of recorded Start / Stop periods stored in the opened Data Log file.
(2)	Sensor Selector (Pane)	Screen area displaying list of recorded sensors. i Initially all sensors are selected: use the checkboxes to select / deselect sensors as required.
(3 a/b/c)	Chart (Pane)	Screen area displaying: <ul style="list-style-type: none"> • Filename and selected Start / Stop period (3_a); • Chart plot of selected sensors (x-axis = time, y-axis = maximum sensor value) (3_b). • List of selected sensors (sensor names are coloured to correspond with chart plot) (3_c).
(4)	Product nomenclature	Displays software header, version number and selected file name / path.
(5)	FILE	Dropdown menu for more options: <ul style="list-style-type: none"> • Open File; • Export ; • Print Preview (previews the current dataset); • Print (prints the current dataset); • Exit (exits the application).
(6)	EDIT	Shows Copy: used to copy tabulated data to clipboard (function as Ctrl C).
(7)	Raw	Select to select millisecond view of chart: <i>notice the time-shift beneath the chart.</i>
(8)	Seconds	Select to select seconds view of chart: <i>notice the time-shift beneath the chart.</i>
(9)	Minutes	Select to select minute view of chart: <i>notice the time-shift beneath the chart.</i>

(10)	Hours	Select to select hour view of chart: <i>notice the time-shift beneath the chart.</i>
(11)	Days	Select to select day view of chart: <i>notice the time-shift beneath the chart.</i>
(12)	Ordered	With Chart (9) unchecked: check <i>Ordered</i> box to order tabulated data values, low to high.
(13)	Chart	Check box: <ul style="list-style-type: none"> • Check to display chart results; • Uncheck to display tabulated results.
(14)	Min	With Chart (9) checked: enter figure (or use up/down arrows) to define y-axis maximum to display (<i>crops data displayed above this value</i>).
(15)	Max	With Chart (9) checked: enter figure (or use up/down arrows) to define y-axis minimum to display (<i>crops data displayed below this value</i>).
(16)	Zoom	With Chart (9) checked: dropdown to change chart scale.

10.6.6 Opening a Data Log File

armBUS™ Viewer will open data log files either directly from a connected mass storage device, or stored location on a local PC or network.

To open and view log files using the software:

- Go to **File > Open**;
- Navigate to the storage location and select the log file for viewing, click **Open**.

With a file loaded, the Stop / Stop (Pane) displays the dataset contained within it; double click a period from the list to load the data into the chart.

10.6.7 Exporting a Data Log File

armBUS™ Viewer will export data log files in two ways, either directly to a connected mass storage device / PC or network location, or by copying highlighting cells / blocks of data, pressing **<Ctrl C>** and pasting into spreadsheet software **<Ctrl V>**.

To export data log files using the software:

- Go to **File > Export**;
- Navigate to a storage location, enter a filename for the export file;
- Click **Save**.



The application exports data in the .xlsx format, compatible with Microsoft Excel (version 2007 and newer) and Google Docs. To view data in an older version of Microsoft Excel, the Microsoft Office Compatibility Pack is required.

10.7 Pressurised hot water system

The hot water reservoir is located in a frame mounted on the base plate of the cabinet (Figure 16). A rotary vane pump is used to circulate the heated water from the reservoir to the heat exchanger. An in-line filter protects the pump against damage from any particulates in the system. A by-pass valve allows the water flow rate to the heat exchanger to be adjusted. The normal position for this valve is a quarter turn from being fully closed. Insulated stainless steel pipework carries water between the hot water system and the product heat exchanger.

As water is heated the vapour pressure in the space above the liquid increases and since the system is sealed further boiling is prevented. System pressure can be observed on the pressure gauge on the top of the unit. If the pressure exceeds 6.0 bar then the pressure switch cuts power to the heater element and the over-pressure message appears on the touch screen. If the pressure switch were to fail and the system pressure continues to rise then at 7 bar the mechanical pressure valve relieves the pressure.

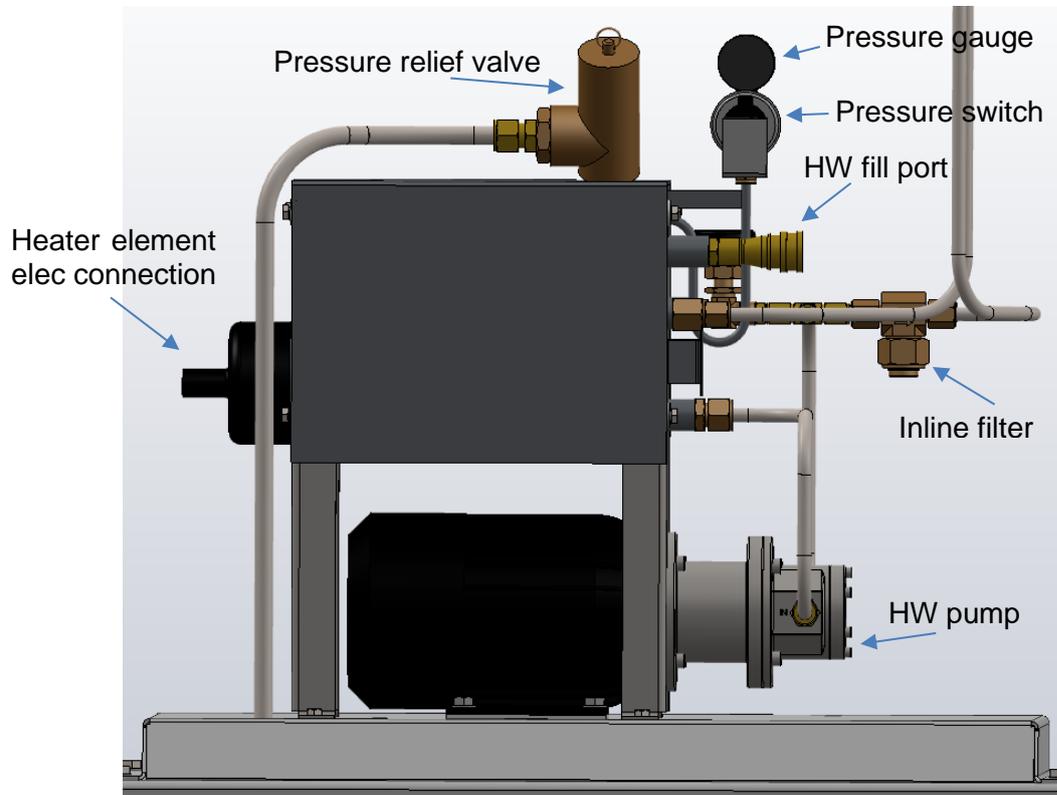


Figure 16 Hot water circulator

10.8 Cooling medium system

Primary coolant for reducing product temperature after heat processing is connected to the FT74XA via quick release connectors on the side of the unit at the bottom see below. The electronic flowmeter inside the cabinet indicates flow rate in litres per minute and is displayed on the touchscreen. Coolant is delivered to the cooling section of the heat exchanger to reduce the temperature of the heat-treated product. Primary coolant is usually mains water, chilled water or chilled glycol supply.

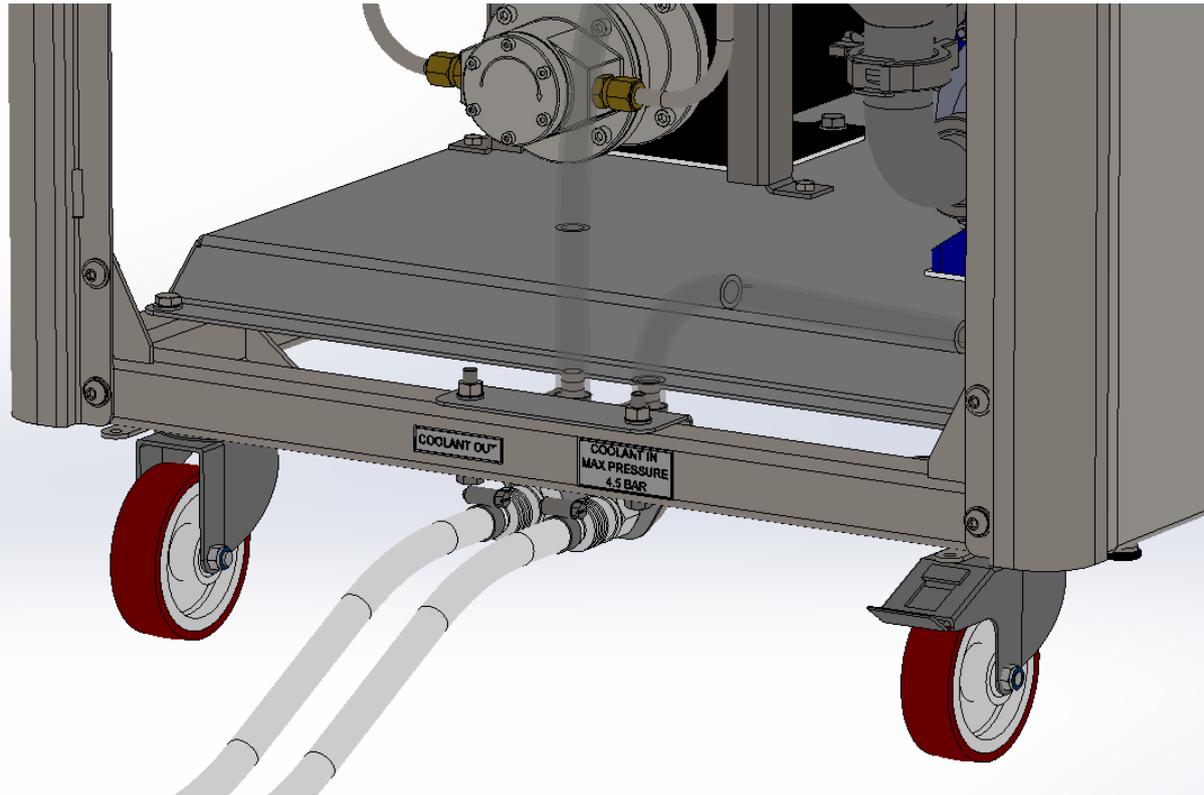


Figure 17 Primary coolant connections

Both the plate and tubular heat exchangers used with FT74XA may be used with a secondary coolant when low product outlet temperatures are required. In this case coolant pipework is attached directly to the heat exchanger. Option FT74-24 (tubular) FT74-33 (plate) provide an additional 2o cooling stage. Glycol connections to FT74-24 are shown below:

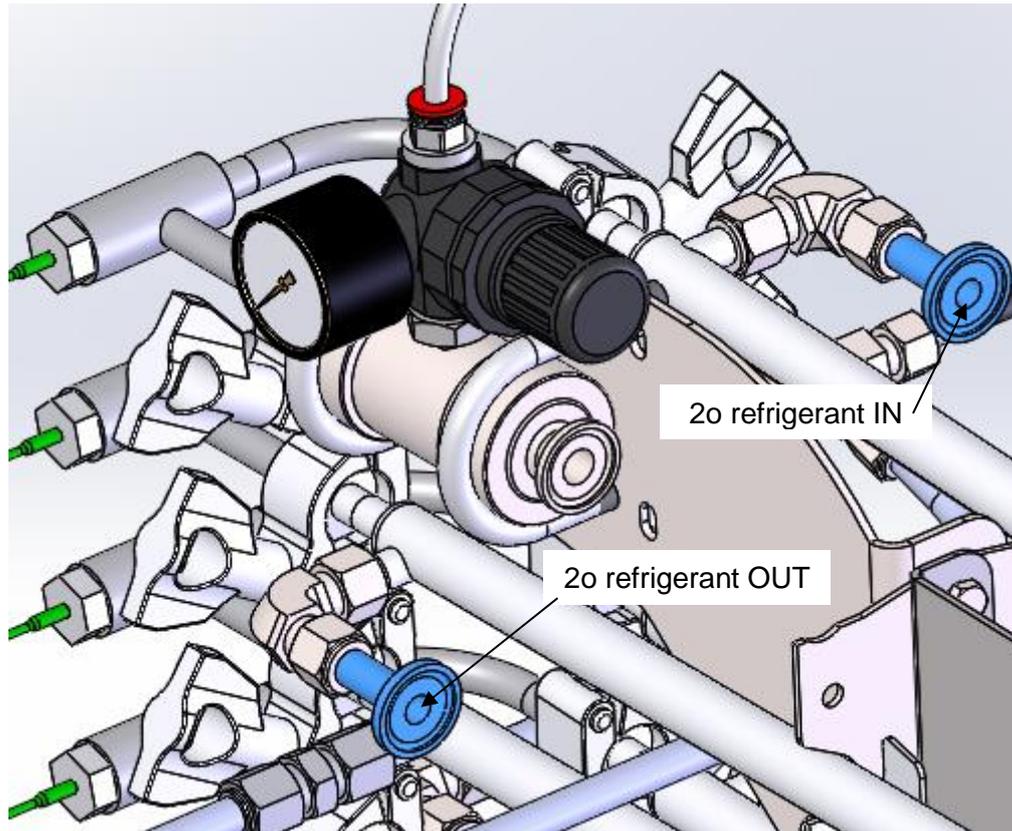


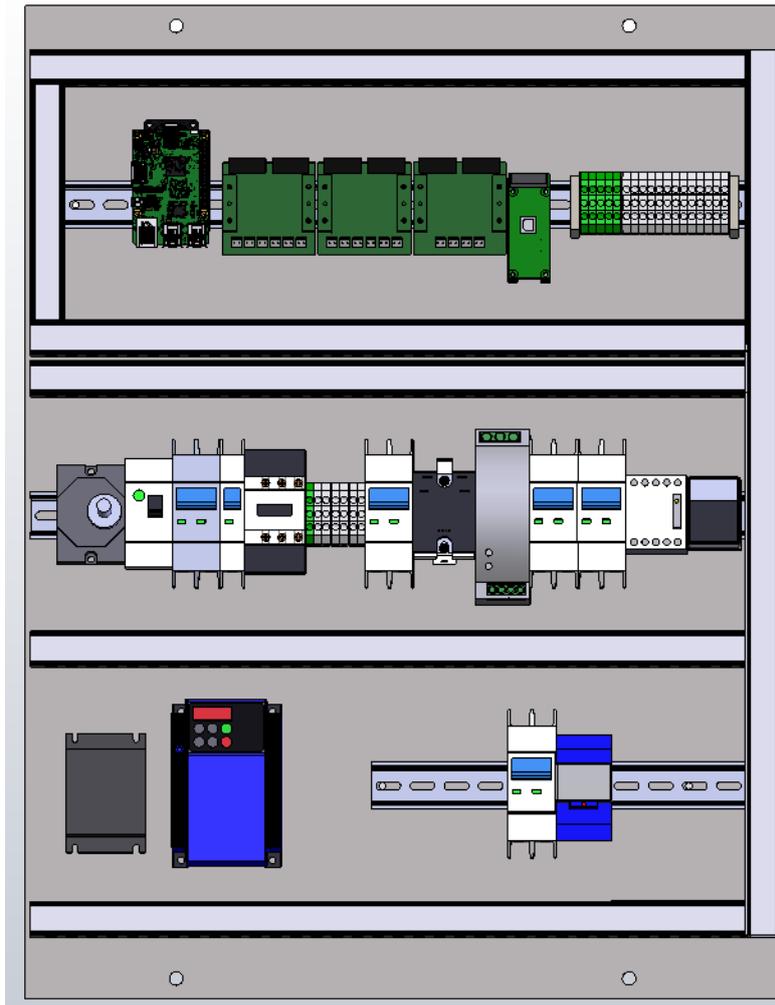
Figure 18 FT74-24 with connections for secondary refrigerant

10.9 Electrical tray

The electrical cabinet is IP65-rated and locked with by a standard key.

An Earth Leakage Circuit Breaker or Residual Current Device shuts off power in the event of a short to earth, protecting personnel. The RCD switch must be placed in the ON position to allow electrical power to the unit.

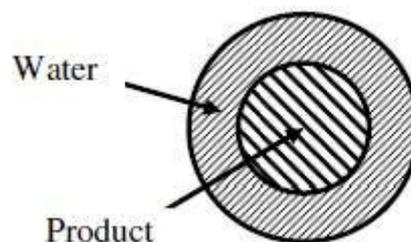
Individual circuits are protected by current tripping miniature circuit breakers (MCBs). The MAIN MCB isolates the whole unit with the exception of the RCD and the EMC filter.



Inside the electrical cabinet

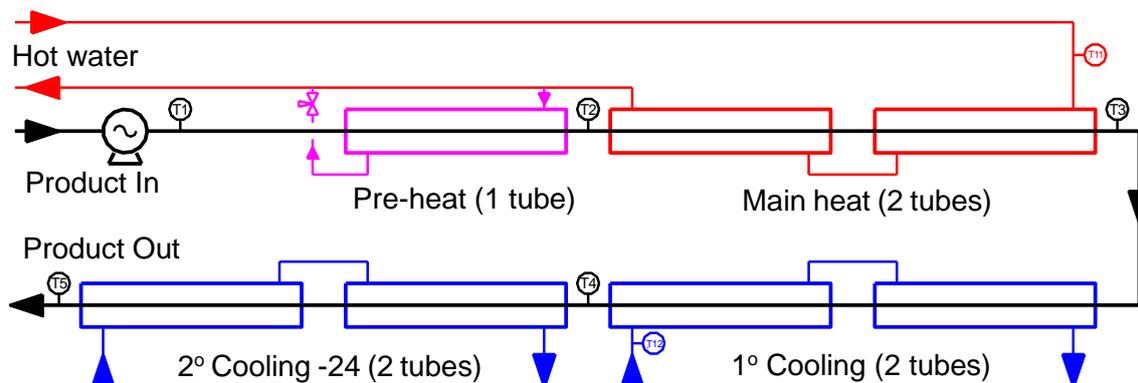
10.10 Tubular heat exchanger (FT74-20-MkIII)

The tubular heat exchanger comprises of 5 sections of dual concentric tubes. In all cases product flows through the centre whilst the service liquid (heating or cooling water) flows through the outer tube.



There is one preheat tube where the amount of heating can be adjusted using a needle valve to control the flow of hot water (FT74-46 option provides a separate pre-heat hot water circuit and automatic temperature control). This enables gentle pre-heating to be used with sensitive products. These are followed by two heating tubes which bring the product up to the required holding temperature. These tubes receive the full flow of water from the pressurised hot water circulator. The heat exchanger is supplied with 2s and 15s holding tubes as standard and

other holding times can be configured using the variable holding tube (FT74-65). Product then passes to the final 4 heat exchanger tubes where it is cooled by mains water, chilled water or glycol depending on set-up – see diagram below.



Schematic of tubular heat exchanger (FT74-20-24)

All the tube sections are of similar stainless steel construction. The tube sections are joined together with 'U' shaped stainless steel pipes which are connected to the heat exchanger tube sections by hygienic tri-clamp stainless steel fittings. These fittings allow easy access to the individual tube sections for inspection and cleaning.

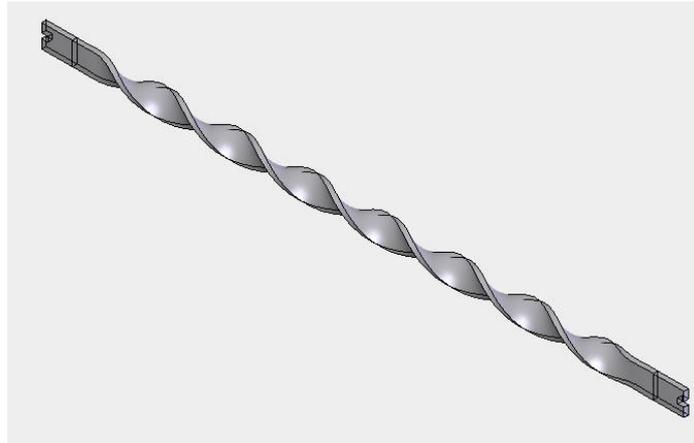
Stainless steel tubing connects the heat exchanger to the hot and cold water systems. Again, tri-clamp fittings are used for easy changing of the heat exchangers.

The heat exchanger is mounted on 4 studs fixed to the top of the cabinet and is held in place by thumbnuts which enables easy interchange between tubular and plate heat exchanger options.

10.11 Turbulence promoters – static mixers (FT74XA-21)

With more viscous materials it can be difficult to reach high holding temperatures due to heat transfer area limitation. This can lead to large temperature differentials between the heating medium and the product which in turn leads to fouling. To avoid this problem static mixers are offered as an option which simply insert into the heating tubes. These improve heat transfer considerably by creating turbulence and also increasing the surface area available for heat transfer. Static mixers improve cooling as well as heating and are recommended for all heat exchanger tubes where heat transfer is an issue.

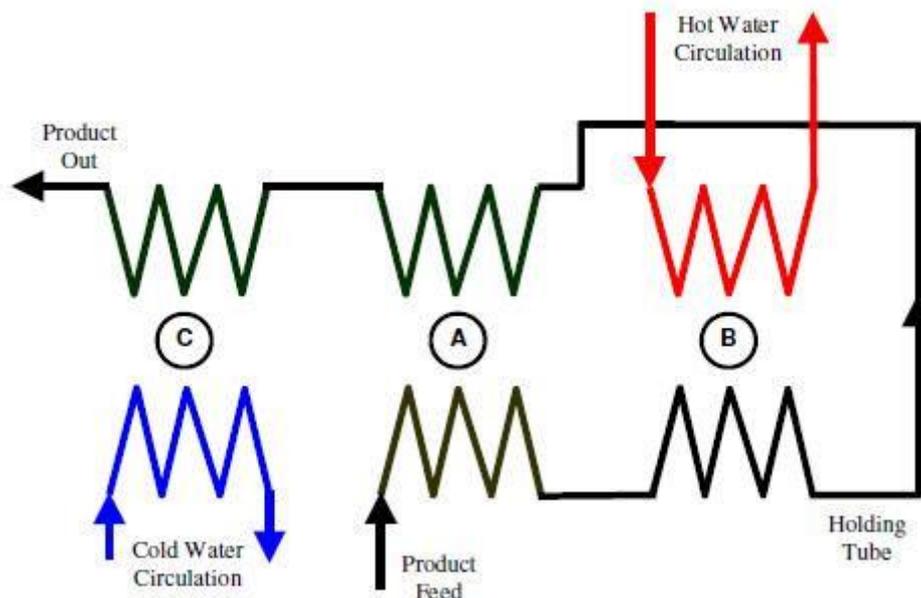
Each tube uses 4 static mixer elements. Each element is twisted to form a helix which promotes turbulence in the product. Each alternate element twists in the opposite direction for added turbulence.



Static mixer element (1 of 4 elements per heat exchanger tube)

10.12 Plate heat exchanger (FT74-30-MkIII)

In standard format the heat exchanger is configured as a conventional three stage design mounted in a single framework. Section (A) is the interchange or regeneration section, section (B) is the heating section and section (C) is the cooling section – see diagram below:



Schematic of plate heat exchanger (FT74-30-MkIII)

The cold, unprocessed product enters the interchange section (A) where it is pre-heated by outgoing product from the heating section. Product then enters the heating section (B) where the temperature is raised to the required holding temperature. The heat exchanger is supplied with 2s and 15s holding tubes as standard and other holding times can be configured using the variable holding tube (FT74-65). After the holding tube the product re-enters section A where it flows counter-currently to unprocessed product where it is pre-cooled before entering section (C) for primary cooling using mains water, chilled water or glycol. See Figures 2, 3, 4 and 5 for heat exchanger plate layouts.

Various options are available for the plate heat exchanger:

10.12.1 Homogeniser plate

This allows product to be led from the plate heat exchanger to a continuous homogeniser (FT91-74XA) and returned during the heat treatment process. The homogeniser plate can be sited in the interchange section upstream of the holding temperature (FT74-31) or downstream of the holding temperature (FT74-32). After homogenisation product is led back to the homogeniser plate and back into the interchange section of the heat exchanger. An interconnecting link (Tube S) is also supplied so that the plate heat exchanger may be used without homogenisation whilst not needing to physically remove the homogeniser plate.

10.12.2 Two-stage cooling (FT74-33)

This can be specified when very low outlet temperatures are required. An additional 11 plates are used in a second cooling stage which may be cooled by glycol e.g. using the FT63.

10.12.3 Additional heating plates (FT74-34)

Eight additional heating plates, 4 in the interchange section and 4 in the heating section may be specified to increase the area for heat transfer. Additional heating plates can improve the flexibility of the heat exchanger for example allowing higher processing flow rates to be used.

10.13 Electromagnetic flowmeter (FT74-40)

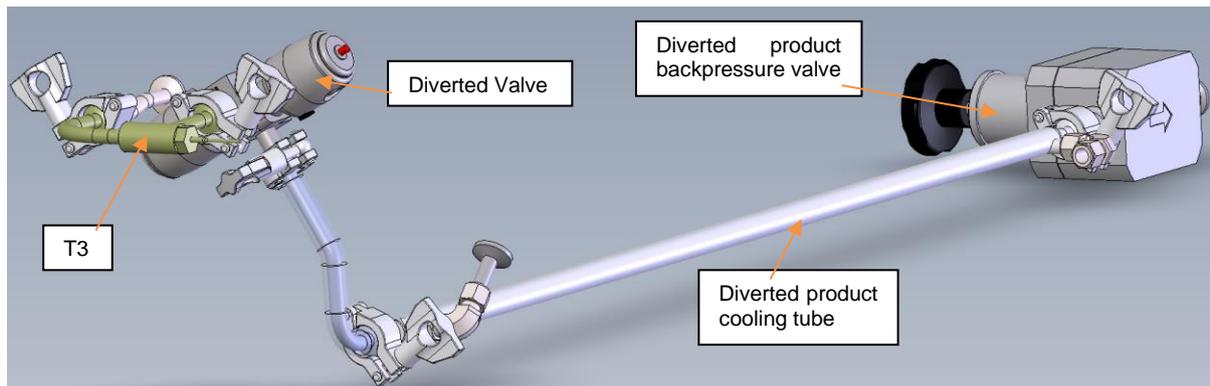
Electromagnetic flowmeters lend themselves to hygienic operation as there are no moving parts. The unit is constructed from stainless steel. The working section of pipe is made from PTFE in the wall of which are a series of electrodes. The flowmeter uses the Faraday principle whereby a magnetic field is applied to the fluid passing through the flow meter. As long as the fluid is sufficiently conductive then this generates a current which is measured by the electrodes and from this the flow rate is determined. This requires a relatively high velocity through the flowmeter hence a narrow bore of 3mm is used. The unit is capable of measuring the flow rate between 2.5 and 150 L/h.

10.14 Variable holding tube (FT74-65)

Both the plate and tubular heat exchangers are supplied with 2s and 15s holding tubes. The optional variable holding tube can be used for longer times in the range 30 to 120s. The unit consists of three separate coils mounted inside an insulated stainless steel housing which may be used separately or linked together to give a range of holding times. The holding times of the three coils alone are 20, 30 and 55 seconds when operated at a product flow rate of 10 L/h.

10.15 Product divert for tubular heat exchanger (FT74XA-22)

The product divert option enables product that is below an operator-defined temperature to be diverted away from the process. Once product temperature is back in range, the product flow through to the filler is restored.



10.16 Pneumatic Pinch valve operation (FT74XA-42)

Back pressure in the heat exchanger system is created by increasing the air pressure to the valve using the pressure regulator. The required system back pressure should be set according to the holding temperature (see 'System Pressures' section 12.7). The standard backpressure valve is a sprung diaphragm valve. Where the product has solids a pneumatically-operated pinch valve replaces the standard valve. The figure below shows the pinch valve and attached air pressure regulator which is used to adjust the backpressure applied to the product.

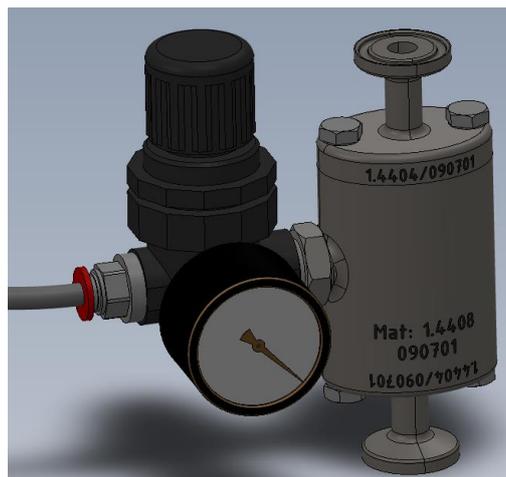


Figure 19 FT74-42 pinch backpressure valve

10.17 Homogenisation (FT91-74XA)

An homogeniser can be incorporated so that the product can be homogenised in line with the FT74XA. The homogeniser can be sited upstream (after-pre-heat) or downstream (at some point in the cooling system). The homogeniser is rated up to 30 L/h and has a maximum operating pressure of 600 bar. The flow rate of the homogeniser is controlled automatically by the FT74XA to match the flow rate to the feed pump flow rate.

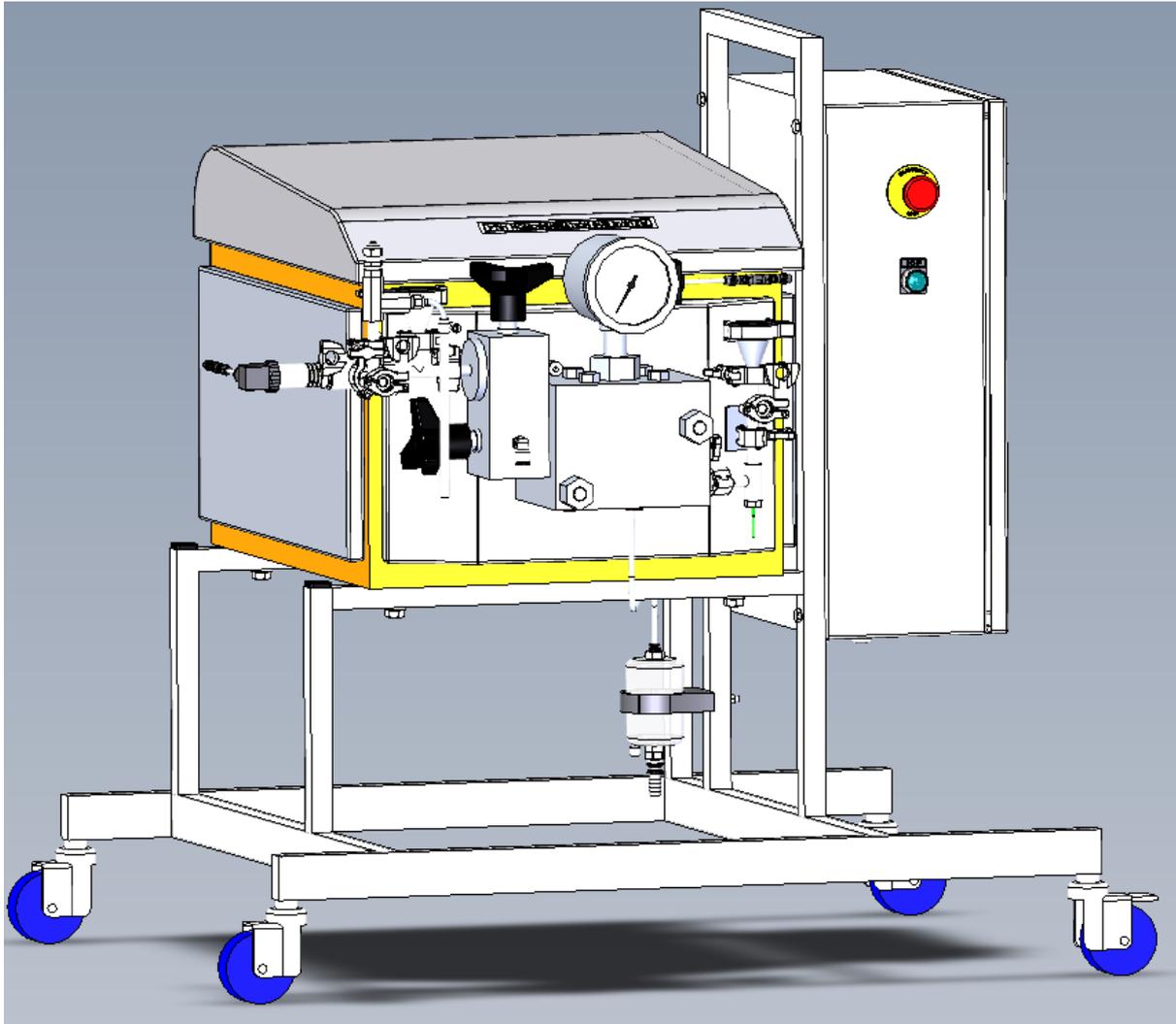


Figure 20 FT91-74XA Homogeniser

10.18 Aseptic processing (FT74XA-45 and FT83)

Although the FT74XA is capable of process temperatures suitable for producing an aseptic product, the product itself is not likely to be aseptic since the FT74XA itself is not pre-sterilised. To achieve this the FT74-45 sterile link option and Sterile Filler (FT83) are required. The FT74-45 provides additional heat exchanger surface area so that sufficiently hot water for sterilisation can be passed from the FT74XA to the sterile filler. The sterile filler provides a sterile environment and the required services for filling of product into bottles etc. For the tubular heat exchanger, FT74XA-45 is attached to the outlet and the backpressure valve is relocated to the outlet of the FT74XA-45. Configuration of the arrangements of plate and tubular heat exchangers with the FT74XA-45 are shown in the Installation section. Note, when the homogeniser is used in the system it is only possible to sterilise the system with upstream homogenisation.

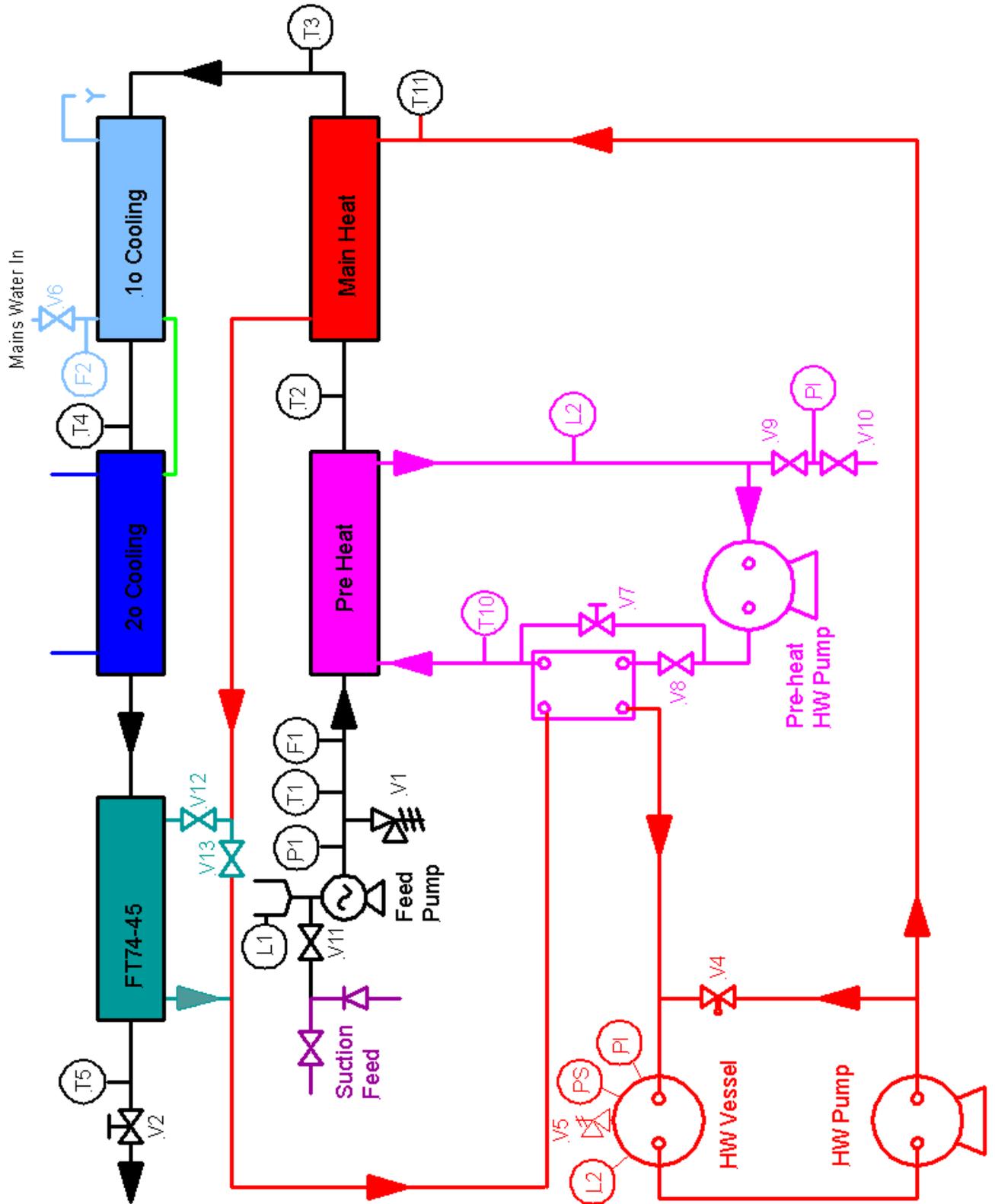


Figure 21 Process schematic for tubular heat exchanger fitted with FT74-45 sterilisation option

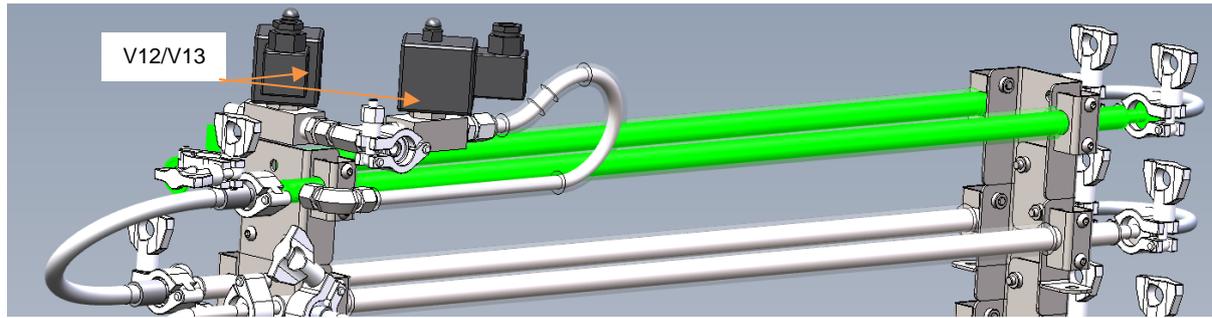


Figure 22 Tubular heat exchanger fitted with FT74-45 sterilisation link (additional tubes shown in green)

10.19 Product Divert for Tubular Heat Exchanger (FT74-22)

Product can be diverted away from the process and to drain or back to the feed hopper when it falls below a particular temperature set by the operator. Typically, the divert temperature will be a few degrees below the product hold temperature. The system consists of a pneumatically operated diaphragm, divert valve and a cooling heat exchanger to cool the diverted product before exiting via a diaphragm backpressure valve. The user defines the divert temperature on the HMI and this can be saved to a recipe for processing a particular product.

10.20 Suction feed (FT74XA-41) and Suction feed with water supply (FT74-53)

This option replaces the feed vessel with a feed assembly for attachment to a supply vessel such as Armfield's FT140. The suction feed can be either with or without a water supply. The benefit of the water supply is that if the product feed goes low level then the system will automatically supply water to the feed pump until the product feed supply is restored. This feature is also very useful for CIP and SIP operations. The suction feed assembly contains a level sensor to protect the feed pump from dry running. It is supplied with a fitting and hose for direct attachment to the FT140 outlet. When suction feed is specified the FT74XA is still supplied with the feed hopper which may be fitted as required. The level sensor of the feed hopper has an in-line connector which is undone and the level sensor of the suction feed is connected in its place.

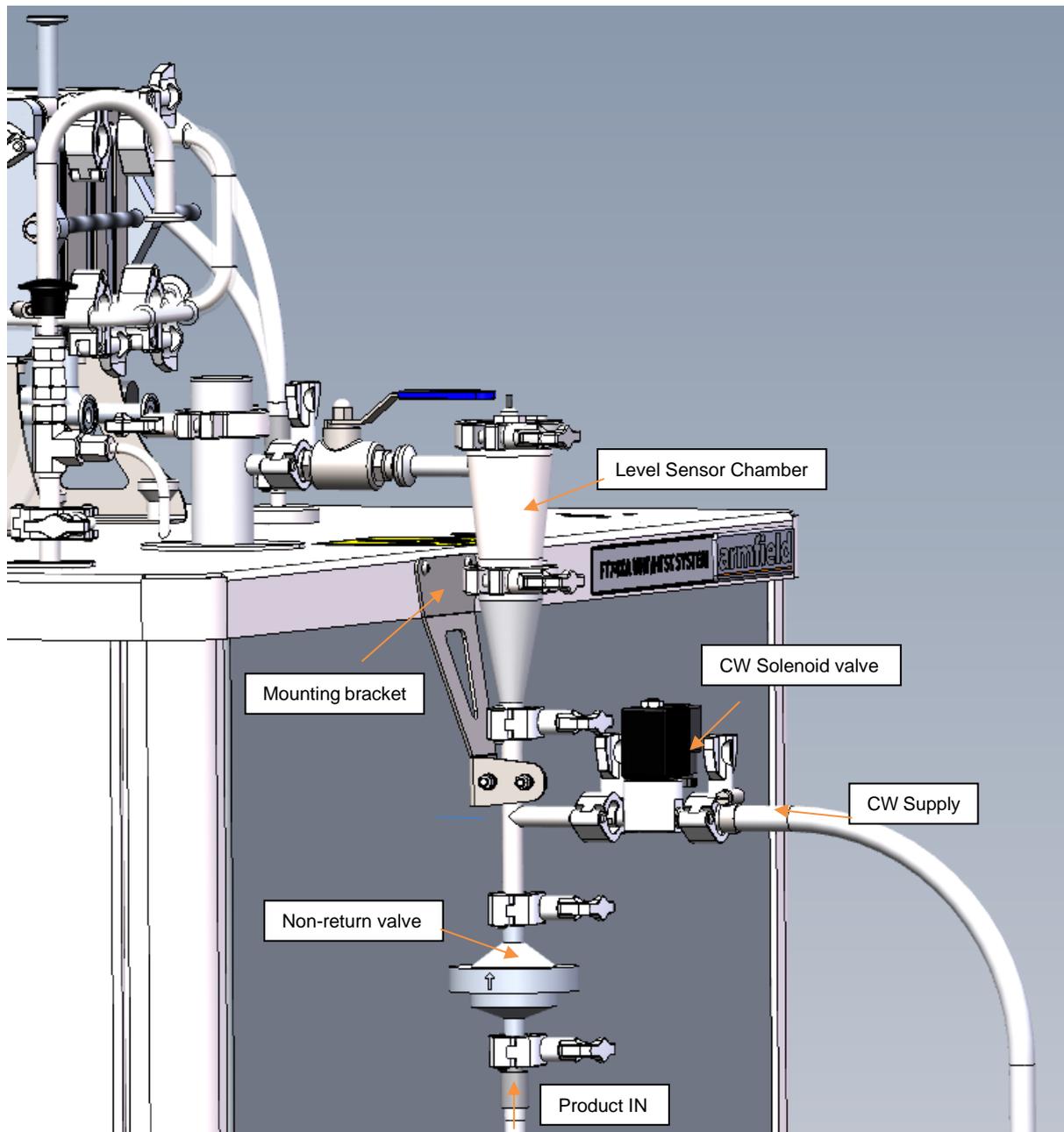


Figure 23 FT74XA feed pump fitted with -53 suction feed option with water supply (via solenoid valve)

10.21 Controllable cooling (FT74-51)

Secondary cooling inlet flow regulating valve can be controlled using software PID control, therefore precisely controlling product temperature after secondary cooling T5.

10.22 pH sensor

An additional pH sensor can be utilized for measuring the product's pH. Its display on the process screen is determined by the configuration within the maintenance screen settings.

pH sensor operating temperature range is 0-100 °C. Maximum sterilisation temperature is 140°C.

pH sensor, if present, can be toggled on in the software via the maintenance menu.

10.23 Cleaning in Place (CIP)

10.23.1 Chemicals

The types and concentrations of cleaning agents and detergents, the recirculation times and temperatures required will depend on the product being processed and the degree of fouling. Some experimentation will be required by users to determine the optimum CIP regime for their equipment and processes.

It is important to test the efficiency of the cleaning regime with new products using the procedure recommended above, i.e. by comparison of the performance of the equipment on water immediately after CIP, with the performance from the same equipment when known to be clean.

The primary cleaning cycle is usually based on caustic soda. A 2% caustic solution (sodium hydroxide, NaOH) is recommended as a starting point. There are alternatives to caustic alone, for example, addition of surface-active agents to the caustic helps to disperse the degraded soil and keep it in suspension. In hard water areas, the addition of a sequestering agent may help to solubilise calcium and magnesium salts.

If the product contained high concentrations of minerals such as calcium then it will be worthwhile to perform an acid wash after the caustic wash. This should be done with nitric acid (HNO₃) at 0.5% concentration or phosphoric acid (1-2 %) circulated at 60-80°C for 20-30 minutes. Once clean, replace the acid in the system with clean water ensuring that it is flushed out properly. To this rinse water a quantity of hypochlorite can be added to make up approximately a 1% solution. Circulate for 10 minutes, drain and then rinse with clean water.

Note: NEVER leave hypochlorite solution or acid in the equipment since it is corrosive to stainless steel even at low concentrations.

Note: if the homogeniser (FT91-174) was used during processing, from time to time it is advisable to manually dismantle the pulse dampeners and clean them.

In normal operation it is possible to clean the unit in place (CIP) without the need to disassemble the heat exchanger. However, should the heat exchanger surfaces undergo heavy fouling due to product burn-on then it may be necessary to strip down the heat exchangers and clean manually.

11 Installation

11.1 Advisory

Before operating the equipment, it must be unpacked, assembled and installed as described in the steps that follow. Safe use of the equipment depends on following the correct installation procedure.

11.2 Electrical Supply

Check the voltage specified on the equipment matches the supply voltage.

Note: this unit **MUST** be earthed. If a permanent electrical installation of the unit is performed then it is important that there is an electrical isolation switch and that a bond test is carried out.

	FT74XA-A	FT74XA-G	FT74XA-E
Green/yellow lead	Earth (Ground)	Earth (Ground)	Earth (Ground)
Brown lead	Live (Hot)	Live (Hot)	Live (Hot) 1
Blue lead	Neutral	Neutral	Neutral
Black 1	n/a	n/a	Live (Hot) 2
Black 2	n/a	n/a	Live (Hot) 3
Fuse rating	30A	30A	16A
Voltage	220-240V	220V	380V
Frequency	50Hz	60Hz	50Hz

The electrical components of the FT74XA are mounted in the electrical cabinet. All MCBs should be in the ON position for correct operation of the unit. **Note:** if a fault condition occurs, one of the MCBs may trip out. The cause of the fault should be investigated before resetting the MCB.

11.3 Cooling medium system

Primary coolant for reducing product temperature after heat processing is connected to the FT74XA via quick release connectors on the side of the unit near to the floor (Figure 24). The coolant flowrate (F2) is shown on the touchscreen. Coolant is delivered to the cooling section of the heat exchanger to reduce the temperature of the heat treated product. Primary coolant may be mains water, chilled water or chilled glycol supply.

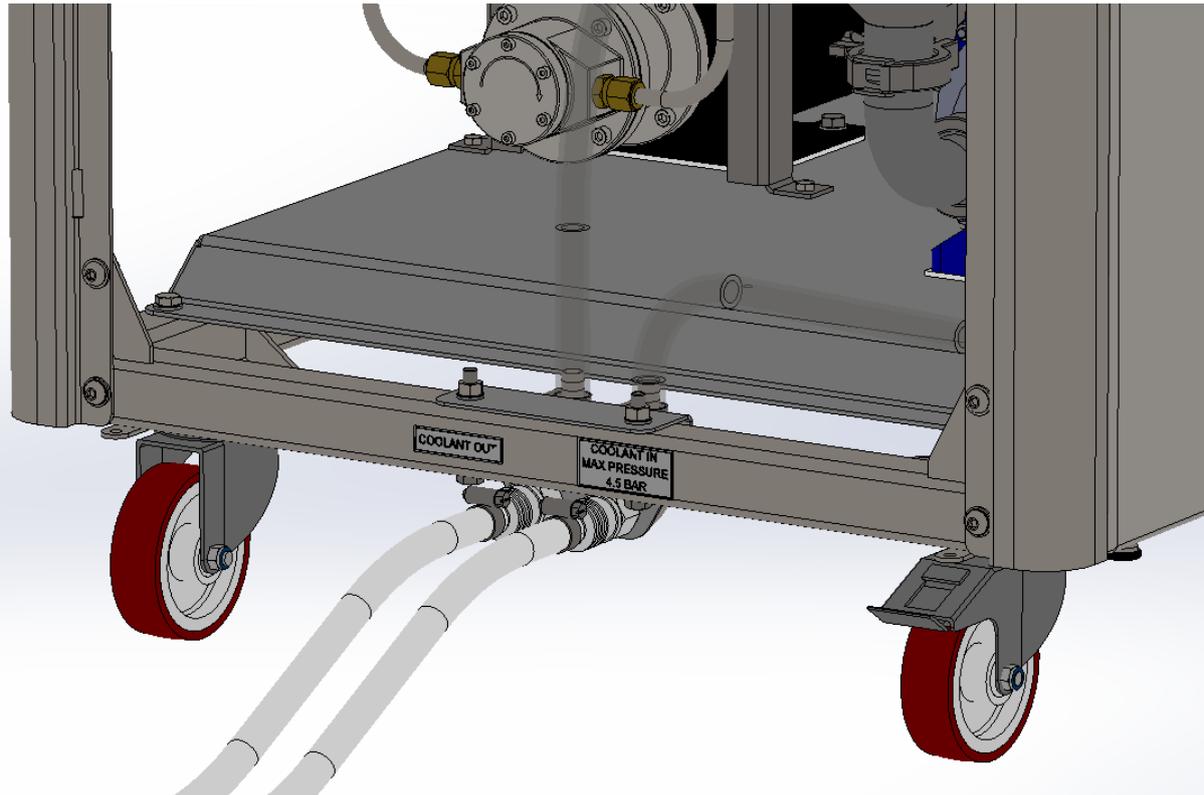


Figure 24 Primary cooling connections

Both the plate and tubular heat exchangers used with FT74XA may be used with a secondary coolant (options required) when low product outlet temperatures are required. In this case coolant pipework is attached directly to the heat exchanger.

11.4 Secondary Cooling systems (Options FT74-33, FT74-24)

For system configurations with dual cooling options fitted (cooling and chilling) the initial cooling section is connected as described in 'Cooling medium system' section 11.3.

Secondary cooling (Chilling) is connected directly to the heat exchangers – see figures below.

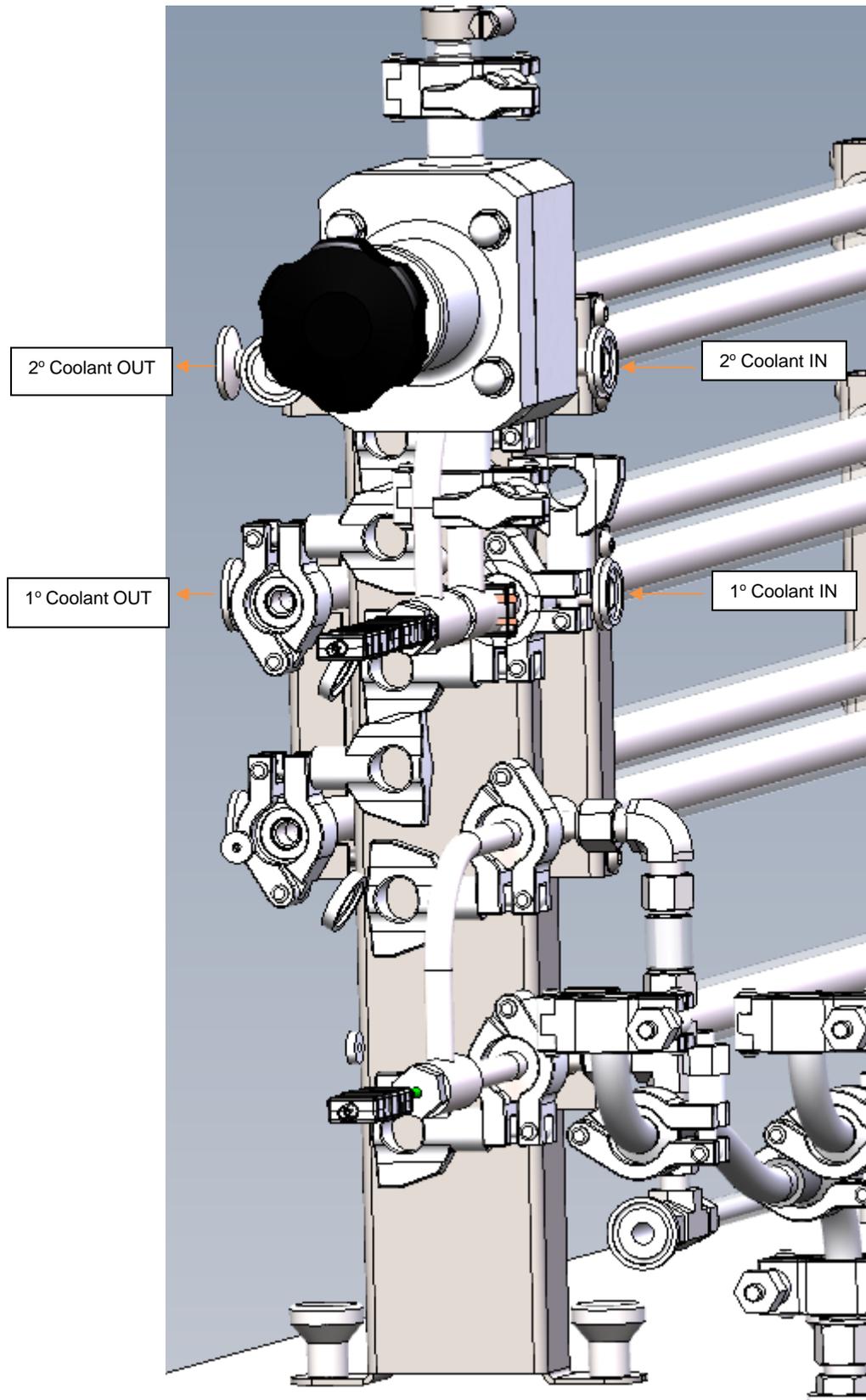


Figure 25 Primary and Secondary coolant connections for the tubular heat exchanger (FT74-24 option)

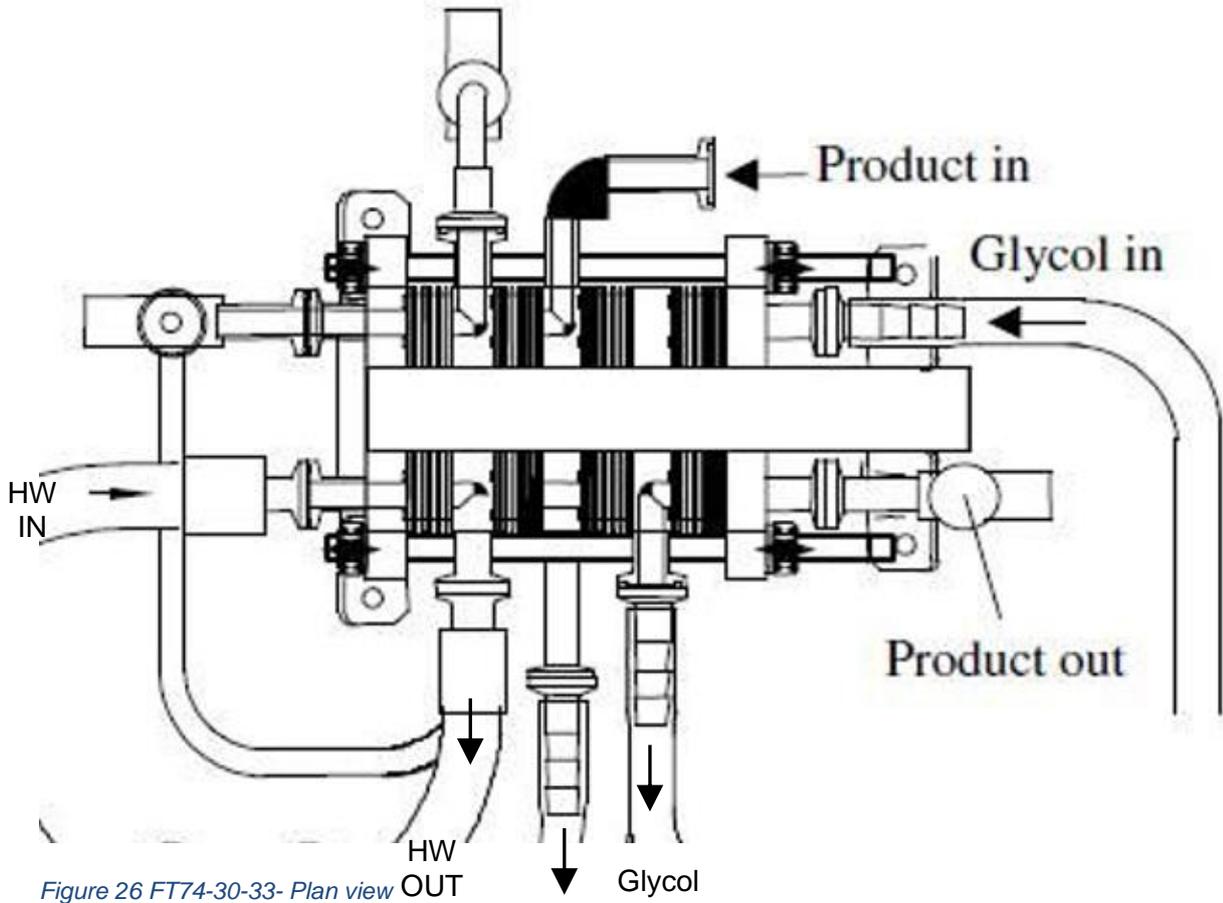


Figure 26 FT74-30-33- Plan view

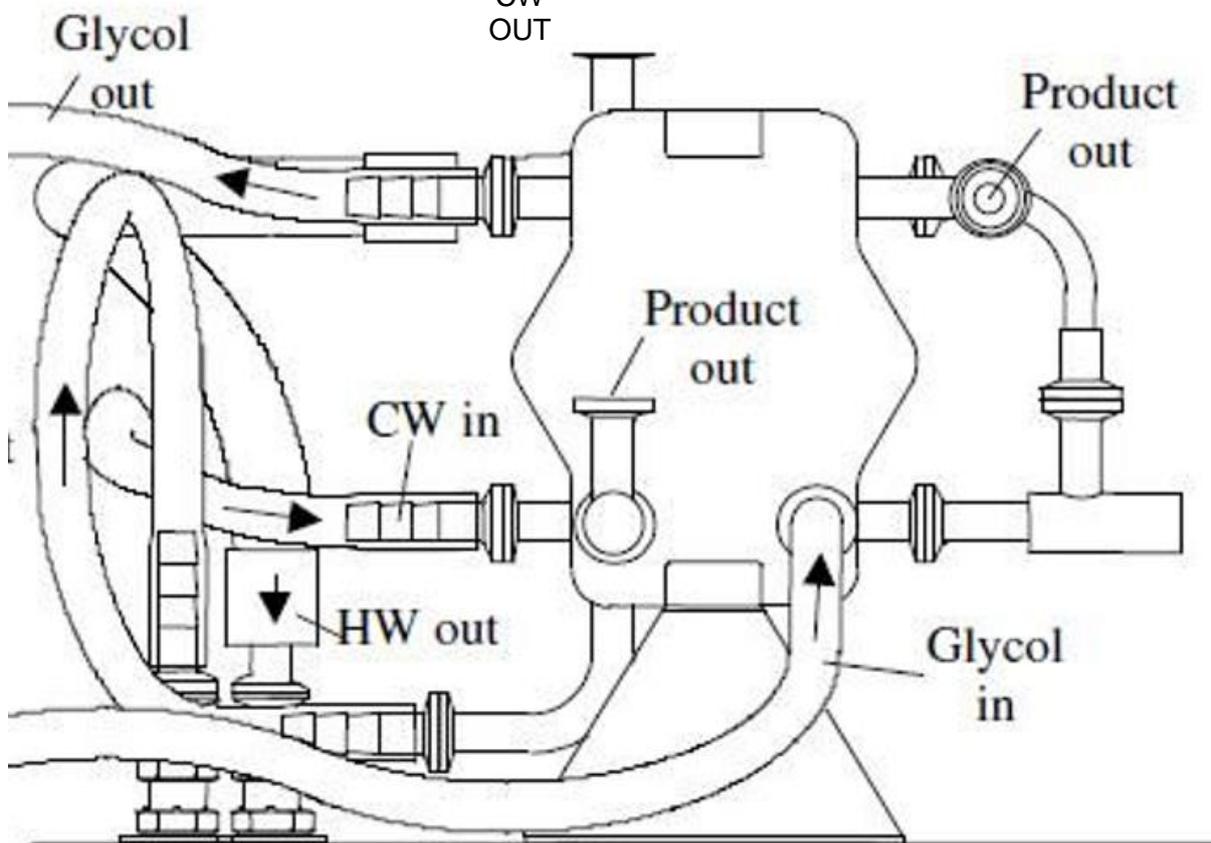


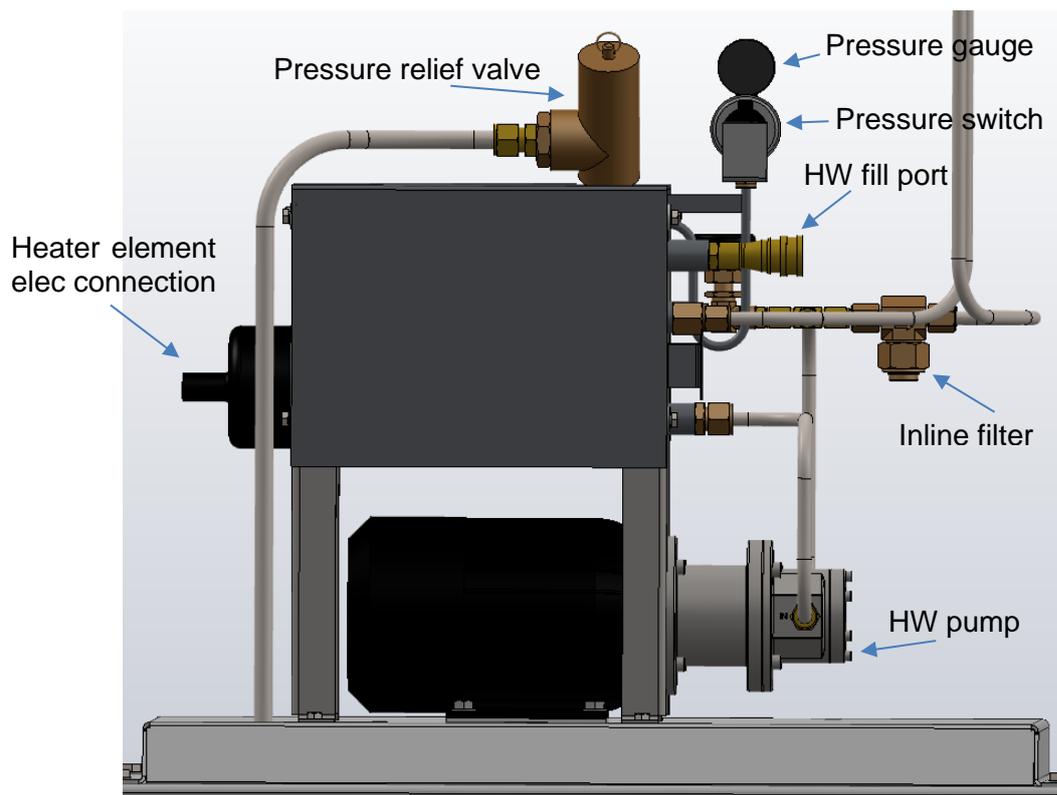
Figure 27 FT74-30-33 End view

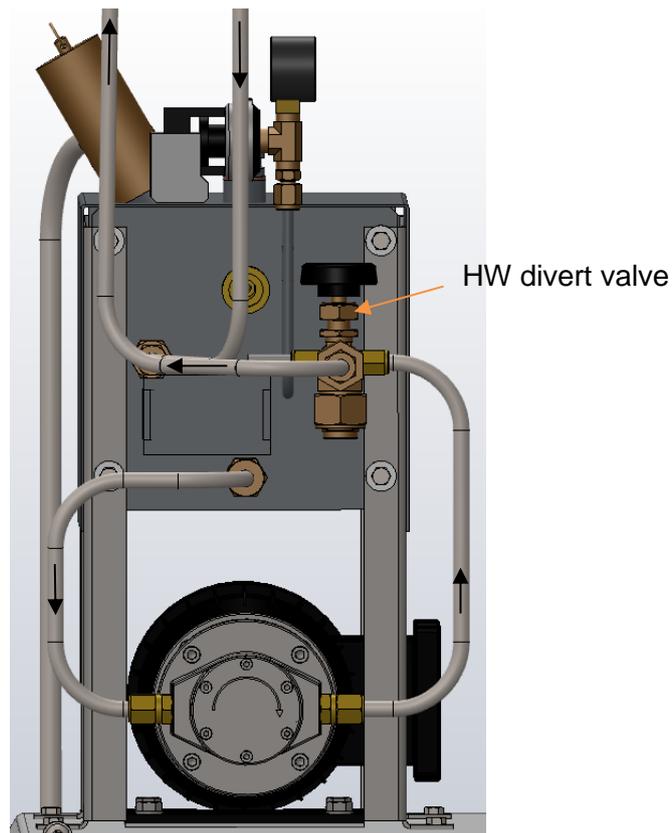
11.5 Filling the hot water circulator

The hot water circulator must be filled with softened or demineralised water to which a small quantity of a conductive salt is added (e.g. 1g of potassium hydrogen carbonate KHCO_3). The conductive salt is necessary to ensure correct operation of the conductive level sensor. Remove the nut from the front of the hot water circulator and fit the tubing and filling funnel supplied with the equipment to the open port. Fill until water overflows from the open port. Operate the hot water circulator (see Operation section below) to force water into the heat exchanger and the refill to overflowing. Remove the tubing and the replace the plug and tighten well.

There will be air inside the headspace of the hot water circulator which must be removed otherwise higher than expected pressures will occur in the hot water circuit which prevent operation at very high temperatures due to pressure limitation. This is done when operating the equipment for the first time. Once the hot water temperature rises above 100 °C then, wearing protective gloves, raise the manual relief of the pressure relief valve. First air will be seen the exit and then steam. Once steam is seen then release the lever so that the pressure relief valve re-seals.

Every time the hot water circuit is opened, which is normally when heat exchangers are changed, it will be necessary to repeat the procedure above.





Pressurised hot water circulator (detailed)

The unit may be filled by attaching the male funnel with suitable male fitting to the hot water circulator fill plug (Level plug).

Caution: Ensure this is done when the boiler is cold and depressurised – check that the analogue pressure gauge attached to the hot boiler reads 0 bar.

11.6 Installing the Equipment

11.6.1 Fitting heat exchangers and holding tubes

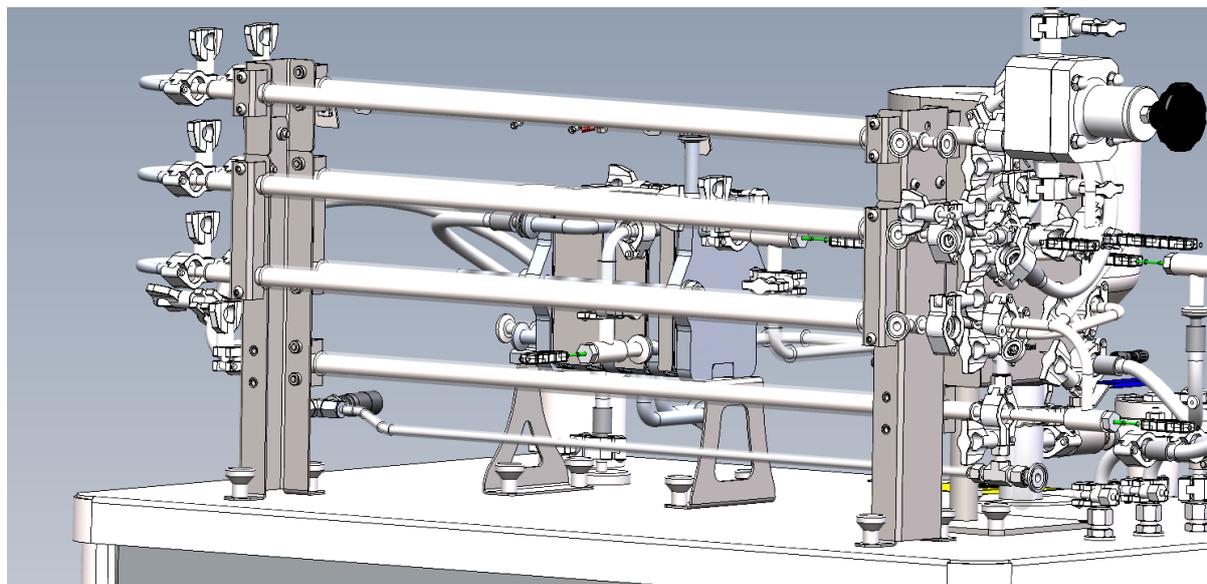
The FT74XA is normally delivered with a heat exchanger already mounted and connected to services. However, if a heat exchanger is removed for cleaning or to fit a different heat exchanger then it is essential to reconnect to the services correctly. Below are given details for mounting and connecting both the plate and tubular heat exchangers also connection of the holding tubes and two-stage cooling lines.

Both the plate and tubular heat exchangers can be operated with a single cooling stage which is usually mains water. Flexible hosing should be attached to the side of the cabinet using the quick-release fittings supplied.

The coolant system is appropriate for use with mains water, chilled water and water/glycol mixtures.

The tubular heat exchanger can be used with two stage cooling when the -24 (double cooling area) or the -25 (double overall area) heat exchanger options are specified. For two stage cooling with the plate heat exchanger, it is necessary to specify the two-stage cooling option (FT74-33). For both heat exchangers the secondary coolant is connected directly to the heat

exchanger rather than via a flowmeter. Plumbing of the coolant lines is shown below for the different options.



Tubular heat exchanger with -24 option– Pre-heat (1 tube) with manual needle valve temperature control, Main heat (2 tubes), primary cooling (2 tubes) and secondary cooling (2 tubes).

11.6.2 Tubular heat exchanger and holding tubes

The tubular heat exchanger is supplied fitted with a 2s holding tube and a 15s holding tube is supplied loose. To fit the 15s holding tube first remove the 2s holding tube then fit in its place.

11.6.3 Tubular heat exchanger (-24 and -27) and two stage cooling

With these two variants of the tubular heat exchanger there are two additional cooling tubes. The service connections are triclamp type and are on the heat exchanger tubes directly. Armfield's FT63 recirculating chiller can be attached directly to these connections. Ensure that the flow is counter-current to the product flow for maximum heat transfer.

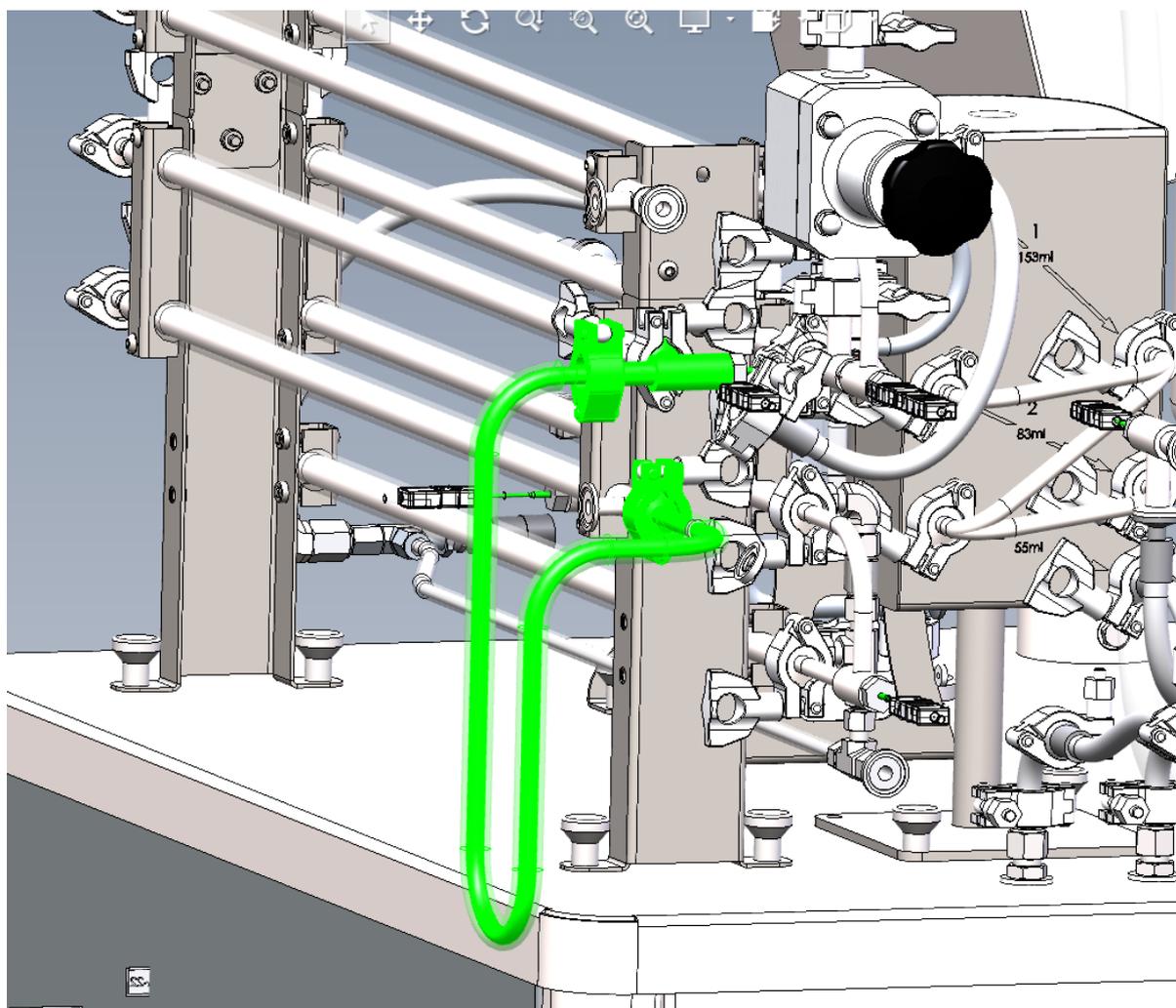


Figure 28 Tubular heat exchanger fitted with 15s holding tube (shown in green)

11.6.4 Fitting the variable holding tube FT74XA-65

The variable holding tube allows product hold times between 30 and 120 seconds to be used. The unit is compatible with both the plate and tubular heat exchangers. Figures below show how the holding tube is configured and connected to the heat exchangers. The stand of the variable holding tube is fastened to the top of cabinet using a retaining screw.

A temperature sensor is mounted at the inlet to the holding tube (**T3**) and also at the return to the heat exchanger (**T8**) which enables the temperature drop across the holding tube to be determined – see diagram below showing arrangement with the plate and tubular heat exchanger options. There are two types of linking tubes used to connect the three coils together, two standard tubes (**V**) and one long tube (**W**). When calculating the overall holding time it is important to include the contribution of the interconnecting tubes and the outlet and return pipework. Below is a table showing the various holding tube configurations, time contributions of the connecting tubes and the overall holding times assuming a product flow rate of 10 L/h and a plug flow regime. Holding times in between the ones given in the table below can be achieved by adjusting the flow rate and these can be calculated using the following equation:

$$\text{Holding time at } X \text{ L/h} = \text{Holding time at } 10 \text{ L/h} \times \frac{10 \text{ L/h}}{X \text{ L/h}}$$

Holding time for coils used (s)	Hold time for other components of holding tube							Overall time (s)	Overall volume (mL)
	Standard link tube (s)	Standard link tube (s)	Long link tube (s)	Inlet temperature sensor (T3) (s)	Inlet hose (s)	Return temperature sensor (T8) (s)	Return hose (s)		
20	-	-	-	2.5	4.5	2.5	4.5	34	94
30	-	-	-	2.5	4.5	2.5	4.5	44	122
55	-	-	-	2.5	4.5	2.5	4.5	69	192
20+30	3	-	-	2.5	4.5	2.5	4.5	67	186
20+55	-	-	4	2.5	4.5	2.5	4.5	92	256
30+55	3	-	-	2.5	4.5	2.5	4.5	102	283
20+30+55	3	3	-	2.5	4.5	2.5	4.5	125	347

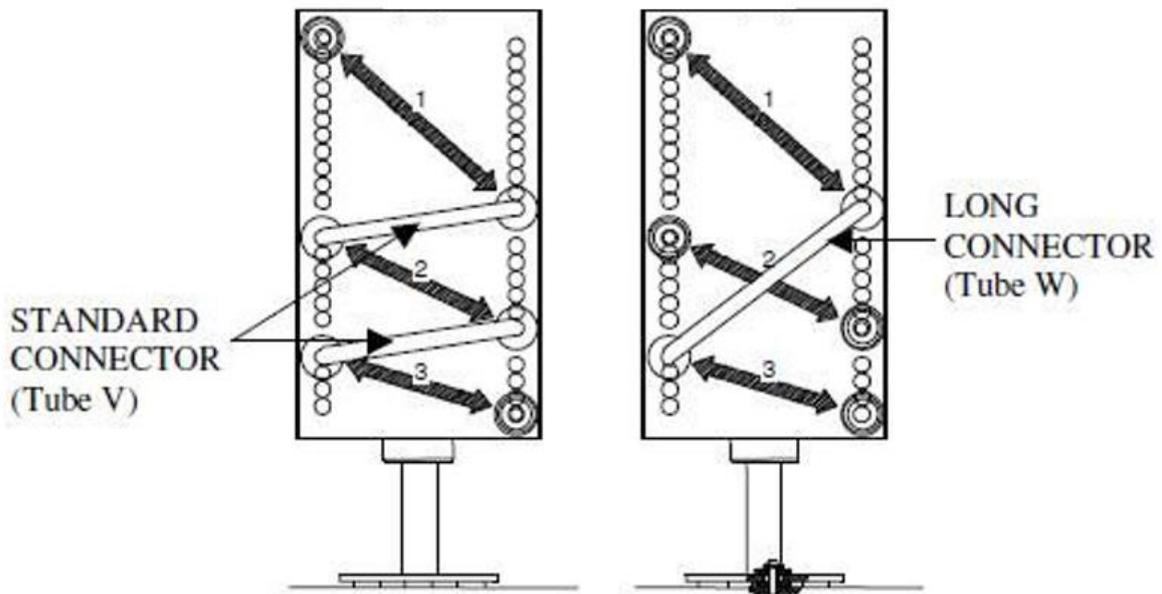


Figure 29 FT74XA-65 variable holding tube

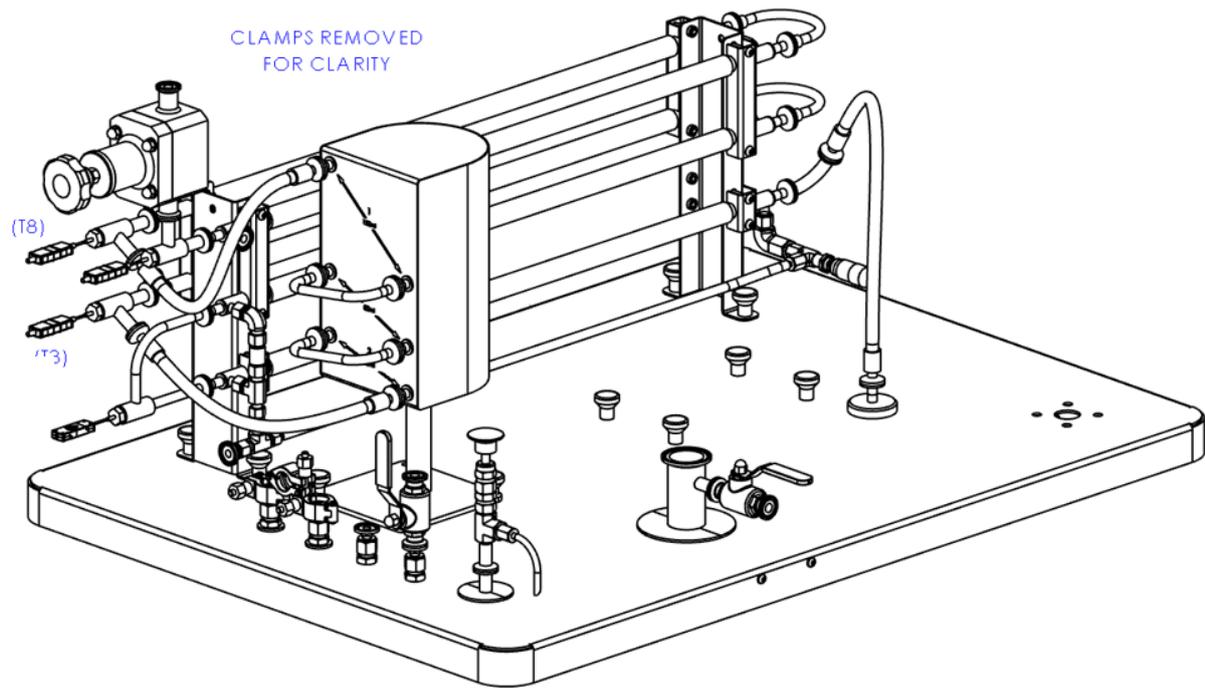


Figure 30 Tubular heat exchanger fitted with FT74XA-65 variable holding tube (feed hopper removed for clarity)

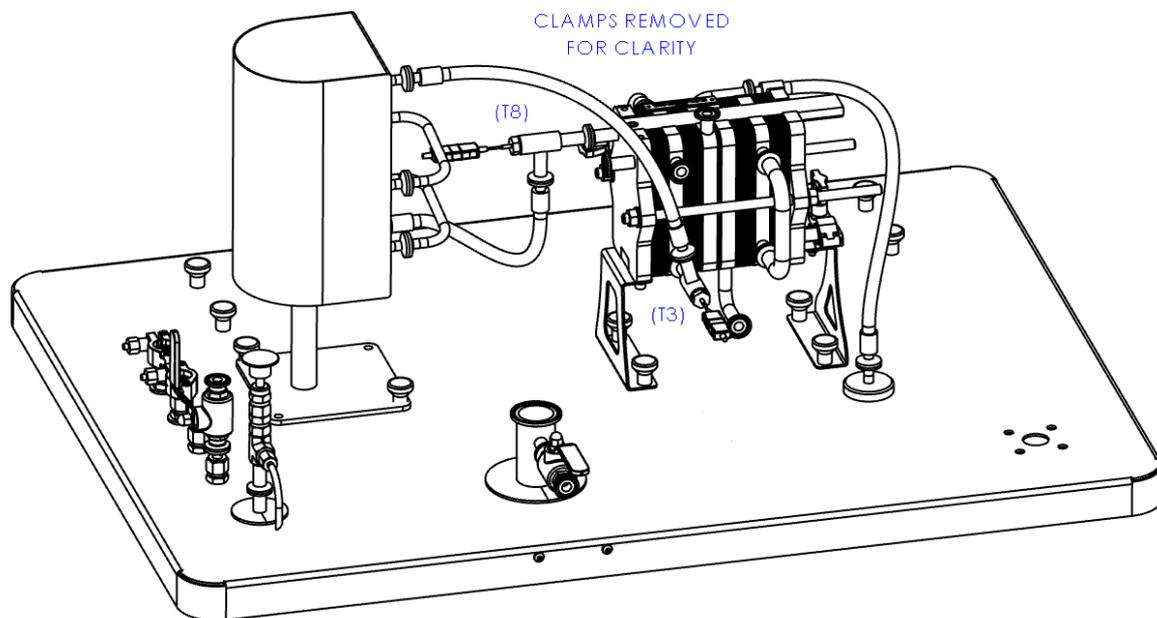


Figure 31 Plate heat exchanger fitted with FT74XA-65 variable holding tube (feed hopper removed for clarity)

11.6.5 Fitting the static mixers (FT74-21) to the tubular heat exchanger

The FT74-21 option contains sufficient number of static mixers for one heat exchanger tubes with four mixer elements being fitted to each tube. These are best fitted to the heat exchanger from the rear of the unit by removing triclamp fittings used to retain the U bends that connect consecutive tubes. The elements should be fitted in correct order for maximised heat transfer. Each consecutive element spirals in the opposite direction. Additionally, the inserts connect

together therefore the two elements in the middle have a connection at both ends whereas the two end elements have a connection at one end alone.

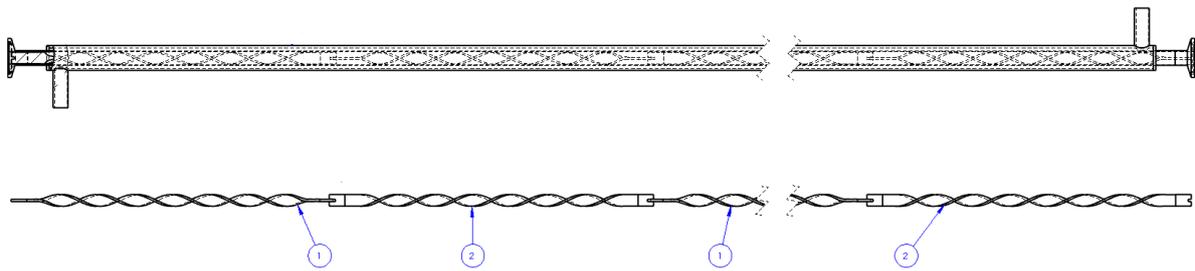


Figure 32 Static mixer elements (4 elements per tube - two types (1 & 2), two of each type). Types 1 and 2 twist in the opposite sense to improve mixing. Mixer elements are shown inside a heat exchanger tube (above) and separately (below).

11.6.6 Connecting flow meter option (FT74-40)

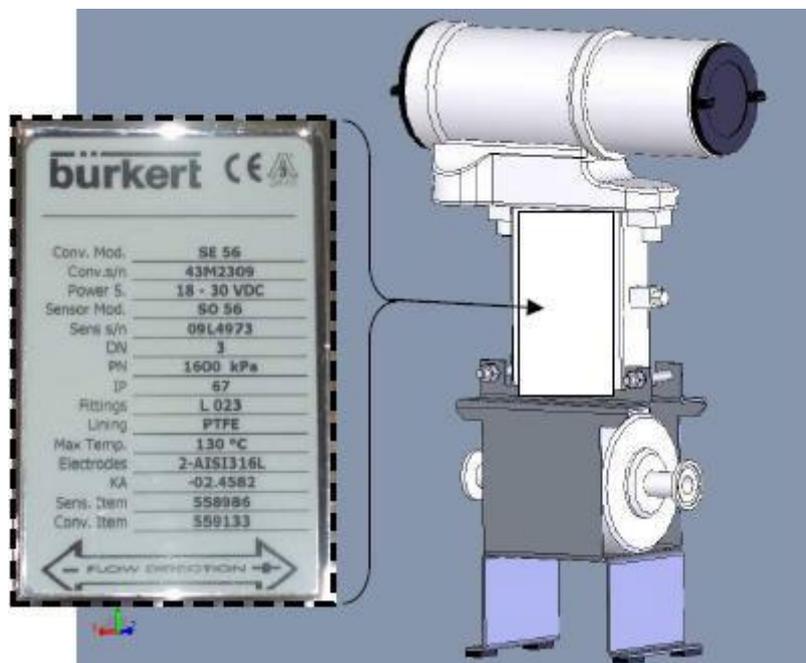
The flow meter option (FT74-40) is fitted between the outlet of the feed pump system and the inlet of the heat exchanger.

When no flow meter is fitted to the FT74XA then the outlet from the feed system is connected directly to the inlet of the heat exchanger using a flexible hose.

Configuration of the tubing also depends on whether or not the system is fitted with the FT74XA-52 CIP pump. See below for the four configuration options.

To connect the flow meter into the system:

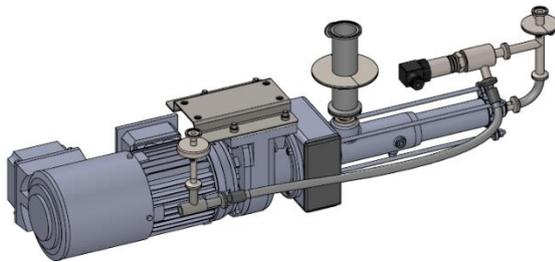
- a. The flexible tubing is disconnected from the feed system outlet.



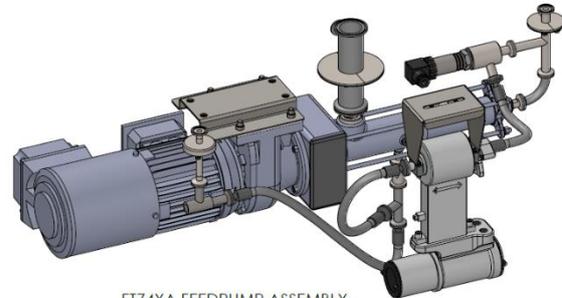
FT74-40 flow meter

Care should be taken to ensure the flow meter is fitted in the right direction. The body of the unit is labelled with a directional arrow as shown above;

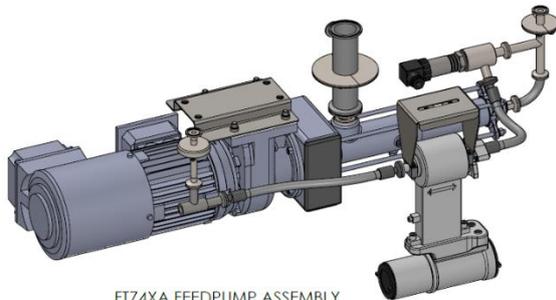
- The inlet from the feed pump should be connected to the side marked with the '-' symbol
- The outlet from flow meter to the heat exchanger, connected to the side marked with the '+' symbol



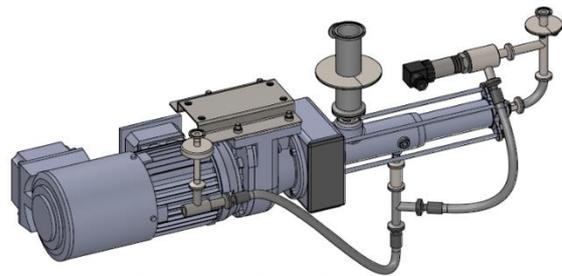
FT74XA FEEDPUMP ASSEMBLY



FT74XA FEEDPUMP ASSEMBLY
WITH FT74XA-40 + FT74XA-52



FT74XA FEEDPUMP ASSEMBLY
WITH FT74XA-40



FT74XA FEEDPUMP ASSEMBLY
WITH FT74XA-52

Figure 33 The four configuration options for the feed pump depending on the presence or absence of the flowmeter (FT74XA-40) and CIP (FT74XA-52).

11.7 Controllable cooling (FT74-51)

Controllable cooling option automatically adjusts the coolant flow into the secondary cooling section to achieve the setpoint temperature T5.

Connect the refrigerant from the chiller to the pressure regulator:

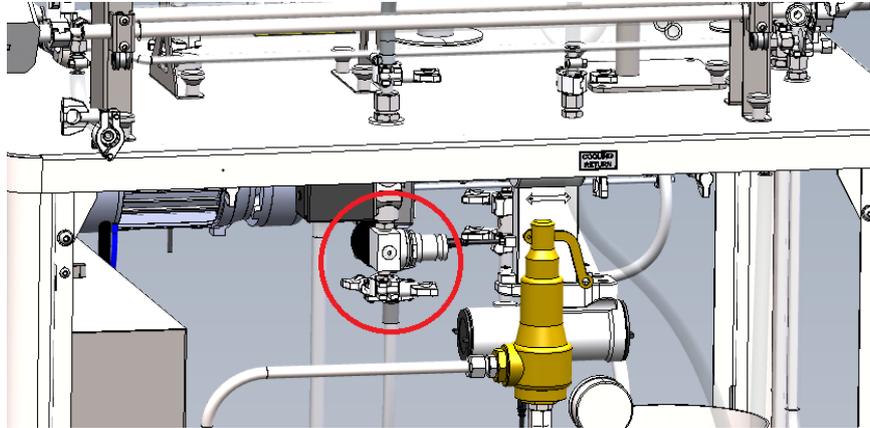


Figure 34. Position of the pressure regulator, where a coolant must be connected to for the -51 controllable cooling option.

Then, connect the line above to the secondary cooling shell side inlet. Connect the secondary cooling shell side outlet to the chiller return line. When the chiller is on, set the pressure regulator to 3bar.

11.8 FT74XA-45 Sterilisation link installation with Tubular and plate heat exchangers

High temp/pressure flexible pipes are used to connect the heat exchangers to the FT74XA-45. Arrangements are shown below:

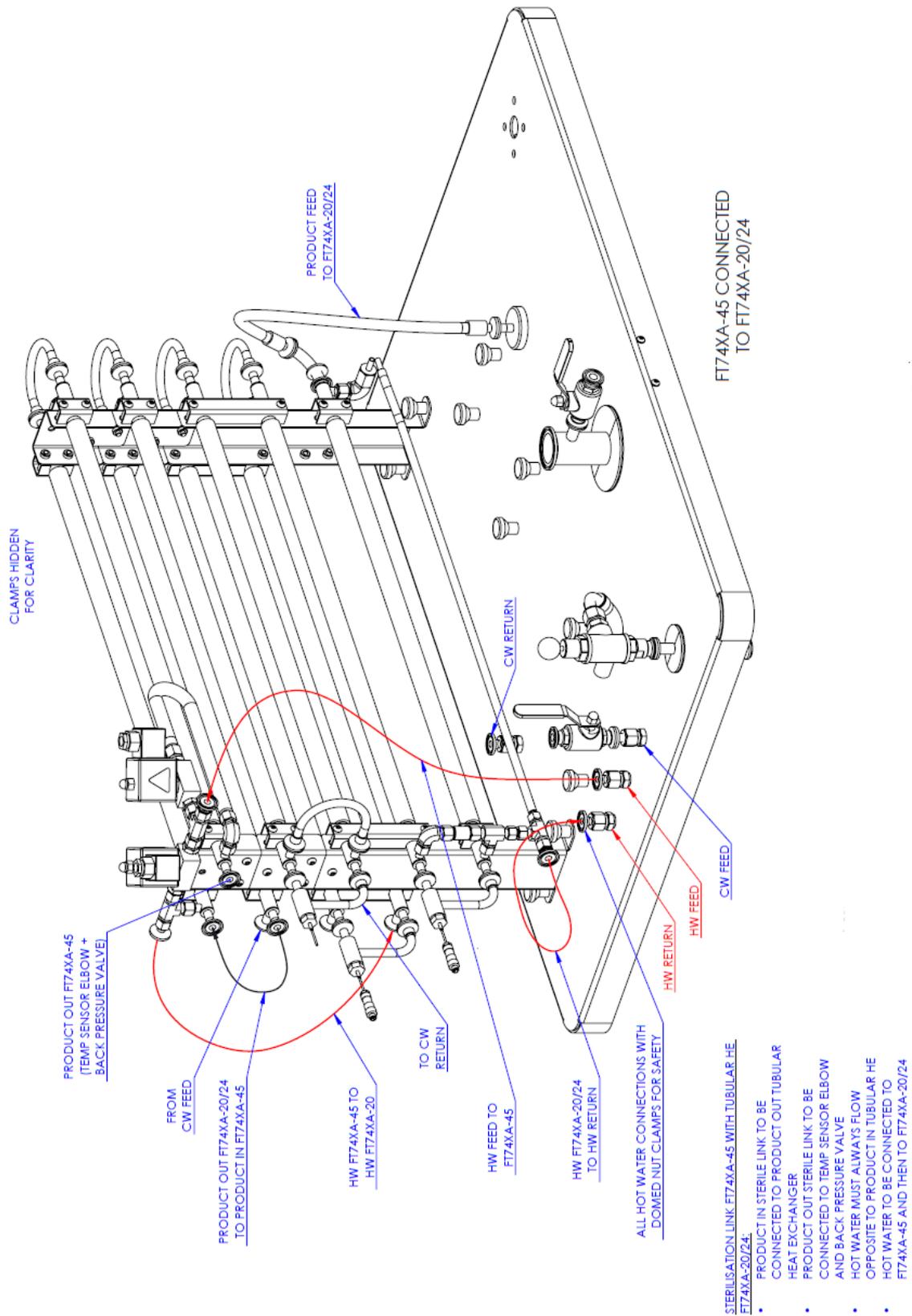


Figure 35 Connections between FT74XA-45 sterilisation link and the tubular heat exchanger

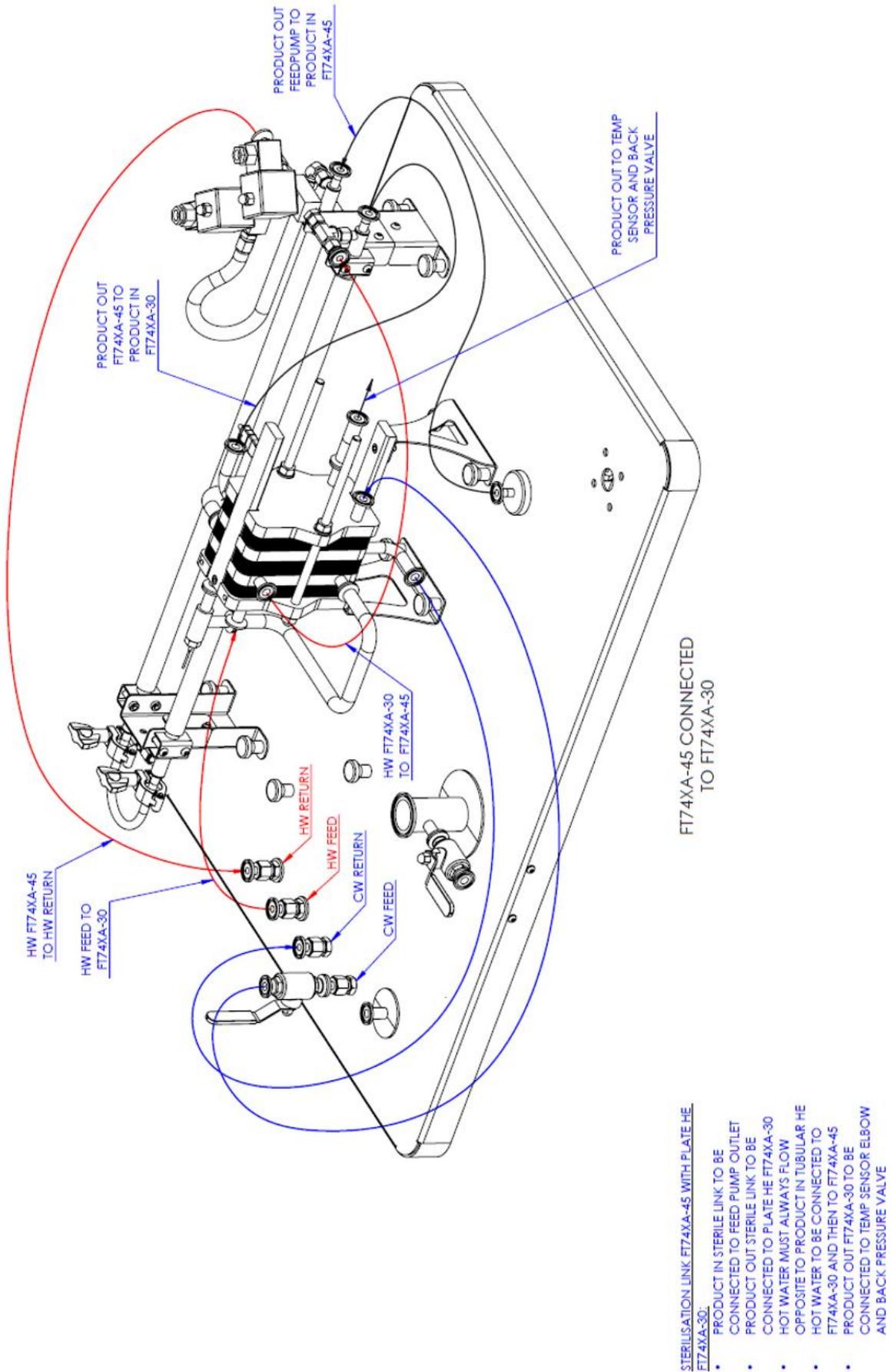


Figure 36 Connections between FT74XA-45 sterilisation link and the tubular heat exchanger

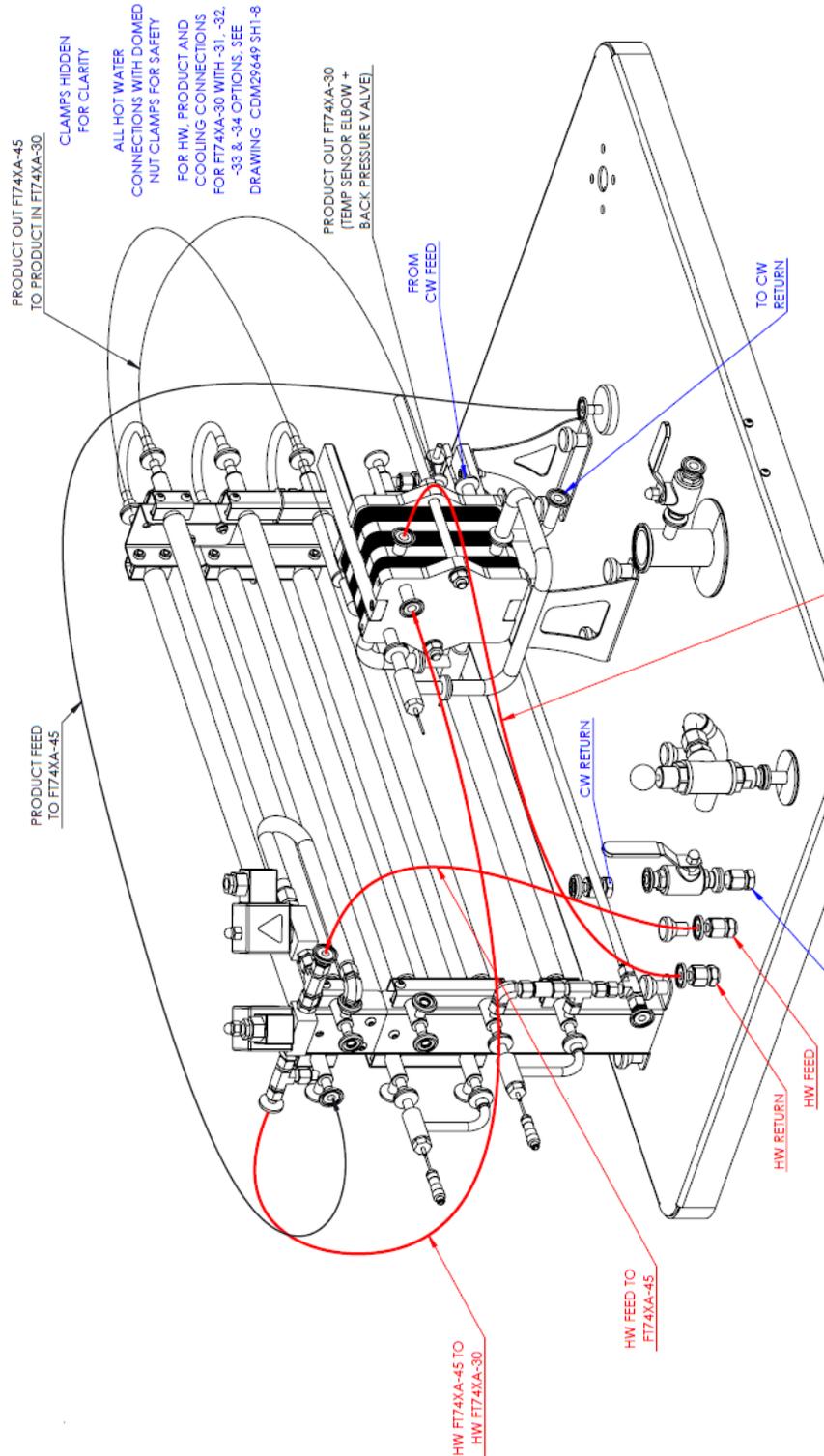
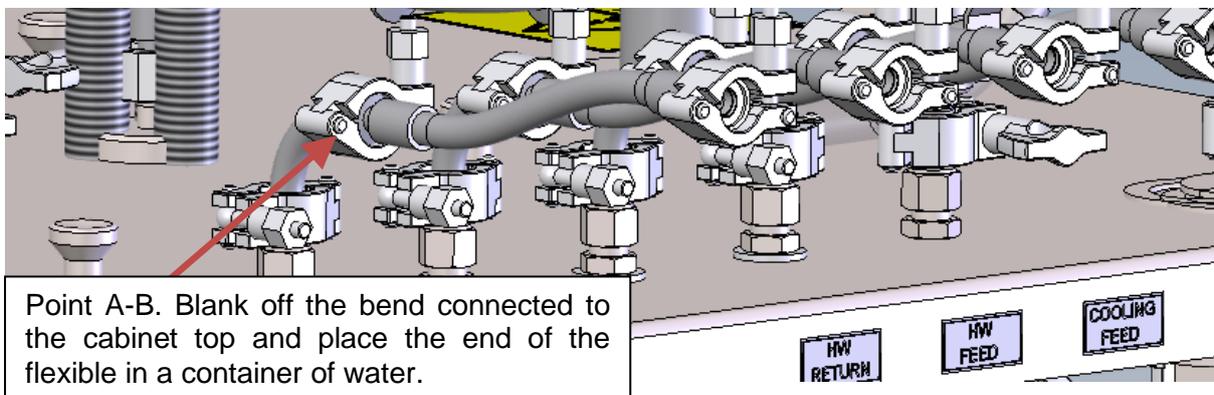


Figure 37 When both tubular and plate heat exchangers have been ordered then the PHE may be connected to the FT74XA-45, as shown.

11.9 FT74XA-46 Controllable Preheat option

To prime the controllable preheat circuit with water. Fully open the red-handled valve. Disconnect the flexible from the pre-heat return at the point where it attaches to the bulkhead fitting on the cabinet top. Attach a cold water supply to the bulkhead fitting. The flexible should be placed into a container to catch any water that escapes. Turn on the cold water supply (low flow) and allow the circuit to fill until water exits the flexible into the container. Turn off the cold water supply and remove this pipe from the bulkhead and re-attach the flexible from the heat exchanger to the bulkhead. Now turn on the cold water supply to the unit and close the valve on the cabinet top which allows cooling water to enter the heat exchanger. There should be 2 bar reading on the cold water pressure regulator gauge. Set the pre-heat set point to below ambient then turn on the feed pump and the pre-heat. Now turn the red-handled valve clockwise until a pressure of 3.5 bar is seen the analogue pre-heat pressure gauge.

NOTE: The pressure regulator on the water inlet to the -46 is set to 2 bar. Continuous water supply must be ensured throughout the operation for the equipment to function properly.



Point A-B. Blank off the bend connected to the cabinet top and place the end of the flexible in a container of water.

Figure 38. Diagram assisting the -46 set-up.

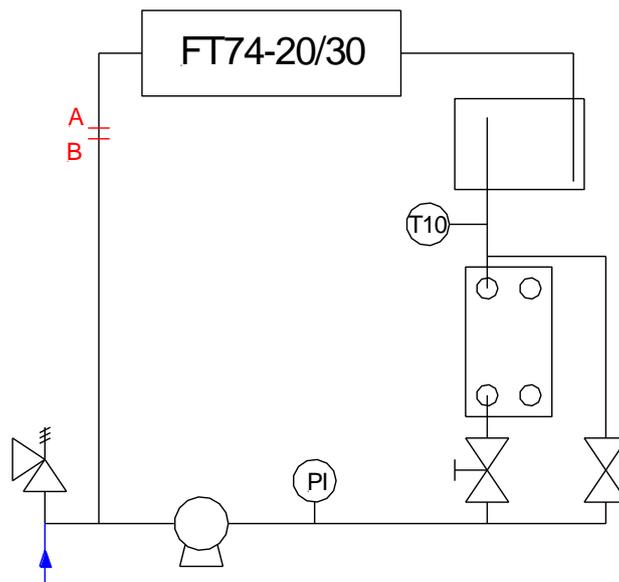


Figure 39. FT74-46 set-up assisting diagram, showing connection points A and B.

11.10 Connecting the homogeniser to FT74XA

11.10.1 Electrical Connections

There are two electrical connections that come from the homogeniser and connect to the FT74:

1. Armbus connection from the homogeniser that connects to the FT74XA
2. Cable for speed control.

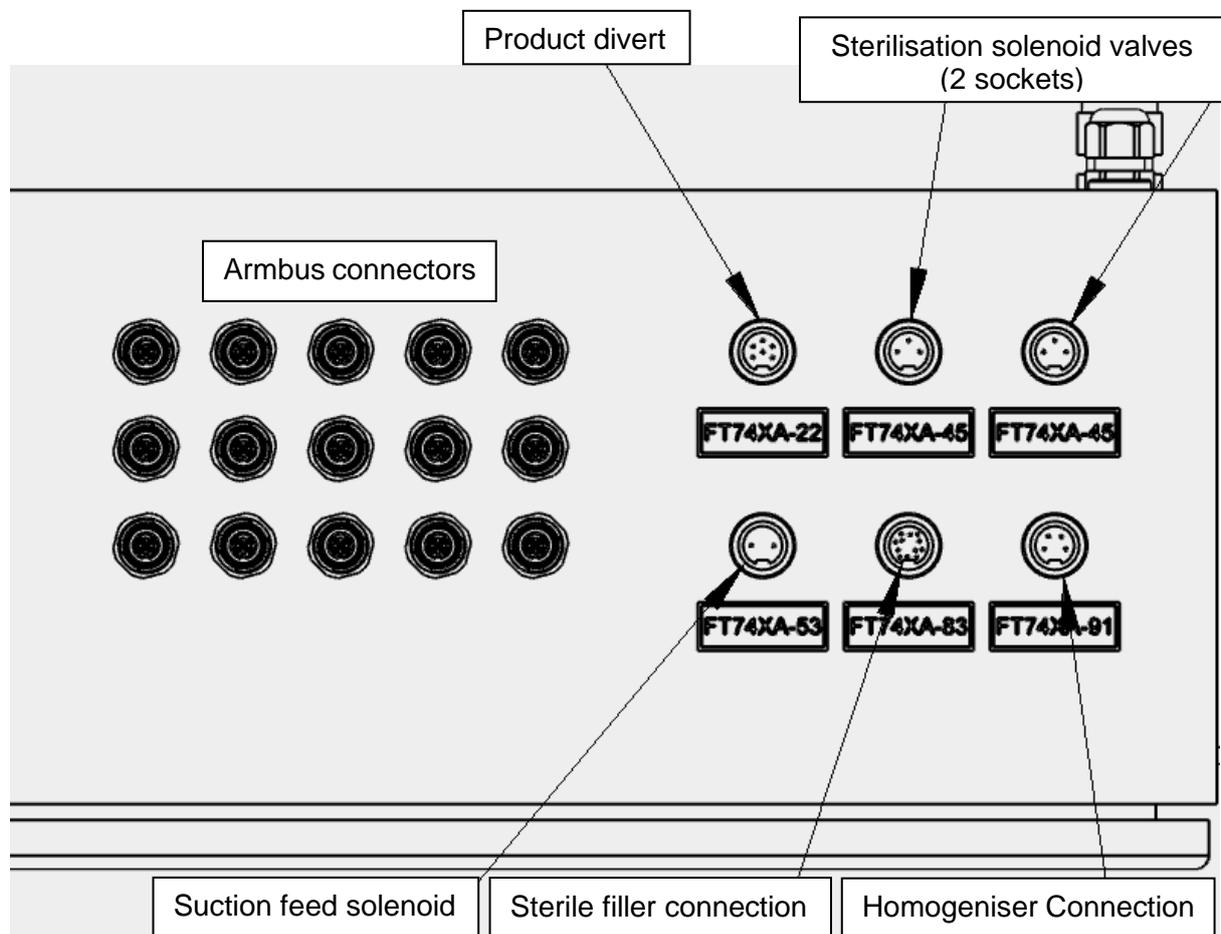


Figure 40 Top of electrical cabinet showing electrical connections

11.10.2 Process connections

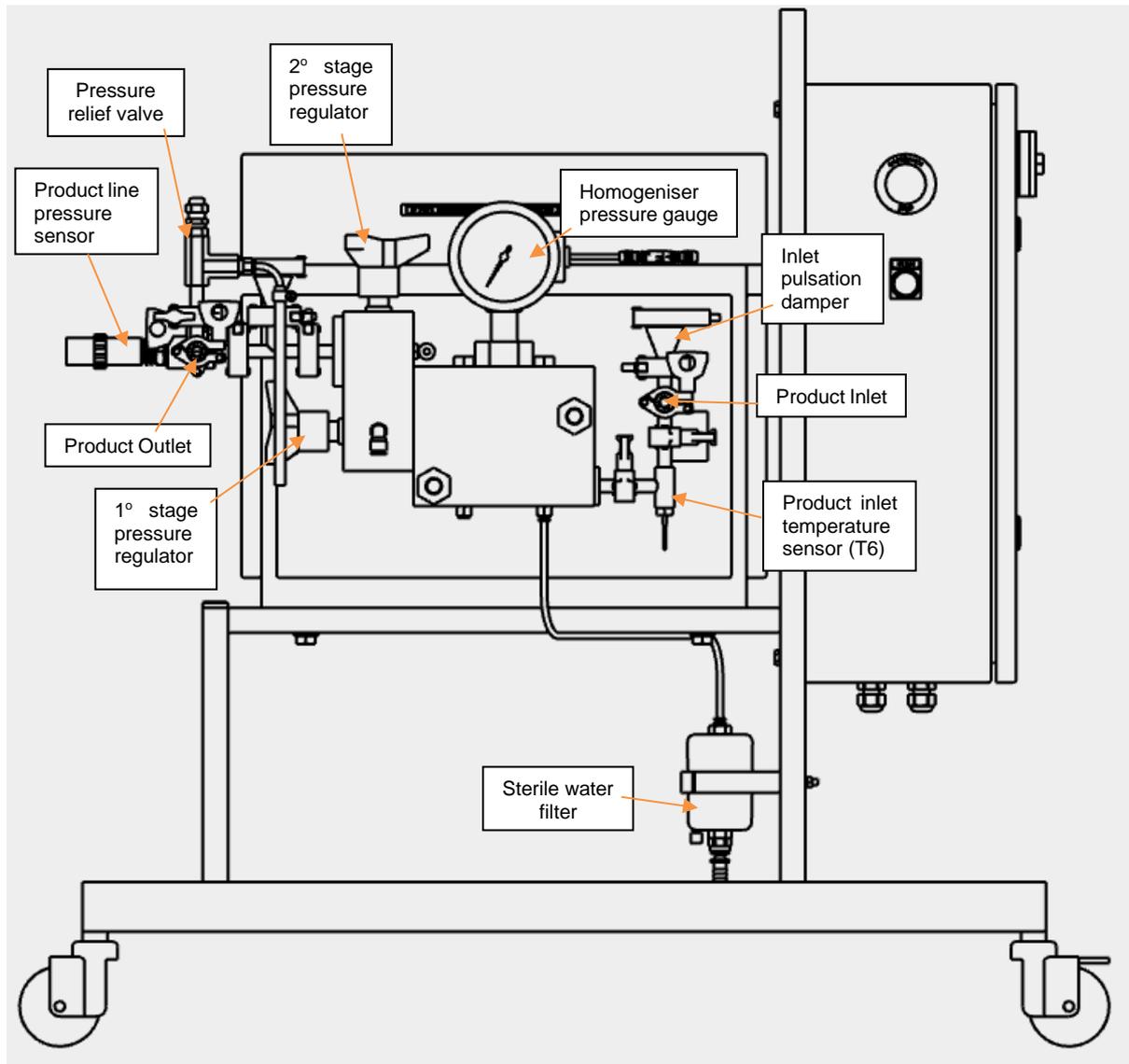


Figure 41 FT91-74XA Key components

Sterile water lubrication to the back of the pistons is provided via the sterile water filter. A cold water supply should be connected to the hosetail at the bottom of the filter. The flow rate should be set so that there is a low, continuous water flow.

Note: homogenizer should not be used with demineralised / deionised / RO water, as this will lead to premature damage to homogenizer valves.

All process connections between the FT74XA and the FT91 should be made with the braided stainless steel flexibles provided with the FT91.

A pressure relief valve is mounted on the outlet of the homogeniser to protect the pipework downstream of homogeniser. The pressure in this line is measured by P2.

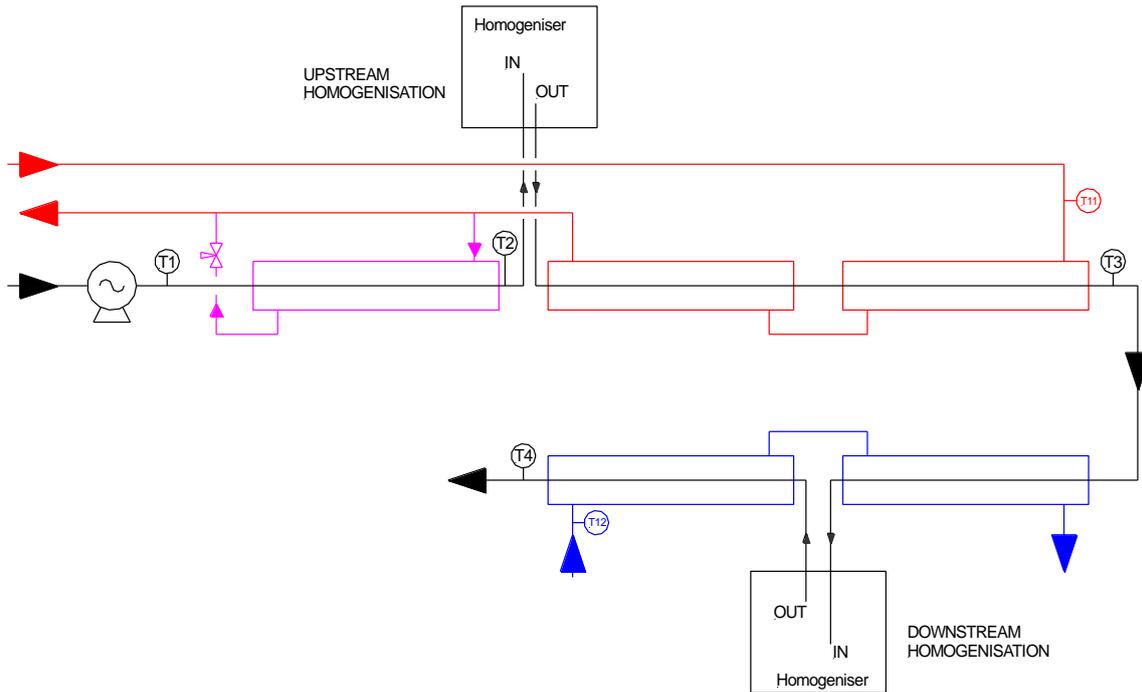


Figure 42 Positioning of the FT91 when connecting to the tubular heat exchanger

The plate heat exchanger can be fitted with intermediate plates to allow product to be taken out either upstream (FT74-31) or downstream (FT74-32) of the heat treatment section. Care should be taken when attaching the homogeniser since the inlet and outlet ports on the homogeniser plate are opposite for the FT74-31 compared to the FT74-32 – see below:

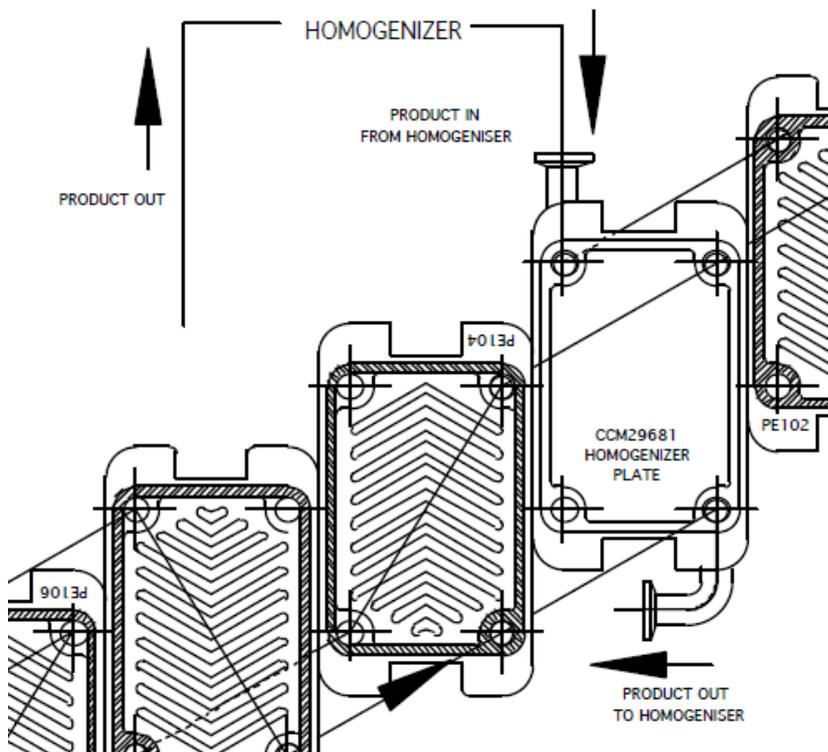


Figure 43 FT74-31 upstream homogeniser plate showing connections to the homogeniser

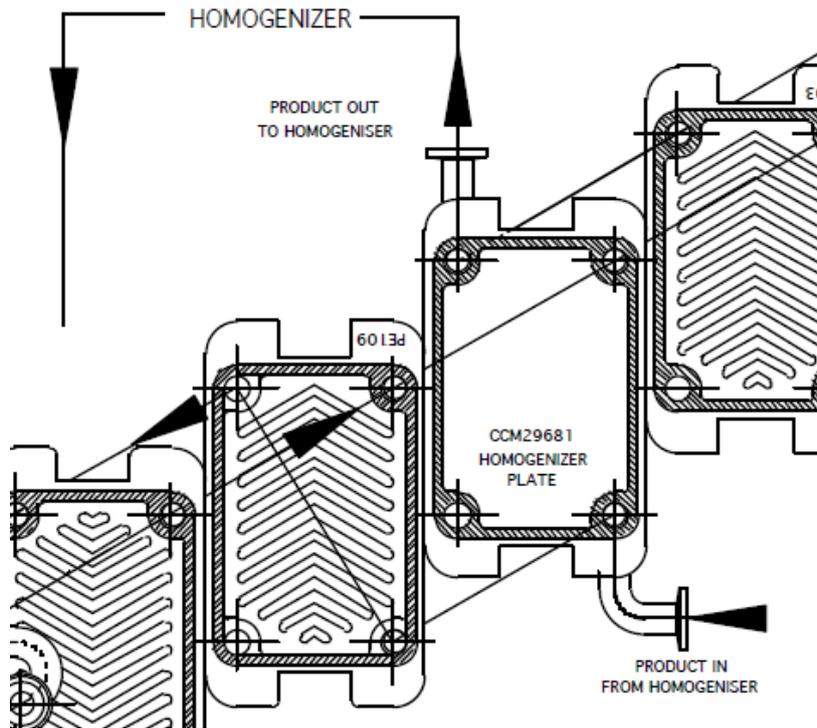


Figure 44 FT74-32 Downstream homogeniser plate showing connections to the homogeniser

11.11 Electrical Wiring Diagram

Please see the following wiring diagrams attached at the rear of this manual. If you are viewing this manual electronically please see accompanying pdf.

PC-0062916E sheets 1 to 3

PC-0062917F sheets 1 to 6 and 8 to 10

12 Operation

Where necessary, refer to the drawings in Equipment Diagrams section 8.

The apparatus must be set up in accordance with the instructions in the Installation section. Additionally, ensure that you have read the Safety section. It is also very important that COSHH sheets pertaining to chemicals are read carefully before being used with the equipment. All operators must be fully trained on the unit before being permitted to operate it independently.

This section details operation of system components in the order in which they should occur therefore, for correct operation, it is important to work through this section systematically.

12.1 Pre-Processing Tests

In order to process product efficiently and with minimal product fouling it is essential that the system is operated with due care and attention and that efficient cleaning of the heat exchanger surfaces through clean in place (CIP) procedures is carried out after each use.

Once product fouling of the heat exchanger surfaces has occurred the heat transfer coefficient is significantly reduced. This leads to even greater delta T's (difference in temperature between the pressurised hot water system and the product) which leads to even more product fouling. It is difficult to know when heat exchanger surfaces are fouled without disassembling the units which is awkward, particularly for the plate heat exchanger. A useful method is to operate the system with water at a flow rate of 10 L/h and at a set-point temperature of 130°C. When following this method with the tubular heat exchanger then the needle valve controlling flow of hot water to the two pre-heat tubes should be fully open. The difference between the hot water and set-point temperature should be recorded. This should be done with the brand new system before product has been used so that a reference point for a clean heat exchanger system is established. Then every time the system is used and then cleaned this procedure should be repeated so that it can be shown that the system has been properly cleaned. This procedure, which should be used for both heat exchanger options, will allow the user to develop efficient clean in place (CIP) procedures for different products and will ensure that the FT74XA is always being used to its best potential.

Fouling of the heat exchanger surfaces can easily occur through negligent operation. Care should be taken never to stop product flow i.e. pumping during processing as this will lead to instant fouling of the heat exchanger surfaces. Another common error is operating at temperatures above the product boiling point with either no or too little back pressure applied to the system. This leads to product boiling, denaturing of the product and fouling of the heat exchanger surfaces. A thorough understanding of the operation section before using the equipment will help to avoid such problems. It is important to observe the hot water temperature during processing. This is best done via the computer software where temperature changes can be observed graphically in real time. If the hot water temperature increases with time whilst the product temperature remains at the set-point then this is a sign of increasing product fouling and processing should be stopped and a CIP procedure implemented.

12.2 Product Limitations

- Particulates

The FT74XA is limited to use with products containing particles no larger than 0.8mm and fibres no longer than 25 mm.

The small size of the orifice through the flow meter means that it is susceptible to blockage.

1 Viscosity

If the product to be used is of a viscous nature, thought should be had as to what type of configuration is best to use.

- Plate heat exchangers are suitable for low viscosity products
- Tubular heat exchangers are suitable for higher viscosity products
- The addition of static mixers (FT74-21)

12.3 Product Processing (non-sterile)

The FT74XA is controlled from the touch screen. The FT74XA powers up to the Introductory screen. From this screen the Standby button is pressed and from the next screen Process is selected to give the screen below:

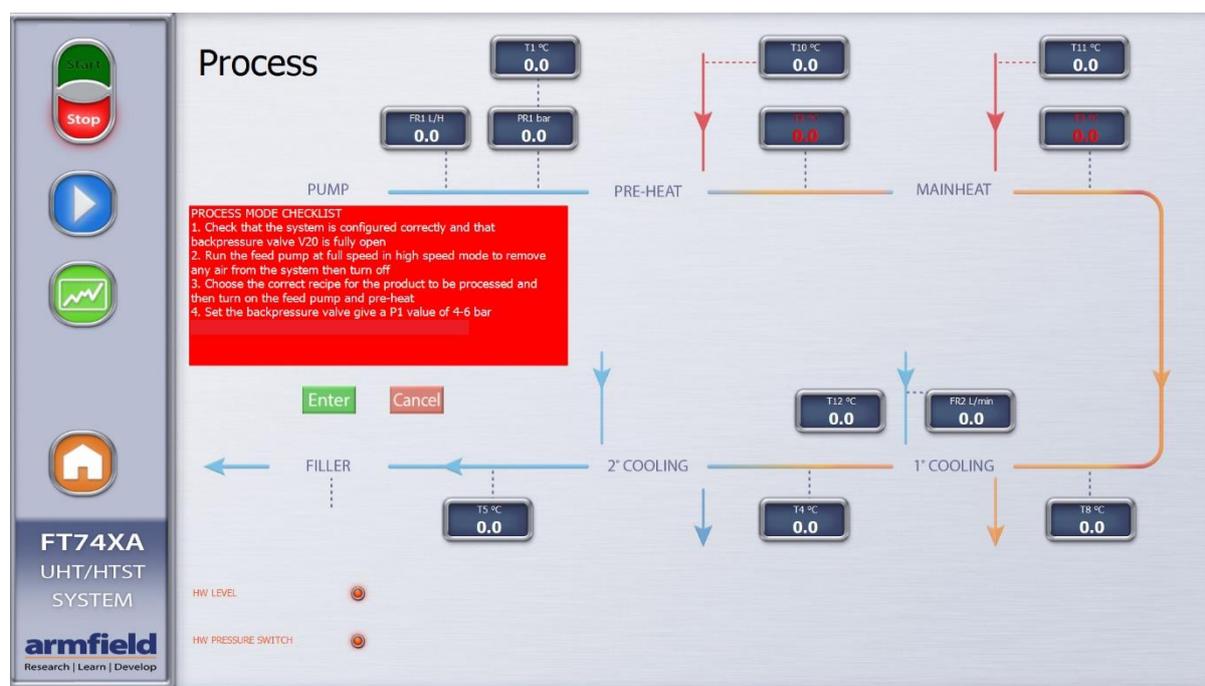


Figure 45 Process setup screen

Once the initial checklist for processing has been attended to then the Enter button is pressed to enter the full Process Screen shown below:

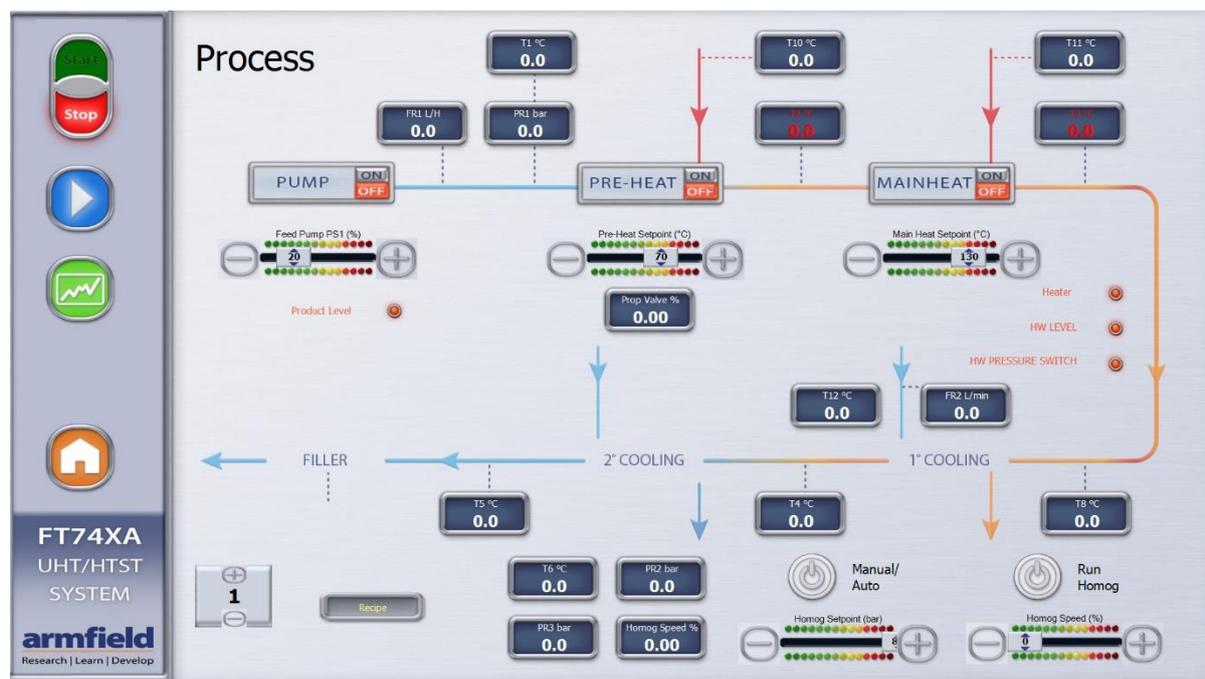


Figure 46 Process screen

1. At the start of operations, the feed tank should be full of clean water and the product outlet hose should be returning to the feed tank. Press the recipe hen return to the Processing screen.
2. Ensure the product backpressure valve is fully open then turn on the feed pump and increase speed to 100%. Continue until all air in the system has exited via the product outlet hose then turn off the feed pump.
3. Either select the recipe to define the processing parameters or set them manually on the process screen.
4. Turn on the feed pump and then set the backpressure valve to give the required pressure at P1 to prevent product boiling. The required backpressure can be determined in Section 12.7. Turn on the cooling systems and then turn on the Main Heat. (Set the required pre-heat temperature using the needle valve for tubular systems without the controllable pre-heat option).
5. Allow all process variables to stabilise then remove the product outlet hose from the feed hopper so that the water level in the hopper drops. The level override switch should be used to drop the level low before adding product to the hopper so that product dilution is minimised.
6. Allow the product to pass through the system, monitor P1 and adjust the backpressure valve as necessary. Wait for all parameters to stabilise before taking samples.
7. Once processing is complete the product heating should be turned off. The feed pump should continue to remove all product from the hopper and then replace with water so that all product is removed from the system. Once the system is cool then the feed pump can be turned off whilst preparations are made for cleaning (CIP)

12.4 Product processing (sterile)

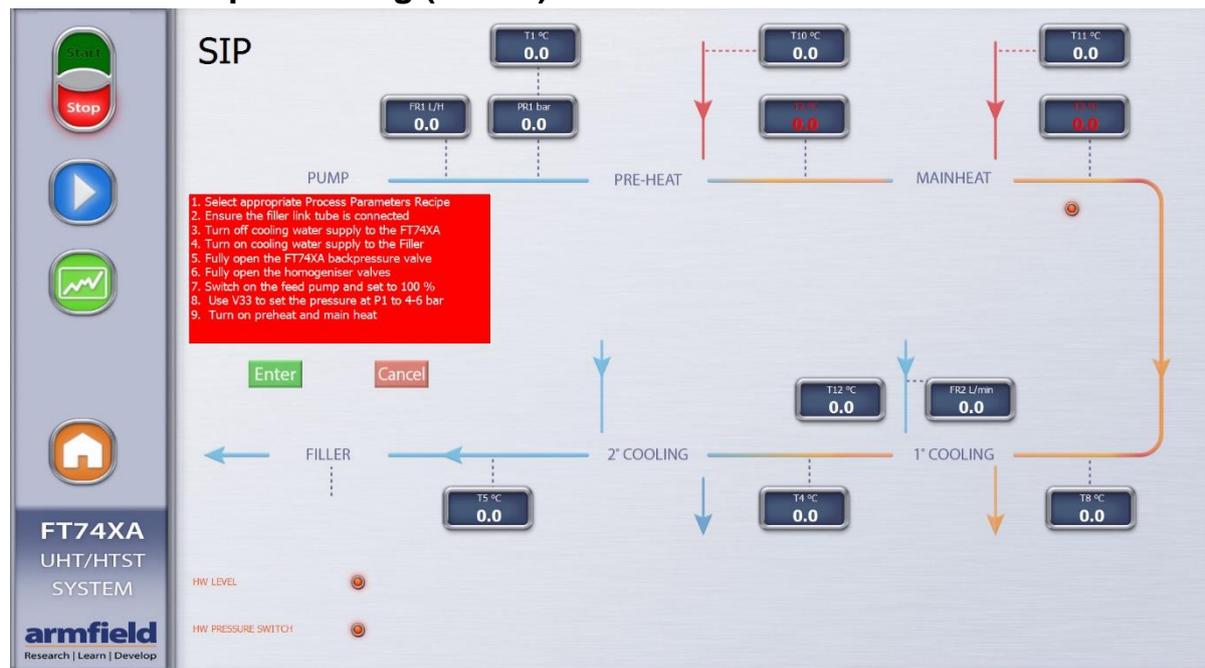


Figure 47 SIP setup screen

1. Ensure that the FT83 has been connected correctly (process and electrical connections)
2. At the start of operations, the feed tank should be full of clean water and the product outlet hose should be returning to the feed tank. Press the recipe button mode then return to the Processing screen.
3. Ensure the product backpressure valve is fully open then turn on the feed pump and increase speed to 100%. Continue until all air in the system has exited via the product outlet hose then turn off the feed pump.
4. Select the recipe. This will define both the sterilisation parameters and also the processing parameters after sterilisation has been completed.

Default SIP recipe settings are as follows:

Pump speed	15%	Sterilisation temp	121°C
Pre Heat Set Point	80°C	Cooldown temp	70°C
Main Heat Set Point	145°C	Proportion	12
Sterilisation time Filling (min)	15	Integral	50
Sterilisation time Divert (min)	5	Derivative	2

5. Enter SIP mode and complete the task list. Once SIP cycle has completed another set of instructions will request that cooling is turned on for the FT74XA. Once relevant downstream temperatures have dropped below the defined cooling temperature then the operator will be requested to transfer backpressure from the FT83 to the FT74XA. Once this has been completed and confirmed then the FT74XA will switch to process mode and operating parameters will automatically be set to the chosen recipe values.
6. Allow all process variables to stabilise then remove the product outlet hose from the feed hopper so that the water level in the hopper drops. The level override switch

should be used to drop the level low before adding product to the hopper so that product dilution is minimised.

7. Allow the product to pass through the system, monitor P1 and adjust the backpressure valve as necessary. Wait for all parameters to stabilise before taking samples. Do not allow the backpressure to rise above 6 bar. If the pressure is continuing to rise then this is probably due to product fouling and processing should be stopped by first turning off the product heating and allowing the system to cool down.
8. Once processing is complete the product heating should be left on but the set point for T3 should be reduced to ambient so that the heater is turned off. This will allow both the product and the hot water loop to cool down (If the heating system was turned off completely then the product loop would cool down quickly but the hot water loop would remain hot). The feed pump should continue to remove all product from the hopper and then replace with water so that all product is removed from the system. Once the system is cool then the feed pump can be turned off whilst preparations are made for cleaning (CIP)

12.5 Operation with the homogeniser (FT91)

If the homogeniser is connected to the FT74XA then additional screen information will be displayed:

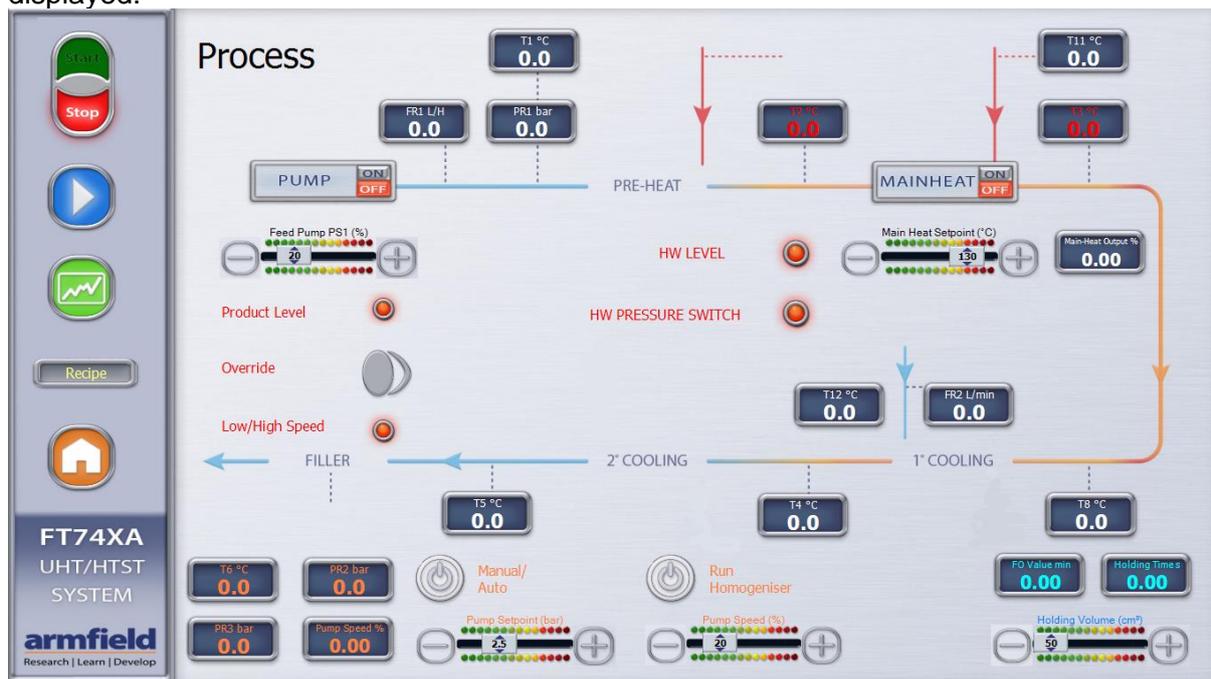


Figure 48 Process screen with homogeniser controls displayed



Figure 49 Homogeniser controls

Note: As well as this manual always read the homogeniser manufacturer's Operation and Service manual before using the equipment.

Note: Both homogenisation valves should be fully open before starting the pump.

Note: Always start the homogeniser in Manual mode and match the flow rate accurately to the feed pump before switching to Auto mode.

The homogeniser pump controls work in the same way as the feed pump controls. To turn the homogeniser on or off, press the "Run homogeniser" button. The button will change to a green colour to indicate the homogeniser is on.

The homogeniser pump Speed can be set by adjusting the percentage on the sliding scale. A similar sliding scale is used to set the desired line pressure (feed pressure to the homogeniser).

P2 displays the line pressure downstream of the homogeniser. P3 displays the homogenisation pressure which is the addition of the 1st and 2nd stage homogenisation pressures. Note: the first stage is always used to provide the bulk of the homogenisation pressure.

When adding pressure always set the first stage first and the second stage second.

12.5.1 Operation method (upstream homogenisation):

1. Ensure that the unit is configured as detailed in the Installation section and that both 1st and 2nd stage valves are wound fully open. (Never start or stop the homogeniser when there is homogenisation pressure (valves partially closed) as this can lead to damage to the homogeniser).
2. Using the sliding scale, set the homogeniser pump speed to a value to match the feed pump flow rate.
3. Using the second sliding scale, set the homogeniser feed pressure (pump set point (bar)).
4. Set up the process on water as normal and wait until steady state is reached and then switch to product processing and again wait for steady state.
5. Once switched to product, turn on the homogeniser and partially close the 1st stage valve to create a pressure of 30-70 bar. The homogeniser should be started at a speed that matches the feed pump speed. Monitor the line pressure to the homogeniser. If the pressure is rising then manually increase the homogeniser speed until it stabilises. If the pressure is falling then manually increase the homogeniser pump speed until it stabilises. The aim is to allow the line pressure to slowly drift towards the chosen line pressure and once this achieved then switch to automatic control. Once in automatic control then the homogeniser speed will be finely adjusted automatically to maintain the chosen line pressure.
6. Once processing is complete, open both homogeniser valves and then turn off the homogeniser. Then switch to water and follow the normal shut down procedures.

Note: When changing the homogeniser speed, monitor the product pressure displays, P1 and "Product pressure", (As shown above) as changes in speed can, dependant upon flow path configuration, cause:

An increase in system pressure resulting in the pressure relief valves operating.

A reduction in system pressure resulting in boiling of the process fluid.

The homogenisation pressure display is derived from the high pressure sensor in the homogenisation head and is displayed in the pop up window.

The product pressure and temperature sensors are supplied with the homogeniser. Dependant upon configuration, they usually measure the temperature of the product as it enters and pressure of the product as it exits the homogeniser and are displayed in the pop up window.

12.6 Clean in Place (CIP)

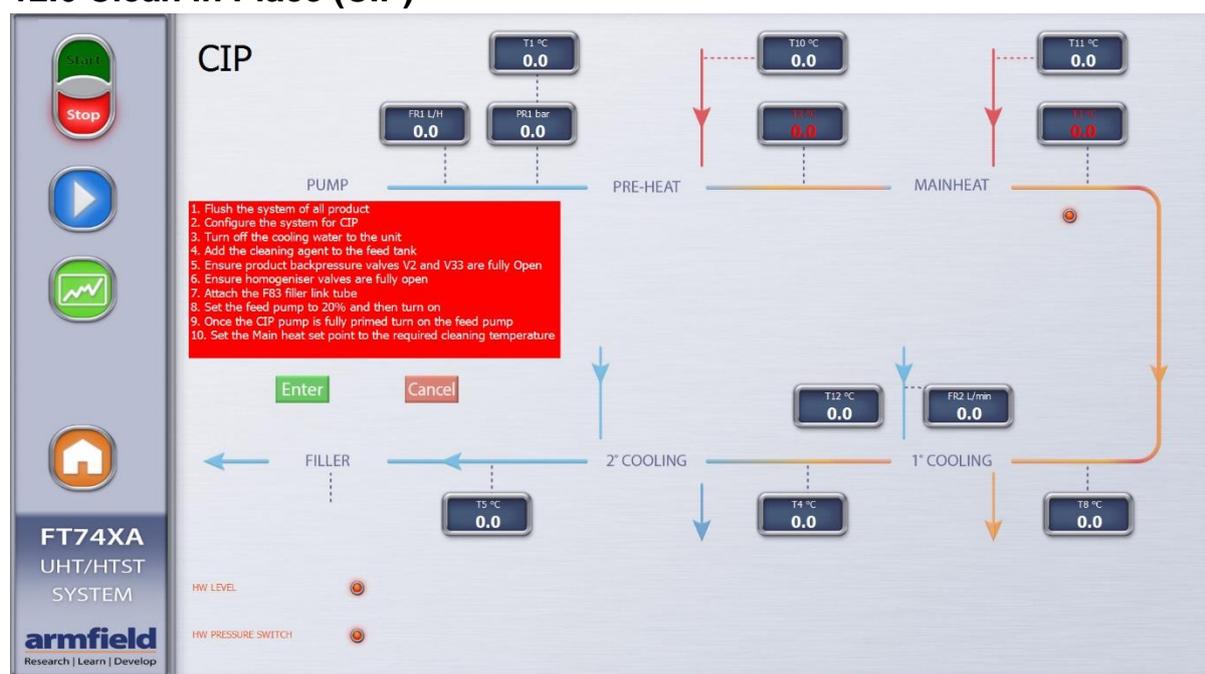


Figure 50 CIP setup screen

After product processing the system will have been cooled down and product will have been drained from the system. There will residual product and perhaps fouling on the heat exchange surfaces that must be cleaned through the CIP cycle.

1. Allow the product level to drop low in the vessel and replenish with clean water. As the vessel re-drains replenish with clean water until the system is generally free of product.
2. Once the system has fully cooled the system pressure can be released by fully opening the backpressure valve. As product leaves the system it will be possible to increase the pump speed without over-pressuring the system.
3. Once the boiler temperature (T11) has dropped below 75 °C the heater can be turned off.
4. Turn off the cooling supply to the FT74XA
5. Return to the Standby screen and then enter CIP mode.
6. Ensure the backpressure valve is fully open
7. Drain the feed hopper, remove the hopper from the feed pump and fit it to the CIP pump. Fit the blanking plate to the top of the feed pump. Connect the outlet of the CIP

pump to the valve on the side of inlet to the feed pump. See the diagram below for the arrangement:

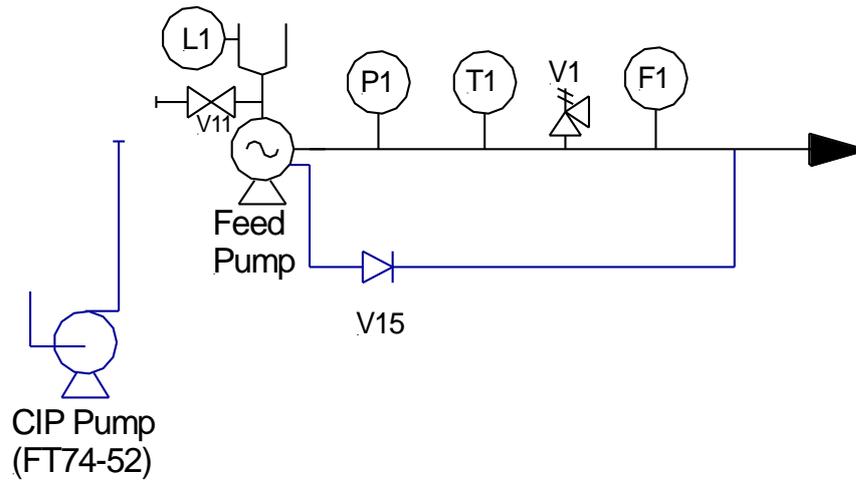


Figure 51 Arrangement for processing

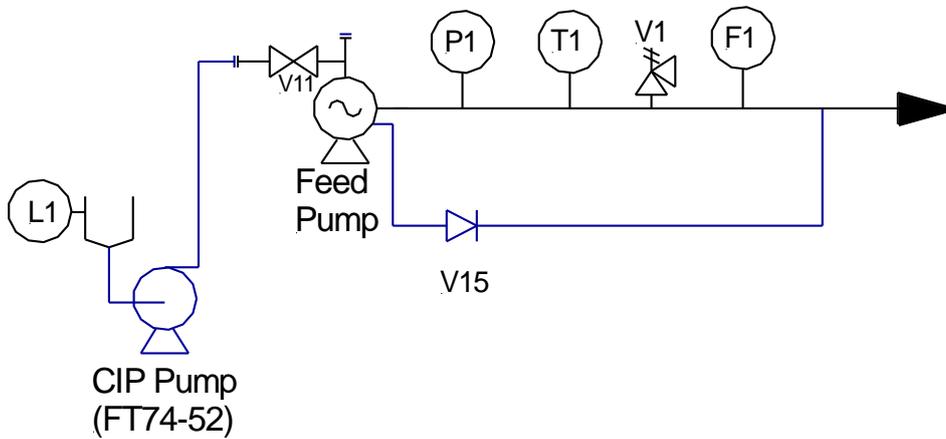


Figure 52 Arrangement for CIP (-52) for FT74XA

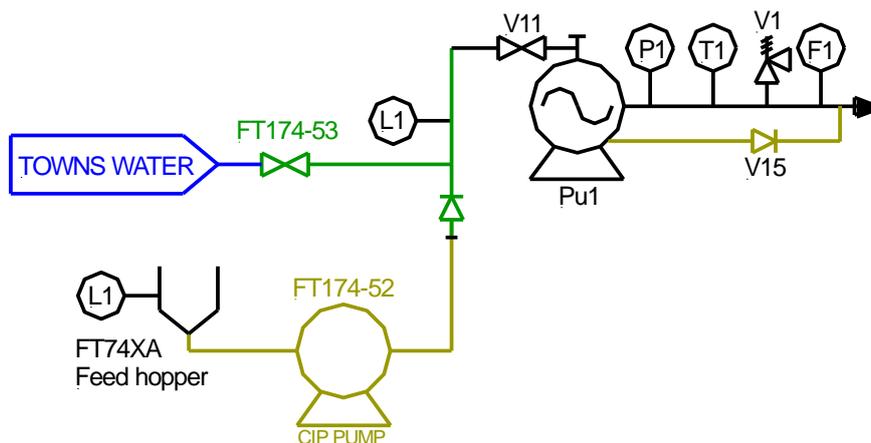


Figure 53 FT74XA-53 (suction feed) connections with CIP (-52 option). For cleaning the FT74XA feed hopper is attached to the inlet of the CIP pump. The outlet of the CIP pump is attached to the suction feed inlet (-53). The level sensor used to control the process must be changed from the -53 level sensor to the feed hopper level sensor. Remember to reverse this procedure once CIP is complete.

8. Turn on the feed pump and increase the speed. Ideally run the feed pump at 100% but this will not be possible with the plate heat exchanger due to the high backpressure. In this case increase the pump speed but do not allow the pressure to exceed 7 bar.
9. Reduce the liquid level in the feed vessel to a minimum and then refill with the cleaning agent. Use appropriate PPE (personal protection equipment) and follow local safety guidelines for handling cleaning agents.
10. Set T3 to the required cleaning temperature and turn on the hot water system. All process temperature values should rise including T1. Start the CIP timing period once all temperatures have stabilised.
11. Turn off the heating system once the cleaning time period is complete. Drain the system of the cleaning solution and replace with clean water. Measure the pH or conductivity to ensure that all cleaning agent has been removed.
12. If a second cleaning agent is to be used then repeat the stages above. Once CIP is complete then reconfigure the system for processing by refitting the hopper on to the feed pump.

12.7 Aseptic operation (FT74-45 and FT83, FT74-91 not fitted).

1. Connect the outlet of the backpressure valve of the FT74XA to the product inlet valve of the FT83 using the braided hose rated for the high pressures and temperatures (supplied with the FT83).
2. Enter Process Mode to select the recipe to be used for product processing and then enter Sterilisation Mode. Sterilisation mode has its own recipe where the sterilisation time, temperature and cooling temperature (temperature to which the system must cool down to before the system allows the operator to switch from Sterilisation Mode to Processing Mode. Follow all instructions on the Sterilisation Mode introduction screen. Ensure that the sterilisation parameters are set as required in terms of sterilisation temperature and time.

Default SIP recipe settings are as follows:

Pump speed	15%	Sterilisation temp	121°C
Pre Heat Set Point	80°C	Cooldown temp	70°C
Main Heat Set Point	145°C	Proportion	12
Sterilisation time Filling (min)	15	Integral	50
Sterilisation time Divert (min)	5	Derivative	2

3. Fully open the backpressure valve of the FT74XA and the FT83 then run the pump at the highest speed possible without exceeding 8 bar pressure at P1 to expel air from pipework. **Note: If the system is fitted with the pneumatic backpressure valve then the valve air pressure regulator should be set to 4.0 bar. This is essential to support the valve during the sterilisation procedure. Failure to do this will result in failure of the flexible valve liner and some steam will exit from the valve pressure regulator.**
4. Turn on the feed pump and set the speed to about 7% (10L/hour)
5. Turn **OFF** the cooling to the FT74XA and turn **ON** the cooling to the FT83. The cooling drain pipe to the FT74XA **MUST** be connected so that any pressure build-up during sterilisation can relieve to drain. If a chiller is connected to the heat exchanger ensure that the return line is left open so that any pressure build-up during sterilisation can relieve to the return line.

6. Adjust the FT74XA backpressure valve to give a pressure at P1 of 4.5 bar. Then adjust the FT83 backpressure valve sufficiently to give a pressure at P1 of 5.0 bar.
7. Turn on the hot water circulator and allow the system to heat up. Once all key temperature sensors exceed the defined sterilisation temperature then the cycle timer will begin counting down. Should any of these temperatures fall below the sterilisation temperature then the cycle timer will reset and automatically re-start once all temperatures return above.
8. Monitor the backpressure throughout the sterilisation cycle and adjust the FT83 backpressure valve as appropriate, ensuring it remains at 5 Bar.
9. Once the sterilisation cycle has completed a message will appear instructing the operator to turn on the cooling to the FT74XA and then wait for the system to cooling. Once the downstream temperature sensors have dropped below the cooling temperature then turn off the cooling water supply to the FT83 and fully open the FT83 backpressure valve. There should remain a 4.5 bar backpressure due to the adjustment of the FT74XA backpressure valve. Once complete then enter Process mode. The system will pick up the process recipe values and adjust the set points accordingly.
10. Once steady state is achieved on water then switch to product and follow the procedures detailed before.

12.8 Key system features

12.8.1 System Pressures

The system pressure is displayed above the feed pump and tank on the main processing screen (see Processing Screen above). When operating at set-point temperatures above 100°C it is essential to pressurise the process line by partially closing the back-pressure valve. Failure to do this results in product boiling which causes fouling of the heat exchanger surfaces. Fouled surfaces have a much reduced heat transfer coefficient which mean greater delta T's are required to reach a particular hold temperature and this in turn may lead to more fouling. The degree of back pressure required to prevent boiling depends on the set-point temperature. The table below gives recommended back pressures for different operating temperatures.

Set-point temperature (°C)	Minimum recommended pressure (bar)
100	0.5
110	1.0
120	1.5
130	2.2
140	3.5
150	4.5

12.8.2 Heater Alarms

To prevent damage to the heating system, two possible alarm states exist;

- A low-level warning (red LED) indicates there is a physical low water level in the reservoir and also when the heater MCB is in the off position. Should the low-level warning occur then first check that the heater MCB is in the on (up) position. If it is then it is likely that the boiler water level is low. Water is lost from the system when heat exchangers are taken off and re-mounted and occasional topping up is therefore expected. Follow the instructions in 'Filling the hot water circulator' section 11.5 for refilling the hot water circulator if the low level light is still illuminated once the heater MCB is in the ON position.

- **Over Pressure:** If during processing the pressure in the boiler rises above the safety cut out level then the over-pressure LED will show red. The feed pump and hot water circulator pump will continue to operate but the heater elements will turn off and the system will cool to reduce the pressure in the boiler. The heating elements will only turn back on once the pressure has fallen below the safe level (approximately 6.5 Bar). If for any reason the pressure should continue to rise, then excess pressure will be vented through the relief valve connected to the boiler system.

13 Equipment Specifications

13.1 Overall Dimensions

Height - 1.45 m

Width - 0.85 m

Depth - 1.00 m

13.2 I/O Feed Pump

A progressing cavity variable speed pump 10-135L/h approximately.

The pump can handle soft particulates up to 0.8mm and fibre lengths up to 25 mm.

13.3 Pressurised hot water circulator

- Water capacity 4.0 L
- Pump circulation rate variable up to 6.0 L/min
- Max water temperature 165°C
- Safety cut outs
 - low level
 - electronic pressure switch
 - mechanical pressure relief valve
- Heating duty 4 or 6 kW

13.4 Flow meter option (FT74-40)

Type: Electromagnetic

Flow range: 5-150 L/h

Accuracy: 1% at 10 L/h

Orifice diameter: 3 mm

13.5 FT74-20 tubular heat exchanger

Number of tubes: 5 (1 preheat, 2 heating, 2 cooling)

Tube diameter (product side): 8.1 mm

Overall tube diameter: 15.8 mm

Length (heated): 0.8 m

Material: 316 stainless steel

Assembled test pressure: 20 bar

Working pressure: 15 bar (maximum)

Standard holding tubes: 2 s and 15 s

13.6 Static mixer option (FT74-21)

This option consists of a set of 8 static mixers, sufficient for two processing tubes of the tubular heat exchanger.

13.7 Plate heat exchanger FT74-30-MkIII

13.7.1 Standard unit

Plate overall dimensions: 75 x 115 mm

Effective diameter: 2.5 mm approximately

Plate thickness: 0.5 mm

Wetted perimeter: 153 mm

Materials: Plates 316 stainless steel

 Gaskets Food grade silicone

Assembled test pressure: 15 bar

Working pressure: 10 bar (max)

Standard holding tubes: 2 s and 15 s

Number of plates: 9 heating, 10 cooling, 10 regeneration

13.8 Homogeniser interconnection plates (FT31/32)

An additional interconnecting plate that allows product to be taken from the regeneration stage and fed to an homogeniser prior to return to the remainder of the regeneration stage of the plate heat exchanger. FT74-31 diverts product prior to the heating section and FT74-32 diverts product after the heating section.

13.9 Two stage cooling option (FT74-33)

The option includes an additional intermediate plate and 11 heat exchanger plates in the second cooling stage. An interconnecting link is provided to allow single stage cooling when required.

13.10 Additional heating plates option (FT74-34)

To extend the capabilities of the plate heat exchanger an additional 8 plates can be specified, 4 for the intermediate section and 4 for the heating section.

13.11 Variable holding tube option (FT74-65)

This unit consists of 3 holding coils mounted in a single insulated container which can be used independently or linked together to give a range of holding times between 30 s and 120 s at 10 L/h. The unit is supplied with an additional temperature sensor to allow both inlet and outlet temperatures to be measured.

13.12 Sterilisation Link (FT74-45)

Number of tubes: 2 (2 heating)

Tube diameter (product side): 8.1 mm

Overall tube diameter: 15.8 mm

Length (heated): 0.4 m

Material: 316 stainless steel

Assembled test pressure: 20 bar

Working pressure: 15 bar (maximum)

13.13 Pneumatic pinch valve (FT74-45)

Required Air Pressure: 6-8 bar

13.14 Product temperature controller settings

The product temperature T3 is controlled to the desired temperature using a three term PID controller. Settings for each of the three terms (Proportional, Integral and Differential), may need to be adjusted to suit particular equipment configurations and processing parameters. Default PID values included below:

P	I	D
12	50	2

13.15 Controllable pre-heat (FT74-46)

Make sure the equipment is set-up as described in installation section.

The pressure regulator on the water inlet to the -46 is set to 2 bar. Continuous water supply must be ensured throughout the operation for the equipment to function properly.

13.16 Controllable cooling (FT74-51)

Option includes pressure regulator and PID controllable valve to control chiller input to secondary cooling tubes.

13.17 Environmental Conditions

This equipment has been designed for operation in the following environmental conditions. Operation outside of these conditions may result reduced performance, damage to the equipment or hazard to the operator.

- a. Indoor use;
- b. Altitude up to 2000 m;
- c. Temperature 5 °C to 40 °C;
- d. Maximum relative humidity 80 % for temperatures up to 31 °C, decreasing linearly to 50 % relative humidity at 40 °C;
- e. Mains supply voltage fluctuations up to $\pm 10\%$ of the nominal voltage;
- f. Transient over-voltages typically present on the MAINS supply;
Note: The normal level of transient over-voltages is impulse withstand (over-voltage) category II of IEC 60364-4-443;
- g. Pollution degree 2.

Normally only nonconductive pollution occurs.

Temporary conductivity caused by condensation is to be expected.

Typical of an office or laboratory environment.

14 Routine Maintenance

14.1 Responsibility

To preserve the life and efficient operation of the equipment it is important that the equipment is properly maintained. Regular maintenance of the equipment is the responsibility of the end user and must be performed by qualified personnel who understand the operation of the equipment.

14.2 General

The equipment should be disconnected from the electrical supply when not in use. After use the unit should be effectively cleaned and left as described earlier.

14.3 RCD Test

Test the RCD by pressing the TEST button at least once a month. If the RCD button does not trip when the Test button is pressed then the equipment must not be used and should be checked by a competent electrician.

14.4 Flexible pipework and gaskets

There are a number of flexible pipes used with the equipment, for example, hot water hoses, cold water hoses and the feed pipe connected to the outlet of the feed pump. It is recommended that these are inspected monthly, particularly the hot water hoses, and should there be any signs of damage then these should be replaced without delay.

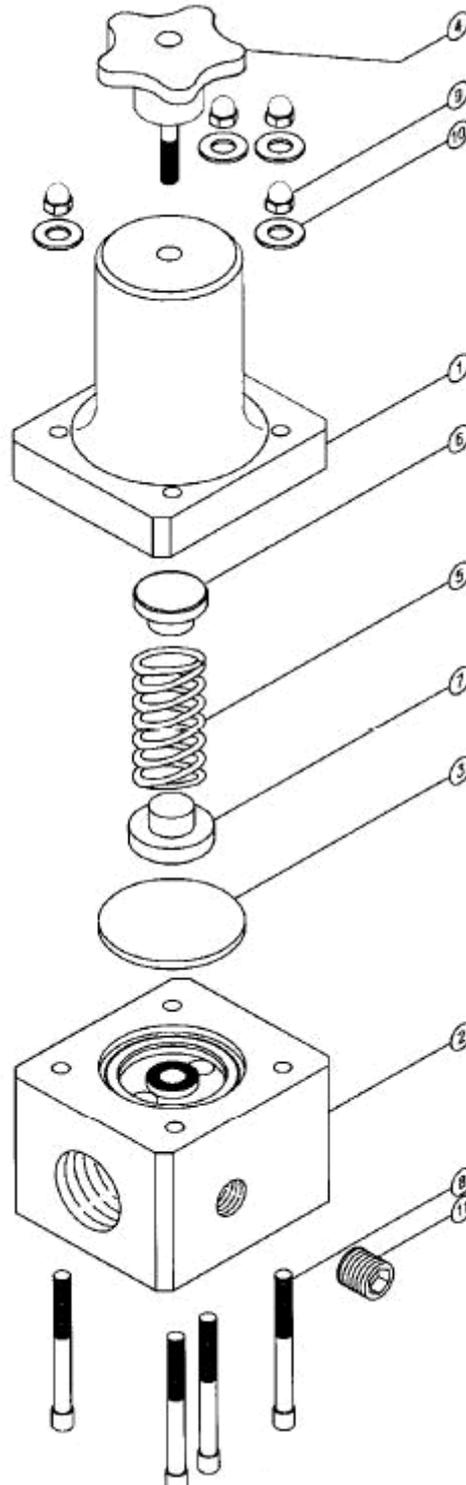
All product and some service lines use the triclamp type connector which are fitted with PTFE gasket seals. These compress with time which means that triclamps need regular tightening. Before each use of the equipment triclamp connectors should be tested for tightness. Eventually gasket compression reaches a stage where it is no longer possible to form a good seal. This is highlighted by metal to metal contact of either the triclamp itself or the end pieces either side of the gasket. In either case the gaskets should be replaced.

14.5 Setting the hot water circulator divert valve

For normal operation the divert valve should be set a quarter turn from fully shut so that the majority of flow passes through the heat exchanger but a small amount diverts back to the hot water circulator. If the valve is fully closed then this can lead to the magnetic drive of the hot water circulator pump de-coupling which then reduces/stops flow. If this occurs, reset the divert valve and turn off the hot water circulator and then back on again. In the course of the life of the plate heat exchanger it may be disassembled and reassembled several times. Each time this occurs the tightening dimension reduces which leads to more back pressure for the hot water circulator. Therefore it may be necessary to open the divert valve further to prevent de-coupling.

14.6 Backpressure valve assembly/disassembly for cleaning

At regular intervals the backpressure valve should be disassembled for cleaning. The procedure for assembly/disassembly is given below:



- Turn off the feed pump.
- Fully open the back pressure valve and allow all pressure to dissipate.

- Remove the back pressure valve from the system.
- Undo the four bolts (see above)
- Clean the diaphragm
 - If the diaphragm is damaged or seriously deformed, replace it.
- Reassemble the unit (making sure the arrow on the top part and the base are in the same direction)
- Torque nuts to 60 inch pounds (6.7N/m) when reassembling
- Re-fit to the FT74XA and then turn on the feed pump. Tighten the valve handwheel until P1 reads approximately 9 bar. There should be no leaks from the valve body. If leaking occurs then tighten each nut, a little at a time until the leaking stops. Then release the handwheel and observe that the pressure remains below 3 bar.

14.7 PID Temperature controller settings

The default PID parameters should not require adjustment for most applications. However, with particularly viscous products or when using high flow rates or long holding tube times it may be necessary to re-tune these parameters.

Note: Before changing the parameters, make a note of the current parameters.

- Begin processing with a set of predefined parameters for the types of heat exchanger being used.
- Increasing the Proportional Value (P) increases the loop gain. If the gain is too high the loop will become unstable and the temperature will oscillate. If the gain is too low the loop will be slow to respond.
- Increasing the integral time (I) increases the response to the loop to longer time period errors, as the response increases in proportion to the time the error has been present. However, a long integral time can also cause overshoots and lead to instability.
- The derivative term (D) reacts to loop disturbances, but again can cause instability if the setting is too high. It is often better to set this term to zero when adjusting the P & I values, then add a small amount of (D) at the end.
- When the loop is optimised correctly, it will be possible to make small changes to the set points and the loop should stabilise at the new set points relatively quickly with minimal overshoots and undershoots.

14.8 Electromagnetic flow meter settings (FT74-40)

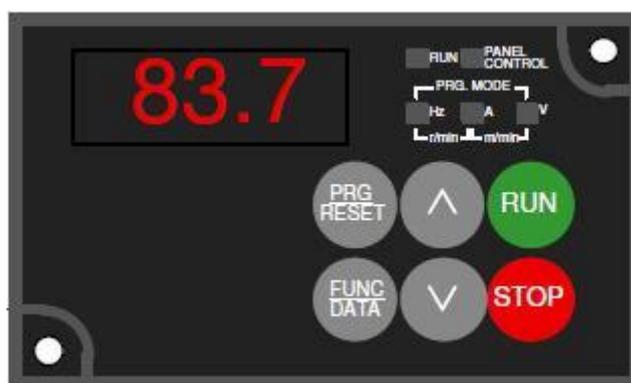
The electromagnetic flowmeter is factory calibrated and should not require further set-up. Accuracy of the flowmeter should be checked every few months and should a loss of calibration occur then Armfield should be contacted.

In order to accurately measure flow rate it is necessary to have a small pipe diameter through the flowmeter so that sufficient fluid velocities are generated. This has the effect of adding back-pressure to the system although this is relatively small at normal processing flow rates. However it is worthwhile determining exactly what this pressure is by running the system with product at room temperature with the back pressure valve fully open. This pressure should then be added to the recommended operating pressure for the particular processing temperature – see ‘System Pressures’ section 12.7.

The small size of the orifice through the flow meter means that it is susceptible to blockage. The FT74XA is limited to use with products containing particles no larger than 0.8mm and fibres no longer than 25mm. Care should be taken in preparation of both water and products for use with the FT74XA in order to prevent particles entering the system. If the flowmeter becomes blocked or partially blocked there will be a rapid rise in system pressure which may activate the pressure relief valve. Processing should be stopped, preferably in a manner avoiding fouling the heat exchanger. Once the system pressure has returned to zero the clamps to the flow meter can be undone and it should be unplugged from the back of the unit. The flowmeter should then be transported to a sink where water should be washed through in the opposite direction to normal flow. It is possible that some products will cause regular blocking problems and it will be necessary to operate the FT74XA without the flow meter in such cases.

14.9 Pump inverter settings

The pump motor is controlled by an inverter which is housed in the electrical tray. The inverter is pre-set in the factory and should not require any adjustment by the user. However, settings that are changed from the factory default values are shown in the table below. The figure below shows the inverter control panel. A manufacturer’s instruction manual is included.



Pump inverter control panel

- The **PRG/RESET** key is used to switch between regular operation mode and programming mode. This key is also used to reset an alarm stopping state.
- The **FUNC/DATA** key is used to switch between different displays such as frequency and current. This use is only when the PRG/RESET key is set so that regular operation

mode is active. When in programming mode the key is used to retrieve or write various function codes and function data.

- The up/down keys are used in programming mode to change the function code or data setting. Once a value has been changed it is necessary to press FUNC/DATA for the new value to be accepted.

Function number	Name	Setting
F00	Data protection	0
F01	Frequency command	1
F02	Operation method	1
F03	Maximum frequency	55
F04	Base frequency	50
F05	Rated voltage	As per motor name plate – usually 230
F06	Maximum voltage	As per F05
F07	Acceleration time	5
F08	Deceleration time	5
F09	Torque Boost	0
F11	Electronic thermal overload (level)	2
F12	Electronic thermal overload (thermal time constant)	5
F15	Frequency limiter (high)	70
F16	Frequency limiter (low)	3
F23	Starting frequency (freq)	0.5
F25	Stop Frequency	0.2
F30	Analogue Output Scaling %	100
F37	Auto Torque boost	2
F40	Torque limiter (driving)	999
F41	Torque limiter (braking)	999
F42	Control Mode	1
F43	Current Limit Mode	1
E01	X1 terminal function	12
E02	X2 terminal function	1
E03	X3 terminal function	2
E20	Y1 terminal function	2
E31	FDT function signal (level)	1
E32	FDT function signal (hysteresis)	0.9
E34	OL function signal (level)	2
C31	Analogue input adjustment Offset	0
C32	Analogue input adjustment Gain	200
P01	Number of motor poles	4
P02	Motor 1 (capacity)	0.25
P03	Motor 1 (rated current)	As per motor name plate – usually 2.12 A

P06	Motor 1 (No-load current)	0.8
P07	Motor 1 (%R1 setting)	Set by Autotune when hot using P04=1
P08	Motor 1 (%X setting)	Set by Autotune when hot using P04=1
H61	Initial Frequency Setting	0

14.10 Dismantling and re-assembly of the plate heat exchanger

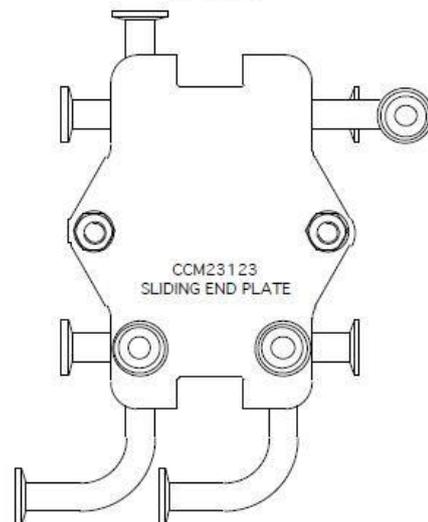
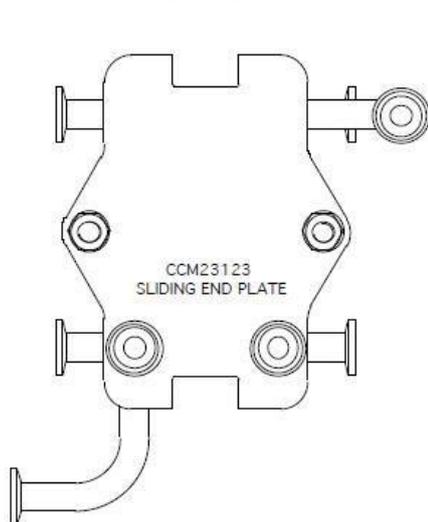
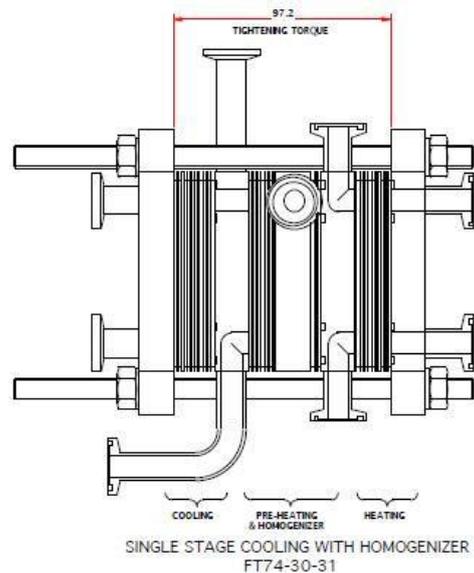
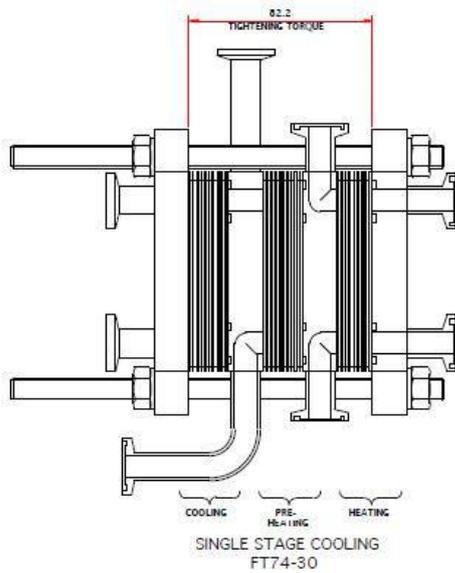
It is essential that the clean in place (CIP) procedure is carried out after every use as described in 'Cleaning in place (CIP)' section. With properly developed CIP procedures the number of manual cleanings through heat exchanger dismantling can be minimised which is important since the procedure affects the life of the gaskets attached to each of the heat exchanger plates.

The plate heat exchanger is made up of stainless steel plate and silicone gasket combinations which are assembled in particular orientations to allow various flow patterns of product and heat transfer media through the exchanger. Each plate and gasket combination has an identification number (PE number) which is etched onto the plate on the gasket side. The diagrams on the following pages show the order in which each of the identified plates is installed, working from the fixed end plate (heating section end).

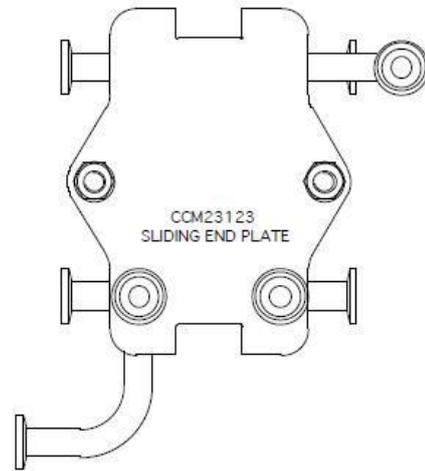
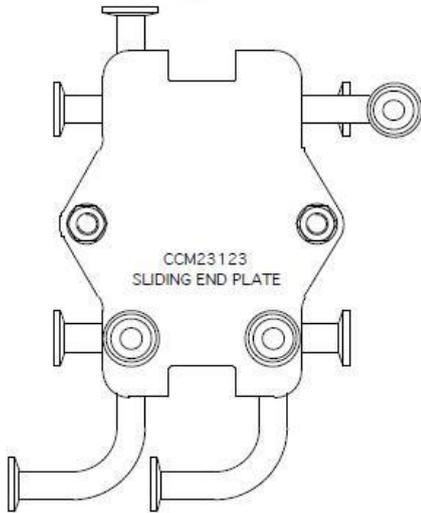
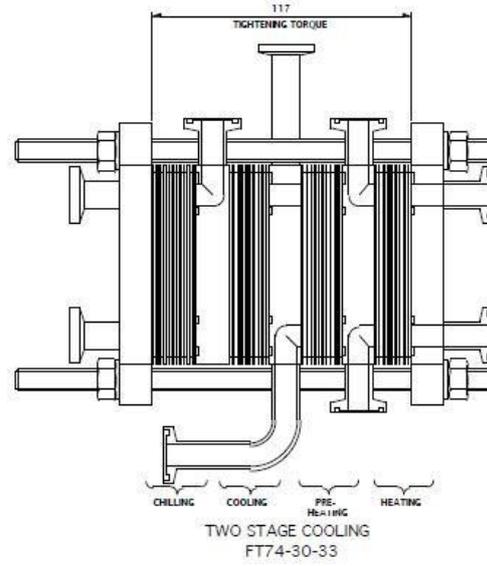
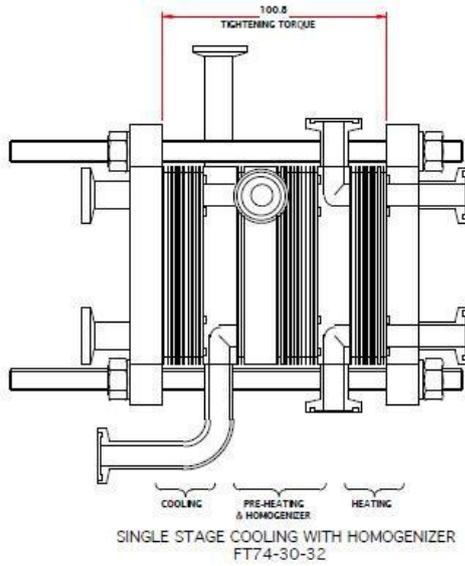
The basic heat exchanger (FT74-30-MKIII) consists of three sections, the interchange section, the heating section and the cooling section. Each section consists of a series of plates clamped between two stainless steel endplates. There are various options which can add additional intermediate plates and sections to the heat exchanger. The advantage of this design is that there are in effect at least 3 heat exchangers on the same framework instead of three independent heat exchangers connected by pipework. Additionally, regeneration of heat from hot to cold product means the process is energy efficient.

- A stainless steel safety cover positioned over the heat exchanger and covering the plates and gaskets protects against injury in the event of escape of hot substances should a gasket fail. This should be removed prior to dismantling the heat exchanger.
- Disconnect all the tri-clamp pipeline connectors on the end plates and the intermediate plates.
- Using a suitable 17mm extended socket or spanner/wrench, remove the two nuts from the studding at the sliding end. These nuts provide the compression which seals the heat exchanger. As the nuts are undone the heat exchanger will expand.
- Remove the cooling section plate stack, first intermediate plate, interchange section plate stack, second intermediate plate and finally the heating section plate stack. When used at elevated temperatures (120-150°C) the plates in the heating section have a tendency to stick together. This is remedied by soaking in strong detergent solution overnight. Once the plates have been cleaned then re-assembly is the reverse of this procedure but close attention should be paid to the order and orientation of the plates as just one plate misaligned will lead to blockage and the exchanger will need to be dismantled again – see Figure 2, 3, 4 and 5 in Equipment Diagrams section 8.

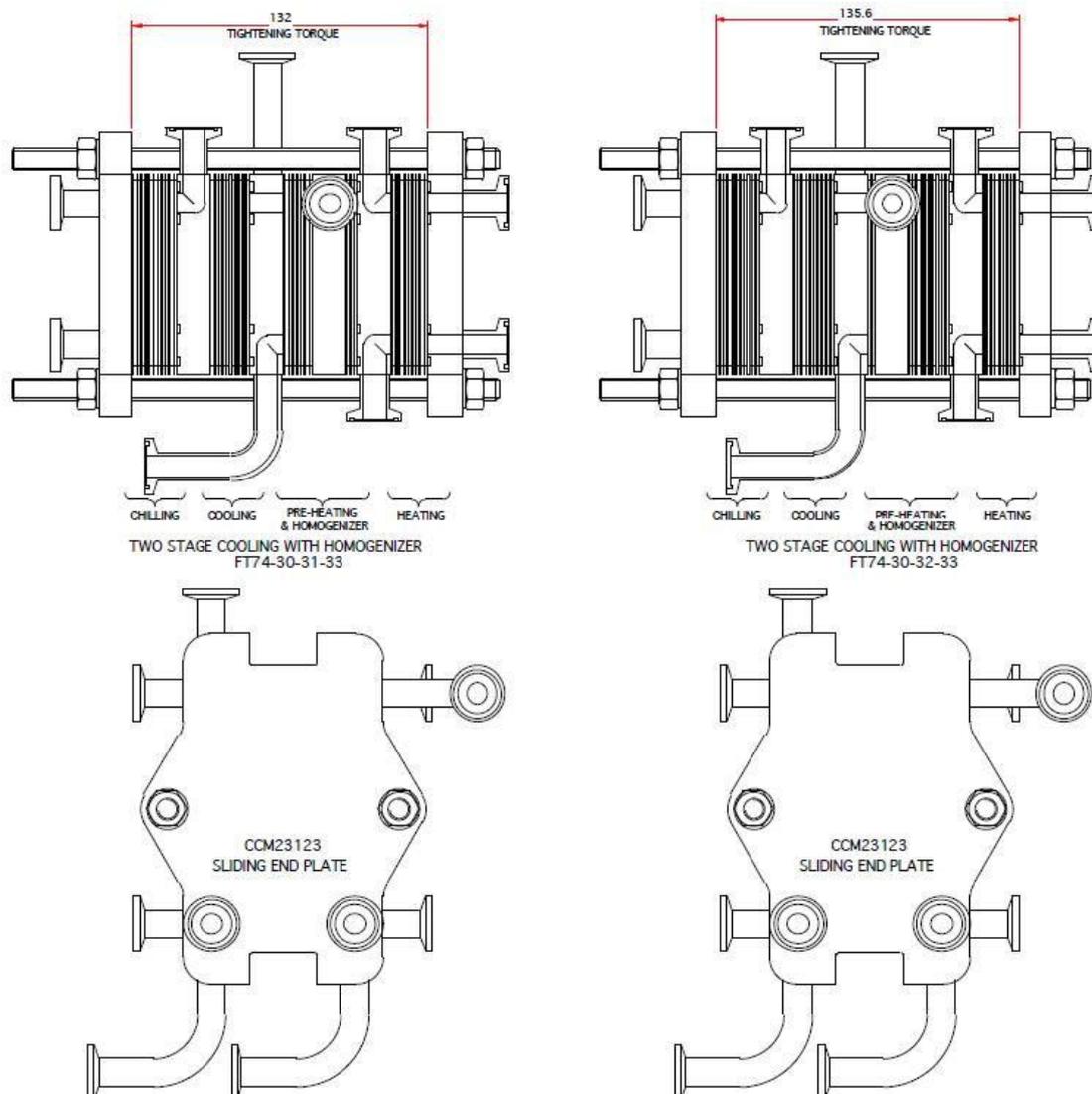
- The final tightening dimension is based on the distance between the inside edge of both end plates and this is set in the factory. This dimension is best measured using a digital vernier gauge and must be identical on both sides of the heat exchanger near the studs. The dimensions for the different heat exchanger configurations are given below. **Note:** since the gasket material takes a 'set', it is important to reduce with dimension slightly after each assembly by approximately 1mm to retain leak-tightness. There is a limit to how tight the plate stacks can be and after a number of dismantles and reassemblies it will be necessary to replace the plates and gaskets. The studs should be tightened evenly so it is advisable to tighten both finger tight first then use a socket wrench or spanner/wrench to tighten one full turn alternately and reduce this to half turns and quarter turns as the final dimension is approached. A small quantity of suitable grease applied to the threads of the stud will assist this operation.



Tightening dimensions for FT74-30 and FT74-30-31. Note: 14.4mm should be added to the tightening dimension if the option FT74-34 is specified



Tightening dimensions for FT74-30-32 and FT74-30-33. Note: 14.4mm should be added to the tightening dimension if the option FT74-34 is specified



Tightening dimensions for FT74-30-31-33 and FT74-30-32-33. Note: 14.4mm should be added to the tightening dimension if the option FT74-34 is specified

14.10.1 Checking for correct operation after reassembly

Reconnect the triclamp fittings for the product side but leave all service connections unmade. Fill the feed tank with water and then, keeping a close eye on the pressure gauge, run the feed pump. If there is no rapid rise in pressure then the plate stack has been reassembled in the correct order. Increase the system pressure to 6 bar by partly closing the back pressure valve. Observe the undone service connections of the heat exchanger for leaks. There may be initial leaks due to plates being deflected by the pressure but then there should be no further leakage. If there is a continuous leakage then it is likely that the studs have not being tightened sufficiently.

Once it has been established that there are no leaks then reattach the service connections. Check that cold water flow is occurring i.e. water passes to drain and the rotameter float rises. Also turn on the hot water circulator, raise the set-point temperature and ensure that the hot water temperature (T4) rises.

A plate heat exchanger that is tightened to a low dimension can cause too great a pressure drop for the hot water circulator pump which can lead to the magnetically coupled head decoupling. This can be overcome by turning off the hot water circulator, opening the hot water circulator by-pass valve slightly, and then turning the hot water circulator back on.

14.11 Dismantling and re-assembly of the tubular heat exchanger

It is essential that the clean in place (CIP) procedure is carried out after every use as described in the Operation section.. With properly developed CIP procedures the number of manual cleanings through heat exchanger dismantling can be minimised. However if reduced heat transfer is detected and fouling is suspected then it is a simple procedure to dismantle the unit for cleaning.

Undo the triclamps so that both ends of all six heating tubes are free and inspect the inner walls of the tubes. If necessary clean the tubes with a tube brush. Re-assemble the heat exchanger and assess the cleaning performance as described above.

Static mixers (FT74-21) are available as an option with the tubular heat exchanger. It is good practice to remove these elements once in a while and check for cleanliness.

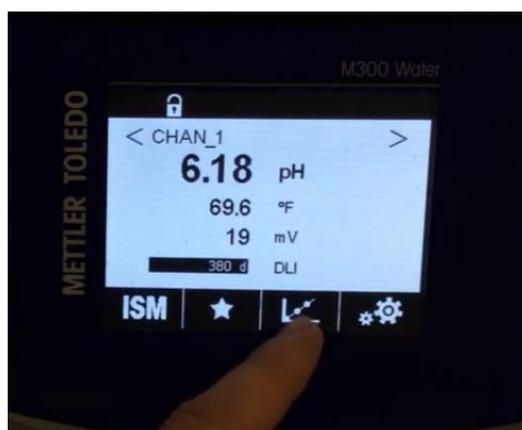
14.12 Replacement of in-line filter elements

The hot water circulator pump is protected from particles by an in-line filter (see 'Pressurised hot water system' section 10.6). This may become blocked in time and may require replacing. This is achieved by undoing the filter housing. The unit is supplied with a spare filter element and instructions for replacement.

14.13 pH sensor

pH sensor can be calibrated in several ways. The steps described below are for the two-point method with buffer solutions of pH 4 and 10 at 25°C. For instructions on how to calibrate sensor using alternative methods, please advise transmitter's MT300 manual.

To calibrate the sensor, in the main menu, click on the calibration logo shown as:



Then, select the 'Calibrate Sensor' tab. Chose the 'Options' menu, and set the Buffer Tab to none. Chose the 'Method' tab and set the calibration method to 2-Point.



After that, click 'Cal' and you will be prompted to insert the probe to buffer 1 and insert the pH the value of the buffer. After the probe reading has stabilised, you will be asked to repeat the same for the buffer number 2. Make sure to rinse the sensor using deionised water before switching between the solutions.

Due to the design of the sensor assembly, complete submersion of the sensor into the buffer may prove impractical and inconvenient. Consequently, it is advisable to pour the buffer into the sensor opening. However, owing to the U-shaped configuration of the assembly, it is imperative for the user to ensure that, while filling it with buffer, the assembly is moved around to expel any trapped air from the U-bend, guaranteeing the sensor is thoroughly immersed in the buffer solution.

For the sensor to show up in the software, adjust the setting via the maintenance screen.

14.14 Storage

The unit should be disconnected from the electricity supply when not in use. Always cover the unit with a dust cloth or plastic sheet if not used for long periods.

15 Contact Details for Further Information

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